PRELIMINARY REPORT ON THE NEW FINDINGS OF MISSISSIPPIAN TRILOBITES IN THE BŘEZINA FORMATION (MORAVIAN KARST, CZECH REPUBLIC)

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(24-41 Vyškov)

Key words: Moravian Karst, Březina Formation, Mississippian, Viséan, trilobites

Abstract

New fossiliferous layers of the Březina Formation were discovered in the valley of the Říčka Brook SSW of the village of Ochoz u Brna in 2011. Four taxa of trilobites were preliminary determined: Archegonus (Phillibole) *cf.* polleni *(Woodward, 1894),* Archegonus (Phillibole) *cf.* cauliquercus *Brauckmann 1981,* Liobole (Liobole) glabra proxima *Chlupáč, 1966 and* ?Spinibole *sp. The newly discovered fossiliferous beds belong to the Viséan (Lower to ?Upper Viséan, approximately cu IIγ–cu IIδ). The occurrence of limestone pebbles and limestone cobbles in aleuropelitic shales was also recorded. The Late Tournaisian foraminifer* Darjella monilis *Malakhova, 1964 was discovered in a dark grey limestone cobble derived from the Hády-Říčka limestone sequence of the Líšeň Formation.*

Introduction

Trilobites from the Březina Formation were previously reported from several localities: Zbrašov near Hranice (Chlupáč 1956, Chlupáč 1958), Březina (Chlupáč 1966, Rak – Viktorýn 2010), the valley of the Říčka Brook (Chlupáč 1966), Čelechovice (Chlupáč 1969) and the Mokrá quarry (Chlupáč 1966, Rak 2004, Rak – Lerosey-Aubril 2009, Kalvoda et al. 2010 , Rak et al. 2012).

New trilobite-bearing beds of the Březina Formation were discovered in the valley of the Říčka Brook near Brno in 2011. The new material was collected from an outcrop situated on the right bank of the Říčka Brook, approximately 150 m NWW from the „Koupaliště" (= "bathing place") hiking signpost, approximately 2.5 km SSW of the village of Ochoz u Brna (fig. 1). Aleuropelitic shales exposed therein are prevalently greenish, considerably

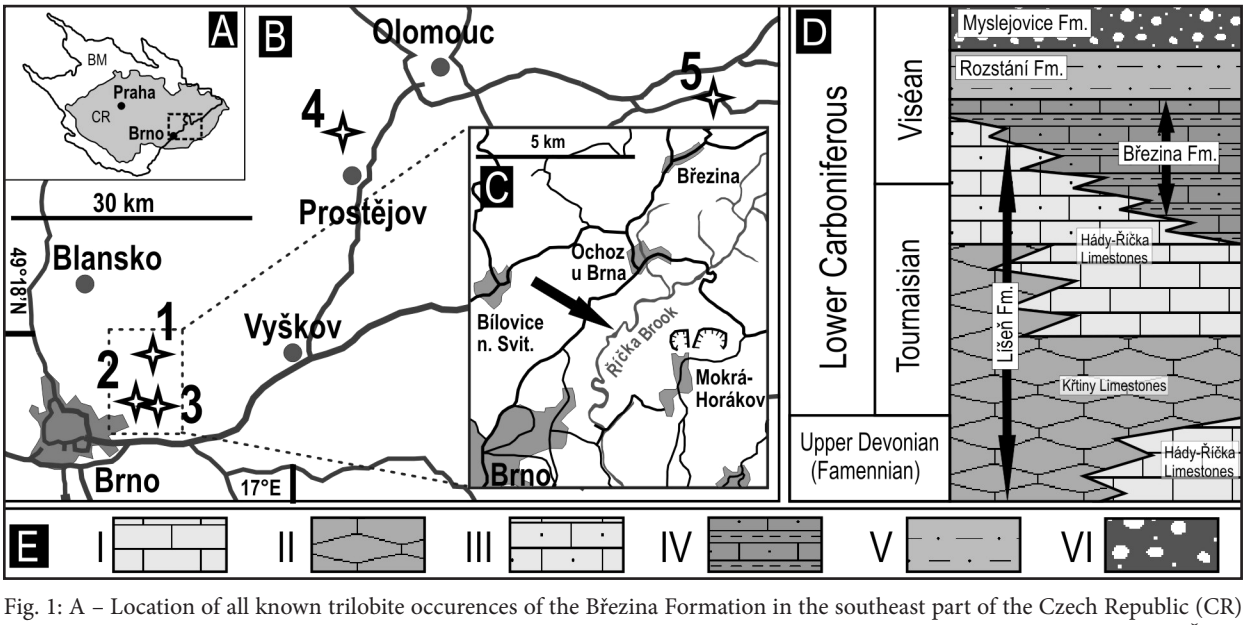

Fig. 1: A – Location of all known trilobite occurences of the Březina Formation in the southeast part of the Czech Republic (CR) and the Bohemian massif (BM). B – Localities of the Březina Formation with trilobite occurence: 1 – Březina, 2 – valley of the Říčka Brook, 3 – Mokrá quarry, 4 – Čelechovice, 5 – Zbrašov near Hranice. C – Geographic position of the new locality (marked by arrow) in the south part of the Moravian Karst. D – Schematic stratigraphical column of the Late Devonian and Early Carboniferous of the Moravian Karst; modified after Kalvoda et al. (2010). E – Lithological symbols used in the stratigraphical column: I – limestones (commonly cherty) with thin intercalations of shales (Líšeň Fm.), II – limestones, commonly nodular (Líšeň Fm.), III – limestones (commonly cherty) with thin intercalations of shales; sandy limestones (Líšeň Fm.), IV – aleuropelitic shales and limestones (Březina Fm.), V – aleuropelitic shales (Rozstání Fm.), VI – conglomerates, greywackes, shales (Myslejovice Fm.).

silicified and poorly bedded. Trilobites, associated with brachiopods, bivalves, cephalopods, corals and crinoids, were obtained from an interval of approximately 0.5 m thickness. Several limestone pebbles and a limestone cobble were also found within these shales. More then 80 remnants of trilobites including about 20 almost complete specimens and about 60 isolated parts of exoskeletons were collected. Tectonic deformation complicates their determination. Several specimens from this locality were now preliminary studied and deposited in the palaeontological collections of the Czech Geological Survey, Prague (inventory numbers TW1–TW4).

Systematic Part

Class Trilobita Walch, 1771
Order Proetida Fortey – Owens, 1975
Family Phillipsiidae Oehlert, 1886
Subfamily Archegoninae Hahn – Brauckmann, 1984
Genus *Archegonus* Burmeister, 1843
Subgenus *Archegonus (Phillibole)* Richter – Richter, 1937

Archegonus (Phillibole) cf. *polleni* (Woodward, 1894)

Remarks: The morphology of the complete specimen (TW1, fig. 2A) is close to *Archegonus (Phillibole) polleni* chiefly due to the short genal spine reaching approximately the first thoracic segment and by the size of the eyes. Although the eyes were broken off, the shape of the fracture line suggests that they were large. As judged from poorly preserved material, the pygidial border seems to be very indistinct or rather absent in comparison with the lectotype of *A. (Ph.) polleni* depicted by Woodward (1894) and Prentice (1967).

A. (Ph.) polleni occurs in Great Britain, Germany and very probably also in Ireland (see Archinal 1992, p. 21). In Germany (Rhenish Massif: Bergisches Land) *A. (Ph.) polleni* appears in two completely different horizons (cu II?γ = ?Late Chadian and cu IIIα = Asbian; Brauckmann 1992, p. 126); both materials cannot yet be distinguished by the preserved characters. In Northern England (type region) the true *A. (Ph.) polleni* is restricted to the latter sequence. The species seems to cover a complete time interval from the Late Chadian to the Asbian (cu II?γ–cu IIIα, Lower to Upper Viséan).

Archegonus (Phillibole) cf. *cauliquercus* Brauckmann, 1981

Remarks: Two almost complete specimens (TW2, fig. 2B, C, E), probably belonging to the same species, are preserved together in one piece of rock. In the first specimen (fig. 2C, E) the right genal spine was completely broken off. The mould of the fragmentary left genal spine suggests its long and tubular shape (fig. 2E). In the second, a markedly disarticulated specimen (fig. 2B), the right librigena is completely lacking, but the left librigena reveals a long tubular genal spine. In both specimens the eyes are not preserved. Due to the considerably poor preservation, the course of the facial sutures can be only locally distinguished. As far as observable, the palpebral lobes seem to be rather large, which suggests the rather large size of the eyes (typical for *Archegonus (Phillibole) aprathensis* subgroup *sensu* Müller – Brauckmann 2010). Both specimens are very similar to *Archegonus (Phillibole) cauliquercus* which was previously known from the cu $IIIα_2$ sequence (Asbian, Upper Viséan) in Germany (Bergisches Land; see Archinal 1992; p. 11).

Genus *Liobole* Richer – Richter, 1949
Subspecies *Liobole (Liobole)* Richter – Richter, 1949

Liobole (Liobole) glabra proxima Chlupáč, 1966

Remarks: The cranidium (TW 3) depicted in fig. 2G is markedly deformed. The course of the facial sutures as well as the shape of the glabella make it possible to determine this specimen as *Liobole (L.) glabra proxima* due to the following characteristics: posterior fixigenae extremely broad, ζ not marked, and constriction of glabella between γ and γ lacking.

This subspecies was originally described in the Czech Republic (Viséan, cu IIγ; localities Březina, Čelechovice – "horizon with *Spinibole olgae*") by Chlupáč (1966, 1969). Subsequently Owens – Tilsley (1995) reported *Liobole (L.) glabra proxima* in south-west England (North Devon; Lower Viséan: Late Chadian, cu IIγ).

Subfamily ?Cystispininae Hahn – Hahn, 1982
?*Spinibole* sp. Chlupáč, 1966

Remarks: The thoracopygon (fig. 2F) is similar to three species, i.e. *Spinibole (Spinibole) ruethenensis* Hahn – Hahn, 1969 (= *Wagnerispina ruethenensis, sensu* Gandl 1977 and Owens – Tilsley 1995), *Spinibole (Combewoodia) coddonensis* (Woodward, 1902) (= *Wagnerispina coddonensis, sensu* Owens – Tilsley 1995) and *Wagnerispina wagneri* Gandl, 1977. The slightly subtriangular shape of the pygidium is closer to *Spinibole (Sp.) ruethenensis*. Although the assignment to the genus *Spinibole* is probable, this specimen cannot be unequivocally allocated to a particular species because of the lack of the cephalon.

Stratigraphic range and distribution of similar taxa: *Spinibole (Sp.) ruethenensis* is known from Germany (Asbian, cu IIδ, Upper Viséan; Rhenish Massif, Harz Mountains). Specimens similar to *Spinibole (Sp.) ruethenensis* were currently recorded by Rak – Viktorýn (2012) also from "the horizon with *Spinibole olgae*" (cu IIγ–cu IIδ, approximately Lower to Middle Viséan) from the vicinity of the village of Březina. *Spinibole (C.) coddonensis* occurs in south-west England (North Devon) and in Germany (Rhenish Massif: Bergisches Land) (both Early Viséan, approximately cu IIγ or Late Chadian). *Wagnerispina wagneri* was described from northern Spain (Late Mississippian: Serpukhovian: Early Namurian, E_{1-2}; Cantabrian Mountains).

Discussion and interpretations

All the previously described trilobites from the Březina Formation in the valley of the Říčka Brook (Chlupáč 1966) were obtained from deep boreholes [bore Ochoz (Říčky) 2, bore V 97] situated approximately 100 m north of the bathing place. Rather poor trilobite material, composed of *Liobole* aff. *glabroides* (Richter – Richter, 1949) and "*Cyrtosymbole (Macrobole)* sp.", was interpreted by Chlupáč (1966) as belonging to the Lower Viséan (cu IIγ).

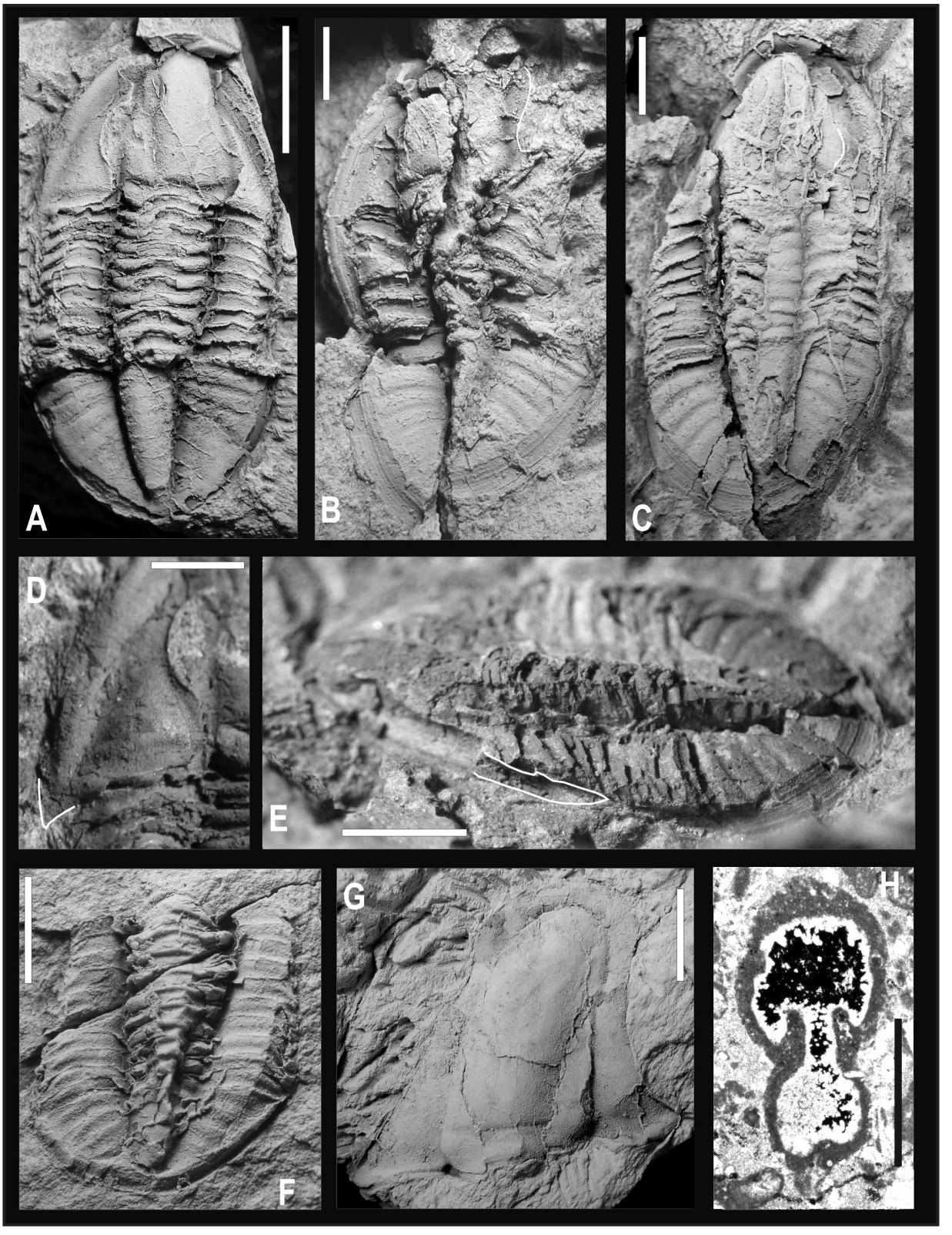

Fig. 2: A – *Archegonus (Phillibole)* cf. *polleni* (Woodward, 1894); dorsal view of complete specimen; TW1a. B – *Archegonus (Phillibole)* cf. *cauliquercus* Brauckmann, 1981; dorsal view of nearly complete but disarticulated specimen; idealized shape of facial suture marked by white line; TW2. C – *Archegonus (Phillibole)* cf. *cauliquercus* Brauckmann, 1981; dorsal view of complete specimen with damaged genal spines; slightly displaced palpebral lobe marked by white line; TW2. D – *Archegonus (Phillibole)* cf. *polleni* (Woodward, 1894); dorsolateral view of left librigena of the specimen depicted in A; TW1. E – *Archegonus (Phillibole)* cf. *cauliquercus* Brauckmann, 1981; dorsolateral view of the specimen depicted in fig. 2C; mould of fragmentary genal spine marked by white line; TW2. F – ?*Spinibole* sp.; thoracopygon; TW4. G – *Liobole (Liobole) glabra proxima* Chlupáč, 1966; lateral view of cranidium; TW3. H – *Darjella monilis* Malakhova, 1964; specimen from a limestone cobble; thin-section. Scale bars: A, G – 5 mm; B, C, D, E – 2 mm; F – 3 mm; H – 1 mm. Specimens A, B, C, F, G coated by ammonium chloride. All trilobites are housed in the Czech Geological Survey, Prague (inventory numbers TW1–TW4). Photo by T. Weiner, J. Kalvoda.

Apart from these findings from boreholes, all the previously described Viséan trilobites known from the Březina Formation derive from Březina, Zbrašov near Hranice and Čelechovice. These localities are characterized by occurrence of *Spinibole (Spinibole) olgae* Chlupáč, 1966, which is accompanied by further taxa ("horizon with *Spinibole olgae" sensu* Chlupáč 1969). Although about 80 trilobite remnants were collected from the newly discovered fossiliferous beds, none of them belong to *Spinibole (S.) olgae*. This suggests an absence or infrequent occurrence of this species, which may have very restricted stratigraphical and/or palaeoecologically limited occurrence.

The exact stratigraphic range of *Spinibole (S.) olgae* is essentially not yet known. Chlupáč (1966, 1969) has allocated this species to the Lower Viséan (cu IIγ). Owens – Tilsley (1995) have correlated "the horizon with *S. olgae*" with the Late Chadian assemblage (Lower Viséan, cu IIγ) in North Devon. Müller – Brauckmann (2010) have dated their *Archegonus (Phillibole) nehdenensis* subgroup (= "*nehdenensis*-Untergruppe") to approximately the cu IIδ (=lower part of *Beyrichoceras-Entogonites* genozone *sensu* Korn in Amler – Gereke 2003). All the previously described Moravian specimens from this subgroup are from "the horizon with *S. olgae*."

The preliminarily studied material from the valley of the Říčka Brook suggests an age of an extremely long time interval from the Early to Late Viséan (approximately cu IIγ to cu IIIα) and thus from the upper part of the *Fascipericyclus-Ammonellipsites* to the lower part of the *Eoglyphioceras* genozones (see Korn – Kaufmann 2008: fig. 7). The Březina Formation is stratigraphically older, however, then cu IIIα (Go IIIα) because this zone is documented within the lower part of the Myslejovice Formation (see fig. 1D) (Kumpera – Lang 1975, Lehotský 2008). A poorly known stratigraphy of the Rozstání Formation (approximately cu IIδ–cu IIIα; fig. 1D), which lies between the Březina and the Myslejovice Formations, was documented by indirect biostratigraphic evidence only (Kalvoda – Bábek 1995). Therefore, the exact age of the newly discovered fossiliferous beds can be approximately allocated to cu IIγ–cu IIδ (approximately Lower to ?Upper Viséan). "The horizon with *S. olgae*" seems to correlate with the same interval (cu IIγ–cu IIδ). However, exact stratigraphic relations between associations of "the horizon with *S. olgae*" and the newly discovered association cannot be unequivocally interpreted.

The assemblage of "the horizon with *S. olgae*" resembles the Late Chadian atheloptic assemblage known from southwest England (North Devon; Owens – Tilsley 1995). Species with reduced eyes [*Liobole (Liobole) glabra proxima*, ?*Spinibole* sp.] co-occur with rather large-eyed species [*Archegonus (Ph.)* cf. *polleni*, *Archegonus (Ph.)* cf. cauliquercus] in the newly discovered fossiliferous beds.

The presence of limestone pebbles and limestone cobbles is not particularly typical for aleuropelitic shales of the Březina Formation. Several subangular to rounded pebbles and one subangular limestone cobble were found on the newly discovered locality. The Late Tournaisian foraminifer *Darjella monilis* Malakhova, 1964 was determined in thin-sections obtained from the limestone cobble (fig. 2H). This species ranges from the lower part of the MFZ 7 zone to the MFZ 8 zone *sensu* Devyust – Hance (in Poty et al. 2006). This cobble is apparently derived from the Hády-Říčka Limestones of the Líšeň Formation. The limestone pebbles in all probability also come from the Líšeň Formation (Frasnian–Viséan).

Conclusion

The trilobite association from the newly discovered fossiliferous parts of the Březina Formation apparently belongs to the Viséan (Lower to ?Upper Viséan). This is in accordance with the occurrence of the reworked Upper Tournaisian limestone cobble. The association seems to be considerably different from other Viséan trilobite associations of the Březina Formation, which is chiefly demonstrated by the absence (or very rare occurrence) of *Spinibole (S.) olgae*, co-occurrence of somewhat large-eyed and rather small-eyed trilobites and by the presence of taxa which were previously unknown from the Březina Formation. The new material needs more detailed subsequent study which would follow.

Acknowledgements

Tomáš Viktorýn is thanked for providing the trilobites of his collections and suggestions of the referee Petr Budil helped to improve the text. The study was supported by the grant project GACR 205/08/0182.

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