ACTA PALAEOBOTANICA
XVIII (2): 35—60, 1977

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COMMENTS ON THE FLORA OF DIATOMS (*BACILLARIOPHYCEAE*) FROM EEMIAN FRESH-WATER SEDIMENTS AT IMBRAMOWICE NEAR WROCŁAW

Uwagi do flory okrzemek (*Bacillariophyceae*) z eemskich słodkowodnych osadów z Imbramowic koło Wrocławia

ABSTRACT. As a complement to a diatomaceous analysis of Eemian profile from Imbramowice (Kaczmarska 1976a, b), critical comments and photographic documentation for 201 taxa of fresh-water diatoms have been presented.

INTRODUCTION

While elaborating the characteristics of the communities of diatoms of the full Eemian interglacial period in a shallow fossil lake in Imbramowice, altogether 439 taxa of those algae were determined as well as the sites of their occurrence in the profile. At the same time, the description and photographs of the ten most characteristic taxa were given (Kaczmarska 1976a). Four new taxa were described on the basis of that material in a separate paper; *Fragilaria imbramoviciana*, *F. lapponica* var. *marciniakae*, *Navicula bronislaae* and *N. starmachii* (Kaczmarska 1976b).

The present paper contains observations on the morphology together with photographs of the more important fresh-water taxa which constitute the necessary taxonomic documentation of this material. Taxa hitherto rarely reported and those which are very changeable, and depart from the descriptions in monographs (Hustedt 1930, 1930—1966; Proshkina-Lavrenko 1949—1950; Zabielina *et al.* 1951; Cleve-Euler 1951—1955; Siemińska 1964; Patrick & Reimer 1966) have been discussed here. The author only considers the original descriptions and illustrations to a limited extent. 194 common taxa which do not cause difficulties in identification have been left out as well as 30 rebedded Tertiary marine taxa.

From the Imbramowice sediments Hartmann (1907) mentioned 20 common taxa among them, 17 found afterwards by the author.

The work was carried out in the Institute of Botany, The Jagiellonian University, under the supervision of Prof. J. Siemińska. I wish to express my deep gratitude to her for aid and kind support in my work and its preparation for publication. Reference was made to iconographic collections being completed in the Institute of Botany, The Polish Academy of Sciences.

TAXONOMIC OBSERVATIONS

Altogether, 201 taxa are considered in this paper. Among them, 19 have rarely been reported from contemporary sites exclusively, and 5 from contemporary and fossil sites. 28 taxa were designated only as genera; when the specimens could clearly be referred to a given species, but not all the characters were convergent, the letters "cf." were placed before the species name; when the whole valve had not survived and all details of ornamentation could not be investigated "?" were placed after the species name; the letters "sp." indicate that it could certainly be designated only as a genus. The large number of uncertain assignaments of diatoms may be connected with their age and indicate that they then differed less than at present (eg. *Malosira islandica*?, *Stauroneis smithii* var. *sagitta*, *Navicula dicephala*, *N. graciloides* var. ?), however it may also be connected with the lack of greater experience on the part of the author.

The taxa are discussed in systematic order. After the Latin name, the basic monograph or detailed publication upon which identification was based, are generally given in parentheses. The size and number of the elements of ornamentation in 10 μm is given before the description of a taxon.

CENTRICAE

Melosira Agardth

M. ambigua (Grun.) O. Müll. (Hustedt 1930, p. 256) Pl. I, fig. 3.
M. arenaria Moore (Hustedt 1930, p. 269) Pl. I, fig. 1; Pl. II, fig. 1.
M. granulata (Ehr.) Ralfs (Hustedt 1930, p. 248) Pl. II, fig. 6.
M. granulata var. *angustissima* Müller (Hustedt 1930, p. 250) Pl. II, fig. 4.
M. islandica O. Müll. (Hustedt 1930, p. 252) Pl. II, fig. 2.
M. cf. *islandica* O. Müll. Pl. I, figs 2, 5, 6 (the diameter 9·2—13·3 μm, height of the valve 10·4—19·2 μm, 18—22 longitudinal lines in 10 μm, 12—14 transversal

lines in 10 μm). Valves always distinctly thick-walled, always with distinctly marked sulcus. The neck (collum) on the whole comparatively large, unlike that in a typical form of this species. The valve-mantle with longitudinal or sometimes oblique rows of puncta the number of which combines characters of colonies of the types a and b (Hustedt 1930, p. 252).

The valves very distinctly connect the specimens with the simultaneously occurring typical *M. islandica*, and differ only in the density of longitudinal rows on the valve-mantle, which makes them similar to *M. italica* (Ehr.) Kütz. (Hustedt 1930, p. 257).

M. italica (Ehr.) Kütz. (Hustedt 1930, p. 257) Pl. II, fig. 3.
M. italica fo. *curvata* (Pant.) Hust. (Siemińska 1964, p. 92) Pl. I, fig. 4.
M. varians Ag. (Hustedt 1930, p. 240) Pl. I, fig. 7.

Cyclotella Kützing

C. bodanica Eulenst. (Hustedt 1930, p. 356) Pl. III, fig. 2.
C. comensis Grun. (Hustedt 1930, p. 353) Pl. II, figs. 5, 7.
C. comta (Ehr.) Kütz. (Hustedt 1930, p. 354) Pl. II, fig. 10.
C. comta var. *oligactis* (Ehr.) Grun. (Hustedt 1930, p. 355) Pl. IV, fig. 7.
C. comta var. *glabriuscula* Grun. (Hustedt 1930, p. 355) Pl. IV, fig. 9.
C. distinguenda Hustedt (In: Gams 1927, p. 329) Pl. III, figs. 4, 7.
C. kützingiana Thw. (Hustedt 1930, p. 338) Pl. II, figs. 8, 11; Pl. III, fig. 1. The presence of this species is also recorded by Hartmann (1907).
C. kützingiana var. *planetophora* Fricke (Hustedt 1930, p. 339) Pl. IV, figs 5, 10.
C. kützingiana var. *radiosa* Fricke (Hustedt 1930, p. 338) Pl. II, fig. 9; Pl. IV, figs 2, 8.
C. meneghiniana Kütz. (Hustedt 1930, p. 341) Pl. IV, fig. 4. The presence of this species is also recorded by Hartmann (1907).
C. ocellata Pant. (Hustedt 1930, p. 341) Pl. III, figs 5, 9, 11.
C. operculata (Ag.) Kütz. (Hustedt 1930, p. 351) Pl. III, figs. 3a, b.
C. operculata var. *mesoleia* Grun. (Hustedt 1930, p. 352) Pl. III, fig. 10.
C. operculata var. *unipunctata* Hust. (Hustedt 1930, p. 351) Pl. III, fig. 6; Pl. IV, fig. 3.
C. stelligera Cl. et Grun (Hustedt 1930, p. 339) Pl. III, fig. 8.

Stephanodiscus Ehrenberg

S. astraea (Ehr.) Grun. var. *intermedia* Fricke (Hustedt 1930, p. 370) Pl. IV, fig. 11.
S. astraea var. *minutulus* (Kütz.) Grun. (Hustedt 1930, p. 369) Pl. IV, figs. 1, 6; Pl. V, fig. 1.
S. dubius Fricke (Hustedt 1930, p. 369) Pl. V, fig. 4.

PENNATAE

Tabellaria Ehrenberg

T. fenestrata (Lyngb.) Kütz. (Hustedt 1931, p. 26) Pl. V, fig. 3.
T. flocculosa (Roth.) Kütz. (Hustedt 1931, p. 28) Pl. V, fig. 2.

Diatoma de Candolle

D. elongatum (Lyngb.) Ag. (Hustedt 1931, p. 99) Pl. V, fig. 9. Only fragments of valves were found.
D. vulgare Bory var. *ehrenbergii* (Kütz.) Grun. (Hustedt 1931, p. 98) Pl. V, fig. 7. The presence of typical forms of this species is recorded by Hartmann (1907).

Fragillaria Lyngbe

F. brevistriata Grun. var. *linearis* Mayer (Cleve-Euler 1953, p. 31) Pl. VI, fig. 1.
F. crotonensis? Kitton (Hustedt 1931, p. 143) Pl. VI, fig. 2. (30·8—43·9 × 2·4—2·8 μm, 14 striae in 10 μm). One ribbon-shaped colony has been found which resembles this species. Since all the ends of shells are broken off and the central areas are not too well separated, the systematic rank of these specimens cannot be determined with certitude. Such valves were found only once in sample 166.

In the previous paper (Kaczmarska 1976a), this colony was included in *Synedra acus* Kütz. var. *radians* (Kütz.) Hust. in the comprehensive table of all taxa found.
F. intermedia Grun. (Hustedt 1931, p. 152) Pl. VI, fig. 4. Some of the valves found are larger than those mentioned by Hustedt and reach the length of 75·0 μm, other details are true to the description.
F. lapponica Grun. (Hustedt 1931, p. 170) Pl. V, fig. 10; Pl. VI, fig. 3. Valves larger than those mentioned by Hustedt and reaching 65·3 μm in length, were found.
F. leptostauron (Ehr.) Hustedt var. *dubia* Grun. (Hustedt 1931, p. 154) Pl. V, fig. 8. Almost elliptical valves were most frequently found. Such specimens were also found by Quennerstedt (1955), and Berg and Petersen (1956).
F. cf. *virescens* Ralfs (Hustedt 1931, p. 163) Pl. V, fig. 6. (30·6 × 5·6 μm, 13—14 striae in 10 μm). One valve with a distinct, untypical expansion in the middle part; the central area in this expansion is as narrow as in the remaining parts of the valve. Similar specimens designated as *F. virescens* were mentioned by Hustedt (1915), Schulz (1928) and Humblet-Pawłowska (1939) from contemporary material. On the other hand, Marciniak (1973) submitted

a photograph of one specimen with a similar expansion found in the Late-glacial and Holocene sediments of the Mikołajskie Lake; she included it in *F. virescens* var. *oblongella* Grun.; however, the specimen from Imbramowice differs from it as the ends of the valves are wedge-shaped and not bluntly-rounded.

Synedra Ehrenberg

S. acus (Kütz.) var. *radians* (Kütz.) Hust. (Hustedt 1932, p. 201) Pl. VI, fig. 5; Pl. VII, figs. 1, 2. Besides a single whole valves, only fragments were usually found; this made it difficult to determine the systematic rank.
S. tenera W. Sm. (Hustedt 1932, p. 211) Pl. VII, fig. 4. (33·8 × 2·1 μm, 20 striae in 10 μm). One specimen was found not in a very good state of preservation.
S. ulna (Nitzsch) Ehr. var. *aequalis* (Kütz.) Hust. (Hustedt 1932, p. 199) Pl. VI, fig. 6.
S. ulna var. *spatulifera* Grun. (Hustedt 1932, p. 200) Pl. VII, fig. 3.

Asterionella Hassall

A. formosa Hassall (Hustedt 1932, p. 51) Pl. V, fig. 5. Only fragments with the ends of valves characteristically widened were found.

Eunotia Ehrenberg

E. arcus Ehr. (Hustedt 1932, p. 282) Pl. VII, fig. 11. Valves distinctly narrowed, in the centre of the ventral part as in *E. arcus* var. *plicata* Brun et Hérib. (Héribaud 1893, p. 131) were also found apart from typical specimens Pl. VIII, fig. 2. After VanLandingham (1969, p. 1489) they have been included within the limits of variability of the typical form.
E. flexuosa (Bréb.) Kütz. (Hustedt 1932, p. 312) Pl. VII, fig. 7.
E. formica Ehr. (Hustedt 1932, p. 308) Pl. VII, fig. 6.
E. cf. *gracilis* (Ehr.) Rabh. Pl. VII, fig. 12; Pl. VIII, fig. 1. (70·5—87·0 × 5·6—7·3 μm, 9—10 striae in the middle, 12—15 at the end). Valves markedly protracted, arcuately curved with parallel margins; striae transverse rather regular, polar nodules rather large. The valves found are relatively broader and somewhat more densely striated than Hustedt (1932, p. 305) mentions for *E. gracilis* which links them with *E. monodon* (W. Sm.) Hust. (Hustedt l.c.). Typical specimens of *E. gracilis* were not found; they were mentioned by Hartmann (1907) but the lack of description and illustration make it impossible to ascertain if he was dealing with the same taxon. Similar, more densely striated valves were also given by Florin (1970; size: 103·0 × 7·5 μm, 10—15 striae in 10 μm) as *E. gracilis* and by Foged (1971a; size: 90·0 × 6·0 μm, 15 striae in 10 μm), with some doubt, as *E. monodon* Ehr. var. *maior* (W.Sm.) Hust.
E. cf. *lunaris* (Ehr.) Grun. Pl. VI, fig. 9; Pl. VIII, fig. 3. (56·6—73·4 × 4·0—

4·2 μm, 12—15 striae in 10 μm). Valves arcuate, with margins parallel to the end or with only a slightly descending dorsal margin, slim (larger valves relatively narrower than smaller valves), slighty rounded at the ends. Terminal nodules small with a fine line running out towards the middle of the valve. These valves are comparatively broader than those given by Hustedt (1932, p. 303), besides they also have a fine line directed towards the middle of the valve. Similar specimens with a line running out from the terminal nodules towards the middle of the valve are also given by Florin (1970), Foged (1971b) and Mölder and Tynni (1971) but the size of these valves are contained within the size limits given by Hustedt.

E. pectinalis (Dilw.?, Kütz.) Rabh. var. *ventralis* (Ehr.) Hust. (Hustedt 1932, p. 280) Pl. VIII, fig. 4.

E. suecica A. Cl. (Hustedt 1932, p. 279) Pl. VI, fig. 8.

E. sudetica O. Müll. (Hustedt 1932, p. 299) Pl. VI, fig. 7; Pl. VII, fig. 8.

E. veneris (Kütz.) O. Müll. (Hustedt 1932, p. 300) Pl. VII, fig. 5.

Eunotia sp. Pl. VII, fig. 13. (34 × 7 μm, 10—14 striae, the length width ratio 1·5). The only specimen found distinctly links with *E. praerupta* Ehr. (Hustedt 1932, p. 280) in the size and density of striae and in the length/width ratio; it differs in the different shape of the valve.

Cocconeis Ehrenberg

C. disculus (Schum.) Cl. (Cleve-Euler 1953, p. 10) Pl. VIII, fig. 7. (9—10 × 8·0—8·1 μm, 8 striae in 10 μm on the pseudoraphe valve). Elliptical valves with broadly rounded ends. Axial area on pseudoraphe valves from linear-lanceolate to broad-lanceolate, covering 1/3 of the valve. The lower density of striae on the valves pseudoraphe is in this material the factor distinguishing the typical form from varieties; here are constantly 8, at the utmost, striae in 10 μm. The striae are crossed by two transparent lines. The valves found are always smaller than Cleve-Euler mentions (l.c.; 24—30 × 15—21 μm, 4—8 striae in 10 μm).

Distinguishing between particular varieties within the same species was often very difficult.

C. disculus var. *diminuta* (Pant.) Cl. (Cleve-Euler 1953, p. 11) Pl. VII, fig. 10. (12—13 × 8·5—9·9, 9—10 striae on the pseudoraphe valve in 10 μm). Central area always large on pseudoraphe valves, amounting to 1/3 of the width of the valve, lanceolate protracted. Transversal striae crossed by three transparent longitudinal lines. They always differ from Hustedt's specimens (1933, p. 800) in the thicker striation of the pseudoraphe valve.

C. disculus var. *minor* Fontel (Cleve-Euler l.c.) Pl. IX, fig. 7. (14·6—17·5 × 8·6—10·6 μm, 10 striae in 10 μm on the pseudoraphe valve). Axial area linear on pseudoraphe valves or, at utmost, slightly lanceolate, narrow.

C. placentula Ehr. var. *intermedia* (Hérib. et Perag.) Cl. Pl. IX, fig. 4. (20·0—20·7 × 10·4—14·8 μm, 11 striae on the pseudoraphe valve near the

margin, 14 in 10 μm near the central area). The valves found are always smaller than those mentioned by Hustedt (1933, p. 348).

C. placentula var. cf. *lineata* (Ehr.) Cl. Pl. IX, figs 1, 2. (19·2—37·9 × 11·0—12·9 μm, 20—22 striae in 10 μm on the pseudoraphe valve). The ornamentation of pseudoraphe valves consists of distinct thick puncta arranged in a few longitudinal, separate, distinctly undulate rows along the margins of the valve. Valves flat or, at utmost, only slightly convex. Hustedt (1932, p. 348) does not give separate size for this variety. The valves found differ from those mentioned by Hustedt in the more distinct structure of longitudinal rows which are thickly punctate here and lie distinctly separate from each other. The size of the valves found was always much lower than that given by Zabielina for this variety (Zabielina *et al.* 1951, p. 191; 40—70 × 30—40 μm; she does not give the number of striae).

C. thumensis A. Mayer (Hustedt 1933, p. 436) Pl. VII, fig. 9. Only characteristic pseudoraphe valves were found.

Achnanthes Bory

A. conspicua A. Mayer Pl. IX, fig. 6. One valve much wider (16·0 × 8·7 μm; 10—11 striae on the pseudoraphe valve) than Hustedt mentions (1933, p. 387, 8·0—14·0 × 4·0—4·5 μm, 14—16 striae in 10 μm) but also with striae in the central area characteristically removed from each other (Pl. XIX, fig. 6) was found as well as typical ones. Sometimes, also teratological valves S-wise curved were found Pl. VIII, fig. 8.

A. exigua Grun. (Hustedt 1933, p. 385) Pl. V, fig. 11. One specimen with very poorly extended valve ends with almost wedge-shaped termination (11·7 × 6·3 μm, 23—24 striae in 10 μm in the pseudoraphe valves) was found besides typical ones.

A. kolbei Hust. (Hustedt 1933, p. 397) Pl. X, fig. 5.

A. lanceolata (Bréb.) Grun. var. *elliptica* Cl. (Hustedt 1933, p. 410) Pl. X, fig. 8. Among other, teratological valves were found (16·6 × 10·8 μm, 14—17 striae in 10 μm) with disordered striation and irregular a semicircular mark in the central area.

A. lapponica Hust. var. *ninckei* (Guerm. et Mang.) Reim. (= *A. ninckei* Guerm. et Mang.) Pl. X, figs. 6, 7, 8. (19·6—25·8 × 8·7—9·0 μm, raphe valve 19—21, 26 at the end, pseudoraphe valve 22—26 striae in 10 μm). Valves varied from lanceolate but with distinctly extended, bluntly rounded ends (in larger specimens) to more elliptical (in small specimens). Raphe valve with S-shaped raphe and polar ends bent in the opposite directions; axial area narrow, central area very slightly lanceolate-expanded, assymetric, on one side reaching to the margins of the valve with a finely marked semicircular or triangular mark; transversal striae radiate to the end of the valve, in the middle part alternately long and short, distinctly more dense toward the end. Pseudoraphe valve with

axial area just as narrow, also bent in the shape of S; central area large, circular; only 2—3 striae in the central area, transversal perpendicular to longitudinal axis, the remaining ones distinctly radiate up to the end of the valve.

The specimens found differ from Reimer's North American specimens in their somewhat greater size (Patrick & Reimer 1966, p. 259; 9—24 × 5—7 μm, 20—24 striae in the middle, 28—31 in 10 μm at the end) and the shape of central area; neither lineate structure of striae was found which, according to Reimer, is particularly clearly visible in larger specimens. On the other hand, the valves from Imbramowice are larger and more sparsely striated than Guermer and Manguin's typical specimens (1953, p. 541; 13—15 × 5—6 μm, 24—39 striae in 10 μm), they also have a different, circular shaped central area in the raphe valve. Being similar in shape to *A. lapponica* Hust. (Hustedt 1933, p. 414), the valves found in Imbramowice differ from it on the other hand in the size and the totally different shape of the central area of the raphe valve (in Hustedt, large, circular assymetric area) and much thicker ornamentation of both valves. This extremely rare taxon, so far found by nobody else, requires closer examinations.

A. peragalli Brun. et Hérib. (Hustedt 1933, p. 412) Pl. IX, fig. 10. Only characteristic pseudoraphe valves were found.

A. ploenensis Hust. (Hustedt 1933, p. 380) Pl. IX, figs. 3, 5, 9. (15·8—16·2 × 5·0—5·6 μm, 19—22 striae on the pseudoraphe valve, 16—19 in 10 μm on the raphe valve). Raphe valves with radiate striae, most marked in the narrowing parts of the valves, almost perpendicular in the extended ends; axial area very narrow, central area not demarcated. Pseudoraphe valves with transversal striae perpendicular or at utmost very slightly radiate through the whole length; axial area lanceolate passing gradually in broad central area (1/3 of the width of the valve) in the middle part of the valve. These specimens are very similar to *A. woldstedtii* Hustedt (1954, p. 435) but in them the striae, specially on raphe valves, are much less densely arranged.

Diploneis Ehrenberg

D. elliptica (Kütz.) Cl. (Hustedt 1937, p. 690) Pl. X, fig. 4, 9.

D. oculata (Bréb.) Cl. (Hustedt 1937, p. 675) Pl. X, fig. 3.

D. oelandica A. Cl. (Cleve-Euler 1953, p. 77) Pl. VIII, fig. 5, 6. (11·5—13·0 × 5·5—5·8 μm, 22—23 striae in 10 μm). Elliptically elongate valves with broadly-rounded ends. Axial area narrow, central area distinctly pronounced, circular. Longitudinal canals very narrow. Ornamentation very delicate. Areolae not visible under an optical microscope. The valves found were always smaller than Cleve-Euler mentions (l.c.). They have been allocated to the same species in view of a distinctly more delicate ornamentation than in *D. ovalis* (Hilse) Cl. var. *oblongella* (Näg.) Cl. to which they are similar in shape and size of valves.

Similar, smaller valves of the same species were found by Marciniak (1973) in Late-glacial sediments of the Mikołajskie Lake.
D. ovalis (Hilse) Cl. (Hustedt 1937, p. 671) Pl. XI, fig. 1.
D. ovalis var. *oblongella* (Näg.) Cl. (Hustedt 1937, p. 672) Pl. X, fig. 2.
D. pseudovalis Hust. (Hustedt 1937, p. 668) Pl. XI, figs. 2, 4.

Stauroneis Ehrenberg

S. anceps Ehr. fo. *gracilis* (Ehr.) Cl. (Hustedt 1959, p. 771). Apart from typical specimens of fo. *gracilis* (Pl. XII, fig. 2.), numerous, untypical valves lying separately (Pl. XII, fig. 3) were found the size and shape being characteristic of this taxon but without the raphe and with striation marked only in that part of the valve where the raphe is generally to be found.
S. laurenburgiana Hust. (Hustedt 1959, p. 808) Pl. XI, fig. 7; Pl. XII, fig. 1. (46·3—47·5 × 11·3—11·8 μm, 18—20 striae in 10 μm). The valves found are somewhat larger than those mentioned by Hustedt. They differ from *S. schulzii* Jouse in thicker striation. There are 22 striae in 10 μm in *S. schulzii* Jouse (Proshkina-Lavrenko 1949—1950).
S. legumen (Ehr.) Kütz. (Hustedt 1959, p. 809) Pl. XI, fig. 3.
S. smithii Grun. (Hustedt 1959, p. 811) Pl. XI, fig. 5. On some valves, the striae are somewhat more sparsely arranged (24—28 in 10 μm).
S. smithii var. *borgei* (Man.) Hust. (Hustedt 1959, p. 811) Pl. X fig. 1. (21·1—26·7 × 5·2—7·9 μm, 22—23 striae in 10 μm). Valves with a shape very similar to those mentioned by Hustedt were found but always larger and with thicker ornamentation.
S. smithii var. *sagitta* (Cl.) Hust. (Hustedt 1959, p. 811) Pl. XI, fig. 6. The occurring species have been assigned to var. *sagitta* in view of thicker ornamentation (22—24 striae in 10 μm) than in var. *incisa* Pant. (26—30 striae in 10 μm, Hustedt l.c.); although a very slight undulation of the margin of the valve characteristic of the latter species is found.

Navicula Bory

N. abiscoensis Hust. (Hustedt 1966, p. 807) Pl. XIII, fig. 1.
N. americana Ehr. (Hustedt 1961, p. 111) Pl. XIII, fig. 2.
N. anglica Ralfs (Hustedt 1930, p. 303) Pl. XIII, fig. 3 (22·1—29·2 × 8·7—10·4 μm, 10—12 striae in 10 μm, only once 13). Valves elliptical with distinctly extended rostrate apices. Axial area very narrow, central area very slightly delimited, circular. Transversal striae radiate towards the end, generally, especially on large valves distinctly punctate The valves found are always distinctly more slender than Hustedt mentions.
N. anglica var. *signata* Hustedt (1943, p. 287) Pl. XIII, fig. 6.
N. anglica var. *subsalsa* Grun. (Hustedt 1930, p. 303) Pl. XIII, fig. 5; Pl. XIV,

figs. 1, 2 (31·7—50·8 × 12·5—15·5 μm, 8—12 striae in 10 μm). Valves elliptically lanceolate with rostrate but not capitate apices, in this material always larger than the valves of typical form. Striae radiate over the whole length of the valve. Axial area narrow, central area poorly formed, variable; circular, elliptically rhomb-shaped, irregular or of finger-like shape. The shape of the valves and the length/width ratio are very similar to those of *N. placentula* (Ehr.) Grun. (Hustedt 1930, p. 303) and var. *rostrata* A. Mayer (Hustedt l.c.), but they differ from those latter in much denser striation. At the same time the valves found are larger and the shape of central area different from the specimens mentioned by Cleve-Euler (1953, p. 141; central area transversely rectangular). On the other hand, Zabielina *et al.* (1951, p. 322) mention specimens differing from those from Imbramowice in the shape of the frustale.

N. cincta (Ehr.) Kütz. (Hustedt 1930, p. 298). Specimens with an isolated punctum were very frequently found (Pl. XII, fig. 4).

N. clementoides? Hustedt (1944, p. 285) Pl. XII, fig. 5. Only one fragment of the valve was found, therefore, not all details of the structure could be examined.

N. cocconeiformis Greg. (Hustedt 1961, p. 131) Pl. XII, fig. 6.

N. contenta Grun. (Hustedt 1930, p. 277) Pl. XIV, fig. 4.

N. contenta fo. *biceps* Arnott (Hustedt 1930, p. 277) Pl. XIV, fig. 9.

N. cryptocephala Kütz. var. cf. *veneta* (Kütz.) Grun (Hustedt 1930, p. 295) Pl. XV, fig. 5; Pl. XVI, fig. 3 (22·3—31·7 × 5·6—6·5 μm, 14—16 striae, only once 16 in 10 μm). Valves elongate, lanceolate, rather sharply rounded at the apices. Axial area very narrow, central area relatively large, expanding abruptly. Striae transversal, slightly radiate in the middle, slightly convergent towards the end. They are longer than typical var. *veneta*, Pl. XIV, fig. 3, have a larger central area, and straight and not arcuately bent transversal striae. In that characteristic they refer *N. cari* Ehr. (Hustedt 1930).

N. cuspidata Kütz. (Hustedt 1961, p. 60). Besides typical valves, craticular plates (Pl. XV, fig. 1) of this species, as well as var. *ambigua* (Ehr.) Cl. (Pl. XV, fig. 2) were also frequently found. The typical form is also recorded by Hartmann (1907).

N. cuspidata var. *heribaudi* Perag. (Hustedt 1961, p. 60) Pl. XIV, fig. 10 (58·7—72·7 × 14·6—16·6 μm, 8—15 striae in 10 μm). Valves rather more slender than those mentioned by Hustedt were found. Craticular plates of this variety were much more frequently found than normal valves.

N. dicephala (Ehr.) W. Sm. (Hustedt 1930, p. 302) Pl. XV, fig. 6 (32·8—33·8 × 7·3—9·2 μm, 9—14 striae in 10 μm). Valves with an extremely variable shape; lanceolate-elongate, linear, sometimes slightly narrowed in the middle, abruptly narrowed at the apices, and wedge-shaped, rostrate or capitate expanded, rectangular. Transversal striae radiate, rectangular towards the apex. The density of striae and their arrangement, rectangular towards the apex of the valve, refer to var. *elginensis* (Greg.) Cl. (Hustedt l.c.), but the variability range of the density of striae includes magnitudes characteristic of variety and typical form. All the valves found are more slender than Hustedt mentions.

N. dicephala var. *neglecta* Krasske (Hustedt 1930, p. 302) Pl. XIV, fig. 6, Pl. XVI, fig. 1.
N. disjuncta Hust. (Hustedt 1961, p. 143) Pl. XVI, fig. 9.
N. exiguiformis Hust. (Hustedt 1944, p. 283) Pl. XIV, fig. 7.
N. explanata Hust. (Hustedt 1966, p. 805) Pl. XIII, fig. 4.
N. globosa Meister (Hustedt 1962, p. 222) Pl. XIV, fig. 8.
N. graciloides A. Meyer (Hustedt 1930, p. 299) Pl. XV, fig. 7; Pl. XVI, fig. 2.
N. graciloides var.? Pl. XV, fig. 8 (31·6—34·6 × 6·9—7·1 μm, 12—14 striae in 10 μm). Lanceolate valves gradually narrowing from the middle expansion to sharply-rounded apices. Axial area very narrow, central area large, abruptly expanded in shape of an hour-glass, bounded by very short rectangular striae on the margin of the valve. The remaining striae in the central part of the valve very strongly radiate, very strongly convergent towards the apices. These specimens have intermediary characteristics between *N. cari* Ehr. and *N. graciloides* A. Mayer (Hustedt l.c.)
N. grimmei Krasske (Hustedt 1966, p. 769) Pl. XII, fig. 7.
N. ignota Krasske (1932, p. 116) Pl. XV, fig. 4 (21—22·7 × 5·8—6·0 μm, 13—18 striae in 10 μm). These valves are distinctly similar in the size and density of striae to those mentioned by Cleve-Euler (1953, p. 180) as *N. lagerstedtii* Cl. var. *palustris* Hust., and by Lund (1946, p. 67) as *N. ignota* Krasske var. *palustris* Hust. These valves differ from the above-mentioned in the presence of an isolated punctum. In this characteristic they are similar to Foged's specimens (1964, p. 93) designated as *N. paludosa* Hust., specially those in fig. 4 in Plate 10, where the striae near the central area are, however, more radiate and bent archwise. After VanLandingham (1975, p. 2597), the valves found in Imbramowice have been designated as *N. ignota* Krasske. He assigns all the specimens given by the above-mentioned authors to the same species.
N. interglacialis Hust. (Hustedt 1966, p. 808) Valves with distinctly capitate apices (Pl. XVI, fig. 11) were more frequently found than typical ones (Pl. XVI, fig. 6), other characters true to the Hustedt's description.
N. joernefeltii Hust. (Hustedt 1961, p. 138) Pl. XIV, fig. 5 (13·3—24·2 × 8·3—12·3 μm, 19—28 striae in 10 μm). In all the valves found in this material, no alternately short and long striae have been found. Apart from this, some valves are somewhat larger and more thickly striated than Hustedt mentions (8·0—20·0 × 6·0—11·0 μm, 25—30 striae in 10 μm).
N. cf. *laterostrata* Hust. (Hustedt 1930, p. 301) Pl. XVI, figs. 5, 10 (15·4—20·4 × 5·6—6·2 μm, 16—22 striae in 10 μm). Valves elliptically-lanceolate with broadly rounded, rostrate, sometimes more or less strongly capitate, apices. Axial area very narrow, central area very large, rectangular. Transversal striae strongly radiate in the middle of the valve, perpendicular to longitudinal axis towards the apex. Sometimes, a fine, thinly streaked, longitudinal rib can be seen along the raphe. These valves are distinctly similar to *N. laterostrata* in the arrangement of striae, their density and punctate structure. They differ in a large, transversely expanded, central area, more strongly radiate striation and the shape and size

of valves in which they are similar to *N. hustedtii* Krasske var. *obtusa* Hust. (Hustedt 1961, p. 150).

N. cf. *limatoides* Hust. (Hustedt 1962, p. 276) Pl. XVI, fig. 4 (9·2—18·1 × 6·2—8·3 μm, 16—18 striae in 10 μm in the middle, 20—22 at the end). Valves elliptically-lanceolate, with broadly rounded, not extended, apices. Raphe straight, filiform, with central pores lying away from each other. Axial area fairly narrow in the polar parts of the valve then it passes into the lanceolate central area. Transversal striae radiate over the whole length of the valve, alternately short and long in the central area. Valves are always smaller than Hustedt mentions (20·0—22·0 × 10·0 μm, 16—24 striae in 10 μm).

N. menisculus Schum. Pl. XV, fig. 3; Pl. XVII, fig. 5. Valves often smaller, reaching 15 μm in length and 7·1 μm in width. The density of striae always 10—12 (most often 11) in 10 μm, (Hustedt 1930, p. 301; size: 18·0—50·0 × 8·0—12·0 μm, 9—11 striae in 10 μm).

N. minimoides? Manguin (1960, p. 276) Pl. XVII, fig. 6 (17·3 × 8·6 μm, 14—15 striae in 10 μm). The only fragment found has characteristically shaped lanceolate-circular central area, the density and arrangement of striae is typical of this species. It is, however, distinctly larger than mantioned by Manguin (12·5 × 6·5 μm, 13 striae in 10 μm). It is also similar in habit to the specimen designated by Marciniak (1973) as *Achnanthes lanceolata* (Bréb.) Grun. var. *elliptica*? Cl.

N. muraliformis Hust. (Hustedt 1961, p. 157) Pl. XVI fig. 8.

N. mutica Kütz. var. *gibbula* Hustedt (1945, p. 915) Pl. XVI fig. 7 (31·3 × 9·3 μm, 15—19 striae in 10 μm). The only valve found has the extended ends and expanded central area characteristic of this taxon. It is, however, larger than the specimen mentioned by Hustedt (l.c.; size 25·5 × 7 μm in the middle part, 6 μm below the expansion, 16—21 striae in 10 μm) and also larger than typical specimens of *N. mutica*. It differs in distinctly non-capitate apices of the valves from *N. paleoarctica* Hust. (= *N. mutica* var. *ventricosa*) to which it is similar in the shape of the valve.

N. cf. *placentula* (Ehr.) Grun. (Hustedt 1930, p. 303) Pl. XVII, fig. 1, Pl. XVIII, fig. 1 (47·9—50·8 × 17·5—18·7 μm, 8—11 striae in 10 μm, only once 13). Valves elliptically-lanceolate with very slightly extended apices. Central area large, distinctly delimited, round-square. Striae radiate, more strongly so towards the end of the valve than in the middle. It differs from typical *N. placentula* in the distinctly denser striae (6—9 in 10 μm, acc. to Hustedt 1930).

N. perpusilla Grun. (Siemińska 1964, p. 308) Pl. XVI, fig. 12.

N. pupula Kütz. var. cf. *pseudopupula* (Krasske) Hust. (Hustedt 1961, p. 121) Pl. XVII fig. 3 (28·3—34·4 × 5·6—6·7 μm, 14—18 striae in 10 μm). Valves elongate, linear, usually very slightly narrowed in the middle, with very poorly extended, broadly rounded apices. Raphe slightly undulate, polar nodules transversely expanded. Axial area very narrow, central area transversely expanded in shape of a hour-glass or almost rectangular, reaching almost up to

the margins of the valve. Transversal striae radiate over the whole length of the valve, distinctly arcuately bent, with the exception of the middle part of the valve, uniformly arranged over the whole length. Thicker striation, lack of rounded wedge-shaped apices and of distinct central narrowing of the valve, distinguished the specimens found from *N. pseudopupula* Krasske (Cleve-Euler 1953, p. 187). They differ from *N. bacillum* Ehr. (Hustedt 1961, p. 113, size; 30—98 × 10—20 μm, 18—20 striae) and its varieties in a smaller width of the valves, finer siliceous rib and lack of thickening on the last stria.

N. cf. *pupula* Kütz. (Hustedt 1961, p. 120) Pl. XVIII, fig. 2 (15·0—20·0 × 5·8—7·9 μm, 16—26 striae in 10 μm). They differ from Hustedt's typical specimens in the lack of the polar areas and a thicker striation in the middle of the valve.

N. pseudosilicula Hust. (Hustedt 1966, p. 787) Pl. XVII, fig. 4.

N. pseudoventralis Hust. (Hustedt 1961, p. 153) Pl. XVIII, fig. 4.

N. rhynhocephala Kütz. (Cleve-Euler 1953, p. 157) Pl. XVII, fig. 2.

N. rhynhocephala var. *amphiceros* (Kütz.) V. H. (Hustedt l.c.) Pl. XVIII, fig. 3.

N. rotunda Hust. (Hustedt 1962, p. 273) Pl. XVI, fig. 13.

N. seminulum Grun. var. *radiosa* Hust. (Hustedt 1962, p. 242) Pl. XVIII, fig. 5.

N. seminuloides Hust. (Hustedt 1962, p. 244) (8·7—12·6 × 4·5—5·4 μm, 22—26 striae in 10 μm). The designation of this species presented certain difficulties. Some specimens (Pl. XVI, fig. 12) are somewhat more slender than Hustedt mentions and it seems as if some were somewhat unsymmetrical in relation to the transversal axis of symmetry.

N. subbacillum Hust. (Hustedt 1961, p. 117) Pl. XVIII, fig. 10.

N. subhamulata Grun. (Hustedt 1961, p. 126) Pl. XVIII, fig. 8.

N. subocculata Hust. (Hustedt 1961, p. 131) Pl. XVIII, fig. 7.

N. subrotundata Hust. (Hustedt 1962, p. 273) Pl. XVII, fig. 7.

N. tuscula (Ehr.) Grun. (Hustedt 1930, p. 308). Teratological valves with disordered striation (Pl. XVIII, fig. 6) were also found besides typical ones.

N. tuscula fo. *minor* Hust. (Zabielina *et al.* 1951, p. 318) Pl. XX, fig. 9 (8·3—19·3 × 8·6—9·7 μm, 12—14 striae in 10 μm). Valves larger than those mentioned by Zabielina (12 × 8 μm, 10—14 striae in 10 μm) were most frequently found.

N. voucheriae Petersen (Hustedt 1961, p. 159) Pl. XVIII, fig. 9.

N. vitabunda Hust. Pl. XVII, figs. 8, 9 (7·6—13·7 × 4·2—5·3 μm, 21—24 striae in 10 μm). Smaller specimens are comparatively broader than Hustedt (1962, p. 223) mentions. But even in such small specimens, the apices of valves are poorly but distinctly extended.

N. vulpina Kütz. Pl. XX, fig. 2. (70·0—76·7 × 15·8—16·4 μm, 8—11 striae in 10 μm). Valves with a somewhat thicker structure were almost exclusively found. In the material from Knapówka (Kaczmarska 1973) also, the striation in this species was somewhat thicker 9—10 striae in 10 μm whereas Hustedt (1930, p. 297) gives 10—11 in 10 μm.

N. wittrockii (Lags.) A. Cl. var. *fennica* A. Cl. Pl. XX, fig. 1 (25·8—33·4 ×

6·9—8·7 μm, 11—15 striae in 10 μm, about 20 puncta in 10 μm). Valves almost linear up to the end, broadly and fairly bluntly rounded at the ends. Raphe slightly undulate, polar nodules somewhat distant from the margins of the valve. Axial area very narrow, central area transversely expanded, rectangular, amounting to 1/2 of the width of the valve. Transversal striae radiate over the whole length of the valve, more strongly in the middle part, arcuately bent, punctate, uniformly arranged with the exception of the central part of the valve. Valves much narrower than Cleve-Euler (1953, p. 188) mentions were found but all those differ from the taxon mentioned by Hustedt (1961, p. 125) as *N. wittrockii* (Lagst.) A. Cl. Also, it is not *N. bacilliformis* Grun. as it is suggested by Hustedt for *N. wittrockii* because, as in the Cleve-Euler's description, the number of striae did not exceed 15 in 10 μm whereas *N. bacilliformis* has 12—15 of them in the middle and 20—22 in 10 μm towards the end of the valve.

Navicula sp. 1. Pl. XX, fig. 7 (30·4 × 7·2, 20—22 striae in 10 μm). Valves elongate, with parallel margins, having broadly and bluntly extended apices. Raphe straight, there is a fine siliceous rib on either side of it. Axial area narrow, linear; central area large, transversely expanded, rectangular. Transversal striae strongly radiate in the middle, rectangular and somewhat thicker towards the apices. The presence of a siliceous rib suggests it belongs to the group *Naviculae bacillares* (Hustedt 1961).

Navicula sp. 2. Pl. XVIII, figs 12, 13; Pl. XX, fig. 10 (7·7—15·2 × 4·3—4·6 μm, usually 24—28 striae, only once 22 in 10 μm). Valves lanceolate, expanded in the middle and uniformly narrowing to gently rounded apices. Raphe straight, filiform. Axial area very narrow; central area very large, transversely expanded, rectangular. Striae radiate over the whole length of the valve, very strongly shortened in the middle part, on the margin of the valve. The valves found refer in the shape of the valve and central area to *N. rotesta* Carter (1970, p. 620; size: 10 × 4, about 32 striae in 10 μm) and to *N. skabitschewskij* (Skabitsch.) Zabielina var. *elliptica* (Skabitsch.) Zabielina (Proshkina-Lavrenko 1949—1950, p. 159; size: 9·4 × 5·9 μm, 21—22 striae in 10 μm). They differ from *N. rotesta* in a thicker striation and are larger, more slender, and much more finely striated than *N. skabitschewskij* var. *elliptica*.

Navicula sp. 3. Pl. XVIII, fig. 14 (7·7—10·8 × 3·2—5·9 μm, 22 striae in the middle, 28 in 10 μm towards the apex). Valves elliptical, with parallel margins and broadly rounded but not extended apices. A distinct siliceous rib along the raphe. Raphe straight, filiform; axial area narrow, linear, central area large, transversely expanded, rectangular. Transversal striae to the end of the valve, irregularly shortened in the middle part, on the margin of the valve. The presence of a siliceous rib indicates that this taxon belongs to the group *Naviculae bacillares* (Hustedt 1961).

Navicula sp. 4. Pl. XVIII, fig. 11 (10·8—12·3 × 3·1—3·7 μm, 24—28 striae in 10 μm). Elliptical valves with parallel margins and broadly rounded apices. Raphe straight, filiform; a fine siliceous rib on either side of it. Axial area very narrow; central area very large, rectangular, reaching up to almost the margins

of the valve. Striae radiate to the end of the valve, strongly irregularly shortened at the central area, perpendicular to longitudinal axis. The valves though very similar to *Navicula* sp. 3, are, however, longer than it, more slender and more densely striated.

Navicula sp. 5. Pl. XIX, figs. 6, 7 (20·0—28·0 × 4·4—5·0 μm, 18—24 striae in 10 μm). Valves elongate, gently expanded in the middle, apices broadly rounded, capitate. Raphe straight, a fine, thinly streaked siliceous rim on either side of it. Axial area narrow, central area transversely expanded, almost reaching up to the margins of the valve. Transversal striae strongly radiate in the middle part, more poorly so towards the apices or even perpendicular to longitudinal axis. The valves found occupy an intermediary position between *N. disjuncta* Hust. (Hustedt 1961, p. 143) and *N. disjunctoides* Manguin (1960, p. 247).

Navicula sp. 6. Pl. XIX, figs. 1, 3 (33·3—38·8 × 7·3—7·9 μm, 11—12 striae in the middle, 13—16 in 10 μm towards the end). Valves lanceolate, narrowing towards the end, distinctly rostrate or capitately extended at the apices. Axial area very narrow, central area very small, lanceolate expanded. Transversal striae radiate in the middle, perpendicular towards the end, only sometimes slightly convergent, always distinctly lineate; the lines arranged in longitudinal rows, parallel to the margins of the valve. These valves are similar to *N. rhynhocephala* Kütz. (Hustedt 1930, p. 296) and *N. lanceolata* (Ag.) Kütz. (Hustedt 1930, p. 305). They differ from *N. rhynhocephala* in the shape and size of central area, they are always more slender. They differ from *N. lanceolata* in distinctly extended apices and a perpendicular or convergent arrangement of striae towards the apex of the valve. At the same time, typical specimens of *N. lanceolata* were found in this material in which the terminal striae were distinctly vertical and not strongly radiate. On the other hand, they differ from *N. lanceolata* var. *tenuirostrata* Skv. (Zabielina *et al.* 1951, p. 326; size: 37·0 × 7·0 μm, 7—8 striae in the middle, 12 in 10 μm at the apex) in distinctly finer striation.

Pinnularia Ehrenberg

P. appendiculata (Ag.) Cl. (Hustedt 1930, p. 317) Pl. XXII, fig. 7.

P. brevicostata Cl. (Hustedt 1930, p. 329) Pl. XX, fig. 8.

P. cardinalis (Ehr.) W. Sm. (Hustedt 1930, p. 337) Pl. XIX, fig. 5.

P. gentilis (Donk.) Cl. (Hustedt 1930, p. 336) Pl. XXI, fig. 4.

P. intermedia Lagerst. (Zabielina *et al.* 1951, p. 356) Pl. XIX, fig. 4.

P. lagerstedtii (Cl.) A. Cl. Pl. XIX, fig. 9; Pl. XX, fig. 5 (19·6—26·7 × 5·3—6·5 μm, 8—9 striae in 10 μm). Valves always somewhat more stocky than in Cleve-Euler's drawings (1955, p. 30), were found. They are similar in the shape of the valve to *P. borealis* Ehr. var. *brevicostata* Hust. (Hustedt 1930, p. 326; size: 28—110 × 8—18 μm, 4—6 striae in 10 μm), they differ, however, in denser striation. They differ from *P. lagerstedtii* (Cl.) Hust. (Foged 1962) in the shape of the central areas.

P. legumen Ehr. (Siemińska 1964, str. 367) Pl. XX, fig. 6.

P. cf. *microstauron* (Ehr.) Cl. Pl. XX, fig. 4 (50·0—57·9 × 9·3—10·6 μm, 9—11 striae in 10 μm). A few valves were found that differed somewhat from those mentioned by Hustedt (1930, p. 320) in slightly extended, wedge-shaped, broadly rounded apices, a broader axial area and thinner striation. Valves with a similar shape are also mentioned by Lund (1946, p. 92, fig. 11a, e) designated as *P. microstauron* (Ehr.) Cl. and Foged (1964, p. 114, Pl. 13, fig. 8, Pl. 14, fig. 19, Pl. 15, fig. 13).

P. molaris Grun. (Hustedt 1930, p. 316) Pl. XX, fig. 3 (26·7 × 4·7 μm, 17—18 striae in 10 μm). The only one specimen found is somewhat smaller than those mentioned by Hustedt.

P. nobilis Ehr. (Hustedt 1930, p. 337) Pl. XIX, fig. 8.

P. pulchra Østr. Pl. XIX, fig. 2; Pl. XXII, fig. 1 (38·0—47·0 × 6·7—8·3 μm, 8—11 striae in 10 μm). The margins of the valves always more gently tri-convex than mentioned by Cleve-Euler (1955, p. 27). In this character they resemble *P. pseudopulchra* A. Cl. (Cleve-Euler l.c.) from which they are generally larger. Specimens with a very similar shape are mentioned by Foged (1964) and Carter (1970) and Foged (1970) though some doubts. The frustules found in Imbramowice are quite different from *P. pulchra* Østr. mentioned by Hustedt (1930, p. 329). Unfortunately, Østrup's original description was not available to me. These valves also resemble to some extent to *P. microstauron* (Ehr.) Cl. var. *ambigua* Meister (Hustedt 1930, p. 320) they differ from them in more poorly radiate and thinner striae.

P. streptoraphe Cl. Pl. XXII, fig. 6 (202·0 × 31·4 μm, 4—4·5 striae in 10 μm). The only valve found has somewhat thicker ornamentation than that mentioned by Hustedt (1930, p. 337; 5 striae in 10 μm).

P. subcapitata Greg. (Hustedt 1930, p. 334) Pl. XXII, fig. 2.

P. viridis (Nitzsch) Ehr. var. *comutata* (Grun.) Cl. (Patrick & Reimer 1966, p. 640) Pl. XII, figs. 3, 4.

P. viridis (Nitzsch) Ehr. var. *elliptica* Meist. (Zabielina *et al.* 1951, p. 374) Pl. XXII, fig. 8.

P. viridis var. *minor* Cl. (Patrick & Reimer 1966, p. 640) Pl. XXI, fig. 5 (73·3—100·5 × 14·0—20·0 μm, 6·5—7 striae in 10 μm). Some valves are somewhat broader than mentioned in the key and sometimes slightly narrowed in the middle.

P. viridis var. cf. *leptogongyla* (Ehr.? Grun.) Cl. (Hustedt 1930, p. 335) Pl. XXI, figs. 1, 3 (60·0—110·0 × 12·5—19·0 μm, 8—11 striae in 10 μm). Valves elongate with very slightly tri-undulate margins, most strongly marked transversal expansion. Axial area lanceolate, fairly broad; central area large, circularly expanded. Transversal striae radiate in the middle of the valve, convergent towards the end. Raphe complex, undulate. They differ from those mentioned by Hustedt in slightly undulate margins and undulate raphe. They are also sometimes somewhat larger; Hustedt gives the size of this variety; 60·0—90·0 μm in length and 14 μm in width.

Neidium Pfitz.

N. affine (Ehr.) Cl. fo. *hercynica* (Mayer) Hust. (Hustedt 1930, p. 243) Pl. XXIII, fig. 2.
N. amphirhynchus (Ehr.) Pfitz. var. *majus* (Cl.) Meister (Cleve-Euler 1955, p. 114) Pl. XXI fig. 7.
N. amphirhynchus var. *undulatum* (Grun.) Meister (Cleve-Euler 1955 l.c.) Pl. XXIII fig. 1. The specimen found is smaller (80·0—15·0, 18—20 striae in 10 μm) than mentioned by Cleve-Euler.
N. binodis (Ehr.) Hust. (Hustedt 1930, p. 933) Pl. XXII, fig. 5.
N. bisulcatum (Lagst.) Cl. var. *lineare* (Østr.) Cl. (Cleve-Euler 1955, p. 110) Pl. XXIV, fig. 6.
N. distincte-punctatum Hust. (Hustedt 1930, p. 247) Pl. XXIII, fig. 3.
N. dubium (Ehr.) Cl. fo. *constricta* Hust. Pl. XXIII, fig. 4. Valves (25·0—35·0 × 9·0—9·6 μm, 24—26 striae in 10 μm) smaller than mentioned by Hustedt 1930, p. 393) were found as well as typical ones.

Caloneis Cleve

C. alpestris (Grun.) Cl. (Cleve-Euler 1955, p. 107) Pl. XXI, fig. 9.
C. amphisbaena (Bory) Cl. (Hustedt 1930, p. 230) Pl. XXI, fig. 10 (60·0—72·0 × 26·0—28·0 μm, 13—15 striae in 10 μm). All the valves found are damaged to a large extent. Since the terminal parts of the valves are lacking it is difficult to determine the systematic rank within with certainty. The number of striae indicates var. *aeqata* Kolbe or var. *fenzlii* Grun. However, the latter is always distinctly lanceolate whereas the fragments of the valves found are always elliptical.
C. bacillum (Grun.) Mer. (Hustedt 1930, p. 236) Pl. XXI, fig. 8.
C. bacillum var. *fontinalis* (Grun.) Mayer (Cleve-Euler 1955, p. 103) Pl. XXI, fig. 6, Pl. XXII, fig. 9 (11·6—16·6 × 4·1—4·6 μm, 24—26 striae in 10 μm). Very small valves elliptically elongate or elliptically-lanceolate in shape with slightly wedge-shaped or broadly rounded ends have been allocated to this taxon. Axial area very narrow at the poles, slightly lanceolate expanded towards the centre or very narrow towards the end. Central area very large, reaching up to the margins of the valve, always distinctly wider than the distance between the central pores. Transversal striae radiate over the whole length, mostly perpendicular at the poles. The first, most central striae refract light somewhat more strongly than the remaining. Many authors assign this variety to the typical form. However, in the material from Imbramowice, the difference in the size of the central area, somewhat finer striation, and lack of valves of a size intermediary between these specimens and the typical form of *C. bacillum* are factors for the isolation of this variety.

C. clevei (Lagst.) Cl. Pl. XXI, fig. 2 (53·3—9·3 μm, 20—21 striae in 10 μm). Only one fragment of the valve was found. It differs slightly in having less capitate valve ends, than mentioned by Hustedt (1930, p. 236).

Amphora Ehrenberg

A. fonticola Maillard (1967, p. 29) Pl. XXIV, figs 1, 8 (26·0—64·0 × 6·9—12·5 μm, 12—14 striae in 10 μm). The valves found differed somewhat from those mentioned by Maillard and Stoermer and Young (1971). The length range of valves is larger than in Maillard's (50·0—55·0 μm) and similar to those of Stoermer and Young's (21·0—63·0 μm) and the more linear shape of valves than it is mentioned by Maillard. On the other hand, the number of striae is closer to Maillard's data (13—14 in 10 μm) than in Stoermer and Young's (14—16 in 10 μm). It seems that the valves found occupy an intermediary position between the specimens presented by the above-mentioned authors. This species has so far been mentioned only by Maillard, Stoermer and Young.

Cymbella Agardth

C. aequalis W. Sm. (Hustedt 1930, p. 361) (30·8—55·8 × 7·9—21·3 μm, 10—12 striae in the middle of the valve, 15 in 10 μm, towards the end). Symmetrical valves (= *C. aequalis* W. Sm. Pl. XXIV, fig. 2) and those of unsymmetrical structure (= *C. obtusa* Greg., Pl. XXIV, fig. 7) were found in this material. Valves of unsymmetrical shape, lanceolate-elliptical, with more strongly convex dorsal margin and less strongly convex ventral margin, ends bluntly rounded and slightly rostrate extended constituted the decided majority. Raphe slightly eccentric, bent to the dorsal side. Axial area lanceolate, central area circularly expanded, usually more linear in small specimens. Transversal striae radiate towards the end of the valve. Identical unsymmetrical specimens were mentioned by Marciniak (1973) from the Late-glacial sediments of Mikołajskie Lake under the name of *C. obtusa* Greg. Both types of valves have been treated as one species and designated as *C. aequalis* in the material from Imbramowice as well as that from Knapówka (Kaczmarska 1973) on the basis of VanLandinghan's opinion (1966, p. 1150).

C. affinis Kütz. (Cleve-Euler 1955, p. 158) Pl. XXV, fig. 1 (20·4—38·5 × 8·3—9·2 μm, 9—13 striae on the ventral side, 10—13 in 10 μm on the dorsal side). Valves distinctly dorsi-ventral with strongly convex dorsal margin and slightly convex, sometimes almost flat, ventral margin. Valves on the ends usually rostrate extended and bluntly rounded or flattened. Axial area narrow, slightly expanded most at the utmost near the central nodule. Transversal striae radiate, towards the end of the valve more so, lineate; about 20 lines in 10 μm. 1—2 isolated puncta near the two central striae on the ventral side.

C. amphicephala Nag. var. *intermedia* A. Cl. (Cleve-Euler 1955, p. 151) Pl. XXV, fig. 6 (27·0—37·0 × 12·0—15·0 μm, 10—16 striae in 10 μm). The valves found differ in somewhat closer striation from those mentioned by Cleve-Euler (28·0—48·0 × 12—15 μm, 10—13 striae in 10 μm) in which they approximate var. *hercynica* (A.S.) Cl. (Cleve-Euler l.c.; 12—17 in 10 μm). On the other hand, they are similar to the typical form in a small and poorly separated central area. However, they differ from it in the shape of the valve and the length/width ratio. On the basis of their shape, the valves found may be also compared to *C. lata* Grun. var. *minor* (Zabielina *et al.* 1952, p. 439), though they differ from this taxon in less differentiated striation and greater size.

C. cesatii (Rabh.) Grun. (Cleve-Euler 1955, p. 132) Pl. XXIV, fig. 4.

C. cymbiformis (Ag?) Kütz. var. *unipunctata* Cl. (Cleve-Euler 1955, p. 160) Pl. XXV, fig. 2 (50·0—67·0 × 13·9—16·0 μm, 9—12 striae in 10 μm, 17—20 lines). VanLandingham (1966, p. 1177) does not differentiate this variety and includes it within the variability of the typical form.

C. diluviana (Krasske) Florin (= *Navicula diluviana* Krasske, = *Cymbella similis* Patrick) Florin 1970, Pl. XXIII, figs. 5, 6, 7.

C. hustedtii Krasske Pl. XXVI, fig. 2 (20·8—22·5 × 7·1—7·9 μm, 11—14 striae in 10 μm). Valves larger than those mentioned by Hustedt were frequently found (1930, p. 363; 20·0 × 7·0, 13 striae in 10 μm).

C. prostrata (Berk.) Cl. Pl. XXIV, fig. 3 (22·9—37·5 × 9·2—12·6 μm, 9—12 striae in 10 μm, 20—23 lines). Valves with somewhat denser striation than Hustedt mentions (20·0—100·0 × 10·0—30·0 μm, 7—10 striae in 10 μm, 20 lines) were found.

C. sinuata Greg. fo. *ovata* Hust. (Hustedt 1930, p. 361) Pl. XXVIII, fig. 6.

C. thumensis A. Mayer (Hustedt 1930, p. 398) Pl. XXIV, fig. 5; Pl. XXV, figs. 3, 7, 10.

C. tumidula Grun. (Hustedt 1930, p. 361) Pl. XXV, figs. 8, 9 (34·7—37·2 × 7·3—8·5, 14—16 striae in 10 μm on the ventral side, 12—14 on the dorsal one). The valves differ from those mentioned by Hustedt in a wider central area which is not circularly but lanceolate expanded and a wider lanceolate axial area, passing gradually into the central area. On one of the valves, three and not two isolated puncta near the three central striae were observed.

Gomphonema Agardth

G. acuminatum Ehr. Pl. XXV, fig. 4 (48·0—85·0 × 10·5—14·0 μm, 7·5—12 striae in 10 μm). Valves much larger than those mentioned by Cleve-Euler (1955, p. 173; 30·0—70·0 × 7·0—11·0 μm, 9—11 striae in 10 μm) were found as well as typical ones.

G. acuminatum var. *elongatum* (W. Sm.) V. H. (Cleve-Euler 1955, p. 175) Pl. XXVI, fig. 3.

G. acuminatum var. *pantocseki* Cl. Pl. XXVI, fig. 1 (41·0—58·0 × 7·8—7·9 in the central expansion, 8·8—9·1 in the upper one, 8—13 striae in 10 μm). The valves found have a wedge-shaped and expanded upper part characteristic of this form, broader than in the central expansion. However, they are often larger and sometimes somewhat narrower in the upper part of the valve than those mentioned by Cleve-Euler (1955, p. 175, 38·0—45·0 μm in length and 10—12 μm in width in the upper expansion).
G. acuminatum var. *turris* (Ehr.) Cl. Pl. XXVI, fig. 5 (56·9—61·2 × 11·6—13·3 μm, 6—8 striae in 10 μm). The valves from Imbramowice are broader and more thickly striated than mentioned by Hustedt (1930, p. 372). Similar, also broader and more thickly striated valves were mentioned by Marciniak (1973) from the Late glacial sediments of Mikołajskie Lake.
G. cf. *augur* Ehrenberg (1843, p. 416) Pl. XXVI, figs. 4, 6, 8 (21·0—43·0 × 6·3—10·0 μm, 12—16 striae in 10 μm). In the valves found, the density of striae, shape of the axial and central areas are characteristic of this species; they differ in clavate rather than in wedge-oval shape since they are most markedly expanded in the upper end and narrow uniformly towards the lower end. Sometimes, in the upper part they are more or less linear. In comparison with Ehrenberg's original figure it was observed that the valve presented by him is not symmetrical, its right side narrows less abruptly than from the left. This produces the impression of more clavate-shape of the right side of the valve. It was therefore decided to assign these valves, though not without some doubt, to *C. augur*, until more detailed investigations are posible.
G. clevei Fricke (1902, Plate 234, figs. 44—46) Pl. XXVII, fig. 7 (34·2 × 5·6 μm, 8 striae in the middle of the valve, 10—12 in 10 μm to the end). Valves lanceolate, expanded in the middle. Axial area lanceolate, passing gradually into a lanceolate central area. An isolated punctum in the central area. In some descriptions valves without an isolated punctum are mentioned (Zabielina *et al.* 1951, p. 473).
G. lanceolatum Ehr. (Cleve-Euler 1955, p. 184) Pl. XXVII, fig. 1.
G. sphaerophorum Ehr. (Hustedt 1930, p. 372) Pl. XXVII, fig. 2.
G. ventricosum Greg. (Hustedt 1930, p. 377) Pl. XXVII, fig. 3.

Epithemia Brebisson

E. argus Kütz. var. *capitata* Fricke (Zabielina *et al.* 1951, p. 480) Pl. XXVIII, fig. 1.
E. intermedia Fricke (Hustedt 1930, p. 387) Pl. XXVI, fig. 7.
E. muelleri Fricke Pl. XXVIII, fig. 8 (23·5—41·0 × 8·8—11·7 μm, 8—11 areolae between septa, 12 areolae in 10 μm, 1—2 septa in 10 μm). Valves or characteristical septa much smaller than mentioned by Hustedt (1930, str. 384) were almost exclusively found.
E. turgida (Ehr.) Kütz. Pl. XXVII, fig. 6 (76·5—90·2 × 13·8—16·6 μm, 8 areolae

in 10 μm, 2—3 areolae in the septum, 3·5—4·5 septa in 10 μm). Valves more slender than Hustedt mentions (1930, p. 387; size: 60·0—220·0 × 15·0—18·0) were found. This species is also recorded by Hartmann (1907).

Rhopalodia O. Muller

R. parallela (Grun.) O. Müll. Pl. XXVIII, fig. 5 (68·0 × 15—16 μm, 7—8 septa in 10 μm). The one valve found is relatively narrower than mentioned by Hustedt (1930, p. 389; 45·0—260·0 × 15·0—38·0).

Nitzschia Hassall

N. angustata (W. Sm.) Grun. (Hustedt 1930, p. 402) Pl. XXV, fig. 5.
N. heufleriana Grun. var.? (Hustedt 1930, p. 414) Pl. XXVIII, figs. 2, 3 (180·0 × 5·2—6·7 μm, 10—12 carinal dots in 10 μm, 24—25 striae in 10 μm). Valves elongate, lanceolate, expanded in the middle, with distinctly narrowed, extended, capitate rounded ends. They differ from typical valves in somewhat denser striation, are longer and expand in the middle part of the valve. Because only one complete half of the valve was found and the remaining fragments are much smaller, it is difficult to determine the precise systematic rank of these specimens.
N. parvula Lewis Pl. XXIX, fig. 6 (37·5—40·0 × 5·6—6·0 μm, 6—7 carinal dots in 10 μm). Valves longer than Hustedt (1930, p. 421) mentions were found.
N. parvula fo. *terricola* Lund (1946, p. 97) Pl. XXVIII, fig. 4.
N. thermalis Kütz. var. *minor* Hilse (Hustedt 1930, p. 403) Pl. XXIX, fig. 3.
Nitzschia sp. 1 Pl. XXVII, fig. 5 (16·2—21·2 × 3·1—3·3 μm, 14—16 carinal dots in 10 μm). Valves lanceolate with distinctly capitate extended ends. Transversal striae very fine, not visible under an optical microscope, carinal dots minute. The frustule very fine, when both valves remain linked both keels are to be seen simultaneously. The valves found resemble *N. fonticola* Grun. (Hustedt 1930, p. 415) to some extent in the shape of the valve and size, but they are always more distinctly capitate and the striation is very fine, invisible under an optical microscope.
Nitzschia sp. 2 Pl. XXVIII, fig. 7 (78·0 × 8—12 μm, 5—7 carinal dots in 10 μm, 22—24 striae in 10 μm). Valves elongate with parallel margins and narrowed in the shape of wedges, rather sharply rounded ends. Only one whole valve and very many fragments were found, some of which reached almost 123 μm in length. Keel relatively wide, carinal dots in shape of distinct lines.

Surirella Turpin

S. biseriata Bréb. (Hustedt 1930, p. 432) Pl. XXIX, fig. 2.
S. biseriata fo. *punctata* Meister (Hustedt l.c.) Pl. XXIX, fig. 1. Probably other varieties of this species also occurred in this material, but the valves were

found always in fragments larger or smaller and this precluded a more precise determination.

S. cf. *turgida* W. Sm. Pl. XXVII, fig. 4 (28·0—32·0 × 13·3—14·6 μm, 30—40 wing canals and windows in 100 μm). Valves equally polar, broad, rhombic-lanceolate, with strongly convex margins, sometimes slightly extended and rather sharply rounded ends. The projection of the wings very distinct, wing canals more or less as the breadth of windows. Rims strongly radiate, convex on the margins, markedly flattened towards the middle. The surface of the valve striated, there are also numerous small spines mainly on the lanceolate axial area. The valves found differ from Hustedt's description (1930, p. 433, 50·0—120·0 × 33·0—50·0 μm, 15—30 wing canals and windows in 100 μm) in their smaller size and denser wing canals.

Surirella sp. Pl. XXIX, figs. 4,5 (37·9—46·3 × 7·5—8·1 μm, 5—5·5 wing canals, only once 6 in 10 μm, 22—24 striae in 10 μm). Valves equally-polar, elongate, with parallel margins and end extended in the shape of wedges, only sometimes slightly capitate. Wings fairly narrow, the projection of the wings rather disctinct. Transversal striae do not extend to the longitudinal axis, leaving a fairly broad axial area. The valves resemble to some extent to *S. terryi* Ward. var. *arctica* Patrick and Freense (1960, p. 285) in the shape of the shell and proportions but differ in the presence of the distinct, fairly broad, axial area.

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STRESZCZENIE

UWAGI DO FLORY OKRZEMEK (*BACILLARIOPHYCEAE*) Z EEMSKICH SŁODKOWODNYCH OSADÓW Z IMBRAMOWIC KOŁO WROCŁAWIA

W uzupełnieniu analizy okrzemkowej eemskiego profilu osadów z Imbramowic (Kaczmarska 1976a i b) przedstawiono uwagi morfologiczne oraz dokumentację taksonomiczną 201 ważniejszych słodkowodnych taksonów znalezionych w tym materiale. Omówiono tu taksony rzadko znajdowane oraz bardzo zmienne, odbiegające od opisów w dostępnych kluczach, monografiach i niekiedy w oryginalnych opisach. Nie uwzględniono 194 taksonów okrzemek pospolitych, których identyfikacja nie nastręczała trudności, w tym 10, których fotografie zamieszczono w poprzedniej publikacji (Kaczmarska 1976a) oraz 30 morskich redeponowanych taksonów trzeciorzędowych.

PLATES

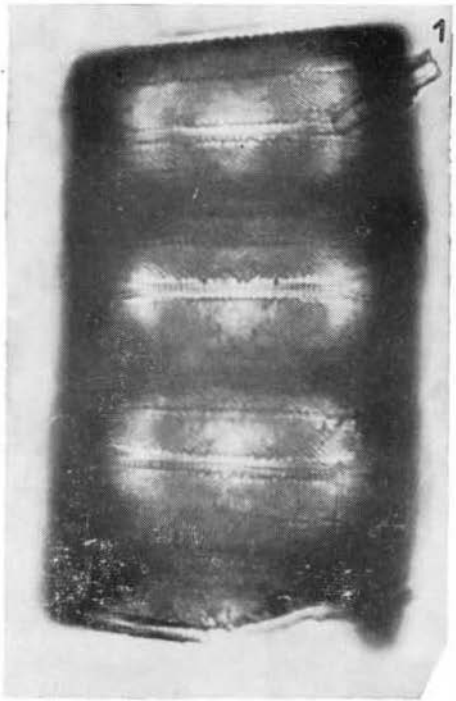
TABLICE

All photographs × 2500, unless otherwise specified
Wszystkie fotografie × 2500, o ile nie zaznaczono inaczej

Plate I

Tablica I

1. *Melosira arenaria*; × 1000
2. *M.* cf. *islandica*
3. *M. ambigua*
4. *M. italica* fo. *curvata*
5, 6. *M.* cf. *islandica*
7. *M. varians*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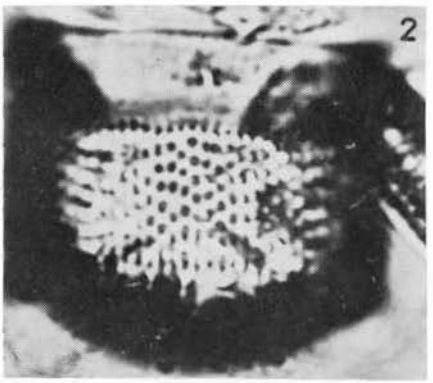
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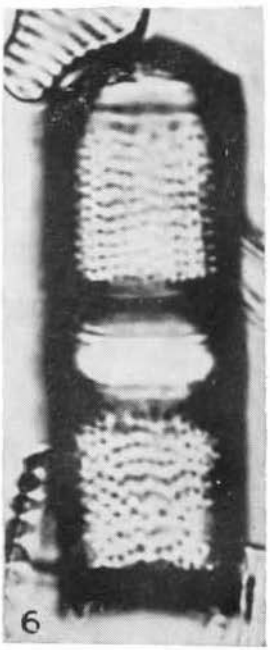
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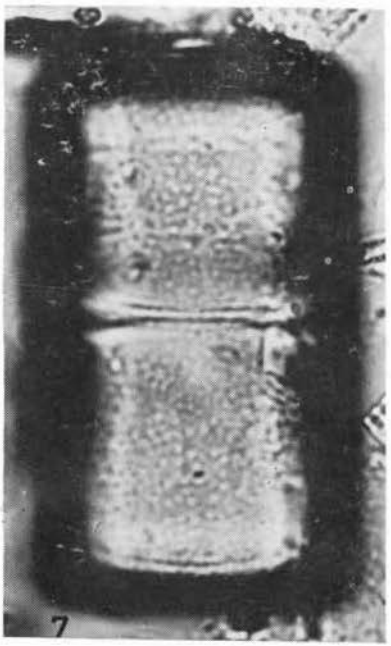
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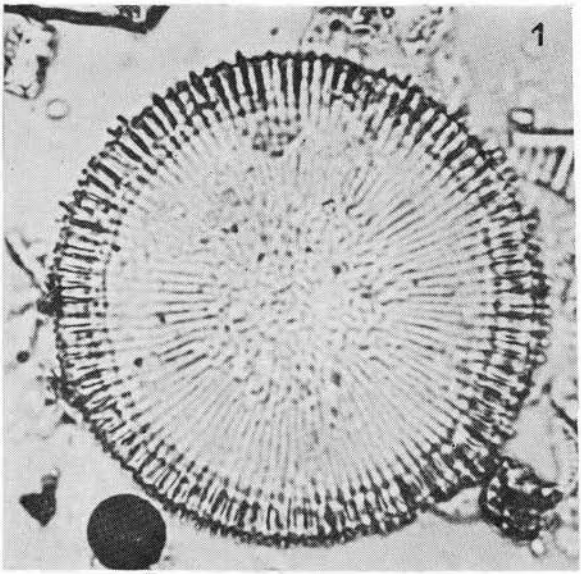
Plate II

Tablica II

1. *Melosira arenaria*; × 1000
2. *M. islandica*
3. *M. italica*
4. *M. granulata* var. *angustissima*
5. *Cyclotella comensis*
6. *Melosira granulata*
7. *Cyclotella comensis*
8. *C. kützingiana*
9. *C. kützingiana* var. *radiosa*
10. *C. comta*
11. *C. kützingiana*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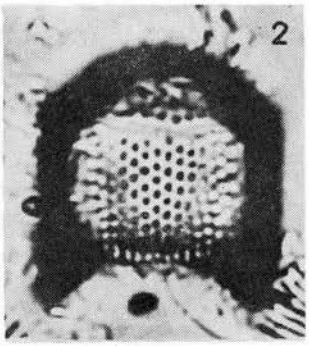
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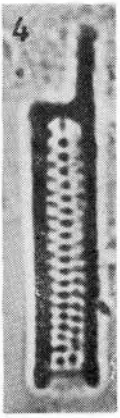
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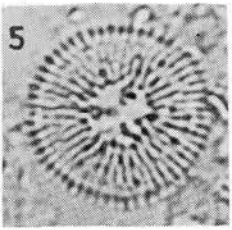
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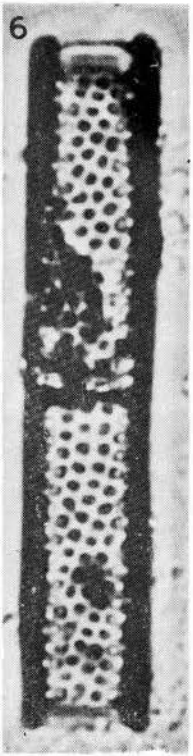
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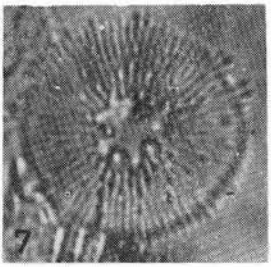
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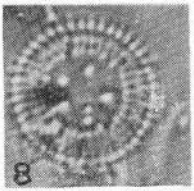
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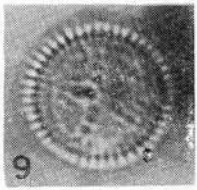
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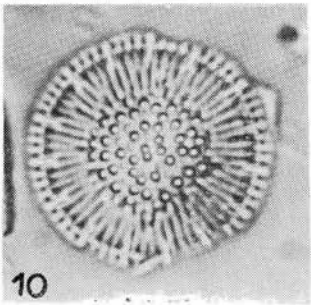
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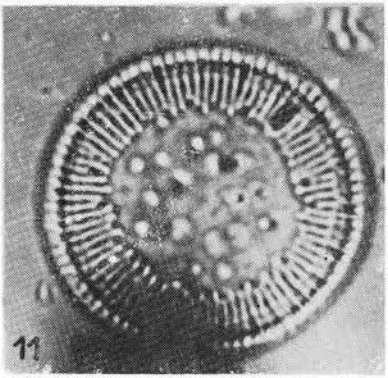
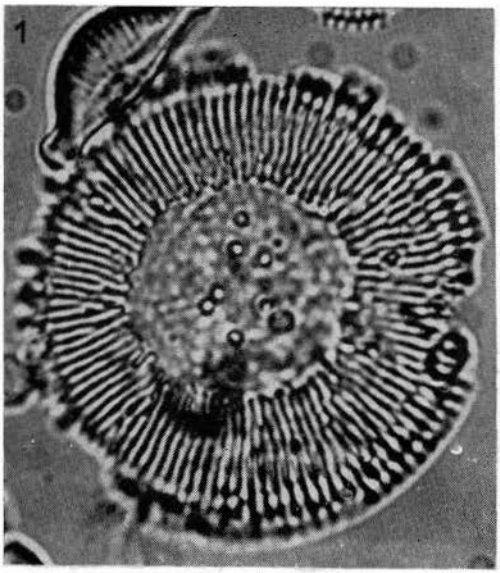

11

Plate III

Tablica III

1. *Cyclotella kützingiana*
2. *C. bodanica*
3a, b. *C. operculata*; fig. a and b show the same valve differently focused
4. *C. distinguenda*
5. *C. ocellata*
6. *C. operculata* var. *unipunctata*
7. *C. distinguenda*
8. *C. stelligera*
9. *C. ocellata*
10. *C. operculata* var. *mesoleia*
11. *C. ocellata*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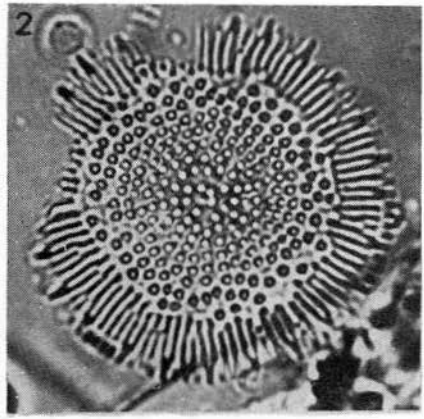
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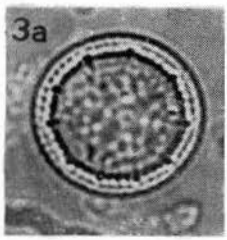
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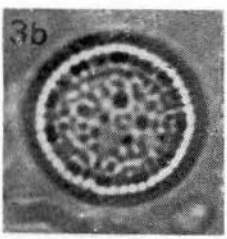
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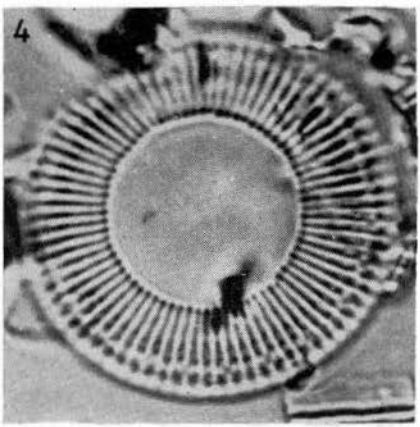
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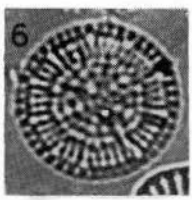
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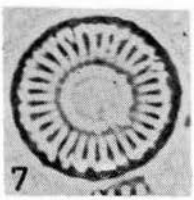
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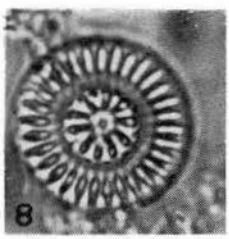
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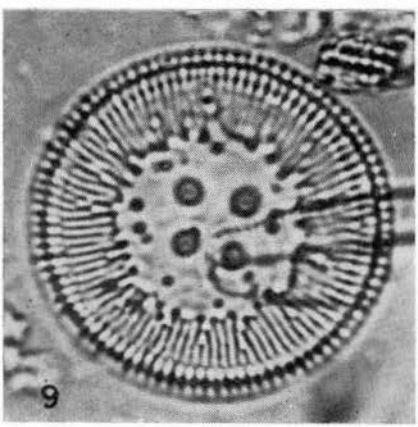
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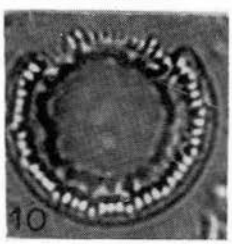
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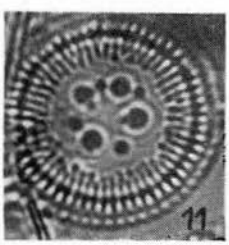
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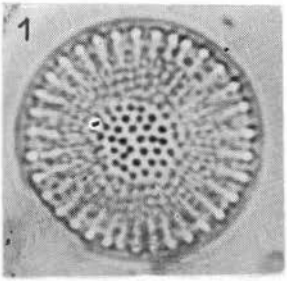
Plate IV

Tablica IV

1. *Stephanodiscus astraea* var. *minutulus*
2. *Cyclotella kützingiana* var. *radiosa*
3. *C. operculata* var. *unipunctata*
4. *C. meneghiniana*
5. *C. kützingiana* var. *planetophora*
6. *Stephanodiscus astraea* var. *minutulus*
7. *Cyclotella comta* var. *oligactis*
8. *C. kützingiana* var. *radiosa*
9. *C. comta* var. *glabriuscula*
10. *C. kützingiana* var. *planetophora*
11. *Stephanodiscus astraea* var. *intermedia*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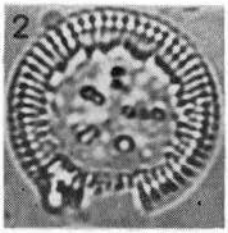
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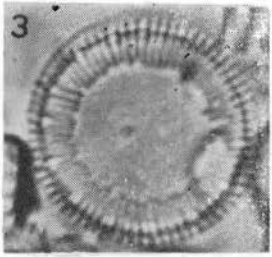
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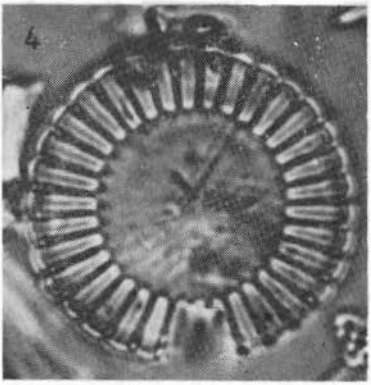
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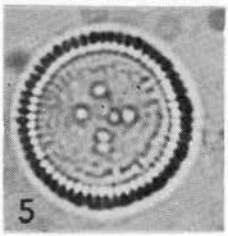
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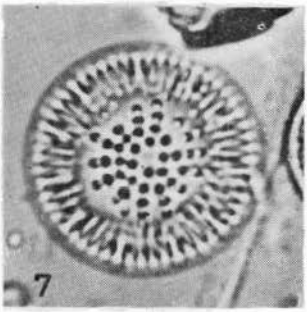
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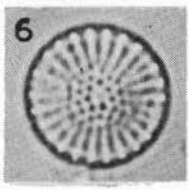
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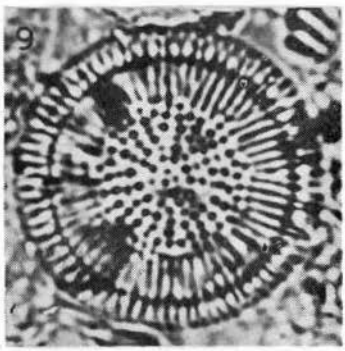
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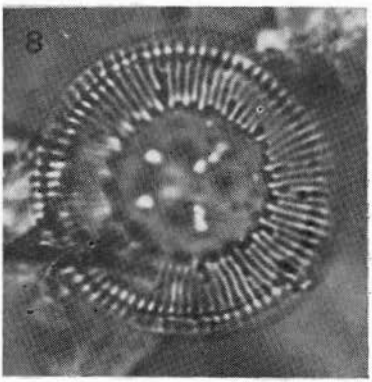
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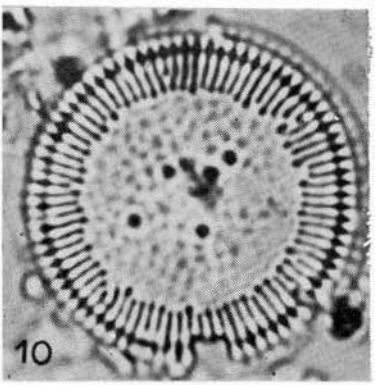
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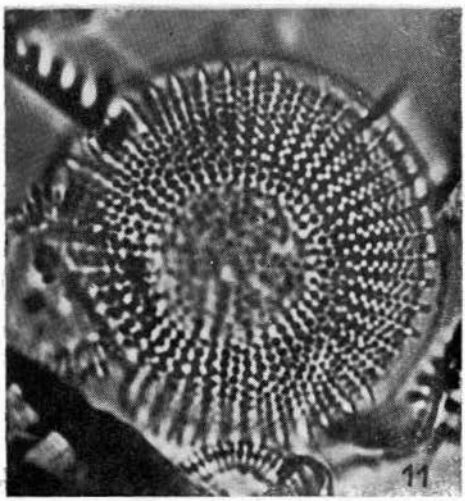
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Plate V

Tablica V

1. *Stephanodiscus astraea* var. *minutulus*
2. *Tabellaria flocculosa*
3. *T. fenestrata*
4. *Stephanodiscus dubius*
5. *Asterionella formosa*
6. *Fragilaria* cf. *virescens*
7. *Diatoma vulgare* var. *ehrenbergii*
8. *Fragilaria leptostauron* var. *dubia*
9. *Diatoma elongatum*
10. *Fragilaria lapponica*
11. *Achnanthes exigua*

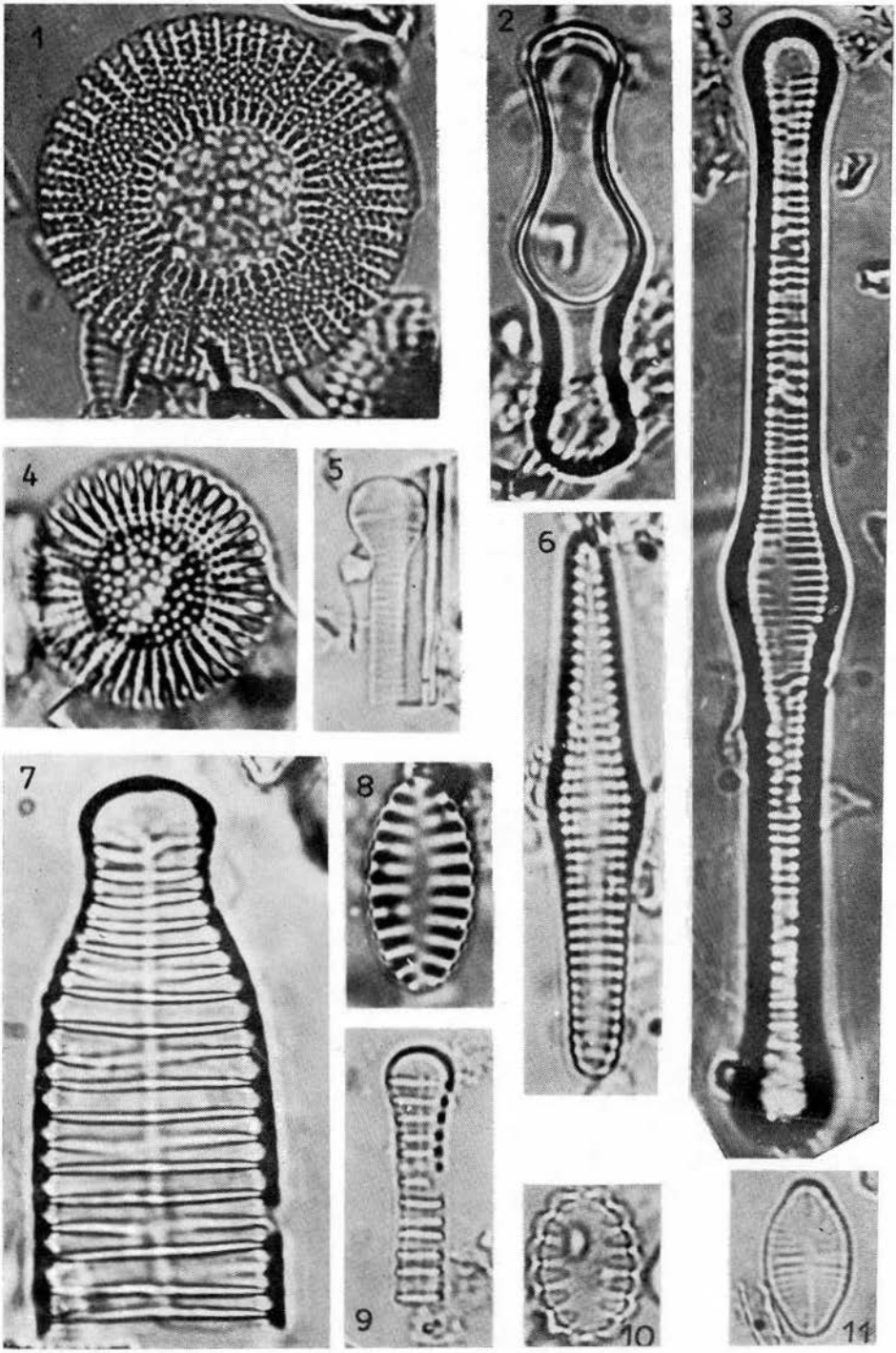
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Plate VI

Tablica VI

1. *Fragilaria brevistriata* var. *linearis*
2. *F. crotonensis*?
3. *F. lapponica*
4. *F. intermedia*
5. *Synedra acus* var. *radians*
6. *S. ulna* var. *aequalis*
7. *Eunotia sudetica*
8. *E. suecica*; × 1000
9. *E.* cf. *lunaris*

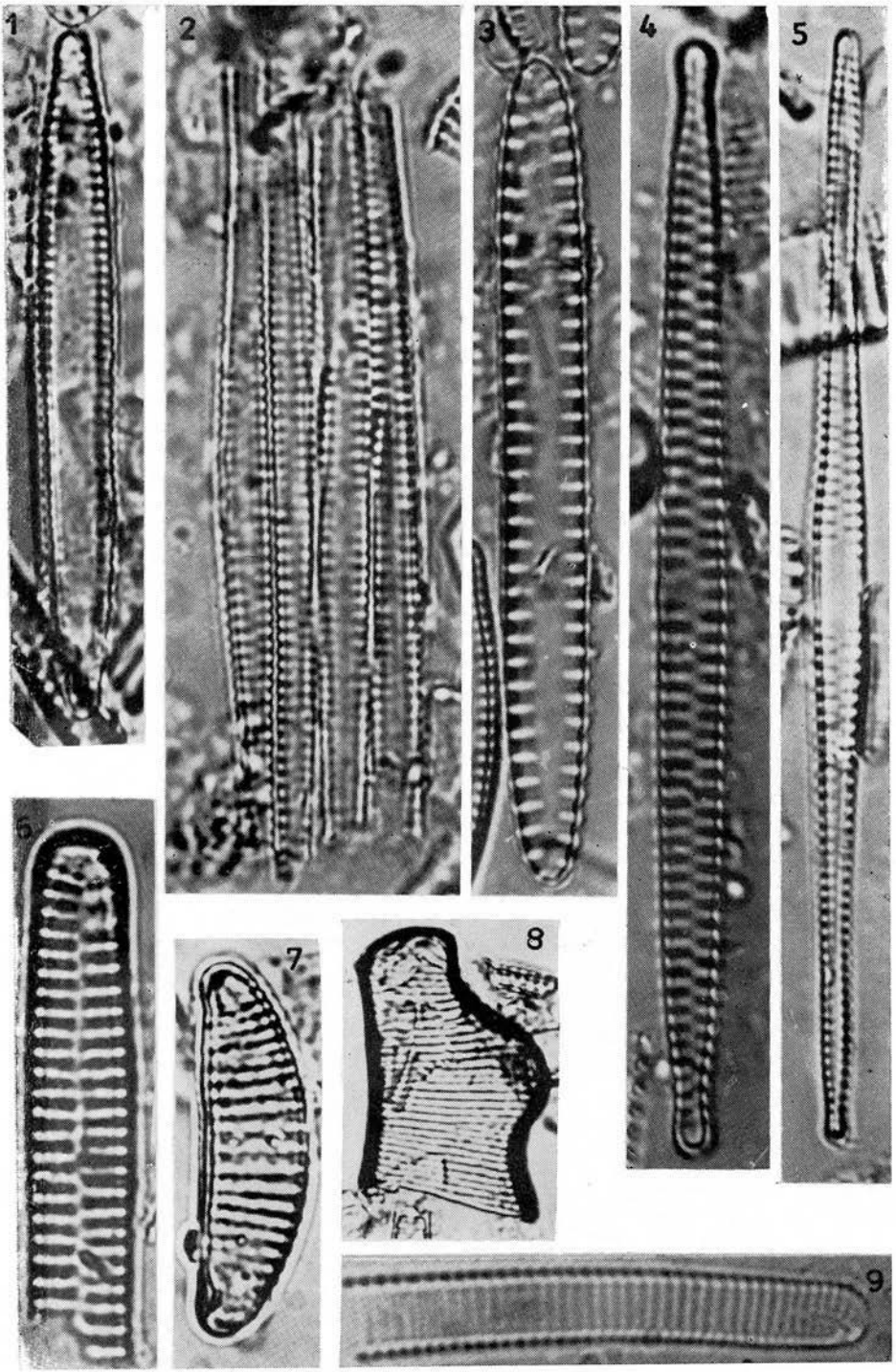
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Plate VII

Tablica VII

1, 2. *Synedra acus* var. *radians*; × 1000
3. *S. ulna* var. *spatulifera*; × 1000
4. *S. tenera*
5. *Eunotia veneris*
6. *E. formica*; × 1000
7. *E. flexuosa*
8. *E. sudetica*; × 1000
9. *Cocconeis thumensis*
10. *C. disculus* var. *diminuta*
11. *Eunotia arcus*
12. *E.* cf. *gracilis*; × 1000
13. *Eunotia* sp.

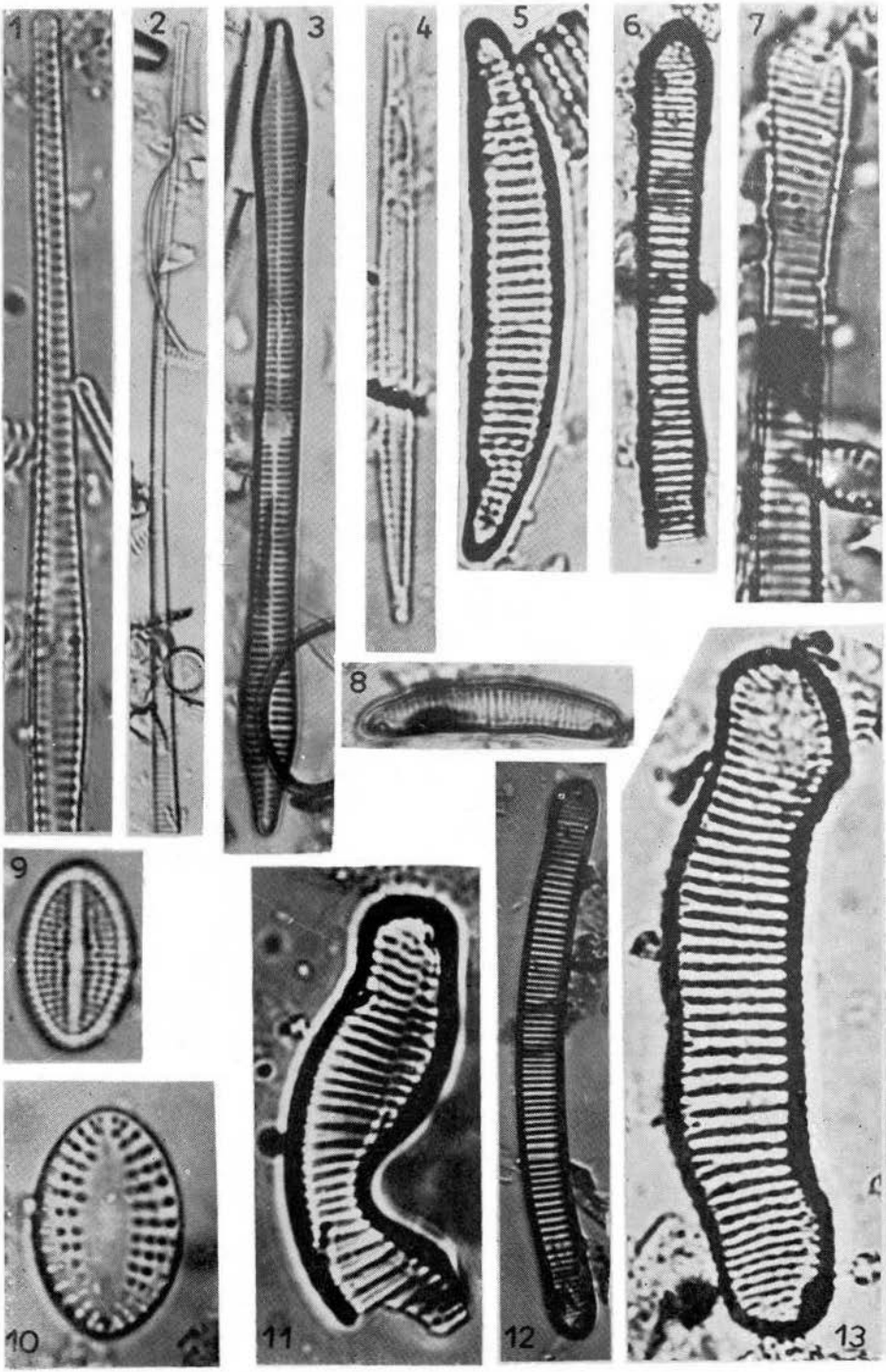
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Plate VIII

Tablica VIII

1. *Eunotia* cf. *gracilis*
2. *E. arcus*
3. *E.* cf. *lunaris*
4. *E. pectinalis* var. *ventralis*
5, 6. *Diploneis oelandica*
7. *Cocconeis disculus*
8. *Achnanthes conspicua*; teratological valve

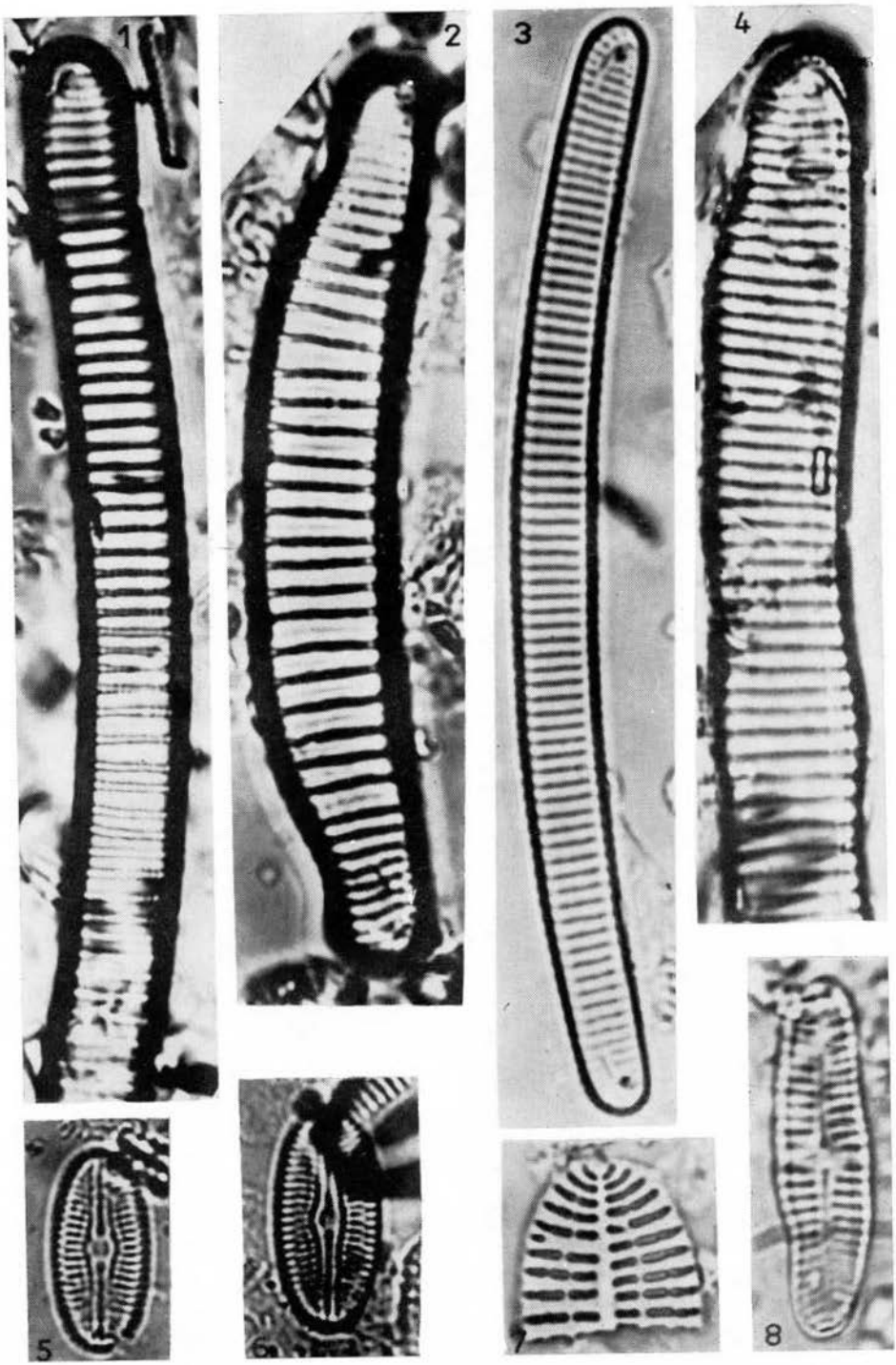

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Plate IX

Tablica IX

1, 2. *Cocconeis placentula* var. cf. *lineata*
3. *Achnanthes ploenensis*
4. *Cocconeis placentula* var. *intermedia*
5. *Achnanthes ploenensis*; fig. 5 and 9 show the same valve differently focused
6. *A. conspicua*; teratological valve
7. *Cocconeis disculus* var. *minor*
8. *Achnanthes lanceolata* var. *elliptica*; teratological valve
9. *A. ploenensis*
10. *A. peragalli*

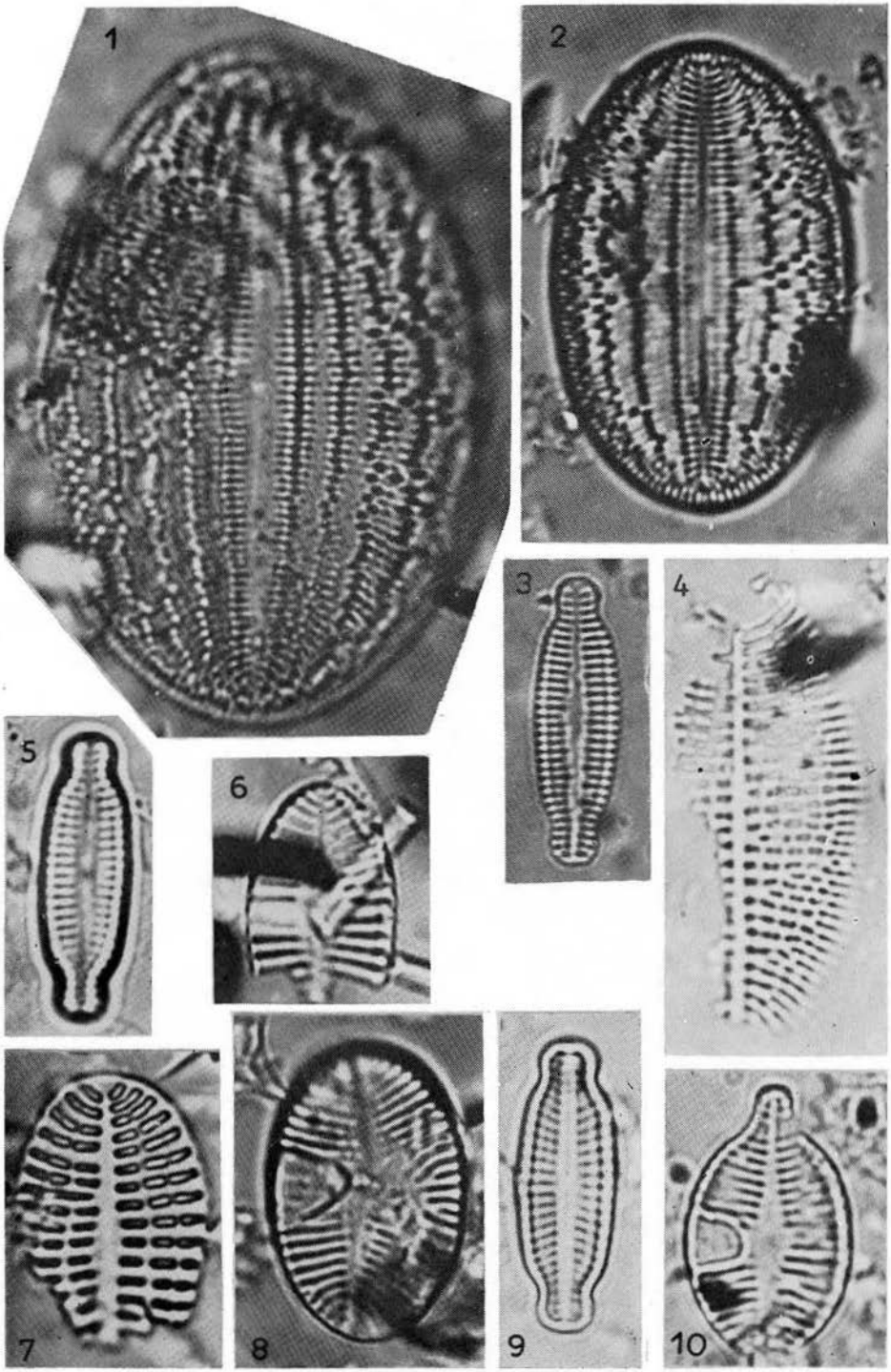
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Plate X

Tablica X

1. *Stauroneis smithii* var. *borgei*
2. *Diploneis ovalis* var. *oblongella*
3. *D. oculata*
4. *D. elliptica*
5. *Achnanthes kolbei*
6, 7, 8. *A. lapponica* var. *ninckei*
9. *Diploneis elliptica*

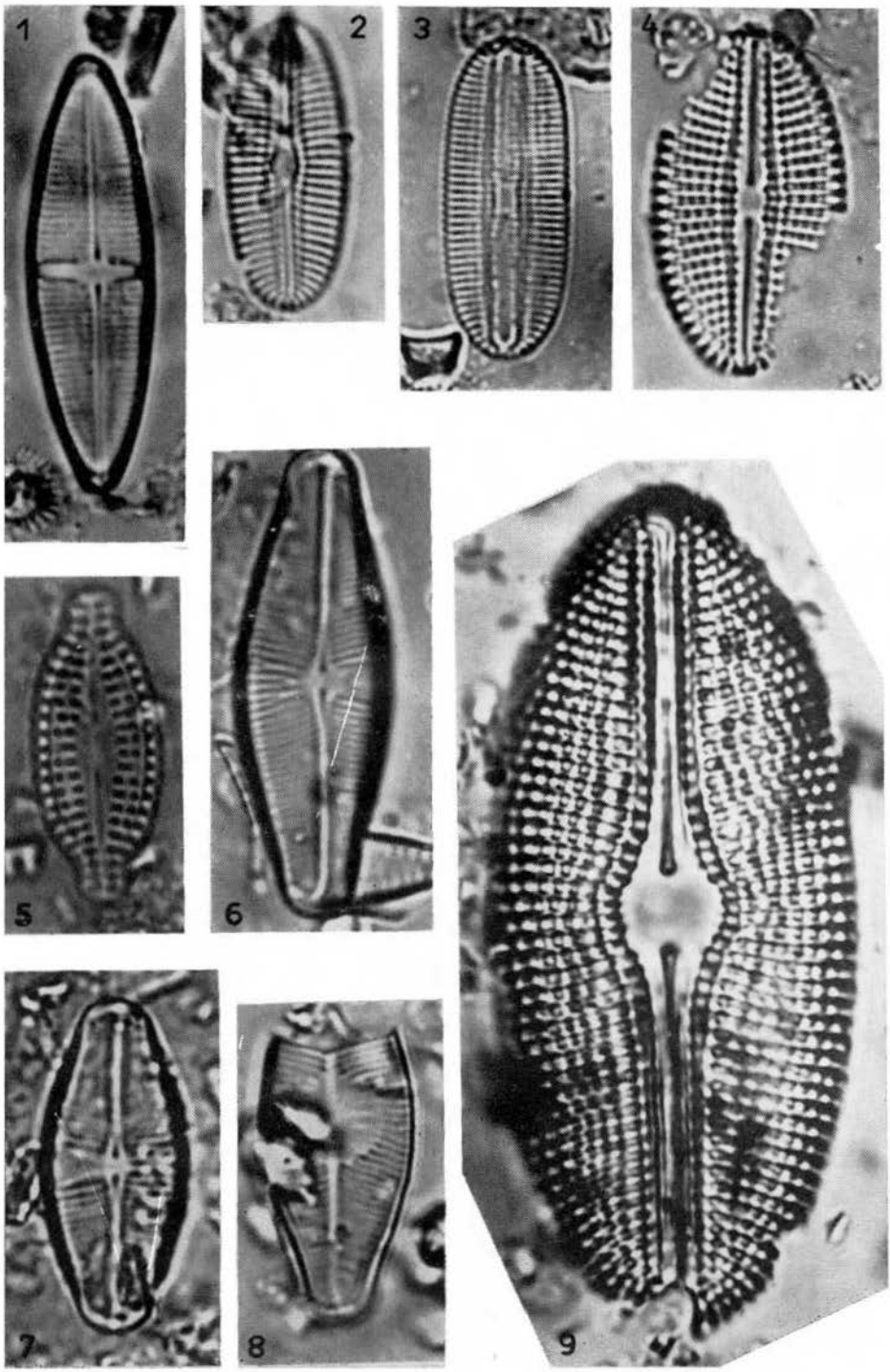

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Plate XI

Tablica XI

1. *Diploneis ovalis*
2. *D. pseudovalis*
3. *Stauroneis legumen*
4. *Diploneis pseudovalis*
5. *Stauroneis smithii*
6. *S. smithii* var. *sagitta*
7. *S. laurenburgiana*

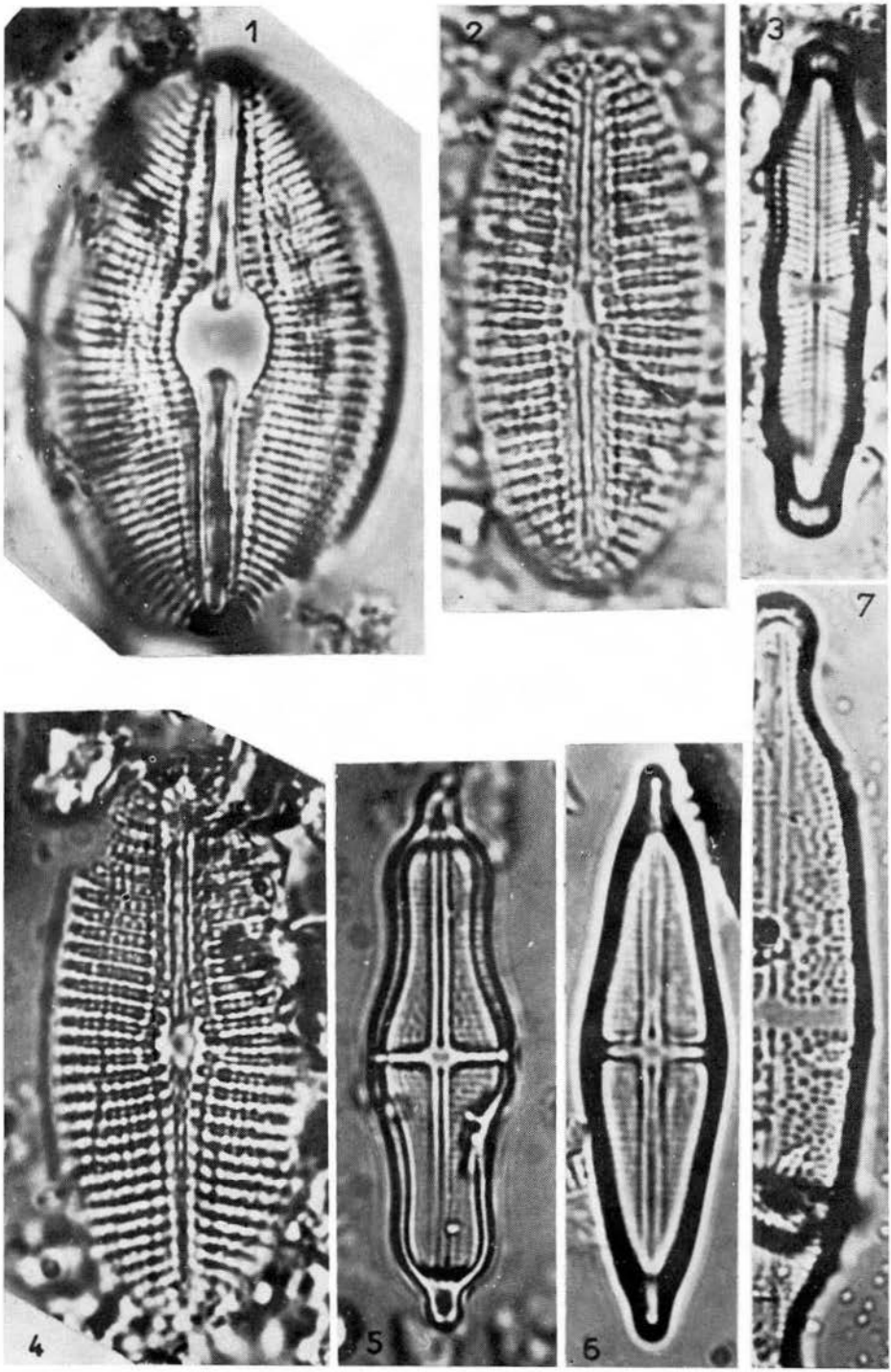
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Plate XII

Tablica XII

1. *Stauroneis laurenburgiana*
2. *S. anceps* fo. *gracilis*
3. *S. anceps* fo. *gracilis*; untypical valve
4. *Navicula cincta*
5. *N. clementoides*?
6. *N. cocconeiformis*
7. *N. grimmei*

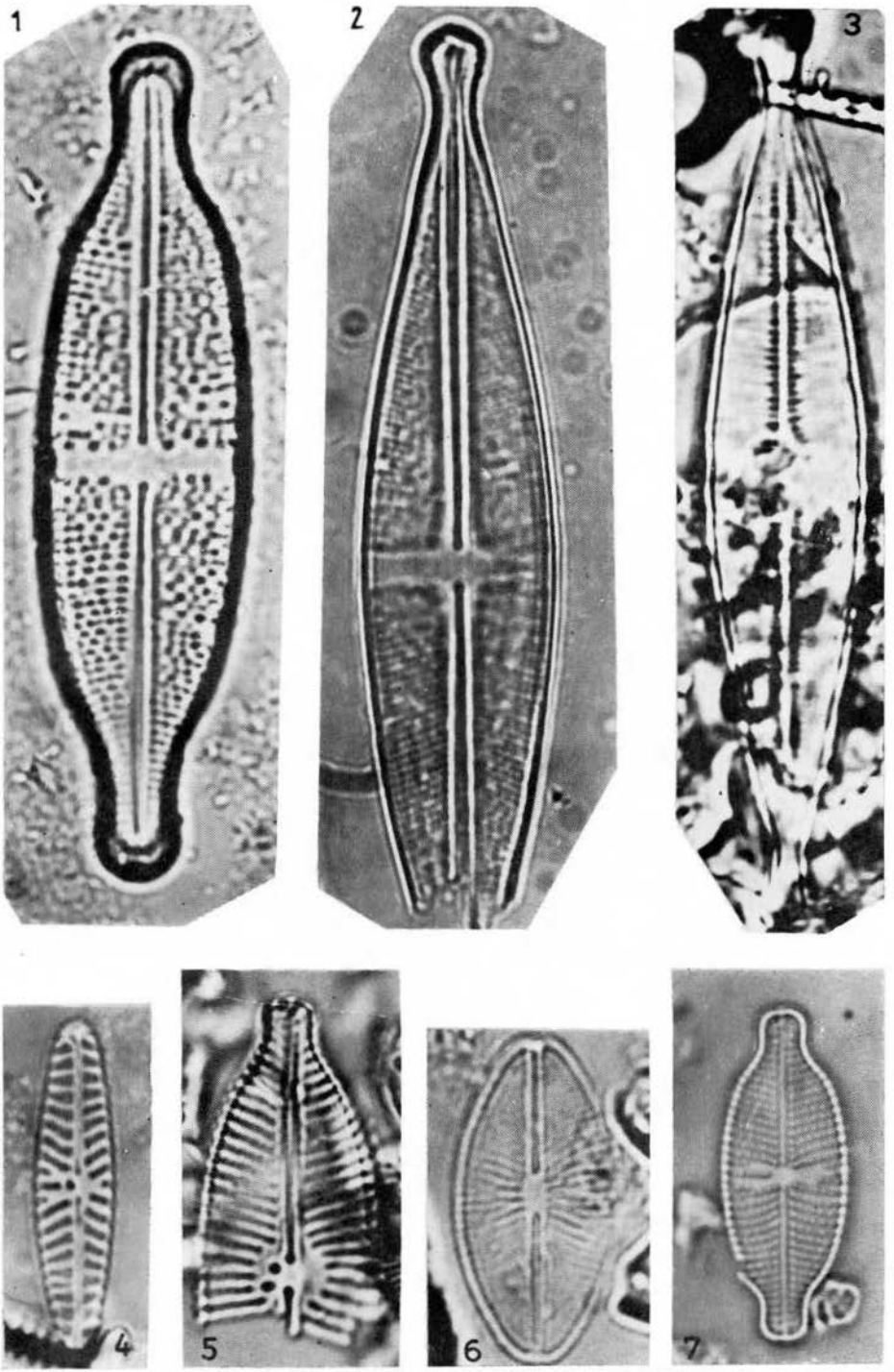
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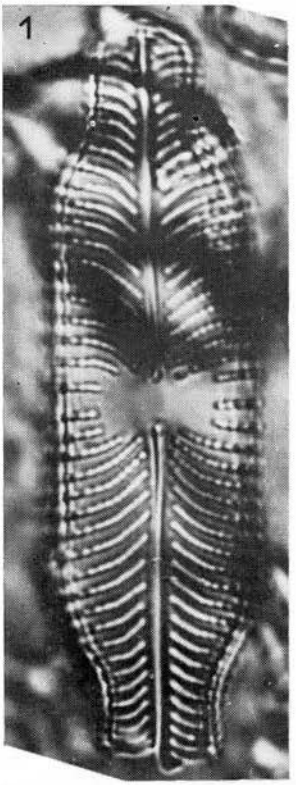
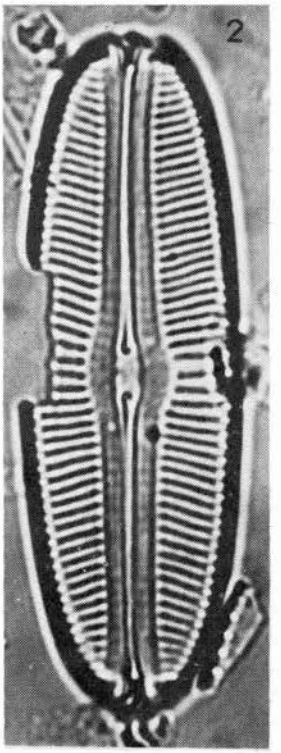
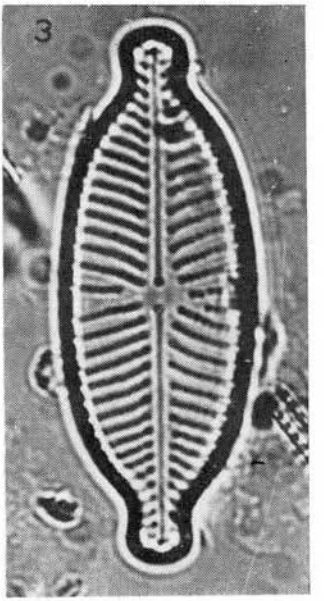
Plate XIII

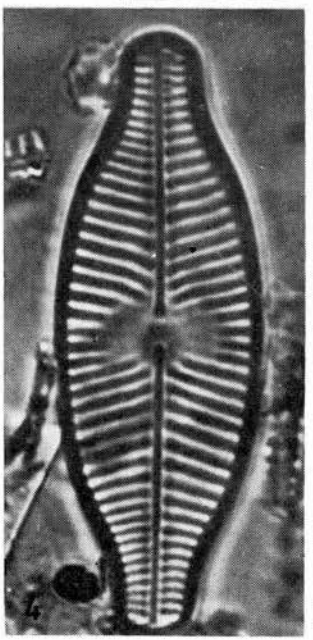
Tablica XIII

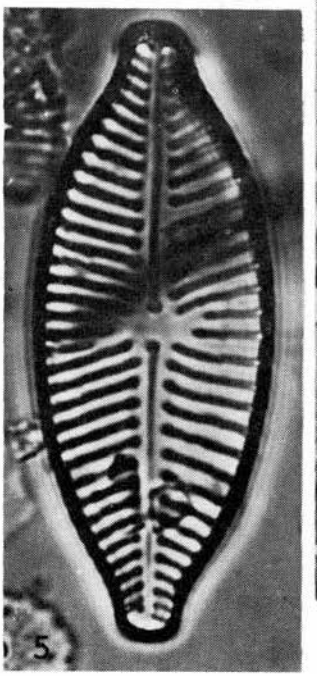
1. *Navicula abiscoensis*
2. *N. americana*
3. *N. anglica*
4. *N. explanata*
5. *N. anglica* var. *subsalsa*
6. *N. anglica* var. *signata*











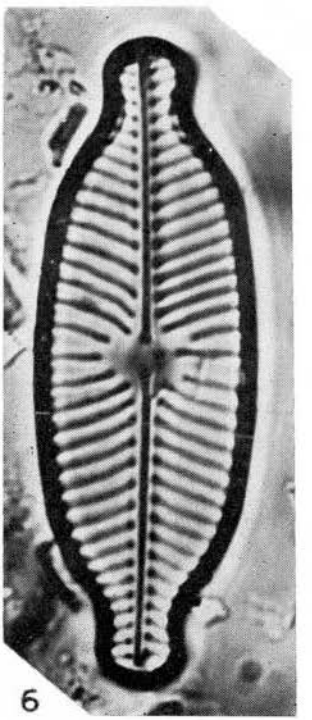


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Plate XIV

Tablica XIV

1, 2. *Navicula anglica* var. *subsalsa*
3. *N. cryptocephala* var. *veneta*
4. *N. contenta*
5. *N. jaernefetii*
6. *N. dicephala* var. *neglecta*
7. *N. exiguiformis*
8. *N. globosa*
9. *N. contenta* fo. *biceps*
10. *N. cuspidata* var. *heribaudi*; × 1000

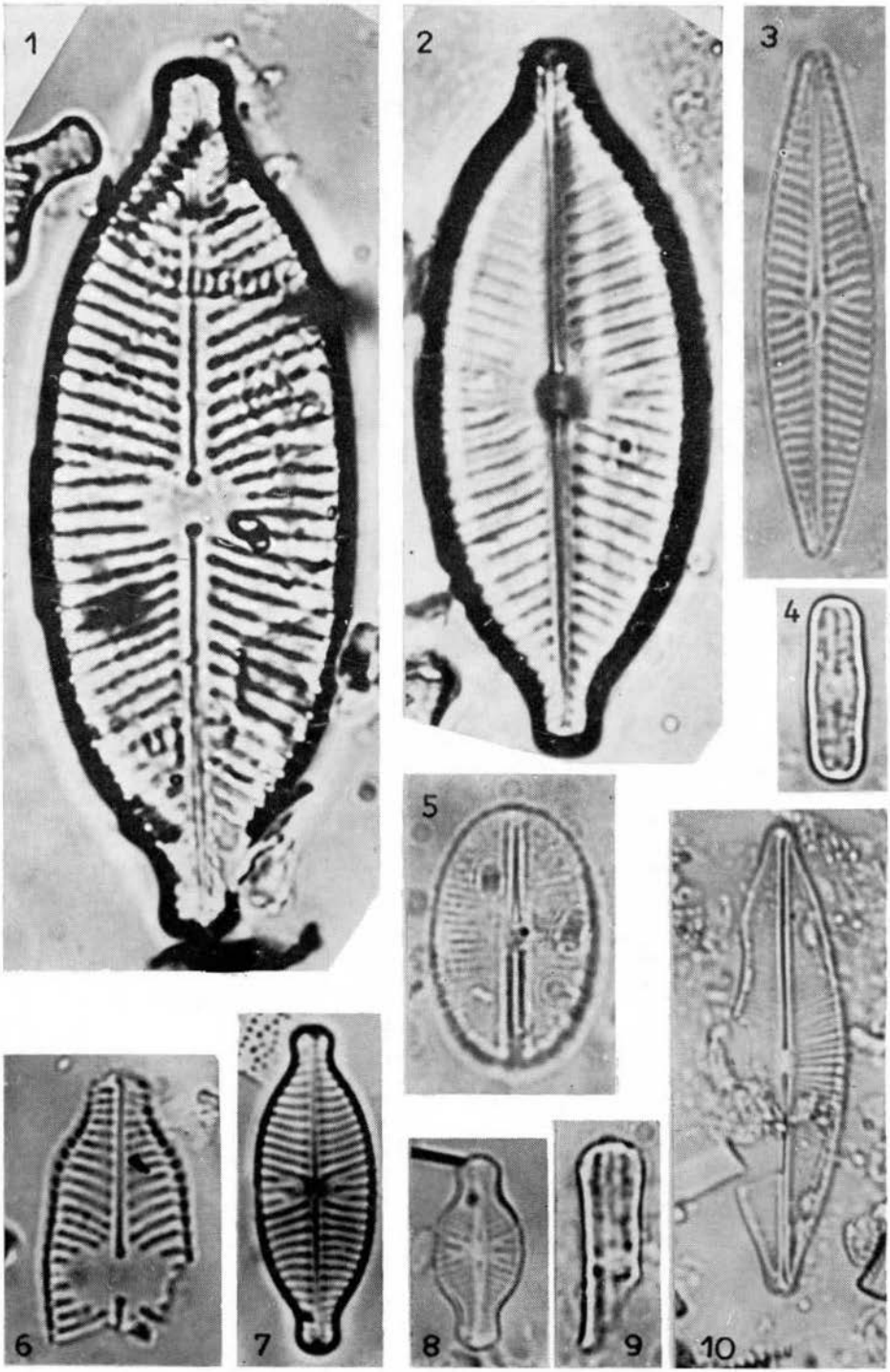

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Plate XV

Tablica XV

1. *Navicula cuspidata*; the apices of the craticular plate
2. *N. cuspidata* var. *ambigua*; craticular plate; × 1000
3. *N. menisculus*
4. *N. ignota*
5. *N. cryptocephala* var. cf. *veneta*
6. *N. dicephala*
7. *N. graciloides*
8. *N. graciloides* var.?

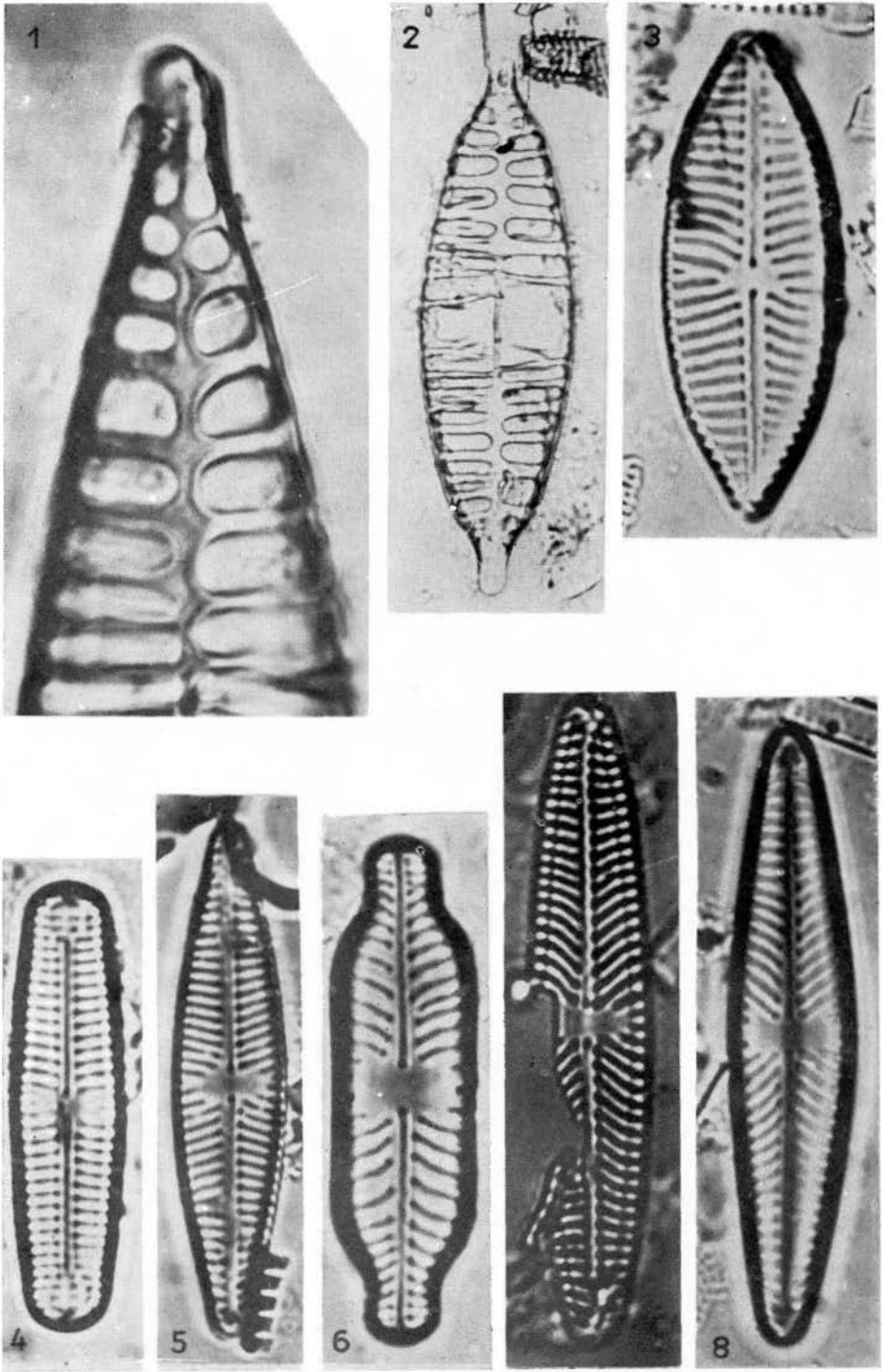
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Plate XVI

Tablica XVI

1. *Navicula dicephala*
2. *N. graciloides*
3. *N. cryptocephala* var. cf. *veneta*
4. *N.* cf. *limatoides*
5. *N.* cf. *laterostrata*
6. *N. interglacialis*
7. *N. mutica* var. *gibbuta*
8. *N. muraliformis*
9. *N. disjuncta*
10. *N.* cf. *laterostrata*
11. *N. interglacialis*
12. *N. seminuloides*
13. *N. rotunda*

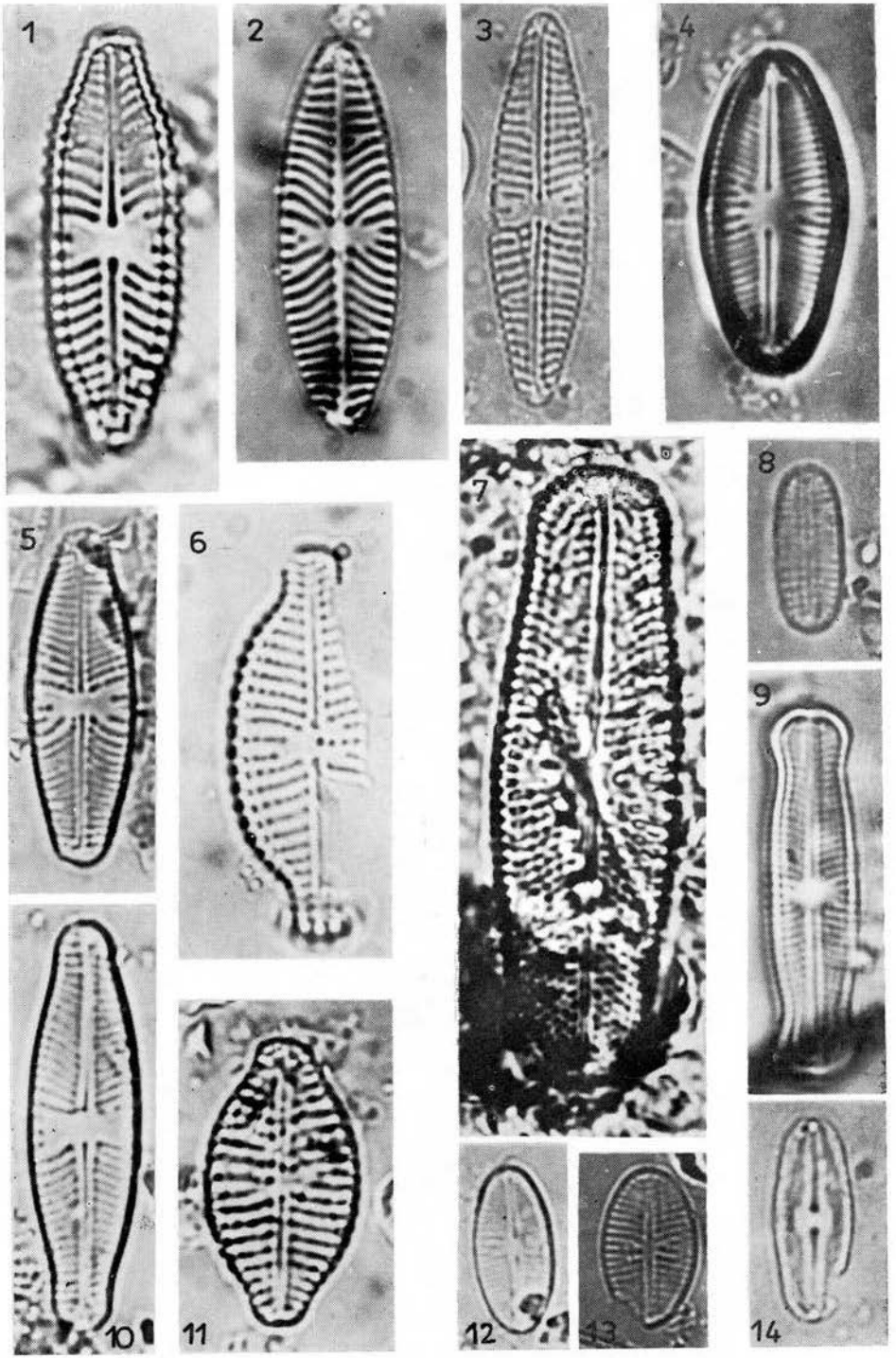
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Plate XVII

Tablica XVII

1. *Navicula* cf. *placentula*
2. *N. rhynhocephala*
3. *N. pupula* var. cf. *pseudopupula*
4. *N. pseudosilicula*
5. *N. menisculus*
6. *N. minimoides*?
7. *N. subrotundata*
8, 9. *N. vitabunda*

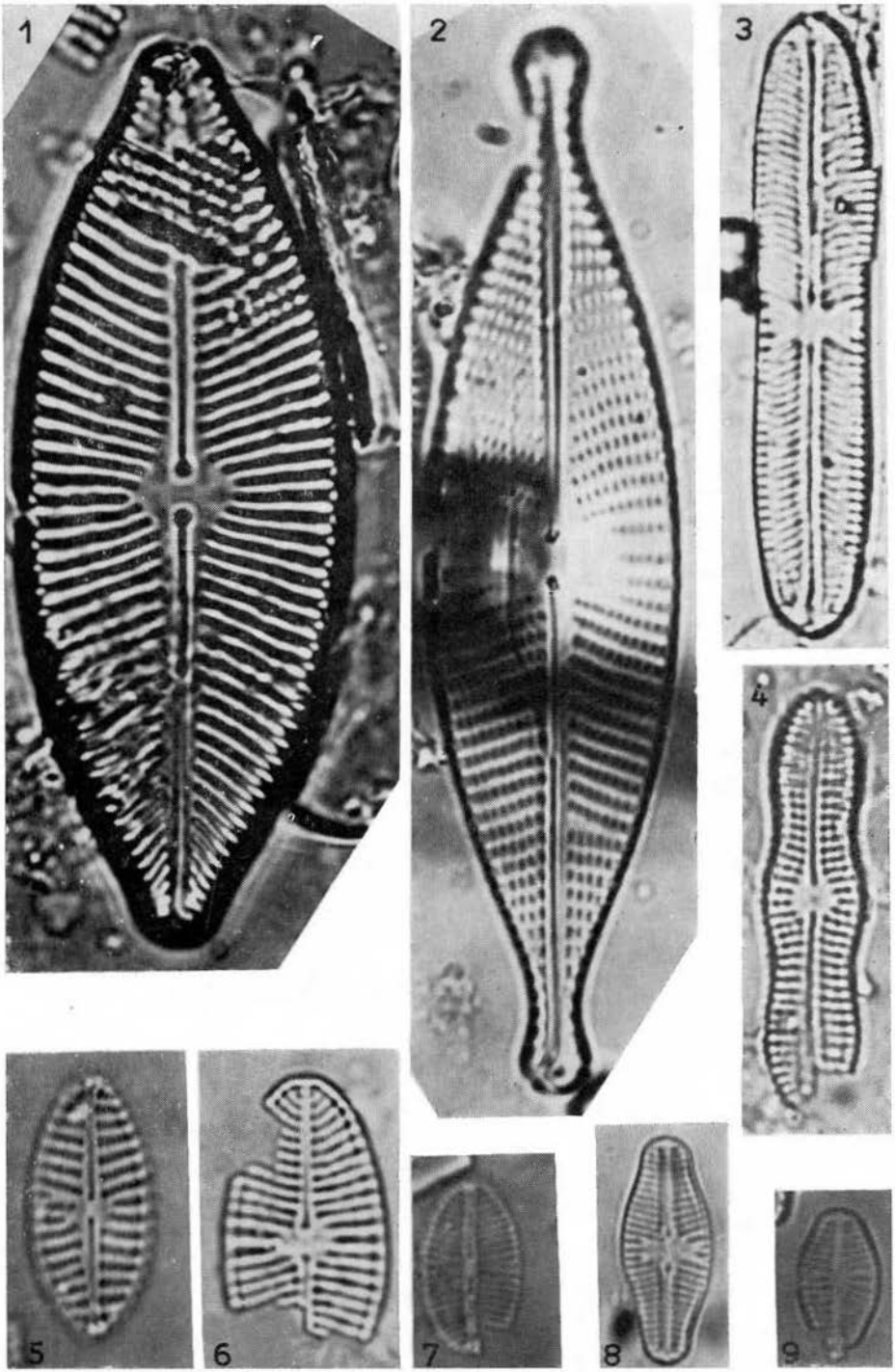
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Plate XVIII

Tablica XVIII

1. *Navicula* cf. *placentula*
2. *N.* cf. *pupula*
3. *N. rhynhocephala* var. *amphiceros*
4. *N. pseudoventralis*; × 3500
5. *N. seminulum* var. *radiosa*
6. *N. tuscula*; teratological valve; × 1000
7. *N. subocculata*
8. *N. subhamulata*
9. *N. vaucheriae*
10. *N. subbacillum*
11. *Navicula* sp. 4
12, 13. *Navicula* sp. 2
14. *Navicula* sp. 3

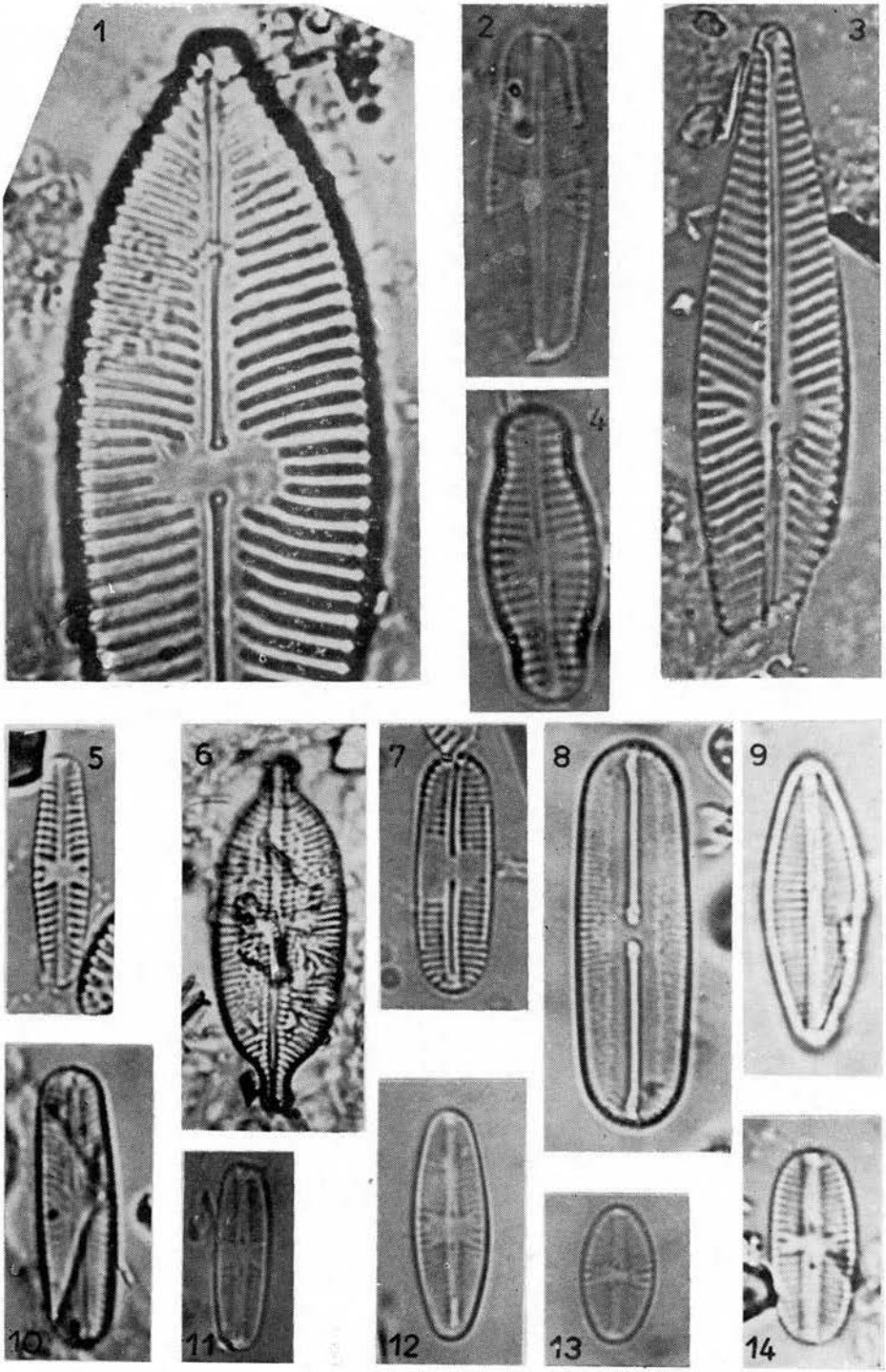
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Plate XIX

Tablica XIX

1. *Navicula* sp. 6
2. *Pinnularia pulchra*
3. *Navicula* sp. 6
4. *Pinnularia intermedia*
5. *P. cardinalis*; × 500
6, 7. *Navicula* sp. 5
8. *Pinnularia nobilis*; × 500
9. *P. lagerstedtii*

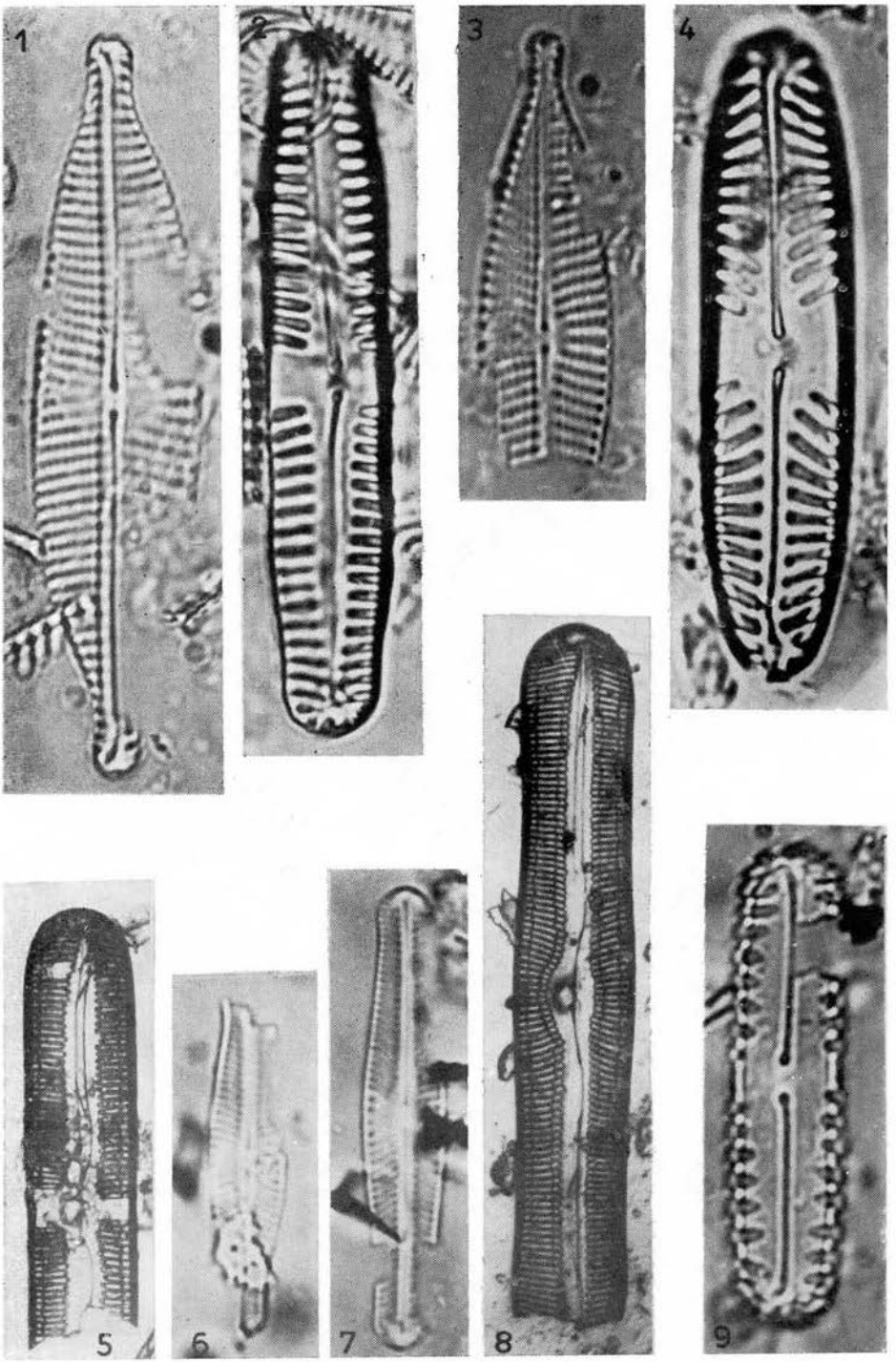
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Plate XX

Tablica XX

1. *Navicula wittrockii* var. *fennica*
2. *N. vulpina*; × 1000
3. *Pinnularia molaris*
4. *P.* cf. *microstauron*
5. *P. lagerstedtii*
6. *P. legumen*; × 1000
7. *Navicula* sp. 1
8. *Pinnularia brevicostata*; × 1000
9. *Navicula tuscula* fo. *minor*
10. *Navicula* sp. 2

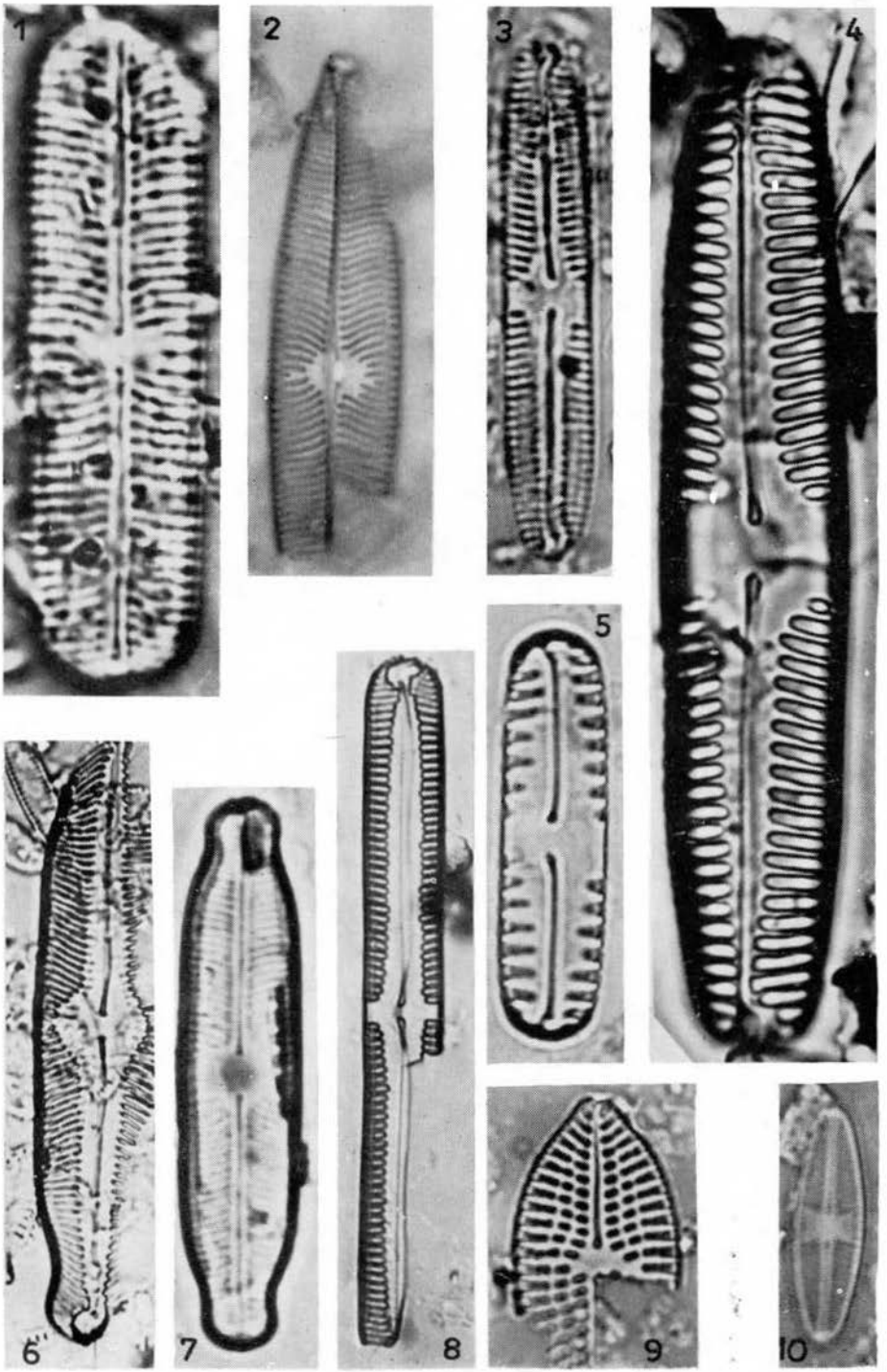
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Plate XXI

Tablica XXI

1. *Pinnularia viridis* var. cf. *leptogongyla*; × 1000
2. *Caloneis clevei*
3. *Pinnularia viridis* var. cf. *leptogongyla*; × 1000
4. *P. gentilis*; × 500
5. *P. viridis* var. *minor*; × 1000
6. *Caloneis bacillum* var. *fontinalis*
7. *Neidium amphirhynhus* var. *majus*; × 1000
8. *Caloneis bacillum*
9. *C. alpestris*
10. *C. amphisbaena*; × 1000

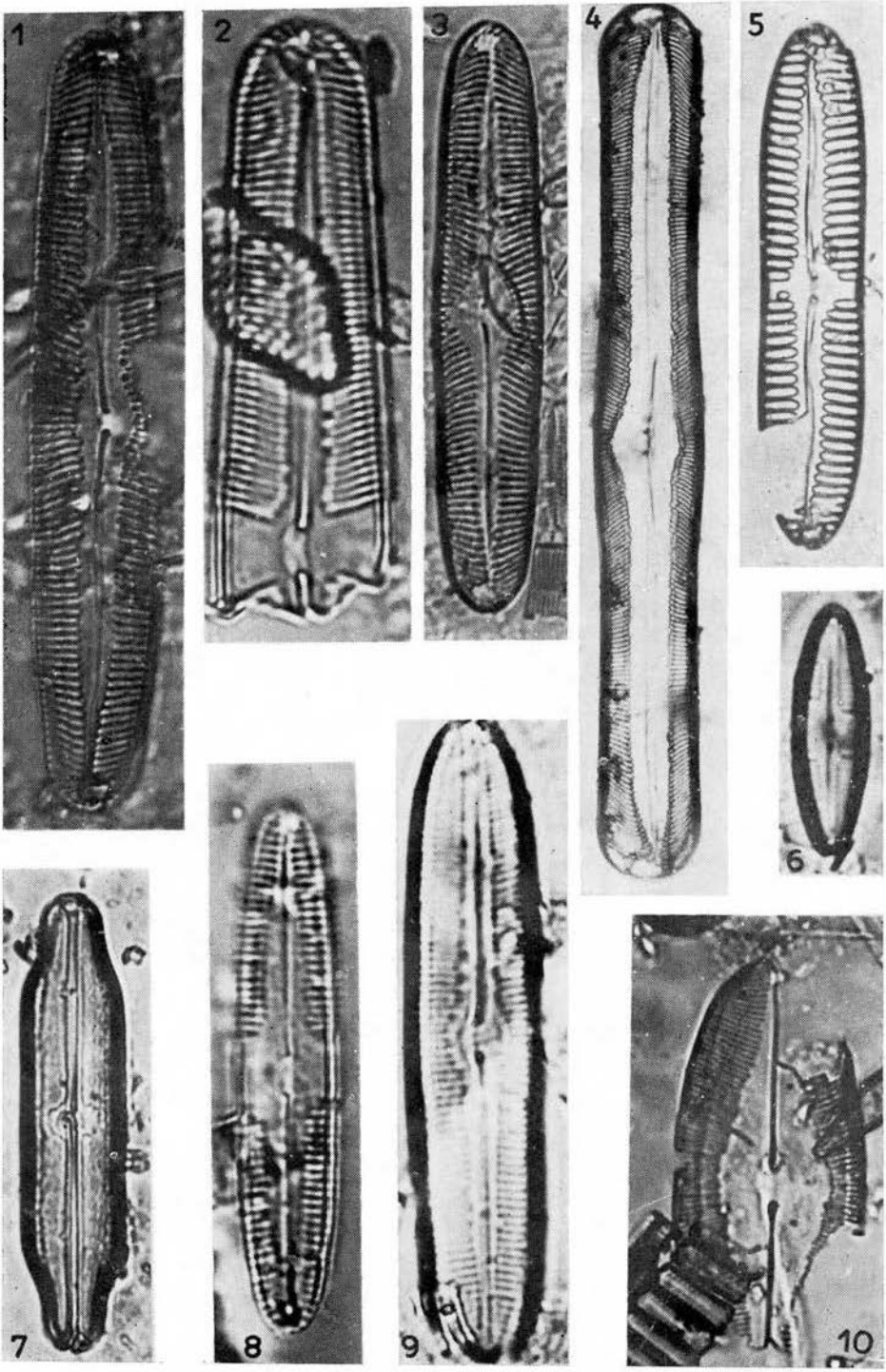
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Plate XXII

Tablica XXII

1. *Pinnularia pulchra*
2. *P. subcapitata*
3, 4. *P. viridis* var. *comutata*
5. *Neidium binodis*
6. *Pinnularia streptoraphe*; × 500
7. *P. appendiculata*
8. *P. viridis* var. *elliptica*; × 1000
9. *Caloneis bacillum* var. *fontinalis*

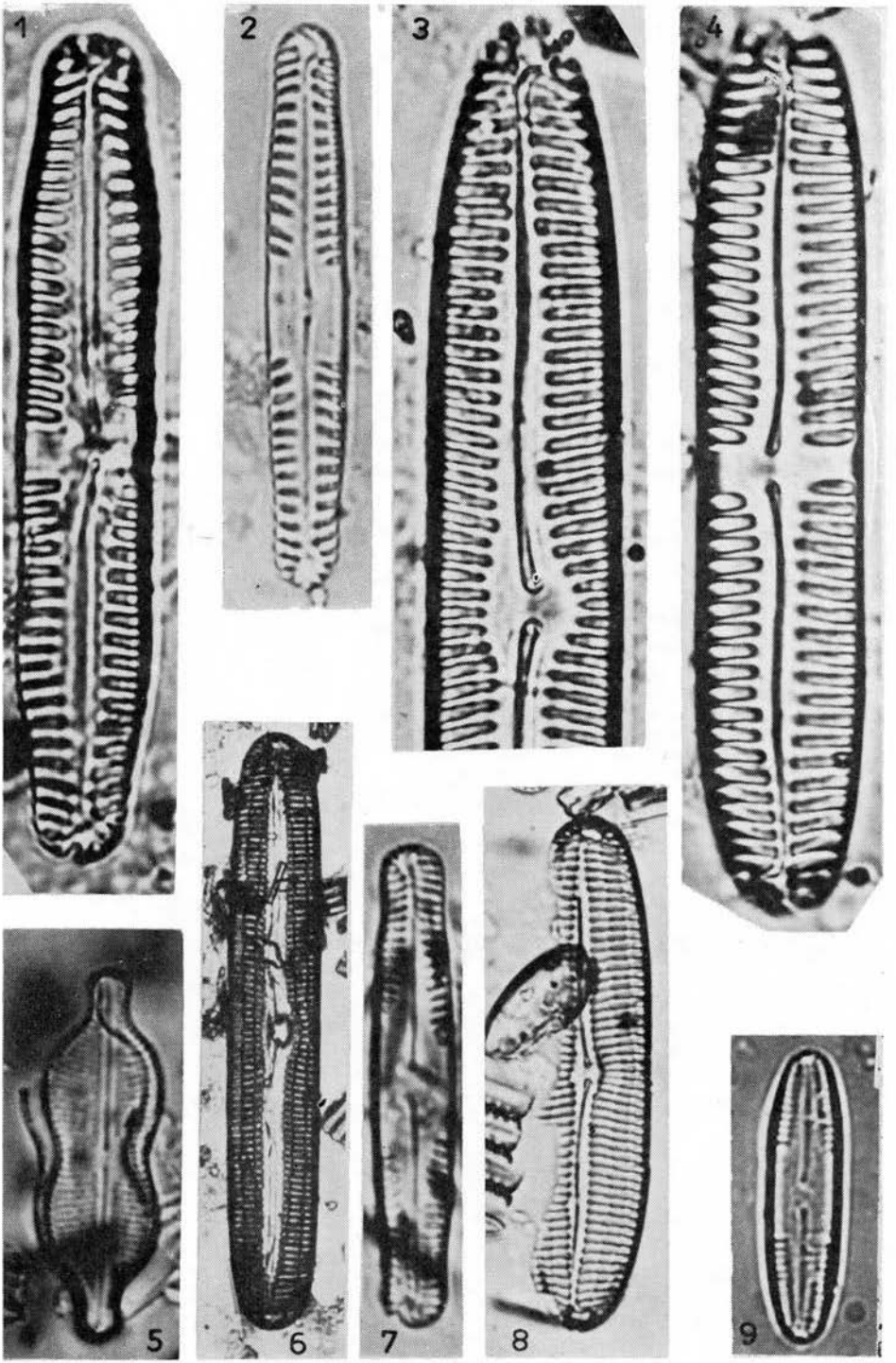

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Plate XXIII

Tablica XXIII

1. *Neidium amphirhynhus* var. *undulatum*
2. *N. affine* fo. *hercynica*
3. *N. distincte-punctatum*
4. *N. dubium* fo. *constricta*; × 1000
5, 6, 7. *Cymbella diluviana*

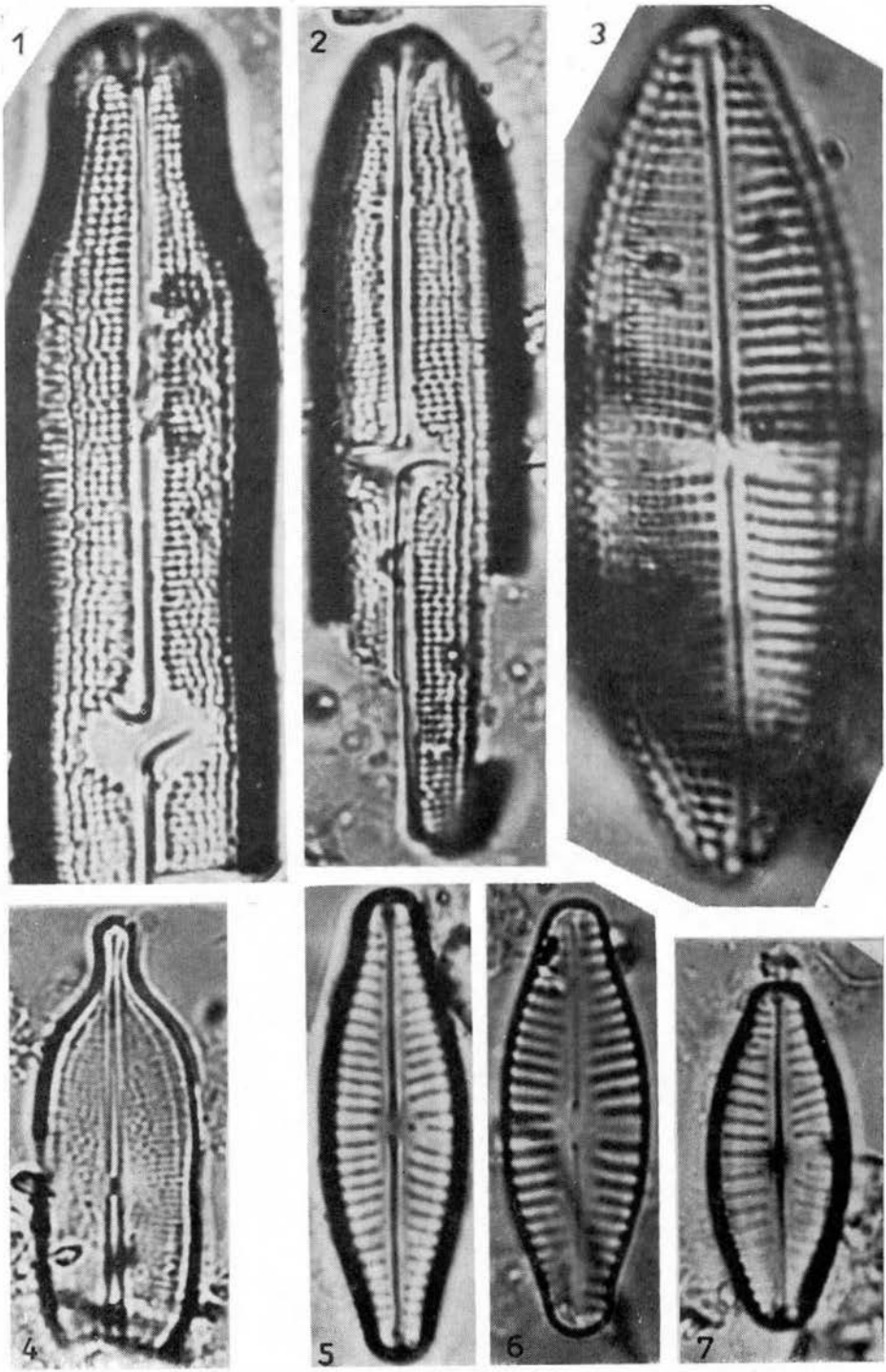
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Plate XXIV

Tablica XXIV

1. *Amphora fonticola*
2. *Cymbella aequalis*
3. *C. prostrata*
4. *C. cesatii*
5. *C. thumensis*
6. *Neidium bisulcatum* var. *lineare*
7. *Cymbella aequalis*
8. *Amphora fonticola*

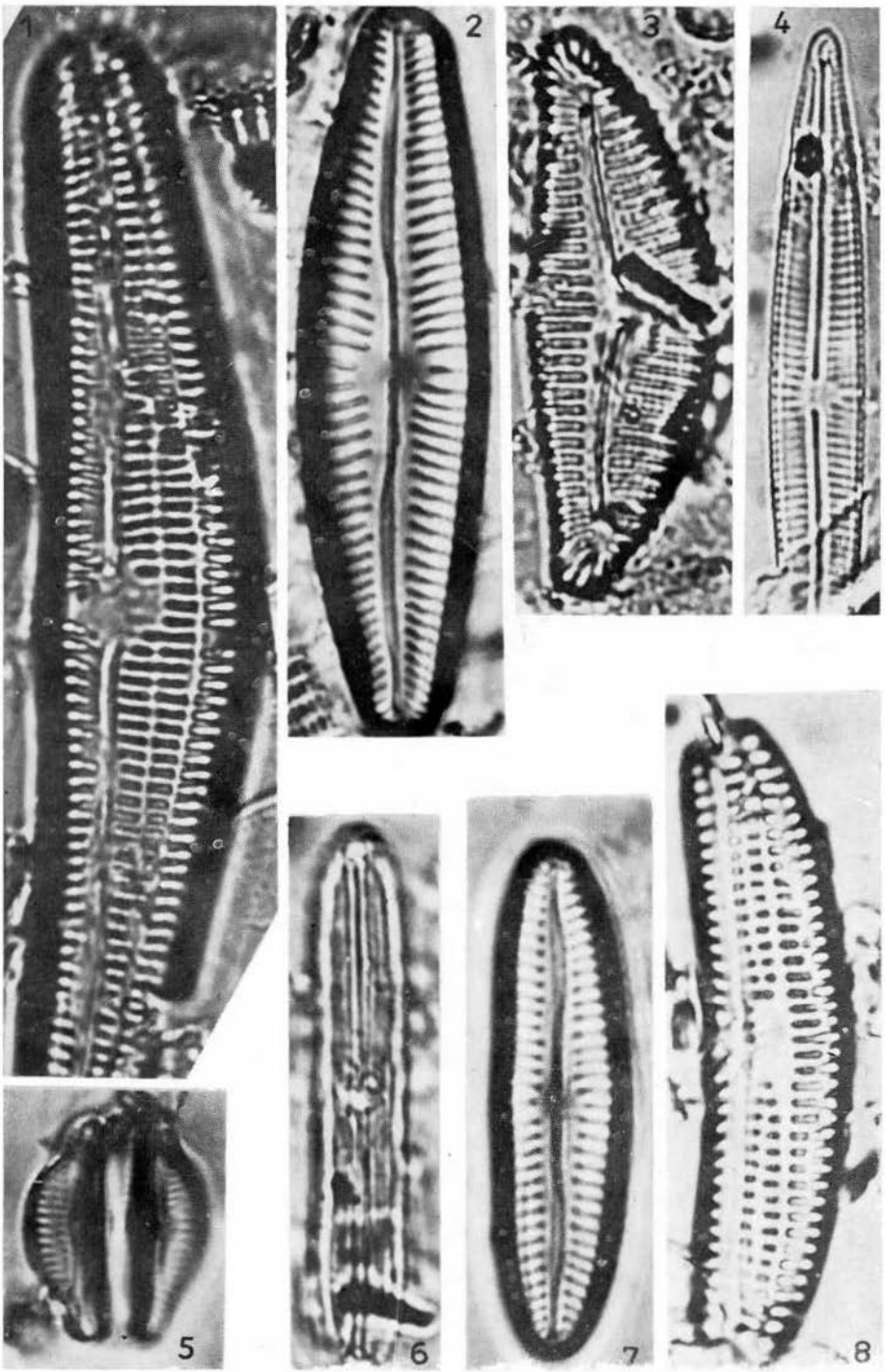
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Plate XXV

Tablica XXV

1. *Cymbella affinis*
2. *C. cymbiformis* var. *unipunctata*; × 1000
3. *C. thumensis*
4. *Gomphonema acuminatum*
5. *Nitzschia angustata*; × 1000
6. *Cymbella amphicephala* var. *intermedia*
7. *C. thumensis*
8. 9. *C. tumidula*
10. *C. thumensis*

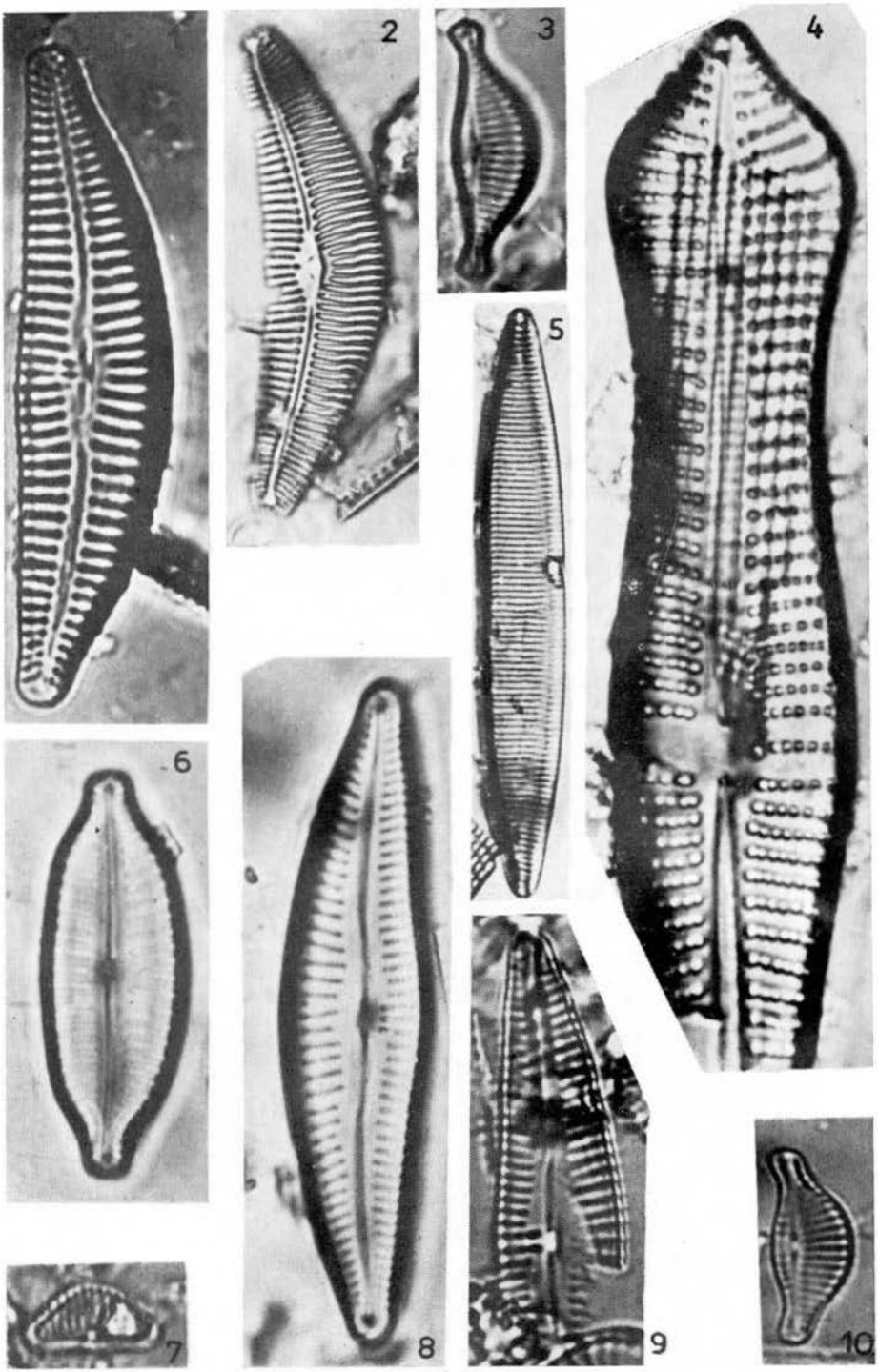

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Plate XXVI

Tablica XXVI

1. *Gomphonema acuminatum* var. *pantocsekii*
2. *Cymbella hustedtii*
3. *Gomphonema acuminatum* var. *elongatum*
4. *G.* cf. *augur*
5. *G. acuminatum* var. *turris*; × 1000
6. *G.* cf. *augur*
7. *Epithemia intermedia*
8. *Gomphonema* cf. *augur*

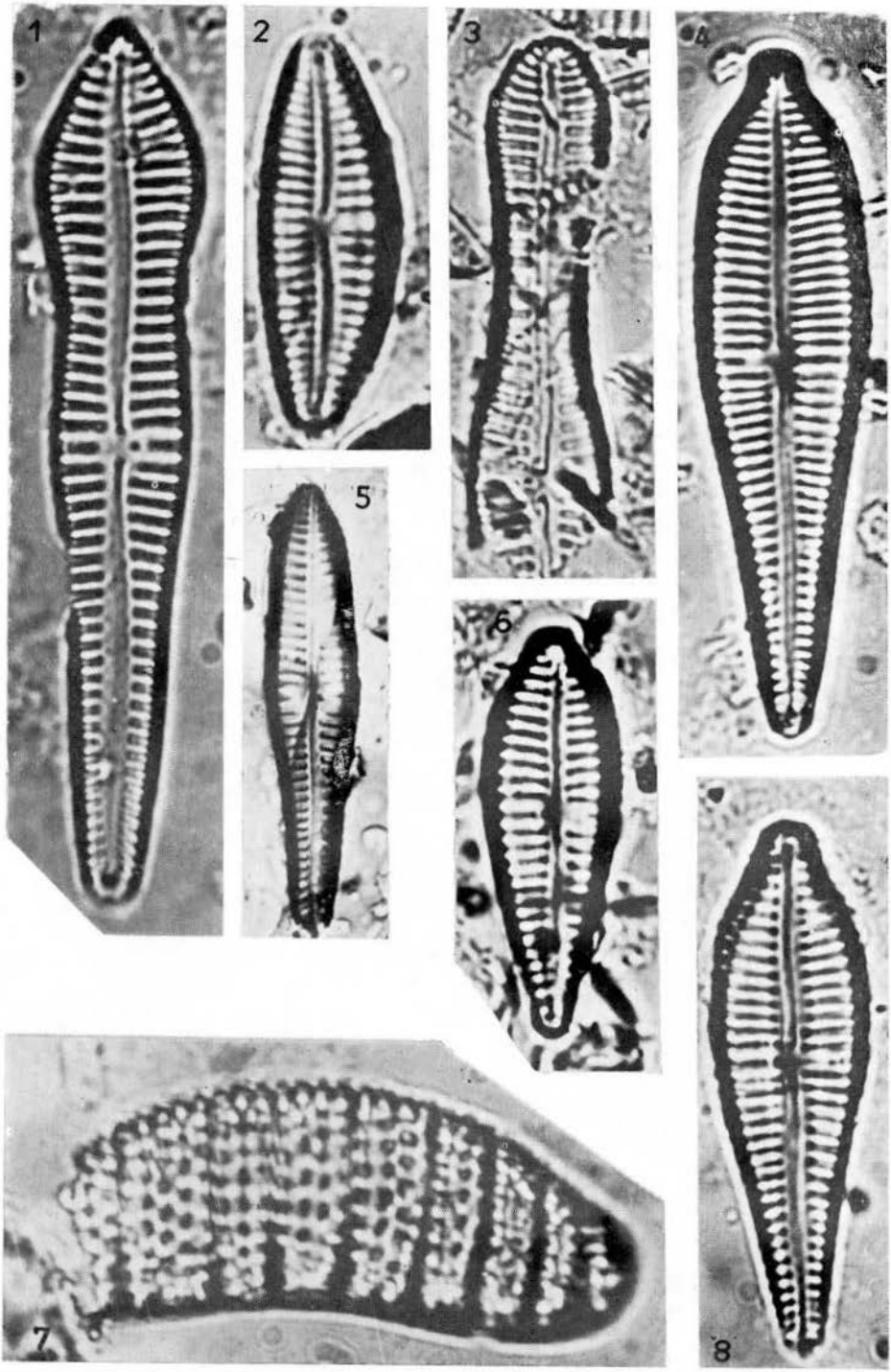

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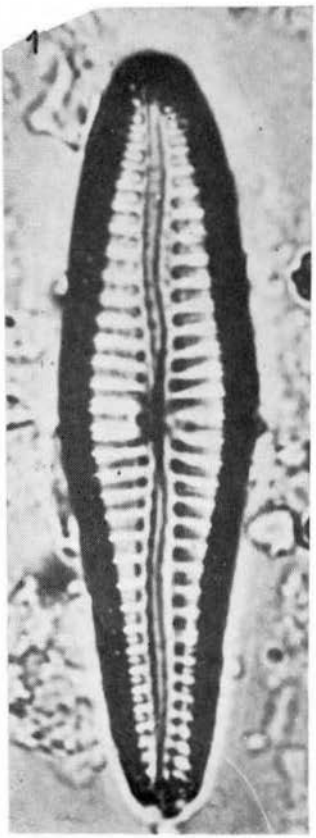
Plate XXVII

Tablica XXVII

1. *Gomphonema lanceolatum*
2. *G. sphaerophorum*
3. *G. ventricosum*
4. *Surirella* cf. *turgida*
5. *Nitzschia* sp. 1
6. *Epithemia tugida*; × 1000
7. *Gomphonema clevei*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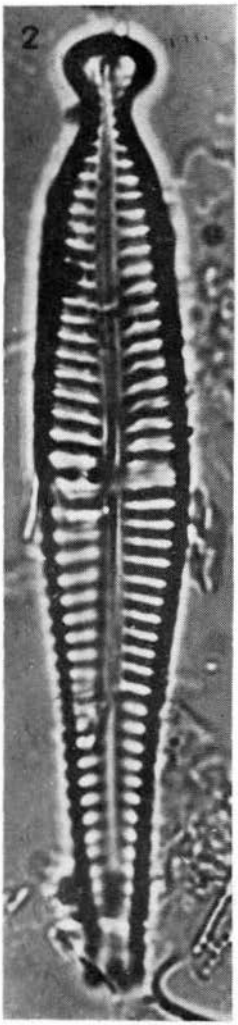
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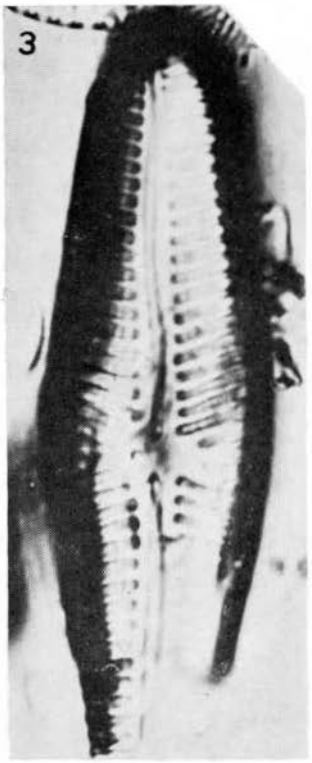
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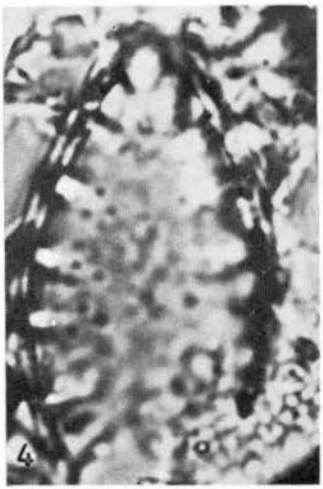
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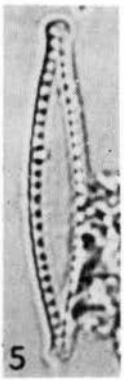
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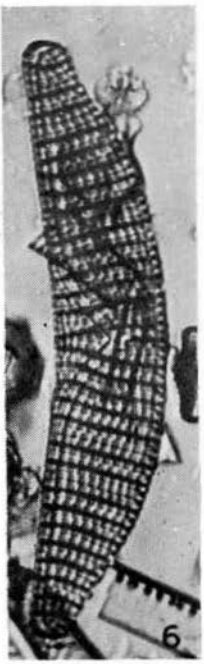
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Plate XXVIII

Tablica XXVIII

1. *Epithemia argus* var. *capitata*
2, 3. *Nitzschia heufleriana* var.?; × 1000
4. *N. parvula* fo. *terricola*
5. *Rhopalodia parallela*
6. *Cymbella sinuata* fo. *ovata*
7. *Nitzschia* sp. 2
8. *Epithemia muelleri*; × 1000

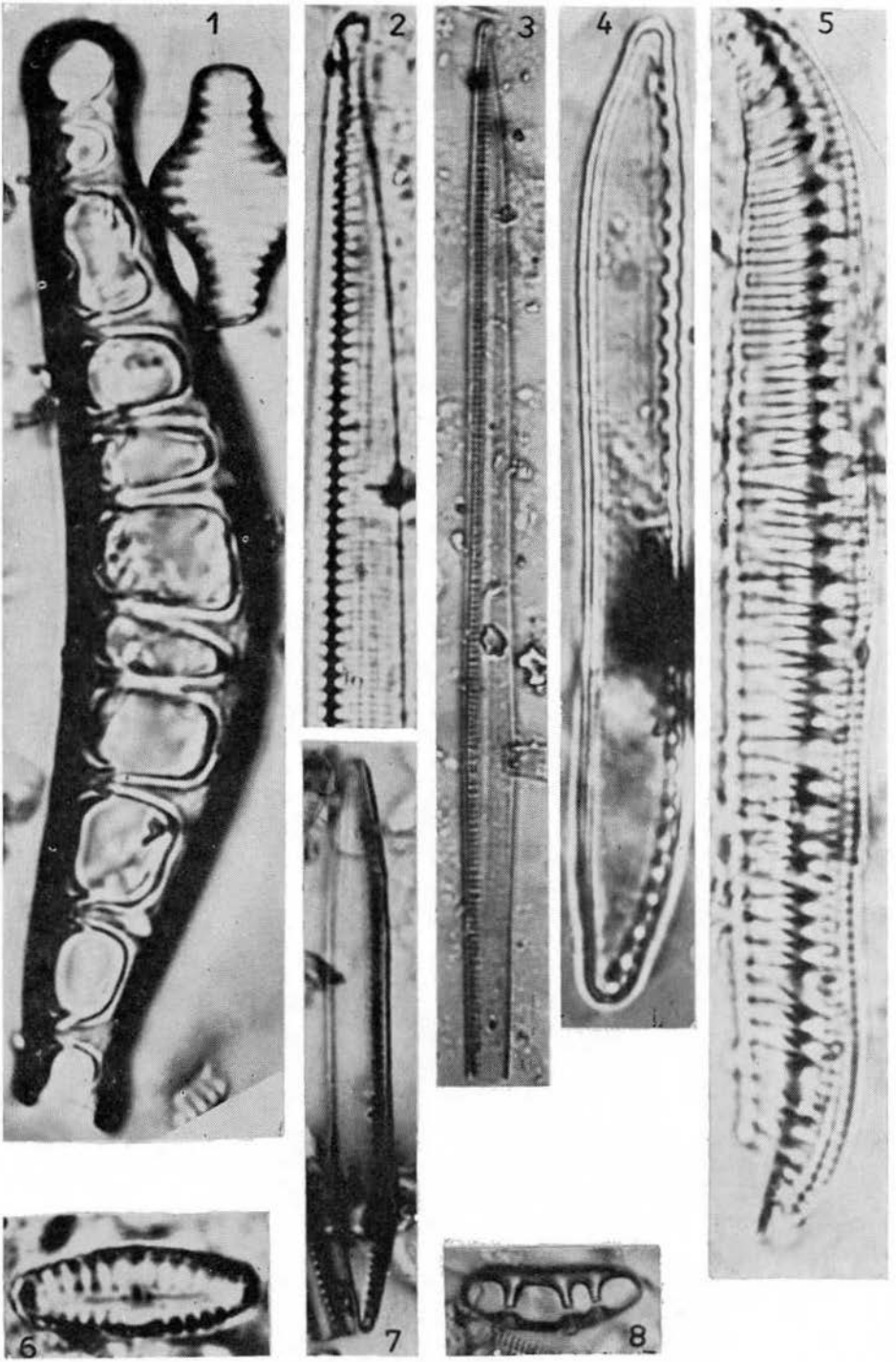

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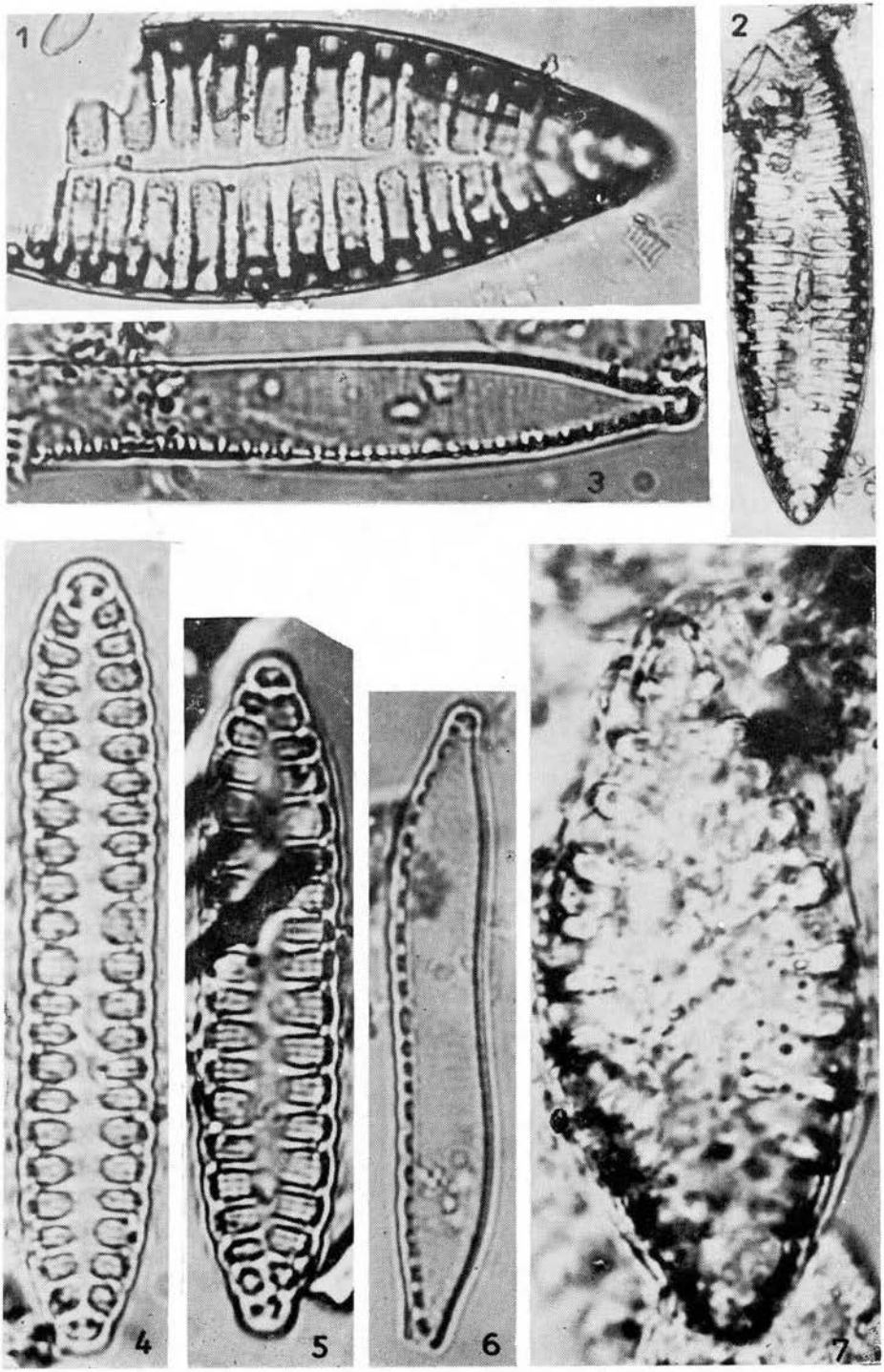
Plate XXIX

Tablica XXIX

1. *Surirella biseriata* fo. *punctata*; × 1000
2. *S. biseriata*; × 500
3. *Nitzschia thermalis* var. *minor*
4, 5. *Surirella* sp.
6. *Nitzschia parvula*
7. *Surirella* cf. *turgida*



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