

## Description of a new desmid species, *Cosmarium pankakoskiiforme*, from the Outer Hebrides, Scotland, UK

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### Abstract

*Cosmarium pankakoskiiforme*, is currently only known from Loch na Gearrachan, North Uist, Outer Hebrides. In size and morphology, there are some similarities with *C. taxichondriiforme* Eichler & Gutwiński 1894, however it has two pyrenoids per semicell and a different ecology. There are a number of other taxa which may be closely related or possibly synonymous, but a new name has been chosen to avoid further taxonomic confusion.

### Introduction

It was mid-June with low water-levels after a lengthy dry period. I decided to sample Loch na Gearrachan, situated at the north end of the island of North Uist, Outer Hebrides. It was the least inspiring site I have sampled for some time with a bed of glacial Lewisian gneiss and a sparse vegetation of *Lobelia dortmanna*. The bed of the loch was too stony to cast the plankton net in case it got damaged, so I walked with it, hand-held, for 50 metres. I ended up with a large pot of 50 percent silt. Back home, I filter most of the silt out and left the rest to settle for 24 hours. On inspection I was surprised to note a familiar looking small desmid but with two pyrenoids per semicell. This was the start of an investigation into similar taxa, as described below.

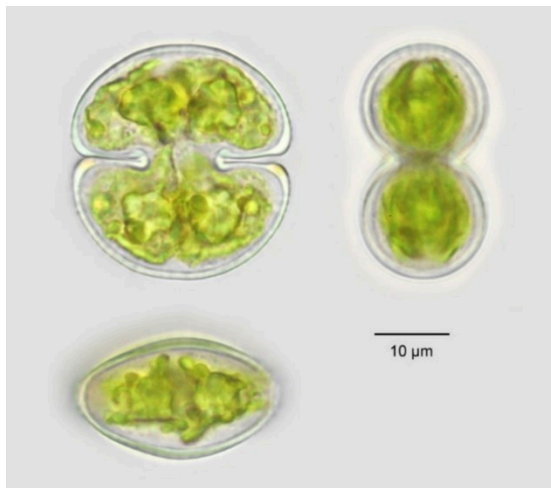


Figure 1. Frontal, lateral and apical views of *C. pankakoskiiforme*. Photo © Chris Johnson.

### *Cosmarium pankakoskiiforme* C.D.N. Johnson spec. nov. (figs. 1-2)

### Description

Cells small to medium sized, marginally longer than broad. Semicells sub-semicircular in outline, deeply constricted; sinus with a thickened-wall at the apex, sinuous margins, often showing an elongate-ovoid opening. Semicell a slightly broadened semicircle, basal angles rounded with yellowish thickening, also a little protracted. Thickening at the basal angles consisting of two papillae in juxtaposition, best seen in side view. Apex broadly rounded; cell wall in face-view faintly undulate, caused by mucus pores. Apical view rhomboid with side thickening, lateral view circular. Chloroplast axile with two central pyrenoid. Zygospore unknown.

Cell dimensions, including Croasdale's (see below): L. 31-37 µm; B. 31-34.5 µm; ls. 10-12.7 µm; Th. 14-18.5 µm; L./B. 1.05-1.08.

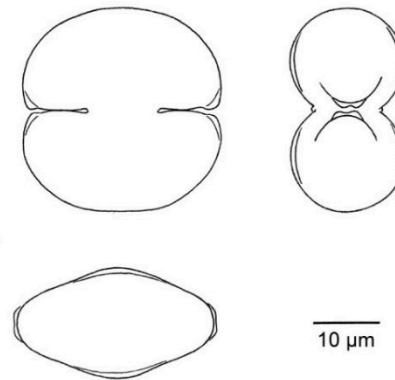


Figure 2. Drawing showing frontal, lateral and apical views of a single vegetative cell of *C. pankakoskiiforme*. © Frans Kouwets.

### Type

Fixed natural sample (plankton net through a shallow loch-edge), collected by C.D.N. Johnson, 20 June 2023, deposited at the Natural History Museum, London, Accession No. BM001243473 (Holotype represented by fig. 2).

### Type locality

UNITED KINGDOM. Loch na Gearrachan, Claddach, North Uist, Outer Hebrides.

Lat: 57.641928°N; Long: 7.420208°W.

## Occurrence

*C. pankakoskiiforme* is currently only known from Loch na Gearrachan, Claddach, North Uist (fig. 3). Samples were collected on 20 June 2023 using a plankton net through shallow water with a gravelly substrate comprising subglacial moraine deposition, consisting of Lewisian gneiss. The only vegetation comprised *Lobelia dortmanna*. The pH 7.9, conductivity 322  $\mu\text{S}/\text{cm}$ .

## Discussion

A literature search reveals clear morphological similarities between the present species and *C. taxichondriforme* Eichler & Gutwiński 1894. These include overall shape of the cells, the undulate nature of the sinuses and thickened basal angles, the centre of the semicells is also thickened. The authors give cell dimensions similar to the North Uist taxon (l.c.: 169, pl. 4: 23; see our fig. 4). The significant distinguishing features of *C. pankakoskiiforme* include two pyrenoids per semicell instead of one and an alkaline as opposed to an acidic habitat, suggesting a different ecology.



Figure 3. Loch na Gearrachan, Claddach, North Uist. Photo © Christine Johnson

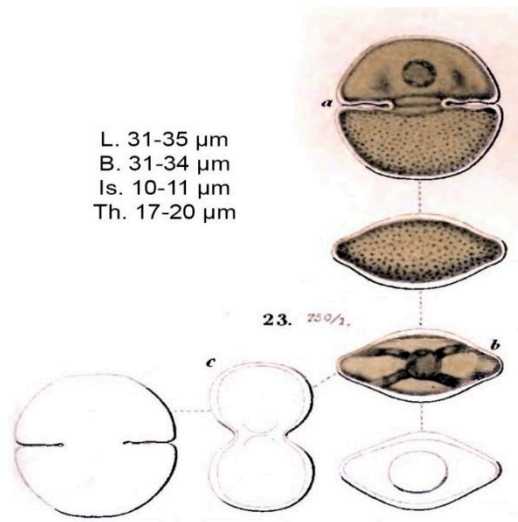


Figure 4. *C. taxichondriforme* from Eichler & Gutwiński (1894).

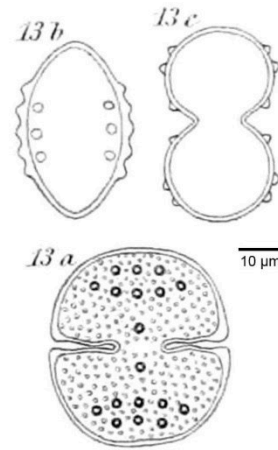


Figure 5. *C. taxichondrum* from Lundell (1871).

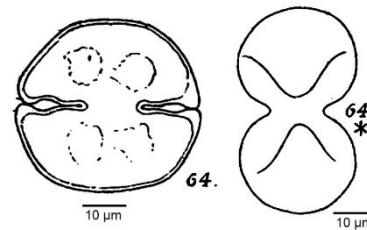


Figure 6. *C. taxichondrum* var. *nudum* from Turner (1892).

Later finds of *C. taxichondriforme* enlarged the size-range considerably. Kouwets (in preparation) has undertaken considerable research into *Cosmaria* and gives cell dimensions for this species as L. 30-45 (-52)  $\mu\text{m}$ , Br. 30-49  $\mu\text{m}$ , Th. 17-25  $\mu\text{m}$ , l. 10-15  $\mu\text{m}$ ; L./Br. 0.9-1.1. This places the taxon under discussion at the start of the size-range.

Another species, with a similar outline profile, is *C. taxichondrum* Lundell 1871. However, this desmid has larger dimensions and eight, sometimes more, tubercles in the upper part of the semicell, and also a supra-isthmial tubercle. It has a single pyrenoid per semicell. The author illustrates these points well (Lundell, l.c.: 39, pl. 2: 13; see our fig. 5): moreover, this rare desmid is found in acidic habitats.

*C. taxichondrum* var. *nudum* W.B. Turner 1893 was established as it differs from the nominate in having two pyrenoids per semicell as opposed to one, and has larger dimensions (l.c.: 60, pl. 8: 64; see our fig. 6). It also has a different ecology from the nominate variety, being found in barely acidic waters. Both the nominate and var. *nudum* are seemingly rare. Coesel (1979) found both *C. taxichondriforme* and the variety *nudum* (in a suggested recombination with *C. taxichondriforme*) in the Netherlands (l.c.: 58, pl. 13: 3-6; see our fig. 7) noting for the former: "The undulated sinus line and the basal angular wall thickening supposed to be characteristic of the species are not always manifest in our material." Irénée-Marie (1949: 274) described a large population from Canada, which he ascribed to *C.*

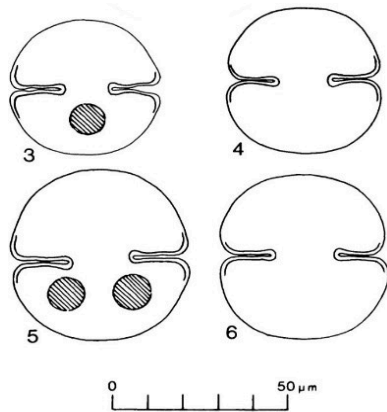


Figure 7. 3-4. *C. taxichondriforme* var. *taxichondriforme*; 5-6. *C. taxichondriforme* var. *nudum* from Coesel (1979).

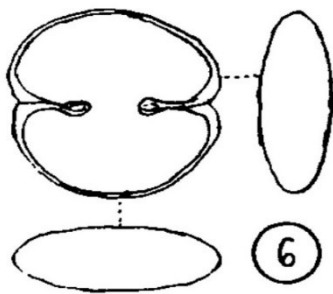


Figure 8. *C. taxichondrum* var. *nudum* from Irénée-Marie (1949).

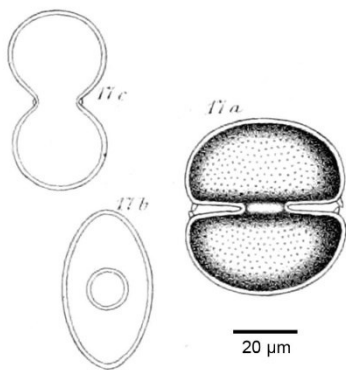


Figure 9. *C. smolandicum* from Lundell (1871).

*taxichondrum* var. *nudum* with smaller dimensions (l.c.: 275), L. 33.8-39.8; B. 30.8-36.8; ls. 9.6-9.8 µm. Surprisingly, no thickness was given even though the rather sketchy drawing (l.c., pl. 5: 6; see our fig. 8) gives side and apical views (neither of these views bear any relation to the taxon being described). The length and breadth match closely with the Loch na Gearrachan population, but the isthmus is smaller. This poorly described and illustrated taxon must be thought of as doubtful in view of the lack of good, detailed information. It may well represent an undescribed species.

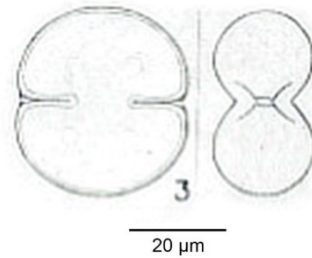


Figure 10. *C. smolandicum* from Insam & Krieger (1936).

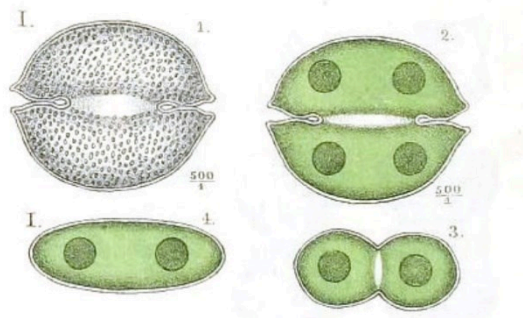


Figure 11. *C. obsoletum* from Reinsch (1867).

*C. taxichondrum* var. *nudum* as originally described by Turner can be dismissed from any association with *C. pankakoskiiforme* on the basis of being substantially larger and preferring an acidic habitat. A comprehensive history of this taxon will be presented in a separate publication (Kouwets, in preparation).

Other similar cells to consider:

Lundell (l.c.: 39, pl. 2: 17; see our fig. 9) clearly described a new species from Småland, Sweden: *C. smolandicum*. It has little in common with the North Uist taxon, having more flattened semicells, open, almost parallel sinuses and papillate basal angles, two pyrenoids per semicell, and dimensions of 54 x 48 µm. However, Insam & Krieger (1936: 108, pl. 3: 3; see our fig. 10) described a form of *C. smolandicum* with papillate basal angles and two pyrenoids per semicell, the sinuses are closed for the most part and has dimensions of 39 x 35 µm. Linking this form with Lundell's cell is stretching boundaries, but it does have features in common with the North Uist taxon, although a little on the large size. Prescott et al. (1981: 287, pl. 157: 7) figures a cell of *C. smolandicum* with emarginate basal angles measuring 42.5 x 41.3 µm (calculated), which is similar, but larger, to that presented by Insam & Krieger (l.c.). Strangely, they do not illustrate Lundell's original figure.

*C. obsoletum* (Hantzsch) Reinsch 1867, has a similar outline profile to *C. pankakoskiiforme* with two pyrenoids per semicell. However, the sinus is open for the latter half of its length raising the basal angles

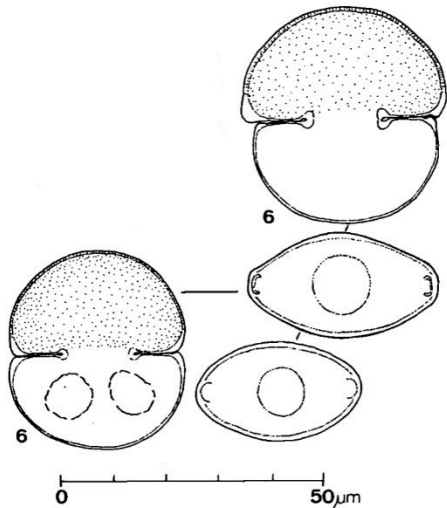


Figure 12. *C. obsoletum* var. *minus* from Lenzenweger (1986).

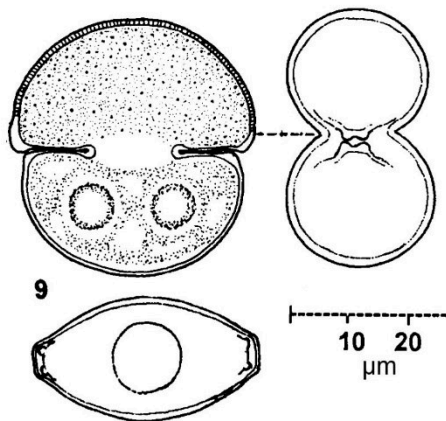


Figure 13. *C. obsoletum* var. *minus* from Lenzenweger (1999).

into a slightly thickened beak-like extension (l.c.: 142, pl. 22D1: 1-4; see our fig. 11). This taxon has a remarkable size range: 34-73 x 42-80  $\mu\text{m}$ . In 1986, Lenzenweger presented a form attributed to *C. obsoletum* var. *minus* (Messikommer) Krieger & Gerloff 1962 with thickened basal angles, indicating that they are sometimes lobed (mamillate) as shown in his figure (Lenzenweger l.c.: 33, pl. 2: 6; see our fig. 12). Lenzenweger figured another cell (l.c., pl. 45: 9; see our fig. 13) with two pyrenoids and the side view clearly shows bipapillate basal angles. The drawing measures 42 x 43.6  $\mu\text{m}$ , which differs slightly from the dimensions given in the text. This variety was originally described as a forma minus (misspelled minor) of *C. smolandicum* by Messikommer (1929: 17, pl. 1: 10), measuring 34-35 X 33-36  $\mu\text{m}$ . The accompanying figure doesn't show any details of the basal angles and in the text Messikommer only stated that they are thickened, not 'mamillate'. No information about the number of pyrenoids was given. Most incomprehensibly,

Krieger & Gerloff (1962) transferred this form to *C. obsoletum* (Hantzsch) Reinsch 1867, a characteristic and very different form with remarkably thickened basal angles with a conspicuous pore. Finally, we should also carefully compare our form with *C. pankakoskii* Grönblad 1947, another similar species with two pyrenoids per semicell. In the original figure (Grönblad l.c., fig. 7; see our fig. 14), only truncate wall-thickenings are indicated and dimensions of 32 x 30  $\mu\text{m}$ . These single measurements would suggest that only a single cell was found. To complicate matters further, he compared his *C. pankakoskii* with *C. crassangulatum* Borge 1894 and *C. crassipelle* Boldt 1885, suggesting that the last mentioned two species may be synonymous (which is now generally agreed). However, these latter taxa have a different profile being more quadrate with flattened apices. There is also doubt regarding the type of chloroplast and number of pyrenoids. They clearly don't relate to the taxon under discussion and will not be considered further.

Croasdale (1956), collecting in the subarctic of Alaska, noted: "The numerous shallow ponds and smaller bog holes are very rich in desmids, in spite of the relatively high pH (6.4-8.6, with pH 8.0 the commonest condition)." She presented a form of *C. pankakoskii* with two pyrenoids per semicell and truncate or bimamillate basal angles, measuring 31-37 x 32-34.5  $\mu\text{m}$ . (l.c.: 44, pl. 3: 2; see our fig. 15). For

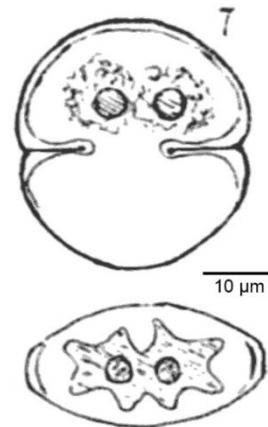


Figure 14. *C. pankakoskii* from Grönblad (1947).

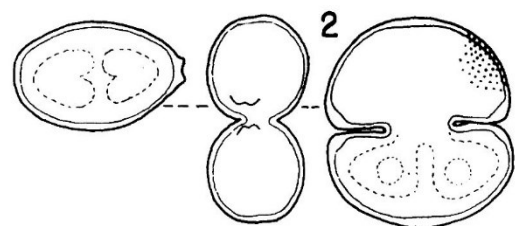


Figure 15. *C. pankakoskii* from Croasdale (1956).

the sites where she collected *C. pankakoskii* she indeed reported a pH of 8.0 (Croasdale l.c.: 63). Förster (1965 [1967]: 144, pl. 5: 39) also presented a form of *C. pankakoskii* with bipapillate basal angles with slightly larger dimensions of 36-39 x 33-35 µm, but with truncate apices (fig. 16).

## Conclusions

The Loch na Gearrachan population of *C. pankakoskiiforme* has dimensions that match *C. tachichondriiforme* at the lower end of its range but displays two pyrenoids per semicell. The latter taxon is superficially similar in outline shape but lacks the papillate or mamillate features of the basal angles. It

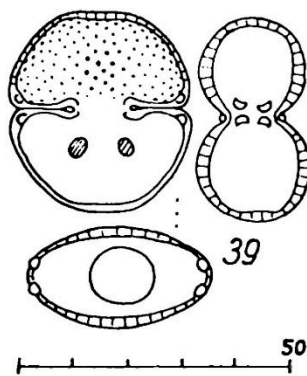


Figure 16. *C. pankakoskii* from Förster (1965 '1967').

is generally larger and has a different ecology. The discussion illustrated that a number of taxa are closely related and possibly synonymous: *C. smolandicum* sensu Insam & Krieger (1936), *C. obsoletum* var. *minus* sensu Lenzenweger (1986), *C. pankakoskii* sensu Croasdale (1956) and *C. pankakoskii* sensu Förster (1965). To avoid further taxonomic confusion a new name has been chosen that reflects the similarity with the taxa just mentioned, especially Croasdale's, which is likely to be synonymous.

## Acknowledgement

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