

Type Examination of Japanese Diatoms Described by Friedrich Meister (1913) from Lake Suwa

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Abstract The type slides for five taxa described by Friedrich Meister (1913) from Lake Suwa were examined. Micrographs of specimens from these type slides are presented and types are designated using individuals from each slide. One new combination is also proposed.

Key words: *Asterionella subtilissima* F. Meister, *Aulacoseira ambigua* f. *japonica* (F. Meister) Tuji et D. M. Williams, comb. et stat. nov., *Aulacoseira pusilla* F. Meister, *Gomphonema globiferum* F. Meister, lectotype, *Melosira japonica* F. Meister, *Melosira pusilla* F. Meister, *Synedra japonica* F. Meister, *Synedra delicatissima* var. *angustissima* Grunow, *Synedra delicatissima* var. *mesoleia* Grunow, *Synedra rostrata* F. Meister.

Introduction

Friedrich Meister (1913, 1914) described 12 new taxa, six from Lake Suwa, Japan, one from “Filter der Wasserversorgung Yokohama”, the other five from “Teich des botanischen Gartens zu Tokyo” (thought to be the Botanical Gardens, Graduate School of Science, the University of Tokyo in Koishikawa). Though these taxa are often found in Japanese freshwater, as periphyton or plankton, their identification has been confused.

Slides prepared by Meister, agreeing with the original descriptions, are found in Hustedt’s collection in the Friedrich Hustedt Study Centre for Diatoms, the Alfred Wegener Institut für Polar- und Meeresforschung. This paper continues reports of the examination of Meister’s type specimens (Tuji and Houki 2004; Tuji and Williams 2006).

In this study, micrographs of type specimens for five taxa described by Meister (1913) from Lake Suwa are presented.

Materials and Methods

Three sources of specimens were examined:

1. Meister’s slides in the Hustedt’s collection in the Friedrich Hustedt Study Centre for Diatoms, the Alfred Wegener Institut für Polar- und Meeresforschung (BRM) are labelled with the species name, a locality and the name of “Meister”. As the descriptions match those given by Meister in 1913 (Meister 1913), they should be considered isotype specimens.
2. Slide no. 801 (Lake Suwa) of Tempère et Peragallo (2nd edition), BM 69152 in the Department of Botany, Natural History Museum, London (BM), is thought to be isotype material (Tuji and Williams, 2006) for Meister (1913).
3. Materials from Lake Biwa and Katata lagoon near Lake Biwa, housed in the Department of Botany, National Museum of Nature and Science (TNS), were examined for appropriate specimens to provide scanning electron micrographs (SEM).

Results and Discussion

Aulacoseira ambigua f. *japonica* (F. Meister) Tuji et D. M. Williams, comb. et stat. nov.

[Figs. 1–4]

Basionym: *Melosira japonica* F. Meister in Archiv f. Hydrobiol. **8**: 311. f. 1. 1913, a later homonym. [Fig. 3]

non: *Melosira japonica* Pant. in Beitr. Kenntn. Foss. Bacill. Ungarns **3**: 62. 1905. pl. 4. f. 63. pl. 8. f. 137. 1892.

Lectotype (designated here): Slide BRM “A3/57”! [Fig. 4]

Isotype: Slide no. 801 of Tempère et Peragallo (2nd ed.), BM 69152! [Figs. 1, 2]

Type locality: Lake Suwa, Nagano Pref., Japan.

Although *Melosira japonica* F. Meister (1913) is a later homonym of *M. japonica* Pantocsek (1905), it has been used in many Japanese research papers (Tanaka, 2002; Tuji, 2006). *Melosira japonica sensu* F. Meister has been sometimes identified as *M. granulata* var. *tenuissima* f. *spiralis* (Wakabayasi and Ichise, 1982).

Melosira japonica Pant. was described from fossil material in Hokkaido and is clearly different from *M. japonica sensu* F. Meister (Tuji, pers. obs.).

Since the structure of the frustule is similar to that of *Aulacoseira ambigua* (Grunow) Simonson, as described by Kobayasi and Nozawa (1981), Tuji and Houki (2001) made it a synonym of *A. ambigua*. Tuji and Houki (2001) used the term “Morphotype” for describing the morphological differences of colonies between *Melosira japonica* (with spiral colonies) and *A. ambigua* (straight colonies). The term “Morphotype”, which was used by Krammer and Lange-Bertalot (1991) as “Morphotyp”, is not suitable in this case, as the term, if used at all, should refer to morphological changes in a taxon.

Tanaka (2002) described *A. ambigua*, which appeared in mesotrophic environments, and *Aulacoseira japonica* nom. nud. (*M. japonica*), which appeared in eutrophic environment. The distribution of both taxa in Lake Biwa supports this ecological difference (Tuji, 1995, pers. obs.).

Since we believe it is important to distinguish the morphological differences observed in the colonies (spiral and straight), and as those differ-

ences correspond to different ecological occurrences, we propose a new combination for *Melosira japonica sensu* Meister.

Four syntype slides have been identified for *Melosira japonica* F. Meister in Hustedt’s collection: BRM, “A3/28”, with the Hustedt’s label “Suwa See Japan VII 1911 St Prap Meister”; BRM “A3/29”, with the Hustedt’s label “Suwa See, Japan VII-IX, 08 St Prap Meister”; BRM “A3/57”, with the Meister’s label “Suwa Sea VII-IX 1908, *Melosira japonica* Meister”; and BRM “A3/58” with the Meister’s label “Suwa Sea VII-IX 1908, *Melosira japonica* Meister”. Last three slides include specimens in single colonies. Individuals found in all slides correspond to the given description of *M. japonica* F. Meister. Here, we propose BRM “A3/57” as the lectotype for *Melosira japonica* F. Meister.

Aulacoseira pusilla (F. Meister) Tuji et Houki in Bull. Natn. Sci. Mus., Tokyo, Ser. B. **30**: 38.

[Figs. 5–20]

Basionym: *Melosira pusilla* F. Meister, Arch. Hydrobiol. **8**: 311. pl. IV, f. 2. 1913.

Lectotype (designated in Tuji and Houki 2004): Slide BRM “A3/61”! [Figs. 5–10]

Isotype: Slide no. 801 in Tempère et Peragallo (2nd ed.), BM 69152! [Figs. 11–18]

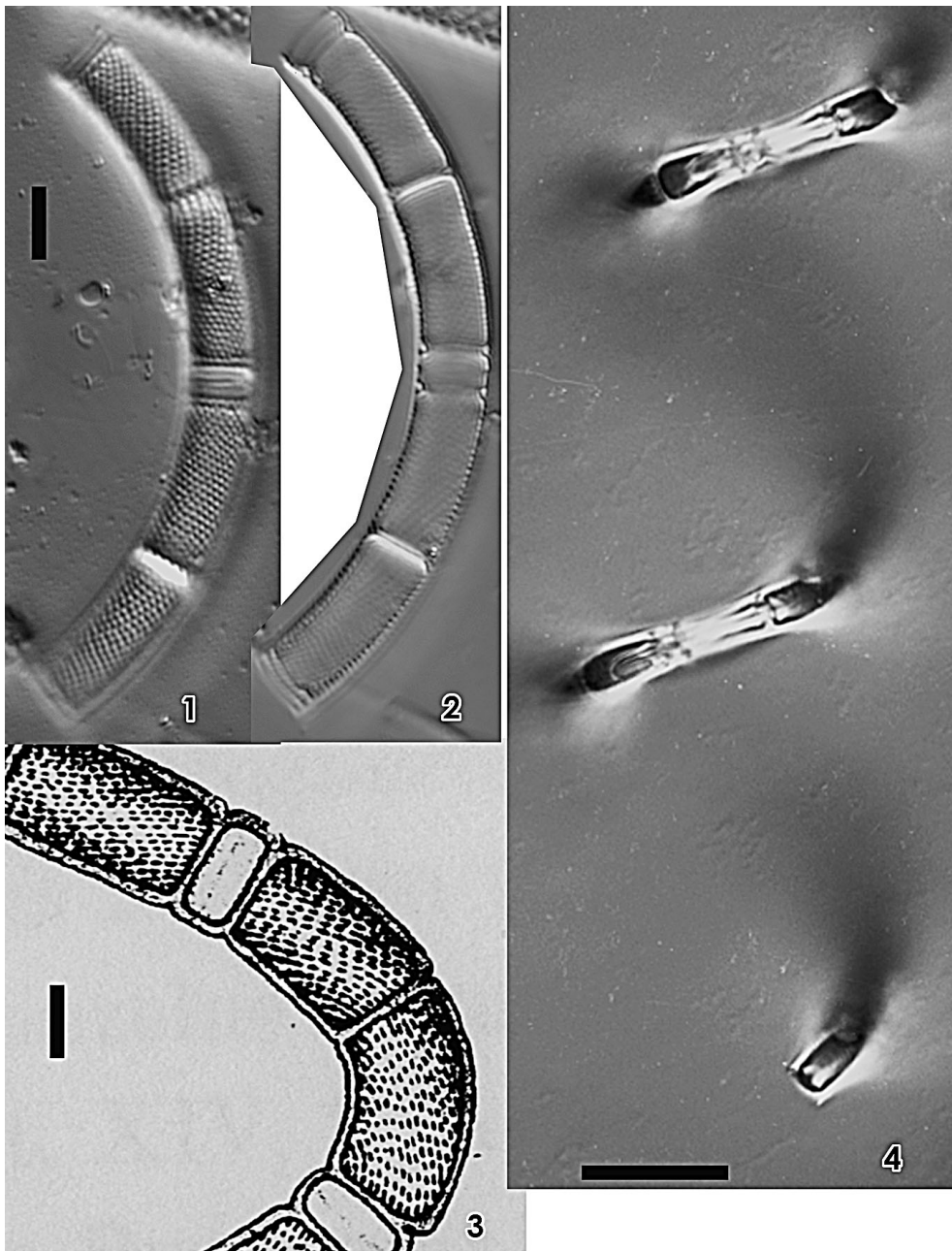
Type locality: Lake Suwa, Nagano Prefecture, Japan.

Synonym: *Aulacoseira subborealis* (Nygaard) Denys, Muylaert et Krammer in Nova Hedwigia **77**: 410. 2003.

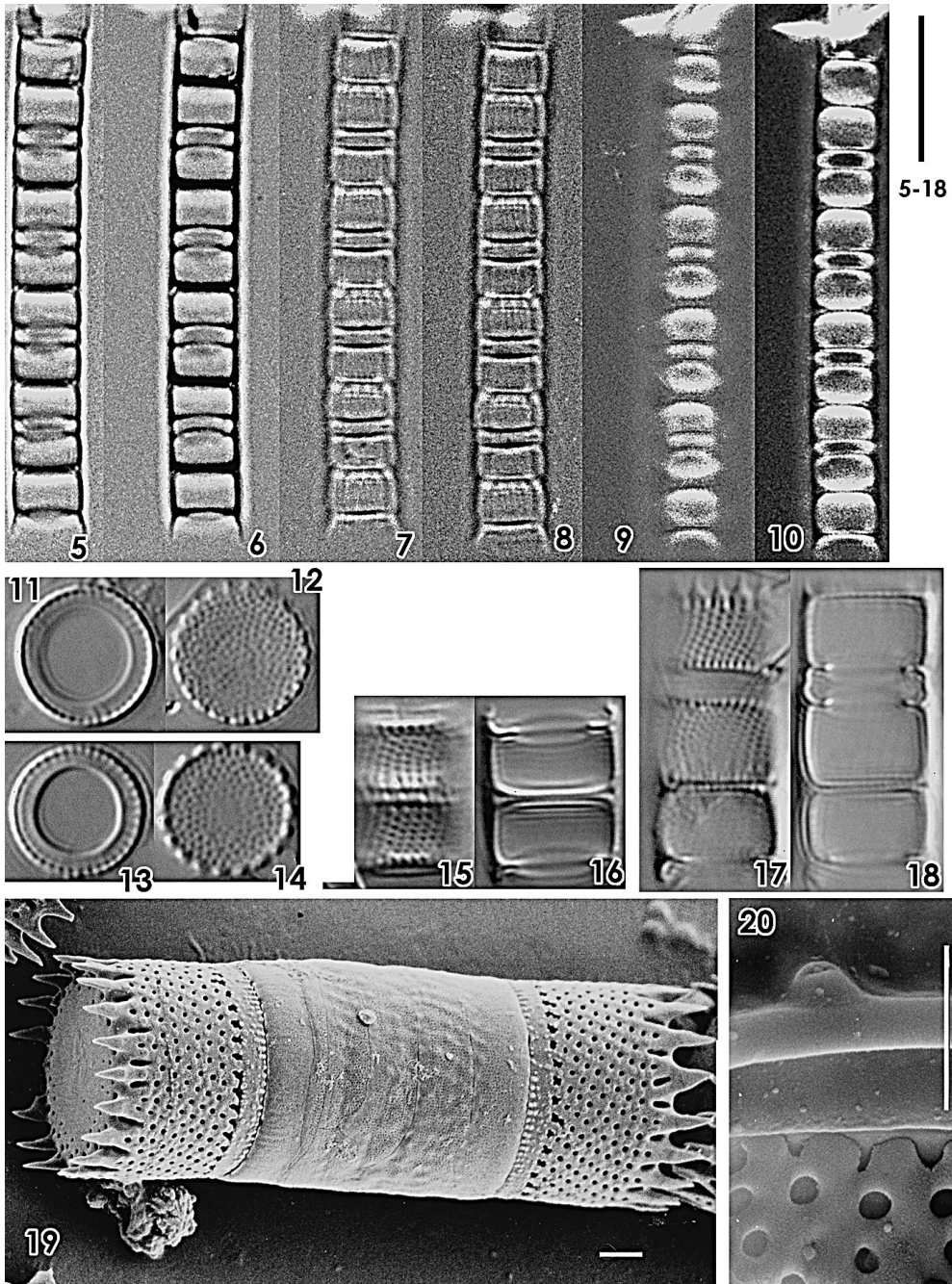
Melosira italica var. *subborealis* Nygaard, Folia Limnologica Scandinavica **8**: 74. pl. 1. f. 8. pl. 2. f. 13–19. pl. 6. f. 24–25. 1956.

Examination and lectotypification for *Melosira pusilla* Meister was undertaken by Tuji and Houki (2004) (Figs. 1–10). Tuji and Williams (2006) also examined the isotype slide in Tempère and Peragallo’s *Diatomees du monde entier* (2nd ed.) (Figs. 11–18) and discussed its morphological variation.

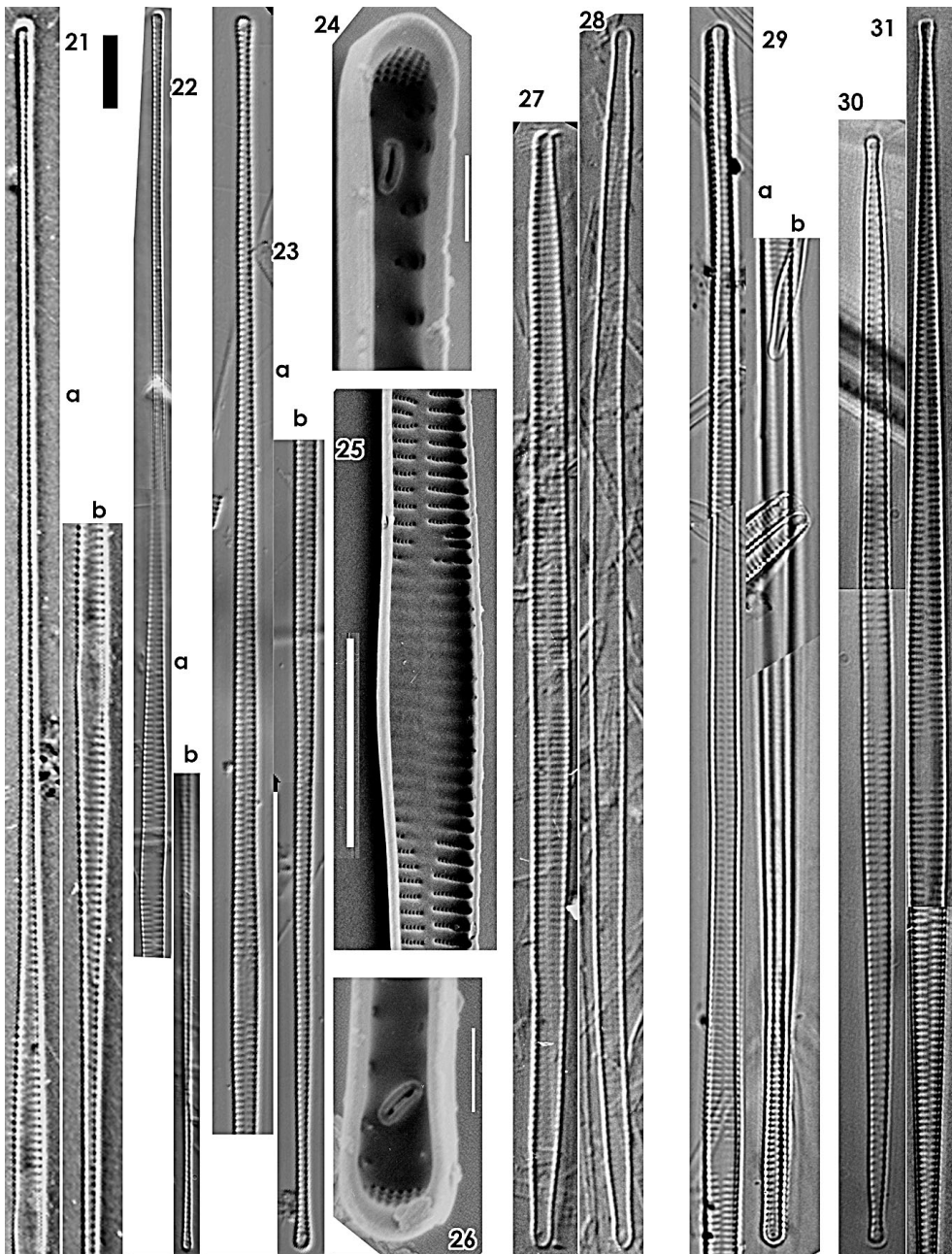
Melosira pusilla F. Meister is commonly found in eutrophic lakes, ponds and reservoirs in Japan. It has been confused with *Aulacoseira distans*



Figs. 1–4. *Aulacoseira ambigua* f. *japonica* (F. Meister) Tuji et Williams, comb. et stat. nov. Figs. 1, 2. BM 69152 (isotype). Fig. 3. Meister's original illustration in Meister (1913). 4. A3/57 (lectotype, BRM). Bar=10 μ m.



Figs. 5–20. *Aulacoseira pusilla* (F. Meister) Tuji et Houki. Figs. 5–10. A3/61 in BRM (lectotype; after Tuji and Houki, 2004). Figs. 11–18. BM 69152 (isotype; after Tuji and Williams, 2006). Figs. 19, 20. Katata lagoon near Lake Biwa (after Tuji and Houki, 2004). Figs. 5–18. Bar=10 μ m. Figs. 19, 20. Bar=1 μ m.



Figs. 21–31. The *Synedra delicatissima* species complex. *Synedra japonica* F. Meister 21. K2/59 (lectotype, BRM). Figs. 22–23. BM 69152 (isotype). Figs. 24–26. Lake Biwa. Figs. 27, 28. *Synedra delicatissima* W. Sm. BM 22475 (lectotype). Fig. 29. *Synedra delicatissima* var. *angustissima* Grunow. 2646a in Grunow collection (lectotype individual, W). Figs. 30, 31. *Synedra delicatissima* var. *mesoleia* Grunow. 1881 in Grunow collection (W). Fig. 30. Lectotype individual. Figs. 21–23, 27–30. Bar=10 μm . Figs. 24, 26. Bar=1 μm . Fig. 25. Bar=5 μm . Figs. 21–26.

(Ehrenb.) Simonsen (Tanaka 2002), *Aulacoseira subarctica* O. F. Müll. (Kawashima and Kobayasi 1993) and *Aulacoseira subarctica* f. *subborealis* (Nygaard) Denys, Muylaert et Krammer (Hirose *et al.*, 2004; Tsugeki *et al.*, 2006) by Japanese diatomists.

Synedra japonica F. Meister in Arch. Hydrobiol. 8: 312. pl. IV, f. 5–6. 1913. [Figs. 21–28]

Lectotype (designated here): BRM “K2/59” !
[Fig. 21]

Isotype: Slide no 801, Tempère et Peragallo (2nd ed.), BM 69152 ! [Figs. 22, 23]

Type locality: Lake Suwa, Nagano Pref., Japan.

In BRM there is one slide labelled “K2/59” for this taxon. It includes just two individuals: On the upper left one specimen is covered in dust and not suitable for detailed examination. The other specimen, on the lower right, as it is visible (Fig. 21), is designated as the lectotype.

Although individuals with finer striae have been observed in the isotype slide (13–14 striae per 10 μm , BM 69152, Fig. 22), it is assumed a simple morphological variation. The description given of *S. delicatissima* var. *angustissima* in Patrick and Reimer (1966) is the same as this taxon.

Synedra japonica is common in the plankton of Japanese Lakes and Reservoirs, and previously identified as either *Synedra acus* (Yoshizawa and Nakamura, 1995) or *Synedra delicatissima* var. *angustissima* (Tanaka, 2002).

The valve are very narrow at the poles (1–2 μm), becoming narrow towards the central area; the poles are weakly spatulate, the sternum is very narrow. Striae are 11–14 per 10 μm (Figs. 21–23).

SEM observations on the material from Lake Biwa revealed two large rimoportulae, one at each end of the frustule (Figs. 24–26).

Examination of the type for *S. delicatissima* var. *delicatissima* W. Sm., using LM (Figs. 27, 28) and SEM, was undertaken by Tuji and Houki (2004). *Synedra delicatissima* has wider and capitate valve poles when compared to *S. japoni-*

ca.

Synedra delicatissima var. *angustissima* was first described by Grunow (1882). In an annotated copy of Van Heurck (1880–1885) (GVHS, housed in W), Grunow noted the slide “2646”, the locality “Attersee” (Lake Attersee, Austria) and the density of striae (12) alongside his original line drawings. Slide “2646a” and raw material “2646” were located in Grunow’s collection and examined using LM. The individual in Figure 29, from slide W 2646a, we designate as the lectotype.

Synedra delicatissima var. *mesoleia* was also first described by Grunow (1882). In GVHS, Grunow noted the slide “1821”, the locality and density of striae (11 1/2) alongside his original line drawings. Slide “1821” was located in Grunow’s collection and examined using LM. The individual in Figure 30, from slide W 1821, we designate as the lectotype.

Synedra delicatissima var. *angustissima* and *S. delicatissima* var. *mesoleia* both have wide and capitate valve poles, and are considered synonyms of *S. delicatissima* var. *delicatissima*. These features separate it from *S. japonica* and are not synonyms.

Synedra rostrata F. Meister in Arch. Hydrobiol. 8: 312. pl. IV, f. 7. 1913. [Fig. 32–37]

Lectotype (designated here): BRM “K2/57” !
[Fig. 33]

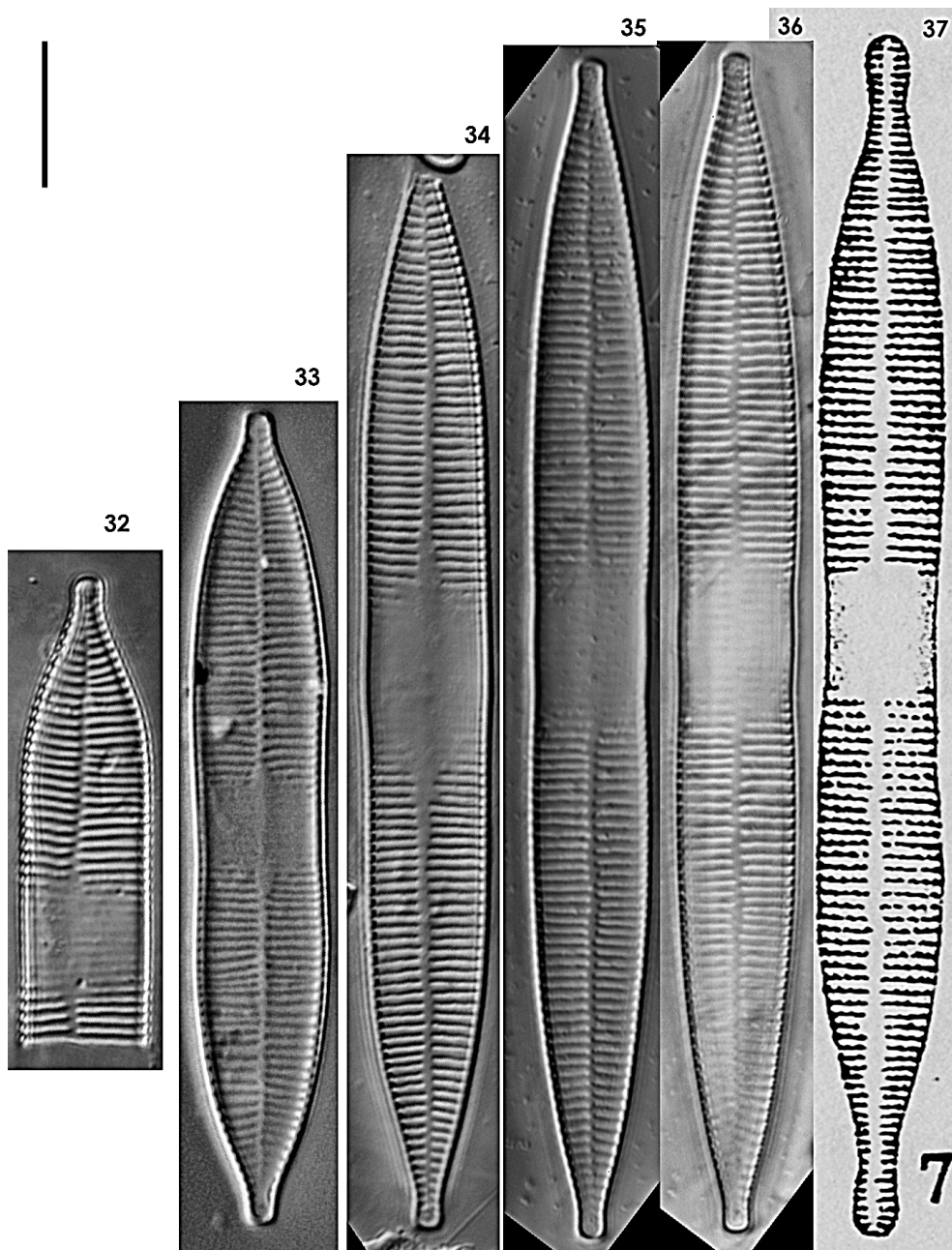
Isotype: Slide no. 801 Tempère et Peragallo (2nd ed.), BM 69152 ! [Figs. 32, 34–36]

Synonym: *Synedra inaequalis* H. Kobayasi in Kobayasi, H., Idei, M., Kōbori, S. et Tanaka, H., Diatom 3: 9–10. f. 2–13. 1987.

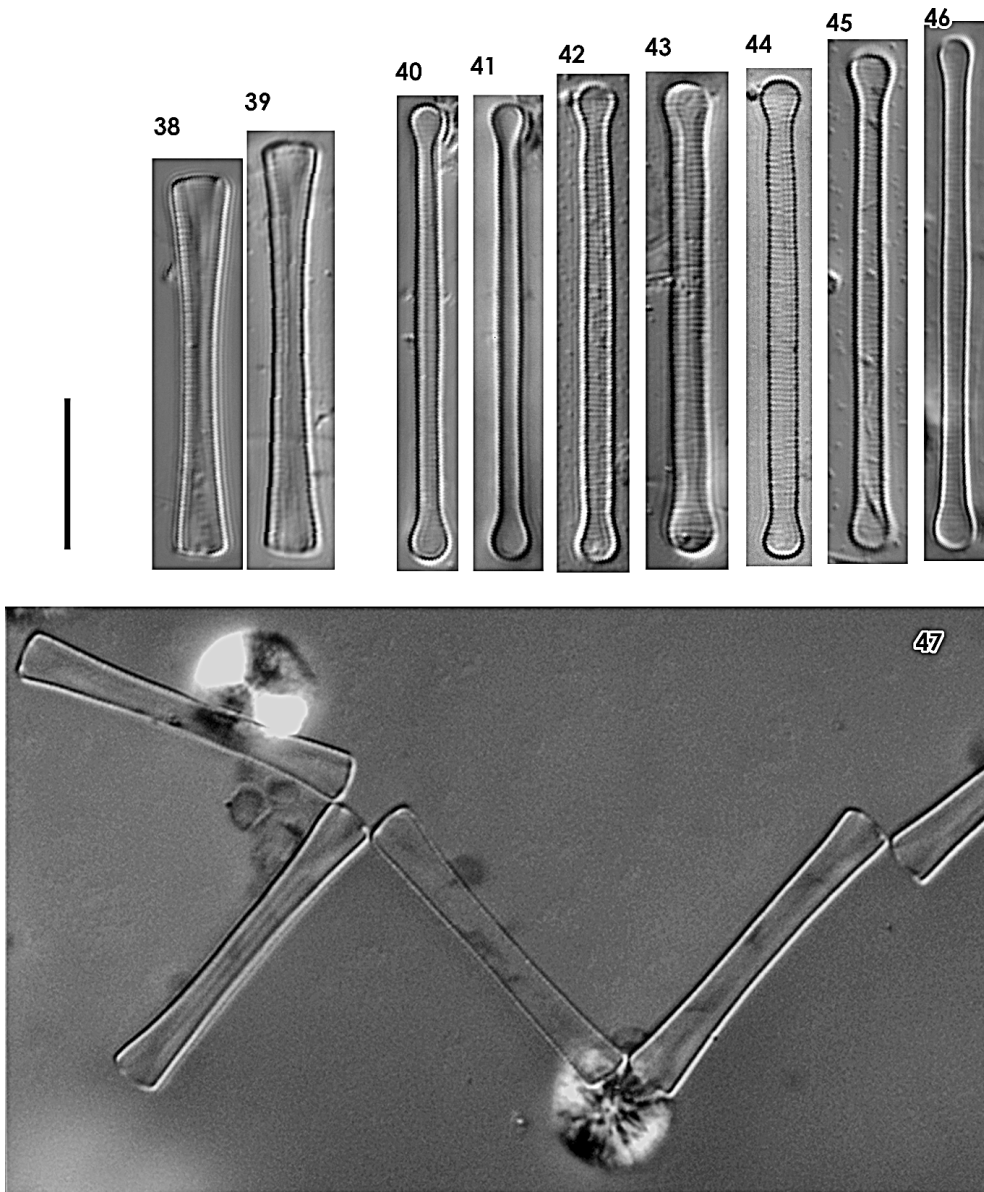
Ulnaria inaequalis (H. Kobayasi) M. Idei in H. Kobayasi’s, Atlas Jap. Diat. Electr. Microsc. 1: 86. 2006.

Type locality: Lake Suwa, Nagano Pref., Japan.

One individual specimen of *Synedra rostrata* F. Meister on slide BRM “K2/57” was found, and designated as lectotype. Both the lectotype individual and others found on the isotype slide correspond with the description given by Meister



Figs. 32–37. *Synedra rostrata* F. Meister. 33. K2/57 (lectotype, BRM). Figs. 32, 34–36. BM 69152 (isotype).
 Fig. 37. Meister's original illustration in Meister (1913). Figs. 31–36. Bar=10 μ m.



Figs. 38–47. *Asterionella subtilissima* F. Meister. 48. KB/81 (lectotype, BRM). Figs. 38–46. BM 69152 (isotype). Figs. 37–46. Bar=10 μ m.

(1913).

SEM micrographs were presented by Kobayasi *et al.* (1987) and Kobayasi *et al.* (2006) as *S. inaequalis*. The variation observed for *Synedra rostrata* F. Meister is that of *Synedra inaequalis* H. Kobayasi in Kobayasi *et al.* (1987), suggesting they are synonyms.

This taxon is common as periphyton in the

oligotrophic rivers and lakes.

Asterionella subtilissima F. Meister in Arch. Hydrobiol. 8: 312. pl. IV, f. 8–10. 1913.

[Figs. 38–47]

Lectotype (designated here): BRM “KB/81” !

[Fig. 47]

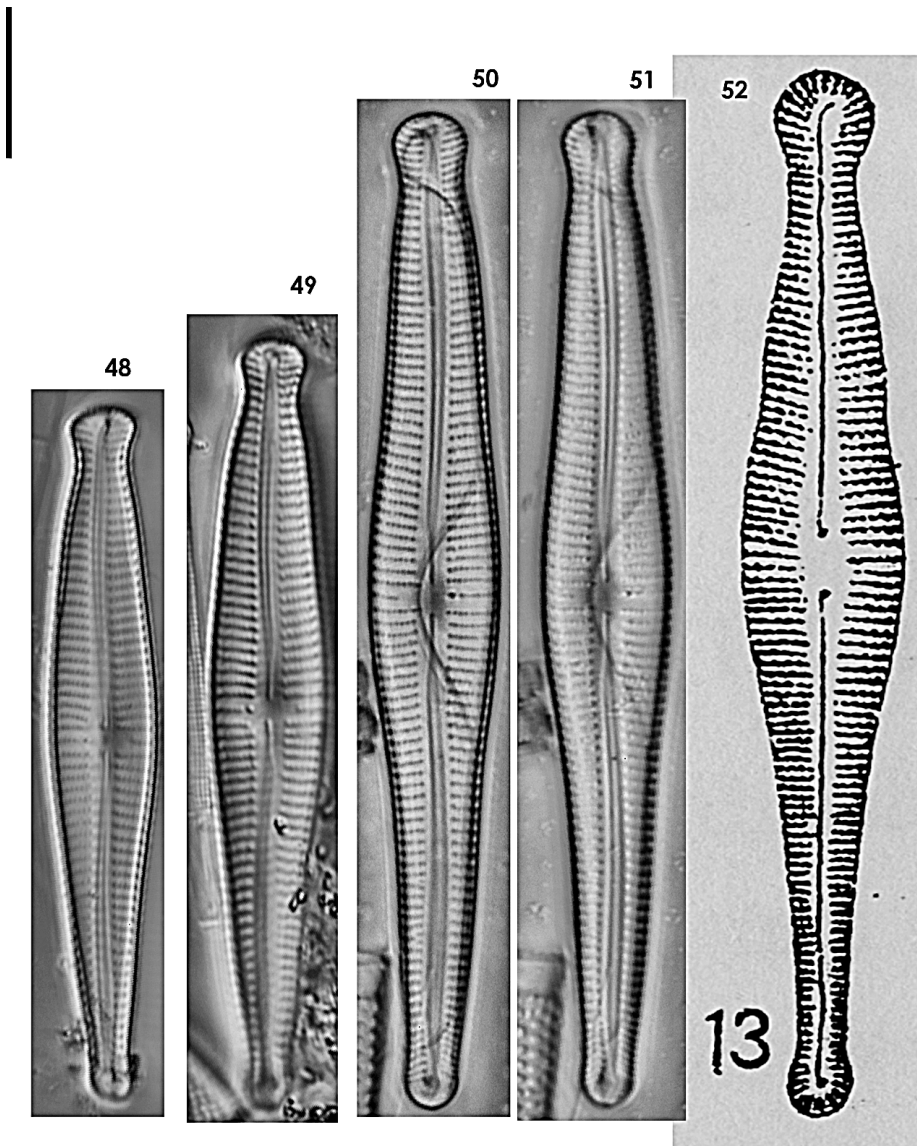
Isotype: Slide no. 801 Tempère et Peragallo

(2nd ed.), BM 69152 ! [Figs. 38–46]

Type locality: Lake Suwa, Nagano Pref., Japan.

One colony on the slide numbered “KB/81” was found to be *Asterionella subtilissima* F. Meister and is designated as lectotype. The lectotype colony was observed only in girdle view (Fig. 47). Valve and girdle views were found for specimens in the isotype slide (BM 69152, Figs.

38–46). *Asterionella subtilissima* has a short valve length and may be compared with *Asterionella gracillima* (Hantzsch) Heib. However, there is a lack of data to clarify the taxonomic states of *A. subtilissima*. The colony formation and the valve structure of *A. subtilissima* is also similar to *Eunotia asterionelloides* Hust. However, the striae of *A. subtilissima* are parallel through to the valve ends (Fig. 40–46), those of



Figs. 48–52. *Gomphonema globiferum* F. Meister. BM 69152 (isotype). Figs. 50, 51. Lectotype. Fig. 52. Meister's original illustration in Meister (1913). Figs. 48–52. Bar=10 μ m.

E. asterionelloides become oblique towards the poles (Simonsen, 1987: pl. 570).

Gomphonema globiferum F. Meister in Arch. Hydrobiol. **8**: 312. pl. IV, f. 13. 1913.

[Figs. 48–52]

Lectotype (designated here): One individual from slide no. 801 Tempère et Peragallo (2nd ed.), BM 69152 ! [Figs. 50, 51]

Isotype: Specimens on slide no. 801 Tempère et Peragallo (2nd ed.), BM 69152 ! [Figs. 48–51]

No specimens of *Gomphonema globiferum* F. Meister were found on any BRM slides. Hence we designate an individual as the lectotype from isotype material (BM 69152). The lectotype is of the morphology for the current concept of this taxon (Tanaka, 2002).

Appendix for related taxa

Synedra delicatissima var. **delicatissima** W. Sm., Synops. Brit. Diat. **72**. pl. XII. f. 94. 1853. — *Ulnaria delicatissima* (W. Sm.) M. Aboal et P. C. Silva 2004.

Holotype: Pg74 #1 in the W. Smith collection in AWH.

Lectotype: BM 22475 designated by Patrick and Reimer (1986; Plate 5, Fig. 2)

[Figs. 27, 28]

Synonyms:

Synedra delicatissima var. *angustissima* Grunow in Van Heurck, Syn. Diat. Belgique pl. XXXIX. f. 10. 1881. — *Ulnaria delicatissima* var. *angustissima* (Grunow) M. Aboal et P. C. Silva 2004.

Lectotype (designated here): an individual in the slide 2646a in Grunow collection (W !) (England finder: P43/3) [Fig. 29]

Synedra delicatissima var. *mesoleia* Grunow in Van Heurck, Syn. Diat. Belgique pl. XXXIX. f. 6. 1881.

Lectotype (designated here): slide 1881 in Grunow collection (W !) [Figs. 30, 31]

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