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*On the MARINE DIATOMACEÆ of NORTHUMBERLAND, with a DESCRIPTION of SEVERAL NEW SPECIES.* By ARTHUR SCOTT DONKIN, M.D., L.R.C.S. Edin., Lecturer on Medical Jurisprudence in the Newcastle-on-Tyne College of Medicine, in connection with the University of Durham.

In my previous communication\* on this subject, I believe I was the first to point out to observers, that in many localities on the sands of the open shore, marine Diatomaceæ, in a living state, can be collected in great abundance; and several to whom I have sent slides, or gatherings, have had opportunities of judging of their richness and purity; amongst whom I may mention my friends, Dr. Greville, Mr. Roper, and Mr. Okeden. Since the publication of my former contribution, the ample experience of three consecutive summers has led me to arrive at the conclusion, that the presence of Diatomaceæ on the sandy beach of still bays is not an accidental occurrence, or the result of peculiarities of season; but, on the contrary, that such localities are the natural habitat of the *free species* belonging to this highly interesting class of microscopic organisms, and that, in such localities, these species are annually, during the spring and summer months, generated in surprising abundance. But my observations have led me to infer that certain conditions are essential to their propagation on the open shore. These are—1, a clean sandy beach; 2, a still or calm condition of the water by which this beach is washed; 3, a certain degree of warmth in the sand.

On the first of these conditions I may remark, that mud seems to be inimical to the propagation of free marine species; for in muddy localities, otherwise favorable to their propagation, they are either entirely absent or very thinly scattered over the surface. As to the second condition, they are never found on such portions of the beach as are subject

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\* 'Trans. Micr. Soc. London,' vol. vi, p. 33, new series.

in ordinary weather to the influence of breakers, but only in sheltered quiet *nooks*, where the tide creeps up and retires again without producing waves, which, beating against the surface of the sand, soon dissipate its tiny occupants. For this reason, the collector may traverse miles of the shore otherwise suitable, without observing a single specimen, until he arrives at some sheltered cove, such, for example, as serves to protect the boats of the fishermen from the violence of the storm. In such favoured spots, the furrows left on the sand by the receding tide will be found to be covered by a chesnut or olive coloured stratum of Diatomaceæ, which may be collected in the manner described in my former paper. It is necessary to add, that these habitats should not be visited by the collector, except during the continuance of calm weather, as immediately after a storm all traces of Diatomaceæ will have disappeared. The third condition, however, seems to be as necessary as the other two; consequently, Diatomaceæ are only observed on the beach between the latter part of April to the beginning of September, as a general rule, when not only the stillness of the sea, but the warmth which the sands acquire from the direct rays of the sun during ebb-tide, favours their propagation. From September to April, the low temperature and the waves of winter prevent their development and aggregation.

I will only here remark, on the propagation of the Diatomaceæ, that although it has not been shown that they form *gonidia*, yet I have reason to believe that *gonidia*, in the form of *still* or *resting spores*, are the sources from which the new *crop* originates on the beach each successive spring. This opinion I have formed from the following facts. First, amongst the myriads of specimens of marine Diatomaceæ I have examined in the living state, I have never observed the process of conjugation. Secondly, I have, as a general rule, found the same species luxuriating in the same circumscribed locality (extending, in many cases, over only a few square yards) which yielded it in the previous summer. The presence of a particular form, year after year, in the same spot, would therefore appear to be due to the propagating cause remaining buried in the sand during the winter, through the course of which not a diatom is to be found. Were the crop of each succeeding spring due to the subdivision of a single frustule, or of a few, accidentally left by the tides, the same locality would produce, in all probability, widely different forms each returning season.

I may mention as a fact of some importance, that I have generally found the species most commonly met with on the

beach, arranged in distinct zones, in the lower of which (that near the low water margin) the *Toxonideæ*, *Pl. lanceolatum*, *Pl. falcatum*, *N. lyra*, *N. forcipata*, &c., occur abundantly. In the upper zone, or that near high-water mark, the predominant forms are *Cocconeis excentrica*, *N. palpebralis*, *Amphiprora pusilla*, *Ep. marina*, *Nitz. virgata*, *Nitz. spatulata*, &c.; in the middle zone, *A. arenaria*, *N. granulata*, *N. humerosa*, *N. Clepsydra*, *N. Northumbrica*, *N. truncata*, &c., are abundant.

Before proceeding to describe the new species which I am about to introduce, I consider it necessary to make a few observations in defence of some of those already published in my previous contribution. Professor Walker Arnott has asserted that the two species forming my new genus *Toxonidea*, *T. Gregoriana* and *T. insignis*, are mere twisted or distorted conditions of *Pleurosigmata*, the former of *Pl. angulatum*, the latter of *Pl. æstuarii* or *Pl. lanceolatum*, Dr. Arnott observes,\* "In *Pleurosigma* I have seen no instance in which the living frustule is twisted" \* \* \* "the S. V. is sigmoid with the median line nearly equidistant from the two sides; but after the valves are detached from the connecting zone, they often become slightly twisted, and as they cannot then present a flat surface to the eye, the median line appears to approach nearer to the one margin than the other.\* This is a confession and explanation of views, on the part of Dr. Arnott, in itself fatal to his hypothesis; for it shows that the twisting or distortion, which he avers the *Toxonideæ* have been subjected to, is not a vital change found in the living frustule, but is the result of boiling in acid, and of drying the valve on glass slides. To prove the inaccuracy of this assertion, I have only to observe, that I have examined numberless specimens of both *Tox. Gregoriana* and *insignis* in a living state, moving in their native element; and that the shape of the valve, and the relative position of all its parts, in each species, is exactly that represented by me in my description† and figures of them. To my own testimony I may be allowed to add that of my friend, Dr. Greville, to whom I sent a living gathering, abounding in these species. In nearly all the very numerous gatherings I have, from time to time, made on the Northumbrian shore during the last four summers, I have found the *Toxonideæ* in some localities in great abundance, and in all they preserve a remarkable uniformity of contour and markings. *Pl. angulatum*, on the contrary, is not a shore

\* 'Micr. Journal,' vol. vi, p. 199.

† 'Trans. Micr. Soc. Lond.,' vol. vi, p. 19, new series.

diatom, as I have ascertained by ample experience in searching after living forms. It is not even a marine species, its habitat being the brackish water of the tidal estuaries, where it occurs abundantly. On the open shore, free from the influence of streams, its occurrence is very rare and accidental.

*Pl. lanceolatum* Dr. Arnott considers to be "a form of *Pl. æstuarii*, Sm., peculiar to clean sand."—*Micr. Jour.*, vol. vi, p. 197). "These two forms," he says, "have not been sufficiently isolated to permit any positive deduction to be drawn." This reads somewhat paradoxical; but I must reply, first, that *Pl. lanceolatum* is a very much larger form than *Pl. æstuarii*, and has not apiculate extremities; the colour of the valve is rich salmon, while that of the latter is bluish inclining to purple; secondly, that both are found in the typical state developed under the same conditions in the same localities, on the surface of the *clean sandy beach*; and thirdly, that I have gathered each form singly in separate localities. Dr. Arnott seems to found his opinion of the identity of these two species on the assertion of Professor Smith, that *Pl. æstuarii* is frequently "*direct*." It is possible, however, that Professor Smith has confounded the two forms together.

Some observers have objected to *Epithemia marina*, that it is a *Nitzschia*; but with this opinion I cannot agree: it has neither the compressed frustule nor the *keeled* valve of that genus; on the contrary, its valve is *inflated*, and I have been able to detect on it a *median line* with central and terminal nodules, which is best seen in dry specimens, when the ventral surface of the F. V. is carefully brought into focus under a high power and good illumination. These characters of the valve, taken in connection with the ornamented appearance of the hoop, would prove the species in question to belong either to the genus *Amphora* or to be a member of a new genus; to the one or the other of which, it and the following closely allied forms, *Nitzschia virgata*, Roper, *Nitz. Amphioxys*, Sm., and *Nitz. vivax*, Sm., ought to be referred. In all of these the striæ are punctate.

In the first two sections of the following list, I have included all the species enumerated under Sections I and II of my former paper.

SECTION I.—*Species described in Professor Smith's Synopsis.*

a. Brackish Water Species.

<i>Epithemia Musculus</i> , Kütz.	<i>Epithemia Constricta</i> , De Bréb.
" <i>Westermanii</i> , Kütz.	"
	<i>Amphora affinis</i> , Kütz.

<i>Campylodiscus parvulus</i> , Sm.	<i>Navicula elegans</i> , Sm.
<i>Surirella lata</i> , Sm.	<i>Pinnularia peregrina</i> , Ehr.
" <i>Gemma</i> , Sm.	<i>Stauroneis crucicula</i> , Sm.
" <i>fastuosa</i> , Ehr.	<i>Pleurosigma distortum</i> , Sm.
" <i>Brightwelli</i> , Sm.	" <i>fasciola</i> , Sm.
" <i>ovata</i> , Sm.	" <i>litorale</i> , Sm.
" <i>solina</i> , Sm.	" <i>Hippocampus</i> , Sm.
<i>Tryblionella marginata</i> , Sm.	" <i>Balticum</i> , Sm.
" <i>punctata</i> , Sm.	" <i>quadratum</i> , Sm.
" <i>acuminata</i> , Sm.	" <i>angulatum</i> , Sm.
<i>Nitzschia sigma</i> , Sm.	<i>Synedra tabulata</i> , Sm.
" <i>bilobata</i> , Sm.	" <i>gracilis</i> , Sm.
<i>Navicula convexa</i> , Sm.	<i>Amphiprora alata</i> , Kütz.
" <i>Jennerii</i> , Sm.	" <i>constricta</i> , Ehr.
" <i>Westii</i> , Sm.	" <i>vitrea</i> , Sm.
" <i>punctulata</i> , Sm.	<i>Amphipleura sigmoidea</i> , Sm.
" <i>pusilla</i> , Sm.	
" <i>Amphisbæna</i> , var., Sm.	

b. Salt-water Species.

<i>Cocconeis scutellum</i> , Ehr.	<i>Navicula didyma</i> , Kütz.
" <i>diaphana</i> , Sm.	" <i>palpebralis</i> , De Bréb.
<i>Eupodiscus crassus</i> , Sm.	" <i>Lyra</i> , Ehr.
" <i>fulvus</i> , Ehr.	" <i>Kennedyii</i> , Sm.
<i>Actinocyclus undulatus</i> , Kütz.	" <i>retusa</i> , De Bréb.
<i>Coscinodiscus radiatus</i> , Ehr.	<i>Pinnularia Cyprinus</i> , Ehr.
" <i>eccentricus</i> , Ehr.	" <i>distans</i> , Sm.
" <i>concinus</i> , Sm.	" <i>directa</i> , Sm.
<i>Triceratium favus</i> , Ehr.	<i>Stauroneis pulchella</i> , Sm.
<i>Campylodiscus Hodgsonii</i> , Sm.	var. pl. 19, fig. 1948.
" <i>Ralfsii</i> , Sm.	<i>Pleurosigma transversale</i> , De Bréb.
" <i>clypeus</i> , Ehr.	" <i>Nubecula</i> , Sm., rare.
" rare.	" <i>formosum</i> , Sm.
<i>Nitzschia spathula</i> , De Bréb.	" <i>elongatum</i> , Sm.
" <i>reversa</i> , Sm.	" <i>delicatulum</i> , Sm.
" <i>closterium</i> , Sm.	" <i>strigosum</i> , Sm.
<i>Synedra superba</i> , Kütz.	" <i>æstuarii</i> , Sm.
<i>Navicula liber</i> , Sm.	<i>Doryphora Boeckii</i> , Sm.
" <i>pygmæa</i> , Sm.	<i>Amphitetras antediluvianum</i> , Ehr.
" <i>Smithii</i> , De Bréb.	<i>Biddulphia aurita</i> , De Bréb.
" <i>humerosa</i> , De Bréb.	" <i>Baileyii</i> , Sm.
" <i>Crabro</i> , Ehr.	

<i>Biddulphia rhombus</i> , Sm.	<i>Grammatophora marina</i> ,
„ <i>turgida</i> , Sm.	„ Kütz.
<i>Gomphonema marina</i> , Sm.	„ <i>serpentina</i> , Kütz.
<i>Achnanthes brevipes</i> , Ag.	<i>Melosira nummuloides</i> , Kütz.
„ <i>subsessilis</i> , Kütz.	<i>Orthosira marina</i> , Sm.
<i>Rhabdonema arcuatum</i> , Kütz.	<i>Isthmia enervis</i> , Ehr.
„ <i>minutum</i> , Kütz.	<i>Schizonema cruciger</i> , Sm.

SECTION II.—*Species discovered since the publication of Professor Smith's Synopsis.*

- Eupodiscus sparsus*, Greg. Trans. Micr. Soc. vol. v, pl. 1, fig. 47).  
*Eupodiscus tessellatus*, Roper. (Micr. Journal, vol. vi, pl. iii, fig. 1).  
*Coscinodiscus concavus*, Ehr. (Greg. in Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 2, fig. 47).  
*Coscinodiscus nitidus*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 2, fig. 45).  
*Coscinodiscus ovalis*, Roper. (Micr. Journal, vol. vi, pl. 3, fig. 4).  
*Amphiprora plicata*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 4, fig. 57).  
*Amphiprora complexa*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 4, fig. 62).  
*Amphiprora maxima*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 4, fig. 61).  
*Amphiprora pusilla*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 4, fig. 56).  
*Amphora Grevilliana*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 5, fig. 90).  
*Amphora cymbifera*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 6, fig. 97).  
*Amphora robusta*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 4, fig. 79).  
*Amphora levis*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 4, fig. 74).  
*Amphora levissima*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 4, fig. 72).  
*Navicula granulata*, De Bréb. (Trans. Micr. Soc. Lond. vol. vi, pl. 3, fig. 19).  
*Navicula clavata*, Greg. (Trans. Micr. Soc. Lond. vol. iv, pl. 5, fig. 17).  
*Navicula angulosa*, Greg. (Trans. Micr. Soc. vol. iv, pl. 5, fig. 8).  
*Navicula rectangulata*, Greg. (Trans. Royal Soc. Edin. vol. xxi, pl. i, fig. 7).

- Navicula nitescens*, Greg. (Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 1, fig. 16).  
*Navicula formosa*, Greg. (Trans. Micr. Soc. Lond. vol. iv, pl. 5, fig. 6).  
*Navicula rhombica*, Greg. Trans. Micr. Soc. Lond. vol. iv, pl. 5, fig. 1). *N. libellus*, of the same author, is obviously a variety of this form (see Trans. Royal Soc. Edin. vol. xxi, part iv, pl. 6, fig. 101).  
*Navicula forcipata*, Grev. (Micr. Jour. vol. vii, pl. 6, figs. 10 and 11).  
*Nitzschia virgata*, Roper. (Micr. Jour. vol. vi, pl. 3, fig. 6).  
*Attheya decora*, West. (Trans. Micr. Soc. vol. viii, pl. 7, fig. 15). This form I gathered in abundance at Cresswell, so long ago as June, 1857. That is long before Mr. West or Mr. Atthey were aware that Diatomaceæ were to be found on the beach there. It is horny, and not siliceous in its structure, and will therefore not bear boiling in acid.  
From the above list I have excluded the following forms contained in the corresponding section of my former paper: *Navicula latissima*, Greg.; a variety of *N. granulata*; *N. Maxima*, Greg. identical with *N. liber*; *N. Barclayana*, Greg. a large form of *N. palpebralis*; *Amphiprora lepidoptera*, Greg., which I inserted erroneously; and *Cocconeis distans*, Greg., of which I have only seen an imperfect specimen.

SECTION III.—*Species new to Britain.*

1. *Eupodiscus tenellus*, De Bréb. (Fig. 16). (“Diatom. Marin. du Littoral de Cherbourg,” memoires de la Société Impériale des Sciences Naturelles de Cherbourg, tome ii, 1854).

Disc colourless, slightly convex, granular; granules moniliform, arranged in convergent lines; surface of disc divided into eight compartments by eight equidistant lines of coarser granules, reaching near to the centre; lines on either side of these interrupted a short distance from the margin; pseudo-nodule marginal.

Of this form De Brébisson justly remarks:

“L'ouverture marginale de cette espèce délicate est si peu distincte, et se confond tellement avec les granules, qu'il serait permis de douter qu'elle appartînt à ce genre, si la structure non celluleuse et la disposition de ses granules n'obligaient à l'y rapporter.”

SECTION IV.—*New Species.*

1. *Pleurosigma falcatum*, n. sp. (Pl. I, fig. 1).—Form of frus-

tule linear on S. V.; on F. V. falcate, or gently arcuate. V. pale straw colour, on S. V., narrow, linear, slightly sigmoid; extremities rounded; median line strongly sigmoid; on F. V. twisted laterally and falcate. Length from '0060" to '0070", breadth of S. V. about '0006"; striæ oblique, fine.

The peculiar form of this singular species is owing to the entire frustule being *twisted laterally* on its *long axis*, and to its being curved in the form of an arc. The frustule has, therefore, one valve curved forward, and convex on its outer surface; the other bent backwards, and concave in its outer surface. The peculiar lateral twisting of the valve is well seen in its F. V. (fig. 1, c).

When examined in the living state, this species has all the appearance of a *Toxonidea*, between which genus and the *Pleurosigmata* it forms a connecting link; it is, however, a genuine *Pleurosigma*, in which the twisting and curvature of the frustule are natural and not accidental conditions. To examine the entire frustule in a prepared state, the material must be macerated in alcohol and ether, and afterwards roasted on a thin glass cover.

*Hab.* Cresswell and Boulmar Bay; plentiful, June to September, 1858 and 1859.

2. *Navicula Trevelyana*,\* n. sp. (fig. 2).—Form on F. V. elongated quadrangular, constricted laterally; on S. V. linear, extremities rounded, margins slightly bulging out near the extremities and middle; valve exceedingly convex, inflated, with large *orbicular unstriated* space around central nodule; median line curved; striæ coarse, costate, strongly convergent around central nodule, strongly divergent near extremities. Length, from '0040" to '0050"; breadth of S. V. about '0008".

This beautiful species I have found in gatherings with *N. rectangulata*, Greg., to which it is closely allied, but twice as large, and widely different in specific characters.

*Hab.* Cresswell and Duridge Bay. May, June, and July, 1857, 1858, and 1859.

3. *Navicula clepsydra*,† n. sp.—Form on F. V. elongated

\* Dedicated to Sir Walter Calverley Trevelyan, Bart., Wallington, Northumberland.

† I have placed this species, as well as the new species of *Navicula* with costate striæ, described in this contribution, in the genus *Navicula*, because I believe the genera *Stauroneis*, Ehr., and *Pinnularia*, Ehr., to be merely sections of the genus *Navicula*, and the characters on which they are established of a purely *specific* nature. Even the late Prof. Smith did not adhere strictly to the definition of these two genera, as given by Ehrenberg, for we find in the 'Synopsis' that he places in the genus *Pinnularia* species which have the features of *Stauroneis*, i.e., *P. divergens*, *P. interrupta*, and *P. Stauronei-formis*. In like manner *Pinnularia Johnsonii*, Sm., is a *Navicula* in the acceptation of Ehrenberg.

quadrangular, constricted laterally; S. V. linear elliptical, extremities rounded; valve convex, compressed laterally, with an imperfectly orbicular stauros not reaching to the margin; striæ coarse, moniliform, monilæ irregular elongated. Length, from '0025" to '0350"; breadth, from '0008" to '0010".

This species I have named from the hourglass-shaped outline of the F. V.; it is a very abundant littoral form, being present in the greater number of gatherings I have made from time to time on the Northumbrian shore; it is very little subject to variation in outline and striation; and though closely allied to *Stauroneis pulchella*, it differs from that species in being a much smaller form, in the outline of the F. V., in the much greater convexity of the valve, in its striation, and size and shape of the stauros. The var. of *S. pulchella*, figured by Professor Smith ('Synop.', vol. i, pl. xix, fig. 194, b), is common on the Northumbrian shore, and seems to take the place of the typical form, which is rare.

*Hab.* Cresswell, Druridge Bay, Tynemouth; coast of Normandy, De Brébisson.

4. *Navicula truncata*, n. sp.—Form on F. V. rectangular, constricted laterally, angles truncated. On S. V. narrow, linear elliptical; extremities subacute; valve convex, compressed laterally; striæ *costate, coarse, parallel*, reaching nearly to the median line. Length, from '0025" to '0035"; breadth of S. V. about '0005".

*Hab.* Boulmar Bay, Druridge Bay, Cresswell, Tynemouth, abundant. Frith of Clyde, the late Professor Gregory.

5. *Navicula Northumbrica*, n. sp.—Form on F. V. broad, quadrangular, with gently rounded angles, and slightly constricted laterally; striæ delicate, *moniliform*; those opposite and on either side of central nodule coarse and opaque, forming a dark bar, extending from nodule towards the margin of valve; valve highly convex, and compressed laterally, from the margins towards the median line, into a keel. S. V. narrow, lanceolate acute. Length, from '0018" to '0030"; breadth of F. V., from '0012" to '0018", of S. V. '0004".

The delicate moniliform striæ and opaque line opposite the central nodules, as seen on the F. V., readily distinguish this form from its allies. The narrow acute S. V. is also very remarkable; for, owing to the valve being so strongly compressed and convex, its margins and median line cannot be brought into focus at the same time with a  $\frac{1}{4}$ -in. or a

½ objective; so that the striæ can only be examined on the F. V.

*Hab.* Very abundant on the Northumbrian shore, in several localities, from May to September, 1857, 1858, and 1859. Coast of Normandy, De Brébisson.

6. *Navicula hyalina*, n. sp. (fig. 6).—Form on S. V. gracefully elliptical, valve colourless, median line bordered on either side by an opaque, shadowy line, broad, gradually widening on either side of central nodule, and suddenly contracting near terminal nodules. Striæ very fine and delicate, probably 75 in '0001'.

The gracefully elliptical outline, hyaline appearance of the valve, and its striation, more delicate than most of the finely marked *Pleurosigmata*, sufficiently distinguish this species from any of the marine *Naviculæ* with which I am acquainted. It is a severe test-object for the best objectives below a one-eighth inch focus.

*Hab.* Cresswell and Boulmar Bay, from July to September, 1858 and 1859.

7. *Navicula cruciformis*, n. sp.—Form on F. V. oblong, constricted laterally, extremities truncate. S. V. linear elliptical; valve convex, compressed laterally, colour brown; striæ costate, about 35 in '001"', reaching to median line, absent from centre, so as to leave a stauros reaching to the margin. Length, about '0030"'; breadth of S. V. '0006"'.  
a, b.

The marine habitat alone, independent of structural peculiarities, distinguishes this species at once from *N. Brébissonii*, Kütz. (*N. Stauroneiformis*, Sm.), which is often gathered at very high altitudes, and which it somewhat resembles in its general appearance.

*Hab.* Boulmar Bay and Cresswell, abundant.

8. *Navicula arenaria*, n. sp.—Form on F. V. oblong, extremities truncate; on S. V. narrow, lanceolate, acute; striæ costate, coarse, slightly convergent opposite central nodule, reaching to the median line; length from '0012"' to '0012"'.  
c, d.

This small form is the most abundant of the littoral species with which I am acquainted, with the exception of *N. gregaria*, the next form to be described, which, however, is more restricted to certain localities.

*Hab.* Boulmar Bay, Druridge Bay, Cresswell, Lyne Mouth, Newbiggin, Tynemouth.

9. *Navicula gregaria*, n. sp.—Form on S. V. broadly lanceolate, apiculate; striæ obscure.

This exceedingly minute form is very abundant in localities where small streams pass over the sandy beach into the sea,

below the high-water level. In such situation it is therefore covered with fresh water for a short period during ebb tide, and with salt water for several hours during the flow. It is not, however, confined to the beach, but forms an olive stratum on the surface of the piers, stones, and piles of our harbours, between the high and low water level, and may be looked upon as the species which occurs in most abundance on our coasts.

In the gatherings I have made of this species I have observed that all the specimens, in a very short space of time, congregated and adhered around any extraneous matter present in the gathering, and that the groups thus formed adhered with wonderful tenacity. This phenomenon I have frequently observed under the microscope, and have been astonished to observe numberless individuals simultaneously directing their course towards the same object, as if controlled by an influence higher than physical force, to which alone the movements of the Diatomaceæ have been referred by many observers.

*Hab.* Chibburn mouth, Druridge Bay, Lyne Mouth, Blyth Harbour, Tynemouth.

10. *Amphora ocellata*, n. sp.—Form on F. V. broad, rectangular, extremities very slightly rounded, colourless; hoop on dorsal surface transversely and very delicately striated; valve inflated, finely striated, with a broad, hyaline band extending across it from posterior margin to central nodule; central nodule indefinite, marginal. Length, about '0028"'; breadth, about '0014"'.  
e, f.

The hyaline, transverse band gives rise to an opaque, eye-shaped spot on each margin of the frustule, when seen on the F. V. From a comparison of specimens of both forms, I feel satisfied that this species is distinct from *A. levis*, Greg. ('Trans. R. Soc. Edin.,' vol. xxi, part iv, pl. iv, fig. 74).

11. *Amphora naviculacea*, n. sp.—Form on F. V. rectangular, angles slightly rounded, valve highly convex, median line gently curved; striæ on dorsal or outer half of valve continuous, and nearly parallel; an inner or ventral half coarser, interrupted, and absent opposite central nodule, strongly divergent on either side of it, and strongly convergent near terminal nodules. Length, from '0030"' to '0035"'; breadth of F. V. about '0011"'.  
g, h.

This species strongly resembles a *Navicula* in its F. V., though the want of symmetry of the valve on either side of the median line, even observable in this view of the frustule, easily determines its generic position.

*Hab.* Cresswell, common, May, 1858.

12. *Amphora lineolata*, n. sp.—Form on F. V. nearly rectangular, slightly convex laterally. Hoop with several longitudinal plicæ, finely striated transversely; valve slightly convex, arcuate on dorsal and linear on ventral margin, with delicate transverse striæ; median line gently curved. Length, about  $\cdot 0030''$ ; breadth of F. V.  $\cdot 0012''$ .

*Hab.* Cresswell and Druridge Bay, May to August, 1857 and 1858.

#### SYSTEPHANIA, Ehr.

"Frustules orbicular; disc cellulose, neither septate nor radiate, with an external cirlet of spines or an erect membrane on the disc, not on the margin; cellules in parallel rows. The spines are subulate, and not unlike the peristome of a moss." (Pritchard's 'Infusoria,' 4to edition, p. 832.)

Such are the characters given by Ehrenberg to a genus of which he has described three species, namely, *S. aculeata*, distinguished by its few spines (12 to 15) and coarse cellules; *S. corona*, with numerous spines (40 to 50) and finer cellules; (about 11 in  $\cdot 001''$ ); and *S. diadema*, with numerous incurved spines and still finer cellules (about 13 in  $\cdot 001''$ ). These three species have only been found, hitherto, in a fossil state in the Bermuda earth.

13. *Systephania Anglica*, n. sp.—Valve circular, finely punctate; punctæ excentric; spines about nineteen, acute, and curved about the margin of the valve. Diameter, from  $\cdot 0012''$  to  $\cdot 0015''$ .

I am glad to be able to add this most curious form to the list of British species; it is the only living representative of the genus hitherto discovered, and from the description above given it will be perceived it differs from *S. aculeata*, *S. corona*, and *S. diadema* in the number and nature of its spines and the minuteness of its areolæ. These are only visible, as excentric lines of punctæ, with a superior English one-fifth or one-eighth objective, and suitable illumination, and would, therefore, have been perfectly invisible by the glasses used by Ehrenberg.

*Hab.* Cresswell, May and June, 1858. Although this species is rare, I have examined several specimens from this locality.

#### DRURIDGIA,\* nov. gen., Donkin.

Filament free, compressed, of two (or few?) frustules; frustules oblong or elliptical, geminate by the persistence of the connecting membrane; valve compressed, elliptical, punctate, siliceous throughout.

This new genus I have established to refer to it a species whose characters cannot be reconciled either to the genus *Podosira*, in which the filament is attached, the frustule spherical or cylindrical, and the valve hemispherical, with an absence of silex from its apex; or to *Melosira*, in which the filament is composed of numerous cylindrical frustules, with hemispherical valves.

14. *Druridgia geminata*, n. sp.—Filament of two frustules; cingulum transparent, delicate; frustule on F. V. oblong, with rounded angles, approaching to elliptical, brown when dry; hoop absent, or restricted to a mere line; valve compressed, on S. V. elliptical, minutely and obscurely punctate. Length, from  $\cdot 0007''$  to  $\cdot 0016''$ ; breadth,  $\cdot 0004''$ .

In the living state the endochrome presents a large, dark, circular spot at each angle of the filament.

In the previous number of this Journal Mr. West has described and figured (vol. viii, Pl. VII, fig. 11) a form, under the name of *Podosira? compressa*, which seems, from his description, to be identical with *Druridgia geminata*; if so, Mr. West has represented the puncta to be much coarser and more scattered and distinct than they ought to be. So much so, that I feel assured that specimens could not be identified by his figure. Mr. West states that his *P. compressa* and *Atheya decora* were found in Druridge Bay and at Cresswell by Mr. Athey, of West Cramlington, from whom he derived his materials. Concerning the publication of these two forms by Mr. West, I think it just to observe that he was well aware, from a call he made me in December, 1859, that I had in my possession a large number of new MSS. species, discovered by me at Cresswell and other localities on the Northumbrian shore, all of which I intended shortly to publish, and only a few of which I had time to show to him on that occasion. Now, bearing this fact in remembrance, I hold that Mr. West, before publishing the two species in question, ought to have inquired whether they were amongst the number of MSS. species. If he had done so, I would have informed him that I discovered them both at Cresswell,

\* From Druridge, Northumberland.

so long ago as the month of June, 1857, at a time, in short, when neither Mr. Athey nor any one else in this country knew that marine diatoms were to be found on the sands in such localities.

*Navicula retusa*, De Bréb. (fig. 17).—Form on F. V. oblong, angles rounded, constricted in the middle; S. V. linear, narrow, extremities rounded. Valve convex near the margin; striæ parallel, costate, subdistant, short, not reaching to the median line, shortest opposite the central nodule; median line delicate; middle third of valve hyaline. Length, from '0020" to '0025"; breadth, about '0004".

Concerning this form, much confusion prevails amongst observers. I have thought it necessary to give a figure of it, to show more clearly the points of difference between it and *N. truncata* and *N. Northumbrica*, to which it is closely allied. The description I have above given of *N. retusa* corresponds with that of Prof. Smith, given in the appendix to the 'Synopsis,' and also with the description of the S. V. given by De Brébisson; it differs from its nearest allies, especially in the linear outline of its S. V., in its short thick striæ, cut short at a considerable distance from the median line, so that the middle third of the valve is hyaline. The F. V. figured by De Brébisson ('Diat. Litt. de Cherl.,' fig. 6) belongs to a different species—to *N. truncata*—although his delineation of the S. V. is correct in outline.

What the late Professor Smith meant by *N. pectinalis*, Bréb., is now somewhat uncertain. According to Professor Arnott, it was unknown to De Brébisson ('Microscopical Journal,' vol. vii, p. 177); its striæ, according to Smith's description, are 16 in '001", and therefore as coarse as those of *N. retusa*, but much coarser than those of *N. truncata* and *N. Northumbrica*. Professor Arnott, however, appears to be acquainted with *N. pectinalis*, and would confer a benefit on the science by describing and figuring it.

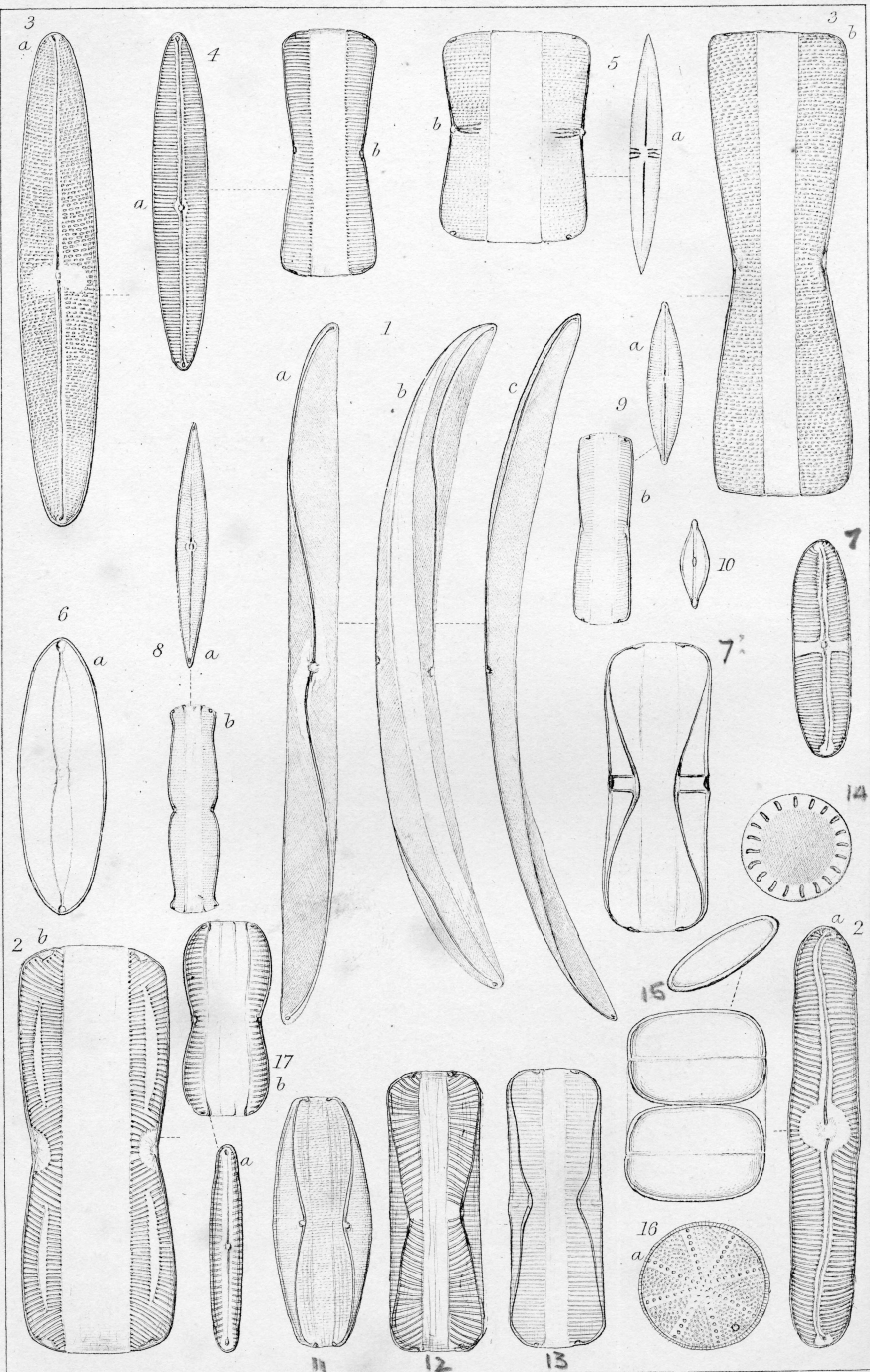
15. *Amphiprora fulva*, n. sp., Donkin ('Trans. Micro. Soc. Lond.,' n. sp., vol. vi, Pl. III, fig. 48).—Form on F. V. oblong, extremities rounded, gradually and deeply constricted in the middle; S. V. narrow, lanceolate, apiculate; valve slightly alate, compressed laterally; median line straight; striæ transverse, fine, probably 60 in '001"; dry valve of a rich salmon colour. Length, from '0050" to '0055".

In my previous contribution (op. cit.), I described and figured the F. V. of this species as that of *Pl. lanceolatum*; but I have since discovered that, in doing so, I have committed an error, and use the present opportunity of correct-



DESCRIPTION OF PLATE I,

Illustrating Dr. Donkin's paper on the Marine Diatomaceae of Northumberland, with a Description of several New Species.



- Fig.
- 1.—a, b, & c, *Pleurosigma falcatum*, n. sp., Donkin.
  - 2.—a & b, *Navicula Trevelyana*, " "
  - 3.—a & b, " *Clepsydra*, " "
  - 4.—a & b, " *truncata*, " "
  - 5.—a & b, " *Northumbrica*, " "
  - 6.—a, " *hyalina*, " "
  - 7.—a, b, " *cruciformis*, " "
  - 8.—a & b, " *arenaria*, " "
  - 9.—a & b, " " small variety.
  - 10.—a, " *gregaria*, n. sp., Donkin.
  - 11.—b, *Amphora ocellata*, " "
  - 12.—b, " *naviculacea*, " "
  - 13.—b, " *lineolata*, " "
  - 14.—a, *Systephania Anglica*, " "
  - 15.—a & b, *Druridgia geminata*, " "
  - 16.—a, *Eupodiscus tenellus*, De Bréb.
  - 17.—a & b, *Navicula retusa*, "

× about 400 diameters.