Observations and epitypification of *Eunotia incisa* W.Gregory (*Eunotiaceae, Bacillariophyceae*)

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Eunotia incisa W.Gregory is a typical and often frequent constituent of the diatom floras in peat bogs and acidic environments (Lange-Bertalot & al. 2011: 121). The species was originally described in 1854 by William Gregory (1803–1858) for fossil specimens from diatomaceous material found in the famous Mull Deposit on the Island of Mull (Hebrides, Scotland) (Gregory 1854a: 96, published April 1854, although no exact date given). In the same month of 1854, Gregory (1854b:105, published April 19th 1854) also mentioned the new species in a short note on the diatoms (mainly species in the genus *Eunotia*) from a fossil deposit of Lillhaggsjön (Lapland, Sweden): "…but especially in the presence of *Eunotia incisa*, first observed by me in the Mull Earth". In Gregory (1854a: 96), William Smith (1808–1857) seemingly is indicated as the author of the species name stating: "These figures represent the new form, which Mr. Smith, to whom I pointed it out, has named *Eunotia incisa*"; however, in the figure captions, the new taxon is listed as "*Eunotia incisa*, n. sp.", clearly indicating that W.Gregory should be considered to be the author of the species. This is confirmed in Smith (1856: 101) where he listed the species as *E. incisa* W.Gregory. Gregory (1854a) added a short description and illustrated the morphological variability of the species by illustrating three valves and one frustule (Gregory 1854a: pl.4: fig. 4, here shown as Fig. 1a). One of the three valves, showing more acutely endings, is considered the most typical representative whereas one of the other figures, indicated by 'β' is described as 'variety β, with rounded apices' (Fig. 1b) and the third valve represents an intermediate form between the previous two (Fig. 1c).

Table 1. List of all *Eunotia incisa* slides from Mull Deposit conserved in **BM**.

BM 424 Mull deposit, Gregory 1854
BM 654 Mull deposit, Dr Gregory 1854
BM 821 Mull deposit, Dr Gregory 1855
BM 20977 Mull deposit, Gregory
BM 20652 Mull deposit, WA 759
BM 23601 Mull deposit, WA 759
BM 23084 Mull, W.S.
BM 631 Mull deposit
BM 1615 Mull deposit
BM 53766 Mull
BM 53930 Mull
BM 54069 Mull

Although the species is reported worldwide from the Arctic to the subantarctic islands (see Guiry & Guiry 2023 for details), a recent assessment of original material has not been published. A lectotype

was designated by Bukhtiyarova (2019: 13, fig. 23, indicated by her on p. 13 as fig. 22, a lapsus) based upon one of the original Gregory figures. However she did not examine original material. A short survey of the Natural History Museum's (BM) Data Portal (https://data.nhm.ac.uk/) yields several microscopic slides of the Mull Deposit with *E. incisa* specified on the label conserved in the **BM**-collection (Table 1). Some of the slides bear the name W.Gregory on the label, others have a number referring to the Walker Arnott collection WA759, and a third category only mentions 'Mull Deposit'. Additionally, vials containing unmounted material are also conserved at **BM** (Williams, pers. comm.).

In the Walker Arnott collection, part of the Van Heurck diatom collection in **BR** (Meise Botanic Garden, Belgium), several vials, all originating from the same material collected by W. Gregory from the Mull Deposit, are conserved (samples WA28, WA29, WA757, WA758, and WA759). Additionally, an historic slide in the Van Heurck collection was made from WA758 and in the exsiccata set '*Types du Synopsis des Diatomées de Belgique'* made by Van Heurck (1882–1885), one sample, Types n°462 labelled "*Melosira distans* Kütz. var. *nivalis*", was prepared based on the same sample WA758. It is not entirely clear whether the Walker Arnott material is 100% identical to the material used by Gregory in his 1854a paper, as a date on the material is missing, although it probably is.

As the species was lectotypified based upon the original drawing by Bukhtiyarova, without having seen the original material, and in recent years, several morphological similar species have been described, such as *E. boreoalpina* Lange-Bertalot & Nörpel-Schempp (in Metzeltin & Lange-Bertalot 1998: 52), *E. incisadistans* Lange-Bertalot & Sienkiewicz (in Lange-Bertalot et al. 2011: 122, pl. 38: figs. 1–40), and *E. sedina* Lange-Bertalot & al. (2011: 215, pl. 47: figs. 1–17), a better grasp of the morphological variability of the type material of *E. incisa* is needed. Given the close morphological similarity between all these taxa in the *E. incisa* complex, we **here designate** Walker Arnott sample WA758 as epitype for the lectotypified illustration in Bukhtiyarova (2019).

Eunotia incisa W.Smith ex W.Gregory (Figs 1–36).
Original description: Gregory (1854a: 96)
Lectotype (designated by Bukhtiyarova 2019: 13, fig. 23 from Gregory (not 22, as stated on p, 13): Gregory, 1854, pl IV [4]: fig. 4)
Epitype (**designated here for the above lectotype of *E. incisa***): Walker Arnott sample WA 758, Mull Deposit, leg. Dr. Gregory, **BR**. Slide **BR**-4938 was made from this sample and the epitype is represented by Fig. 5.
Registration (for the above epitypification): http://phycobank.org/107363
Further original material: **BM**-collection: see Table 1**.**
Synonyms: *Eunotia sudetica var. incisa* (W.Smith ex W.Gregory) Manguin (in Bourrelly & Manguin 1950: 169), *Eunotia veneris var. incisa* (W.Smith ex W.Gregory) A.Cleve (1953: 112)
Description: Frustules in girdle view rectangular, often weakly in the shape of a parallelogram (Fig. 1d). Valves usually heteropolar with straight ventral margin and clearly convex dorsal margin, throughout the entire cell diminution cycle. Apices distinctly flattened and elongated, acutely rounded. Valve dimensions (n=40): length 30–45 µm, width 5–6 µm. Striae parallel in the valve middle, becoming radiate towards the apices, 18–21 in 10 µm in the middle, becoming denser at the apices, up to 24 in 10 µm. Striae uniseriate, composed of very fine, rounded areolae, 35–40 in 10 µm. Areolae denser on valve mantle at apices (Fig. 35). Striae interrupted at the valve face/mantle junction by a rather narrow hyaline sternum (Fig. 31). Raphe branches short, curved and undulating, entirely located on valve mantle (Figs 31, 35). Central raphe endings located in hyaline zone, lacking bordering areolae (Fig. 32). Terminal raphe fissures short, knob-like, terminating well before the apices. Internally, central raphe endings located on weakly raised

plate. Helictoglossae well developed, raised, located well before the apices (Figs 34, 36). Pseudosepta well developed. One rimoportula present, externally visible as large pore on the dorsal margin (Figs 33, 34, white arrows), internally well separated from the helictoglossae (Fig. 36, arrow).

The var. β as depicted in the original drawings of *E. incisa* in Gregory (1854a, our Fig. 1b) showing truncated, bluntly rounded apices was not observed in the epitype material. Lange-Bertalot et al. (2011: 120) doubted conspecificity with *E. incisa* ("4β = variety β with rounded apices appears questionable").

Typical parallelogram-like or distinctly trapezoid frustules in girdle view were not observed in the Walker Arnott material. Lange-Bertalot & al. (2011, pl. 36: fig. 34) showed one frustule with this typical frustule outline, although the frustule was not photographed in the type material. Lange-Bertalot & al. (2011: 121) gave a broader width range (3–7 µm) than observed in the epitype material. The lowest valve length (10 µm) is also much smaller than in the epitype material. Stria density, on the other hand, is comparable.

Eunotia incisadistans is separated from *E. incisa* in having a much lower stria density (10–14 in 10 µm versus 18–21 in 10 µm in *E. incisa*). Valves with such a low stria density have not been observed in the epitype material. *Eunotia boreoalpina* has more protracted, rostrate apices and a slightly lower stria density (13–17 in 10 µm).

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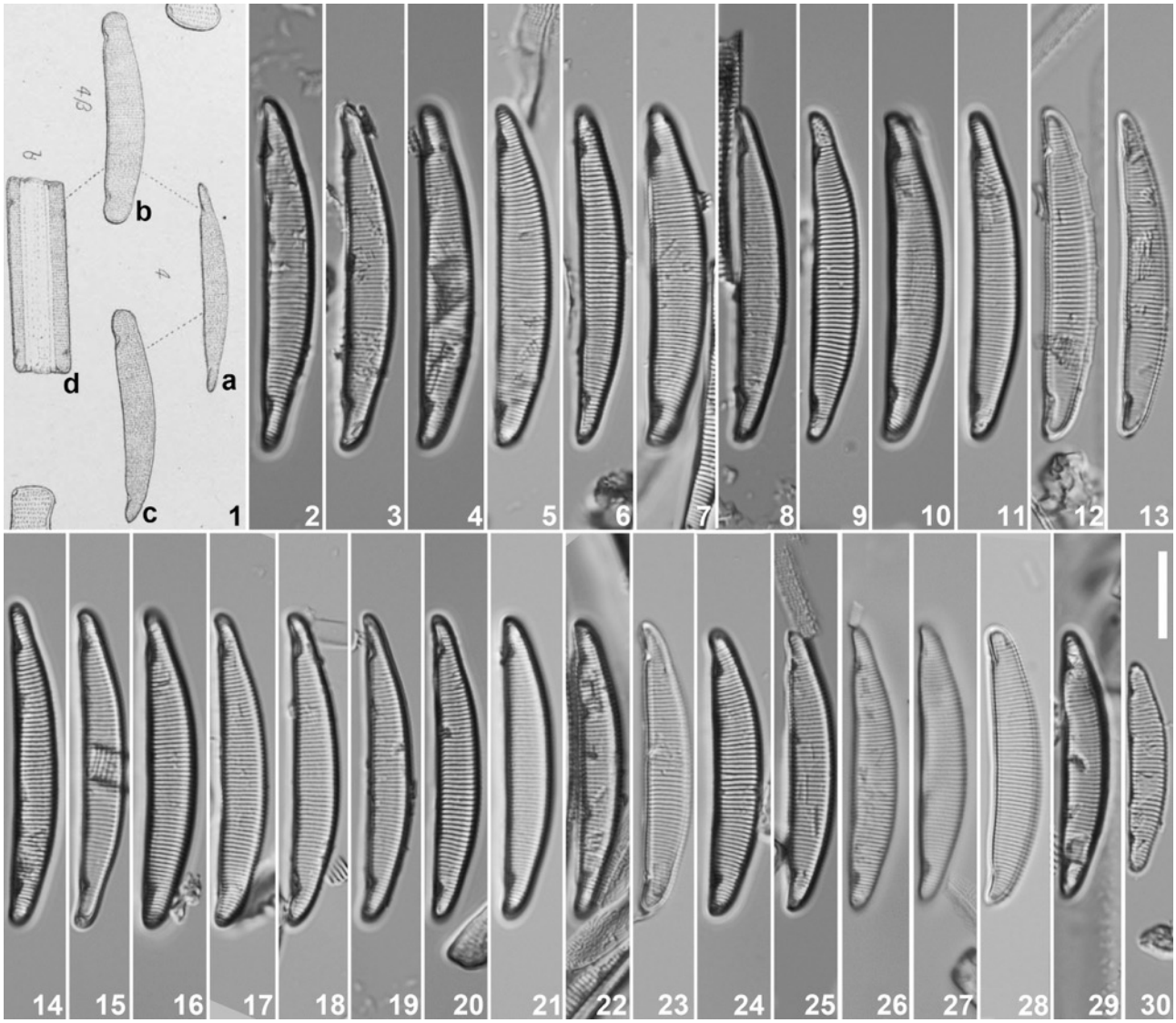
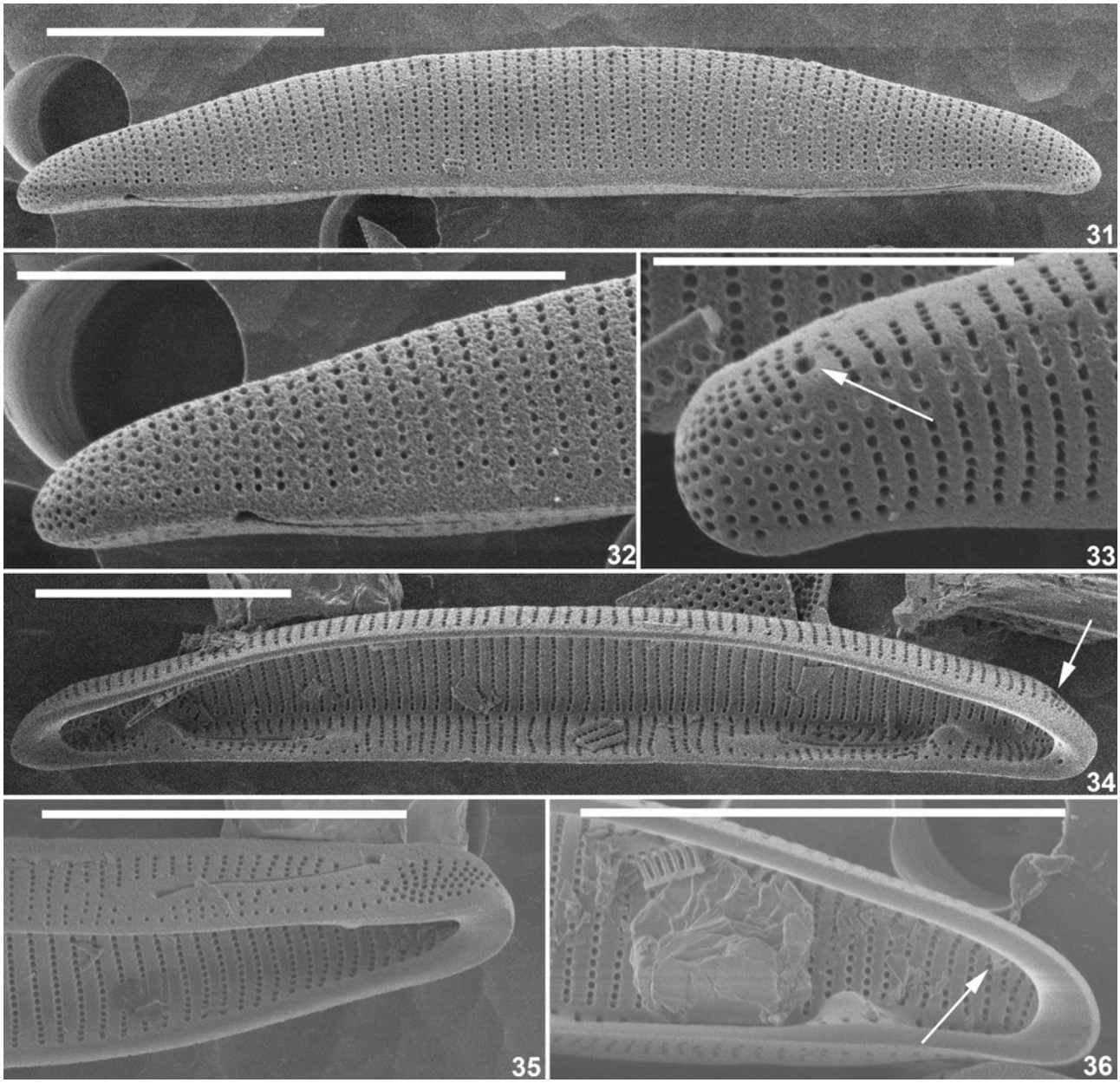


Figs 1–30. ***Eunotia incisa*** W.Smith ex W.Gregory. **Fig. 1.** Original drawing of *E. incisa* from Gregory (1854, plate IV, Fig. 4). **Fig. 1a** represents the lectotype designated by Bukhtiyarova et al. (2019). **Fig. 1b.** Valve with clearly truncated, broadly rounded apices. **Fig. 1c.** Intermediate valve between a and b. **Fig. 1d.** Drawing of a frustule. **Figs 2–30.** LM pictures taken from the epitype slides (Walker Arnott WA758, Mull Deposit, Scotland, UK, **BR**- 4938. Scale bar = 10 µm.



Figs 31–36. ***Eunotia incisa*** W.Smith ex W.Gregory. SEM pictures taken from the epitype slides (Walker Arnott WA758, Mull Deposit, Scotland, UK, **BR**- 4938). **Fig. 31**. External view of an entire valve. **Fig. 32**. Detail of Fig. 30 showing an enlargement of the valve apex with the raphe running on the valve mantle. **Fig. 33**. External detail of the dorsal margin showing the external rimoportula opening (white arrow). **Fig. 34**. Internal view of an entire valve. The white arrow shows the external rimoportula opening. **Fig. 35**. External view of the valve mantle showing the entire raphe branch and the more densely spaced areolae at the apex. **Fig. 36**. Internal detail of a valve apex showing the pseudoseptum and the rimoportula at the dorsal side (white arrow). Scale bars = 10 μm.