DESMIDS FROM SOME LAKES ON SIGNY ISLAND, SOUTH ORKNEY ISLANDS, ANTARCTICA

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Abstract. From material collected in several lakes on Signy Island, South Orkney Islands, five new taxa have been added to the sparse desmid flora of the Antarctic and sub-Antarctic. These are *Closterium parvulum* var. *parvulum* Näg., *Cosmarium margaritatum* (Lund) Roy & Biss forma., *C. binum* Nordst., *C. sexangulare* var. *minus* Roy and Biss. and a *Cosmarium* new to science, here named *C. decussare*. In fresh material from Signy Island, *Roya anglica* G. S. West and *Closterium jenneri* var. *jenneri* were found in laboratory cultures. These are also new records for the region.

Introduction

The material on which this paper is based was collected from lakes on Signy Island in 1977 and 1979. In none of the samples could desmids be said to be abundant, but since so little is known about Antarctic desmids, especially those from Signy Island, and because some are of particular interest, we have spent a considerable time on their examination. Priddle and Belcher (1982) have produced an annotated list of benthic algae from Signy Island in which some desmids are recorded and illustrated. Our paper thus complements their list and we hope clarifies some of the taxonomic questions posed by their brief descriptions. The ecological background to the lakes can be gained from papers by Heywood and others (1979, 1980), Priddle (1980), Light and Heywood (1973).

As far as can be ascertained, only 22 desmids have been identified from the Antarctic and sub-Antarctic. These are as follows:

by Fritsch 1912
Penium cruciferum De Bary – Granite Harbour
Ross Sea

by Hirano 1965
Order Zygnematales. Fam: Mesotaeniaceae
Mesotaenium endlicherianum Näg – S. Orkney Is.
Cylindrocystis brebissonii Menegh – S. Orkney Is.
C. brebissonii var. *minor* West and West – S. Orkney Is.
C. crassa De Bary – Antarctica and S. Orkney Is.
Ancylonema nordenskioldii Berggren – Antarctica

Order Desmidiales. Fam: Desmidiaceae
Cosmarium antarcticum Gain – Antarctica
C. crenatum Ralfs – Antarctica
C. curtum (Bréb.) Ralfs – Antarctica
C. pseudoconnatum Nordst. – Antarctica
C. undulatum Corda – Antarctica
C. undulatum var. *minutum* Wittr. – Antarctica

by Opalinski 1972
Cosmarium subtumidum Nordst – Thala Hills

C. cucurbita Bréb. – Thala Hills
(=*Actinotaenium cucurbita* (Bréb.) Teiling ex Ružička and Pouzar)
C. regnellii – Thala Hills

by Heywood 1977
Cosmarium globosum Bulnh. – Ablation Point
(=*Actinotaenium globosum* (Bulnh.) Förster 1969)
C. quadratum Ralfs – Ablation Point

by Seaburg Parker and others 1979
Cylindrocystis brebissonii Meng. S. Victoria Land

by Priddle and Belcher 1982
? *Gonatozygon aculeatum* Hass. – Signy Island
? *Penium cucurbitinum* Bréb. – Signy Island
(=*Actinotaenium cucurbitinum* (Biss.) Teiling)
? *P. curtum* Bréb. – Signy Island
(=*A. curtum* (Bréb.) Teiling ex. Ružička and Pouzar)
Cosmarium laeve Rab.– Signy Island
C. regnellii (Wille (see, however, below) – Signy Island
C. subspeciosum var. *validus* Nordst.
? *C. tuddalense* var. *americanum* Kreiger and Gerloff
Staurastrum punctulatum Bréb – Signy Island

by Parker and others 1972
Staurastrum disputatum – Palmer Station area

by Broady 1981
Actinotaenium cucurbita (Bréb.) Teil. ex Ružička & Pouzar – Victoria Land, Antarctic

In the present study we add five taxa to the above list, though we question Priddle and Belcher's identification of *Cosmarium regnellii* and believe that what they found was *C. polygonum*. Also we describe a quadrate form, facies *quadriradiata* of *Staurastrum punctulatum* and more interestingly, a *Cosmarium* which we believe to be new to science.

The Desmids

Closterium parvulum var. *parvulum* Näg (Fig. 1)

Priddle and Belcher record a *Closterium* from Signy Island which, they state, resembles *C. leibleinii* Kutz. ex Ralfs. Their table in Fig. 3 shows that it occurs in Moss L., Emerald L., Tranquil L. and Light L., but the range of lengths which they give (70–100 μm) would seem too small for this species. Ružička (1977) for example, quotes lengths ranging from 120 to 200 μm while Förster (1982) states the normal range to be 110–215 μm. The only *Closterium* we have identified was from Light L. and this was considerably larger than their supposed *C. leibleinii* (116.0 μm long), and with no sign of the median inflation typical of this desmid.

The Light L. specimens were characteristic in all their significant features of *C. parvulum* var. *parvulum*. The lunate cells without any median ventral inflation (Fig. 1A) have a smooth cell wall, terminating in acute apices and each has a clearly visible end pore typical of this taxon (Fig. 1B). The arc formed by the dorsal wall was in the range 152–176°. Cell breadth was 18.0 μm and the length/breadth ratio 6.40. In one of the specimens, four to five small terminal vacuolar granules were still present.

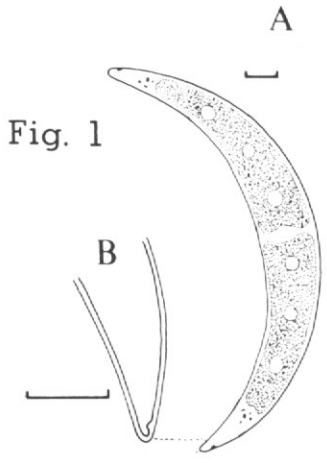

Fig. 1

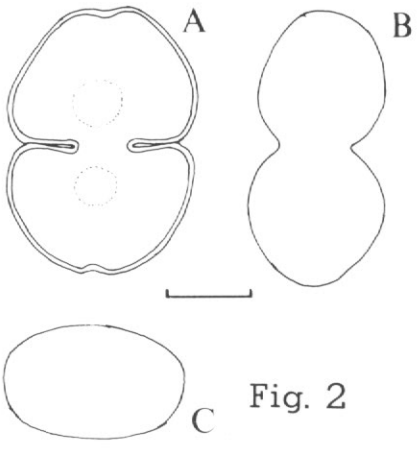

Fig. 2

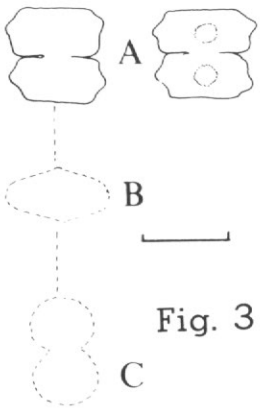

Fig. 3

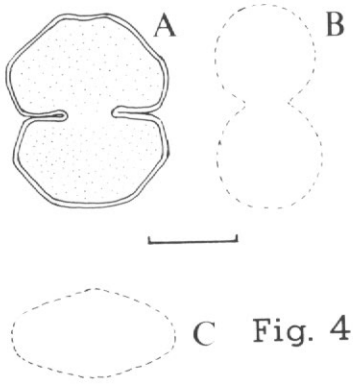

Fig. 4

Figs. 1–4. Scale bars all 10 μm.

Fig. 1. *Closterium parvulum* var. *parvulum* Näg. A, whole cell; B, cell apex showing distinctive mucilage pore.

Fig. 2. *Cosmarium laeve* var. *laeve* Rabenh. A, front view; B, side view; C, apical view.

Fig. 3. *Cosmarium polygonum* var. *polygonum* f. *polygonum* Prescott and others. A, front views; B, apical view; C, side view.

Fig. 4. *Cosmarium sexangulare* var. *minus* Roy and Biss. A, front view; B, side view; C, apical view.

Cosmarium laeve var. *laeve* Rabenh. (Fig. 2)

This desmid has been recorded from Signy Island by Priddle and Belcher (1982) as a commonly occurring 'secondary epiphyte' in six of their 17 study lakes. We have found specimens only in samples from superficial sediments from Light L. and the desmid was infrequent.

As indicated by our illustrations, the semicells are typical of the range of forms encountered in populations of this desmid, varying from rounded to slightly

trapeziform with the upper lateral margins flattened (cf. Förster, 1982, Taf 23.1). The apices of some specimens are only indistinctly notched or retuse while others are almost flat, but in all cases the apical cell wall shows a slight central thickening. The cell dimensions are towards the upper size range measuring 30.8–34.3 μm long × 23.0 μm broad and isthmus 6.0–5 μm, and thus approaching the dimensions of the f. *major* Borge as quoted by Komarck and Ružička (1966), i.e. 32–40 μm long × 24–30 μm broad (see also Ružička, 1966). Prescott and others (1981) quote 14–36.0 μm long × 11–26 μm broad for the var. *laeve*.

Cosmarium polygonum (Näg.) Arch. (Fig. 3)
var. *polygonum* f. *polygonum* Prescott and others.

Priddle and Belcher (1982) report that the small *Cosmarium, C. regnellii* Wille occurs within the secondary epiphytic community on aquatic mosses and also in the gut of a browsing ostracod (Priddle and Dartnall, 1978). We have found a small number of desmids in Moss L. samples which resembles *C. regnelli* but which we would identify as *C. polygonum*. This small desmid has however many features in common with *C. regnelli* and can easily be mistaken for it. Not only is it of comparable dimensions but the hexagonal cells, which are almost as broad as long, have a straight or faintly retuse apex. The lateral margins are also slightly retuse. The essential distinguishing feature which would be overlooked unless the cells were critically examined in apical view, preferably with a ×100 oil immersion objective, is a median conical tumour on each lateral face (Fig. 3B).

The dimensions of the Signy specimens were 12.0 μm long × 2.0 μm broad, isthmus 3.0 μm, thus lying at the lower end of the size range of the species, which is 10–24 μm long × 9–20 μm broad, isthmus 3–9 μm (Prescott and others, 1981).

Cosmarium margaritatum (Lund.) Roy and Biss. forma (Fig. 5)

The largest of the desmids found in the Signy collections we ascribe to *C. margaritatum* though it does not agree in all details with the generally accepted descriptions of this species in West and West (1908), Prescott and others (1981), Förster (1982). The desmid was quite common in Sombre L., Moss L. and Light L.

The cells, though similar in shape to the type var. *margaritatum* Prescott and others having mostly ellipsoidal and sub-rectangular semicells with a narrow, linear sinus separating the adjacent semicells, are considerably larger. The range of dimensions quoted by Prescott and others are 60–105 μm long × 56–82 μm broad and isthmus 19–31 μm. In marked contrast, the Signy Island specimens varied between 119.0 and 133.0 (140) μm long × 86.6–96.6 μm broad and isthmus 28.0–37.0 μm. The cell thickness has been found to be 63.0–66.6 μm.

The type species is reported to have 28–32 granules showing round the margin of each semicell but the larger Signy Island specimens possess at least 50 such marginal granules (Fig. 5A). The prominent granules, which cover the semicell faces, are regularly disposed in oblique series across the face of each semicell, the series intersecting one another approximately at right angles (decussating). In the published descriptions of the var. *margaritatum*, there is said to be some 12 granules in each series, whereas in the Signy specimens we find rows of 16–20 granules. An additional noteworthy feature of these much larger cells are distinctive pores in the cell wall, six of which surround each granule (Fig. 5B). Also a ring of wall material appears to surround each, so that, as shown in our illustration (Fig. 5B), each pore is surrounded by a more or less regular circle. In one or two specimens, we observed

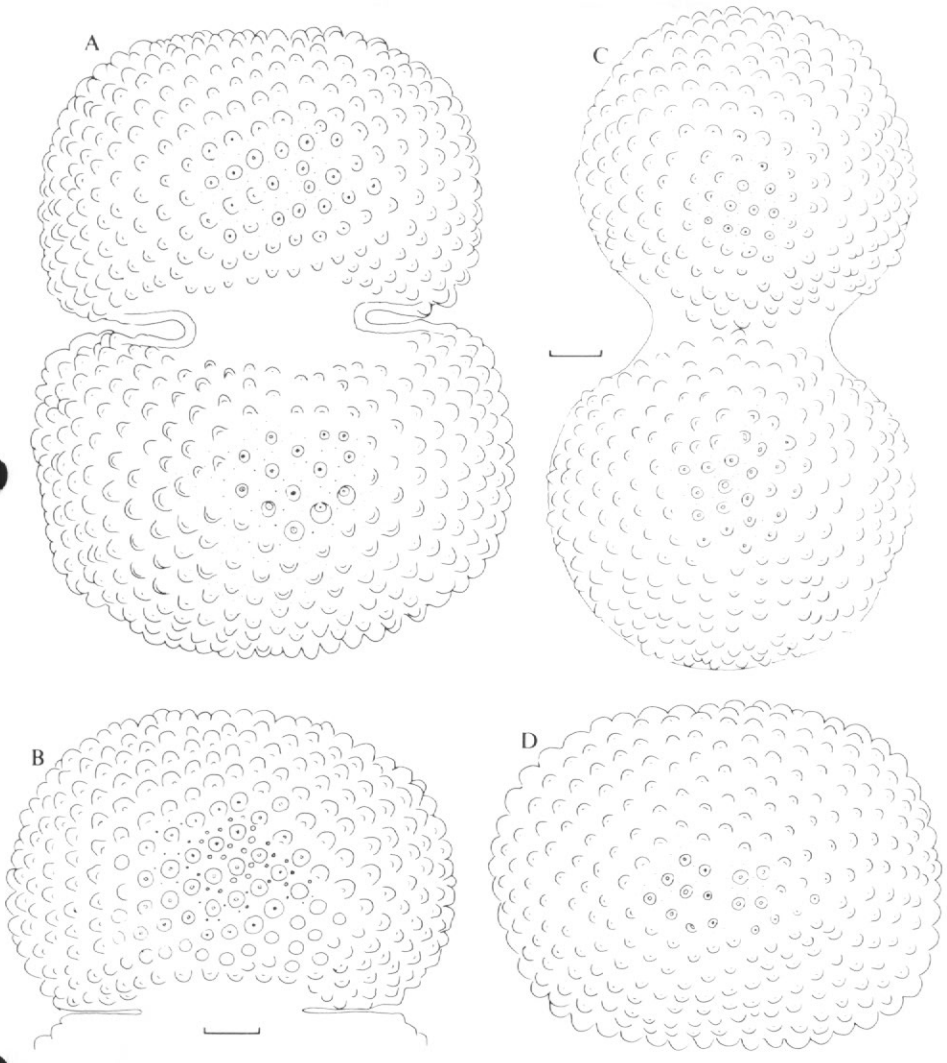

Fig. 5. *Cosmarium margaritatum* (Lund) Roy & Biss. forma. A and B, front view; C, side view; D, apical view. Scale bars 10 μm.

that in the central region of the semicell face, the pores varied considerably in size, as shown (Fig. 5B).

Because initially we were uncertain about the extent of the ornamentation on the cell apices of our specimens and the fact that at least some figures of the related species *C. brebissonii* Menegh. ex Ralfs show the apex of this latter desmid to be devoid of granular ornament (see West and West, 1908, Pl. LXXIX, figs. 10, 11; Förster, 1982, Taf. 30, Abb. 18), we examined cells in apical view with special care. This showed that, as with other semicell surfaces, the apex of our *C. margaritatum* is completely ornamented with well-developed, regularly disposed granules round which there is the hexagonal arrangement of pores, similar to that on the side view of the semicells (Fig. 5D).

In agreement with the descriptions given elsewhere of *C. margaritatum* var. *margaritatum* the side view of each semicell is more or less circular in outline, while in apical view the semicells are broadly elliptical (Fig. 5C).

Although it is tempting to designate these large forms of *C. margaritatum* as a new variety (e.g. var. *major*), we feel that, because desmids can vary so much in size, its elevation to varietal status is unwarranted.

Cosmarium binum Nordst. (Fig. 6)

This cosmopolitan species has been found quite frequently in samples from Light L.; however, our specimens do not agree in all respects with many of the descriptions and illustrations of *C. binum*. In most of these the lateral marginal crenae or granules, which are larger nearer the less granulate apex, are often emarginate or bigranulate and this latter characteristic feature is not always apparent (Fig. 6A). However, in this respect the Signy Island specimens closely approach the form of

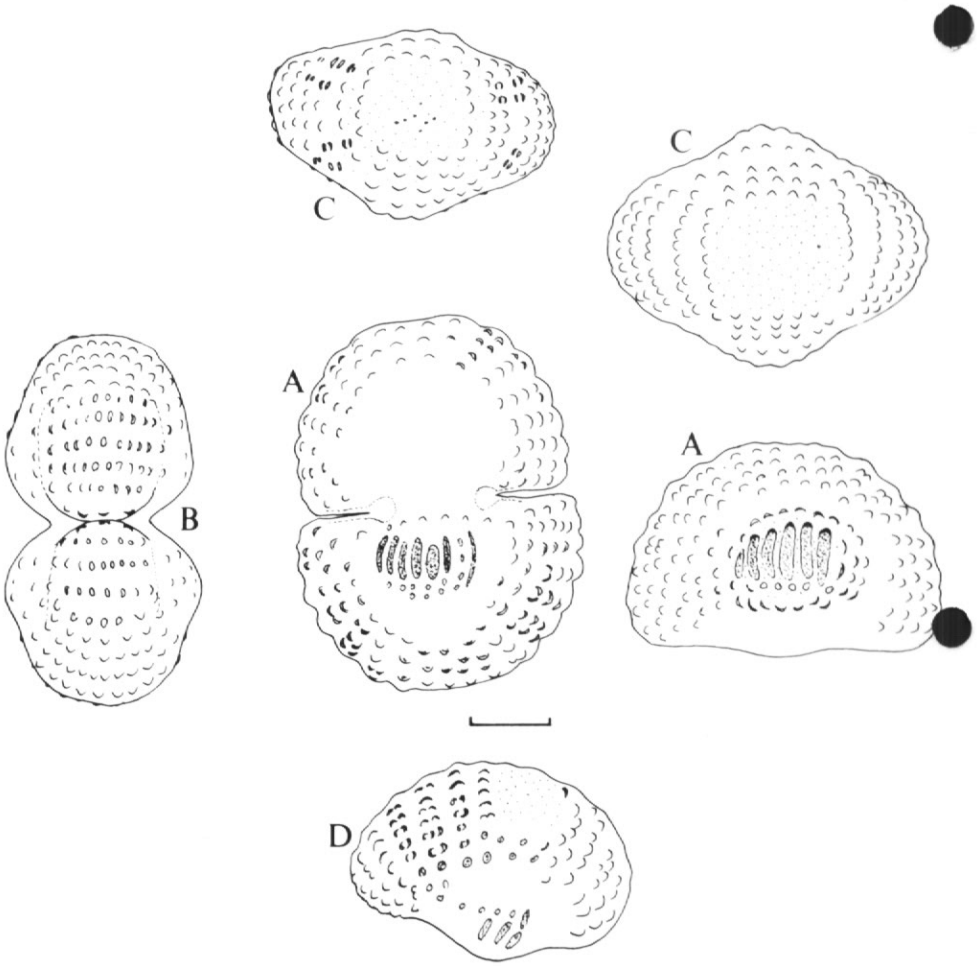

Fig. 6. *Cosmarium binum* Nordst. A, front view; B, side view; C, apical views; D, oblique view of apex. Scale bar 10 μm.

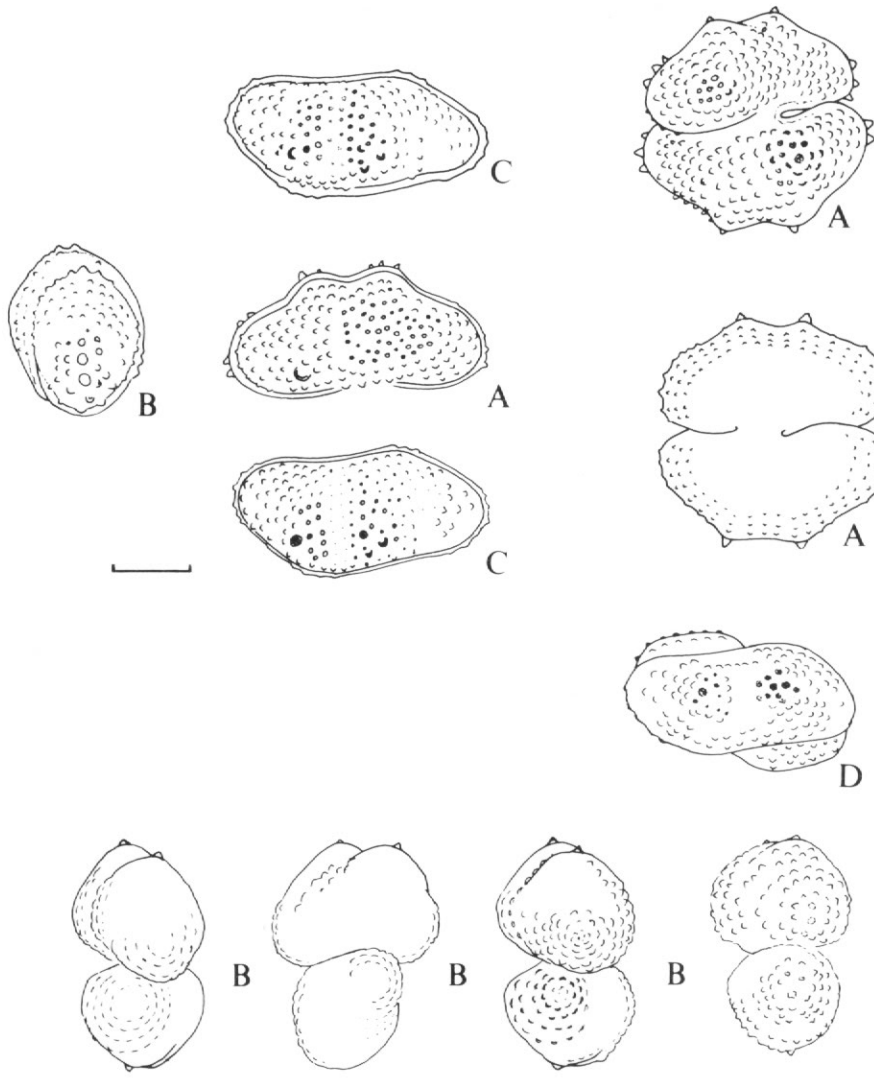

Fig. 7. *Cosmarium decussare* sp. nov. A, front views; B, side views; C, apical views; D, apical view showing semicells twisted with respect to one another. Scale bar 10 μm.

those described by Wailes (1930) from Mt Ferguson, British Columbia (see Prescott and others, Pl. CXXIV, fig. 8), and bigeminate granules are apparent when cells are tilted, so that both apex and lateral face can be seen (Fig. 6D). The range of dimensions of the Signy cells were found to be as follows: 50.4–56.0 μm long × 39.2–43.8 μm broad, isthmus 12.6–15.5 μm; cell thickness 26.6–32.2 μm.

All our specimens, when seen in apical view, revealed that the granulation on the semicell apex is very much reduced (Fig. 6C). A conspicuous feature of the face of each semicell is the double, supra-isthmal row of seven to eight granules and the strongly ribbed central tumour between which pores are clearly visible (Fig. 6A). Each sinus is deep and straight, and has a markedly thickened wall at the apex.

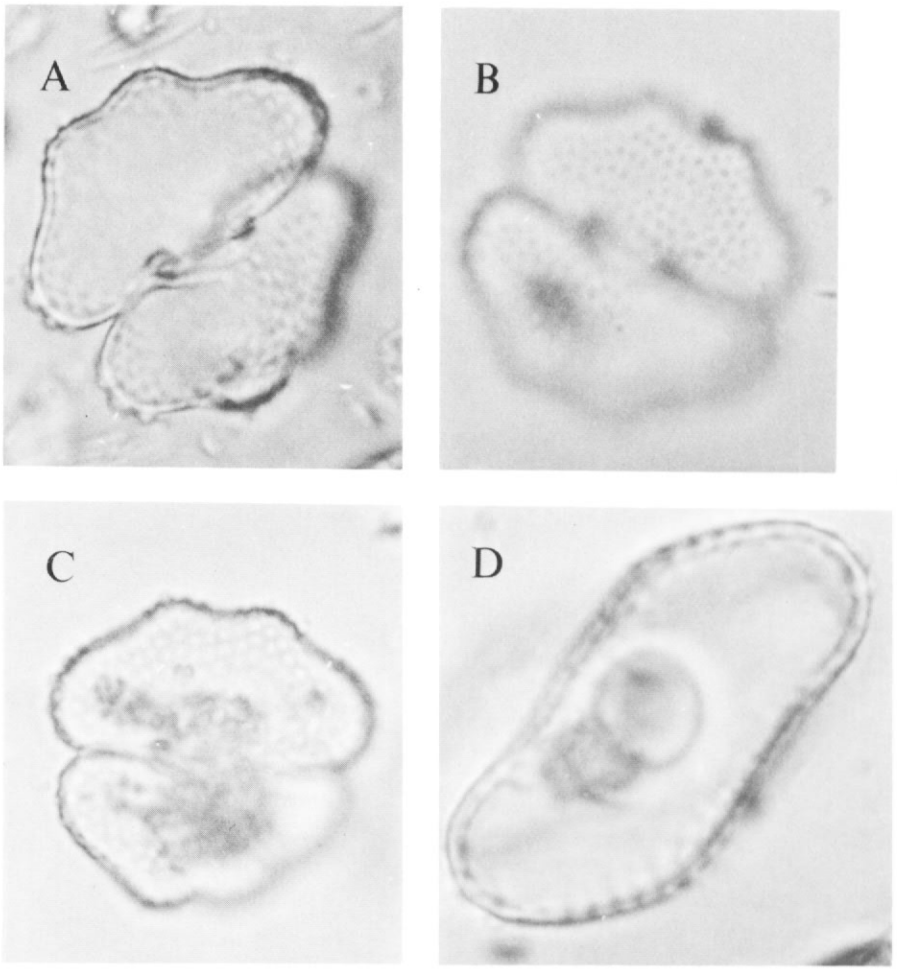

Fig. 8. *Cosmarium decussare* sp. nov. A, front view of empty cell showing prominent apical and especially lateral granules. Note also the twisting of semicells at the isthmus; B, front view focused on upper cell wall showing granules. Note even distribution of granules and no indication of a median tumour or enlarged granules in this region; C, front view showing cell outline with granules on apices and lateral margins somewhat more pronounced than elsewhere; D, apical view showing parallelogram shaped outline of semicell.

Cosmarium decussare sp. nov. (Figs. 7 and 8)

Priddle and Belcher (1982, p. 46 and Fig. 2j) record *Cosmarium* sp. B. – 'a distinctive species with the finely ornamented, angular semicells twisted with respect to each other' from Moss L. and Changing L. In Light L. samples we have found a *Cosmarium* species which we are fairly confident is their sp. B, largely because in the considerable number of specimens that we have examined the semicells are twisted from 17 to 30° with respect to one another. The semicells are angular with, as shown in their fig. 2j, a retuse apex and their walls are ornamented with small granules.

Indeed these cells, which are only slightly longer than broad, measure 31.5–32.3 μm long × 30.8 μm broad, have a very distinctive morphology. The basal angles of each semicell are broadly rounded while the upper lateral margins are distinctly

concave and the apex is retuse (Figs. 7A and 8A–C). The sinus, which separates adjacent semicells, is deep and markedly closed due to their twisting at the isthmus and consequent overlapping (Figs. 7A and 8A–C). The sinus is, however, slightly inflated at the apex (Figs. 7A and 8A and B). The cell wall is densely covered by small granules arranged in concentric circles around the angles. The apical angles of each semicell have one (sometimes two) more or less prominent enlarged granules which may show different degrees of development on adjacent semicells. The margins of the basal angles of the semicells bear several (often three) similarly enlarged granules.

In side view (Fig. 7B), the semicells, which are in the region of 14.0 μm thick, resemble flattened spheres on which an enlarged, prominent granule is clearly visible on the apex of each such sphere. In vertical view, not only is it possible to observe how adjacent semicells are twisted with respect to one another (Fig. 7D), an example of torsion symmetry (Teiling, 1957; Brook, 1981), but each semicell shows what Teiling (1957) describes as semiradial asymmetry. Such asymmetry as exhibited by the Signy *Cosmarium* here described is very uncommon in this genus. The radii of these biradiate cells are slightly curved in a clockwise direction so that the apical view of the semicells resembles a parallelogram with rounded angles and slightly concave longer sides (Figs. 7C and D and 8D). The two prominent granules on each apex, which are surrounded by rings of smaller granules, can be clearly seen in vertical view.

Superficially the cells of this Signy desmid resemble *Cosmarium ornatum* Ralfs and more particularly *C. protractum* (Näg) De Bary in surface view. However, in addition to the very characteristic isthmal torsion of our desmid, there is another feature which would seem to set it apart – the cell wall ornamentation. In both *C. ornatum* and *C. protractum* the central face of each semicell has a circular grouping of granules on a broad tumour, the latter being prominent in both taxa in vertical view. As indicated above, and as can be seen in our Figs. 7C and D and 8D, the sides of our desmid show no such tumour and instead are straight to slightly concave. The absence of such tumours, the unique shape of the semicells in vertical view and the marked twisting of adjacent semicells are, in our view, sufficiently distinctive characters to set this desmid apart as a new species. In view of the fact that the adjacent semicells in vertical view are decussate we propose to call this desmid *Cosmarium decussare*.

Cosmarium decussare sp. nov.

Cells in surface view only slightly longer than broad, the basal angles of each semicell broadly rounded but the upper lateral margins distinctly concave and apex retuse. Sinus deep and closed due to twisting of adjacent semicells at the isthmus. Cell wall covered by small granules arranged concentrically around the angles. In side view semicells appear as depressed spheres. In vertical view the radii of the biradiate semicells slightly curved in clockwise direction and resembling a parallelogram, with rounded angles and slightly concave longer sides. Adjacent semicells twisted from 17 to 30° with respect to one another.

Length 29.5–32.3 μm
Breadth 30.8–31.5 μm
Thickness 13.3–14.0 μm
Isthmus 5.6–7.0 μm

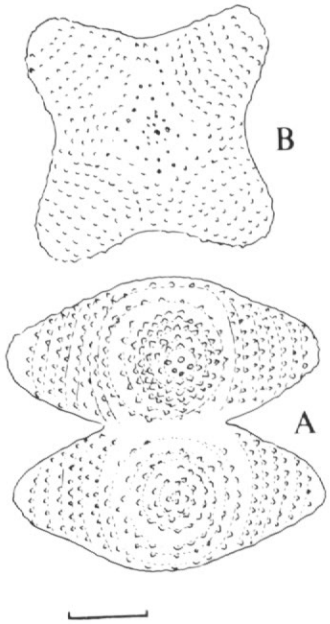

Fig. 9. *Staurastrum punctulatum* Breb. fac. *quadriradiata* A, side view; B, apical view. Scale bar 10 μm.

Cosmarium decussare species nova.

Cellulae superficie visae paullo tantum longiores quam latiores; angulis basis utriusque semicellae late rotundatis, sed marginibus superis lateralibus manifesto concavis et apice retuso. Sinus altus et clausus ob semicellas contiguas ad isthmum convolutas. Cellulae paries granulis parvis obtecta circum angulos concentrice dispositis. Semicellae e latere visae habitu similes sphaeris complanatis. Aspectu verticali radii semicellarum biradiatarum paullum curvati secundum horologii motum et similes formae parallelogrammae, angulis rotundatis ac lateribus longioribus paullo concavis. Semicellae contiguae nonnihil inter se tortae.

Cosmarium sexangulare var. *minus* Roy and Biss (Fig. 4)

A few cells of this *Cosmarium* have been found in Moss L. They are typical of the var. *minus* with respect to shape, the semicells being elliptic-hexagonal with flattened to slightly concave apices. In vertical view the semicells are elliptical. The cell walls were observed to be minutely punctate. Dimensions were towards the upper range of the var. *minus* being 24.5 μm long × 21.0 μm broad, isthmus 7.0 μm broad.

Staurastrum punctulatum Breb. fac. *quadriradiata* (Fig. 9)

The commonly occurring triradiate form of *S. punctulatum* has already been recorded from Signy Island by Broady (1979) and by Priddle and Belcher (1982) in Emerald L. and Sombre L. As stated by West and West (1912, p. 180) quadriradiate (and pentaradiate) cells are rare, as we have also found in rich gatherings of *S. punctulatum* from numerous British localities.

The Signy specimens, which were very rare, were almost as long as broad, the dimensions being 39.0 μm long × 42.0 μm broad. The typically deep but open sinus

was 14.7 μm in depth. The quadrangular apical view is worthy of note, in that the semicell margins are markedly concave.

Fresh material which Dr Priddle arranged to be sent from Signy Island lakes and which was allowed to stand in our laboratory in low light intensity, was found after three weeks to contain well-developed colonies of *Dictyosphaerium ehrenbergii* Naeg. and *Pediastrum kawraiskyi* Schmidle. Two living specimens of desmids were found in the tubes and both are new records for the sub-Antarctic. These were the saccoderm *Roya anglica* G. S. West and *Closterium jenneri* var. *jenneri* Ralfs.

Acknowledgement

The authors are grateful to Dr Julian Priddle who provided the samples on which this paper is based. Also they wish to thank Dr John Lund, FRS, and the Fritsch Collection of the Freshwater Biological Association for references supplied from their valuable iconography. They are also indebted to Mr J. E. Jones of the Royal Latin School, Buckingham, for the Latin diagnosis of the new species, *Cosmarium decussare*.

Received 27 May 1983; accepted 14 July 1983

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