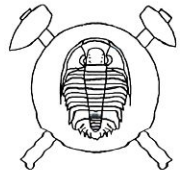
Genus *Lingulops* (Lingulata, Brachiopoda) in Silurian of the Barrandian



Rod *Lingulops* (Lingulata, Brachiopoda) v siluru Barrandienu (Czech summary)

(2 figs., 1 plate)

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A new species *Lingulops barrandei* sp. n. is described from the Kopanina Formation (Ludlow) of the Barrandian. Functional morphology of the genus is discussed.

Key words: Brachiopoda, Lingulata, Silurian, Barrandian, Czech Republic

Joachim Barrande, in his "Systême Silurien du centre de la Bohême" published in 1879, figured numerous species of organophosphatic brachiopods of Silurian age from Central Bohemia. He uniformly referred them to genera *Lingula* Bruguiere and *Discina* Lamarck, with only a few exceptions. All his species are based in specimens collected by a hammering. The phosphatic shells are broken inside their walls and internal features are obscured. Details of external ornamentation are often poor. Problematical minute species were not described by Barrande (1879) at all.

Phosphatic fossils are rather common in residues after etching of Silurian limestones by acetic acid. Conodonts, fragments of linguloid and discinoid shells, microscopic acrotretaceans constitute significant part of residues. Light-gray tuffaceous, bioclastic limestone, rich in chonetid *Shagamella margarita* (Barrande), shields of trilobites *Metacalymene baylei* (Barrande), *Otarion diffractum* Zenker, and *Acanthalomina minuta* (Barrande) yielded numerous, exceptionally well-preserved valves of an previously unknown elliptoglossid.

Type material is kept in the paleontological collections of the Department of biology, University of West Bohemia, Plzeň (PCZCU).

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Order Lingulida Waagen, 1885
Superfamily Linguloidea Menke, 1828
Family Obolidae King, 1846
Subfamily Elliptoglossinae Popov & Holmer, 1994

Remarks: Subfamily Elliptoglossinae Popov & Holmer is characterized by small smooth shell without pitted micro-ornamentation, rudimentary pseudointerareas and no pedicle notch or pedicle groove. Subfamily comprises two genera only (Popov & Holmer 1994). Genus *Elliptoglossa* Cooper, 1956 ranges since early to late Ordovician with several morphologically uniform species worldwide. Genus *Lingulops* Hall, 1872 is less perfectly known and differs from *Elliptoglossa* by having a well-developed thickened visceral platform in both valves. It occurs since Ordovician to Silurian, and is known from U.S.A. and Estonia (Hall 1872, Sinclair 1945, Cooper 1956, Gorjansky 1969). On territory of Bohemia, the only elliptoglossid has been described in the early Arenig siltstones (Mergl 1995).

Genus *Lingulops* Hall, 1872

Type species: *L. whitfieldi* Hall 1872; Upper Ordovician (Hudson River Group), U.S.A.

Remarks: *Lingulops* Hall is characterized by raised anterior border of visceral platform. Specimens from Silurian of Bohemia have posterior part of the visceral area impressed into shell wall while anterior part of the visceral area is weakly but distinctly raised above valve floor. It is never excavated anteriorly or supported anteriorly by distinct median ridge. Muscle impressions, despite prominent platform in visceral areas of both valves, are bilaterally symmetric and possess advanced but obolid pattern.

Lingulops barrandei sp. n.

Pl. I

Holotype: Incomplete dorsal valve, figured in Pl. I, figs. 2, 3 (specimen PCZCU 001)
Type horizon: Ludlow, Kopanina Formation, *Encrinuraspis beaumonti* Horizon.
Type locality: Barrandian, Králův Dvůr, Kosov quarry.
Name: To honour of Joachim Barrande.
Material: More than hundred free valves, often fragmentary.

Description: Shell biconvex, equivalved, rather thick-walled, in largest specimens 3.3 mm long (average 2.3–2.7 mm).

Ventral and dorsal valves have the same outline, being broadly elliptical, 145–150 % long as wide, widest slightly posterior to midlength. Posterior margin broadly parabolic, anterior margin semicircular. Umbo of both valves marginal, posteriorly extended into acute edge. Larval shell not well defined, smooth. Shell convexity

prominent, both transversally and axially, with depressed posterolateral parts of valves.

Exterior with regularly spaced concentric fila of nearly uniform size, weakly coarsening anteriorly. Post-larval micro-ornamenation of fine striae crossing obliquely growth fila and interspaces. Striae do not continue to very shell periphery, because smooth shell deposits of internal limbus also cover the posterolateral margin of the exterior.

Interior of dorsal valve with distinct visceral area. Center of visceral area is located slightly posteriorly to valve center, and it is about 40–50 % as long, and about 50 % as wide as the valve. Boundary of visceral area is defined by muscle scars and shell pad, generally elevated outside the perimyal line. The anterior part of visceral area rests on an elevated platform, while the posterior part is below the adjacent valve floor. There are six pairs of muscle impressions, with the most prominent, obliquely striated central muscle scars (Fig. 1A). Extravisceral area has smooth surface except of anteromedian part, where proximal parts of vascula media are poorly impressed. Divergent but very weak lines medianly bound the feebly wrinkled marginal area in apical chamber; these structures may be interpreted as rudimentary impression of dorsal pseudointerarea. Posterior and lateral margins of dorsal valve are massive, thickened, with broad and anteriorly tapering limbus. Limbus in anterior half is less prominent. Surface of limbus is smooth, but its outer half in posterior part is transversally wrinkled.

Interior of ventral valve has conspicuous, broadly triangular platform in the visceral area. The platform is impressed posteriorly but raised anteriorly. Its anterior boundary is marked by large paired muscle impressions of central muscles. Posterior part of triangular platform is limited by weak, paired muscle impression with obscure borders. A pair of crescentic muscle scar is located posterolaterally to central muscle scars. Mantle canal system poorly impressed, with a narrow divergent proximal part of vascula lateralia which are rapidly recurved subparalel to valve margin. Limbus of the same shape as present in the dorsal valve.

Comparison: All species previously referred to *Lingulops* have much raised visceral platform, some of them, e.g. *L. norwoodi* (James) and *L. cliftonensis* Foerste, have dorsal visceral platform undercut. *Lingulops mirus* Gorjansky from the Upper Ordovician of Estonia is based on a single valve. Otherwise similar to Bohemian species, *L. mirus* is larger and is more acute posteriorly. Moreover, Gorjansky (1969) considered this ventral valve as dorsal one.

Occurrence: Apart the type locality and horizon, some poor remains of the same or closely related species are known from the Motol Formation (Wenlock) at the Sv. Jan (Elektrárna) locality.

Life position of *Lingulops barrandei*

Biconvex minute shells *Lingulops barrandei* have no structure similar to pseudointerareas and pedicle groove. Their absence indicates, that this species lacks functional pedicle. Outer surface of shell does not show any cicatrix or traces of abrasion. The shell was probably laying freely at sea bottom, with the commissure subhorizontal, weakly raised about sediment-water interface. The stability of the shell was achieved by displacement

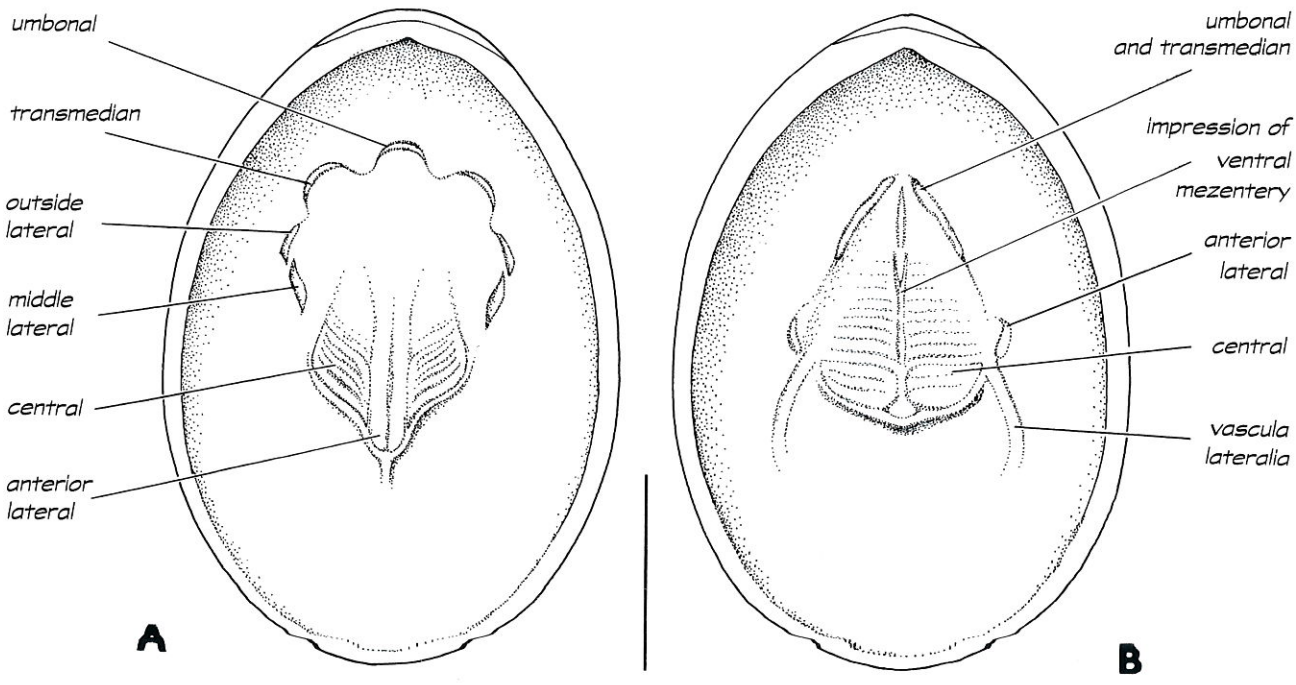

Fig. 1. *Lingulops barrandei* sp. n.
Muscle scars and pallial markings in interior of dorsal valve (A) and interior of ventral valve (B). Bar equals to 1 mm.

of visceral area to the center of the shell. Shifting of the center of gravity and grouping of muscles into the center of the shell also make much more effective opening the shell during feeding. Inhalant and exhalant currents could penetrate into mantle cavity along entire commissure, also along the posterior margin (Fig. 2) due rotation of upper valve. In contrary, location of visceral area in posterior part of the shell, as present in majority of obolids, makes possible to open a gap for feeding currents only along anterior commissure of the shell, as known in recent *Lingula*.

A total volume of mantle cavity in *Lingulops* was enlarged but filtering chamber with small lophophore was restricted only to anterior half of the mantle cavity. The resulting reduction of filtering capacity may explain the minute size of elliptoglossids.

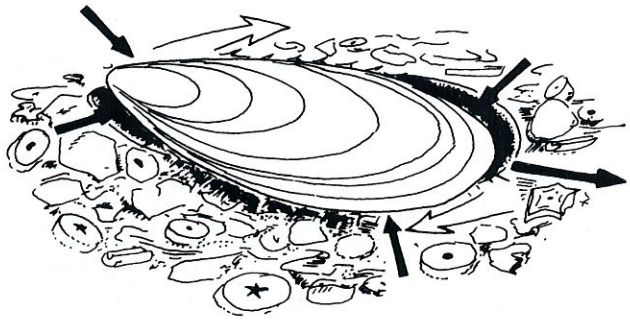

Fig. 2. Reconstruction of *Lingulops barrandei* in feeding position. Black arrows: inhalant and exhalant currents, white arrows: direction of rotation of upper valve.

The prominent smooth limbus and weakly impressed pallial markings indicate that there were few and fine (if any) setae along the periphery of the mantle. There are no structures which could be referred to setal follicle impressions, otherwise well developed in the morphologically similar genus *Paterula* Barrande.

Elliptoglossids and above all *Lingulops* display remarkable morphological similarity to calcareous-shelled craniopsids. The genus *Craniops* Hall occurs in Bohemian Silurian in beds of nearly the same age (Mergl 1986). The shell of *Craniops* has the same size, similarly vaulted and ornamented valves, but umbones are located more centrally. Visceral area of *Craniops* also occupies subcentral position with raised anterior margin of visceral area. However, some species of *Craniops* possess cicatrix on the ventral valve, which indicate that specimens were attached by cementation to the firm substrate. Analogous cicatrix is unknown in any shell of *Lingulops*. Although there are restricted stratigraphical and spatial data about distribution of *Lingulops*, it probably has the same behavior and demands to environmental factors as *Craniops*.

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Rod *Lingulops* (Lingulata, Brachiopoda) v siluru Barrandienu

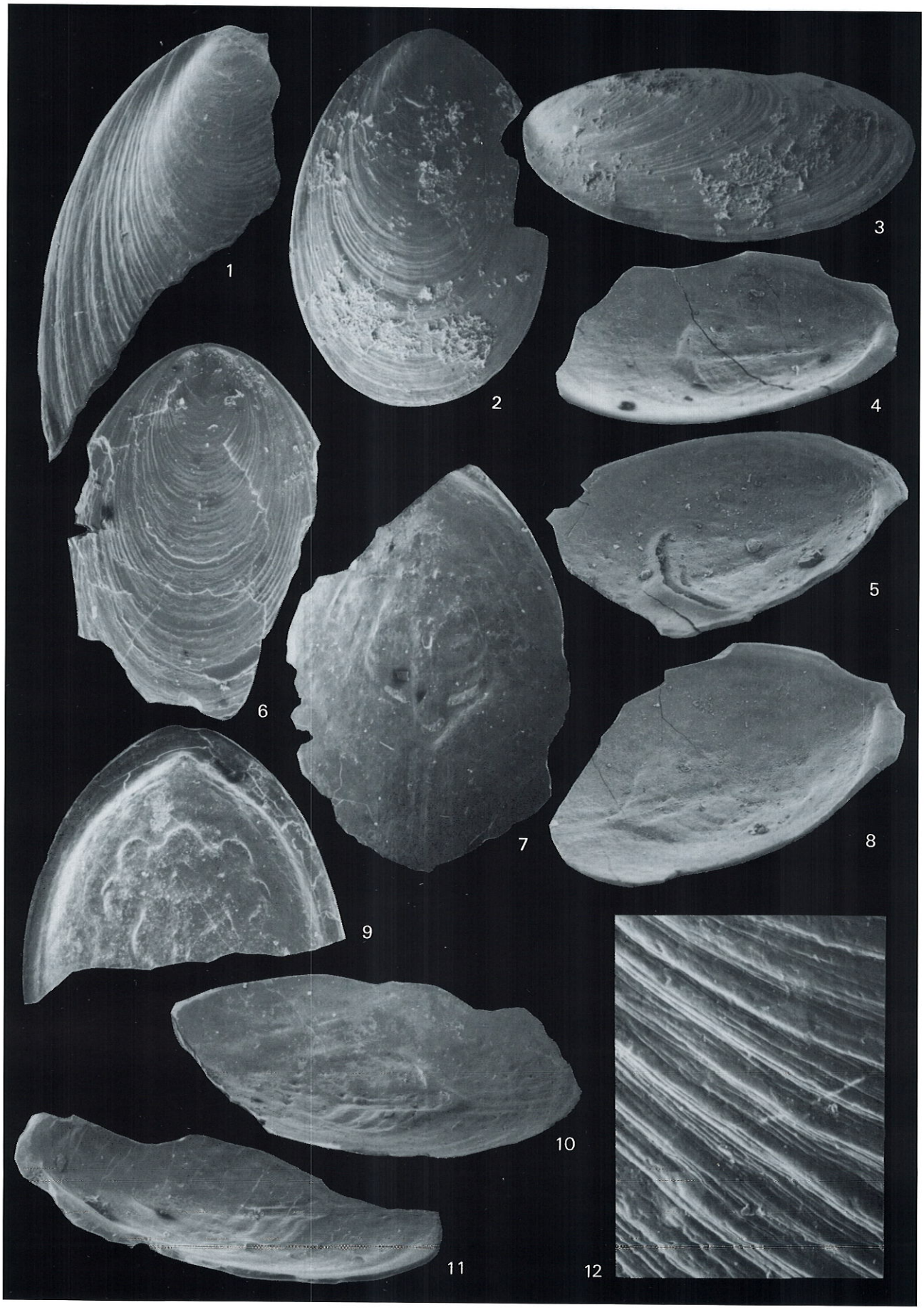
V práci je popsán nový druh *Lingulops barrandei* sp. n. z kopaninského souvrství (ludlow) Barrandienu. Autor předpokládá, že *Lingulops* měl posunuty tělní orgány směrem k centru těla, což umožnilo využít pro proudění vody plášťovou dutinou i štěrbiny podél zadního okraje misek. Posunutím tělních orgánů k centru misek došlo k posunutí těžiště do nejnižšího místa a získání dostatečné stability na dně. V tomto ohledu je morfologie misek rodu *Lingulops* a misek craniopsidních brachiopodů analogická a odráží podobný způsob života, nikoliv však fyletickou příbuznost.

Explanation of plate I

Lingulops barrandei sp. n.

1 – incomplete ventral valve, exterior, PCZCU 002, x45.
2, 3 – holotype, dorsal valve, exterior, PCZCU 001, x35.
4 – ventral valve, interior, oblique view, PCZCU 003, x25.
5 – ventral valve, interior, oblique view, PCZCU 004, x40.
6 – dorsal valve, exterior, PCZCU 005, x35.
7 – ventral valve, interior, PCZCU 006, x40.
8 – dorsal valve, interior, oblique view, PCZCU 007, x40.
9 – incomplete dorsal valve, interior, PCZCU 008, x40.
10 – dorsal valve, interior, oblique view, PCZCU 006, x40.
11 – dorsal valve, interior, oblique view, PCZCU 009, x40.
12 – detail of micro-ornamentation, PCZCU 002, x270.

M. Mergl: Genus *Lingulops* (Lingulata, Brachiopoda) in Silurian of the Barrandian (Pl. I)



For explanation see. p. 157