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and a Record of Current Researches relating to

Invertebrata, Cryptogamia, Microscopy, &c.,

including Embryology and Histology Generally.

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XXXIV.—New Species and Varieties of Diatomaceae from the Caspian Sea. By A. Grunow, Hon. F.R.M.S. Translated with additional Notes by F. Kirton, Hon. F.R.M.S.

(Read 11th June, 1879.)

Plate XXI.

*Amphora* (angusta Greg. var. ?) oblongella Grunow.—A. minuta, a latere primario angusta, oblonga, polis rotundatis, valvis cymbiformis obtusiusculis, ventre plano, linea media subrecta margine inferiori approximata, striis dorsalisibus subradiantibus 14–16 in ·01 mm., ventralibus brevissimis. Longit. ·032–·036 mm.; latit. ·008–·0010.

Harbour of Baku, common.

Its relationship to the very imperfectly figured *A. angusta* Greg. is very doubtful. The striae on the ventral portion appear to be much longer—Gregory gives 17 in the ·01 mm. (“about 44 in ·001”’’); still slighter is its resemblance to *A. nana* Greg., with 19 striae in ·01 mm. The ventral striae also appear to be shorter. The relationship of these forms is therefore scarcely probable.

*A. lineata* Greg. var. subconstricta Grun.—Trustulitis in media parte levissime constrictis, striis punctatis dorsalisibus 15 in ·01 mm., ventralibus tenuissimis. Longit. ·035–·045 mm.; latit. ·011.

Harbour of Baku, common.

I have frequently met with a more strongly constricted *Amphora* in diatom gatherings from Tahiti (Tonga and Samoa Islands), which I likewise consider to be a form of *A. lineata* and have

**DESCRIPTION OF PLATE.**

Fig. 1.—*Coscinodiscus nobilis* Grun., from Java, ·420.

2.—a, *Podosira maxima* Kgg., from Peru, ·920.

(Cyclotella maxima, authentic specimen.)

b c, Structure of inner and marginal portions of valve.

d, Two frustules of *P. maxima*, with the connecting membrane, showing the granular endochrome, ·290.

3.—*P. stellulifera* Grun., Monterey deposit, ·99.


b c, Structure of the inner portion and the margin of the valve, ·510 / 1.

5.—a b, *Hyalodiscus scoticus* (Kgg.) Grun., ·99.

(Cyclotella scotica Kgg., authentic specimen.)

(Fig. a, dried specimen with endochrome.)

c, Structure of valve, ·510 / 1.

6.—a, *P. Argus* Grun., California, ·49.

b c, Structure of inner portion and margin of valve, ·510 / 1.

7.—a, *P. hormoideae* Montagne, Lima, ·99.

b, Structure of valve, ·510 / 1.

8.—Small fragment of outer portion of *Coscinodiscus Gazella*, ·49.
called it var. *constricta*. It is somewhat larger and more robust than the Caspian form, but otherwise differs but little; striæ 12–14 in *01 mm.*

**Gomphonema.**

*Gomphonema (olivaceum var.?) stauroneiformis* Grun.—G. valvis lanceolatis vel subclavatis, obtusis, striis subradiantis, subtilissime punctatis, area transversa centrali interruptis. Longit. *053–07 mm.*; latit. valv. *01–012 mm.*; striæ 10–13 in *01 mm.* Stipites plerumque longissimæ.

This Gomphonema is distinguished from *G. olivaceum* principally by its greater size and more conspicuous, smooth, central area. I have hitherto met with this form in mountain streams in the Tyrol and Switzerland and presume that it has often been mistaken for *G. dichotenum*.

The forms from the Caspian Sea are still larger (*065–15 mm.* long) and might be called var. *Caspia*. The upper part is frequently shorter than the lower; this is often the case with the mountain species.

**Mastogloiaceæ.**

*Mastogloia Smithii* Thwaites var. *intermedia* Grun.—Minor, valvis late lanceolatis parum productis, nodulo centrali vix laterali ter dilatato, striis tenuioribus, 18–19 in *01 mm.* Longit. *032–037 mm.*; latit. *0125 mm.*

Harbour of Baku, common.

Var. *abnormis* Grun. valvis lanceolatis, obtusiusculis, loculis ab marginis remotis, lineæ medie approximatis, striis subradiantis, tenuissime punctatis, 18 in *01 mm.*

Baku Harbour, rare.

A peculiar form, in which the loculi are apparently placed between the margin and median line. I have observed something similar in a *Mastogloia* from Seychelles, which I have named *M. Seyshellensis*. It differs from the Caspian form by its greater length and more lanceolate valves with occasionally capitate produced apices, and its delicate striæ (26–29 in *01 mm.*).

*M. (Smithii var. ?) pusilla* Grun.—M. minuta, valvis lanceolatis obtusiusculis, loculis mediis ceteros magnitudine superantibus, striis subradiantis, tenuissime punctatis, 17 in *01 mm.*, nodulo centrali rotundato. Longit. *012–013 mm.*; latit. *007–0075 mm.* Not common in the Harbour of Krasnowodsk. Resembles *M. exigua* of Lewis, but the valves are more obtuse and more strongly striate; the loculi are numerous and marginal.

[I fail to detect any resemblance between the figure of *M. exigua* and *M. pusilla*; the former has acute apices, loculi 2–5 (generally only 3), striæ obscure. In the latter the ends are obtuse, the striæ distinct, and the loculi numerous.—F. K.]
NAVICULEE.

*Navicula Trochus* Ehr. var. *biconstricta* Grun.—Valves with three equal stout inflations, and slightly produced obtuse apices 0·042 mm. long. Inflations 0·001 mm. (this should be 0·01); constrictions 0·006 broad. Striae transverse (18–20 in 0·01 mm.), radiant at the centre, two large thickened sickle-shaped lines on each side of the central area.

Rare in Baku Harbour.

Although of very different form it appears nevertheless to belong to the series of which *N. Trochus* is the type, but which has only one central inflation. I have, however, many forms before me in which the ends are produced and a couple of slight depressions are visible, evidently showing a transition to the above described extreme variety. Characteristic of *N. Trochus* is the circular smooth space round the central nodule, and which has the two sickle-shaped forks on each side.

[N. Trochus of authors is not *N. Trochus* of Ehrenberg according to Dr. Donkin. A careful examination of the figures of *N. Follis* in the 'Mikrogeologie' will show that what has generally been considered *N. Trochus* is probably *N. Follis*. Dr. Lewis, in his paper on "Extreme and exceptional Variation of Diatoms," also refers the so-called *N. Trochus* to *N. Follis* (Professor H. L. Smith concurs in this view), but considers it to be only an extreme variety of *N. serians*, a view with which I am disposed to agree. The variety described by Herr Grunow I think more nearly resembles *N. trinitus* of Lewis, *c. c. née* Smith, and which he says is found in large rivers and brackish water, whilst *N. Follis* is only found in fresh.—F. K.]

*N. Schneideri* Grun.—N. major, valvis lanceolatis obtusiusculis, nodulo centrali oblongo, nodulis terminalibus minutis, sulcis duobus lineae mediae approximatis longitudinalibus, striis punctatis obliquis varie arcuatis 14 in 0·01 mm. longitudinalibus 13 in 0·01 mm. Longit. 0·143–0·145 mm.; latit. 0·042–0·043 mm.

Rare on the pier of Cape Bail.

A well marked *Navicula*; on each side of the median line is a conspicuous line of coarse striae, between which and the striae is a narrow, smooth furrow, connecting it with the subsection Diploneis, but distinguished from it by the striae which cross the valve in curved oblique lines resembling those on *N. oblique-striata* A. Schmidt, Demerara River. Atlas, pl. 13, figs. 41, 42.

[N. *Iridis* has a similar striaion.—F. K.]

* The figure, in the 'Infusionsthieren,' of *N. Trochus* is certainly very like what is usually known by that name; the probable solution is that they are both one species.
Pleurosigma.

Pleurosigma attenuatum, var. Caspia Grunow.—Somewhat smaller, narrower, and less sigmoid than the type species, apices less acute. Striae the same as in P. attenuatum and P. Hippocampus.

Not uncommon in Baku Harbour.

Between P. attenuatum and P. Hippocampus there exists only the unimportant distinction, a difference in the outline of the valve. The Caspian form is distinguished from both by being narrow, less sigmoid, and by its more obtuse apices. The structure of these allied forms under high powers appears very similar; between the strongly-marked lines of beads faint outlines of other beads may be seen. Whether these delicate puncta belong to a second valve or are an optical delusion must remain for the present undecided; it is certain, however, that the valves of Pleurosigma are composed of two layers, which separate when acted upon by long boiling in acids. [I have observed this in P. angulatum.]

[The faint markings here alluded to have been seen by other observers. It is most probable that the valves of Pleurosigma have a similar structure to many other diatoms in possessing what I call “secondary valves,” which in some genera are like, and in others unlike, the primary valve. Schmidt calls them Regenerationshulle.

—F. K.]

P. elongatum, var. gracile Grunow.—Narrower and less sharply pointed than Smith’s figure. Striae somewhat stronger. Oblique striae, 17–18 in 0.01 mm.; transverse, 19 in 0.01 mm. Length, 13–32 mm.; breadth, 0.024–0.025 mm.

Common in Baku Harbour.

Schizonema.

Schizonema (minutum Kg. var. ?) Caspium Grunow.—Sch. minutissimum, filamentis brevissimis, subsimplicibus vel parce dichotome ramosis, inferne irregulariter transverse rugosis, superne laevibus, hyalinis, apicem versus vix conspicuis. Frustula inclusa irregulariter libera disposita, valvis lanceolatis, obtusiuseulis, 0.035–0.052 mm. longis, 0.007–0.008 mm. latis, nodulo centrali parvo oblongo, striis parallelibus 12 in 0.01 mm., in media parte parum distantioribus, subradiantibus, in area minuta nodulum centralem ambiente deficientibus.

On Cladophora in Baku Harbour common.

In S. minutum, Kg. Bac., pl. 23, fig. 5, the frustules occur in straight lines, in which it resembles S. humile Kg.; but in the latter species they principally occur in the chief filament (Haupt-schlauch). In the Caspian form this is never the case.
NITZSCHIACEA.

[We omit the remarks of the author on this family, as we hope his monograph will be in the hands of the diatomist ere long. He unites the genus Tryblionella with Nitzschia, remarking that "long observation of this genus (Nitzschia) had convinced him that the genus Tryblionella was not sufficiently distinct to warrant their separation;" he therefore relegates the following forms to the former genus.—F. K.]


T. punctata W. Sm. Baku Harbour.

T. apiculata Greg. [not W. Sm. as stated by Grunow].


The valves of this species have a longitudinal ridge (längsfläkt), but the transverse striae are not interrupted by it as they are in many other species. By direct light the surface of the valve appears irregularly punctate (shagreen-like); this is still more conspicuous in the closely allied form Nitzschia Brightwellii (Kitton), in which it is clearly shown that the large puncta and the fine regular lines of striae belong to different layers of the valve.

[The striae on T. circumsuta and N. Brightwellii have a certain family resemblance, but the structure of the valve is conspicuously different in the former species. Close to the punctate margin runs a longitudinal V-shaped furrow, forming a ridge near the centre of the valve, which gradually descends towards the margin; a section made across the centre of the valve would be something like three-fourths of the letter W, W. This peculiarity is more or less visible in all the Tryblionelle. Nitzschia Brightwellii has the surface of the valve flat, like all the true Nitzschias. T. circumsuta is elliptic lanceolate. N. Brightwellii is linear lanceolate.—F. K.]

Nitzschia Sigma W. Sm. var. intercedens Grun. Length, 2 mm.; breadth, 0.0065 mm. Keel puncta, 7 in 0.01 mm.

N. Sigma embraces a great number of forms, the extremes of which would not with certainty be relegated to one species were it not that so many intermediate forms exist between them. The following are the principal:

Var. ? maxima Grun. Length, 9 mm.; breadth, 9 mm.; keel puncta, 3-4 in 0.01 mm.; transverse striae, 15-18 in 0.01 mm.

Var. valida Grun. Length, 5 mm.; breadth, 0.017-0.022; keel puncta, 3×5 in 0.01 mm.; transverse striae, 18-21 in 0.01 mm.
Var. consimilis Grun. Length, 0·4 mm.; breadth, 0·013 mm.; keel puncta, 5–7; transverse striae, 23–26 in 0·01 mm.

This form stands midway in the transition from N. Sigma proper.

Var. genuina Grun. Length, 0·25 mm.; breadth, 0·011 mm.; keel puncta, 7–9; transverse striae, 20–24 in 0·01 mm.

Var. ? fasciculata Grun. Length, 0·095 mm.; breadth, 0·036 mm.; keel puncta, 4–6; transverse striae, 28–30 in 0·01 mm. It is the Homoeocladia sigmoidea W. Sm., at least what I have hitherto considered to be that species. I cannot admit that it is a Homoeocladia. It is distinguished from N. Sigma proper by its distant keel puncta as well as by its delicate striation.

Var. intercedens Grun. Length, 0·30 mm.; breadth, 0·009 mm.; keel puncta, 6–7; transverse striae, 28–33 in 0·01 mm.

Var. ? Sigmatella Gregory. Length, 32 mm.; breadth, 0·006 mm.; keel puncta, 8–10; transverse striae, 25–28 in 0·01 mm. Valves more or less strongly sigmoid.

[Nitzschia Sigmatella Gregory is no Nitzschia. Wm. Smith also refers this form to the genus Nitzschia under the sp. name of curvula. Dr. Lewis considers it an extreme form of Surirella, and names it S. intermedia. I have seen authentic specimens of N. Sigmatella and N. curvula W. Sm., and am satisfied that they are identical, and also that they are not allied to Nitzschia excepting in outline.—F. K.]

Var. ? rigida Grun. Length, 0·20 mm.; breadth, 0·008; keel puncta, 8–11; transverse striae, 28–32 in 0·01 mm. According to Dr. Arnott this is Amphipleura sigmoidea W. Sm. (?A. rigida Kg.?). A small form of this is perhaps Navicula lamprooampa Ehr. in Kg. B. Nitzschia flexa Schumann appears to belong here.

Var. anguilla Schumann. Valves acute; 0·045 mm. in length; 0·003 mm. in breadth; keel puncta, 11–12; transverse striae, 29–30 in 0·01 mm.

Var. ? Clausii Hantzsch. Resembles the preceding. Valves with produced rounded apices, 0·045 mm. long, 0·004 mm. broad; keel puncta, 10–11 in 0·01 mm.; striae very delicate.

In this series (in which the distinctions are based upon the size of valve, and distance of keel puncta and striae) may be included some irregular forms.

Var. ? subrecta Grun. Valve lanceolate sigmoid, flexure very slight, often scarcely distinguishable. Length, 0·11 mm.; breadth, 0·008 mm.; keel puncta, 10–11; transverse striae, 28–30 in 0·01 mm.
Var. ? abrudens Grun. Valve linear lanceolate, not sigmoid. Length, 1.105 mm.; breadth, 0.108 mm.; keel puncta, 3-4½; transverse striae, 22 in 0.01 mm.

To the Nitzschia Sigma group belong the following species of Homeoecladia.

H. Kotschyri Grun. Valve, 0.22 mm. long, 0.007 mm. broad; keel puncta, 7-7½; transverse striae, 24 in 0.01 mm.; connecting zone with strong longitudinal striae. Salt Lake Atchin Gholm (leg. Kotschy), growing singly and in tufts.

H. subcohærens Grun. Valve, 0.03-0.045 mm. long, 0.004 broad; keel puncta, 9-10; transverse striae, 33-34 in 0.01 mm., forming slight, delicate, and frequently ramifying threads, without a definite integument. China, Bengal.

Herr Frauenfeld gathered a similar form in Leith, Scotland; it was partly in single frustules and partly in bushy tufts.

Licmophoreæ.

Licmophora flabellata Ag. Kg. Bac. tab. 12, figs. 1, 2, 4; W. Smith, B. D. tab. xxxii. fig. 234.

Var. ? gracillima Grun. Frustules shorter and narrower (0.101 mm. long, 0.009 mm. broad); in the upper part linear, the lower cuneate. Rare.

I have never seen this form in a living state, but only in single frustules. I have also seen no front view, and am therefore unable to decide whether it is allied to L. Remus or L. Romulus.

Coscinodiscææ.

Cyclotella Caspia Grun.—C. minuta, margin tenuissime striato, centro undulato, irregulariter punctato. Diam. 0.18 mm.; latit. marginis, 0.004 mm.; striae radiantes, 21 in 0.01.

Not uncommon in the Harbour of Baku.

Approaches most nearly to C. operculata Kg., but is distinguished by the absence of marginal puncta (spines?) and by its delicate striae. I reckon as Cyclotella only those forms with sharply-defined radiating marginal striae. To distinguish the species requires great caution. C. operculata has a strongly striated margin (striae 16-17 in 0.01 mm.).

C. antiqua W. Sm. is closely allied to C. operculata. It is distinguished by the presence of large triangular excavations near the centre. I have observed many transitional forms in C. operculata var. radiosa.

To the large forms of C. operculata is allied a Cyclotella, which Eulenstein found in the Bodensee (Lake Constance) and named it C. Bodanica, and which I also have seen in soundings from the Traunsee (Lake of Gmunden).

The largest were 0.06 mm. in diameter, with broad (0.015 mm.)
margins; the puncta (spines) submarginal; the radiating striae on
the inner part of the margin 11 in .01 mm., on the outer part
about 13 in .01 mm. The centre is marked with (excepting a
small speck in the middle) delicate radiating puncta.

To C. Bodanica Eulestein joins a not uncommon North
American Cyclotella, which is distinguished by its smaller size
and more distant punctate lines in the centre, and which I at one
time called var. affinis.

C. Dallasiana W. Sm., a common form in brackish water
localities; it is distinguished from C. operculata by its much
greater size, stronger striation of the marginal band (9–12 in
.01 mm.), and a semicircular arch of larger puncta on the edge of
the irregularly punctate centre. [The puncta are distinct on the
specimens from Para River, but their presence is doubtful on those
from many other localities.—F. K.] To C. Dallasiana may possibly
belong Cosinodiscus striatus Kg. and Discoplea sinensis Ehr.
Dr. Arnott, in his note on the genus Cyclotella, 'Q. M. Journal,'
p. 96, to C. Dallasiana. Brightwell's form I know well, and have
seen the original specimen from which the figure (a very indifferent
one) was made. The C. Dallasiana of Smith, of which I have
also seen authentic specimens, differs considerably from C. stylorum.
The marginal band is narrow and finely striate; the large granulate
centre is undulate, but not the whole valve. C. stylorum also
shows this, but in a much less degree. In the latter the marginal
band is much broader, the striae stronger, and the valves much more
robust; it is moreover a much commoner form. I have it from many
North American localities, the Para River mud, South America,
and in mud from the mouth of the Rokelle, Sierra Leone (where Mr.
Brightwell first observed it). I do not know of any British habitat.
C. Dallasiana, on the contrary, is much less common. Smith
found a single specimen in a slide of a gathering from the Medway.
Mr. Roper detected it in Thames mud. It also occurs in the Para
River mud. I know of no other habitats. Those from the Para
are very fine, and the depression and elevation of the centre very
distinct. I am disposed to refer the form called by L. W. Bailey †
Cymatopleura (?) Campylodiscus, to this species. His description is
as follows:—"Large, lateral view almost circular, sometimes broadly
oval (his figure is perfectly circular; the oval appearance might be
caused by the valve being tilted); marginal striae short, close, and
showing under a high power gland-like dots. Lateral valve with
one deep undulation, surface finely striated. Hab. Honeylake
Valley, foot of Sierra Nevada."

* In the work referred to, Dr. Arnott says C. radiata: this is an error; in the
copies of his paper (privately distributed) he alters it to stylorum.
† 'Boston Journ. of Nat. Hist.,' vol. vii. p. 350, pl. 8, fig. f.
He does not notice its presence in the Para mud, where it is not very rare; this perhaps throws suspicion on the identity of the two species. He, however, notices another form, which he thinks is a var. of his C. pulchella (which he says is perhaps the same as stylorum), "and well deserves the name" (l. c. p. 348).

In the work just above quoted is a figure of what he calls C. Kützingiana var. and which he describes thus: "The central portion is large, elevated, and irregularly punctate; the striae are minute and closely radiant, reaching the margin, but interrupted before reaching the margin by a finely undulate circle." His figure very much resembles that of C. Caspia; the centre is, however, larger and more finely punctate; it is also very like the small valves of C. stylorum.

C. compta Ehr. has a resemblance to C. Meneghiniana Kg., but differs in its more strongly granulate centre, and that every second, third, or fourth marginal stria is stouter than the others.

C. Meneghiniana Kg. is identical with C. rectangulata Brev., and like C. Caspia, has no marginal spine, but a more strongly striated margin (7 to 9 delicately punctate striae in .01 mm.). C. Kützingiana W. Sm. appears to be the same species.

C. Kützingiana (Ehr. ?) Chauvin, has, according to original examples from Chauvin, likewise no marginal spines, but a very delicately striate margin (12–14 in .01 mm.). C. Caspia perhaps might be considered a very delicately striate form of this species. In kieselguhr from Domblitten is found a very interesting form with an oval centre and 14–15 marginal striae in .01 mm. This I consider a var. ? of C. Schumannii.

The remaining species of Cyclotella is Discoplea græca (Ehr. ?) Schumann; D. umbilicata (Ehr. ?) Schumann, and D. bipunctata Schumann seem to be of similar structure. Most of Ehrenberg's species are unrecognizable.

C. scotica Kütz. appears, according to the original examples from Constantinople (query, identical with the Scottish form ?), to be no Cyclotella, but a Podosira; the entire valve is very delicately and irregularly punctate, and beset with a single circle of stout spines.

Discoplea annulata Schumann seems to be allied to Melosira Westii, and D. umbilicata Ehr. to be identical with the latter.

Cyclotella bella A. Schmidt.—This is perhaps a Stephanodiscus, or may belong to the genus Coscinodiscus. The same applies to C. punctata W. Sm., C. Astrea and minutula Kg. (these two appear to merge completely into each other). C. Careonensis Eulestein does not belong to C. Astrea as Eulestein considered, but is a good species, characterized by the smooth radiating lines starting from the intramarginal spines, and which pass through the radiate puncta. C. spinosa Schumann is identical.
with *Stephanodiscus Niagare* Ehr. The latter is distinguished from *C. Carcenumis* by the greater number of smooth rays separating the radiating puncta, part only of which proceed from the marginal spines. The lines of puncta in *S. Niagare* are simple in the centre, but consist of two, or at most three, contiguous puncta as they approach the periphery, whereas the lines of puncta in *C. Carcenumis* occur in groups.

Dr. Arnott, in the paper previously quoted (p. 246), says: "Smith unfortunately referred a species (*C. minutula*) obtained in Lough Mourne deposit to *C. antiqua*, a species which does not occur in any of the Irish deposits which I have examined." It is somewhat difficult to imagine how Professor Smith could have mistaken *C. minutula* for *C. antiqua*, the difference being so well marked. I have never been able to find the latter in the Lough Mourne deposit or in the marl Co. Down, but in a deposit from Strangford, Co. Down, it is not uncommon, and I think finer than in the Peterhead deposit.

**Melosireæ.**

*Melosira Borreri* Greville. Sm. S. B. D. tab. 50, fig. 330.

Var. *moniliformis = M. moniliformis* Ag. Kützing, Bacil. tab. 3, fig. 2.

Var. *subglobosa* Grun.—Generally somewhat smaller. Frustules nearly spherical or elongated, the ends slightly flattened.

Var. *octogona* Grun.—Frustules nearly cylindrical, with flat ends and broadly oblique corners, so that the frustules in f. v. appear octagonal.

The three varieties are not uncommon in Baku Harbour.

The filaments are attached by a short stipes to other algae, particularly Cladophora. The frustules are sometimes attached to each other and sometimes connected by a short gelatinous isthmus.

The interesting var. *octogona*, which I for a long time thought a very different species, and which I first found on *Vaucheria javanica* Kg. from Java, had such oblique corners to the cylindrical frustules that I could not recognize its relationship to *M. Borreri*. I afterwards found examples which more nearly approached *M. Borreri* on algae from Upolo, Australia, and Kamtschatka, and which stood between it and the typical *M. Borreri*, from the Lagunes of Venice. The vars. *octogona* and *suborbicularis* are usually more finely punctate than *M. Borreri*; the latter has frequently the central part of the valve smooth, whilst the former almost always have it punctate. The puncta in all the forms of
M. Borrelli are in groups and irregularly disposed, so that the valves have a shagreen-like appearance.

Podosira levis Greg. does not appear to me to differ from P. Montagnei.

P. hormoides (Montagne nec W. Smith) = P. nummuloides Ehr. — According to the original examples, approaches very near to P. Montagnei, and differs principally in the valves being less convex. The structure is very similar, but the puncta are more distant (18 in .01 mm. against 21–22 in P. Montagnei), and the larger puncta are fewer in number and more radiant.

[The arrangement adopted by Herr Grunow is that of Pfitzer, who divides the Diatomaceae into two groups, Placochromatice and Cocochromatice. See O. Meara’s Analysis of Dr. Pfitzer’s System in ‘Q. M. J.,’ vol. xii., n. s., and M. P. Petit’s in ‘M. M. J.,’ vol. xviii.—F. K.]

[Since the preceding paper was written I have received from my friend Herr Grunow the following notes on Cosciodiscus, Hyalodiscus, and Podosira.—F. K.]

Cosciodiscus nobilis Grun.—This is the form I refer to C. regius Wallich in my paper on Diatoms from the Caspian Sea (p. 27*: “Zu dieser durch ein glattes Centrum ausgezeichneter Gruppe gehören noch C. perforatus Ehr. und C. apiculatus Ehr., so wie C. regius Wallich”). It is not C. regius, of which, through the kindness of Mr. Kitton, I have since seen specimens. It is much larger (1·4 mm.) than C. nobilis whose greatest diameter is .54 mm. C. regius has no smooth centre, but a wide space in the middle covered with irregularly disposed puncta, and distant, variously shaped, slightly curved spines. The valves are cylindrical and in s. v. have radiant lines of puncta (3 in .01 mm.). On the cylindrical part (f. v.) the puncta are parallel (5 in .01 mm.) and are separated from the radiant rows by a circular smooth space on the upper edge of the valve. The slightly convex valves of C. nobilis have a smooth centre and closer and smaller puncta (about 7 in .01 mm.) which become hexagonal as they approach the margin, and are separated into groups by radiating lines which are sometimes scarcely visible. I have a smaller form from the Samoan Islands (.06–.13 mm.) with a smooth centre and more radiating puncta (5 in .01 mm.). It resembles C. apiculatus Ehr., and might be named C. apiculatus var. Samoensis. A similar form occurs in the Monterey deposit. C. nobilis was collected by Krock, and communicated to me by Professor Cleve. Pl. XXI., Fig. 1, .10.

* Not noticed in my résumé.—F. K.
C. Gazellae Janisch.—Diameter of valve (as far as can be ascertained from fragments), 1·8 to 1·9 mm., thus exceeding even C. regius in size. Centre smooth, like C. nobilis, but bordered by a circle of small spines similar to those occurring in C. regius; the radiating rows of puncta are somewhat closer than those in that species (6–7 in .01 mm.). Upper edge of valve smooth, precisely as in C. regius. Near the margin numerous short irregularly curved striae (consisting of darker puncta) are visible.

‘Gazelle’ sounding, No. 125, 30° 53’ S. lat., 177° 6’ E. long.; depth 4151 metres. ‘Challenger’ sounding, station 265, depth 2900 fathoms. This form was named by Herr Janisch in remembrance of the scientific expedition made by the German ship, ‘Gazelle,’ in the years 1874–1876. Pl. XXI., Fig. 8 (t 159).

I have found fragments that can only belong to this species in a sample of Nottingham deposit in which it was not uncommon.

C. regius was originally distributed under the MS. name of Rex. It is undoubtedly the largest diatom, excepting C. Gazellae, hitherto discovered. C. regius was first found, in the Bay of Bengal in 1857, by Dr. Wallich. The lighter portions of one of the ‘Challenger’ dredgings (station 265, depth 2900 fathoms) consist almost entirely of fragments of this species. C. nobilis is by no means an uncommon form; I have found it in the stomachs of Noctilucae collected at Gorleston Pier (Norfolk), associated with C. concinnum, for which it is sometimes mistaken. I have also seen it in gatherings from Harwich, Hong Kong, Arafura Sea, and Sea of Java. It differs from C. concinnum in its large smooth area and its more distinct puncta and radiating lines. The rows of puncta in C. concinnum terminate in a small central rosette of small cells. C. tenuis Bailey* is undoubtedly the same species, † as is C. centralis of Schulze.

In ‘Casp. See Algen,’ Herr Grunow says, “Allied to Podosira hormoides is a form which I provisionally call Hyalodiscus maximus. It is without doubt identical with Cyclotella maxima.” In the communication now received are the following additional remarks.

Podosira maxima (Kützing) Grunow, in Cleve and Grunow’s ‘Arctic Diatoms,’ Cyclotella maxima Kütz. ad specem. authent., Hyalodiscus maximus Grun. l. c. ex parte, Actinoptychus interpunctatus Brightwell.—I have adopted with some hesitation

† Bailey (l. c.) also says, “that he has seen from the same locality (Para River) a similar form with three processes.” (I have seen C. radiatus with similar processes.) This is no doubt the same species as that found in the Java Sea. The so-called processes are not constant, and are probably only abnormal growths; see Prof. H. L. Smith, ‘Amer. Journ. of Micr.,’ Aug. 1877.—F. K.
M. Petit’s views in separating *Podosira* from *Hyalodiscus* on account of the granular arrangement of the endochrome, and therefore remove this species from *Hyalodiscus*. The puncta are in radiant and oblique lines 13–15 in '01 mm. in the middle and 18 on the margin of the valve. The beginning of new rays of puncta is mostly marked by a small blank space which appears under certain focussing like a small dark spot. The centre of the valve is more irregularly punctate, and occasionally a very small irregularly bordered umbilicus is visible. Californian specimens reach a diameter of '24 mm. and have somewhat coarser puncta (12–14 in '01 mm.), but it is impossible to separate them into distinct species, and they can only be considered as a variety “Californica” of *P. maxima*. Pl. XXI., Fig. 2 a (²⁰₀₀₀⁄₁), authentic specimen of *Cyclotella maxima* Kg. from Peru (leg. Hayne). Fig. 2 b, structure of the inner part of the valve (¹⁵₁₀₀⁄₁). Fig. 2 c, structure of the margin (¹⁵₁₀₀⁄₁). Fig. d, two frustules cohering by a broad connecting membrane, of rare occurrence, but which evidently shows how nearly allied *P. maxima* is to *P. hormoides*. The two frustules exhibit the granular arrangement of the endochrome (²⁰₀₀₀⁄₁).

*P. hormoides* Montagne (nee Smith) is nearly allied to *P. maxima*, and differs only by its smaller size, more convex valves, and somewhat closer puncta. The cell contents are granular. As with other diatoms, we find in some gatherings of *P. hormoides* and *P. maxima* certain specimens not varying much in size, which lead to the conclusion that we have to do with distinct species; but in gatherings from other localities intermediate forms appear, and I have scarcely any doubt that *P. maxima* is only a large form of *P. hormoides*. Pl. XXI., Fig. 7 a (⁰₀₀₀⁄₁), authentic specimen from Lima. Fig. 7 b (¹⁵₁₀₀⁄₁), structure of the valve.

*P. ambiguа* Grun. in Cleve and Möller, 'Arctic Diatoms,' (*Hyalodiscus stelliger* Grun. nee Bailey Novara ex parte.)—This species is distinguished from *P. maxima* by a much larger and more sharply defined dark umbilicus, its smaller size and somewhat closer rows of puncta (15–17 in '01 mm. in the middle of the valve). Common at the island of St. Paul, Cape of Good Hope, Kerguelen’s Land, &c., and is very constant in these localities, where *P. maxima* does not occur. I have seen specimens of *P. maxima* from other localities with a small umbilicus, and other intermediate forms may probably be detected. The cell contents are granular. *Hyalodiscus subtilis* is distinguished by its much finer striaion and coherent endochrome, which sometimes form radiant lobes easily visible even in dried specimens. A very large form of *P. ambiguа* (var. *Kamschatica*), attaining a diameter of
274 mm. (umbilicus 0.035 mm.), occurs rarely in the Sea of Kamtschatka. From St. Paul, Southern Ocean, Pl. XXI., Fig. 4 a (1.0). Fig. 4 b, c (1.5:1.0), structure of inner part and margin of valve.

P. stellulifera Grun., 'Casp. See Algen,' p. 35.—This form is distinguished from P. hormoides and P. maxima by a circle of larger puncta (spines?) near the margin of the highly convex valve which has a broad border. The stellate appearance of the blank dots is not always so obvious as in the specimen here represented, and I have seen a specimen where the inner part very much resembled P. hormoides. Pl. XXI., Fig. 3 (1.0), Monterey deposit.

[In the 'Casp. See Algen,' p. 35, is the following additional description. Diameter of valve, 0.08 mm. With the exception of the irregularly punctate centre (about 0.01 mm. in diameter), the valve has delicate radiating puncta (17-18 in 0.01 mm.). The larger puncta are irregularly scattered, and have a peculiar stellate appearance. The cell membrane is somewhat thick. The large marginal puncta (spines?), 4 in 0.01 mm. This form, which occurs in Herr Weissflog's collection, I name P. stellulifera.]

P. Argus Grun., 'Casp. See Algen,' p. 35.—Valve highly convex; diameter, 0.107 mm.; cell membrane very thick. The inner concave valve is delicately striate; striæ radiant (16 in 0.01 mm.). On the convex side is a sharply defined circular space, with a finely dentate margin, within which are three to four concentric circles of large oval dots (depressions?). California, in the collection of Herr Weissflog. Pl. XXI., Fig. 6 a (1.5:1.0); 6 b, c, structure of inner portions and of the broad border of the valve.

Hyalodiscus scoticus (Kg.) Grun., in Cleve and Grunow's 'Arctic Diatoms.' (Cyclotella scotica Kg. ad specim. authent. Podosira hormoides Wm. Sm. nec Mont. P. Frankhlini Grun., 'Casp. See Algen,' p. 34.) I have, through the kindness of Dr. Van Heurck, seen authentic specimens of C. scotica Kg. from two Scotch localities. I am unable to say whether the C. scotica from Constantinople, to which I alluded in the 'Casp. See Algen,' p. 30, is identical, my preparation being mounted dry and insufficiently cleansed, but the Scotch specimens are without doubt the P. hormoides of W. Smith. I have never seen the granules in the endochrome of this very common species, and there can scarcely be any doubt of its belonging to the genus Hyalodiscus. A stronger reason for uniting it to this genus is the absolute impossibility of specifically distinguishing it from H. subtilis. Anyone who doubts this has only to carefully examine the Californian gatherings, or No. 2 of Cleve and Möller's from Finnmark, in which every possible intermediate form may be seen, to
be convinced of the correctness of this view. Pl. XXI., Fig. 5 a, b (9°9°), Cyclotella scotica Kg. from Scotland; 5 c (15°7°), structure of valve.

In a future paper I hope to give delineations of some forms of H. levis Ehr., H. radiatus (Pyxidicula radiata O'Meara), and H. maximus Petit.