The hexactinellid sponge *Cyathophycus* from the Lower Ordovician Klabava Formation of the Prague Basin, Czech Republic

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Abstract. – A unique cluster of pentactine spicules has been observed in the lower part of the Olešná Member of the Klabava Formation (Upper Tremadocian or earliest Floian) in the Prague Basin. Some 100 pentactines of uniform size are arranged in one layer of regular quadrules. Although the general shape of the sponge is not preserved, the orientation of the pentactines in the quadrules is consistent with attribution to *Cyathophycus* Walcott, 1879. • Key words: Porifera, *Cyathophycus*, Ordovician, Tremadocian, Floian, Klabava Formation, Prague Basin, Czech Republic.

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Isolated spicules of hexactinellid sponges have been known from the Olešná Member of the Klabava Formation (Upper Tremadocian to Floian) for 120 years (Feistmantel 1884, Počta 1898). The diversity and detailed morphology of these spicules has recently been revealed (Mergl & Doušpek 2006) but the general shape of the sponges and their spicule arrangement have remained unknown. A unique cluster of spicules has been observed in the palaeontological collection in the National Museum, Prague, a specimen collected by Celda Klouček some 80 years ago.

The spicule cluster is preserved on a bedding plane of a red-brown siltstone that was collected in a small quarry near Olešná village (SW part of the Prague Basin; Fig. 1). The site is no longer accessible as the quarry was abandoned 50 years ago and has been filled with scree and deposits from a nearby village. Although detailed collecting data are therefore absent, the stratigraphic level of the specimen can be reliably deduced. This stratigraphical succession has uniform lithology in the area and is exposed in another adjacent quarry situated to the SW (Mergl 1986).

The layers of red-brown siltstones (Olešná Member of the Klabava Formation, Upper Tremadocian and early Floian) were exposed on the west wall of the original quarry just above steeply tilted cherts of the subjacent Mílina Formation (Kettner 1916). A strikingly red, fine-grained bedded siltstone begins 2 m above the lithological boundary of the Mílina and Klabava formations in the second quarry. Siltstones in the original quarry were exposed for approximately 15 meters.

The fauna of the siltstones is uniform, with organophosphatic lingulate brachiopods and spicules, with pectactines more abundant from unit H upwards (Mergl 1986; Fig. 1). Characteristic lingulate brachiopods *Dactylotreta prisca* Mergl, 2002 and *Celdobolus mirandus* (Barrande, 1879) are also present on the slab with the sponge and thus unambiguously confirm the local stratigraphic position of the specimen. A total lack of organic-walled index fossils makes international correlation of the Olešná Member less clear, but the geological position and dominance of drepanostoidform conodonts indicate the *P. deltifer* to *P. proteus* zones; the presence of *Westergaardodina* has limited stratigraphic value (Mergl 2006).

Systematic palaeontology

Order Reticulosa Reid, 1958
Suborder Protospongioidea Hinde, 1887
Superfamily Hintzespongioidea Finks, 1983
Family Hintzespongiidae Finks, 1983

Genus *Cyathophycus* Walcott, 1879

Type species. – *Cyathophycus reticulatus* Walcott, 1879; Middle Cambrian; Canada.

Cyathophycus sp.

Figure 2

Material. – A cluster of spicules preserved as external moulds in red-brown siltstone, stored in the palaeontological collections of the National Museum, Prague (NM L 39308).

Description. – The single fragment is surely only a small part of what was probably a fairly large reticulosid sponge. The irregular cluster of spicules (15 x 28 mm) consists of

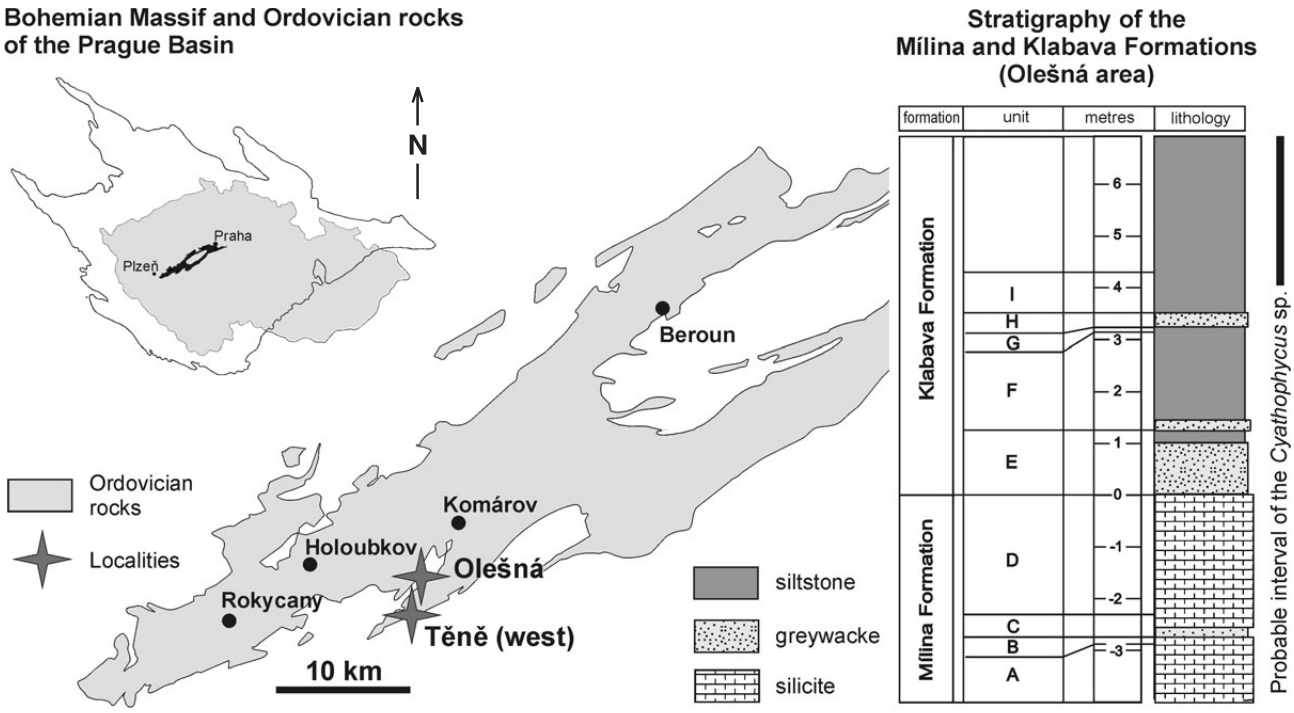

Figure 1. Map showing locality and stratigraphy of the *Cyathophycus* sp. specimen.

large pentactines of rather uniform size. In total, 107 pentactines have been observed, most in a nearly original position or only slightly displaced (Fig. 2A). The skeletal net is relatively well organised with consistent orientation of spicules. By application of small displacement and weak rotation of some spicules on the specimen, it is possible to reconstruct a hypothesised original regular grid of spicules (Fig. 2D). Spicules were arranged in discrete rows in a single layer and formed regular, gently elongate quadrules. These are 2.0–2.5 mm long and 2.0–1.5 mm wide, in junctions with short overlap of the tips of some tangential rays.

Longer tangential lateral rays are gently arched and weakly inclined toward the proximal axial ray. Shorter tangential lateral rays are less arched and much more steeply sloping toward the axial ray. The inter-ray angle ranges from 60° to 90°, nevertheless, in most spicules the angle is near 80° to 90° and the lower angle is distinct only in a few spicules. Lengths of longer lateral rays are mostly between 2.0–2.5 mm, but actual length was probably slightly longer because the ray tips are often obscured because of the preservation. The longest preserved tangential rays attain 3 mm, but the length of the shorter lateral rays is always smaller than 2 mm. Diameters of the proximal part of the tangential lateral rays are 0.10–0.12 mm. All rays evenly taper toward the tips. The surface of the rays seems smooth and surely was devoid of any coarser structure.

The axial ray is shorter than the tangential rays but its actual length is unknown because it is always preserved as an external mould (Fig. 2C). The diameter of the axial ray is *ca* 0.15 mm. Because the counterpart of the specimen is not available, it is unclear whether there were opposite distal axial rays in the preserved spicules. However, it is unlikely that all spicules were hexactines because several spicules have been observed with sedimentary cover in their axial parts without any hole indicating the presence of a distal axial ray; these spicules are surely the pentactines.

Remarks. – The specimen represents a sponge with a thin wall of parallelly arranged pentactines forming regular quadrules in probably one layer. This suggests that the sponge is a reticulosid. The sponge is preliminary referred to *Cyathophycus* Walcott, 1879, although there are some differences from other species of the genus. Unlike the structure of the wall known in other species of *Cyathophycus* (Dawson 1889, Rigby 1995, Botting 2003a, b), there are spicules of only one size order, and those spicules lack distal rays being pentactines instead of hexactines. In addition, a multilaminar body wall probably was not developed. *Cyathophycus reticulatus* Walcott, 1879 and *C. quebecensis* Dawson, 1889 have a vertically elongate quadrangular opening differing from the almost quadrate openings of *C.* sp. Similar quadrate openings are present in *C. pseudoreticulatus* Rigby, 1995 from the Middle Ordovician Vinini Formation of Nevada. This species differs in the slightly smaller size of spicules with prominent distal and proximal axial rays and two ranks of quadrules of which the first-order is smaller than in *C.* sp.

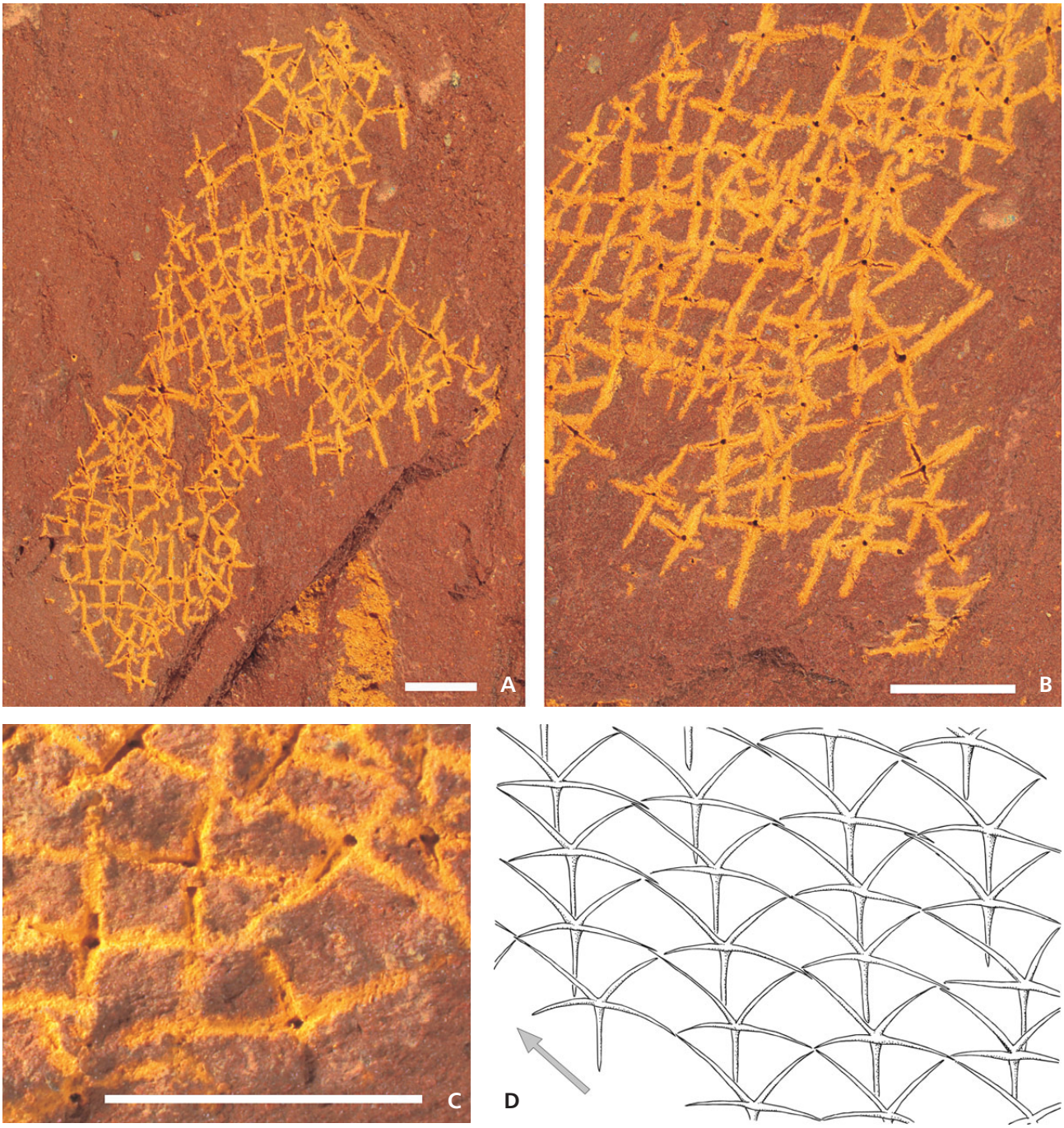

Figure 2. *Cyathophycus* sp., specimen NM L 39308. • A – a cluster of 107 spicules. • B – detail of cluster showing regular grid of spicules. • C – detail of pentactines. • D – diagrammatic reconstruction of the mesh of pentactines in a sponge wall. Bar equals to 3 mm, arrow indicates vertical direction.

Isolated spicules with a morphology similar to those preserved in *Cyathophycus* sp. are abundant in more localities of the Olešná Member. The size and morphology of the spicules in *Cyathophycus* sp. are identical with the large pinnate pentactines isolated from the phosphatic clasts in the lower part of the Olešná Member and described by Mergl & Duršpek (2006; Fig. 2D). These spicules were formerly referred to *Pyritonema feistmanteli* Počta, 1898 but were redescribed and left in open nomeclature as "Gen. et sp. indet. A" by Mergl & Duršpek (2006).

Among the material described by Mergl & Duršpek (2006) are also present smaller pentactines and small thick-rayed hexactines. These differently sized spicules possibly belong to different ranks of spicules indicating the more complex and multilaminar body wall of another reticulosid. Whether the small cluster of large pentactines with reversely

inclined lateral rays of large pentactines (Mergl & Duršpek 2006, fig. 5A, B) indicates a further species or represents a different part of the body of *Cyathophycus* sp. needs further study.

Age and locality. – Klabava Formation, lower part of the Olešná Member; abandoned small quarry E of the Olešná village, Beroun District, Czech Republic.

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References

BARRANDE, J. 1879. Systême silurien du centre de la Bohême. I*ére partie. Recherches paléontologiques. Vol. 5. Classe des Mollusques. Ordre des Brachiopodes*. 226 pp. Prague & Paris.

BOTTING, J.P. 2003a. Growth patterns of Lower Palaeozoic sponges. *Lethaia 36*, 41–52.
DOI 10.1080/00241160310001263

BOTTING, J.P. 2003b. *Cyathophycus* and the origin of demosponges. *Lethaia 36*, 335–344.
DOI 10.1080/00241160310006385

DAWSON, J.W. 1889. New species of fossil sponges from the Siluro-Cambrian at Little Métis on the Lower St. Lawrence. *Transactions of the Royal Society of Canada 7(4)*, 31–55.

FEISTMANTEL, K. 1884. Spongienreste aus silurischen Schichten von Böhmen. *Sitzgberichtung der Köninglichen Böhmischen Gesellschaft der Wissenschaft,* 1–7.

FINKS, R.M. 1983. Fossil Hexactinellida, 101–115. *In* BROADHEAD, T.W. (ed.) *Sponges and spongiomorphs: Notes for a short course*. University of Tennessee Press, Knoxville.

HINDE, G.J. 1887. A monograph of the British fossil sponges. Part. 1. Sponges of Palaeozoic and Jurassic strata. 92 pp. *Palaeontographical Society, London 40(1)*, 1–92.

KETTNER, R. 1916. Příspěvek ke stratigrafii vrstev krušnohorských ($d_1\alpha$). Část 1, 2. *Rozpravy České akademie pro vědy, slovesnost a umění, Třída II, 25(16, 34)*, 1–33, 1–32.

MERGL, M. 1986. The Lower Ordovician (Tremadoc–Arenig) *Leptembolon* Community in the Komárov area (SW part of the Prague Basin; Bohemia). *Folia Musei rerum naturalium Bohemiae occidentalis, Geologica 24*, 1–34.

MERGL, M. 2002. Linguliformean and craniiformean brachiopods of the Ordovician (Třenice to Dobrotivá Formations) of the Barrandian, Bohemia. *Acta Musei nationalis Pragae, Series B – historia naturalis 58(1–2)*, 1–82.

MERGL, M. 2006. Paraconodont *Westergaardodina* in the Lower Ordovician of the Prague Basin, Czech Republic. *Bulletin of Geosciences 81(4),* 305–308.
DOI 10.3140/bull.geosci.2006.04.305

MERGL, M. & DURŠPEK, J. 2006. Sponge spicules and radiolarians from the Olešná Member of the Klabava Formation (Ordovician, Prague Basin, Czech Republic). *Bulletin of Geosciences 81(1)*, 17–26. DOI 10.3140/bull.geosci.2006.01.017

POČTA, F. 1898. O zbytcích hub z české pánve paleozoické. *Rozpravy České akademie císaře Františka Josefa pro vědy, slovesnost a umění, Třída II 7*, 24.

REID, R.E.H. 1958. *A monograph of the Upper Cretaceous Hexactinellida of Great Britain and Northern Ireland, Part 1.* i–xlvi. Palaeontographical Society, London.

RIGBY, J.K. 1995. The hexactinellid sponge *Cyathophycus* from the Lower-Middle Ordovician Vinini Formation of Central Nevada. *Journal of Paleontology 69*, 409–416.

WALCOTT, C.D. 1879. Fossils of the Utica Slate. *Transactions of the Albany Institute 10*, 18–19.