

June 29th, one cast skin was removed.

July 4th, one	„	„
„ 9th, one	„	„
„ 11th, one	„	„

At this date four individuals were given to a friend, so that the number was reduced to four.

July 15th, one cast skin was removed.

„ 17th, one	„	„
„ 18th, one	„	„
„ 21st, one	„	„
„ 30th, one	„	„
August 3rd, one	„	„
„ 4th, two	„	„
„ 12th, one of the prawns died during the moulting.		
„ 14th, one cast skin was removed from the aquarium.		
„ 21st, one	„	„
September 2nd, one	„	„

So that the period appears to vary from twelve to twenty-four days. This variation may depend upon the quantity of food taken by the respective individuals, and also on the varying temperature of the aquarium, which, from its small capacity and other circumstances, is very liable to be readily affected by the heat of the sun through the day, and the effects of radiation during a clear night. I may mention that if these cast skins are not removed from the water, the prawns will devour all the smaller and softer parts, as the legs, the palpi, and the false or swimming feet, with great rapidity.

I hope in a future communication to add several observations on other varieties of the *Palæmonidæ*.

Apothecaries' Hall, Blackfriars, March 12, 1855.

XXIII.—*Report on a Collection of Diatomaceæ made in the District of Braemar by Professor Balfour and Mr. George Lawson.* By R. K. GREVILLE, LL.D. &c.*

[With a Plate.]

IN the course of the autumn of last year, Professor Balfour made a botanical excursion with a small party of friends and pupils to the mountainous district of Braemar; and his attention having been directed for some time past to the Diatomaceæ, he, and Mr. George Lawson made a considerable number of gatherings in a great variety of situations, from the patches of snow which even in summer are always to be found in certain nooks and

* Read before the Botanical Society of Edinburgh, Feb. 8, 1855.

corners of Ben-na-Muic-Dhui, down to the valleys of the Dee, Glen Callater and Glen Tilt. The gatherings were subsequently placed in my hands, with a request that I would examine and report upon them to the Botanical Society. I have accordingly submitted the collections to a patient investigation, and in now presenting my account of them, I have to acknowledge the kind assistance of the Rev. William Smith, Professor of Natural History in the Cork College, to whom I referred the new and dubious forms as the individual most competent to give an authoritative decision in such cases.

The following is a general list of the species collected, which, although not so extensive as might have been anticipated, is rich in rare and interesting forms. The new species, and those recently or for the first time added to the British flora, are printed in *italics*.

- | | |
|---|---|
| Epithemia turgida (<i>Ehr.</i>). | Pinnularia major (<i>Kütz.</i>). |
| — alpestris, <i>W. Sm.</i> | — viridis (<i>Ehr.</i>). |
| — rupestris, <i>W. Sm.</i> | — hemiptera, <i>Bréb.</i> |
| — gibba (<i>Ehr.</i>). | — acuminata, <i>W. Sm.</i> |
| Eunotia Arcus (<i>Ehr.</i>). | — lata (<i>Bréb.</i>). |
| — incisa, <i>Greg.</i> | — alpina, <i>W. Sm.</i> |
| — gracilis, <i>W. Sm.</i> | — late-striata, <i>Greg.</i> |
| — monodon, <i>Ehr.</i> | — radiosa (<i>Kütz.</i>). |
| — diodon, <i>Ehr.</i> , three forms. | — acuta, <i>W. Sm.</i> |
| — <i>Camelus</i> , <i>Ehr.</i> | — tenuis, <i>Greg.</i> |
| — triodon, <i>Ehr.</i> , two forms. | — divergens, <i>W. Sm.</i> |
| — tridentula, <i>Ehr.</i> | — stauroneiformis, <i>W. Sm.</i> |
| — tetraodon, <i>Ehr.</i> | Stauroneis Phœnicenteron (<i>Ehr.</i>). |
| — quaternaria, <i>Ehr.</i> | — gracilis, <i>Ehr.</i> |
| Cymbella cuspidata, <i>Kütz.</i> | — anceps, <i>Ehr.</i> |
| — affinis, <i>Kütz.</i> | Synedra lunaris, <i>Ehr.</i> |
| — ventricosa, <i>Kütz.</i> | — radians, <i>W. Sm.</i> , with vars. β . |
| — Scotica, <i>W. Sm.</i> | and γ . |
| — Helvetica, <i>Kütz.</i> | Cocconema lanceolatum, <i>Ehr.</i> |
| — lunata, <i>W. Sm.</i> , nov. sp. | — cymbiforme, <i>Ehr.</i> |
| — æqualis, <i>W. Sm.</i> , nov. sp. | — Cistula, <i>Ehr.</i> |
| Amphora ovalis, <i>Kütz.</i> | Gomphonema acuminatum, <i>Ehr.</i> , |
| Cocconeis Pediculus, <i>Ehr.</i> | with var. γ . |
| Cyclotella operculata, <i>Kütz.</i> | — dichotomum, <i>Kütz.</i> |
| Surirella linearis, <i>W. Sm.</i> | — tenellum, <i>W. Sm.</i> |
| — biseriata, <i>Bréb.</i> | — capitatum, <i>Ehr.</i> , with var. β . |
| Cymatopleura Solea (<i>Kütz.</i>). | — olivaceum (<i>Lyngb.</i>). |
| Navicula cocconeiformis, <i>Greg.</i> , | — intricatum, <i>Kütz.</i> |
| nov. sp. | Meridion circulare, <i>Ag.</i> |
| — rhomboides, <i>Ehr.</i> | — constrictum, <i>Ralfs.</i> |
| — crassinervia, <i>Bréb.</i> | Himantidium Arcus, <i>Ehr.</i> |
| — serians, <i>Kütz.</i> | — majus, <i>W. Sm.</i> |
| — firma, <i>Kütz.</i> | — pectinale (<i>Dillw.</i>). |
| — ovalis, <i>W. Sm.</i> | — undulatum, <i>W. Sm.</i> |
| — angustata, <i>W. Sm.</i> | Odontidium hyemale (<i>Lyngb.</i>). |
| — gibberula, <i>Kütz.</i> | — mesodon (<i>Ehr.</i>). |
| — cryptocephala, <i>Kütz.</i> | — anomalum, <i>W. Sm.</i> , nov. sp. |

Odontidium Tabellaria, <i>W. Sm.</i>	<i>Diatomella Balfouriana</i> , <i>W. Sm.</i> ,
— ? <i>Harrisonii</i> , var. β , <i>W. Sm.</i>	nov. gen.
Denticula tenuis, <i>Kütz.</i>	Tabellaria flocculosa (<i>Roth.</i>)
— obtusa (<i>Lyngb.</i>)	— fenestrata (<i>Lyngb.</i>)
— sinuata, <i>W. Sm.</i>	Melosira nivalis, <i>W. Sm.</i>
Fragilaria virescens, <i>Ralfs.</i>	— <i>distans</i> , <i>Kütz.</i>
Achnanthidium flexellum, <i>Breb.</i>	Orthosira spinosa, <i>W. Sm.</i> , nov. sp.
— lanceolatum, <i>Breb.</i>	— orichalcea (<i>Mert.</i>)
Diatoma tenue (<i>Ag.</i>)	

I shall now proceed to notice the new species and a few others of novelty or rarity.

Eunotia Camelus, Ehr.? Pl. IX. fig. 1. Length $\cdot 0009''$.

This is recorded in Kützing's 'Species Algarum,' published in 1849, as a native of the two widely separated localities, Cayenne and Labrador. It occurred in a recent state in one of the Braemar gatherings, and has been observed by Professor Gregory in others from Carr Bridge and Ben Nevis, and by Professor Walker-Arnott in one from Fell End, Lancashire. I have likewise seen it fossil, but very rarely, in Lapland Bergmehl. This diatom, in the opinion of the Rev. Professor Smith, is certainly the *E. Camelus* of Ehrenberg and Kützing, notwithstanding the inaccurate figure given by the latter, in which the base of the frustule is represented as concave. In the form under consideration the base is so remarkably straight, that it is difficult to conceive how an artist could have made such an error in its delineation. Professor Gregory, moreover, informs me that he has seen in the Mull deposit a form exactly corresponding with Kützing's figure; so that it is possible that two species may have been confounded together. Under these circumstances I consider it advisable to refer our diatom doubtfully to *E. Camelus*, and to add a figure for the guidance of the student. I have unfortunately no access to Ehrenberg's illustration (Amer. t. 2).

Eunotia tridentula, Ehr. Pl. IX. fig. 2. Length $\cdot 0005''$.

Found along with the preceding. It belongs to a little group of minute, linear forms, quite distinct from the more robust and convex series having the same number of undulations. The only station given by Kützing for this species is America. Dr. Gregory has observed it in a great variety of gatherings from Banffshire; Carr Bridge, Morayshire; from the Findhorn and from Ben Nevis. Professor Smith obtained it also last year at a high elevation in Auvergne. It is probably therefore of general distribution.

Eunotia quaternaria, Ehr. Pl. IX. fig. 3. Length $\cdot 0007''$.

A species scarcely to be distinguished from the last, except by

the additional tooth or undulation. Cayenne is the only locality recorded by Kützing, but, like the preceding, it has probably escaped notice on account of its minuteness. Since I detected it along with *E. tridentula* in one of the Braemar gatherings, Professor Gregory has observed it in those from Carr Bridge and Ben Nevis. Dr. Walker-Arnott has also met with it, and it is in Professor Smith's list from Auvergne. In this form, as well as in *E. tridentula*, the base is slightly concave, and there is a small undulation near each end.

Eunotia incisa, Greg. Length ·0008".

First observed and well figured by Professor Gregory in his account of the rich fossil diatomaceous earth of Mull, published in the 'Journal of Microscopical Science.' He has since found it in various recent gatherings; in fact, it appears to be very generally diffused throughout the alpine districts of this country. It is of frequent occurrence in the Braemar gatherings. I have likewise seen it in fossil deposits from the United States. Professor Smith, I believe, entertains some doubts whether this diatom be a genuine *Eunotia*; and it must be confessed that it has much the aspect of a *Himantidium*, bearing a close resemblance in form to *H. Veneris*, Kütz., as Professor Gregory has remarked. Kützing however admits it as a new species, and as the striation is that of a *Eunotia*, I feel disposed to retain it as such. Although not strictly speaking a novelty, I refer to it in this place chiefly in order to correct a slightly erroneous view regarding the outline. In examining the frustule under a power of three or four hundred diameters, there does appear to be an incision or notch near each extremity of the frustule; hence the specific name. But on the application of higher powers the apparent notch is found to be a deception caused by the nodule and a slight contraction, commencing at the nodule and continued to the apex. It is, in fact, the nodule interrupting the marginal continuity of the frustule, which causes the appearance of an incision. I find among living specimens quite as extensive a range of form as is represented by Professor Gregory in the paper above referred to.

Cymbella æqualis, W. Sm. Pl. IX. fig. 4. Length ·0014".

A very distinct new species, so nearly symmetrical as to be liable at a hasty glance to be taken for a *Navicula*. There is however a curve at the shortly produced, obtuse extremities. The striæ are fine, but not very close. This form was abundant in one gathering only, composed of coarse black peaty mud extremely difficult to clean.

Cymbella lunata, W. Sm. Pl. IX. fig. 5. Length $\cdot 0013''$.

Another new species, about the same size as the last, but the striæ are much stronger and more distant, and the shape narrow and elongated. The larger segment of the valve has a gentle and equal curve, while the smaller segment is nearly straight, a character sufficient of itself to distinguish it from the larger *C. Helvetica*, which is ventricose. From *C. Scotica* it is separated by the coarse striæ and the obtuse ends.

Navicula cocconeiformis, Greg. MS. Pl. IX. fig. 6.

Length $\cdot 0008''$ to $\cdot 0011''$.

Navicula nugax, W. Sm. MSS.

A new species, somewhat similar in outline to *Achnanthidium flexellum*, with striæ so fine that I have not succeeded in resolving them. I find that this species has been known for above a year to Professor Gregory, who had both sketched and named it previous to my detection of it in the Braemar gatherings. He had obtained it from Elchies and various other places in Banffshire, and latterly from Loch Leven.

Pinnularia hemiptera, Bréb.

This species, found, as Professor Smith informs me, not unfrequently since the first volume of his work was published, I met with almost pure near the Pass of Killiecrankie early last summer. It was obtained by squeezing the moisture out of *Sphagnum*, and along with it occurred an undescribed species, *Pinnularia gracillima*, Greg. MSS. In the autumn I again found it in the mountainous district of Redesdale in Northumberland, by resorting to the same process, and singular enough, *P. gracillima* was there also, with scarcely any intermixture of other diatoms. *P. hemiptera* greatly resembles *P. viridis*, but is distinguished from it by the much finer striæ, and perhaps also by a more strictly linear outline. It was scarce in the Braemar gatherings, and unaccompanied by *P. gracillima*.

Pinnularia late-striata, described by Professor Gregory from the Mull deposit, and found recent by Professor Smith in Grassmere, is scattered through a number of the Braemar gatherings, generally associated with other of the alpine *Pinnularia*, as *P. lata*, *P. alpina*, *P. divergens*, &c. Though not plentiful anywhere, it seems to be generally diffused. Professor Gregory informs me that it occurs in more than half of the very numerous Scottish gatherings which he has examined. Professor Smith likewise found it in Auvergne.

Odontidium anomalum, W. Sm. Pl. IX. fig. 7-9.

Odontidium anomalum, W. Sm., Ann. of Nat. Hist. vol. xv. p. 7.
pl. 1. fig. 8.

A new and very interesting diatom, discovered last summer by Professor Smith in the Cevennes at an elevation of about 4000 feet, and by Professor Balfour and Mr. Lawson in Braemar immediately afterwards. It was exceedingly scarce, and mixed with *Melosira distans*, Kütz. This species is described and figured by Smith in his paper on the Diatomaceæ of the South of France, recently published in the 'Annals of Natural History.' Its chief character rests on the linear valves, constricted towards the obtuse extremities; but the very peculiar structure of the valves as seen in the front view affords besides a most conspicuous distinction. This structure arises from the presence of "internal cells," which Professor Smith regards as an abnormal condition of the filament, because frustules of the more usual description (as occurring in other species) may be occasionally found side by side with others containing internal cells. Theoretically, this view may be correct; but it is certain that in the only specimens hitherto observed in France and Scotland, the filaments are almost exclusively composed of frustules containing the internal cells, and which thence derive a most marked character; while the normal frustules are, as Professor Smith justly remarks, rarely to be detected. It would be a very curious fact if this diatom should prove to be known everywhere in an abnormal condition—and that that condition should be one of increased development. This so-called abnormal structure—which according to my view differs considerably from that exhibited in the figure which illustrates Professor Smith's paper—is very beautiful under the microscope. Each frustule in the figure referred to contains an internal cell, elliptical or linear-elliptical (as the filaments happen to vary in breadth from .0006" to .0015"), converging to a point at each end, and traversed longitudinally by a median line. The following, on the contrary, is the result of my own observations, made, I may add, before I saw Professor Smith's paper. When a frustule becomes abnormal it is divided by an elliptically curved line, the centre of the curve approaching very close to the lateral margin, while the extremities of the line terminate nearly in the middle of each end of the frustule. On each side of the termination of the line are situated the minute nodules which are present in every condition of the diatom. A single frustule is thus subdivided into two cells, as will be more readily perceived by referring to the figures. The same arrangement precisely, takes place in the adjoining frustule, only the direction of the line is reversed; so that when

the two frustules are viewed in connexion, the lines form a symmetrical elliptical figure truncated at each end, for they are very far from converging to a point. The median line of the "internal cell," represented by Professor Smith's artist, is in fact the junction of two frustules. A somewhat similar arrangement appears to exist in *Meridion Zinckeni*, Kütz.*, as far as I can judge from the figures given by the author, for I have not had an opportunity of examining specimens myself.

Among the interesting acquisitions made during the excursion, the first place must unquestionably be given to a very minute form discovered in both Glen Callater and Canlochlan, but extremely rare. Judging from the general character of the frustules, Professor Smith was inclined to think that they belonged to a filamentous species, but being unfortunately all in a scattered state, he could not with any certainty assign its place in the system. He therefore, with some doubt, bestowed upon it the provisional name of *Grammatophora? Balfouriana*. Having had occasion to examine this most remarkable diatom minutely in the preparation of this report, I have come to the conclusion that Professor Smith is correct in referring it to one of the filamentous groups. My reasons for coinciding in this view are—1. That, apart from the peculiar structure, which of itself is almost sufficient evidence, there is a greater variation in the relative length and breadth of the frustules than would be likely to occur in other diatomaceous groups. In some the length is more than equal to twice the breadth, while others are exactly square, and between these two extremes every gradation may be observed; resembling in this inequality, *Fragilaria*, *Odontidium*, *Grammatophora*, and other filamentous genera having plano-compressed frustules. 2. Two nodules exist at each extremity of the frustule, as in *Odontidium*, *Fragilaria*, &c.

With reference to the genus of this diatom I have ventured to take a more decided course, as it does not appear to me that it can be regarded even doubtfully as a *Grammatophora* without doing violence to that genus. The vittæ in the frustules of *Grammatophora* are, to borrow a portion of Kützing's definition, "medio interruptæ, plus minusve curvatæ;" they are, in fact, with the exception of this interruption, continuous throughout; whereas in the form under consideration they are as much interrupted at each end as they are in the middle, and are be-

* Professor Gregory informs me that this diatom was pointed out to him by De Brébisson in a gathering made by me last summer at Duddingston Loch. I had not observed it myself, and Dr. Gregory's slide containing it is not at the present moment accessible. Dr. Gregory has since observed it in some Banffshire gatherings.

sides not in the slightest degree curved. Two internal septa run through the frustule, as in *Grammatophora*, and upon these the so-called vittæ are developed, but which, from the causes above mentioned, are so much abbreviated as to resemble elongated coloured nodules; for in the shorter frustules their form becomes merely oblong or even oval. Unquestionably there is an evident affinity with *Grammatophora*; but upon the whole, seeing that, besides the differences already referred to, all the known species of the last-named genus are marine, I hope it will not be considered as a rash proceeding if I propose to establish a new genus for the reception of this curious fresh-water diatom.

DIATOMELLA, nob.

Frustules quadrangular (forming at first a plano-compressed filament, at length separating). Coloured vittæ two, straight, interrupted in the middle and at each end. Length $\cdot 0004''$ to $\cdot 0010''$.

Diatomella Balfouriana. Pl. IX. fig. 10-13.

Grammatophora? *Balfouriana*, W. Sm. MSS.

The general characters of this minute species are visible without difficulty under a magnifying power of 400 or 500 diameters. The frustule is surrounded by a thickened border, and is divided into three more or less equal parts by two straight internal septa or bars not clearly defined externally, on each of which, at about equal distances between the middle and ends, are situated two dark-coloured short vittæ, while at the ends themselves the septa terminate in minute nodules. In the most elongated frustules the coloured vittæ are linear, but they contract in proportion as the frustules diminish in length, until they lose the character of vittæ and resemble nodules. The middle portion of the frustule is blank, while the spaces between the septa and the margin are transversely striated, but it requires a power of at least 600 diameters to bring this character out. The frustules of this diatom are not unfrequently seen in the process of self-division, and one of these I have represented in the plate. It will be perceived that a narrow separation has already taken place, and that in each portion the lateral striæ are apparent, while as yet there is only one septum. The next stage in the process would probably be the division of the single septum into two, followed by the development of the blank middle space.

Melosira nivalis, W. Sm.

A new species previously determined by Professor Smith, and which will appear in the forthcoming second volume of his work.

I am not aware of the original station. It is scattered through two or three of the Braemar gatherings, and I found it near the Pass of Killiecrankie last summer. Professor Smith is, I believe, under an impression that *Coscinodiscus minor* may turn out to be the sporangial form of this species.

Melosira distans, Kütz.

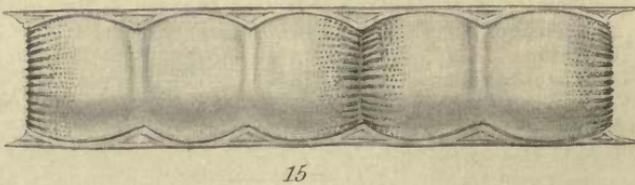
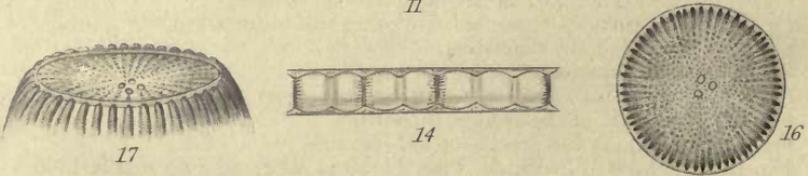
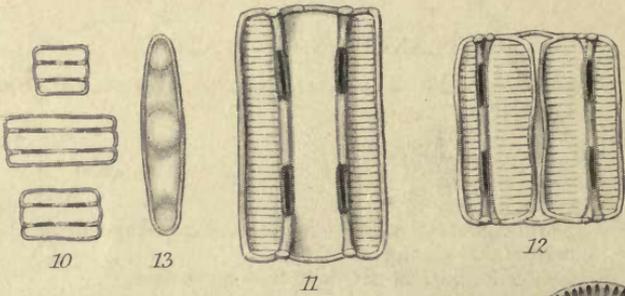
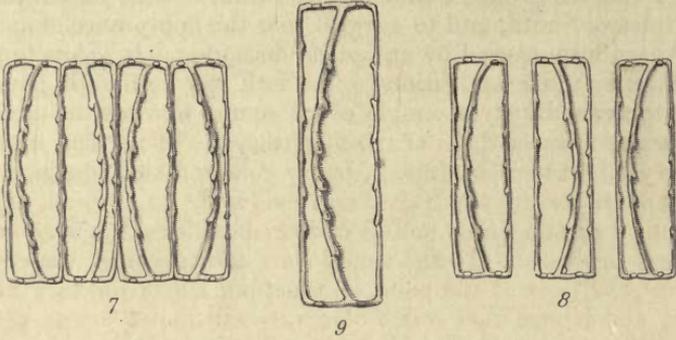
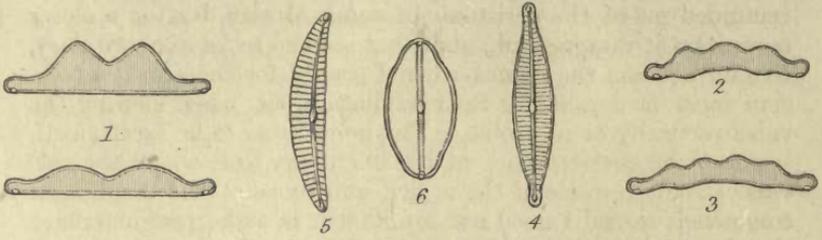
I was not aware of this diatom having been previously collected in this country, until Professor Gregory recently informed me that he had noticed it in a gathering from Elgin, as well as in some other collections from the north of Scotland, but believing that it was already known as a British species, he had not drawn attention to it. The gathering placed in my hands is remarkably pure, and agrees exactly with slides in my possession from Bilin and Habichtswald, stations given by Kützing. Professor Smith found it also in Auvergne. It is much to be regretted that a note of the precise locality of this diatom was not preserved, as it is the only station for the rare *Odontidium anomalum*, which was found intermixed with it.

Orthosira spinosa, W. Sm. Pl. IX. fig. 14–17.

Orthosira spinosa, W. Sm., Ann. of Nat. Hist. vol. xv. p. 8. pl. 1. fig. 12.

This is another instance of the all but simultaneous discovery of a new species by Professor Smith in France, and Professor Balfour in Scotland. It was collected by the former on Mont Dore, at an elevation of 4236 feet; by the latter in a locality where it would be produced under a corresponding temperature, if we take into consideration the difference of latitude. The structure of this plant is very interesting. The outer wall of the cylindrical filament is continuous, but separates spontaneously at the junction of the valves, where the inner wall contracts in a rounded manner. The valve is here beautifully striated, the striæ being coloured and semi-opaque at the junction, but soon becoming colourless, and gradually disappearing in the transparent tissue of the valve. When the orifice of the valve is examined, it is found to be closed by a concave diaphragm marked with radiating striæ, coloured at the circumference and pale and moniliform as they approach the centre, where there are usually three or four minute perforations. The peculiar character of the species lies, according to Professor Smith, in the valves or frustules being furnished at the point of junction with a fringe of spine-like processes; but I confess that I have been unable to make out this character to my satisfaction. I





have indeed occasionally thought that I perceived a fringe which reminded me of the peristome of some Mosses, but on a closer inspection it disappeared; and what seemed to be extraordinary, I could not find the spines when I sought for them in the position most favourable for their exhibition, viz. when viewing the valve vertically or in profile. The point then to be ascertained, seems to be the structure at the boundary line, where the valvular striæ terminate at the orifice, and those of the diaphragm commence. And I need not say, that it is with great deference that I venture to take a different view from so high an authority as Professor Smith, and to suggest that the appearance of spines may have been caused by an optical deception. It seems to me, after reiterated examinations with both low and high powers, that the valvular striæ simply curve round towards the edge of the orifice to meet those of the diaphragm. The striæ (or vittæ as they might well be called), being coloured and conspicuous, and the tissue of the valve very pellucid, do present, when viewed in certain lights and in certain directions, the semblance of short processes. In the view I have now given of the structure of the valve at the point of junction, I may however be in error, and I hope that other observers will endeavour to determine the question. The filaments of this species vary in diameter from $\cdot 0007''$ to $\cdot 0015''$.

EXPLANATION OF PLATE IX.

- Fig. 1. *Eunotia Camelus*? The lower figure represents an unusually depressed form.
- Fig. 2. *Eunotia tridentula*.
- Fig. 3. *Eunotia quaternaria*.
- Fig. 4. *Cymbella æqualis*.
- Fig. 5. *Cymbella lunata*.
- Fig. 6. *Navicula cocconeiformis*. This and all the above as seen under a power of 600 diameters.
- Fig. 7. Portion of a filament of *Odontidium anomalum*.
- Fig. 8. Three frustules separated, but otherwise in their relative position. Magnified 400 diameters.
- Fig. 9. A single frustule more highly magnified.
- Fig. 10. Frustules of *Diatomella Balfouriana*; magnified 400 diameters.
- Fig. 11. A frustule of the average proportion.
- Fig. 12. Frustule in the process of self-division.
- Fig. 13. Side view of frustule. Figs. 11-13 as seen under a power of 1000 diameters.
- Fig. 14. Portion of filament of *Orthosira spinosa*; magnified 300 diameters.
- Fig. 15. Portion of filament showing the character of the striation, &c.
- Fig. 16. The diaphragm as seen vertically.
- Fig. 17. Orifice of valve with marginal striation, closed by the diaphragm.