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Part I.

Jan. 1854.

OBSERVATIONS  
 ON THE  
 DIATOMACEOUS DEPOSIT  
 OF  
 M U L L.

WITH  
 REMARKS ON THE TRUE VALUE OF SPECIFIC CHARACTERS,  
 AND  
 ORIGINAL FIGURES DRAWN FROM NATURE,  
 OF SEVERAL  
 NEW SPECIES AND INTERESTING VARIETIES.

BY WILLIAM GREGORY, M.D., F.R.S.E., &c.  
 PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF EDINBURGH.

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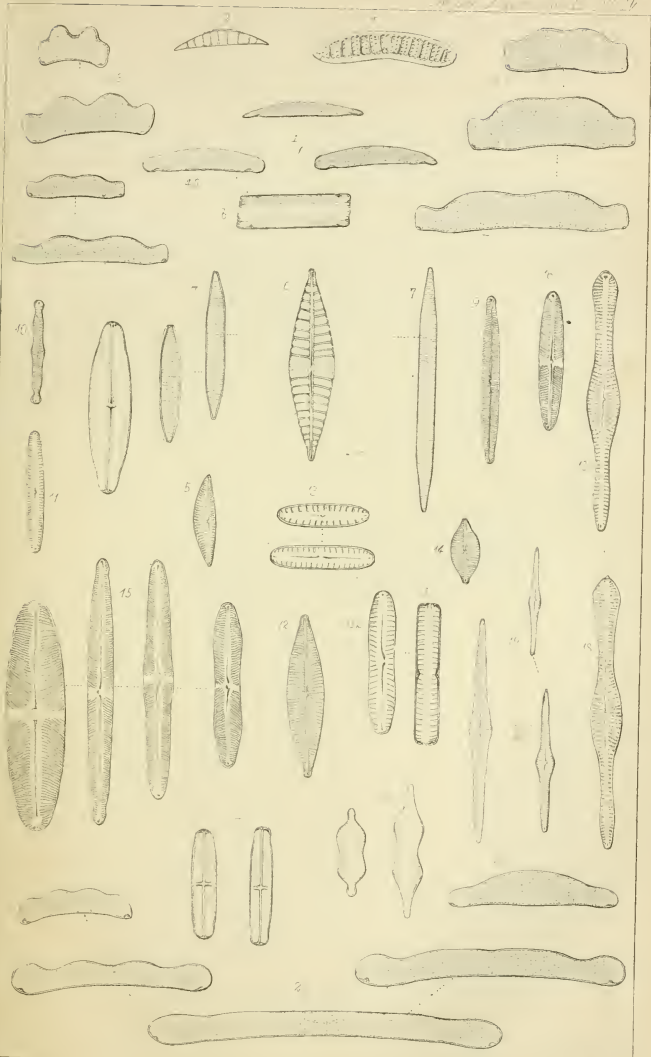
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## DESCRIPTION OF PLATE.

Fig.

- 1.—A variety of *Epithemia Argus*.
- 2.—A valve of *Epithemia gibberula*?
- 3.—Seven varieties of *Eunotia bigilba*, Kütz.
- 4.—*Eunotia incisa*, n. sp.
- 4  $\beta$ .—Variety  $\beta$ , with rounded apices.  
b. Front view.
- 5.—A *Cymbella*, qu. ? a variety of *C. Helvetica* ? or a n. sp. ?
- 6.—Remarkable variety of *Surirella Craticula*.
- 7.—*Tryblionella angusta*. Three modifications.
- 8.—*Navicula affinis*.
- 9.—*Pinnularia tenuis*, n. sp.
- 10.—*Pinnularia undulata*, n. sp.
- 11.—*Pinnularia parva*, n. sp. ?
- 12.—*Pinnularia*, uncertain, allied to *P. radiosa* or *P. peregrina*.
- 13.—*Pinnularia latestriata*, n. sp.
- 13  $\beta$ .—Var.  $\beta$ , with front view.
- 14.—*Pinnularia exigua*, n. sp. ?
- 15.—*Pinnularia divergens* ? four varieties.
- 16.—*Pinnularia stauroneiformis*.
- 17.—*Stauroneis rectangularis*, n. sp.
- 18.—*Gomphonema Brebissonii* ? n. sp. ?
- 19.—*Gomphonema* (?) *Hebridense*, n. sp.
- 20.—A variety of *Himantidium Arcus*, or possibly of *H. majus*.
22. .—Remarkable sporangial pustules of *Odontidium Tabellaria*.
- 21.—4 varieties of *Himantidium bideus*







## ON THE DIATOMACEOUS DEPOSIT OF MULL.

THE two notices which have already appeared in the Journal have made known the occurrences, in this deposit, of about ninety distinct forms, of which two were noted as being new to science. But the continued and diligent examination of it, which I have carried on during my residence abroad last summer, has led to results so much more remarkable, that I have to beg of the readers of the 'Journal' to regard those papers as merely introductory to a more satisfactory and complete account of this interesting deposit. This I shall now attempt to give; but the limits of this paper, and of the illustrative plate, will not allow me to complete it at this time, and a large portion of my materials must therefore be reserved for a subsequent number of the 'Journal.'

My observations have been made on a very large number of excellent slides; and the method of search which I have found to answer best is the following, which I briefly notice here, because, by a slight alteration in the usual mode of keeping notes of what is seen, it is easy afterwards to find any required object, by the help of these notes alone:—

I always begin, then, the examination of a slide at the right-hand side, and carry it on by successive vertical sweeps, the first and all the odd numbers being downward sweeps (apparently, really upward), and the even numbers upward ones. I find this a great help to the memory. If in the first sweep I notice nothing remarkable, it is simply recorded thus | 1 |. If I see in it a peculiar or very fine specimen, I note this after the number, prefixing certain abbreviated signs to show whether it be above, or below, or near the middle horizontal line, or near the top or bottom of the sweep. Thus, | 1. B m, *P. latestriata* S. V. fine. N b, *S. Craticula* | signifies that in sweep 1, below the middle line (really, not apparently), I find a fine S.V. of the new *Pinnularia*, and near the bottom, a *Surirella Craticula*. Having made the first sweep, I now shift to the second, and the extent of shift is, as nearly as possible, half a diameter of the field. I use for searching, either Ross's 1-4th or Smith and Beck's 1-5th, with the 2nd eye-piece. This high power is necessary on account of the numerous small forms; of course I note the object-glass used, or by means of the draw-tube make the field of the 1-4th equal to that of the 1-5th. I go on in this way over the whole slide, noting every remarkable form, and as the number of sweeps varies, according to the diameter of the cover, from 60 to 80 and upwards, it is easy to see that the exploration of a full slide is a matter of considerable time and labour. But the notes, being once made as above recommended, serve not only as a record of the remarkable contents of the slide, but as

a means of finding any object. If the object be in a sweep near the right side, say in 4, I make four shifts from the side onwards, and move up or down according to the record, and am sure to find the object instantly. If it be further on, I look for some very conspicuous object, such as a fine *P. alpina*, &c., not far from it (with a low power), and, replacing the high power, count the shifts from that; or with the high power I take the first striking object in that part of the slide, and, referring to the notes, use it as a point of departure. I may, however, in every case, count from the beginning or end of the sweeps, that is, from the right or left sides of the slide, and if the shifts have been well made, the object is always very soon found; and if not, it must be very near, on one side or the other, and by trying a little, it is sure to appear. There is really no more trouble in keeping the notes in the above-described way than in any other. But in the case of any very remarkable form, which requires further examination, I move to the nearest edge of the circle, and note carefully any marks there, by which I can find the object in a moment, at any time. If there are no marks there, I look on the opposite side, or on one of the two other sides, and if none have marks naturally, which very rarely happens, I place a spot of ink, and note it. In this way my notes serve as finders, without the annoyance, incidental to the finders recently proposed, of having continually to change the object-glass. At the same time, the application of a scale to one side of the slide, as recommended in a recent number of the 'Journal,' answers well for finding single objects, although its use is too troublesome to allow it to be employed in a case like the present, where hundreds of forms have to be marked.

I have just said that the exploration of a single slide demands both time and labour to no small extent; and I must add, that a single exploration, however careful, is never sufficient. A second or a third will invariably detect interesting or even new forms, overlooked on the first, as I have very often experienced.

And this leads me to remark, that the results hitherto obtained from a careful exploration of the Mull deposit have been such as to convince me that none of the known deposits have yet been fully investigated. Indeed, few are willing to devote to them the time and labour necessary for this purpose. At the suggestion of the Rev. Mr. Smith, therefore, I propose to examine all the fossil Diatomaceous deposits I can procure, which I the more readily undertake because, being lame, and unable to walk far, I cannot attempt the collection, personally, of living species. I beg therefore to mention that I shall feel extremely grateful to observers for any portions of such de-

posits, from any part of the world, which they can spare for examination; and that I shall be happy to supply them with the Mull deposit, which it will soon, I fear, be impossible to obtain in situ, as I understand a great part of it has been removed in the course of agricultural improvements, and employed as manure. I have, fortunately, sufficient for microscopical purposes.

I proceed now, in the first place, to lay before the reader a list, corrected to the end of November, 1853, of the known forms which I have detected in the Mull deposit. In the second place, I shall briefly describe some of the new forms which have occurred, leaving the remainder for the next part of this paper; and thirdly, I shall notice certain striking varieties of known and figured forms, in which the deposit is remarkably rich. I shall conclude with remarks on the classification and nomenclature of the Diatomaceæ, on which subject the study of this deposit promises to throw much light. As the first volume of the 'Synopsis' of the Rev. Mr. Smith is, or ought to be, in the hands of every student of the Diatomaceæ, I shall adopt the names employed in that work, in order to facilitate reference. The 'Synopsis' is the only work on the subject, so far as I have yet seen, in which the figures are really calculated to assist the observer. In organisms, such as the Diatomes, in which the markings constitute essential characters, and in which, also, the number of forms having a great general resemblance, and differing only in small but important particulars, is very great, nothing short of the utmost attainable accuracy in the figures is of the smallest value. The attempt to find one's way through the labyrinthine mass of Diatomaceous forms, in the absence of actual specimens of all the described forms, by the help of the kind of figures often given, is an utterly hopeless one. Such figures actually tend to confuse the young observer. But the beautiful figures of Mr. T. West, in the 'Synopsis,' as I can testify from ample experience, are precisely such as the student requires for his guidance. They combine minute accuracy in form and markings with a very remarkable and very rare quality, that, namely, of presenting to the eye the true general aspect or character of the forms, a point of the utmost importance, because many species, and even genera, are easily recognized by their aspect alone. There is nothing at all to be compared to these figures, for practical utility, anywhere to be found: on the contrary, in some works, not only are the markings inaccurate, or altogether omitted (evidently because inferior objectives have been used), but the character or general aspect of the surface is often so entirely missed that the reader fails to recognize forms with which he

is familiar. Although the 'Synopsis' is not yet completed, it fortunately happens that most of the genera occurring in the Mull deposit are treated of in the volume already published; and of course, where I can refer to figures so accurate, it is unnecessary to figure the species about to be enumerated. I shall only, therefore, give figures of such forms as are new or newly distinguished, or such as exhibit important varieties not figured in the 'Synopsis.'

The following is the list of forms observed and identified with species figured or to be figured in the 'Synopsis,' and in the order of that work. Those marked with *a* are so abundant as to be characteristic of the deposit; *f* is attached to such as, although less abundant, are frequent, and occur in every slide; *r* indicates such as are less frequent, or perhaps rather scarce, but may usually be found; while *rr* denotes that the form is hitherto of extreme rarity in the deposit.

- |  |                                   |
|--|-----------------------------------|
| 1. Epithemia turgida, <i>f</i>           | 38. Cymatopleura Solea, <i>rr</i> |
| 2. " Zebra, <i>r</i>                     | 39. " elliptica, <i>r</i>         |
| 3. " Argus, <i>r</i>                     | 40. Nitzschia Amphioxys, <i>r</i> |
| 4. " ocellata, <i>rr</i>                 | 41. " sigmoidea, <i>r</i>         |
| 5. " rupestris, <i>r</i>                 | 42. " Sigma, <i>rr</i>            |
| 6. " gibba, <i>f</i>                     | 43. " linearis, <i>f</i>          |
| 7. " ventricosa, <i>rr</i>               | 44. " minutissima.                |
| 8. Eunotia gracilis, <i>f</i>            | 45. Navicula rhomboides, <i>a</i> |
| 9. " triodon, <i>r</i>                   | 46. " serians, <i>a</i>           |
| 10. " tetraodon, <i>a</i>                | 47. " dicephala, <i>f</i>         |
| 11. " Diadema, <i>a</i>                  | 48. " affinis, <i>f</i>           |
| 12. " bigibba? <i>a</i>                  | 49. " ovalis, <i>f</i>            |
| 13. Cymbella Ehrenbergii, <i>rr</i>      | 50. " firma, <i>r</i>             |
| 14. " cuspidata, <i>f</i>                | 51. " gibberula, <i>r</i>         |
| 15. " affinis, <i>f</i>                  | 52. " angustata, <i>r</i>         |
| 16. " maculata, <i>a</i>                 | 53. " obtusa, <i>rr</i>           |
| 17. " Helvetica, <i>a</i>                | 54. " Semen, <i>rr</i>            |
| 18. " Scotica, <i>a</i>                  | 55. " Crassinervia, <i>r</i>      |
| 19. Amphora ovalis, <i>r</i>             | 56. " tumida, <i>rr</i>           |
| 20. Cocconeis Placentula, <i>f</i>       | 57. " pusilla, <i>rr</i>          |
| 21. " flexella (Thwaitesii), <i>f</i>    | 58. " inflata, <i>rr</i>          |
| 22. Coscinodiscus excentricus, <i>rr</i> | 59. Pinnularia major, <i>a</i>    |
| 23. Cyclotella Kützingiana, <i>f</i>     | 60. " viridis, <i>a</i>           |
| 24. " Rotula, <i>rr</i>                  | 61. " acuminata, <i>a</i>         |
| 25. " antiqua, <i>r</i>                  | 62. " oblonga, <i>a</i>           |
| 26. Surirella biseriata, <i>f</i>        | 63. " divergens, <i>a</i>         |
| 27. " linearis, <i>f</i>                 | 64. " acuta, <i>a</i>             |
| 28. " splendida, <i>rr</i>               | 65. " interrupta, <i>a</i>        |
| 29. " nobilis, <i>rr</i>                 | 66. " Tabellaria, <i>f</i>        |
| 30. " Craticula, <i>rr</i>               | 67. " mesolepta, <i>f</i>         |
| 31. " minuta, <i>rr</i>                  | 68. " nobilis, <i>f</i>           |
| 32. " ovata, <i>rr</i>                   | 69. " gibba, <i>f</i>             |
| 33. " constricta, <i>rr</i>              | 70. " lata, <i>f</i>              |
| 34. " Brightwellii, <i>r</i>             | 71. " alpina, <i>f</i>            |
| 35. Tryblionella marginata, <i>rr</i>    | 72. " radiosa, <i>r</i>           |
| 36. " angusta, <i>f</i>                  | 73. " viridula, <i>r</i>          |
| 37. Cymatopleura apiculata, <i>f</i>     | 74. " gracilis, <i>r</i>          |

75. <i>Pinnularia cardinalis</i> , <i>rr</i>	98. <i>Gomphonema dichotomum</i> , <i>f</i>
76. „ <i>stauroneiformis</i> , <i>f</i>	99. „ <i>capitatum</i> , <i>f</i>
77. <i>Stauroneis Phœnicenteron</i> , <i>a</i>	100. „ <i>constrictum</i> , <i>f</i>
78. „ <i>gracilis</i> , <i>a</i>	101. „ <i>Vibrio</i> , <i>f</i>
79. „ <i>anceps</i> , <i>f</i>	102. <i>Himantidium Arcus</i> , <i>a</i>
80. „ <i>dilatata</i> , <i>rr</i>	103. „ <i>majus</i> , <i>a</i>
81. „ <i>acuta</i> , <i>rr</i>	104. „ <i>pectinale</i> , <i>a</i>
82. „ <i>linearis</i> , <i>r</i>	105. „ <i>bidens</i> , <i>a</i>
83. <i>Pleurosigma attenuatum</i> , <i>r</i>	106. „ <i>undulatum</i> , <i>a</i>
84. <i>Synedra biceps</i> , <i>a</i>	107. „ <i>gracile</i> , <i>a</i>
85. „ <i>var. β</i> , <i>recta</i> , <i>f</i>	108. <i>Fragilaria capucina</i> , <i>f</i>
86. „ <i>radians</i> , <i>f</i>	109. <i>Odontidium Tabellaria</i> , <i>rr</i>
87. „ <i>Ulna</i> , <i>r</i>	110. <i>Denticula tenuis</i> (?), <i>r</i>
88. „ <i>capitata</i> , <i>f</i>	111. <i>Tetracyclus lacustris</i> , <i>r</i>
89. „ <i>Vancheriæ</i> , ? <i>r</i>	112. <i>Tabellaria fenestrata</i> , <i>a</i>
90. „ <i>delicatissima</i> , <i>rr</i>	113. „ <i>ventricosa</i> , <i>f</i>
91. <i>Cocconema lanceolatum</i> , <i>r</i>	114. „ <i>flocculosa</i> , <i>f</i>
92. „ <i>cymbiforme</i> , <i>f</i>	115. <i>Diatoma vulgare</i> , <i>r</i>
93. „ <i>Cistula</i> , <i>f</i>	116. <i>Melosira varians</i> , <i>r</i>
94. „ <i>parvum</i> , <i>f</i>	117. „ <i>arenaria</i> , <i>rr</i>
95. <i>Gomphonema coronatum</i> , <i>a</i>	118. <i>Orthosira nivalis</i> , <i>a</i>
96. „ <i>acuminatum</i> , <i>f</i>	119. „ <i>aurichalcea</i> , <i>a</i>
97. „ <i>tenellum</i> , <i>f</i>	

The predominance of the forms marked *a*, and the frequency of most of those marked *f*, give its peculiar character to this deposit. Perhaps the group of the *Himantidia*, all of which are most abundant, constitutes the most striking feature. But several *Pinnulariæ*, the two first-named *Naviculæ*, several *Eunotiæ*, the *Tabellariæ*, the *Orthosiræ*, *Synedra biceps*, and *Gomphonema coronatum*, are all very prominent. Of the *Pinnulariæ*, *P. major* is found in very fine specimens and of great frequency, but *P. divergens* (?) is the most abundant, and exhibits numerous and interesting varieties. In some portions of the earth very fine specimens of *P. latu* and *P. alpina* occur frequently. I am not aware that the latter beautiful species, which is rare in the living state, has yet been observed in any other deposit. Some specimens of it, as well as of *P. latu*, attain to twice the length of those figured in the 'Synopsis.'

Having now noticed those forms which agree with the species in the 'Synopsis,' I have next to mention those which, although known abroad, are not given as British species in that work, and such as appear to be altogether new. As most of them, so far as they are now to be mentioned, are figured on the accompanying plate (Pl. IV.), perhaps the best way will be to notice them briefly in the order in which they occur in the plate, being that of the 'Synopsis.' I should add, that several of the figures are also varieties of forms already mentioned.

Fig. 1. This is apparently a modification of *Epithemia Argus*, and calls for no special remark.

Fig. 2. This represents a valve of an *Epithemia*, not very rare in the deposit. It differs both in form, aspect, and

markings from *E. rupestris*, when we compare the same parts, and I am disposed to refer it to *E. gibberula*, Ehr., so far as I can judge from the separate valves, which have not yet occurred united. 120, r.

Fig. 3. These figures show a few of the forms of *Eunotia bigibba*? which I have introduced into the foregoing list because I believe Mr. Smith now admits it as a distinct form. It varies most remarkably in length and in the form and proportions of the dorsal prominences, which in some cases seem to be blended into one; but, in all its variations, the square apices are constant, and at once distinguish it from *Himantidium bidens*. (Pl. IV., fig. 20.) In some individuals, there are two ventral as well as two dorsal prominences. (I use the terms dorsal and ventral merely to designate the convex and concave sides.)

Fig. 4. These figures represent the new form, which Mr. Smith, to whom I pointed it out, has named *Eunotia incisa*. One shows the more frequent, probably the typical form, with acute apices; another, the variety  $\beta$ , with rounded apices, which is also broader; and a third exhibits an intermediate form, with one acute and one obtuse apex. All have the notches, close to the terminal puncta, from which the specific name is taken. The striæ are fine, 44 in .001", and require good object-glasses, with careful adjustment, to render them visible, especially if in balsam. Those on  $\beta$ , however, are more readily seen from its breadth. I find this form, in balsam, an excellent test-object for ascertaining the adjustment and the general performance of an object-glass. Ross's 1-4th and Smith and Beck's 1-5th, if duly adjusted, bring out the striæ perfectly, even without the condenser. I see that this species resembles in form *Himantidium Veneris*, Kütz; but the latter, as figured, has no trace of the notches, nor of striæ, and Professor Kützing, to whom I sent a portion of the deposit, regards mine as a new form. This species must be added to those above named as being most abundant, and characteristic of the deposit. I have detected it in a deposit labelled from the banks of the Spey, in that of Lillhaggasön in Lapland, and in that of the Lüneburg heath; but it has not yet been observed in the living state. (I may state here that the two last-named deposits, although widely distant in locality, exhibit a perfect agreement in the nature and relative proportions of the species. I shall take an early opportunity of describing a form which I find in both, but of which I can see no mention in any work on the subject.) 121, a.

Fig. 5. The next form is either a *Cymbella* or a *Cocconema*, these genera, when fossil, being undistinguishable, if indeed they are really distinct. It is abundant in the deposit, and the



reader, on comparing it with the figures of *Cymbellæ* and *Cocconemata* in the 'Synopsis,' all of which occur along with it, will see that it differs from all. It approaches nearest to *Cymbella Helvetica*, but is much shorter, and also broader, in proportion, and is very permanent and uniform in these characters. It is possibly a variety of that species, but one which certainly ought to be figured. Regarding it, for the present, in this light, I shall not give it a separate name. 122, f.

Fig. 6. This is a very remarkable and puzzling form. It has the form of a large and broad *Navicula seriata*, with the strong median line and large central punctum of that species; but it has also bars resembling those of *Surirella craticula* (qu. *canaliculi*?), and beneath these fine, but very distinct, cross striæ. There are also indications of longitudinal lines. This strange medley of characters makes it very difficult to class it properly. For the present, I shall consider it as *Surirella craticula*, with abnormal or sportive development of the median line and central punctum, and some variation in form.

Fig. 7. These three figures represent a *Tryblionella*, frequent in the deposit, which would appear to be a form of *T. angusta*. It is in some cases narrower than the figure given in the 'Synopsis,' and in all these the apices are more acute and more produced. It also occurs shorter and broader. There are individual specimens still shorter and broader than the left-hand figure here given. The striæ are very fine, and, I rather think, are more numerous than Mr. Smith states them to be in *T. angusta*.

Fig. 8. This is *Navicula affinis*, as it occurs in the deposit, perhaps nearer the typical form than that figured in the 'Synopsis.' It will be seen that in size, as well as form and aspect, it approaches to *N. firma*, and should, perhaps, form but one species with it.

Fig. 9. This is a remarkably long and narrow *Pinnularia*, which appears to me distinct from all others. It is of delicate aspect and very fragile, has a strongly-developed median line, and sides parallel, except just at the apices. The striæ are radiate in the middle, and distinct. Its form and aspect, as well as the much finer striation, and the very delicate margins, seem to me to distinguish it from *P. acuta*; but even if it be a variety of that species, it is so marked a one, that it requires to be named. I therefore propose for it the provisional name of *P. tenuis*. 123, f.

Fig. 10. This is a remarkable small capitate *Pinnularia*, which is perhaps allied to *P. mesolepta*, but differs from all the figures of that species which I have seen. The sides are slightly undulated, the striæ very delicate, and the rounded heads are of almost the same width as the very narrow body, giving it a peculiar aspect. It never exceeds, and frequently falls short

of, the size here shown. (In all the figures the power used is 400 linear.) I propose to name this form *P. undulata*. *P. mesolepta* also occurs in the deposit. The present form is at once distinguished by its much smaller size, and very much finer striation, from the latter, as figured in the 'Synopsis,' as well as from another somewhat analogous form, *Navicula nodosa*, Kütz. 124, f.

Fig. 11. This is a small *Pinnularia*, with very distinct striae. There are several forms nearly approaching it, which want of space prevents me from figuring at present. This one may be supposed to have some relation to *P. gibba*, but is, certainly, not gibbous. The others, which I hope to figure hereafter, are still more distinct from *P. gibba*; and, on the whole, I am satisfied that they, or some of them, ought to constitute a new species, to which I would give the name of *P. parva*. 125, f.

Fig. 12 represents a very elegant *Pinnularia*, which is, perhaps, allied to *P. radiosa*; but yet, as may be seen by referring to the 'Synopsis,' has a different character, almost intermediate between those of *P. radiosa* and of *P. peregrina*. I figure it, that it may be compared with those or other forms, but do not venture to name it as certainly distinct, r.

Fig. 13. This is the new species described by me in the last number of the 'Journal' as *Pinnularia Hebridensis*. But as Mr. Smith, before seeing my form, found it living at Grasmere in August last, and has named it *P. latestriata*, I adopt his name as the better of the two. It exhibits two varieties: one, the type, as I believe, elliptico-lanceolate; the other more linear, and frequently very slightly constricted in the middle, as in fig. 13,  $\beta$ . The costæ, 10 to 11 in .001", are divergent, not reaching the middle line. It is very remarkable that this beautiful species should have been detected living so immediately after I had found it in this deposit, and that, in fact, it must have been thus observed by Mr. Smith, even if I had not noticed it in the Mull earth, where it is rather scarce. In the gathering made by Mr. Smith, at Grasmere (which has yielded two other new and beautiful forms), this *Pinnularia*, so long overlooked, is the most frequent of all the *Pinnulariæ* present. I am informed that it has since been found living near Ipswich, a neighbourhood so well searched that one would have thought so marked a form could not have escaped notice. These facts strongly confirm what I have above said in regard to the necessity of strict exploration, and prove that it is not only the fossil deposits, but also the gatherings of living forms, which have been imperfectly studied. 126, r.

Fig. 14. This is a very pretty small form, either a *Navicula* or a *Pinnularia*, which does not agree with any figures known to me. Its form is broadly elliptical, with acute but not pro-

duced apices. The striæ are distinct and radiate. It is, possibly, a form of *P. gracilis*, but differs very much from that species, as figured in the 'Synopsis,' or as it occurs in the deposit. It may be called, if new, *N.* or *P. exigua*. 127, r.

Fig. 15. These figures represent some of the varieties of *Pinnularia divergens*. Even the typical form, in this deposit, varies considerably from that figured in the 'Synopsis,' being smaller, and having about 21 costæ in .001 instead of 11, as in that figure. It farther occurs broad and elliptical, without terminal constriction; with parallel sides, and very narrow, and in many cases with a very slight but perceptible constriction in the middle. These varieties are seen in the figures, but there are many more. I may here mention that the normal form, which is not here figured, although in shape and arrangement of markings wonderfully close to the figure in the 'Synopsis,' yet differs from it so materially in the number of striæ, that I am led to doubt if it be truly *P. divergens*. If a distinct species, then this species will include not only that normal form, and the four varieties here figured, but also *P. stauroneiformis* (fig. 16), and, as I have reason to believe from the occurrence of forms to be hereafter figured, *P. interrupta*, W. Sm. also.

Fig. 16. This figure represents *P. stauroneiformis* as it often appears in our deposit. There are other modifications, which, as mentioned in the last paragraph, may have to be united to fig. 15.

Fig. 17. This figure represents a new species of *Stauroneis*, which is not figured in any work I have seen. Its form is nearly rectangular, the stauros distinct, not reaching the margin, the striæ so delicate that it is very difficult to see them. I name it *S. rectangularis*. 128, r.

Fig. 18. This is a large *Gomphonema*, which was included under *G. acuminatum*, but appears to have been recently distinguished. I cannot ascertain whether this be the form called *G. Brebissonii*; but as it has not yet been figured, I give it. It is supposed by some to be merely the sporangial frustule of *G. acuminatum*. This is a point I am unable to decide. 129, f.

Fig. 19. This I consider to be a *Gomphonema* not yet described. It is so abundant in the deposit as to be one of the characteristic forms. It seems to stand between *G. tenellum* and *G. Vibrio*; its striæ are finer than in most species of *Gomphonema*. It is possible that it may be a *Pinnularia*, and without the F. V., which, as I do not yet know, it is not easy to pronounce. But it has so much the aspect of a *Gomphonema*, that I shall consider it as such, and propose for it, in the meantime, the name of *G. Hybridense*, from its abundance in the deposit. 130, a.

Fig. 20. This is one of the forms of *Himantidium Arcus*, at

least I conjecture it to be so. It is possible, from the character of the striæ, that it may belong to *H. majus*.

Fig. 21. These figures represent several varieties of *Himantidium bidens*, in which the two dorsal prominences are seen, as the valve lengthens, to sink, and finally to disappear, leaving a nearly straight line. But the apices never vary. The modifications of this, as of all the *Himantidia* in the deposit, as well as of *Eunotia bigibba* and *Pinnularia divergens*, above figured, are quite endless.

Fig. 22. These are remarkable, I believe, sporangial frustules of *Odontidium tabellaria*,  $\beta$ .

I have now noticed all the figures in this plate; and, adding to the former list such of those now mentioned as are different, we have in all 130 distinct forms in these two lists. But this is not all, for I have not been able to figure or describe at this time a considerable number of forms still undetermined, several of which I believe to be new. These must be reserved for another occasion. Moreover, I have now to mention a few species which I have not introduced hitherto, because they are not here figured, and do not occur in the 'Synopsis,' unless as included under other names. Thus I have observed—

131. *Navicula trochus*, new to Britain, *rr*.

132. *Navicula levissima*, new to Britain, *rr*.

133. *Navicula apiculata*, one of the new forms lately found at Grasmere by Mr. Smith, *rr*.

134. *Cocconema gibbum*, *f*, new to Britain, at least not in the 'Synopsis.'

135. *Eunotia Camelus*, Kütz: this, although not in the 'Synopsis,' I cannot but regard as a distinct form, *f*.

136. *Eunotia depressa*, Kütz: the same remark applies to this form as to the last, *f*.

137. *Himantidium exiguum*, Bréb: this is certainly distinct.

138. *Orthosira punctata*: this is another new form, observed, I believe, living, by Mr. Smith, who showed it to me. I had seen it in the deposit, but had neglected it, not having seen any good figures of *Orthosira*, *rr*.

I should now proceed to make some remarks on the classification and nomenclature of the Diatomaceæ, but must postpone these to the next number of the 'Journal,' when I shall also describe the remaining forms. Some, I believe, will have to be added to each of the divisions of this paper, but chiefly to those new as British species, or new to science. I cannot, however, conclude without expressing my obligations to Mr West, for the trouble he has taken in producing the very beautiful figures in the Plate.







