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NOTICE of some NEW SPECIES of BRITISH FRESH-WATER DIATOMACEÆ. By WILLIAM GREGORY, M.D., F.R.S.E., Professor of Chemistry.

HAVING examined with some minuteness the fossil Diatoms in the Mull earth and in the Glenshira sand, both of which deposits yielded a very large number of species, I felt desirous to compare with them the species at present living in our waters. Accordingly I obtained, from various friends, gatherings from a great many different localities, both in England and in Scotland. Those which I have been able to study with some care, up to the present time, are almost all from fresh water, and, postponing to a future opportunity an account of the marine gatherings, I propose now very briefly to notice the results obtained from a number of fresh-water gatherings, more especially with reference to such species as are either altogether new or new to Britain.

It is well known that in no department of Natural History are the species, whether recent or fossil, so universally distributed over the earth's surface. All the more common species are found, according to Ehrenberg, in his recent great work, 'Microgeologie,' not only in the Arctic and Antarctic regions, but under the Equator, between the tropics, and in the temperate zones. But few forms seem to be characteristic of any country or quarter of the globe. The remarkable genus *Terpsinoæ*, and a few others, have not yet occurred in Europe, but are found at widely distant localities in other parts of the world. A very striking example of the wide-spread distribution of diatoms is that of a beautiful little *Pinnularia*, which I first noticed in the Mull earth, and which Mr. Smith, who shortly afterwards found it recent at Grasmere, named *Pinnularia latestriata*, a name which I adopted instead of *P. Hebridensis*. I have since met with it in at least three-fourths of all the gatherings I have examined from fresh water, although invariably scattered. I could find no figure of this species in

any work to which I had access, neither in Ehrenberg's Atlas of 1838, in Kützing, nor in Rabenhorst. Nor did any English observer know it. But I now find that Ehrenberg had described it as *P. borealis* ten or twelve years ago, although his figure, which, if published, appeared in the Berlin Transactions or the Berlin Monthly Reports, was entirely unknown to all our authorities in this country, none of whom, more than myself, have been able to consult Ehrenberg's very numerous papers on the Berlin Transactions, or Monthly Reports, except as quoted by Kützing or Rabenhorst, neither of whom noticed this species. I mention these facts, to explain how it was, that a species long ago described, and I believe figured, by Ehrenberg, was regarded by all our authorities as new when I found it in the Mull earth two years ago. And now I find, in Ehrenberg's Microgeologie, not only that the species is common, which, so far as concerns Britain, I had myself noticed, but that it is one of two specified by him as occurring in every latitude and in every quarter of the globe, more uniformly than any others.* The fact, that it so long escaped notice in this country is explained by its occurring always scattered, and

* The two forms named by Ehrenberg are *Pinnularia borealis* and *Eunotia* (*Nitzschia*, Sm.) *amphiocys*. Having lately examined about 60 small specimens of earth, found attached to plants in the University Herbarium here, and given to me by Professor Balfour, I find, in accordance with what is stated by Ehrenberg, that every one of these specimens of earth, which are chiefly from different parts of South America, contains diatomaceous exuvia, and many of them in considerable quantity. I have detected, in examining only one slide of that part of each earth which is insoluble in acids, not only Diatomaceæ, to the extent of from 20 to 40 or even 50 species, in each case, most of which are identical with British forms, but also spiculæ of Sponges, and many Phytolitharia, exactly as Ehrenberg has done in the numerous similar earths analysed by him. It is most remarkable, that the two species above named occur in at least four-fifths of all the exotic earths I have yet examined; and one of them, *P. borealis*, in very nearly the whole of them. I may add, that I seldom explore a fresh-water gathering at home without finding one or both of these two species. Sufficient attention has not yet been paid to the fact of the invariable presence of Diatomaceæ, &c., in all earths in which plants are found. Ehrenberg, in his 'Microgeologie,' has established the fact as an universal one, and pointed out the important bearing it has on the growth of the soil. Indeed, it is difficult to imagine a more effectual agent in the transference of silica from the waters to the solid earth, than the growth of Diatomaceæ, the shells of which are as indestructible as their multiplication is rapid. Ehrenberg is of opinion that they live in the soil, as well as in water, and the constant presence of moisture in the soil renders this conceivable. Although the proportion of silicious matter, dissolved in ordinary water, is but small, it is evidently sufficient to supply the shells of millions of Diatoms in a very short time; and it is therefore probable, that as fast as it is extracted from the water by them, it is dissolved from the rocks or earths in contact with the water; so that the supply never fails.

never, as many other forms do, in crowds together. But this consideration shows the necessity of minute search, without which many of the scattered forms would escape observation. Many similar examples might be adduced.

It would be intolerably tedious to give a list of all the species observed in these gatherings, of which I have examined, more or less minutely, upwards of 200. I may state that, with few exceptions, I have met with all the known British fresh water species, and that I have found various new localities for many rare and curious forms.

Few, if any, of the new species which have occurred, are confined to one locality; most of them have been found in several and these widely distant stations.

These new species may be conveniently arranged in three sections: 1. Those already described by foreign naturalists, but now first detected as British forms. 2. Those which, although I have myself recognised them as entirely new forms, have been also, either about the same time or subsequently, observed by others. Although these are still unpublished MS. species, and in many cases, my own observations were by much the earliest, yet as I find that these forms have been named by Mr. Smith, I adopt his names, to avoid the confusion arising from synonyms. 3. Species which, so far as I can discover, have nowhere as yet been described or figured.

I. Species, now first found as British, but known to foreign authors.

1. *Eunotia tridentula*, Ehr., fig. 1, Pl. I.*—Banffshire, R. Findhorn.
2. *Navicula follis*, Ehr.—Lochleven, (qu. ? Trochus ?)
3. *N. dubia*, Kütz.—Elgin, Lochleven.
4. *N. bacillum*, Ehr.—Lochleven.
5. *Pinnularia nodosa*, Kütz. (Legumen, Ehr.)—Elgin, Elchies, &c.
6. *P. megaloptera*, Ehr.—Benrinnes, Elgin.
7. *P. dactylus*, Ehr.—Benrinnes, Elgin.
8. *P. pygmaea*, Ehr. (*Nana*, W. G.)—Near Edinburgh.
9. *Stauroneis Legumen*, Kütz.—Elgin, R. Findhorn, Duddingston Loch.
10. *S. ventricosa*, Kütz.—Elchies, Elgin.
11. *Cocconema cornutum*, Ehr. ?—Lochleven.
12. *Gomphenema subtile*, Ehr., Elgin.—Glenshire sand.
13. *Meloma distans*, Ehr. (Gallionella).—Elgin, Elchies, Lochleven.

I do not give these as in all cases absolutely distinct species,

* The species are numbered to correspond with the figures in Plate I.

but only as the forms figured under the names here given by Ehrenberg and Kützing. It is indeed probable that *Pinnularia megaloptera* is only a long form of *P. costata* (*lata*, Sm.); and that *N. dubia* may be a variety, as some believe, of *N. firma*, although I am rather inclined to think that *N. amphigomphus*, Ehr. and *N. dilatata*, Ehr., both of which occur in Lochleven with *N. dubia*, may be forms of one species with the latter, but distinct from *N. firma*. For this reason, I have only mentioned *N. dubia* in my list. The remarkable form which I have referred to *N. Bacillum*, Ehr. is perhaps, as I find from Ehrenberg's 'Microgeologie,' rather his *N. Americana*, although, to judge from his figures, these two form but one species. It is also probable that *Pinnularia Dactylus* is only a variety of *P. major*.

II. MS. species; named by Prof. Smith, but unpublished.

13. *Navicula apiculata*, Sm.—Mull earth, Elgin, Dhu Loch, in Glenshira.

14. *N. rostrata*, Sm.—Near Haddington, Lochleven; near Oban, Linlithgowshire, Dhu Loch in Glenshira, Elgin; also recently near Hamilton, and at Borthwick Castle.

15. *N. scutelloides*, Sm.—Norfolk, Lochleven.

16. *Mastogloia Grevillei* (for the locality only), Lochleven.*

At one time I regarded *Navicula scutelloides* as one of the innumerable varieties of *Navicula varians*, a form to which I have lately directed attention, as showing the extent to which shape and outline may vary on the diatoms, without materially affecting other characters. But my friend Dr. Greville has suggested that the form in question is rather a *Cocconeis*, and his opinion possesses much weight.

III. Species now first described and figured.

17. *Cymbella*? † *sinuata*, W. G.—Dhu Loch in Glenshira,

* I give a figure of *Mastogloia Grevillei*, first observed by Dr. Greville in a gathering from the Pentland Hills. I subsequently found it in my Lochleven gathering, but not having then seen Dr. Greville's species, I did not at first recognise it. It is scarce on the gathering from Lochleven, but will probably be found in abundance in some part of the lake, or in some of the streams which supply it.

† I am by no means sure that this form is correctly referred to the genus *Cymbella*. I at one time supposed it might be a *Eunotia*, or a *Pinnularia*, or possibly a *Gomphonema*. But the general opinion among those to whom I have shown it is that it comes nearest to *Cymbella*. It is marked, however, as doubtful. Some have conjectured it to be an abnormal state of some form, not specified. But it occurs in so many localities, always with the same characters, that I cannot but regard it as a normal and distinct species. Dr. Greville has recently met with it in various gatherings from the vicinity of the Bridge of Allan, and I have again found it in several from the neighbourhood of Hamilton.

and Loch Etive, Argyllshire; R. Calder and R. Avon, Lanarkshire; Lochleven. Fossil in the Mull earth and Glenshira sand.

I have thus named the curious little form represented in fig. 17. It is narrow, slightly arcuate, with rather square, slightly expanding apices. On the generally concave side are three rounded but gentle prominences; the central one considerable, the lateral ones, which are near the ends, very slight. Striæ conspicuous, sub-distant, about 20 in '001, not reaching, or hardly reaching, the median line, which seems to be, as in the known *Cymbella*, a little nearer the ventral surface. There is in most cases a blank space round the central nodule. Length from '0008 to '0012 inch.

The characters of this species are very constant. It varies somewhat in size, and a little also in the form of the apices, which are in some less square than in others.

I first noticed it in the Mull earth, then in a slide mounted by Professor Smith for *Gomphonema gemmatum*, the locality of which was not given; then in the Glenshira sand, and subsequently in the other localities named. It has always been, hitherto, scattered, and does not seem to have been yet found in the spots where it grew. But it appears to be widely diffused.

18. *Cymbella turgida*, W. G. Elgin.—This pretty species has only occurred to me, as yet, in one British gathering, from a moss near Elgin, but I have seen it in two specimens of soil from South America. It is short and broad, the dorsal line almost perfectly circular, while the ventral one is nearly straight. The apices are acute, and somewhat produced. The two halves are very unequal, the dorsal being very broad, the ventral remarkably narrow. Striæ very conspicuous, strong and sharp, about 24 in '001. Length '002 to '0025 of an inch. Of the British *Cymbella*, *C. maculata* comes nearest to it, but differs in form, in the shape of the apices, in striatum and in general aspect. In the Elgin gathering the only one in which as yet it occurs, the species is very uniform and well marked on its characters.

19. *Cymbella obtusa*, W. G.—This species occurs in many gatherings; as Lochleven, those from Banffshire, from Lanarkshire, Argyllshire, &c. Dr. Greville finds it in one from Braid Hills. It is rather small, with very obtuse apices, and the striæ are inconspicuous, much finer than in any of the known species. I think I have seen it named *C. Scotica*, but Professor Smith's figure of that species, which accurately represents a very common form, is very narrow and has extremely acute apices. Length '001 to '0015. Striæ about

36 in $\cdot 001$. I name this and the preceding species with some hesitation, not that they are not well-marked forms, as may be seen from the figures, but because the genus *Cymbella*, as well as the allied one *Cocconeia*, is not in a satisfactory state, and requires a thorough investigation, in which the forms I here describe must be considered. The same remark applies to the next species.

20. *Cymbella Pisciculus*, W. G.—This form occurs in a very interesting gathering from Norfolk, and Dr. Greville has recently found it near Bridge of Allan. I have also lately seen it in various gatherings, including that from Lochleven. It is rather large, broad, and has somewhat square apices. Length about $\cdot 0016$. Striæ about 30 in $\cdot 100$.

21. *Cymbella Arcus*, W. G.—This pretty form I have very recently found in two gatherings from the neighbourhood of Hamilton. The ventral surface is straight, the dorsal highly arcuate, and slightly undulating, broad in the middle, very narrow towards the extremities, like a strung bow. The apices are rather square, expanding a little, after a slight construction. The striæ are best seen about the middle, where the frustule is broadest. Length about $\cdot 0014$. Striæ about 30 in $\cdot 001$.

22. *Navicula cocconeiformis*, W. G.—Occurs in Elgin, Elchies, and some other Banffshire localities, and Lochleven, and recently in various gatherings from different parts of Scotland. In form it is short, broad, nearly oval, but with a slight angularity in the middle, and flattened apices. Some specimens are almost rhombic. In shape it comes very near to *Cocconeis flexella* (Thwaitesii), and it has much the aspect of that form, except that the median line is quite straight. Striæ not resolvable. Length from $\cdot 0006$ to $\cdot 0012$. I understand that this form has been named *N. mugax* by Professor Smith, but I consider my own name, given much earlier, as more characteristic. Besides this, Dr. Greville has lately figured it under the name here adopted.

23. *Navicula lacustris*, W. G.—This fine species has only as yet occurred in the gathering from Lochleven, in which, though not abundant, it is yet far from scarce. It presents two well-marked varieties, α and β , which pass into each other by intermediate forms: α , which is rather more abundant than the other, is elliptico-lanceolate, with acute apices. Nodule bright in the centre, but without definite outline. Median line double. Striæ fine, but distinct, slightly inclined; about 28 or 30 in $\cdot 001$; length from $\cdot 0016$ to $\cdot 0025$ inch: β agrees in every point with α , except in outline. It is broad, has straight sides, sometimes even a little incurved, and sud-

denly contracted to narrow produced extremities. These two varieties are seen in figs. 23 and 23 β , and there exists an intermediate form. The only species with which this could in any way be confounded is *N. firma*, var. β . But the latter is longer and larger, always of a brown colour, and in *N. firma* not only are the striæ much finer and less conspicuous, but they are almost exactly parallel. It is not easy in a drawing to give certain peculiarities of aspect, but any one who compares the two species, *N. firma β and *N. lacustris*, will perceive that the latter has an aspect entirely different from the former. Moreover the side lines, always seen in *N. firma*, never occur in *N. lacustris*.*

24. *Navicula bacillaris*, W. G.—This pretty little species was first observed in several gatherings from Duddingston Loch, and has since occurred in many others, as Lochleven, Elchies, Elgin, and in large quantity in two from the neighbourhood of Dundee. It is linear, narrow, with rounded and slightly pointed apices. It has a very smooth aspect, and the striæ are so fine that it is difficult to resolve them. Length from $\cdot 0012$ to $\cdot 002$ inch.

25. *Navicula lepida α , W. G.—This form occurs in the Lochleven gathering, where it is not rare, and I have recently seen it in others, as in those from Hunter's Bog, and in one of Dr. Balfour's from Borthwick Castle.* It is small, of a narrow oval, and has at first sight a smooth polished aspect; but on closer inspection the striæ are seen to be by no means very fine, but rather difficult to catch from their transparency. They are distinctly but slightly radiate. The central nodule is indefinite, and assumes frequently the aspect of a hazy cross-band, approaching to that of a false stauros. It is a very neat and well-marked little form, and its characters are very constant, varying considerably only in length; the average being about $\cdot 0015$ inches.*

25 β . *Navicula pileata*? β , W. G.—This is another small form, which in some points is so near the last, that I regard it for the present as a variety of *N. lepida*. It is small, of a very short oval shape, and the striæ are both more distinct and more radiate than in *N. lepida*, but yet it exhibits at first sight the same apparent absence of striation. The difference is in the structure of the nodule, which in the present case is always very definite, transparent and glassy; the same peculiar aspect is seen in the terminal nodules; this form hardly ever varies even in length. I have only once seen a specimen a good deal longer and narrower in proportion, and consequently

* Dr. Greville has also found it in a recent gathering from Duddingston Loch (April, 1855).

in form close to *N. lepida*, but the nodule retained its characteristic aspect.

26. *Navicula incurva*, W. G.—This elegant species I have observed in two or three gatherings from the River Findhorn, and very sparingly in that from Lochleven. It is rather narrow, with somewhat angular shoulders, contracted suddenly towards the apices, which are produced and square, and more gently towards the centre. Length about $\cdot 0017$ inch. The striæ have not yet been resolved. It seems to belong to a group, all of which have irresolvable striæ, such as *N. producta* and *N. affinis*; but its very characteristic and constant form render it quite distinct.

27. *Navicula longiceps*, W. G.—This little form occurs in the Morayshire and Banffshire gatherings along with the equally minute species *Pinnularia linearis*, *P. subcapitata*, *P. gracillima*, and *N. bacillaris*. It is small, linear, narrow, but not very long, contracted near the extremities, and subsequently continuing of uniform width to the broadly rounded apices. Nodule indefinite, striæ not yet resolved. Length about $\cdot 0012$ inch. It is more frequent in the Elchies gathering than in any of the others, and is very permanent in its characters. I have named it, from the peculiarly long shape of the contracted ends.

28. *Pinnularia biceps*, W. G.—This well-marked form occurs in the gatherings from Elgin, Elchies, and Lochleven, as well as in some others, and is by no means rare. It is rather large, linear, contracted towards the ends, and expanding into large round heads. The striæ which have, as in *P. divergens*, three centres of radiation, do not reach the median line, and towards the central nodule leave a large round blank space, on the sides of which of course the striæ are much shortened. There are two varieties: β , which is less constricted and subcapitate; and γ , which has three undulations on each side, and is capitate like the type. Length from $\cdot 002$ to $\cdot 003$ inch. Striæ about 24 in $\cdot 001$ inch. This species approaches to *P. divergens*, which, however, is not capitate, and besides has the central blank space in the form of a broad false stauros, reaching to the margin, so that there are no striæ on either side of the central nodule.

29. *Pinnularia linearis*, W. G.—This little form occurs in the gatherings from Elgin, Elchies, and several other Banffshire localities, also in Lochleven and elsewhere. It is small, linear, narrow, very slightly narrower at the apices, and occasionally a little contracted just before them. The striæ are fine, very nearly parallel, reaching the median line. Nodule small, somewhat elongated; it has a distinct border, formed

apparently by a line parallel to the outer margin, and this border is very broad for so small a form. Length from $\cdot 001$ to $\cdot 0012$. Striæ about 40 in $\cdot 001$ inch.

30. *Pinnularia subcapitata*, W. G.—This is another small and linear species, which is found in the same gatherings as the last, and also *P. vaciva*. It is linear, narrow, constricted, subcapitate, the ends rounded. The striæ are subdistant, conspicuous, short. Length about $\cdot 0013''$.

31. *Pinnularia gracillima*, W. G.—This species occurs in the Elgin and Elchies gatherings, in others from Banffshire, and in various other localities. It is, I believe, the same as that which Mr. Smith has named *P. vaciva*; but I had named it long before, and as Dr. Greville has adopted my name in a recent paper in the Annals, I retain it. It is very narrow and long in proportion, varying a good deal in length, as from $\cdot 0014$ to $\cdot 0025$. It has a constriction towards the apices, which again expand into longish rounded heads. Striæ fine but distinct; I have not counted them. Dr. Greville has found this species in the district of the Tummel and elsewhere.

32. *Pinnularia digito-radiata*, W. G.—This species occurs in several gatherings from Duddingston Loch, also in Lochleven and elsewhere, and is not very rare. It is rather small, in form linear elliptic or elliptic-lanceolate, and somewhat narrow. It has a delicate aspect, and the striæ are distinct, though rather fine, except at the centre, and much inclined. The central nodule expands a good deal laterally, and from it on each side diverge five or six very strong striæ or costæ in a digitate fashion, as may be seen perhaps a little too strongly marked in fig. 32. This character comes out well under a high power. Length from $\cdot 0014$ to $\cdot 002$ inch. Striæ about $\cdot 25$ in $\cdot 001''$. This species has some resemblance to the more finely striated varieties of what I have named *N. varians*. But as *N. varians* occurs along with the new form they are easily compared, and it is seen that the striation of *N. varians* is much coarser and far more conspicuous, so that the aspect of the two forms is quite different.

33. *Pinnularia Elginensis*, W. G.—This species is another of the numerous capitate forms which occur in fresh water. It is rather small, not very narrow, with straight sides, contracted towards the extremities, and again expanding into somewhat square truncate heads. The nodule is rather indefinite, the striæ not conspicuous but easily resolvable, fine and very slightly radiate or inclined. It may possibly be a *Navicula*, but it is often very difficult to know to which of these two allied genera, *Navicula* or *Pinnularia*, we ought to refer a

species. It seems to be distinguished by the character of its striation from all similar forms yet described. *N. varians* sometimes takes nearly the same outline, but is at once known by its conspicuous and highly radiate striæ. Length about .0013 inch. Striæ about 30 in .001".

34. *Pinnularia globiceps*.—This elegant little form occurs not unfrequently in a very beautiful gathering from Norfolk, the same in which I first noticed *Cymbella pisciculus*. I have met with it also, or at least a form much resembling it, in the recent mud from the Dhu Loch in Glenshire. It is well marked by its globular extremities and prettily curved outline, swelling a little at the middle part. The terminal nodules are very prominent, casting a shadow, the central are indefinite. The striæ are fine but sharp and distinct, not reaching the median line. They have three centres of divergence, and are entirely absent from a broad crucial space, like a large false stauros, the upper and lower parts of which pass into the long blank caused by the striæ not reaching the median line. In fact the arrangement of the striæ and blank space is like what we see in *P. divergens*, Sm. Towards the apices the blank space expands again. Length .0014 inch. Striæ from 36 to 40 in .001". It is possible that this form may be allied to *P. Stauroneiformis*, or to *P. divergens*, as it is also possible that the two last named may belong to one species. The name must therefore be considered as provisional for the present. In any case it must be distinguished as a striking and well-marked form, even if only a variety.

N.B.—Since writing the above I have observed, in some gatherings from the neighbourhood of Duddingston Loch and Arthur's Seat, as well as in some from the Bridge of Allan, the latter made by Dr. Greville, and in one from Borthwick, made by Dr. Balfour, a form apparently allied to *P. globiceps*, which for the present I shall call *P. globiceps* β. It has a much less elegant curve, but in most points agrees with the form here described.

35. *Stauroneis obliqua*, W. G.—This very curious and well-marked species has only occurred, as yet, in the gathering from Lochleven, in which it is, though far from frequent, always to be found, from 3 or 4 to 10 or 12 in a slide. In form it is elliptico-lanceolate, usually rather short and broad, sometimes longer. The stauros is broad and distinct, but less so towards the margin, which, however, it reaches. The striæ are fine and slightly curved from the middle towards the extremities; but the most striking character is the peculiar position of the median line, which does not, as usual, unite the apices centrally, but has one of its ends on one side of

the apex, the other on the opposite side of the opposite apex, thus dividing the valve into two halves, which, although equal, are so placed that the narrowest part of one corresponds to the broadest of the other, as is well shown in the figures. In some cases, as may be seen in the larger figure, the median line is slightly sigmoid, but this is rare. The obliquity just described, which I do not remember to have seen in any other species, is invariably present; at least I have found it in at least 150 specimens which I have examined. The length is from .001 to .0022 inch. Striæ, by the measurement of Professor Kelland, 45 in .001 inch. I may add that Professor Kelland thinks the median line is twisted, as it were on its own axis, to a certain extent.

36. *Stauroneis* (?) *ovalis*, W. G.—This very pretty little form first occurred to me in some gatherings made on the River Findhorn by my friend Mr. Crawford, of Overton. In one of these it is quite the predominating form, and in all of them *N. incurva*, already described, also occurs. I have recently found it, much more sparingly, in Lochleven, in which I also detected *N. incurva*. The form is a pure oval, .001 inch long, and it is crossed by what at first I took for a stauros, which is broad and reaches the margin. But I cannot, with a high power, satisfy myself that this is really a stauros, as it seems to vanish, or is so transparent that it cannot well be traced. The valve appears to be convex, as when the stauros is brought into focus, the other parts are but dimly visible. The striæ have not yet been resolved. As the genus of this form is not yet determined, I retain the name *Stauroneis* with a mark of interrogation. It is more probable that it may prove to be a *Cocconeis*. At all events, it appears to be a distinct and well-marked species. Length about .001 inch. I have recently observed it in two gatherings from Lanarkshire.

37. *Stauroneis dubia*, W. G.—This is a still smaller form, and, as the name indicates, its true position is not quite settled. It occurs in some of the gatherings from Duddingston Loch, and in others from the Hunter's Bog, and is far from scarce. It is small, narrow, of an elliptico-lanceolate form, the apices slightly truncated. There is a stauros, whether true or false is not yet ascertained, but probably true. When examined under a high power, the valve exhibits two parallel marginal lines within the margin on each side, the stauros not reaching farther than the inner one of these lines. The striæ have not yet been resolved. Length from .0008 to .0012 inch.

38. *Survirella tenera*? W. G.—This pretty form occurs in

the Elchies gathering, where it is frequent, along with *S. biseriata* and *S. nobilis*, so that it can be at once distinguished from them. It has exactly the form of *S. nobilis*, but is smaller and rather narrower in proportion. It differs from *S. biseriata* in having one end round, the other acute. From both of these species it differs still more in the fact of having its canaliculi very much narrower and more numerous. Its length is from $\cdot 003$ to $\cdot 005$ inch. Canaliculi fine, about 10 in $\cdot 001$ inch. It is possible that it may be the perfectly developed *S. linearis*, but I have not as yet been able to ascertain this.

39. *Gomphonema insigne*, W. G., *rude*, Sm.—This species was first observed in some gatherings from Duddingston Loch, but I found it subsequently to be pretty widely distributed. It is distinguished by its size and the coarseness of its striation. The S.V. is doubly conical, the angle at the broadest part being strongly marked. The F.V. is cuneate. Length from $\cdot 002$ to $\cdot 0024$ inch. Striæ 18 to 20 in $\cdot 001$ ". I believe that Mr. Smith has named this form, which I sent him when I first observed it, *G. rude*, but I am not quite certain of this. If so, there can be no objection to his name.

40. *Gomphonema ventricosum*, W. G.—This well-marked species occurs in a gathering from the banks of the Spey, near Elchies, different from that which I have spoken of as the Elchies gathering. The middle part is much expanded, and both extremities are obtuse and rounded, the longer limb being a little expanded at the apex. It is short and broad in proportion, and very uniform in its characters. Length about $\cdot 0014$ inch. Striæ about 30 or 32 in $\cdot 001$ ". Dr. Greville has recently (April, 1855) found this species tolerably frequent in several gatherings made by him near the Bridge of Allan.

41. *Gomphonema æquale*, W. G.—This species occurs in the Elchies gathering, which is from a spring in the grounds of the house. I have seen it also in that from Elgin, and in some of the other Banffshire gatherings, as well as in some from Lanarkshire. It is shorter than the last, and is distinguished from it, as well as from other *Gomphonemata*, by the position of the nodule, which is central, whereas in other species it lies always nearer one end. In form it is linear elliptical, but towards the extremities it is suddenly contracted, and again expands, so as to be almost capitate. In this it agrees nearly with some forms of *G. tenellum*, from which, however, it differs, both in having much wider and coarser striæ, and in the central position of the nodule. Length $\cdot 001$ inch. Striæ rather distant, not reaching the median line, conspicuous, about 22 or 24 in $\cdot 001$ ".

42. *Gomphonema Sarcophagus*, W. G.—This species occurs abundantly in the Lochleven gatherings, but it occurs also in several gatherings made near Edinburgh, and in others from Fife, Stirlingshire, Lanarkshire, and elsewhere. Indeed it would seem not to be uncommon. In form it is linear, rather narrow, the sides gently curved, so as to form a sort of shoulder at the widest part, after which it contracts a little, and again expands to a somewhat truncate extremity. The opposite end is narrower, and, with the exception of a trifling expansion at the apex, becomes continuously narrower. These things give to it very nearly the shape of a coffin. The F.V. is, as usual in this genus, cuneate. Length about $\cdot 0014$ inch. Striæ 20 to 22 in $\cdot 001$ ".

I have now only to add a few words on the distribution of the *Diatomaceæ* in our fresh waters. I have not only found, as Ehrenberg has done, that a large number of species occur in every locality, but even in the case of the forms just described, which, from their having been overlooked, might be supposed to be very rare, most of them have been observed in more than one, frequently in several different and distant stations.

It must not be supposed that the gatherings which I have examined are exhausted. The fact is, that only a small number of them, no doubt the most interesting and the most promising, have been at all minutely explored, and I would particularly direct attention to the fact, that with the exception of only two or three species, all the forms now figured are actually to be found in four gatherings, those, namely, of which I have spoken as Elchies, Elgin, Lochleven, and Duddingston Loch. Several of these forms were first observed in other gatherings, though not many, but in time they have all been found in these four. Nay, the Lochleven gathering alone has been found to yield nearly the whole of them. If, therefore, I had been confined to these four gatherings alone, I should have detected, by careful exploration, all the forms now figured as new. This shows what I formerly alluded to, the importance of minute examination, without which many interesting forms are daily overlooked. It is no argument against this to say that species cannot well be ascertained from a few scattered specimens, for what is rare and scattered to-day, may be found in abundance to-morrow. Thus the doubtful *Stauroneis* which I have figured occurs very sparingly in the Lochleven gathering. Had it never occurred but there, its character could have been easily ascertained. But in the Findhorn gatherings it occurs abundantly. *Stauroneis obliqua* occurs, at present, only in Lochleven, and that sparingly; but

its characters are so well marked that we need not wait till it shall be found in abundance, as it probably will some day. It would, however, certainly have been overlooked in Lochleven, but for the minute search to which the gathering was subjected. The same remarks apply to *Navicula lacustris* and to *Navicula lepida*.

Whenever, therefore, a gathering is met with which appears to contain a great variety of forms, like the four above mentioned, it should be systematically and minutely searched, and any striking forms, no matter how scarce, noted and figured. If true species, they will most probably be found in greater abundance elsewhere.

It is much to be regretted that no work yet published contains figures of all the known species or forms named as species by their observers. Even in Ehrenberg's last great work, in which many hundred species are figured, I observe the names of about 350 species, most of which are described as remarkable or characteristic of certain localities, not one of which is figured, although most of the common species are many times represented.

Supposing, then, that all those forms which I have just described as new to science should prove to be good and distinct species, of which I cannot, of course, be sure, it is out of my power to ascertain whether they may not agree with some of the species named, but not figured, in his last work, by Ehrenberg. I ought to mention, however, that several of the species of my first section, new to Britain only, were considered by myself and others as new to science, till I found them figured in Ehrenberg's 'Microgeologie,' when of course I adopted his names for them.

*An Account of the STRUCTURE and RELATIONS of SAGITTA
BIPUNCTATA. By G. BUSK, F.R.S.*

THE minute creature to which the above name has been given, though abundant, perhaps, in all seas, and noticed so long ago as in the year 1781, has received but little attention from zoologists in general. Its curious and interesting structure, however, and doubtful position in the animal kingdom, render it a subject well worthy of further research; and its minute size, and the extreme delicacy and transparency of its tissues, make it peculiarly an object of microscopical investigation. Though perhaps unknown, even by sight, to many of our readers, the *Sagitta bipunctata* will probably be met with on every part of the coast; and it may be procured,

DESCRIPTION OF PLATE I.

Illustrating Professor Gregory's paper on some new species of British Diatomaceæ.

N. B.—Most of the figures in this Plate have not been drawn to the scale now usually adopted, of 400 diameters, but to a scale considerably smaller, which, according to my estimation, does not much exceed 300 diameters. This remark applies particularly to the larger forms, such as figs. 4, 5, 6, 7, 11, 28, 38. The reader is requested to bear this in mind, when comparing these figures with those of the Synopsis of the Rev. Professor Smith. As for the smaller forms, they generally vary so much in size that the figures may be held to represent average individuals under a power of rather less than 400 diameters.

I. *Species new to Britain.*

- | Fig. | Fig. |
|---------------------------------------------|-------------------------------------------|
| 1.— <i>Eunotia tridentula</i> , Ehr. | (<i>P. pachyptera</i> , Ehr. ? <i>P.</i> |
| 2.— <i>Navicula Trochus</i> , Ehr. | <i>lata</i> , Sm., var. ?) |
| 3.— " <i>dubia</i> , Kütz. | 7.— <i>Pinnularia dactylus</i> , Ehr. |
| 4.— " <i>Bacillum</i> , Ehr. | 8.— " <i>pygmæa</i> , Ehr. 41 |
| (qu. <i>N. Americana</i> , Ehr. ?) | 9.— <i>Stauroneis Legumen</i> , Kütz. |
| 5.— <i>Navicula (Pinnularia) nodosa</i> , | 10.— " <i>ventricosa</i> , Kütz. |
| Kütz. | 11.— <i>Cocconeoma cornutum</i> , Ehr. |
| 32 6.— <i>Pinnularia megaloptera</i> , Ehr. | 12.— <i>Gomphonema subtile</i> , Ehr. |

II. *New Species, named by other writers, but not yet figured.*

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|--------------------------------------|---------------------------------------------|
| 13.— <i>Navicula apiculata</i> , Sm. | 15.— <i>Navicula scutelloides</i> , Sm. 477 |
| 503 14.— " <i>rostrata</i> , Sm. | 16.— <i>Mastogloia Grevillii</i> , Sm. 1269 |

III. *New Species, now first named.*

- | | |
|-------------------------------------------------|------------------------------------------------------|
| 17.— <i>Cymbella</i> (?) <i>sinuata</i> , W. G. | 33.— <i>Pinnularia Elginensis</i> , W. G. 140 |
| 18.— " <i>turgida</i> , W. G. | 34.— " <i>globiceps</i> , W. G. 72 |
| 19.— " <i>obtusa</i> , W. G. | 35.— <i>Stauroneis obliqua</i> , W. G. 999 |
| 20.— " <i>Pisciculus</i> , W. G. | 35†.— " " with sigmoid |
| 21.— " <i>Arcus</i> , W. G. | median line. |
| 504 22.— <i>Navicula cocconeiformis</i> , W. G. | 36.— <i>Stauroneis</i> (?) <i>ovalis</i> , W. G. 915 |
| 23.— " <i>lacustris</i> , W. G. | 37.— " <i>dubia</i> , W. G. 911 |
| 23β.— " " var. | 38.— <i>Surirella tenera</i> , W. G. 2235 |
| 574 24.— " <i>bacillaris</i> , W. G. | This form frequently occurs |
| 524 25.— " <i>lepida</i> , W. G. | twice as large as the |
| 25β.— " " var. ? | figure, but with the |
| 612 26.— " <i>incurva</i> , W. G. | same proportions. |
| 70 27.— " <i>longiceps</i> , W. G. | 39.— <i>Gomphonema insigne</i> , W. G. 1742 |
| 28.— <i>Pinnularia biceps</i> , W. G. | Side view. |
| 28β.— " " var. | <i>b.</i> Front view. |
| 77 29.— " <i>linearis</i> , W. G. | 40.— " <i>ventricosum</i> , W. G. |
| 48+59 30.— " <i>subcapitata</i> , W. G. | 41.— " <i>æquale</i> , W. G. |
| 72 31.— " <i>gracillima</i> , W. G. | 42.— " <i>Sarcophagus</i> , W. G. |
| 124 32.— " <i>digitariata</i> , W. G. | <i>b.</i> Front view. |

