

THE BIVALVE *CUNEAMYA* FROM THE LATE ORDOVICIAN OF BOHEMIA

MARIKA POLECHOVÁ

Czech Geological Survey, Klárov 3, 11843 Prague 1, the Czech Republic; e-mail: marika.polechova@geology.cz.

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Abstract: The bivalve species *Cuneamyia catilloides* from the Late Ordovician of Bohemia, previously assigned to the genus *Grammysia*, is revised. *Cuneamyia catilloides* is an important element of the *Modiolopsis* Community Group in the Letná Formation. The genus *Grammysia* very probably does not occur in the Ordovician of Bohemia and is restricted to the Silurian and Devonian strata. *Cuneamyia catilloides* with strong commarginal costae was probably an infaunal filter feeder. *Cuneamyia* is a cosmopolitan genus, occurring on Avalonia, Baltica, Laurentia, Perunica and West Gondwana.

Key words: *Cuneamyia*, Late Ordovician, Bohemia, systematics, palaeoecology, palaeobiogeography

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Introduction

The bivalves from the Ordovician rocks of Bohemia are primarily known through the monographs of Barrande (1881) and Pfab (1934). Růžička and Prantl (1960) designated some lectotypes of the bivalves species described by Barrande (1881). Horný (1960) and McAlester (1965) revised the genus *Babinka*. Kříž (1995) recognised the presence of the genus *Coxiconchia* in the Middle Ordovician strata of Bohemia and Kříž (1997) briefly summarised the palaeoecology of the Ordovician bivalves. In the last decade, bivalves from selected stratigraphical intervals were revised (Kříž and Steinová 2009, Steinová 2012 and Polechová 2013). *Cuneamyia catilloides* (BARRANDE in PERNER, 1903) from the Late Ordovician is a peculiar species originally assigned to gastropods which requires special attention. In this contribution, systematics, palaeoecology and some palaeogeographic affinities of *Cuneamyia catilloides* (BARRANDE in PERNER, 1903) are discussed.

Material and methods

The material described herein comes partly from the collection of Joachim Barrande housed in the National Museum (prefix NM) and from the collections of Jiří Kříž, Milan Šnajdr and Ondřej Zicha (prefixes JK, MŠ, OZ) stored at the Czech Geological Survey. All figured specimens were coated with ammonium chloride before being photographed (Parsley et al. 2018).

Systematic palaeontology

Remarks. The classification used by Carter et al. (2011) is adopted here.

Class Bivalvia LINNAEUS, 1758
Subclass Autobranchia GROBBEN, 1894
Infraclass Heteroconchia HERTWIG, 1895
Cohort Cardiomorphi FÉRUSSAC, 1822
Subcohort Cardioni FÉRUSSAC, 1822 (= Euheterodonta
GIRIBET et DISTEL, 2003)
Family Grammysiidae MILLER, 1877
Subfamily Cuneamyinae MORRIS,
DICKINS et ASTAFIEVA-URBAJTIS, 1991
Genus *Cuneamyia* HALL et WHITFIELD, 1875

Type species. By original designation, *Cuneamyia miamiensis* HALL et WHITFIELD, 1875 from the Upper Ordovician of the United States.

Remarks. The type species of *Cuneamyia* HALL et WHITFIELD, 1875 was depicted by Pojeta (1971) although the locality and stratigraphical horizon remained unknown. Generally, the type material is poorly preserved. Ulrich and Scofield (1894) related the genus *Cuneamyia* to *Grammysia* DE VERNEUIL, 1847. *Grammysia* shows a pronounced radial sulcus in sculpture but *Cuneamyia* possesses only commarginal lines without a radial sulcus. Both genera *Grammysia* and *Cuneamyia* are reported from Ordovician and Silurian strata. Moreover, *Grammysia* is also known from Devonian strata. Ordovician *Cuneamyia* is also known from the Late Ordovician of Argentina (Sánchez 1990), Canada (Foerste 1924), Norway (Soot-Ryen and Soot-Ryen 1960, Toni 1975), Sweden (Dahlqvist et al. 2010) and the United Kingdom (Hurst 1979, Lockley 1980).

***Cuneamya catilloides* (BARRANDE in PERNER, 1903)**

Pl. 1, Figs 1–6, Pl. 2, Fig. 3a–d, Pl. 3, Figs 1–8

1903 *Grammysia catilloides* Barr. sp.; Perner, pl. 43, figs 24–30.

1907 *Grammysia? catilloides* Barr. sp. (= *Capulus catilloides* Barr. M. S.); Perner, pl. 121, figs 19–22.

Lectotype. Designated herein. Specimen NM-L 18100, internal mould of the shell depicted by Barrande in Perner (1903) on pl. 43, as figs 28–30, re-illustrated here on Pl. 1, Fig. 5a, b.

Paralectotypes. Specimen NM-L 18101, internal mould of the shell figured by Barrande in Perner (1903) on pl. 43, as fig. 27, re-illustrated here on Pl. 1, Fig. 2a, b; specimen NM-L 18102, internal mould of the shell depicted by Barrande in Perner (1903) on pl. 43, as fig. 25, re-illustrated here on Pl. 2, Fig. 3a–d.

Type locality and horizon. Upper Ordovician, Sandbian, Letná Formation; Děd near Beroun, the Czech Republic.

Material. Nineteen right valves, four left valves.

Emended diagnosis. *Cuneamya* with triangular shell and strong shell sculpture composed of numerous commarginal costae and finer lines.

Description. Shell triangular, of medium size, inflated, inequilateral with opisthogyrate umbones closer to the anterior margin. Posterior part of the shell larger than the anterior part. Anterior and posterior margin convex, steeply sloping to the ventral part. Umbones pronounced, large, inflated ventral margin rounded. Dorsal margin straight with well developed costae. Hinge unknown, seems to be edentulous. Muscle scars not preserved. Shell sculpture consists of numerous commarginal costae and finer lines, in some specimens radial ribs are presented (NM-L 18098, NM-L 51894).

Remarks. Barrande (1881: pl. 80, box vi, figs 5–8; herein Pl. 2, Fig. 4a–c) depicted “*Grammysia praecox* from the locality Dvorce (Devonian, Lochkov Formation). This specimen has a radial sulcus, which seems to be a typical feature of the genus *Grammysia*. Perner (1903: pl. 43, figs 24–30, 1907: pl. 121, figs 19–23; herein Pl. 1, Figs 1–6, Pl. 2, Fig. 3a–d) depicted “*Grammysia catilloides*” from the Late Ordovician with a note in French: “Barrande voyait dans cette forme un *Capulus? catilloides*. Dans le registre de ces planches, nous trouvons cette remarque: “Les fig. 28–29 montrent bien la vue cardinale, qui exclut la possibilité de considérer ce fossile comme bivalve.” De plus, il comparait ces formes avec *Metoptoma Niobe* Bill. Palacoz. Foss., p. 37. et plus tard avec le genre *Ambonychia* Hall. A notre avis, il est impossible de considérer les formes en question comme des Gastéropodes. Il suffit de jeter un coup d’oeil sur les figures p. ex. *Grammysia globosa* Hall, Pal. N. York, Vol.5, Part 1. Lamellibranchiata, Pl. LXII, fig.10-19 or *Ambonychia corrugata* Ldstm (Fragm. silur. Pl. XV, fig.1-5) pour se persuader des affinités qui existent entre ce fossile et les bivalves, affinités qu’indique l’habitus.” Translation to English: “Barrande considered this form as *Capulus? catilloides*. In the list of these plates we found this remark: “The figures 28 and 29 show a cardinal view which

excludes the possibility to consider this fossile as a bivalve.” Moreover, he compared these specimens with *Metoptoma Niobe* Bill. Palacoz. Foss. 1, p. 37 and later with the genus *Ambonychia* Hall. In our opinion, it is impossible to classify these specimens (with reservation) as Gastropods, it is sufficient only to glance at the figures of *Grammysia globosa* Hall, Pal. N. York, Vol.5, Part 1. Lamellibranchiata, Pl. LXII, fig. 10-19 or *Ambonychia corrugata* Ldstm (Fragm. silur. Pl. XV, fig.1-5) to find affinities which existed between these bivalve fossils and accomodate these specimens in bivalves.”

Perner (1903) also compared specimens of *Grammysia* with *Paracyclas? libens* (pl. 3, figs 27–29; herein Pl. 2, Figs 1, 2a, b) from the locality Butovice (upper Silurian, Kopanina Formation). However *Paracyclas? libens* has the umbo in a central position and sculpture is different, composed of commarginal lines. *Cuneamya catilloides* is probably restricted to the Late Ordovician.

Generally, *Cuneamya catilloides* seems to be different from the other species of *Cuneamya* in the triangular shape of the shell. *Cuneamya miamiensis* HALL et WHITFIELD, 1875 from the Late Ordovician of the USA is more elongated with finer commarginal lines. *Cuneamya* cf. *miamiensis* is also mentioned by Hurst (1979) from the Late Ordovician of England, but without description and illustration. *Cuneamya scapha* HALL et WHITFIELD, 1875 from the Late Ordovician of the USA and the subspecies *C. scapha brevior* FOERSTE, 1924 from the Late Ordovician of Canada differs in a more elongated and inflated shell. *Cuneamya* sp. 1 (Toni 1975) from the Late Ordovician of Norway differs in a more elongated shell and pronounced umbo. *Cuneamya* sp. 2 (Toni 1975) from the Late Ordovician of Norway seems to have a very elongated shell and terminal umbo. *Cuneamya* sp. 3 (Toni 1975) from the Late Ordovician of Norway has finer commarginal lines. *Cuneamya multistriata* SOOT-RYEN et SOOT-RYEN, 1960 from the Late Ordovician of Norway has a more elongated shell, and its commarginal lines are finer than in *C. catilloides*. *Cuneamya? minuta* SOOT-RYEN et SOOT-RYEN, 1960 from the Late Ordovician of Norway differs in having a more elongated shell. Tunicliff (1982) described a specimen, which was left in open nomenclature as Bivalve gen et sp. indet. The specimen is not complete, but it shows affinities to *Cuneamya* with pronounced commarginal costae. *Cuneamya* sp. from the Late Ordovician of North Wales (Lockley 1980) is preserved as an internal mould of an articulated specimen. It differs from *C. catilloides* in a more elongated shell and finer commarginal lines. Dahlquist et al. (2010) mentioned the genus *Cuneamya* from the Late Ordovician (Hirnantian) of Sweden but without description and illustration, a comparison is thus not possible.

Occurrence. Central Bohemia; Upper Ordovician; Sandbian, Letná Formation (Děd near Beroun); Katian, Vinice Formation (Trubín, Vinice); Katian, Zahořany Formation (Zahořany); Katian, Králův Dvůr Formation (Kosov).

Palaeoecology

Cuneamya was probably an infaunal burrower. The sculpture on the commarginal ribs and lines is characteristic

for burrowers. Pronounced sculpture among shallow water burrowing taxa stabilised the animal in the substrate. Moreover, species with well expressed sculpture are considered as slow burrowers (Stanley 1970). The shape of the shell is almost circular (in lateral view), which indicates the direction of burrowing was vertically downwards (Stanley 1970). *Cuneamyia* is relatively abundant in the *Modiolopsis*-dominated bivalve community known from Letná Formation at the locality Děd near Beroun (Drabov). Chlupáč (1965) recognized that material designated as Drabov was derived from at least three different stratigraphical horizons, all of them belong to the upper part of the Letná Formation. The *Cuneamyia* material probably comes from the first horizon, called “the oldest fossil-rich layer” by Chlupáč (1964). How it was shown e.g. by Babin (1966) and Babin and Hamman (2001), the *Modiolopsis* species had been dominant in many communities since the Early Ordovician. Kříž and Steinová (2009) characterised the *Modiolopsis* Community Group which inhabited shallow, high energy and sandy nearshore environments. Other occurrences of *Cuneamyia catilloides* in strata above the Letná Formation are scarce; the determination of this species in off-shore fine grained siliciclastics and shales is also complicated by deformation of the shell.

Palaeogeographic affinities

During the Early and Mid Ordovician, bivalves were restricted mainly to low-latitude basins around Gondwana in the southern hemisphere (Cope and Kříž 2014). Late Ordovician bivalves are more dispersed, which also confirms the occurrences of the genus *Cuneamyia* from the Late Ordovician strata of Avalonia, Baltica, Laurentia, Perunica and West Gondwana.

Conclusions

(1) The Late Ordovician bivalve *Grammysia catilloides* is newly described as *Cuneamyia catilloides*, lectotype and paralectotypes are designated and newly illustrated herein.

(2) Pronounced commarginal ribs and the shape of the shell (nearly circular) are characters indicating that this species was, most probably, an infaunal burrower. *Cuneamyia catilloides* is the most abundant species in the shallow water *Modiolopsis* Community Group known from the Letná Formation in the locality Děd near Beroun.

(3) *Cuneamyia* is a widespread bivalve genus known from the Late Ordovician of Avalonia, Baltica, Laurentia, Perunica and West Gondwana, clearly supporting the tendency towards cosmopolitanism in bivalves during the Late Ordovician.

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Explanations to the plates

PLATE 1

Cuneamyia catilloides (BARRANDE in PERNER, 1903)

1. Zahořany Formation, Zahořany; NM-L 18098.
a – Lateral view on the right valve $\times 1.7$; b – Detail of the umbo $\times 3.1$; c – Detail of the sculpture on the ventral margin $\times 4.4$.
2. Letná Formation, Děd near Beroun; NM-L 18101, paralectotype. a – Lateral view on the right valve $\times 1.7$; b – Dorsal view on the right valve $\times 2.2$
3. Letná Formation, Děd near Beroun; NM-L 11887. Lateral view on the right valve $\times 2.5$.
4. Vinice Formation, Trubín; NM-L 18099. a – Lateral view on the right valve $\times 2.5$; b – Detail of the umbo region $\times 4.5$.
5. Letná Formation, Děd near Beroun; NM-L 18100, lectotype. a – Lateral view on the right valve $\times 3$; b – Dorsal view on the right valve $\times 2.2$.
6. Letná Formation, Děd near Beroun; NM-L 11886. a – Lateral view on the right valve $\times 3.5$; b – Dorsal view on the right valve $\times 2.2$.

PLATE 2

Paracyclas? libens BARRANDE in PERNER, 1903

1. Kopanina Formation, Butovice; NM-L 5433. Incomplete valve $\times 4.3$.
2. Kopanina Formation, Butovice; NM-L 5434. a – Right valve? $\times 1.9$; b – Dorsal view on the right? valve $\times 4.0$.

Cuneamyia catilloides (BARRANDE in PERNER, 1903)

3. Vinice Formation, Vinice; NM-L 18102, paralectotype. a – Lateral view of the two valves $\times 0.3$; b – Lateral view of the incomplete valve $\times 1.5$; c – Lateral view of the left? valve $\times 2.1$; d – Detail of the left? valve $\times 3.1$.

“*Grammysia*” *praecox* BARRANDE, 1881

4. Lochkov Formation, Dvorce; NM-L 26369. a – Complete specimen with another bivalve *Neklania* on one rock sample $\times 1.2$; b – Right valve with pronounced radial sulcus $\times 2.1$; c – Detail of the right valve with radial sulcus $\times 3.0$.

PLATE 3

Cuneamyia catilloides (BARRANDE in PERNER, 1903)

1. Vinice Formation, Vinice; NM-L 51901. Lateral view on the right valve $\times 3.0$.
2. Letná Formation, Děd near Beroun; NM-L 51898. Negative of the right? valve $\times 1.75$.
3. Letná Formation, Děd near Beroun; NM-L 51895. Lateral view on the right valve $\times 2.5$.
4. Letná Formation, Děd near Beroun; NM-L 51899. a – Lateral view on the right valve $\times 2.2$; b – Dorsal view on the right valve $\times 4.0$.
5. Letná Formation, Děd near Beroun; NM-L 51900. Lateral view on the right valve $\times 2.1$.
6. NM-L 51897; Letná Formation, Děd near Beroun. a – Lateral view on the right? valve $\times 2.3$; b – Dorsal view on the right? valve $\times 3.6$.
7. Vinice Formation, Vinice; NM-L 51896. Lateral view on the left valve $\times 3.4$.
8. Králodvůr Formation, Kosov; NM-L 51894. a – Lateral view on the right valve $\times 3.0$; b – Detail of the sculpture $\times 5.2$.

PLATE 1





