Phytotaxa 272 (1): 037–062
http://www.mapress.com/j/pt/
Copyright © 2016 Magnolia Press

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

http://dx.doi.org/10.11646/phytotaxa.272.1.2

Ten new Bacillariophyta species from James Ross Island and the South Shetland Islands (Maritime Antarctic Region)

RALITSA ZIDAROVA[1*], KATEŘINA KOPALOVÁ[2] & BART VAN DE VIJVER[3,4]
[1] *"St. Kliment Ohridski" Univeristy of Sofia, Faculty of Biology, Department of Botany, 8 Dragan Tzankov Blvd., 1164 Sofia, Bulgaria.*
[2] *Charles University in Prague, Faculty of Science, Department of Ecology, Viničná 7, 12844 Prague 2, Czech Republic.*
[3] *Botanic Garden Meise, Department of Bryophyta & Thallophyta, Nieuwelaan 38, B–1860 Meise, Belgium.*
[4] *University of Antwerp, Department of Biology, ECOBE, Universiteitsplein 1, B–2610 Wilrijk, Antwerpen, Belgium.*
** Author for correspondence (E-mail: zidarova.r@gmail.com)*

Abstract

The present paper describes 10 new diatom (Bacillariophyta) species from the Maritime Antarctic Region. Five of the newly described taxa: *Caloneis australis sp. nov.*, *Mayamaea sweetloveana sp. nov.*, *Navicula romanedwardii sp. nov.*, *Sellaphora antarctica sp. nov.* and *Sellaphora gracillima sp. nov.* have been previously reported from the Antarctic Region but were force-fitted into incorrect names. Five other taxa: *Chamaepinnularia elliptica sp. nov.*, *Cosmioneis regigeorgiensis sp. nov.*, *Mayamaea tytgatiana sp. nov.*, *Muelleria pimpireviana sp. nov.* and *Pinnularia pinseeliana sp. nov.* are newly discovered taxa. The morphology of all new species is studied using both light and scanning electon microscope observations and compared with similar species from the Antarctic Region and worldwide. Data about the ecology and confirmed Antarctic distribution of the new species are added.

Keywords: Antarctica, diatoms, morphology, taxonomy

Introduction

The past few years, the diatom flora of the Maritime Antarctic Region (Chown & Convey 2007) has undergone a major revision. The Maritime Antarctic species from several diatom genera, including *Stauroneis* Ehrenberg (1843: 45) (Van de Vijver *et al*. 2004, Zidarova *et al*. 2014a), *Hantzschia* Grunow (1877: 174) (Zidarova *et al*. 2010), *Muelleria* (Frenguelli 1924: 256) Frenguelli (1945: 172) (Van de Vijver *et al*. 2010a, 2014a), *Luticola* D.G.Mann in Round *et al*. (1990: 670) (Kopalová *et al*. 2011, Van de Vijver *et al*. 2011a, Zidarova *et al*. 2014b), *Navicula* Bory (1822: 128) (Van de Vijver *et al*. 2011b), *Pinnularia* Ehrenberg (1843: 45) (Van de Vijver & Zidarova 2011, Zidarova *et al*. 2012) and *Nitzschia* Hassall (1845: 435) (Hamsher *et al*. 2016) were (almost) fully revised. Following the adoption of a narrower species concept in diatom taxonomy, combined with detailed light and scanning electron microscope observations and comparisons of the Antarctic taxa with diatom species present worldwide, the true identity of many species in these genera was clarified. This resulted in the description of a large number of new diatom taxa (see references listed here above). New diatom species were also discovered in other genera, such as *Achnanthidium* Kützing (1844: 75) (Van de Vijver & Kopalová 2014, Taylor *et al*. 2014), *Halamphora* (Cleve 1895: 117) Levkov (2009: 165) (Van de Vijver *et al*. 2014b), *Humidophila* Lowe *et al*. (2014: 352) (Kopalová *et al*. 2015), *Craticula* Grunow (1867: 20) (Van de Vijver *et al*. 2010b, 2015), *Planothidium* Round & Bukhtiyarova (1996: 351) (Van de Vijver *et al*. 2013a) and *Eunotia* Ehrenberg (1837: 44) (Van de Vijver *et al*. 2014c). All recent studies also indicated that in the past due to force-fitting (Tyler 1996) and taxonomic drift, many of the typically Antarctic diatom species remained unrecognized, this way obscuring the real diversity and biogeography of Antarctic diatoms (Sabbe *et al*. 2003, Van de Vijver *et al*. 2005, Zidarova *et al*. 2014b).

The present paper describes ten new taxa belonging to several genera: *Caloneis australis sp. nov.*, *Chamaepinnularia elliptica sp. nov.*, *Cosmioneis regigeorgiensis sp. nov.*, *Mayamaea sweetloveana sp. nov.*, *Mayamaea tytgatiana sp. nov.*, *Muelleria pimpireviana sp.nov.*, *Navicula romanedwardii sp. nov.*, *Pinnularia pinseeliana sp. nov.*, *Sellaphora antarctica* sp. *nov.* and *Sellaphora gracillima sp. nov.* Five of these taxa have been previously reported from the Antarctic Region under the names of common European taxa, whereas the five others are identified for first time.

Accepted by Saúl Blanco Lanza: 5 Aug. 2016; published: 26 Aug. 2016

Study sites

The South Shetland Islands, situated just north of the Antarctic Peninsula (63° 00' S, 60° 00' W), in the Maritime Antarctic Province (Chown & Convey 2007), is an archipelago consisting of several larger and many smaller islands and islets, such as King George Island, Livingston Island, Nelson Island, Deception Island and Snow Island. Most of the landmasses are covered by permanent ice and snow, leaving only small, coastal parts ice-free in summer. The climate of the islands is typically maritime with mean annual temperatures around -5 °C, high precipitation levels and strong westerly winds (Chipev & Veltchev 1996). The terrestrial vegetation is limited to lichens and mosses with only two flowering plants.

James Ross Island (64° 10' S, 57° 45' W) is a large island located in the northwestern part of the Weddell Sea, close to the northern tip of the Antarctic Peninsula. The island is situated in the transition zone between the Maritime Antarctic and Continental Antarctica regions (Øvstedal & Lewis-Smith 2001). Only its northern part (Ulu Peninsula) is ice-free. The temperature is comparable to the South Shetland Islands but precipitation is limited to only 150 mm/y in the northern part (Aristarain *et al*. 1987), with high evaporation rates reducing the formation of large open water bodies. The terrestrial vegetation is almost entirely composed of non-vascular plants, forming a bryophyte-lichen tundra.

Materials and methods

Samples were collected from several islands of the South Shetland Archipelago (Livingston Island, Deception Island, King George Island, Nelson Island) and James Ross Island. Sampling methods follow those given in Kopalová *et al*. (2012, 2013, 2014) and Kopalová & Van de Vijver (2013). Diatom samples from Byers Peninsula (Livingston Island) and James Ross Island were prepared for further analysis following the method described in Van der Werff (1955): small parts of the samples were cleaned by adding 37% H_2O_2 and heating to 80 °C for about 1 h. The reaction was completed by addition of $KMnO_4$. Following digestion and centrifugation (three times 10 minutes at 3700 g), cleaned material was diluted with distilled water to avoid excessive concentrations of diatom valves on the slides. Samples obtained from Hurd Peninsula (Livingston Island), Deception Island, King George Island and Nelson Island were prepared according to the method described in Hasle & Fryxell (1970): small subsamples were cleaned using concentrated H_2SO_4 followed by the addition of $KMnO_4$. The samples were then bleached with $H_2C_2O_4$ and washed several times with distilled water. Cleaned diatom valves were mounted in Naphrax®. Light microscopy (LM) observations were done at Olympus BX51 and Olympus BX53 microscopes, equipped with Differential Interference Contrast (Nomarski) optics and Colorview Soft Imaging Systems. Samples and slides are stored at the BR-collection, property of the Belgian federal government and given in permanent loan to the Botanic Garden Meise (Belgium). For scanning electron microscopy (SEM), parts of the oxidized suspensions were filtered through a 1-µm Isopore™ polycarbonate membrane filter (Merck Millipore). The stubs were sputter-coated with a Gold-Palladium layer of 20 nm and studied in a ZEISS Ultra SEM microscope at 3 kV (Natural History Museum London, UK). Diatom terminology follows Ross *et al*. (1979) and Round *et al*. (1990). For each new taxon, the number of specimens measured on the type slide is indicated (n).

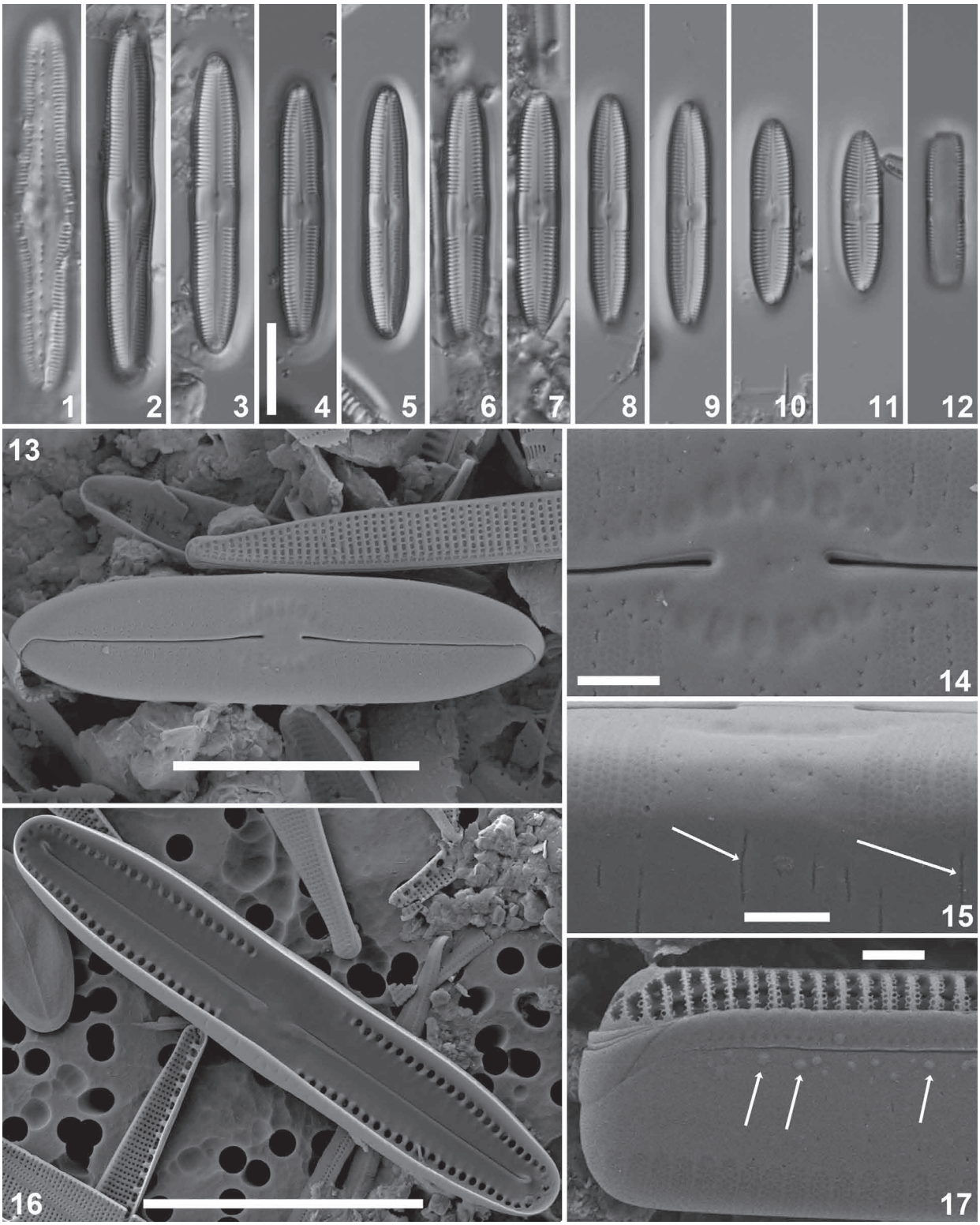
The following (main) literature was used to compare the new species and to justify their separation of the already known taxa: Lange-Bertalot (1993, 2001), Lange-Bertalot & Metzeltin (1996), Lange-Bertalot *et al*. (1996, 2004), Rumrich *et al*. (2000), Wetzel *et al*. (2013, 2015), Spaulding *et al*. (1999), Van de Vijver *et al*. (2010a).

In addition, the type slides containing the type of *Navicula seibigiana* Lange-Bertalot (1993: 137–138) (Praep. Hintz 160, Eu-CH 15 in Coll. Lange-Bertalot, Botan. Institut Universität Frankfurt a.M.) and *Caloneis bacillum* (Grunow 1863: 155) Cleve (1894: 99) (slide IV-18-A8 in the Van Heurck Collection at the Botanic Garden Meise, Belgium) were examined.

Results

Division **Bacillariophyta**
Class **Bacillariophyceae**
Subclass **Bacillariophycidae**

Order **Naviculales**
Family **Pinnulariaceae**
Genus ***Caloneis*** P.T. Cleve (1894: 96)



FIGURES 1–17. *Caloneis australis sp. nov*. LM and most SEM pictures taken from the holotype population (sample BY062) from Livingston Island (South Shetland Islands). 1–12. Light microscopy observations. Fig. 1 shows an intial valve, and Fig. 12 shows the girdle view. 13. SEM of an entire valve, externally. 14. SEM detail of the valve showing the central area and the lunate markings. 15. SEM detail of the valve face and mantle showing the striae; arrows indicate the slits on the mantle. 16. SEM of an entire valve, internal view (picture taken from James Ross Island, sample JRI032). 17. SEM detail of the mantle and girdle, showing the single row of pores on the valvocopula; arrows indicate the rounded plaques (picture taken from James Ross Island, sample JRI015). Scale bar represents 10 µm except for figs 14, 15 and 17 where scale bar = 1 µm.

***Caloneis australis* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 1–17)**

LM observations (Figs 1–12): Frustules in girdle view rectangular (Fig. 12). Larger valves linear with weakly undulating margins, slightly inflated in the middle, and broadly rounded, almost not-protracted apices (Figs 2, 3). Smaller valves linear to linear-elliptic with almost straight margins and broadly rounded, non-protracted apices (Figs 9–11). Initial valves (Fig. 1) with distinctly inflated valve margins in the valve middle. Valve dimensions (n=16): length 17.0–40.2 (42.0) µm, width 4.6–6.2 (7.7) µm. Axial area linear, very narrow near the apices but gradually widening towards the central area. Central area forming a broad rectangular, occasionally (Fig. 11) asymmetrical fascia. Two lunate markings always visible in the central area in LM, located on both sides of the proximal raphe endings. Initial valves (Fig. 1) lacking raphe, with clearly lanceolate axial area widening to the valve middle, forming a rhombic central area, bordered on both sides by short striae. Raphe lateral with unilaterally weakly deflected, indistinct, distantly spaced proximal raphe endings, terminating in the central area beyond the striae. Distal raphe fissures visible in larger and medium-sized valves (*e.g*., Figs 3, 5), strongly hooked opposite to the proximal raphe endings. Striae parallel to weakly radiate throughout the entire valve, 22–24 in 10 µm. Longitudinal lines are hard to resolve. SEM observations (Figs 13–17): Valve face flat, curving into a deep mantle (Fig. 13). Mantle quite large with a straight margin showing several longer irregular, deep slits and small rounded plaques (Figs 15, 17, arrows). Striae continuing shortly onto the mantle, multiseriate, composed of four rows of small, rounded poroids, occluded by hymenes (Figs 14, 15). Raphe branches straight with almost straight to weakly unilaterally deflected, indistinct proximal raphe endings (Figs 13, 14). Distal raphe fissures elongated, hooked, continuing onto the mantle (Fig. 13). Several (6–7) elliptic, shallow depressions, organized in two lunate patterns present in the central area (Figs 13, 14). Internally, raphe branches straight. Proximal raphe endings shortly unilaterally bent (Fig. 16). Distal raphe endings terminating onto small linear-elliptical helictoglossae (Fig. 16). Axial plate covering the alveoli, leaving only small marginal openings bordered by costae ridges, weakly thickened and raised from the valve face (Fig. 16). Girdle composed of at least three, open bands, with a single row of small, elliptical pores on the pars exterior (Fig. 17).

Type:—ANTARCTICA. South Shetland Islands: Livingston Island, Byers Peninsula, sample BY062 (62° 38’ 34.5” S, 61° 00’ 39.5” W, 80 m a.s.l.), *B. Van de Vijver*, *17 January 2009* (holotype BR! 4449, isotype PLP! 303).

Etymology:—The specific epithet ‘*australis*’ (Latin for ‘southern’) refers to the geographic distribution of the new species.

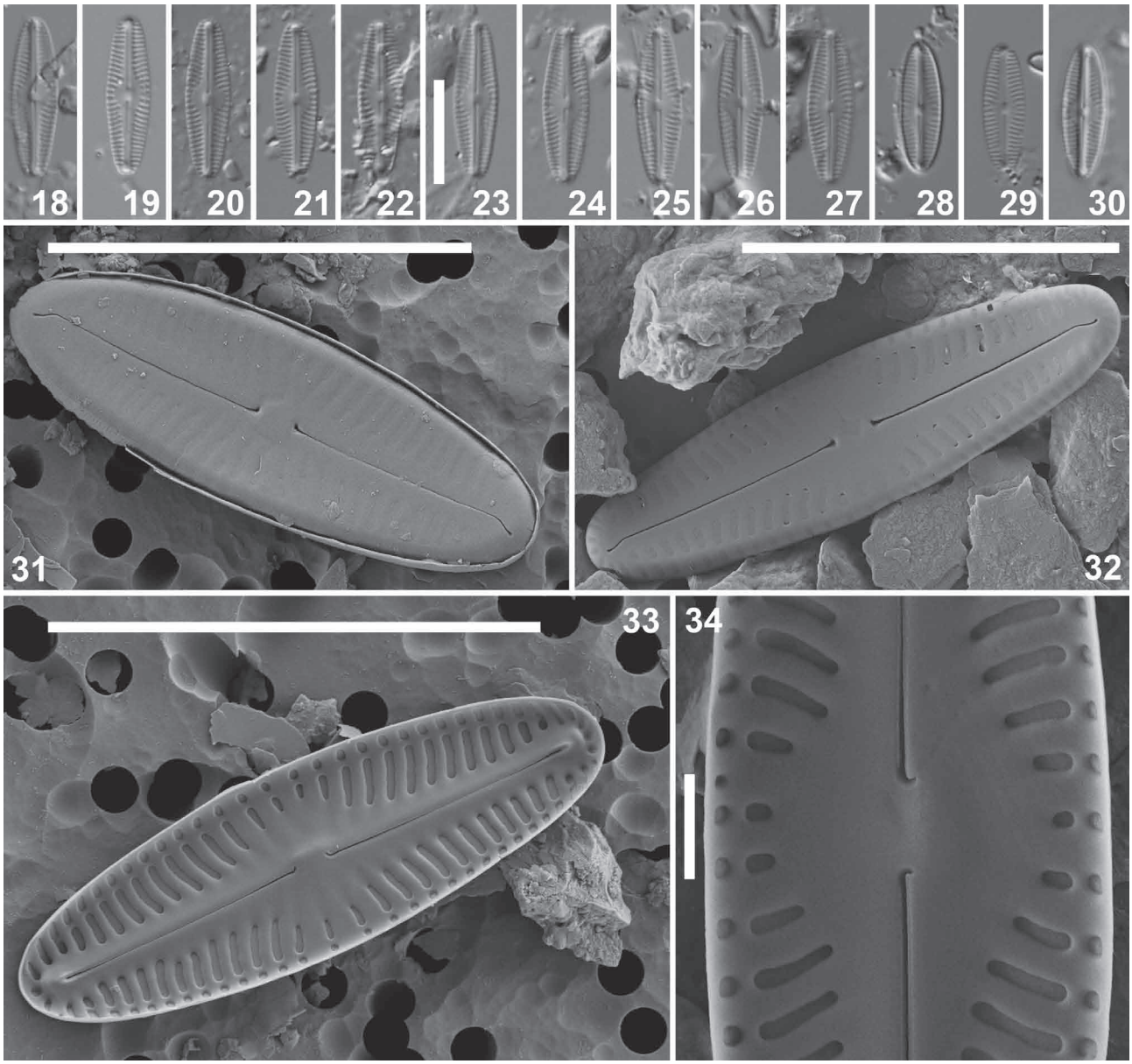
Ecology and confirmed distribution:—*Caloneis australis* has been observed with certainty on all major islands of the South Shetland Archipelago and on James Ross Island. It is however likely that the species is more widespread in the region but up to now it has been reported probably under the name of *Caloneis bacillum*. Careful analysis of all past records of the latter taxon in Antarctica should lead to a better biogeographical distribution of the new species. Large populations of *Caloneis australis* are typical in both larger lakes and small pools on the islands with a slightly alkaline pH (7.1–7.8), low to moderate conductivity (50–670 µS/cm) and low nutrient and sulphate levels.

Family **Pinnulariaceae**
Genus ***Chamaepinnularia*** Lange-Bertalot & Krammer in Lange-Bertalot & Metzeltin (1996: 32)

***Chamaepinnularia elliptica* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 18–34)**

LM observations (Figs 18–30): Valves elliptic-lanceolate to rhombic-elliptic (*e.g*. Figs 20, 25) in larger specimens, more strictly elliptic in smaller valves with clearly convex margins and broadly rounded apices. Valve dimensions (n=27): length 12.0–15.0 µm, width 3.8–4.5 µm. Valves on Livingston Island, the South Shetland Islands (Figs 28–30) slightly smaller than valves on James Ross Island (Figs 18–27). Axial area weakly lanceolate, narrow near the apices and gradually widening towards the central area. Central area variable in size, rhombic (*e.g*. Fig. 26) to rounded (*e.g*. Fig. 27), rarely asymmetric (Fig. 19), bordered on both sides by several shortened striae, never forming a fascia. Raphe straight with straight simple to weakly drop-like expanded pores. Distal fissures not discernible in LM. Striae radiate in the middle, becoming parallel toward the apices, 22–24 in 10 µm. SEM observations (Figs 31–34): Striae composed of two large areolae, one located on the valve face and a second on the mantle, separated by a silica line at the valve face/mantle junction, covered externally by porous hymenes (Figs 31, 32). Areolae continuing around the poles (Fig. 32). Virgae and striae of equal width. Raphe branches straight. Proximal external raphe endings shortly deflected to one side, terminating in small, spatulate pores (Figs 31, 32). Distal raphe fissures short, finishing on the valve face, deflected opposite the central raphe endings (Figs 31, 32). Internally, proximal raphe endings unilaterally bent (Fig. 34). Distal endings terminating in small helictoglossae (Fig. 33). Central nodule clearly developed (Fig. 33).

Type:—ANTARCTICA. James Ross Island: Lachman 2 Lake, sample JRI-D02 (63° 47’ 59.9” S, 57° 48’ 31.1” W), *L. Nedbalová*, *22 January 2008* (holotype BR! 4450, isotype PLP! 304).

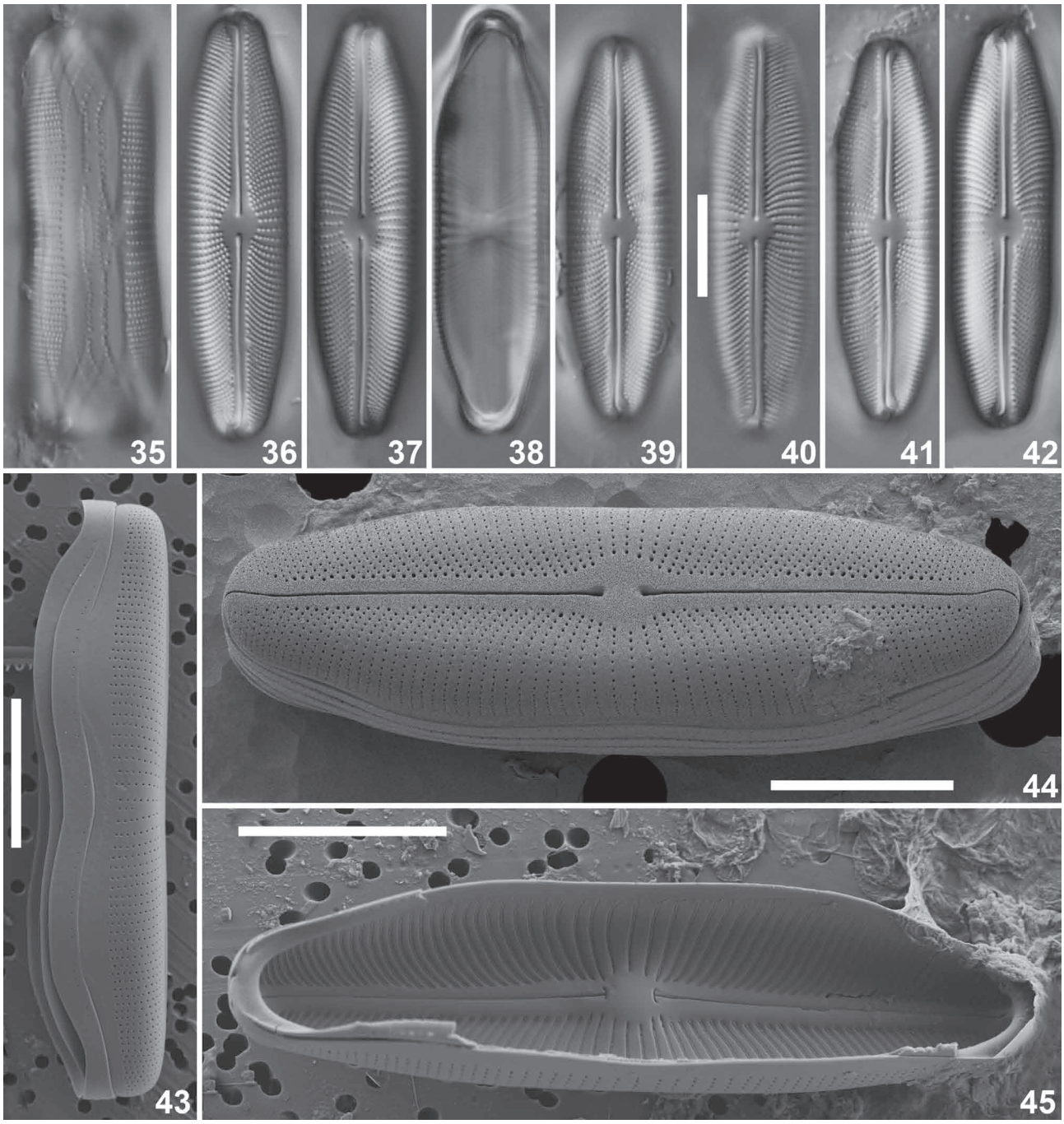


FIGURES 18–34. *Chamaepinnularia elliptica sp. nov*. Most LM and part of the SEM pictures taken from the holotype population (sample JRI-D02) from James Ross Island. 18–27. Light microscopy observations. 28–30. LM views of valves from South Shetland Islands. 31. SEM of an entire valve, external view (picture taken from Livingston Island, sample BY040). 32. SEM of an entire valve, external view. 33. SEM of an entire valve, internal view (picture taken from Livingston Island, sample BY040). 34. SEM of an entire valve, internal view. Scale bar represents 10 µm except for fig. 34 where scale bar = 1 µm.

Etymology:—The specific epithet refers to the overall elliptic shape of the valves of this species.

Ecology and confirmed distribution:—*Chamaepinnularia elliptica* has been found on several localities in the Maritime Antarctic Region, although never in large populations. The largest populations were observed on James Ross Island and Livingston Island. On James Ross Island, the species was found in a large, coastal lake with an almost circumneutral pH (7.3) and a low conductivity value (120 µS/cm). On Livingston Island, the largest population was recorded in a circumneutral (pH 6.7) run-off river from the Rotch Dome ice cap bordering Byers Peninsula. Only a few valves were observed on King George Island and Nelson Island (South Shetland Islands) among cyanobacterial mats and green algae on the bottom of small pools and on very wet soils.

Family **Cosmioneidaceae**
Genus ***Cosmioneis*** D.G. Mann & Stickle in Round *et al.* (1990: 665)



FIGURES 35–45. *Cosmioneis regigeorgiensis sp. nov*. LM & SEM pictures taken from the holotype population (sample KGI9) from King George Island, South Shetland Islands. 35–42. LM views of 8 valves from the type population. Fig. 35 shows the girdle view. 43. SEM view of the mantle and girdle bands. 44. SEM of an entire valve, external view. 45. SEM of an entire valve, internal view. Scale bar represents 10 µm.

Cosmioneis regigeorgiensis Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 35–45)

LM observations (Figs 35–42): Frustules in girdle view rectangular (Fig. 35). Valves linear with parallel margins, showing occasionally a slight concavity in the middle (Fig. 41). Valve apices protracted, rostrate, bluntly rounded. Pseudosepta present (Fig. 38). Valve dimensions (n=10): length 35–50 µm, width 9.5–10.5 µm. Axial area very narrow, linear. Central area small, elliptic (Fig. 37) to rounded (Fig. 42). Raphe filiform, straight to weakly undulated. Proximal raphe endings almost straight, drop-like. Distal fissures elongated, sickle-shaped. Striae coarsely punctate, weakly to moderately radiate in the middle, where more distantly spaced, 8–11 in 10 µm, becoming more radiate and denser towards the apices, 16–18 in 10 µm. Areolae visible in LM, *ca*. 22–24 in 10 µm. SEM observations (Figs 43–45): Mantle margin clearly undulating (Fig. 43). Girdle consists of several perforated bands (Fig. 43). Striae

uniseriate, composed of small, rounded areolae (Fig. 44). Proximal raphe endings spathulate. Distal fissures shortly continuing onto the mantle (Fig. 44). Internally, large pseudosepta clearly visible (Fig. 45). Central nodule well developed, clearly raised (Fig. 45). Proximal raphe endings anchor-shaped (Fig. 45). Distal endings terminating onto small helictoglossae. Striae forming one long groove, covered by porous hymenes. Virgae weakly raised (Fig. 45).

Type:—ANTARCTICA. South Shetland Islands: King George Island, Fildes Peninsula, sample KGI9 (62° 11' 34.0" S, 58° 55' 47.6" W), *B. Uzunov*, *30 January 2013* (holotype BR! 4451, isotype PLP! 305).

Etymology:—The specific epithet '*regigeorgiensis*' refers to the island where the species was described from: King George Island, '*regi*' (from Latin '*rex*', meaning king) and '*georgiensis*' (from George).

Ecology and confirmed distribution:—*Cosmioneis regigeorgiensis* has only been found in the type locality on King George Island. The sample was an endolithic algal sample, taken from a cracked coastal rock. The dominant species in the sample was *Humidophila vojtajarosikii* Kopalová *et al*. in Kopalová *et al*. (2015: 126) and contained, besides other *Humidophila* taxa and several *Luticola* species, *Achnanthes taylorensis* D.E. Kellogg *et al*. (1980: 174–175) and several marine species, probably blown on the rock surface by seasprays.

Family **Naviculaceae**
Genus ***Mayamaea*** Lange-Bertalot (1997: 71)

***Mayamaea sweetloveana* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 46–58)**

LM observations (Figs 46–56): Valves elliptic with convex margins and broadly rounded, never protracted apices. Valve dimensions (n=20): length 6.0–7.0 µm, width 3.0–3.5 µm. Axial area very narrow, linear, conforming with the sternum. Central area almost entirely lacking. Raphe straight, enclosed in a heavily silicified sternum. Distal raphe fissures not discernible in LM. Striae strongly radiate throughout the entire valve, 25–30 in 10 µm. Central striae alternatingly shortened. Areolae not discernible in LM. SEM observations (Figs 57–58): Striae composed of several square to rounded areolae, *ca*. 50 in 10 µm, covered externally by clearly porous hymenes. Areolae becoming more elongated near the valve mantle (Fig. 57). Around the apices areolae more slit-like, positioned at the mantle/valve face junction. External raphe branches straight with distinctly enlarged, spathulate, almost not deflected proximal raphe endings. Distal raphe fissures very short, deflected opposite to the proximal raphe endings, never continuing onto the mantle but terminating near the last striae at the apices (Fig. 57). Internal raphe branches straight with simple proximal raphe endings (Fig. 58). Distal raphe endings terminating onto small helictoglossae (Fig. 58). Areolae clearly visible as rectangular to rounded pores (Fig. 58).

Type:—ANTARCTICA. James Ross Island: Ulu Peninsula, Naděje Lake, sample D24 (63° 48' 51.9" S, 57° 50' 05.6" W), *L. Nedbalová*, *13 February 2008* (holotype BR! 4452, isotype PLP! 306).

Etymology:—The specific epithet refers to Drs. Maxime Sweetlove (Ghent University, Belgium), member of the CCAMBIO project.

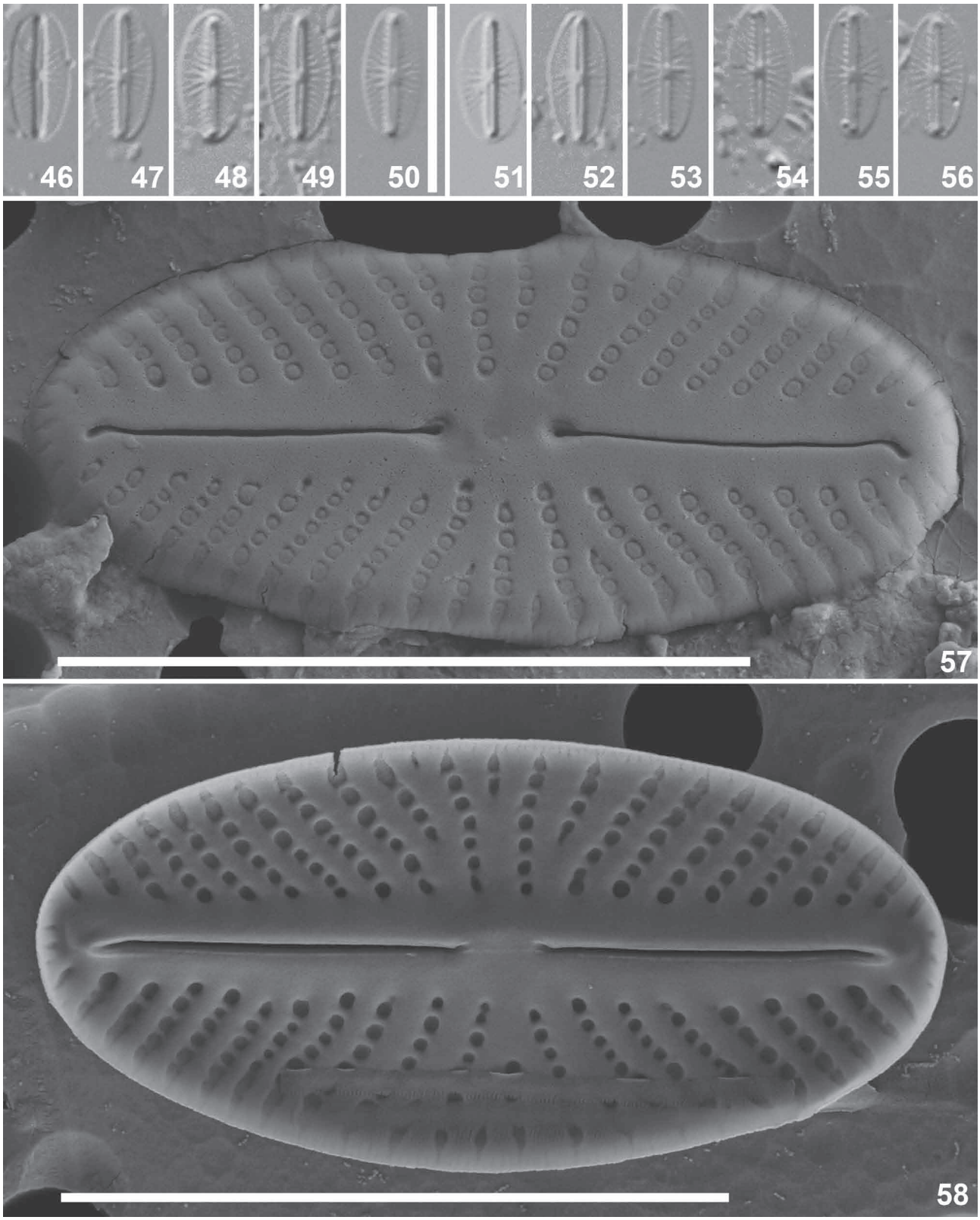
Ecology and confirmed distribution:—*Mayamaea sweetloveana* has up to now only been found in a few samples from James Ross Island. Due to confusion with other *Mayamaea* taxa such as *M. atomus* (Kützing 1844: 108) Lange-Bertalot (1997: 72) and *M. permitis* (Hustedt 1945: 919) Bruder & Medlin (2008: 327), its actual distribution is not entirely clear. The largest population (almost 75% of all counted valves) was observed in Naděje Lake, a cirque lake on Ulu Peninsula (James Ross Island). This is a rather shallow lake at an elevation of 240 m a.s.l. with an alkaline pH (8.4), low conductivity (<250 µS/cm) and low nutrient and phosphate values.

***Mayamaea tytgatiana* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 59–80)**

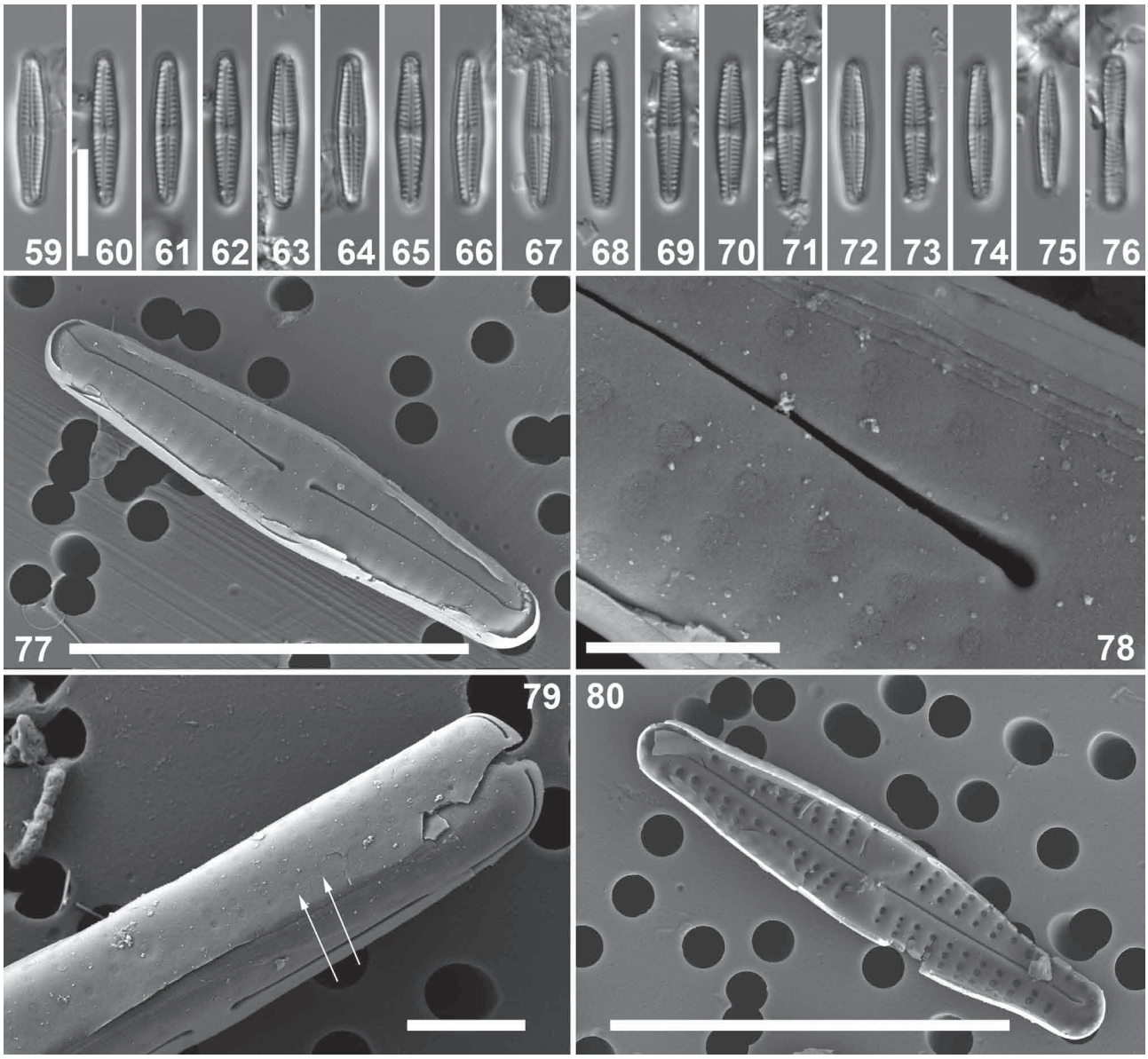
LM observations (Figs 59–76): Frustules in girdle view rectangular (Fig. 76). Valves narrowly linear-lanceolate with weakly convex margins and gradually narrowing, slightly protracted, rounded to almost subrostrate apices. Valve dimensions (n=28): length 12.0–15.0 µm, width 2.5–3.0 µm. Axial area very narrow, linear. Central area forming a bow-tie shaped, asymmetrical fascia, widening toward the margins. Raphe slightly curved with distinct, drop-like enlarged proximal endings, weakly deflected to one side. Distal raphe fissures barely visible in LM, hooked. Striae moderately radiate in the middle, becoming parallel and even weakly convergent toward the apices, 19–22 in 10 µm. Areolae not discernible in LM. SEM observations (Figs 77–80): Striae composed of several rounded areolae, *ca*. 35 in 10 µm, covered externally by clearly porous hymenes (Figs 77, 78). Areolae gradually becoming smaller on the valve mantle, usually rounded, rarely slit-like near the mantle edge (Fig. 79, arrows). At the apices mantle areolae often elongated (Fig. 79). External raphe branches straight to weakly curved with distinctly enlarged, weakly unilaterally deflected proximal raphe

endings (Figs 77, 78). Distal raphe fissures elongated, hooked opposite to the proximal raphe endings, continuing onto the mantle (Figs 77, 79). Internally, central nodule thickened (Fig. 80). Internal raphe branches straight with simple proximal raphe endings (Fig. 80). Distal raphe endings terminating onto small helictoglossae (Fig. 80). Areolae clearly visible as rounded pores (Fig. 80).

Type:—ANTARCTICA. South Shetland Islands: Deception Island, sample D37 (62° 59' 25.5" S, 60° 37' 31.7" W), *R. Zidarova*, *24 January 2013* (holotype BR! 4453, isotype PLP! 307).



FIGURES 46–58. *Mayamaea sweetloveana sp. nov*. LM & SEM pictures taken from the holotype population (sample D24) from James Ross Island. 46–56. LM views of 11 valves from the type population. 57. SEM of an entire valve, external view. 58. SEM of an entire valve, internal view. Scale bar represents 10 µm except for figs 57 and 58 where scale bar = 5 µm.



FIGURES 59–80. *Mayamaea tytgatiana sp. nov*. LM & SEM pictures taken from the holotype population (sample D37) from Deception Island (South Shetland Islands). 59–76. LM views of 18 valves from the type population. Fig. 76 shows the girdle view. 77. SEM of an entire valve, external view. 78. SEM detail of the valve externally, showing the enlarged central raphe endings and rounded areolae with external hymenes. 79. SEM view of the valve mantle with the slit-like areolae (arrows) and the hooked, elongated distal raphe endings. 80. SEM of an entire valve, internal view. Scale bar represents 10 µm except for fig. 78 where scale bar = 1 µm and fig. 79 where scale bar = 2 µm.

Etymology:—The specific epithet refers to Dr. Bjorn Tytgat (University of Ghent), member of the CCAMBIO project.

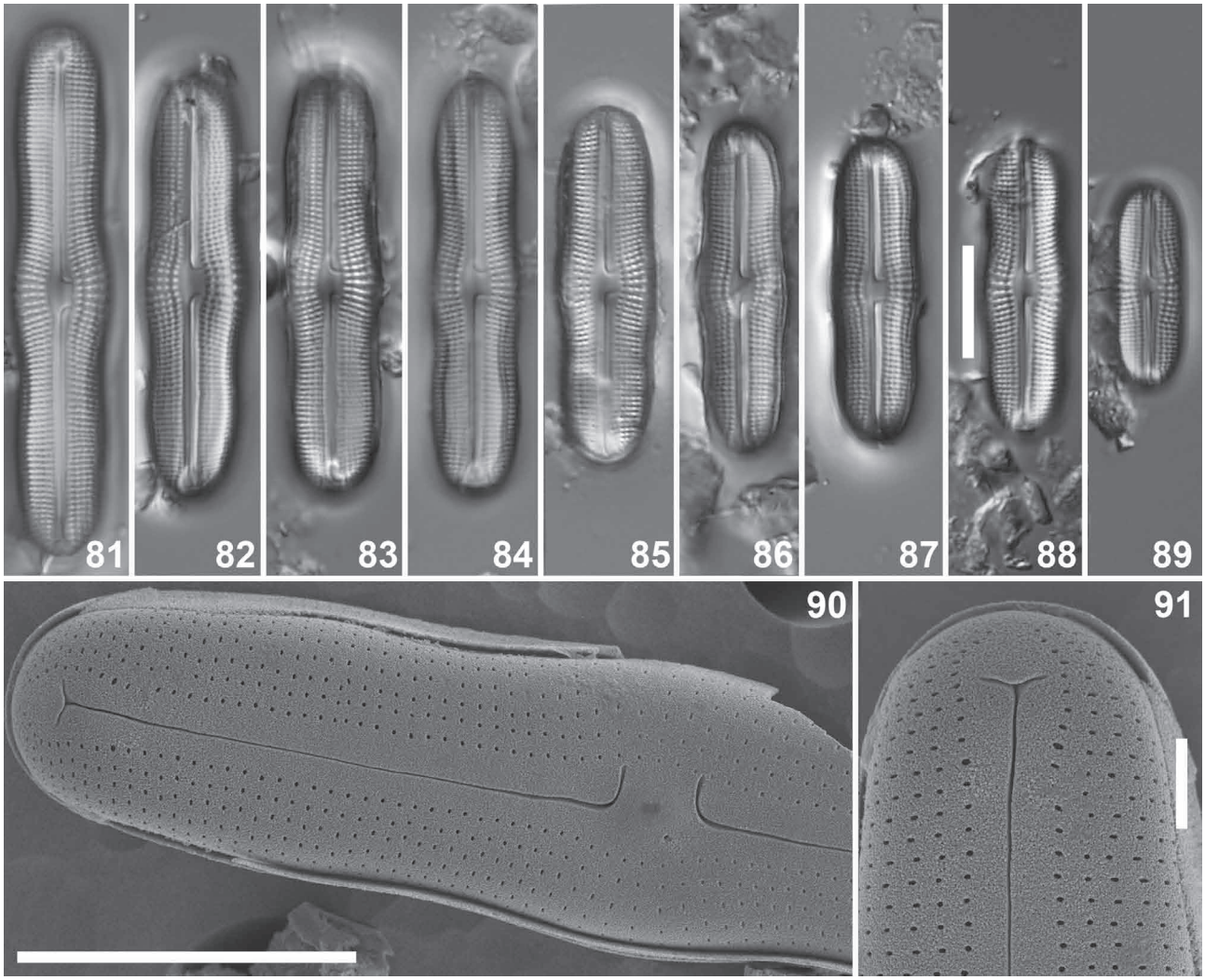
Ecology and confirmed distribution:—*Mayamaea tytgatiana* has up to now only been found in a few samples from Deception Island (South Shetland Islands). The largest population was observed on almost dry mosses growing in a small crack of a costal rock. The accompanying diatom flora included typically aerophilic diatom taxa, such as various *Luticola* and *Humidophila* species.

Family **Neidiaceae**
Genus ***Muelleria***

***Muelleria pimpireviana* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 81–91)**

LM observations (Figs 81–89): Valves linear with broadly rounded apices. Larger and medium-sized valves with a distinct inflation in the middle (Figs 81–88). Smallest valves with straight, non-inflated, parallel margins (Fig. 89). Valve dimensions (n=17): length 18.3–47.5 µm, width 6.0–9.0 µm. Axial narrow, linear, widening in the valve center to form a small, elliptic central area. Raphe straight. Proximal raphe endings moderately distantly spaced, clearly unilaterally bent at an angle of approx. 90 degrees, long, extending to the first row of areolae. Distal raphe endings visible in largest valves, bifurcate (Fig. 81). Striae near the central area (4–5 striae) more distantly spaced than the others, radiate, whereas other striae only slightly radiate, becoming parallel and denser toward the apices, finally parallel to very slightly convergent (Figs 85, 86). Central striae 11–16 in 10 µm, distal striae 19–22 in 10 µm. Areolae coarse, 15–20 in 10 µm. SEM observations (Figs 90–91): Striae composed of rounded to slightly transapically elongated areolae of almost equal size (Fig. 90). Proximal raphe endings clearly unilaterally bent, extending up to, or into, but never beyond the first row of areolae (Fig. 90). Distal raphe endings straight, clearly bifurcate, terminating shortly onto the valve face just before the valve face/valve mantle junction (Fig. 91). Striae continuing curving around the distal raphe endings and onto the mantle (Fig. 91). Canal punctae never observed (Figs 90, 91). Due to the rarity of the species in the samples, observations on the valve interior could not be made.

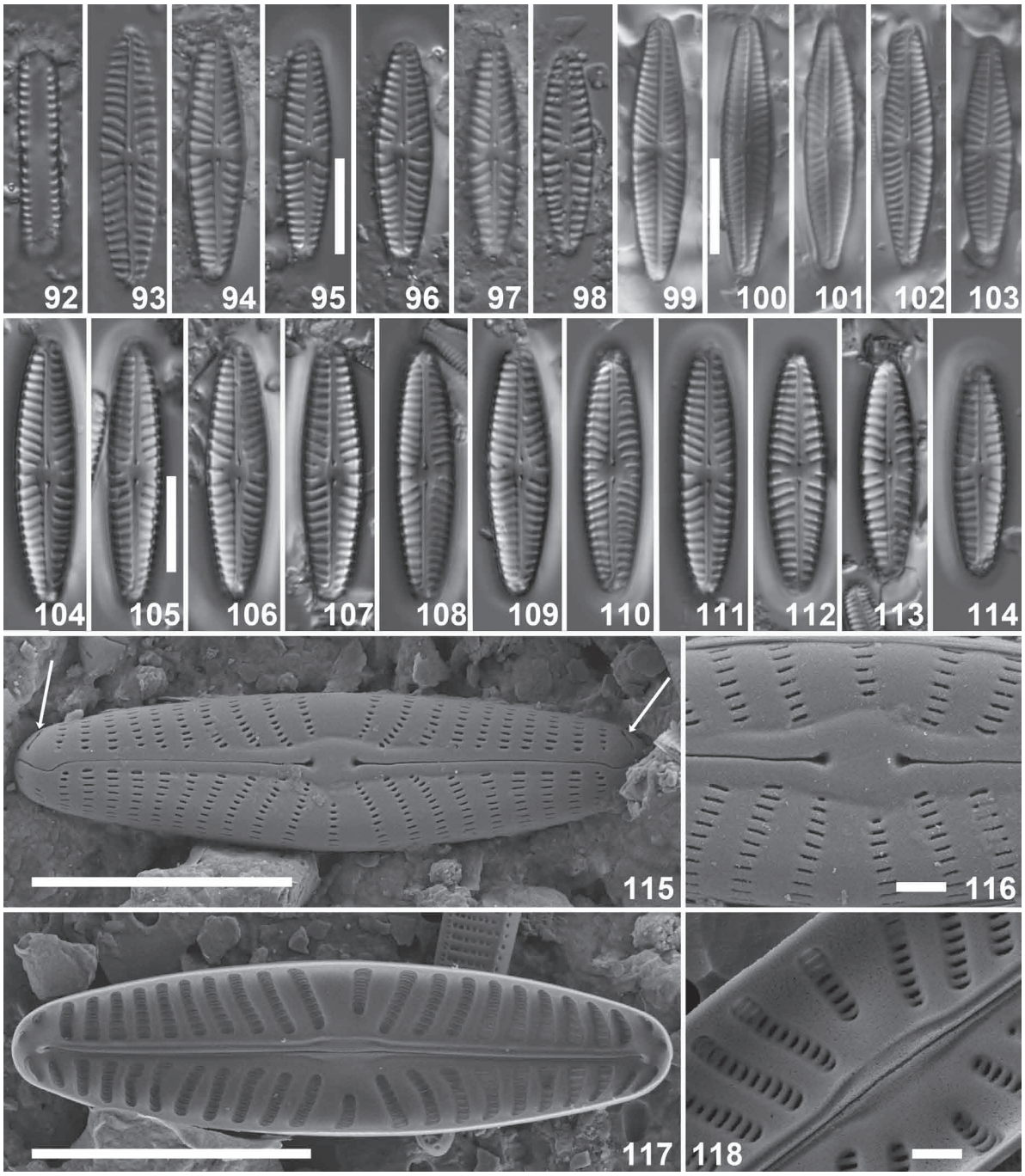
Type:—ANTARCTICA. South Shetland Islands: Nelson Island, sample NI26 (62° 14' 10.1" S, 59° 00' 05.6" W), *R. Zidarova*, *20 February 2013* (holotype BR! 4454, isotype PLP! 308).



FIGURES 81–91. *Muelleria pimpireviana sp. nov*. LM & SEM pictures taken from the holotype population (sample NI26) from Nelson Island (South Shetland Islands). 81–89. LM views of 9 valves from the type population. 90. SEM of the valve exterior. 91. SEM detail of the apex, showing the bifurcated distal raphe endings. Scale bar represents 10 µm except for fig. 91 where scale bar = 2 µm.

Etymology:—The species is named after Prof. Dr. Christo Pimpirev (Bulgarian Antarctic Institute), a leader of 24 Bulgarian Antarctic expeditions, to acknowledge his personal long-term dedication to Antarctica, and without whom Bulgarian scientific campaigns on the South Shetland Islands would not have been possible.

Ecology and confirmed distribution:—*Muelleria pimpireviana* has been rarely observed on several islands of the South Shetland Archipelago (Nelson Island, King George Island and Livingston Island). The largest population was found in a moist, circumneutral (pH 7.1) soil at the base of a coastal rock on Nelson Island. The accompanying diatom flora included several other *Muelleria* species and various *Luticola* and *Pinnularia* taxa. Occasionally, the species was also observed on wet terrestrial mosses and on the bottom of a shallow pool.



FIGURES 92–118. *Navicula romanedwardii sp. nov*. and *Navicula seibigiana s.s*. LM & SEM pictures of *Navicula romanedwardii* taken from the holotype population (sample D18) from James Ross Island and two other populations on James Ross Island and South Shetland Islands (indicated below). LM pictures of *Navicula seibigiana* taken from the type slide (Praep. Hintz 160, Eu-CH 15 in Coll. Lange-Bertalot). 92–98. *Navicula romanedwardii*, LM views of 7 valves from the type population. Fig. 92 shows the girdle view in LM. 99–103. *Navicula seibigiana s.s*., LM views of 5 valves from the type population. 104–114. *Navicula romanedwardii*, LM views of 11 valves from a Deception Island population (sample D37). 115. *Navicula romanedwardii*, SEM of an entire valve, external view. Arrows show the slits at the apices. 116. *Navicula romanedwardii*, SEM detail of the central area and central raphe endings. 117. *Navicula romanedwardii*, SEM of an entire valve, internal view (picture taken from James Ross Island, sample JRI015). 118. *Navicula romanedwardii*, SEM detail of the central part of the valve internally, showing the continuous raphe (picture taken from James Ross Island, sample JRI015). Scale bar represents 10 µm except for figs 116 and 118 where scale bar = 1 µm.

Family **Naviculaceae**
Genus ***Navicula***

***Navicula romanedwardii* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 92–98, 104–118)**

LM observations (Figs 92–98, 104–114): Frustules in girdle view rectangular (Fig. 92). Valves lanceolate to rhombic-lancoleolate (*e.g*., Figs 96, 97). Margins usually clearly convex. Valve apices acutely rounded, never protracted. Valve dimesions (n=20): length 23–29 µm, width 5.5–7.0 µm. Axial area narrow, widening towards the central area. Central area rather small, rhombic, widening towards the margins. Single shortened stria present on each side of the central area. Raphe filiform, straight. Proximal raphe endings deflected, terminating in distinctly drop-like pores. Distal fissures hooked towards the secondary side. Striae in the valve middle strongly radiate, becoming parallel to weakly convergent near the apices, 8–10 in 10 µm. Areolae discernible in LM. SEM observations (Figs 115–118): Striae composed of small lineolae, *ca*. 35 in 10 µm (Fig. 115). Striae narrower than the virgae (Figs 115, 116). At each valve apex, one transapically positioned slit present next to the distal raphe fissures (Fig. 115, arrows). External raphe branches situated on a thickened, raised sternum (Fig. 115). Proximal raphe endings drop-like expanded (Fig. 115). Distal raphe fissures elongated, continuing onto the mantle and finishing at the valve poles below the slits (Fig. 115). Internally, areolae situated in transapically running grooves (Fig. 118). Areolae occluded by individual hymenes (Fig. 117). Raphe running laterally on a distinctly developed raphe sternum, continuing near the well developed, apically elongated central nodule (Fig. 118). Internal distal raphe endings terminating shortly onto small helictoglossae (Fig. 117).

Type:—ANTARCTICA. James Ross Island: soil near Muddy Lake, sample JRI-D18 (63° 51’ 50.1” S, 57° 57’ 12.2” W), *L. Nedbalová*, *1 February 2008* (holotype BR! 4455, isotype PLP! 309).

Etymology:—The species is named after Mr. Roman Edward, a sailor and zodiac boat driver during several Bulgarian Antarctic expeditions, in recognition of his help in the scientific activities on Livingston Island.

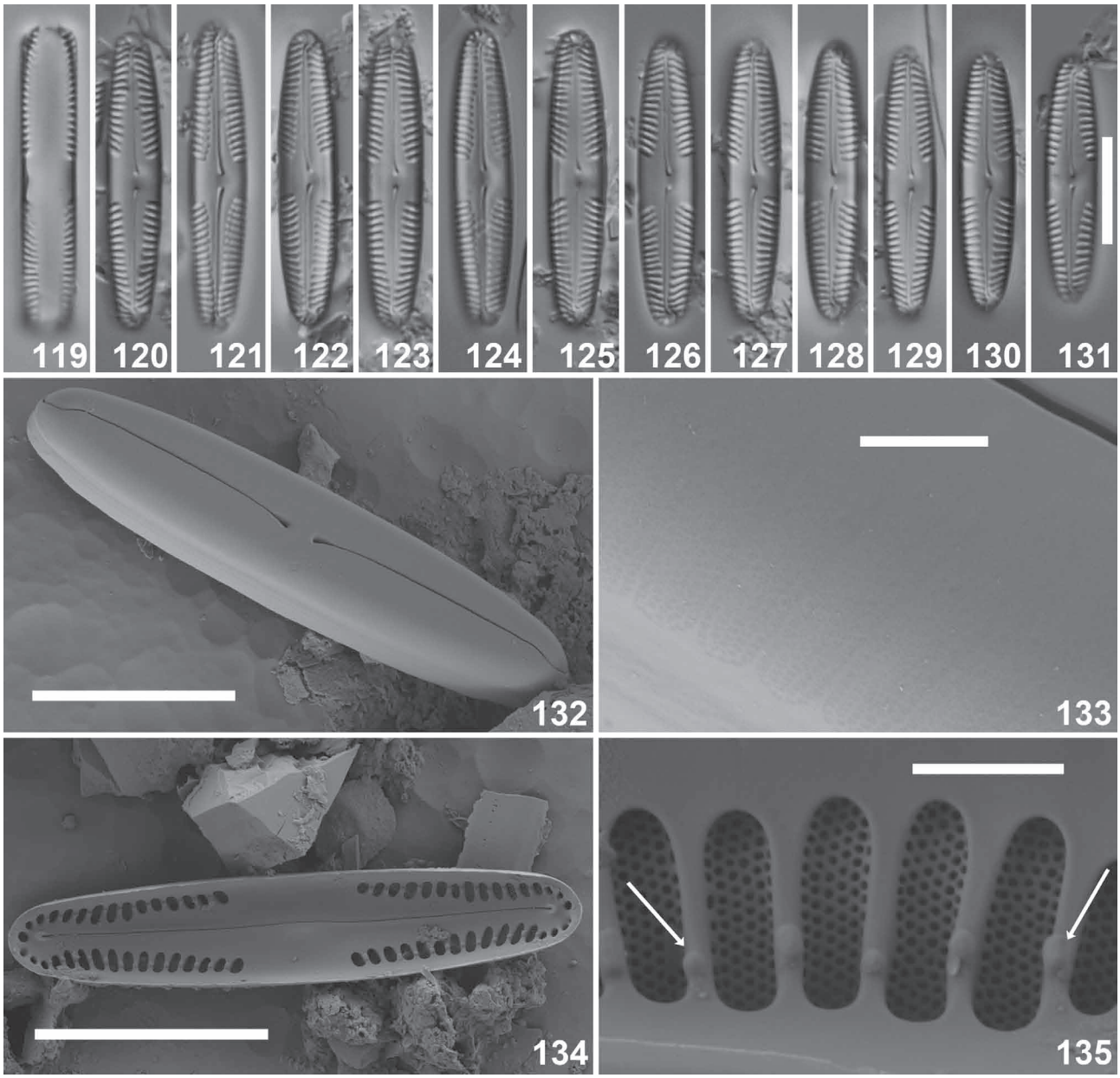
Ecology and confirmed distribution:—*Navicula romanedwardii* is a widely distributed species in Maritime Antarctica, observed on all major islands of the South Shetland Archipelago and on James Ross Island. The species had also been recorded on the Antarctic continent (see Van de Vijver *et al*. 2011b). On James Ross Island, the largest populations were found in the epipelon and epilithon of larger lakes, having an almost circumneutral to slightly alkaline pH (6.8–7.6), moderate to high specific conductance values (100–200 µS/cm) and moderate nutrient values (TP 46–592 µg/L), together with various *Nitzschia* species. On the South Shetland Islands *Navicula romanedwardii* was observed in a variety of habitats, ranging from small pools and streams to moss vegetation cover and soils, but usually in low abundances. A large population was found on Deception Island (South Shetland Islands) on almost dry mosses. Occasionally, the species was also observed in seepage areas.

Family **Pinnulariaceae**
Genus ***Pinnularia***

***Pinnularia pinseeliana* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 119–135)**

LM observations (Figs 119–131): Frustules in girdle view rectangular (Fig. 119). Valves narrowly lanceolate with weakly but still markedly convex, never parallel margins. Apices non (Figs 130, 131) to weakly protracted (Figs 120, 125), never capitate nor rostrate, broadly rounded. Valve dimensions (n=25): length 24–30 µm, width 4.5–5.5 µm. Axial area narrow near the apices, gradually but distinctly widening towards the central area. Central area large, forming a rectangular (rarely) to wedge-shaped (mostly) fascia. Raphe lateral, with straight to weakly curved branches. Proximal raphe endings clearly expanded, drop-like, unilaterally deflected. Distal raphe fissures elongated, hooked. Striae strongly radiate near the central area, becoming convergent near the apices, 13–15 in 10 µm. Striae near the central area shortened. Longitudinal lines absent. SEM observations (Figs 132–135): Striae externally covered by hymena (Fig. 132). Alveoli composed of 6–7 rows of small areolae (Fig. 133). Raphe curved. Proximal raphe endings drop-like, deflected (Fig. 132). Distal fissures elongated, continuing onto the mantle (Fig. 132). Internally, raphe continuous over the central nodule due to siliceous flap covering the proximal endings (Fig. 134). Distal endings terminating on short helictoglossae (Fig. 134). Alveoli opening via a small elliptic fenestra to the valve interior, showing 6–7 rows of small, rounded areolae (Figs 134, 135). Between the alveoli, virgae bearing elevated siliceous outgrowths (Fig. 135, arrows).

Type:—ANTARCTICA. South Shetland Islands: Deception Island, sample CC2 (62° 58’ 24.0” S, 60° 42’ 30.0” W), *G. Mataloni*, *February 2002* (holotype BR! 4456, isotype PLP! 310).



FIGURES 119–135. *Pinnularia pinseeliana sp. nov*. LM & SEM pictures taken from the holotype population (sample CC2) from Deception Island (South Shetland Islands).119–131. LM views of 13 valves from the type population. Fig. 119 shows the girdle view. 132. SEM of an entire valve, external view. 133. SEM detail of the valve externally, showing the alveoli of the striae. 134. SEM of entire valve, internal view. 135. SEM detail of the valve interior. Arrows showing the elevated siliceous outgrowths on the virgae. Scale bar represents 10 µm except for figs 133 and 135 where scale bar = 1 µm.

Etymology:—The species is named after Drs. Eveline Pinseel in recognition of her important scientific contributions to the taxonomy and morphology of the genus *Pinnularia*, more specifically the *Pinnularia borealis*-complex.

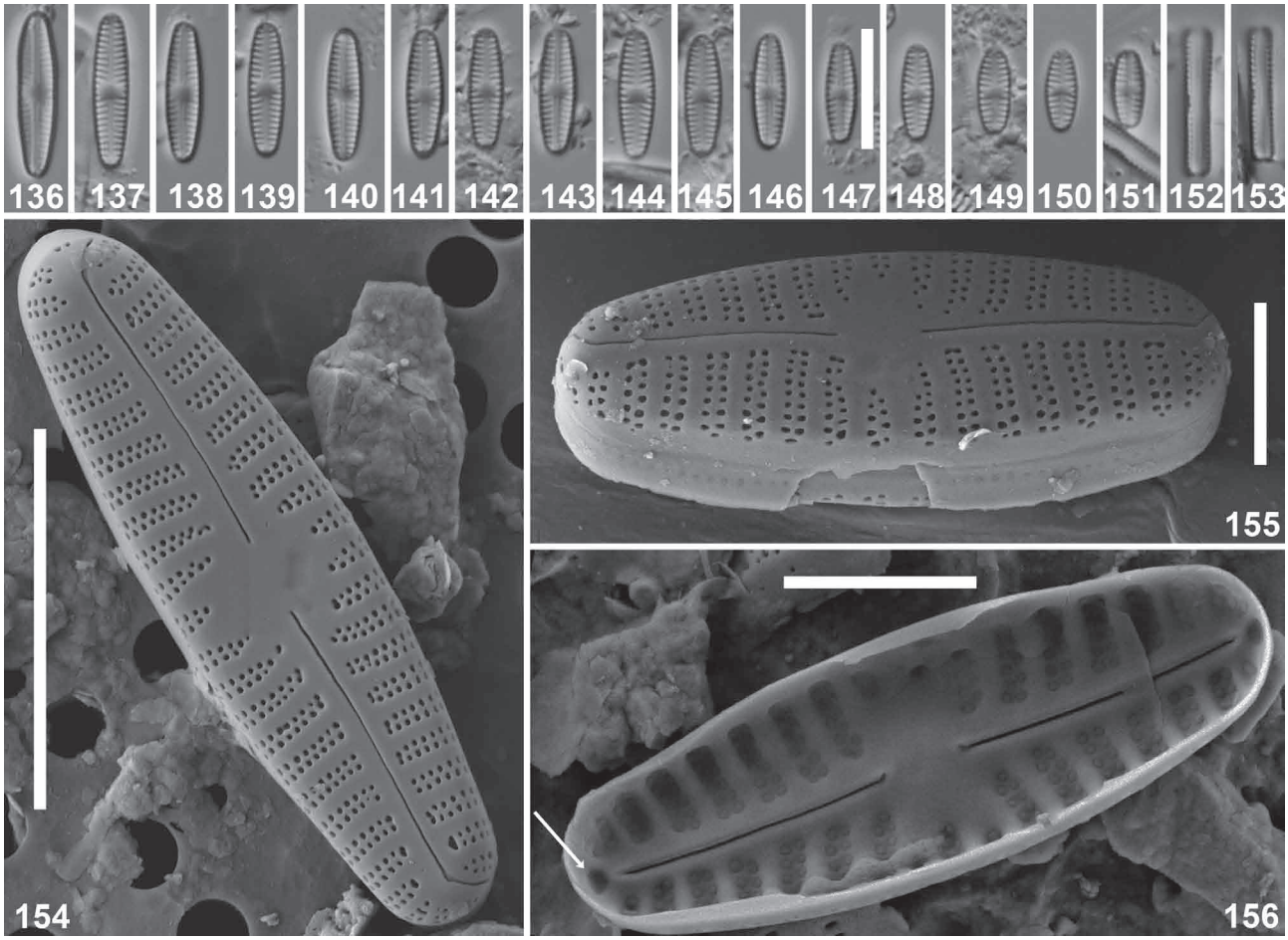
Ecology and confirmed distribution:—*Pinnularia pinseeliana* is a rare species and only found in some soil samples on Deception Island (South Shetland Archipelago). The largest population was observed in a warm soil at Cerro Caliente. The soil had a temperature of 19.1 °C and was further characterized in having a weakly acid pH (6.3), a very low conductivity (50 µS/cm) and a rather high amount of organic matter (6.5%) (Fermani *et al*. 2007).

Family **Sellaphoraceae**
Genus ***Sellaphora*** Mereschkowsky (1902: 186)

***Sellaphora antarctica* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 136–156)**

LM observations (Figs 136–153): Frustules in girdle view rectangular (Figs 152, 153). Valves linear-elliptic with weakly convex to almost parallel (largest specimens) margins. Valve apices not protracted, bluntly rounded. Valve dimensions (n=20): length 7.5–15.0 µm, width 2.5–3.5 µm. Axial area narrow, linear, not or only weakly widening (Fig. 136) near the central area. Central area large, rounded, sometimes asymmetrical (Fig. 149), bordered on both sides by usually 2, up to 4 shortened striae. Raphe slightly curved with indistinct to slightly expanded, distantly spaced proximal raphe endings. Distal raphe fissures not visible in LM. Striae radiate in the middle, becoming parallel at the apices, 18–21 in 10 µm. Areolae not discernible in LM. SEM observations (Figs 154–156): Externally, valve face flat (Fig. 154, 155). Striae biseriate composed of small, almost rounded to slightly apically elongated areolae (Fig. 154). Striae bordering the central area becoming uniseriate near the valve middle (Figs 154, 155). External raphe branches straight to weakly curved. Proximal raphe endings almost straight, simple, never expanded (Fig. 154). Distal raphe fissures elongated, hooked opposite the proximal raphe endings, continuing onto the mantle (Fig. 154, 155). Mantle striae very short, finishing immediately beyond the valve face/mantle junction (Fig. 155). Around the apices striae reduced to a few areolae (Fig. 154). Valvocopula with one row of rounded poroids (Fig. 155). Internally, raphe straight with simple, weakly unilaterally deflected proximal raphe endings (Fig. 156). Distal raphe endings terminating onto weakly developed helictoglossae (Fig. 156). Areolae internally occluded by individual hymenes. At each apex, one shallow depression present (Fig. 156, arrow).

Type:—ANTARCTICA. South Shetland Islands: Livingston Island, Byers Peninsula, sample BYM-051 (62° 38’ 20.1” S, 61° 06’ 44.2” W, 60 m a.s.l.), *B. Van de Vijver*, *15 January 2009* (holotype BR! 4457, isotype PLP! 311).



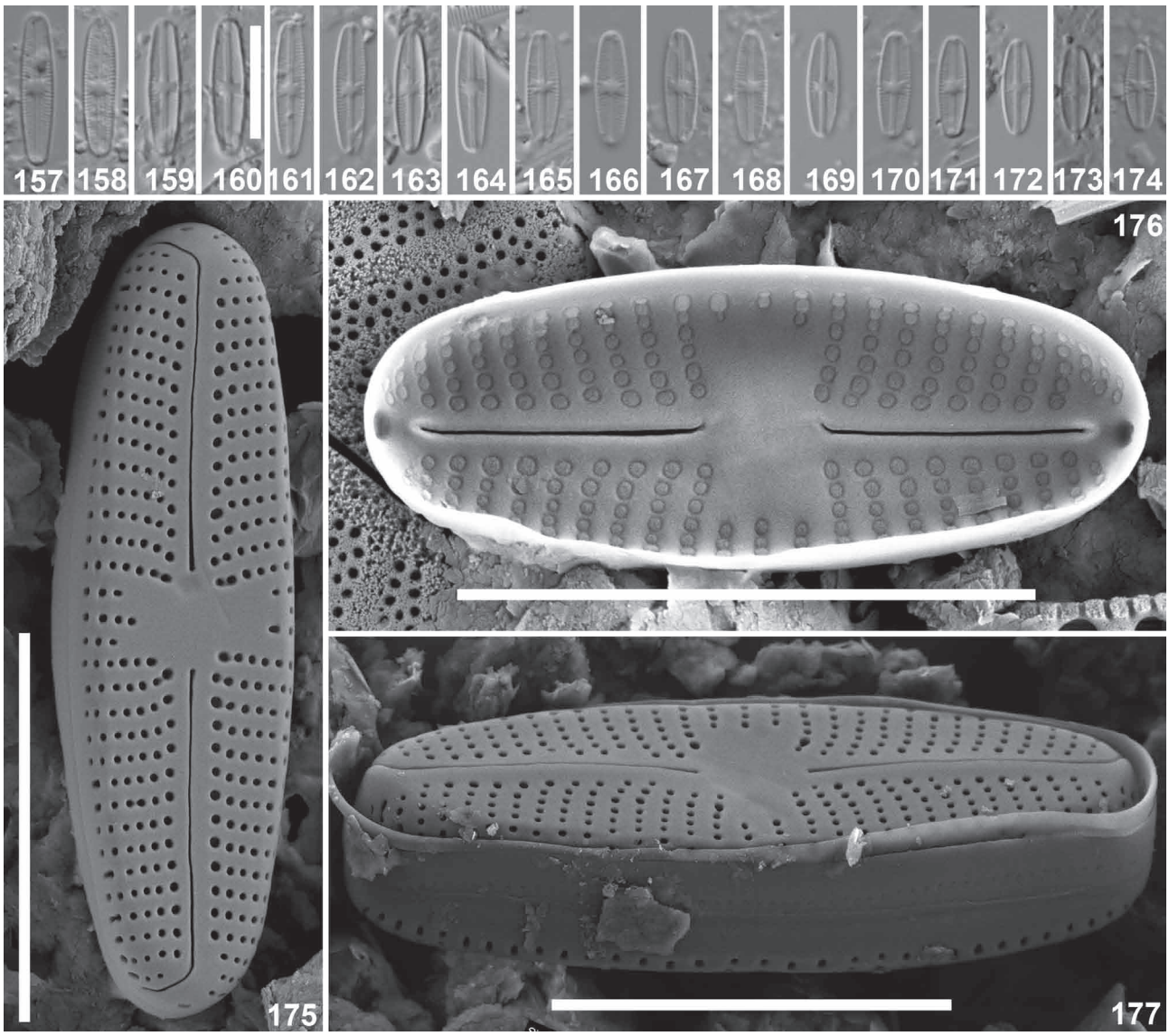
FIGURES 136–156. *Sellaphora antarctica sp. nov*. LM and part of the SEM pictures taken from the holotype population (sample BYM051) from Livingston Island (South Shetland Islands). 136–153. LM views of 18 valves from the type population. Figs 152–153 represent girdle view. 154. SEM of an entire valve, external view (picture taken from James Ross Island, sample JRI-004). 155. SEM of the valve exterior, showing the mantle and girdle. 156. SEM of an entire valve, internal view (picture taken from James Ross Island, sample JRI-11). Arrow indicates the shallow depression present at each apex. Scale bar represents 10 µm except for fig. 154 where scale bar = 5 µm and figs 155 and 156 where scale bar = 2 µm.

Etymology:—The specific epithet refers to the region where the species was first discovered.

Ecology and confirmed distribution:—Due to possible confusion with *Sellaphora seminulum* (Grunow 1860:

552) D.G.Mann (1989: 2) in the past the exact distribution of *S. antarctica* based on literature data is not known. The new species has been found with certainty on Livingston Island and King George Island (South Shetland Islands) and on James Ross Island. Under the name *Sellaphora* cf. *seminulum* it was also reported from Signy Island (South Orkney Islands) and Beak Island (Antarctic Peninsula area) by Sterken *et al*. (2015, figs 3BR-BT). The largest population of *Sellaphora antarctica* was found living on submerged mosses in a large lake having a circumneutral pH (7.3) and a low conductivity level (<100 µS/cm). The sample was dominated by several *Psammothidium* (Grunow in Cleve & Grunow 1880: 21) Bukhtiyarova & Round (1996: 3) taxa.

***Sellaphora gracillima* Zidarova, Kopalová & Van de Vijver, *sp. nov*. (Figs 157–177)**



FIGURES 157–177. *Sellaphora gracillima sp. nov*. LM and most of the SEM pictures taken from the holotype population (sample BY049) from Livingston Island (South Shetland Islands).157–174. LM views of 18 valves from the type population. 175. SEM of an entire valve, external view. 176. SEM of an entire valve, internal view. 177. SEM of an entire valve, showing the valve mantle and girdle (picture taken from Livingston Island, sample BY051). Scale bar represents 10 µm except for figs 175–177 where scale bar = 5 µm.

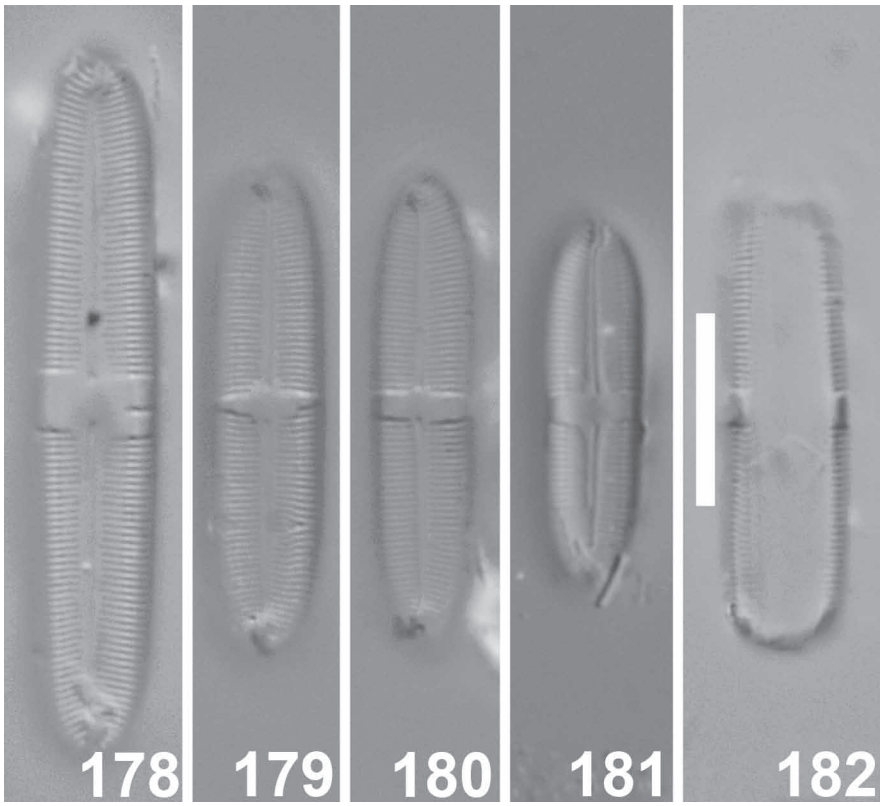
LM observations (Figs 157–174): Valves linear to linear-elliptic with almost parallel or weakly convex valve margins. Apices non protracted, broadly rounded. Valve dimensions (n=25): length: 8.5–14.0 µm, width 2.5–3.5 µm. Axial area very narrow, linear. Central area moderately large, transapically elongated, rounded (Fig. 157) to rectangular (Fig. 172) but often asymmetrical in shape due to several (2–5) irregularly shortened striae. Raphe filiform with straight, indistinct proximal raphe endings. Distal raphe endings not discernible in LM. Striae fine, radiate throughout the entire valve, 30–32 in 10 µm. Striae near the central area weakly curved. Areolae not visible in LM. SEM observations (Figs 175–177): Externally, valve face flat (Figs 175, 177). External raphe branches straight to slightly curved (Fig. 175). Proximal raphe endings weakly and gradually expanded, almost straight to weakly unilaterally

deflected (Fig. 175). Distal raphe fissures elongated, hooked opposite the proximal raphe endings, continuing onto the mantle beyond the last striae (Fig. 175). Striae uniseriate, composed of small rounded areolae, shortly extending onto the mantle to just below the valve face/mantle junction (Figs 175, 177). Areolae near the axial area slightly larger than the others (Fig. 175). Open foramina present at the apices (Fig. 175). Internally (Fig. 176), raphe straight. Proximal raphe endings terminating on a thickened central nodule, weakly deflected. Distal raphe endings terminating onto weakly developed helictoglossae. Internal areolar openings rounded, covered by individual, porous hymenes (Fig. 176). Shallow depressions present at both valve apices (Fig. 176). Girdle composed of 2 open copulae, the valcocopula bearing a single row of small rounded poroids (Fig. 177).

Type:—ANTARCTICA. South Shetland Islands: Livingston Island, Byers Peninsula, sample BY049 (62° 38' 43.1" S, 61° 02' 22.9" W, 75 m a.s.l.), *B. Van de Vijver*, *14 January 2009* (holotype BR! 4458, isotype PLP! 312).

Etymology:—The specific epithet '*gracillima*' refers to the fine striation of the species.

Ecology and confirmed distribution:—*Sellaphora gracillima* has been probably reported in the past as *Eolimna* (*Navicula*) *minima* (Grunow in Van Heurck 1880: 107) Lange-Bertalot in Moser *et al*. (1998: 153) or as *Navicula tantula* Hustedt (1943: 162) on several localities in the Maritime Antarctic Region (Kellogg & Kellogg 2002, Kopalová & Van de Vijver 2013, Kopalová *et al*. 2013, 2014, Sterken *et al*. 2015, figs 3AX, AY). So far, it is only with certainty present on Livingston Island, South Shetland Islands. The largest population was observed in a lake situated on the main central plateau on Byers Peninsula, next to Limnopolar Lake at an altitude of 75 m. The lake has a pH of 7.6 with a conductivity value of 60 µS/cm. Both nutrient and mineral levels are quite low (Kopalová & Van de Vijver 2013).



FIGURES 178–182. *Caloneis bacillum*, LM, type (slide IV-18-A8, Van Heurck Collection at the Botanic Garden Meise, Belgium). Scale bar represents 10 µm.

Discussion

The present paper shows once more that force-fitting (Tyler 1996) and taxonomic drift in the past as well as the lack of sufficient consistency in diatom taxonomy through the years have caused much confusion about the diversity, true identity and the exact biogeography of many Antarctic diatoms. A good example is the newly described *Navicula romanedwardii*. This species was reported numerous times from different Antarctic localities as either *Navicula cincta* (Ehrenberg 1854: plate 10/2) Ralfs in Pritchard (1861: 901) or *N. eidrigiana* Carter (1979: 78), while more recently it was (doubtfully) identified as *Navicula* cf. *seibigiana* by Van de Vijver *et al*. (2011b, p. 291). Van de Vijver *et al*.

(2011b) already discussed the differences between the Antarctic taxon and *Navicula cincta s.s.*: *N. cincta* has linear to linear-lanceolate valves with almost parallel margins and rather acutely rounded apices, compared to the lanceolate to rhombic-lanceolate valves with convex margins and rounded, never protracted apices of the Antarctic populations. Based on the measurements of the photographs of the type material of *Navicula cincta*, depicted in Lange-Bertalot (2001, plate 41, figs 1–5), *N. cincta* has a denser striation (11–13 striae in 10 µm) compared to the new Antarctic taxon (8–10 striae in 10 µm). Other differences include the less radiate striae and the more asymmetric central area in *Navicula cincta*. *Navicula eidrigiana* has larger valve dimensions and a lower number of lineolae, 24 vs. above 35 in 10 µm (Lange-Bertalot 2001, see also Van de Vijver *et al*. 2011b). Another morphologically similar species to *Navicula romanedwardii* is *N. wiesneri* Lange-Bertalot (1993: 140–141) but the latter shows differences in the internal raphe structure with clearly developed internal central raphe endings terminating on the central nodule (Lange-Bertalot 1993, Plate 42, figs 4–5), contrary to *N. romanedwardii* that has a continuous raphe. Moreover, *N. wiesneri* can be differenciated by the higher number of striae (11.5–14 *vs*. 8–10 in 10 µm) and the lack of a raised raphe sternum (Lange-Bertalot 2001, Van de Vijver *et al*. 2011b).

The most similar species to *Navicula romanedwardii* is *Navicula seibigiana*. Van de Vijver *et al*. (2011b) noted that the valves of the Antarctic populations of the species they identified as *Navicula* cf. *seibigiana* (described here as *Navicula romanedwardii*) have wider apices, a larger central area and larger virgae compared to the European *Navicula seibigiana* (Lange-Bertalot 1993, p. 253, figs 14–15). However, Van de Vijver *et al*. (2011b) did not consider these differences sufficient to justify the separation of the Antarctic populations from *Navicula seibigiana sensu stricto*. Further examination of the type slide of *Navicula seibigiana* (Praep. Hintz 160, Eu-CH 15 in Coll. Lange-Bertalot, Botan. Institut Universität Frankfurt a.M.) revealed that apart from the smaller apices, the differences in the central area and the smaller virgae, *Navicula seibigiana* has also slightly narrower valves (not exceeding 6 µm in width), narrower and even weakly protracted apices (Figs 99–103) whereas in the Antarctic populations (*i.e*. *N. romanedwardii*) the valve width could be up to 7 µm and the apices are never protracted. According to Lange-Bertalot (2001), the number of the striae in *Navicula seibigiana* may vary between 9 and 11 in 10 µm. Our counts on the depicted valves on the type slide of *Navicula seibigiana* showed that it has 11–12 striae in 10 µm, *i.e*. a slightly denser striation compared to *N. romanedwardii* (8–10 striae in 10 µm). Based on all above differences we consider the two taxa not conspecific and the Antarctic populations, previosuly asigned as *Navicula* cf. *seibigiana* in Van de Vijver *et al*. (2011b) are separated as an independant taxon. *Navicula parinacota* Rumrich & Lange-Bertalot in Rumrich *et al*. (2000: 164) from Chile has a similar raphe structure with raised raphe sternum and continuous internal raphe but has a larger valve width (of up to 8 µm), smaller virgae, denser areolae (*ca*. 40 *vs*. *ca*. 35 in 10 µm) and lacks the distantly spaced striae in the valve middle typically present in *N. romanedwardii*. Finally, the Mongolian *Navicula tuulensis* Metzeltin *et al*. in Metzeltin *et al*. (2009: 66) has similar dimensions and striation pattern, but more linear-elliptic valves with less convex margins and considerably lower number of areolae, 17–20 *vs*. *ca*. 35 in 10 µm (Metzeltin *et al*. 2009).

The taxonomic value of the genus *Caloneis* and its separation from the genus *Pinnularia* is still under debate. The genus *Caloneis* was erected by Cleve (1894: 46) based on light microscopy observations and the presence of longitudinal lines, but such lines are also present in species of the genus *Pinnularia*. Several authors, *i.e*. Cox (1988), Round *et al*. (1990) and Mann (2001) agreed that the plastid and frustule structure of the two genera do not support their separation. More recently, based on molecular phylogenetic analyses, Souffreau *et al*. (2011) concluded that the genus *Caloneis* should be merged with the genus *Pinnularia*, as the genus *Caloneis* is not monophyletic and, as currently delimited, not evolutionarily meaningful. Since at the present moment, there is still no conclusive decision on the taxonomic position for the genus *Caloneis* (R. Jahn, pers. comm.) and based on the morphological features of *Caloneis australis* (valve outline, presence internally of only small marginal alveoli openings), the new Antarctic taxon is still placed within the genus *Caloneis*.

Caloneis australis was earlier reported from the South Shetland Islands and James Ross Island as *Caloneis bacillum* or *C. silicula* (Ehrenberg 1843: 419) P.T. Cleve (1894: 51) (see for instance Zidarova 2008, Kopalová *et al*. 2014). Kellogg & Kellogg (2002) listed a total of 32 records for *Caloneis bacillum* and 21 records for *C. silicula* for the entire Antarctic and sub-Antarctic Region. During the recent survey on the South Shetland Islands and James Ross Island, we only recorded *Caloneis australis*. It is not unlikely that most of the historic Antarctic records of *Caloneis bacillum* and/or *C. silicula*, and even the sporadic (older) records of *C. schumanniana* (Grunow in Van Heurck 1880: 99) Cleve (1894: 53) from the Maritime Antarctic Region (listed in Kellogg & Kellogg 2002), all represent *C. australis*.

Originally, *Caloneis bacillum* was described by Grunow (1863, as *Stauroneis bacillum* Grunow 1863: 155) from the English North Sea coast (Newhaven, UK) as a marine-brackish taxon (Witkowski *et al*. 2000). Through the years however, as the original description was not well known by other authors, different species have been assigned to *Caloneis bacillum*, enlarging its original description. For instance, the valves named and depicted as *Caloneis bacillum*

in Krammer & Lange-Bertalot (1986, Plate 173, figs 9–20) from several European populations clearly do not belong to one species, although they were all lumped under *C. bacillum*. Therefore, comparison between the new taxon and *Caloneis bacillum* should only be based on the original description of *Caloneis (Stauroneis) bacillum* in Grunow 1863: "*valvis anguste lineari oblongis apice rotundatis*, *nodulo centrali magno omnem valvae latitudinem occupante*, *striis transversis tenuissimis ultra 70 in 0.001". Longit. 0.0010–0.0015"*, *latit. valvae 0.0002–0.0003".—Tab. nostr. 13 fig. 16 a*, *b (400/1). Habitat in aqua subsalsa ad litora Angliae prope Newhaven (legi August 1861)*" and illustrations of the type material (slide IV-18-A8 in the Van Heurck Collection at the Botanic Garden Meise, Belgium, Figs 178–182). The two taxa have similar valve dimensions (width 5.0–6.7 µm in *Caloneis bacillum* vs. 4.6–6.2 µm in *C. australis*). The main difference between them is the shape and width of the central area which is much narrower in *C. bacillum* compared to *C. australis* (compare Figs 178–181 and Figs 2–11). Moreover, *Caloneis bacillum* lacks the typical lunate markings that are always present in the central area of *C. australis* (Figs 178–181 and Figs 2–11). The apices in *Caloneis bacillum* are much more broadly rounded than in *C. australis*. Finally, considering also the ecological differences between the Antarctic taxon and *C. bacillum*, the latter being a brackish-marine taxon ("*Habitat in aqua subsalsa"*, Grunow 1863) and *Caloneis australis* typically found in freshwater habitats, we suggest a separation of these two taxa. Conspecificity with *Caloneis silicula* cannot be completely excluded, but till detailed LM and SEM observations on the type of *C. silicula* are made, we propose to keep the Antarctic populations, showing a finer striation, as a separate taxon. Cleve (1894: 51) transferred *Navicula silicula* Ehrenberg (1843: 419) to the genus *Caloneis* and reported it as a species having elongated valves, gibbous in the middle with 16–18 striae in 10 µm. This stria density is maintained in all valves and populations that, although slightly different from the original description, have been lumped into *Caloneis silicula* through the years. *Caloneis australis* however, has typically a higher number of striae (22–24 in 10 µm) and a smaller valve width rarely exceeding 6 µm, compared to *C. silicula*, where the reported valve width ranges from 8 till 10 µm (Antoniades *et al*. 2008). The third broad-concept taxon, *Caloneis schumanniana*, can hardly be confused with *C. australis*. According to the original drawing of Grunow's species in Van Heurck (1880, plate XI, fig. 21), *Caloneis schumanniana* has a considerably more inflated valve middle compared to the linear valves with weakly undulating margins of *C. australis*, and a much smaller central area, not forming a fascia, whereas in *C. australis* a fascia is always present. The most similar species to *Caloneis australis* are the Arctic *C. falcifera* Lange-Bertalot *et al*. (2004: 12), described from the Yugorski Peninsula (Lange-Bertalot *et al*. 2004) and *C. fasciata* (Lagerstedt 1873: 34) Cleve (1894: 50) from Spitsbergen (Lagerstedt 1873). *Caloneis falcifera* can be differentiated from *C. australis* by its more linear, slightly larger valves (length 25–60 µm and width above 6.5 µm) with a coarser striation (18–21 *vs*. 22–24 striae in 10 µm). Moreover, in *Caloneis falcifera* the lunate markings in the central area are composed of 5–7 short striae (Lange-Bertalot *et al*. 2004) and not of elliptic depressions as in *C. australis*. *Caloneis fasciata* has narrower valves (max. 4 µm wide) making this valves look much more slender that *C. australis* (Antoniades *et al*. 2008). *Caloneis fontinalis* (Grunow in Van Heurck 1885: 103) Lange-Bertalot & E. Reichardt in Lange-Bertalot & Metzeltin (1996: 29) has a considerably broader lanceolate axial area (Lange-Bertalot & Metzeltin 1996, Plate 87, figs 14–15) to be confused with *C. australis*. Finally, the sub-Antarctic *Caloneis* species reported by Van de Vijver *et al*. (2002) as *Caloneis* cf. *bacillum sensu auct. nonnull.* from Crozet Archipelago (Southern Indian Ocean) has a different valve outline with more linear-lanceolate valves, having convex margins (and not linear to linear-elliptic with weakly undulating margins) and a denser striation of up to 26 (and not 22–24) striae in 10 µm, and clearly, the sub-Antarctic populations represent a different species from the Maritime Antarctic *Caloneis australis*.

There has been much confusion about the identity of many small naviculoid species worldwide and more specifically in Antarctica. For instance, *Eolimna minima* has been recorded on various localities in the Maritime Antarctic, whereas *Sellaphora seminulum* has a large number of reports from both the entire Antarctic and sub-Antarctic regions (Kellogg & Kellogg 2002). Wetzel *et al*. (2015) revised intensively the type material of several small-celled naviculoid species in the widely distributed *Sellaphora seminulum–Eolimna minima* complex, which resulted in the transfer of for instance *Eolimna minima* and several related taxa, earlier erroneously associated with *E. minima*, to the genus *Sellaphora*. A key feature of the genus *Sellaphora* is the single H-shaped chloroplast (Mereschkowsky 1902, Mann *et al*. 2008). Unfortunately, it was not possible to observe the chloroplast structure of *Sellaphora antarctica* and *S. gracillima* but based on the other morphological features of these taxa, they both fit into the currently accepted concept for the genus *Sellaphora*: solitary, naviculoid cells with a flat valve face with or lacking a conopeum; uniseriate, rarely biseriate uninterrupted striae, composed of small round poroids, that are internally occluded by hymenes; slightly expanded central raphe endings, deflected to the primary side and elongated, hooked distal raphe fissures; usually pits present at the apices (Wetzel *et al*. 2015).

In Antarctica, *Sellaphora antarctica* has probably been reported in the past as *Sellaphora seminulum*. Wetzel *et al*. (2015) discussed the correct identity of the latter species and concluded that most populations, identified as *S.*

seminulum worldwide actually represent *Sellaphora saugerresii* (Desmazières 1858: 506) C.E.Wetzel & D.G.Mann in Wetzel *et al*. (2015: 209, see also figs 112–127, 251–269) and that *S. seminulum sensu stricto* (Wetzel *et al*. 2015, figs 158–179, 295–301) is a different species, with a different valve outline and striation pattern.

Sellaphora antarctica can be separated from *S. seminulum s.s.* as the latter has a different valve outline with slightly rostrate protracted apices and a larger valve width (3.5–4.5 µm vs. max. 3.5 µm in *S. antarctica*), a butterfly shaped central area (and not rounded as in *Sellaphora antarctica*), as well as much more radiate striae that are only occasionally biseriate. Additionally, *S. seminulum s.s.* clearly possesses large foramina at valve apices (Wetzel *et al*. 2015, figs 300–301), whereas in *S. antarctica* large foramina at the apices are absent and only shallow depressions are internally present.

Based on the raphe structure, striation pattern and areolae, *Sellaphora antarctica* is similar to *Sellaphora saugerresii*. In LM, the two taxa can however be separated based on slight differences in valve outline, valve width and the shape of the central area. The valve margins of *Sellaphora saugerresii* are more convex, giving the valves a more lanceolate outline, whereas in *Sellaphora antarctica* the margins are almost parallel making the valves look more linear in outline. The valve width of *Sellaphora antarctica* is smaller (up to 3.5 µm) than in *Sellaphora saugerresii* (above 3.5 µm, Wetzel *et al*. 2015). The central area of *Sellaphora antarctica* is more rounded whereas the central area of *Sellaphora saugerresii* is usually bow-tie shaped (to even rectangular) (Wetzel *et al*. 2015). The striae in *Sellaphora antarctica* are parallel at the apices, whereas in *S. saugerresii* the striae at the apices are weakly radiate. Moreover, compared to the type of *Sellaphora saugerresii*, *S. antarctica* has a lower stria density (18–21 *vs*. 21–22 in 10 µm). Additionally, *Sellaphora antarctica* lacks the large foramina at the apices present in *S. saugerresii* (Wetzel *et al*. 2015).

Due to its small valve size, *Sellaphora antarctica* might be confused with other small naviculoid diatom species in the Antarctic Region showing a similar valve outline, such as *Chamaepinnularia antarctica* Van de Vijver *et al*. (2013b: 193). The latter has a comparable valve width but shows more lanceolate valves with more convex margins and narrower apices, as well as a higher number of striae, 21–23 (*vs*. 18–21) in 10 µm (Van de Vijver *et al*. 2013b).

Sellaphora gracillima is morphologically similar to several species, in the past erroneously associated with *Eolimna minima*. Kellogg & Kellogg (2002) listed 29 records of *Eolimna minima* from the entire (sub-)Antarctic Region, and it is likely that many of these records in Antarctica represent *Sellaphora gracillima*. Wetzel *et al*. (2015) found out that *Navicula minima* (=*Eolimna minima*) should in fact be considered as a younger synonym of *Sellaphora saugerresii* and that all populations earlier considered to be *Eolimna minima* represent partly *Sellaphora atomoides* (Grunow in Van Heurck 1880: 107) C.E. Wetzel & Van de Vijver in Wetzel *et al*. (2015: 219) and partly *Sellaphora nigri* (De Notaris in De Notaris & Baglietto 1872: 296) C.E.Wetzel & Ector in Wetzel *et al*. (2015: 221). Of the latter two, *Sellaphora atomoides* is most similar to *S. gracillima*. Both species can however be differentiated by the shape of their central area that is symmetrical and bow-tie shaped in *Sellaphora atomoides* (Wetzel *et al*. 2015) but asymmetrical and irregular in shape in *S. gracillima*. *Sellphora gracillima* almost always has shortened striae in its central area whereas in *S. atomoides* they are usually absent. *Sellaphora nigrii* has elliptic, less linear valves with convex margins, a symmetrical central area and a coarser striation of 25–28 striae in 10 µm (*vs*. 30–32 in *S. gracillima*) (Wetzel *et al*. 2015).

According to the records of *Mayamaea* Lange-Bertalot (1997: 71) species, in the Antarctic the latter genus seemed to be represented by mostly cosmopolitans (Kellogg & Kellogg 2002). Only one Antarctic endemic taxon has been described in the genus: *Mayamaea josefelsteri* Kopalová *et al*. in Van de Vijver *et al*. (2013b: 195) from James Ross Island. Of the recorded in Antarctica cosmopolitans, three taxa are confirmed from the region (B. Van de Vijver, pers. obs.), currently identified as *Maymaea atomus*, *M. permitis* and *M. excelsa* (Krasske 1925: 51) Lange-Bertalot (1997: 72). The description of *M. sweetloveana* and *M. tytgatiana* increases the total number of the Antarctic *Mayamaea* species with 33%. With its small valve size, *Mayamaea tytgatiana* can be confused with other small-celled naviculoid taxa having uniseriate striae and rounded areolae, externally occluded by hymenes, such as species of *Eolimna* Lange-Bertalot & Schiller in Schiller & Lange-Bertalot (1997: 166) or *Adlafia* Moser *et al*. in Moser *et al*. (1998: 87). Species of the genus *Adlafia* are characterized by dense to very dense striae, abruptly changing their direction from radiate to convergent near the apices (Moser *et al*. 1998, Lange-Bertalot 2001), a feature lacking in the new Antarctic taxon. The genus *Eolimna*, as it was defined by Schiller & Lange-Bertalot (1997), typically has hymenes located in the middle of the areolar canal, contrary to the new taxon that has externally occluding hymenes. Species of the genus *Mayamaea* have small elliptic valves, a simple raphe with distal fissures hooked to one side opposite to the central raphe endings, a strongly silicified raphe sternum internally, straight internal raphe fissures with simple raphe endings and usually uniseriate striae, composed of rounded areolae with external hymens (Lange-Bertalot 1997, 2001). The areolae are usually replaced or supplemented on the mantle by elongated slits (Lange-Bertalot 1997, 2001).

Mayamaea tytgatiana lacks the typically elliptic valve outline of most *Mayamaea* taxa and the inner raphe sternum is not as heavily silicified as in most *Mayamaea* taxa. Slit-like areolae are only rarely present at the end of the striae on the mantle and helictoglossae are relatively small. However, based on the raphe structure, the uniseriate striae with rounded areolae having external hymenes, and the presence, though rarely, of slit-like areolae on the mantle, the new taxon is placed in the genus *Mayamaea*. Due to the narrowly linear-lanceolate valve outline, *Mayamaea tytgatiana* can hardly be confused with any other of the currently known *Mayamaea* species since they mostly have an elliptical outline. In LM however, several Antarctic or sub-Antarctic *Chamaepinnularia* taxa, such as *C. australomediocris*, *C. aerophila* Van de Vijver & Beyens in Van de Vijver *et al*. (2002: 26) and *C. antarctica*, have similar valve outline. *Chamaepinnularia australomediocris* has wider valves with a width of above 3 µm (and not up to 3 µm) and a finer striation of more than 23 striae in 10 µm (Schmidt *et al*. 1990, Van de Vijver *et al*. 2002), compared to the 19–22 striae in 10 µm in *Mayamaea tytgatiana*. From *Chamaepinnularia antarctica*, the new taxon could be separated in LM based on the central area. The fascia in *Mayamaea tytgatiana* is clearly visible in LM, whereas *Chamaepinnularia antarctica* never has a fascia (Van de Vijver *et al*. 2013b). Finally, *Chamaepinnularia aerophila* has clearly more capitate valves with a more tumid central part (Van de Vijver *et al*. 2002).

Chamaepinnularia elliptica clearly belongs to the genus *Chamaepinnularia*, based on its valve size and stria structure, with each stria composed of two areolae: one larger on the valve face and one smaller on the valve mantle, separated by a silica line on the valve face/valve mantle junction (Lange-Bertalot & Metzeltin 1996). In this genus, three Antarctic taxa have been already described and known for the Maritime Antarctic Region: *Chamaepinnularia australomediocris* Lange-Bertalot & R. Schmidt in Schmidt *et al*. (1990: 65) Van de Vijver in Van de Vijver *et al*. (2002: 27), *C. gerlachei* Van de Vijver & Sterken in Van de Vijver *et al*. (2010b: 432) and *C. antarctica* Van de Vijver *et al*. in Van de Vijver *et al*. (2013b: 193). All other (past) records from the Maritime Antarctic Region, listed in Kellogg & Kellogg (2002) belong to presumably widely distributed species outside Antarctica. None of the already known Antarctic *Chamaepinnularia* species could be confused with *Chamaepinnularia elliptica*. The new species is morphologically most similar to *Chamaepinnularia parsura* (Hustedt 1962: 240) C.E.Wetzel & Ector in Wetzel *et al*. (2013: 156) and *C. evanida* (Hustedt 1942: 66) Lange-Bertalot in Lange-Bertalot & Metzeltin (1996: 34), the latter with one doubtful record from Signy Island, the South Orkney Islands (Oppenheim 1990). *Chamaepinnularia parsura* has comparable valve dimensions and similar valve outline to the new Antarctic taxon, but slightly narrower valves of up to 4.0 µm, narrowly (cuneiformly) rounded apices and a narrower axial area (Wetzel *et al*. 2013). The two taxa can be easily separated by the shape of the central area. *Chamaepinnularia parsura* has a fascia which is variable in size and shape (Wetzel *et al*. 2013), whereas in *C. elliptica* a fascia is always absent. In SEM, both taxa differ in their raphe structure. The external distal raphe fissures in *Chamaepinnularia parsura* are elongated and hooked (Wetzel *et al*. 2013, p. 159, figs 73, 75), whereas in *C. elliptica* the distal raphe endings finish short and weakly deflected. The internal proximal raphe endings in *Chamaepinnularia parsura* are distinctly unilaterally hooked (Wetzel *et al*. 2013, p. 159, figs 74, 76), whereas in *C. elliptica* the internal proximal raphe endings finish shortly bent onto a prominent central nodule. *Chamaepinnularia evanida* has a similar central area to *C. elliptica*, but its valves are more rhombic-lanceolate with a smaller width (2.8–3.2 µm *vs*. 3.8–4.5), it has a much finer striation of 28–30 (*vs*. 22–24) striae in 10 µm and elongated and hooked distal raphe fissures (Wetzel *et al*. 2013, figs 84–86). Finally, *Chamaepinnularia schauppiana* Lange-Bertalot & Metzeltin (1996: 36) has a more linear-elliptic valve outline with less convex margins and a considerably lower number of striae, 16–18 (*vs*. 22–24) in 10 µm (Lange-Bertalot & Metzeltin 1996).

The genus *Muelleria* represents one of the most species-rich genera in the Antarctic Region (Van de Vijver *et al*. 2014a). Up to the year 1997, most Antarctic reports referred to only one species: *Muelleria gibbula* (P.T. Cleve 1894: 140) S.A. Spaulding & Stoermer (1997: 99) (Kellogg & Kellogg 2002). In the past two decades, a fairly large number of new *Muelleria* species was recognized and described (*i.e*. Spaulding *et al*. 1999; Van de Vijver *et al*. 2002, 2010a, 2014a), with 16 of the species showing a restricted distribution to only the Antarctic Region and even its sub-regions (Van de Vijver *et al*. 2014a), whereas the presence of *Muelleria gibbula* was not confirmed in any of these studies. Despite the large number of *Muelleria* taxa described in the past years from Antarctica, one taxon could not be identified using the available literature (Spaulding *et al*. 1999, Van de Vijver *et al*. 2002, 2010a, 2014a). *Muelleria pimpireviana*, and mostly its smaller valves, is morphologically similar to several other Antarctic *Muelleria* species, including *M. australoatlantica* Van de Vijver & S.A. Spaulding in Van de Vijver *et al*. (2010a: 29), *M. varipunctata* S.A. Spaulding & Kociolek in Spaulding *et al*. (1999: 327) and *M. algida* S.A. Spaulding & Kociolek in Spaulding *et al*. (1999: 318). However, none of these species shows linear valves with a distinctly gibbous middle part, as can be seen in the larger and medium-sized individuals of *Muelleria pimpireviana*. *Muelleria australoatlantica* has a comparatively smaller valve width of 6–7 µm (*vs*. 6–9 µm in *M. pimpireviana*), longer proximal raphe endings, extending into the first 2–3 rows of areolae (and not up to or into the first row of areolae), lacks bifurcation of its

distal raphe endings, present in the new taxon, and has canal punctae (Van de Vijver *et al*. 2010a) that have not been observed in *M. pimpireviana*. *Muelleria varipunctata* has bifurcate distal raphe endings and a similar valve dimensions range, but more acutely rounded apices and a completely different areola structure, with enlarged areolae bordering the raphe (Spaulding *et al*. 1999), a feature clearly not present in *M. pimpireviana*. The bifurcated distal raphe endings in *Muelleria varipunctata* are much longer, finishing onto the mantle and the distal raphe is hooked (Spaulding *et al*. 1999, figs 32–33), whereas in *M. pimpireviana* the distal raphe endings are straight and short, with a bifurcation onto the valve face. In addition, canal punctae are absent in *Muelleria pimpireviana*, contrary to *M. varipunctata* (Spaulding *et al*. 1999). *Muelleria algida* is a larger species with a width of above 9 µm, with linear valves that are not inflated in the middle and elongated, bifurctated distal raphe endings that terminate onto the valve mantle (Spaulding *et al*. 1999). Other Antarctic taxa, such as *Muelleria meridionalis* S.A. Spaulding & Stoermer (1997: 102) and *M. variolata* S.A.Spaulding & Kociolek in Spaulding *et al*. (1999: 325) both have lanceolate valves, the latter with even rostrate apices, and lack bifurcations of the distal raphe endings (Spaulding *et al*. 1999). Finally, Cholnoky (1955) described *Navicula vandermerwei* Cholnoky (1955: 17) from South Africa, later transferred to the genus *Muelleria* by Van de Vijver & Cocquyt (in Van de Vijver *et al*. 2010a: 38). The identity of Cholnoky's taxon is poorly known from only the original drawing and a single valve found in the type material, both shown in Van de Vijver *et al*. (2010a, figs 103 & 104). No SEM studies have been possible for this taxon so far and comparisons between the new Antarctic taxon and *Muelleria vandermerwei* could only be based on the type of the latter, depicted in Van de Vijver *et al*. (2010a, fig. 104) and the description therein. Careful comparison and measurements of the single type specimen of *Muelleria vandermerwei* (Van de Vijver *et al*. 2010a, fig. 104) showed the latter as a smaller ("*rather small*", Van de Vijver *et al*. 2010a, p. 38) and slender species with a width of 5.5 µm, having a higher length to width ratio, compared to the robust and wider valves of *M. pimpireviana*. *Muelleria vandermerwei* has a finer striation of 24 striae (*vs*. 19–22) in 10 µm, as given in Van de Vijver *et al*. (2010a) and measured by us; in addition, areolae of the striae in *M. vandermerwei* are finer, not discernible in LM, contrary to the clearly visible areolae even in the smallest valves of *M. pimpireviana* (Figs 81–89). Therefore conspecifity between the two taxa should be excluded.

In 2012, an extensive revision was published on Maritime Antarctic non-Distantes species of the genus *Pinnularia*, describing twelve new taxa (Zidarova *et al*. 2012). Nevertheless, the populations that were found on Deception Island could not be identified with the illustrations and descriptions in Zidarova *et al*. (2012). *Pinnularia pinseeliana* can be confused with *P. australoschoenfelderi* Zidarova *et al*. (2012: 18) but has a different striation pattern with 13–15 striae in 10 µm, compared to 10–12 striae in 10 µm in *P. australoschoenfelderi*. The valve apices are more broadly rounded in contrast with the acutely rounded apices in *P. australoschoenfelderi* (Zidarova *et al*. 2012). The related *Pinnularia magnifica* Zidarova *et al*. (2012: 18) can be separated by the same reasons: lower stria density (9–10 in 10 µm), more acutely rounded apices and a lanceolate valve outline contrary to *P. pinseeliana* that has a linear to linear-lanceolate outline with almost parallel margins. Smaller valves of *Pinnularia microstauroides* Zidarova *et al*. (2012: 20) show a similar valve outline to *P. pinseeliana*, but have a much smaller, often asymetrical central area; in addition, in *P. pinseeliana* undulating margins as in *P. microstauroides* (Zidarova *et al*. 2012) have never been observed. *Pinnularia schoenfelderi* Krammer (1992: 70–71) also shows some similarities but has a very narrow axial area, never widening towards the central area as is the case in *P. pinseeliana*. The striae near the central area are shorter in *P. pinseeliana* as a result of this wider axial area. The central area is smaller in *Pinnularia schoenfelderi* giving the proximal raphe endings a shorter course beyond the striae. The striae in *Pinnularia pinseeliana* are usually more radiate that in *P. schoenfelderi*. *Pinnularia obscura* Krasske (1932: 117) has a lower stria density (10–13 in 10 µm), a very irregular striation pattern with often less radiate striae, an almost rectangular fascia and a filiform raphe reducing the similarity with *P. pinseeliana*. The combination of a widening axial area with a lateral raphe, radiate striae and a large fascia justifies the separation of *P. pinseeliana* as a new taxon.

Finally, in the genus *Cosmioneis*, there are only a handful number of taxa known worldwide and only one was reported from the Antarctic Region. Kellogg & Kellogg (2002), although mentioning the genus in their overview, listed no records of *Cosmioneis* taxa but Van de Vijver *et al*. (2002) found *Cosmioneis grossepunctata* (Hustedt 1944: 271) D.G.Mann in Round *et al*. (1990: 666) in several samples on the sub-Antarctic Ile de la Possession. The latter can be separated from *Cosmioneis regigeorgiensis* based on its elliptic valve outline with clearly convex margins contrary to the parallel, even slightly concave margins in *C. regigeorgiensis*. Although careful analysis of the pictures of *Cosmioneis grossepunctata* in Van de Vijver *et al*. (2002, plate 54) showed that at least one of the depicted valves (plate 54, fig. 1) has a similarity with the new species. Further investigation of the sub-Antarctic material will be necessary to reveal their possible conspecifity. *Cosmioneis incognita* (Krasske 1932: 112–113) Lange-Bertalot in Werum & Lange-Bertalot (2004: 134) is much smaller, with a valve length of max. 30 µm and a valve width of 7.5–8.0 µm (*vs*. above 9.5 µm in *C. regigeorgiensis*). The holotype of *Cosmioneis incognita*, illustrated in Lange-Bertalot *et al*. (1996, plate 14,

fig. 1), shows a small valve with a coarse striation pattern. The central striae are quite distantly spaced with shortened striae positioned between them, a feature never observed in *Cosmioneis regigeorgiensis*. The other valves that are illustrated in Lange-Bertalot *et al*. (1996, plate 14, figs 2–4) as *Cosmioneis incognita*, and originating from Southern Chile, most likely represent another species as they have a very different valve outline (more convex margins), and are also not conspecific to *Cosmioneis regigeorgiensis*. *Cosmioneis lundstroemii* Cleve in Cleve & Grunow (1880: 13) D.G.Mann in Round *et al*. (1990: 666) can be separated based on its stria density, valve outline and areola density. The central striae in the latter are equidistant, contrary to *Cosmioneis regigeorgiensis* that has clearly more spaced central striae.

Acknowledgements

This study was supported as a long-term research development project RVO no. 67985939. Samples on Byers Peninsula (Livingston Island) were taken in the framework of the IPY-Limnopolar Project POL2006-06635 (Ministerio de Ciencia y Tecnologia, Spain). Sampling and studies on Deception Island, King George Island and Nelson Island were done within ДМУ 03–63 (Science Fund, Bulgaria). Dr. Blagoy Uzunov (University of Sofia) is thanked for his help during the field work on Deception Island, Nelson Island and King George Island in 2013, and the staff of Decepción Base on Deception Island and Bellingshausen Station on King George Island are thanked for their assistance. Bulgarian Antarctic Institute is acknowledgeed for logistical support. Part of this research was funded within the BELSPO project CCAMBIO. Dr. Alex Ball and the staff of the IAC laboratory at the Natural History Museum are thanked for their help with the scanning electron microscopy. The authors would like to thank the members of expedition to the Czech J.G. Mendel Antarctic Station for field support and assistance. The referees are thanked for their constructive remarks.

References

Antoniades, D., Hamilton, P., Douglas, M.S.V. & Smol, J.P. (2008) Freshwater diatoms of the Canadian High Arctic Islands: Ellef Ringnes, northern Ellesmere and Prince Patrick islands. *Iconographia Diatomologica* 17: 1–649.

Aristarain, A.J., Pinglot, J.F. & Pourchet, M. (1987) Accumulation and temperature measurements on the James Ross Island, Antarctic Peninsula, Antarctica. *Journal of Glaciology* 33 (115): 357–362.

Bory de Saint-Vincent, J.B.M (1822) *Dictionnaire Classique d'Histoire Naturelle*. Rey & Gravier, libraires-éditeurs; Baudouin Frères, libraires-éditeurs, Paris.

Bruder, K. & Medlin, L.K. (2008) Morphological and molecular investigations of naviculoid diatoms. II. Selected genera and families. *Diatom Research* 23: 283–329.
http://dx.doi.org/10.1080/0269249X.2008.9705759

Bukhtiyarova, L. & Round, F.E. (1996) Revision of the genus *Achnanthes* sensu lato. *Psammothidium*, a new genus based on *A. marginulatum*. *Diatom Research* 11: 1–30.
http://dx.doi.org/10.1080/0269249X.1996.9705361

Carter, J.R. (1979) On the identity of Navicula cincta Ehrenberg. *Bacillaria* 2: 73–84.

Chipev, N. & Veltchev, K. (1996) Livingston Island: an Environment for Antarctic Life. *Bulgarian Antarctic Research*, *Life Sciences* 1: 1–6.

Cholnoky, B.J. (1955) Diatomeen aus salzhaltigen Binnengewässern der westlichen Kaap-Provinz in Südafrika. *Berichte der Deutschen Botanischen Gesellschaft* 68: 11–23.

Chown, S.L. & Convey, P. (2007) Spatial and temporal variability across life's hierarchies in the terrestrial Antarctic. *Philosophical Transactions of The Royal Society*, *Series B* 362: 2307–2331.
http://dx.doi.org/10.1098/rstb.2006.1949

Cleve, P.T. (1894) Synopsis of the Naviculoid Diatoms, Part I. *Kongliga Svenska-Vetenskaps Akademiens Handlingar* 26: 1–194.

Cleve, P.T. (1895) Synopsis of the Naviculoid Diatoms, Part II. *Kongliga Svenska-Vetenskaps Akademiens Handlingar* 27: 1–219.

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

Cox, E.J. (1988) Variation within the genus *Pinnularia* Ehrenb.: further evidence for the use of live material in diatom systematics. *In:* Round, F.E. (Ed.) *Proceedings of the 9th International diatom symposium*. Biopress, Bristol, pp. 437–447.

De Notaris, G.E. & Baglietto, F. (1872) Erbario crittogamico italiano. Serie II. Fascicolo XIII. Genova, Giugno 1872. *Nuovo Giornale Botanico Italiano* 4: 296–297.

Desmazières, J.B.H.T. (1858) *Navicula saugerri* Desmazières. *In: Plantes cryptogames de France* Ed. 2 (2), fasc. 11–12, n° 506.

Ehrenberg, C.G. (1837) Über ein aus fossilen Infusorien bestehendes, 1832 zu Brod verbacknes Bergmehl von den Grenzen Lapplands in Schweden. *Bericht über die zur Bekanntmachung geeigneten Verhandlungen der Königlich-Preussischen Akademie der Wissenschaften zu Berlin* 1837: 43–45.

Ehrenberg, C.G. (1843) Mittheilungen über 2 neue asiatische Lager fossiler Infusorien-Erden aus dem russischen Trans-Kaukasien (Grusien) und Sibirien. *Bericht über die zur Bekanntmachung geeigneten Verhandlungen der Königlich-Preussischen Akademie der Wissenschaften zu Berlin* 1843: 43–49.

Ehrenberg, C.G. (1854) *Mikrogeologie*. *Einundvierzig Tafeln mit über viertausend grossentheils colorirten Figuren*, *Gezeichnet vom Verfasser*. *[Atlas]*. Leopold Voss, Leipzig, 40 pls.

Fermani, P., Mataloni, G. & Van de Vijver, B. (2007) Soil microalgal communities on an Antarctic active volcano (Deception Island, South Shetlands). *Polar Biology* 30: 1381–1393.
http://dx.doi.org/10.1007/s00300-007-0299-6

Frenguelli, J. (1924) Diatomeas de Tierra del Fuego. *Anales de la Sociedad Cientifica Argentina* 97: 87–118, 231–266.

Frenguelli, J. (1945) El Platense y sus diatomeas, Las diatomeas del Platense. *Revista del Museo de La Plata (Nueva Serie)*, *Sección Paleontología* 3: 77–221.

Grunow, A. (1860) Ueber neue oder ungenügend gekannte Algen. Erste Folge, Diatomeen, Familie Naviculaceen. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien* 10: 503–582.

Grunow, A. (1863) Ueber einige neue und ungenügend bekannte Arten und Gattungen von Diatomaceen. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien* 13: 137–162.

Grunow, A. (1867) *Reise seiner Majestät Fregatte Novara um die Erde*. *Botanischer Theil*. *Band I. Algen*. Aus der Kaiselich-Königlichen Hof-und Staasdruckerei, Wien, 104 pp.

Grunow, A. (1877) New diatoms from Honduras, with notes by F. Kitton. *Monthly Microscopical Journal*, *London* 18: 165–186.
http://dx.doi.org/10.1111/j.1365-2818.1877.tb00123.x

Hamsher, S., Kopalová, K., Kociolek, J.P., Zidarova, R. & Van de Vijver, B. (2016) The genus *Nitzschia* on the South Shetland Islands and James Ross Island. *Fottea* 16: 79–102.
http://dx.doi.org/10.5507/fot.2015.023

Hasle, G.R. & Fryxell, G.A. (1970) Diatoms: cleaning and mounting for light and electron microscopy. *Transactions of the American Microscopical Society* 89 (4): 469–474.
http://dx.doi.org/10.2307/3224555

Hassall, A.H. (1845) *A history of the British Freshwater Algae (including descriptions of the Diatomaceae and Desmidiaceae) with upwards of one hundred Plates*. *I. Text*. Taylor, Walton and Maberly, London, 462 pp.

Hustedt, F. (1942) Süßwasser-Diatomeen des indomalayischen Archipels und der Hawaii-Inseln. Nach dem Material der Wallacea-Expedition. *Internationale Revue der gesamten Hydrobiologie und Hydrographie* 42 (1/3): 1–252.
http://dx.doi.org/10.1002/iroh.19420420102

Hustedt, F. (1943) Die Diatomeenflora einiger Hochgebirgsseen der Landschaft Davos in den schweizer Alpen. *Internationale Revue der gesamten Hydrobiologie und Hydrographie* 43: 124–197.

Hustedt, F. (1944) Neue und wenig bekannte Diatomeen. *Bericht der Deutschen Botanischen Gessellschaft* 61: 271–290.

Hustedt, F. (1945) Diatomeen aus Seen und Quellgebieten der Balkan-Halbinsel. *Archiv für Hydrobiologie* 40: 867–973.

Hustedt, F. (1962) Die Kieselalgen Deutschlands, Österreichs und der Schweiz unter Berücksichtigung der übrigen Länder Europas sowie der angrenzenden Meeresgebiete. *In:* Rabenhorst, L. (Ed.) *Kryptogamen Flora von Deutschland*, *Österreich und der Schweiz*. Akademische Verlagsgesellschaft m.b.h., Leipzig 7 (Teil 3, Lief. 2), pp.161–348.

Kellogg, D.E., Stuiver, M., Kellogg, T.B. & Denton, G.H. (1980) Non-marine diatoms from late Wisconsin perched deltas in Taylor Valley, Antarctica. *Palaeogeography*, *Palaeoclimatology*, *Palaeoecology* 30: 157–189.
http://dx.doi.org/10.1016/0031-0182(80)90055-3

Kellogg, T.B. & Kellogg, D.E. (2002) Non-marine and littoral diatoms from Antarctic and Subantarctic regions. Distribution and updated taxonomy. *Diatom Monographs* 1: 1–795.

Kopalová, K. & Van de Vijver, B. (2013) Structure and ecology of freshwater diatom communities of Byers Peninsula (Livingston Island, South Shetland Islands). *Antarctic Science* 25 (2): 239–253.
http://dx.doi.org/10.1017/S0954102012000764

Kopalová, K., Nedbalová, L., de Haan, M. & Van de Vijver, B. (2011) Description of five new species of the diatom genus *Luticola* (Bacillariophyta, Diadesmidaceae) found in lakes of James Ross Island (Maritime Antarctic Region). *Phytotaxa* 27: 44–60.
http://dx.doi.org/10.11646/phytotaxa.27.1.5

Kopalová, K. Veselá, J., Elster, J., Nedbalová, L., Komárek, J. & Van de Vijver, B. (2012) Benthic diatoms (Bacillariophyta) from seepages and streams on James Ross Island (NW Weddell Sea, Antarctica). *Plant Ecology and Evolution* 145 (2): 190–208.
http://dx.doi.org/10.5091/plecevo.2012.639

Kopalová, K., Nedbalová, L., Nývlt, D., Elster, J. & Van de Vijver, B. (2013) Diversity, ecology and biogeography of the freshwater diatom

communities from Ulu Peninsula (James Ross Island, NE Antarctic Peninsula). *Polar Biology* 36: 933–948.
http://dx.doi.org/10.1007/s00300-013-1317-5

Kopalová, K., Ochyra, R., Nedbalová, L. & Van de Vijver, B. (2014) Moss-inhabiting diatoms from two contrasting Maritime Antarctic islands. *Plant Ecology and Evolution* 147: 67–84.
http://dx.doi.org/10.5091/plecevo.2014.896

Kopalová, K., Kociolek, J.P., Lowe, R.L., Zidarova, R. & Van de Vijver, B. (2015) Five new species of the genus *Humidophila* (Bacillariophyta) from the Maritime Antarctic Region. *Diatom Research* 30: 117–131.
http://dx.doi.org/10.1080/0269249X.2014.998714

Krammer, K. (1992) *Pinnularia*. Eine monographie der europaischen taxa. *Bibliotheca Diatomologica* 26: 1–353.

Krammer, K. & Lange-Bertalot, H. (1986) Bacillariohyceae 1. Teil: Naviculaceae. *In:* Ettl, H., Gerloff, J., Heynig, H. & Mollenhauer, D. (Eds.) *Süßwasserflora von Mitteleuropa*. Gustav Fisher Verlag, Yena, 876 pp.

Krasske, G. (1925) Die Bacillariaceen-Vegetation Niederhessens. *Abhandlungen und Bericht LVI des Vereins für Naturkunde zu Cassel*, *84-89 Vereinsjahr 1919-1925* 56: 1–119.

Krasske, G. (1932) Beiträge zur Kenntnis der Diatomeenflora der Alpen. *Hedwigia* 72 (3): 92–135.

Kützing, F.T. (1844) *Die Kieselschaligen*. *Bacillarien oder Diatomeen*. Nordhausen, 152 pp.
http://dx.doi.org/10.5962/bhl.title.64360

Lagerstedt, N.G.W. (1873) Sötvattens-Diatomaceer från Spetsbergen och Beeren Eiland. *Bihang till Kongliga Svenska Vetenskaps-Akademiens Handlingar* 1 (14): 1–52.

Lange-Bertalot, H. (1993) 85 Neue Taxa und über 100 weitere neu definierte Taxa ergänzend zur Süßwasserflora von Mitteleuropa. Vol. 2/1–4. *Bibliotheca Diatomologica* 27: 1–454.

Lange-Bertalot, H. (1997) *Frankophila*, *Mayamaea* und *Fistulifera*: drei neue Gattungen der Klasse Bacillariophyceae. *Archiv für Protistenkunde* 148 (1–2): 65–76.
http://dx.doi.org/10.1016/S0003-9365(97)80037-1

Lange-Bertalot, H. (2001) *Navicula* sensu stricto. 10 genera separated from *Navicula* sensu lato. *Frustulia*. *Diatoms of Europe* 2: 1–526.

Lange-Bertalot, H. & Metzeltin, D. (1996) Indicators of Oligotrophy. 800 taxa representative of three ecologically distinct lake types. *Iconographia Diatomologica* 2: 1–390.

Lange-Bertalot, H., Külbs, K., Lauser, T., Nörpel-Schempp, M. & Willmann, M. (1996) Dokumentation und Revision der von Georg Krasske beschriebenen Diatomeen-Taxa. *Iconographia Diatomologica* 3: 1–358.

Lange-Bertalot H., Genkal S.I. & Vechov N.V. (2004) New freshwater species of Bacillariophyta. *Inland Water Biology* 4: 12–17.

Levkov, Z. (2009) *Amphora* sensu lato. *Diatoms of Europe* 5: 1–916.

Lowe, R.L., Kociolek, J.P., Johansen, J.R., Van de Vijver, B., Lange-Bertalot, H. & Kopalová, K. (2014) *Humidophila* gen. nov., a new genus for a group of diatoms (Bacillariophyta) formerly within the genus *Diadesmis*: species from Hawai'i, including one new species. *Diatom Research* 29: 351–360.
http://dx.doi.org/10.1080/0269249X.2014.889039

Mann, D.G. (1989) The Diatom genus *Sellaphora*: Separation from *Navicula*. *British Phycological Journal* 24: 1–20.
http://dx.doi.org/10.1080/00071618900650011

Mann, D.G. (2001) A discussion of *Caloneis* and related genera. *Diatom* 17: 29–36.

Mann, D.G., Thomas, S.J. & Evans, K.M. (2008) Revision of the diatom genus *Sellaphora*: a first account of the larger species in the British Isles. *Fottea* 8: 15–78.
http://dx.doi.org/10.5507/fot.2008.002

Mereschkowsky, C. (1902) On *Sellaphora*, a new genus of Diatoms. *Annals and Magazine of Natural History* 9 (7): 185–195.
http://dx.doi.org/10.1080/00222930208678565

Metzeltin, D., Lange-Bertalot, H. & Nergui, S. (2009) Diatoms in Mongolia. *Iconographia Diatomologica* 20: 1–684.

Moser, G., Lange-Bertalot, H. & Metzeltin, D. (1998) Insel der Endemiten Geobotanisches Phänomen Neukaledonien (Island of endemics New Caledonia - a geobotanical phenomenon). *Bibliotheca Diatomologica* 38: 1–464.

Oppenheim, D.R. (1990) A preliminary study of benthic diatoms in contrasting lake environements. *In:* Kerry, K.R. & Hempel, G. (Eds.) *Antarctic Ecosystems: Ecological Change and Conservation*. Springer-Verlag, Berlin, pp. 91–99.
http://dx.doi.org/10.1007/978-3-642-84074-6_9

Øvstedal, D.O. & Lewis-Smith, R.I. (2001) *Lichens of Antarctica and South Georgia*. *A guide to their identification and ecology*. Cambridge University Press, Cambridge, 704 pp.

Pritchard, A. (1861) *A history of infusoria*, *living and fossil: arranged according to Die infusionsthierchen of C.G. Ehrenberg; containing colored engravings*, *illustrative of all the genera*, *and descriptions of all the species in that work*, *with several new ones; to which is appended an account of those recently discovered in the chalk formations*. *xii*. *Edition IV*, *revised and enlarged by J.T. Arlidge*, *W. Archer*, *J. Ralfs*, *W.C. Williamson and the author*. Whittaker and Co., London, 968 pp.
http://dx.doi.org/10.5962/bhl.title.7440

Ross, R., Cox, E.J., Karayeva, N.I., Mann, D.G., Paddock, T.B.B., Simonsen, R. & Sims, P.A. (1979) An amended terminology for the siliceous components of the diatom cell. *Nova Hedwigia Beiheft* 64: 513–533.

Round, F.E. & Bukhtiyarova, L. (1996) Four new genera based on *Achnanthes* (*Achnanthidium*) together with a re-definition of *Achnanthidium*. *Diatom Research* 1: 345–361.
http://dx.doi.org/10.1080/0269249X.1996.9705389

Round, F.E., Crawford, R.M. & Mann, D.G. (1990) *The diatoms: Biology and Morphology of the genera*. Cambridge University Press, Cambridge, 747 pp.

Rumrich, U., Lange-Bertalot, H. & Rumrich, M. (2000) Diatomeen der Anden. Von Venezuela bis Patagonien/Feurland und zwei weitere Beträge. *Iconographia Diatomologica* 9: 1–672.

Sabbe, K., Verleyen, E., Hodgson, D.A., Vanhoutte, K. & Vyverman, W. (2003) Benthic diatom flora of freshwater and saline lakes in the Larsemann Hills and Rauer Islands, East Antarctica. *Antarctic Science* 15: 227–248.
http://dx.doi.org/10.1017/S095410200300124X

Schiller, W. & Lange-Bertalot, H. (1997) *Eolimna martinii* n.gen., n.sp. (Bacillariophyceae) aus dem Unter-Oligozan von Sieblos/Rhon im Vergleich mit ahnlichen rezenten Taxa. *Paläontologische Zeitschrift* 71: 163–172.
http://dx.doi.org/10.1007/BF02988485

Schmidt, R., Mäusbacher, R. & Müller, J. (1990) Holocene diatom flora and stratigraphy from sediment cores of two Antarctic lakes (King George Island). *Journal of Paleolimnology* 3: 55–74.
http://dx.doi.org/10.1007/BF00209300

Souffreau, C., Verbruggen, H., Wolfe, A.P., Vanormelingen, P., Siver, P.A., Cox, E.J., Mann, D.G., Van de Vijver, B., Sabbe, K. & Vyverman, W. (2011) A time-calibrated multi-gene phylogeny of the diatom genus *Pinnularia*. *Molecular Phylogenetics & Evolution* 61: 866–879.
http://dx.doi.org/10.1016/j.ympev.2011.08.031

Spaulding, S.A. & Stoermer, E.F. (1997) Taxonomy and distribution of the genus *Muelleria* Frenguelli. *Diatom research* 12: 95–115.
http://dx.doi.org/10.1080/0269249X.1997.9705405

Spaulding, S.A., Kociolek, J.P. & Wong, D. (1999) A taxonomic and systematic revision of the genus *Muelleria* (Bacillariophyta). *Phycologia* 38: 314–341.
http://dx.doi.org/10.2216/i0031-8884-38-4-314.1

Sterken, M., Verleyen, E., Jones, V.J., Hodgson, D.A., Vyverman, W., Sabbe, K. & Van de Vijver, B. (2015) An illustrated and annotated checklist of freshwater diatoms (Bacillariophyta) from Livingston, Signy and Beak Island (Maritime Antarctic Region). *Plant Ecology and Evolution* 148: 431–455.
http://dx.doi.org/10.5091/plecevo.2015.1103

Taylor, J.C., Cocquyt, C., Karthick, B. & Van de Vijver, B. (2014) Analysis of the type of *Achnanthes exigua* Grunow (Bacillariophyta) with the description of a new Antarctic diatom species. *Fottea* 14: 43–51.
http://dx.doi.org/10.5507/fot.2014.003

Tyler, P.A. (1996) Endemism in freshwater algae, with special reference to the Australian region. *Hydrobiologia* 336: 127–135.
http://dx.doi.org/10.1007/BF00010826

Van de Vijver, B. & Kopalová, K. (2014) Four *Achnanthidium* species (Bacillariophyta) formerly identified as *Achnanthidium minutissimum* from the Antarctic Region. *European Journal of Taxonomy* 79: 1–19.
http://dx.doi.org/10.5852/ejt.2014.79

Van de Vijver, B. & Zidarova, R. (2011) Five new taxa in the genus *Pinnularia* sectio *Distantes* (Bacillariophyta) from Livingston Island (South Shetland Islands). *Phytotaxa* 24 (1): 39–50.
http://dx.doi.org/10.11646/phytotaxa.24.1.6

Van de Vijver, B., Frenot, Y. & Beyens, L. (2002) Freshwater diatoms from Ile de la Possession (Crozet Archipelago, Subantarctica). *Bibliotheca Diatomologica* 46: 1–412.

Van de Vijver, B., Beyens, L. & Lange-Bertalot, H. (2004) The genus *Stauroneis* in the Antarctic and (Sub-)Antarctic Regions. *Bibliotheca Diatomologica* 51: 1–317.

Van de Vijver, B., Gremmen, N.J.M. & Beyens, L. (2005) The genus *Stauroneis* (Bacillariophyceae) in the Antarctic region. *Journal of Biogeography* 32: 1791–1798.
http://dx.doi.org/10.1111/j.1365-2699.2005.01325.x

Van de Vijver, B., Mataloni, G., Stanish, L. & Spaulding, S.A. (2010a) New and interesting species of the genus *Muelleria* (Bacillariophyta) from the Antarctic Region and South Africa. *Phycologia* 49: 22–41.
http://dx.doi.org/10.2216/09-27.1

Van de Vijver, B., Sterken, M., Vyverman, W., Mataloni, G., Nedbalova, L., Kopalová, K., Elster J., Verleyen, E. & Sabbe, K. (2010b) Four new non-marine diatom taxa from the Subantarctic and Antarctic regions. *Diatom Research* 25: 431–443.
http://dx.doi.org/10.1080/0269249X.2010.9705861

Van de Vijver, B., Zidarova, R. & de Haan, M. (2011a) Four new *Luticola* taxa (Bacillariophyta) from the South Shetland Islands and James Ross Island (Maritime Antarctic Region). *Nova Hedwigia* 92: 137–158.
http://dx.doi.org/10.1127/0029-5035/2011/0092-0137

Van de Vijver, B., Zidarova, R., Sterken, M., Verleyen, E., de Haan, M., Vyverman, W., Hinz, F. & Sabbe, K. (2011b) Revision of the genus *Navicula s.s*. (Bacillariophyceae) in inland waters of the Sub-Antarctic and Antarctic with the description of five new species. *Phycologia* 50: 281–297.
http://dx.doi.org/10.2216/10-49.1

Van de Vijver, B., Wetzel, C., Kopalová, K., Zidarova, R. & Ector, L. (2013a) Analysis of the type material of *Achnanthidium lanceolatum* Brébisson ex Kützing (Bacillariophyta) with the description of two new *Planothidium* species from the Antarctic Region. *Fottea* 13: 105–117.
http://dx.doi.org/10.5507/fot.2013.010

Van de Vijver, B., Kopalová, K., Zidarova, R. & Cox, E.J. (2013b) New and interesting small-celled naviculoid diatoms (Bacillariophyta) from the Maritime Antarctic Region. *Nova Hedwigia* 97: 189–208.
http://dx.doi.org/10.1127/0029-5035/2013/0101

Van de Vijver, B., Zidarova, R. & Kopalová, K. (2014a) New species in the genus *Muelleria* (Bacillariophyta) from the Maritime Antarctic Region. *Fottea* 14: 77–90.
http://dx.doi.org/10.5507/fot.2014.006

Van de Vijver, B., Kopalová, K., Zidarova, R. & Levkov, Z. (2014b) Revision of the genus *Halamphora* (Bacillariophyta) in the Antarctic Region. *Plant Ecology and Evolution* 147: 374–391.
http://dx.doi.org/10.5091/plecevo.2014.979

Van de Vijver, B., de Haan, M. & Lange-Bertalot, H. (2014c) Revision of the genus *Eunotia* (Bacillariophyta) in the Antarctic Region. *Plant Ecology and Evolution* 147: 256–284.
http://dx.doi.org/10.5091/plecevo.2014.930

Van de Vijver, B., Kopalová, K. & Zidarova, R. (2015) Three new *Craticula* species (Bacillariophyta) from the Maritime Antarctic Region. *Phytotaxa* 213 (1): 35–45.
http://dx.doi.org/10.11646/phytotaxa.213.1.3

Van der Werff, A. (1955) A new method of concentrating and cleaning diatoms and other organisms. *Verhandlungen der Internationalen Vereinigung für Theoretische und Angewandte Limnologie* 12: 276–277.

Van Heurck, H. (1880) *Synopsis des Diatomées de Belgique*. *Atlas*. Ducaju & Cie., Anvers, 1–30 pls.

Van Heurck, H. (1885) *Synopsis des Diatomées de Belgique*. *Texte*. Martin Brouwers & Co., Anvers, 234 pp.
http://dx.doi.org/10.5962/bhl.title.1990

Werum, M. & Lange-Bertalot, H. (2004) Diatoms in springs from Central Europe and elsewhere under the influence of hydrologeology and anthropogenic impacts. *Iconographia Diatomologica* 13: 1–417.

Wetzel, C.E., Martínez-Carreras, N., Hlúbiková, D., Hoffmann, L., Pfister, L. & Ector, L. (2013) New combinations and type analysis of *Chamaepinnularia* species (Bacillariophyceae) from aerial habitats. *Cryptogamie*, *Algologie* 34: 149–168.
http://dx.doi.org/10.7872/crya.v34.iss2.2013.149

Wetzel, C.E., Ector, L., Van de Vijver, B., Compère, P. & Mann, D.G. (2015) Morphology, typification and critical analysis of several ecologically important small naviculoid species (Bacillariophyceae). *Fottea* 15: 203–234.
http://dx.doi.org/10.5507/fot.2015.020

Witkowski, A., Lange-Bertalot, H. & Metzeltin, D. (2000) Diatom flora of marine coasts I. *Iconographia Diatomologica* 7: 1–925.

Zidarova, R.P. (2008) Algae from Livingston Island (S Shetland Islands): a check-list. *Phytologia Balcanica* 14: 19–35.

Zidarova, R., Van de Vijver, B., Quesada, A. & de Haan, M. (2010) Revision of the genus *Hantzschia* (Bacillariophyceae) on Livingston Island (South Shetland Islands, Southern Atlantic Ocean). *Plant Ecology and Evolution* 143 (3): 318–333.
http://dx.doi.org/10.5091/plecevo.2010.402

Zidarova, R., Kopalová, K. & Van de Vijver, B. (2012) The genus *Pinnularia* (Bacillariophyta) excluding the section Distantes on Livingston Island (South Shetland Islands) with the description of twelve new taxa. *Phytotaxa* 44 (1): 11–37.
http://dx.doi.org/10.11646/phytotaxa.44.1.2

Zidarova, R., Kopalová, K. & Van de Vijver, B. (2014a) The genus *Stauroneis* (Bacillariophyta) from the South Shetland Islands and James Ross Island (Antarctica). *Fottea* 14: 191–207.
http://dx.doi.org/10.5507/fot.2014.015

Zidarova, R., Levkov, Z. & Van de Vijver, B. (2014b) Four new *Luticola* taxa (Bacillariophyta) from Maritime Antarctica. *Phytotaxa* 170 (3): 155–168.
http://dx.doi.org/10.11646/phytotaxa.170.3.2