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(DIATOMACEAE) FROM THE VAAL DAM
CATCHMENT AREA (SOUTH AFRICA)

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SOME NEW AND RARE NITZSCHIAE
(DIATOMACEAE) FROM THE VAAL DAM
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In studies of the ecology of diatoms, particularly in the case of studies concerned in any way with organic pollution, one of the most important genera of diatoms concerned is the genus *Nitzschia* Hassall. This is, moreover, a genus of which the systematics is not well known, and, in consequence, the identification of some species is difficult. In any ecological study, however, the correct identification of all the species concerned is of prime importance, since misidentification of any of the species (and particularly of the ecologically important species) inevitably leads to misleading results and wrong conclusions.

In this paper some apparently new species of *Nitzschia* are described, and other species are commented upon or discussed in order to make available further facts about their distribution. Certain of the latter species have not previously been recorded from South Africa, and are thus new records for this country.

The samples on which these observations are based were collected during a survey carried out for the National Institute for Water Research by two of its officers, Dr. B. J. Cholnoky and Mr. F. M. Chutter, during the year 1960. The survey covered the catchment area of the Vaal Dam in the Transvaal. I am very grateful to these two gentlemen for making the material collected available to me, and in particular to Dr. Cholnoky for his unfailing help and guidance.

The collecting stations from which the samples investigated were taken are listed below. The pH values given were taken by Mr. Chutter, using a Colour pH meter.

Vaal 401. Grootvlei — a colliery dam, situated on the road between Balfour and Villiers. pH 8.5.

- Vaal 409. A small swampy stream between the Vaal River, where it is crossed by the Villiers-Standerton road, and Standerton. There was a large quantity of filamentous algae floating on the water surface.
- Vaal 410. The Waterval River between Standerton and the Vaal River where it is crossed by the Villiers-Standerton road. pH 8.5.
- Vaal 411. The Grootspuit stream near its confluence with the Waterval River alongside the road to Standerton. pH 8.7.
- Vaal 412. Waterval River below the bridge on the road to Greylingstad from Standerton. pH 8.7.
- Vaal 413. Small stream between station Vaal 412 and Standerton; flowing very slowly. pH 8.8.
- Vaal 498. The Waterval River at Roodebank between Standerton and Leslie, above the waterfalls; very fast flowing water. pH 9.4.

In the samples collected from the above stations, the species of *Nitzschia* described or discussed below were found. In each account the number or numbers quoted at the end are those of the station(s) at which the specimens were collected.

Nitzschia Hassall 1845.

Nitzschia acicularis (Kützing) W. Smith. (cf. Hustedt 1930:423, F. 821).

The specimen figured here is only 32μ long and 2μ wide, and is one of the smaller examples of this species. Such smaller specimens were also found by O. Müller, (1905:137-205), who described them as a new form of the type, namely forma *angustior* O. Müller. Müller's forma *angustior* is now regarded by Cholnoky (personal communication) as being more typical of the species than the specimens originally described. In these small specimens the valve shape is more lanceolate than in the forma *typica*, and thus the ends, though produced, are relatively short. Fig. 1—Vaal 410.

Nitzschia acicularioides n. sp.

These specimens fall into the group *Nitzschiellae* (Rabenhorst) Grunow on account of the structure of the valves. They show a strong resemblance to *Nitzschia acicularis* (Kützing) W. Smith (cf. Hustedt 1930:423, F. S21), from which they differ only in that the two central carinal pores are more widely separated than the rest. This wider separation was a constant feature in all the specimens seen; they can therefore not be assigned to the species *Nitzschia acicularis*. This characteristic feature, namely the greater separation of the two central carinal pores, is reminiscent of *N. spiculum* Hustedt (1949:150, T 13, F. 1-4.), in which the same separation is seen; the valve of *N. spiculum*, however, differs in shape from that of the new species, being linear and not produced at the poles, and also being relatively narrower than that of *N. acicularoides*. The valves of *N. acicularoides* are spindle-shaped in the middle, and vary somewhat in shape in different individuals, the central part is sometimes linear with parallel sides, sometimes more lanceolate; the ends are long and narrowly produced, in some cases consisting of little more than the keel. Length 51-59 μ , width 2-2.5 μ . The keel is excentric, and has 16-18 (usually 18) small carinal pores in 10 μ , of which the two central pores are more widely separated than the rest; there the keel is sometimes visibly impressed. The transapical striae are too fine to be seen under the light microscope. The cell walls are weakly silicified. Fig. 2-4—Vaal 410 and 411.

Valvae in parte mediana filiformes, angustissime lineares sive lanceolatae, apicibus angustis, carinam solum contingentibus, 51-59 μ longae, 2-2,5 μ latae. Carina valde excentrica, poris carinalibus parvis, 16-18 (fere 18) in 10 μ , centralibus duobus distantioribus. In positione opportuna impressio levis carinae super canale mediano visibilis. Striae invisibiles. Membranae cellularum levissime silificatae.

Habitat: in lacu artificiale putei uni Grootvlei dicto ad viam publicam inter pagos Balfour et Villiers Africae Meridionalis.

Typus: praeparatum n:o Vaal 401 in collectione C. S. I. R., Grahamstown.

Iconotypus: figurae nostrae n:o 2-4.

Nitzschia amphioxoides Hustedt (1949:140, T. 13, F. 65-72).

The valve of *N. amphioxoides* is typically linear, and generally has slightly concave sides and cuneate ends with more or less capitate poles. The specimen illustrated here does not entirely conform to the typical shape, but nevertheless conforms to the rest of the diagnosis, having a length of 39μ , a width of 4μ , 13 carinal pores in 10μ , and 24 transapical striae in 10μ . The shape of the valve of this specimen is more lanceolate than that of the type, with only a very slight concavity on the keel side of the valve; the ends are, however, cuneate and the poles are capitate. The keel is slightly sunken in the middle, and the two central carinal pores are farther apart than the others. Such a slight difference in the shape of the valve is insufficient ground on which to differentiate this specimen from the typical *N. amphioxoides*, and I am therefore referring it to that species. Fig. 5 — Vaal 401.

Nitzschia capitellata Hustedt (1930:414, F. 792).

The specimen illustrated is of a shape which is abnormally short compared with the type. In the Belgian Congo Hustedt (1949:139, T. 12, F. 36-38) found small examples of this species which had a length of 35μ . In South Africa Cholnoky (1957:73, F. 205-208) has also found similar small forms. This specimen is, however, only 25μ long, but it nevertheless conforms to the rest of Hustedt's description, which he has modified slightly in his Congo paper (l. c.). It can therefore be assigned to the species *N. capitellata* Hustedt. Fig. 6 — Vaal 498.

Nitzschia exilis n. sp.

The affinity of this new species is difficult to determine, as I have only seen one specimen. I have not been able to associate this specimen with any species known to me, and I am therefore obliged to describe it as a new species. When more material becomes available it may prove possible to associate this species with *N. gracilis* Hantzsch (cf. Hustedt 1930:416, F. 794); *N. gracilis* is, however, broader has capitate ends and is weakly silici-

fied. The new species is long and narrowly linear with gradually tapering ends, the poles are regularly and sharply rounded and are not capitate, 86μ long and 1.5μ wide. The keel is excentric and has 12 carinal pores in 10μ , of which the central two are not more widely separated than the rest. The transapical striae are too fine to be seen under the light microscope. The valve walls are fairly well silicified. Fig. 7 — Vaal 410.

Valvae anguste lineares, apicibus longe protractis, angustis, polis regulariter sed anguste rotundatis, non capitatis, circiter 86μ longae. 1.5μ lataeque. Carina excentrica, poris carinalibus 12 in 10μ , medianibus non distantioribus. Striae transapicales subtilissimae, invisibiles. Cellulae bene silificatae, non hyalinae.

Habitat: in rivo Waterval River inter pagum Standerton et pontem viae ad Villiers super fluvio Vaal in Africa Meridionale.

Typus: praeparatum n:o Vaal 410 in collectione C. S. I. R., Grahamstown.

Iconotypus: figura nostra n:o 7.

Nitzschia fonticola Grunow (cf. Hustedt 1930: 415, F. 800).

In the sample Vaal 498 a series of specimens was found in which some very small examples of *N. fonticola* and the typical forms were linked. Drawings have been made to illustrate this linkage. The smallest specimen found in this series is 5μ long and 2.5μ wide. In some of the smaller examples a resemblance to *N. epiphytica* O. Müller (cf. Hustedt 1949: 143, T. 13, F. 53-65) is shown. This is due to the irregular spacing of the carinal pores, which sometimes causes the two central pores to be more widely separated than the rest. This is, however, not a constant feature. This is well illustrated in Figs. 10 and 11. The original diagnosis of the species should be altered to accommodate these small forms, and corrected so that the range of length is $5-30\mu$ long. Fig. 8 — Vaal 498.

Nitzschia immunda n. sp.

The specimens of this new species show a strong similarity to *N. tropica* Hustedt (1949; 147, T. 11, F. 34-38), from which they differ in that the valve is narrower and has a greater number

of transapical striae in 10μ than *N. tropica*. The valves are lanceolate with slightly produced and capitate ends; about 27μ long and 2μ wide. Few specimens were seen and thus the full range of variation could not be determined. The keel is excentric and has 14 carinal pores in 10μ , of which the central two are wider apart than the rest; the keel is visibly impressed. The transapical striae are easily visible under Phase Contrast and are 27-30 in 10μ . Fig. 14 — Vaal 410.

Valvae lanceolatae, apicibus leviter protractis et levissime capitatis, circiter 27μ longae, 2μ lataeque, sed numerus speciminum observatorum pro determinatione variationis non satis esse opinatur. Carina excentrica in parte mediana impressa, poris carinalibus circiter 14 in 10μ , medianibus duobus modice distantibus. Striae transapicales distinctae, 27-30 in 10μ .

Habitat: in rivo Waterval River inter pagum Standerton et pontem viae publicae ad Villiers super fluvio Vaal in Africa Meridionale.

Types: praeparatum n:o Vaal 410 in collectione C. S. I. R., Grahamstown.

Iconotypus: figura nostra n:o 14.

Nitzschia Kützingiana Hilse (cf. Hustedt 1930:416, F. 802).

This species, very common in South African rivers, is very variable in shape. I have included in this paper some drawings to illustrate this variability. In all the specimens illustrated the transapical striae are too fine to be seen under the light microscope. Fig. 16 shows an extremely narrow form, which is only 1.5μ wide. Fig. 15-18 — Vaal 410, 411 and 413.

Nitzschia lauenburgiana Hustedt (1945:402, T. 40, F. 6, 7, 9-11).

Apart from the length of the valve, this specimen conforms to the description of *N. lauenburgiana* and I am therefore assigning it to that species. Hustedt found specimens reaching a length of 150μ , while this specimen is 190μ long. *N. lauenburgiana* has not previously been recorded from South Africa and further large specimens may well be found here. Hustedt's orig-

inal specimens were found in some North German Lakes (l. c.), and the species was again found at a later date by Cholnoky (1963:189, F. 89) in Dutch New Guinea. This is a new record for South Africa. Fig. 19—Vaal 411.

Nitzschia obligata n. sp.

This species, which was rare in the sample, cannot be associated with *N. Kützingiana* Hilse (cf. Hustedt 1930:416, F. 802) which it resembles, because of its greater length and because it has more widely spaced carinal pores. Neither can it be associated with *N. palea* (Kützing) W. Smith (cf. Hustedt 1930:416, F. 801) on account of the shape of the valve. I am obliged, therefore, to describe this diatom as a new species. The valve is lanceolate, gradually tapering to the poles which are sharply rounded and very slightly capitate. The valves are 45μ long and 2.5μ wide; the full range of variation cannot, however, be given, as few specimens were seen. The keel is excentric and has 14 carinal pores in 10μ . The two central pores are not farther apart than the rest. The transapical striae are very fine and are not visible using the light microscope. Fig. 20—Vaal 412.

Valvae anguste lanceolatae, apicibus gradatim attenuatis, anguste sed regulariter rotundatis, non sive levissime protractis, non capitatis, circiter 45μ longae, circiter $2,5\mu$ latae, sed variatio tota ignota. Carina excentrica, poris carinalibus circiter 14 in 10μ . Striae transapicales invisibiles.

Habitat: in rivo Waterval River sub ponte viae publicae inter pagos Standerton et Greylingstad Africae Meridionalis.

Typus: praeparatum n:o Vaal 412 in collectione C. S. I. R., Grahamstown.

Iconotypus: figura nostra n:o 20.

Nitzschia perspicua Cholnoky (1960:262, F. 36).

Cholnoky described this species from the Swartkops River near Port Elizabeth in the eastern Cape Province. The specimen illustrated here conforms to Cholnoky's description. In this specimen the keel and carinal pores are very well silicified and prom-

inent, but the margin of the valve opposite the keel is very weakly silicified and barely visible. Fig. 21 — Vaal 413.

Nitzschia silica n. sp.

These weakly silicified valves show a strong resemblance to *N. bacata* Hustedt (1937-39: 485, T. 41, F. 30-33), but differ in the shape and size of the valve, and the number of carinal pores. The valves are linear to lanceolate in shape. The larger forms have a linear central portion with parallel walls, the ends are relatively long and cuneate, with sharply rounded poles. The smaller forms are more lanceolate and in consequence the ends are less cuneate. The valves are 20-29.5 μ long and 2 μ wide. The keel is excentric and scarcely visible, there are 16-18 (usually 16) carinal pores in 10 μ , of which the central two are more widely separated than the rest. The transapical striae are too fine to be seen under the light microscope. The structure of the valves is very delicate and the whole diatom is weakly silicified. Fig. 22-24 — Vaal 401.

Valvae maiores in media parte lineares, apicibus longe cuneato-attenuatis, minores longe et anguste lanceolatae, 20-29.5 μ longae, circiter 2 μ latae. Carina excentrica indistincta, poris carinalibus 16-18 (fere 16) in 10 μ , medianis duobus distantiores, sed carina super canalem centralem non impressa. Striae transapicales subtilissimae. invisibiles. Membrana cellularum levissime silificata.

Habitat: in lacu artificiali putei uni Grootvlei dicto ad viam publicam inter pagos Balfour et Villiers Africae Meridionalis

Typus: praeparatum n: o Vaal 401 in collectione C. S. I. R., Grahamstown.

Iconotypus: figurae nostrae n: o 22-24.

Nitzschia spiculoides Hustedt (1949: 151, T. 13, F. 5-6).

According to the original diagnosis of this species given by Hustedt (l. c.) the striae are too fine to be seen with the light microscope. The specimen found here conforms to the description of *N. spiculoides* with exception that the striae are visible.

Although difficult to see there are about 40 striae in 10μ . Considering that the striae are difficult to see, and that the specimen conforms to the rest of the description I am assigning it to *N. spiculoides*. This then necessitates the alteration of the diagnosis by inserting the observation that *N. spiculoides* has 40 or more striae in 10μ . Fig. 25 — Vaal 498.

Nitzschia subacicularis Hustedt (1937-39:490, T. 41, F. 12).

Hustedt seems to have been uncertain about this species since a drawing given in his Congo paper (Hustedt 1949:150, T. 11, F. 61) differs from his original description (l. c.). The original description gives 14-16 carinal pores and 33 transapical striae in 10μ , while the Congo specimen had about 9 carinal pores and 23 transapical striae in 10μ . This would suggest either that the Congo specimen is a mis-identification, or else that Hustedt had insufficient material to enable him to give the full range of variation in his original description. The specimen illustrated here has dimensions very much larger than those given by Hustedt, being 62.5μ long and 3μ wide. In its other characteristics this specimen conforms to Hustedt's original description, and I am therefore referring it to this species. Fig. 26 — Vaal 410.

Nitzschia subvitrea Hustedt (1872-1960:T. 347, F. 18-19).

The typical valve of *N. subvitrea* is linear with parallel sides; this can be seen in Hustedt's drawings in Schmidt's Atlas (l. c.) and in his paper on the Sunda Islands (Hustedt 1937-39:471, T. 40, F. 12). The valve in the present specimen is, however, slightly concave on the keel side of the valve and slightly convex on the side away from the keel. Fig. 27 — Vaal 410.

Nitzschia vitrea Norman var. *salinarum* Grunow (cf. Hustedt 1930: 411, F. 787).

This variety is uncommon in South African rivers and it is thus of interest to note its presence in this sample. Fig. 28 — Vaal 498.

SUMMARY

1. 5 new species of *Nitzschia* from the Vaal Dam Catchment Area are described and figured. These are *Nitzschia acicularoides*, *N. exilis*, *N. immunda*, *N. obligata* and *N. silica*.
2. A number of other *Nitzschia* species are commented on, in some cases making new records for South Africa. The new record for South Africa is *Nitzschia lauenburgiana* Hustedt.
3. The details are to be found in the text.

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