

above facts: indeed, I have rarely tried a sample from any of these clays, either near a fresh or brackish stream, in which a careful washing would not eliminate abundance of Diatomaceous remains. Of course, some will be richer than others, but I have found them in all. Let it not be thought that too enthusiastic a view has been taken of the subject. I have sent a set of slides illustrative of all the above-mentioned deposits to the Editors of this Journal, and I think they will bear me out in the assertion that neither their richness nor their interest has been overstated.*

From these facts it appears that not the surface merely, but the whole mass of these tidal deposits, is penetrated by these minute and wondrous organisms; while from the fact of their being found at Neyland at a depth of 40 feet below the present surface, and close upon the rock which forms the original bed of this estuary, the mind is irresistibly led to the conclusion that they have existed there from the time when the waters first rolled over the spot, when silence and solitude reigned supreme where now resounds the "busy hum" of the hundreds who are employed in bringing one of the great arteries of commerce and civilization to its ocean home.

In making out the list of the forms in the Neyland deposits, I have carefully abstained from inserting the names of any but those which I could identify with certainty, either from Mr. Smith's work or from information furnished to me by Mr. Roper, to whose kind assistance I am deeply indebted during the time I have been studying the subject. Being but a beginner in the study, I thought this the best plan to adopt; but I am sure, from what I have observed, that were these deposits well examined by other and more experienced investigators than myself, the list might be far more extended, and many new forms brought to light. Still, if I shall have been the means of drawing attention to the subject of these deep deposits, or of extending in any way, however small, the boundaries of this interesting field of research, I shall feel amply recompensed for any trouble I have taken in this matter.

Q.T.M.S.
1855-
Plate IV

On a POST-TERTIARY LACUSTRINE SAND, containing DIATOMACEOUS EXUVIÆ, from *Glenshira*, near *Inverary*. By WILLIAM GREGORY, M.D., F.R.S.E., Professor of Chemistry.

THIS remarkable deposit was sent to me in February last by the Duke of Argyll, who had found it in the valley of Glen-

* The slides sent us by Mr. Okeden are uncommonly rich in the various forms of *Diatomaceæ*.—EDS.

shira, the waters of which flow into Loch Fine, well known as a sea-loch, at its upper part. The sand occurs above a mile from the mouth of the valley, lying under a considerable depth of good alluvial soil. It is nearly black, with shining particles of mica, and very dense. It consists chiefly of the detritus of the surrounding mountains, formed of micaceous schist, and contains therefore much quartz and mica. There is also a considerable proportion of an iron ore, and of a dark matter of vegetable origin, and apparently somewhat of a peaty character. To the last-named ingredients the dark colour of the sand is due.

On placing a little of it under the microscope, I noticed one or two Diatomaceous forms, such as a *Navicula didyma*, a *Cocconeis scutellum*, and a *Synedra radians*. But the proportion of these was so small that without some purification nothing could be done. After various trials, I found the following plan to yield tolerably satisfactory results.

The mass was first warmed, and when the violence of the action had passed, boiled, with the most concentrated nitromuriatic acid. This not only dissolved the iron ore, but completely removed the dark organic matter, and left a sand of a pale-yellowish colour, in which the Diatomes were more easily seen.

The next step was to remove, by subsidence in water and decantation, the greater part of the quartz and all but the finest and lightest scales of mica, which, having much the same density as the shells, could not be got rid of. Any attempt to push the process farther caused a loss of shells. The residue thus obtained was now found to be rich in Diatomes; and when mounted in Canada balsam, the mica became so transparent as not materially to interfere with the examination of the shells. The entire residue did not exceed 1-20th of the original sand, and the Diatomes formed only from 1-5th to 1-3rd of the residue, so that they could not have amounted to much more than 1 or 2 per cent. of the mass.

It will be seen from this, that the *Glenshira* deposit is of an entirely different character from those earths in which Diatomes have usually been found in the fossil state, such as the Raasay or Mull deposits, which consist entirely of Diatomaceous shells. On the other hand, it presents all the characters of a lacustrine or estuarial deposit or mud, such as the Thames mud, or similar deposits now forming in estuaries or lakes. Of course the predominant mineral ingredients are such as are yielded by the adjacent rocks, and the Diatomes have merely been deposited in small proportion along with these. We shall see that there is a very remarkable analogy,

as far as concerns the Diatomæ present, between this sand and the Thames mud recently described by Mr. Roper in the second volume of the "Journal."

The first glance at the Glenshira sand under the microscope leads to the observation, that, like the Thames mud, it contains both marine and fresh-water forms. In this respect it resembles the deposit or mud of all estuaries. From its position, however, there is every reason to conclude that it was formed in its present locality, when that part of the valley was occupied by a fresh-water lake, which is now confined to the lower part of the valley, but has evidently extended much higher in former periods. The question of course naturally occurs, whence came the abundant marine forms? But this is easily explained, if we attend to what is going on in the present small fresh-water lake. The level of this lake is precisely that of half tide, so that at high water the sea flows into it, while at ebb tide the water of the lake runs into the sea

This remarkable state of matters produces a mixture, in the lake, of fresh-water and marine forms, both animal and vegetable. The Duke of Argyll mentions, that nets, thrown for salmon in the lake, have been drawn up full of herring; that other marine animals occur in it, and that marine algæ are also found, dwarfed by the influence of the fresh water. Having been supplied with some of the deposit or mud now forming in the lake, I examined it, and found it very closely to resemble the sand from the higher level, save that the proportion of organic matter was considerably greater. But, like the older sand, it contains both marine and fresh-water Diatomæ, and these belong in many instances to the same species. I have noticed some difference in the relative proportions of species, and I shall take an opportunity of carefully studying the recent deposit or mud of the lake; but in the mean time I can state, that in all essential characters the recent deposit agrees with the fossil one.

From these facts it may be inferred that the lacustrine sand of Glenshira, which I refer to the post-tertiary period, on the authority of the Duke of Argyll and of Mr. Smith of Jordanhill, both of whom are familiar with the localities, was formed in the lake when that lake occupied the part of the valley where the sand occurs, and that the relative levels of lake and sea were then the same as now. This seems to be the simplest mode of accounting for the abundance both of fresh-water and of marine forms. Had the sand been deposited in sea water, it could not have been, as it is, extremely rich in fresh-water species, and there is no reason to suppose

it to have been formed in an estuary, like the Thames mud, when we see a similar deposit in course of formation at the present hour in the fresh-water lake, not much more than a mile from the spot.

But if this be admitted, then it must also follow that, since the relative levels of sea and lake were the same then as now, and since the sand occurs at a considerably higher level than that of the present lake,—it must, I think, follow, that the sea has fallen, or the land has risen, since the period when the sand was deposited. This is a conclusion at which geologists have arrived in many instances, from other phenomena, such as raised beaches, as, for example, in the Clyde, with which Loch Fine communicates. It is interesting to find the study of the Diatomaceous forms, occurring so scantily in this deposit, assisting to throw light on one of the *questiones vexatæ* of geology.

I have said that the Diatomæ are but scantily diffused in the Glenshira sand; and this is true, since they do not much exceed 1 per cent. of the mass. But when we examine the purified or cleaned residue, in which they are, as it were, concentrated, we are struck at once with the very large number of species present.

In this respect the Glenshira sand far surpasses every deposit hitherto described, even that of Mull, in which I have found 150 species, and the Thames mud, in which Mr. Roper detected 104 species.

In the Mull deposit all the species, with a very few exceptions, and these so rare as to be evidently accidental, derived from the proximity of the sea, and possibly carried by the winds, belong to fresh water. But in the Thames mud and in the Glenshira sand, as already stated, both classes of forms occur abundantly. It is this which accounts for the large number of species. Up to the present time I have recognised in the latter not less than 240 species, and I am quite satisfied that a good many remain to be identified. Judging from what has been done already, I cannot doubt that the number of species will, before long, amount to at least 250.

In consequence of the circumstances under which it has been formed, this deposit does not contain any one or more greatly predominant form, as is generally observed to be the case in deposits formed where the Diatomæ grew and died. As they have all been transported by water, they constitute, when the quartz, mica, and other matters which separate them are removed, a mixture of a very remarkable kind, in which a large number of forms are tolerably abundant, and a still larger number are pretty frequent, while none are so pre-

dominant as we find them in recent gatherings, and a good many are so scarce, that we have often to search long before finding additional specimens, although with patience we generally succeed in doing so.

The peculiar constitution we have described renders a complete study of this deposit a work of much time and labour. I soon found that it was only by pursuing the minute and systematic mode of search which I have described in my account of the Mull deposit, that I could hope to determine the species present in this one. I have found it, however, advantageous, in consequence of the large number and relative scarcity of new forms in the Glenshira sand, to adopt the plan of marking any striking forms, or such as require to be examined, or are to be figured, when first observed. I find the best way of marking is, after fixing on the form, to put on the 2-3rd objective, and under that power to place one spot of ink *just above*, but not *on*, the form. This is much more rapidly and easily done than drawing a circle round it, and it interferes much less with the remaining forms. A note is kept of all the spots made on each slide, arranging them in a certain order, according as they follow in the regular course of sweeping the slides. By this means any marked form is instantly recovered; and I have been able to place in the hands of Mr. West, in the course of one forenoon, a number of new and striking forms so great, that without some such method I could not have pointed them out, from their comparative scarcity, under a much longer time.

It may be here mentioned, that, in studying a mixture like the present, no examination, short of a thorough and minute search, would suffice. Without this we should infallibly miss a large proportion of the most interesting forms. To give some idea of the necessity of this, I may state that I have found it necessary to explore, minutely and repeatedly, 60 well-filled slides of this deposit, and that I have not yet exhausted it, as even now I hardly ever search one of these slides without observing something new or interesting previously overlooked.

This is no doubt very laborious, but without labour nothing can be well done, and in the present case the results have been highly satisfactory. I have recognised upwards of 200 known species, while a number remain that for the present I cannot exactly name, for want of good figures; and besides this, I have distinguished about 25, probably more, new and undescribed forms, most of which are very interesting. Such is a general account of the results obtained; and after these preliminary remarks I shall now proceed to the details. I shall

first give the list of known species, under the two heads of marine and fresh-water forms, as Mr. Roper has done in the case of the Thames mud; and I shall then briefly describe the new species, which will also be figured. But as circumstances have rendered it impossible for me to have more than one plate in the present number of the 'Journal,' I am compelled to reserve one-half of the figures till the next number.

It is proper to explain that I shall have to mention several new forms, as occurring in this deposit, which I do not figure, although no figures have as yet appeared of them. The reason is, that these forms have been recently observed by others, prior to me, and it is to be presumed that the first observers will take an early opportunity of describing and figuring them. I propose to figure all such forms as are now, for the first time, distinguished by myself, and also some striking varieties of known species, in which the Glenshira deposit is uncommonly rich. Without further preamble, let us now proceed to the list of known forms.

I. Marine Species,

including such as occur in both sea water and brackish water, as well as those which seem to belong to brackish water more especially:—

1. Epithemia Musculus.	22. Amphipleura sigmoidea.
2. Amphora affinis.	23. Navicula Liber.
3. " tenera.	24. " Smithii.*
4. " costata.	25. " Jenneri.
5. Cocconeis Scutellum.	26. " convexa.
6. " Grevillii.	27. " elegans.
7. Coscinodiscus radiatus.	28. " palpebralis.
8. " excentricus.	29. " punctulata.
9. Eupodiscus crassus.	30. " pusilla.
10. " Ralfsii.	31. " Didyma.
11. Campylodiscus parvulus.	32. " nitida.†
12. Surirella fastuosa.	33. " granulata, Bréb.‡
13. " constricta.	34. Pinnularia directa.
14. Tryblionella punctata.	35. " Cyprinus.
15. " acuminata.	36. " peregrina.
16. Nitzschia Sigma.	37. Stauroneis pulchella.
17. " angularis.	38. " salina.
18. " birostrata.	39. Pleurosigma formosum.
19. Amphiprora alata.	40. " angulatum.
20. " constricta.	41. " Balticum.
21. " vitrea.	42. " strigosum.

* *N. elliptica*, W. Sm. M. de Brébisson has given this name, on account of the term '*elliptica*' having been long applied to another species by continental writers.

† This is a beautiful new species, to be figured in vol. ii. of Mr. Smith's 'Synopsis.'

‡ Also a very fine new form. Prof. Arnott finds it in the Clyde.

- | | |
|---------------------------------|----------------------------|
| 43. Pleurosigma rigidum. | 56. Biddulphia aurita. |
| 44. Synedra superba. | 57. Melosira Borreri. |
| 45. " acicularis. | 58. " sulcata. |
| 46. Gomphonema marinum. | 59. Orthosira nummuloides. |
| 47. Achnanthes longipes. | 60. Podosira hormoides. |
| 48. " brevipes. | 61. " maculata. |
| 49. " subsessilis. | 62. Bacillaria paradoxa. |
| 50. Rhabdonema arcuatum. | 63. Dictyocha Speculum. |
| 51. " minutum. | 64. " gracilis. |
| 52. Zygocecos Surirella.* | 65. " Fibula. |
| 53. Grammatophora marina. | 66. " trifenestra. |
| 54. " serpentina. | 67. Schizonema Crux. |
| 55. Amphitetras antediluvianum. | |

Total, 67 marine species.

II. Fresh-water Species,

including such as occur in both fresh and brackish water:—

- | | |
|---------------------------|-----------------------------|
| 1. Epithemia Hyndmanni. | 34. Cyclotella operculata. |
| 2. " turgida. | 35. " rotula. |
| 3. " gibba. | 36. Campylodiscus costatus. |
| 4. " Argus. | 37. " bicostatus.† |
| 5. " Zebra. | 38. Surirella minuta. |
| 6. " Westermanni. | 39. " pinnata. |
| 7. " rupestris. | 40. " ovata. |
| 8. " Sorex. | 41. " Brightwellii. |
| 9. " proboscoidea. | 42. " Crumena.‡ |
| 10. " alpestris. | 43. Tryblionella marginata. |
| 11. " longicornis. | 44. Cymatopleura Solea. |
| 12. " constricta. | 45. Nitzschia sigmoidea. |
| 13. Cymbella Ehrenbergii. | 46. " minutissima. |
| 14. " Helvetica. | 47. " acicularis. |
| 15. " Scotica. | 48. " linearis. |
| 16. " maculata. | 49. " amphioxys. |
| 17. " affinis. | 50. " vivax. |
| 18. " cuspidata. | 51. Amphipleura pellucida. |
| 19. Eunotia Arcus. | 52. Navicula rhomboides. |
| 20. " monodon. | 53. " ovalis. |
| 21. " diodon. | 54. " minutula. |
| 22. " triodon. | 55. " firma. |
| 23. " tetradon. | 56. " affinis. |
| 24. " bigibba. | 57. " amphisbæna. |
| 25. " Camelus. | 58. " crassinervia. |
| 26. " incisa. | 59. " lanceolata. |
| 27. " depressa. | 60. " gibberula. |
| 28. Amphora ovalis. | 61. " angustata. |
| 29. " minutissima. | 62. " Semen. |
| 30. Cocconeis Pediculus. | 63. Pinnularia major. |
| 31. " Placentula. | 64. " viridis. |
| 32. " Thwaitesii. | 65. " lata. |
| 33. Coseinodiscus minor. | 66. " acuta. |

* Figured by Mr. Roper in No. VII. of the 'Journal.'

† Figured by Mr. Roper, *loc. cit.*

‡ A new fresh-water species, first distinguished, I believe, by Professor Walker Arnett.

- | | |
|-------------------------------|---------------------------------|
| 67. Pinnularia radiosa. | 105. Gomphonema dichotomum. |
| 68. " oblonga. | 106. " Fusticulus.† |
| 69. " divergens. | 107. " insigne.‡ |
| 70. " gibba. | 108. Meridion circulare. |
| 71. " gracilis. | 109. " constrictum. |
| 72. " viridula. | 110. Achnanthes exilis. |
| 73. " mesolepta. | 111. Achnanthidium lanceolatum. |
| 74. " stauroneiformis. | 112. " coarctatum, |
| 75. " latestriata.* | Bréb. |
| 76. " undulata.* | 113. Himantidium majus. |
| 77. " tenuis.* | 114. " Arcus. |
| 78. " parva.* | 115. " pectinale. |
| 79. " exigua.* | 116. " gracile. |
| 80. Stauroneis Phœnicenteron. | 117. " bidens. |
| 81. " gracilis. | 118. Fragillaria capucina. |
| 82. " anceps. | 119. " virescens. |
| 83. " dilatata. | 120. Odontidium mesodon. |
| 84. " punctata. | 121. " mutabile. |
| 85. " rectangularis.* | 122. " Tabellaria. |
| 86. Pleurosigma attenuatum. | 123. " Harrisoni.§ |
| 87. Synedra Ulna. | 124. Denticula tenuis. |
| 88. " radians. | 125. " sinuata. |
| 89. " pulchella. | 126. Tabellaria fenestrata. |
| 90. " obtusa. | 127. " flocculosa. |
| 91. " biceps. | 128. " ventricosa. |
| 92. " lunaris. | 129. Diatoma vulgare. |
| 93. " acicularis. | 130. " elongatum. |
| 94. Cocconeis lanceolatum. | 131. Melosira varians. |
| 95. " Cistula. | 132. Orthosira arenaria. |
| 96. " cymbiforme. | 133. " nivalis. |
| 97. " gibbum. | 134. Mastogloia elliptica. |
| 98. Gomphonema geminatum. | 135. " Dansei. |
| 99. " acuminatum. | 136. Colletonema neglectum. |
| 100. " coronatum. | 137. " vulgare. |
| 101. " curvatum. | 138. " subflexile. |
| 102. " constrictum. | 139. Encyonema prostratum. |
| 103. " capitatum. | 140. " cæspitosum. |
| 104. " tenellum. | |

Total, 140 fresh-water species, which, added to 67 marine forms, gives a grand total of 207 species, known as British.

To these must be added a few which have now, for the first time, occurred in this country, though known on the Continent. Such are—

208. Navicula nodosa,|| Kützing.
 209. Pinnularia pachycephala,† Rabenhorst.
 210. " (Navicula) Gastrum,** Ehr.

* These six species are figured in my account of the Mull deposit.

† This species has lately been distinguished by Mr. Smith.

‡ A new species, which I shall describe and figure in the next number of the 'Journal,' along with several other recent forms, which I have observed during the past year.

§ A beautiful form, lately detected by Mr. Harrison.

|| To be figured in the next number of the 'Journal.'

†† Occurs also in the Mull deposit, and will be figured in next number.

** This form is figured in the present paper. See fig. 20.

We have thus in the Glenshira sand 210 known and described species, with the exception of one or two recently observed and likely to be soon figured. But I feel quite assured that there are a good many more, belonging to this category, which I am unable clearly to identify, from the want of good figures, especially in those genera to be figured in vol. ii. of Mr. Smith's Synopsis. In particular, there appear to be several discoid forms of the genera *Melosira* and *Orthosira*, &c., which will be found to be of known species.

Let us now turn to those forms which appear to be undescribed, of which the proportion is unusually great in this deposit. It has been already mentioned that only about one-half of these forms can be figured on the accompanying plate, and that the remainder will be given in the next number of the 'Journal.' It will probably be best to describe the forms here figured as they occur on the plate, in which the order of the Synopsis is followed. It must be borne in mind that some of the figures represent varieties of known forms, and that the two first belong to the two new forms observed by me in the Lillhaggsjön and Lüneberg deposits, and described in last number of the 'Journal.'

Fig. 1, Plate IV., shows two forms of *Eunotia Falx*, W. G. This very remarkable form needs no farther description beyond what will be found in the 'Transactions of the Microscopical Society,' vol. ii., p. 105. It has not yet occurred as a British form. It occurs with fresh-water species.

Fig. 2 represents an example of *Nitzschia Sigmatella*, W. G., also observed in the two deposits just named. But it occurs, as I have formerly stated, in the Mull deposit also; and since describing it I have found it, not only in the sand of Glenshira, but also in a recent gathering from Elchies, in Banffshire. It is therefore a British species, and, from the Banffshire locality, belongs to fresh water. (211.)

Fig. 3. *Cymbella truncata*, W. G. This pretty and well-marked species occurs in the Mull deposit, but sparingly. It is frequent in the Glenshira sand, and cannot, I think, be referred to any of the species of *Cymbella* or *Cocconema*, figured by Mr. Smith. Of course it is impossible, in a fossil deposit, to ascertain whether it be really a *Cymbella*, that is, free, or a *Cocconema*, that is attached by a stipes. It is possible and even probable, that this species has been noted on the Continent, but I have not been able to see any figure with which it can be safely identified. It is very uniform in its characters, always exhibiting the truncate or square ends from which I have named it. It is sometimes a good deal longer than the figure here given, which may be taken as typical.

It is a fresh-water form, and I have found it in many recent gatherings. (212.)

Fig. 4. *Amphora Arcus*, W. G. This fine form has not occurred in its entire state, but is frequent in the detached condition. The halves have precisely the form of a strung bow, often very elegantly curved. The striæ are coarse and moniliform. I have no certain means of ascertaining its habitat, but I suspect it to be marine. (213.)

Fig. 5. *Amphora incurva*, W. G. This is also a very pretty form, most probably marine, and occurring detached, like the last. The striæ are very much finer than in *A. Arcus*. (214.)

Fig. 6. *Amphora angularis*, W. G. This is a striking form, and unlike the two preceding it occurs now and then complete, when it exhibits short square apices. It has a slight constriction in the middle. Habitat unknown. (215.)

Fig. 7. *Cocconeis transversalis*, W. G. This neat little form is distinguished from the other species of the genus by having fine transverse striæ. Its form is a pure oval. Habitat not known. (216.)

Fig. 8. *Cocconeis speciosa*, W. G. This form is nearly allied to *C. Scutellum*, but is usually smaller, and has somewhat of an angular form. The chief distinction lies in the striæ, which are much less numerous than in *C. Scutellum*, not exceeding 12 in '001", and they are formed of much fewer and much larger granules. Like *C. Scutellum* it occurs both with and apparently without a margin; and it might be taken for a variety of that species, but for the number and peculiar character of the striæ. I have closely searched several slides of marine origin, full of *Cocconeis Scutellum* of every degree of development, but I have not found in them one example of *C. speciosa*. I therefore regard it as a distinct species. (217.)

Fig. 9. *Cocconeis distans*, W. G. This very beautiful form is at once characterised by the equal size of the dots or granules, and their great distance from each other, so that it almost loses the aspect of striation. The form is purely oval. (218.)

Fig. 10. *Cocconeis costata*, W. G. This is a fourth new species of the genus, and is at once characterised by its very strong and entire costæ, which seem to be double lines or bands, expanding a little externally. It is a perfectly well-marked species. The habitat of this, as well as of the two preceding forms, is unknown, but they are probably of marine origin. (219.)

Fig. 11. *Eupodiscus*, qu? *Ralfsii* β. This disc, which is not unfrequent, has a finely-radiate surface, the radii composed of small puncta, as in *E. Ralfsii*. But there is no trace of the peculiar blank spaces among the rays, which, so far as I know,

appear to be characteristic of *E. Ralfsii*. This latter species occurs with the usual characters; and I am inclined to regard the form, fig. 11, as distinct, but do not venture to give it as a species without further investigation. It is, in all probability, a marine form.

Fig. 12. *Surirella fastuosa* β . This species is finely developed, inasmuch that it might almost be taken for a distinct species. I am disposed, however, to regard it only as a finely-developed *S. fastuosa*, as figured by Smith, and probably more truly typical than the form he has figured. It agrees well, except in being larger, with Kützing's figure. It is known to be a marine species.

Fig. 13. *Tryblionella constricta*, W. G. This pretty little form is very frequent in the deposit. Its form is that of *Cymatopleura apiculata*, but it is very much smaller, and has all the characters of *Tryblionella*. Striæ transverse, fine, but distinct. I am informed by Mr. West, that he long ago met with it in gatherings from Poole Bay. It is a marine form. (220.)

Fig. 14. *Amphiprora vitrea*, β ? This fine form is frequent in the deposit. The peculiar arrangement of the median line, with its double curvature, at once strikes the eye. Indeed, on comparing it with the figure of *A. vitrea*, in the 'Synopsis,' it might be supposed to be a distinct species. But in the mean time, and until further examination, I refer it to the species named. It is a marine species.

Fig. 15. *Navicula birostrata*, W. G. This is a well-marked species. Form elliptical, with contracted, slightly produced, somewhat truncate apices. Striæ fine, somewhat inclined. It appears to vary a good deal in size. Habitat unknown. (221.)

Fig. 16. *Navicula rhombica*, W. G. This beautiful form is frequent in the deposit. Its form is rhombic, varying from short and rather broad, with obtuse apices, to long and narrow, with acute apices. Striæ very fine, transverse, quite distinct, even in balsam, which at once distinguishes it from *N. rhomboides*. The median line and central nodule are also quite different; and, in consequence, it differs totally in aspect from *N. rhomboides*, which is also present in the deposit, and with which it cannot be confounded. Habitat not known. (222.)

Fig. 17. *Navicula gastroides*, W. G. This form, when small, has some resemblance to *N. pusilla*; but is of much stouter habit, and has a brown colour, even in balsam. Besides this, it occurs much larger, being then more elliptical, while the smaller individuals are often almost orbicular. Striæ radiate and inclined. The median line and central nodule are very strongly developed, and the short apices appear as the

truncate extremities of the broad median line. Its habitat is not certainly known. (223.)

Fig. 18. *Navicula crassa*, W. G. This is a fine and well-marked species. Form elliptical, with a very slight inflexion before the obtuse apices. It varies considerably in size; has a very stout habit, and a brown colour in balsam. There is a large round spot in the centre, within which the two halves of the median line terminate in small round knobs, but do not meet. Striæ transverse, very fine, but distinct, not quite reaching the central line. It is frequent in the deposit, and is probably a marine form. (224.)

Fig. 19. *Navicula maxima*, W. G. This is a fine large form, much less frequent than any of the preceding. Form linear, elliptical, broad, with obtuse extremities. Striæ fine, transverse, reaching the central line. There seems to be a variety which is longer and narrower. Habitat unknown. (225.)

Fig. 20. *Pinnularia (Navicula) Gastrum*, Ehr. This little form is new to Britain, having been found by Ehrenberg in Mexican and North American gatherings. It is short, broadly lanceolate, with obtuse extremities slightly constricted. Striæ distinct, strongly radiate. The habitat is not given in Kützing, but it is probably marine. (226.)

Fig. 21. *Pinnularia apiculata*, W. G. This is another well-marked little species, which is not rare in the deposit. Form linear, narrow, contracted to small truncate apices. Striæ distant, transverse, hardly reaching the median line. Habitat unknown. (227.)

Fig. 22. *Synedra Vertebra*, W. G. This form, which is very frequent in the deposit, belongs to the same division as *S. pulchella* and *S. acicularis*. It differs, however, from both these forms, which also occur in the deposit, and can thus be compared with it, in the remarkable relative width of the central portion, which has a somewhat curved outline, and the equally remarkable way in which it suddenly contracts to the very slender terminal portions. In the largest specimens, these are very long. Its form resembles that of certain vertebræ, and it has been named so as to recal this resemblance. Nodule strongly developed. Striæ very fine. The habitat of this species is unknown. (228.)

Fig. 23. *Synedra undulans*, W. G. This is, perhaps, the most remarkable of all the forms in the Glenshira sand. It is exceedingly elongated, and so slender that a perfect specimen has not yet occurred to me. It consists of a middle portion rather wider than the rest, tapering both ways to a very small width. From this point it extends on both sides,

for a long way, of uniform width, and terminates in small oval expansions. The narrow part has strong moniliform striae, which, in the central and terminal expansions, are resolved, except just at the margin, into a general granulation. The margin is undulated, except for a short distance from each apex. It will be seen by one of the figures, which is not so long as some are, that the narrow part, on one side, without any part of the central long expansion, is frequently so long as to extend the whole way across the field, with a power of 400, that is, probably, 1-50th to 1-40th of an inch. This would make the length of the entire form to be probably from the 1-20th to the 1-15th of an inch, or more. This, with its extreme tenuity, accounts for its not occurring entire in a deposit carried by water, where it must have been constantly agitated. I have been informed by Mr. West, that a similar form, possibly of the same species, although shorter, occurs in a gathering from Port Natal, in the hands of Mr. Shadbolt. This curious *Synedra* is, therefore, a marine form, and I anticipate that it will be found recent on our own coasts. (229.)

Having now briefly described the new forms in the Glenshira sand, so far as they are here figured, I am compelled to postpone the remainder to the next number of the Journal, in which another plate will be required for them, as very nearly as many remain to be described as we have now been enabled to figure. In the meantime, besides the *Eumotia Falx*, which is not yet a British form, we have described 18 new forms, all from this one deposit, and one new to Britain. These, added to the list of known forms, make up the number of 229 species now recorded as occurring in the Glenshira sand, besides those to be hereafter noticed and figured.

It may be noticed here, that I intend to publish, as soon as the necessary figures can be prepared, a description of a very remarkable series of forms, occurring both in the Glenshira sand, and in various fresh-water gatherings, in which, indeed, I first observed them. They agree perfectly in general aspect, and the peculiar characters of the markings; but differ to a very surprising degree in form or outline. These may possibly constitute several species, and would certainly be considered as such by some authorities. But, both on account of their resemblance, or rather identity, in markings, and from the occurrence of intermediate or transition forms, by which the different types appear, in many cases at least, to pass into one another, there is some ground for regarding them as belonging to one species. Without deciding this question, I

have, for the convenience of description, grouped them under the name of *Navicula varians*, and I feel assured that the study of these forms will throw much light on the question, to which I have already directed attention, of the true value of form as a specific character.

I cannot conclude, for the present, without expressing the very great obligations I am under to Mr. Tuffen West, not only for the great care and accuracy with which he has drawn and engraved the figures, but also for the valuable assistance I have derived from his extensive and exact knowledge of the British Diatomaceæ in this long and laborious investigation. It is, indeed, fortunate for British microscopists that they have an artist who is not more distinguished for the beauty of his drawings than for his knowledge of the microscope, and his intimate acquaintance with the objects to be represented.

N.B.—Since the preceding pages were printed, I have observed a fragment of *Synedra undulans* in a slide from Poole Bay, sent to me by the Rev. W. Smith. I have no doubt that the gathering, if searched, will yield entire specimens. I am also informed by M. de Brébasson that he has seen the same form in marine gatherings from Brest, but supposed it to be *S. gigantea*, Lobarzewsky, from which species, however, he now finds it to be quite distinct.

I may take this opportunity of mentioning that the following species must be added to the list of known forms in the Glenshira sand, as I have noticed them quite recently.

- | | |
|------------------------------------|--------------------------------|
| 230. Tryblionella angusta. | 233. Gomphonema cristatum. |
| 231. " Scutellum. | 234. Mastogloia apiculata. Sm. |
| 232. Amphiprora elegans, Bleakley. | |

No. 232 is a splendid marine form, observed last spring by Mr. Bleakley, near Harwich. No. 234 is a very fine marine species, which occurs in great abundance along with 232 at Poole Bay. I have understood that Mr. Smith has named it as above, but that it may possibly be referable to another species.—W. G.

A few Remarks on a Paper, read before the Royal Society by
Dr. J. W. GRIFFITH, *on the ANGULAR APERTURE of OBJECT-*
GLASSES. By Dr. F. D'ALQUEN.

IN the last number of the 'Microscopical Journal' an abstract of the above paper was given, and, if you think the subject of sufficient interest to your readers, I should feel obliged if the following observations could appear in your next number, in refutation of the only novel point in Dr. Griffith's paper.

DESCRIPTION OF PLATE IV.

Illustrating Prof. Gregory's Paper on the Glenshira Sand.

Fig.

- 1.—*Eunotia Falx*, n. sp. 3248
(Found in the deposits of Lüneberg and Lillhaggsjön. See Vol. II., p. 104, of this Journal.)
- 2.—*Nitzschia Sigmatella*, n. sp. 2099
(Found as above, but also in the Mull deposit, and, with all the following figures, in the Glenshira sand.)
- 3.—*Cymbella truncata*, n. sp. =1391
- 4.—*Amphora Arcus*, n. sp. 1672
- 5.— " *incurva*, n. sp.
- 6.— " *angularis*, n. sp. 1585
- 7.—*Cocconeis transversalis*, n. sp. 2812
- 8.— " *speciosa*, n. sp. 1812
- 9.— " *distans*, n. sp. 812
- 10.— " *costata*, n. sp. 1722
- 11.—*Eupodiscus Ralfsii?* var. 4762 - 4772
- 12.—*Surirella fastuosa*, var. 2276
- 13.—*Tryblionella constricta*, n. sp. 2014
- 14.—*Amphiproa Vitrea*, var. ? 1267
- 15.—*Navicula birostrata*, n. sp.
- 16.— " *rhombica*, n. sp. 587
- 17.— " *gastroides*, n. sp. 466
- 18.— " *crassa*, n. sp. 459
- 19.— " *maxima*, n. sp. 565 - 564
- 20.—*Pinnularia Gastrum*, Ehr. 137
- 21.— " *apiculata*, n. sp. 116
- 22.—*Synedra Vertebra*, n. sp. 2615
- 23.— " *undulans*, n. sp. 2656

