

# *Cosmarium askernishense* C.D.N. Johnson 2023

## Taxonomic Account

(Figs. 1-3)

**Description:** Cells 1.25–1.37 times longer than broad with an acute, open sinus from the start. Semicells somewhat variable in outline, in frontal view broadly trapeziform with the lower lateral angle straight to marginally convex running smoothly into rounded lateral angles, the broadest part of the semicell about one third up from the isthmus. Upper laterals are slightly convex running smoothly into the apex which is also slightly convex. The cell wall is quite thick and uniformly and densely punctate (mucus pores). There is noticeable cell-wall thickening at the widest points and, less so, at the apex. In side view the semicells are orbicular with a lenticular wall thickening. The apical view is broadly ellipsoid with rather narrowly rounded poles and a considerable, broad wall thickening on either frontal side. Chloroplast axile with a single large pyrenoid per semicell. Zygospore unknown.

Dimensions: L: 34–36.5  $\mu\text{m}$ , B: 26.5–28  $\mu\text{m}$ , Is: 8–9  $\mu\text{m}$ , Th: 18.5–19  $\mu\text{m}$ , L/B: 1.25–1.37.

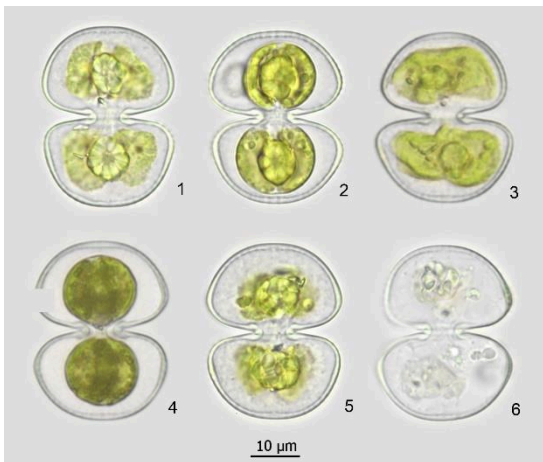


Figure 1. A montage of *C. askernishense* cells: Nos. 1,2,4,5 are representative of the species. The upper semicell of No. 3 has not completed its development. No. 6 is distorted and oblique but useful for emphasising the lateral wall thickening. Photograph © Chris Johnson.

**Type:** Fixed natural sample (plankton net through aquatics), collected by C.D.N. Johnson, 9 August 2021, deposited at the Natural History Museum, London, Accession No. BM013788934. (Holotype represented by fig. 3).

**Type locality:** UNITED KINGDOM. Loch a' Chafain, near Askernish, South Uist, Outer Hebrides.

**Etymology:** Named after the nearby township of Askernish, South Uist, Outer Hebrides.

Lat: 57.192549°N Long: 7.387511°W.

**Occurrence:** *C. askernishense* is currently only known from Loch a' Chafain, South Uist. (fig. 4). Cells were captured on two separate occasions (9 August 2021 and 31 July 2022) using a plankton net through marginal vegetation comprising: *Nymphaea alba*, *Potamogeton natans*, *Ranunculus flammula* & *Lobelia dortmanna*. The pH: 7.1-7.4, conductivity: 188  $\mu\text{S/cm}$ .

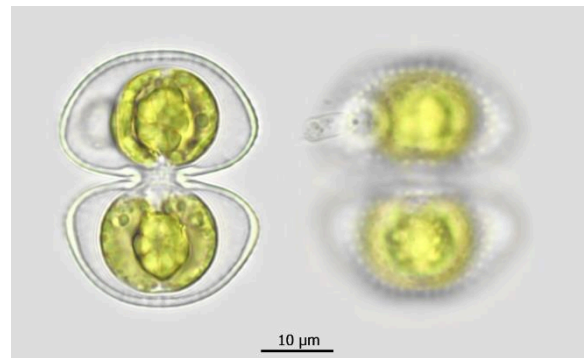


Figure 2. Vegetative cell of *C. askernishense* showing the numerous mucus pores. Photograph © Chris Johnson.

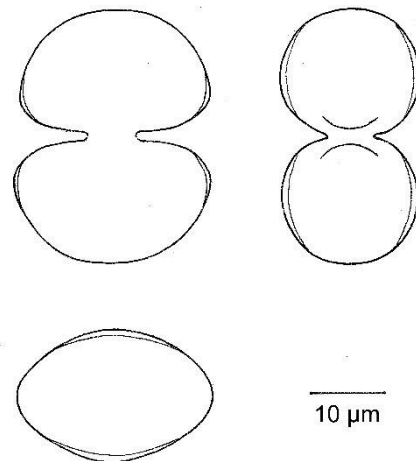


Figure 3. Drawing showing frontal, lateral and apical views of a single vegetative cell of *C. askernishense*. Drawing © Frans Kouwets.



Figure 4. Loch a' Chafain, South Uist. Photograph © Christine Johnson.

### Discussion

Checking the literature; there is a clear similarity between the present species and the *Cosmarium contractum* complex. Many forms associated with this complex display a central cell-wall thickening and it is these taxa that I have concentrated on for comparative purposes.

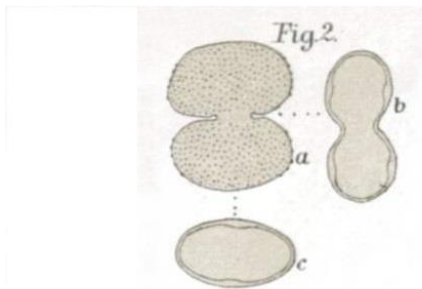


Figure 5. *C. ellipsoideum* var. *notatum* from Raciborski (1892). Dimensions: L: 33, B: 28, ls: 10, Th: 16 µm, L/B: 1.18.

*Cosmarium ellipsoideum* var. *notatum* was first described by Raciborski (1892, p. 373, pl. 7:2) from Australia (fig. 5). From the same site, Playfair (1907, p. 193, pl. 5: 15) described *Cosmarium incrassatum*, which is regarded as synonymous with Raciborski's

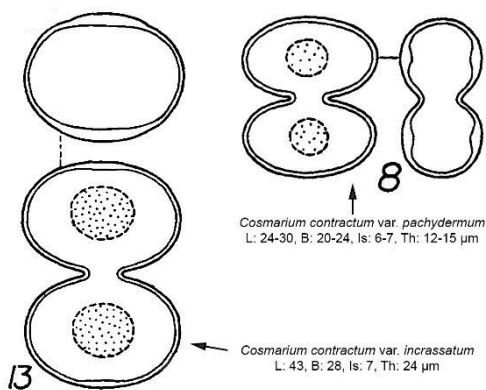


Figure 6. *C. contractum* var. *pachydermum* and var. *incrassatum* from Scott & Prescott (1958).

find. *C. ellipsoideum* F.E.V. Elfving 1881 currently is generally associated with *C. contractum* E.O.O. von Kirchner 1878 (see W. & G.S. West 1902, 1905). Also from Australia, Scott & Prescott (1958, p. 44, pls. 12: 8 & 13: 13) published two varieties: *C. contractum* var. *incrassatum* and var. *pachydermum*. (fig. 6). Most confusingly, under the same varietal names Scott & Prescott (1961) depict cells with a markedly different morphology from Indonesia. Away from northern Australia and south-east Asia, from eastern Canada Croasdale & Grönblad (1964, p. 176, pl. 11: 18) record *C. contractum* var. *incrassatum* with an aberrant morphology in addition to various other forms associated with *C. contractum* pointing to their broad species concepts, similar as that expressed by Scott & Prescott.

These varieties are considered here because they have a similar cell-wall thickening as seen in side and apical views. However, on closer examination the shape of the central wall thickening in the present form differs from the forms mentioned above in that it is less clearly defined covering a larger area. In addition, the forms mentioned above differ in their semicell shape, being ellipsoid in varying degrees both in frontal and apical view. In frontal view the sides are completely rounded with the widest point in the centre, without any differentiation between upper and lower angles. In apical view the poles of the semicell are broadly rounded in some forms resulting in a more oval shape.

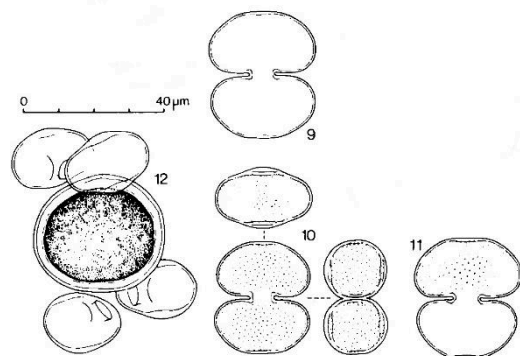


Figure 7. *C. contractum* var. *incrassatum* from Kouwets (1988).

Kouwets (1988, p. 66, fig. 3: 9-12) found cells which he identified as *C. contractum* var. *incrassatum* as described by Scott & Prescott (1958; see fig. 7). The semicells being trapezoid with the widest part about one third up from the isthmus (similar to the Askernish cells). However, as with the forms mentioned above, the apical view is elliptical with a well-defined, somewhat bulging wall thickening. In addition, the fractionally extended isthmus has produced sinuses which are slightly open at the apex and run parallel before opening widely. This

characteristic is rather similar to Raciborski's var. *notatum* but differs from the gradual widening from the apex of the sinuses of *C. askernishense*. The globose zygospores found in the French material clearly point to an affinity with *C. contractum*.

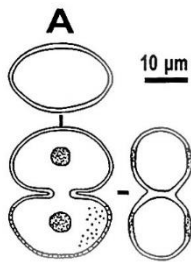
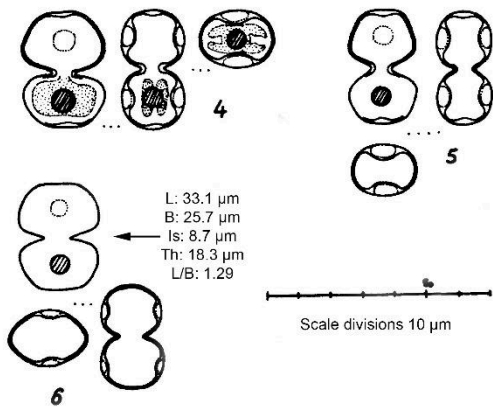


Figure 8. *C. contractum* var. *incrassatum* from John & Williamson (2009)

An interesting find from the west of Ireland by John & Williamson (2009, p. 63, pl. 12: A; see fig. 8) would seem to be an intermediate form between Kouwets' find from south-west France and the Askernish find. Named as *C. contractum* var. *incrassatum*, the length and breadth are similar to the Askernish cell but with a perceived narrower isthmus and smaller thickness. The shape of the sinuses matches closely those of Kouwets. Of note is the small amount of lenticular thickening in side view and no obvious thickening in apical view. Some similarity was also found with *C. contractum* var. *subtrapeziforme* Kurt Förster 1973. This variety was discovered in a ditch in Florida, USA (Förster l.c., p. 548, pl. 10: 4-5). However, it differed in having the upper laterals straight and drawn into the apex more sharply, with a narrower isthmus and a greater L/B ratio (1.4-1.75). On the same plate Förster (l.c., pl. 10: 6) illustrated an unnamed form of var. *subtrapeziforme* which has closer similarities with *C. askernishense* in its outline shape and lenticular thickening, and particularly in its apical view being rugby-ball shaped with ends that are subacute (see our fig. 9).



Figs. 4-5: *Cosmarium contractum* var. *subtrapeziforme* Förster  
Fig. 6: *Cosmarium contractum* var. *subtrapeziforme* forma

Figure 9. *C. contractum* var. *subtrapeziforme* from Förster (1973).

It should be noted that from the same region Förster reported two more varieties of *C. contractum*, viz. var. *incrassatum* and the new var. *ornatum* Kurt Förster 1973, both with oval-elliptic apical views. Kanetsuna & Yamagishi (2011, p. 17, pl. 6: 11) show an image of a zygospore of *C. contractum* var. *subtrapeziforme*, also from Florida. What can be seen of the attached cells would seem to fit Förster's concept. However, on the same plate (pl. 6: 12) is an image of a vegetative cell in face view which doesn't seem to fit Förster's concept and is nearer to *C. askernishense* in outline but lacking any noticeable wall thickening. This little-known variety would seem to be confined to Florida, USA and is not known from the western Palaearctic (see our fig. 10).

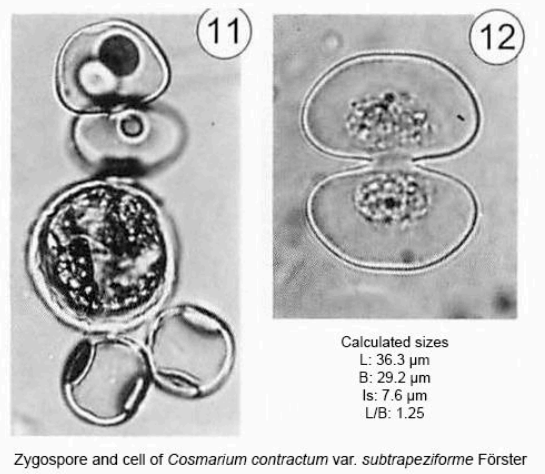


Figure 10. *C. contractum* var. *subtrapeziforme* from Kanetsuna & Yamagishi (2011).

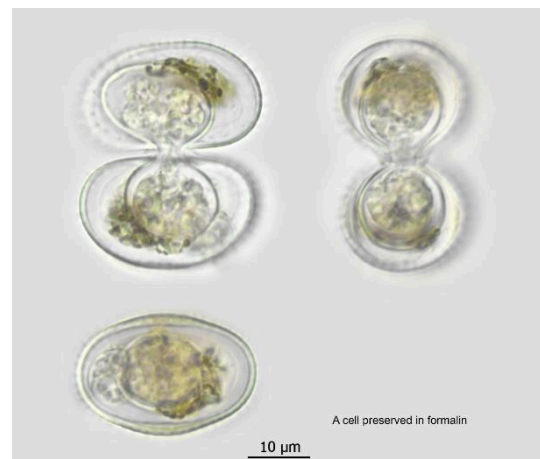
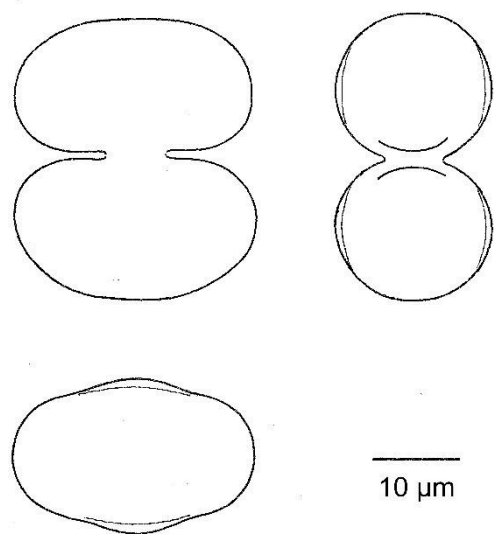


Figure 11. Frontal, lateral and apical views of a vegetative cell of a different form with broadly elliptic semicells, also related to the *C. contractum* complex (note that the frontal view is slightly distorted). Photograph © Chris Johnson.

The discussion above concerns the relationship between *C. askernishense* and the *C. contractum* complex. However, in addition to *C. askernishense* the sample contains a variety of forms with more oval-elliptic semicells that are obviously also related

to *C. contractum*. These forms have a rather broad central wall thickening and an elliptic apical view with broadly rounded poles. (see figures 11 & 12).



**Figure 12.** Drawing showing frontal, lateral and apical views of a single vegetative cell of the form with elliptic semicells. Drawing © Frans Kouwets.

Moreover, the dimensions vary within wider limits than *C. askernishense*: 31–36 x 25–31.5 µm. These forms are more in agreement with Raciborski's var. *notatum* mentioned above; intermediate forms or dichotypical cells were not encountered. The true relation between the present new species with trapeziform semicells and the forms with more elliptic semicells is unknown. Molecular studies may throw more light on this subject. Finally, two more species should be considered in identifying the Askernish form. Taylor (1934) described *Cosmarium refringens* from Newfoundland with somewhat rounded trapeziform semicells with thickened lateral angles and a prominent sublenticular central wall thickening (Taylor l.c., p. 265, pl. 50: 10). Unfortunately, no apical view was given. Croasdale (1956) mentioned it from Alaska but figured a form with more hexagonal semicells and a very widely gaping sinus (Croasdale l.c., p. 50, pl. 6: 1). However, she also figured an apical view which is rhomboid with rather narrowly rounded poles. From Finland Grönblad (1920) described *Cosmarium subcoliferum* which is somewhat intermediate between Taylor's and Croasdale's forms, in apical view showing even more narrowly rounded poles (Grönblad l.c., p. 49, Pl. 5: 16–18). Krieger & Gerloff (1962, p. 82) transferred it as var. *subcoliferum* to *C. refringens*. Last mentioned taxon seems to be very rare and only a few finds have been published; their relation with the *C. contractum* complex and the Askernish form is unknown and needs further study after new finds.

## Conclusion

*C. contractum* is a confused species complex with some cells displaying smooth walls and others with a noticeable thickening – the above-mentioned taxa fall into the latter group. There are similarities in some aspects of the cells' morphology with the Askernish desmid such as the wall thickening, but there are other notable differences as described. An argument could be made to add another variety or, indeed, a forma to this complex but the author feels this would just add to the confusion. The author considers that there is sufficient difference to warrant species rank.

## Acknowledgements

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