Transfer of *Fragilaria neoelliptica* Witkowski to the genus *Nanofrustulum* Round, Hallsteinsen & Paasche (*Fragilariaceae, Bacillariophyta*)

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Fragilaria neoelliptica Witkowski was first described in 1994 from the uppermost layer of a sediment core collected in the "Gulf of Gdańsk proper", Poland in 1992 (Witkowski 1994: 128). The purported resemblance of this taxon to *Fragilaria elliptica* Schumann (1867: 52, pl. I, fig. 5) at the light microscopy (LM) level (Witkowski 1994) was only superficial since re-examination of type material under light and scanning electron (SEM) microscopy suggested it was a member of the genus *Pseudostaurosira* D.M.Williams & Round (1988: 276), resulting in its transfer as *Pseudostaurosira elliptica* (Schumann) Edlund, E.Morales & Spaulding (2006: 58).

Morales (2002) transferred *F. neoelliptica* to the genus *Pseudostaurosira* based on the spines interrupting the striae, round areolae containing branched volae, and the apical pore fields composed of round poroids. However, he misinterpreted the girdle band structure, stating that the cingulum was composed of up to 10 plain ligulate copulae.

Reinterpretation of the material studied by Morales (2002) from the Caloosahatchee River in Lee County, Florida, U.S.A. shows that, apart from the valvocopula and the first copula, all the remaining bands in the cingulum are in fact composed of quasifract bands, the main distinguishing feature of *Nanofrustulum* Round, Hallsteinsen & Paasche (Round & al. 1999: 345). Therefore, *F. neoelliptica* needs to be transferred to *Nanofrustulum*, together with the provision of a more detailed description of the frustule structure in this taxon.

Nanofrustulum neoellipticum* (Witkowski) E.Morales, *comb. nov. (Figs 1–11 LM; 12–15 SEM)

Basionym: *Fragilaria neoelliptica* Witkowski 1994, *Bibliotheca Diatomologica*, Vol. 28, p. 128, pl. 10: figs. 1–13.

Synonym: *Pseudostaurosira neoelliptica* (Witkowski) E.Morales 2002, *Limnologica* 32, p. 105, pl. 1: figs 10–21, pl. 3: figs 1–6.

Description: Frustules rectangular in girdle view (Fig. 15). Valves narrowly elliptic with cuneate or broadly rounded apices (Figs 1–14). Length 3–14 µm, width 2–4 µm, stria density 12–15 in 10 µm [morphometric measurements resulting from the combination of descriptions by Witkowski (1994) and Morales (2002)]. Axial area lanceolate (Figs 1–14). Virgae doubly flared, externally at the same level as axial area and striae (Figs 12, 13), internally at the same level as virgae, but both above striae (Fig. 14). Transition between valve face and valve mantle abrupt (Figs 12, 13). Valve mantle edge parallel to valve face-mantle junction, except at apices where the mantle is curved in a pervalvar sense (Fig. 15). Siliceous plaques along abvalvar valve mantle edge present (Fig. 15). One row of round, squarish to transapically ovoid areolae present on the same stria, progressing from axial area to mantle, only interrupted by spines at valve face/mantle junction (Figs 13–15). Striae internally lying in a single depression running from valve face to mantle (Fig. 14). Volae delicate, arising from the inner periphery of each areola and directed inwards (Figs 12, 15). Spines located on vimines, arising from a single point, circular to apically elliptic base, cylindrical body with soft core, and narrowly spatulate tips (Figs 13–15). Stipules absent. Wart-like, whitish depositions present, especially on the valve mantle, surrounding areolae (Fig. 15). Apical pore fields of cavernous appearance, composed of up to 6 rows of round poroids lying in shallow troughs, present at both apices, located at or just below valve face/mantle junction, and opening interiorly into a elliptic depression (Figs 12–15). Girdle composed of an

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open, unperforated, ligulated valvocopula (Fig. 15, upper asterisk, open end denoted by white arrow heads), and open, slender first copula of similar characteristics to valvocopula (Fig. 15, lower asterisk), a second open copula with a first quasifract portion (Fig. 15, black arrows) and several quasifract, ligulated copulae, also lacking perforations (Fig. 15).

Comments: *Nanofrustulum neollipticum* is the only taxon with a narrowly elongated elliptic valve shape, with cuneate or broadly rounded apices among all the nine species currently ascribed to *Nanofrustulum* (Round & al. 1999, Witkowski & al. 2010, Li & al. 2018, Morales & al. 2019, Guiry & Guiry 2021). In general, the girdle structure in *Nanofrustulum* species is poorly known, the one presented here for *N. neoellipticum* seems to be unique among all those described to date. *Nanofrustulum trainori* (E.Morales) E.Morales (in Morales & al. 2019: 275) also has the first two elements of the cingulum as open elements (Morales 2001, fig. 6 k, Morales & al. 2010, fig. 38), with the valvocopula being wider, but all the rest of the elements are quasifract (Morales 2001, fig. 6 k). The original description of the cingulum by Morales (2001: 113–115, for *Pseudostaurosira trainori* E. Morales) as having "up to 8 open, plain, ligulate copulae" was a misinterpretation of the girdle structure in *N. trainori*. *Nanofrustulum shiloi* (J.J.Lee, Reimer & McEnery) Round, Hallsteinsen & Paasche (Round & al. 1999: 345, 346) seems to have a wide, open valvocopula and at least one open copula (Li & al. 2018, figs 296–299), although Li & al. (2018, figs 284, 285, 290–295) show several girdle arrangements for this same taxon, which indicates that either girdle band structure in their cultures was variable or that they were dealing with different taxa, indistinguishable at the molecular level, as shown in their fig. 2, "subclade VI". In any case, none of the girdle structures shown by these authors match the one described herein for *N. neoellipticum*. *Nanofrustulum cataractarum* (Hustedt) C.E.Wetzel, E.Morales & Ector (in Morales & al. 2019: 275) has all girdle components quasifract and no open elements can be seen in Wetzel & al. (2013, figs 2 F, G), Grana & al. (2015, figs 16, 17), and Beauger & al. (2018, figs 84–86). In *N. sourniae* (Chunlian Li, Riaux-Gobin & A.Witkowski) E.Morales, M.H.Novais & M.Morais (in Morales & al. 2019: 275) the valvocopula at least seems to be open (Li & al. 2018, fig. 441), although the protologue describes copulae as being "plain". In *N. squamatum*, the valvocopula is open, while the rest of the girdle elements are quasifract (Witkowski & al. 2010, fig. 5). In *N. rarissimum* E.Morales, Novais, C.E.Wetzel & Ector (in Morales & al. 2019: 269) the valvocopula is open, and from the first copulae to the rest in the epi- or hypocingulum the fragmentation is progressively higher (Morales & al. 2019, fig. 2A). For the rest of the taxa currently in *Nanofrustulum* published illustrations are insufficient to make any comparison.

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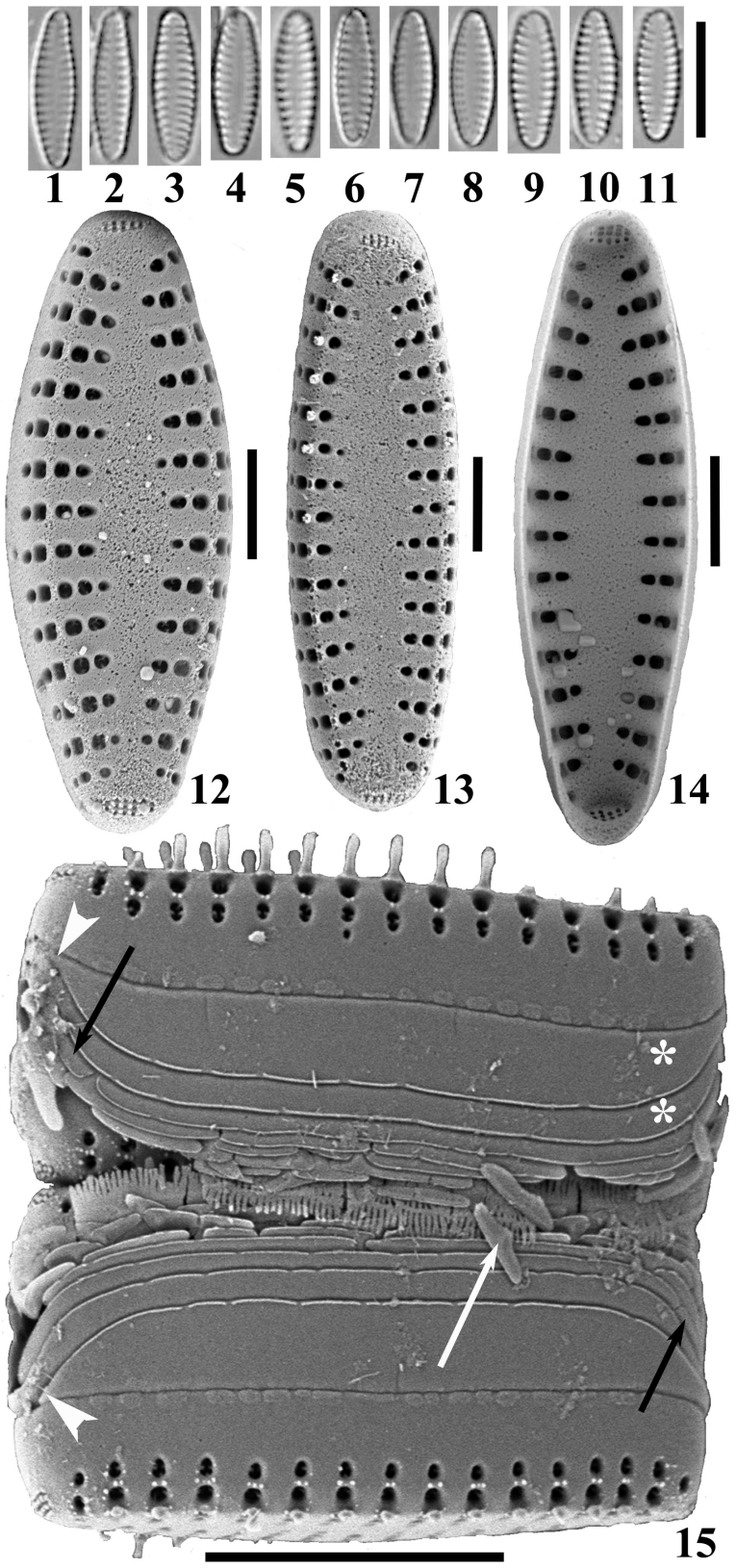

Figs 1–15. ***Nanofrustulum neoellipticum*** **(Witkowski) E.Morales,** ***comb. nov.*** from the Caloosahatchee River, Florida, U.S.A. **Figs 1–11.** LM images showing size range in the sample. **Figs 12–15.** SEM images. Notice open valvocopula (white arrow heads), unfragmented valvocopula and first copula (white asterisks), and partially fragmented second copula (black arrows). Scale bars = 10 µm (Figs 1–11), 2 µm (Figs 12–14), 5 µm (Fig. 15).

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