

Diatoms from the Hida Mountain Range in the Japan Alps

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The Hida Mountain Range consisting of the North and the Central Japan Alps is situated at the central part of Honshu Island of Japan. This mountain range is about 100 kilometres long from south to north and about 40 kilometres in width. The peaks over 2,000 metres in altitude are more than 80 in number, 11 of which reach over 3,000 metres in altitude. The highest, Mt. Okuhodaka-dake, is 3,190 metres above sea level. The Kurobe-gawa River and the Takase-gawa River, the upper streams of the Shinano-gawa River, both known as two of the largest streams in this area, divide the range into several mountain groups.

The climate is rigorous and during the period from October to May, these mountains are usually covered with much snow. Perpetual snow is found in the shaded slopes of the valleys of the high altitude area.

There are many swamps, sphagnum-moors and bogs fed by cold water from the melting snow there, and also there are a lot of small alpine lakes and ponds in the high altitude area of Mt. Norikura-dake (alt. 3,026 m), Shirouma-dake (alt. 2,933 m), and some other high mountains.

The freshwater algal flora and the phytoplanktons are rather poorly found in these alpine lakes in the Japan Alps. The author collected the microscopic algal samples in the area several times during the years from 1942 to 1944 (chiefly the summer materials). Only the desmids found in the samples were already reported in the author's previous article (HIRANO, 1953). The floristic and taxonomic descriptions of diatoms from the samples of the Hida Mountain Range will be given below.

The Japan Alps, covering the high mountainous ranges in the central part of Japan, was named by an English missionary and alpinist, Walter WESTON (1861-1940), who was one of the pioneers of this beautiful area. It is characteristic of its typical alpine forest of the temperate zone in the Japanese Islands. Although the author's diatom materials from the area is somewhat limited, the study of these materials may certainly contribute to the comparative study and chorological analysis of the alpine diatom flora in the various parts of Japan.

The diatom materials described in the present paper were collected mainly from the alpine ponds and bogs in the sphagnum-moors and the lake-sides of many alpine lakes located at the elevation of over 2,000 metres line. In the area surveyed, most of the diatom localities are found in the creeping pine (*Pinus pumila*) zone of the mountain ridge (the lowest distribution line of *Pinus pumila* in the Japan Alps is about 2,000 m in altitude). In the vicinity of the source of the Kurobe-gawa River, however, the

alpine diatom localities are found in the field of alpine flowers surrounded by the coniferous tree forests. Usually, there is no direct connection of water between the alpine sphagnum-moors and the source of the rivers or streams.

As was already pointed out by several diatomists, the diatom flora of sphagnum-moors in Japan consists of the limnophilous species such as the members of the genera *Eunotia* and *Pinnularia*, which are the dominant components of the diatom flora of the area. A number of the species of the genera *Neidium*, *Cymbella* and *Gomphonema* are also common in the alpine region of the Japan Alps, but their distribution range, particularly that of the latter two, is rather limited.

The alpine diatom flora in the Japan Alps is quite different from that of the low-land areas in the Japanese areas, and is characterized by the northern and alpine species as already reported by some European diatomists.

The common species of diatom found in the author's materials are as follows:

Eunotia Meisteri and var. *bidens*, *E. perpusilla* var. *tridentata*, **E. parallela*, *E. polydentula* var. *monodon*, *E. praeminor* var. *polaris*, *E. praemonos* var. *musciicola*, **E. triodon*, *E. crista-galli*, **E. robusta* var. *diadema*, *Neidium perminutum*, *Caloneis fasciata*, *Pinnularia biceps* and var. *minor*, *P. Carlsoni*, *P. divergentissima*, *P. isostauron*, **P. islandica*, *P. stauroptera* var. *minuta*, *P. subcapitata* var. *lapponica*, *P. streptoraphe*, *P. stomatophora*, *Cymbella alpina*, *C. heteropleura*, **C. hebridica*, *C. microcephala* forma *minor*, *C. perpusilla*, *Surirella lapponica*.

The species with an asterisk in the list are also found in the alpine sphagnum-moors of the Mts. Daisetsu-zan area in the central part of Hokkaido, North Japan (HIRANO and IWAKI, 1970). Some of these widely distributed, alpine species are also recorded from the Shiretoko Peninsula in the north-eastern part of Hokkaido (FUKUSHIMA & KISHIMOTO, 1968).

Localities

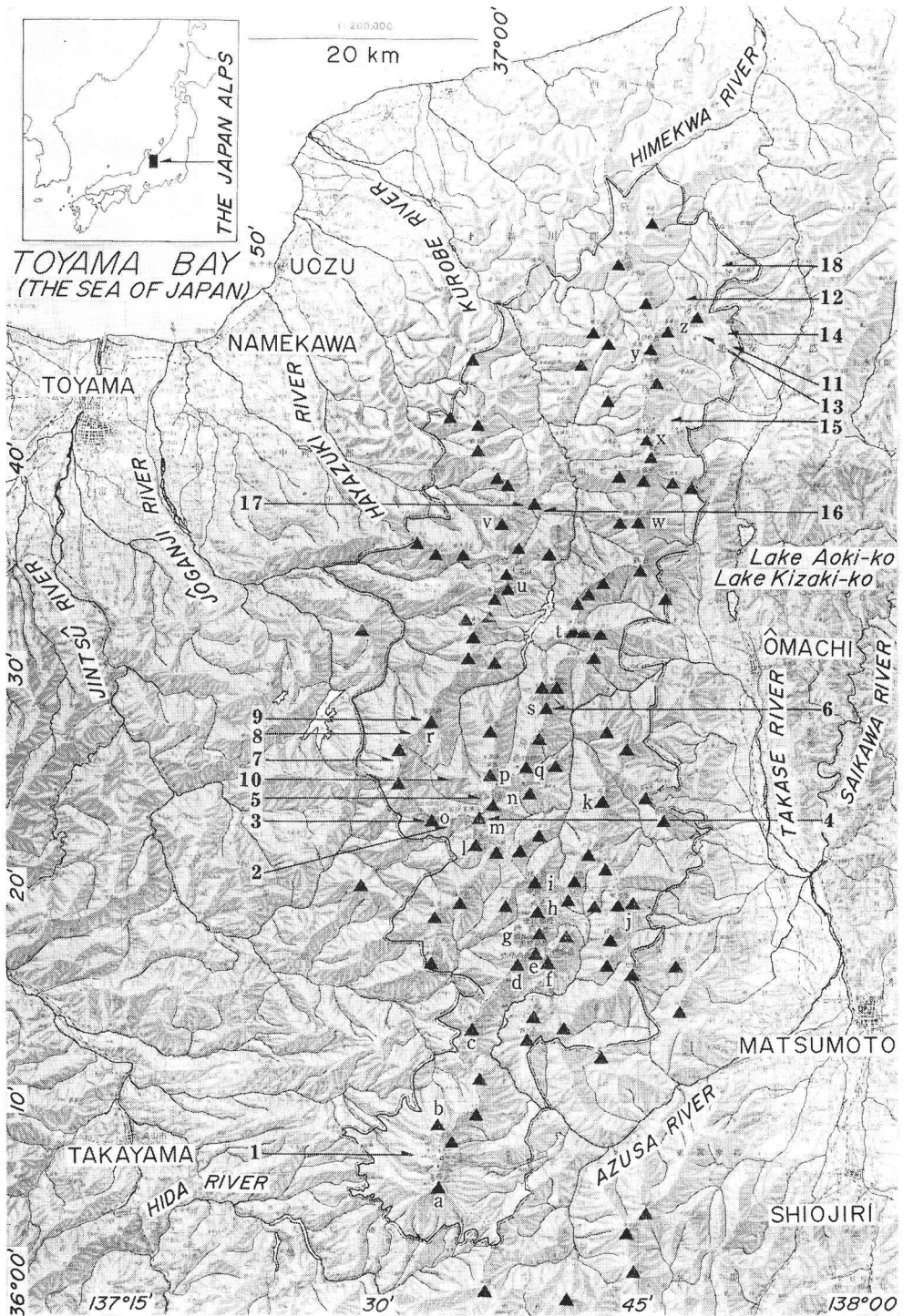
Eighteen stations surveyed are shown in the map of Figure 1.

1. Ponds in Mt. Norikura-dake. Mt. Norikura-dake is an extinct volcano

Fig. 1. Map of the Hida Mountains (the Japan Alps) showing the stations surveyed. The area surrounded by the curved double lines (heavy solid and thin broken lines) indicates the Chûbu Mountainous National Park. Solid triangles indicate the mountains over 2000 meters above sea level.

Stations, Nos. 1-18, see "Localities" in the text. The main peaks (a-z) and their altitudes are as follows:

a, Mts. Norikura-dake (3026 m); b, Mt. Ô-nyû-dake (2744 m); c, Mt. Yake-dake (2455 m); d, Mt. Nishi-hodaka-dake (2909 m); e, Mt. Oku-hodaka-dake (3190 m); f, Mt. Mac-hodaka-dake (3090 m); g, Mt. Karasawa-dake (3103 m); h, Mt. Kita-hodaka-dake; i, Mt. Yariga-dake (3180 m); j, Mt. Jônen-dake (2857 m); k, Mt. Tsubakuro-dake (2763 m); l, Mt. Sugoroku-dake (2860 m); m, Mt. Mitsumata-rengé-dake (2841 m); n, Mt. Washiu-dake (2924 m); o, Mt. Kurobe-gorô-dake (2840 m); p, Mt. Suishô-dake (2978 m); q, Mt. Noguchi-gorô-dake (2924 m); r, Mt. Yakushi-dake (2926 m); s, Mt. Eboshi-dake (2627 m); t, Mt. Harinoki-dake (2821 m); u, Mts. Tateyama (3015 m); v, Mt. Tsurugi-dake (3003 m); w, Mt. Kashima-yari-ga-dake (2890 m); x, Mt. Karamatsu-dake (2696 m); y, Mt. Shirouma-ga-dake (2933 m); z, Mt. Shirouma-norikura-ga-dake (2437 m).



located at the southern part of the Japan Alps (the North Japan Alps). This mountain includes several peaks (the highest peak, Mt. Ken-ga-mine, is 3,063.4 m in altitude). There are several alpine lakes such as Gongen-ike, Kame-ga-ike, Turuga-ike, Gono-ike and Ohniu-ike near the top of the mountain (alt. 2,700–3,000 m). The last one, Ohniu-ike, is located at the lowest position among the alpine lakes of Mt. Norikura-dake and is fed by a stream. The diatom material was collected from the surface of dead leaves in water by a scraping method.

2. Bogs in the Kurobe-goro-taira moor. Kurobe-goro-taira is a col (alt. 2,350 m) located between the ridges of Mt. Kurobe-goro-dake (alt. 2,849.6 m) and Mt. Mitsumata-reng-dake (alt. 2,841.2 m). There are many small bogs in the sphagnum-moors located in the col.

3. Pools in the cirque of Mt. Kurobe-goro-dake. This “Kar” is located at the eastern slope of Mt. Kurobe-goro-dake. There is a small pool fed by water from the melting snow (the source of the Goro-zawa Valley).

4. A pond at Mt. Mitsumata-reng-dake. This small pond (alt. 2,550 m) is located in the col between Mt. Mitsumata-reng-dake and Mt. Washiu-dake (alt. 2,924.2 m). The location is very near from the Mitsumata-reng hut.

5. The Kurobe-genryu-daira moor. Kurobe-genryu-daira is a slope located on the south-western slope of Mt. Jii-dake (alt. 2,821 m). The sphagnum-moor is found between the altitude range from 2,600 to 2,700 metres.

6. A pond at Mt. Eboshi-dake. This is a small alpine lake located near the top of Mt. Eboshi-dake (alt. 2,627 m).

7. Ponds and bogs in the Mt. Kami-no-take (also called Mt. Kitamata-dake) moor. Mt. Kami-no-take is a broad ridge (the highest peak, Mt. Kami-no-take, is 2,662 m in altitude). There are several ponds and many bogs of the sphagnum-moor in the place.

8. Bogs in the Tarobei-daira ridge. Tarobei-daira is a broad ridge of gentle slope (alt. 2,250 m) near Mt. Taro-yama (alt. 2,373 m). There are many small bogs in this place. No direct connection of water between each bog and running streams is found.

9. Bogs in Mt. Yakushi-dake (Alt. 2,926 m). Mt. Yakushi-dake is located between Mt. Kurobe-goro-dake and Mt. Tateyama (alt. 3,015 m). There are several small sphagnum-bogs on the southern slope of this mountain.

10. Bogs in the Kumono-taira plateau. Kumono-taira is a highland plateau located on the south ridge of Mt. Jii-dake. A lot of small sphagnum-bogs surrounded by the creeping pine and other alpine coniferous trees are found between the altitude range from 2,500 to 2,600 metres.

11. The Kami-no-ta moor of Mt. Shirouma-dake. Kamino-ta is a small sphagnum-moor located on the south-eastern slope of Mt. Shirouma-norikura-dake. There are several small bogs in the shape of terraces in this moor (alt. about 1,700 m).

12. Moor-bogs near Lake Shirouma-ô-ike. Lake Shirouma-ô-ike (alt. 2,379 m) is a typical alpine lake of the Japan Alps. It is located on the north-eastern ridge

of Mt. Shirouma-dake (alt. 2,933 m) and Mt. Shirouma-norikura-dake. A number of sphagnum-bogs are found near the shore of Lake Shirouma-ô-ike.

13. Bogs in the Tengu-no-hara plateau. Tengu-no-hara is a wide, east ridge or alpine plateau of Mt. Shirouma-norikura-dake. The altitude range is from 2,200 to 2,300 metres. There are many sphagnum-bogs in the place.

14. The highland moor in the vicinity of the Seijo University hut of Mt. Shirouma-dake. This is a rather small-sized moor and is located on the south-eastern slope of the Tengu-no-hara moor. The Kami-no-ta moor (No. 11) is located at the lower elevation of this moor. There are several small bogs surrounded by the coniferous trees in the place.

15. The highland moor of the Happo-one ridge. This is located at the eastern ridge or alpine slope of Mt. Karamatsu-dake (alt. 2,696.5 m). A lot of small bogs are found in the moor between the altitude range from 1,700 to 1,800 metres. Topographically, most of these bogs are located in the place of the gentle slopes of the ridges. Happo-ike Pond (alt. 2,100 m), a small alpine pond, is located at the highest part of this moor group.

16. Sen'nin-ike Pond. This is a typical alpine pond located on the east ridge of Mt. Sen'nin-yama (alt. 2,202 m). It is surrounded by the creeping pine trees. Sphagnums grow on the shore of this pond, but the alpine moor is not yet developed around it.

17. A pond of Ike-no-taira. This is a small alpine pond (alt. 2,000 m) located just below the Ike-no-taira hut. The area around this pond is a rather flat alpine grassland.

18. Kazafuki-kami-no-ta moor and Ô-ike Pond. Kazafuki-Ô-ike Pond is located in the wide pass or the alpine plateau surrounded by Mt. Kazafuki-Ô-dake (alt. 1780 m), Mt. Mae-yokokura-dake (alt. 1940 m) and Mt. Iwasuge-yama (alt. 1780 m). Its altitude is 1,778 metres. The Kazafuki-kami-no-ta moor contains a number of small bogs located near the pond.

Fam. Coscinodiscaceae

Melosira distans (EHRENB.) KÜTZ. in HUSTEDT, Krypt. Fl. 7, p. 262, f. 110, 1930.

Valves 9μ in diameter. Hab. Gono-ike. Distr. Previously known from Mt. Daisetsu.

var. *lirata* (EHRENB.) BETHGE in HUSTEDT, l.c. p.264, f.111, 1930.

Valves 12μ in diameter. Hab. Ohniu-ike. Distr. Mt. Daisetsu.

Cyclotella stelligera CLEVE & GRUN. in HUSTEDT, Süsw.-fl. 10. p. 100, f.65, 1930; A. CLEVE, K. V. A. Handl. 2: 1, p. 43, f. 52, 1951.

Valves 12μ in diameter. Hab. Gongen-ike, Kurobegoro-daira, Kumono-taira, Tengunohara, and Kurobegorodake. Distr. Shiretoko, Hokkaido.

Fam. Fragilariaceae

Tabellaria flocculosa (ROTH) KÜTZ in HUSTEDT, Süsw.-fl. 10, p. 123, f. 101, 1930.

Valves 25μ long, 7μ broad. Hab. Happo-one. Distr. Shiretoko.

Diatoma hiemale (LYNGB.) HEIBERG in HUSTEDT, Süssw.-fl. 10, p. 129, f. 115, 1930.

Valves 21μ long, 8μ broad. Hab. Ohniu-ike. Distr. Mt. Daisetsu and Shiretoko.
var. ***mesodon*** (EHRENB.) GRUN. in HUSTEDT, l.c. p. 129, f. 116, 1930.

Valves 20μ long, 7μ broad. Hab. Happo-one. Distr. Mt. Daisetsu and Shiretoko.

Ceratoneis arcus KÜTZ. var. ***recta*** CLEVE in KOBAYASHI, Journ. Jap. Bot. 40, p. 126, f. 1-5, 1965.—*C. recta* IWAHASHI, Journ. Jap. Bot. 12, p. 391, f. 1a-c, 1936.

Valves 40μ long, 7.5μ broad, and striae 13-14 in 10μ . Hab. Ohniu-ike, Norikura. Distr. Arakawa River. This species was previously known from River Arakawa, and I found it only once in a broken specimen. It has probably come to the lake through an income stream.

Peronia Heribaudi BRUN. & PERAG. in HUSTEDT, Krypt. Fl. 7: 2, p. 202, f. 739, 1932.

Valves $22-40\mu$ long, $3-3.5\mu$ broad, and striae 15-16 in 10μ . Hab. Kazafuki-O-ike, Koshiki-ike. Distr. Daisetsu-zan and Shiretoko, Hokkaido.

Eunotia alpina (NÄG.) HUSTEDT in Süssw.-fl. 10, p. 185, f. 252, 1930.

Valves 45μ long, 2.5μ broad, and striae 20 in 10μ . The present specimens resemble *E. lunaris* in some respects but differ from it in having narrower valves and a number of fine striae. Hab. Eboshi-dake. Distr. New to Japan.

Eunotia arcus EHRENB. in HUSTEDT, l.c. p. 175, f. 216, 1930; A. CLEVE, K.V.A. Handl. 4: 1, p. 123, f. 463a-d, 1953 (as var. *genuina* MEISTER).

Valves small, slightly arcuate, ventral margin slightly concave and dorsal margin more convex than the curvature of the ventral margin and in some specimens dorsal margin shows a straight side in the middle, valves suddenly narrowed near the ends which are elongated and slightly reflexed, rounded at the extremity so that they give a somewhat capitate appearance; terminal nodules distinct and sited somewhat back on the ventral margin, striae distinct and equidistant. Valves $43-48\mu$ long, $4-5\mu$ broad, and striae 13-14 in 10μ . The present specimens resemble the one, of which the figure was given by HUSTEDT in a general appearance but differ from the European forms in the form of the valval end which is not produced and in the striae arrangement. Hab. Gongen-ike, Gono-ike, Ohniu-ike, Kurobe-goro-daira, Kamino-take, Mitsumata-rence-dake, Eboshi-dake, Kumono-taira, Happo-one, Tenguno-hara, near Shirouma-Ô-ike. Distr. Daisetsu-zan.

var. ***curvata*** A. CLEVE in l.c. 4: 1, p. 123, f. 463, i.j. 1953.

Valves small, moderately curved, median part of the valve linear and with the almost parallel sides, gradually attenuated toward the ends which are recurved to the dorsal side, rounded at the extremity, striae distinct 17-18 in 10μ . Valves are 23μ long, 2.5μ broad. The figure by A. CLEVE of the variation of this species shows the

number of striae of 23–25 in 10μ but the present specimens have 17–18 in 10μ . The present specimens resemble somewhat the typical form of this species but differ from it in its narrower valve and its strong curvature and also differ from var. *curvata* in its shorter valve, the dense arrangement of striae and the end that is not capitate. Hab. Gono-ike. Distr. Shiretoko.

Eunotia crista galli CLEVE in HUSTEDT, Krypt. Fl. 7:2, p. 294, f.760, 1932.

Valves 38–40 μ long, 7.5–8 μ broad, and striae 13–14 in 10μ . Hab. Happo-one. Distr. Shiretoko.

Eunotia exigua (BRÉB.) GRUN. in A. CLEVE, l.c. 4:1, p. 106, f. 439, 1953.

Valves small, long and narrow, slightly curved, ventral side slightly concave or almost straight, dorsal side slightly convex but recurved near the end, cell slightly narrowed to the ends which are truncate. Valves 28–35 μ long, 3–4.5 μ broad, and striae 16–18 in 10μ . Hab. Gongen-ike, Kamega-ike, Gono-ike, Happo-one, Taro-bei-daira, Mitsumata-rence-dake, Kurobe-goro-daira, Yakushidake, Kumono-taira, Tenguno-hara, near Shirouma-Ô-ike, Seijo-hut. Distr. Daisetsu-zan.

var. ***compacta*** HUSTEDT in l.c. p. 176, f. 225, 1930.

Valves 45 μ long, 2.5 μ broad, and striae 16–17 in 10μ . The end of the valves distinctly capitate, terminal nodules distinct and raphe disposed deep inside of the ventral margin. Hab. Gongen-ike. Distr. Shiretoko.

Eunotia faba (EHRENB.) GRUN. var. ***densestriata*** ÖSTR. in A. CLEVE, l.c. 4:1, p. 112, f. 449e, 1953.

Valve 15 μ long, 5 μ broad, and striae 18 in 10μ . Hab. Ikenotaira. Distr. New to Japan.

var. ***nipponica*** SKVORTZOW in Philip. Journ. Sci. 61, p. 21, pl.14, f. 4, 1936.

Valves 12–19 μ long, 2–3 μ broad, and striae 20–28 in 10μ . Valves not capitate at the end. Hab. Kurobe-goro-taira, Tenguno-hara, near Shirouma-O-ike, and Seijo-hut moor. Distr. Daisetsu-zan.

Eunotia fallax A. CLEVE in l.c. 4:1, p. 99, f. 426a, 1953.

Valves small, narrow sublinear, slightly curved, median part linear and parallel on the sides, dorsal side slightly convex and ventral side concave, gradually and rapidly attenuated near the end, ends produced and slightly recurved toward the dorsal side, extremity obliquely truncate, terminal nodules slightly developed, striae distinct, equidistant but denser near the ends. The present specimens resemble *E. arcus* but the shape of the valval end is different from that of *E. arcus* which has a recurved, obliquely truncate apex of the end. Hab. Kamega-ike. Distr. New to Japan.

var. ***gracillima*** A. CLEVE in HUSTEDT, Krypt. Fl. 7:2, p. 288, f. 753b-e, 1932; A. CLEVE, l.c. 4:1, p. 99, f. 426b,c, 1953.

Dorsal margin convex, ventral margin slightly concave, central part of the valve sublinear, not parallel, gradually attenuated toward the end, ends slightly dilated, having a truncate apex, so that the end of the valve is slightly capitate, striae rather

roughly disposed and equidistant, length of valve $17-40\mu$, breadth $2.5-3.5\mu$, and striae $10-12$ in 10μ . The present specimens resemble *E. tenella* but are distinguished from it in their fewer number of striae. Hab. Tarobei-daira, Mitsumata-rengé-dake, Kamino-take, Kumono-taira, southern side of Yakushi-dake, Tenguno-hara, Kurobe-goro-taira. Distr. New to Japan.

Eunotia Kocheliensis MÜLLER in MAYER, Denkschr. Kgl. Bayer. Bot. Ges. 13, F. N. 7, p. 25, pl. 1, f. 63, 1915.

var. ***alpina*** HIRANO, var. nov.

Valvae minores, reniformes, 5μ longae, 3.5μ latae et striae radiatae. The present specimens are shorter and smaller than those of the typical form. Hab. southern side of Yakushi-dake.

Eunotia lapponica A. CLEVE in Bih. Kongl. Sv. Vet. Akad. Handl. 21, Afd. 3, no. 2, p. 29, pl. 1, f. 29, 30, 1895; HUSTEDT, Krypt. Fl. 7:2, p. 295, f. 762, 1932.

Valves of medium size, robust, slightly curved, gradually attenuated from the median part to the ends which are rounded and in some specimens slightly recurved upward, ventral margin slightly concave, dorsal margin convex, striae fine and densely disposed, 20 in 10μ , terminal nodules large, raphe well developed and deep in the inner part of the valval end. The present specimens resemble somewhat *E. monodon* but are distinguished from it in their dense disposition of striae. Hab. near Seijo-hut. Distr. Daisetsu-zan.

Eunotia lunaris (EHRENB.) GRUN. in HUSTEDT, Süßsw.-fl. 10, p. 183, f. 249, 1930; A. CLEVE, K. V. A. Handl. 4: 1, p. 88, f. 412a,b, 1953 (as var. *genuina* GRUN.).

Valves 50μ long, 4μ broad, and striae $14-15$ in 10μ . Hab. Gongen-ike, Kurobe-goro-daira, Kumono-taira, and Tengunohara. Distr. Shiretoko, Mt. Daisetsu-zan.

var. ***attenuata*** A. CLEVE in l.c. 4:1, p. 90, f. 413 p.r. 1953.

Valves $29-35\mu$ long, $3.4-4\mu$ broad, and striae 18 in 10μ . Hab. Eboshidake, Kumono-taira, Tengunohara, and near Shirouma-ôike.

var. ***falcata*** (BRÉB.) A. BERG in A. CLEVE, l.c. 4:1, p. 89, f. 413c-g, 1953.

Valves $20-23\mu$ long, $2.5-3\mu$ broad, and striae $20-22$ in 10μ . Hab. Kumonotaira. Distr. N. Europe.

Eunotia Meisteri HUSTEDT in Süßsw.-fl. 10, p. 179, f. 230, 1930; A. CLEVE, l.c. 4:1, p. 111, f. 448, 1953.

Valves 11μ long, 3.5μ broad, and striae 20 in 10μ .

Hab. Tarobei-daira, Eboshidake, Kumonotaira, and Tengunohara.

var. ***bidens*** HUSTEDT in Süßsw.-fl. 10, p. 179, f. 231, 1930

Valves $9-10\mu$ long, 3.5μ broad, and striae ca. 20 in 10μ . Hab. Tengunohara, Kaminotake. Distr. Europe.

Eunotia parallela EHRENB. in HUSTEDT, Süßsw.-fl. 10, p. 183, f. 247, 1930.

Valves $47-80\mu$ long, $7.5-9\mu$ broad, and striae 8 in 10μ . Hab. Ohniu-ike, Tenguno-hara. Distr. Shiretoko, Daisetsu-zan.

Eunotia pectinalis (KÜTZ.) RABENH. in HUSTEDT, l.c. p. 180, f. 237, 1930.

Valves slightly curved, both sides parallel but gradually and slightly attenuated to the ends which are slightly recurved, ends not capitate, strongly striated, striae 11–12 in 10μ . Valves 80μ long, 5.5μ broad. Hab. Ohniu-ike, Happo-one, and Tengunohara. Distr. Daisetsu-zan.

var. ***elongata*** V. H. in A. CLEVE, l.c. 4:1, p.83, f.409a, 1953.

Valves 100μ long, 6μ broad, and striae 11 in 10μ . Hab. Kamega-ike.

var. ***minor*** (KÜTZ.) RABENH. in HUSTEDT, l.c. p. 182, f. 238, 1930.

Valves 22μ long, 5μ broad, and striae 15 in 10μ . Dorsal side convex but not flattened in the middle, ventral side straight and not concave. The present specimens resemble *E. sudetica* but the number of striae is larger than that of the *E. sudetica* and coincides with that of the *E. pectinalis*. The breadth of the valve is nearer to the size described by A. CLEVE. Hab. Gono-ike, Happo-one, near Shirouma-ôike.

forma ***impressa*** (EHRENB.) HUSTEDT in l.c. p. 182, f. 239, 1930.

Valves 27μ long, 4μ broad, and striae 17 in 10μ . Hab. Gongen-ike. Distr. Daisetsu-zan.

Eunotia perpusilla (GRUN.) A. CLEVE var. ***tridentata*** (MAYER) Å. BERG in A. CLEVE, l.c. 4:1, p. 102, f.430d-f, 1953.

Valves rather minute, slender and slightly curved, ends capitate and rounded at the extremity, dorsal margin convex, having three waves, elevations slight and not acute, ventral margin concave, also having three slight waves, striae fine but distinct about 20 in 10μ . Valves 20μ long and 2.5μ broad. These tiny specimens differ somewhat from the European forms figured by A. CLEVE. The central elevation on the dorsal margin is acute in the European forms but rounded in my specimens. Also the valves in the present specimens are relatively longer than those of the European specimens. Hab. Kumono-taira, Tengunohara. Distr. New to Japan.

Eunotia polydentula (BRUN.) Å. BERG var. ***monodon*** MAYER in A. CLEVE, l. c. 4:1, p. 101, f. 429f, 1953.

Valves rather minute, slightly curved, ventral margin slightly excavated in the median part, dorsal margin strong convex without elevation as seen in the typical form, ends capitate and rounded at the extremity. Valves 18μ long, 3.5μ broad, and striae ca. 20 in 10μ . Hab. Southern side of Yakushidake. Distr. New to Japan.

Eunotia praerupta EHRENB. in HUSTEDT, Krypt. Fl. 7:2, p. 280, f. 747A:a, 1932.

Valves of medium size, slightly curved, dorsal margin strong convex in the middle and reflexed near the end, ventral margin slightly concave or hollow in the middle, valves attenuated from the inflated median part toward the end and abruptly attenuated below the end, ends truncate-convex at the extremity, end part of the valve capitate, terminal nodules distinct and located at the extremity above the ventral side, striae roughly arranged and substriated between the complete striae in some specimens. Valves 30μ long, 10μ broad, and striae 9–10 in 10μ . Hab. Gono-ike, Mitumata-

renge-dake, Kumono-taira. Distr. New to Japan.

var. *muscicola* PETERS. in Bot. Icel. 2, p. 377, f. 3, 1928; HUSTEDT, Krypt. Fl. 7:2, p. 280, f. 747A:h, 1932.

Valves small, almost straight or slightly curved, dorsal margin convex-flattened in the middle and slightly recurved near the end, ventral margin slightly excavated in the middle, ends truncately rounded and slightly capitate, striae distinct, 11–15 in 10μ . Valves $16\text{--}20\mu$ long, $5\text{--}10\mu$ broad. The present specimens are distinguished from *E. praeminos* var. *curta* in their dense arrangement of striae. Hab. Ohniu-ike, Gongen-ike, Kurobe-goro-dake-cirque, Tarobei-taira, Mitsumata-renge-dake, Eboshi-dake, Happo-one. Distr. New to Japan.

Eunotia praenana A. CLEVE in l.c. 4:1, p. 131, f. 477, 1953.

Valves minute, half-rhomboidal or subtriangular in outline, dorsal margin strong convex, ventral margin almost straight and somewhat excavated in the middle, end part of the valve slightly produced toward the ventral side, ends rounded, striae slightly radial, about 20 in 10μ . Valves $9\text{--}10\mu$ long, 3.5μ broad. Hab. Tarobei-daira. Distr. New to Japan.

Eunotia praerupta EHRENB. var. *platycephala* MAYER in Denkschr. Bayer. Bot. Ges. 13, N. F. 7, p. 9, f. 18, 1915; HIRANO, Act. Phytotax. Geobot. 21, p. 187, f. 3, 1965.

Valves rather large, slightly curved, dorsal margin convex, having two slight waves, ventral margin slightly hollowed in the middle, end part of the valve distinctly constricted, ends capitate, extremity of the end truncately rounded, median part of the valve subparallel, suddenly attenuated and constricted below the end, striae distinct and 9–10 in 10μ . Valve 80μ long, 12μ broad. Hab. Happo-one. Distr. Europe and Bhutan. New to Japan.

Eunotia repens Å. BERG var. *arcuata* (NÄG.) A. CLEVE in l.c. 4:1, p. 90, f. 414a-c, 1953.

Valve 40μ long, 2.5μ broad, and striae 24 in 10μ . Hab. Tengenohara. Distr. New to Japan.

Eunotia robusta RALFS in HUSTEDT, Sussw.-fl. 10, p. 171, f. 203, 1930.

Valves $52\text{--}80\mu$ long, $14\text{--}18\mu$ broad, and striae 10 in 10μ . Hab. Happo-one, Kurobe-genryu-daira. Distr. Shiretoko, Daisetsu-zan.

var. *diadema* (EHRENB.) RALFS in HUSTEDT, l.c. p. 171, f. 205, 1930.

Valves $68\text{--}70\mu$ long, 20μ broad, and striae 12 in 10μ . Hab. Happo-one, Distr. Daisetsu-zan.

Eunotia suecica A. CLEVE in HUSTEDT, l.c. p. 174, f. 210, 1930.

Valves $68\text{--}70\mu$ long, $12\text{--}14\mu$ broad, and striae 10 in 10μ . Hab. Mitsumata-renge-dake, Eboshi-dake, Kurobe-goro-daira, Ohniu-ike, Happo-one. Distr. New to Japan.

Eunotia sudetica O. MÜLL. in HUSTEDT, l.c. p. 182, f. 242, 1930.

Valves small, dorsal margin straight, ventral margin strong convex but slightly reflexed near the end, gradually and rapidly attenuated toward the ends, ends somewhat produced and rounded at the extremity, terminal nodules distinct, raphe incised behind the end on the ventral side, striae regularly disposed, about 15 in 10μ but denser near the end. Valves $18-25\mu$ long, and 5μ broad. Hab. Gongen-ike, Mitsumata-enge-dake, Kurobe-goro-daira, Tarobei-taira, Kamino-take, Eboshi-dake, Kumono-taira, Kurobe-genryu-daira, Tenguno-hara, near Shirouma-O-ike, Shirouma-kamino-ta, Seijo-hut moor. Distr. Daisetsu-zan.

Eunotia tenella (GRUN.) HUSTEDT in l.c. p. 175, f. 220, 1930; A. CLEVE, l.c. 4:1, p. 104, f. 435, 1953.

Valves small, almost straight, gradually attenuated toward the end, ventral margin almost straight, median part of the valve subparallel, dorsal margin slight convex but slightly reflexed behind the end, ends obliquely rounded at the extremity, striae fine, about 18–20 in 10μ , terminal nodules distinct, incised on the ventral side. Valves $18-21\mu$ long, 2.5μ broad. Hab. Ohniu-ike. Distr. Daisetsu-zan.

Eunotia triodon EHRENB. in A. CLEVE, l.c. 4:1, p. 105, f. 437h-m, 1953.

Valves 30μ long, 12μ broad, and striae 12–13 in 10μ . Hab. Ohniu-ike. Distr. Daisetsu-zan.

Eunotia valida HUSTEDT in l.c. p. 178, f. 229, 1930.

Valves small, slightly curved or almost straight, gradually attenuated toward the ends which are slightly recurved toward the dorsal side, ends rounded, ventral margin straight or slightly concave, dorsal margin convex, median part of the valve subparallel, terminal nodules distinct, raphe slightly developed and incised obliquely on the ventral margin, striae distinct, 13–14 in 10μ . Valves $24-45\mu$ long, 3.5μ broad. Hab. Mitsumata-enge-dake, Eboshi-dake, Kumono-taira, near Shirouma-O-ike. Distr. Shiretoko and Daisetsu-zan.

Eunotia veneris (KÜTZ.) O. MÜLL. in A. CLEVE, l.c. 4:1, p. 112, 1953.

Valves small, slightly curved, ventral margin concave, dorsal margin strong convex and slightly reflexed near the end, gradually and rapidly attenuated toward the ends which are acutely rounded, terminal nodules distinct just behind the end on the ventral side, striae slightly radiate, densely disposed, about 20 in 10μ . Valves $18-22\mu$ long, 4.5μ broad. Hab. Eboshi-dake. Distr. Shiretoko and Daisetsu-zan.

Actinella punctata LEWIS in A. CLEVE, l.c. 4:1, p. 132, f. 480, 1953.

Valves $48-100\mu$ long, 5μ broad, and striae 13–14 in 10μ . Hab. Tenguno-hara. Distr. Daisetsu-zan.

Fam. Achnanthaceae

Cocconeis placentula (EHRENB.) HUSTEDT var. ***euglypta*** (EHRENB.) CLEVE in

HUSTEDT, l.c. p. 190, f. 261, 1930.

Valves 19μ long, 10μ broad, and striae 20 in 10μ . Hab. Ohniu-ike. Distr. Shiretoko.

var. *lineata* (EHRENB.) CLEVE in HUSTEDT, l.c. p. 190, f. 262, 1930.

Valve 18μ long, 10μ broad, and striae 17–18 in 10μ . Hab. Ohniu-ike. Distr. Daisetsu-zan.

Achnanthes exigua GRUN. var. *heterovalvata* KRASSKE in A. CLEVE, l.c. 4:5, p. 35, f. 544 e,f, 1953.

Valve 18μ long, 7μ broad, and striae ca. 30 in 10μ . Hab. Kurobe-goro-daira, Tenguno-hara, and Happo-one.

Achnanthes Grimmei KRASSKE in A. CLEVE, l.c. 4:5, p. 41, f. 570, 1953.

Valve 10μ long, 3μ broad, and striae 16 in 10μ . Hab. Gono-ike. Distr. New to Japan.

Achnanthes kryophila BOYE PETERS. in A. CLEVE, K. V. A. Handl. 4:5, p. 37, f. 550a-c, 1953.

Valves 11 – 12μ long, 5 – 6μ broad, and striae ca. 24 in 10μ . Hab. Gongen-ike, Gono-ike, Ohniu-ike, Mitsumata-rengedake, Kumono-taira, Kurobe-jii-daira. Distr. Mt. Daisetsu-zan.

Achnanthes lanceolata (BRÉB.) GRUN. in HUSTEDT, Süßw.-fl, 10, p. 207, f. 306a, 1930; A. CLEVE, l.c. 4:5, p. 25, f. 527a-c, 1953.

Valves 15 – 18μ long, 5 – 6μ broad, and striae 14–15 in 10μ . Hab. Ohniu-ike. Distr. Shiretoko, Hokkaido.

Fam. Naviculaceae

Frustulia rhomboides (EHRENB.) DeTONI in HUSTEDT, l.c. 10, p. 220, f. 324, 1930.

Valves 63 – 85μ long, 14 – 17μ broad. Hab. Kamino-take, Kurobe-goro-daira, Kumono-taira, Kurobe-genryu-daira, Tarobei-daira, Happo-one, Tenguno-hara, Shirouma-kaminota. Distr. Daisetsu-zan, Shiretoko.

var. *saxonica* (RABENH.) DeTONI in HUSTEDT, l.c. 10, p. 221, f. 325, 1930.

Valves 53 – 70μ long, 11 – 12μ broad, and striae 35 in 10μ . Hab. Yakushi-dake, Kamino-take, Eboshi-dake, Kurobe-goro-daira, Kumono-taira, Tarobei-daira, Happo-one, near Shirouma-O-ike, Tenguno-hara, Shirouma-kaminota, Gono-ike. Distr. Daisetsu-zan, Shiretoko.

var. *Shiretokensis* FUKUSHIMA & KISHIMOTO in Journ. Yokohama City Univ. 180, p. 10, pl. 4, f. M, 1968.

Valves 92 – 98μ long, 12 – 13μ broad. Hab. Kurobegoro-daira, Tengunohara. Distr. Shiretoko, Hokkaido.

Caloneis fasciata (LAGERSTEDT) CLEVE in A. CLEVE, l.c. 5:4, p. 104, f. 1149, 1955.

Valves small, lanceolate with the rounded ends, axial area narrow-linear but gradually spread toward the central area which forms a transverse broad fascia, striae very fine. The number is not very clear in my slide but the species usually has about 24–30 in 10μ . Valves with a longitudinal line near the margins, 20–25 μ long, 5 μ broad. Hab. Mitsumata-enge-dake. Distr. Lake Yuno-ko.

Neidium bisulcatum (LAGERSTEDT) CLEVE in HUSTEDT. l.c. p. 242, f. 374, 1930.

Valves 55–70 μ long, 10–12 μ broad, and striae 26–27 in 10μ . Hab. Kamega-ike, Tarobei-daira, Kurobe-goro-daira, Kamino-take, Yakushi-dake, Kurobe-genryu-daira, Happo-one, Tenguno-hara, near Shirouma-O-ike. Distr. Shiretoko.

var. ***nipponicum*** SKVORTZOW in Philip. Journ. Sci. 61, p. 29, pl. 3, f. 1, 1936; PATRICK & REIMER, Diat. U.S. p. 398, pl. 36, f. 13, 1966.

Valves of under medium size, sublinear-lanceolate with the parallel sides on the median part of the valve, narrowed to the ends which are rounded, end part of the valve cuneate, central area transversely elliptic, axial area narrow-linear. Valves 28–37 μ long, 8–9 μ broad, and striae ca. 30 in 10μ . The present form coincides with that reported by SKVORTZOW from Lake Kizaki located at the eastern foot of the Hida Mountain Range. PATRICK & REIMER give a smaller dimension in their American forms than the original of the Japanese forms. Hab. Mitsumata-enge-dake, Sen-nin-ike. Distr. Lake Kizaki.

Neidium dubium (EHRENB.) CLEVE in HUSTEDT, l.c. p. 246, f. 384, 1930.

Valves moderately large, long elliptic with the rostrated ends, sides subparallel and slightly convex, axial area narrow and linear, central area transversely elliptic or subrectangular, raphe straight, striae punctate, horizontal, about 16 in 10μ , slightly divergent near the end. Valves 70–75 μ long, 20–21 μ broad. Hab. Kurobe-goro-daira, Tenguno-hara. Distr. New to Japan.

Neidium iridis (EHRENB.) CLEVE in HUSTEDT, l.c. p. 245, f. 379, 1930.

Valves 90–140 μ long, 12–26 μ broad, and striae 11–15 in 10μ . Hab. Kurobe-goro-daira, Happo-one. Distr. Shiretoko.

forma ***major*** A. CLEVE in l.c. 5:4, p. 119, f. 1174a, b, 1955.

Valves 140–160 μ long, 34–42 μ broad, and striae 15–16 in 10μ .

Hab. Seijo-hut moor, Kurobe-goro-dake-cirque.

forma ***vernalis*** REICHELDT in HUSTEDT, l.c. p. 245, f. 380, 1930.

Valves 95 μ long, 20 μ broad, and striae 16 in 10μ . Hab. Ohniu-ike. Distr. New to Japan.

var. ***amphigomphus*** (EHRENB.) V.H. in HUSTEDT, l.c. p. 245, f. 382, 1930.

Valves 90–92 μ long, 27–28 μ broad, and striae 14–15 in 10μ . Hab. Happo-one. Distr. Shiretoko.

var. ***ampliata*** (EHRENB.) CLEVE in HUSTEDT, l.c. p. 245, f. 381, 1930.

Valves 58–62 μ long, 14–15 μ broad, and striae 22–24 in 10 μ . Hab. Tarobeitaira, Kurobe-goro-daira, Kumono-taira, Kurobe-genryu-daira, Shirouma-kaminotanbo, Tenguno-hara, near Shirouma-O-ike. Distr. Shiretoko.

Neidium perminutum A. CLEVE in l.c. 5:4, p. 110, f. 1158, 1955.

Valves small, linear, both sides parallel, gradually attenuated toward the end, ends rounded, axial area narrow-linear, central area transversely depressed rhomboidal, striae very fine, not visible, 22–23 μ long, 4–5 μ broad. Hab. Mitsumata-rengedake. Distr. New to Japan.

Diploneis elliptica (KÜTZ.) CLEVE in HUSTEDT, l.c. p. 250, f. 395, 1930.

Valve 40 μ long, 12 μ broad, and costae 9–10 in 10 μ . Hab. Ohniu-ike. Distr. Sapporo.

Stauroneis anceps EHRENB. var. ***amphicephala*** (KÜTZ.) V.H. in A. CLEVE, l.c. 4:5, p. 207, f. 943c, 1953.

Valves 42 μ long, 8 μ broad, and striae 20–25 in 10 μ . Valves rather of under medium size, linear-lanceolate with the protracted-rostrate or capitate ends, both lateral sides almost straight and parallel or slightly convex, extremity of the end truncate and convex, axial area narrow-linear, fascia rectangular, slightly broadening to the valve-side, striae fine, slightly radial. Hab. Ohniu-ike. Distr. New to Japan.

Stauroneis incerta A. CLEVE in l. c. 4:5, p. 206, f. 939, 1953.

var. ***constricta*** HIRANO, var. nov.

Valvae parvae, lineari-lanceolatae, leviter et late constrictae ad medium, marginibus lateralibus paene rectis, apicibus rostratis et late capitatis, area centralis anguste linearis, striae fine et radialiter dispositis, fascia dilatata ad marginem. Valvae 20 μ longae et 5 μ latae, striis ca. 30 in 10 μ . Hab. Ohniu-ike.

Stauroneis phoenicenteron EHRENB. var. ***intermedia*** (DIPPEL) A. CLEVE in l. c. 4:5, p. 210, f. 944e, 1953.

Valves 100 μ long, 20 μ broad, and striae ca. 16–17 in 10 μ . Hab. Eboshi-dake. Distr. New to Japan.

Anomoeoneis brachysira (BRÉB.) GRUN. in A. CLEVE, l. c. 4:5, p. 198, f. 919a, b, 1953

Valves 18–36 μ long, 5–8 μ broad, and striae 25–27 in 10 μ . Hab. Eboshi-dake, Kurobe-genryu-daira, Kurobe-goro-dake-cirque, Happo-one. Distr. Daisetsu-zan.

Navicula Borrichi BOYE PETERS. var. ***subcapitata*** BOYE PETERS. in A. CLEVE, l. c. 4:5, p. 190, f. 899a, 1953.

Valves small, lanceolate, ends slightly protracted-rostrated, margins convex or very slightly triundulate, axial area narrow, linear, central area expanded to form a transversely rectangular fascia but not reaching the margin which is furnished with short striae, striae fine and densely arranged, ca. 25 in 10 μ . Valves 23 μ long,

5 μ broad. The present specimens show an intermediate form between the typical and var. *subundulata*. Hab. Happo-one. Distr. New to Japan.

Navicula seminulum GRUN. in A. CLEVE, l. c. 4: 5, p. 179, f. 876a-e, 1953 (as var. *genuina* A. CL.)

Valve 15 μ long, 4 μ broad, and striae 22 in 10 μ . Hab. Kurobe-genryu-daira.

Navicula subtilissima CLEVE in HUSTEDT, l. c. p. 285, f. 475, 1930.

Valves linear-lanceolate with the capitate ends, axial area narrow-linear, central area slightly dilated or in some specimens rectangular, striae densely disposed, about 40-54 in 10 μ by A. CLEVE. Valves 22-25 μ long, 4-5 μ broad. Hab. Gono-ike, Tarobei-daira, Eboshi-dake, Kumono-taira, Happo-one, Seijo-hut moor. Distr. Daisetsu-zan.

Navicula verecunda HUSTEDT in A. CLEVE, l. c. 4: 5, p. 144, f. 797, 1953.

Valves minute, sublinear-elliptic with the inflated median part, ends slightly rounded, axial area narrow but dilated in the middle, striae dense and about 22-25 in 10 μ , median striae slightly separated from each other. Valves 10-12 μ long, 3.5-4 μ broad. Hab. Moor between Kurobe-goro-dake and Kamino-take, Ohniu-ike. Distr. New to Japan.

Pinnularia aestuarii CLEVE var. *interrupta* (HUSTEDT) A. CLEVE in l. c. 5: 4, p. 82, f. 1115b, c, 1955.

Valves of medium size, long linear with the slightly attenuated ends, ends rounded, lateral margins parallel in the major part of the valve, axial area broad and linear, its breadth almost equal to the one-third of the valve breadth, gradually dilated to the central area which forms a broad transverse fascia, raphe complex and waved, terminal fissures forming a "question-mark" shape, striae radial in the median part but convergent near the end, 11-12 in 10 μ . Valves 80 μ long, 10 μ broad. Hab. Ohniu-ike. Distr. New to Japan.

Pinnularia appendiculata (AG.) CLEVE in A. CLEVE, l. c. 5: 4, p. 17, f. 1004a-d, 1955 (as var. *genuina* A. CL.).

Valves 70 μ long, 7.5 μ broad, and striae 10 in 10 μ . Hab. Happo-one. Distr. Shiretoko, Sanpoji-ike of Tokyo.

Pinnularia biceps GREGORY in A. CLEVE, l. c. 5: 4, p. 62, f. 1088 a, c, d, 1955.

Valves 50-62 μ long, 11-12 μ broad, and striae 12 in 10 μ . Hab. Kazafuki-O-ike, Koshiki-ike. Distr. Senjoga-ike near Tokyo.

var. *minor* (BOYE PETERS.) A. CLEVE in l. c. 5: 4, p. 63, f. 1088k-m, 1955.

Valves 32-35 μ long, 7.5-8 μ broad, and striae 14 in 10 μ . Hab. Eboshi-dake, Kurobe-genryu-daira. Distr. Shiretoko.

Pinnularia bogotensis (GRUN.) CLEVE in A. CLEVE, l. c. 5: 4, p. 44, f. 1058a-c, 1955 (as var. *genuina* A. CL.).

Valves fairly large, linear-lanceolate, median part of the valve slightly inflated,

gradually attenuated toward the ends which are rounded at the extremity, axial area narrow lanceolate and suddenly dilated at the central area, central area rhomboid, striae strong radial in the centre and shortened gradually but convergent near the end, 11–12 in 10μ , terminal fissures comma-shaped. Valves 110μ long, 15μ broad. Hab. near Seijo-hut moor. Distr. New to Japan.

Pinnularia borealis EHRENB. in HUSTEDT, l. c. p. 326, f. 597, 1930.

Valves $35\text{--}43\mu$ long, 10μ broad, and costae 5 in 10μ . Hab. Gongen-ike, Ohniu-ike, Mitsumata-rengedake, Eboshi-dake. Distr. Daisetsu-zan.

Pinnularia brebissonii (KÜTZ.) CLEVE var. ***diminuta*** (GRUN.) CLEVE in A. CLEVE, l. c. 5: 4, p. 54, f. 1072g, 1955.

Valves 25μ long, 6μ broad, and striae 14 in 10μ . Hab. Koshiki-ike. Distr. New to Japan.

Pinnularia Carlsoni A. CLEVE in l. c. 5: 4, p. 58, f. 1081, 1955.

Valves small, lanceolate, ends elongate, slightly capitate, rounded at the extremity, central area broad rhomboid-elliptic, axial area narrow-lanceolate, striae slightly radial in the median part but convergent at the end, about 12 in 10μ . Valves $28\text{--}30\mu$ long, 8μ broad. The present specimens are slightly smaller than the description of the forms reported by European diatomists. The present forms also resemble *P. lapponica* but they are slightly larger. Hab. Happa-one, Kurobe-goro-daira. Distr. New to Japan.

Pinnularia divergens W. SM. var. ***minor*** A. CLEVE in l. c. 5: 4, p. 51, f. 1071a, 1955.

Valves of moderate size, lanceolate linear, ends elongate-rostrate, rounded at the extremity, axial area linear and fairly broad, dilated in the median part of the valve, central area rhomboid, both edges of the fascia forming a rounded thickening at the margin, raphe waved, filamentous, terminal fissures comma shaped, striae strong radial in the centre and convergent at the end of the valve, 9–10 in 10μ . Valves 110μ long, 19μ broad. Hab. Kurobe-genryu-daira. Distr. New to Japan.

Pinnularia divergentissima (GRUN.) CLEVE in A. CLEVE, l. c. 5: 4, p. 57, f. 1077a-d, 1955.

Valves small, lanceolate, ends rounded, axial area narrow-lanceolate, gradually dilated toward the centre, central area making a broad fascia, striae radial in the centre and convergent at the end, 14 in 10μ . Valves 30μ long, 5μ broad. Hab. Ohniu-ike, Happa-one. Distr. New to Japan.

Pinnularia interrupta W. SM. forma ***minutissima*** HUSTEDT in l. c. p. 317, f. 574, 1930.

Valves $20\text{--}26\mu$ long, 5μ broad, and striae 12 in 10μ . Hab. Mitsumata-rengedake, Tarobei-daira. Distr. Daisetsu-zan.

Pinnularia islandica ÖSTR. in A. CLEVE, l. c. 5:4, p. 23, f. 1019a, b, 1955 (as var. *genuina* RABENH.)

Valves of moderate size, sublinear, margin very slightly convex, ends rounded, axial area narrow-lanceolate, gradually dilated toward the central area which is elongate and elliptic, raphe filamentous, terminal fissures half-circular, striae radial in the centre and convergent near the end, about 10–11 in 10μ . Valves 90–100 μ long, 12–13 μ broad. The present specimens resemble *P. sudetica* var. *commutata* but they are larger in size. The axial area of *P. sudetica* var. *commutata* is narrow-linear and abruptly dilated in the central nodule into a elliptic central area. Hab. Kamino-take, Kumono-taira, Kamega-ike, and Tenguno-hara. Distr. Shiretoko and Kawagoe near Tokyo.

Pinnularia isostauron (GRUN.) CLEVE in A. CLEVE, l. c. 5:4, p. 84, f. 1116a, b, 1955.

Valves of under medium size, linear but attenuated near the end, ends rounded, margins parallel but in some specimens slightly concave, axial area fairly broad and linear, fascia transverse, raphe slightly waved, striae parallel throughout, 10 in 10μ . Valves 35–50 μ long, 7–8 μ broad. Hab. Ohniu-ike. Distr. New to Japan.

Pinnularia karelica CLEVE var. ***japonica*** HUSTEDT in Arch. Hydrobiol. **18**, p. 165, pl. 5, f. 3, 1927; KOBAYASHI, Bull. Chichibu Mus. Nat. Hist. no. 10, p. 74, f. 75, 1960.

Valves of medium size, linear, robust with subparallel sides, slightly rostrate near the ends which are broadly rounded, axial area narrow-sublanceolate, central area broadly elliptic, raphe slightly waved, terminal fissures curved semicircular, striae radial in the median part but convergent near the ends, about 12 in 10μ . Valves 56–65 μ long, 11–13 μ broad. Hab. Tarobei-daira, Happo-one. Distr. Lake Aoki-ko, Nagatoro in Chichibu.

Pinnularia leptosomoides A. CLEVE var. ***smolandica*** A. CLEVE in l. c. 5:4, p. 21, f. 1006a, b, 1955.

Valves of under medium size, linear and gradually narrowed near the end, ends rounded, axial area narrow-linear, slightly dilated in the centre, striae almost parallel but slightly radial in the centre and slightly convergent at the end, about 13–14 in 10μ . Valves 48 μ long, 7 μ broad. The present specimens related to *P. isostauron* but are distinguished from it in their dense disposition of striae without a fascia. Hab. Gongen-ike. Distr. New to Japan.

Pinnularia molaris (GRUN.) CLEVE in A. CLEVE, l. c. 5:4, p. 18, f. 1005, 1955.

Valves small, sublinear, gradually attenuated toward the ends which are rounded at the extremity, axial area narrow-lanceolate, raphe simple, slightly curved near the centre of the valve, central area dilated rhomboid, with the transverse fascia which is dilated toward the margin, striae distinct, radial in the centre and convergent near the end, 13–14 in 10μ . Valves 35 μ long, 7 μ broad. Hab. Ohniu-ike. Distr. Lake Yuno-ko and Shiretoko.

Pinnularia parva (EHRENB.) CLEVE in A. CLEVE, l. c. 5: 4, p. 28, f. 1030a-g, 1955. (as var. *parvula* (RALFS) A. CLEVE)

Valves lanceolate-linear, ends rounded, median part of the valve slightly inflated, axial area narrow-linear and slightly dilated a both sides at the central part of the valve, striae radial in the centre and convergent near the end, 12-13 in 10μ . Valves 82μ long, 13.5μ broad. Hab. Tenguno-hara. Distr. New to Japan.

Pinnularia stauroptera (RABENH.) CLEVE var. ***minuta*** MAYER in A. CLEVE, l. c. 5: 4, p. 68, f. 1901o, 1955.

Valves $60-72\mu$ long, $9-10\mu$ broad, and striae 10-11 in 10μ . Hab. Ohniu-ike, Tarobei-daira, Kumono-taira, Kurobe-genryu-daira, Happo-one, Tenguno-hara, Kurobe-goro-dake-cirque, near Seijo-hut moor. Distr. New to Japan.

forma ***medioconstricta*** A. CLEVE in l. c. 5: 4, p. 68, f. 1091r, s, 1955.

Valves slightly constricted in the middle. Valve 40μ long, 7μ broad. Hab. Kurobe-genryu-daira. Distr. New to Japan.

var. ***lanceolata*** A. CLEVE in l. c. 5: 4, p. 68, f. 1091u-w, 1955.

Valves lanceolate, margins slightly convex, ends rostrate and rounded at the extremity, axial area lanceolate, striae radial in the centre, 9 in 10μ . Valves 57μ long, 10μ broad. Hab. Kurobe-genryu-daira. Distr. New to Japan.

var. ***parva*** GRUN. in A. CLEVE, l. c. 5: 4, p. 68, f. 1091m, 1955.

Valves of medium size, linear-lanceolate with the long rostrated ends, axial area lanceolate, raphe filamentous, terminal fissures comma-like, central area rhomboid, fascia present, striae strongly radial but convergent near the end, 10 in 10μ . Valves $67-75\mu$ long, $10-11\mu$ broad. Hab. Kurobe-genryu-daira. Distr. New to Japan.

Pinnularia stomatophora (GRUN.) CLEVE in A. CLEVE, l. c. 5: 4, p. 41, f. 1054a, 1955.

Valves linear-lanceolate, sides straight and parallel, gradually attenuated near the apices which are rounded, axial area linear and relatively wide, about 1/3 of the valve-breadth, many granules arranged irregularly from the centre to near the ends along on both sides of the raphe. Valves $86-90\mu$ long, $13-14\mu$ broad, and striae 10 in 10μ . Hab. Kurobe-genryu-daira, Kurobe-goro-dake-cirque. Distr. New to Japan.

Pinnularia streptoraphe CLEVE in A. CLEVE, l. c. 5: 4, p. 85, f. 1117a-c, 1955. (as var. *genuina* A. CLEVE)

Valves large, linear and not inflated at the middle, with rounded ends, axial area broad linear and equal to the one-third of the valve breadth, dilated unequally on both sides at the central nodule, terminal fissures being a question-mark, striae slightly radial in the centre and slightly convergent near the end, about 8 in 10μ , each stria furnished with a broad crossing band, raphe complex and twisted. Valves $105-170\mu$ long, $20-28\mu$ broad. Hab. Kurobe-genryu-daira. Distr. New to Japan.

Pinnularia subcapitata GREGORY in A. CLEVE, l. c. 5: 4, p. 64, f. 1090a, b, 1955.

Valves small, sublinear, margins slightly convex and gradually attenuated to the rostrated end, axial area narrow-lanceolate, central area slightly dilated and elliptic, striae radial in the centre of the valve and convergent at the rostrated part of the end, about 12–14 in 10μ , in some specimens central part of the valve forms a transverse fascia in various degree but not in other specimens. Valves $30\text{--}48\mu$ long, $5.5\text{--}7.5\mu$ broad. Hab. Kamega-ike, Gongen-ike. Distr. Shiretoko, Daisetsu-zan, Kawagoe near Tokyo.

var. ***lapponica*** A. CLEVE in l. c. 5: 4, p. 65, f. 1090i-m, 1955.

Valves slender, sublinear with the very slightly convex sides, ends slightly and long rostrated, central part of the valve forming a broad fascia. Valves $43\text{--}58\mu$ long, $7\text{--}7.5\mu$ broad, and striae 10 in 10μ . Hab. Kurobe-genryu-daira, near Seijo-hut moor. Distr. New to Japan.

Pinnularia sudetica HILSE var. ***commutata*** (GRUN.) A. CLEVE in l. c. 5: 4, p. 75, f. 1105b-d, 1955.

Valves of medium size, sublinear, gradually attenuated toward the ends which are rounded, in some specimens slightly rostrated at the end, axial area narrow-lanceolate, dilated at the central nodule, central area elliptic rhomboid but somewhat unequal on both sides, striae densely disposed, slightly radial in the central part of the valve and slightly convergent toward the end, 12–13 in 10μ . Valves $65\text{--}95\mu$ long, $10.5\text{--}12\mu$ broad. Hab. Gongen-ike, Kamega-ike, Gono-ike, Ohniu-ike, Tarobei-daira, Mitsumata-rengedake, Kurobe-genryu-daira, Kurobe-goro-dake-cirque, Kurobegoro-daira, Kumono-taira, Yakushi-dake, near Shirouma-O-ike, Seijo-hut moor, Tengunohara, Happo-one. Distr. Daisetsu-zan.

var. ***rupestris*** (HANTZSCH) A. CLEVE in l. c. 5: 4, p. 75, f. 1105g, h, 1955.

Valves $86\text{--}90\mu$ long, $13\text{--}14\mu$ broad, and striae 10 in 10μ . Hab. Eboshi-dake, northern side of Kamino-take, Mitsumata-rengedake, Gongen-ike. Distr. New to Japan.

Pinnularia viridis (NITZSCH) EHRENB. in HUSTEDT, l. c. p. 334, f. 617a, 1930; A. CLEVE, l. c. 5: 4, p. 73, f. 1103a, b, 1955. (as var. *genuina* A. CL.)

Valves $88\text{--}120\mu$ long, $20\text{--}21\mu$ broad, and striae 9 in 10μ . Hab. Ohniu-ike, Happo-one, Mitsumata-rengedake, Kurobe-genryu-daira. Distr. Shiretoko, Daisetsu-zan, Yuno-ko.

var. ***intermedia*** CLEVE in A. CLEVE, l. c. 5: 4, p. 74, f. 1103c, d, 1955.

Valves 110μ long, 15μ broad, and striae 12 in 10μ . Valves linear, both margins parallel and with the rounded ends. Hab. Kamega-ike. Distr. New to Japan.

Cymbella alpina GRUN. in HUSTEDT, Süßw.-fl. 10, p. 352, f. 641, 1930; A. CLEVE, l. c. 5: 4, p. 153, f. 1229a, 1955.

Cymbellaceae

Valves small, asymmetric-lanceolate, slightly curved, both margins convex, ends rounded, axial area narrow, slightly dilated toward the ventral side in the central area, but not dilated toward the dorsal side, striae slightly radial and roughly disposed especially in the central part of the valve and slightly denser near the end, 7–8 in 10μ . Valves $38\text{--}40\mu$ long, $9.5\text{--}10\mu$ broad. Hab. Eboshi-dake. Distr. New to Japan.

Cymbella gracilis (RABENH.) CLEVE in HUSTEDT, l. c. p. 359, f. 663, 1930.

Valves $32\text{--}36\mu$ long, $5.5\text{--}6\mu$ broad, and striae 13 in 10μ . Hab. Happo-one, Kurobe-genryu-daira. Distr. Daisetsu-zan, Kawagoe near Tokyo.

Cymbella hebridica (GREGORY) CLEVE in A. CLEVE, l. c. 5: 4, p. 128, f. 1182a, b, 1955. (as var. *genuina* A. CL.)

Valves of under medium size, lunate with the produced apices, extremity of the end obtusely rounded, ventral margin slightly convex, dorsal margin strongly convex, raphe straight and slightly curved in the centre, axial area narrow, linear, disposed in the centre of the valve breadth and slightly dilated to form a long elliptic central area, striae slightly radial, equidistant in general but slightly separated from each other in the centre, especially on the dorsal side, about 13–14 in 10μ . Valves $42\text{--}48\mu$ long, $10\text{--}11\mu$ broad. The present specimens resemble *C. turgida* in the outline of the valve but the number of striae in 10μ is larger than that of the *C. turgida* and in the present specimens the number of striae is far more than that of the description by A. CLEVE.

Cymbella heteropleura EHRENB. in A. CLEVE, l. c. 5: 4, p. 149, f. 1220a, b, 1955.

Valves rather large, slightly asymmetric, long elliptic-lanceolate with the mamillately produced ends on both poles, poles well rounded, raphe slightly curved and excentric in disposition, axial area linear and abruptly dilated to form a rhomboid central area, striae distinct and radial, 9–10 in 10μ . Valves 100μ long, 28μ broad. Hab. Happo-one. Distr. Shiretoko, Daisetsu-zan.

Cymbella microcephala GRUN. forma *minor* GRUN. in A. CLEVE, l. c. 5: 4, p. 136, f. 1193a, b, 1955.

Valves minute, sublinear-lanceolate but slightly asymmetric, ends distinctly capitate, axial area present but indistinct, central area present, in this area striae short, striae horizontal throughout and fine, about 20–30 in 10μ by A. CLEVE. Valves $12\text{--}15\mu$ long, 3μ broad. Hab. Gongen-ike, Tarobei-daira, Eboshi-dake, Mitsumata-enge-dake, Kurobe-genryu-daira, Yakushi-dake, Kumono-taira, Tenguno-hara, Shirouma-kamino-tanbo. Distr. New to Japan.

Cymbella naviculiformis AUERSW. in A. CLEVE, l. c. 5: 4, p. 152, f. 1226, 1955.

Valves 38μ long, 9μ broad, and striae 12–13 in 10μ . Hab. Happo-one. Distr. Shiretoko, Yuno-ko, Senjoga-ike, Tatara-numa, and Kawagoe.

Cymbella perpusilla A. CLEVE in l. c. 5: 4, p. 155, f. 1232a, b. 1955.

Valves small, slightly asymmetric, sub lanceolate, ends rostrate-subcapitate, raphe straight, axial area narrow but distinct, slightly dilated at the central area, striae slightly radiate, 12–13 in 10μ , median striae short. Valves 30μ long, 6μ broad. Hab. Kazafuki-O-ike. Distr. Sapporo, Senjoga-ike.

var. ***lanceolata*** HIRANO, var. nov.

Valvae sub lanceolatae, leviter asymmetricae, marginibus ventralibus leviter convexis, marginibus dorsalibus plus convexis, apicibus valvarum elongato-rostratis cum extremitatibus rotundatis, area axialis angusta leviter excentrice disposita paene recta. Valvis 20μ longis et 4.5μ latis. Hab. Kurobe-goro-daira.

Cymbella ventricosa KÜTZ. in A. CLEVE, l. c. 5: 4, p. 124, f. 1177 a–c, 1955. (as var. *genuina* MAYER)

Valves 37μ long, 10μ broad, and striae 11 in 10μ . Hab. Ohniu-ike. Distr. Shiretoko, Lake Yuno-ko, Tatara-numa, Kawagoe, and Sanpoji-ike in Tokyo.

Gomphonema angustatum (KÜTZ.) RABENH. in HUSTEDT, l. c. p. 373, f. 690, 1930.

Valve 23μ long, 6μ broad, and striae 13–14 in 10μ . Hab. Ikeno-taira. Distr. Shiretoko, Yuno-ko, Arakawa.

var. ***productum*** GRUN. in A. CLEVE, l. c. 5: 4, p. 179, f. 1270, g, h, k, 1955.

Valves lanceolate with the rostrated, somewhat capitate ends, median striae separated from the adjacent striae in some distance, one very short and the other with a distinct isolated puncta. Valve 25μ long, 5.5μ broad, and striae 13 in 10μ . Hab. Ohniu-ike. Distr. Shiretoko, Yuno-ko.

Gomphonema gracile EHRENB. in HUSTEDT, l. c. p. 376, f. 702, 1930; A. CLEVE, l. c. 5: 4, p. 185, f. 1281a, b, 1955.

Valves 45 – 54μ long, 8 – 9μ broad, and striae 13 in 10μ . Hab. Kurobe-genryu-daira. Distr. Arakawa, Kejoga-ike.

var. ***major*** GRUN. in A. CLEVE, l. c. 5: 4, p. 186, f. 1281d, e, 1955.

Valves 67 – 72μ long, 10μ broad, and striae 10–11 in 10μ . Hab. Happo-one. Distr. New to Japan.

Fam. Epithemiaceae

Rhopalodia gibberula (EHRENB.) O. MÜLL. var. ***producta*** (GRUN.) A. CLEVE in l. c. 3:3, p. 43, f. 1415d-i, 1952.

Valves 54μ long, 8μ broad, and costae 3–5 in 10μ . Hab. Kurobegenyu-daira. Distr. Sapporo, Shiretoko, Daisetsu-zan, Yuno-ko.

Fam. *Nitzschiaceae*

Hantzschia amphioxys (EHRENB.) GRUN. in HUSTEDT, Süssw.-fl. **10**, p. 394, f. 747, 1930.

Valves 30μ long, 8μ broad, and striae 25 in 10μ . Hab. Ohniu-ike. Distr. Shiretoko, Daisetsu-zan, Kawakoe near Tokyo.

Nitzschia palea (KÜTZ.) W. SM. forma *minuta* A. CLEVE in l. c. **3**: 3, p. 90, f. 1504b, 1952.

Valves 20μ long, 2.5μ broad. Hab. Ohniu-ike, Mitsumata-rengedake. Distr. New to Japan.

Nitzschia thermalis KÜTZ. var. *intermedia* GRUN. in A. CLEVE, l. c. **3**: 3, p. 64, f. 1445d-f, 1952.

Valves 48μ long, 5μ broad, and striae not visible. Hab. Mitsumata-rengedake. Distr. New to Japan.

Fam. *Surirellaceae*

Surirella delicatissima LEWIS in A. CLEVE, l. c. **3**: 3, p. 119, f. 1560, 1952.

Valves 40μ long, 3.5μ broad. Hab. Kurobegen-ryu-daira. Distr. Daisetsu-zan, Shiretoko, Senjoga-ike.

Surirella lapponica A. CLEVE in **3**: 3, p. 118, f. 1558a-d, 1952.

Valves $65-102\mu$ long, $7-8\mu$ broad. Hab. Kurobe-genryu-daira. Distr. New to Japan.

Surirella linearis W. SM. in A. CLEVE, l. c. **3**: 3, p. 109, f. 1535 a, b, 1952.

Valves $70-76\mu$ long, $15-17\mu$ broad. Hab. Kurobe-genryu-daira. Distr. Daisetsu-zan, Shiretoko, and Sanpoji-ike.

Surirella biseriata BREB. in HUSTEDT, Süssw.-fl. **10**, p. 432, f. 831-832, 1930.

Valve 115μ long, 23μ broad. Hab. Gongen-ike. Distr. Daisetsu-zan.

var. *constricta* (EHRENB.) GRUN. in HUSTEDT, l. c. p. 434, f. 839, 1930.

Valves 90μ long, 15μ broad. Hab. Kurobe-genryu-daira. Distr. Shiretoko, Daisetsu-zan.

Plate 1

1. *Pinnularia aestuarii* CLEVE var. *interrupta* (HUSTEDT) A. CLEVE Ohniu-ike.
2. *Eunotia robusta* RALFS var. *diadema* (EHRENB.) RALFS Happo-one.
3. *Eunotia robusta* RALFS Kurobe-genryu-daira.
- 4,5. *Eunotia lunaris* (EHRENB.) GRUN. 4. Kazafuki-kamino-ta; 5. Kumono-taira.
6. *Eunotia pectinalis* (KÜTZ.) RABENH. var. *elongata* V. H. Kamega-ike.
7. *Frustulia rhomboides* (EHRENB.) De TONI var. *Shiretokensis* FUKUSHIMA & KISHIMOTO Kurobegoro-daira.
- 8,9. *Eunotia valida* HUSTEDT 8. Mitsumata-rengo-dake; 9. near Shirouma-O-ike.
10. *Eunotia perpusilla* (GRUN.) A. CLEVE var. *tridentata* (MAYER) A. BERG Tenguno-hara.
11. *Eunotia repens* A. BERG var. *arcuata* (NÄG.) A. CL. Tenguno-hara.
- 12,13. *Cyclotella stelligera* CLEVE & GRUN. 12. Tenguno-hara; 13. Kumono-taira.
- 14,15. *Navicula subtilissima* CLEVE Kumono-taira.
16. *Eunotia faba* (EHRENB.) GRUN. var. *densestriata* ÖSTR Ikeno-taira.
- 17,18. *Melosira distans* (EHRENB.) KÜTZ. var. *lirata* (EHRENB.) BETHGE Ohniu-ike.
- 19-21. *Eunotia Meisteri* HUSTEDT 19. Kumono-taira; 20, 21. Eboshi-dake.
22. *Eunotia praenana* A. CLEVE Sen-nin-ike.
23. *Eunotia Kocheliensis* MÜLLER var. *alpina* HIRANO, var. nov. Yakushi-dake.
- 24-26. *Eunotia lunaris* (EHRENB.) GRUN. var. *attenuata* A. CLEVE 24. Kumono-taira; 25. Tenguno-hara; 26. near Shirouma-O-ike.
27. *Eunotia pectinalis* (KÜTZ.) RABENH. Shirouma-kamino-ta.
- 28,29. *E. pectinalis* var. *minor* (KÜTZ.) RABENH. forma *impressa* (EHRENB.) HUSTEDT Ikeno-taira.
- 30,31. *Eunotia tenella* (GRUN.) HUSTEDT 30. Tenguno-hara; 31. Seijo-University hut moor.
32. *Eunotia fallax* A. CLEVE var. *lapponica* A. CLEVE Kame-ga-ike.

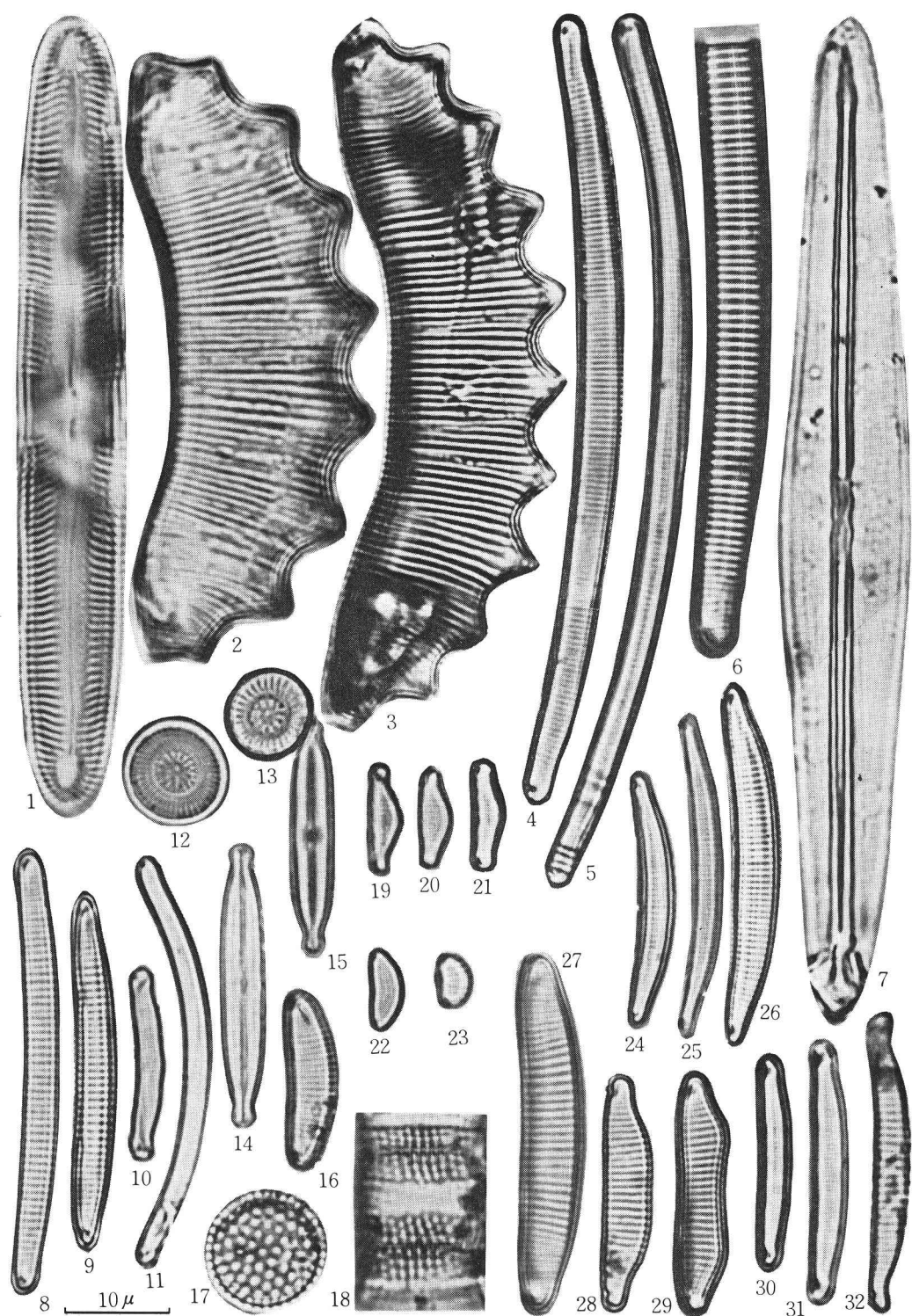


Plate 2

1. *Actinella punctata* LEWIS Koshiki-ike.
- 2-10. *Eunotia lapponica* A. CLEVE 2,3. Shiro-uma-kamino-ta; 4. near Seijo-hut; 5. Happo-one; 6. near Seijo-hut; 7,8. Tarobei-daira; 9. Tenguno-hara; 10. near Seijo-hut.
- 11-16. *Eunotia praerupta* EHRENB. 11-14. Mitumata-rengé-dake; 15. Gono-ike; 16. Kurobegoro-dake-cirque.

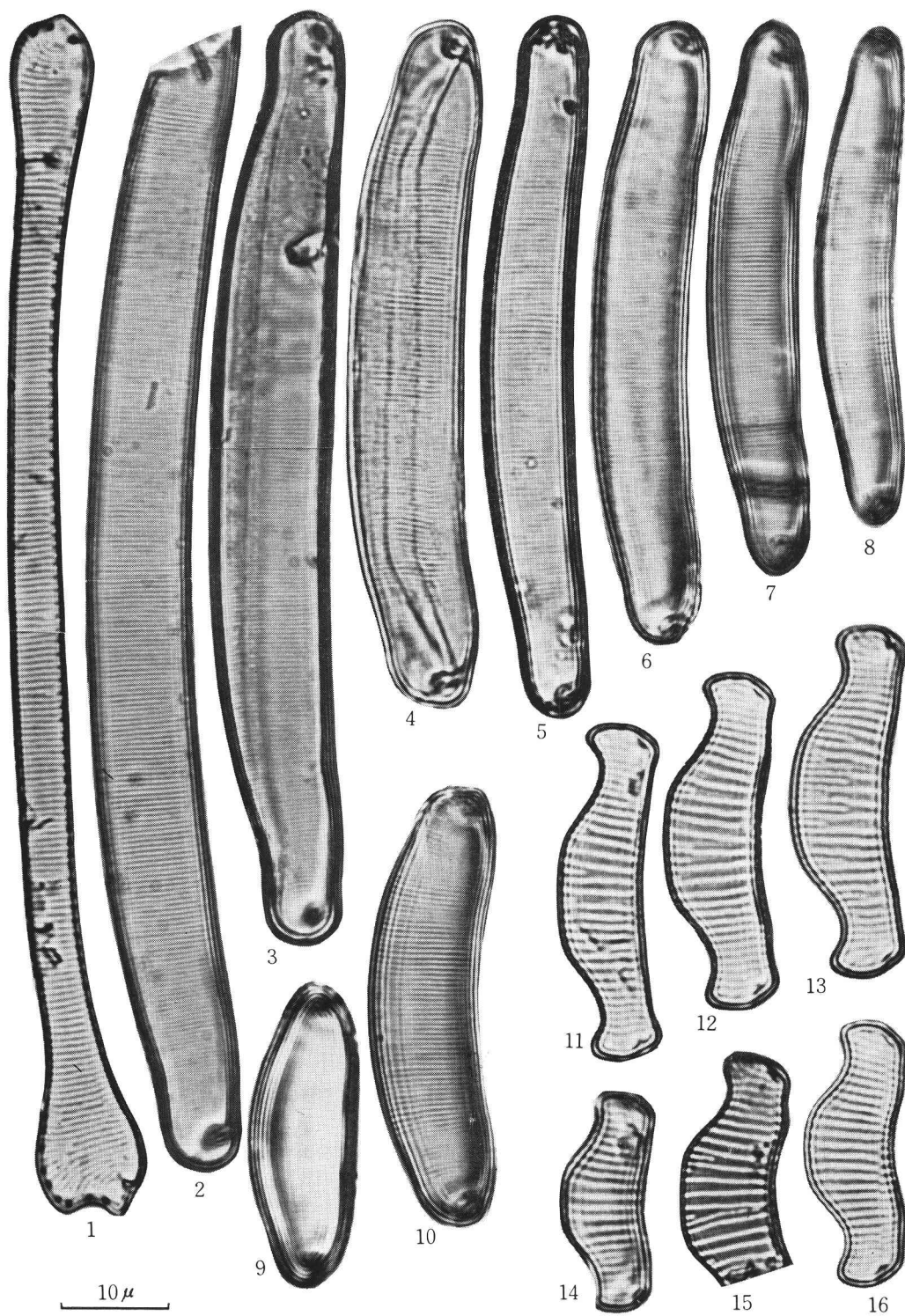


Plate 3

1. *Eunotia praerupta* EHRENB. var. *platycephala* MAYER Happa-one.
2. *Eunotia parallela* EHRENB. Tenguno-hara.
- 3-9. *Eunotia suecica* A. CLEVE 3. Happa-one 4. Mitsumata-rence-dake; 5. Kurobe-goro-taira; 6. Mitsumata-rence-dake; 7. Happa-one; 8. Eboshi-dake; 9. Kurobe-goro-taira.
- 10-16. *Eunotia praerupta* EHRENB. var. *musciicola* PETERS. 10. Happa-one 11. Eboshi-dake; 12, 13. Mitsumata-rence-dake; 14. Tarobei-daira; 15, 16. Ohniu-ike.
17. *Stauroneis anceps* EHRENB. var. *amphicephala* (Kütz.) V. H. Ohniu-ike.
- 18-21. *Cymbella perpusilla* A. CLEVE Kazafuki-O-ike.

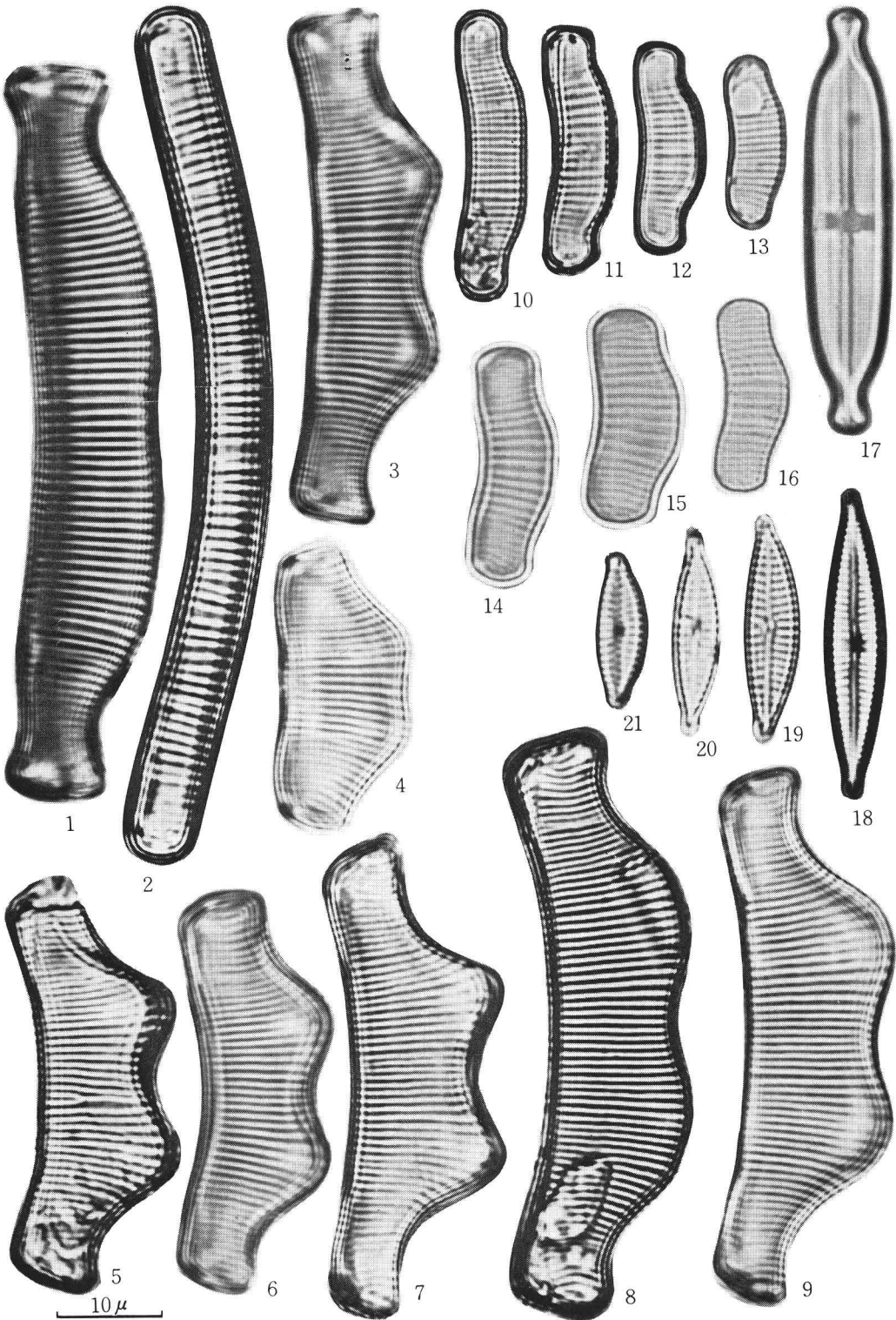


Plate 4

1. *Gomphonema gracile* EHRENB. var. *major* GRUN. Happo-one.
- 2-5. *Gomphonema gracile* EHRENB. 2,3. Kurobe-genryu-daira; 4. Kurobe-goro-dake-cirque; 5. Kurobe-genryu-daira.
- 6-14. *Eunotia arcus* EHRENB. 6-9. Kamino-take; 10. Tenguno-hara; 11,12. Tarobei-daira; 13. Kurobe-genryu-daira; 14. Kamino-take north slope.
15. *Eunotia arcus* var. *curvata* A. CLEVE Gono-ike.
- 16-22. *Eunotia fallax* A. CLEVE var. *gracillima* KRASSKE 16-18. Mitsumata-rengo-dake; 19. Kamino-take; 20,21. Tenguno-hara; 22. Tarobei-daira.
- 23-28. *Eunotia exigua* (BRÉB.) GRUN. 23. Tenguno-hara; 24. near Shirouma-O-ike; 25. Kamega-ike; 26. Tenguno-hara; 27. near Shirouma-O-ike; 28. Mitsumata-rengo-dake.
29. *Eunotia exigua* (BRÉB.) GRUN. var. *compacta* HUSTEDT Gongen-ike.
- 30,31. *Eunotia pectinalis* (KÜTZ.) RABENH. 30. Happo-one; 31. Tenguno-hara.
32. *Eunotia pectinalis* var. *minor* (KÜTZ.) RABENH. Happo-one.
33. *Eunotia pectinalis* var. *minor* forma *impressa* (EHRENB.) HUSTEDT Gongen-ike.

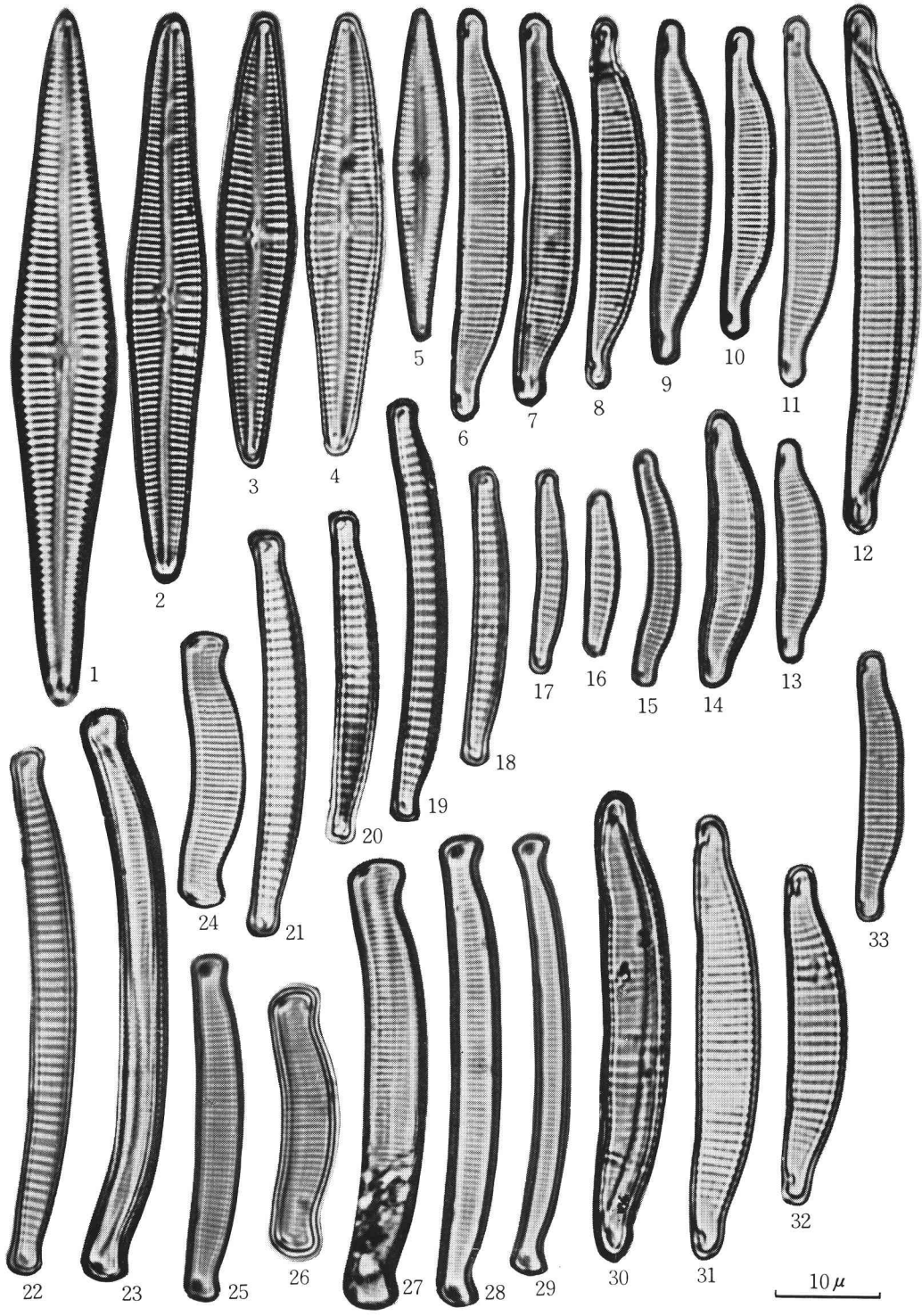


Plate 5

- 1,2. *Surirella lapponica* A. CLEVE Kurobe-genryu-daira.
- 3-5. *Pinnularia stauroptera* (RABENH.) CLEVE var. *lanceolata* A. CLEVE Kurobe-genryu-daira.
6. *Pinnularia stauroptera* var. *minuta* MAYER Ohniu-ike.
7. *Pinnularia parva* (EHRENB.) CLEVE Tenguno-hara.
- 8,9. *Pinnularia interrupta* W. SM. var. *minutissima* HUSTEDT Mitsumata-rengedake.
- 10,11. *Pinnularia Carlsoni* A. CLEVE 10. Happo-one; 11. Kurobe-goro-dake-cirque.
12. *Pinnularia molaris* (GRUN.) CLEVE Ohniu-ike.
- 13-15. *Pinnularia isostauron* (GRUN.) CLEVE Ohniu-ike.
16. *Pinnularia leptosomoides* A. CLEVE var. *smolandica* A. CLEVE Gongen-ike.
- 17-24. *Eunotia sudetica* O. MÜLL. 17. Shirouma-kamino-ta; 18. Happo-one; 19. Sen-nin-ike; 20. near Shirouma-O-ike; 21. Sen-nin-ike; 22. near Shirouma-O-ike; 23,24. Kamino-take.

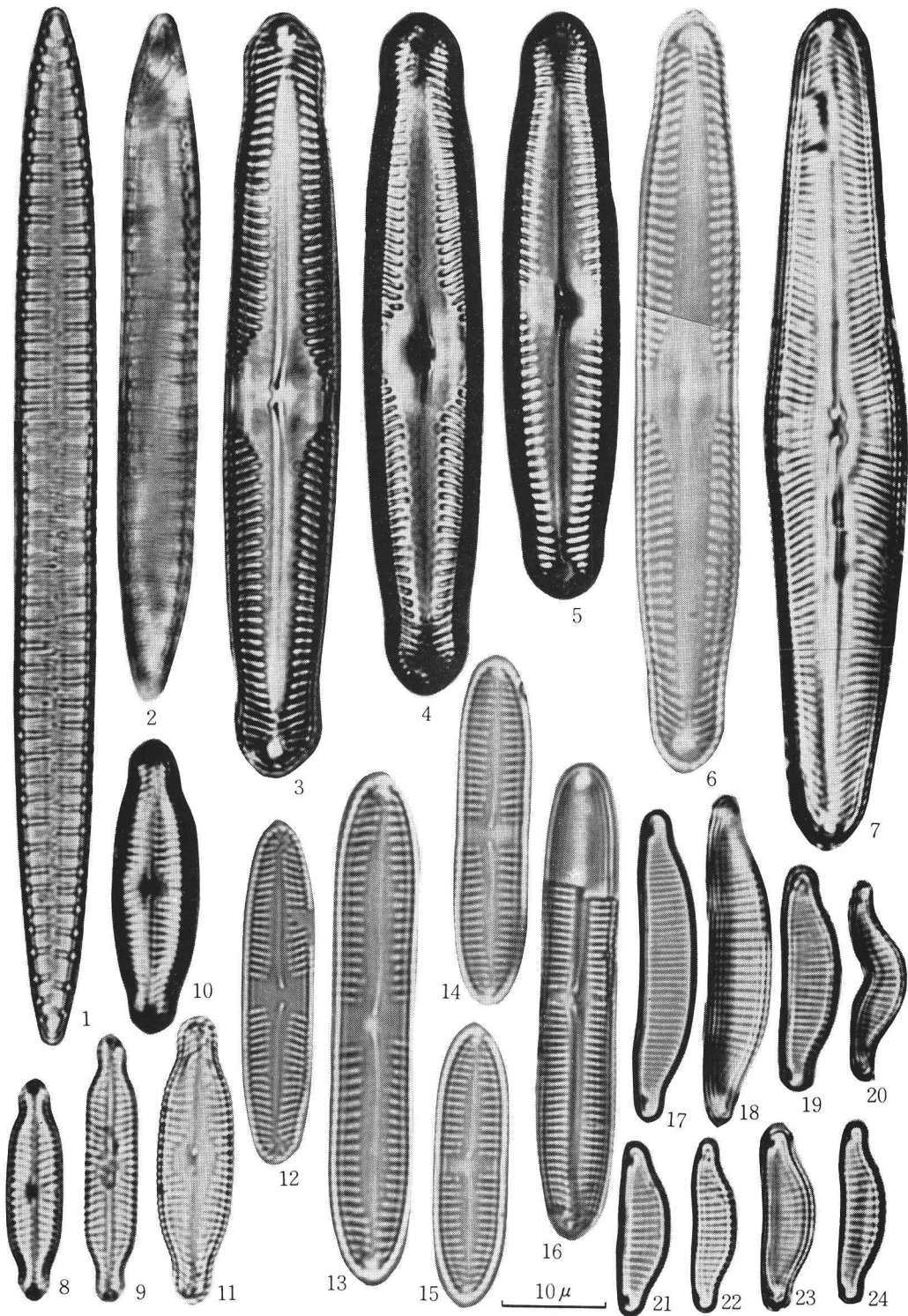


Plate 6

- 1-5. *Pinnularia islandica* ÖSTR. 1. Sen-nin-ike; 2. Kamino-take; 3. Tenguno-hara; 4. Kumono-taira;
5. Tenguno-hara.
6,7. *Cymbella perpusilla* A. CLEVE 6. Kamino-take north slope; 7. Tarobeidaira.
8,9. *Eunotia Meisteri* HUSTEDT var. *bidens* HUSTEDT 8. Tenguno-hara; 9. Kamino-take north slope.
10. *Eunotia lunaris* (EHRENB.) GRUN. var. *falcata* (BRÉB.) A. BERG Kumono-taira.
11,12. *Eunotia polydentula* (BRUN.) A. BERG var. *monodon* MAYER 11. Yakushi-dake south slope; 12.
Tenguno-hara.

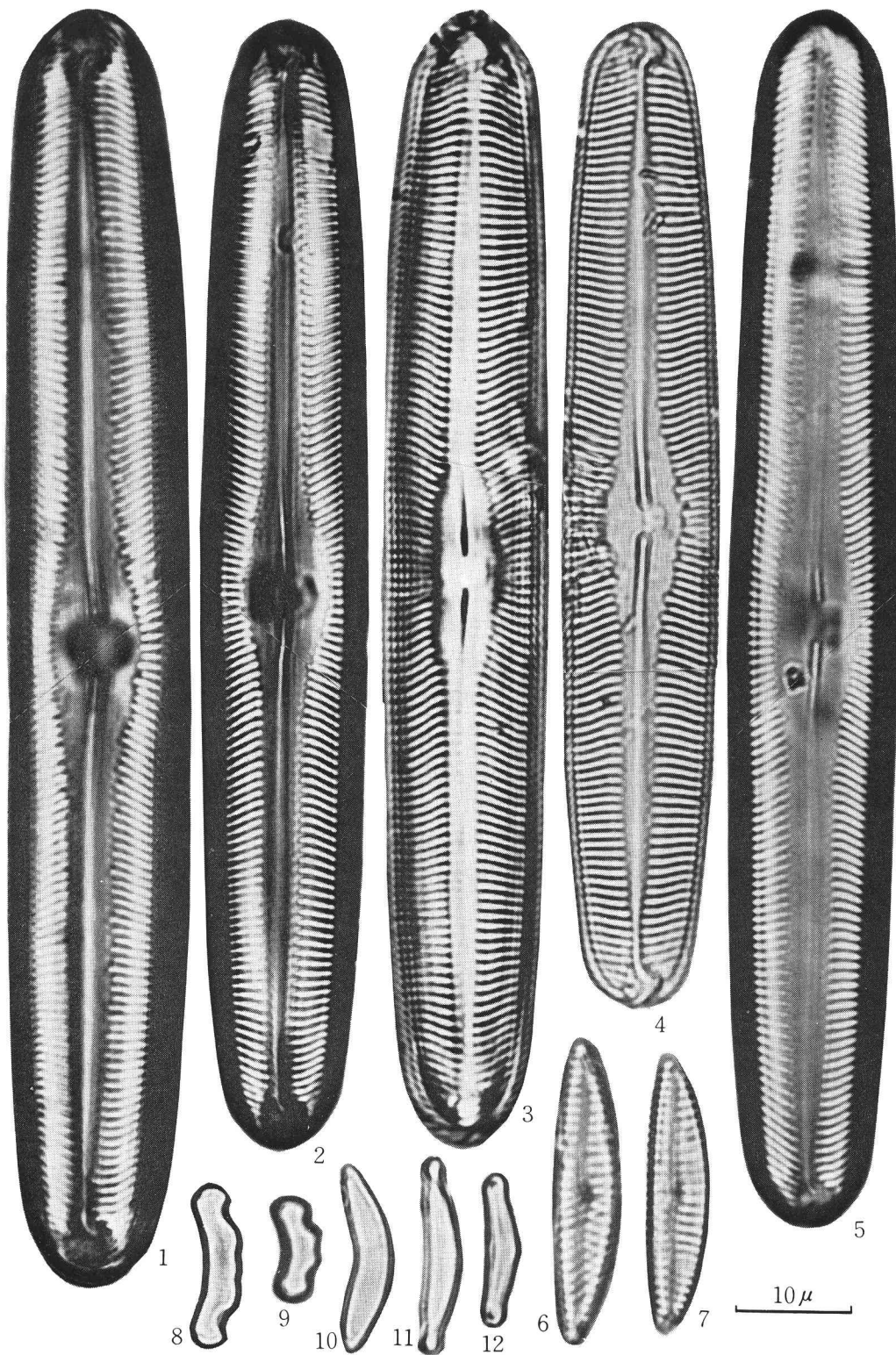


Plate 7

- 1-11. *Pinnularia sudetica* HILSE var. *commutata* (GRUN.) A. CLEVE 1. Gongen-ike; 2. Gono-ike; 3. Kumono-taira; 4. Happo-one; 5. Kurobe-goro-taira; 6. Kumono-taira; 7. Tenguno-hara; 8. Eboshi-dake; 9. Tarobei-daira; 10. Eboshi-dake; 11. Mitumata-rengedake.
- 12,13. *Eunotia alpina* (NÄG.) HUSTEDT Eboshi-dake.

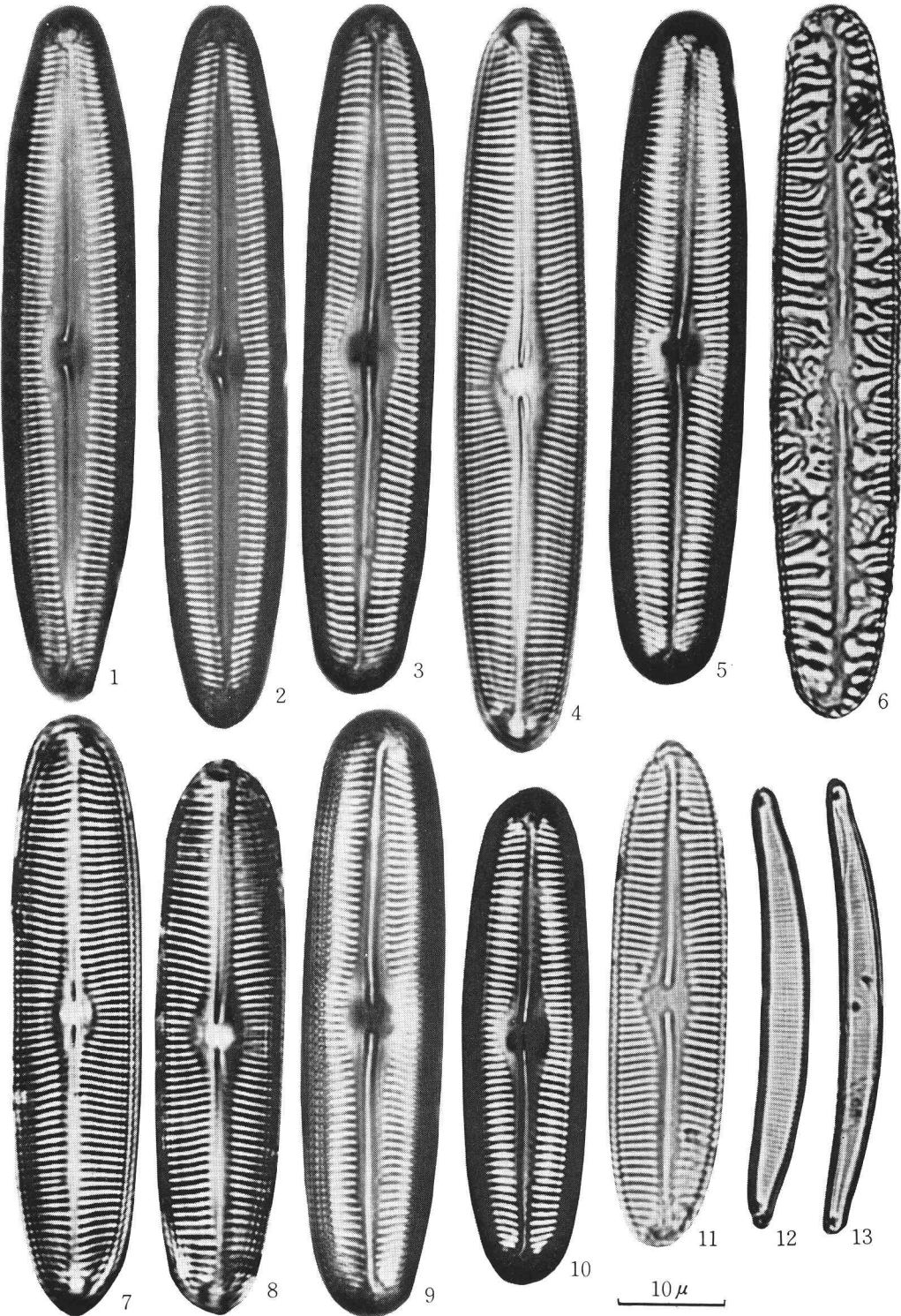


Plate 8

- 1-4. *Pinnularia viridis* (NITZSCH) EHRENB. 1. Eboshi-dake; 2. Happa-one; 3. Kurobe-genryu-daira;
4. Ohniu-ike.
5-7. *Pinnularia subcapitata* GREGORY 5. Eboshi-dake; 6. Mitsumata-rengedake; 7. Eboshi-dake.
8,9. *Cymbella microcephala* GRUN. forma *minor* GRUN. 8. Tarobei-daira; 9. Sen-nin-ike.

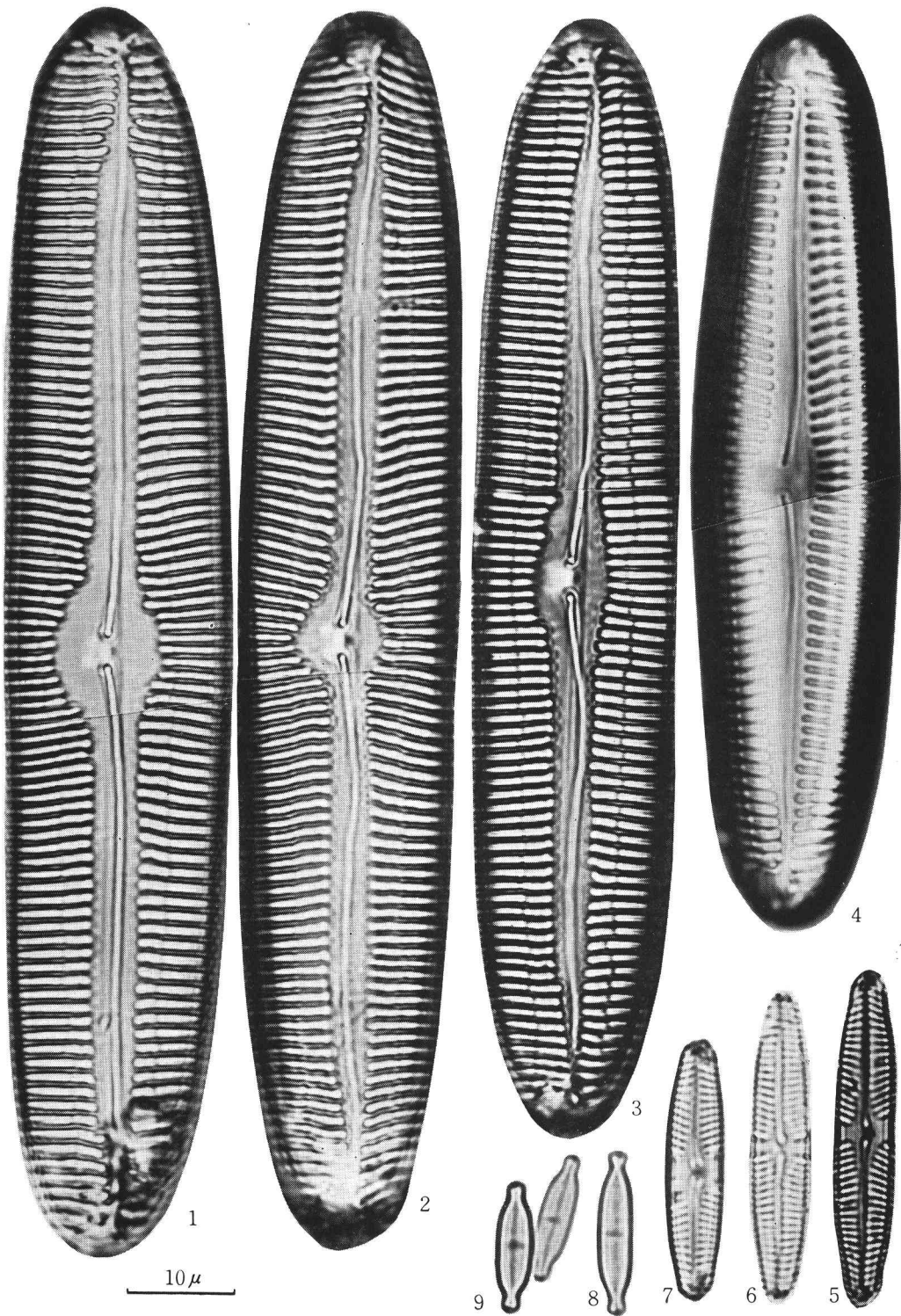


Plate 9

- 1,2. *Pinnularia stauroptera* (RABENH.) CLEVE var. *parva* GRUN. 1. Kurobe-genryu-daira; 2. Happo-one.
- 3-8. *Pinnularia subcapitata* GREGORY var. *hilseana* (JANISCH) O. MÜLL. 3-5. Happo-one; 6. Seijo hut moor.
- 9-13. *Pinnularia subcapitata* GREGORY var. *lapponica* A. CLEVE 9, 10. Happo-one; 11. Kurobe-genryu-daira; 12. Happo-one; 13. Mitsumata-rengedake.
- 14-16. *Pinnularia borealis* EHRENB. 14. Eboshi-dake; 15. Gongen-ike; 16. Ohniu-ike.
- 17,18. *Neidium perminutum* A. CLEVE Mitsumata-rengedake.
- 19. *Neidium iridis* (EHRENB.) CLEVE var. *amphiatum* (EHRENB.) CLEVE Tarobei-daira.

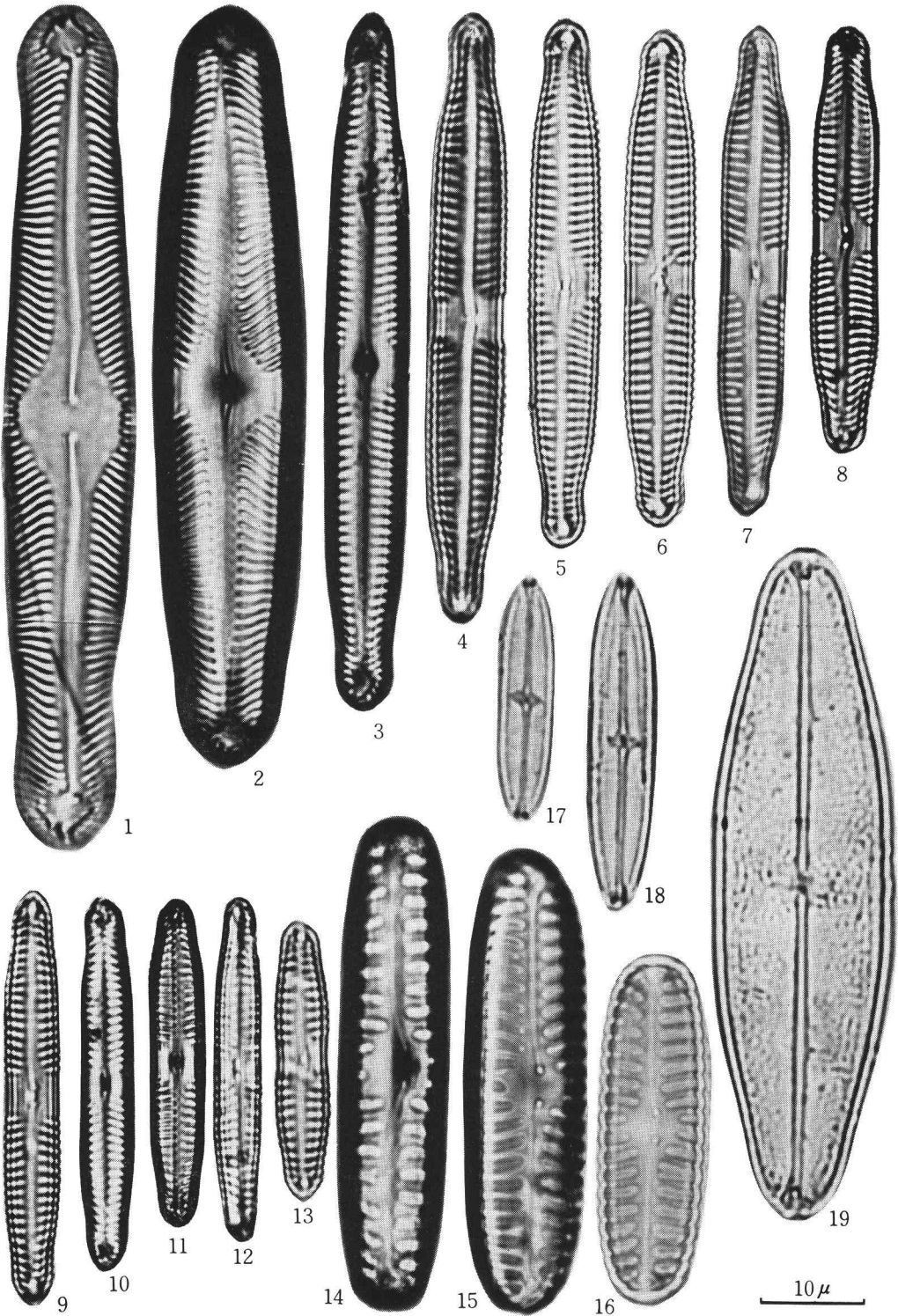


Plate 10

- 1-6. *Pinnularia karelica* CLEVE var. *japonica* HUSTEDT 1. Seijo-hut moor; 2,3. Koshiki-ike; 4. Seijo hut moor; 5. Happo-one; 6. Ohniu-ike.
7,8. *Pinnularia biceps* GREGORY 7. Koshiki-ike; 8. Kazafuki-O-ike.
9. *Neidium dubium* (EHRENB.) CLEVE near Shirouma-O-ike.
10,11. *Neidium bisulcatum* (LAGERSTEDT) CLEVE 10. Yakushi-dake south slope. 11. *Kurobe-genryu-daira*.
12. *Neidium bisulcatum* var. *nipponicum* SKVORTZOW Mitumata-reng-dake.
13,14. *Eunotia faba* (EHRENB.) GRUN. var. *nipponica* SKVORTZOW 13. near Shirouma-O-ike; 14. Seijo-hut moor.

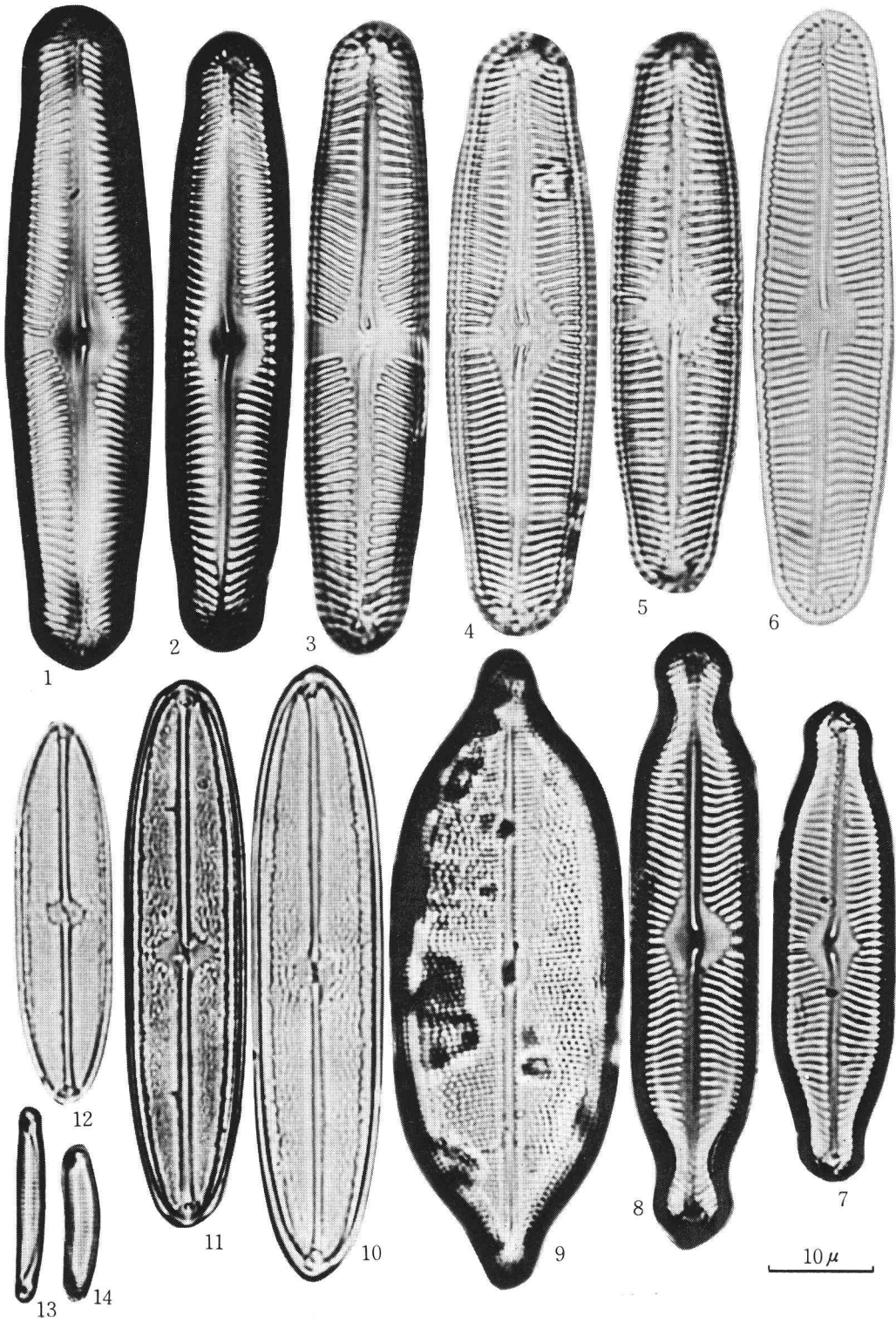


Plate 11

1. *Pinnularia bogotensis* (GRUN.) CLEVE Seijo-hut moor.
- 2,3. *Pinnularia stomatophora* (GRUN.) CLEVE 2. Kurobe-goro-dake cirque; 3. Kurobe-genryu-daira.
- 4,5. *Pinnularia divergens* W. SM. var. *minor* A. CLEVE Kurobe-genryu-daira.
- 6,7. *Pinnularia biceps* GREGORY var. *minor* (BOYE PETERS.) A. Cl. 6. Eboshi-dake; 7. Kurobe-genryu-daira.
- 8,9. *Pinnularia appendiculata* (AG.) CLEVE Kurobe-genryu-daira.
10. *Pinnularia brebissonii* (KÜTZ.) CLEVE var. *diminuta* (GRUN.) CLEVE Koshiki-ike.
- 11,12. *Caloneis fasciata* (LAGERSTEDT) CLEVE Mitsumata-rengo-dake.
13. *Gomphonema angustatum* (KÜTZ.) RABENH. var. *productum* GRUN. Ohniu-ike.
14. *Stauroneis incerta* A. CLEVE var. *constricta* HIRANO, var. nov. Ohniu-ike.

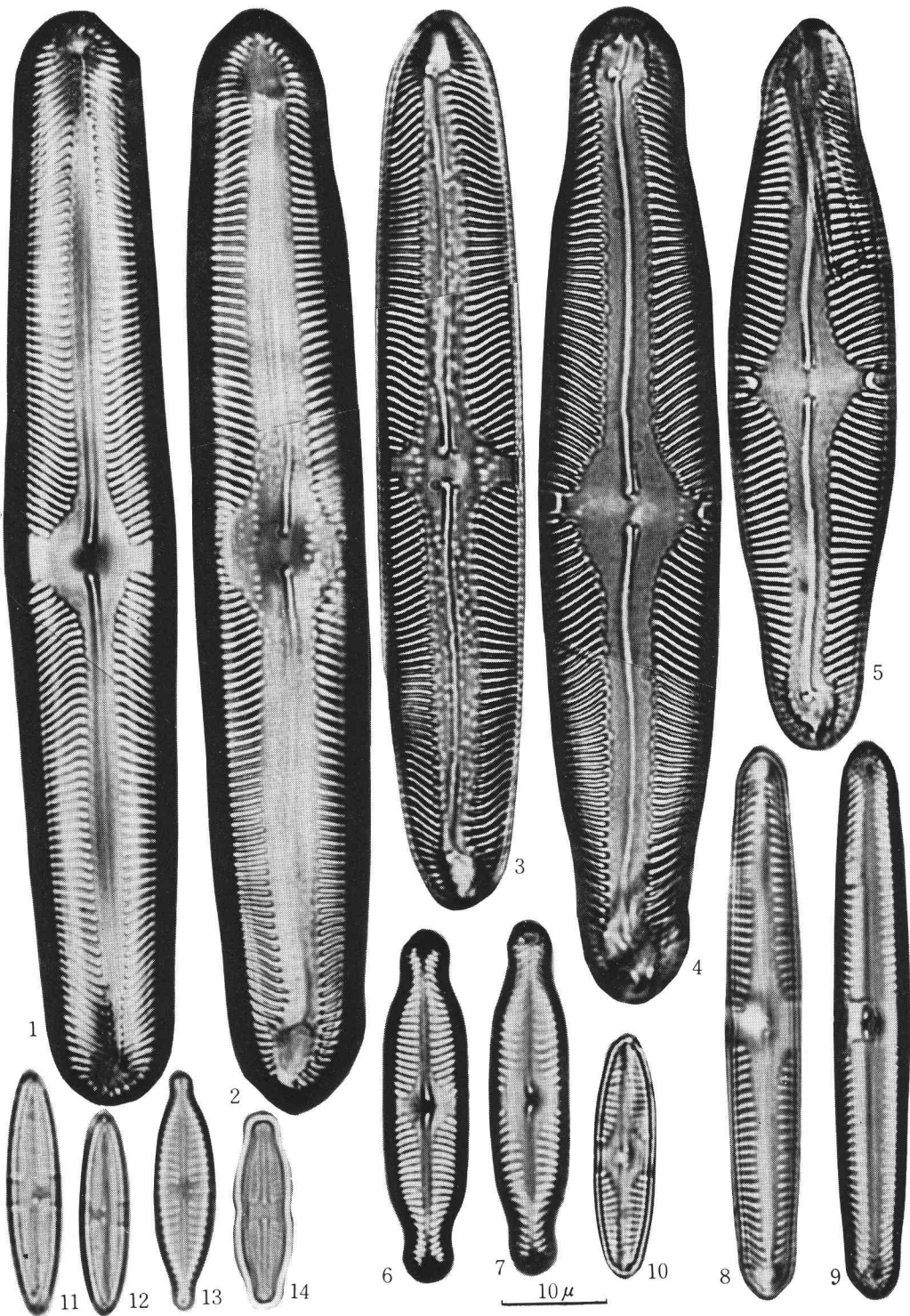


Plate 12

- 1-18. *Pinnularia subcapitata* GREGORY 1. Seijo-hut moor; 2,3. Kumonotaira; 4. Tenguno-hara; 5. Kumono-taira; 6. Eboshi-dake; 7,8. Mitsumata-rengedake; 9. Tarobei-daira; 10. Kurobe-genryu-daira; 11. Mitsumata-rengedake; 12. Gongen-ike; 13,14. Mitsumata-rengedake; 15,16. Yakushi-dake south slope; 17. Tarobei-daira; 18. Gongen-ike.
19. *Navicula verecunda* HUSTEDT Tarobei-daira.
20. *Navicula seminulum* GRUN. Kurobe-genryu-daira.
21. *Achnanthes Grimmei* KRASSKE Gono-ike.
- 22,23. *Achnanthes kryophila* BOYE PETERS. 22. Kurobe-genryu-daira; 23. near Shirouma-O-ike.
- 24-26. *Achnanthes lanceolata* (BRÉB.) GRUN. Ohniu-ike.
27. *Navicula Borrichi* BOYE PETERS. var. *subcapitata* BOYE PETERS. Happo-one.
- 28,29. *Eunotia veneris* (KÜTZ.) O. MÜLL. Eboshi-dake.

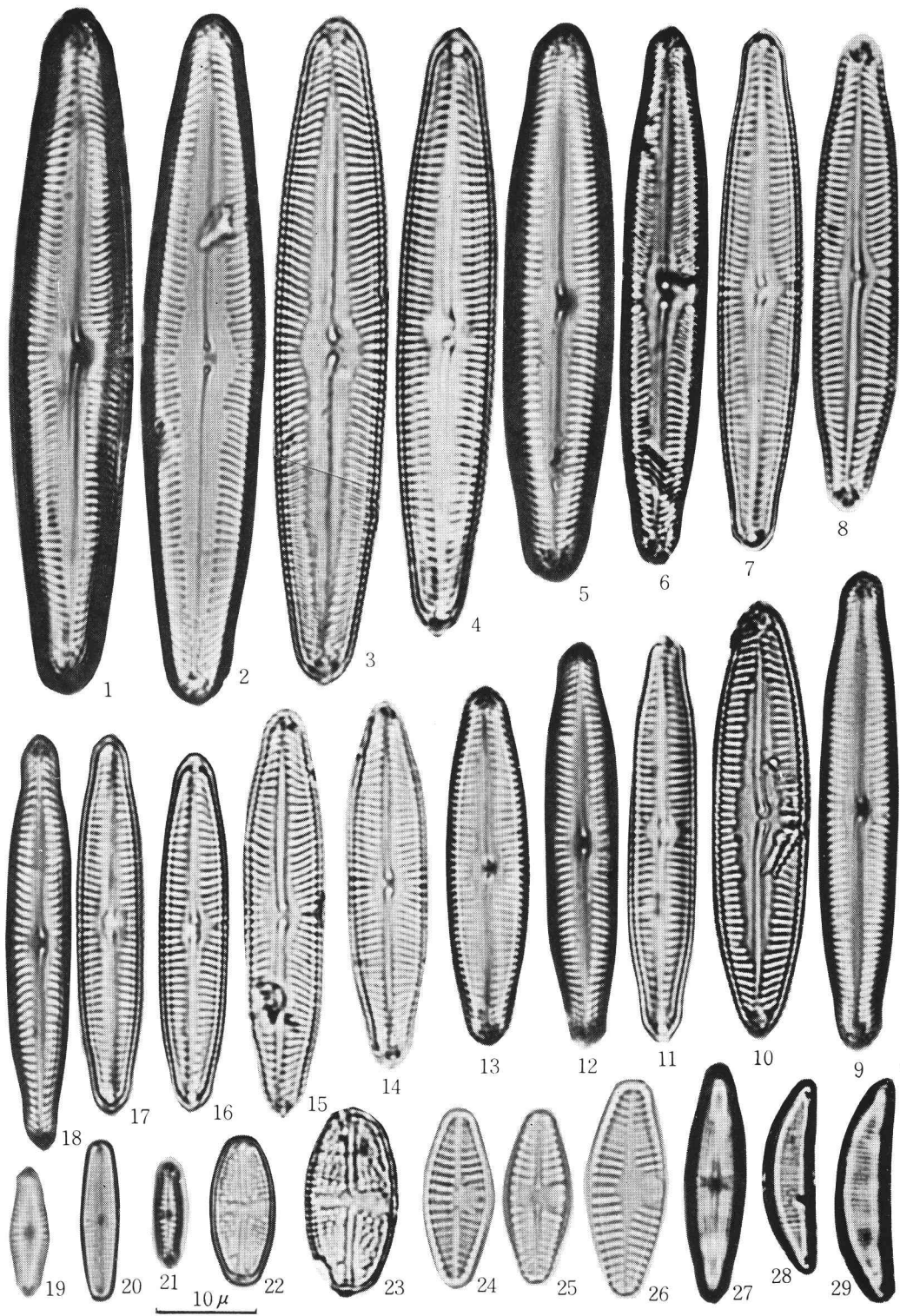


Plate 13

1. *Surirella linearis* W. SM. var. *constricta* (EHRENB.) GRUN. Kurobe-genryu-daira.
- 2-9. *Cymbella hebridica* (GREGORY) CLEVE 2. Happo-one; 3. Sennin-ike; 4. Happo-one; 5. Sen-nin-ike; 6. near Shirouma-O-ike; 7,8, Tenguno-hara; 9. near Shirouma-O-ike.
- 10,11. *Cymbella naviculiformis* AUERSW. Happo-one.
- 12,13. *Cymbella ventricosa* KÜTZ. Ohniu-ike.
- 14,15. *Cymbella gracilis* (RABENH.) CLEVE 14. Kurobe-genryu-daira; 15. Happo-one.
- 16,17. *Cymbella alpina* GRUN. Eboshi-dake.
- 18,19. *Eunotia crista galli* CLEVE Happo-one.
20. *Diploneis elliptica* (KÜTZ.) CLEVE Ohniu-ike.

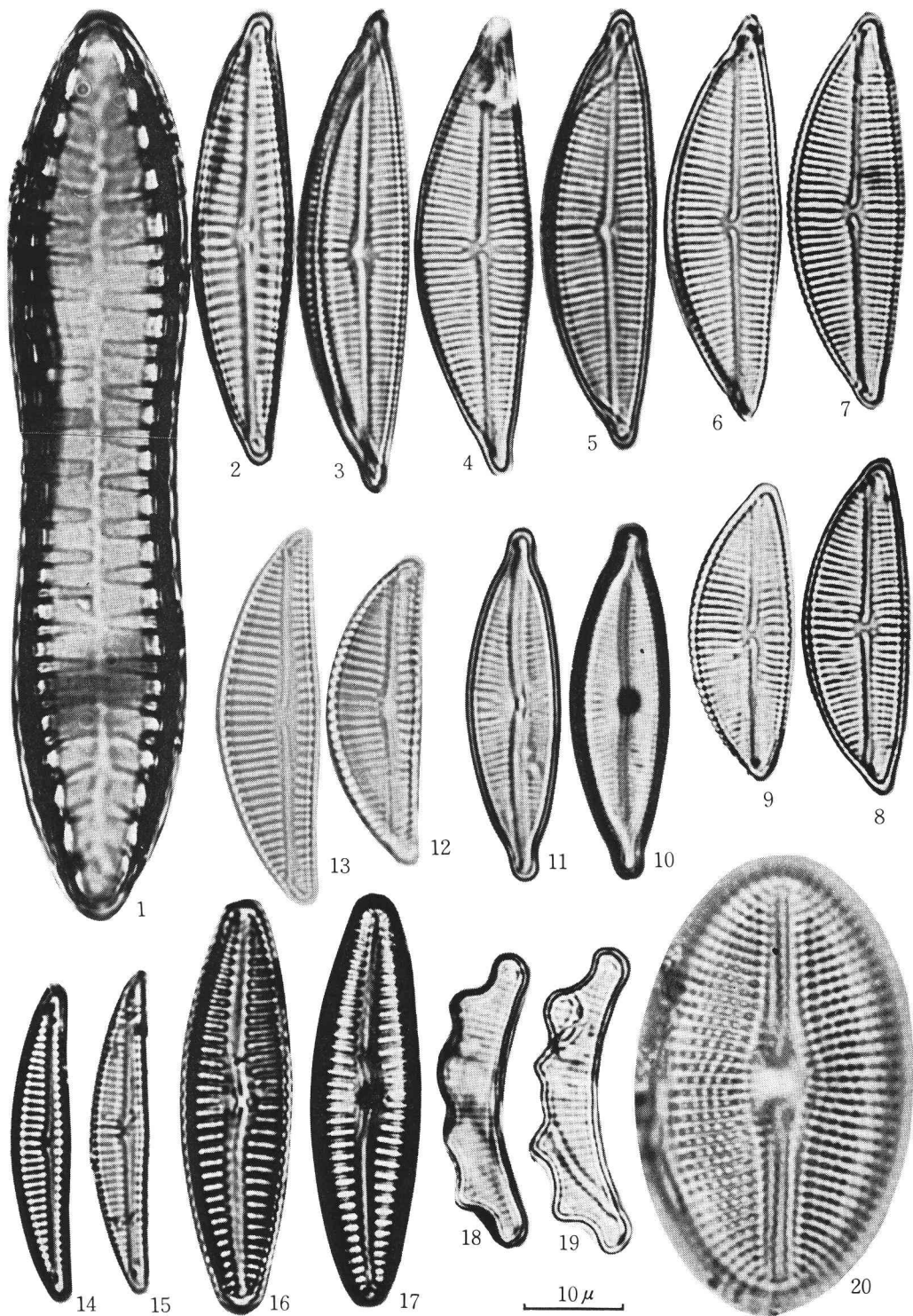


Plate 14

1. *Neidium iridis* (EHRENB.) CLEVE forma *vernalis* REICHELTL Happono.
2. *Neidium iridis* (EHRENB.) CLEVE Kurobe-genryu-daira.
3. *Surirella biseriata* BRÉB. Gongen-ike.
- 4,5. *Surirella linearis* W. SM. 4. Kurobe-genryu-daira; 5. Gono-ike.
- 6,7. *Diatoma hiemale* (LYNGBYA) HEIBERG Ohniu-ike.
- 8,9. *Gomphonema angustatum* (KÜTZ.) RABENH. 8. Mitsumata-rengo-dake; 9. Ikeno-taira.

