Research Article

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Revisiting Potter Cove, King George Island, Antarctica, 12 years later: new observations of marine benthic diatoms

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Abstract: Continuous observations of Antarctic benthic diatoms are necessary to detect changes in species composition and biodiversity that may result from environmental changes. The present work provides a systematic list of benthic diatoms from Potter Cove (62.03°S 58.35°W) collected during summer 2015. The new findings are compared with observations made 12 years ago (summer 2003). In total, 80 taxa were found, similar to that encountered earlier, but 17 species (21% of the total species number) were not observed in 2003, and 26 species (31%) of those reported in 2003 did not appear in 2015. The dominant species in 2003 and 2015 was the large epipelic and cosmopolitan *Gyrosigma fasciola*. Most of the species either newly observed in the present study, or absent in the present study but observed previously, occurred either rarely or very rarely. *Gyrosigma arcuatum* and *Pleurosigma diversestriatum* were newly observed in 2015 and not previously reported from polar regions. This study provides systematic and ecological information on all taxa encountered and is illustrated with light microscopy and scanning electron microscopy (SEM) images. We emphasize that ice-inhabiting and other benthic diatoms should be included when considering the biodiversity of polar diatoms. Thus, we hope that the present study will add a piece to the puzzle of climate change effects on the benthic diatoms in this vulnerable region and will complement earlier published species records in the area.

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1 Introduction

During the second half of the 20th century, the West Antarctic Peninsula has been exposed to a rapid and significant rise in temperature (Turner et al. 2019), reducing the length of the sea-ice season (Ducklow et al. 2013) and causing coastal glacier retreat (Cook et al. 2016; Rückamp et al. 2011). Coastal glacier retreat around King George Island is considered particularly fast (Turner et al. 2014), likely resulting in cascading effects for all marine organisms including microalgae, the basis of the food web. At Potter Cove, King George Island, earlier studies have shown that benthic diatoms form dense microbial mats on soft-bottoms at 5–7 m water depth (Wulff et al. 2008a) and SCUBA divers confirmed the presence of these diatom mats at least down to 15 m depth. In this area, benthic diatoms are an important carbon source for the benthic fauna (Braeckman et al. 2021; Daglio et al. 2018; Pasotti et al. 2015; Zacher et al. 2007) but reduced light conditions adjacent to the glaciers in Potter Cove has lowered the primary production of the microphytobenthos and changed the soft-sediment metabolic balance from net autotrophy to heterotrophy (Braeckman et al. 2021).

During summer 2003, benthic (living in or on sediment) and epiphytic (on macrophytes) diatoms were collected from Potter Cove, King George Island, and diatom taxa were documented and illustrated (Al-Handal and Wulff 2008a,b), including a description of four new species (Al-Handal et al. 2008, 2010). The biodiversity and zonation of polar benthic microalgae were reviewed by Wulff et al. (2009). Since then, several investigations on benthic diatoms have been made either in Potter Cove or adjacent regions around the Antarctic Peninsula. In Marian Cove, King George Island, Moon et al. (2015) and Ahn et al. (2016) observed heavy growth of benthic diatoms associated with the occurrence of megafauna. During 2018 and 2019, Bae et al. (2021) sampled benthic diatoms from the outer to the

inner part of Marian Cove and a total of 92 taxa were found. In Terra Nova Bay, Baldi et al. (2011) identified 23 taxa and, in a hard substratum colonization study in South Bay, Livingston Island, Zidarova et al. (2020) identified 30 taxa. The effect of oil pollution on the Antarctic benthic diatom communities was studied by Polmear et al. (2015) who exposed benthic diatom communities to hydrocarbon compounds for a period of five years and found complex changes in community composition, where relative abundances of species like *Pleurosigma elongatum* and *Melosira adeliae* were significantly reduced by the exposure to hydrocarbons. The effect of grazing on benthic diatom assemblages, dominated by *Pseudogomphonema kamtschaticum*, grown on ceramic tiles in Potter Cove was estimated by Daglio et al. (2018), suggesting that extracellular compounds secreted by benthic diatoms may act as an important carbon source for limpets in Potter Cove. Although focusing on community composition, most of these investigations did not provide a detailed taxonomic description. Apart from the studies by Al-Handal and Wulff (2008a,b), very few micrographs of the benthic diatoms in Potter Cove were provided in any of the above cited publications.

In the present study, we revisited our locations from 2003 in 2015 and provide information on taxonomic, ecological, and distribution observations of the benthic diatoms that we collected. Due to the fast rate of changes in environmental factors, this region could provide a model system for studying climate change effects on polar benthic marine ecosystems.

2 Materials and methods

Samples were collected from Potter Cove (62.03°S 58.35°W) which is a small basin located on the south east coast of King George Island (Figure 1). More detailed descriptions of our methods are provided in Al-Handal and Wulff (2008a) and Hoffmann et al. (2019). Sediment samples were collected and processed in the same manner as in our previous study in 2003, however, the number of samples and sampling period differed: from October to December (2003, 42 samples), and February (2015, 15 samples). In the present study, sediment samples were collected from the eastern coast of the cove in the area between Potter Creek and Matias Creek. Sampling was made by scraping the surface sediment while SCUBA diving. All samples were kept in plastic vials to which 5 ml glutaraldehyde was added for preservation (final concentration 2.5%). In the laboratory (University of Gothenburg, Sweden), preserved samples were checked to ensure that no species were lost during the following cleaning procedures. This is of particular concern for delicate or very large specimens. Thereafter, samples were first washed with deionized water to remove salts and boiled with 35% hydrogen peroxide for 15 min. Parts of the samples were heated more gently with hydrogen peroxide in a water bath for 48 h to clean delicate frustules that could get destroyed during the more vigorous treatment. All cleaned material was rinsed with deionized water and 0.8 ml of the cleaned diatoms were allowed to settle on a cover slip and left to dry at room temperature. Cover slips with dry diatoms were inverted, put on microscope slides with the mounting medium Naphrax@ (Brunel Microscopes Ltd, Chippenham, Wiltshire, UK) and examined on a Zeiss Axioplan 2 imaging light microscope (LM; Carl Zeiss AB, Gothenburg, Sweden). Scanning electron microscope (SEM) images were taken using Hitachi SU8010 SEM at the Berlin-Dahlem Botanical Garden and Botanical Museum (BGBM), Germany.

We arranged taxa systematically following the classification of Round et al. (1990) and we used the terminology proposed by Ross et al. (1979) and Round et al. (1990). In the species descriptions, valve length refers to the apical axis of the valve, and valve width to the maximum transapical axis. Literature on which identification was based is shown for each species. Terms used in the descriptions are length, i.e., the means of valve apical axis, width, and transapical axis. The relative occurrence of species is expressed as the following: rare if a species appears sporadically in the slide, frequent when several specimens are observed, and common when specimens appear all around the slide.

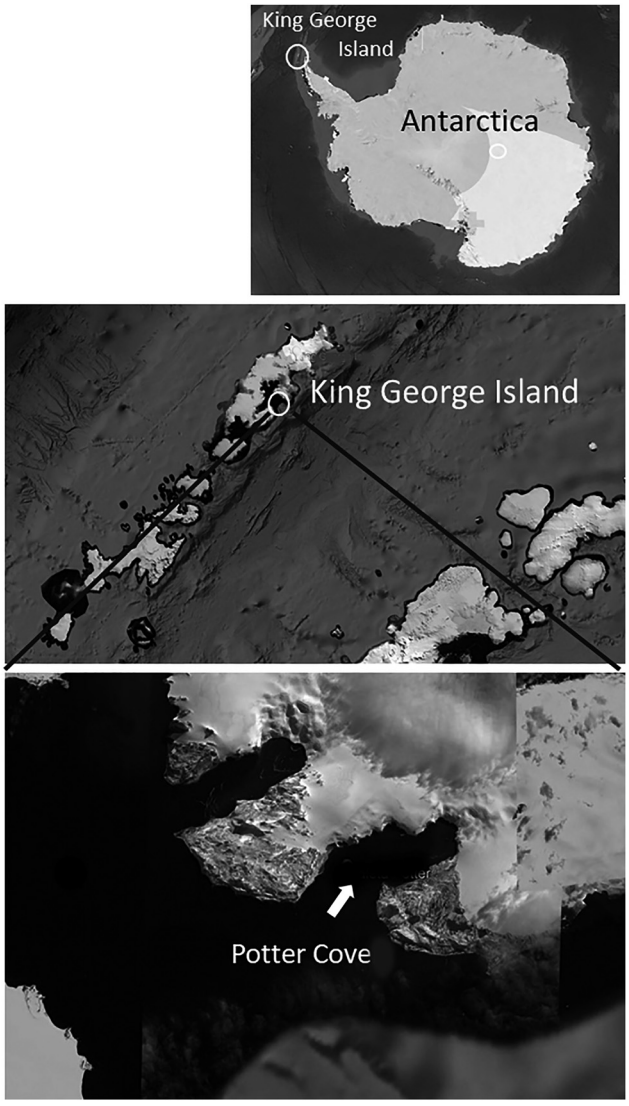


Figure 1: Map of sampling locations in Potter Cove, King George Island, Antarctica.

3 Results

Eighty diatom taxa were observed from Potter Cove in the present study, which is similar in species richness to the 84 taxa observed 12 years earlier (Al-Handal and Wulff 2008a). However, species composition and abundance differed slightly between the two studies. Some species were observed only in 2003, while others were only observed in 2015. Table 1 indicates the presence or absence of species observed during each sampling occasion (Al-Handal and Wulff 2008a). Of the newly observed taxa, 21% were not found in 2003, and 31% of those reported in 2003 were not found in the present study. Among the new observations, *Gyrosigma arcuatum* and *Pleurosigma diversestriatum* have not, to our knowledge, been previously reported from polar regions. The most common species which appeared in large numbers were *Cocconeis imperatrix*, *Entomoneis paludosa*, *Gyrosigma fasciola*, *Gyrosigma obscurum*, *Pleurosigma strigosum*, *Petroneis plagiostoma*, *Navicula directa*, *Navicula perminuta*, *Pinnularia quadratarea*, and *Nitzschia hybrida*. Unlike previous findings, *Thalassiosira* spp. were poorly represented in the present material.

The following is a taxonomic listing of all taxa encountered in the sediment with notes on their ecology and distribution.

Class Coscinodiscophyceae

Family Thalassiosiraceae

***Porosira glacialis* (Grunow) Jørgensen (Figures 2–4, 107, 108)**

Literature: (Hendey 1964, p. 88, pl. 1, fig. 12; Scott and Thomas 2005, p. 84, fig. 2.41a–f).

Description: Diameter 54–72 µm.

Remarks: Valve areole very fine, either arranged in fascicules or irregularly scattered, sometimes indistinct. Valve surface with scattered spines. A single labiate process located below valve margin and visible in LM.

Ecology and distribution: This is a marine neritic species widely distributed in both the Arctic and Antarctica (bipolar), normally associated with sea-ice flora. It is also known from temperate waters (Pike et al. 2009). According to Armand et al. (2005), *P. glacialis* is found on the sediment only as resting spores. In our material, all specimens were vegetative cells that might have been deposited from the plankton. Frequent in Potter Cove.

***Thalassiosira eccentrica* (Ehrenberg) Cleve (Figure 5)**

Literature: (Fryxell and Hasle 1972, p. 300, figs. 1–18; Hendey 1964: p. 80, pl. 24, fig. 7 [as *Coscinodiscus eccentricus* Ehrenberg]; Simonsen 1974, p. 9, pl. 2, figs. 1–3).

Table 1: Comparison of the occurrence of marine benthic diatoms in Potter Cove, King George Island, Antarctica in 2003 (Al-Handal and Wulff 2008b) and 2015 (present study).

Species	2003	2015
Achnanthes bongrainii (M. Peragallo) A. Mann	r	–
Achnanthes cf. *groenlandica* (Cleve) Grunow	–	f
Actinocyclus actinochilus (Ehrenberg) Simonsen	r	c
Actinocyclus curvatulus Janisch	r	–
Amphora cf. *eximia* Carter[a]	r	–
Amphora gourdonii M. Peragallo	–	f
Amphora marina W. Smith	f	f
Amphora cf. *laevissima* Gregory	r	–
Amphora spectabilis Gregory	r	–
Amphora sp. 1	–	r
Amphora sp. 2	–	r
Asteromphalus parvulus Karsten	–	r
Biremis ambigua (Cleve) D. G. Mann	–	f
Caloneis sp.[b]	vr	r
Campyloneis frenguellii Riaux-Gobin *et* Guerrero	–	f
Cocconeis antiqua Tempère *et* Brun[c]	f	f
Cocconeis costata Gregory	r	–
Cocconeis costata var. *antarctica* Manguin	r	–
Cocconeis costata var. *hexagona* Grunow	–	r
Cocconeis dallmannii Al-Handal, Riaux-Gobin, Romero *et* Wulff	–	r
Cocconeis fasciolata (Ehrenberg) Brown	r	f
Cocconeis hauniensis Witkowski	vr	–
Cocconeis cf. *imperatrix* A. Schmidt	r	c
Cocconeis matsii (Al-Handal, Riaux-Gobin *et* A.Wulff) Riaux-Gobin, Compère, Romero *et* Williams	–	f
Cocconeis melchioroides Al-Handal, Riaux-Gobin, Romero *et* Wulff	–	r
Cocconeis moronensis A. Schmidt	vr	–
Cocconeis pinnata Gregory *ex* Greville	r	–
Cocconeis scutellum Ehrenberg	vr	–
Cocconeis sp. 1	vr	–
Cocconeis sp. 2	vr	–
Corethron pennatum (Grunow) Ostenfield	r	f
Coscinodiscus asteromphalus Ehrenberg	vr	–
Coscinodiscus radiatus Ehrenberg	–	vr
Cylindrotheca closterium (Ehrenberg) Reimann *et* Lewin	–	r
Diploneis smithii (Brébisson) Cleve	r	r
Diploneis weissflogii (Schmidt) Cleve	–	vr
Diploneis sp.	–	r
Entomoneis gigantea Grunow	vr	r
Entomoneis kjellmanii (Cleve) Poulin *et* Cardinal	f	r
Entomoneis paludosa (W. Smith) Reimer	f	c
Entopyla ocellata (Arnott) Grunow	r	f
Eucampia antarctica (Castracane) Mangin	vr	–
Eunotia praerupta Ehrenberg	vr	–
Fogedia cf. *giffeniana* (Foged) Witkowski, Lange-Bertalot, Metzeltin *et* Bafana	r	–
Fragilaria striatula Lyngbye	–	f
Fragilariopsis cylindrus (Grunow *ex* Cleve) Helmcke *et* Krieger	–	r
Fragilariopsis rhombica (O'Meara) Hustedt	r	–
Gogorevia parexigua (Metzeltin *et* Lange-Bertalot) Kulikovskiy *et* Kociolek[d]	r	–

Table 1: (continued)

Species	2003	2015
Grammatophora angulosa Ehrenberg	r	–
Grammatophora angulosa var. *islandica* (Ehrenberg) Grunow	r	–
Gyrosigma arcuatum (Donkin) Sterrenburg	–	r
Gyrosigma fasciola (Ehrenberg) Griffith *et* Henfrey	c	c
Gyrosigma cf. *obscurum* (W. Smith) Griffith *et* Henfrey	–	c
Halamphora holsatica (Hustedt) Levkov[e]	vr	–
Hippodonta hungarica (Grunow) Lange-Bertalot, Metzeltin *et* Witkowski	r	–
Licmophora abbreviata Agardh	f	–
Licmophora antarctica Carlson	f	f
Licmophora belgicae Peragallo	–	f
Licmophora decora Heiden	r	–
Licmophora gracilis (Ehrenberg) Grunow	f	f
Licmophora luxuriosa Heiden	–	r
Lyrella hennedyi (W. Smith) Stickle *et* D. G. Mann	–	r
Melosira adeliae Manguin	r	r
Melosira sol (Ehrenberg) Kützing	–	f
Minidiscus trioculatus (Taylor) Hasle	r	–
Navicula cf. *cancellata* Donkin	c	f
Navicula directa (Smith) Brébisson	f	c
Navicula cf. *perminuta* Grunow	c	c
Navicula sp. 1	vr	r
Navicula sp. 2	–	r
Nitzschia angularis W. Smith	–	f
Nitzschia cf. *australis* (Peragallo) A. Mann	vr	r
Nitzschia cf. *gelida* Cleve *et* Grunow	–	r
Nitzschia hybrida Grunow	r	c
Nitzschia mitchelliana Greenleaf	–	r
Nitzschia cf. *obtusa* W. Smith	–	r
Nitzschia pellucida Grunow	r	–
Nitzschia sigma (Kützing) W. Smith	–	r
Nitzschia tubicola Grunow	r	–
Nitzschia sp. 1	r	–
Odontella litigiosa (Van Heurck) Hoban	f	c
Paralia sulcata (Ehrenberg) Cleve	–	vr
Parlibellus delognei (Van Heurck) E. J. Cox	r	–
Parlibellus crucicula (W. Smith) Witkowski, Lange-Bertalot *et* Metzeltin	–	f
Parlibellus sp. 1	vr	–
Parlibellus sp. 2	r	–
Petroneis plagiostoma (Grunow) D. G. Mann	c	c
Petroneis sp. 1	r	c
Petroneis sp. 2	r	–
Pinnularia quadratarea (A. Schmidt) Cleve	f	c
Planothidium lanceolatum (Brébisson *ex* Kützing) Lange-Bertalot	r	–
Planothidium vicentii Manguin	vr	–
Pseudogomphonema kamtschaticum (Grunow) Medlin	f	f
Pleurosigma diversestriatum Meister	–	r
Pleurosigma eudon var. *kerguelensis* Heiden *et* Kolbe	vr	vr
Pleurosigma strigosum W. Smith	–	c
Podosira stelliger (Bailey) A. Mann	–	vr
Porosira glacialis (Grunow) Jørgensen	–	f
Rhabdonema arcuatum (Lyngbye) Kützing	–	r
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot	r	–

Table 1: (continued)

Species	2003	2015
Staurophora sp.	–	r
Stellarima microtrias (Ehrenberg) Hasle *et* Sims	–	f
Surirella fastuosa (Ehrenberg) Ehrenberg	–	vr
Surirella sp.	–	r
Synedra kerguelensis Heiden	r	–
Synedropsis fragilis (Manguin) Hasle, Medlin *et* Syvertsen	r	–
Synedropsis recta Hasle, Medlin *et* Syvertsen	r	–
Synedropsis sp.	–	f
Tetramphora rhombica (Kitton) Stepanek *et* Kociolek[f]	vr	–
Thalassionema nitzschioides (Grunow) Mereschkowsky	r	r
Thalassiosira eccentrica (Ehrenberg) Cleve	–	r
Thalassiosira gracilis (Karsten) Hustedt	r	f
Thalassiosira lentiginosa (Janisch) Fryxell	vr	–
Thalassiosira maculata Fryxell *et* Johansen	vr	–
Thalassiosira oliveriana (O'Meara) Makarova *et* Nikolajev	–	r
Thalassiosira ritscheri (Hustedt) Hasle	vr	–
Thalassiosira tumida (Janisch) Hasle	r	–
Thalassiosira sp.	–	r
Trachyneis aspera (Ehrenberg) Cleve	f	f
Trachyneis cf. *robusta* Petit	r	–
Triceratium favus Ehrenberg	–	r
Trigonium arcticum (Brightwell) Cleve	–	r

vr, very rare, few cells found; r, rare, 1–5%; f, frequent, 5–20%; c, common, >20%; –, not observed. [a]Reported as *Amphora* cf. *fogediana* (Grunow) Lange-Bertalot in Al-Handal and Wulff (2008a). [b]Reported as *Caloneis* sp. 1 in Al-Handal and Wulff (2008a). [c]Reported as *Cocconeis schuettii* Van Heurck in Al-Handal and Wulff (2008a). [d]Reported as *Achnanthidium exigua* (Grunow) Lange-Bertalot in Al-Handal and Wulff (2008a). [e]Reported as *Amphora holsatica* Husted in Al-Handal and Wulff (2008a). [f]Reported as *Amphora rhombica* Kitton *ex* A. Schmidt in Al-Handal and Wulff (2008a).

Description: Diameter: 48–55 µm.

Ecology and distribution: A widely distributed marine neritic species, known from the Arctic (Katsuki et al. 2004). Rare in Potter Cove.

Thalassiosira gracilis (Karsten) Hustedt (Figure 6)

Literature: (Hasle and Syvertsen 1997, p. 82, pl. 12; Scott and Thomas 2005, p. 99, fig. 2.50a–f).

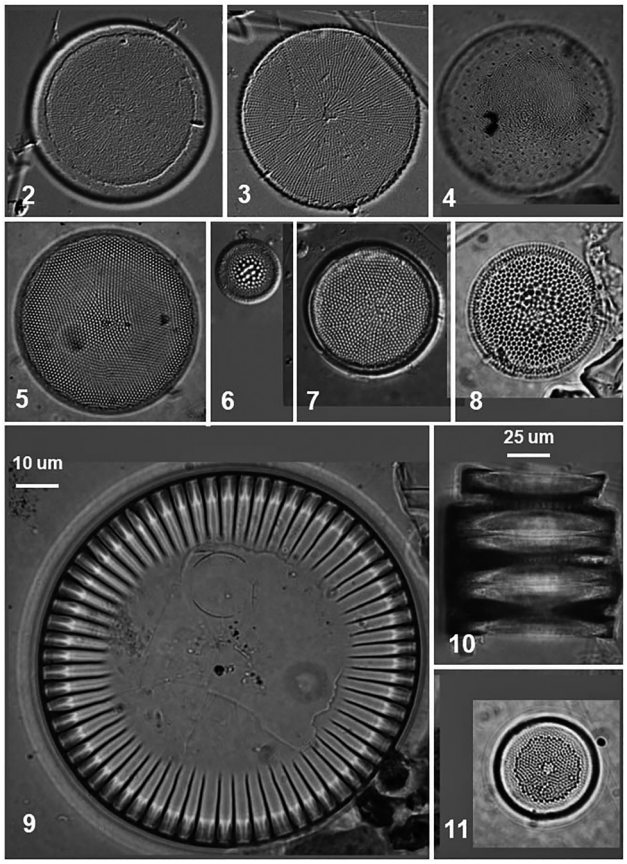
Description: Diameter 14–18 µm.

Remarks: A small species but can be easily recognized under LM by its large central areole.

Ecology and distribution: Widely distributed in Antarctica and the Southern seas. It has not previously been observed in Potter Cove but was frequent in the examined material.

Thalassiosira oliveriana (O'Meara) Makarova *et* Nikolajev (Figure 7)

Literature: (Scott and Thomas 2005, p. 99, figs. 2.57a–b).



Figures 2–11: Marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (2–4) *Porosira glacialis*. (5) *Thalassiosira eccentrica*. (6) *Thalassiosira gracilis*. (7) *Thalassiosira oliveriana*. (8) *Thalassiosira* sp. (9, 10) *Melosira sol*, (10) showing chain of cells in girdle view. (11) *Melosira* cf. *adeliae*.

Description: Diameter 48–55 µm.
Remarks: Marginal processes are difficult to resolve under LM but the irregular to radial arrangement of areole is distinct and the thickened marginal valve band is very clear.
Ecology and distribution: A marine species only found in Southern seas and Antarctica (Scott and Thomas 2005). Rare in Potter Cove.

***Thalassiosira* sp. (Figure 8)**
Description: Valves circular, flat to slightly convex, 40–48 µm in diameter. Areole coarse, eccentric, 6–9 in 10 µm in the center, 8–11 in 10 µm near the margin. Marginal processes 3–4 in 10 µm. Labiate process undiscernible in LM.
Ecology and distribution: Marine species, rare in Potter Cove.

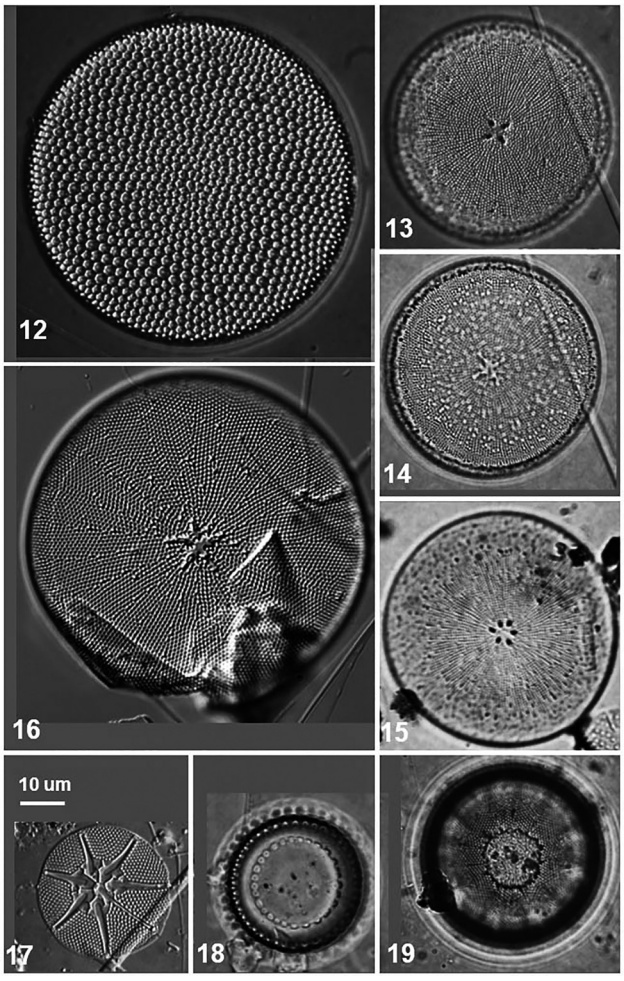
Family Melosiraceae
***Melosira* cf. *adeliae* Manguin (Figure 11)**
Literature: (Manguin 1960, p. 236, pl. 1, figs. 11–13; Scott and Thomas 2005, p. 66, figs. 2.31a–f).
Description: Diameter 28–32 µm.
Remarks: Chains of this species were not observed, and specimens encountered were probably deposited on the sediment from its natural epiphytic habitat.
Ecology and distribution: Widely distributed in and around Antarctica, mostly as an epiphyte (Majewska and De Stefano 2015). Rare in Potter Cove.

***Melosira sol* (Ehrenberg) Kützing (Figures 9, 10)**
Literature: (Hustedt 1930, p. 270, fig. 115 a–d; Scott and Thomas 2005, p. 66, fig. 2.32a–f).
Description: Diameter 62–158 µm.
Remarks: Large specimens of unusual valve size were observed with valve diameter not previously reported. Chains of 3–8 frustules were observed, frustules were connected with narrow bands attached to valves by teeth-like projections (Figure 10).
Ecology and distribution: A marine species widely distributed in Antarctica (Scott and Thomas 2005) but does not seem to be of worldwide distribution. Frequent in Potter Cove.

Family Coscinodiscaceae
***Coscinodiscus radiatus* Ehrenberg (Figure 12)**
Literature: (Hendey 1964, p. 76, pl. 22, fig. 7; Hustedt 1930, p. 420, fig. 225).
Description: Diameter 114 µm.
Ecology and distribution: A widely distributed marine oceanic species recorded in the Arctic (Pearce et al. 2014). Only a single specimen was observed in Potter Cove material.

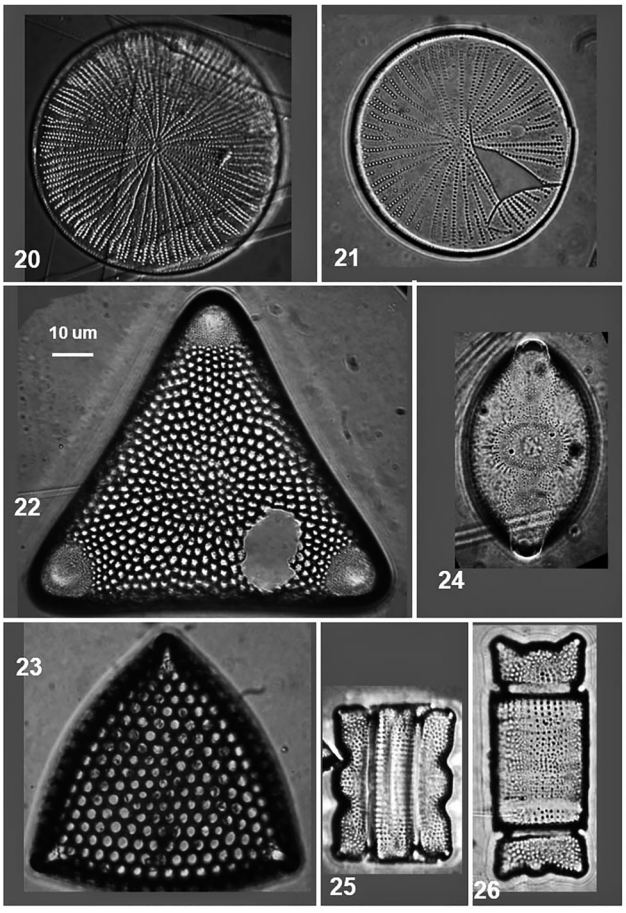
***Stellarima microtrias* (Ehrenberg) Hasle *et* Sims (Figures 13–16)**
Literature: (Hasle and Sims 1986, p. 111, figs. 19–21; Scott and Thomas 2005, p. 47, fig. 2.19).
Description: Diameter 62–94 µm.
Remarks: This species can be easily distinguished by the absence of marginal rimoportulae which are only located at valve center. Number of central rimoportulae in the observed specimens is 3–5 but these can be up to eight.
Ecology and distribution: A common Antarctic marine sea-ice species. It has been widely recorded from recent plankton and benthic habitats as well as from Cretaceous, Paleocene, Eocene, and Miocene deposits (Hasle and Sims 1986). A detailed discussion on its distribution is found in Armand et al. (2005). Frequent in Potter Cove.

Family Hemidiscaceae
***Actinocyclus actinochilus* (Ehrenberg) Simonsen (Figures 20, 21)**
Literature: (Scott and Thomas 2005, p. 52, fig. 2.22a–f; Villareal and Fryxell 1983, p. 461, figs. 21–32).



Figures 12–19: Marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (12) *Coscinodiscus radiatus*. (13–16) *Stellarima microtrias*, figures showing variable number of central rimoportulae. (17) *Asteromphalus parvulus*. (18) *Paralia sulcata*. (19) *Podosira stelliger*.

Description: Diameter 36–61 µm, areole 6–13 in 10 µm.
Remarks: Areole arranged in radial rows in fascicules, length and number of areole rows inside fascicules vary between specimens and these are either straight or weakly undulate.
Ecology and distribution: This marine species has been widely reported around Antarctica under various synonyms. In his work on the Antarctic diatoms, Peragallo (1921) described *Actinocyclus actinochilus* under various new species names including *Charcotia janus*, *C. bifrons*, *C. australis*, *C. valdiviae*, *C. castracanae*, *C. chromaradiatus*, *C. decrescens*, *C. irregularis*, *C. irregularis*, *C. disperses*, *C. micropunctatus*, *C. ornatus*, and *C. minor*. These are in addition to several other names in other geographical locations (Simonsen 1982). Common in Potter Cove.



Figures 20–26: Marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (20, 21) *Actinocyclus actinochilus*. (22) *Trigonium arcticum*. (23) *Triceratium favus*. (24–26) *Odontella litigiosa*.

Family Asterolampraceae

***Asteromphalus parvulus* Karsten (Figure 17)**

Literature: (Hustedt 1958, p. 128, fig. 91; Scott and Thomas 2005, p. 17, fig. 2.3a–d).
Description: Diameter 27–34 µm, hyaline rays seven.
Ecology and distribution: Marine planktonic species that can be present in the benthos. Widely distributed in Antarctica and the Southern seas. Rare in Potter Cove.

Family Paraliaceae

***Paralia sulcata* (Ehrenberg) Cleve (Figure 18)**

Literature: (Hendey 1964, p. 73, pl. 23, fig. 5; Witkowski et al. 2000, p. 37, pl. 8, figs. 10, 11).
Description: Diameter 33–34 µm.
Ecology and distribution: A marine benthic species, often found in the plankton. Widely distributed in the Northern Hemisphere from the Arctic to the equator (Witkowski et al. 2000), also reported in sediment cores from the Ross Sea, Antarctica (Nishimura et al. 1998). Only two specimens were observed in the samples from Potter Cove.

Family Hyalodiscaceae

***Podosira stelligera* (Bailey) A. Mann (Figure 19)**

Literature: (Desikachary 1988, pl. 601, figs. 1–13, pl. 602, figs. 1–11; Hendey 1964, p. 90, pl. 22, fig. 6).

Description: Diameter 62–65 µm.

Ecology and distribution: A widely distributed marine tychopelagic species, particularly in the northern hemisphere, probably with limited distribution in Antarctica. Few specimens were observed in Potter Cove.

Family Triceratiaceae

***Trigonium arcticum* (Brightwell) Cleve (Figure 22)**

Literature: (Hendey 1937, p. 282, pl. 10, fig. 1; Scott and Thomas 2005, p. 18, fig. 2.6a–f).

Description: Length of valve side 148–156 µm, areole 3–3.5 in 10 µm.

Remarks: All specimens observed possessed slightly concave valve sides.

Ecology and distribution: A marine species widely distributed in Antarctica and the Southern seas (Scott and Thomas 2005), also recorded from the sub-Arctic (Scholz and Einarsson 2015). Previously reported as an epiphyte in Potter Cove (Al-Handal and Wulff 2008b). Rare in the material examined.

***Triceratium favus* Ehrenberg (Figure 23)**

Literature: (Hendey 1964, p. 108, pl. 25, fig. 4; Hustedt 1930, p. 708, fig. 463).

Description: Length of valve side 118–127 µm, areole 2.5–3 in 10 µm.

Remarks: Specimens observed had slightly convex valve margins and coarser areole. Valve outline appears similar to *Triceratium broeckii* but in this species areole clearly decrease in size at the center.

Ecology and distribution: A widely distributed marine species (Hendey 1964). It does not seem to be encountered in Antarctica but has been reported from New Zealand (Stidolph 1980). Rare in Potter Cove.

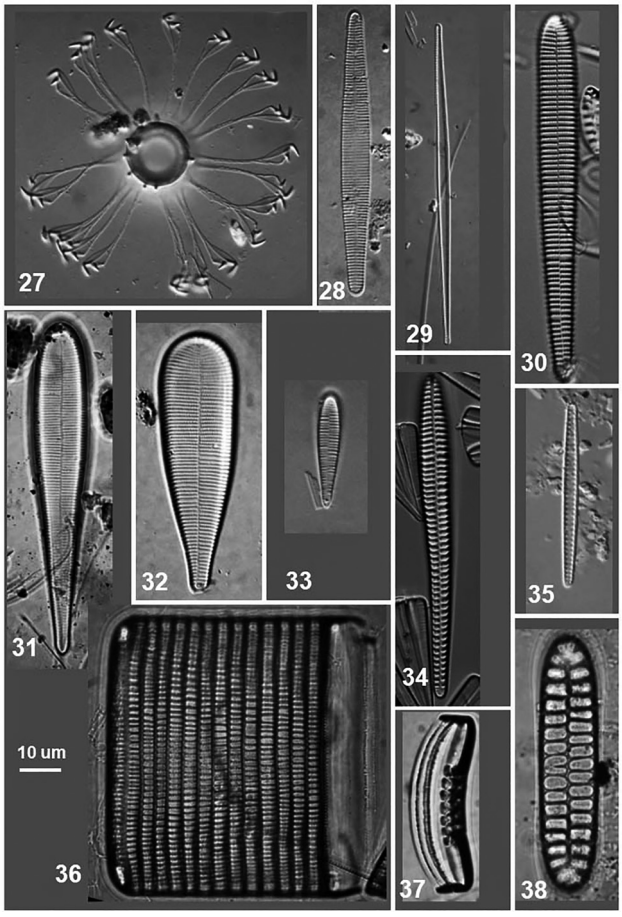
***Odontella litigiosa* (Van Heurck) Hoban (Figures 24–26)**

Literature: (Hoban et al. 1980, p. 598, figs. 27–38; Scott and Thomas 2005, p. 48, fig. 2.20a–f).

Description: Valve length 21–56 µm, width 10–24 µm.

Remarks: *O. litigiosa* was one of the most common species in Potter Cove and observed in every sample examined, mostly in its anthropomorpha and litigiosa phases (Al-Handal and Wulff 2008a).

Ecology and distribution: A marine Antarctic species, either found in the plankton, on the sediment or as epiphytic (Al-Handal and Wulff 2008a). Common in Potter Cove.



Figures 27–38: Marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (27) *Corethron pennatum*. (28) *Fragilaria striatula*. (29) *Synedropsis* sp. (30) *Licmophora antarctica*. (31–32) *Licmophora belgicae*. (33) *Licmophora gracilis*. (34) *Licmophora luxuriosa*. (35) *Thalassionema nitzschioides*. (36) *Rhabdonema arcuatum*. (37, 38) *Entopyla ocellata*.

Family Corethraceae

***Corethron pennatum* (Grunow) Ostenfeld (Figure 27)**

Literature: (Crawford et al. 1998, p. 5, figs. 6–25; Fryxell and Hasle 1971, p. 335, figs. 1–6; Scott and Thomas 2005, p. 65, fig. 2.29a–f).

Description: Diameter 15–32 µm.

Ecology and distribution: This is a cosmopolitan species widely distributed in the plankton from the Arctic to the Antarctic (Scott and Thomas 2005). Frequent in Potter Cove.

Class Fragiliariophyceae

Family Fragilariacea

***Fragilaria striatula* Lyngbye (Figure 28)**

Literature: (Poulin et al. 1984c, p. 358, figs. 61–66; Witkowski et al. 2000, pl. 28, figs. 1–6).

Description: Length 67 µm, width 3–5 µm, striae 28 in 10 µm.
Remarks: This species has been previously reported from Potter Cove under *Synedra kerguelensis* Heiden (Al-Handal and Wulff 2008a). Only a single specimen was observed and appeared identical to the images of *S. kerguelensis* shown in Simonsen (1992, plate 16, figures 4–6) but slightly different from those illustrated in Witkowski et al. (2000) which are rather short and more lanceolate.
Ecology and distribution: A marine benthic species. According to Witkowski et al. (2000), this species is distributed in the Arctic and North Europe. However, it has been widely distributed in Antarctica and the Southern seas (Heiden and Kolbe 1928; Hendey 1937).

***Synedropsis* sp. (Figure 29)**
Description: Length 91–105 µm, width 3–4 µm, striae 13–15 in 10 µm.
Remarks: This species looked similar to *Synedropsis fragilis* (Manguin) Hasle, Medlin *et* Syvertsen (Hasle et al. 1994, page 265, figures 124–141) but was longer and possessed coarser striae (23–26 in 10 µm for *S. fragilis*).
Ecology and distribution: Marine benthic species. Frequent in Potter Cove.

Family Licmophoraceae
***Licmophora antarctica* Carlson (Figure 30)**
Literature: (Al-Handal and Wulff 2008b, p. 428, figs. 2–5; Carlson 1913, p. 30, pl. 3, figs. 23, 24).
Description: Length 63–108 µm, width 6–10 µm, striae 10–12 in 10 µm.
Ecology and distribution: A marine epipelic and epiphytic species. Although *L. antarctica* is widely distributed in Potter Cove and has been found to be common as epiphytes on most macrophytes (Al-Handal and Wulff 2008b), it does not seem to be widely distributed in other localities in Antarctica. It has been reported by Frenguelli and Orlando (1958) from North Antarctica and from Admiralty Bay (Fernandez et al. 2014).

***Licmophora belgicae* Peragallo (Figures 31, 32)**
Literature: (Cremer et al. 2003, p. 95, fig. 97; Simonsen 1992, p. 28, pl. 24, figs. 1–5, both as *L. decora*).
Description: Length 72–110 µm, width 13–22 µm, striae 11–15 in 10 µm.
Remarks: This species has been previously reported from Potter Cove as *L. decora* Heiden (Al-Handal and Wulff 2008a, page 54, figures 7, 9). According to Hustedt (1958), *L. decora* is a synonym for *L. belgicae*, which was first described by M. Peragallo (1921). The name *L. decora*, however, is still widely used in recent literature.
Ecology and distribution: Although this species is considered epiphytic, it has not been found on any of the several macrophytes examined from Potter Cove but was always found in sediment samples. Widely distributed in Antarctica (Fernandez et al. 2014). Frequent in Potter Cove.

***Licmophora gracilis* (Ehrenberg) Grunow (Figure 33)**
Literature: (Cremer et al. 2003, p. 95, figs. 98, 99; Poulin et al. 1984b, p. 280, figs. 31–34; Witkowski et al. 2000, p. 65, pl. 18, figs. 12–18, pl. 19, figs. 7–15).
Description: Length 22–28 µm, width 4–6 µm, striae 20–24 in 10 µm.
Remarks: Although this species may reach 120 µm length (Witkowski et al. 2000), only smaller specimens were observed in the present study.
Ecology and distribution: A widely distributed marine epiphytic species, found in the Arctic and in several locations in Antarctica (Fernandez et al. 2014). Frequent in Potter Cove.

***Licmophora luxuriosa* Heiden (Figure 34)**
Literature: (Al-Handal and Wulff 2008b, p. 429, figs. 9–15; Heiden and Kolbe 1928, p. 572, pl. 6, figs. 140, 141; Simonsen 1992, p. 28, pl. 25, figs. 1–7, pl. 27, figs. 1–3).
Description: Length 80–88 µm, width 8–9 µm, striae 8–9 in 10 µm.
Remarks: Few specimens were observed on the sediment and appeared with slightly denser striae than normally found in this species (5–6 in 10 µm).
Ecology and distribution: A marine epiphytic species, rarely found in the plankton or attached to sediment grains. Only known from the Southern seas and Antarctica (Al-Handal and Wulff 2008b). Rare in Potter Cove.

Family Thalassionemataceae
***Thalassionema nitzschioides* (Grunow) Mereschkowsky (Figure 35)**
Literature: (Scott and Thomas 2005, p. 144, fig. 2.80a–d).
Description: Length 31–36 µm, width 2.5–3 µm, striae (single areole) 10–11 in 10 µm.
Remarks: Images of this species shown in Scott and Thomas (2005) from Antarctic material appear with rather different lanceolate valves and subcapitate apices and may belong to a different taxon. Valves of *T. nitzschioides* have almost parallel margins and rounded apices. Heiden in Heiden and Kolbe (1928) described several varieties in material collected from Antarctica based mostly on variations in valve outline. According to Hustedt (1958), these varieties may have no taxonomic validity. In the present work, only the nominate variety is considered.

Ecology and distribution: A widely distributed marine planktonic species from the Arctic to Antarctica (Hasle 2001). Rare in Potter Cove.

Family Rhabdonemataceae

***Rhabdonema arcuatum* (Lyngbye) Kützing (Figure 36)**

Literature: (Hendey 1964, p. 172, pl. 35, figs. 10–12; Poulin et al. 1984b, p. 284, figs. 54, 56–59; Witkowski et al. 2000, p. 76, pl. 13, figs. 2–4).

Description: length 86–92, width 8–12 µm, striae 6–8 in 10 µm.

Remarks: Three specimens were observed in the whole material. This is an epiphytic species and seldom found in the plankton or attached to sediment grains.

Ecology and distribution: A marine species mostly found in warm and temperate waters but also reported from the sub-Arctic (Poulin et al. 1984b) and the Arctic (von Quillfeldt 2000) and from Antarctica (Al-Handal and Wulff 2008b). Rare in Potter Cove.

Family Entopylaceae

***Entopyla ocellata* (Arnott) Grunow (Figures 37, 38, 109–111)**

References: (Al-Handal and Wulff 2008b, p. 427, figs. 57–62, 65; Desikachary 1988, p. 11, pl. 584, figs. 10, 11).

Description: Length 48–75 µm, width 10–16 µm, striae 4–6 in 10 µm.

Remarks: This species is characterized by having large and wide apical pore fields occupying two thirds of the concave valve face (Figures 109, 110). A very narrow sternum (not visible under LM) runs from pole to pole. Two rimoportula open externally as small, elongated openings located centrally under each pore field and internally as large crescent-like openings located transversely with short stalks (Figure 111) which are very characteristic for this species.

Ecology and distribution: A marine epiphytic or benthic species. Widely distributed as epiphyte in King George Island (Al-Handal and Wulff 2008b). Frequent in the present material.

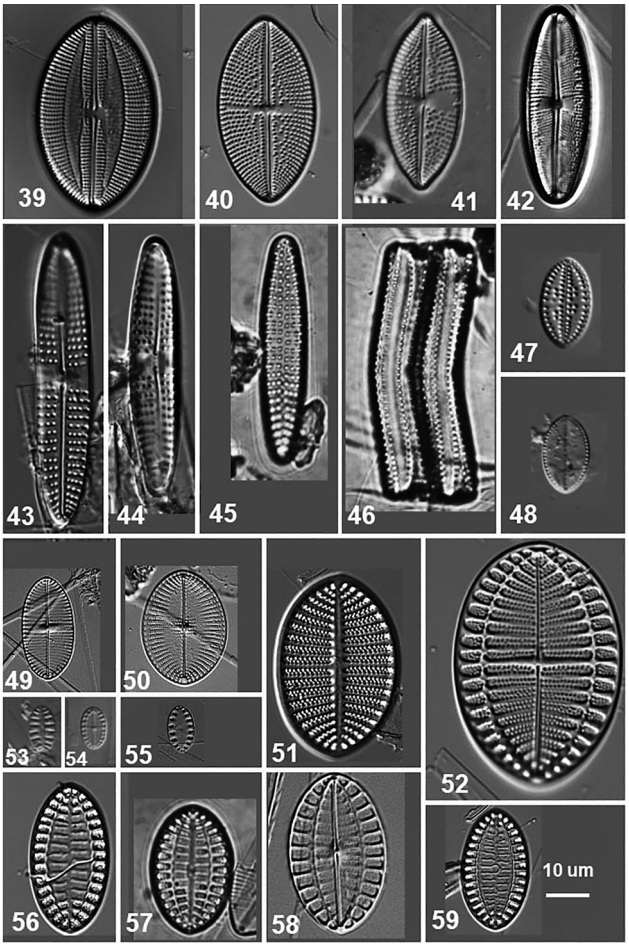
Class Bacillariophyceae

Family Lyrellaceae

***Lyrella hennedyi* (W. Smith) Stickle *et* D. G. Mann (Figure 39)**

Literature: (Hendey 1964: p. 212, pl. 33, fig. 14 as *Navicula hennedyi* W. Smith; Witkowski et al. 2000: p. 233, pl. 99, figs. 2, 3).

Description: Length 38–41 µmm width 26–28 µm, striae 12–13 in 10 µm, areole 17 in 10 µm.



Figures 39–59: Marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (39) *Lyrella hennedyi*. (40) *Petroneis* sp. (41) *Petroneis plagiostoma*. (42) *Staurophora* sp. (43–46) *Achnanthes* cf. *groenlandica*, (43, 44) raphe valve, (45) sternum valve, (46) two cells in girdle view. (47) *Cocconeis californica*. (48) *Cocconeis californica* var. *kerguelensis*. (49) *Cocconeis costata* var. *hexagona*. (50) *Cocconeis dallmannii*. (51) *Cocconeis fasciolata*. (52) *Cocconeis imperatrix*. (53) *Cocconeis matsii*. (54, 55) *Cocconeis melchioroides*. (56–59) *Cocconeis orbicularis*, (56, 59) sternum valve, (57, 58) raphe valve.

Ecology and distribution: A widely distributed marine benthic species. Not recorded previously from Potter Cove. Rare in the present material.

***Petroneis plagiostoma* (Grunow) D. G. Mann (Figure 41)**

Literature: (Hustedt 1961–66, p. 700, fig. 1694a,b; Witkowski et al. 2000, p. 329, pl. 102, figs. 5–6).

Description: Length 38–56 µm, width 20–25 µm, striae 11–12 in 10 µm, areole 10–11 in 10 µm.

Ecology and distribution: A widely distributed marine littoral species. Common in Potter Cove.

***Petroneis* sp. (Figure 40)**
Description: Length 41–55 µm, width 23–32 µm, striae 10–11 in 10 µm, areole 12–14 in 10 µm.
Remarks: This species appeared similar to *P. marina* (Ralfs) D. G. Mann but with narrower central area which is slightly dilated transversely.
Ecology and distribution: Marine benthic species. Common in Potter Cove.

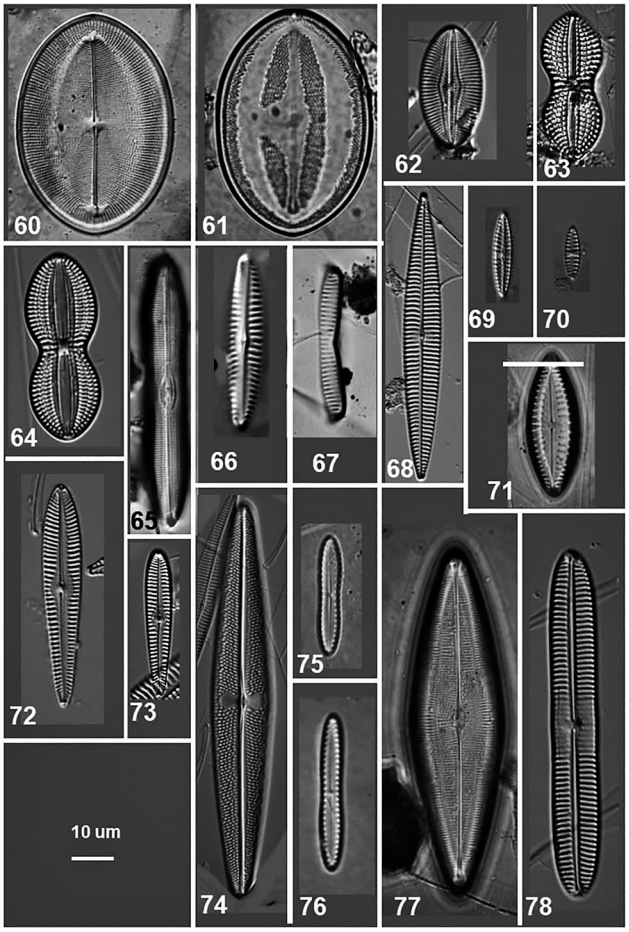
Family Anomoeoneidaceae
***Staurophora* sp. (Figure 42)**
Description: Valves elliptic to linear elliptic with broadly rounded apices, 48–55 µm long, 16–20 µm wide. Raphe very slightly bent in the middle of the valve, proximal endings simple and apart, distal endings deflected in opposite directions. Axial area narrow, central area large, expanding laterally to form a stauros not reaching valve margin. Striae radiate, 20–22 in 10 µm in the middle. Areole more distant near valve margin.
Ecology and distribution: A marine benthic species. Rare in Potter Cove.

Family Achnanthaceae
***Achnanthes* cf. *groenlandica* (Cleve) Grunow (Figures 43–46)**
Literature: (Witkowski et al. 2000, p. 89, pl. 44, figs. 1–7).
Description: Length 56–82 µm, width 11–15 µm, striae 5–6 in 10 µm.
Remarks: This species looks similar to *Achnanthes groenlandica* in valve outline, dimensions and striae density, but differs in the shape and size of the central area where it is larger and slightly depressed in the area between raphe proximal endings. Raphe endings penetrate into the central area and not on its outer edge. A similar species has recently been described as epizoic on turtles, *Achnanthes squaliformis* Majewska *et* Van de Vijver (Majewska et al. 2017) but this species possesses denser striae and an axial area pushed to the side on the rapheless valve.
Ecology and distribution: *Achnanthes groenlandica* is a widely distributed marine species which may live attached to sediment grains or as an epiphyte. Also recorded from the Arctic (Pearce et al. 2014). Frequent in Potter Cove.

Family Cocconeidaceae
***Campyloneis frenguellii* Riaux-Gobin *et* Guerrero (Figures 56–59, 113, 114)**
Literature: (Riaux-Gobin and Romero 2003, p. 38, pl. 57, figs. 3–4 as *Cocconeis* cf. *orbicularis*; Riaux-Gobin et al. 2019, p. 161, figs. 54–59).
Description: Length 28–41 µm, width 18–32 µm, striae 3.5–4 in 10 µm (raphe valve), 2.5–3 in 10 µm (rapheless valve).
Remarks: This species is characterized by its large marginal alveole which encompass tetraseriate striae. On the rapheless valve, another set of alveole is observed between the marginal alveole and the axial area but these do not reach valve center and their number varies from 2 to 5, their size decreases towards the center. The observed specimens were larger than those reported in the literature cited (17–18 µm long, 11–13 µm wide).
Ecology and distribution: A marine cold-water species. It is very rarely mentioned in the literature and have only been reported from its type locality in Antarctica and from southern Argentina (Romero 1995). Frequent in the present samples from Potter Cove but were not encountered in the collections made during 2003–2006 from the same locality (Al-Handal and Wulff 2008a,b).

***Cocconeis antiqua* Tempère *et* Brun (Figures 60, 61)**
Literature: (Al-Handal and Wulff 2008b, p. 426, figs. 28–29, 35–36 [as *Cocconeis schuettii* van Heurck 1909]; Scott and Thomas 2005, p. 127, fig. 2.69a–d).
Description: Length 47–72 µm, width 35–47 µm, striae 14–16 on raphe valve, 24–26 on rapheless valve.
Remarks: The taxonomic position of *Cocconeis antiqua* has been discussed and revised by Romero (2011) where several taxa previously described by Van Heurck were considered as synonyms of this species. These include *C. gautierii* var. *gautierii*, *C. gautierii* var. *inornata*, *C. litigiosa*, *C. schuettii* var. *schuettii*, and *C. schuettii* var. *minor* Van Heurck.
Ecology and distribution: *Cocconeis antiqua* does not seem to have been found outside Antarctica since its description in 1909 by Van Heurck (Van Heurck 1909). Frequent in all samples examined from Potter Cove.

***Cocconeis californica* Grunow (Figure 47)**
Literature: (Poulin et al. 1984a, p. 49, figs. 5–11; Riaux-Gobin and Romero 2003, p. 21, figs. 15, 18, 19, pl. 8, figs. 1–8, pl. 9, figs. 1–5, pl. 10; Witkowski et al. 2000, p. 102, pl. 36, figs. 29, 30, pl. 42, figs. 8–15).
Description: Length 17–22 µm, width 12–15 µm, striae 10–11 in 10 µm.
Remarks: Specimens observed were with lower stria density than previously recorded from Potter Cove (Al-Handal and Wulff 2008b, striae 11–16 in 10 µm) or those reported from Kerguelen (12–18 in 10 µm) by Riaux-Gobin and Romero (2003).
Ecology and distribution: Widely distributed marine periphytic species. Rare in Potter Cove.



Figures 60–78: Marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (60, 61) *Cocconeis antigua*. (62) *Diploneis smithii*. (63) *Diploneis weissflogii*. (64) *Diploneis* sp. (65) *Caloneis* sp. (66, 67) *Navicula cancellate*. (68) *Navicula directa*. (69, 70) *Navicula perminuta*. (71) *Navicula* sp. (72, 73) *Pseudogomphonema kamtchaticum*. (74) *Trachyneis aspera*. (75, 76) *Biremis ambigua*. (77) *Parlibellus crucicula*. (78) *Pinnularia quadratarea*.

***Cocconeis californica* var. *kerguelensis* Heiden (Figure 48)**

Literature: (Hustedt 1958, p. 143, figs. 96–99 [as *Cocconeis curiosa* (Hustedt)]; Riaux-Gobin and Romero 2003, p. 21, figs. 16, 17, pl. 11, figs. 1–11).

Description: Length 14–18 µm, width 9–11 µm, striae 13–15 in 10 µm.

Remarks: In the study area, this species was always found with *C. californica* var. *californica* which is the nominate variety. Most of the observed specimens bear very few striae (formed of one areola) on both sides of the axial area near valve poles.

Ecology and distribution: Antarctic marine species, usually found as epiphyte. Rare in Potter Cove.

***Cocconeis costata* var. *hexagona* Grunow (Figure 49)**

Literature: (Riaux-Gobin and Romero 2003, p. 24, figs. 4, 5, pl. 3, figs. 1–10; Witkowski et al. 2000, p. 104, pl. 35, figs. 14, 15, pl. 38, fig. 35).

Description: Length 22–27 µm, width 9–12 µm, striae (raphe valve) 14–15 in 10 µm.

Remarks: The transverse fascia of the central area in the observed specimens did not reach valve margin as normally observed in this species (Riaux-Gobin and Romero 2003).

Ecology and distribution: Widely distributed marine benthic and epiphytic species, Reported from the Arctic (Hsiao 1980). Rare in Potter Cove.

***Cocconeis dallmannii* Al-Handal, Riaux-Gobin, Romero *et* Wulff (Figure 50)**

Literature: (Al-Handal et al. 2008, p. 275, figs. 33–47, 49–62).

Description: Length 24–30 µm, width 18–22 µm, striae (raphe valve) 10–11 in 10 µm.

Remarks: This species has originally been described from Potter Cove Al-Handal and Wulff (2008b). The observed specimens appeared slightly larger than previously reported with coarser striae on the raphe valve.

Ecology and distribution: A marine benthic and epiphytic species, it has not been reported outside its type locality (Potter Cove). Rare in the examined material.

***Cocconeis fasciolata* (Ehrenberg) Brown (Figure 51)**

Literature: (Riaux-Gobin and Romero 2003, p. 26, figs. 26–28, pl. 19, figs. 1–11; Scott and Thomas 2005, p. 127, fig. 2 [68 a–d]).

Description: Length 41–48 µm, width 27–32 µm, striae (rapheless valve) 4–5 in 10 µm.

Ecology and distribution: A marine periphytic species. Although it was recorded from North Europe, the species seems more distributed in the Antarctic Peninsula (Scott and Thomas 2005). Frequent in Potter Cove.

***Cocconeis imperatrix* A. Schmidt (Figure 52)**

Literature: (Al-Handal and Wulff 2008b, p. 426, figs. 46–49; Manguin 1960, p. 305, figs. 358, 359; Riaux-Gobin and Romero 2003, p. 28, figs. 29–31, pl. 20, figs. 1–7, pl. 21, figs. 1–8).

Description: Length 38–65 µm, width 25–44 µm, striae (raphe valve) 3–4 in 10 µm.

Remarks: Scott and Thomas (2005) considered *Cocconeis imperatrix* as a synonym of *Cocconeis fasciolata*. Studying valve structure of both taxa in Potter Cove revealed noticeable variation between them so that it can be considered to be a separate entity (Al-Handal and Wulff 2008b).

Ecology and distribution: A marine species mostly reported from Antarctica. Common in Potter Cove.

***Cocconeis matsii* (Al-Handal, Riaux-Gobin *et* Wulff) Riaux-Gobin, Compère, Romero *et* Williams (Figure 53)**
Literature: (Al-Handal et al. 2010, p. 6, figs. 13–18, 25–34 as *C. pinnata* var. *matsii*).
Description: Length 10–13 µm, width 5–7 µm, striae (rapheless valve) 7–8 in 10 µm.
Remarks: This species was originally described from Potter Cove as *C. pinnata* var *matsii* but was considered a distinct species based on stria and areola density and structure (Riaux-Gobin et al. 2003). These authors, however, did not provide images for specimens but rather established a new combination.
Ecology and distribution: The species has not been reported outside its type locality in Potter Cove. Frequent in the material examined.

***Cocconeis melchioroides* Al-Handal, Riaux-Gobin, Romero *et* Wulff (Figures 54, 55)**
Literature: (Al-Handal et al. 2008, p. 271, figs. 2–15, 18–22).
Description: Length 10–12 µm, width 6–8 µm, striae (raphe valve) 13–15 in 10 µm.
Ecology and distribution: A marine Antarctic epiphytic and benthic species. It was originally described from Potter Cove (Al-Handal et al. 2008b) but has also been recently reported from the Ross Sea (Majewska and De Stefano 2015).

Family Diploneidaceae
***Diploneis smithii* (Brébisson) Cleve (Figure 62)**
Literature: (Hendey 1964, pl. 32, fig. 10; Krammer and Lange-Bertalot 1986, p. 291, pl. 112, figs. 2–4; Witkowski et al. 2000, p. 193, pl. 90, figs. 7, 15, pl. 91, figs. 1–2).
Description: Length 23–30 µm, width 14–16 µm, striae 14–16 in 10 µm.
Remarks: Only small specimens of *D. smithii* were encountered, but it might reach up to 200 µm. It is a rather variable species with several varieties described. The common feature which separates *D. smithii* from closely related taxa such as *D. fusca* and *D. nitescens* is the undivided striae which are formed of double rows of alternating areole.
Ecology and distribution: A widely distributed marine and brackish-water species, recorded from the sub-Arctic (Cardinal et al. 1984). Rare in Potter Cove.

***Diploneis weissflogii* (Schmidt) Cleve (Figure 63)**
Literature: (Podzorski and Håkansson 1987, p. 61, pl. 21, figs. 6–7; Witkowski et al. 2000, pl. 92, figs. 4–5).
Description: Length 42 µm, width 10 µm (middle), striae 7–8 in 10 µm.
Ecology and distribution: This species has mostly been recorded from warm waters around the world. Only a single specimen was observed in the material examined.

***Diploneis* sp. (Figure 64)**
Description: Length 51–55 µm, width 23–26 µm (middle), striae 8–10 in 10 µm.
Remarks: This species appears similar to *Diploneis interrupta* (Kützing) Cleve but with coarser striae and 2–4 longitudinal lines interrupting transapical striae.
Ecology and distribution: Marine species. Rare in Potter Cove.

***Caloneis* sp. (Figure 65)**
Description: Length 72–85 µm, width 10–14 µm, striae 18–20 in 10 µm.
Remarks: The specimens observed were similar to some forms of the freshwater species *Caloneis silicula* (Ehrenberg) Cleve but with denser striae and raphe proximal endings bent when entering the central area.
Ecology and distribution: Rare in Potter Cove.

***Navicula cancellata* Donkin (Figures 66, 67)**
Literature: (Hendey 1964, p. 203, pl. 30, figs.18–20; Witkowski et al. 2000, p. 271, pl. 138, figs. 1–3, pl. 144, figs. 1–7).
Description: Length 40–55 µm, width 8–11 µm, striae 7–8 in 10 µm.
Ecology and distribution: A widely distributed marine coastal species, reported from the Arctic (Hsiao 1980). Frequent in Potter Cove.

***Navicula directa* (W. Smith) Brébisson (Figure 68)**
Literature: (Poulin 1990, p. 138, pl. 18.1, fig. 24; Scott and Thomas 2005, p. 157, fig. 2.87a–d; Witkowski et al. 2000, p. 275, pl. 129, fig. 1, pl. 133, figs. 10–12).
Description: 52–90 µm, width 8–12 µm, striae 8–11 in 10 µm.
Remarks: This is one of the most common species encountered in the present study. It appeared in all samples examined.
Ecology and distribution: A widely distributed marine bipolar species (von Quillfeldt 2000). Common in Potter Cove.

***Navicula* cf. *perminuta* Grunow (Figures 69, 70)**
Literature: (Busse and Snoeijs 2002, figs. 11–15; Krammer and Lange-Bertalot 1986, p. 112, pl. 35, figs. 14–20).
Description: Length 11–24 µm, width 4–6 µm, striae 14–16 in 10 µm.
Remarks: The species illustrated here is considered as *N. perminuta* following the literature cited. A wide variation in valve outline and striae density has been observed (Al-Handal and Wulff 2008a) and may not correspond to the original description of the species. Type material has not been examined and therefore the identity of this species remains questionable.

Ecology and distribution: A widely distributed marine and brackish-water species. Common in Potter Cove.

***Navicula* sp. 1 (Figure 71)**
Description: Valves broadly lanceolate with weakly produced rounded apices, 32–48 µm long, 22–26 µm wide. Raphe straight, proximal raphe endings slightly expanded. Axial area wide and elliptic, central area not separated from axial area. Striae radiate, coarse, short and distant, 6–7 in 10 µm.
Ecology and distribution: Marine species. Rare in Potter Cove.

***Navicula* sp. 2 (Figure 112)**
Description: Valve elliptic with broadly rounded apices, 9–12 µm long, 4–6 µm wide. Raphe weakly undulating, proximal raphe endings small and round, terminal endings hooked into same direction and not reaching valve mantle. Axial area elliptic, central area not distinguished from the axial area. Striae radiate, 20–22 in 10 µm, middle striae are shorter.
Remarks: This is a very small species which is very difficult to resolve in LM.
Ecology and distribution: Marine benthic species. Rare in Potter Cove.

***Pseudogomphonema kamtchaticum* (Grunow) Medlin (Figures 72, 73)**
Literature: (Al-Handal and Wulff 2008b, p. 430, figs. 95–100; Medlin and Round 1986, p. 216, figs. 64–70; Witkowski et al. 2000, p. 343, pl. 60, figs. 13–16).
Description: Length 40–65 µm, width 5.5–10 µm, striae 12–14 in 10 µm.
Remarks: Specimens observed in Potter Cove possess less dense striae than reported for this species which normally range between 16 and 23 in 10 µm (Medlin and Round 1986; Scott and Thomas 2005). Specimens smaller than 40 µm were not observed although it might be as small as 18 µm.
Ecology and distribution: This is a marine species mostly found as epiphytic and rarely on the sediment, also reported from the Arctic (Klochkova et al. 2014). Frequent in Potter Cove.

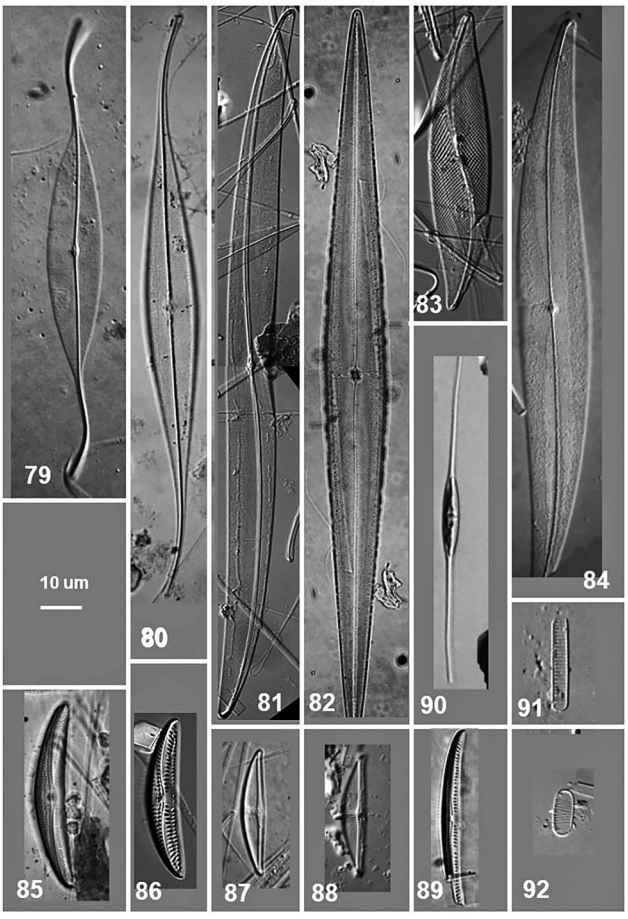
***Trachyneis aspera* (Ehrenberg) Cleve (Figure 74)**
Literature: (Cardinal et al. 1984, p. 391, figs. 98–102; Hendey 1964, p. 236, pl. 29, fig. 13; Witkowski et al. 2000, p. 355, pl. 159, figs. 1–6, 9).
Description: Length 62–104 µm, width 12–15 µm, striae 14–16 in 10 µm.
Remarks: A species with variable outline and wide size variation. Specimens observed in the present study had denser striae than normally found in this species (6–8 in 10 µm) and vary from previous observations in the same region (9–11 in 10 µm, Al-Handal and Wulff 2008b).
Ecology and distribution: A widely distributed marine littoral species. Recorded from the sub-Arctic and the Arctic (Cardinal et al. 1984; von Quillfeldt 2000). Frequent in Potter Cove.

Family Neidiaceae
***Biremis ambigua* (Cleve) D.G. Mann (Figures 75, 76)**
Literature: (Hendey 1964: p. 233, pl. 34, figs. 5–8 [as *Pinnularia ambigua*]; Witkowski et al. 2000, p. 158, pl. 155, figs. 2–6).
Description: Length 32–45 µm, width 5–7 µm (middle of the valve), striae 8–9 in 10 µm.
Ecology and distribution: A widely distributed marine and brackish-water species, recorded from the Arctic and from the tropics (von Quillfeldt 2000). It has not been previously observed in Potter Cove. Frequent in the material examined.

***Prestauroneis crucicula* (W. Smith) Genkal *et* Yarushina (Figure 77)**
Literature: (Genkal and Yarushina 2017, p. 355, figs. 1a–d, 2a–d; Witkowski et al. 2000, p. 321, pl. 103, figs. 11–13).
Description: Length 71–94 µm, width 18–26 µm, striae 20–24 in 10 µm.
Remarks: Some valves of *P. crucicula* may look similar to *P. delognei* (Van Heurck) Cox even with the arrangement of striae in the center but can be distinguished by the position of raphe distal endings where in *P. delognei* they clearly terminate below valve apices. All observed specimens had striae denser than normally found (14–18 in 10 µm).
Ecology and distribution: A marine and brackish-water species. Previously found in Potter Cove as an epiphyte but was rather rare. Frequent in the material examined.

Family Pinnulariaceae
***Pinnularia quadratarea* (A. Schmidt) Cleve (Figure 78)**
Literature: (Snoeijs and Vilbaste 1994, p. 94, fig. 182; Witkowski et al. 2000, p. 335, pl. 155, figs. 17–21).
Description: Length 44–95 µm, width 10–13 µm, striae 8–10 in 10 µm.
Remarks: In our previous records of 2003, this species was less common in Potter Cove but in the present study it appeared in high numbers with larger valve size.
Ecology and distribution: Widely distributed marine species in temperate and polar regions (Cardinal et al. 1984; Hsiao 1980). Common in Potter Cove.

Family Pleurosigmataceae
***Gyrosigma arcuatum* (Donkin) Sterrenburg (Figure 79)**
Literature: (Jahn et al. 2005, p. 306, fig. 8).



Figures 79–92: Marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (79) *Gyrosigma arcuatum*. (80) *Gyrosigma fasciola*. (81) *Gyrosigma* cf. *obscurum*. (82) *Pleurosigma eudon* var. *kerguelensis*. (83) *Pleurosigm diversestriatum*. (84) *Pleurosigma strigosum*. (85) *Amphora gourdonii*. (86) *Amphora marina*. (87, 88) *Amphora* sp. 1. (89) *Amphora* sp. 2. (90) *Cylindrotheca closterium*. (91, 92) *Fragilariopsis cylindrus*.

Description: Length 85–90 µm, width 13–14 µm, striae not resolved under LM.
Remarks: This species has rarely been described in recent literature but is mentioned only in diatom checklists from Europe and North America (e.g., Hendey 1974; Mather et al. 2010) and is mostly referred to as *G. fasciola* var. *arcuata* (Donkin) Cleve. The species can be easily distinguished from *G. fasciola* by its shorter and strongly arcuate valve poles. Jahn et al. (2005) typified this species and separated it from *G. fasciola*.
Ecology and distribution: It is difficult to trace the distribution of this species as in many records it might have been confused with *G. fasciola*. It does not seem to have been reported from Antarctica even in its varietal rank but was observed in the sub-Arctic (Cardinal et al. 1986 as var. *arcuata*). The species has not been observed in previous samples from Potter Cove. Rare in the present material.

***Gyrosigma fasciola* (Ehrenberg) Griffith *et* Henfrey (Figure 80)**
Literature: (Al-Handal and Wulff 2008a, p. 54, figs. 101, 130–131; Krammer and Lange-Bertalot 1986, p. 300, fig. 116.6).
Description: Length 97–140 µm, width 11–14 µm, transverse striae 21–24 in 10 µm.
Remarks: One of the most common benthic diatoms in Potter Cove. It forms a thick diatom film in some places.
Ecology and distribution: A marine and brackish-water species of worldwide distribution but more frequent in the marine littoral of the Atlantic and the North Sea (Jahn et al. 2005). Reported from the Arctic (Cardinal et al. 1986; von Quillfeldt 2000). Common in Potter Cove.

***Gyrosigma* cf. *obscurum* (W. Smith) Griffith *et* Henfrey (Figure 81)**
Literature: (Krammer and Lange-Bertalot 1986, p. 299, fig. 116: 1, 2; Patrick and Reimer 1966, p. 346, pl. 24, fig. 7).
Description: Length 144–170 µm, width 9–11 µm, transverse striae 28–30 in 10 µm.
Remarks: There has been controversial debate on whether this species belongs to *Gyrosigma* or *Pleurosigma* (Reid 2004; Sterrenburg 1993, 2003) based on the angle of striae crossing in the center of the valve. The transverse striae which cross the apical axis at 90° can be easily seen under LM but the oblique striae were very difficult to resolve. According to Reid (2004), molecular analysis supports placing this species in *Gyrosigma* which is followed here. The observed specimens matched well the description of *G. obscurum* but as this species is considered freshwater, doubt arose. According to Sterrenburg (2003), marine records of this species were inaccurate.
Ecology and distribution: This species appeared in large numbers in Potter Cove but have not been observed in previous collections.

***Pleurosigma diversestriatum* Meister (Figure 83)**
Literature: (Hendey 1970, p. 152, pl. 6, fig. 62; Sterrenburg 2001, p. 124, figs. 6, 15–18).
Description: Length 71–75 µm, width 15–18, oblique striae at the center 19–21 in 10 µm. Oblique striae cross each other at ca 65° at the center and the raphe curvature is about 19°.
Ecology and distribution: This marine species has only been reported from warm waters in tropical and subtropical regions. Its occurrence, although rare in Antarctica, may expand its environmental preferences.

***Pleurosigma eudon* var. *kerguelensis* Heiden *et* Kolbe (Figure 82)**
Literature: (Al-Handal and Wulff 2008b, p. 430, figs. 103, 104; Manguin 1960, p. 318, pl. 30, fig. 373; Simonsen 1992, p. 74, pl. 72, figs. 1–5).

Description: Length 190–200 µm, width 18–20 µm, transverse striae 20–22 in 10 µm.
Ecology and distribution: A marine Antarctic species. Previously reported from Potter Cove both on the sediment and as an epiphyte (Al-Handal and Wulff 2008b). Very rare in the examined material.

***Pleurosigma strigosum* W. Smith (Figure 84)**
Literature: (Cardinal et al. 1986, p. 187, figs. 70, 72; Hendey 1964, p. 246, pl. 36, fig. 7; Sterrenburg 2003, p. 159, figs. 1–4, 22–25).
Description: Length 145–260 µm, width 18–30 µm, transverse striae 20–24 in 10 µm.
Ecology and distribution: A widely distributed marine species, also found in estuaries. Previously recorded from Fuego district in south Antarctica (Frenguelli 1943) and from the sub-Arctic (Cardinal et al. 1986). It has not previously been observed in Potter Cove but was found in large numbers in the present samples.

Family Catenulaceae
***Amphora gourdonii* M. Peragallo (Figure 85)**
Literature: (Al-Handal and Wulff 2008b, p. 413, figs. 91, 92; Peragallo 1921, p. 60, pl. 2, fig. 23).
Description: Length 38–55 µm, width 8–9 µm, dorsal striae 9–10 in 10 µm, ventral striae 10–12 in 10 µm.
Ecology and distribution: An Antarctic marine species. Distribution of this species is not known and it has only been reported from two locations in Antarctica (see Al-Handal and Wulff 2008b). Previously found as a rare epiphyte in Potter Cove. Frequent in the present material.

***Amphora marina* W. Smith (Figure 86)**
Literature: (Levkov 2009, p. 80, pl. 76, fig. 7; Witkowski et al. 2000, p. 144, pl. 162, figs. 8–14, pl. 166, figs. 9–11).
Description: Length 28–41 µm, width 7–9 µm, dorsal striae 16–18 in 10 µm, ventral striae 11–14 in 10 µm.
Ecology and distribution: A widely distributed marine species. Previously found in Potter Cove. Frequent in the present material.

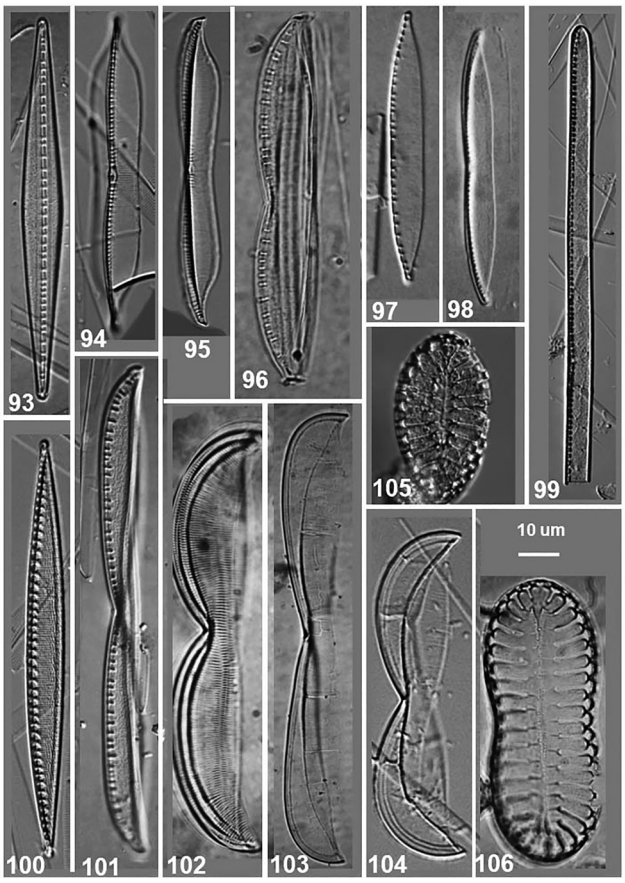
***Amphora* sp. 1 (Figures 87, 88)**
Description: Length 26–34 µm, width 4.5–6 µm, striae very fine and difficult to resolve in LM.
Remarks: This species is very similar to the images given by Simonsen (1992, page 73, plate 69, figures 12, 13) for *Amphora lunula* var. *parvula* Heiden, as published in Heiden and Kolbe (1928), of material collected from Antarctica. Simonsen, however, doubted the identification of this taxon which may belong to a different species.
Ecology and distribution: Marine species. Rare in Potter Cove.

***Amphora* sp. 2 (Figure 89)**
Description: Length 42 µm, width 4.5 µm, ventral striae 13 in 10 µm.
Remarks: A single specimen of this species was observed and could not be matched to any of the described taxa.
Ecology and distribution: Not known.

Family Bacillariaceae
***Cylindrotheca closterium* (Ehrenberg) Reimann *et* Lewin (Figure 90)**
Literature: (Hendey 1964, p. 283, pl. 2, fig. 8; Reimann and Lewin 1964, p. 289, pl. 124, figs. 1–4, pl. 125, figs. 1–4; Witkowski et al. 2000, p. 374, pl. 212, figs. 4–6 [both as *Nitzschia closterium*]).
Description: 72–80 µm, width, 4.5–5 µm.
Remarks: Species with delicate frustules which often get destroyed in routine cleaning of diatoms.
Ecology and distribution: A widely distributed benthic species and very common in sea-ice diatom communities both in Antarctica (Kang and Fryxell 1992) and the Arctic (von Quillfeldt 2000). Rare in Potter Cove.

***Fragilariopsis cylindrus* (Grunow ex Cleve) Helmcke *et* Krieger (Figures 91, 92, 115, 116)**
Literature: (Hasle 1965, p. 34, fig. 12:6–12; Snoeijs and Vilbaste 1994, p. 50, fig. 138; Witkowski et al. 2000, p. 360, pl. 213, figs. 8–14).
Description: Length 5–11 µm, width 2–3 µm, striae 15–20 in 10 µm, fibulae 15–20 in 10 µm.
Ecology and distribution: A common bipolar sea-ice diatom, particularly in summer and autumn (Kang and Fryxell 1992) but also found in brackish-water of the Baltic Sea, forming ribbon-like colonies (Snoeijs and Vilbaste 1994). *Fragilariopsis cylindrus* has been used as an indicator species for sea-ice movement in both polar regions (von Quillfeldt 2004). It was not observed in Potter Cove during the previous collection. Rare in the material examined.

***Nitzschia angularis* W. Smith (Figure 93)**
Literature: (Hendey 1964, p. 281, pl. 39, fig. 6; Witkowski et al. 2000, p. 368, pl. 199, figs. 5, 6).
Description: Length 82–105 µm, width 8–12 µm, fibulae 5–6 in 10 µm.
Remarks: Striae are very fine and difficult to resolve under LM, normally appearing mottled as a result of crossing transverse and oblique lines.
Ecology and distribution: Widely distributed species in temperate and North European waters (Hendey 1964). Also recorded in the sea-ice of the Arctic (Hsiao 1980) and from surface sediment in Antarctica (Prasad and Nienow 1986). Frequent in Potter Cove.



Figures 93–106: Marine benthic diatoms in Potter Cove, King George Island, Antarctica in summer 2015. (93) *Nitzschia angularis*. (94, 95) *Nitzschia australis*. (96) *Nitzschia mitchelliana*. (97) *Nitzschia* cf. *gelida*. (98) *Nitzschia hybrida*. (99) *Nitzschia* cf. *obtusa*. (100) *Nitzschia sigma*. (101) *Nitzschia* sp. (102) *Entomoneis gigantea*. (103) *Entomoneis kjellmanii*. (104) *Entomoneis paludosa*. (105) *Surirella fastuosa*. (106) *Surirella* sp.

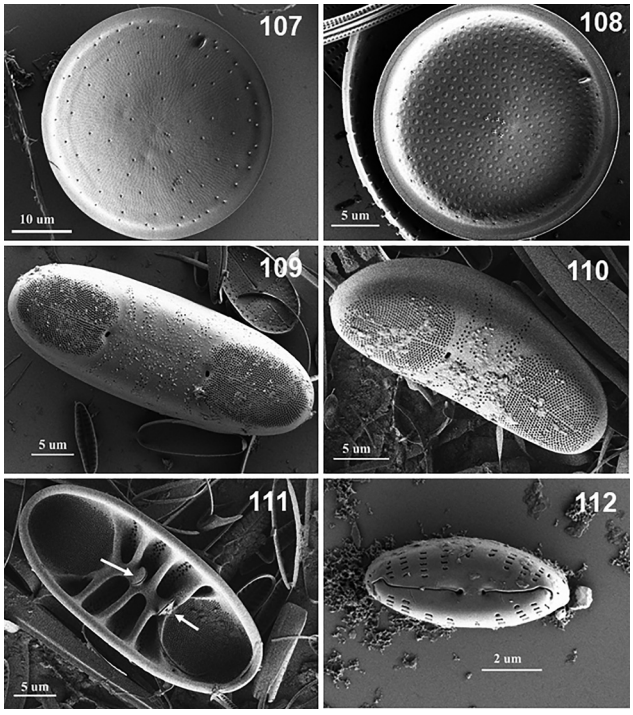
Nitzschia australis (M. Peragallo) A. Mann (Figures 94, 95, 118)

Literature: (Mann 1937, p. 63, pl. 6, fig. 1; Peragallo 1921, p. 65, pl. 3, figs. 17, 18 as *N. dubia* var. *australis*; Scott and Thomas 2005, p. 187, fig. 2.107a–f).

Description: Length 70–85 µm, width 7–10 µm, fibulae 14–16 in 10 µm.

Remarks: Striae are very fine but look coarser at valve center. Both Peragallo and Mann (cited above) reported 19–20 striae in 10 µm while Scott and Thomas (2005) recorded 19–25 in 10 µm. The observed specimens appeared to have less dense striae. This Antarctic species has rarely been reported and described in recent literature.

Ecology and distribution: Antarctic marine species. Rare in Potter Cove.



Figures 107–112: SEM images of the marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (107, 108) *Porosira glacialis*, internal valve view showing the single marginal labiate process. (109–111) *Entopyla ocellata*, (109, 110) external valve view showing the wide and superficial apical porefield which occupies large area of valve face, (111) internal valve structure showing the narrow and crescent-like rimoportula openings (white arrows). (112) *Navicula* sp. 2.

Nitzschia cf. *gelida* Cleve *et* Grunow (Figure 97)

Literature: (Lange-Bertalot and Krammer 1987, p. 20, fig. 7:1–3; Witkowski et al. 2000, p. 383, pl. 198, figs. 4–6).

Description: Length 68–75 µm, width 10–12 µm, fibulae 4–5 in 10 µm, striae very fine, could not be resolved under LM.

Remarks: The specimens observed were rather similar to the Arctic species *N. gelida* but differed by their very small size. *Nitzschia gelida* is much larger with length range 120–140 µm.

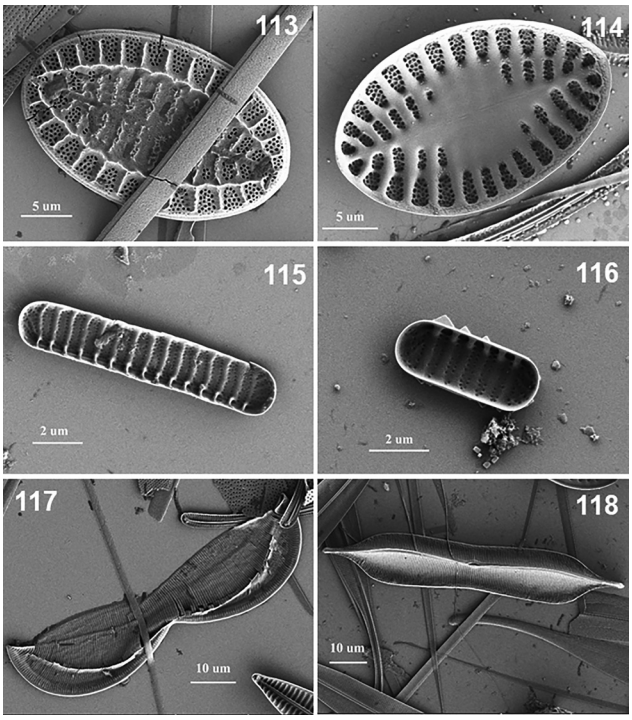
Ecology and distribution: *Nitzschia gelida* is a marine species known from the Arctic (Hsiao 1980). Rare in Potter Cove.

Nitzschia hybrida Grunow (Figure 98)

Literature: (Krammer and Lange-Bertalot 1988, p. 61, pl. 46, figs. 3–6; Witkowski et al. 2000, p. 385, pl. 191, figs. 12–14).

Description: Length 61–76 µm, width 9–11 µm, fibulae 10–11 in 10 µm, striae 26–28 in 10 µm.

Remarks: Observed specimens had denser striae than previously found in this region (Al-Handal and Wulff 2008b).



Figures 113–118: SEM images of the marine benthic diatoms in Potter Cove, King George Island, Antarctica, summer 2015. (113, 114) *Cocconeis orbicularis*, external and internal faces of sternum valve. (115, 116) *Fragilariopsis cylindrus*, internal valve sides. (117) *Entomoneis paludosa*. (118) *Nitzschia australis*.

Ecology and distribution: A widely distributed marine and brackish-water species, reported from the Arctic (von Quillfeldt 2000). Common in Potter Cove.

***Nitzschia mitchelliana* Greenleaf (Figure 96)**
Literature: (Witkowski et al. 2000, p. 394, pl. 193, figs. 1, 2).
Description: Length 88–105 µm, width 11–13 µm (center), fibulae 5–6 in 10 µm.
Remarks: The long and short irregularly arranged and more spaced fibulae is the main feature to recognize this species.
Ecology and distribution: Perhaps this is a cold-water species, it has been reported from Spitsbergen and Finnmark (Cleve 1883) and Kara Sea (Cleve and Grunow 1891) and is widely spread in the Arctic (Witkowski et al. 2000). Its occurrence in Potter Cove may indicate its bipolar distribution. Rare in the material examined.

***Nitzschia* cf. *obtusa* W. Smith (Figure 99)**
Literature: (Krammer and Lange-Bertalot 1988, p. 25, fig. 17:1, 2, fig. 18.1; Witkowski et al. 2000. p. 396, pl. 201, figs. 7–9).
Description: Length 160–165 µm, width 13–14 µm, fibulae 10–11 in 10 µm, striae very fine.
Remarks: This species appears very similar to *N. obtusa* but has denser fibulae and striae. *Nitzschia obtusa*, however, is a brackish-water species and unlikely to be found in marine habitats.
Ecology and distribution: A widely distributed brackish-water species. Rare in Potter Cove.

***Nitzschia sigma* (Kützing) W. Smith (Figure 100)**
Literature: (Hendey 1964, p. 281, 282, pl. 42, fig. 1; Witkowski et al. 2000, p. 404, pl. 206, figs. 1–10).
Description: Length 82–105 µm, width 14–18 µm, striae 32–34 in 10 µm, fibulae 5–6 in 10 µm.
Remarks: A species with a wide variation in valve outline, striae and fibulae density. The observed specimens bear coarser and less dense fibulae, Krammer and Lange-Bertalot (1988) reported 7–12 fibula in 10 µm while Hendey (1964) reported eight in 10 µm.
Ecology and distribution: A widely distributed marine and brackish-water species. reported from the Arctic as sea-ice diatoms (Wiktor et al. 1998). Not found previously in Potter Cove. Rare in the material examined.

***Nitzschia* sp. (Figure 101)**
Description: Raphe broadly linear, constricted in the middle with rounded, slightly produced apices, 110–140 µm, 11–14 µm wide. Raphe eccentric, fibulae 4–6 in 10 µm, median fibulae distant. Striae very fine, not resolved in LM, areole irregularly and randomly dispersed.
Ecology and distribution: Not known.

Family Entomoneidaceae
***Entomoneis gigantea* (Grunow) Nizamuddin (Figure 102)**
Literature: (Grunow 1860, p. 568, pl. 4, fig. 12 as *Amphiprora gigantea*; Nizamuddin 1983, p. 704).
Description: Length 92–110 µm, 15–18 µm, striae 14–18 in 10 µm.
Remarks: Specimens observed in the present study appeared to have slightly denser striae than previously reported from Potter Cove (Al-Handal and Wulff 2008a).
Ecology and distribution: A widely distributed marine benthic species, also reported from sub-Arctic regions (Scholz and Einarsson 2015). Rare in Potter Cove.

***Entomoneis kjellmanii* (Cleve) Poulin *et* Cardinal (Figure 103)**
Literature: (Poulin and Cardinal 1983, p. 114, figs. 23, 24; Witkowski et al. 2000, p. 198, pl. 173, fig. 11).
Description: Length 86–110 µm, width 9–12 µm, striae very fine, difficult to resolve in LM.
Remarks: Valves of the observed specimens had striae much denser than reported for this species (15–16 in 10 µm) and may represent a different variety.

Ecology and distribution: A widely distributed marine bipolar species which may reach high densities among sea-ice species (Trenerry et al. 2001). Rare in Potter Cove.

***Entomoneis paludosa* (W. Smith) Reimer (Figures 104, 117)**

Literature: (Tatenda et al. 2015, p. 12, figs. 21–34; Witkowski et al. 2000, p. 199, pl. 109, figs. 26, 27, pl. 173, fig. 8).

Description: Length 68–91 µm, width 14–18 µm, striae 20–24 in 10 µm.

Remarks: A species with variable valve outline particularly in the shape and angle of the junction (swelling) between valve face and the keel.

Ecology and distribution: This is a widespread brackish-water species, found even in rivers with high salt content. In Potter Cove, it was one of the common species that was found in all samples examined. It has been reported as a sea-ice diatom from the Arctic (Brown et al. 2014).

Family Surirellaceae

***Surirella fastuosa* (Ehrenberg) Ehrenberg (Figure 105)**

Literature: (Hendey 1964, p. 288, pl. 40, fig. 4; Witkowski et al. 2000, p. 414, pl. 215, figs. 1–3).

Description: Length 45 µm, width 25 µm, fibulae three in 10 µm.

Remarks: A single specimen of this species was observed and probably drifted into the region.

Ecology and distribution: A widely distributed marine benthic species in tropical and temperate regions.

***Surirella* sp. (Figure 106)**

Description: Length 68–80 µm, width 20–26 µm (middle part), fibulae three in 10 µm.

Remarks: This species looks very similar to *Surirella seychellarum* Hustedt but differs in that the linear central area is open wide near at its distal endings and not tapered to a narrow end.

Ecology and distribution: Not known.

4 Discussion

Benthic diatom species richness was little changed from 2003 to 2015, but 17 newly observed species updates Potter Cove species richness to 101. The most common species were *Cocconeis imperatrix*, *Entomoneis paludosa*, *Gyrosigma fasciola*, *Gyrosigma obscurum*, *Pleurosigma strigosum*, *Petroneis plagiostoma*, *Navicula directa*, *Navicula perminuta*, *Pinnularia quadratarea*, and *Nitzschia hybrida*. Unlike the previous observations, *Thalassiosira* spp. were poorly represented in the present material most likely due to differences in either the timing of the phytoplankton bloom or our sampling relative the bloom, causing temporal differences of cell deposits from the water column. Interestingly, two of the newly observed species, *Gyrosigma arcuatum* and *Pleurosigma diversestriatum* had not been previously reported from polar regions and *P. diversestriatum* is only reported from tropical regions (Al-Handal and Al-Shaheen 2019; Sterrenburg 2001). The occurrence of rare taxa could be due to the fact that they were recently introduced to the area or merely be a coincidence, i.e., a result of the large diversity of benthic diatoms relative the amount of taxonomic studies in polar areas.

The large, epipelic and cosmopolitan species *G. fasciola* makes up the majority of the biomass of the microphytobenthic community in Potter Cove. In all samples, present and previous, it appeared in high abundance and, in several samples, it constituted ca 90% of the diatom assemblages. *Gyrosigma fasciola* is also known as a benthic and sea-ice associated species in the Arctic (Cardinal et al. 1986; von Quillfeldt 2000), and it is very common on mudflats in Europe (Jahn et al. 2005; Jesus et al. 2009). Moreover, in Antarctica it has been shown that this species can withstand long dark periods and tolerate high irradiances and doses of ultraviolet radiation (Wulff et al. 2008a,b,c). Despite its high abundance in Potter Cove, *G. fasciola* seems to have limited distribution around the Antarctic Peninsula and is missing from most floristic literature on Antarctic diatoms. However, it is easily destroyed during the cleaning process and it could be overlooked if only cleaned samples are studied (e.g., Hoffmann et al. 2019).

In Potter Cove and adjacent areas, subtidal benthic diatoms form coherent brown films that are several millimeters thick on the silty sediment (e.g., Wulff et al. 2008a). The number of species deposited from the water column (pelagic) is small and these generally do not contribute significantly to benthic diatom productivity, although some were found in moderate numbers in our samples. The most abundant of these species were *Porosira glacialis* and *Stellarima microtrias*. These two species are sea-ice forms (Armand et al. 2005) and contribute considerably to phytoplankton production. Although they were not found in our previous survey in Potter Cove, *P. glacialis* is frequently observed in the Arctic and its potential is being explored for mass cultivation with different biotechnical applications (Svenning et al. 2019). Because the study area is located where two creeks discharge, some freshwater diatoms were observed but these were not taken into consideration as they are not part of the normal marine diatom flora. However, with salinity changes due to increasing glacier melting rates, this could change.

The Antarctic Peninsula is one of the areas of Antarctica experiencing the most climate change and increasing sea water temperatures (Lee et al. 2017). It has been suggested that during the late Miocene, when the global temperature was 2–4 °C higher than present, diatom diversity was 20% lower compared to modern values (Lazarus et al. 2014). Melt water and drifting ice from glacier melting can cause substantial damage to pelagic and benthic communities (Peck et al. 2006). It has also been demonstrated that glacial melt may lead to a remarkable shift in the metabolism of the Antarctic microphytobenthos – from net autotrophic to net heterotrophic (Braeckman et al. 2021).

Since our first studies (Al-Handal and Wulff 2008a,b), the major glacier in Potter Cove, the Fourcade Glacier, has retreated further (Rückamp et al. 2011) with consequent changes in turbidity and sedimentation (Deregibus et al. 2016; Pasotti et al. 2015), affecting microbenthic primary production through reduced irradiance (Hoffmann et al. 2019). Although microbenthic primary productivity is most likely decreasing due to glacier retreat (Braeckman et al. 2021), the biodiversity of benthic diatoms is not necessarily decreasing if the available niche space is occupied by species better adapted to ongoing changes such as increased temperatures. One such example could be the presence of *Pleurosigma diversestriatum*, not previously reported from polar regions. We hope that the present species list could add a piece to the puzzle of how climate change affects the benthic diatoms in this vulnerable region and could provide a complement to earlier published species records in the area.

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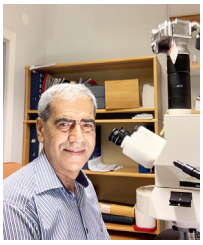

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