

## ORIGINAL COMMUNICATIONS.

NOTES on ARACHNOIDISCUS, PLEUROSIGMA, AMPHIPRORA,  
EUNOTIA, and AMPHORA. By G. A. WALKER-ARNOTT,  
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ARACHNOIDISCUS.—Since my observations on this genus were published in the last number of this Journal, at p. 100, my attention has been called to the 'Annals and Mag. of Nat. Hist.,' for 1848, vol. i, p. 393, in which there is a translation of Ehrenberg's paper on *Hemiptychus*. I am likewise informed by another correspondent that it was published in the 'Berlin Proceedings' for 1848, p. 7. I have not access to the original, but from what is said in the translation, it is clear that Ehrenberg got his specimens from Mr. Topping, of London; and as it is generally well understood that the *Arachnoidiscus* was obtained by Mr. Topping from Ichaboe guano, the suspicion I threw out is verified. Whether it was certainly from Patagonia, that the Danish vessel Waldemar (spoken of by Ehrenberg) brought its cargo of guano, I know not; Ehrenberg understood this, and his information may have been correct, although doubts arise from the following considerations. From that guano Ehrenberg obtained the diatom which he has called *Entopyla australis*, for which he quotes as a synonym his former *Surirella* (?) *australis*; now my impression, from studying attentively his generic character, is that the *Entopyla australis* is the same as my *Eupleuria* (or *Gephyria*) *incurvata*, which is from Ichaboe and Saldanha Bay guano; while his *Sur. australis*, from the Falkland Islands, and not, I believe, from guano at all, is probably my *Eu. ocellata*. But it is almost impossible to determine this point without seeing perfect specimens.

I may add, that I am now informed by M. De Brebisson, that the single frustule of *Arachnoidiscus*, which he detected on *Sphacellaria olivacea*, sent him by Mr. Ralfs, and which is the authority for that genus being British, belongs to *A. ornatus*,\* and is therefore the same as from Ichaboe and the Cape. As the species of this genus, like other diatoms, are gregarious, the discovery of only one frustule seems to indicate some error about its title to a place in the catalogue of British genera.

\* Ehrenberg's specific appellation was *ornatus*; such (and not *formosus*) is the name which I obviously intended to give to the second *Arachnoidiscus* at page 162, about the middle. This readers will please to correct.

PLEUROSIGMA.—I find from some correspondents that the remarks I made in the last number of the 'Microsc. Journ.,' p. 164, have conveyed more than one erroneous impression. I had no intention to find fault with any gentlemen supplying Dr. Donkin with the information they gave; they got the information from friends in a perfectly legitimate way, and furnished it as legitimately, although from not coming directly from myself, it was partly incorrect and partly misunderstood. Had Dr. D. applied to me, I would have at once explained to him how the diatom in question came to be referred to *Amphiprora*; and then, I have no doubt, the paragraph at p. 33, which appeared to me uncourteous, would not have been written. Mere MS. trivial names are, by common consent, referred to every day; but unless the giver has himself published his reasons for such names, whether generic or specific, they are quoted without note or comment, and solely as provisional ones or synonyms; a departure from this would imply a right to give to the public information not intended for it, and which was obtained privately. This right, however, happily does not exist;\* for if it did, it would destroy all friendly intercourse by letters.

The synonyms I gave were less with the intention to criticise Dr. Donkin's new forms, as to show that others had been engaged also on several of the same; and that in the present dislocated state of this branch of science, (now that we have lost Professor Smith as a common bond of connection,) it is desirable that before any one publishes new or supposed new British species, he should make extensive inquiries among diatom collectors, so as to discover if the same have not previously occurred to them, but perhaps under a slightly different form, and if the difference cannot be explained by extrinsic causes. By submitting the diagnosis, and taking the opinions of several, naturalists as well as microscopists, students of cause as well as those of effect, a person is more likely to come to a correct conclusion than by trusting to oneself, or consulting those only who are likely to agree with him; at all events, the species is thus amply discussed before publication, and not left to after-criticism. Some of the synonyms I adduced (at p. 165) are not published, and although the species have been long known and in many of our cabinets, and although probably Dr. Donkin would have adopted such MS. names, so far as they were

\* See, in regard to private correspondence, 'Notes and Queries,' 2d series, vol. v, pp. 47, 76.

eligible, had he been aware of them, still those names which he has given, that are accompanied by a clear diagnosis, have now the right of priority.

In my remarks I mentioned that the figure of the F.V. of *Pleurosigma lanceolatum* could not belong to it; I have since received a specimen of this through the kindness of Dr. D., and to me the striæ appear horizontal, while those of *P. lanceolatum* (S.V.) are diagonal. As to what *P. lanceolatum* itself is, different observers are entitled to hold different opinions; Mr. Roper's *P. transversale*  $\beta$  is, I believe, allowed by all to be identical; and if I do not coincide with him, it is solely because there seems to me more points of dissimilarity from, than of resemblance to, *P. transversale*. Taking into consideration that *P. æstuarii* is "frequently direct," and that what Professor Smith would have called the "type" of that species has the ends "somewhat produced" or apiculate, and also the striation, I am almost satisfied that *P. lanceolatum* is a form of it peculiar to clean sand; but as yet neither *P. lanceolatum*\* nor the apiculate state of *P. æstuarii* have occurred, so far as I know, sufficiently isolated to allow of any positive deduction being drawn. What is considered the non-apiculate state of *P. æstuarii*, has been got copiously in some gatherings; but that chiefly differs from a small form of *P. angulatum* by the slightly more difficult striæ, and may be considered one of a numerous group of intermediate diatoms, none of which can be referred with certainty to any species as at present (too stringently) limited, and yet are destitute of any marked peculiarity to permit of a separation,—a group that will ultimately cause the union of several "*test species*" of that genus. The *P. lanceolatum* of Dr. Donkin must not be confounded with Mr. Norman's species of the same name, (noticed, but not defined, in the 'Ann. of Nat. Hist.' for 1857, vol. xx, p. 159); this last does not seem to me distinct from small forms of *P. strigosum*, Sm.† I referred *P.*

\* I have the same form from Cumbræ in the Clyde, accompanied by *Toronidea insignis* and *Gregoriana*, and *Pleur. angulatum*. If *P. lanceolatum* be distinct from *P. æstuarii*, it is to it that *Tox. insignis* may be referred; but I cannot indicate any marks by which the anomalous state of each is to be recognised, except by the normal form which accompanies it. *Tox. Gregoriana* I refer to the sand form of *Pl. angulatum*.

† I may here mention that "*P. strigosum*" seems to have been adopted by Smith on the supposition that the Hull *Nav. strigosa*, of Harrison, was the same; this, however, I have ascertained, is not the case. *N. strigosa* of Harrison and Sollitt ('Micr. Journ.,' ii, p. 62), is *P. angulatum*, Sm.; while their *N. angulata* is *P. quadratum*, Sm.; their *N. lineata* is *P. elongatum*, Sm. It is not, however, improbable that these and some others form a single species.

*Wansbeckii*, Donk., to *Amphiprora Ralfsii*; the examination of a specimen from Dr. Donkin satisfies me that I was wrong, and that it is a true *Pleurosigma*, and the same which Smith has called *P. Balticum*  $\beta$ ; I learn from Mr. Roper that his opinion quite coincides with my own. This also is the same which is called *Navicula scalprum* by Kutzing, as far at least as regards the form found by De Brébisson (see 'Kutz. Sp. Alg.,' p. 85); and it may be the same as that figured by Kutzing (Bac. tab. 30, fig. 13), from Trinidad, and since called by him *N. Scalpellum*, but it scarcely agrees with the figure of *N. scalprum* given by Gaillon and Turpin (who first gave the name), in the 'Mem. du Mus.,' xv, t. 10, fig. 3, and which figure is copied by Kutzing (Bac. tab. 4, fig. 25), and appears rather to indicate *P. Hippocampus*, Sm. In *P. Balticum*,  $\beta$  and  $\gamma$  of Smith, the striæ are as numerous as 64 or 65 in '001; and from notes before me I find that some others raise that number to 85; this creates a doubt if these two varieties ought not to be separated from a species which has only about 38. I believe that the usual state of *P. Balticum* is scarcely or not at all found at Hull, whilst the var.  $\gamma$  occurs copiously at Hessle, and sparingly in several other places in that neighbourhood; this, however, by itself, affords no valid reason for the separation, any more than that the mixture of all the three would prove them only to be varieties of the same species.

AMPHIPRORA.—The verbal distinction between this genus and its cognates *Navicula* and *Pleurosigma* is so slight as to be easily passed over. It is unnecessary to refer to Kutzing's generic character of *Amphiprora*, which is obtained from the Front View only, while that of *Navicula* (including *Pleurosigma*) is derived from the Side View; "the so-called wings (*alæ*), or projections (as has been remarked by Meneghini), belong to the secondary surfaces (S. V.) and constitute the only distinctive character of the *Amphiprora*." By comparing Smith's analytical table at p. 9 of vol. i. of his 'Synopsis of Br. Diat.,' with the characters given at pp. 43, 46, and 61, it will be seen that his views are that in *Amphiprora* the F. V. of the frustule and valves is deeply constricted laterally, while the valves, or S. V., are furnished at the median line with a ridge or keel; in the two others, on the other hand, the F. V. is without a conspicuous constriction, and the valve is plane or convex merely, and the median line destitute of a keel. There is thus a double character, and when the one is not very decided the other may be taken as a guide. I

believe that Smith's views are now almost universally adopted; at the same time there are some cases which require careful consideration.

*Pleurosigma* is said to have sigmoid valves, that is, flat, but bent laterally in the same plane, at the one end, in a different direction from what they are at the other. In *Navicula* the opposite character is not given, but is implied. In *N. Jenneri* and *N. convexa* the valves, at first sight, appear to be sigmoid; but the cause of this is easily understood by examining the F. V.; from it, it will be seen that the entire frustule is not simply bent to the right or left, but has a slight spiral twist; so that when the valves are separated they do not lie flat, and the result is the apparent sigmoid median line: had the valve not been twisted, the median line would have been perfectly straight and central. In *Pleurosigma* I have seen no instance in which the living frustule is twisted;\* "the F. V. is either of a linear, or linear-lanceolate, form" (Sm.), and 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 to the other. How far the amount of this inequality can be relied on for the distinction of species is doubtful; *P. decorum* is principally separated by Smith from *P. formosum* by such an appearance. I am not aware that this twist has been seen except in those species which have oblique striæ, and it may be dependent on that structure.

In *Amphiprora* the median line in the entire frustule is usually straight, and when not so this arises from the torsion of the frustule; in *A. alata* and *A. paludosa* the frustule presents both appearances, as shown at fig. 124 *b*, and *b'*, and fig. 260 *b*, and *b'*, of 'Smith's Diat.' I have not, however, myself detected the twisted form in these while the diatom was alive, and it is often not so even after being dried, or maceration in weak acid. When the valves are separated from the connecting zone, their tendency to assume the spiral form is much more striking, as exhibited by Smith

\* I have not myself the F.V. observed of the living frustule of any of the anomalous or distorted states which form the genus *Toxonidea* of Donkin; of these states I have seen five, one I would refer to *Pleur. æstuarii*, a second, if distinct, to *P. lanceolatum*, a third to *P. transversale*, a fourth to *P. angulatum*, and the fifth to *P. strigosum*. The third of these I have detected lately, but of it only one frustule; the others I have already noticed (p. 165).

in his fig. 124 *a*, and *a'*; when this occurs the median line, formerly straight, becomes also spirally twisted.\*

The genus *Amphiprora*, as appears to me, may be readily distinguished from *Pleurosigma* by attending to these considerations. The extreme thinness of the connecting zone in the latter renders it almost impossible to obtain a F. V., unless in fluid agitated by a drop of spirit of wine, while in the former the F. V. is readily detected, the connecting zone being of considerable breadth; in *Pleurosigma* the F. V. is less in breadth than the breadth of the valve, while in *Amphiprora* it is generally the reverse.

I have not seen any *Amphiprora* with the principal or coarser striæ oblique, although, from the facility of torsion in its valves such instances may occur. But as all diatoms, with striæ composed of dots, have four rows of striæ, two diagonal, one horizontal, and one longitudinal; and as the visibility of each depends, when delicate, on the position the valve presents to the illuminating oblique pencil of light, the closer or more difficult striæ are sometimes seen when the others are not, and thus may be occasionally mistaken for the predominating or coarser ones, which alone are made use of in specific characters. I may here remark that when the dots are placed so as to form rectangles, the transverse and longitudinal lines are always the most remote, and therefore predominate; and it is generally supposed that, when the dots are quincuncial, the diagonal lines are always most apparent; but this conclusion is not correct, for when the diagonal lines make, with the transverse, an angle greater than  $60^\circ$ , the transverse rows are more remote than the diagonal, and when the angle is less than  $30^\circ$ , the longitudinal rows are the more remote and easily detected. In the quincuncial structure, therefore, the diagonal lines predominate only when the angle of inclination is more than  $30^\circ$  and less than  $60^\circ$ ; but the transverse and longitudinal cannot both preponderate in the same species.

To distinguish *Navicula* from those species of *Amphiprora* which have the frustule straight and no *alæ*, is considerably more difficult, and I doubt if there be any characters more readily available than those mentioned by Smith, viz., the con-

\* The facility of twisting and the amount seem to depend on the smaller or greater quantity of siliceous matter assimilated by the frustule; and this again, in all diatoms, varies in the same species according to the vigour of its growth, arising from locality, season of the year, and other incidental causes. Our whole knowledge of these beings is as yet in an embryo state, and will be best promoted by extensive morphological observations on species about which all are agreed; till then the limiting characters of species, and the species themselves, must be very unsatisfactory.

stricted frustule and carinate valve or median line; the first of these is not to be much relied on, as it is exhibited slightly in some species of *Navicula*, while it is observed only in a modified manner in *A. vitrea*. In this species, and also in *A. elegans*, there seem to be frequently four valves to the frustule; I have seen the same structure in *Schizonema crucigerum*, *Pinnularia major*, *lata*, *alpina*, and some others, but it is accidental and not characteristic of such species.

Dr. Gregory, in his paper on 'Clyde Diatoms,' introduces into the descriptions of some of his forms, a notice of a "plate" which is said to be *above* the valves; he does not seem to consider its occurrence as universal in the genus, but characteristic of certain species only. How these plates are formed or attached I do not understand. I am not aware that they have been seen separated *from* the valves, and if a peculiarity of structure *of* the valves, they ought to be traced in these. Although, however, I have attempted to model in clay or putty a frustule with the valves as figured and described, connected by a zone, I have not succeeded in constructing anything like these plates. That there is such an appearance is unquestionable, so that a suspicion arises that such plates do not lie *above* the valves, and indeed have no actual existence, but that the whole arises from our seeing the margin, or the surface outline of the valve, through the medium of part of the frustule. If proved to be actually external and above the valves, or to be caused by any other difference of structure from what is usual in the genus, its importance as a specific distinction will be readily allowed.

I exclude, at present, from the genus the curious and perfectly distinct *A. complexa* of Dr. Gregory. As the slices are not perforated, they cannot be annuli, such as occur in *Rhabdonema*; and if entire lamina of the connecting zone,\* an obscure affinity with *Rhipidophora* would be established. The true structure of this diatom, and therefore its genus, is however quite uncertain.

\* In various species, particularly marine ones, of different genera of diatoms, as *Navicula*, *Amphora*, *Amphiprora*, and *Schizonema*, the connecting zone exhibits frequently a lamellar structure, the number and appearance of the lamellæ varying much in the same species according to circumstances. *Navicula Libellus* of Dr. Gregory, on that account, seems to be the well-known and not uncommon state of *Schizonema Grevillii*. When these lamellæ are perfect, the frustule is necessarily divided by them into two cells, a proof that it is then undergoing self-division; but the cause of this appearance, or why it is not to be detected at all times in the same species, is unknown to me. Several, if not all, of Dr. Gregory's group of "complex Amphoras" are in this predicament; at least in these the lamellæ are not described and figured as annular or with a perforation, as would be were the zone not in the variable or transition stage, and thus unsuited for specific distinctions.

**EUNOTIA.**—To define this genus appears to have caused Professor Smith some trouble; at first his intention seems to have been chiefly to distinguish it from *Epithemia*, with which it was combined by Ehrenberg; but in his second volume, under *Himantidium*, he proposes to introduce the radiating striæ as a character. One of his species (*E. arcus*) may be left out of consideration, as this grows attached to small algæ, by the end, by means of a "cushion-like pedicel," as in *Synedra*, to which genus it belongs; indeed, when I met with it, in that state, near Brodick, in Arran (July 1854), it was so closely intermingled with *S. pulchella* and *S. gracilis* that I then felt disposed to consider it a deformity of one of these. In all the genuine species of *Eunotia* which I have examined previous to or after a very slight maceration in acid, I find the portion called the valve by Smith to be more composite than can be inferred from his figures, each being made up of parallel slices or lamina, easily observed in the F. V.; and I have been so unfortunate as never to see the connecting zone as represented: indeed, had Mr. West's accuracy not been beyond suspicion, I should say, as the result of my own observations on recent gatherings, that this broad zone did not exist, and that the supposed single valve was composed of several valves, each separated by a very slender and almost invisible zone. I therefore, at present, consider each supposed valve to be formed of a series of frustules, and that the connecting zone figured in Smith's work is some accidental enlargement of one of the slender connecting zones. Be that as it may, the divisibility of the supposed valve into several is perfectly different from what has been seen in the genus *Himantidium*, where the valves are incapable of dividing, and are separated by a siliceous zone of considerable breadth. This structure at once enables us to remove *E. gracilis*, Sm., (although the frustules are often solitary) to *Himantidium*, under which genus the small state of it had been previously described by Kutzing as *H. exiguum* of De Brébisson.

**AMPHORA.**—Some friends having expressed a wish that I should explain my views of the structure of the genus *Amphora* more fully than given at p. 184 of this volume of the 'Micr. Journ.,' I subjoin the following extract from the paper as originally prepared.

Kutzing's ideas of the structure of this genus are not very clear. If we compare his description of it with that of *Navicula*, and suppose that in the former he has mistaken the *Front* for the *Side* view of the frustule, the characters of both will scarcely differ, and his views would thus be much the same



as my own, which, indeed, occurred to me from supposing Kutzing's observations to have been misprinted. If, on the other hand, he has not inverted these, he must have looked on the frustule as a hollow spheroid, and that planes passing longitudinally through the central nodules and the eye, would cut off the valves. Smith has obviously understood Kutzing in this sense, and although some expressions and his figures would seem to indicate that he was not altogether satisfied on the subject, he adapted his generic character to it, and described each valve with the central nodule marginal; in this way the whole portion between the median lines must be considered as the connecting zone. But that such cannot be its real structure is obvious: 1st, from there being a deep groove or hollow in front: 2nd, from the sides of this groove, nearly up to the median line, being striated precisely as on the other side: 3rd, from the median line forming a ridge; the first of these is best seen by putting the entire frustule, before being macerated, into balsam; the two last require us to examine it obliquely when not in balsam. The anterior margin of the valves, where they are attached to the connecting membrane, is thus not close to or on a level with the nodule, but considerably farther from the eye, closer to and more directly above the posterior margin.

The form of the frustule of *Amphora* may thus be compared to that of a coffee-bean, rounded on the back and hollowed out in front, a transverse section being somewhat reniform or lunate. If we take two circular pieces of paper, gum them together by their edges, and mark this disk on the margin, with two dots of ink at the extremities of a diameter which is at right angles to another which may be supposed the axis or line of self-division; the dots will represent the central nodules, and the edge of the disk the median line; a diatom like that would only differ from the genus *Navicula* by the valves being much folded or *compressed*, while in *Navicula* they are usually nearly flat or *depressed*. If we now bend up the sides of the disk, so that the central nodules approach each other, this will in some degree represent an *Amphora*, the only difference being that in the disk the curves of both surfaces are almost parallel, the one concave, the other convex, while in *Amphora* the anterior or concave one is usually smaller than and of a different kind from the posterior. In *Amphora*, then, the median line, as that ought to be called which connects the central with the subterminal nodules, although apparently marginal, is similar to what is observed in other Diatomaceæ in which nodules exist; indeed, this genus only differs by the portion of each valve on the one

side of the central nodule being smaller and differently curved from that on the other, whereas, in most genera of the group, these two portions are alike.

The incurvation of the valves is at its *minimum* when they are in the incipient state, at its *maximum* when the frustules have separated after self-division. The proximate cause is the contraction of that half of the valves which in the disk of paper is next the eye, and its consequent thickening, for the quantity of silex is probably the same on both sides; but the cause of the contraction I cannot explain. By this bending in of the valves the central nodule, which was apparently marginal, now assumes a position sometimes nearly vertical to the line of fission, but sometimes reaching to only one fourth of that distance. The *maximum* incurvation and also the projection of the median line on the plane of the field of view (a line of double curvature) vary in the same species, although generally within certain limits. The true form of the valve would be nearly got by completing the apparent outline by the addition of the incurved part; but the apparent outline of the frustule itself, at the *maximum* incurvation of the valves, is found to be more easily observed and convenient for description; and to this, there is no objection, if those frustules only be used in which the connecting membrane is at its *minimum* breadth. The striæ on the valve are precisely alike on each side of the median line, but from some being seen through the medium of the valves, and others presenting themselves directly to the eye, the former appear faint and hazy; the latter, between the median line and the outline, are therefore alone referred to, in their definitions, by the more eminent diatomists. From the minuteness of the object, its inequality of surface, the necessity of using high powers and these with a large angle of aperture, it is impossible to bring all the parts into view, without altering the focus, or to give a perfectly accurate representation of the structure except by models.

The portion separating the two valves, or the connecting zone, varies much in all diatoms, but more so in *Amphora* than in most other genera. At first it is narrow, then it becomes broader and broader, but is in most species striated very differently from the valves, if striated at all.\* The new or intermediate valves, which it projects, are at first destitute of

\* The circumstance of the structure of the connecting zone being the same, or very different from that of the valves, indicates two groups or sections of the genus. As this is quite independent of self-division, it is of more importance than the splitting of the connecting zone into several plates, at least until the cause of this be ascertained.

silix and imperfectly seen, then they become more and more conspicuous and siliceous, rapidly altering in shape and position; the primary valves also alter in position, but not in form. The central nodules of the two new valves appear now at the back, nearly where the connecting zone formerly was, while the back of each half of the double frustule is removed to the side, or is placed right and left of the spectator's eye, instead of directly before him; thus each half of the twin frustule occupies a position at right angles to what the parent frustule did, and which the perfect separated one ought to do. Finally, the two portions of the double frustule separate from each other in front like the two valves of a mussel-shell; the amount of separation depending on the strength of the remains of the siliceous band that connects them, and causing the general outline to vary extremely. In characterising or figuring the *forms* of this genus, it is therefore necessary, for the sake of comparison, that each be viewed under *precisely* the same circumstances; moreover, so many changes take place whilst the process of self-division goes on, that no descriptions or figures are of much use in the identification of permanent forms or species, unless when taken from the simple but perfect frustule before self-division commences, or from its valves.

Although the structure of the genus adopted by Kutzing and Smith be not what I conceive the correct one, no practical inconvenience arises, as their specific characters have been selected from the same parts on which they must otherwise have relied. It is, however, somewhat different with that given by the late Dr. Gregory in his paper in vol. xxi of the 'Trans. of the Royal Soc. of Edinb.' p. 510; but here I experience considerable difficulty from his having introduced into his descriptions several terms, neither employed by any other writer, nor explained by himself, the meaning of which the reader is left to discover. From a careful comparison of the figures, I presume that by "ventral margin" he intends sometimes both the anterior and posterior margin of the folded valve, and sometimes the irregular margin of a portion of the still adhering connecting membrane; by "dorsal margin," the outline of the frustule; and by "inner curve line," the median line of the valve; most of which vary in appearance according to the position presented to the eye by the frustule during self-division. There are other terms, however, about which I am more doubtful; as "inner margin," "outer margin," and inner or outer "compartments of the valves;" although it is probable that all, in some way, refer to the connecting zone. Dr. Gregory's theory is, that "what is

usually called the entire frustule" consists of "two frustules in the act of self-division," and consequently of *four* valves, and it results from this that what is commonly called a single frustule is composed of two new valves, forming or formed, in addition to the two primary ones; in short, that the small portion seen in front alone belongs to the original frustule. If we now take what is usually called a double frustule (as in Smith's fig. 28 *d*), which by Dr. Gregory's theory must consist of four frustules or eight valves, three-fourths of the whole must be either in the transition state, or represent six valves, each identical with the two original ones, but in a different position. As I cannot suppose that Dr. Gregory intended to take distinctive marks from the connecting zone in its variable state, or from more valves than one, or from their accidental relative position, it appears to me that his hypothesis, if correct, would much increase the difficulty of finding constant characters, and cause the rejection of several on which he depends, as well as the annihilation of many of his new forms.

I may here mention that *A. marina* of Smith, alluded to by Dr. Gregory under his No. 76, is precisely what Dr. Gregory calls *A. Proteus*. Smith's figure ('Ann. of Nat. Hist.' for 1857, vol. xix, tab. i, f. 2) is far from good, and represents the double frustule towards the close of the self-dividing process. Some years ago Smith gave it the MS. provisional name of *A. Scotica*, from its having been first detected on the west coast of Scotland by Mr. Henedy of Glasgow; he omitted it in the second volume of his 'Synopsis,' being not quite satisfied with its claims to be specifically distinguished from *A. affinis*; but these doubts were removed by afterwards finding it in the summer of 1856 near Havre and Biarritz, on the French coast, and thus having an opportunity of studying it in the living state, and drawing up a specific character.