

TRANSACTIONS.

On a species of FILAMENTOUS DIATOM new to BRITAIN.  
By ARTHUR S. DONKIN, M.D., Morpeth.

(Read June 10th, 1857.) TMS. 1858.

IN the 'Quarterly Journal of Microscopical Science,' vol. iv, p. 105, Mr. Brightwell, in a communication on the filamentous long-horned Diatomaceæ, describes two species of these singular Algæ as the first which have been, in a living state discovered in this country: these are *Chaetoceros Wighamii*, gathered by Mr. Wigham, at Breydon, near Yarmouth, in July, 1854; and *Goniothecium hispidum*, since found with the preceding, in the bay of the Isle of Roa, near Ulverstone. Since the date of Mr. Brightwell's communication, no other native member of the family has, I believe, been discovered.

Within the last few days, however, it has fallen to my lot to discover a third species in a recent condition, which, if I am not mistaken, has hitherto been found only in a fossil state in certain diatomaceous earths, and in the guano deposit on the coast of Peru; from which it appears to possess a very wide geographical range. This species is the *Syndendrium diadema* of Ehrenberg, easily recognised by the peculiar form of its frustule, with its numerous styles having branched extremities proceeding from its larger or more convex surface. This species was discovered in the following manner. A few days ago, I purchased a lobster taken off the Cresswell coast, nine miles to the east of Morpeth, not far from low-water mark, where the sea bottom is covered with flat rocks and the larger Algæ luxuriant. After subjecting the contents of this lobster's stomach to the action of boiling nitric acid for several minutes in a small retort, and after removing the acid from the remaining sediment by repeated ablutions with distilled water, I was not a little astonished to discover on all the slides—on which a portion of this sediment was placed—several specimens of *Syndendrium diadema*; its frustules being more numerous than those of any other diatom. From this fact it would appear, that this remarkable form is quite common on this part of the Northumbrian coast (but this I mean shortly to ascer-

tain by future investigation); and if so, which I little doubt, it will materially assist, by the facility offered for the study of its living form and economy, in solving the question as to whether the group, to which it belongs, ought to be classed amongst the *Diatomaceæ*, from which it has been excluded by Professor Smith in his recent 'Synopsis,' and by others, as of a doubtful character. It will also assist in determining whether those various species of the same family, hitherto observed only in a fossil or semi-fossil condition, have in the living state their frustules aggregated into filaments, or whether these exist as separate and independent organisms.

That the different genera constituting the filamentous *Algæ* will, by future investigation, be ultimately classed amongst the diatoms, although perhaps as an aberrant sub-family, I am inclined to believe. They possess one essential characteristic of the *Diatomaceæ*, namely, an external siliceous envelope, rendering their minute forms indestructible, either by the lapse of time or by the action of decomposing agents, ordinary or extraordinary, by which all other organized structures are resolved into their ultimate elements. But future observation must determine their relative position to their congeners by a careful study of their mode of development, and of the reproduction of their species.

*On the MARINE DIATOMACEÆ of NORTHUMBERLAND, with a Description of EIGHTEEN NEW SPECIES.* By ARTHUR S. DONKIN, M.D. Morpeth, Northumberland.

(Read October 21st, 1857.)

T.M.S. 1858.  
plate III

HAVING in the course of the past summer had occasion to visit the shores of this county for relaxation and pleasure, I embraced the opportunity thus thrown in my way of examining to some extent her marine *Diatomaceous products*; a work for which I was in some measure prepared, by having for the last few years devoted a portion of my leisure time to this particular field of inquiry, more especially in studying the fresh-water species.

I must own, too, that I was in no small degree prompted to the undertaking by knowing that the Northumbrian waters, have hitherto been, to the microscopist, unexplored regions. For, however carefully certain branches of her

natural history have been studied by the labours of her native naturalists—her ornithology by the immortal Bewick, and, more recently, by the accomplished Mr. Selby—her zoophytology by the late Dr. Johnston, and by Messrs. Alder and Hancock—no one yet had thought it worth his while to explore her springs, streams, lakes, subalpine tarns, and the waters of her extensive sea-board, in search of those microscopic beings, the *Diatomaceæ*; beings on whose surfaces, invisibly minute to the unaided vision of man, the omniscient hand of Creative Wisdom has found sufficient space to carve designs, so varied and elaborately beautiful, that their investigation has become a pleasurable pursuit even to some of the most philosophic spirits of the present age.

After some considerable investigation carried on amongst the fresh-water *forms*, which everywhere in this county abound, I became convinced of the accuracy of Professor Gregory's remark,\* to the effect, that those in search of new species belonging to this already extensive group, must procure his materials from the boundless waters of the ocean. This accurate suggestion I have followed, and have now to lay the result of my labours before this society. But before entering *in medias res*, a few brief remarks on the physical characters of this coast, and the manner in which I procured the objects of my research, may be novel and interesting to some of our members.

The Northumbrian shore, extending from the Tyne to the Tweed, embraces a coast line of about seventy miles, washed by the waters of the German Ocean; it presents, in this wide range, attractions of the highest order to the tourist, the archeologist, and the naturalist. Here are the Farn Islands, the favourite resort of sea-fowl, and the scene of the heroic feat of Grace Darling. The Saxon monastery of St. Cuthbert, at *Lindisfarne*, fills the mind with poetical associations:

"A solemn, huge, and dark-red pile,  
Placed on the margin of the isle;

Which could twelve hundred years withstand  
Wind, waves, and northern pirates' hand."

Here, too, are the lofty towers of Bambrough—

"King Ida's castle, huge and square,—"

and the baronial castles of Dunstanborough and Warkworth, pointing, amidst their dismantled solitude, to bygone times

\* 'Trans. Micr. Soc.,' vol. v, p. 86.

of feudalism, when the pursuits of war and rapine left science no votaries.

The natural features of this district are not less varied than its historical records are attractive. Here are rude precipitous promontories, some of sandstone, others of massive basaltic columns, rearing their heads majestically above the storm, and bidding bold defiance to the onward sweep of the incessant surge, which, in its futile efforts to upheave these cyclopean monsters from their primeval birthplace, is scattered back in clouds of white and sparkling spray, forming a picture sufficiently fascinating even to the most apathetic of nature's admirers. In such situations as these, flat reef-shaped rocks of sandstone, covered with a luxuriant growth of the larger Algæ, stretch far beneath the waves; at ebb tide these are laid bare for a considerable distance, and abound in *grallatorial* bipeds, and in all that would grace an aquarium. Beyond these "points" again, the eye rests on calm, sleepy bays, surrounded by a sandy beach, and by sand hills, the creation of the winds, and which the matting *sea-reed* (*Psamma arenaria*) prevents from being dissipated by the same element. Here also are the estuaries and mouths of several rivers discharging their waters into the ocean, and forming harbours for the extensive prosecution of the coal trade.

That a shore such as I have described should abound in diatoms might readily be supposed. The method I pursued in procuring these I shall now pass on to describe; I have found it superior to any other for obtaining marine forms. Professor Smith states,\* that "the shallow pools left by the retiring tide at the mouths of our larger rivers" are the favourite habitat of marine species. But such localities I have found not to be half so prolific in species as the *sands of still bays, on the shore, where they are exposed by the reflux of the tide, at a distance corresponding with the half-tide margin*. In these places, where the sands are sloping towards the sea, and grooved out into small furrows, filled with salt water oozing out from behind, the abundance of diatoms aggregated into a living mass, imparts to the surface of the sand different hues of chestnut and olive; the difference of colour being due to the nature of the species present. These coloured patches, it is interesting to observe, are, during the sunshine, studded with numerous minute air-bubbles, undoubtedly given off by the diatoms themselves.

To separate the diatoms thus detected from the surface

\* 'Synops.,' vol. i, Introd., p. i.

of the sand I found to be impossible. I therefore seized hold of the nearest bivalve shell which happened to lie in the way, and with this I carefully scooped up the surface of the coloured sand. This I emptied into a wide-mouthed, stoppered bottle, capable of holding eight ounces, until half full; the other half of the bottle I filled up with salt water. I then shook the whole briskly and allowed the bottle to stand for a short period. The sand, being composed entirely of fine round grains of quartz and the minute fragments of shells, settled at the bottom in a few seconds, leaving the diatoms all suspended in the water above, and forming by their abundance a chestnut-coloured cloud, but not more than 1 part in 1000 of the whole sand collected. The coloured water was then poured into another bottle and formed the gathering, while the sand was thrown away. The diatoms, in their turn, were separated from the superfluous water by subsidence, and brought home in 1½ oz. bottles. In this manner I soon found that any quantity could be collected in a pure and unmixed condition, affording an excellent opportunity of examining their living forms, and one of which I availed myself on every occasion.

After carefully examining materials collected in this way from various parts of the beach, I detected not less than about 100 species, all these strictly marine, and, with a few exceptions, each species in considerable abundance. But I was not a little surprised to find that out of this large number it was utterly impossible to refer more than forty-eight of these to Professor Smith's 'Synopsis.' I found, too, that I had gathered eighteen of the new forms discovered by Professor Gregory in the estuary of the Clyde, and described in his various papers on the Glenshira Sand, and in his more recent and very valuable contribution on the Marine Diatomaceous Forms of the Clyde.\* The remaining species, above thirty in number, are entirely new and undescribed, many of them of great interest and beauty. As, however, a description of the whole of these would extend the present communication to an undue length, I shall, on this occasion, confine myself to a few, and take an early opportunity to describe the remainder, together with my future investigations on this shore, in a separate paper.

In recording all the marine species found on the Northumbrian shore, I shall arrange them under the following heads for the sake of reference: I. *Species described in Professor Smith's 'Synopsis.'* II. *Species described by Professor Gregory*

\* 'Trans. Royal Soc. Edinb., vol. xxi, part iv.

as new, or new to Britain, in his various papers. III. Species entirely new, and for the first time described in the present paper.

I. Species described in Professor Smith's 'Synopsis.'

Amphora affinis.	Pinnularia directa.
"    salina.	Stauroneis pulchella.
Tryblionella punctata.	Pleurosigma formosum.
"    acuminata.	"    elongatum.
Cocconeis scutellum.	"    prolongatum.
"    diaphana.	"    strigosum.
Eupodiscus Ralfsii, $\beta$ sparsus.	"    quadratum.
Actinocyclus undulatus.	"    angulatum.
Coccinodiscus radiatus.	"    æstuarii.
Nitzschia spathula.	"    balticum.
"    reversa.	"    hippocampus.
"    closterium.	Amphiprora vitrea.
Synedra superba.	Biddulphia Baileyii.
"    tabulata.	"    aurita.
Navicula pygmalæ, $\beta$ minutula.	Gomphonema marinum.
"    palpebralis.	Achananthes brevipipes.
"    Smithii.	"    subsessilis.
"    punctulata.	Rhabdonema arcuatum.
"    Jenneri.	"    minutum.
"    humerosa.	Grammatophora marina.
"    didyma.	"    serpentina.
"    crabro.	Melosira nummuloides.
"    lyra.	Orthosira marina.
Pinnularia distans.	Isthmia enervis.

The stipitate forms enumerated above, I need not say, were not gathered in their natural habitat on the sands; but the frequent occurrence of their frustules, in such a locality, was a sufficient indication of their abundance on the larger Algæ, with which the neighbouring rocks of the shore are covered.

The beautiful and curious *Biddulphia Baileyii* was plentiful in several of the gatherings; it seems to me to be a free species; I have observed its frustules undergoing the process of self-division.

*Navicula Smithii* is here a plentiful species; *N. Lyra* is also very common in all its varieties; *N. crabro* frequent; and *N. humerosa* occurs abundantly in some localities; it is a species variable in its outline, but very uniform in its striation; its *dry valve is colourless*, thus differing widely from *N. granulata*, Bréb.

II. Species new, or new to Britain; first discovered by Professor Gregory in the estuary of the Clyde.\*

*Campylodiscus simulans*, Greg. ('Trans. Micr. Soc.,' vol. v, Pl. I, fig. 41).—This species occurs in Druridge Bay, but is somewhat scarce; it appears to me to be a genuine *Campylodiscus*. The valves, in all the specimens in my gathering, are orbicular and saddle-shaped; the *median or central space* is oval, with truncate extremities reaching nearly to the margin; it is marked transversely with parallel lines from side to side, and its *long axis in one valve* is at *right angles to that of the same space of the opposite*; the centre of the entire frustule thus presents a finely *fenestrated* appearance when in a certain focus, owing to the crossing at right angles of the transverse lines of the two opposed spaces. In these respects it differs widely from *Surirella fastuosa* and *lata*, of which Professor Gregory thinks it may be a variety.

*Coccinodiscus concavus*, Ehr. (Greg., 'Clyde Forms,' pl. ii, fig. 47).

Frequent along the coast.

*Navicula granulata*, Bréb.—The form of this species varies widely, from being in some specimens nearly orbicular to linear, or linear constricted in others; the extremities being always obtuse and produced. The striæ are coarse and widely punctate, *but always uniform*. It cannot be confounded with *N. humerosa*, Bréb. (*quadrata*, Greg., 'Trans. Micr. Soc.,' vol. iv, Pl. V, fig. 5), which also varies much in outline, by the most careless observer. As both forms were abundant in some of my gatherings, I have had an opportunity of comparing hundreds of specimens.†

*Hab.* Cresswell and Linemouth, abundant.

*Navicula latissima*, Greg. ('Trans. Micr. Soc.,' vol. iv, Pl. V, fig. 4).

Frequent at Linemouth.

\* I have satisfied myself that all the species enumerated under this head occur on the Northumbrian shore, having carefully compared specimens with those contained in series of slides, kindly sent to me by Professor Gregory, illustrative of all his new Clyde forms.

† I may also mention that, independent of these, I have detected several other species found in the Clyde, of which Professor Gregory intends shortly to publish a description. I have therefore not alluded to these in this paper.

† I have thought proper to give two figures of this large and beautiful species (fig. 19, *a* and *b*), to show how much it varies in its outline. The dry valve, when seen with a low power, is of a dull bluish colour, inclining to purple; while that of *N. humerosa* is colourless and hyaline.

*Navicula clavata*, Greg. ('Trans. Micr. Soc.,' vol. iv, Pl. V, fig. 17).

Frequent at Chibburn Mouth, Druridge Bay, and very large.

*Navicula maxima*, Greg. ('Cly. For.,' pl. i, fig. 18).

Frequent at Cresswell.

*Navicula angulosa*, Greg. ('Trans. Micr. Soc.,' vol. iv, Pl. V, fig. 8).

At Linemouth plentiful.

This species is very easily recognised from *N. Barclayana*, Greg. I did not find a single frustule of it in the gathering from Cresswell, in which the latter form was most abundant.

*Navicula Barclayana*, Greg. ('Cly. For.,' pl. i, fig. 9).

Frequent in many localities; at Cresswell abundant.

Easily recognised from *N. palpebralis*, Bréb.

*Amphiprora maxima*, Greg. ('Cly. For.,' pl. iv, fig. 61).

Frequent; at Cresswell plentiful.

*Apr. pusilla*, Greg. ('Cly. For.,' pl. iv, fig. 56).

Frequent; at Cresswell plentiful.

*Apr. lepidoptera*, Greg. ('Cly. For.,' pl. iv, fig. 59).

Frequent near Newbiggin.

*Amphora Grevilliana*, Greg. ('Cly. For.,' pl. v, figs. 89 and 90).

This beautiful and strongly marked species is abundant at Cresswell and frequent at Linemouth.

*A. cymbifera*, Greg. ('Cly. For.,' pl. vi, fig. 97).

Plentiful at Linemouth.

*A. levis*, Greg. ('Cly. For.,' pl. iv, fig. 74 c).

This species is abundant near Newbiggin. In Druridge Bay I have found frustules identical with that of fig. 74 d, which Professor Gregory now considers to be a distinct species, and not a variety of *A. levis*.

*A. levissima*, Greg. ('Cly. For.,' pl. iv, fig. 72).

At Newbiggin very abundant.

*A. robusta*, Greg. ('Cly. For.,' pl. iv, fig. 79).

This interesting and well-marked species is frequent at Cresswell.

*Cocconeis distans*, Greg. ('Cly. For.,' pl. i, fig. 23).

Near Newbiggin frequent.

### III. New Species.

The first two species which I have to describe as new are forms so remarkable, and so different in certain structural peculiarities from every member of any of the genera hitherto

discovered, that it becomes essentially necessary to establish an entirely new genus to which to refer them. This genus (to be characterised by the curve of the median line, and by the structure of the valve) I have termed *Toxonidea* (τοξον and *idea*, bow-shaped).

### TOXONIDEA.

Frustules free; valves elongated, convex, *with two sides not symmetrical*; striated, striæ oblique. Median or longitudinal line *arcuate*, with central and terminal nodules, *the latter curving towards the same side of the valve*.

One distinguishing feature, then, of this new genus, in addition to the *arcuate median line*, being the *oblique striation of the valve* (probably due to cellular structure), found so well developed in one section of the genus *Pleurosigma*, it is evident that it bears a close natural affinity to this latter group, and that both are members of the same sub-family. That the *arcuate curve* of the median line, together with the want of symmetry observable in the opposite margins of the valve, which indeed is strongly *arcuate* on one side, in one of the forms, and slightly so in the other, to say nothing of the total absence of any sigmoid tendency, is a structural difference sufficient to warrant the separation of these two species in question from the genus *Pleurosigma*, is apparent from the fact, that to admit them into it would be equivalent to abolishing the most distinctive character on which that group has been founded by Professor Smith, who observes that "the sigmoid flexure of the valve, more or less present in all our native species, at once distinguishes this genus from its allies."

1. *Tox. Gregoriana*,\* n. sp.—Valve straw-coloured, lanceolate; extremities obtuse, and curved strongly towards one side of the valve. Median line, on each side of the central nodule, curved first towards one side of the valve, then, some distance from the extremities, gradually and more strongly towards the opposite, until it reaches the terminal nodules; when viewed from one extremity to the other it has a most graceful appearance, resembling a representation of an unbent *Scythian bow*. Length from 0.008" to 0.009"; breadth from 0.001" to 0.0016". Striæ oblique, fine, probably 50 in 0.001".†

\* I have dedicated this species to Professor Gregory, my former and highly esteemed teacher, by whom our knowledge of British marine Diatomaceæ has been considerably enlarged.

† I may here state that, in describing the *striæ* of this, as well as of the following seven species, I have merely attempted to *guess* the number of

I have already remarked that want of symmetry in the opposite margins of the valve is a well-developed character of the genus *Toxonidea*. This is well illustrated in the present species, and is more easily understood by examining the valve itself (fig. 1, Pl. III), which presents an appearance different from that of any other known diatom. One margin, which, as in the next form to be described, I shall term the *dorsal*, follows very closely the curve of the median line, and is gently arcuate through the greater portion of its extent; but near to the extremities of the valve it curves gradually backwards in the opposite direction. The ventral margin, on the other hand, bears no relation to the median line; it is almost linear, but slightly convex until near the extremities, where, after approaching close to the median line, it curves strongly backwards to its junction with the dorsal margin. The ventral margin then is linear elliptical. The striation appears to be as fine as that of *Pl. angulatum*, and the *areolation* of the *Pleurosigmata*, with a sufficient power and illumination, is very distinct.\* The striæ, however, are much more easily resolved as *transverse* than as *oblique*; owing, doubtless, to some structural peculiarity of the valve not found in the *Pleurosigmata*.† When viewed with a good  $\frac{1}{2}$  objective, and very oblique light from the mirror, the striæ always appear transverse, like a finely marked *Stauroneis*, unless the light fall upon it at a particular angle, when they come out distinctly in an oblique manner.

these in 0.001", by taking *Pl. angulatum* as a standard, by which I visually compared them. It is therefore probable that I may be, in some instances, a little wide of the truth. If so, the error was unavoidable, as the highest power I possess is a superior one-fifth objective; with this it is quite impossible to count lines so fine as those with which the forms in question are marked. But this is a deficiency of little practical utility, as the microscopist must learn to measure the *marking* of minute objects by the eye rather than by the micrometer.

\* With one of Smith and Beck's instruments, their one-fifth objective of 100° aperture, No. 1 eye-piece, five inches of the draw-tube, and the illumination afforded by their achromatic condenser, having the central portion of the illuminating pencil cut off by a central stop, the areolation becomes very distinct; but much more so with No. 2 eye-piece and the same length of draw-tube, giving a power of 655 diameters.

† On discovering this species, on the 28th of June last, I sent a specimen to Mr. Shadbolt, as a very remarkable *Pleurosigma*, which I termed *Pl. arcuatum*, not having then detected the smaller form which led to the formation of the present genus. After examining it carefully, he wrote to me as follows: "Your *Pl. arcuatum* is undoubtedly new, but I have some doubts about the *genus*; the aspect and general appearance is very like a *Pleurosigma*; but under a low power it looks like a *Stauroneis*, owing to a peculiarity in the internal part of the frustule. The areolation is very distinct, and is exhibited with a one fifth without difficulty when properly illuminated."

This splendid species I found plentiful in gatherings from Cresswell and Linemouth. In a gathering from Newbiggin, in which the next form abounded, I could not detect a single frustule. It occurs on several other parts of the coast.

2. *Tox. insignis*, n. sp.—Valve straw-coloured; dorsal margin strongly arcuate, ventral linear; extremities subacute, on dorsal margin produced. F. V. linear lanceolate, only seen in the living frustule. Median line not central, strongly arcuate near the centre. Length from 0.0048" to 0.006"; breadth of S. V. about 0.001". Striæ very fine, probably from 75 to 80 in 0.001".

This very remarkable form in its outline, in short specimens especially, very much resembles a strung bow or a "cocked" hat. The strongly arcuate curve of the dorsal margin ceases a short distance from the extremities of the valve; the margin then pursues an almost linear course to its termination, thus giving the extremities on this side a produced appearance. The almost linear ventral margin at each extremity curves gently backwards. The median line is most gracefully arcuate; it curves strongly towards the ventral margin, and after nearly approaching it, continues an almost rectilinear course, though just perceptibly backwards to the terminal nodules, which are strongly curved to the dorsal side. The median line is far from central, being situated no great distance from the ventral margin.

The striæ are remarkably fine and most difficult to exhibit, and, as in the preceding species, come out transversely much more easily than as obliquely. The areolation I have observed with a  $\frac{1}{2}$ , but with this power it is very faintly seen, even with the most favorable illumination and careful manipulation. The valve is undoubtedly a far more difficult test object for a  $\frac{1}{4}$  or a  $\frac{1}{2}$  objective than any of the *Pleurosigmata* at present employed for that purpose, with the exception of *Pl. fasciola* and *Pl. obscurum*, which, however require the aid of a superior  $\frac{1}{8}$  or  $\frac{1}{12}$  for the full exhibition of the striæ, owing to their *faintness*.

I have frequently examined the living frustule of this species; it moves through the water with the S. V. uppermost, occasionally turning on its dorsal surface for a few seconds, thus exhibiting a good view of the F. V.

*Hab.* Frequent at Cresswell, and near Newbiggin abundant.

#### PLEUROSIGMA.

Observations made on some of the species of this genus, about to be described, have convinced me that *sigmoid flexure*

of the valve is not so general as to render it applicable for one of the most important generic distinctions of a group so extensive as that of *Pleurosigma*. It appears to me, that curvature of the median line, and not of the valve itself, must be looked upon as a characteristic feature of this genus, and that all its known species prove these two important facts: First, that the median line may be sigmoid, even strongly so, without any obvious curvature of the valve; for example, *Pl. lanceolatum* and *Pl. carinatum* (figs. 4 and 5, Pl. III). Secondly, that when the valve is sigmoid, it is so in conformity with the median line, as in *Pl. hippocampus* and others; and that, although the whole valve may not observe the same amount of curve throughout as the median line, yet one margin at least, towards each extremity, generally does so.

### Section I. *Striation oblique.*

3. *Pl. marinum*, n. sp.—Valve straw-coloured, lanceolate, straight, slightly sigmoid near the extremities, obtuse. Median line sigmoid on each side of the central nodule. Length 0·0055" to 0·006"; breadth of S. V. about 0·001". Striæ probably from 45 to 50 in 0·001".

The well-marked sigmoid flexure of the median line, on both sides of the central nodule, at once distinguishes this from any other British species belonging to the present section, and renders it easy of recognition.

*Hab.* Newbiggin North Sands, plentiful. This is the only locality in which I have found this species.

4. *Pl. lanceolatum*, n. sp.—Valve straw-coloured, perfectly straight, broadly lanceolate, acute. Length from 0·0055" to 0·006"; breadth from 0·001" to 0·0014". Median line straight, or gently sigmoid in the middle; terminal nodules curved in opposite directions. Striæ very fine, probably about 70 in 0·001".

This species is remarkable in consequence of the valve being free from the slightest sigmoid flexure. In most specimens the only indication of curve exhibited by the median line is observable in the terminal nodules; in others again, in addition to this, there is a very gentle curve in opposite directions on either side of the central nodule for a short distance. The striæ are remarkably fine, and require the most careful manipulation with very oblique light to render them visible with a superior  $\frac{1}{2}$  objective. The valve, therefore, is a test object of much greater delicacy than that of *Pl. angulatum*, though not equal to *Tox. insignis*.\*

\* As corroborative of my opinion on this matter, I may adduce the tes-

*Hab.* Plentiful along the coast between the Coquet and the Wansbeck. Newbiggin North Sands, abundant.

5. *Pl. carinatum*, n. sp.—Valve straight, linear lanceolate, acute, very convex, colour dull purple. Length about 0·0046"; breadth about 0·0005". Striæ fine, probably from 55 to 60 in 0·001". Median line strongly curved on either side of the central nodule, until it approaches close to the margin of the valve, in which direction it continues to its termination; its marginal portion forming a prominent ridge or keel, which is much more prominent on one side of the central nodule than on the other. This peculiarity gives the F. V. an unequally keeled appearance, as seen in fig. 5 b.

The keeled appearance of the F. V. at first led me to suspect that the present form ought to be referred to the genus *Amphiprora*. But the strong sigmoid flexure of the median line, and the distinctly oblique striation, together with the absence of marginal plates,\* which Professor Gregory has shewn to be so generally present in the members of this genus, has convinced me that it is a genuine *Pleurosigma*. The striæ are not easily resolved in the S. V., owing to its great convexity; they however come out very distinctly in the F. V.

*Hab.* Newbiggin North Sands, abundant; Linemouth and Cresswell, frequent.

### Section II. *Striæ longitudinal and transverse.*

6. *Pl. rectum*, n. sp.—Valve pale straw-coloured, very convex, linear, narrowest in the middle, straight, extremities rounded on one margin, somewhat obtuse. Median line strongly sigmoid; marginal for the terminal half of its extent on either side of the central nodule. Length from 0·0045" to 0·005"; breadth about 0·0006". Longitudinal and transverse striæ distinct, fine, probably 60 in 0·001".

The S. V. appears sigmoid at the extremities; but it is not so. This appearance is due to one margin, on opposite sides near each extremity, following the convex curve of the median line.

*Hab.* Frequent. At Cresswell, abundant.

timony of Mr. Shadbolt, who, after examining one of my specimens with a power much higher than I possess, sent me the following reply: "Your *Pl. lanceolatum* has markings as you indicate (oblique), which are easily resolvable under my one-twelfth, but with difficulty by the one-fifth. They are much more difficult than those of *Pl. angulatum*."

\* "On the Marine Diatomaceous Forms of the Clyde," Trans. Royal Soc. Edinb., vol. xxi, part iv, p. 32.

7. *Pl. Wansbeckii*, n. sp.—Valve pale straw-coloured, slightly convex, linear lanceolate, acute, slightly sigmoid near the extremities. Median line gently sigmoid, not central, not marginal. Length from 0.0045" to 0.005"; breadth about 0.0006". Longitudinal and transverse striæ probably 50 or more in 0.001".

This species bears merely a *generic* resemblance to *Pl. angustum*, n. sp., and cannot be confounded with it. It differs widely from *Pl. rectum*, n. sp., in its much longer, acute, and gracefully sigmoid valve; in its median line, which is much less curved, and never approaches close to the margin; in its striæ, which are not so fine; and in its habitat.

*Hab.* Pools left by the tide, where the water is strongly brackish, at the mouth of the Wansbeck. It is not a *littoral* form. I have never met with a single specimen on the beach, where the other allied forms, described in this paper, are abundant. This fact alone, independent of structural differences, would prove it to be distinct from any of these.

8. *Pl. minutum*, n. sp.—Valve a very pale-brown colour, oblong, acute, exceedingly convex. Median line strongly sigmoid. Length about 0.0025"; breadth about 0.0005". Striæ very fine; transverse distinct, probably 55 in 0.001"; longitudinal very obscure, owing to great convexity of the valve.

The median line in this minute species, the smallest of the genus I have seen, is not so marginal near the extremities as that of *Pl. rectum*. It differs also in its size and in the outline of the valves.

*Hab.* Cresswell, abundant. Frequent in some other localities.

9. *Pl. angustum*, n. sp.—Valve dull purple, rather opaque, exceedingly convex, linear; extremities acute, and slightly apiculate. Median line marginal, except in the middle, for a short space on each side of the central nodule, where it crosses the valve, forming a prominent ridge or keel. Length from 0.005" to 0.0055"; breadth about 0.0006", narrowest in the middle. Striæ obscure, longitudinal, visible a little on one side of the median line.

In this curious form the median line overlaps the margin of the valve on either side, and prevents its being seen in this situation. The great convexity (and opacity of the dry) valve renders it almost impossible to resolve its striæ; although I have seen the longitudinal near the concave side of the median line. It is evidently allied to *Pl. rectum*, but

differs as much from it as is possible for two nearly allied forms to do.

*Hab.* Chibburn Mouth, Druridge Bay, abundant. This is the only locality in which it has occurred to me. In the Cresswell gathering, in which *Pl. rectum* was abundant, I could not find a single frustule of this species.

10. *Pl. arcuatum*, n. sp.—Valve very pale-brown, straight, broadly lanceolate; extremities produced into two long, obtuse, strongly arcuate beaks, curved in opposite directions. Length from 0.004" to 0.0046"; breadth about 0.0005". Striæ obscure. Median line straight, and terminating at the commencement of the extremities.

The long, strongly arcuate, and somewhat obtuse, extremities (resembling the *bill* of the *curlew*, *Numenius arcuata*), and the short, wide body of the valve, distinguish the present species from *Pl. macrum*, to which, however, it is closely allied. It is, besides, much shorter than the latter species; never exceeding 0.005", which is about half its length, according to the measurement of Professor Smith, given in his 'Synopsis.' The extremities, also, are much longer in proportion to the valve than in *Pl. macrum*.

*Hab.* Chibburn Mouth, Druridge Bay, and Cresswell, abundant.

#### COCCONEIS.

The species next to be described I have had some difficulty in referring to the present genus, in consequence of its frustules being *free*, and *not adherent* to the larger Algæ; a character which has been insisted upon by Ehrnberg, in the establishment of this genus, and adhered to by Professor Smith in his 'Synopsis.' The frustule in this species is also remarkable *in not having the median line central*. But in certain other respects it appears to me to be a true *Cocconeis*. I have therefore classed it as such, and have done so under the impression that, as our knowledge of the Diatomaceæ increases, it will be found necessary to extend the basis of distinction on which many of the present genera have been founded, in too limited and arbitrary a manner, in order that they may thus be made to embrace a much larger number of species, and thereby prevent the formation of new genera for the purpose of including every new form which may present certain structural peculiarities *apparently* anomalous.

11. *C. excentrica*, n. sp.—Frustules free. Valve disciform, convex near the margin. Median line not central, with terminal nodules not reaching to the margin. Striæ convergent, widely punctate, punctæ closer and more conspicuous



near the margin, thus forming a somewhat opaque and broad marginal band in the dry valve. Diameter from 0.001" to 0.002".

The eccentric position of the short median line seems to distinguish this species from every other member of the genus. The frustules are free, and have the power of moving. The endochrome is central, and of a pale-green colour, leaving the marginal portion of the valve with its radiate striæ distinctly visible. The dry valve is colourless, and the central portion much more translucent than the marginal. In balsam the opaque appearance of the marginal band becomes obliterated.

*Hab.* Linemouth, abundant; Cresswell, plentiful.

#### BACILLARIA.

12. *B. cursoria*, n. sp.—Frustules adherent, by means of some invisible connecting medium, into a filament, and having the power of moving, one along the opposed surface of the other. Form narrow, linear lanceolate, acute, with a central longitudinal line composed of thickly set, transverse punctæ, extending from one extremity to the other. Structure hyaline, not striated. Length from 0.0028" to 0.0034"; breadth about 0.0004". The only view which I have ever seen of this species is that which always exhibits the frustule with the central, longitudinal, and punctate line uppermost, as in fig. 12a. Whether this punctate line is situated on the middle of the S. V. and indicates a keel, or whether it extends down the centre of the F. V., corresponding with the intervalvular space, I am not prepared positively to decide, although I incline strongly to the latter opinion. My reasons for this opinion are the following:

First. Because a group of dry frustules preserving their natural, relative position, always presents each frustule to view with this line in the centre, and because *such a group* or filament always exhibits the F. V., and not the S. V., of each individual frustule. The same is seen in a *similar group* or filament of *B. paradoxa*; never the S. V.

Secondly. Because in frustules which appear to be undergoing the process of self-division, the punctate line is double, the distance between the two lines varying according to the degree to which the process has proceeded. (See fig. 12b, Pl. III.)

This species is so abundant on the sands in some localities on this coast, that, in the clean gatherings from these, I have enjoyed frequent opportunities of observing the movement

which a filament of its frustules exhibits. The following are the facts which I have ascertained regarding this most remarkable phenomenon:

1. When the filament is in a quiescent state, the frustules are all drawn up side by side, their extremities being all in a line, thus forming a *group*.

2. When a filament, previously at rest, resumes its activity, the movement is commenced by the *second* or *inner* frustule, at one end of the filament, gliding forward along the contiguous surface of the *first* or *outer* frustule, until their opposite extremities overlap each other. This is soon followed by a similar movement of the 3d, 4th, and 5th, &c., all moving forward in the same direction, and each frustule gliding along the surface of the one preceding it, until they have extended themselves into a lengthened filament or chain. In the course of two or three seconds after this has been accomplished, a *retrograde* movement, exactly of the same character, begins to take place, and continues until the filament has retraced its course, and stretched itself out in a direction exactly opposite to the position it had previously occupied. This phenomenon is repeated again and again, and in this manner the whole group is kept in a state of activity for an indefinite period of time, and all the while, if no impediment produces irregularity, the *outer* or *terminal frustule*, next to which the movement commenced, *maintains a stationary and fixed position*.

3. The rapidity with which each individual frustule moves is in direct ratio to its distance from the terminal *stationary* frustule, being most rapid at the opposite or moving extremity of the filament. On this account, most of the frustules, while the filament is moving to and fro, cross a line drawn at right angles to the middle of the long axis of the stationary frustule, at the same instant of time, afterwards shooting past each other like horses on a racecourse.

4. The force with which the filament moves is very great, so much so, that I have observed it upset and shove aside a large frustule of *A. arenaria*, n. sp., at least six times its own bulk, obstructing its path. This force is, in a great measure, due to the rapidity with which the frustules move. The time which a filament, even of considerable length, occupies in crossing the field of the microscope being only a few seconds.

5. Light appears to be a necessary stimulus for the maintenance of this motion. When a filament, in active motion, is placed in the dark for a short period, and then examined, the movement is seen to have ceased; but again commences

when the filament is exposed to the light for a short time. Is this singular movement, with which the present species is endowed, not a vital phenomenon and independent of physical causes for its existence?

6. When the moving extremity becomes entangled in any kind of substance intercepting its course, the opposite or stationary extremity commences to move, and continues to do so until the entangled extremity is set free; sometimes, in such instances, a frustule in the centre remains fixed, a movement of each half of the filament in opposite directions, on either side of it, taking place. But all these irregularities cease as soon as the impediment has been got rid of.

These facts lead to the conclusion that the present species is a true *Bacillaria*, although apparently somewhat anomalous in the structure of its frustule. The gliding movement of one frustule over the contiguous one is the same as is observed in *B. paradoxa*. But it differs from this latter species in this essential particular, that the whole of its filament moves on one side of a terminal frustule which is stationary; while in *B. paradoxa*, each half of the filament moves in opposite directions on either side of a central stationary frustule.

Whether the filament is at first attached, and afterwards free, as in *B. paradoxa*, I cannot positively decide, although I believe it to be free, owing to its only occurring in the shallow furrows on the beach, where there is not a single vestige of vegetable life, except the free species of diatoms with which it is mixed.

I think there can be little doubt that the form found by Professor Gregory in the Glenshira sand, and described as *Nitzschia socialis*, of which a group of frustules are figured ('Trans. Micr. Soc.,' vol. v, Pl. I, fig. 45) is another member of the same genus. "This species," he observes (*op. cit.* p. 80), "is remarkable from its occurring in the prepared material, after boiling with acids, in groups of six, eight, ten, or twelve, or more, without any apparent connection between them." Groups such as these, of the present species, are common on slides mounted from gatherings in which it occurs.

#### AMPHIPRORA.

13. *Apr. duplex*, n. sp.—F. V. rectangular, broad, rounded at the extremities, and very deeply constricted in the middle. Marginal plates also much constricted, and rounded at the extremities. Hoop broad. Structure exceedingly hyaline. Valve not striated, and without punctæ on either side of the

keel. S. V. narrow, linear-lanceolate, acute, exceedingly convex; keel strongly sigmoid. Length from 0.002" to 0.0026"; breadth variable.

This form bears a strong resemblance to *Apr. alata*, in the contour of its F. V. But the absence of striæ in the valve and of punctæ on each side of the keel, together with the narrow linear shape of the S. V., prove it to be quite distinct from, though nearly allied to this species. The endochrome also is differently arranged from that of *Apr. alata*. The frustule undergoing division presents a very beautiful appearance, from the interlacing of the external surfaces of the contiguous and newly formed valves; as seen in fig. 13 c. A double appearance is thus produced. I may mention, as a curious fact, that nine tenths of all the specimens contained in a gathering from Druridge Bay, in which this species occurred abundantly, were in this double condition. This would show that the frustules remain adherent for a considerable period after being fully developed, by the process of self-division, which, in the present species, progresses with great rapidity.

#### EPITHEMIA.

14. *E. marina*, n. sp.—Form on F. V. rectangular, elongated; "hoop" on dorsal or convex surface of frustule ornamented with several longitudinal lines of round, distinct, and widely set punctæ; on ventral surface, hyaline. Length from 0.004" to 0.007"; breadth from 0.001" to 0.0018". S. V. inflated, gently arcuate on outer or dorsal margin, on inner or ventral nearly linear, but slightly constricted in the middle; extremities suddenly produced, acute. Canaliculi conspicuous, 11 in 0.001". Striæ 11 in 0.001", widely punctate; punctæ large and rather inconspicuous. Dry valve a bright blue, in balsam colourless.

The fact of the "hoop" being hyaline in texture, on the ventral or concave surface of the frustule, and on its opposite, convex or dorsal surface, ornamented with six or more rows of large, round, widely set punctæ, as may be easily seen by carefully focusing, together with the peculiar incurved longitudinal line observable near the inner margin of each valve, shows that it is nearly allied to Professor Gregory's group of complex *Amphora*.\* But the outline of the entire frustule with its inflated valves, which appear to me to possess canaliculi and striæ which are widely punctate, have induced me, for the present at least, to include this large and beautiful

\* 'Trans. Royal Soc. Edinb.,' vol. xxi, part iv, p. 47.

species in the genus *Epithemia*. With this opinion, I may mention, Professor Gregory concurs, while, on the other hand, Mr. Roper considers it to be a *Nitzschia*. But notwithstanding the high esteem in which I hold his accuracy and experience as a scientific observer, I cannot reconcile my views, on this point, with his. It seems to me, that this curious, and somewhat anomalous, form is without those essential generic peculiarities of the true *Nitzschia*, namely, compressed valves, with a keel to each, and its accompanying line or lines of punctæ.

#### AMPHORA.

In describing the following Amphoræ I have adopted the terms *dorsal* and *ventral*, as employed by Ehrenberg. These, though discarded by Mr. Ralfs and Professor Smith, are essentially necessary for the description of several recently discovered species of the present genus, in which the difference of structure, observable in each of these surfaces, is so great, that when a frustule is seen in a focus first shewing the one, and afterwards in a different focus exhibiting the other, the difference of appearance is so great that an observer, unaware of this fact, might readily suppose that he was looking at two widely different forms. This is well illustrated in fig. 15 *a* and *b*. The term "*hoop*" I have also used, in the same sense as employed by Dr. Carpenter,\* to designate the siliceous plate intervening between the margins of the opposed valves. It will be observed that I have employed these terms, in the same sense, in reference to *Epithemia marina*.

15. *A. litoralis*, n. sp.—Form on F. V. oval, with truncate extremities. Hoop on dorsal surface broad, oval, slightly constricted, and marked with seven or more longitudinal lines of linear, transversely set punctæ; hoop on ventral surface linear, narrow, widest in the middle and at the extremities, hyaline. Length from 0.002" to 0.003"; breadth from 0.0008" to 0.0012". S. V. dorsal margin arcuate, ventral linear; extremities obtuse; longitudinal line gently curved, situated some distance from the ventral margin, and dividing the valve into an outer and inner compartment; central nodule expanded into a strong, opaque, transverse bar, reaching to the dorsal margin. Striæ very distinct, moniliform; those of the inner compartment the finer.

The present species is evidently a member of Professor Gregory's group of *complex Amphoræ*. The *complex* structure,

\* 'On the Microscope,' p. 303.

in this group, is apparently developed, only, in the hoop of the dorsal surface of the frustule, which seems to be constructed, like the bottom of a flattish boat, of several narrow longitudinal segments, which, like deals, are placed edgewise with their extremities convergent. This structure is well seen in fig. 15 *b*, Pl. III, and still better in *A. Grevilliana*, Greg., and *A. spectabilis*, Greg. The complex structure then is only observed as Professor Gregory has already pointed out "when the frustule is in a particular focus."

*Hab.* Chibburn Mouth, Druridge Bay; abundant.

16. *A. arenaria*, n. sp.—Frustule hyaline, colourless. F. V. rectangular; extremities slightly rounded; sides somewhat uneven, slightly bulged out in the middle and at the extremities. Length from 0.004" to 0.006"; breadth about 0.0016". S. V. convex, linear, dorsal margin rounded, near the extremities, towards the apices situated on the ventral margin. Central nodule some distance from the inner margin; longitudinal line much curved, first towards the dorsal, then near the extremities, to the ventral margin, where it joins the terminal nodules.

The F. V. presents a space of the shape of a sand-glass between the two gracefully curved longitudinal lines. This space, when the dorsal surface is in focus, is faintly marked with from six to eight longitudinal lines; the outer converging at their extremities. These indicate a complex structure of the frustule.

This large and interesting form is exceedingly hyaline and transparent when mounted in balsam. Mr. Shadbolt, who carefully examined specimens with a very high power, informs me that "it (the S. V.) is ornamented with markings of dots at right angles to the axis as well as parallel thereto; but these are of the most delicate nature, and discoverable with *difficulty* under the most careful manipulation with a  $\frac{1}{2}$  objective of 165° aperture, and with peculiar illumination by the achromatic condenser."

The living frustule is remarkably beautiful; the whole being filled with endochrome, having a greenish appearance, and collected in different places into large, bright-yellow globules. In the water the ventral surface is always uppermost.

*Hab.* Common along the southern portion of the Northumbrian shore. At Cresswell remarkably abundant, forming at least seventy parts in one hundred of the whole chestnut-coloured, diatomaceous mass with which the sinuosities in the sand, at low water, are covered.

## NAVICULA.

17. *N. lineata*, n. sp.—Form of S. V. linear-elliptical, occasionally constricted a little in the middle. Striæ distinct, costate, and interrupted in the middle by a longitudinal, transparent line, running from one extremity of the valve to the other, nearly parallel with its margin; striæ also cut short, some distance from the median line, by another transparent longitudinal line parallel to the last, and succeeded by a line of indistinct punctæ. Median line broad, and bounded on either side by a narrow, rectilinear, transparent line. Length from 0.0023" to 0.0035"; breadth from 0.0008" to 0.0013". Valve brown in balsam.

58-89x  
20-33µm  
This species is easily recognised from *N. didyma* and its varieties by its costate, bisected striæ, and by the much larger blank space on either side of the median line; the constriction of the valve, when it exists, is also much slighter. Each half of the valve is divided into three distinct, narrow compartments, by three transparent lines running longitudinally between the extremities; the two outer being parallel to each other and to the margin, and the inner parallel to the contiguous median line. The two outer compartments each inclose a band of striæ, while the third or inner is hyaline, and bordered by a longitudinal row of indistinct transverse punctæ.

*Hab.* Cresswell Bay and Linemouth, abundant; not general in its distribution.

18. *N. æstiva*, n. sp.—Form gracefully elliptical; colour of dry valve blue, in balsam brown. Striæ fine, distinct, costate, or very obscurely moniliform, reaching close to the median line, and crossed a short distance on either side of it by a narrow, opaque, longitudinal line. Length from 0.0026" to 0.0045"; breadth from 0.0012" to 0.0022".

66-114x  
50-56/100  
This large and very beautiful species differs from *N. Smithii* in its much more gracefully elliptical figure, in its costate and much finer striæ, and in the much darker brown colour of the valve when mounted in balsam. *N. Smithii*, as it occurs on the Northumbrian shore, is a much smaller species, with rather coarse, moniliform striæ, and is nearly colourless in balsam when examined with a low power; it is likewise much more general in its distribution than the present species, and occurs in every strictly marine gathering which I have made.

*Hab.* At Cresswell and Linemouth, abundant.

## Postscript.

Since the preceding pages were read before the Micro-

scopical Society I have, by the kindness of Mr. Roper, and of Dr. Montgomery, of Penzance, been favoured with slides of *Pl. rectum*, n. sp., gathered at Penzance. The former gentleman informs me that Professor Walker-Arnott has very recently discovered it there, and named it *Amphiprora Ralfsii*. But as my description of this form has already been made public, I have retained it in the present contribution. I must also add, that however reluctant I may be to dissent from so high an authority as Professor Arnott, yet I am convinced that this species is a *Pleurosigma*, and not an *Amphiprora*. My reasons for holding this opinion are as follows: 1st. Because the S. V. has a sigmoid appearance; the sigmoidure resulting from the opposite margin, near each extremity, following the convex curve of the contiguous median line. 2dly. Because the structure of the valve is that of a *Pleurosigma*—the striæ being distinctly longitudinal and transverse,—as may be observed without difficulty by using a good  $\frac{1}{2}$  objective and the achromatic condenser with a central stop, aided by careful manipulation. In this way the striæ, though very fine, come out very sharp and distinct. The only evidence on which it appears to me the supposition rests of its being an *Amphiprora* is the contour of the F. V., which is keeled and constricted. But the discovery of *Pl. lanceolatum* and *Pl. carinatum* show that this character, apart from the structure of the valve, cannot be relied upon. In both these species the F. V. is very distinctly keeled, and as deeply constricted in the middle as most of the *Amphiproræ*; and yet their valvular structure proves them to be *Pleurosigmata*—the striæ being very distinctly oblique, and indicating the hexagonal areolation of one section of that genus.

These facts show that the outline of the frustule and of the S. V. is not sufficient to determine whether a particular species belongs to the one genus or to the other, and that in every instance the structure of the valve is the only character on which any reliance can be placed. The presence or absence of lateral or marginal plates, which Professor Gregory has recently shown to be so universally developed in the *Amphiproræ*, is also a feature of great importance, and will materially assist in the discrimination of species. In concluding, I may add that all the new species of straight *Pleurosigmata* described in this paper are closely allied to the *Amphiproræ*, and form a connecting link between this latter genus and the one to which they belong.

It is necessary here to add that, while these pages were passing through the press, I have been informed by Mr. Roper that *Pl. lanceolatum*, n. sp., Pl. III, fig. 4, is identical with

the *variety* of *Pl. transversale*, Bréb., described by him in the last (October) number of the 'Microscopical Journal'; that *Pl. lanceolatum*, however, is distinct from *Pl. transversale*, I think is proved by the fact that the former is the most common member of its genus on the Northumbrian shore, while I have never, yet, met with a single specimen of the latter. I may also state that De Brébisson considers it a distinct species; he has informed me, within the last few days, that in September, 1852, he discovered it on the sands at Dives, with many other species. But, unfortunately, he never published any description of these.

On a NEW METHOD of MOUNTING OBJECTS. By THOMAS SHEARMAN RALPH, Esq., Wellington, New Zealand.

(Read November 12th, 1857.)

WITH the accompanying specimens which I have sent for the acceptance of the Society, I feel much pleasure in adding a few observations as to the mode in which they have been prepared, and the manner of mounting them. I have looked over all the papers and communications of the Society in the 'Quarterly Journal,' and I hope what I have to say may prove as useful to some of the members as many of their observations have been to me at this far distant point of the globe. And I trust what I may have to say, if not savouring of novelty or usefulness, will be acceptable, as a proof that I have not been idle in the interests of the Society.

The specimens, as those now sent, will be found to be mounted on perforated slides of glass—a plan which I saw put into practice some years ago, but which was then only adopted with wooden slides; but I think the present is a more suitable mode of mounting, as the glass is less likely to bend. I found considerable difficulty at first in making the preparations; but practice has made me more handy, and I am able to complete a sample in ten minutes. And as they are neater looking, I think they may supersede the use of the wooden ones. The method which I employ, when put into practice, will also enable any person to make cells of any required form or size, such as those in which tongues of the mollusca have been put up.

Take a slide, of as great a thickness as can be usually had,

## DESCRIPTION OF PLATE III,

Illustrating Dr. Donkin's paper on the Marine Diatomaceæ  
of Northumberland.

- Fig.
- 1.—*Toxonidea Gregoriana*, n. sp.
  - 2.— „ *insignis*, n. sp.
  - 3.—*Pleurosigma marinum*, n. sp.
  - 4.— „ *lanceolatum*, n. sp. (*a*, S. V.; *b*, F. V.)
  - 5.— „ *carinatum*, n. sp. (*a*, S. V.; *b*, F. V.)
  - 6.— „ *rectum*, n. sp.
  - 7.— „ *Wansbeckii*, n. sp.
  - 8.— „ *minutum*, n. sp.
  - 9.— „ *angustum*, n. sp.
  - 10.— „ *arcuatum*, n. sp.
  - 11.—*Cocconeis excentrica*, n. sp.
  - 12.—*Bacillaria cursoria*, n. sp. (*a*, F. V.; *b*, frustule undergoing self-division; *c*, a group of frustules.)
  - 13.—*Amphiprora duplex*, n. sp. (*a*, S. V.; *b*, F. V.; *c*, a double frustule.)
  - 14.—*Epithemia marina*, n. sp. (*a*, S. V.; *b*, F. V.)
  - 15.—*Amphora litoralis*, n. sp. (*a*, F. V., ventral surface in focus; *b*, F. V. dorsal surface in focus; both drawn from the same frustule.)
  - 16.— „ *arenaria*, n. sp. (*a*, F. V.; *b*, S. V., outer surface; *c*, the same, inner surface.)
  - 17.—*Navicula lineata*, n. sp.
  - 18.— „ *æstiva*, n. sp.
  - 19.—*a* and *b*. *N. granulata*, Bréb.

Magnified 400 diameters.

9.

