A PRELIMINARY SURVEY OF THE TERRESTRIAL ALGAE OF THE ANTARCTIC PENINSULA AND SOUTH GEORGIA

By P. A. BROADY

ABSTRACT. A total of 70 taxa of algae from 47 genera were found in 37 soil and vegetation samples from South Georgia and ten localities along the Antarctic Peninsula. Descriptions of the sample sites and the distribution of each alga are given. Four genera were not found previously in an intensive study at Signy Island, South Orkney Islands. 16 species not found in the latter study are illustrated and described in detail. It is concluded that before meaningful comparisons can be made between localities in the Scotia arc–Antarctic Peninsula region more thorough studies must be conducted.

THIS paper describes algae found in 37 soil and vegetation samples from the Antarctic Peninsula (sampled by I. B. Collinge), Alexander Island (sampled by R. B. Heywood and J. J. Light) and South Georgia (sampled by the author). The samples were collected in February–April 1974 and examined between December 1975 and May 1976 after a period of deep-frozen storage (*c.* —20° C). The aim of the study was to make a preliminary taxonomic survey of the terrestrial algae from the above localities for comparison with the more completely surveyed Signy Island, South Orkney Islands (Broady, 1976, 1977*a*, *b*, 1979*a*, *b*, *c*). The samples were not examined as thoroughly as those used in the Signy Island study and several algae were identified only to the genus, but most of these are illustrated.

Few studies have been made of the terrestrial algal flora of the Antarctic. A survey of the early literature on fresh-water algae, including some terrestrial collections, has been given by Hirano (1965). Bunt (1954) described the terrestrial diatoms of Macquarie Island and also gave a short review of similar studies in the Antarctic. Broady (1979*c*) has reviewed terrestrial algal studies in Antarctica.

SAMPLE SITES

The 11 localities from which samples were collected are shown in Fig. 1. These localities are listed below in order of increasing latitude. Unfortunately, it was not possible to collect detailed information regarding the sample sites.

South Georgia (*lat. 54° 16′ S., long. 36° 30′ W.*)

All three samples were taken near the British Antarctic Survey station at King Edward Point.

1. Turf of *Polytrichum alpestre* Hoppe and *Chorisodontium aciphyllum* (Hook. f. et Wils.) Broth., flanked by tussock grass (*Poa flabellata* (Lam.) Hook, f.) and *Festuca erecta* D'Urv. grassland.
2. *Festuca erecta* grassland; the sample included dead material, litter and the underlying relatively dry soil.
3. *Poa flabellata* in elephant seal (*Mirounga leonina* (L.)) wallow area; the sample was taken from the base of the pedestals.

King George Island (*lat. 62° S., long. 58° W.*)

4. Fildes Peninsula, near beach opposite Ardley Island; freely to imperfectly drained carpet of *Drepanocladus uncinatus* (Hedw.) Warnst.
5. Location as for sample 4; *Prasiola crispa* (Lightf.) Menegh. and underlying soil; close to the nest of a giant petrel (*Macronectes giganteus* Gmelin).
6. Location as for sample 4; *Polytrichum alpinum* Hedw. and *Drepanocladus uncinatus*; not an extensive stand.

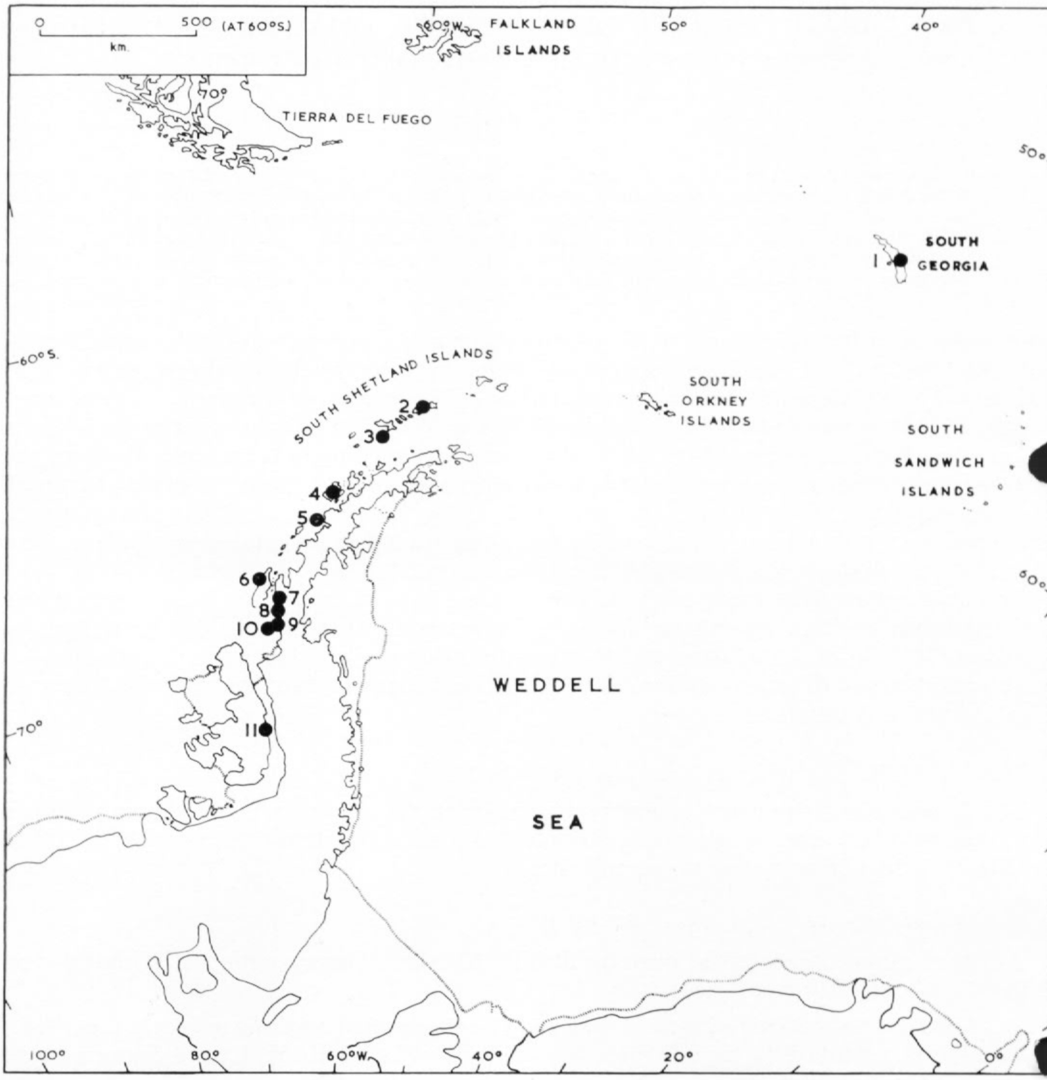

Fig. 1. The Antarctic Peninsula and Scotia arc regions showing the sampling localities. 1. South Georgia; 2. King George Island; 3. Deception Island; 4. Anvers Island; 5. Argentine Islands; 6. Blaiklock Island; 7. Adelaide Island; 8. Horseshoe Island; 9. Stonington Island; 10. Neny Island; 11. Alexander Island.

Deception Island (*lat. 62° 59′ S., long. 60° 34′ W.*)

7. *Prasiola crispa* and underlying soil with guano from Dominican gulls (*Larus dominicanus* Lichenstein).

Anvers Island (*lat. 64° 45′ S., long. 64° 05′ W.*)

8. Lichfield Island near Arthur Harbour; *Polytrichum alpestre* and *Chorisodontium aciphyllum* turf with associated encrusting white lichen.

9. Location as for sample 8; a wet saturated carpet of *Calliergon sarmentosum* (Wahlenb.) Kindb.
10. Torgerson Island, Arthur Harbour; small patches of *Deschampsia antarctica* Desv. associated with *Prasiola crispa*; penguin rookery about 20 m. away.

Argentine Islands (lat. 65° 15′ S., long. 64° 16′ W.)

11. Galindez Island; *Polytrichum alpestre* turf; below cloud searchlight near the British Antarctic Survey station.
12. Location as sample 11; poorly drained wet carpet of *Calliergon sarmentosum.*
13. Location as sample 11; *Deschampsia antarctica* on top of a small sea cliff; guano deposited by *Larus dominicanus* on surface.

Blaiklock Island (lat. 67° 41′ S., long. 69° 10′ W.)

14. *Deschampsia antarctica* near uninhabited hut.
15. Unidentified moss in small stands near uninhabited hut.

Adelaide Island (lat. 67° 46′ S., long. 68° 54′ W.)

16. Avian Island; *Prasiola crispa* and underlying soil near the edge of a penguin colony.
17. Location as sample 16; restricted wet carpets of *Drepanocladus uncinatus* on rock ledges and in crevices in rocks; near penguin rookery.
18. Location as sample 16; unidentified wet moss on flat area near small pond.
19. Rothera Point; wet carpet of *Drepanocladus uncinatus.*
20. Lagoon Island; *Deschampsia antarctica* in rock cleft.

Horseshoe Island (lat. 67° 50′ S., long. 67° 10 ′ W.)

21. Mineral soil without macroscopic vegetation cover from north-facing shore of lake near Sally Cove.
22. Unidentified moss in rock clefts on knoll overlooking Sally Cove.

Stonington Island (lat. 68° 11′ S., long 67° 00′ W.)

23. *Prasiola crispa* in rock crevices near the British Antarctic Survey station; organic contamination from seal meat.

Neny Island (lat. 68° 12′ S., long. 67° 02′ W.)

24. *Colobanthus quitensis* (Kunth) Bartl. on rocky knoll with a colony of Dominican gulls; well drained.
25. Location as sample 24; *Prasiola crispa* and underlying soil.
26. Location as sample 24; unidentified moss.

Alexander Island (lat. 70° 50′ S., long. 68° 30′ W.)

All the samples were collected at Ablation Point near the camp site occupied by R. B. Heywood and J. J. Light in February 1974.

27. Moss from the edge of a small wet stand; no surface water but water present in the base of the core hole.
28. Unidentified moss close to sample 27.
29. Damp scattered patches of unidentified moss.
30. Unidentified moss, dry on surface but damp below.
31. Unidentified moss as sample 30.
32. Salt-encrusted lichen on a gravel substrate.

33. Mineral soil without macroscopic vegetation cover; damp.
34. Mineral soil similar to 33 but with a dry surface.
35. Mineral soil similar to 33 below moss samples 29, 30 and 31.
36. Mineral soil similar to 33; very wet with water filling the core hole.
37. Mineral soil similar to 33; dry surface but damp below.

Methods

Precautions were taken to avoid contamination of samples both in the field and during storage and transport. Knives and corers were heat- or alcohol-sterilized before sampling. Sample cores were stored and transported in sterile aluminium canisters. Samples were stored frozen at *c.* −20° C until 1 December 1975.

Two methods were used to stimulate algal growth in the samples:

i. Moist plate enrichment culture.
ii. Culture in mineral salts medium solidified with 2 per cent agar.

Both methods have been described by Broady (1979*c*). The mineral salts nutrient medium (Bold's basal medium; Chantanachat and Bold, 1962) was supplemented with 1·5 per cent of a garden soil extract for the supply of vitamins and micro-nutrients. Algae which developed were examined microscopically at magnifications up to 1,000 diameters.

The excellent volumes by Bourrelly (1966, 1968, 1970) were used for the identification of algae to generic level. Literature used for identification to species has been given by Broady (1979*c*). The algae recovered from the samples in this preliminary study, but which were not found in the Signy Island samples, still require isolation and complete study in unialgal cultures. This is necessary for final identification of many microscopic algae (Bold, 1970). Other algae, for which more accurate identifications have been made, have been described by Broady (1979*c*).

Algae Recovered

The following is a list of the algal genera identified from the South Georgia and Antarctic Peninsula samples:

Phylum Schizophyta
- Class Cyanophyceae
  - Order Chroococcales
    - *Aphanocapsa* (1 sp.)
    - *Chroococcus* (1 sp.)
    - *Gloeocapsa* (1 sp.)
    - *Synechococcus* (1 sp.)
  - Order Nostocales
    - *Anabaena* (1 sp.)
    - *Calothrix* (1 sp.)
    - *Lyngbya* (more than 2 spp.)
    - *Nodularia* (1 sp.)
    - *Nostoc* (more than 1 sp.)
    - *Oscillatoria* (more than 2 spp.)
    - *Phormidium* (5 spp.)
    - *Plectonema* (2 spp.)
    - *Pseudanabaena* (1 sp.)
    - *Schizothrix* (4 spp.)
    - *Tolypothrix* (1 sp.)

PHYLUM PYRRHOPHYTA
CLASS DINOPHYCEAE
Order Dinococcales
Gloeodinium (1 sp.)

PHYLUM CHROMOPHYTA
CLASS XANTHOPHYCEAE
Order Mischococcales
Botrydiopsis (2 spp.)
Chloridella (2 spp.)
Chlorocloster (1 sp.)
Ellipsoidion (1 sp.)
Gloeobotrys (2 spp.)
Monodus (1 sp.)
Order Tribonematales
Heterococcus (1 sp.)
Heterothrix (2 spp.)

CLASS BACILLARIOPHYCEAE
Order Eunotiales
Eunotia (1 sp.)
Order Naviculales
Hantzschia (1 sp.)
Navicula (undetermined number of spp.)
Pinnularia (1 sp.)
Unidentified diatoms (undetermined number of spp.)

PHYLUM CHLOROPHYTA
CLASS EUCHLOROPHYCEAE
Order Volvocales
Chlamydomonas (3 spp.)
Chloromonas (1 sp.)
Order Tetrasporales
Chlamydocapsa (2 spp.)
Signiosphaera (1 sp.)
Order Chlorococcales
Chlorella (3 spp.)
(?) *Chlorococcum* (1 sp.)
(?) *Muriella* (2 spp.)
Myrmecia (1 sp.)
Sphaerocystis (1 sp.)
(?) *Spongiochloris* (1 sp.)
Trebouxia (1 sp.)

CLASS ULOTHRICOPHYCEAE
Order Ulothricales
Chlorhormidium (2 spp.)
Raphidonemopsis (1 sp.)
Stichococcus (1 sp.)
Order Ulvales
Prasiola (1 sp.)

Order Chaetophorales

Chlorosarcinopsis (1 sp.)
Desmococcus (1 sp.)
Gongrosira (1 sp.)

Class Zygophyceae

Order Zygnematales

Cylindrocystis (1 sp.)

In the following account the algae are referred to in the above sequence. The sample(s) in which each was found are given by the sample numbers (S: alga found in the Signy Island terrestrial flora). For those algae not previously described by Broady (1979*c*), a description and drawings are provided.

Phylum Schizophyta

Class Cyanophyceae

Order Chroococcales

Aphanocapsa grevillei (Hass.) Rabenh. (S, 29)
Chroococcus minutus (Kuetz.) Naeg. (S, 28, 30)
(?) *Gloeocapsa* sp. (29)
Synechococcus maior Schroet. (S, 26, 32)

Order Nostocales

Anabaena sp. (21, 29, 35, 36)

Fig. 2a–f

Trichomes blue-green, straight or flexuous or sometimes greatly twisted (Fig. 2f), generally sheathless (Fig. 2*a*) but occasionally sheath present (Fig. 2b and e), 3–4 μm. wide, constricted at transverse walls; cells mostly shorter than wide, 1–3 μm. long; heterocysts frequent, often at regular intervals along trichomes, frequently terminal (Fig. 2a), rarely two adjacent (Fig. 2c); rarely trichomes terminating with a slightly conical vegetative cell (Fig. 2d); akinetes rare (Fig. 2e), smooth walled, ellipsoidal, 6 μm. by 3·5 μm.

Close to *A. variabilis* Kuetz. except for the generally larger cell size of that alga.

Calothrix sp. (28, 29, 31)

Fig. 3a–c

Trichomes blue-green, straight or flexuous, up to 1·5 mm. long, 7–11 μm. wide at base, constricted at transverse walls, tapering to 1·5–3·0 μm. wide at apex, with basal heterocyst; sheath generally thin, hyaline or light brown, occasionally stratified at base (Fig. 3c); cells shorter than wide at base, at apex 10–22 μm. long, often colourless.

Close to *C. braunii* Born. et Flah. The cells are somewhat narrower (6–7 μm.) in that species.

Lyngbya limnetica Lemm. (S, 29, 30, 31, 32)
Lyngbya perelegans Lemm. (S, 26, 31, 34)
Lyngbya spp. (S, 6, 22, 28, 35)

Nodularia sp. (28, 30)

Fig. 4a and b

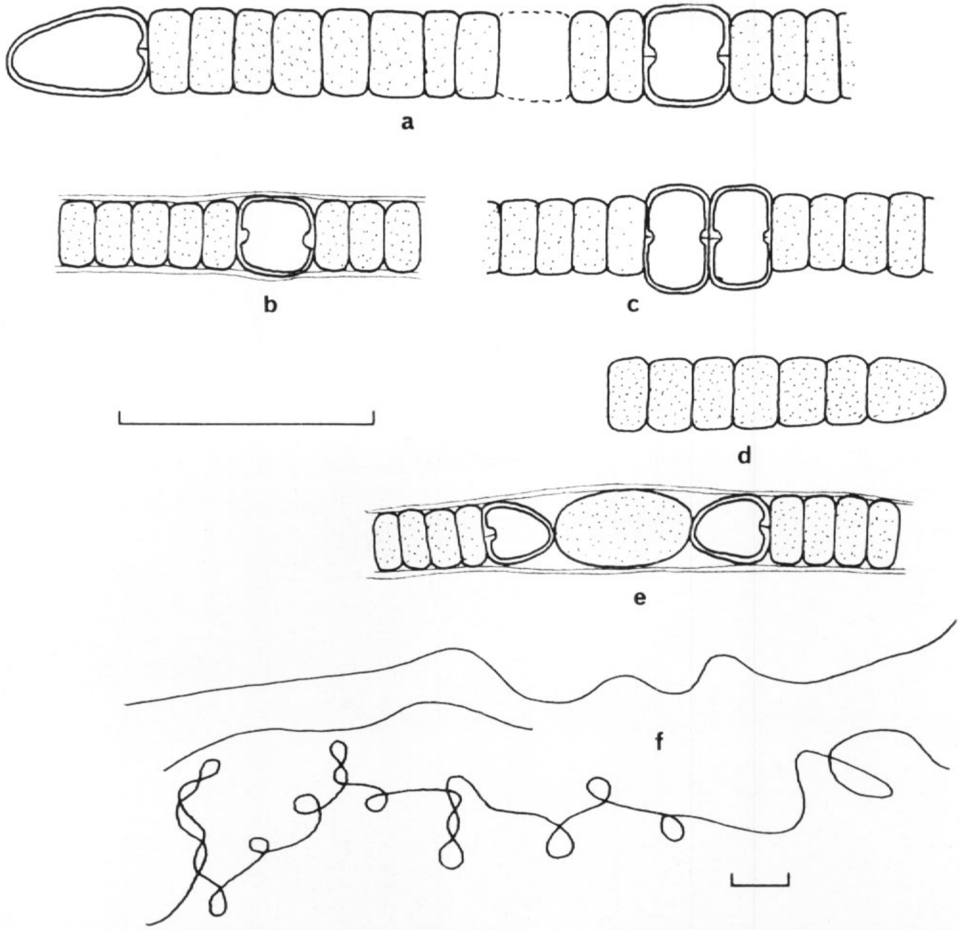

Fig. 2. a–f. *Anabaena* sp. The upper scale is 10 μm. and refers to a–e; the lower scale is 100 μm. and refers to f.

Trichomes blue-green, straight or flexuous, 3–4 μm. wide; cells generally as long as wide, 2·5–4·0 μm. long; sheath hyaline, up to 4 μm. thick; heterocysts intercalary, rectangular, [illegible]–7·5 μm. long by 5–6 μm. wide; single trichome usually contained in each sheath (Fig. 4a) sometimes two or three trichomes in same sheath possible due to coalescing of separate sheaths but branching of these not observed (Fig. 4b).

Nostoc sp. (4, 13, 19, 28, 29)

Fig. 5a–d

Thalli microscopic (Fig. 5b and c); trichomes blue-green, twisted, 5–6 μm. wide, contained within brown gelatinous sheath; cells barrel-shaped, 5–6 μm. long, with granular contents; heterocysts almost spherical (Fig. 5a and d), 7·5 μm. in diameter, often no gelatinous material around heterocysts (Fig. 5d); faint markings around gelatinous sheath at position of each transverse wall (Fig. 5a and d).

Culture work needs to be performed, e.g. Kantz and Bold (1969), and akinete formation observed before this alga can be identified with confidence.

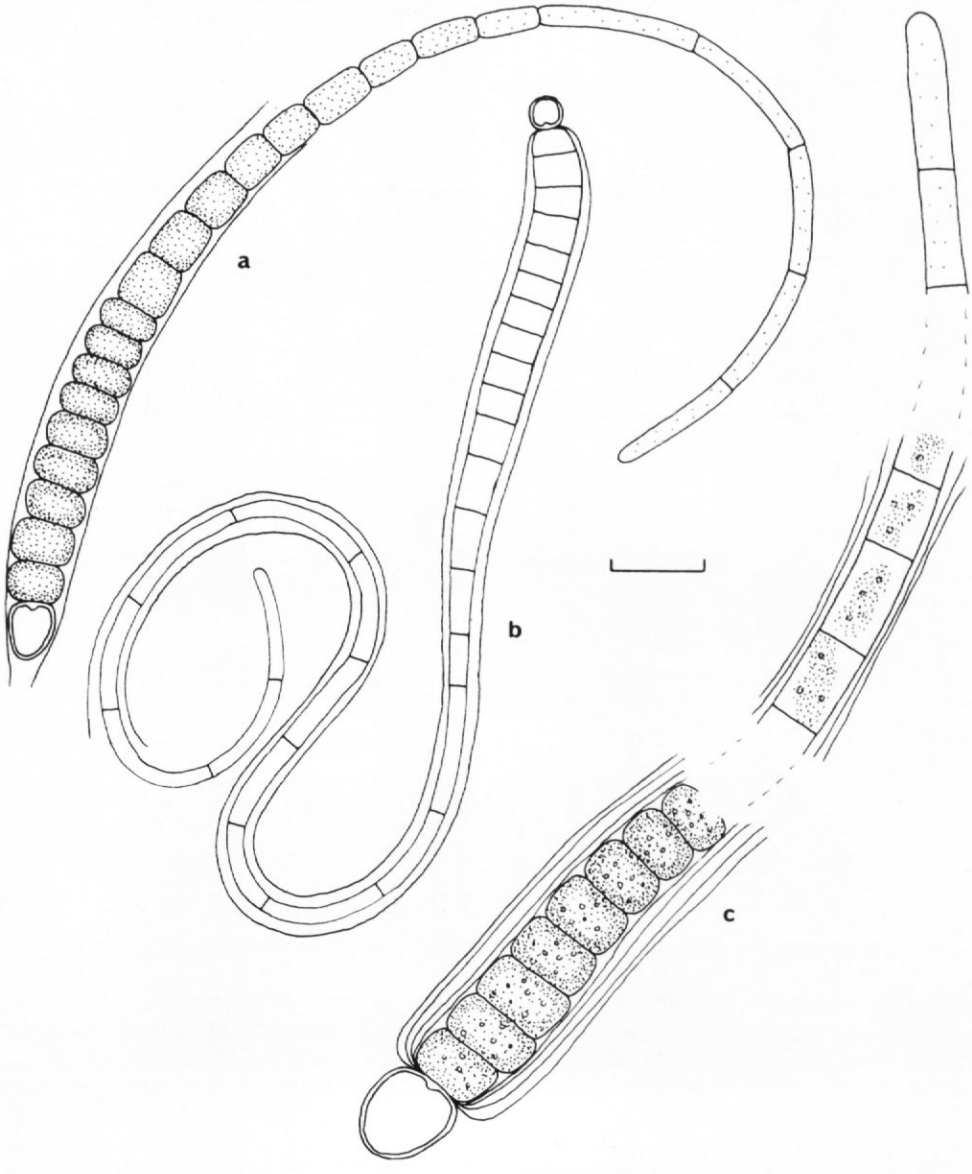

Fig. 3. a–c. *Calothrix* sp. The scale is 10 μm.

Nostoc spp. (S, 13, 22, 26, 29, 30, 31, 32, 35)

These algae must be isolated and examined in unialgal cultures before they can be assigned to a species.

Oscillatoria amoena Gom. (S, 13, 21, 24, 35)
Oscillatoria spp. (S, 13, 21, 24, 35)
Phormidium autumnale (Ag.) Gom. (S, 5, 7, 10, 13, 14, 18, 22, 24, 25, 26)

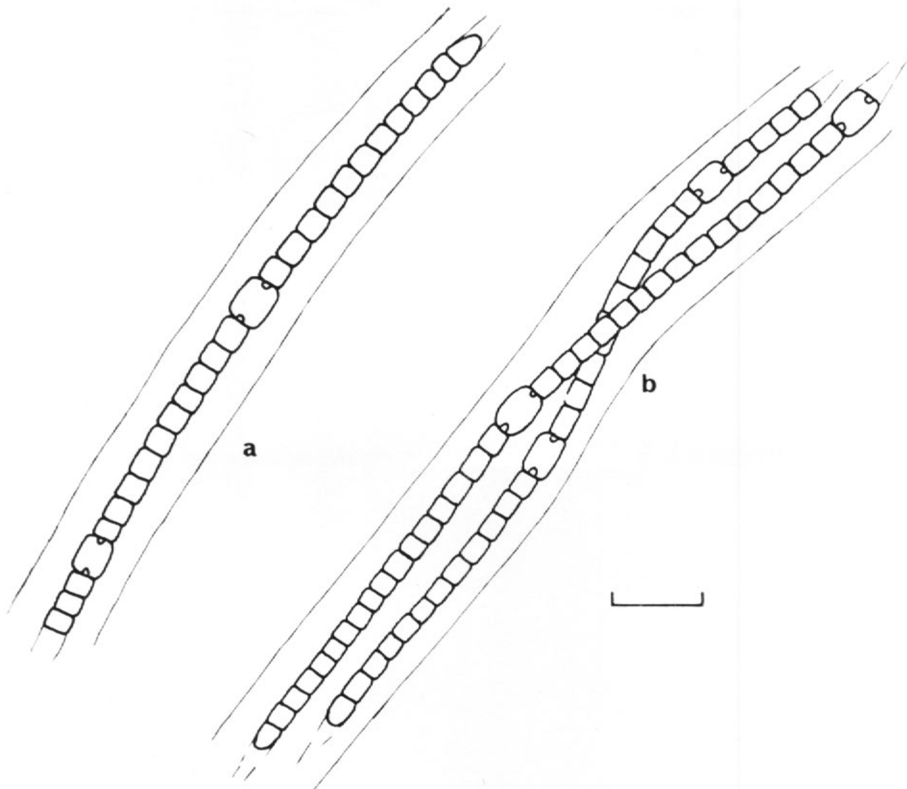

Fig. 4. a and b. *Nodularia* sp. The scale is 10 μm.

Phormidium foveolarum Gom. (S, 13, 33)
Phormidium frigidum Fritsch (S, 21)
Phormidium priestleyi Fritsch (S, 22, 23, 24, 25, 26)
Phormidium rubroterricola Gardner (S, 10, 14, 18, 21, 23, 24, 25)
Plectonema notatum Schmidle (S, 35)
Plectonema sp. (22)
Pseudanabaena catenata Lauterb. (S, 31)
Schizothrix fragilis (Kuetz.) Gom. (S, 21, 35)

Schizothrix sp. I (22)

Fig. 6a–e

Trichomes pale blue-green, narrow, 1–1·5 μm. wide, mostly straight or flexuous, occasionally more contorted (Fig. 6e), not constricted at transverse walls, single or up to four per sheath (Fig. 6a–d); cells 3–6 μm. long, terminal cell without calyptra, rounded, not attenuated; sheath thin, hyaline.

Similar to *Schizothrix* sp. A described from Signy Island (Broady, 1979*c*) but with narrower trichomes and trichomes not so contorted.

Schizothrix sp. II (4)

Fig. 7a–d

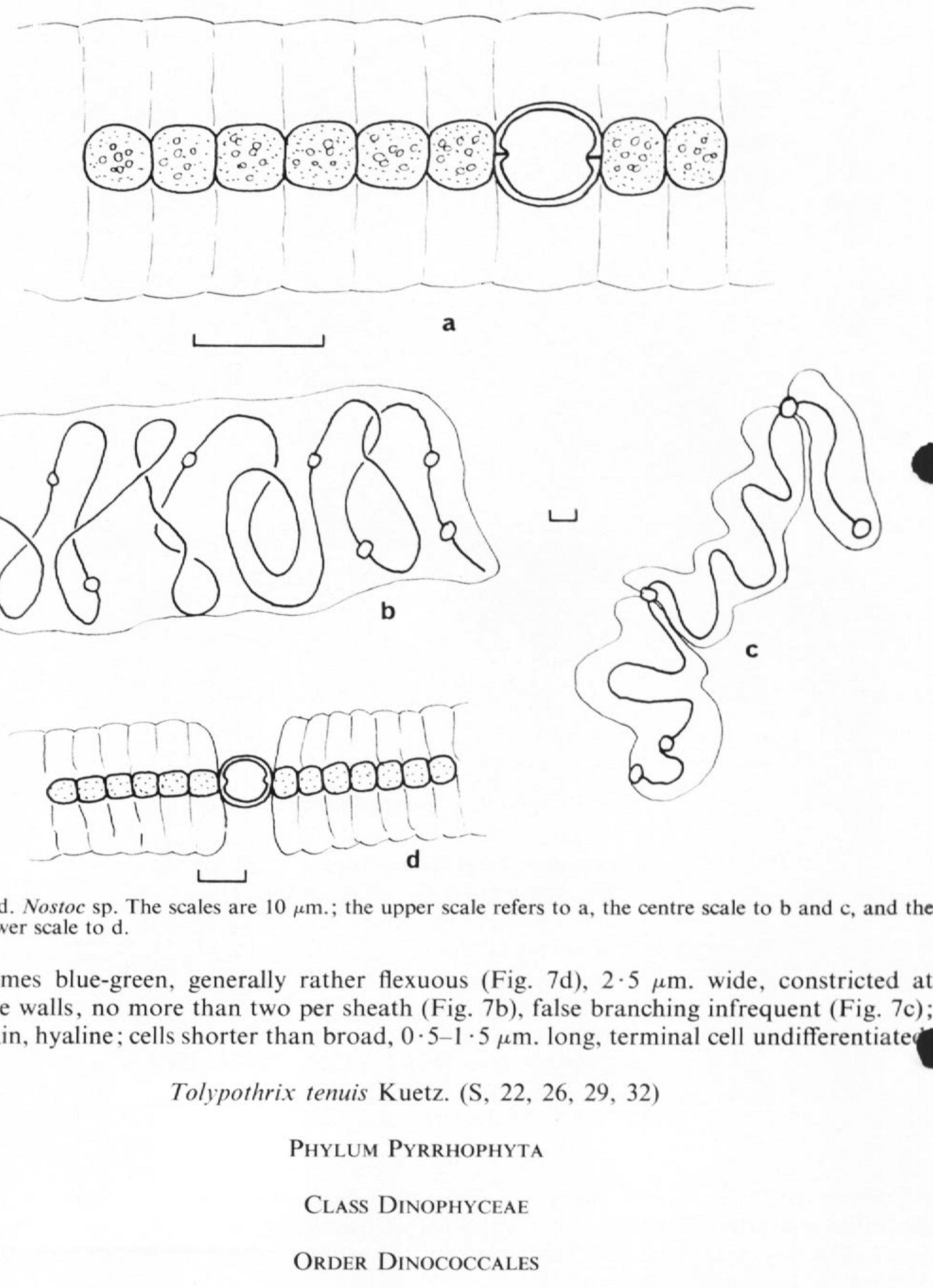

Fig. 5. a–d. *Nostoc* sp. The scales are 10 μm.; the upper scale refers to a, the centre scale to b and c, and the lower scale to d.

Trichomes blue-green, generally rather flexuous (Fig. 7d), 2·5 μm. wide, constricted at transverse walls, no more than two per sheath (Fig. 7b), false branching infrequent (Fig. 7c); sheath thin, hyaline; cells shorter than broad, 0·5–1·5 μm. long, terminal cell undifferentiated.

Tolypothrix tenuis Kuetz. (S, 22, 26, 29, 32)

PHYLUM PYRRHOPHYTA

CLASS DINOPHYCEAE

ORDER DINOCOCCALES

Gloeodinium montanum Klebs (S, 29, 31)

PHYLUM CHROMOPHYTA

CLASS XANTHOPHYCEAE

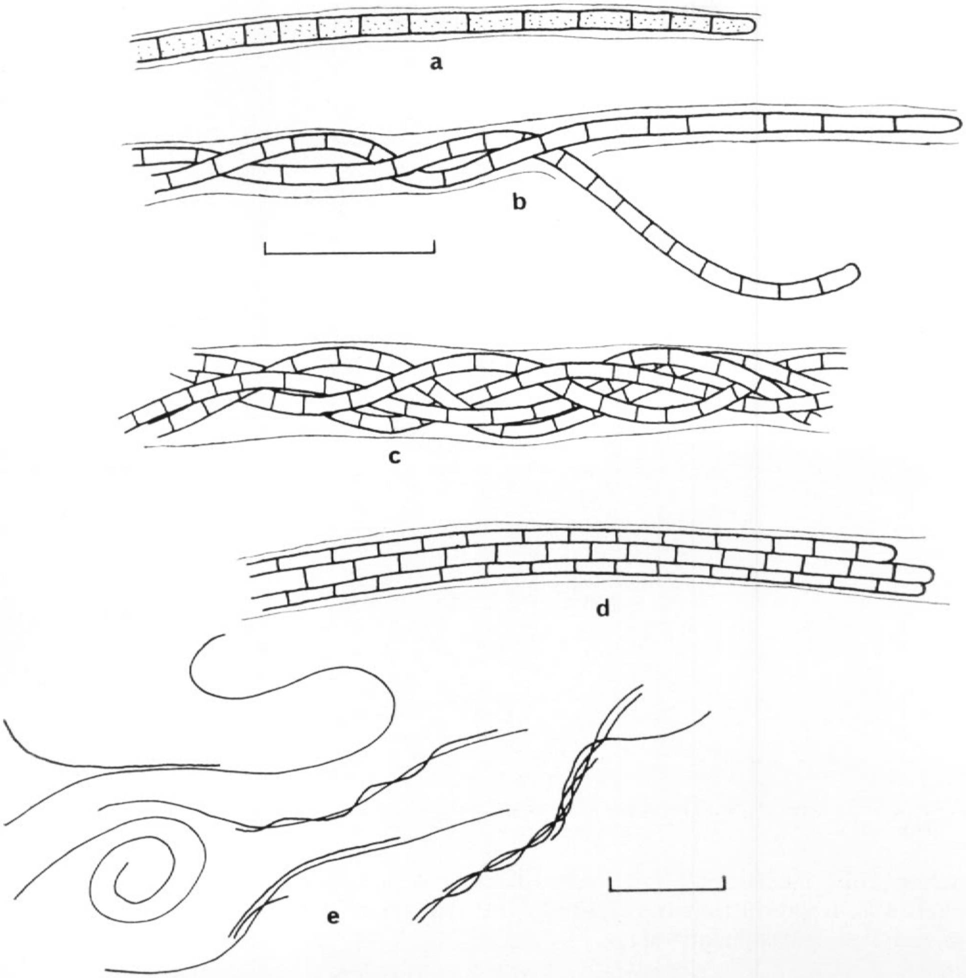

Fig. 6. a–e. *Schizothrix* sp. I. The upper scale is 10 μm. and refers to a–d; the lower scale is 100 μm. and refers to e.

Order Mischococcales

Botrydiopsis constricta Broady (S, 9, 13, 17, 18, 24)

Described by Broady (1976).

Botrydiopsis sp. (15)

Fig. 8a–d

Cells spherical, up to 48 μm. in diameter; wall thin in young cells (Fig. 8a) thickening up to 4 μm. in older cells (Fig. 8c) when often faintly stratified, with granules of brown ferric hydroxide on outer surface, either small and scattered (Fig. 8b) or larger and fewer in number (Fig. 8c); chromatophores yellow-green, numerous, parietal, plate-like, sometimes fusiform in larger cells; reproduction not observed.

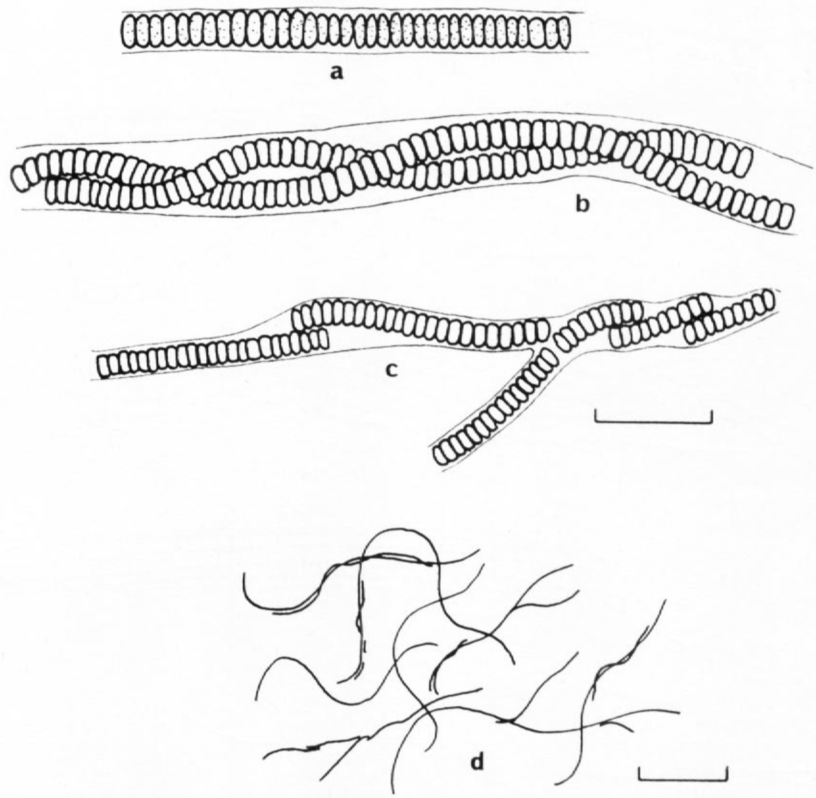

Fig. 7. a–d. *Schizothrix* sp. II. The upper scale is 10 μm. and refers to a–c; the lower scale is 100 μm. and refers to d.

Pascher (1939) illustrated *B. intercedens* Pascher with granules of ferric hydroxide on the outer cell wall. Reproduction and especially the structure of the zoospores require observation before this alga can be identified.

Chloridella sp. A (S, 12, 28, 35, 36)
Chloridella sp. (5, 15, 18)
Chlorocloster cf. *simplex* Pascher (4)

Fig. 9a–d

Cells almost fusiform, usually slightly curved with rounded apices (Fig. 9a–c), 7–13 μm. long by 1·5–2·5 μm. wide; chromatophore single, yellow-green, plate-like, parietal, in central region of cell; oil droplets present; reproduction by formation of two autospores released by rupture of sporangium wall (Fig. 9d).

C. simplex has cells with a larger maximum dimension, 5 μm. by 20 μm. otherwise it is very similar to this alga.

Ellipsoidion sp. (35)
Gloeobotrys terrestris Reisigl (S, 2, 9, 23)

Gloeobotrys sp. (36)

Fig. 10a–d

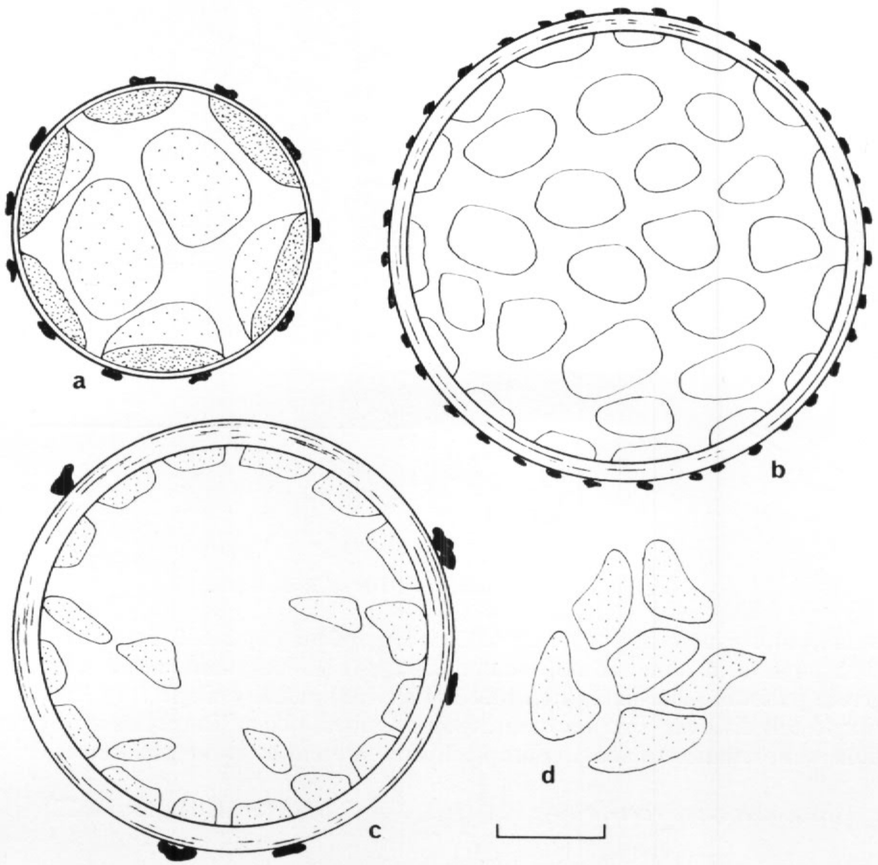

Fig. 8. a–d. *Botrydiopsis* sp. The scale is 10 μm.

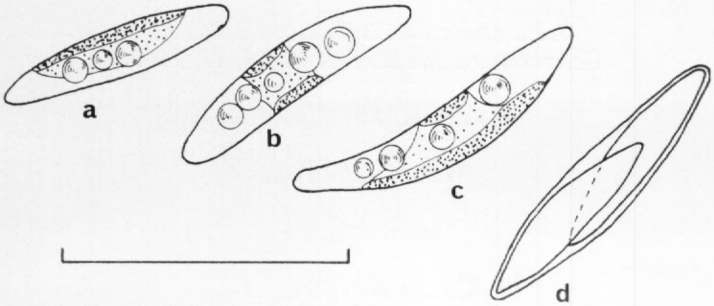

Fig. 9. a–d. *Chlorocloster* cf. *simplex* Pascher. The scale is 10 μm.

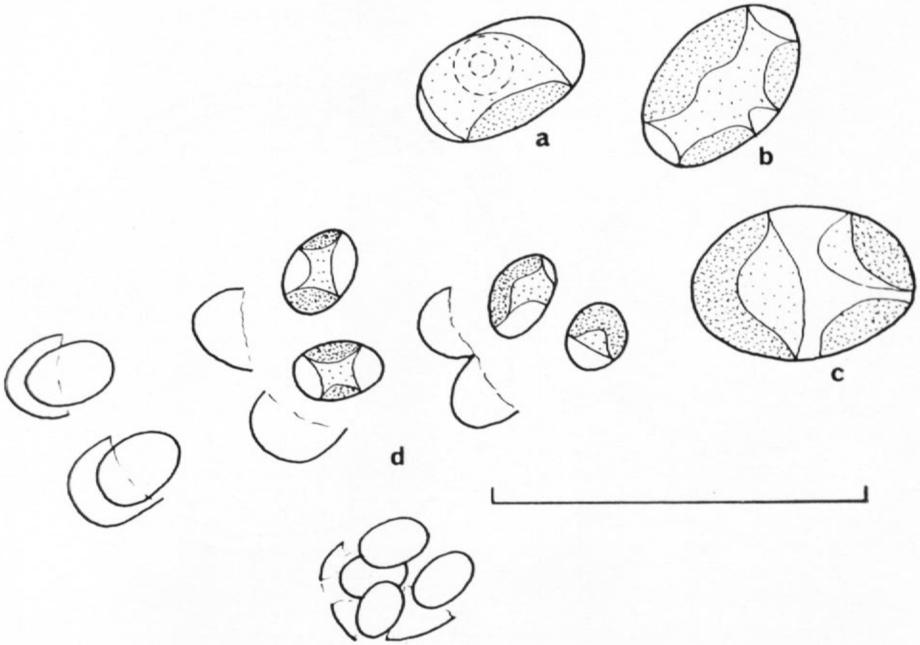

Fig. 10. a–d. *Gloeobotrys* sp. The scale is 10 μm.

Cells small, ellipsoidal to short cylindrical, 3·5–5·5 μm. long by 2·5–3·5 μm. wide, irregularly arranged throughout hyaline, homogenous mucilage (Fig. 10d), uninucleate; chromatophore yellow-green, parietal, plate-like, often lobed (Fig. 10b), usually single (Fig. 10a and b) but more prior to cell division (Fig. 10c); autospores formed, two or four released by rupture of sporangium wall, remains of sporangium wall often present as two equal halves (Fig. 10d).

Monodus subterraneus Boye Pet. (S, 1, 2, 4, 5, 6, 8, 10, 11, 12, 15, 18, 22)

ORDER TRIBONEMATALES

Heterococcus sp. (22, 23, 36)

Isolation and examination of unialgal cultures are required as there may be several species.

Heterothrix debilis Vischer (S, 24, 36)
Heterothrix exilis Pascher (S, 14, 15, 24, 36)

CLASS BACILLARIOPHYCEAE

ORDER EUNOTIALES

Eunotia sp. (19)

ORDER NAVICULALES

Hantzschia amphioxys (Ehr.) Grun. (S, 28, 29, 30, 31, 32, 34, 36)
Navicula spp. (30, 35)

Pinnularia borealis Ehr. (S, 15, 25, 26, 34, 36)
Unidentified diatoms (21, 36)

PHYLUM CHLOROPHYTA

CLASS EUCHLOROPHYCEAE

ORDER VOLVOCALES

Chlamydomonas chlorostellata Flint and Ettl (S, 10, 13, 18, 25)

Chlamydomonas sp. (15, 28)

Fig. 11a–d

Cells ellipsoidal, 10–15 μm. wide by 15–22 μm. long (Fig, 11a), spherical in transverse section with large prominent axial pyrenoid, two contractile vacuoles and small hemispherical terminal papilla; pyrenoid unusually shaped being a short, broad, curved cylinder (Fig. 11c and d); nucleus usually anterior or rarely posterior; chromatophore green, complex, parietal portion reticulate in surface view (Fig. 11b) joined to axial portion by radiating arms (Fig. 11a), axial portion containing pyrenoid (Fig. 11a); stigma absent; four zoospores formed.

Chlamydomonas spp. (4, 15, 26)

These algae require isolation and examination in unialgal cultures before attempting identification.

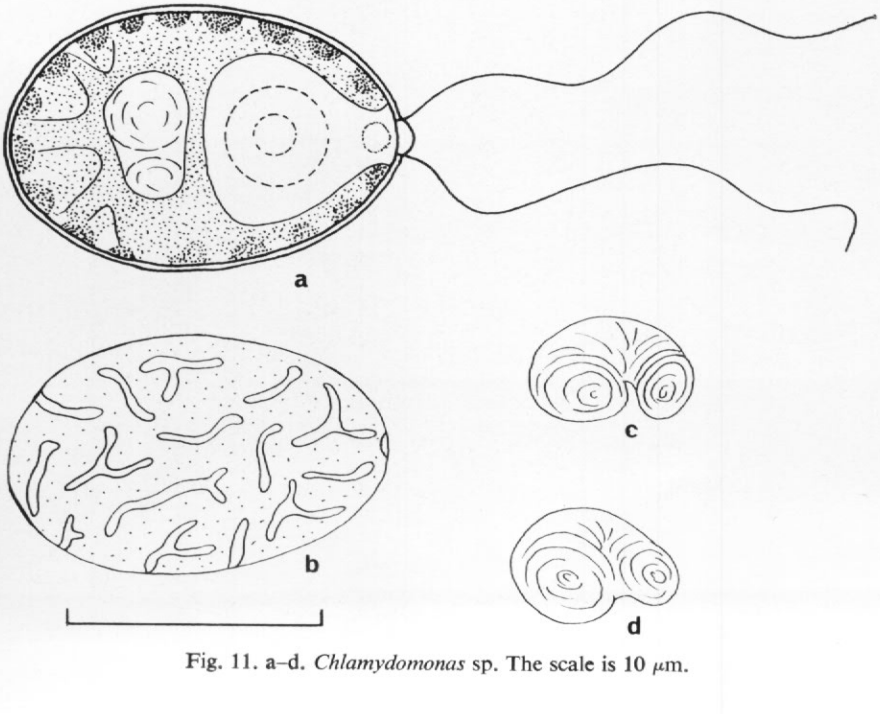

Fig. 11. a–d. *Chlamydomonas* sp. The scale is 10 μm.

Chloromonas palmelloides Broady (S, 1, 2, 4, 8, 12, 13)

Described by Broady (1977*a*).

Order Tetrasporales

Chlamydocapsa lobata Broady (S, 9)

Described by Broady (1977*a*).

Chlamydocapsa sp. A (S, 1)

Signiosphaera multinucleata Broady (S, 15, 17, 18)

Described by Broady (1977*a*).

Order Chlorococcales

Chlorella vulgaris var. *autotrophica* (Shihira and Krauss) Fott and Novakova (S, 4, 13, 24, 36)

Chlorella sp. I (35)

Fig. 12a–f

Cells vivid green, spherical, up to 23 μm. in diameter, uninucleate; chromatophore single, parietal, irregularly lobed (Fig. 12 a–d), lacking pyrenoid but containing starch grains; aplanospores (Fig. 12f) formed, two to many released from sporangium, may themselves be dividing prior to release.

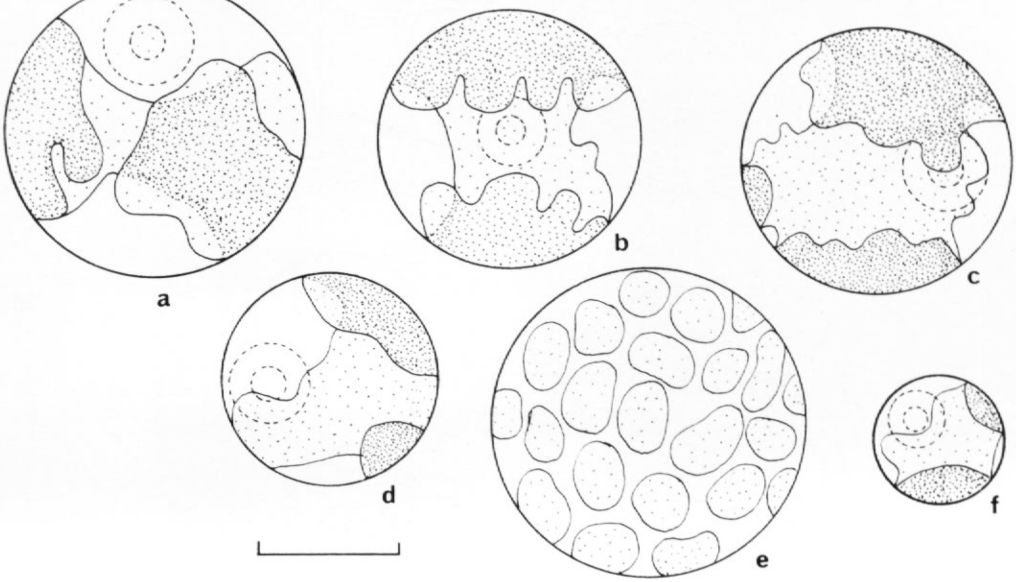

Fig. 12. a–f. *Chlorella* sp. I. The scale is 10 μm.

Chlorella sp. II (35)

Fig. 13a–f

Cells sub-spherical, 2·5–6·0 μm. in diameter; chromatophore single, parietal, lobed plate containing pyrenoid (Fig. 13a–d); oil globules present; four or eight autospores formed, prior to spore formation there may be more than one chromatophore (Fig. 13e).

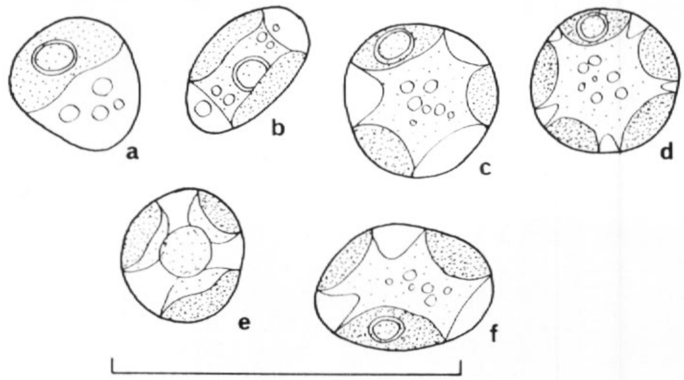

Fig. 13. a–f. *Chlorella* sp. II. The scale is 10 μm.

(?) *Chlorococcum* sp. (15, 18, 24)

Fig. 14a–f

Cells spherical to ellipsoidal, 8–14 μm. in diameter, tending to remain in loose aggregates, uninucleate; chromatophore single, parietal, deeply lobed plate with one (Fig. 14a and c) or two (Fig. 14b) pyrenoids around which small starch grains visible; autospores (Fig. 14d) released by fragmentation of sporangium wall, spores being released may be dividing (Fig. 14f).

This alga requires examination in unialgal culture for elucidation of the reproductive mechanisms, especially to check on the formation of zoospores and, if produced, their structure.

(?) *Muriella* sp. I (35)

Fig. 15a–i

Cells spherical, 6–18 μm. in diameter; chromatophores numerous in larger cells (Fig. 15c and f), fewer in smaller cells (Fig. 15a, b and e), parietal, plate-like, lacking pyrenoids but starch granules revealed on treatment with Lugol's iodine solution (Fig. 15i); aplanospores, 2·5–3·5 μm. in diameter with single chromatophore, formed in large numbers (Fig. 15d), released by rupture of sporangium wall (Fig. 15h) but tending to remain in loose aggregates after release (Fig. 15g).

Further observations on unialgal cultures are required. The absence of zoospores needs confirmation; their presence could make this alga a species of *Bracteacoccus* Tereg.

(?) *Muriella* sp. II (34)

Fig. 16a–i

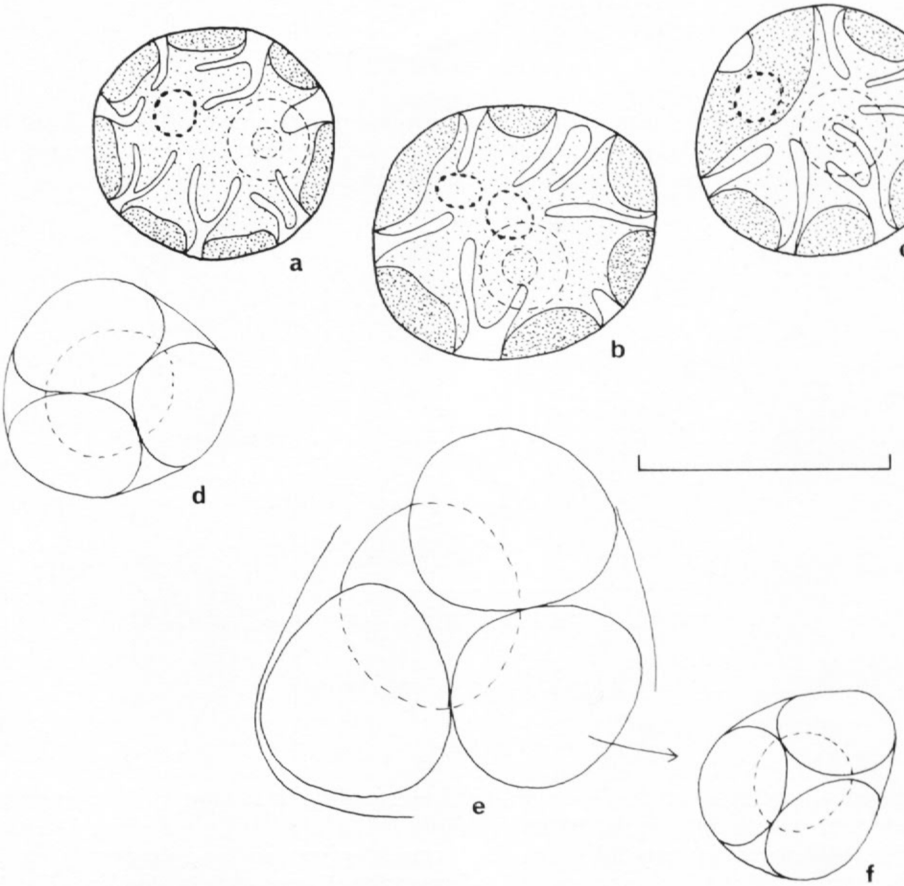

Fig. 14. a–f. (?) *Chlorococcum* sp. The scale is 10 μm.

Cells spherical, 4–13 μm. in diameter, with several parietal, plate-like chromatophores lacking pyrenoids (Fig. 16a, b, f and g), starch revealed by treatment with Lugol's iodine solution; autospores formed containing few parietal chromatophores (Fig. 16c and d), two four or eight released by rupture of sporangium wall (Fig. 16e, h and i).

This alga is similar to the previous alga in requiring further observation in unialgal culture before identification. The presence of autospores containing more than one chromatophore and the smaller number of chromatophores in adult cells distinguish it from that alga.

Myrmecia bisecta Reisigl (S, 9, 15, 18, 23)

Sphaerocystis oleifera Broady (S, 11)

Described by Broady (1976).

(?) *Spongiochloris* sp. (24)

Fig. 17a–j

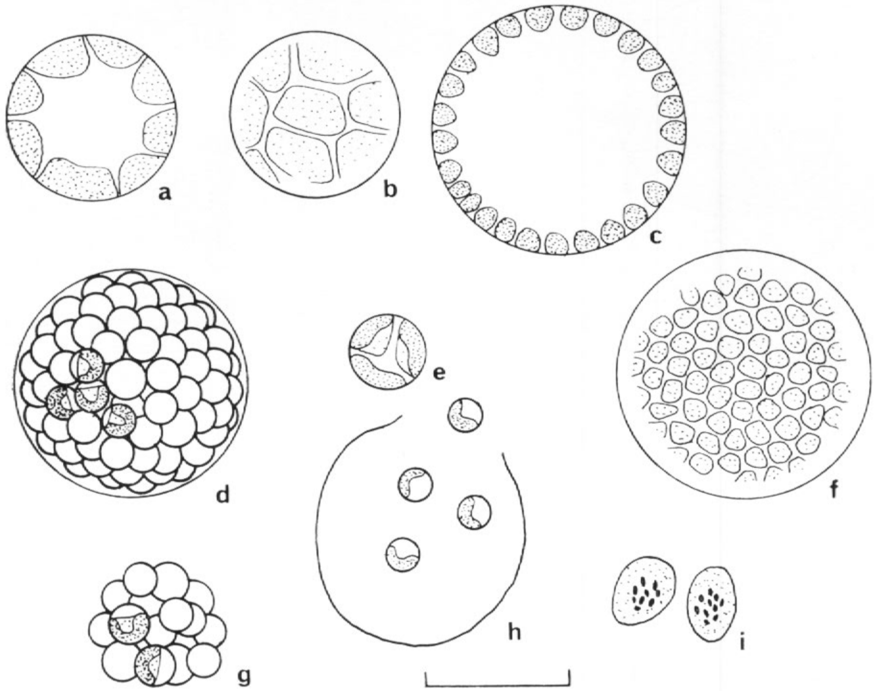

Fig. 15. a–i. (?) *Muriella* sp. I. The scale is 10 μm.

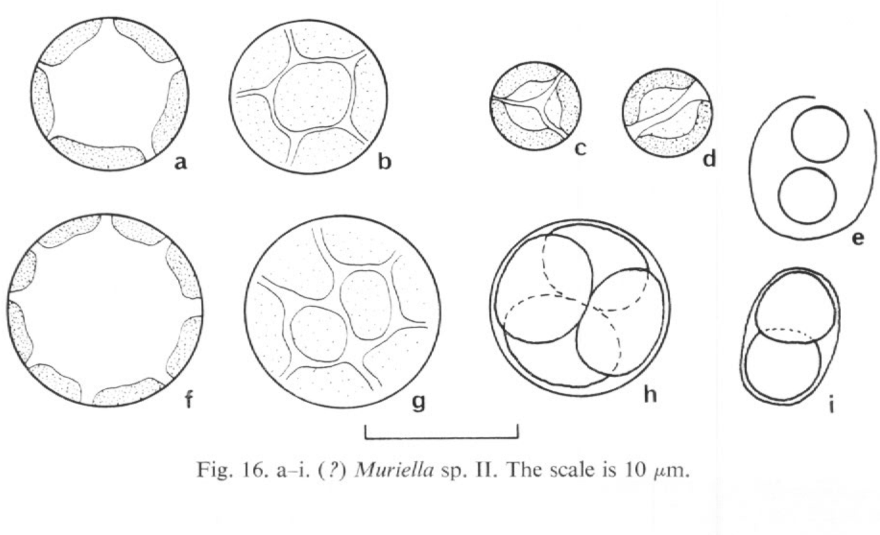

Fig. 16. a–i. (?) *Muriella* sp. II. The scale is 10 μm.

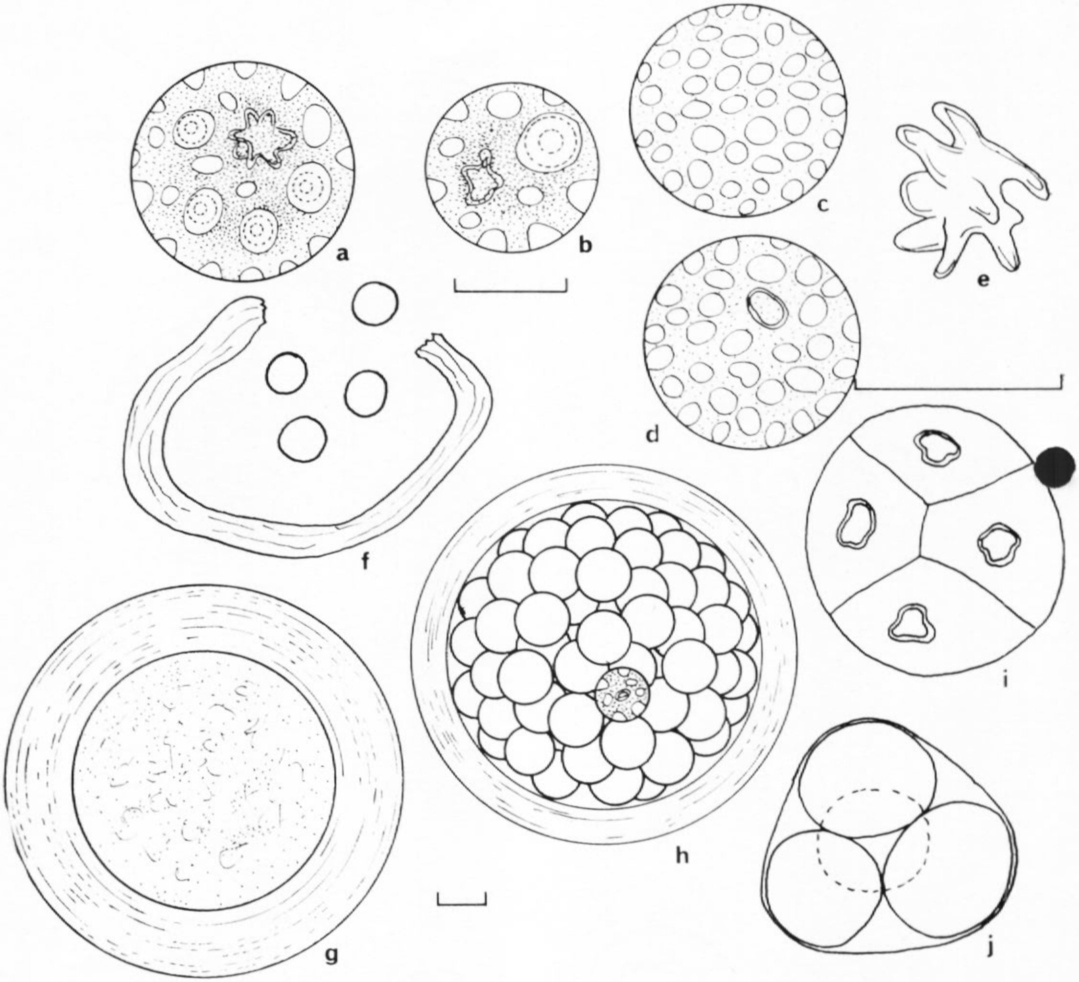

Fig. 17. a–j. (?) *Spongiochloris* sp. The scales are 10 μm.; the upper scale refers to a–d, i and j, the centre scale to e, and the lower scale to f, g and h.

Cells spherical, 9–150 μm. in diameter; chromatophore single, sponge-like filling cell (Fig. 17a, b and d), in surface view appearing reticulate (Fig. 17c) with an approximately central pyrenoid; several nuclei in larger cells each in cavity in chromatophore (Fig. 17a), smaller cells uninucleate (Fig. 17b); pyrenoid in small cells approximately spherical, in larger cells irregular with radiating arms (Fig. 17e); cell wall thin in small cells but often up to 9 μm. thick in larger cells and faintly stratified, occasionally even thicker up to 15 μm. thick in cells 100 μm. in diameter (Fig. 17g); red-orange granular contents, probably carotenoids, present in some of larger cells; autospores formed, from four to large numbers (Fig. 17h–j) released by rupture of sporangium wall (Fig. 17f); sporangium wall often thick but not invariably so, sporangia up to 165 μm. in diameter, autospores 9–15 μm. in diameter.

This alga also requires further examination in unialgal culture especially in order to investigate the reproductive mechanisms. *Spongiochloris* Starr produces naked zoospores; these have not been observed in the present alga. The similar *Spongiococcum* Deason is uninucleate and produces walled zoospores.

Trebouxia sp. (S, 1)

CLASS ULOTHRICOPHYCEAE

ORDER ULOTHRICALES

Chlorhormidium flaccidum (A. Br.) Fott (S, 3, 5, 6, 13, 22)
Chlorhormidium sp. (14, 15)
Raphidonemopsis sessilis Deason var. A (S, 18, 23, 36)
Stichococcus bacillaris Naeg. *sens. ampl.*
(S, 2, 3, 5, 6, 9, 10, 13, 15, 17, 18, 20, 22, 23, 25, 35, 36)

ORDER ULVALES

Prasiola crispa (Lightf.) Menegh. (S, 5, 7, 10, 16, 23, 25)

ORDER CHAETOPHORALES

Chlorosarcinopsis sp. B (S, 13, 35)
Desmococcus vulgaris Brand (S, 10, 16, 23, 24, 25)
Gongrosira terricola Bristol (S, 19)

CLASS ZYGOPHYCEAE

ORDER ZYGNEMATALES

Cylindrocystis sp. (31)

DISCUSSION

The total numbers of genera and species of algae found in the South Georgia and Antarctic Peninsula samples were considerably lower than those found at Signy Island (Table I). This was probably a result of the smaller number of samples examined, 37 compared with 123 at Signy Island, and the less intensive analysis of the samples in the present survey. Only four previously unrecorded genera appeared in the present study, namely *Anabaena*, *Chlorocloster*, (*?*) *Muriella* and (*?*) *Spongiochloris*. None of these was widespread. Of the genera found at Signy Island but not in the present study, only six were at all common at Signy Island and could have been reasonably expected in the present study: *Tribonema*, *Heterotrichella*, *Achnanthes*, *Trochiscia*, *Planophila* and *Microthamnion*. Their absence may have been due to the small number of samples examined.

TABLE I. TOTAL NUMBERS OF ALGAL GENERA AND SPECIES FOUND IN THE SOUTH GEORGIA AND ANTARCTIC PENINSULA SAMPLES COMPARED WITH THOSE FROM SIGNY ISLAND, AND THOSE COMMON TO BOTH REGIONS

Taxa	*South Georgia and Antarctic Peninsula*	*Signy Island*	*Common to both regions*
Genera	47	72	42
Species	70	162	40

The distribution of the species between the classes of algae was in some respects similar to that found at Signy Island (Table II). In both studies, the most frequent class was the Cyano-

TABLE II. DISTRIBUTION OF SPECIES BETWEEN ALGAL CLASSES

Class	*South Georgia and Antarctic Peninsula*	*Signy Island*
Cyanophyceae	26	49
Dinophyceae	1	1
Chrysophyceae	0	1
Xanthophyceae	12	17
Bacillariophyceae	4+	29
Euchlorophyceae	17	33
Ulothricophyceae	8	21
Zygophyceae	1	10

phyceae and the second most frequent was the Euchlorophyceae. The Xanthophyceae and Ulothricophyceae were also well represented in both studies. In the present study, the Bacillariophyceae were not thoroughly identified but there was a poor diatom flora in the samples. The Zygophyceae were poorly represented compared with Signy Island. It has already been recognized that the number of species of fresh-water desmids decreases with increasing latitude in Antarctica (Hirano, 1965) and the present results could reflect this trend. However, the single record of *Cylindrocystis* was at Ablation Point, Alexander Island, the locality at the highest latitude, which suggests that it will also be found at the lower latitudes. On the whole, there was no suggestion of a pattern due to increasing latitude in the total numbers of species recovered from the 11 localities (Table III). The numbers from a single locality were more a reflection of the number of samples examined and the types of habitat from which samples were collected. A larger number of samples collected from a wider

TABLE III. NUMBERS OF ALGAL SPECIES RECOVERED FROM EACH LOCALITY SAMPLED

Location	*Number of samples*	*Number of species*
South Georgia	3	7
King George Island	3	13
Deception Island	1	2
Anvers Island	3	12
Argentine Islands	3	15
Blaiklock Island	2	14
Adelaide Island	5	16
Horseshoe Island	2	19
Stonington Island	1	10
Neny Island	3	20
Alexander Island	11	36

range of habitats would probably have contained far more algae at each locality. At South Georgia, the three samples represented a particularly small fraction of the habitats available for terrestrial algal growth. However, it is interesting to note that the furthest south samples contained the most species, indicating a probable minimum potential number of species for similar samples from more northerly localities.

If sites of a particular type are examined without regard to their location, similarities with Signy Island are apparent (Table IV), e.g. the poor algal flora in the *Polytrichum alpestre–Chorisodontium aciphyllum* turves and the high numbers in the soils below *Deschampsia antarctica* and in mineral soils without macroscopic vegetation cover. As at Signy Island, *Monodus subterraneus* and *Chloromonas palmelloides* were the major algal components amongst the *Polytrichum alpestre–Chorisodontium aciphyllum* turves (sites 1, 8 and 11).

TABLE IV. COMPARISON OF SPECIES NUMBERS FROM SIMILAR HABITATS AT SOUTH GEORGIA AND THE ANTARCTIC PENINSULA WITH THOSE AT SIGNY ISLAND

Habitat	*South Georgia and the Antarctic Peninsula*	*Signy Island*
Polytrichum alpestre–Chorisodontium aciphyllum turves	5	16
Drepanocladus uncinatus carpets	13	86
Calliergon sarmentosum carpets	8	57
Unidentified mosses	36	—
Soils below *Deschampsia antarctica* and *Colobanthus quitensis*	23	72
Bird- or seal-enriched sites often with a cover of *Prasiola crispa*	16	40
Mineral soils without macroscopic vegetation cover	28	102

It is apparent that before meaningful comparisons can be made between the terrestrial algal floras of islands in the Scotia arc and localities on the Antarctic Peninsula a wider variety of habitats require sampling at each locality. More detailed environmental data are also required, particularly for moisture and nutrient regimes at the sample sites. A site at high latitude with moisture and nutrients optimal for algal growth is likely to yield more species than a site at a lower latitude where these factors are sub-optimal, despite the generally more favourable climate of the latter as terrestrial algae are able to utilize favourable conditions even if these are available for only a small part of the year. Also, samples must be examined with equal thoroughness, ideally over a long period and using culture techniques (Koob, 1967) in order to obtain maximum efficiency for the recovery of algae.

ACKNOWLEDGEMENTS

I thank the British Antarctic Survey for the opportunity to undertake this research. The collection of samples by I. B. Collinge, Dr. R. B. Heywood and J. J. Light is gratefully acknowledged. Drs. W. Block and R. I. L. Smith are thanked for providing criticism of the manuscript. Professor D. C. Smith kindly provided facilities in the Department of Botany, University of Bristol, for this study.

MS. received 22 October 1976

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