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**Contributions to the Diatom Flora of Southern Africa.
II. Diatoms from the Hog's Back Region of the Amatola
Mountains, Eastern Cape Province, South Africa**

by MALCOLM H. GIFFEN

(University College of Fort Hare, Cape Province, South Africa, and Council for Scientific and Industrial Research, National Institute for Water Research, Pretoria), (with 95 figs.)

This paper deals with the diatom flora of the Hog's Back region of the Amatola Mountains in the Eastern Cape Province, South Africa. These mountains form part of the Great Winterberg Range which constitutes a portion of the great escarpment of Southern Africa, separating the Coastal regions from the Central Plateau. The area under review lies some 32 Km north of the town of Alice, which is 107 Km due west of the port of East London.

Geologically the region is situated in the sedimentary shales of the upper Beaufort Series of the Karroo System and the mountains appear to owe their existence to the presence of thick sheets of igneous dolerite that have protected the sedimentary rocks from destruction. These eroded sheets usually form precipitous cliffs, below which the talus slopes and upper parts of the shales are clothed with dense indigenous temperate forest (Auckland Forest section of the Hog's Back Forest Conservancy).

The region is drained chiefly by the Tyumie River and its numerous tributary streams viz. Auckland Stream, Kaffirkop Stream, Crab River, together with many small unnamed rivulets, some arising as springs at the base of the rocky cliffs enclosing the head of the valley which falls rapidly from 1800 m to 710 m above sea level at the floor of the valley.

The climate of the region may be regarded as warm temperate to sub-tropical, with summer rainfall, i. e. 70% precipitation during the summer months from October to March. There are few periods of great heat, an average of 8 days of 38°C., and frosts occur on about 13 days per year. The average rainfall from 1880—1951 is 585 mm. (In 1945 the absolute maximum temperature recorded was 45.2°C. The average of days of high temperature 38°C. is 8. The record year of 1931 produced 23 days.)

Summary of Climatic Conditions during the years 1948—1951.

	mm	Abs. max.	Mean max.	Abs. min.	Mean min.	Mean
1948	545	40.7	24.43	-1.65	16.2	17.4
1949	284	41.4	25.44	-1.65	15.88	17.8
1950	815	40.5	23.80	-2.20	15.5	17.3
1951	381	41.0	24.38	-2.20	14.8	17.3
	507	40.5	24.51	-1.92	15.59	17.7

The hydrogen-ion concentration of the waters of the various stations was determined by means of a portable pocket pH meter and are as follows:

Station	Location	Samples	pH
Station 1.	Kaffirkop stream	24—28	6.8
Station 2.	Kaffirkop stream (spring).	29	6.4
Station 3.	Auckland stream	30—31	6.6
Station 4.	Stream in forest, 4000 ft (1220 m)	75—76	6.8
Station 5.	Dolerite Cliffs, 4300 ft (1310 m)	48, 48a, 51, 163	7.2
Station 6.	Tor Doone Stream, 5120 ft (1560 m)	146	6.4

The water can therefore be regarded as neutral to slightly acid. Analysis of the diatom flora bears this out very clearly as well known basiphilic species are scarce and not well represented. The waters are also fairly unpolluted as shown by the scarcity of known pollution indicators, e. g. *Nitzschia palea* (KG.) W. SM. which occurred in numbers in only one sample.

During the years 1948 to 1951, over 100 samples were collected from the Hog's Back streams but only the following have been fully investigated. They may be taken as typical samples chosen from six stations at varying altitudes from the base of the mountains, e. g. Kaffirkop Stream (825 m above mean sea level) to the general level of the plateau (Tor Doone Stream: 1560 m). This survey excludes the highest altitudes, viz., those of the Elandsberg (1980 m) and Gaika's Kop (1955 m).

The following samples are included:

24. Kaffirkop Stream, 810 m, surface of mud in pools; 44 forms recorded.
25. The same: from roots of trees in the stream: 9 forms.
26. The same: from liverworts [*Aneura (Riccardia) fastigiata* L. and L.] on stones in running water: 48 forms.
27. The same: from surface of mud in pools upstream: 35 forms.
28. The same: from surface of mud in pools further upstream: 46 forms.
29. The same: from the sandy surface of a spring entering the main stream: 28 forms.

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- 30. Auckland Stream (840 m) from mud washed off sticks in the stream: 44 forms.
- 31. The same: from mud on rocks in the stream: 46 forms.
- 48. Auckland Forest: from wet seepage on dolerite rocks (1070 m): 32 forms.
- 48a. The same: later collection from locality of 48: 37 forms.
- 51. Auckland Forest: scrapings of rocks near to but above 48: 58 forms.
- 75. Auckland Forest: from a small stream in the forest (1220 m) on loose bark in stream: 50 forms.
- 76. The same: from mud in stream: 31 forms.
- 146. Tor Doone Stream (1560 m) on wet sand with *Vaucheria* sp.: 42 forms.
- 163. Auckland Forest: same locality as 48, from a large lump of moss detached from high up on the cliff during a storm: 24 forms.

Table
 Summary of Genera and Species

GENERA	Total	Species	New Species	Varieties	Forms
<i>Achnanthes</i>	17	12		5	
<i>Amphipleura</i>	1	1			
<i>Amphora</i>	7	5		2	
<i>Anomoeconeis</i>	2	2			
<i>Caloneis</i>	4	2		2	
<i>Cocconeis</i>	4	1		3	
<i>Cymbella</i>	11	9	1	1	
<i>Diploneis</i>	2	2			
<i>Epithemia</i>	1			1	
<i>Etnotia</i>	18	12		4	2
<i>Fragilaria</i>	2	1		1	
<i>Frustulia</i>	8	4	1	3	
<i>Gomphonema</i>	10	6		3	1
<i>Gyrosigma</i>	1	1			
<i>Hantzschia</i>	2			2	
<i>Melosira</i>	3	1		2	
<i>Meridion</i>	1	1			
<i>Navicula</i>	39	28	2	5	4
<i>Neidium</i>	6	3		2	1
<i>Nitzschia</i>	17	16		1	
<i>Pinnularia</i>	12	11		1	
<i>Rhopalodia</i>	2	2			
<i>Stauroneis</i>	6	6			
<i>Stenopterobia</i>	1	1			
<i>Surirella</i>	15	9	1	4	1
<i>Synedra</i>	5	3		2	
<i>Tabellaria</i>	1	1			
	198	140	5	44	9

Systematic part.

Achnanthes, Bory 1922.

A. affinis GRUNOW (cf. HUSTEDT, Kieselalg.: 381, F. 826; CHOLNOKY 1957a: 88; 1960a: 13). — Samples 24, 26, 30, 146.

A. austriaca HUSTEDT var. *capensis* CHOLNOKY (1959a: 5, F. 1—4). The specimens seen here agree very closely with CHOLNOKY's description and figures but differ in the number of striae 25—28 in 10 μ , as against 30 in 10 μ . It appeared to be very scarce, only a few individuals were seen, mostly of the raphe-valve. — Samples 134, 145. — (Fig. 1, 2).

A. coarctata (BRÉB.) GRUN. (cf. HUSTEDT, Kieselalg. 2: 419, F. 872a—c). This species occurred rarely in my material, in only a few samples and in restricted numbers. In its ecology it belongs to waters with low pH values, which probably accounts for its presence in the two samples viz. seepage from a swampy stream bank (31) and floating rotting bark (151). — Samples 24, 31, 28.

A. exigua GRUN. (cf. HUSTEDT, Kieselalg. 2: 386, F. 832a, b; CHOLNOKY 1962b: 5). This was seen in several samples but never in numbers, and can be regarded as scarce in the region. — Samples 27, 51, 146.

A. exigua GRUN. var. *constricta* TORRA (cf. HUSTEDT l. c.: 386, F. 832g). More frequently observed and in greater numbers than the species but never common. — Samples 24, 28, 30, 146.

A. exigua GRUN. var. *elliptica* HUSTEDT (cf. HUSTEDT in A. S. Atl. T. 413, F. 13, 14; CHOLNOKY 1954b: 205, F. 1, 2). — Sample 51, not common. — (Fig. 3, 4).

A. exilis KÜTZING (cf. HUSTEDT, Kieselalg. 2: 378, F. 822; CHOLNOKY 1962a: 60). This species has been previously recorded from the Cape Province (CHOLNOKY l. c.). — Samples 27, 30.

A. inflata (KÜTZ.) GRUN. (cf. HUSTEDT, l. c.: 421, F. 673). Well represented in a great many samples throughout the Amatola region. CHOLNOKY (1962b: 6) remarks that this diatom occurs more infrequently in the temperate parts of South Africa than in the subtropical regions. The striae vary in density in the local specimens, usually being closer than in the description. Some individuals were seen with abnormal striation. — Samples 24, 25, 26, 27, 28, 29, 31, 51.

A. lanceolata (BRÉB.) GRUN. (cf. HUSTEDT, l. c.: 408, F. 863a—d; CHOLNOKY 1962b: 6). Never frequent in any sample. — Samples 24, 26, 27, 28, 29, 146.

A. lanceolata (BRÉB.) GRUN. f. *rostrata* (OESTR.) HUSTEDT (c. f. HUSTEDT, l. c.: 410, F. 8632—m). This variety is much more common than the type and occurs generally in greater numbers. CHOLNOKY (1956: 56; 1957a: 39; 1962a: 60; 1962b: 6). discusses the ecology of *A. lanceolata* and its

variety *rostrata* more common in the Cape clarification. CHOLNOKY describes which the maximum during moderate climate. Hence more common in Cape Province the maximum conditions of *A. lanceolata* v. *rostrata* in Province in su

var. *rostrata* in *A. linearis* (C. Generally distributed in Samples 26, 27, 28, 29, 30, 31, 51, 146.

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variety *rostrata* in a number of papers. He points out that the species is more common in Europe than the variety (1962a) and that the distribution in the Cape Province is similar. I feel that this latter statement needs clarification. In his paper "Diatomeen aus der Kaap-Provinz" (1962b) CHOLNOKY dealt with the Western Cape, a region of Winter rainfall in which the maximum growth and multiplication of diatoms takes place during moderately cool temperatures somewhat similar to the European climate. Hence he is correct in stating that the typical *A. lanceolata* will be more common. In the region under investigation for this paper, the Eastern Cape Province, the climate differs in being a Summer rainfall area, with the maximum development of the flora taking place under sub-tropical conditions of moderately high temperatures. From this it follows that *A. lanceolata* var. *rostrata* will reach full development in the Eastern Cape Province in suitable conditions. This is well shown in the abundance of the var. *rostrata* in the Amatola region. — Samples 24, 26, 146.

A. linearis (W. SMITH) GRUN. (cf. HUSTEDT, Kieselalg. 2: 378, F. 821 a). Generally distributed in the neutral to slightly acid waters of the region. — Samples 26, 30, 31, 75.

A. microcephala (KG.) GRUN. (cf. HUSTEDT, l. c.: 376 F. 819). Recorded from two samples, but rich in individuals. — Samples 24, 48.

A. minutissima KG. (cf. HUSTEDT, l. c.: 376, F. 820a—e). Abundant in all samples throughout the region. — Samples 24, 26, 30, 31, 48, 48a, 75, 76.

A. oblongella OESTR. (cf. HUSTEDT 1937—1939, Suppl. 15: 199; A. S. Atl. T. 407 F. 49—54; CHOLNOKY 1954c: 272, F. 13—17; 1959a: 8, F. 41—45). This species was identified in only three samples. My observations agree with those of CHOLNOKY (1954c) in that many forms are irregular in shape and show irregular striation. — Samples 27, 51, 75, 76 (Figs. 5—7).

A. Krasskei HUSTEDT (l. c. 2: 403, F. 854b; CHOLNOKY 1959a: 11, F. 66—69; 1960b: 8). Present in most samples from the area. — Samples 24, 26, 28, 29, 30, 51, 75 (Fig. 8, 9).

A. subaffinis CHOLNOKY (1959a: 11, F. 70, 71; 1960a: 18, F. 25—28). This species, first described by CHOLNOKY from the Western Cape Province, occurs in the Eastern Cape in very similar conditions i. e. mountain streams near the foot of the mountains. It has also been recorded from mountain gorges. My specimens agree within very close limits with CHOLNOKY's figures (1959a: 11, F. 70, 71) in the stronger striae bounding the transverse area, in the slightly radial striae, but the striae are closer on both valves being 34—36 in 10 μ . as against 30—32 in 10 μ . Dimensions 13—15 μ long, 3.5—4 μ wide, striae 34—36 in 10 μ . — Samples 31 (rare), 51 (frequent). (Fig. 10—12).

A. subhudsonis HUSTEDT var. *Kraeuselii* CHOLNOKY. (1954c: 271, F. 5—10; 1956a: 56; 1960a: 18, F. 29—32). This small species was recorded from

only one sample but may have been overlooked in others. The forms seen were typical of CHOLNOKY's description and figures. In this region it occurs in similar habitats amongst wet mosses and liverworts and on wet rocks. This is apparently the first record from the Cape Province. — Sample 26, infrequent. (Fig. 13, 14).

Amphipleura KÜTZING 1844.

A. pellucida KG. (cf. HUSTEDT Bacill.: 218, F. 321; Kieselalg. 2: 724, F. 1095; CHOLNOKY 1962b: 9). Very rare in the region under investigation. — Sample 30.

Amphora EHRENBERG 1840.

A. coffeaeformis (AGARDH) KÜTZING. (cf. HUSTEDT, Bacill.: 345, F. 634; CHOLNOKY, 1960b: 234). This species can be regarded as rare in the region as it occurred in very small numbers in a few samples. It belongs to neutral to weakly basic waters and its habitat in the Kaffir Kop Stream is near the limit of its distribution. — Samples 24, 29, 31.

A. montana KRASSKE (cf. HUSTEDT, 1937—1939 Suppl. 15: 413, T. 24, F. 6—8. CHOLNOKY, 1960a: 24, F. 62; 1962b: 10). Widely distributed in South Africa, and recorded from the Western Cape (CHOLNOKY 1962b), the species occurred rarely in only two samples in the Amatola region. — Samples 27, 29.

A. Normani RABENHORST (cf. HUSTEDT, Bacill.: 343, F. 630.) — Samples 27, 28, 29, 30.

A. ovalis KG. (cf. HUSTEDT, Bacill.: 342, F. 628.) — Samples 31, 51.

A. ovalis var. *libyca* (EHR.) CLEVE. This variety usually occurs in greater numbers than the type in any of the samples. — Samples 31, 51.

A. ovalis var. *pediculus* (KG.) GRUN. (cf. HUSTEDT, Bacill.: 343, F. 629.) Common in the region and usually frequent in all samples. — Samples 24, 26, 27, 29, 51.

A. submontana HUSTEDT (1949a: 112, T. 11, F. 4. CHOLNOKY, 1958a: 103, F. 1; 1962b: 10.) Identified in only one sample and rare. — Sample 24.

Anomoeoneis PFITZER 1871.

A. exilis (KG.) CLEVE (1895: 8; HUSTEDT, Bacill.: 264 F. 429; Kieselalg 2: 751, F. 1114a—d.) Found only in one sample and rare, thus possibly displaced. — Sample 26.

A. brachysira (BRÉB.) CLEVE (1895: 7; cf. HUSTEDT Kieselalg. 2: 748, F. 1112e—h; CHOLNOKY 1960c: 352.) I have followed CHOLNOKY (l. c.) in regarding *A. brachysira* (BRÉB.) CLEVE as a species rather than as a variety of *A. seriata* (BRÉB.) CL. I include also the var. *thermalis* GRUN. (= f.

thermalis HUSTEDT the species and acidic waters of 51, 163.

C. aequatoria 14, F. 88—91.) individuals were

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C. bacillum v 236, F. 361.) —

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thermalis HUSTEDT) as in my material there is no sharp boundary between the species and the variety. This form occurs only in the neutral to slightly acidic waters of the mountain streams in the region. — Samples 28, 48, 48a, 51, 163.

Caloneis CLEVE 1891.

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tion. —

C. aequatorialis HUSTEDT (1922: 148, T. 1, F. 5, 6; CHOLNOKY, 1959a: 14, F. 88–91.) This was recorded in only two samples and only a few individuals were seen. — Samples 29, 51.

C. bacillum (GRUN.) MERESCHK. (cf. HUSTEDT, Bacill.: 236, F. 359; CHOLNOKY, 1960b: 237.) — Sample 51 (rare).

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C. bacillum var. *lancettula* (SCHULTZ) HUSTEDT. (cf. HUSTEDT, Bacill.: 236, F. 361.) — Sample 29 (rare).

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C. silicula (EHR.) CLEVE var. *brevistriata* O. MÜLLER (1909, Engl. Bot. Jahrb. 43, 11, T. 1 F. 13. FRITSCH and RICH, 1930: 99, F. 3 A–D.) In one sample some forms were seen which agree very closely with the description and figures given by O. MÜLLER (1909: 11, T. 1, F. 13). This variety is also recorded and figured by FRITSCH and RICH (l. c.) from the Cape Province. CHOLNOKY (1962b: 15, F. 19, 20) describes and figures a new species *Caloneis vehemens*, also from the Cape Province, which seems to be identical with MÜLLER's variety in shape, dimensions and number of striae (18–20 in 10 μ). Both forms also show the striae as radiate at the ends and continuing as very short striae beyond the terminal nodules. — Sample 24 (Fig. 15–16).

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Cocconeis EHRENBERG 1838.

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C. placentula EHR. (cf. HUSTEDT, Kieselalg, 2: 347, F. 802a, b.) This occurs in many samples. — Samples 24, 26, 27, 31.

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C. placentula EHR. var. *ranomafanensis* MANGUIN (1952: 19 Plate I, f. 1, and figs. 28a, b). This variety differs from the type in the broadly elliptical to rectangular shape with rounded to cuneate ends, which are shortly and bluntly apiculate. Dimensions 29–50 μ long, 15–33 μ broad, striae in rapheless valve 16–18 in 10 μ , in the raphe valve 15–19 (mostly 18) in 10 μ . It is usually strongly silicified and appears yellow to orange when mounted in hyrax. It is closely related to *C. placentula* var. *euglypta* in the elongated puncta, 5–6 in 10 μ , disposed in longitudinal rows. — Samples 24, 25, 26, 27, 28, 29, 30, 31, 75, 76. (Fig. 17, 18).

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C. placentula var. *euglypta* (EHR.) CLEVE (cf. HUSTEDT, Kieselalg. 2: 349, F. 802c.) — Sample 24.

C. placentula var. *lineata* (EHR.) CLEVE (cf. HUSTEDT, Kieselalg. 2: 348, F. 802d.) Found in only one sample. — Sample 24.

Cymbella AGARDH 1830.

C. Abbottii CHOLNOKY and CLAUS (1961b: 329, Abb. 2, F. 3; CHOLNOKY 1962b: 17, F. 21–24.) In one sample occurred a number of individuals which I have assigned to *Cymbella Abbottii* CHOLNOKY and CLAUS. They were not entirely typical of CHOLNOKY's figures (l. c.) though very close in shape and size to figure 3 (1961b) but not as curved nor tapered as in figures 21–24 (1962b). In fact they could be taken as forms of *Navicula subtilissima* CL. but for the very slight asymmetry of the valve and the complete lack of resolvable striae in the middle of the valve. Dimensions 15–18 μ long, 3–4 μ broad. — Sample 48a, (Fig. 19).

C. amphicephala NAEG. (cf. HUSTEDT, Bacill.: 355, F. 651; A. S. Atl. T. 377 F. 31–41; CHOLNOKY, 1960a: 31, F. 79, 80.) — Sample 29.

C. amatolensis n. sp. Valve lanceolate, almost symmetrical, with very slightly produced ends and broad rounded poles, 70–93 μ long, 9–12 μ broad. Raphe almost centrally placed in the valve, with the fissure obliquely oriented to the surface, appearing narrowly band-shaped; central pores moderately distant, bent slightly towards the dorsal side, terminal pores comma-shaped curving ventrally; axial area lanceolate very broad, about $\frac{1}{3}$ to $\frac{1}{2}$ of the width of the valve, central area variable from scarcely widened on one side by shortening of the central striae to a small rounded area. Striae strongly radiate in the middle, convergent near the ends, 11–13 in 10 μ in the middle to 16–18 at the ends, distinctly but finely punctate; from one to three of the middle striae, usually only one, on the dorsal side end in isolated puncta.

Cymbella amatolensis shows affinities to *Cymbella incerta* GRUN. (cf. CLEVE 1894: 170; 1881: 13, T. 16, F. 12 as *C. naviculacea* GRUN.), from which it differs in the wider striae, convergent at the ends and the presence of isolated puncta on the middle striae. A similar form is *Cymbella Oliffii* CHOLNOKY (1956: 63, F. 23–27) which differs in the radiate striae throughout and the moderately narrow longitudinal area. Type slide No. 48. (Fig. 20 to 23.) — Samples 27, 48, 48a, 163.

Valvae lanceolatae, paene symmetricae, apicibus levissime protractis, polis late regulariterque rotundatis, 70–93 μ longae, 9–12 μ latae. Rraphe paene in axe valvae decurrens, fissuris membranam oblique penetrantibus, itaque imagine microscopica anguste vittaeformis, poris centralibus modice distantibus, leviter in directione dorsale deflexis, fissuris terminalibus comma-formibus, in directione ventrale deflexis. Area axialis late lanceolata, tertiam sive secundam partem superficiei valvae occupans, area centralis abbreviatione striarum medianarum, nonnumquam unilateraliter solum, sive saepe asymmetricè evoluta. Striae in media parte valvae valde radiantes, 11–13 in 10 μ , ad apices versus convergentes, 16–18 in 10 μ , distincte sed subtiliter punctatae. Striae dorsales medianae 1–3 — fere una solum — puncto isolato in area centrale ornatae.

Habitat in aqua
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Typus: praepar-

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Sample 31.

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Habitat in aquis dulcibus torrentium montium Hog's Back in vicinitate oppidi Grahamstown provinciae Capensis in Africa Meridionale.

Typus: praeparatum Nr. 48 in collectione GIFFEN, Fort Hare, Cape Province.

Iconotypus: figurae nostrae Nr. 20—23.

C. cistula (HEMPR.) GRUNOW (cf. HUSTEDT, Bacill.: 363, F. 676a, b). — Sample 31.

C. cryptocephala HUSTEDT (cf. HUSTEDT 1942a: 99, F. 196—200). I have little doubt that the forms I have assigned to the above species are correctly determined. The species was represented by numerous examples which agree closely with HUSTEDT's description and figures, although some of the individuals show a more linear shape than given by HUSTEDT. — Samples 48, 48a, 146. (Fig. 24, 25).

C. gracilis (RABH.) CLEVE (1894: 169; cf. CHOLNOKY, 1958a: 107, F. 22, 23; HUSTEDT, Bacill.: 359, F. 663.) My specimens agree with the description in CLEVE (l. c.) and the figures given by CHOLNOKY. I am also in agreement with CHOLNOKY that weak silicification cannot be regarded as a character as it is not evident in the specimens from this region. — Samples 48a, 163. (Fig. 26).

C. Kappii CHOLNOKY (1953a: 142 — under the name *C. turgidula* GRUN. var. *Kappii* CHOLNOKY; 1956: 61, F. 17—20.)

Specimens were seen in only one sample from the region and agree in most characters with CHOLNOKY's description and figures. However in my specimens the only difference that can be seen lie in the central pores which are, at first, looped towards the ventral margin and then turn upwards dorsally. — Sample 27. (Fig. 27, 28.)

C. microcephala GRUN. (cf. HUSTEDT, Bacill.: 351, F. 637; CHOLNOKY, 1960b: 238.) Not uncommon in the neutral or slightly acid waters of the region under investigation. — Samples 48, 48a.

C. naviculiformis AUERSWALD (cf. HUSTEDT, Bacill.: 356, F. 653; CHOLNOKY, 1960b: 239). — Samples 29, 75, 76.

C. perpusilla A. CLEVE-EULER (cf. HUSTEDT, Bacill.: 361, F. 666; CHOLNOKY 1954b: 207 F. 13—15; 1955a: 161 F. 13). Typical forms were seen in moderate numbers. — Samples 48a, 163.

C. turgida GREG. var. *pseudogracilis* CHOLNOKY (cf. CHOLNOKY 1958a: 112, F. 49, 50; CHOLNOKY 1955a: 160, F. 11, 12 under the name *C. Mesiana* CHOLNOKY; HUSTEDT, 1937—1939, Suppl. 15, 428, T. 25, F. 15, 16 under the name *C. gracilis* HUSTEDT nec CLEVE). This variety occurred in large numbers in several samples. It can readily be separated from *C. gracilis* (RABH.) CL. by the wide longitudinal area. The form has been previously recorded from the Western Cape Province by CHOLNOKY (1962b: 19). — Samples 26, 27, 51, 48a, 163. (Fig. 29—31).

Diploneis EHRENBERG 1844.

D. Smithii (BRÉB.) CLEVE (1894: 96; cf. CHOLNOKY 1960a: 37; 1962b: 20.) Previously recorded from the fresh waters of South Africa and widely distributed. — Samples 24, 26, rare in 27, 28, 29.

D. subovalis CLEVE (1894: 96, pl. 1, F. 27; HUSTEDT, Kieselalg. 2: 667, F. 1063 a, b.) — Samples 24, 26, 28, 48a.

Epithemia BRÉBISSON 1838.

E. zebra (EHR.) KÜTZING var. *saxonica* (KÜTZ.) GRUN. (cf. HUSTEDT, Bacill.: 385 F. 730; FRICKE in A. S. Atl. T. 252 F. 3—14; CHOLNOKY, 1962b: 21.) This form is common in the region under investigation and is very variable. CHOLNOKY (l. c.) is of the opinion that this variety can scarcely be maintained and his contention is supported by the variation seen in my samples. — Samples 27, 28, 29, 30, 31.

Eunotia EHRENBERG 1837.

E. exigua BRÉB. (cf. HUSTEDT, Kieselalg. 2: 285, F. 751 a—5.; CHOLNOKY, 1962b: 23.) This species has been recorded from the Western Cape Province, (CHOLNOKY, 1962b: 23). Dimensions 32—34 μ long, 3 μ broad, striae 19—21 in 10 μ . — Samples 48, 48a, 163. (Fig. 32, 33).

E. flexuosa (BRÉB.) KÜTZING (cf. HUSTEDT, Kieselalg. 2: 312, F. 778; CHOLNOKY 1962b: 23. — Samples 48, 51.

E. flexuosa var. *transvaalensis* CHOLNOKY (1955a: 166, F. 33, 34; 1959a: 22, F. 129; 1963a: 167, F. 23.) Recorded by CHOLNOKY from the Western Cape Province (du Toit's Kloof) and recently from Dutch New Guinea (1963a: 23). This variety occurred in one sample in the Eastern Cape material. Dimensions 50—100 μ long, 5—6.5 μ broad, striae 10—12 in 10 μ . — Sample 51. (Fig. 34).

E. formica EHRENBERG (cf. HUSTEDT, Kieselalg. 2: 308, F. 775. CHOLNOKY, 1962b: 23). Numerous individuals of this species occurred in one sample from the Hog's Back region. They showed considerable variation in shape and size. It is a recent new record for South Africa being reported from the Berg River, Western Cape (CHOLNOKY, 1962b). — Sample 51. (Fig. 35, 36.)

E. gracilis (EHR.) RABH. (cf. HUSTEDT, Kieselalg. 2: 305, F. 771; CHOLNOKY, 1956: 66, F. 38). Typical examples were seen in a number of samples. This species has not apparently been recorded from the Cape Province, although present in the Transvaal and Natal. — Sample 48, 48a, 51, 75, 163.

E. lunaris (EHR.) GRUN. (cf. HUSTEDT, Kieselalg. 2: 302, F. 769 a, b, d, e; 1949a: 70, T. 2, F. 11—15; CHOLNOKY, 1962b: 23). The species is known from many localities in the Cape Province but was rare in the investigated region of the Eastern Cape Province. — Samples 51, 75, 163.

E. mogolensis (CHOLNOKY, 1962b, 24). This species is widespread in the Eastern Cape Province.

E. montana (CHOLNOKY, 1962b, 24). This species is widespread in the Eastern Cape Province.

E. pectinalis (CHOLNOKY, 1962b, 24). This species is widespread in the Eastern Cape Province.

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E. pectinalis (CHOLNOKY, 1962b, 24). This species is widespread in the Eastern Cape Province.

E. polydentata (CHOLNOKY, 1954c: 19). This species is widespread in the Eastern Cape Province.

E. polydentata (CHOLNOKY, 1954c: 19). This species is widespread in the Eastern Cape Province.

E. Siolii (HUSTEDT, 1906: 48—50). This species is widespread in the Eastern Cape Province.

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E. mogolensis CHOLNOKY (1954d; 123, F. 10; 1958a; 114, F. 64—67; 1962b, 24). Typical examples were seen in a number of samples. The species is widespread in South Africa. — Samples 51, 163. (Fig. 37, 38).

E. montana HUSTEDT. (1949a: 66, T. 3, F. 13—33; CHOLNOKY, 1960c: 354, F. 6, 7; 1962b: 24). — Samples 29, 48, 48a, 75.

E. pectinalis (KÜTZ.) RABH. (cf. HUSTEDT, Kieselalg. 2: 296, F. 763a—k; CHOLNOKY, 1960b: 242; 1962b: 24). — Samples 31, 48, 48a.

E. pectinalis var. *minor* (KG.) RABH. (cf. HUSTEDT, Kieselalg. 2: 298, F. 763d—f; Cholnoky, 1960b: 243; 1962b, 24). — Samples 51, 75, 163.

E. pectinalis var. *minor* f. *impressa* (EHR.) HUSTEDT (cf. HUSTEDT, Kieselalg. 2: 298, F. 763 g, h; CHOLNOKY, 1962b: 25). CHOLNOKY (l. c.) regards the separation of this form as purposeless as var. *minor* and f. *impressa* grade into each other. — Sample 51.

E. pectinalis var. *minor* f. *intermedia* KRASSKE (cf. HUSTEDT, Kieselalg. 2: 298, F. 763 l—o). — Sample 51, 75.

E. pectinalis var. *undulata* (RALFS) RABH. (cf. HUSTEDT, Kieselalg. 2: 298, F. 763 i). — Samples 48, 163.

E. polydentula BRUN (cf. HUSTEDT, Kieselalg. 2: 292, F. 759 a, b. CHOLNOKY, 1954c: 277, F. 34, 35; 1960b: 243; 1962b: 320, F. 19—24). This variable species has now been recorded from a number of localities in South Africa and is probably widespread, but is not frequent in the material under investigation being found in only two samples and very few individuals were seen. — Samples 48a, 30.

E. Stollii HUSTEDT (1952a: 143, T. 5, F. 13—15; CHOLNOKY, 1954c: 279, F. 48—50; 1960b: 243, F. 13—15). The small forms I have assigned to this species agree more closely with the figures by CHOLNOKY (1960b, F. 13—15) than they do with HUSTEDT's original figures. The individuals seen vary in length from 15—19 μ and breadth 4.5—5 μ , striae 10—11 in 10 μ , very finely punctate. — Sample 51. (Fig. 39—42).

E. sulcata HUSTEDT (1937—1939, Suppl. 15: 173, T. 11, F. 7—9; CHOLNOKY 1957c: 62, F. 48—51; 1960a: F. 122; 1962b: 26). Many of the forms assigned to this species which were seen in samples from the Amatola region, proved difficult to separate from *E. montana* HUSTEDT (v. s.). The shapes are very similar and the number of striae in 10 μ the same, and the only character differing much in the two species seems to be in the punctuation of the striae which are about 30 in 10 μ in *E. montana* and around 42—45 in 10 μ in *E. sulcata*. — Samples 48, 48a, 51, 163. (Fig. 43).

E. tenella (GRUN.) A. CLEVE (cf. HUSTEDT, Kieselalg. 2: 284, F. 749, CHOLNOKY, 1960 a: 42; 1962b: 26). Dimensions 18—22 μ long, 3.5—4 μ broad, striae 16—17 in 10 μ . — Sample 75.

E. tenella var. *densestriata* CHOLNOKY (1955a: 169, F. 49—50). In one sample a large number of individuals were observed which agree closely

with CHOLNOKY's var. *densestriata*. In many cases, however, the striation was even closer than in his description, i. e. up to 30 in 10 μ . — Sample 48.

Fragilaria LYNGBYE 1819.

F. familiaris (KÜTZ.) HUSTEDT (1957: 229; Kieselalg. 2: 207, F. 697 c, as *Synedra rumpens* KG. var. *familiaris* (KG.) GRUN.). — Samples 31, 51, 75, 76.

F. lapponica GRUN. f. *lanceolata* HUSTEDT (1942a: 25, F. 21–23). I have very little doubt that the specimens I have placed under this species are correctly determined. They are identical in shape, size and the number of striae as described by HUSTEDT (l. c.). However, HUSTEDT's figures of the girdle view (Kieselalg. 2: 170, F. 678), of the typical form are unlike those seen in my material where they are groggily obese, having an intercalary band three to four times as wide as the valve. Similar girdle views are seen in *Fragilaria pinnata* EHR. by HUSTEDT in A. S. Atl. T. 298, F. 70. Dimensions: 9–20 μ long, 4–6 μ broad, striae 9–12 in 10 μ . — Sample 146. (Fig. 44–46, valve; 47–48, girdle).

Frustulia GRUNOW 1865.

F. caffra n. sp. Valves linear-inflated in the middle, with rounded capitate ends, 38–40 μ long, 7–8 μ broad. Transapical striae slightly radiate in the middle, convergent near the ends, 28–30 in 10 μ ; longitudinal striae forming irregular wavy lines of distinct puncta, about 22 in 10 μ .

This species has the shape of *Frustulia vulgaris* var. *capitata* KRASSKE (cf. HUSTEDT, Kieselalg. 2: 731, F. 1100b), but differs in the density of its striae both in the closer transapical and the wider longitudinal striae. It also shows close resemblance to *F. subvulgaris* CHOLNOKY (1959a, 27, F. 160) in shape, but separates from that species in its greater dimensions and particularly in the much wider longitudinal striae. Type slide 76. (Fig. 49, 50). — Sample 76.

Valvae lineares, partibus medianibus inflatis, apicibus capitato-protractis, regulariter rotundatis, 38–40 μ longae, 7–8 μ latae. Rhaphe directa, filiformis, fissuris inter costas axiales distinctas, modo generis *Frustuliae*, decurrentibus, poris centralibus parvis, distantibus, nodulis terminalibus ab marginibus polaribus remotis. Area axialis angustissime linearis, centralis haud evoluta, lanceolata. Striae transapicales in media parte valvae, apud nodulum centrale, modice radiantes, ceterum capitulis exceptis parallelae, in capitulis valde convergentes, 28–30 in 10 μ . Costae longitudinales undulatae, in relatione distantibus, circiter 22 in 10 μ .

Habitat in torrene uno parvo silvae Auckland in montibus Hog's Back in vicinitate oppidi Grahamstown provinciae Capensis Africae Meridionalis.

Typus: praeparatum Nr. 76 in collectione GIFFEN, Fort Hare, Cape Province.

Iconotypus: figurae nostrae Nr. 49 et 50.

F. javanica HUSTEDT (1937–1939, Suppl. 15: 215, T. 16, F. 3; CHOLNOKY, 1957a: 55, F. 95–98; 1959a: 27). This species, recorded by CHOLNOKY from

Natal (1957a) and several samples further material species is at hon 30, 48a, 75. (Fig.

F. rhomboides CHOLNOKY, 1960

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G. angustatum — Sample 25.

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Natal (1957a) and from the South Western Cape (1959a) was found in several samples but in each only one or two individuals were seen. Until further material has been investigated, it is impossible to say whether the species is at home ecologically in the region under investigation. — Samples 30, 48a, 75. (Fig. 51).

F. rhomboides (EHR.) DE TONI (cf. HUSTEDT, Kieselalg. 2: 728, F. 1098a; CHOLNOKY, 1960b: 245; 1962b: 27). — Samples 28, 48, 48a, 51.

F. rhomboides var. *saxonica* (RABH.) de TONI (cf. HUSTEDT, l. c.: 729, F. 1099; CHOLNOKY 1960b: 245; 1962b: 27). — Samples 31, 48, 48a.

F. rhomboides var. *amphipluroides* GRUNOW (cf. HUSTEDT l. c. 729, F. 1098b). A single valve of this variety was seen in one sample, and until more examples are recorded, little can be said of its place in the ecology of the Amatola region. At present it must be regarded as a displaced form. — Sample 30, 146. (Fig. 52).

F. tugelae CHOLNOKY (1956: 71, F. 69; 1957a: 55, F. 99—101). My specimens from the Hog's Back, though otherwise similar, differ in the degree to which the margin in the middle of the valve, is constricted. In most of the specimens observed, the constriction is very slight to completely absent. Not previously recorded from the Cape Province. — Samples 48, 48a, 75, 76. (Fig. 53—56).

F. vulgaris (THWAITES) DE TONI (cf. HUSTEDT, Kieselalg. 2: 730, F. 1100a; CHOLNOKY 1959a: 28; 1962b: 28). As CHOLNOKY states (l. c.) the typical form of the species is well represented in the Southern portions of the Cape Province, and the same distribution is found in the Eastern Cape. — Samples 24, 26, 27, 28, 29, 31, 48, 51, 75, 76, 146.

F. vulgaris var. *angusta* CHOLNOKY (1953b, 142, F. 17; 1954b: 214 F. 61; 1957c: 63, F. 58, 59). This variety is by no means as widely distributed in the region under review as the typical species, and was seen in only two samples and in very restricted numbers. It must be regarded here as outside its normal ecological limits. — Samples 76, 146.

Gomphonema AGARDH 1824.

G. angustatum (KG.) RABH. (cf. HUSTEDT, Bacill.: 373, F. 690—694). — Sample 25.

G. Clevei FRICKE (in A. S. Atl. T. 234, F. 44—46; CHOLNOKY, 1960b, 28). The species is common and abundant in the neutral waters of the Eastern Cape Province. CHOLNOKY states that it is very infrequent in the Southern Cape region. (1962b: 28). — Samples 24, 25, 26, 27, 30, 31.

G. gracile EHR. (cf. M. SCHMIDT & FRICKE in A. S. Atl. T. 236, F. 16—28; HUSTEDT, Bacill.: 376, F. 702, 703; CHOLNOKY 1960b: 247; 1962b: 29). Very uncommon and found in only one sample. — Sample 76.

G. longiceps EHR. var. *montanum* (SCHUM.) CLEVE (cf. HUSTEDT, Bacill.: 375, F. 707; CHOLNOKY, 1962b: 30). Widespread in the Cape Province, it occurs chiefly in the slightly acid waters of the Hog's Back region. — Samples 26 (probably displaced), 75, 76, 146.

G. longiceps var. *subclavatum* GRUN. (cf. HUSTEDT, Bacill.: 375, F. 705; CHOLNOKY, 1962b: 30). This variety is much more common in the region and is very variable in shape and size. — Samples 75, 76, 146.

G. longiceps var. *subclavatum* f. *gracilis* HUSTEDT (cf. HUSTEDT, Bacill.: 375, F. 706). HUSTEDT's f. *gracilis*, which CHOLNOKY regards as inseparable from the variety as it glides completely into the broader normal forms, occurred in one sample and showed no intermediates in the Hog's Back region. — Sample 163.

G. parvulum (KG.) GRUN. (cf. HUSTEDT, Bacill.: 372, F. 713 a—c; CHOLNOKY 1962b: 30.) This is probably the most widespread species in the region and is present in waters which vary from slightly acid to slightly alkaline. It is also extremely variable in form. — Samples 25, 26, 51, 76, 146.

G. parvulum var. *lagenula* (GRUN.) FRENGUELLI (cf. HUSTEDT, Bacill.: 373; 1949a: 119, T. 11, F. 8—11; CHOLNOKY, 1960b: 247; 1963b: 30). Widespread and abundant in the area. — Samples 24, 26, 31, 48, 48a, 51, 76.

G. perminutum CHOLNOKY (1957a: 56, F. 104; 1960a: 47, F. 143, 144; 1962b: 30). This small species was seen in several samples but is easily overlooked. Dimensions: 7—8 μ long, 2—2.5 μ broad, striae 26 in 10 μ . — Samples 31, 146. (Fig. 57).

G. Schweickerdtii CHOLNOKY (1953b: 143, F. 18, 19; 1957a: 57, F. 105, 106; 1962b: 30). This was found in several samples from neutral waters of the region. It never occurred abundantly, but was not rare. — Samples, 24, 25, 26, 27. (Fig. 58).

Gyrosigma HASSALL 1845.

G. scalproides (RABH.) CLEVE (cf. CLEVE, 1894: 118; HUSTEDT, Bacill.: 226, F. 338; CHOLNOKY 1962b: 31). This is the only species of *Gyrosigma* recorded from the neutral waters of the region. — Samples 26, 27 (rare), 30, 31.

Hantzschia GRUNOW 1880.

H. amphioxys (EHR.) GRUN. var. *africana* HUSTEDT (in A. S. Atl. T. 345, F. 31; CHOLNOKY, 1962b: 32). This occurred only in samples from neutral waters in the region and never in numbers. — Samples 26, 28, 30, 75.

H. amphioxys var. *vivax* (HANTZSCH) GRUNOW (cf. HUSTEDT, Bacill.: 394, F. 750). — Sample 28 (rare).

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N. cari EHR.
Suppl. 15: 266, 267

N. carminata
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Melosira AGARDH 1824.

M. granulata (EHR.) RALFS var. *angustissima* O. MÜLLER (cf. HUSTEDT, Kieselalg. 1: 250, F. 104d; CHOLNOKY, 1960b: 248; 1962b: 33.) — Sample 51.

M. Roeseana RABH. var. *epidendron* GRUN. (cf. HUSTEDT, Kieselalg. 1: 266, F. 112 c, d; CHOLNOKY, 1960a: 51.) This variety occurred in several samples as isolated valves and cannot be regarded as autochthonous in the material examined. However, it has been frequently observed in diatom communities inhabiting mosses in the Hog's Back region (unpublished observations).

Ross (1947) states that according to the rules of priority the names should be changed to *Melosira dendroteres* (EHR.) R. ROSS and *M. dendroteres* var. *Roeseana* (RABH.) R. ROSS on account of EHRENBERG's *Liparogyra dendroteres* E. (Ber. Kgl. Akad. Wiss., Berlin 1848).

This form has not been previously recorded from the Cape Province. — Samples: 26, 28, 31, 48, 75, 76, 163.

M. varians AGARDH (cf. HUSTEDT, Kieselalg. 1: 240, F. 100). Abundant in most of the neutral to slightly acid waters of the region, this species is apparently a new record for the Cape Province. — Samples: 25, 26, 27 (rare), 28, 29, 30, 31.

Meridion AGARDH 1824.

M. circulare (GREVILLE) AGARDH (cf. HUSTEDT, Kieselalg. 1: 93, F. 627 a—h; FRICKE in A. S. Atl. 1. 267, F. 34—49, 55—59; CHOLNOKY, 1960b: 248; 1962b: 33). This occurred in great numbers in only one sample and I find that I agree with CHOLNOKY (1962b: 33), that it is impossible to separate the var. *constrictum* (RALFS) VAN HEURCK as it grades into the species without a break. — Sample 146.

Navicula BORY 1824.

N. cari EHR. var. *angusta* GRUN. (cf. HUSTEDT, Bacill.: 299; 1937—1939, Suppl. 15: 266, T. 20, F. 32). — Samples 28, 48, 48a, 75, 163.

N. carminata HUSTEDT var. *africana* CHOLNOKY (1959: 35, F. 189, 190; GIFFEN 1963: 236, F. 65). The presence of this diatom which is widespread in the alkaline, brackish waters of South Africa is surprising in the neutral to slightly acid waters of the Hog's Back region. There are, however, highly mineralised springs feeding the rivers in the area, some containing small percentages of chlorides which may account for the presence of this species here. — Sample 24.

N. cincta (EHR.) RALFS (cf. HUSTEDT, Bacill.: 298, F. 510; CHOLNOKY, 1962b: 36). — Samples 24, 48a.

N. cinctaeformis HUSTEDT (cf. HUSTEDT, 1937-1939, Suppl. 15: 265, T. 19, F. 11-12; CHOLNOKY 1957c: 68, F. 68; 1962b: 36, f. 39). The few specimens seen in my material agree closely with those figured by CHOLNOKY (l. c.) both in form and size, being more or less 30 μ long. — Sample 51. (Fig. 59).

N. contenta GRUN. (cf. HUSTEDT, Kieselalg. 3: 209, F. 1328a-d; CHOLNOKY 1962b: (37). This species occurred in only one sample, but is easily overlooked. — Sample 28.

N. contenta f. *biceps* (ARNOTT) GRUN. (cf. HUSTEDT, l. c. 209, F. 1328 h, i; CHOLNOKY, l. c.: 37). The forma proved to be much more abundant than the type, as has also been noted by CHOLNOKY (l. c.) in the Western Cape Province. — Samples 27, 28, 76, 146.

N. contenta f. *parallela* J. BOYE PETERSEN (cf. HUSTEDT, l. c.: 209, F. 1328 e-g; CHOLNOKY, l. c.: 37). — Sample 24, 28 (infrequent).

N. cryptocephala KG. (cf. HUSTEDT, Bacill. 295, F. 496). This is probably one of the most abundant species in the Hog's Back area. — Samples 24, 26, 27, 28, 29, 30, 31, 48, 48a, 51, 75.

N. cryptocephaloides HUSTEDT (cf. HUSTEDT, 1937-1939, Suppl. 15: 261, T. 18, F. 1, 2; CHOLNOKY, 1955b, 18, F. 29, 30; GIFFEN, 1963, 236). This species is widespread in South African waters and has been recorded from the Cape Province by CHOLNOKY (1962b, 38), and from the alkaline and slightly saline waters of the coast in the Eastern Cape Province (GIFFEN 1963: 236). — Sample 75.

N. dicephala (EHR.) W. SM. var. *undulata* OESTRUP (cf. HUSTEDT, Bacill.: 303, F. 527 as *N. dicephala* f. *undulata* (OESTR.) HUSTEDT; CHOLNOKY, 1962b: 38). The specimens seen were small viz. 21.5-24 μ long, with 13-15 striae in 10 μ , but there is no doubt as to their identity. — Sample 146.

N. dissuta n. sp. Valve linear-lanceolate with convex margins and broad capitate, slightly truncate rounded ends, 20-24 μ long, 5 μ broad. Raphe straight thread-like, axial area lanceolate, moderately wide, central area slightly widened. Transapical striae 22-23 in 10 μ , radiate throughout, slightly shortened on both sides of the central nodule, often with one or two very short striae in the middle. Striae faintly punctate, the final puncta near the axial area more pronounced than the others. Type slide 30. This new species, which was rather scarce in one sample, is very similar in size and shape to *Navicula disjuncta* HUSTEDT (Kieselalg. 3: 143, F. 1274 a-4.) but differs in the wider lanceolate axial area and the oval and narrower central area. — Sample 30. (Fig. 60, 61).

Valvae lanceolatae, marginibus lateralibus regulariter convexis, apicibus capitatis, capitulis in relatione magnis, latisque, leviter truncatorotundatis, 20-24 μ longae, circiter 5 μ latae. Rraphe directa, filiformis, poris centralibus parvis, deflexis, fissuris terminalibus in eodem sensu flexis, margine valvae polare distantibus. Area

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axialis lanceolata, in media parte valvae in aream centalem distinctam, circulem sive lanceolatam transiens. Striae transapicales per totam longitudinem valvae radiantes, apud aream centalem leviter abbreviatae, saepe cum singulis brevissimis intercalatis, 22-23 in 10 μ , subtiliter sed distincte punctatae, punctis ultimis ad marginem areae axialis in imagine microscopica validioribus.

Habitat in torrente Auckland Stream dicto in montibus Hog's Back in vicinitate oppidi Grahamstown provinciae Capensis in Africa Meridionale.

Typus: praeparatum Nr. 30 in collectione GIFFEN. Fort Hare, Cape Province.

Iconotypus: figurae nostrae Nr. 60 et 61.

N. exigua (GREG.) O. MÜLLER (cf. HUSTEDT, Bacill.: 305, F. 538; 1949a; 97, T. 5, F. 10; CHOLNOKY 1959a: 38, F. 205; 1962b: 39). This species occurred only in two samples and never in great numbers. — Samples 51, 146.

N. Fritschii LUND (1946: 77, F. 7 A-G; = *N. insociabilis* HUSTEDT nec KRASSKE, HUSTEDT, Kieselalg. 3: 181, F. 1315a-h; see CHOLNOKY 1957a: 62, F. 130; 1959: 38, F. 209; 1960a: 59, F. 188). CHOLNOKY in his papers quoted above, has discussed the taxonomy of *N. Fritschii* LUND and *N. insociabilis* KRASSKE in detail and shows quite conclusively, in my opinion, that HUSTEDT is mistaken in maintaining the identity of the two species. Ecologically also they belong to different conditions. In the region under investigation *N. Fritschii* LUND inhabits neutral waters. In an earlier paper (GIFFEN, 1963, 237), I have recorded this species from the slightly alkaline and very slightly brackish waters of the Gulu River system of the Eastern Cape Coast. — Sample 24 (not common).

N. gastrum EHRENBERG (cf. HUSTEDT, Bacill.: 305, F. 537). The specimens seen, although on the small side, 29-30 μ long, agree closely with the type in shape, having distinctly capitate ends. They have, however, much closer striae, 13-14 in 10 μ , which place them near *N. gastrum* var. *transvaalensis* CHOLNOKY (1958a, 120, F. 91-93), which has 12-14 striae in 10 μ , and produced but not capitate ends. CHOLNOKY's *N. gastrum* var. *transvaalensis* may be a new species. — Specimens 24, 146.

N. granoryza n. sp. Valva linear with very slightly conical or regularly rounded ends, 12-16 μ long, 3 μ broad. Raphe straight, thread-like, central pores moderately close; axial area narrow, linear, central area slightly widened through shortening of the middle striae. Striae parallel 16 in 10 μ , slightly convergent at the ends.

This new species is similar in shape and size to *Navicula dispensata* HUSTEDT et MANGUIN f. *rostrata* MANGUIN (Kieselalg. 3: 240, F. 1366e) but differs in the wider striae, 16 as against 24 in 10 μ , and in the convergence in the end striae. Type slide 48. — Sample 48. (Fig. 62, 63).

Valvae lineares, apicibus regulariter sive levissime conice rotundatis, non protractis, 12-16 μ longae, circiter 3 μ latae. Rraphe directa, filiformis, poris centrali-

bus, terminalibusque in eodem sensu deflexis, poris centralibus modice distantibus. Area axialis anguste linearis, in media parte dilatatione aream centralem distinctam, apicaliter elongatam, lanceolatam, parvam formans. Striae, ultimis polaribus exceptis, parallelae, polares modice convergentes, 16 in 10 μ , ad polos versus densior positae.

Habitat in aquis destillantibus ad rupes doleriticas in silva Auckland dicta montium Hog's Back in vicinitate oppidi Grahamstown provinciae Capensis in Africa Meridionalis.

Typus: praeparatum Nr. 48 in collectione GIFFEN, Fort Hare, Cape Province.

Iconotypus: figurae nostrae Nr. 62 et 63.

N. hungarica GRUN. (cf. HUSTEDT, Bacill. 298, F. 506; CHOLNOKY 1962b, 41). — Sample 24.

N. hungarica var. *capitata* (EHR.) CLEVE; (cf. HUSTEDT l. c. 298, F. 508; CHOLNOKY, 1962b, 41). — Samples 24, 26, 27, 30, 31.

N. lapidosa KRASSKE (cf. HUSTEDT, Kieselalg. 3: 162, F. 1296; CHOLNOKY 1960a, 67, F. 211). This species has not apparently been recorded from the Cape Province. — Sample 51. (Fig. 64).

N. mutica KÜTZ. (cf. HUSTEDT, Bacill.: 274—275, F. 435a, b). — Samples 26, 75, 146.

N. mutica f. *nivalis* (EHR.) HUSTEDT (cf. HUSTEDT, 1957: 31; as var. in Bacill.: 275, F. 453c). — Samples 28, 163.

N. nyassensis O. MÜLLER (cf. HUSTEDT in A. S. Atl. T. 396, F. 35—38 and T. 397, F. 43—44; CHOLNOKY, 1960a: 71, F. 221). Seen in only one sample No. 24.

N. obsoleta HUSTEDT (1942a: 69, f. 12—16; CHOLNOKY, 1957c: 70, F. 77, 78), Apparently this has not been recorded from the Cape Province. — Sample 146. (Fig. 65).

N. pelliculosa (BRÉB.) HILSE (cf. HUSTEDT, Kieselalg. 3: 172, F. 1035). A few forms occurred in one sample which I have assigned to this species on account of their shape and size and the marked middle rib with distant terminal nodules. The striae were not resolvable. This species has not apparently been recorded from South Africa. — Sample 146. (Fig. 66).

N. pseudohalophila CHOLNOKY (1960b: 74, F. 231—235; 1962b: 44; GIFFEN, 1963: 240, F. 76, 77). This species is apparently widespread in the Eastern Cape Province as well as in Natal, from which region it was first described. In the Hog's Back region it occurred rarely in the neutral waters. In the lower reaches of the Amatola Streams where the water becomes alkaline (pH of 8.2—8.4) it becomes very abundant and reaches its maximum development. — Samples 24, 27.

N. pupula KÜTZ. (cf. HUSTEDT, Bacill.: 281, F. 467a). — Samples 26, 30, 75.

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N. pupula f. *minutula* CHOLNOKY (1957c: 70, F. 79). Small forms of *N. pupula* KG. were seen in one sample which are identical with CHOLNOKY's f. *minutula*, 10—12 μ long, 5—6 μ broad, with 28 striae in 10 μ . — Sample 31.

N. radiosa KÜTZ. (cf. HUSTEDT, Bacill.: 299, F. 513; CHOLNOKY 1960b: 253; 1963b: 45). — Sample 30.

N. ravinae CHOLNOKY (1960a: 77, F. 240). Numerous individuals of this small species were seen in several samples, which are identical in size and shape with *N. ravinae* CHOLNOKY. Certain individuals, however, showed a slightly greater length than given in the original description and in most of the specimens the middle radiate striae were exceptionally difficult to resolve even in phase contrast. Dimensions 16—21 μ long, 3—3.5 μ broad. — Samples 48, 48a, 76, 163. (Fig. 67).

N. rhynchocephala KÜTZ. (cf. HUSTEDT, Bacill. 269, F. 501). — Samples 24, 26, 27, 29, 30, 75.

N. Schroeteri MEISTER (cf. HUSTEDT, 1937—1939, Suppl. 15: 267, T. 18, F. 16; A. S. Atl. T. 405, F. 6—11; CHOLNOKY 1954b: 219, F. 91; GIFFEN 1963: 242). This species is apparently widely distributed in South Africa and particularly in the Cape Province. In the region under investigation, however, though plentiful in the neutral to slightly acid waters of the area, it does not reach the maximum development it shows in the more alkaline waters elsewhere. The specimens seen are usually more lanceolate and often taper gradually to a less rounded apex. These forms are clearly linked to the typical species by intermediate stages. — Samples 24, 26, 28, 29, 30, 31. (Fig. 68).

N. subatomoides HUSTEDT (cf. HUSTEDT, Kieselalg. 3: 271, F. 1400; CHOLNOKY 1957a: 67, F. 163—165). A few individuals of the species were seen in two samples and agree closely with both HUSTEDT's figures and dimensions and also with those of CHOLNOKY. Dimensions 9—10 μ long, 6 μ broad, striae ca. 40 in 10 μ . — Samples 51, 75, 146. (Fig. 69).

N. subhamulata GRUN. (cf. HUSTEDT, Kieselalg. 3: 126, F. 1258; CHOLNOKY 1957a: 67, F. 166, 167). Apparently not previously recorded from the Cape Province. — Samples 28, 30.

N. subtilissima CLEVE (cf. CLEVE 1894: 141; HUSTEDT, Kieselalg. 3: 89, F. 1235; CHOLNOKY, 1962b: 47). Most of the specimens in the Hog's Back material differ from Hustedt's figures in possessing much less tapering margins and larger "capita". Usually, also, they are shorter, being 16—20 μ long. — Samples 26, 48, 48a, 163. (Fig. 70).

N. tenella BRÉBISSON (cf. HUSTEDT, Bacill.: 299 as *Navicula radiosa* var. *tenella* VAN HEURCK; CHOLNOKY 1962b: 47; CHOLNOKY and CLAUS 1961b: 335). Not uncommon in the acid waters of the region. — Sample 31.

N. tenelloides HUSTEDT (1937—1939, Suppl. 15: 269, T. 19, F. 13; CHOLNOKY 1956: 80, F. 98; 1962b: 48). — Sample 30. (Fig. 71).

N. tuscula (EHR.) GRUN. (cf. HUSTEDT in A. S. Atl. T. 272, F. 23–27; Bacill.: 308, F. 552; CHOLNOKY 1962b: 49). This species, which seems rare in South Africa, occurred in two samples and was extremely scarce in both, but has been noted in unworked samples from the same Hog's Back region. The species has been recorded previously from the Cape Province by CHOLNOKY (l. c.). — Samples 28, 76.

N. viridula KÜTZ. var. *linearis* HUSTEDT (1937–1939, Suppl. 15: 264; CHOLNOKY 1959: 53; 1962b: 50). — Sample 48.

N. vulpina KÜTZ. (cf. HUSTEDT, Bacill.: 297, F. 504; CHOLNOKY 1959a: 53). — Samples 27, 29, 30, 31.

N. Zanoni HUSTEDT (1949a: 92, T. 5, F. 1–5; CHOLNOKY 1959a: 55, F. 280; 1962b: 51; GIFFEN 1963: 243). This species was present in great numbers in only one sample (26), and very scarce in one other sample. As an indicator of neutral to basic waters, it is more or less outside its habitat in the investigated region. — Samples 26, very rare in 31.

Neidium PFITZER 1871.

N. affine (EHR.) CLEVE (1894: 68, 69; HUSTEDT, Bacill.: 242, F. 376). — Samples 75, 76.

N. affine f. *hercynica* (A. MAYER) HUSTEDT (cf. HUSTEDT, Bacill.: 242). A number of specimens were seen in one sample which I have assigned to this form as they agree with HUSTEDT's description (l. c.). There are two other species with which it could be confused, viz. *N. iridis* (E.) CL. f. *vernalis* REICHELDT (HUSTEDT, Bacill.: 245, F. 380), which has a similar shape, but is larger and possesses 16–19 striae in 10 μ , i. e. much coarser than in the form in question; and *N. Hermannii* HUSTEDT (1937–1939, Suppl. 15: 408, T. 16, F. 11; CHOLNOKY 1957a: 71, F. 191) which is smaller with much closer striae, i. e. 34–36 in 10 μ . — Sample 51. (Fig. 72).

N. affine var. *amphirhynchus* (EHR.) CLEVE (cf. HUSTEDT, Bacill.: 243, F. 377; CHOLNOKY 1962b: 51). Abundant in many samples. — Samples 25, 27, 51, 76, 146.

N. affine var. *longiceps* (GREG.) CLEVE (cf. HUSTEDT, Bacill.: 244, F. 378). Abundant in some samples. — Samples 24, 75.

N. dubium (EHR.) CLEVE (cf. HUSTEDT, Bacill.: 246, F. 384). This species was moderately abundant in one sample. — Sample 51.

N. iridis (EHR.) CLEVE (cf. HUSTEDT, Bacill.: 245, F. 379). This occurred very rarely in the material. CHOLNOKY (1957a: 69; 1962b: 52) considers that the species *N. affine*, *N. iridis* and *N. productum* require critical revision as the boundaries between these three species are not sharp and the maintenance of their individuality is doubtful. — Sample 26.

N. adapta HUSTEDT (1956: 81, F. 10). Seen in one sample.

N. amphibia (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35).

N. capitellata (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 57–58). Region in neutral to basic waters.

N. Chasci CLEVE (1956: 81, F. 10). Specimens which description and carinal pores are not sharp (Fig. 74).

N. Clausii HUSTEDT (1937–1939, Suppl. 15: 336, F. 7–8). In neutral to slightly basic waters. As *N. Clausii* can probably be distinguished from *N. affine* (30, 48, 48a, 51).

N. dissipata (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35).

N. ignota (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35).

N. interrupta (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35).

N. irremissa (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35). Have placed in *N. affine* because of shorter diameter and broader carinal pores.

N. linearis (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35). — Samples 24, 75.

N. obtusa WILSON (1922: 422, F. 817d). In basic and often under investigation.

N. palea (KÜTZ.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35). Samples 28, 30.

N. parvuloides (EHR.) HUSTEDT (1937–1939, Suppl. 15: 348, F. 34–35). Species was rare.

Nitzschia HASSALL, 1845.

N. adapta HUSTEDT (cf. HUSTEDT, 1949a; 135, T. 12, F. 3-6; CHOLNOKY 1956: 81, F. 106, 107. 1957a: 72, F. 198, 199). Numerous specimens were seen in one sample. — Sample 27.

N. amphibia GRUNOW (cf. HUSTEDT, Bacill.: 414, F. 793; A. S. Atl. T. 348, F. 34-37). — Samples 27, 28, 29, 31.

N. capitellata HUSTEDT (cf. HUSTEDT, Bacill.: 414, F. 792; A. S. Atl. T. 348, F. 57-59; 1949a, T. 12, F. 36-38). Present in the investigated region in neutral waters. — Samples 27, 29.

N. Chasei CHOLNOKY (1954b: 220, F. 98; 1957a: 74, F. 209-211). The specimens which I have placed here agree very closely with the original description and figures but are longer, being mostly 16-17 μ in length, carinal pores and transapical striae 16 in 10 μ . — Samples 28, 30. (Fig. 73, 74).

N. Clausii HANTZSCH (cf. HUSTEDT, Bacill.: 421, F. 814; A. S. Atl. T. 336, F. 7-11). This species appeared in a number of samples, chiefly in neutral to slightly acid waters, but always in very restricted numbers. As *N. Clausii* HANTZSCH reaches full development in alkaline waters, it can probably be regarded in the Hog's Back area as displaced. — Samples 30, 48, 48a, 51, 75.

N. dissipata (KG.) GRUNOW (cf. HUSTEDT, Bacill.: 412, F. 789; CHOLNOKY 1952b: 54; GIFFEN 1963: 245). — Samples 24, 26, 30, 31, 75, 146.

N. ignorata KRASSKE (cf. HUSTEDT, Bacill.: 422, F. 819; CHOLNOKY 1960b: 260; 1962b: 56). — Sample 30.

N. interrupta (REICHEL) HUSTEDT (cf. HUSTEDT in A. S. Atl. T. 351, F. 9 to 13). — Samples 30, 31.

N. irremissa CHOLNOKY (1959a: 57, F. 298-300). The forms which I have placed here agree in shape with the original description but they are shorter than the limits given there. Dimensions 30-36 μ long, 3-4 μ broad, carinal pores 18 in 10 μ . — Samples 30, 31. (Fig. 75).

N. linearis (AG.) W. SMITH (1853: 39, pl. 13, F. 110 and Pl. 31, F. 110; HUSTEDT, Bacill.: 409, F. 784). Generally distributed in the Amatola region. — Samples 24, 26, 27, 28, 29, 30, 31, 75, 76, 146.

N. obtusa W. SMITH var. *scalpelliformis* GRUNOW (cf. HUSTEDT, Bacill.: 422, F. 817d; CHOLNOKY 1962b: 57). This species seems characteristic of basic and often saline waters and was never abundant in the material under investigation. — Samples 51, 75, 146.

N. palea (KG.) W. SMITH (1856: 89; HUSTEDT, Bacill.: 416, F. 801). — Samples 28, 30, 31, 48, 48a, 75, 146, 163.

N. parvuloides CHOLNOKY (1954b: 221; 1955a: 179, F. 72, 73). This species was rare in one sample but fits well with the original description

and figures, dimensions being 36–38 μ long, 4 μ broad, carinal pores 9–10 in 10 μ , striae ca 35 in 10 μ . — Sample 51.

N. perminuta GRUNOW (cf. HUSTEDT 1943b: 230, F. 80–87; Bacill.: 415 as *N. frustulum* var. *perminuta* GRUN.; CHOLNOKY 1959: 58, F. 306 to 309). — Sample 51.

N. sigma (KG.) W. SMITH (1853: 39, pl. 13, F. 108; HUSTEDT, Bacill.: 420, F. 813). Found in several samples from the neutral waters in the region. — Samples 24, 28, 29.

N. sublinearis HUSTEDT (in A. S. Atl. T. 334, F. 27–29; Bacill.: 411, F. 786). — Samples 29, 30, 31, 146.

N. subvitrea HUSTEDT (cf. HUSTEDT in A. S. Atl. T. 347, F. 18; CHOLNOKY 1957c: 78, F. 111–112). Only a single specimen was seen, so the species must be regarded as displaced. — Sample 28. (Fig. 76).

Pinnularia EHRENBERG 1840.

P. acrosphaeria BRÉBISSEON (cf. HUSTEDT, Bacill.: 330, F. 610). This species is rare in the region investigated as only two or three specimens were seen in one sample and a broken frustule in another. — Samples 28, 75 (broken valve).

P. appendiculata (AG.) CLEVE (1895: 75; HUSTEDT, Bacill.: 317, F. 570a; A. S. Atl. T. 313, F. 10, 11). — Samples 51, 76, 146.

P. eburnea (CARLSON) ZANON (1941: 49, T. 3, F. 16–18; CHOLNOKY 1959: 62; 1960: 108, F. 324–331). This is one of the commonest species of *Pinnularia* in the Hog's Back region. — Samples 48, 48a, 51, 75, 76, 146, 163.

P. gibba EHR. var. *sancta* GRUNOW (cf. HUSTEDT 1937–1939, Suppl. 15: 395, T. 20, F. 35; 1949: 107, T. 6, F. 17, 20). — Samples 26, 51, 146. (Fig. 77–79).

P. graciloides HUSTEDT (cf. HUSTEDT, 1937–1939 Suppl. 15, T. 22, F. 9, 10). — Samples 26, 28. — (Fig. 80).

P. interrupta W. SMITH (1853: 59, pl. 19, F. 184; HUSTEDT, Bacill.: 317, F. 573). Widespread in the Cape Province. — Samples 51, 75, 146.

P. maior (KG.) CLEVE (1895: 89; HUSTEDT, Bacill.: 331, F. 614). — Samples 51, 163.

P. mesolepta: (EHR.) W. SMITH (1853: 58, Pl. 19, F. 182; HUSTEDT, Bacill.: 319, F. 575a). — Samples 51, 75, 146.

P. stomatophora GRUNOW (cf. HUSTEDT, Bacill.: 327, F. 605; A. S. Atl. T. 392, F. 14). Very few examples of this species were observed. They agree with HUSTEDT's figure (l. c.) in being without the lunate markings beside the central nodule. — Sample 75. (Fig. 81).

P. subcapitata (EHR.) GRUNOW (1860: F. 6–15). — Sample 51.
P. valida HUSTEDT (1937–1939, Suppl. 15: F. 40). — Sample 51.
P. viridis (NATHAN) GRUNOW (1860: F. 48, 48a, 51, 75).

R. gibba (EHR.) GRUNOW (1860: F. 13–15). — Sample 51.
R. gibberula (NATHAN) GRUNOW (1860: T. 254, F. 13–15).

S. Abbottii (EHR.) GRUNOW (1860: F. 13–15). — Sample 51.
S. anceps EHR. (1860: F. 13–15). — Sample 51.
S. acuta W. SMITH (1853: F. 1163) — Sample 51.
S. Borrichii (EHR.) GRUNOW (1860: F. 13–15). — Sample 51.
S. Kieselalg. 2: 8 in the region: completely typical.
S. Kieselalg. Widely distributed, mostly in the region.
S. phoenicea (EHR.) GRUNOW (1860: F. 1118). — Sample 51.

S. intermedia (EHR.) GRUNOW (1860: F. 1118). — Sample 51. (Fig. 81).

S. acanthophora (EHR.) GRUNOW (1860: F. 1118). — Sample 51. (Fig. 81).
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P. subcapitata GREGORY (cf. CLEVE 1895: 75; HUSTEDT 1949a: 101, T. 8, F. 6–15). — Samples 28, 51, 75.

P. valida HUSTEDT (1949a: 106, T. 6, F. 22; CHOLNOKY 1962c: 334, F. 40). — Samples 48, 48a, 163.

P. viridis (NITZSCH) EHR. (cf. HUSTEDT, Bacill.: 334, F. 617a). — Samples 48, 48a, 51, 75, 163.

Rhopalodia O. MÜLLER 1897.

R. gibba (EHR.) O. MÜLLER (cf. FRICKE in A. S. Atl. T. 253, F. 1–13; HUSTEDT, Bacill.: 390, F. 740). — Samples 26 (rare), 28.

R. gibberula (EHR.) O. MÜLLER (cf. FRICKE in A. S. Atl. T. 253, F. 23–37; T. 254, F. 13–21). Samples 24, 28, 51.

Stauroneis EHRENBERG 1843.

S. Abbottii CHOLNOKY and CLAUS (1961b: 338, F. 21, 22; CHOLNOKY 1962b: 67, F. 106). Examples of this recently described species, observed in one sample, differed somewhat from the author's figures in being more linear in shape and without the capitate ends. — Sample 48a — (Fig. 82, 83).

S. anceps EHR. (cf. HUSTEDT, Kieselalg. 2: 771, F. 1120a; CHOLNOKY 1962b: 68). — Samples 76, 146.

S. acuta W. SMITH (1853: 59, pl. 19, F. 187; HUSTEDT, Kieselalg. 2: 819, F. 1163) — Sample 28 (rare).

S. Borrichii (BOYE PETERSEN) LUND (1946: 63, F. 3 C–H; HUSTEDT, Kieselalg. 2: 803, F. 1151a, b). This species must be considered to be rare in the region as only a very few individuals were seen. These were completely typical. — Sample 51, 75. — (Fig. 84).

S. Kriegeri PATRICK (cf. HUSTEDT, Kieselalg. 2: 780, F. 1136a–c). Widely distributed in the Hog's Back region of the Amatola Mountains, mostly in neutral waters. — Samples 30, 31, 75.

S. phoenicenteron (NITZSCH) EHR. (cf. HUSTEDT, Kieselalg. 2: 766, F. 1118). — Samples 26, 31, 75.

Stenopterobia BRÉBISSON 1867.

S. intermedia (LEWIS) VAN HEURCK (cf. HUSTEDT, Bacill.: 428, F. 830). — Sample 51. (Fig. 85).

Surirella TURPIN 1828.

S. acanthophora n. sp. Valve heteropolar, ovate elliptic with broad rounded ends, 45–60 μ long, 30–35 μ broad; wing moderately wide with 35 to 45 canals in 100 μ . The edges of each canal are decorated

with 3 to 4 short strong conical spines. Axial area (pseudoraphe) narrow, lanceolate, beset with a row of spines along the middle line. Valve surface faintly striate, striae 25–28 in 10 μ .

This new species belongs to a group of tropical and sub-tropical species of *Surirella* such as *S. spinosa* HUSTEDT, *S. margaritacea* O. MÜLLER, *S. Chasei* CHOLNOKY, with ovate to elliptic valves in which the surface of the valve is decorated with spines or thorns of varying size and number. *S. acanthophora* differs from the above in the small number of spines, their distribution only along the edges of the canals and the single row of spines along the middle line of the valve. A point of interest seen under phase contrast, is that each rather robust spine is tipped with 3–4 fine bristles, stellately arranged upwards and outwards (Fig. 95). Type slide No. 30/6 in the GIFFEN Collection. — Samples 30, 31. — (Fig. 92–95).

Valvae heteropolae late ovatae, apicibus apicalibus late regulariterque, basalibus angustior et in valvis nonnullis levissime cuneatorotundatis. Proiectio alarum distincta, fenestrellae latiores quam canales, canalibus 35–45 in 100 μ . Canales ad margines spinis distinctis, in latere uno 3–4 muniti. Spinae bene evolutae, acumine setae tres stellatae positae, cum illuminatione "phase contrast" dicta distinctae ferentes. Area axialis anguste lanceolata, in linea mediana serie spinarum, descriptibus similium, munita. Striae transapicales subtiles, 25–28 in 10 μ .

Habitat in aquis dulcibus torrentium in silva Auckland dicta montium Hog's Back prope oppidum Grahamstown in Provincia Capense Africae Meridionalis.

Typus: praeparatum Nr. 30/6 in collectione GIFFEN, Fort Hare, Cape Province.

Iconotypus: figurae nostrae Nr. 92–95.

S. anassae CHOLNOKY (1957a: 84, F. 278, 279; 1959: 65, F. 342; GIFFEN 1963: 253, Pl. 8, F. 108). This species is widespread in the neutral to slightly basic waters of the coastal belt of South Africa from Natal through the Eastern Cape province to the Bot River in the South Western Cape. In the Eastern Cape it reaches larger dimensions than given in the author's original description (see GIFFEN, 1963: 253). — Samples 24, 27, 28, 29.

S. angusta KÜTZ. (cf. HUSTEDT, Bacill.: 435, F. 844, 845; GIFFEN 1963: 253). Widespread in Eastern Cape waters. Many abnormal specimens are seen, as in Fig. 86. — Samples 26, 30, 31, 146.

S. biseriata BRÉBISSEON var. *bifrons* (EHR.) HUSTEDT (cf. HUSTEDT Bacill.: 433, F. 831–833). This appeared in one sample from neutral to slightly acid water in the Hog's Back area. Dimensions 96–101 μ long, 35–37 μ broad, wing canals 13–16 in 10 μ . — Samples 48, 48a.

S. cuspidata HUSTEDT (1949a: 155, T. 15, F. 8–10; CHOLNOKY 1956: 91., F. 133). This species was not abundant and belonged to the narrow and short forms observed by Hustedt in the Congo. Dimensions of observed individuals varied from 62 to 80 μ long, 7–8 μ broad with 40 wing canals in 100 μ and 22–23 striae in 10 μ . — Sample 163. — (Fig. 87).

S. delicatissima 1957c: 84, F. 13

closely to the type 55 in 100 μ , striae

S. delicatissima weakly silicified CHOLNOKY's description pronounced and viz. 30–32 in 10

S. linearis W. F. 837, 838). Ab Samples 24, 26, 27

S. linearis var. This variety is under restriction varies from Samples 24, 30, 31

S. linearis var. F. 840; CHOLNOKY the type in the series characters, namely wing projection of these characters maintained. In Samples 28, 51.

S. margaritacea F. 7; HUSTEDT 1951: 518, Pl. 175, F. 6 this species occurs in a meagre description both in his Nyctelia (A. S. Atl. T. 36) broad, with 28–30 pseudoraphe, in middle line of the wide lanceolate size from 43 to 50 (mostly 35). The Samples 26, 28,

S. ostentata CHOLNOKY 1955b: 21, F. 4 large numbers.

S. robusta EHR.

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S. delicatissima LEWIS (cf. HUSTEDT, Bacill.: 436, F. 846, 847; CHOLNOKY 1957c: 84, F. 136; 1958a: 139, F. 165—167). All individuals seen conform closely to the type; dimensions 45—55 μ long, 5—6 μ broad, canals 45 to 55 in 100 μ , striae 22—23 in 10 μ . — Sample 163. — (Fig. 88).

S. delicatissima var. *africana* CHOLNOKY (1959: 65, F. 345). This very weakly silicified variety occurred in one sample and agrees well with CHOLNOKY's description and figures, although a few forms do not show the pronounced and narrow ends and the striae appear to be slightly closer viz. 30—32 in 10 μ . — Sample 51. — (Fig. 89).

S. linearis W. SMITH (1853: 31, pl. 8, F. 58; HUSTEDT, Bacill.: 434, F. 837, 838). Abundant in many samples from the region investigated. — Samples 24, 26, 27, 28, 30, 31, 51, 75.

S. linearis var. *constricta* (EHR.) GRUN. (cf. HUSTEDT, Bacill.: 434, F. 839). This variety is usually associated with the type in the samples. The constriction varies from barely perceptible to the degree usually figured. — Samples 24, 30, 31.

S. linearis var. *helvetica* (BRUN) MEISTER (cf. HUSTEDT, Bacill.: 434, F. 840; CHOLNOKY 1962b: 73). This variety is also usually associated with the type in the samples examined. CHOLNOKY (l. c.) discusses the diagnostic characters, namely the development of thorns and the better developed wing projection of this variety and finds that there is extreme variability of these characters. In consequence he doubts whether the variety should be maintained. In my material the thorns are never strongly developed. — Samples 28, 51.

S. margaritacea O. MÜLLER (1905: 37, T. 2, F. 12; in A. S. Atl. T. 245, F. 7; HUSTEDT in A. S. Atl. T. 309, F. 11—14; HUBER-PESTALOZZI 1942: 518, Pl. 175, F. 635). In the Hog's Back region of the Amatoia Mountains this species occurred in a number of samples and agree fully with the rather meagre description by MÜLLER (l. c.) and the small and inadequate figures both in his Nyasaland paper and in A. S. Atl. T. 245, F. 7. HUSTEDT's figures (A. S. Atl. T. 309, F. 11—14) show forms of 38 to 60 μ long, 20—26 μ broad, with 28—40 wing canals in 100 μ . In F. 11 Hustedt shows a narrow pseudoraphe, in the other figures (12 and 13), the canals meet along the middle line of the valve. In the majority of my specimens there is a moderately wide lanceolate area. Measured examples show considerable variation in size from 43 to 95 μ long, 23 to 40 μ in width, with 23 to 40 canals in 100 μ (mostly 35). The canals and lanceolate area are closely beset with thorns. — Samples 26, 28, 146 — (Fig. 90, 91).

S. ostentata CHOLNOKY (1962a, 106; *S. ovata* KG. var. *africana* CHOLNOKY 1955b: 21, F. 46). Not uncommon in neutral waters but never seen in large numbers. — Samples 30, 51, 75, 146.

S. robusta EHR. (cf. HUSTEDT, Bacill.: 437, F. 850). — Sample 51.

S. splendida (EHR.) KÜTZ. (cf. HUSTEDT 1957: 361; 1930: 437, F. 851, 852 as *S. robusta* var. *splendida* (EHR.) V. H.). — Samples 26, 31, 48, 48a, 75.

S. tenera GREGORY (cf. HUSTEDT, Bacill.: 439, F. 854, 855). Widespread in the region under review and often in considerable numbers. — Samples 24, 26, 28, 29, 30, 31, 75, 76.

S. tenera f. *minor* CHOLNOKY (1958a: 140, F. 168). Associated with the type were many very small individuals which I have assigned to the above form with which they agree closely. — Samples 26, 27, 75, 146.

Synedra EHRENBERG 1830.

S. rumpens KÜTZ. (cf. HUSTEDT, Kieselalg. 2: 207, F. 697a, b). Abundant in one sample only. — Sample 76.

S. tabulata (AG.) KG. var. *fasciculata* (KG.) GRUN. (cf. HUSTEDT, Kieselalg. 2: 218, F. 710i—l; CHOLNOKY 1959a: 67, F. 349—352). This species which seems to reach its greatest development in slightly alkaline waters was seen in one sample from neutral water, never in great numbers. — Sample 76.

S. ulna (NITZSCH) EHR. (cf. HUSTEDT, Kieselalg. 2: 195, F. 691 A, a—c). Generally distributed. — Samples 25, 26, 27, 28, 75, 76.

S. ulna var. *danica* (KG.) GRUN. (cf. HUSTEDT, Kieselalg. 2: 200, F. 691 A, f). — Samples 28, 31, 48a, 75, 76, 146.

S. vaucheriae KÜTZ. (cf. HUSTEDT, Kieselalg. 2: 194, F. 689a—c; CHOLNOKY, 1957a: 87, F. 287—293). — Samples 30, 31, 146

Tabellaria EHRENBERG 1839.

T. flocculosa (ROTH) KÜTZ. (cf. HUSTEDT, Kieselalg. 2: 28, F. 558; CHOLNOKY 1960b: 268). — Samples 26, 48a, 51, 76.

I wish to acknowledge my thanks and indebtedness to Professor J. J. ROSS, Rector of the University College of Fort Hare, Cape Province, at which this work was carried out, and to Dr. B. J. CHOLNOKY of the National Institute for Water Research, Council for Scientific and Industrial Research, Pretoria, for his encouragement and assistance.

Sets of slides used in the preparation of this work have been presented to the British Museum in London, the Riksmuseet in Stockholm, the Senckenberg Museum in Frankfurt a. M. and the collection of F. HUSTEDT in Bremen.

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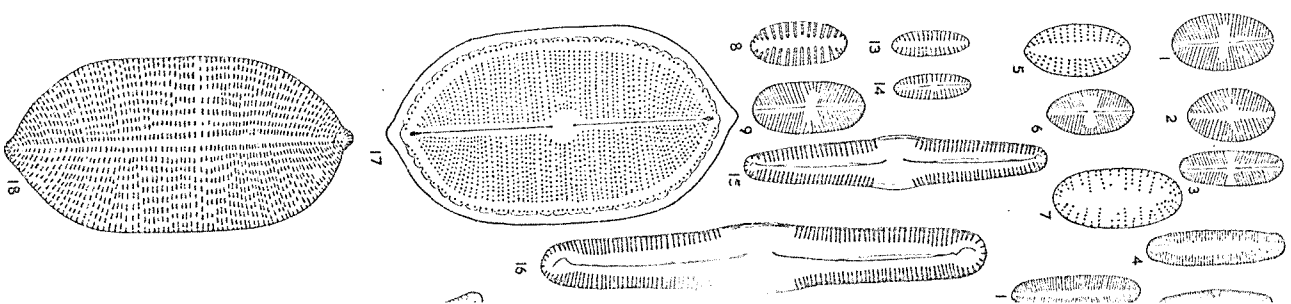
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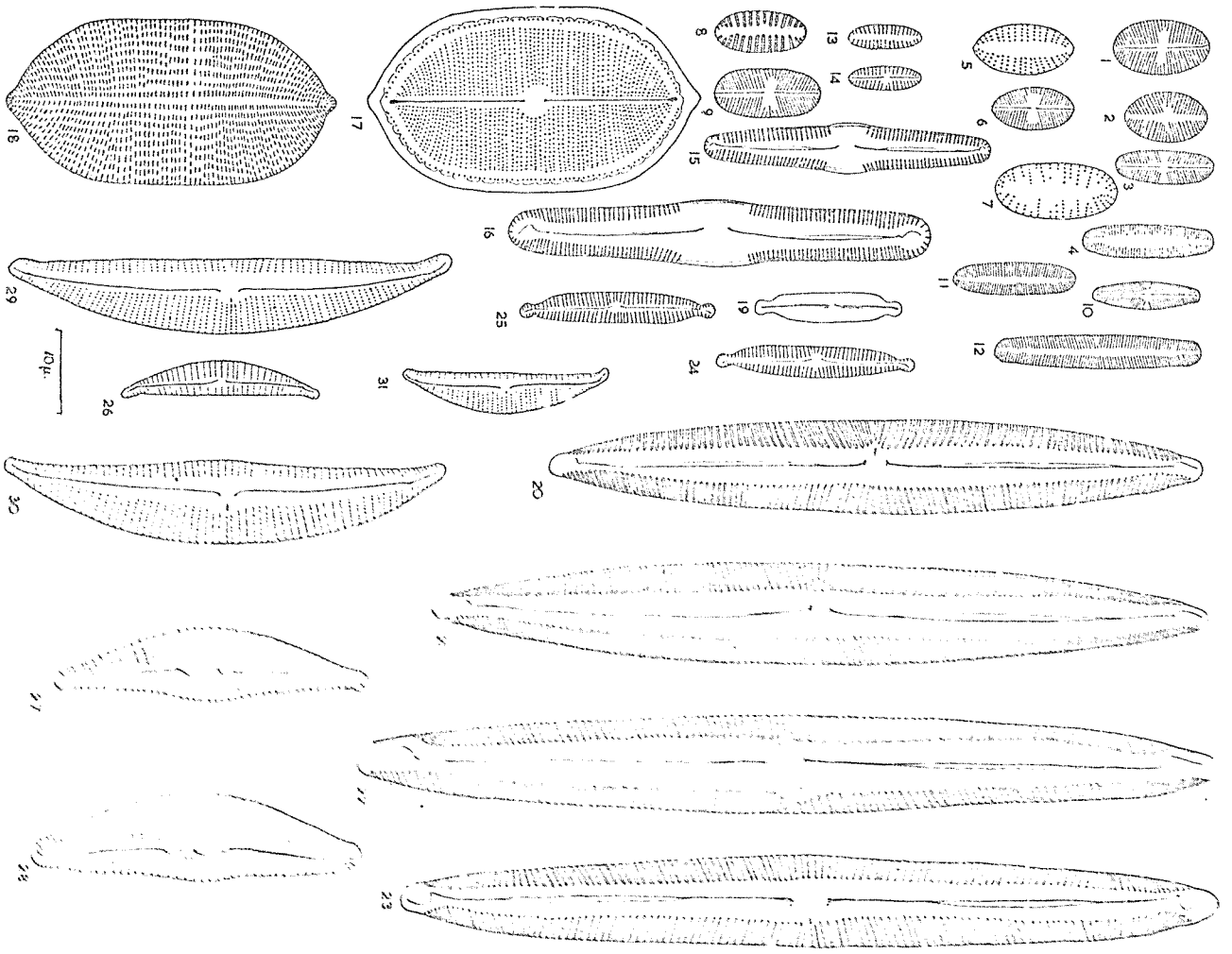
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PLATES



- Plate I
- 1, 2. *Achnanthes austriaca* HUSTEDT var. *cepenensis* CHOLNOKY ... 3, 4. *A. exigua* GRUN, var. *elliptica* HUSTEDT — 5—7. *A. oblongella* ØSTRUP — 8, 9. *A. saxonica* KRASSE — 10—12. *A. subaffinis* CHOLNOKY — 13, 14. *A. subhundsorffii* HUSTEDT var. *Kraussellii* CHOLNOKY — 16. *Caloneis silicida* (E.) CL. var. *brevistriata* O. MÜLLER — 17, 18. *Cocconeis placenta* E. var. *ramomafanensis* MANGUIN — 19. *Cymbella Abbotii* CHOLNOKY and CLAUS — 20—23. *C. amatolensis* n. sp. — 24, 25. *C. cryptocephala* HUSTEDT — 26. *C. gracilis* (RABH) CL. — 27, 28. *C. Kappii* CHOLNOKY — 29—31. *C. turgida* GREGORY var. *pseudogracilis* CHOLNOKY



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Plate II

32, 33. *Eunotia exigua* BREB. — 34. *E. flexuosa* (BREB.) KG. var. *transvaalensis* CHOLNOKY — 35, 36. *E. formica* E. — 37, 38. *E. mogolensis* CHOLNOKY — 39—42. *E. Siolii* HUSTEDT — 43. *E. sulcata* HUSTEDT — 44—48. *Fragilaria lapponica* GRUN. f. *lanceolata* HUSTEDT — 49. 50. *Frustulia caffra* sp. n. — 51. *F. javanica* HUST. — 52. *F. rhomboides* (E.) DE TONI var. *amphipleuroides* GRUN. — 53—56. *F. tugelae* CHOLNOKY — 57. *Gomphonema perminutum* CHOLNOKY — 58. *G. Schweickerdtii* CHOLNOKY — 59. *Navicula cinctaeformis* HUST. — 60, 61. *N. dissuta* n. sp

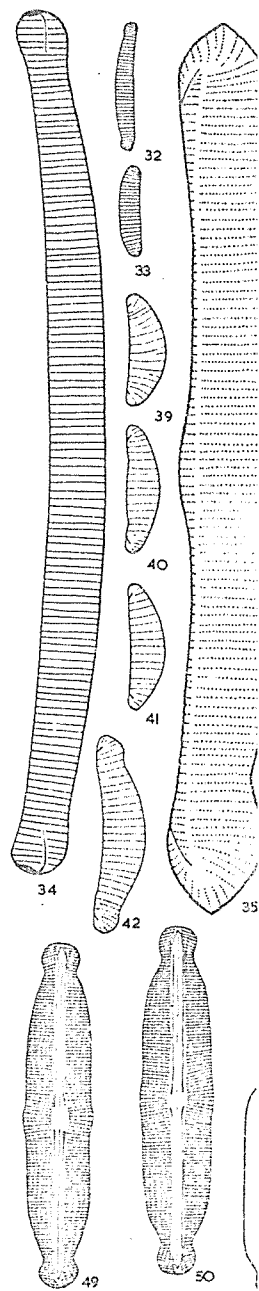
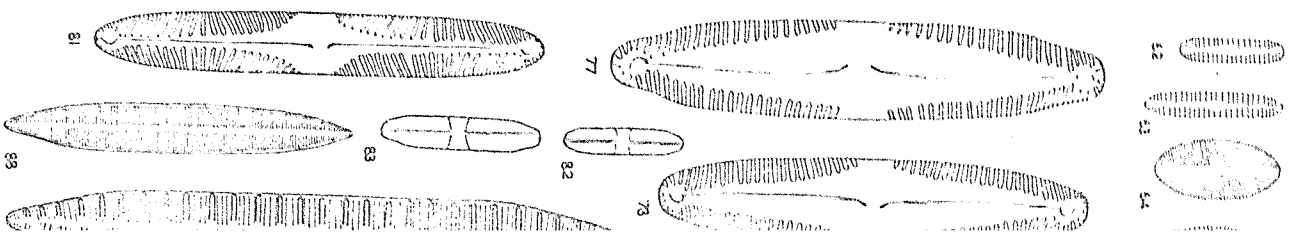
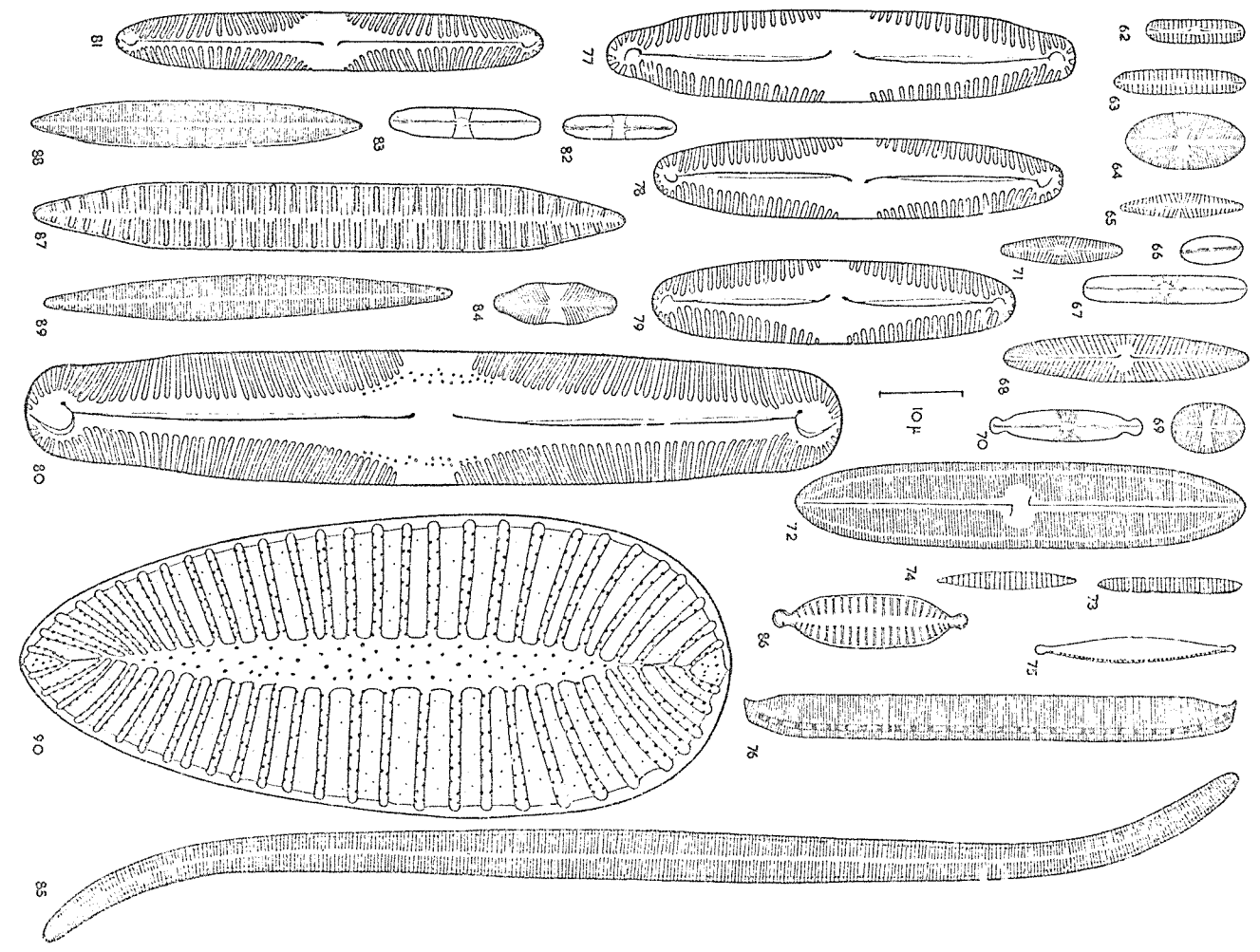


Plate III
 62, 63. *Nesiteula granopyza* sp. n. — 64. *N. lapidosa* KRASSKE. — 65. *N. obsolleta* HUST. — 66. *N. pelliculosa* (BREB.) HULSE. — 67. *N. rasinae* CHODSICZY. — 68. *N. Schroeteri* MEISTER. — 69. *N. subatomoides* HUST. — 70. *N. subnitens* CL. — 71. *N. renelloides* HUST. — 72. *Neidium affine* (E.) CL. f. *hercynica* (A. M.S. 189) HUST. — 73, 74. *Nitzschia Chaseli* CHOLNOKY. — 75. *N. tremula* CHODSICZY. — 76. *N. subvirea* HUST. — 77 — 79. *Pinnularia gibba* (E.) W. SMITH var. *sancta* CHODSICZY. — 80. *P. graciloides* HUST. — 81. *P. stomatophora* GRÜN. — 82, 83. *Stauroneis Abbottii* CHOLNOKY. — 84. *S. Borrerii* (BOYE PETERSEN) LUND. — 85. *Stenopterobia intermedia* (LEWIS) VAN HEURCK. — 86. *Surrella angusta* KG. — 87. *S. caudata* HUST. — 88. *S. delicatissima* LEWIS. — 89. *S. delicatissima* var. *africana* CHODSICZY. — 90. *S. mutigurticea* O. MÜLLER.





N. obsoleta TY. — 68. *N. a* CL. — 71. ER) HUST. — 76. *N. sub-* IRUN. — 80. *neis Abbottii* *erobia inter-* *vidata* HUST. NOKY — 90.

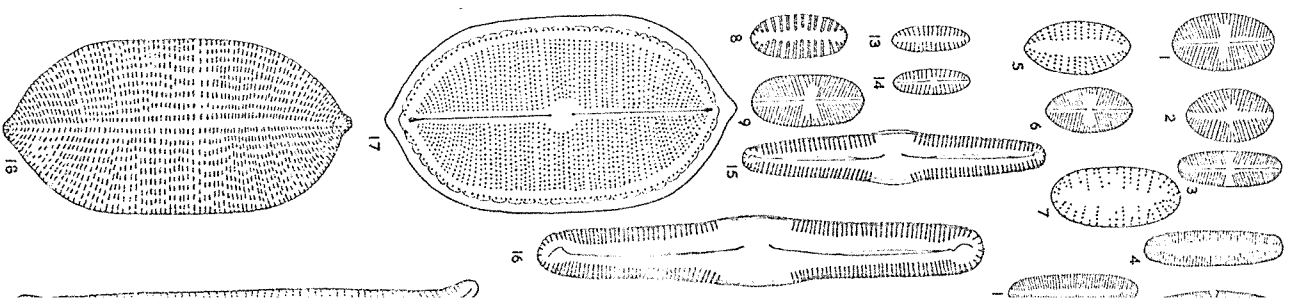


Plate I

- 1, 2. *Achnanthes austriaca* HUSTEDT var. *cepensis* CHOLNOKY — 3, 4. *A. exigua* GRÜN, var. *elliptica* HUSTEDT — 5—7. *A. oblongella* ØSTRUP — 8, 9. *A. saxonica* KRASSE — 10—12. *A. suboffinis* CHOLNOKY — 13, 14. *A. subhundsensis* HUSTEDT var. *Krauseltii* CHOLNOKY — 16. *Caloneis silicula* (E.) CL. var. *brevistriata* O. MÜLLER — 17, 18. *Cocconeis placentula* E. var. *ranonafanensis* MANGUIN — 19. *Cymbella Abbottii* CHOLNOKY and CLAUS — 20—23. *C. amatoiensis* n. sp. — 24, 25. *C. cypriocephala* HUSTEDT — 26. *C. gracilis* (RABH.) CL. — 27, 28. *C. Kappii* CHOLNOKY — 29—31. *C. turgida* GREGORY var. *pseudogracilis* CHOLNOKY

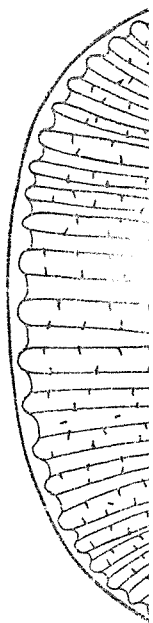
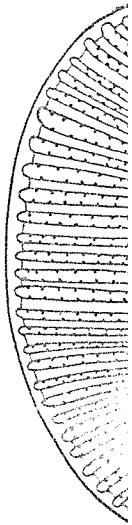
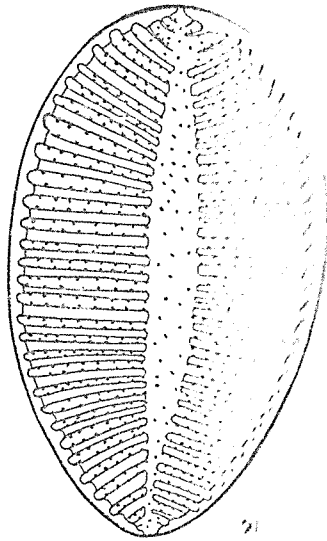
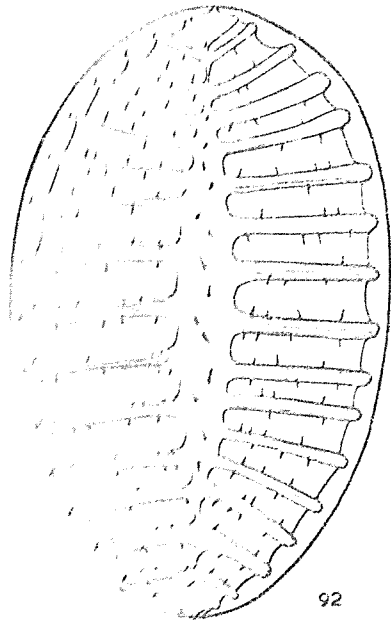


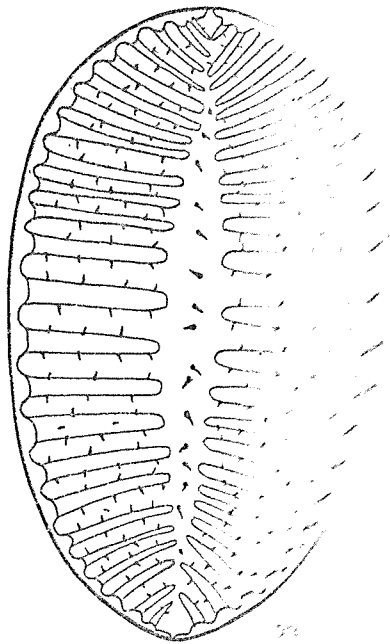
Plate IV
91. *Surirella margaritacea* O. MÜLLER — 92—95. *S. acanthophora* sp. n.



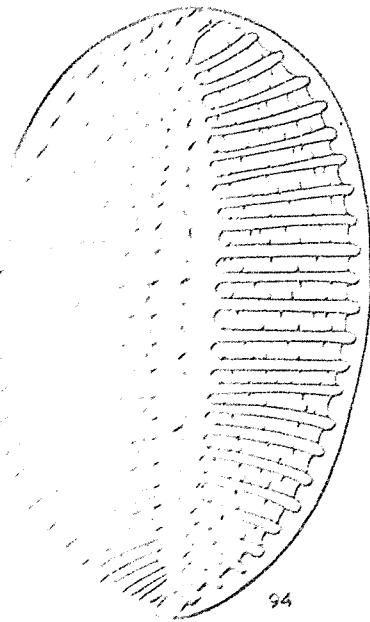
91



92



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