

## Some problematical arthropods from the Upper Ordovician Letná Formation of Bohemia

### Někteří problematičtí členovci z letenského souvrství českého svrchního ordoviku (Czech summary)

(4 text-figs., 4 plates)

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The description of so far incompletely known enigmatic arthropods *Zonozoe drabowiensis* Barrande, 1872, *Furca bohémica* Fritsch, 1908, *F. pilosa* sp. n. and *Nothozoe pollens* Barrande, 1872 is presented or supplemented. The new genus *Zonoscutum* n. gen. with *Z. solum* sp. n. as the type species is established and remnants of a giant arthropod (possibly eurypterid) are reported in the open nomenclature. All material derives from the Letná Formation (lower Berounian, Upper Ordovician) of the Barrandian area, Czech Republic.

**Key words:** Arthropoda incertae sedis, Upper Ordovician, Barrandian area, Czech Republic



The Ordovician strata of the Barrandian area of central Bohemia contain, apart from common trilobites and other fossils, also rare remains of unusual arthropods whose systematic position is uncertain and variably interpreted. Some of these fossils are known since the classic investigations of J. Barrande who described them in the Supplement to the first volume of his grandiose work "Système silurien du centre de la Bohême" (1872). Later authors presented descriptions of other new finds and discussions of affinities, though these arthropod remnants are still problematic in many respects (e.g., Jahn 1893, Fritsch 1908a, b, Perner 1919, Chlupáč 1963, 1965, 1988).

New collections made at the Barrandian localities and recent progress in systematic arthropod studies call for a revision of some known taxa and description of new finds, which derive particularly from the Letná Formation of early Upper Ordovician age (lower Berounian = lower Caradocian).

The reference material is deposited in collections of the National Museum, Prague (inventory numbers prefixed by L).

#### Systematic part

Phylum Arthropoda

Order ? Aglaspidida Walcott, 1911

Superfamily and family uncertain

#### Genus *Zonozoe* Barrande, 1872

Type species: *Zonozoe drabowiensis* Barrande, 1872

#### *Zonozoe drabowiensis* Barrande, 1872

Pl. I, figs. 1–3

1872 *Zonozoe drabowiensis* Barrande; Barrande, p. 554–555, pl. 25, figs. 33–38.

1963 *Zonozoe drabowiensis* Barrande; Chlupáč, pl. 1, fig. 5.

1965 *Zonozoe drabowiensis* Barrande; Chlupáč, p. 10–13, pl. 1, figs. 1–8, Text-fig. 1.

1968 *Zonozoe drabowiensis* Barrande; Bergström, fig. 6D.

**Lectotype:** Internal mould of prosomal shield L23586 selected from Barrande's originals, figured by Barrande (1872) on pl. 25, figs. 33–35, refigured here on Pl. I, fig. 1. The former selection of the lectotype by Chlupáč (1965, pl. 1, figs. 1, 2) cannot be regarded as valid, as the selected specimen did not derive from the original Barrande's material which is now available.

**Material:** Five isolated prosomas from the old collections (internal moulds), one prosoma from the new author's collection.

**Remarks:** The newly found specimen from Trubská (L33029, Pl. I, figs. 2, 3.) agrees in essential features with those formerly described from Drabov. Also its dimensions (sag. length 13 mm, tr. width 24 mm) are comparable with average measurements of the old material. The partly preserved counterpart exhibits the smooth outer surface of the prosoma lacking any expressed sculpture.

The systematic assignment of *Z. drabowiensis* is doubtful: after the discovery of appendages in aglaspidids (Briggs, Bruton and Whittington 1979, Hesselbo 1992), the systematic position of this group became less clear and Aglaspidida were removed from Chelicerata either as a separate class (Selden 1993), order of uncertain affinities (Hesselbo 1992), or as a separate subclass and order (Hou – Bergström 1997). This change also concerns all presumed Ordovician aglaspidids. As neither opisthosoma, nor appendages of *Zonozoe* are known, it should be ranged only tentatively with Aglaspidida, though the position of eyes and evidently well mineralized exoskeleton point to this assignment.

**Occurrence:** The upper part of the Letná Formation (lower Caradocian = lower Berounian), the oldest and the upper fossil-rich interval sensu Chlupáč (1965). Localities Děd (= Drabov) – the assignment to the oldest fossil-

liferous interval is demonstrated by the co-occurrence of *Deanaspis goldfussi* (Barr.), fields between Trubská and Trubín (new collection, the upper fossiliferous interval sensu Chl. 1965).

**Zonoscutum n. gen.**

Type species: *Zonoscutum solum* sp. n., described herein.

**Diagnosis:** Prosoma broadly elliptical in outline, relief strongly suppressed (glabellar area not distinctly delimited). Two small eye tubercles situated anteromedially, occipital area marked by gently increased adaxial vaulting. Posterolateral angles angulate, without spines. Exoskeleton thin, mineralized.

**Comments:** See the type species.

***Zonoscutum solum* sp. n.**

Pl. I, figs. 4-8; Text-fig. 1

**Holotype:** Isolated prosoma (L33021), internal mould, figured on Pl. I, figs. 4-8.

**Type locality:** Fields between Trubín and Trubská.

**Type horizon:** Upper part of the Letná Formation, the Second (upper) fossiliferous interval sensu Chlupáč (1965).

**Material:** The holotype.

the occipital area close to the posterior margin. Slight indications of laterally trending furrows are visible abaxially from the glabellar area (observable only in very oblique light as unsharp depressions). A narrow flat and steeply falling doublure is traceable along the anterior margin of the prosoma, not differing in convexity from the lateral profile of the shield. Surface of the prosoma smooth.

**Dimensions:** sagittal length 20 mm, transv. width 30 mm.

**Remarks:** The similarity with *Zonozoe* is expressed in the transversally broad, elliptical outline, in two eye tubercles situated close to the sag. axis, in presence of anterior doublure, ventrally steeply inclined posterolateral angles and thin and mineralized exoskeleton. The principal differences distinguishing *Zonoscutum* are: the absence of a distinct trilobation, very slightly differentiated glabellar area, uniform vaulting, more anteriorly placed eye tubercles and bluntly angular posterolateral angles not protruded into genal spines. Also the pit-like depressions and laterally trending slightly indicated furrows situated abaxially from the presumed glabellar area are lacking in *Zonozoe*. The absence of the trunk and appendages prevents the discussion on systematic affinities and *Zonoscutum* should be regarded as an arthropod in-

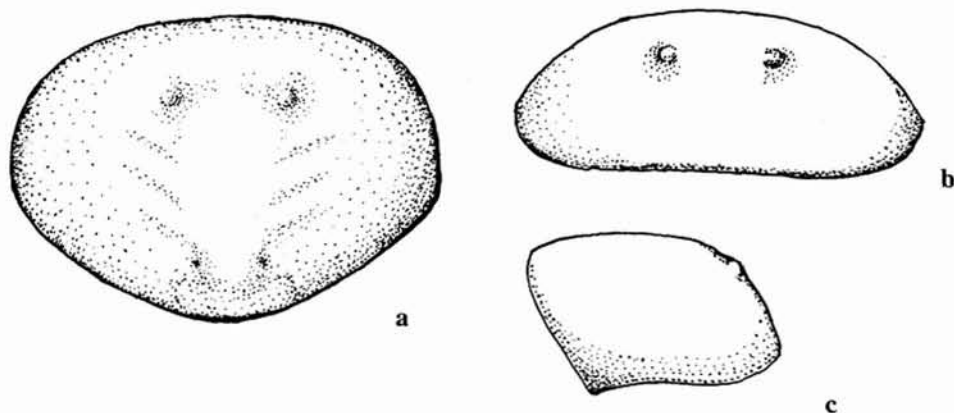


Fig. 1. *Zonoscutum solum* sp. n. drawing after the holotype, a - dorsal view, b - anterior view, c - lateral view.

**Description:** Exoskeleton thin, mineralized. Prosoma broadly elliptical in outline, sag. length/transv. width ratio 0.6 (2:3). Anterior outline broadly arcuate, posterior outline of gently more marked curvature. Posterolateral angles bluntly angulate, steeply falling ventrally, without spines. Transversal and sagittal vaulting steeply arcuate. Glabellar area not clearly differentiated from lateral parts but in very oblique light its slight elevation as a backward narrowing lanceolate area can be observed. Two marked tubercles - interpreted as eye tubercles - are placed within the anterior third of the prosoma, their distance is equal to about 1/4 of the transv. width of the prosoma. Two gently indicated and unsharp pit-like depressions are indicated in the mid-posterior prosomal quarter, followed post. by a slight increase of vaulting in

*certae sedis* with only possible but not demonstrable affinities with aglaspidids or synziphosurids.

**Occurrence:** The upper part of the Letná Formation, fields between Trubín and Trubská, NE of Dubová hora. The only known specimen was found by the author in a light yellow-brown sandstone with numerous fragments of *Dalmanitina socialis* (Barr.). These rocks evidently belong - according to their stratigraphic position and fauna - to the upper fossil-rich interval distinguished by the author (1965) within the upper part of the Letná Formation in the vicinity of Beroun.

Class ? Marrellomorpha Stormer, 1944

Order ? Marrellida Raymond, 1935

Family ? Marrellidae Walcott, 1912

**Genus *Furca* Barrande (MS) Fritsch, 1908**

Type species: *Furca bohémica* Fritsch, 1908

**Diagnosis:** Shield consisting of subtrapezoidal median body which is laterally and posteriorly prolonged into three pairs of distally tapering spiny processes. Anterolateral process short, lateral process markedly longer and posterolat. curved, posterolateral processes strong and long, gently curved. Circumference bordered by densely packed spines (the anterior margin denticulate in the type species).

**Species:** *Furca bohémica* Fritsch, 1908, *Furca pilosa* sp. n.

***Furca bohémica* Fritsch, 1908**

Pl. III, figs. 1–4; Text-fig. 2a

- 1847 *Pharostoma pulchrum* nobis; Hawle and Corda, p. 88, pl. 5, fig. 49a.  
 1868 *Furca bohémica* Barr.; Bigsby, p. 192 (nomen nudum).  
 1908a *Furca bohémica* Barr. in litt.; Fritsch, p. 8–9, pl. 11, figs. 1, 2, 3 (non cetera).  
 1908b *Furca bohémica* Barr.; Fritsch, p. 797–798.  
 1918 *Furca bohémica* Barrande; Perner in Novák and Perner, p. 12.  
 1919 *Furca bohémica* Barr. M.S.; Perner, p. 32–33.

**Lectotype** (here designated): Isolated cephalic shield (L27715) with damaged median body, figured by Fritsch (1908) on pl. 11, fig. 1, refigured here on Pl. III, fig. 1 (selected from two Fritsch's syntypes).

**Type locality:** "Drabov" near Beroun.

**Type horizon:** The upper part of the Letná Formation, the oldest fossil-rich interval sensu Chlupáč (1965).

**Material:** 15 specimens from the old collections preserved either as internal moulds or counterparts, 8 recently collected specimens (internal moulds and counterparts).

**Description:** Shield spinose, gently convex. Slightly arched median body of the shield bears laterally three pairs of prominent, distally tapering spiny processes with numerous smaller spines of the second order. The anterior margin is straight, transversal, denticulate at the outer margin. The median body subtrapezoidal, gently narrowing posteriorly. Its convexity is low and the highest point of convexity is placed anteromedially, where, however, no distinctly delimited node or tubercle appears. Some specimens show a longitudinally prolonged axial depression or groove in the posterior part of the median body, perceptible particularly on internal moulds.

Anterolateral corners protrude into short subtriangular, markedly tapering and slightly backward curved anterolateral processes. Laterally, the median body passes into the large lateral, backward curved and rapidly tapering spiny processes of the second pair. Posterolateral corners of the median body are protruded into the longest, posteriorly less curved and very prominent processes of the third pair whose length exceeds the length of the median body. All margins of the shield are denticulate and bear numerous densely packed and flat spines of the second order, only exceptionally well preserved. As shown

in several specimens, the cross-section of all three pairs of prominent spiny processes was elliptical and the dense spines of the second order are situated laterally and horizontally to the main plan of the shield, forming a spinose fringe.

**Measurements** of the lectotype – sag. length 24 mm, tr. width 22 mm.

**Remarks:** All available material of *Furca bohémica* is preserved in rather coarse-grained sandstone or quartzite and tiny details are hardly observable. This concerns also the lectotype, and some other specimens offer a better picture of the morphologic features (e.g. L32994, L32995, Pl. III, figs. 2–4).

The general shape of the shield in the plan view strongly resembles the most typical and common Burgess Shale fossil *Marrella splendens* Walcott, 1912 of Middle Cambrian age. This similarity was recognised already by Perner (1919) who ranged *Furca bohémica* directly to the family Marrellidae Walcott, 1912, though one year earlier he still compared *Furca* with a pygidium of a trilobite (Perner in Novák – Perner 1918). His view contrasted with Fritsch (1908a, b), who regarded *Furca bohémica* as a larval stage of a crinoid.

After the thorough revision of *Marrella splendens* by Whittington (1971), a more substantiated comparison can be made. Unfortunately, in *Furca* only the presumed head shield is known, whilst in *Marrella* the entire body with appendages and soft parts is available.

The wedge-shape pattern of the cephalic shield with subtriangular longitudinal section and vertical frontal slope cannot be demonstrated in *Furca*, in which the anterior margin seems to be linear. *Furca* shows a distinct pair of anterolateral processes whose anterior margin is transversal and continuous with the anterior margin of the median body. *Marrella* lacks this projections and its angulate anterolat. margins are caused by lateral or oblique position of the shield compacted in the shale (comp. Whittington 1971, text-fig. 26, pl. 17, figs. 1, 2). Exceptional is the specimen of *Marrella* figured by Whittington (1971) on pl. 18, fig. 3 which shows branching of lateral spines – this, however, seems to be a true branching, not demonstrating the presence of a separate anterolateral process as is the case in *Furca*. The spinose fringe of *Furca* is characteristic and markedly differs from *Marrella*, which shows only minute serration in the posterior part of the cephalic shield, and no longer spines of the second order are developed.

In spite of these differences, a clear similarity between *Marrella* and *Furca* exists and relationships are plausible, though so far not demonstrable owing to our incomplete knowledge of *Furca*.

The Lower Devonian *Mimetaster hexagonalis* (Gülich, 1931) from the Hunsrück Slate exhibits also the head shield with three pairs of long spiny processes with secondary spines (cf. redescription by Stürmer – Bergström 1976) but the shape, direction and distant secondary spines clearly differ from *Furca*. In spite of that, relationships cannot be excluded.



Hawle and Corda (1847) regarded *Furca bohemica* as a hypostome of the calymenid trilobite *Pharostoma pulchrum*. Though this concept appeared as demonstrably erroneous and was corrected by Barrande (1852, p. 577), the idea that *Furca* could be merely a ventral cephalic plate of an arthropod cannot be fully excluded as yet. The spinose cephalic fringe of *Duslia* (see Chlupáč 1988) much resembles that of *Furca* and the possibility that *Furca bohemica* might be a hypostome of *Duslia insignis* Jahn cannot be fully neglected. The measurements of *Furca bohemica* would correspond to those of head shields of *Duslia* and both taxa occur at the same localities and in the same stratigraphic level (the oldest fossil-bearing interval of the Letná Formation at Veselá and the Ostrý hill near Beroun).

The establishment of *Furca pilosa* sp. n. makes the connection between *Furca bohemica* and *Duslia insignis* less plausible, as we cannot assign *F. pilosa* to any known arthropod. Owing to this, the affinities of *Furca* remain enigmatic and the concept of closer relationships with *Marrella* should be considered. The problem may be solved only by future finds either of the trunk of *Furca*, or its connection with *Duslia*.

The mode of fossilisation of *Furca bohemica* differs from that of accompanying trilobites, brachiopods and most other shelly fossils occurring in the same layers. Remains of *Furca* are often darker pigmented by Mn or C and point to a different primary composition and a lesser thickness of the cuticle than is the case in accompanying exoskeletal parts of trilobites or shells of brachiopods. Though the original cuticle of *Furca bohemica* was dissolved, the peculiarities in preservation are characteristic.

The preservation in coarse-grained rocks caused differences in interpretations of some morphologic features by previous authors. The figures by Hawle and Corda (1847) and Perner (1919) are very schematic. The restored figure by Fritsch (1908a,b) is strongly idealised especially in presence of bordering plates and circular median elevation. The circular median elevation is not expressed in actual specimens and only a slight and unsharp increase of convexity in the anteromedian part can be observed in some specimens. No regular plates, but only flat spines were observed as bordering elements of the spinose shield of *Furca bohemica*.

**Occurrence:** The upper part of the Letná Formation at Drabov (Děd) and Veselá near Beroun (old collections), new collections derive from the W slope of the Ostrý hill in the same area and belong demonstrably to the oldest fossiliferous interval distinguished by Chlupáč (1965) within the Letná Formation (collected by the author and Š. Rak).

#### ***Furca pilosa* n. sp.**

Pl. II, fig. 1; Pl. III, fig. 5; Text-fig. 2b

**Holotype:** Specimen L32998 figured here on Pl. II, fig. 1, and Pl. III, fig. 5.

**Locus typicus:** Drabov near Beroun.

**Stratum typicum:** Letná Formation, probably upper part.  
**Material:** The holotype (old collection of the National Museum, Prague).

**Diagnosis:** General plan of the shield analogous as in *Furca bohemica*, the main difference is the markedly stronger spinosity, expressed in substantially longer and slender spines of the second order which considerably exceed the width of the paired spinose processes of the first order. Spines are developed even on the anterior margin of the shield, where they show a radial arrangement.  
**Measurements** (including the spinose fringe): Length 29 mm, width 28 mm.

**Remarks:** The close similarity with *Furca bohemica* causes no doubts on affinities between both species, but the differences in spinosity allow a clear distinction.

The holotype of *F. pilosa* shows in centre of the median body two small cavities which are evidently caused by organic remains (ostracods?) imprinted into the shield. The lateral and posterolateral spiny projections exhibit on the right side a longitudinal groove probably resulted from the compaction.

**Occurrence:** Locality "Drabov", Letná Formation. The holotype is preserved in dark grey thinly bedded quartzite rich in clastic mica and small limonite partings. Though the exact finding place is not known, the type of the rock markedly differs from those in which the specimens of *F. bohemica* are preserved. Consequently, *F. pilosa* probably derives from a different stratigraphic level within the Letná Formation.

#### ***Furca* sp.**

Pl. III, fig. 6

The specimen L33001, preserved as the internal mould and its counterpart, shows well the morphology of the median body and two pairs of spiny processes of the first order. However, it exhibits only very slight indices of the spinose fringe. Consequently, it cannot be decided whether it belongs to *Furca bohemica* or *F. pilosa* and it is left in the open nomenclature. It can be presumed, that the spinose fringe was removed during the transport of the shield by currents.

**Occurrence:** SW slope of the hill Ostrý near Beroun, the oldest fossiliferous interval within the upper part of the Letná Formation.

**Class:** Crustacea Pennant, 1777

**Subclass:** ? Phyllocarida

**Superordo:** ? Phyllocarida Packard, 1879

**Order and family:** uncertain

#### **Genus *Nothozoe* Barrande, 1872**

**Type species:** *Nothozoe pollens*, Barrande, 1872 (by monotypy).

**Diagnosis:** Carapace bivalve, valves smooth, subovate in outline, posterolateral curvature broader than the

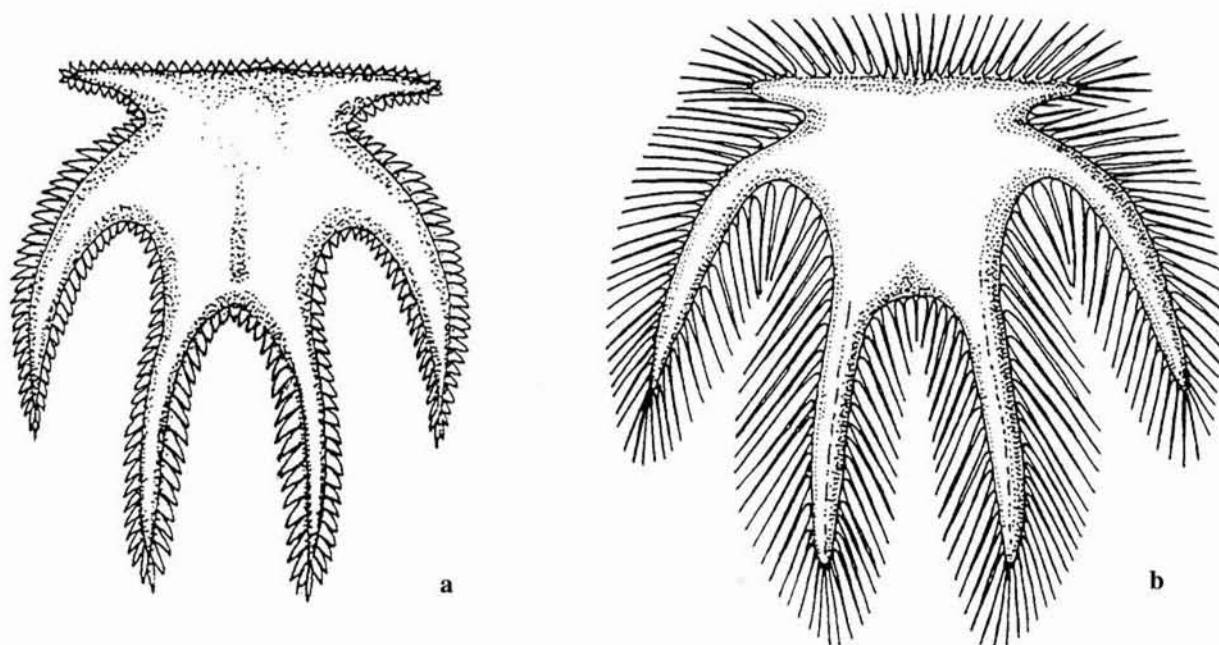


Fig. 2. a – *Furca bohémica* Fritsch, reconstruction according to several specimens; b – *Furca pilosa* sp. n., reconstruction after the holotype. Gently enlarged.

anterolateral one. Vaulting moderate, anterolateral nodes, border furrow and border not differentiated. Dorsal margin gently curved.

**Species:** *Nothozoe pollens* Barrande, 1872, *Nothozoe? barrandei* Chlupáč, 1970 (Novák MS), Upper Ordovician of Bohemia.

### *Nothozoe pollens* Barrande, 1872

Pl. I, figs. 9–11; Text-fig. 3b

1872 *Nothozoe pollens* Barr.; Barrande, p. 536–537, pl. 23, figs. 15–21, pl. 27, figs. 1–4.

1929 *Nothozoe pollens* Barr.; Gürich, p. 48.

1934 *Nothozoe pollens* Barrande, 1868; Straelen et Schmitz, p. 170.

1969 *Nothozoe pollens*, Rolfe, p. R325, fig. 150, 3.

**Lectotype** (here selected): Isolated right carapace valve L18844, internal mould, figured by Barrande (1872) on pl. 27, fig. 2, refigured here on Pl. I, fig. 10.

**Locus typicus:** “Drabov” near Beroun.

**Stratum typicum:** Upper part of the Letná Formation.

**Material:** 46 specimens preserved as internal moulds, some of them with counterparts, all in yellow or light grey sandstone or quartzite.

**Description:** Carapace bivalve, known only as isolated valves of medium or larger size. Valves gently asymmetrically ovoid in shape, vaulting moderate, gradually diminishing posterolaterally. Dorsal margin forms a very low arc, anterolateral margin broadly rounded, but markedly narrower than the broadly arcuate posterolateral margin. Maximum length between the anterolateral and posterolateral curvatures, maximum dorsoventral width in posterior third of the valve. Vaulting moderately sloping from its maximum in the anterior third of the valve, symmetrical in anterior view, gently asymmetrical

in posterior view (steeper inclined dorsally). Surface of valves smooth, without differentiated anterolateral nodes and the border (on internal moulds and counterparts). Traces of sculpture lacking.

**Measurements:** The holotype exhibits the maximum length 49 mm, max. dorsoventral width 31 mm. The smallest specimen shows the length 31 mm, width 20 mm, the largest complete valve is 65 mm long and 40 mm wide, but some incompletely preserved valves point to still larger dimensions (maximum extrapolated length is around 70–80 mm).

**Remarks:** The ovoid shape of carapace valves and completely smooth surface are the main diagnostic features. Unlike other phyllocarids, *N. pollens* shows no anterolateral nodes, nor differentiated border, thus resembling some conchostracans. As the appendages remain unknown, no conclusions on real affinities can be made. Shower (1961) ranged *Nothozoe* with ostracods (possibly a leperditiid) but pointed out its large dimensions. In agreement with Krestovnikov (in Černyševa, ed. 1960) and Rolfe (1969), the assignment with Phyllocarida *incertae sedis* (uncertain order and family) is adopted.

The cuticle of *Nothozoe pollens* was evidently thin: it is never covered by thicker limonite cover as is the obvious case in co-occurring trilobites and brachiopods, and its preservation is similar as in accompanying conulariids and rare arthropod remains described herein from the same localities.

*Nothozoe pollens* is so far the only certain representative of the genus. The generic assignment of *Nothozoe? barrandei* Chlupáč, 1970 is doubtful, and the remnant reported in Bigsby (1868, p. 200) as *Nothozoe Bohémica* Barr. was by Barrande (1872, explanations to

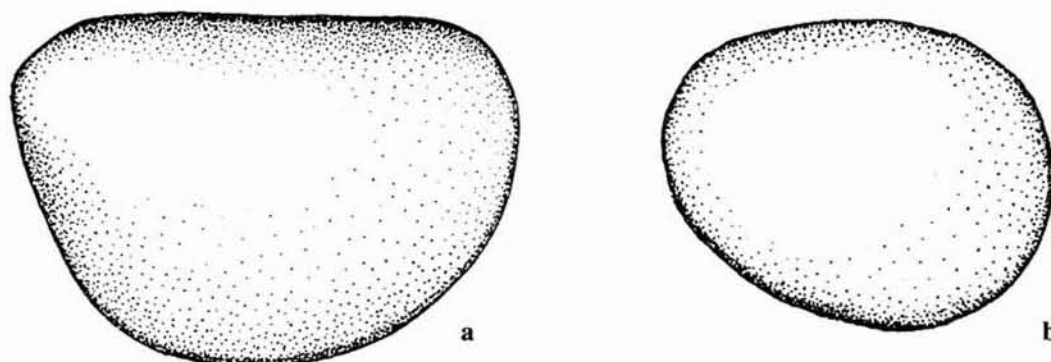


Fig. 3. a – *Nothozoe? barrandei* Chl., reconstruction of the left carapace valve, x0.5; b – *Nothozoe pollens* Barr., drawing of the left carapace valve, natural size.

pl. 30, figs. 14, 15) reclassified as “fossile de nature indéterminée” (in author’s view, it is an indeterminate cephalopod or gastropod remnant from the Silurian Kopanina Formation, locality Dlouhá hora according to Barrande’s designation).

The Lower Cambrian “*Nothozoe*” *vermontana* Whitfield, 1884 from Vermont, North America, whose originals were retained in *Nothozoe* by Ulrich and Bassler (1931), differs in shape and is evidently not congeneric. Occurrence: *N. pollens* is the most common problematic arthropod from the Letná Formation at the localities near Beroun. The majority of specimens housed in the National Museum, Prague, is preserved in light grey to yellow quartzite with remnants of the frequent trilobite *Dalmanitina socialis* (Barrande), and probably derives from the upper fossiliferous interval (sensu Chlupáč 1965) at the localities designated by the cumulative name “Drabov”, within the upper part of the Letná Formation. This was also demonstrated by author’s collections made at the Mount Děd and on the fields between Trubín and Trubská. Only few specimens of *N. pollens* from the old collections are contained in quartzites with fragments of the trilobite *Deanaspis goldfussi* (Barrande) which are typical for the oldest fossiliferous interval sensu Chlupáč (1965). Rare occurrence of *N. pollens* in this interval was confirmed by author’s collections at the localities Veselá and the Ostrý hill.

#### Remnants of a giant arthropod (eurypterid?)

Pl. IV, figs. 1–7; Text-fig. 4

Rare finds of fragmentary preserved extraordinary large arthropod were made by the author at the fossil localities within the upper part of the Letná Formation near Beroun. They are smooth and thin, in all cases incomplete exoskeletal parts which can be in most cases interpreted as fragments of segments of a hitherto unknown giant arthropod. Some of these finds deserve special attention:

The specimen L33022 (Pl. IV, fig. 1; Text-fig. 4a) from Veselá is a smooth fragment of a somite which shows a broadly, gently asymmetrically rounded lateral margin

and markedly broadly concave adjacent margin, interpreted here as the posterior. Along this margin a line, situated in regular, adaxially gently increasing distance, delimits a slightly more convex band which can be most likely identified with the articulating facet allowing movable connection between segments. The preserved incomplete sag. length of the fragment is 45 mm, width 72 mm.

The specimen L33026 (Pl. IV, fig. 5; Text-fig. 4e) from the same locality is also a smooth fragment of probable somite which shows on one side a straight margin bordered by a distinct line situated in equal distances. The other primary limit is broadly concave, without any accompanying line, other limits of the fragment are evidently secondary. The surface shows irregular unevennesses caused by imprints of coarser grains of the rock and fragments of fossils. The s-form trace represents an ichnofossil imprinted in the thin cuticle of the shield. The maximum diameter of the fragment is 100 mm.

The largest remnant L33023 (Pl. IV, fig. 2; Text-fig. 4b) derives from the locality Ostrý. It is a smooth shield whose one margin is broadly arcuate and partly bordered by a line similar to that observed in above mentioned specimens. The other margin is straight and lacking the border line, between both margins is a broad notch of probably primary origin. The maximum diameter of the remnant is around 100 mm. The specimen and its counterpart were found isolately in debris and show effects of weathering.

The specimen L33024 (Pl. IV, fig. 3; Text-fig. 4c), found in the light quartzite on the field between Trubská and Trubín, is again a smooth, probably somite fragment with a narrow and gently arcuate border line on one side and faint wrinkles observable in oblique light. The maximum diameter of the fragment is 102 mm.

The specimen L33025 (Pl. IV, fig. 4; Text-fig. 4d) from Děd, preserved in hard light grey quartzite, represents evidently a fragmentary somite with subparallel anterior and posterior margins and broken off lateral parts. Its surface is smooth and no distinct border lines are observable, but one of primary limits shows slight thickening indicated by a narrow rim. The diameter of the fragment is 130 mm.

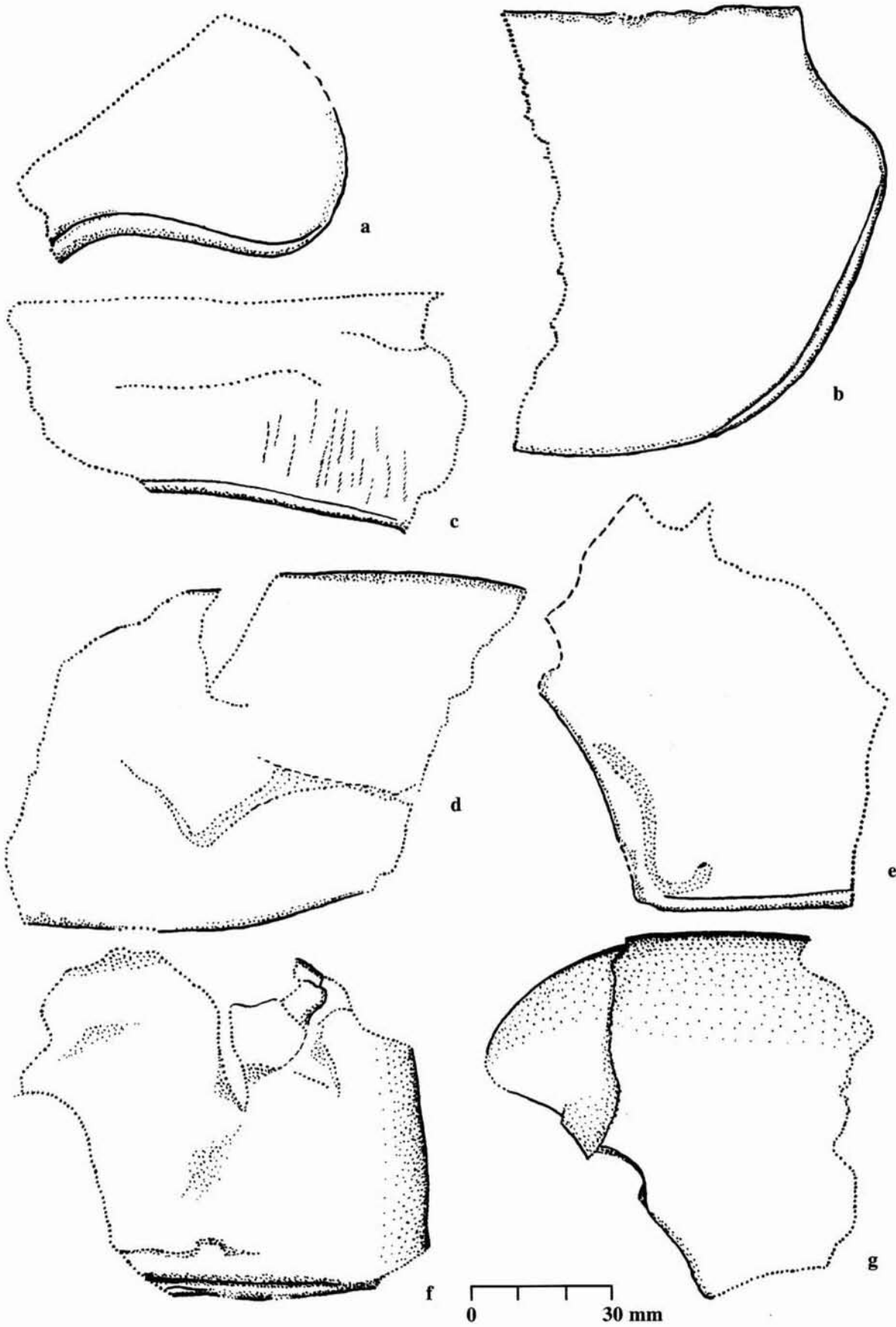


Fig. 4. Fragments of a large arthropod (probable segments).

a - L33022, Veselá; b - L33023, Ostrý; c - L33024, Trubská; d - L33025, Děd; e - L33026, Veselá; f - L33027, probably Děd; g - L33028, Veselá. All specimens gently reduced.



The only specimen from the old collection is L33027 (Pl. IV, fig. 6; Text-fig. 4f), whose locality is not known (the lithology points to the Letná Formation at Děd or Veselá). It is again a fragmentary smooth somite which shows a distinct border line and narrow border on one side and the other, probably primary margin situated in right angle. Pressure deformations caused partial breaking and imprints of foreign bodies (coarser grains, fillings of burrows). The preserved width is 90 mm, length 77 mm.

The specimen L33028 (Pl. IV, fig. 7; Text-fig. 4g) from Veselá shows a distinct overlap of the shield pointing to primary flexibility of the thin exoskeleton. Due to fragmentation, the interpretation of this remain is difficult (overlapping somite fragment?). There exists some similarity with the partly overlapping shield fragment which Fritsch (1908, p. 21, pl.3, figs. 2,3) briefly described and figured as *Leptophycus papyraceus* in his monograph *Problematica silurica* (loc. Drabov, coll. Barrande).

All specimens represent parts of very large and thin, flexible shields in which other fossil remains, coarser grains of the matrix rock or ichnofossils were readily imprinted. This is often the case in thin exoskeletal parts of Silurian and Devonian eurypterids, commonly observed at different localities and in different types of rocks. Another characteristic features are distinct fine border lines which may be interpreted as limits of articulating facets between neighbouring somites

Apart from probable somite fragments, also other remnants could belong to these large arthropods. They are straight or gently curved isolated flat spines which might represent telsons or other spiny processes (cp. Chlupáč 1970, pl. 10, figs. 5–7, attributed with reserve to *Nothozoe? barrandei* Chl.). Other possibly conspecific remains are subquadrate or lanceolate, more or less regularly wrinkled thin exoskeletal parts found together with above-mentioned large somite fragments. They might represent joints of legs or gill-like appendages, but their relation to somite fragments remains obscure.

A common feature of all reported remains is the mode of preservation: they are preserved as imprints ("films") lacking the marked limonite cover which replaced the primary carbonate shells of most accompanying fossils, particularly trilobites and articulate brachiopods. The cuticle of described arthropods was evidently very thin, flexible and probably of different composition, analogous to some other thin-shelled enigmatic arthropods (e.g. *Duslia*) occurring in the same beds.

The material gathered so far does not allow to recognize diagnostic features and to make any conclusion about the affinities. The size, shape and thin cuticle would agree e.g. with eurypterids, which are rare in Ordovician and reached their maximum development in the uppermost Silurian and lowest Devonian (Přídolí to Lochkovian). Large eurypterids, however, are known even from the Ordovician, as documented by the North American *Megalograptus ohioensis* Caster et Kjellesvig-Waering, 1955 which belongs to the best known eurypterids (cp. Caster – Kjellesvig-Waering 1964).

The remnants of large arthropods need not be so rare as it would seem from the so far known material. It is very probable that their remains were found during the extensive fossil collecting in the Barrande's time and later, but due their lack of sculpture and less distinctive shape they were omitted and not included in collections. Occurrence: Upper part of the Letná Formation, the oldest fossiliferous interval (localities Veselá, Ostrý hill, Děd-top) and the Second or upper interval (fields between Trubská and Trubín). Associated with common disarticulated trilobites, less frequent orthid brachiopods, ostracods, echinoderms, conulariids and rare non-trilobite arthropods (at Ostrý in the same beds with *Furca bohemica*).

### Conclusion

The described unusual arthropod remains found in the upper part of the Letná Formation occur together with other common fossils, particularly trilobites. Their habitat was evidently the shallow shelf zone and their remnants were evidently subjected to a transport on rather short distances. Together with formerly described special arthropods, exemplified by *Duslia insignis* Jahn, 1893, *Triopus draboviensis*, Barrande, 1872, *Caryon bohemicum* Barrande, 1872, *Drabovaspis complexa* (Barrande, 1872), *Chacharejocaris? novaki* Chlupáč, 1963 a.o., they add the fauna of the Letná Formation a special character differing from "normal" Ordovician associations. The future investigations should elucidate the affinities and systematic position of these extraordinary fossils.

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### Někteří problematičtí členovci z letenského souvrství českého svrchního ordoviku

Ve fauně letenského souvrství na Berounsku jsou obsaženy většinou vzácné zbytky problematických členovců, jejichž systematické zařazení je nejisté. I když některé tyto nálezy byly popsány již Barrandem (1872), který je považoval většinou za ostrakody nebo části trilobitů, byly tyto zbytky později různě hodnoceny (např. Jahn 1908, Chlupáč 1965 aj.).

V předložené práci je doplněn popis druhu *Zonozoe drabowiensis* Barrande, 1872, řazeného s výhradou k aglaspididům, nově je vymezen rod *Zonoscutum* n. gen. s typickým druhem *Z. solum* sp.n. a revidován záhadný rod *Furca* Fritsch, zastoupený typickým druhem *F. bohémica* Fritsch, 1908 a novým druhem *F. pilosa* sp.n. U rodu *Furca* je diskutována jak možnost příslušnosti k čeledi Marrellidae, tak možnost interpretace jako hypostomu členovce *Duslia insignis* Jahn, 1893. Revidován je rod *Nothozoe* s typickým druhem *N. pollens* Barrande, 1872, patrně náležející k phyllocaridům. Z různých lokalit letenského souvrství na Berounsku jsou popsány neúplné zbytky velkého členovce (snad eurypterida), který mohl být zatím největším známým živočichem českého ordoviku.