Observations and typification of *Synedra fontinalis* W.Smith (*Fragilariaceae, Bacillariophyta*) and its transfer to the genus *Fragilaria* Lyngbye

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Reverend William Smith (1808–1857) undertook in 1854 (Auvergne, France) and 1856 (Pyrenees, France) two excursions to sample mostly freshwater diatoms in several regions in France (Smith 1855, 1857). In the material he collected, Smith found a large number of unknown diatoms that he described in his two trip reports (Smith 1855, 1857). For most of these taxa, however, only the species name remained known as a vague souvenir of the work Smith published with the exception of *Achnanthidium lineare* W.Smith, which was revisited in 2011 (Van de Vijver & al. 2011). For a long time, it was unclear if and where the original material of these two excursions was conserved. Original Smith material is conserved in the Van Heurck collection (**BR**, Meise Botanic Garden, Belgium) and the Natural History Museum (**BM**, London, UK) (Smith 1859, Hoover 1976) but these gatherings only concern the samples used for the *Synopsis of British Diatomaceae*. Additionally, at least two (incomplete) sets of original slides from the Auvergne and Pyrenees excursions were found in **BR** and **W**, and during an intensive search in the personal sample collection of Henri Van Heurck (1837–1919) (**BR**) most (though not all) raw samples from both excursions were retrieved and subsequently prepared for examination.

Currently, the majority of European taxa belonging to the genus *Fragilaria* are being revised mostly based on the analysis of their type material (e.g., Van de Vijver & Ector 2020, Van de Vijver & al. 2020, 2021). One of the taxa described by Smith (1857) from the Pyrenees was *Synedra fontinalis* W.Smith. The taxon was observed in only one sample, collected from a spring near the Salut Source at Bagnères-de-Bigorre, a small thermal spa town not far from the Lourdes pilgrimage shrine (Hautes-Pyrénées department, Occitanie region, France). Smith described the taxon as follows "Frustules scattered; S. V. linear lanceolate, in the smaller specimens elliptical lanceolate; extremities produced, subcapitate; nodule indefinite. Striae 27 in 001". Length 0006" to 0014". Greatest breadth of valve 00015" to 0002"" and illustrated it with three small line drawings (Fig. 1).

Synedra fontinalis was only rarely found and apart from three nineteenth-century records, the species was apparently never reported subsequently (Peragallo 1884, Belloc 1887, Trutat 1894); at least, the taxon was never reported under Smith's name. The taxon was known for a long time in various biomonitoring reports as "*Fragilaria* aff. *vaucheriae* morphotype 1" in the *Atlas des diatomées des Alpes-Maritimes et de la Région Provence-Alpes-Côte d'Azur* [Ector & Hlúbiková 2010, p. 62, pl. 20, figs 1–16 (LM), pl. 23: figs 1–6 (SEM), Bouillide River at Biot, Department Alpes-Maritimes, Region Provence-Alpes-Côte d'Azur, France] and as "*Fragilaria* sp. 1" in the *Atlas des diatomées de la région Languedoc Roussillon* [Asconit Consultants 2013, figs 1–21 (LM), Vidourle River at Marsillargues, Department Hérault, Region Occitanie, France]. A preliminary analysis of the illustrated valves in both Atlases and the first observations of the valves in Smith's slide indicated that both taxa were most likely conspecific. Unfortunately, while *Synedra fontinalis* proved to be very abundant in the type sample, the original material was missing in the Van Heurck collection (**BR**). By coincidence, the material was found in the diatom collection of the Royal

Botanic Garden in Edinburgh (**E**, Scotland, UK), after having seen a scan of the sheet containing the sample on the Garden's wesbsite, underscoring the importance of the digitization of diatom collections worldwide (Van de Vijver, pers. obs.).

The type material is rather species-poor and is dominated by *Achnanthidium microcephalum* Kützing (50% of all counted valves), *Nitzschia amphibia* Grunow (18%), *Synedra fontinalis* (13%), *Cocconeis pediculus* Ehrenberg (10%) and *Gomphonema parvulum* Kützing (9%). This assemblage points to an alkaline, eutrophic environment with saprobity levels up to α-mesosaprobic. The observation of *Cocconeis pediculus* indicates the presence of filamentous algae such as *Cladophora* sp. as the species is often found as an epiphyte on these algae (Lange-Bertalot & al. 2017).

The morphology of the observed specimens indicates that the species should be transferred to the genus *Fragilaria*. The new combination *Fragilaria fontinalis* (W.Smith) Van de Vijver, D.M.Williams, C.E.Wetzel & Ector is proposed hereunder. In this contribution, we detail observations on specimens of *F. fontinalis* from a slide prepared from the original William Smith sample collected at the Source de Salut (Bagnères-de-Bigorre, Department Hautes-Pyrénées, Region Occitanie, France), kept in **E** and **BR**, using light and scanning electron microscopy. The material from Source de Salut is designated as lectotype.

Fragilaria fontinalis (W.Smith) Van de Vijver, D.M.Williams, C.E.Wetzel & Ector, comb. nov. (Figs 1–38)

Basionym: *Synedra fontinalis* W.Smith, *Annals and Magazine of Natural History*, *2nd series*, Vol. 19 (n° 109), p. 9, pl. 1: fig. 9 a, b, 1857.

Lectotype (here designated): **BR-**4659, slide prepared from sample Source de Salut, Bagnères-de-Bigorre, France, leg. W. Smith, coll. date 6.VIII.1856, original material present in **E** and the Van Heurck collection (**BR**). The lectotype is represented by Figs 2–38.

Isolectotypes: VI-2-A5 and VI-2-A6 (Salut Bigorre Pyrénées, elev. 1860, 1856, **BR**!), BM1046 (Greville, Source Salut. Pyr. W.Sm. '56, elev. 1860 ft, **BM**!), BM 20867 (Roper, W.S. 1856, Salut Source Bagnères-de-Bigorre, elev. 1860 ft, **BM**!). All isolectotypes prepared from original material.

Registrations: http://phycobank.org/102776 (new name); http://phycobank.org/102778 (lectotype). As there are two independent nomenclatural acts, two Phycobank registration numbers have been added, one for the new name and one for the lectotype of the basionym.

Description: Frustules in girdle view rectangular, solitary or with few frustules joined together (Figs 2–3). Ribbon-like colonies not observed. Valves linear to linear-lanceolate in longer valves becoming typically lanceolate to rhombic-lanceolate in smaller specimens. Longer valves having almost parallel margins, shorter valves with clearly convex margins. Apices distinctly protracted, capitate to rostrate. Continuous series of large, triangular marginal spines present, running from apex to apex, positioned on vimines between mantle and valve face striae (Fig. 36). Valve dimensions (n=40): valve length 14–38 µm, width 4.0–5.0 µm. Sternum very narrow, linear, gradually widening from apex to central area. Central area distinct, unilateral with depressed, rounded hyaline zone at one side of sternum and clearly shortened striae at opposite site. In larger valves, central area expanded from one margin to the other, forming an almost complete hyaline central area. Ghost striae not present (Fig. 37). Striae, uniseriate, composed of large, raised virgae compared to small, depressed vimines (Figs 36–37), parallel in valve middle occasionally becoming weakly radiate at apices, alternating, 10–11 in 10 µm. Areolae, small, rounded to apically elliptical, externally covered by individual cribra (Fig. 36). One rimoportula present at one apex, eccentrically placed, replacing part of final stria at apex (Fig. 36). Apices devoid of striae. Apical pore field of ocellulimbus type, large, well delimited, composed of 7 rows of very small pores, entirely located on the mantle (Figs 36–37). Internally, rimoportula very large, straight (Fig. 38). Central area shallowly but clearly depressed (Fig. 38).

Fragilaria fontinalis shows some similarity with *Fragilaria uliginosa* Kulikovskiy & al. in Kulikovskiy & al. (2010: 37), recently described from Siberia. The latter has similar valve dimensions and type of spines but differs in possessing a much higher stria density (15–17 in 10 µm) (Kulikovskiy & al. 2010, Wetzel & Ector 2015).

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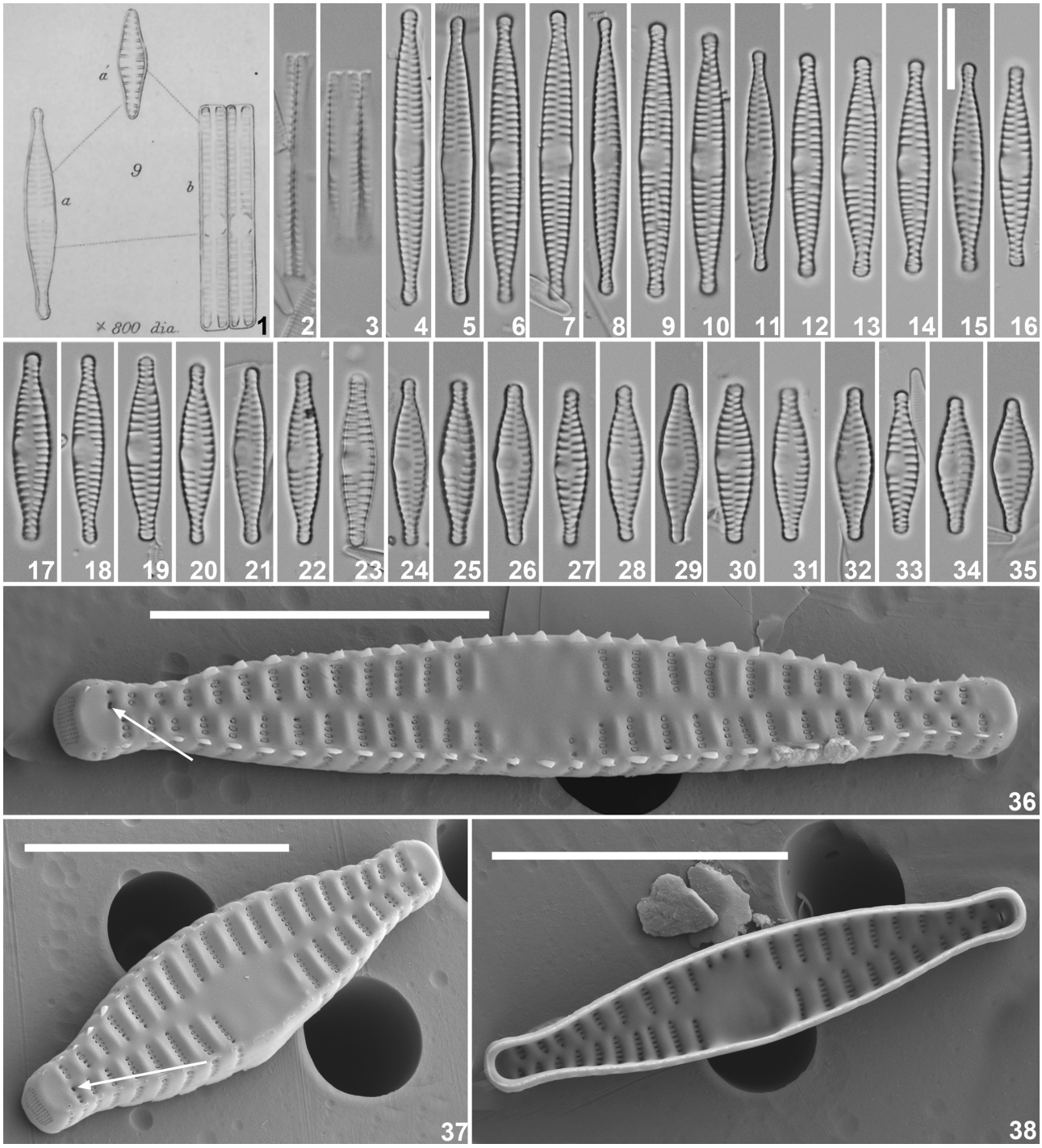

Figs 1–38. ***Fragilaria fontinalis*** (W.Smith) Van de Vijver, D.M.Williams, C.E.Wetzel & Ector, *comb. nov.* LM and SEM pictures taken from the lectotype material (Source de Salut, Bagnères-de-Bigorre, France, leg. W. Smith, coll. date 06.VIII.1856). **Fig. 1.** Original drawing from Smith (1857) representing *Synedra fontinalis*. **Figs 2–35.** Cell diminution series cycle of *Fragilaria fontinalis.* Figs 1 & 2 show frustules in girdle view. **Fig. 36.** SEM external view of a large valve showing the row of marginal spines, the large central area lacking ghost striae, the rimoportula (arrow) and the apical pore field. **Fig. 37.** SEM external view of a small valve showing the apical pore field and the rimoportula (arrow). **Fig. 38.** SEM internal view of an entire valve. Scale bar = 10 µm.