Observations on the type material and typification of two small-celled brackish *Nitzschia* species of the section *Lanceolatae* (*Bacillariaceae, Bacillariophyceae*)

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Lange-Bertalot (1976) discussed and illustrated the original material ('*Typenmaterial*'), of a large number of *Nitzschia* species described in the nineteenth century, mostly by Grunow or Kützing, belonging to the "*Nitzschiae Lanceolatae*", originally introduced by Cleve & Grunow (1880: 94), as "Gruppe" *Lancecolatae*) to subdivide the former *Nitzschia* "Gruppe" *Lineares* introduced by Grunow (Grunow 1862: 558). Two of the species briefly discussed in Lange-Bertalot (1976) were the brackish-water species *Nitzschia communis* Rabenhorst and *N. ovalis* Arnott.

Nitzschia communis is a relatively common species in brackish-water communities (Lange-Bertalot & al. 2017). It was originally described by Rabenhorst in 1860 as number 949 in his exsiccata '*Die Algen Europa's, Fortsetzung der Algen Sachsens, resp. Mittel-Europa's*'. Originally, the species had a different, though unpublished name, as Rabenhorst on the label of number 949 clearly stated that he had received the material from Carl (Karl) Gottlob Gerstenberger (1825–1912), a Dresden schoolteacher and amateur cryptogamist. The latter had named the species "*Nitzschia frustulium* Gerstenberger" in a letter ("in litt."). Rabenhorst commented on this species as follows: "*Herr Gerstenberger hält diese Art für identisch mit* Synedra frustulium [*sic*] *Ktz. die ich (Süssw. Diat.) zur Gattung* Frustulia *gestellt habe. Das find aber, ohne den Gattungscharacter zu berücksichtigen, schon in der Form zwei himmelweit verschiedene Dinge: die vorliegende is fast noch einmal so dick, an den Enden Leicht verschmälert, kolbig abgerundet,* Frustulia minuta *ist schlank, an den Enden zugespisst, die Spitzen selbst aber stumpf. An* Frustulia *errinert sie höchstens deshalb, weil man sie gewöhnlich in Schleim gebettet im Wasser findet, doc hist dies bekanntlich eine allen Bacillarien periodisch zukommende Eigenschaft.* [Mr. Gerstenberger considers this species identical to *Synedra frustulium* [*sic*] Ktz., which I (*Süssw. Diat.*) have placed in the genus *Frustulia*. However, even disregarding the genus, these are two worlds apart in form: the present one is almost twice as thick, slightly tapered at the ends, and club-shaped; *Frustulia minuta* is slender, pointed at the ends, but the tips themselves are blunt. It only resembles *Frustulia* because it is usually found embedded in mucilage in the water, but this is a well-known characteristic of all Bacillaria.]" Rabenhorst described the species as *Nitzschia communis*, found in a ditch near Dresden by Gerstenberger. He also references an illustration in *Hedwigia* 2(7), pl. 6: fig. 3, but it was apparently never published, instead there is a drawing of *Scytonema gracile* Kützing. Two descriptions for the species were provided in Grunow (1862) and Rabenhorst (1864). Grunow (1862: 561, 578, pl. 12: fig. 18) mentions the species on two pages. On p. 561, he wrote a clear description: "*Klein, Frustuln in der Hauptansicht breit linear mit verdünnten Enden, Schalen lanzettlich mit schwach vorgezogenen Enden, schmäler wie die Hauptseiten (so dass bei Präpraten die Frustuln meist in der hauptansicht liegen) Kielpunkte um circa 26 in 0,001".* [Small, frustules broadly linear in the main view with thinned ends, shells lanceolate with weakly projecting ends, narrower than the main sides (so that in specimens the frustules are usually in the main view), keel points around 10 in 10 µm.]. Curiously, Grunow (1862: 561) also suggested a possible link with *Synedra notata* as he added '(*Synedra notata* Kg. ?)', a species that is now considered to belong to the genus *Ulnaria* as *U. ulna* var. *notata* (Kützing) Aboal, although Aboal & al. (2003: 113) never examined the original material and simply transferred the taxon without justification to the genus *Ulnaria*. On another page, 578, Grunow suggested that the species might actually represent a

juvenile (‘Jugendzustand’) of *Nitzschia linearis*. Rabenhorst (1864) provided a Latin description for the species: “*N. parva, lineari-oblonga, sub polis attenuata, apicibus obtusis vel obtuso - truncatis; membrana connexiva latiuscula delicatissime plicata; valvis anguste elliptico - lanceolatis, apicibus obtusis ; nodulis carinalibus 26–28 in 0,001". Long. l/90–1/78'" = 0,0009–0,0011".*” [Small *Nitzschia*, linear-oblong, attenuated beneath the poles, with blunt or obtusely truncate apices; the broad connective membrane very delicately folded; valves narrowly elliptic-lanceolate, with obtuse tips; carinal nodules 10–11 in 10 µm. Length 22–25 µm*]” Later authors, such as Cleve & Grunow (1880: 97), or Van Heurck’s *Atlas* of the *Synopsis des Diatomées de Belgique* (Van Heurck 1881, pl. LXIX [69]: fig. 32) confirm the original observations. In the latter record, Grunow annotated the figure with the origin of the drawing: Grunow sample 1281, which is based on Rabenhorst’s exsiccata sample 949. Krammer & Lange-Bertalot (1988, pl. 79: figs 1, 2) illustrated two valves from Rabenhorst 949, indicating that it was ‘*Typenmaterial’*. As a formal lectotypification was never carried out, and also not in Lange-Bertalot (1976: 275) where only the indication ‘Typenmaterial’ is used, Rabenhorst’s sample 949, conserved in the Van Heurck collection (**BR**, Meise Botanic Garden, Belgium) is here designated as lectotype.

Nitzschia ovalis Arnott ex Cleve & Grunow was originally described in Cleve & Grunow (1880: 95) as “*N. ovalis* Arnott (Mspt.)”. The author is the Scottish botanist George Arnott Walker Arnott (1799–1868) who most likely described the species in a manuscript he sent to Cleve and/or Grunow, as the abbreviation ‘Mspt.’ stands for the Latin word *Manuscriptum*. A short description was included: “*Diese kleine Form hat fast von allén Arten dieser Gruppe die verhältnissmässig breitesten Schaalen, welche länglich eiförmig und an den Enden abgerundet sind. Ganze Frusteln je nach der Lage eiförmig öder länglich gegen die abgestumpften Enden hin schmäler werdend. Kielpunkte 12–13 in 0,01 mm., Querstreifen sehr zart. Länge 0,014–0,02 mm., Schaalenbreite 0,005–0,0065 mm.* [This small form has the relatively broadest valves of almost all species in this group, which are oblong-ovate and rounded at the apices. Entire frustules are either ovate or oblong, tapering towards the blunt ends, depending on their position. Keel points 12–13 in 10 µm. Transverse striations very delicate. Length 14–20 µm. Valve width 5.0–6.5 µm.]” Two syntype localities were cited: Durham in NE England and the Kara Sea where the species was said to be quite rare (‘*Im Karischen Meere selten*’). Despite this rareness, the only illustration that was given in Cleve & Grunow (1880, pl. 5: fig. 103) was based on a specimen from the Kara Sea. Van Heurck (1881, pl. LXIX [69]: fig. 36) illustrated several valves that he identified as ‘*N. ovalis* Arnott Manuscer’, the latter word very likely indicating again that Walker Arnott had described the species in an unpublished manuscript. Based on the note in the copy of Van Heurck’s *Atlas* of the *Synopsis des Diatomées de Belgique*, annotated by Grunow and conserved in the Grunow collection (**W**, Natural History Museum Vienna, Austria), the three drawings were based on valves from Durham. Van Heurck also included the species in his exsiccata set (Van Heurck 1882–1885) as slide Types n°414 (“Durham (Angleterre)”). Most of the original vials of Van Heurck’s exsiccata set are conserved in the Van Heurck collection (**BR**), including the vial labelled Types n°414. On the back of the vial, Van Heurck noted the origin of the sample: “189^2 Durham – *Nitzschia ovalis* Arnott 365”. The number 189^2 refers to the sample with this number in the Walker Arnott collection, of which a subsample is kept in BR but also in the Royal Botanic Garden Edinburgh (**E**, Scotland, UK). Combining the original catalogue notes kept in **E** and **BR**, clearly shows that the sample was collected in Durham, on the bank of the river on 30th August 1863 by the English amateur diatomist Thomas Glazebrook Rylands (1818–1900). The species was reported later from saline environments such as in Krasske (1927: 269) who found the species in a brine sample collected in Bad Salzuflen, a thermal spa resort in the Lippe district (North Rhine-Westphalia, Germany). This was apparently contradicted by Hustedt (1930: 417) who catalogued the species as a freshwater species. Lange-Bertalot (1976: 276) indicated Van Heurck’s Types n°414 as the ‘*Typenmaterial*’

*See Schuster et al. (2023) for the interconversion of British inch (") and Paris line (''').

but did not formally lectotypified the species. He also illustrated two valves from slide 414. The same sample was illustrated in Krammer & Lange-Bertalot (1988, pl. 79: figs 7–11), again marked as '*Typenmaterial*'. The species was formally described by Walker Arnott in Cleve & Grunow (1880: 95), but it is more likely that Walker Arnott had described the species much earlier in his letters (now at **BM**) based on the material in his own collection. Therefore, Walker Arnott sample 189[2] can be considered the original material and should thus be designated as lectotype material for *N. ovalis*.

The original material for both *N. communis* (Rabenhorst 949) and *N. ovalis* (Walker Arnott sample 189[2]) was retrieved from the Van Heurck collection, part of the herbarium of Meise Botanic Garden (**BR**), allowing both a light and scanning electron microscopy analysis of these species. The current contribution discusses and illustrates the morphology of *N. communis* and *N. ovalis* and formally lectotypifies for each species the original material and slide.

Nitzschia communis Rabenhorst (Figs 1–22)
Original publication: Rabenhorst (1860: no. 949)
Lectotype (here designated): BR-4962 (Fig. 5 best represents the lectotype), slide prepared from Rabenhost no. 949.
Duplicates of the here-designated lectotype: BM-collection: **BM** 49914-20, *N.ovalis*, Rylands from WA 189[2], 190[2].
Type locality: Dresden, Germany (leg. Herr Gerstenberger), conserved in the Van Heurck collection (**BR**).
Registration: http://phycobank.org/107737
Description: Valves linear to linear-elliptic with straight, almost parallel margins throughout most of their length, very slightly gradually tapering towards obtusely rounded, rather broad apices. Valve dimensions (n=40); length 25–30 µm, width 4.0–4.5 µm. Raphe keel eccentrical, positioned at valve face/mantle junction (Fig. 19). Raphe branches straight, continuous, lacking central raphe endings (Fig. 20). Valve face flat, bordered by weakly raised margin. Striae very fine, 30–34 in 10 µm, weakly discernible in LM, uniseriate, composed of very small, rounded areolae. Areolae on keel not differentiated from valve face areolae (Figs 19–20). Fibulae distinct, relatively broad, irregular in size and distribution, 10–11 in 10 µm, usually connected to 2–3 rows of areolae. Central nodule absent, central fibulae not more spaced than others.

Nitzschia ovalis Arnott ex Cleve & Grunow (Figs 23–43)
Original publication: "*N. ovalis* Arnott (Mspt)" ex Cleve & Grunow (1880: 95, pl. V [5]: fig. 103)
Syntype localities: "Durham in England. Im Karischen Meere rare." [Durham, England; Kara Sea, common]
Homotypic synonym: *Homoeocladia ovalis* (Arnott ex Cleve & Grunow) Kuntze (1898: 409)
Lectotype (here designated): BR-4963 (Fig. 31 best represents the lectotype), slide prepared of original Walker Arnott sample 189[2], Durham [probably from the River Wear], northeastern England (coll. 30 viii 1863), conserved in the Van Heurck collection (**BR**).
Registration: http://phycobank.org/107739
Description: Valves broadly lanceolate in longer specimes to elliptic-lanceolate in smaller forms with convex margins throughout most of their length, gradually narrowing towards the non-protracted, acutely rounded apices. Valve dimensions (n=40); length 12–25 µm, width 5.0–5.5 µm. Raphe keel eccentrical, positioned at the valve face/mantle junction (Fig. 41). Raphe continuous, lacking central raphe endings (Fig. 41). Valve face flat with very weakly inflated keel. Striae very fine, ca 40 in 10 µm, not discernible in LM, uniseriate, composed of very small, rounded areolae. Mantle striae composed of 3 small areolae (Figs 42). Fibulae distinct, relatively broad, irregular in size and distribution, 7–9 in 10 µm. Central nodule absent, central fibulae not more spaced than others (Fig. 43).

Note: the original collection was made by the Scottish botanist George Arnott Walker Arnott (1799–1868), known widely as Walker Arnott.

Aboal, M., Álvarez Cobelas, M., Cambra, J. & Ector, L. (2003). Floristic list of non-marine diatoms (*Bacillariophyceae*) of Iberian Peninsula, Balearic Islands and Canary Islands. Updated taxonomy and bibliography. *Diatom Monographs* 4: 1–639.

Cleve, P.T. & Grunow, A. (1880). Beiträge zur Kenntniss der arctischen Diatomeen. *Kongliga Svenska Vetenskaps-Akademiens Handlingar* 17(2): 1–121.

Grunow, A. (1862). Die österreichischen Diatomaceen nebst Anschluss einiger neuen Arten von andern Lokalitäten und einer kritischen Uebersicht der bisher bekannten Gattungen und Arten. Zweite Folge. Familie Nitzschiaea. *Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien* 12: 545–588.

Hustedt, F. (1930). *Bacillariophyta (Diatomeae) Zweite Auflage.* In: Die Süsswasser-Flora Mitteleuropas. Heft 10. (Pascher, A. Eds), pp. [i]–viii, [1]–466. Jena: Verlag von Gustav Fischer.

Krammer, K. & Lange-Bertalot, H. (1988). *Bacillariophyceae. 2 Teil: Bacillariaceae, Epithemiaceae, Surirellaceae.* In: Süßwasserflora von Mitteleuropa. Band 2. (Ettl, H., Gerloff, J., Heynig, H. & Mollenhauer, D. Eds), pp. [i]–x, [1]–610. Jena: Gustav Fischer Verlag.

Krasske, G. (1927). Diatomeen deutscher Solquellen und Gradierwerke. *Archiv für Hydrobiologie* 18: 252–272.

Kuntze, O. (1898). *Revisio generum plantarum.* Vol. 3(3) pp. 1–576. Leipzig, London, Milan, New York, Paris: Arthur Felix, Dulau & Co., U. Hoepli, Gust. E. Stechert, Charles Klincksieck.

Lange-Bertalot, H. (1976). Eine Revision zur Taxonomie der *Nitzschiae lanceolatae* Grunow. Die "klassischen" bis 1930 beschriebenen Süsswasserarten Europas. *Nova Hedwigia* 28: 253–307.

Lange-Bertalot, H., Hofmann, G., Werum, M. & Cantonati, M. (2017). *Freshwater benthic diatoms of Central Europe: over 800 common species used in ecological assessments.* English edition with updated taxonomy and added species (Cantonati, M. et al. eds). pp. [1]–942, 135 pls. Schmitten-Oberreifenberg: Koeltz Botanical Books.

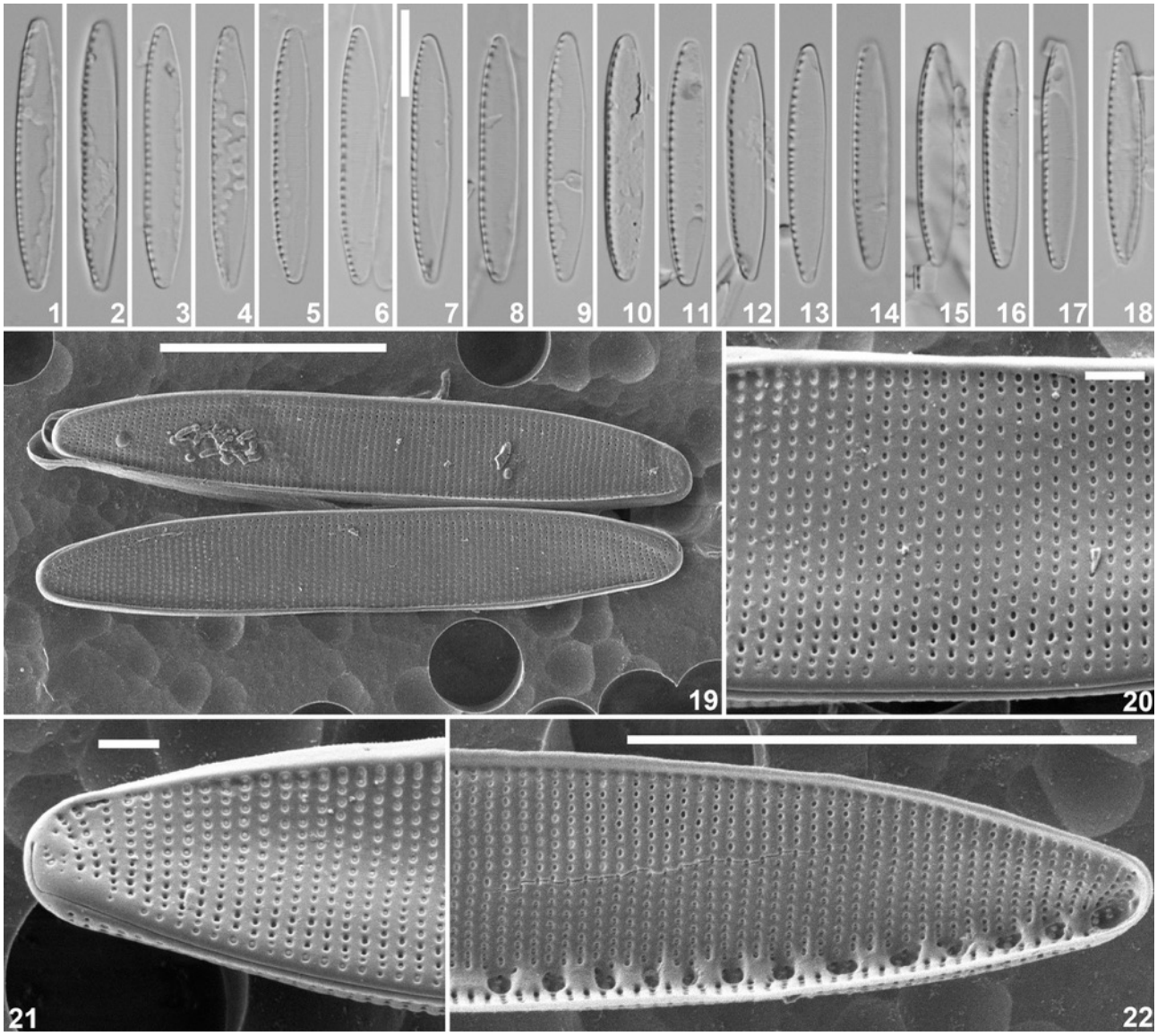
Rabenhorst, L. (1864). *Flora europaea algarum aquae dulcis et submarinae. Sectio I. Algas diatomaceas complectens, cum figuris generum omnium xylographice impressis*. pp. 1–359. Lipsiae [Leipzig]: Apud Eduardum Kummerum.

Schuster, T.M., Hamilton, P.B., Haring, V., Edlund, M.B. & Van de Vijver, B. (2023). An introduction to the catalogue of Albert Grunow's 19th century diatom collection at W including a palaeographic aid. *Annalen des Naturhistorischen Museums in Wien*, Serie B, Botanik und Zoologie 125: 101–122.

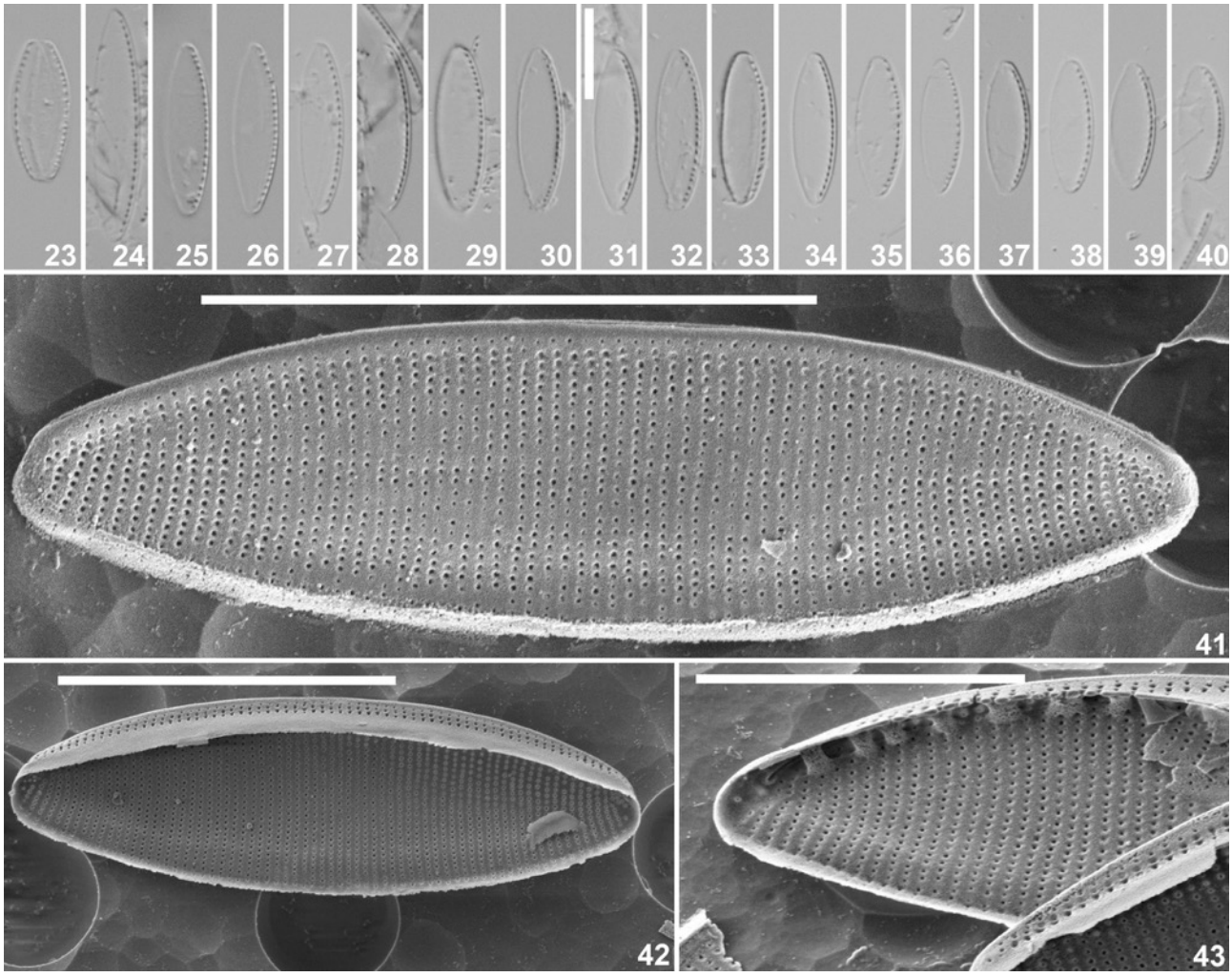
Van Heurck, H. (1881). *Synopsis des Diatomées de Belgique Atlas.* pp. pls XXXI–LXXVII [31–77]. Anvers: Ducaju et Cie.

Van Heurck, H. (1882–1885). *Types du Synopsis des Diatomées de Belgique*, Séries I–XXII, Anvers.

Van Heurck, H. (1885). *Synopsis des Diatomées de Belgique. Texte.* pp. [1]–235. Anvers: Martin Brouwers & Co.



Figs 1–22. ***Nitzschia communis*** **Rabenhorst**. LM and SEM pictures taken from the lectotype sample (**BR**-4962, Rabenhorst exsiccata 949, Dresden, Germany,). Figs 1–18. LM pictures showing valves in decreasing length. Fig. 19. SEM external view of two entire valves. Fig. 20. SEM external view of the central area. Fig. 21. SEM external view of a valve apex. Fig. 22. SEM internal view of half of a valve. Scale bars = 10 µm, except for Figs 20–21 where scale bar = 1 µm.



Figs 23–43. ***Nitzschia ovalis*** **Arnott**. LM and SEM pictures taken from the lectotype sample (**BR**-4963, Walker Arnott sample 189[2], Durham, UK). Fig. 23. A frustule in girdle view. Figs 24–40. LM pictures showing valves in decreasing length. Fig. 41. SEM external view of an entire valve. Fig. 38. SEM internal view of an entire valve in oblique view showing the mantle. Fig. 43. SEM internal view of half of a valve. Scale bar = 10 µm, except for Figs 38–40 where scale bar = 1 µm.