

Observations on the original material of *Asterionella ralfsii* W.Smith (*Fragilariophyceae*, *Tabellariaceae*) conserved in Meise Botanic Garden (Belgium)

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The genus *Asterionella* Hassall, 1850 is one of the most common planktonic diatom genera in freshwater environments with its type, *A. formosa* Hassall, probably being one of the most recognisable and frequently reported diatom species worldwide. A second *Asterionella* species, *A. ralfsii* W.Smith, is much rarer in Europe. The species was originally described in 1856 by William Smith (1808–1857) based on a diatomaceous sample sent to him by John Ralfs (1807–1890) from “Dolgelly Earth” (Dolgellau, a town in Gwynedd, North Wales, United Kingdom). Surprisingly, Smith (1856: 81) did not consider it a new species description, as he added his name and not ‘n.sp.’, the latter being an indication that the species was described as new. Adding ‘W.Sm.’ to the name indicated that Smith considered it a new name or a new combination, as he stated himself in Smith (1853, p. 4): “The letters n. sp. denote that the species to which they are appended is believed to be now for the first time described : W. Sm. that the species has been previously described, or the generic or specific name been altered, by the present writer ; in the latter case the original appellation is given in the list of synonyms.” In this case, *A. ralfsii* is considered a new name for *Diatoma stellare* Ralfs, a species that Smith considered to be a manuscript name as he added MSS to the name. A literature search did not yield any valid description nor mentioning of that name. The original sample, conserved in the William Smith collection, part of the Van Heurck diatom collection in **BR** (Meise Botanic Garden, Belgium), was labelled “*Diatoma stellare** Ralfs MSS-orig. sp. – Dolgelly – J.R. (=John Ralfs) sept 1844” (Fig. 1, lower sample). A second sample, in a different handwriting but containing the same material based on the sample label (and following visual inspection of the mica), is likewise conserved in **BR** (Fig. 1., upper sample). On opening the original sample in **BR**, a small inscription became visible (“*D. stellare* Ralfs” quae ... Jenner) (Fig. 2). This corresponds to the record in Smith (1856, p. 81) where he noted “ad specim. Herb. Jenner” indicating that the specimens came from the Herbarium of the eminent botanist Edward Jenner (1803–1872). In the Natural History Museum (**BM**, London, UK), two samples from Dolgelly Earth are also present in the collection (**BM** 001166895, **BM** 001166896). One of these samples contains a mica specimen from Herb. Jenner in the British Museum labelled “*Diatoma stellare* Dolgelly Sept. 30/44 Mr. Ralfs”, whilst the other is labelled “*Asterionella Ralfsii* Dolgelly 1844”, both identical to the materials in **BR**.

Smith (1856: 81) provided a brief description (*Frustules on F.V. [=Front view of Frustule] exactly linear; valve attenuated towards one extremity, constricted towards the other, which is rounded and capitate; striae obscure. Length frustule .0018" [=45.7 µm]. v.s.*) but he did not illustrate his new species. The first illustration was by West (1860: fig. 9) who declared that the species appeared quite similar to a *Diatoma* species and that he rarely saw more than 6 cells joined together in a

* The generic noun *Diatoma* Bory, 1924, *nom. et typ. cons.* was long treated as neuter (and still is by some) but as a conserved name is now treated as feminine.

[typical *Asterionella*-like] star (Fig. 3). Also Pritchard (1861, pl. IV [4]: fig. 18, represented here as Fig. 4) apparently did not observe a complete star-like colony (such as is commonly observed in *A. formosa*, see for instance Pritchard 1861, pl. IV [4]: fig. 17, our Fig 4, white arrow) as he only illustrated 4 cells placed almost adjacent to each other on a substrate.

Subsequent authors published a series of misidentifications and wrong combinations confusing the correct taxonomic identity of *A. ralfsii*. Ross (1956: 79) analysed the original material from **BM** and compared it with several historic records, establishing a first list of possible synonyms and misidentifications. In 1970, Körner (1970: 601) further unraveled the many mistakes that were published by Van Heurck (1896), Hustedt (1932) and Cleve-Euler (1953) who recombined the species for instance as *Asterionella gracillima* var. *ralfsii* (W.Smith) A.Cleve or confused it with *Peronia fibula* (Brébisson ex Kützing) R.Ross. Körner (1970, figs 20–35) analysed several samples containing *A. ralfsii* populations from Europe and North America, separating two varieties (*A. ralfsii* var. *hustedtiana* Körner 1970: 611 and *A. ralfsii* var. *americana* Körner 1970: 613) and lectotypified the species with the original material conserved in **BM** (“Herb. British Museum (Natural History) London (herb. Jenner): “*Diatoma stellare*, Dolgelly, Sept. 30/44, Ralfs”). He determined the type locality as being a ‘boggy pool at the base of Cader Idris, near Dolgelly/Wales, J.Ralfs coll.’ based on a slide (**BM** 47207) labelled as such by Walker Arnott (the slide was added as iso[lecto]type). He illustrated his observations with line drawings of the valve outlines and scanning electron microscopy images, the latter unfortunately only from the two new varieties.

Both light and scanning electron microscopy illustrations of the original Dolgelly population of *A. ralfsii* have, so far, not been published. In the present contribution, we analysed the original material from Herb. Jenner conserved in **BR** using both LM and SEM techniques and completed the morphological description provided in Körner (1970: 609). Both samples in **BR** can be added as isolectotypes to the series of iso(lecto)types listed in Körner (1970, p. 608).

Asterionella ralfsii W.Smith (Figs 1–40).

Original description: Smith (1856, p. 81)

Lectotype (designated in Körner, 1970: 608): **BM** 001166895, Herb. British Museum (Natural History) London (herb. Jenner): “*Diatoma stellare*, Dolgelly, Sept. 30/44, Ralfs”.

Isolectotypes: **BM**-collection: **BM** 001166896, **BM** 24422, and **BM** 36337; **BR**-collection: **BR**-4941, and **BR**-4942

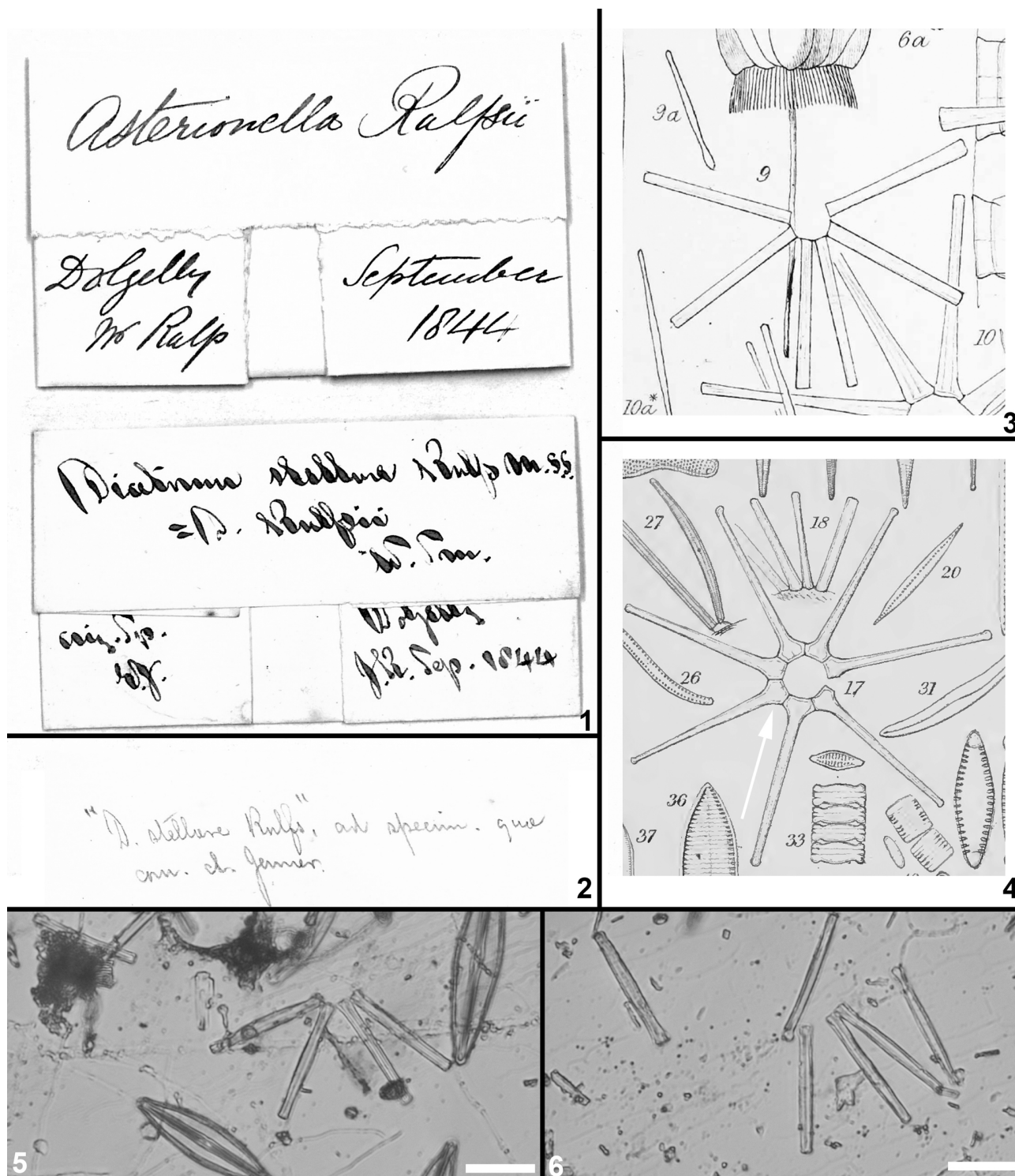
Homotypic synonyms: *Asterionella formosa* var. *ralfsii* (W.Smith) Wolle 1890; expl. pl. XLVI [46], figs 5, 6. *Asterionella gracillima* var. *ralfsii* (W.Smith) A.Cleve 1953: 77, fig. 401B i–k.

Heterotypic synonym *Diatoma stellaris* Ralfs (in Smith 1856: 81), *nom. illeg.*, *non* *Diatoma stellaris* Bailey 1851: 39.

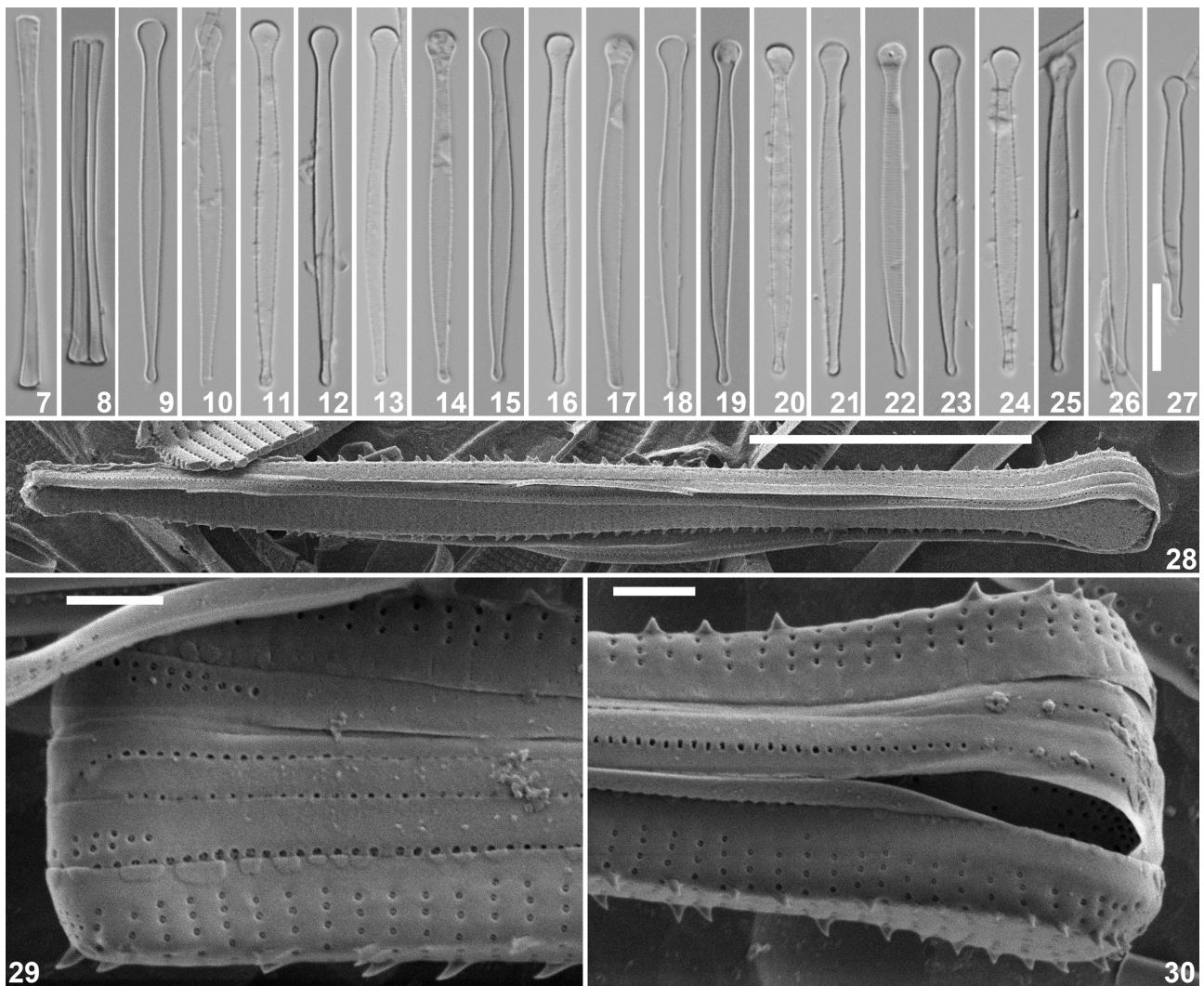
Description: Frustules in girdle view narrow, rectangular, joined into small colonies of up to 6 cells (Figs 5, 6). Star-shaped colonies not observed. Girdle composed of several, narrow, open, single row perforated copulae (Figs 28–30). At apices, additional scattered perforations pars exterior observed (Fig. 29). Valves heteropolar. Margins convex, rarely straight, gradually tapering towards weakly protracted, (sub-)capitate foot pole. Head pole inflated, capitate, broadly rounded. Valve dimensions (n=30): 25–42 µm, width at valve middle 2.0–3.0 µm, headpole 3.0–3.5 µm, foot pole ca 1.5 µm. Valve margin with irregularly spaced, continuous series of small, acutely ending, shark tooth-like spines, running from head to foot pole (Figs 28, 31). At foot pole several large, protruding spines visible. Mantle shallow with large siliceous plaques at mantle edge (Figs 29, 30). Striae in LM hardly discernible, ca 30 in 10 µm, uniseriate, composed of very small, rounded areolae. In the areolar canal close the valve exterior, areolae closed by thin siliceous plates (Figs 35, 36). At head poles, large hyaline zones visible (Figs 33, 34). Apical pore fields present at both apices, at foot pole composed of 2–3 short parallel rows of rimmed,

rounded pores (Figs 35, 36). At head pole, pore field forming a zone of dense series of small pores at the tip of the pole (Figs 32–34). Internally, pore fields visible as denser zones of small pores at both apices, the largest located at the head poles (Figs 37–40). One rimoportula visible at either head pole (Figs 32, 38) or foot pole (Figs 35, 40), externally as a rounded to slit-like opening, internally as a distinct labiate structure. When present at one pole, no rimoportula visible at the other.

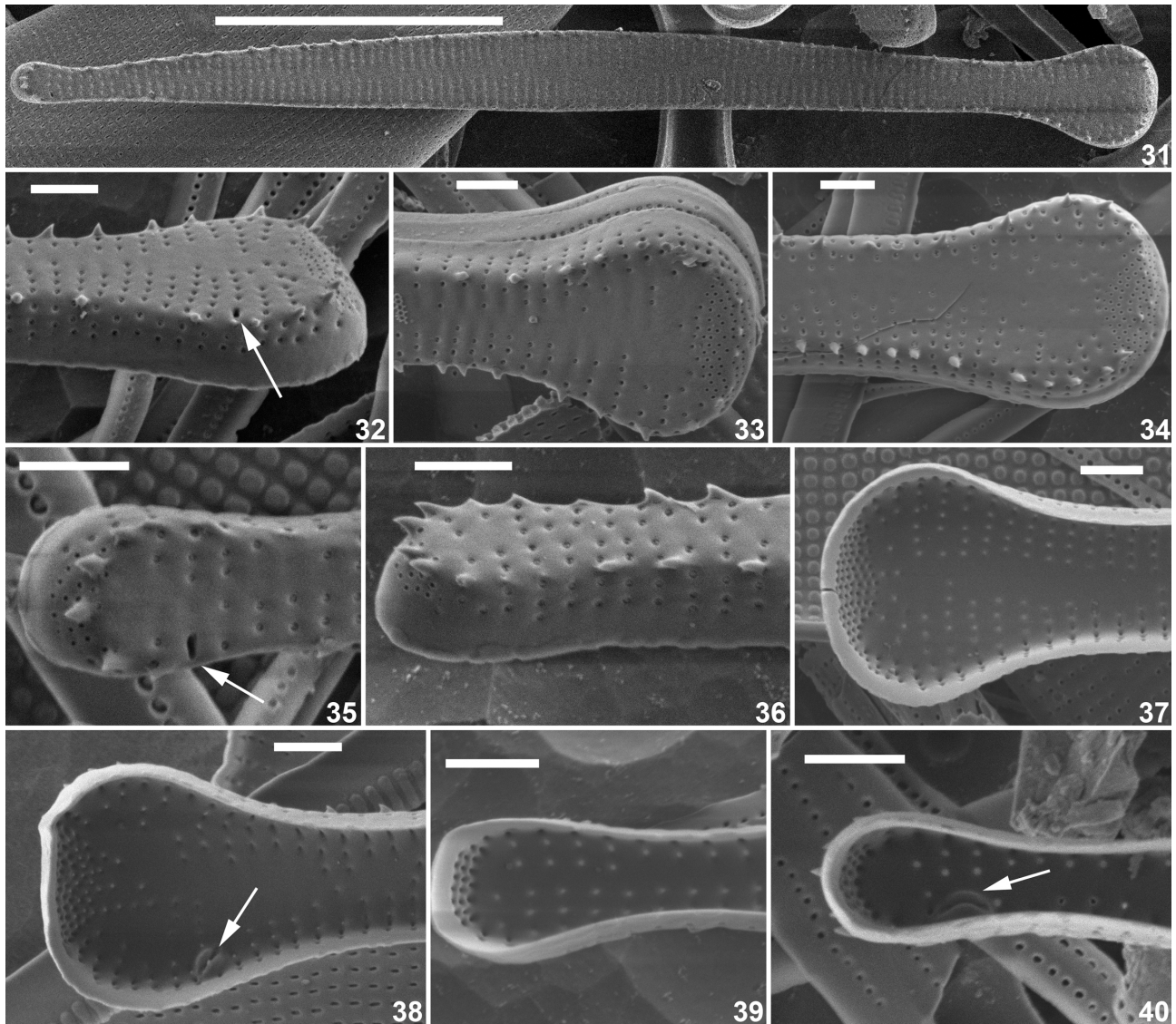
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Figs 1–6. *Asterionella ralfsii* W.Smith. Fig. 1. Scan of the labels of the two samples (conserved in the William Smith collection in **BR**) collected by J. Ralfs from Dolgelly Earth containing the type population of *A. ralfsii*. Fig. 2. Short note present in one of the samples mentioning the name *Diatoma stellare*. Fig. 3. Scan of the drawing of *A. ralfsii* in West (1860). Fig. 4. Scan of the drawing of *A. formosa* (fig. 17, arrow) and *A. ralfsii* (fig. 18) in Pritchard (1861). Figs 5 & 6. LM pictures at 400x magnification of several frustules of *A. ralfsii*, taken directly from the original mica. Scale bar = 20 μ m.



Figs 7–30. *Asterionella ralfsii* W.Smith. LM and SEM pictures taken from the original J.Ralfs sample in the W. Smith collection in **BR** (**BR**-4941, Dolgelly Earth, North Wales, UK). **Figs 7, 8.** Three frustules in girdle view. **Figs 9–27.** LM pictures showing valves in decreasing length. **Fig. 28.** SEM external view of an entire frustule in girdle view. **Fig. 29.** SEM external detail of the foot poles of an entire frustule showing the girdle bands. **Fig. 30.** SEM external view of the head poles of an entire frustule. Figs 7–28. Scale bar = 10 µm. **Fig. 29.** Scale bar = 10 µm, except for Figs 29 & 30 where scale bar = 1 µm.



Figs 31–40. *Asterionella ralfsii* W.Smith. SEM pictures taken from the original J.Ralfs sample in the W. Smith collection in **BR** (BR-4941, Dolgelly Earth, North Wales, UK). **Fig. 31.** SEM externa view of an entire valve. **Figs 32–33=4.** SEM external details of three head poles, one (Fig. 32, arrow) showing the position of the external rimoportula opening. **Figs 35 & 36.** SEM external details of two foot poles, one (Fig. 35, arrow) showing the position of the external rimoportula opening. **Figs 37 & 38.** SEM internal details of two head poles, one (Fig. 38, arrow) showing the position of the internal labiate structure of the rimoportula. **Figs 39 & 40.** SEM internal details of two foot poles, one (Fig. 40, arrow) showing the position of the internal labiate structure of the rimoportula. Scale bar = 1 μ m, except for Fig. 31 where scale bar = 10 μ m.