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Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number:

1072954 Registered office: Mortimer House, 37-41 Mortimer Street,
London W1T 3JH, UK

Transactions of the Botanical Society of Edinburgh

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tped18>

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Published online: 01 Dec 2010.

To cite this article: R. K. Greville L.L.D. F.R.S.E. c. (1860) II. Descriptions of some new species and varieties of *Naviculæ*, &c., observed in Californian Guano, *Transactions of the Botanical Society of Edinburgh*, 6:1-4, 245-249, DOI: [10.1080/03746606009467738](https://doi.org/10.1080/03746606009467738)

To link to this article: <http://dx.doi.org/10.1080/03746606009467738>

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rochnus. In the articulated filaments which crown its growing apices and tubercles, it also corresponds with all the other genera of this order.

II. *Descriptions of some new species and varieties of Naviculæ, &c., observed in Californian Guano.* By R. K. GREVILLE, LL.D., F.R.S.E., &c. (Plate V.)

Among the *Naviculæ* I have observed in Californian Guano are several of a very perplexing appearance; especially those belonging to the group of which *N. Lyra* may be considered the representative. Some of these forms strikingly illustrate the exceeding difficulty of determining what characters really go to constitute a species among these minute and variable plants. But it is amusing to notice the difference of opinion which still exists on the question of species. Professor J. G. Agardh, after quoting some eminent naturalists, thus briefly recapitulates:—"Ex his, quæ breviter attulimus, satis, credo, apparet, tres nostræ ætatis vel excellentissimos naturæ investigatores in illa, quam proposuimus, quæstione dijudicanda, inter se dissentire. Schleidenius sola individua, Lindley species, Friesius species et genera a natura vult constituta, majores omnes ordines ab arte inventos esse."*

We have unquestionably much to learn regarding the value of characters presented by the Diatomaceæ. In the present state of our knowledge, it would appear that scarcely any one character taken by itself is to be relied on; and that even a combination of characters which may be sufficient for the determination of species in one genus, may be unsatisfactory in another; and where groups or sections happen to be what is called exceedingly natural, the difficulty is greatly increased. Indeed, it often becomes a question, whether it is best to leave a doubtful variety to embarrass the diagnosis, or to separate it under a provisional character. No law can be laid down on this subject which shall practically be a clear and unerring guide. Among the Diatomaceæ, the process of self-division, by means of which any deviation from the normal condition of a species becomes stereotyped and perpetuated with inconceivable rapidity, complicates the idea of a species

* *Theoria Systematis Plantarum, &c.*, 1858, a learned and valuable work.

to an extent unknown among the higher orders of vegetables. For example, let A represent a species of Diatom. By some unknown cause, one of its progeny, B, becomes so changed as to constitute a well-marked variety. Another of its progeny, C, undergoes a different but equally decided change; and possibly the same thing may occur in others. Now, these varieties or aberrations from the typical condition may be propagated, according to the late Professor Smith's calculation, at the rate of a thousand millions in a single month. Then, as there is no reason why B and C should not also have an indefinite number of nonconformist children, all removed in one character or another a *second stage* from the type, and producing duplicates by thousands of millions, it is manifestly impossible to say where the confusion is to end. But this is not all. By the process of conjugation, what Mr Thwaites calls "Sporangial frustules" are produced, which are very much larger than the ordinary size of the parents, and these, it is presumed, multiply equally freely by self-division, and are equally liable, from accidental causes, to have their deviations from the normal state perpetuated. Such is the theory; and to arrive at anything like fixed specific distinctions would seem to be almost a hopeless endeavour. Nevertheless, by correcting processes unknown to us, we cannot doubt that the typical characters of real species are preserved. There must be a limit to the influence of the disturbing causes above mentioned; for order and individuality are conspicuous in the marvellous works of the Great and All-wise Creator.

NAVICULA, Bory.

N. irrorata, n. sp., Grev. Valve oblong, suddenly contracted at the obtuse and produced extremities; striæ slender, conspicuously moniliform, interrupted, forming a broad band parallel with the margin, and a very narrow and irregular one next the median line; the linear blank spaces disappearing before reaching the ends. Length '0055" to '0070"; breadth '0020" to '0024"; striæ 15 in '001". (Pl. V., fig. 1.)

In Californian Guano.

A remarkable species, having considerable affinity with *N. prætexta* (Ehr.), figured in Professor Gregory's Paper on the Diatomaceæ of the Clyde (Trans. Roy. Soc. Edin., vol.

21). The striæ in *N. irrorata* are slender, and, under a sufficiently magnifying power, are found to be composed of distinct oval granules, about 15 in '001". The marginal band of striæ constitutes about a third of the entire breadth of the valve; the inner edge of the band forming a straight line until near the extremities, where it curves inwards. Opposite the nodule several of the striæ are finer and more crowded. Next the median line they are curiously irregular, influencing to a corresponding extent the contour of the blank spaces. At the nodule these striæ consist of three or four granules; at the distance of about a third of the space between the nodule and the extremity, the granules are rather suddenly reduced to one; then after a similar interval, they are increased to two, until they nearly reach the produced ends, which are filled up with granules more or less closely and irregularly disposed.

N. polysticta, n. sp., Grev. Valve elliptical, obtuse; striæ forming a narrow external band, moniliform, passing into distinct punctiform granules, which are scattered over the whole vacant area of the valve. Length, '0024"; breadth, '0011"; striæ, 25 in '001". (Pl. V., fig. 2.)

In Californian Guano.

A minute but apparently well-marked species, allied to the preceding and to *N. prætexta*. The outline is purely elliptical; the marginal band of striæ less than the fourth part of the width of the entire valve. The space thus left unoccupied by true striæ is filled up by irregularly scattered puncta.

N. Lyra, Ehr., var. *recta*, Grev. Valve elliptical, obtuse; blank spaces contracted at the nodule, but otherwise parallel throughout their length with the median line, from which they are separated by a very narrow band. Length, '0084"; breadth, '0026"; striæ, 24 in '001". (Pl. V., fig. 3.)

In Californian Guano.

I offer this truly splendid *Navicula* as a variety of the protean *N. Lyra*, the precise characters of which species we are not, I apprehend, even yet in a position to define. I have only seen two examples of the extraordinary size I have represented, which may be sporangial frustules, but have noticed many approaching towards it, all more or less elliptical or slightly produced at the ends, and distinguished by the straight narrow blank spaces.

N. approximata, n. sp., Grev. Valve oblong, obtuse, produced at the ends; striæ interrupted; the linear acuminate

blank spaces separated from the median line by an extremely narrow band, straight opposite the nodule, somewhat converging towards the extremities. Length about $\cdot 0044''$; breadth about $\cdot 0018''$; striæ, 17 in $\cdot 001''$. (Pl. V., fig. 4.)

In Californian Guano.

Although belonging to the same group, and allied to *N. Lyra*, this seems to be really distinct. I have examined many frustules, and they uniformly agree in the total absence of any contraction of the blank spaces opposite the nodule. On the contrary, there is frequently a tendency to become slightly convex at that part, as is seen in the figure I have given. From *N. Henedyi* it differs in the form, in the linear blank spaces being closely parallel with the median line, and in the much larger proportion of blank space round the nodule in consequence of the greater shortness of the extremely narrow bands of striæ next the median line. The striæ are also less numerous than in both *N. Lyra* and *N. Henedyi*.

N. Californica, n. sp., Grev. Valve broadly elliptical, obtuse, the sides somewhat angular; striæ moniliform, interrupted, constituting a narrow marginal band, and a very narrow row on each side the median line, the larger portion of the valve being blank space. Length, $\cdot 0044''$; breadth, $\cdot 0027''$; marginal striæ, 20 in $\cdot 001''$. (Pl. V., fig. 5.)

In Californian and South African Guano.

A very fine and apparently well-marked species. A larger series of specimens might exhibit the same tendency to variation in outline that is so frequent in the section of *Navicula* furnished with interrupted striæ. In an individual from South African Guano now before me, the frustule is somewhat narrower, but in other respects precisely the same, even to the sides of the valve, which, being straight for a short space in the middle, produces an angular appearance. The singularly large proportion of blank space at once arrests the eye, and in contrast with it the exceedingly narrow row or band of striæ close to the median line. It may be remarked that these striæ, which are usually assumed to be the continuation of the marginal striæ, interrupted only by the intervening blank space, in this case take an unexpected direction. The marginal striæ throughout their whole length are arranged so as to form lines (were they continued) concentric with the extremities; but near the ends, the short striæ next the median line, instead of being pointed so as to meet the others

concentrically, are directed so as to form an acute angle with them, and actually do so where the two sets of striæ meet.

N. nummularia, n. sp., Grev. Valve suborbicular; striæ moniliform, interrupted by two narrow linear blank spaces, which contract opposite the nodule, and then curve outwards and converge and meet at the terminal nodules. Length, '0012" to '0018"; breadth, '0010" to '0015"; striæ about 24 in '001". (Pl. V., fig. 6.)

In Californian Guano.

A curious little species belonging to the *N. Lyra* group, with the striæ highly concentric with the extremities. The blank spaces have a considerable resemblance to those of *N. forcipata*. Were it not for these blank spaces the frustules might easily be referred to *Cocconeis*. This may prove to be an extreme form of some other species.

N. gemmata, n. sp., Grev. Valve linear oblong, obtuse, the sides straight or slightly concave; striæ moniliform, interrupted, reaching half-way to the median line, with a single row of puncta intermediate between the striæ and the line. Length about '0058"; breadth about '0016"; striæ, 10 in '001". (Pl. V., fig. 7.)

In Californian Guano.

An exceedingly brilliant and beautiful diatom, well distinguished by the distant striæ, which form a band parallel with the side of the valve, and gradually narrowing at the ends. Two rows of puncta (one on each side) are situated half-way between the striæ and the median line, which diminish in size as they approach the nodule and the extremities. The affinity of *N. gemmata* is with *N. Crabro* and its allies.

STAURONEIS, Ehr.

S. apiculata, n. sp., Grev. Valve elliptical oval, obtusely apiculate; stauros linear, reaching half-way from the median line to the margin. Length, '0020"; breadth, '0010"; striæ fine, 34 in '001". (Pl. V., fig. 8.)

In Californian Guano.

A graceful, but inconspicuous object, not liable to be confounded with any other species known to me.

Explanation of Plate.

Fig. 1. *Navicula irrorata*; 2. *N. polysticta*; 3. *N. Lyra*, var. *recta*; 4. *N. approximata*; 5. *N. Californica*; 6. *N. nummularia*; 7. *N. gemmata*; 8. *Stauroneis apiculata*.

PLATE V

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R. H. G. del^{ts}

DIATOMACEÆ

W. & A. K. Johnson