Table S1. Locations of sampling sites from which algae were visible to the naked eye in the Wright Valley.

Date sampled	Sample number	S	E	Altitude (m)
22/12/2010	1	77.44523	162.5993	
22/12/2010	2	77.44523	162.5993	
23/12/2010	3	77.46366	162.48057	
23/12/2010	4	77.46716	162.50247	347
24/12/2010	5	77.49956	162.3513	343
24/12/2010	6	77.49956	162.3513	343
26/12/2010	7	77.49924	162.25429	204
26/12/2010	8	77.48121	162.36234	223
28/12/2010	9	77.51749	162.17674	202
28/12/2010	10	77.51749	162.17674	202
29/12/2010	11	77.53067	162.09396	266
29/12/2010	12	77.53246	162.17674	450
29/12/2010	13	77.5324	162.09457	284
31/12/2010	14	77.53463	162.09796	333
31/12/2010	15	77.55161	162.20377	1119
31/12/2010	16	77.55465	162.20247	1247
31/12/2010	17	77.54424	162.20253	
31/12/2010	18	77.5515	162.20299	1100
1/01/2011	19	77.52048	161.7809	138
1/01/2011	20	77.53359	161.80667	268
4/01/2011	21	77.54212	160.7291	927
4/01/2011	22	77.54212	160.7291	927
5/01/2011	23	77.53927	161.3856	113
6/01/2011	24	77.5463	161.52695	186
6/01/2011	25	77.54703	161.52773	189
6/01/2011	26	77.54703	161.52773	189
7/01/2011	27	77.53613	161.11371	153
8/01/2011	28	77.57017	161.36143	325
8/01/2011	29	77.57017	161.3614	325
8/01/2011	30	77.5676	161.38451	321
8/01/2011	31	77.56604	161.41493	334
8/01/2011	32	77.540395	161.39389	81
9/01/2011	33	77.52831	161.48367	198
9/01/2011	34	77.556	161.38148	697
10/01/2011	35	77.55535	160.84259	

Table S2. Pit labels, GPS coordinates and characteristics of the soil-sampling sites used for 454 16S DNA sequencing.

Pit	S	E	Elev_m
GT1000	S77.49565	E162.42313	767 m
GT1001	S77.49558	E162.42395	748 m
GT1002	S77.49547	E162.42524	737 m
GT1003	S77.49547	E162.42529	735 m
GT1004	S77.51265	E162.29685	488 m
GT1005	S77.51386	E162.30012	529 m
GT1100	S77.50273	E162.34950	444 m
GT2005	S77.53561	E162.08934	400 m
GT1007	S77.50679	E162.29707	344 m
GT1008	S77.50107	E162.33220	336 m
GT1009	S77.54137	E161.98405	408 m
GT1010	S77.54258	E161.83408	415 m
GT2006	S77.54136	E161.98404	412 m
GT1013	S77.52650	E162.07935	226 m
GT1014	S77.52006	E162.09115	188 m
GT1015	S77.53343	E162.07617	299 m
GT2002	S77.53330	E162.07567	310 m
GT2003	S77.53393	E162.07541	313 m
GT1054	S77.46413	E162.47303	314 m
GT1055	S77.46410	E162.47388	284 m
GT1052	S77.51408	E162.15828	184 m
GT2015	S77.52049	E162.00170	190 m
GT2016	S77.52132	E161.99729	176 m
GT1072	S77.52410	E162.03304	170 m
GT1073	S77.52392	E162.03425	165 m
GT1074	S77.46598	E162.43290	261 m
GT1075	S77.46691	E162.43188	257 m
GT1076	S77.52448	E162.04099	166 m
GT1077	S77.52379	E162.04418	169 m
GT1078	S77.46600	E162.43915	254 m
GT1079	S77.46660	E162.43647	261 m
GT1068	S77.41887	E162.67579	396 m
GT1069	S77.41813	E162.67318	411 m
GT1070	S77.41886	E162.67578	396 m
GT1071	S77.41661	E162.66796	449 m
GT1056	S77.52089	E161.77651	169 m
GT1057	S77.52089	E161.77651	169 m
GT1058	S77.52089	E161.77651	169 m
GT1059	S77.52089	E161.77651	169 m
GT1064	S77.53921	E161.38527	119 m
GT1065	S77.53923	E161.38495	121 m
GT1066	S77.53938	E161.38551	120 m
GT1067	S77.53963	E161.39484	120 m
GT1084	S77.52565	E161.7887	146 m
GT1085	S77.52706	E161.78676	150 m
GT1086	S77.527	E161.7813	145 m
GT1087	S77.5263	E161.77998	145 m
GT1080	S77.54919	E161.18368	800 m
GT1081	S77.54969	E161.24763	816 m
GT1082	S77.52193	E160.88235	982 m
GT3003	S77.52194	E160.88295	983 m
GT1044	S77.42119	E162.68245	347 m
GT1045	S77.42126	E162.68156	347 m
GT1046	S77.42082	E162.68146	353 m
GT1047	S77.42078	E162.68228	357 m
GT1038	S77.53454	E162.08930	983 m
GT1039	S77.50596	E162.16643	206 m
GT1040	S77.54252	E162.17272	743 m

GT1041	S77.50578	E162.17003	202 m
GT1048	S77.53297	E161.13163	205 m
GT1049	S77.53287	E161.13119	218 m
GT1050	S77.52669	E161.23541	274 m
GT1051	S77.52659	E161.23612	258 m
GT1016	S77.54641	E161.46601	211 m
GT1017	S77.54200	E161.46354	160 m
GT1018	S77.55522	E161.43550	281 m
GT1019	S77.54606	E161.48145	228 m
GT1060	S77.53606	E161.11239	149 m
GT1061	S77.53584	E161.12042	152 m
GT1062	S77.53594	E161.12727	152 m
GT1063	S77.53341	E161.16466	121 m
GT1032	S77.44724	E162.51046	261 m
GT1033	S77.45226	E162.47385	380 m
GT1042	S77.46088	E162.46954	267 m
GT1043	S77.46118	E162.47267	263 m
GT1034	S77.52861	E162.13802	286 m
GT1035	S77.50283	E162.16237	308 m
GT1036	S77.52673	E162.13899	266 m
GT1037	S77.50283	E162.1624	312 m
GT1020	S77.52418	E160.72910	924 m
GT1021	S77.52395	E160.72921	933 m
GT1022	S77.52335	E160.72961	926 m
GT1023	S77.52379	E160.72767	926 m
GT1024	S77.55649	E160.73212	867 m
GT1025	S77.53668	E160.80619	823 m
GT1026	S77.55684	E160.84395	786 m
GT1027	S77.52025	E160.76312	950 m
GT1028	S77.56752	E161.30836	323 m
GT1029	S77.53894	E161.32760	230 m
GT1030	S77.52978	E161.23953	235 m
GT1031	S77.53782	E161.32922	163 m
GT1011	S77.55542	E161.52564	366 m

Supplementary data file 2: detailed taxonomic descriptions and references.

Empire Eukaryota Chatton, 1925

Phylum Chlorophyta A.Pascher, 1914

Class Chlorophyceae Wille in Warming, 1884

Order Chlamydomonadales Fritsch in G.S.West & Fritsch, 1927

Family Chlamydomonadaceae F.Stein, 1878

Genus *Chlamydomonas* Ehrenberg, 1833

***Chlamydomonas* cf. *micropapillata* Moewus, 1931**

Fig. 2a

Reference. Ettl (1983), p. 376.

Description. Unicellular, cells ellipsoidal (rarely pyriform or spherical), 4.1–6.5 µm wide, 6.2–8.1 µm long, each possessing 2 flagella of equal length emerging symmetrically from an indistinct (but possibly bimamellate) apical papilla. Chloroplast green, parietal, plate-like, oriented centrally but to one side of the cell, containing a stigma in medial (less often apical) position and a prominent pyrenoid with segmented starch shell. Nucleus located basally, and 2 contractile vacuoles apically. Reproduction by zoospores. Some evidence of sexual reproduction in culture (cells apparently fused). Cells become rounded and lose flagella on an uncooled microscope stage within a few minutes.

Notes. The lateral form of the chloroplast in this species suggests the section Chlorogoniella in the scheme of Ettl (1983). The combination of basal nucleus and small papilla places the strain in the species *Chlamydomonas micropapillata*. However, the chloroplast in this species as depicted occupies more of the cell than in our strain, which occupies the smallest end of the known size range (up to 7 µm wide, 13 µm long). The identification is therefore tentative. Two species in section Chlorogoniella are known with more reduced chloroplasts, *Chla. oligochloris* Pascher & Jahoda 1928 and *Chla. celerrima* Pascher 1927; however, these species have centrally located nuclei and differing cell shapes. No close relatives were determined by using sequences of the *rbcL* gene (Fig. 3); 18S could possibly be more informative. No molecular data are available for other strains of *Chla. micropapillata*.

Distribution. Found in site 35 (pond, Labyrinth, as a cultured strain).

Global distribution. Chla. micropapillata is recorded from Germany (Ettl 1983) and Britain (Pentecost 2011).

***Chlamydomonas cf. gloeophila* Skuja, 1948**

Fig. 2b–c

Reference. Ettl (1983), p. 364.

Description. Unicellular, young cells ellipsoidal, near-spherical, pyriform, or curved rod-like, 1.9–4.4 µm wide, 4.7–7.7 µm long, each possessing 2 flagella of equal length emerging symmetrically from cell apex; papilla not evident. Chloroplast green, parietal, plate-like, oriented centrally, containing a stigma in medial position and a pyrenoid with indistinct starch shell. Mature cells (akinetes?) becoming pyriform or (more usually) spherical and enlarged, 5.1–7.8(–9.4) µm wide, 5.1–8.1(–9.8) µm long, with pyrenoid distinct and large oil body developing, and with a thicker wall. Reproduction by zoospores.

Notes. The occurrence of dorsiventral asymmetry in young cells combined with a central chloroplast reduces the species assignment of this strain to seven possibilities according to Ettl (1983). Most of these are shaped differently (e.g. curvature at either end of the cell), or a larger size. The remainder, *Chla. gloeophila* Skuja 1948, *Chla. komarekii* Ettl 1976, and *Chla. lunata* Pascher & Jahoda 1928, appear more similar (though all occupy a slightly larger size range). Of these, the first is described as producing profuse akinetes, very similar in appearance and size (to 9 µm in diameter) to those found in our strain. The vegetative cells differ slightly, having a more pointed apex, noticeable papilla, and larger length range in the published description (up to 12 µm long); the identification is therefore tentative. No molecular data are available for other strains of *Chla. gloeophila*. Our strain is a close relative of *Chla. perpusilla* Gerloff 1940. Jungblut *et al*. (2012a) reported an environmental clone 18S sequence in a

similar phylogenetic relationship with *Chla. perpusilla* from a pond on the McMurdo Ice Shelf (GenBank accession JN207861, see their fig. 4) but it is not yet known whether this is the same taxon.

Some thirteen isolates of volvocalean genera have been reported from the Dry Valleys by numerous authors: *Chlamydomonas* sp. from Lake Vanda and *Chla. nivalis* (Bauer) Wille from the Victoria Valley (Holm-Hansen 1964); *Polytomella* sp. from Lake Bonney, *Furcilia lobosa* Stokes from Lake Fryxell, *Brachiomonas submarina* Bohlin f. *obtusa* Hazen from Lake Vanda, *Chloromonas alpina* Wille from Lakes Hoare and Bonney, *Chla. intermedia* Chodat from Lakes Bonney, Fryxell, and Hoare, *Chla. acuta* Korschikoff from Lakes Vanda and Miers and the Victoria Valley, *Chla. globosa* Snow from Lakes Canopus and Hoare, and *Chla. ehrenburgii* Goroschankin from Lakes Brownworth, Fryxell, and Hoare (Seaburg et al. 1979); *Chlamydomonas* sp. (McKnight et al. 2000) and *Chla.* sp. CCMP 1619 (Odom et al. 2004) from Lake Bonney; and *Chla. raudensis* Ettl (syn. *Chla. subcaudata* Wille) from Lake Bonney (Dolhi et al. 2013 and references therein). The latter species has been reported as widespread (Raymond & Morgan-Kiss 2013), although commonly relying on morphological identification, and the strain UWO241 has received considerable attention in physiological studies. Most of these species lack sequence data, A notable exception is *Chla. raudensis*, the *rbcL* sequence of which differs from those of *Chla.* cf. *micropapillata* and *Chla.* cf. *gloeophila* by p-distances of 0.100 and 0.102 respectively; all three species are relatively distant phylogenetically (not shown).

Distribution. Found in sites 24 (Lake Canopus, as cultured strain) and 35 (pond, Labyrinth, as cultured strain). Two clones from site 30 are close genetically to this species (Fig. 3; differing by P-distances of 0.015–0.017 from the cultured strains in the *rbcL* gene) and we assume that these correspond to the same entity (since Taq error associated with cloning could easily explain this difference).

Global distribution. Chla. gloeophila is reported from the Czech Republic and Austria (Ettl 1983), Germany (Täuscher 2013), and Spain (Alvárez Cobelas & Gallardo 1986).

Family Chlorococcaceae Blackman & Tansley, 1902

Genus *Chlorococcum* Meneghini, 1842

***Chlorococcum* sp. 1**

Fig. 2d–f

Reference. Ettl & Gärtner (1995), p. 305; Broady (1979), p. 70.

Description. Unicellular to loosely colonial, with cells resulting from division often remaining attached; young cells spherical to ellipsoidal, mature cells spherical, 10.0–27.4 µm wide, 11.2–27.4 µm long. Chloroplast parietal, cup-shaped but often indistinct due to granular cell contents and red carotenoid pigment, containing 1–3 large distinct pyrenoids with segmented starch sheaths. Contractile vacuoles not observed. Reproduction by autospores, 2–4–8 per sporangium, and by zoospores, 8 per sporangium; zoospores biflagellate, ellipsoidal, 6.8–7.7 µm wide, 8.7–9.7 µm long, with cup-shaped parietal chloroplast in posterior position and containing a lateral stigma and distinct pyrenoid with segmented starch shell.

Notes. The segmented starch shell around the pyrenoid excludes many species in the scheme of Ettl & Gärtner (1995). The apparent absence of contractile vacuoles does likewise, but we have adopted a conservative approach regarding this feature due to the granular cytoplasm, which also makes chloroplast features difficult to observe. Consequently, the size and shape of the different life cycle stages offer the best chance of a successful identification. The species with most similar zoospore and vegetative cell sizes is *Ccm aegyptiacum* Archibald 1979. The incisions in the chloroplast reported for that species are not discernible in our material (but see caveat above). A type culture of this species exists (UTEX LB 2221) but sequence data are unavailable. Nonetheless, this species assignment could in principle be tested. Other *Chlorococcum* species reported from Antarctica are *Ccm. lobatum* (Korschikoff 1926) Fritsch & John 1942, which has narrower zoospores and an absence of ellipsoidal younger cells, and two species from Signy Island (Broady 1979): *Ccm. infusionum* (Schrank 1811) Meneghini 1843 (as *Ccm. humicola* (Nägeli) Rabenhorst 1868), which has a different size range according to the description of the Signy Island material, and *Ccm. ellipsoideum* Deason & Bold 1960, which is close in size and shape (according to Broady (1979), but not to Ettl & Gärtner (1995)) but has a continuous starch shell around the pyrenoid. The reliability of this character is uncertain and it is conceivable that our material is the same entity as that described by Broady (1979), especially since his material lacked contractile vacuoles. Our strain is distant from other strains identified as *Chlorococcum* for which sequence data are available (Fig. 3; short sequences were omitted, but were not close matches in preliminary analyses). In view of all these uncertainties, we have opted against a species epithet for this strain.

Distribution. Found in sites 9 (pond below Bartley Glacier, as cultured strain) and 25 (Lake Canopus, as cultured strain). Unsequenced strains of identical morphology appeared in cultures from sites 1 (stream near Wright Lower Glacier), 3 (soil below Denton Glacier), 4 (stream below Denton Glacier), 19 (Bull Lake inflow), and 26 (a second Lake Canopus sample).

Global distribution. Ccm. aegyptiacum is known previously from field soil in Egypt (Ettl & Gärtner 1995). *Ccm. ellipsoideum* is widely reported, but seems unlikely to represent the same entity throughout. Two sequences referred to *Chlorococcum* spp. were recovered from clone libraries from soil samples collected in the Labyrinth and near the Commonwealth Glacier (Taylor Valley; Fell *et al*. 2006); these were identified using LSU rDNA so it is unknown whether either corresponds to our *Chlorococcum* sp. 1. Holm-Hansen (1964) recorded *Ccm. infusionum* and *Ccm. humicola* in cultures from Lake Vanda and a shallow pond in the Wright Valley, as well as elsewhere in Southern Victoria Land; either of these could correspond to our material, but without molecular data it is difficult to be certain.

Class Trebouxiophyceae Friedl, 1995

Order Chlorellales Bold & M.J.Wynne, 1985

Family Chlorellaceae Brunnthaler, 1913

Genus *Chlorella* Beyerinck, 1890

***Chlorella* cf. *mirabilis* Andreeva 1973**

Fig. 2g–i

Reference. Ettl & Gärtner (1995), p. 406.

Description. Unicellular; young cells roughly tetrahedral with blunt apices following division, quickly becoming spherical, 4.4–5.5 µm in diameter; mature cells growing to 5.1–6.8(–9.4) µm in diameter, often filled with oil bodies/granular content. Chloroplast green, cup-shaped, parietal, containing 1 small pyrenoid with starch shell. Reproduction by autospores, only 2 observed per sporangium, sporangium wall very fine and difficult to observe.

Notes. The shape of young cells in this species is distinctive, and leads to its identification as *Chll. mirabilis.* This species falls outside the Chlorellales (Huss *et al*. 1999) but to our knowledge has not yet been transferred into another genus. An 18S gene sequence is needed to confirm the identification; since such a sequence is available for the type strain, this was attempted. The sequence in GenBank (X74000) contains two introns, and is a possible explanation for our lack of success. The closest known relative of our strain is an unnamed strain of *Chlorella* from the Norwegian Arctic (Fig. 3; Ahn *et al*. 2012), differing by a P-distance of 0.007.

Distribution. This species was found in sites 24 (Lake Canopus, as a cultured strain) and 27 (pond at head of North Fork, as a cultured strain).

Global distribution. The species was originally known from tundra soil in Russia/Ukraine (Ettl & Gärtner 1995). It has also been cultivated from soil on King George Island, Antarctica, and has been considered for industrial processes under low ambient temperature (Shukla *et al*. 2013).

Phylum Ochrophyta Cavalier-Smith in Cavalier-Smiith & E.E.Chao, 1996

Class Xanthophyceae Allorge ex Fritsch, 1935

Order Mischococcales nomen nudum

Family Botrydiopsidaceae nomen nudum

Genus *Pseudopleurochloris* C.Andreoli, I.Moro, N.La Rocca, F.Rigoni, L.Dalla Valle & L.Bargelloni, 1999

***Pseudopleurochloris* sp. 1**

Fig. 2j

Reference. Andreoli *et al*. (1999), p. 157.

Description. Unicellular; young cells spherical to slightly ellipsoidal, 4.7–5.9 µm wide, 4.7–6.8 µm long, with thin walls and 2–3 parietal, plate-like yellow-green plastids and a single nucleus in each cell; mature cells spherical to slightly irregular in shape, 9.8–13.6 µm in diameter, with thick walls and 4–8 parietal, plate-like yellow-green plastids and several (requiring EM to confirm) nuclei in each cell. Strongly ellipsoidal cells (approximately 1.5 times longer than wide) rare in both age groups, occurring as prelude to division. Cytoplasmic contents of all cells granular. Reproduction via autospores, 2–4 per sporangium; zoospores not observed.

Notes. Our strain is very similar to *P. antarctica* Andreoli, Moro, La Rocca, Rigoni, Valle & Bargelloni as judged by features visible under LM and phylogenetically (Fig. 3). However, the species description by Andreoli *et al*. (1999) places much weight on ultrastructural features, which are not yet available for our strain, and the two strains differ by a P-distance of 0.026, so we have opted conservatively not to apply a species epithet. *Pseudopleurochloris antarctica* was established in cultures from a pack ice core in Wood Bay, Antarctica. It is tempting to assume that *P. antarctica* was an airborne contaminant in such a site, but the cell numbers reported by Andreoli *et al*. (1999) in the ice core show that it was surely growing there. Consequently, the ecologies of the two strains also seem to differ.

Distribution. Found in sites 14 and 16 (soil near the Conrow and Bartley glaciers respectively, as cultured strains).

Global distribution. There appears to be only one other record of this genus: that of the type species, established in cultures from pack ice in Wood Bay, coastal Victoria Land, Antarctica.

Genus *Chlorellidium* Vischer, 1936

***Chlorellidium tetrabotrys* Vischer & Pascher, 1937**

Fig. 2k

Reference. Ettl (1978), p. 271.

Description. Colonial, frequently consisting of groups of 10 or more cells resulting from sequential divisions, but also found singly. Young cells spherical to ellipsoidal, 3.4–4.7 µm wide, 3.9–5.1 µm long, containing 1–2 parietal, plate-like, yellow-green plastids. Mature cells spherical to ellipsoidal to hemispherical, depending on origin and position in colony, 5.3–9.1 µm wide, 8.4–10.0 µm long, containing 1–10 parietal, plate-like, yellow-green plastids. Approximately spherical giant cells occasionally produced, up to 17 µm wide, with plastids arranged evenly around the cell perimeter or sometimes towards one side; cytoplasm divided by cytoplasmic strands separating vacuolar space, gradually becoming a single large vacuole. Reproduction by binary fission or zoospore production, 16 per sporangium; zoospores approximately spherical, 4 µm in diameter, containing a single parietal yellow-green plastid and possessing a single flagellum (requires EM to confirm).

Notes. The published description of this species agrees closely with that of our strain, and their *rbcL* sequences are identical (Fig. 3).

Distribution. Found in site 26 (Lake Canopus, as a cultured strain).

Global distribution. Originally cultivated from greenhouses in Switzerland and the Czech Republic, and thought to be an introduced tropical alga (Ettl 1978). Since found elsewhere in Europe including South Tyrol, Dalmatia (Ettl & Gärtner 1995) and Romania (Cărăuş 2012). This appears to be the first record from Antarctica.

Order Tribonematales Pascher, 1939

Family Heteropediaceae Hibberd, 1982

Genus *Heterococcus* Chodat, 1908

***Heterococcus conicus* Pitschmann 1963**

Fig. 2l–m

Reference. Rybalka *et al*. (2013), p. 9.

Description. Colonial, with central masses of semi-adherent spherical or near-spherical cells, 3.9–11.6 µm in diameter, and elongate ellipsoidal to pyriform to club-shaped cells at the margin, some of which form short branching filaments. The larger spherical cells may form chains and irregular clumps. Chloroplasts plate-like, parietal, yellow-green, 1–8 per cell. Reproduction by

binary fission and zoospore production (16 per sporangium); zoospores ellipsoidal, 3.3–3.7 µm wide, 4.1–4.7 µm long, each possessing a single flagellum (requires EM to confirm) and a single parietal yellow-green chloroplast containing an obvious stigma.

Notes. Species of *Heterococcus* are known to be very difficult to identify using morphology. Recently, a taxonomic scheme based on molecular data was established (Rybalka *et al*. 2013) and this is used here. Our strain of *H. conicus* differed by a P-distance of 0.003 in the *rbcL* gene from the designated epitype of the species, and forms a well-supported group with the designated epitype of this species (Fig. 3).

Distribution. Found in sites 7 (stream opposite Meserve Glacier, as cultured strain) and 10 (pond below Bartley Glacier, as cultured strain).

Global distribution. This is extremely difficult to evaluate, given the inaccuracy associated with morphological identification. Molecular data show, however, that this species occurs elsewhere in Antarctica and in Germany (although the precise locations have proven difficult to establish from the information obtainable).

Heterococcus leptosiroides **Pitschmann 1963**

Fig. 2n–o

Reference. Rybalka *et al*. (2013), p. 9.

Description. Colonial, cells arranged in sarcinoidal packets, but frequently released as single spherical to ellipsoidal cells, 5.9–6.9 µm wide, 5.9–7.5 µm long; adherent cells up to 10 µm in diameter. Larger cells form chains and clumps, and smaller cells may develop into short branching filaments. Chloroplasts plate-like, parietal, yellow-green, 1–10 per cell, often containing obvious stigma. Reproduction by binary fission and zoospore production (sporangia not observed); zoospores spherical, approximately 5 µm in diameter, each possessing a single flagellum (requires EM to confirm) and a single parietal yellow-green chloroplast containing an obvious stigma.

Notes. The same morphological difficulties apply as for *H. conicus*. Identification is based on molecular data. Our strain of *H. leptosiroides* differed by a P-distance of 0.002 in the *rbcL* gene from the designated epitype of the species (Fig. 3; Rybalka *et al*. 2013).

Distribution. Found in site 29 (sublithic soil near pond in South Fork, as cultured strain).

Global distribution. As for *H. conicus*, this is difficult to determine. Molecular data indicate that the only sequenced strains are derived from Antarctica to date, although as for *H. conicus* the collection localities are difficult to determine for these strains.

Empire Prokaryota Allsop, 1969

Phylum Cyanobacteria Stanier ex Cavalier-Smith, 2002

Class Cyanophyceae Schaffner, 1909

Order Oscillatoriales Cavalier-Smith, 2002

Family Microcoleaceae Strunecký, Johansen & Komárek, 2013

Genus *Microcoleus* Desmazières ex Gomont, 1892

Microcoleus vaginatus **(Vaucher) Gomont, 1892**

Fig. 4a–l

Reference. Komárek & Anagnostidis (2005), p. 473.

Description. Filaments straight to slightly curved, tapered from the terminal 3–10 cells, hemispherical to slightly conical calyptrae present. Solitary or tangled in groups, sheath fine, each containing 1 filament. Motile by gliding. Trichome division by necridic cells. Older filaments may be slightly doliiform, but generally not constricted at cross walls, at which granular deposits are common; cells isodiametric to shorter than wide (rarely longer), 5.9–7.2 µm wide, (2.5–)5.0–7.2(–8.4) µm long. Thylakoids visibly peripheral in LM. Light green, grey, pale blue-green, or pale purple.

Notes. Morphology and molecular data place this strain in the widely distributed and well-known species *Phormidium autumnale* Trevisan ex Gomont, which has recently been transferred to *Microcoleus* (Strunecký *et al*. 2013). A traditional diacritical character defining *Microcoleus* was the presence of multiple trichomes in a single sheath, which has not been observed in our strains; however, this feature is now known to be facultative and not known in all strains (Strunecký *et al*. 2013). Although not resolved by 16S sequence data, the lengths of the IGS region in the cultured strains and clones suggest that at least four subgroups may be present in the valley (Fig. 5). However, these subgroups do not correspond to habitat type.

Distribution. Found in sites 2 (soil near the Wright Lower Glacier, as clones), 3 (stream near the Wright Lower Glacier, as a cultured strain), 4 (stream below Denton Glacier, as clones), 9 (pond below Bartley Glacier, as clones), 10 (pond below Bartley Glacier, as cultured strain), 11 (soil below Conrow Glacier, as clones and a cultured strain), 12 (soil near Bartley Glacier, as clones), 24 (Lake Canopus, as clones), 28 (pond, head of North Fork, as clones), 29 (sublithic soil near pond in South Fork, as clones), and 30 (pond in South Fork, as cultured strain).

Global distribution. The species is regarded as cosmopolitan (Komárek & Anagnostidis 2005).

Order Pseudanabaenales nomen nudum

Family Pseudanabaenaceae Anagnostidis & Komárek, 1988

Genus *Leptolyngbya* Anagnostidis & Komárek, 1988

***Leptolyngbya* cf. *foveolarum* (Rabenhorst ex Gomont) Anagnostidis & Komárek 1988**

Fig. 4m–q

Reference. Komárek & Anagnostidis (2005), p. 188.

Description. Filaments straight to arcuate, non-tapered, with rounded terminal cells lacking calyptrae; may be solitary but frequently coiled or twisted into clusters. Sheath fine, may be difficult to observe except in gaps between cells within the trichome, each containing one filament. Trichome division by necridic cells. Cells constricted at cross walls, appearing short and slightly rounded, isodiametric to shorter than wide, 1.2–2.4 µm wide, 1.2–1.8 µm long; thylakoids visibly peripheral in LM. Pale blue-green to greyish.

Notes. The taxonomic scheme of Komárek & Anagnostidis (2005) presents three possibilities: *L. foveolarum*, which is a close match morphologically, *L. tenerrima* (Kützing ex Hansgirg) Komárek 2001, which has narrowed terminal cells and a slightly larger size range, and is best known among submerged vegetation with copious organic matter, or *L. boryana* Anagnostidis & Komárek 1988, which is wider (always >2 µm wide). However, the 16S gene of *L. foveolarum* strain Komarek 1964/112 differs significantly from that of our strain, and strains assigned to this morphotype are widely dispersed across the phylogeny (Fig. 6). Molecular data place three strains of *L. antarctica* as closest to our material, but this species is reported by Komárek & Anagnostidis (2005) and Komárek (2007) as being only 0.5(–1) µm wide. Furthermore, sequences of *L. antarctica* available in GenBank do not form a monophyletic group, and strain ANT.LAC.V6 from the Vestfold Hills, which is close to our strain genetically, appears to have a quite different morphology (Taton *et al*. 2006). More recently described candidate species from Antarctica, *L. fritschiana* Komárek 2007 and *L. borchgrevinkii* Komárek 2007, differ in terminal cell morphology, colour, ecology, and lack constrictions at cross walls. A strain named by Fernandez-Carazo *et al*. (2011) as *L.* cf. *foveolarum* closely resembles our strain, but is distant from it genetically (Fig. 6).

Distribution. Found at site 27 (pond at head of North Fork, as cultured strain). Three clones from site 14 (soil below the Conrow Glacier) are close genetically, differing by a P-distance of 0.002–0.004 from the cultured strain. Whether all of these represent the same entity is questionable, given that the strains of *L. antarctica* mentioned above differ by only 0.004, and at least one of these is known to differ morphologically. The spacer region is of variable length in the clones from site 14, but in one (KM052835) it is identical to that of the cultured strain; we have therefore concluded that these represent the same entity.

Global distribution. The species *L. foveolarum* has been recorded worldwide (Komárek & Anagnostidis 2005), including from Antarctica (Fernandez-Carazo *et al*. 2011). However, this biogeography is subject to the concerns mentioned above. Environmental clone data indicate close relatives elsewhere in Antarctica, as well as in the Netherlands and Mexico.

***Leptolyngbya* sp. 1**

Fig. 4r–t

Reference. Komárek & Anagnostidis (2005), p. 206; Perkerson *et al*. (2011), p. 1406.

Description. Filaments straight to arcuate, non-tapered, with rounded terminal cells lacking calyptrae; solitary or grouped, but not usually coiled or twisted; sheath fine, may be difficult to observe except in gaps between cells within the trichome, each containing 1 filament. Trichome division by fragmentation. Cells constricted at cross walls, appearing block-like with blunt corners, (rarely) shorter than wide to isodiametric to longer than wide, 1.2–1.6 µm wide, 1.5–2.5 µm long; thylakoids visibly peripheral in LM. Pale blue-green.

Notes. Morphologically, the species *Nodosilinea bijugata* (Kongisser) Perkerson & Kovácik is a good match for our strain (Komárek & Anagnostidis 2005, Perkerson *et al*. 2011). However, molecular data available for the genus *Nodosilinea* show our material to be phylogenetically distant (Fig. 6). No close relatives of our strain were identified in GenBank. Given this situation we have opted not to select a specific epithet until more data become available.

Distribution. Found at site 25 (Lake Canopus, as cultured strain).

Global distribution. Unknown.

Genus *Pseudanabaena* Lauterborn, 1915

***Pseudanabaena* cf. *amphigranulata* (Van Goor) Anagnostidis, 2001**

Fig. 4u–w

Reference. Komárek & Anagnostidis (2005), p. 86.

Description. Filaments straight to arcuate, non-tapered, with rounded terminal cells lacking calyptrae; solitary or grouped, but not usually coiled or twisted; sheath apparently absent, cells instead surrounded by a thin mucilage film. Trichome division by fragmentation. Cells slightly constricted at cross walls, isodiametric to longer than wide, 1.2–1.9 µm wide, 1.5–2.5 µm long, usually with aerotopes at the cell poles; thylakoids visibly peripheral in LM. Pale blue-green.

Notes. The aerotopes at cell poles, which may be difficult to observe, place the strain in the genus *Pseudanabaena* according to the scheme of Komárek & Anagnostidis (2005). The published description of *P. amphigranulata* corresponds strongly to our strain, which occupies the smallest end of the range in length and width of cells of the sizes described (up to 2.2 µm wide and 5(–7) µm long). No other sequence data for this species are available.

Distribution. Found at sites 27 (pond, head of North Fork, as clones), 28 (pond, South Fork, as clones), and 35 (pond, Labyrinth, as cultured strain).

Global distribution. Known reliably from eutrophic ponds with muddy benthos in the Netherlands, but regarded as possibly more widespread throughout the world (Komárek & Anagnostidis 2005). Molecular data indicate close relatives elsewhere in Antarctica, as well as from alpine sites in Spain and China. This is the first occasion that a strain referable to this material has appeared in culture.

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