

New Mississippian trilobite association from the Brno vicinity and its significance (Moravian Karst, Czech Republic)

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Abstract: Eleven trilobite species (*Archegonus* (*Archegonus*) *aequalis philliboloides* R. Hahn, 1967, *Bollandia persephone* (Hahn & Hahn, 1970), *Bollandia* cf. *megaira* (Hahn & Hahn, 1970), *Liobole* (*Panibole*) cf. *jugovens* (Osmólska, 1968), *Liobole* (*Sulcubole*) *glabroides* (Richter & Richter, 1949), *Semiproetus* (*Macrobole*) *drewerensis latipalpebratus* (Osmólska, 1973), *Proliobole vigilax* (Chlupáč, 1961), *Cyrtoproetus* (*Cyrtoproetus*) *cracoensis cracoensis* (Reed, 1899), *Carbonocoryphe* (*Carbonocoryphe*) *bindemanni* Richter & Richter, 1950, *Tawstockia* (*Beleckella*) *milleri* (Hahn & Hahn, 1971), *Cunningella* (*Cunningella*) cf. *auge* Hahn & Hahn, 1968) are described for the first time from the shales of the Březina Formation in Mokrá Quarry near Brno (Bohemian Massif, Moravian Karst). This typical trilobite association — comparable to that previously described from the Erdbacher Kalken of Steeden in Hessen (Germany) — was found during excavation in the Mokrá Quarry but they do not come from the exact Tournaisian–Viséan boundary. Stratigraphical correlation and comparison of material is mentioned below, as is the history of the trilobite research from the Moravian Karst.

Key words: Carboniferous, Moravian Karst, paleontology, biostratigraphy, trilobites.

Introduction

The Tournaisian–Viséan (T–V) boundary was intensively investigated during the last two decades because of growing evidence that the former T–V stratotype at Bastion in Dinant Synclinorium in Belgium does not fulfill the conditions required for GSSP and has to be replaced (Kalvoda 1983, 1990; Devuyt 2006). The Working Group on the T–V boundary was set up in 1995 by the Subcommittee on Carboniferous Stratigraphy in order to find a section to replace the inadequate GSSP of the base of the Viséan (Bastion section, Namur–Dinant Basin, southern Belgium) and to establish the criterion (appearance of the foraminifer *Eoparastaffella simplex*; Devuyt et al., 2003 and references therein). The studies showed that the historical criterion for the base of the Viséan can be retained, as *E. simplex* is part of an evolutionary lineage starting in the latest Tournaisian (Hance & Muchez 1995; Hance 1997; Devuyt 2006). The Pengchong section of Guangxi (southern China) was proposed as the best candidate for a new stratotype for the base of the Viséan (Hance 1997; Devuyt et al. 2003). The highest occurrence of the conodont *Scaliognathus anchoralis europensis*, at about 30 m below the boundary in the GSSP at Pengchong.

The Mokrá Quarry exposes one of the best successions for the biostratigraphy of the T–V boundary interval and even though complicated by tectonics, and active quarrying, it can serve as a reference section for Europe. Abundant and diverse foraminifers and conodonts are accompanied here by rich trilobite fauna (Kalvoda et al. 2010). The goal of the present work is, therefore, to describe the distribution of

trilobites and to calibrate them precisely in terms of the foraminiferal and conodont zonation.

Research on Mississippian trilobites from the Moravian Karst

There was no systematic study of Lower Carboniferous trilobites from Moravia until the 1960. Just a few papers reporting sporadic fragments of trilobites exist. Chlupáč (1956) found Carboniferous trilobites in greenish shales of the Březina Formation (Mississippian) during his stratigraphical investigations near Hranice na Moravě. At that time these shales were supposed to be Devonian in age. Because of the stratigraphical importance of this discovery trial pits, which helped to understand the relation of stratigraphy correctly were excavated. Trilobite fauna described from pelitic facies from Moravia are derived just from three localities until today. All these sites were challenged during Chlupáč's investigation of Moravia in 1956–65. Six trilobite taxa were described by Chlupáč (1966) from greenish and brown-red-dish silt shales from fields along the eastern border of the village of Březina, ca. 400 m from the crossroads near western border of this village. The trilobite association derived from this site is stratigraphically older than the trilobite taxa from the new found facies in the Mokrá Quarry. In 1956 Chlupáč described six trilobite taxa from the northern border of the Marian Valley (Mariánské údolí) from greenish shales of the Březina Formation (Mississippian) from a field south of the village of Zbrašov near Hranice na Moravě. He noticed another occurrence of Lower Carboniferous trilobites

from the Říčka Valley (Údolí Říčky), (about 100 m, N of the new bathing place), and established two other trilobite taxa.

All the trilobite associations studied by Chlupáč during the years 1956–65 belong to the Upper part of the *Pericyclus* Stage cu II γ (=Lower Viséan). Chlupáč (1965) noted the trilobite occurrence from test pits from the neighbourhood of the Mokrá Quarry, but they derived from carbonate facies of the Hádý-Říčka Limestones and not from shales. There is no published paper discussing a presence of Lower Carboniferous (Mississippian) trilobites of the Březina Formation.

Geological settings of the Mokrá Quarry near Brno

The village of Mokrá is situated northwest of Brno (Czech Republic), in the southernmost part of the Moravian Karst (Fig. 1). Devonian and Carboniferous rocks cropping out in the Mokrá Quarry represent the sedimentary cover of the Brunovistulian Unit which were situated on the southern tip of Laurussia during the Variscan time (Kalvoda et al. 2003). It is often regarded as the eastern-most continuation of the Rhenohercynian Zone (Franke 1989; Kalvoda 1998; Kalvoda et al. 2002, 2003, 2008) and was involved in the collision with the Lugodanubian terranes (Armorican Terrane Assemblage of Tait et al. 1997; Kalvoda et al. 2008).

In the large quarries of the cement works, a sequence of Frasnian reefoid limestones (Macocha Formation), Famennian to Viséan calciturbidites and rarely also hemipelagites (Lišeň Formation), transitional flysch sediments (Březina Formation) and typical flysch (Rozstání, Myslejovice Formations) is cropping out (Fig. 2). Different facies developments are tectonically convergent here, they underwent a polyphase deformation and complex overthrusting (Rez 2004a,b). In the late Tournaisian–early Viséan, a lithologically different facies development of turbidites represents a facies change from different granulometric types of limestones (Hádý-Říčka

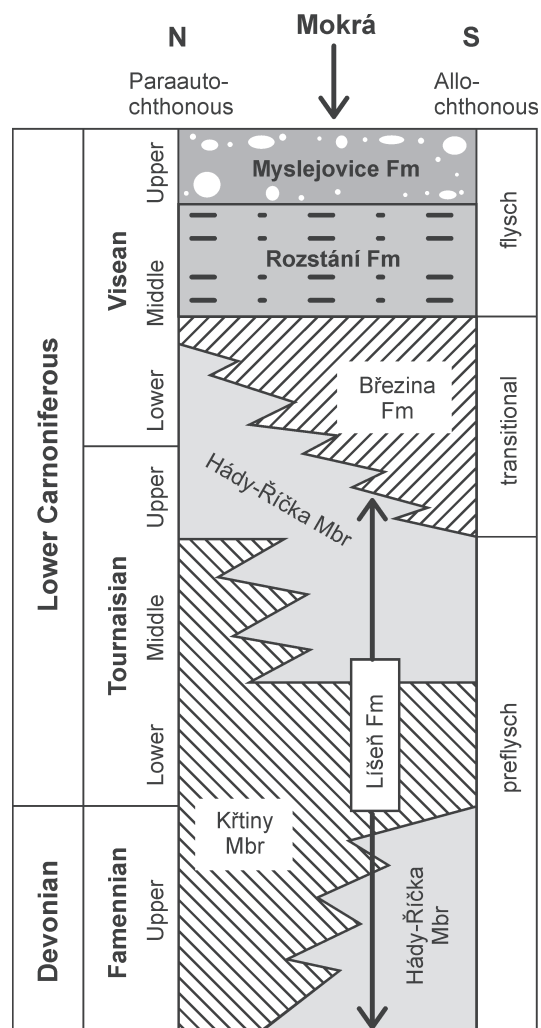


Fig. 2. General lithostratigraphical table of the Upper Devonian and Lower Carboniferous in the Mokrá quarries.

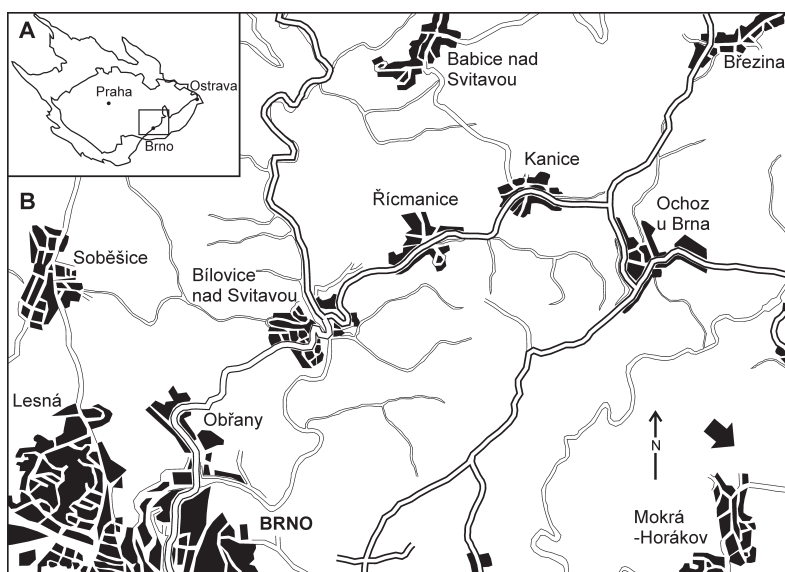


Fig. 1. Location of the Moravian Karst region within the Bohemian Massif and the Czech Republic; B — Location of Mokrá Quarry (showed by a star).

Limestones) to limestones with reddish to greenish shale intercalations and shales with limestone intercalations (Březina Formation) (Fig. 2). Both facies interfinger and the boundary between them is often hard to determine. The limestones contain abundant foraminiferal fauna, locally rugose corals, variable amounts of conodont fauna and in its deeper facies developments also trilobite fauna and brachiopods associated with bivalves and ammonoids (Kalvoda et al. 2010). The T-V boundary was studied both in the uppermost Hádý-Říčka Limestones and in the Březina Formation which crop out in the eastern benches of the quarry.

Biostratigraphy

The high resolution biostratigraphy of the T-V boundary interval is primarily based on

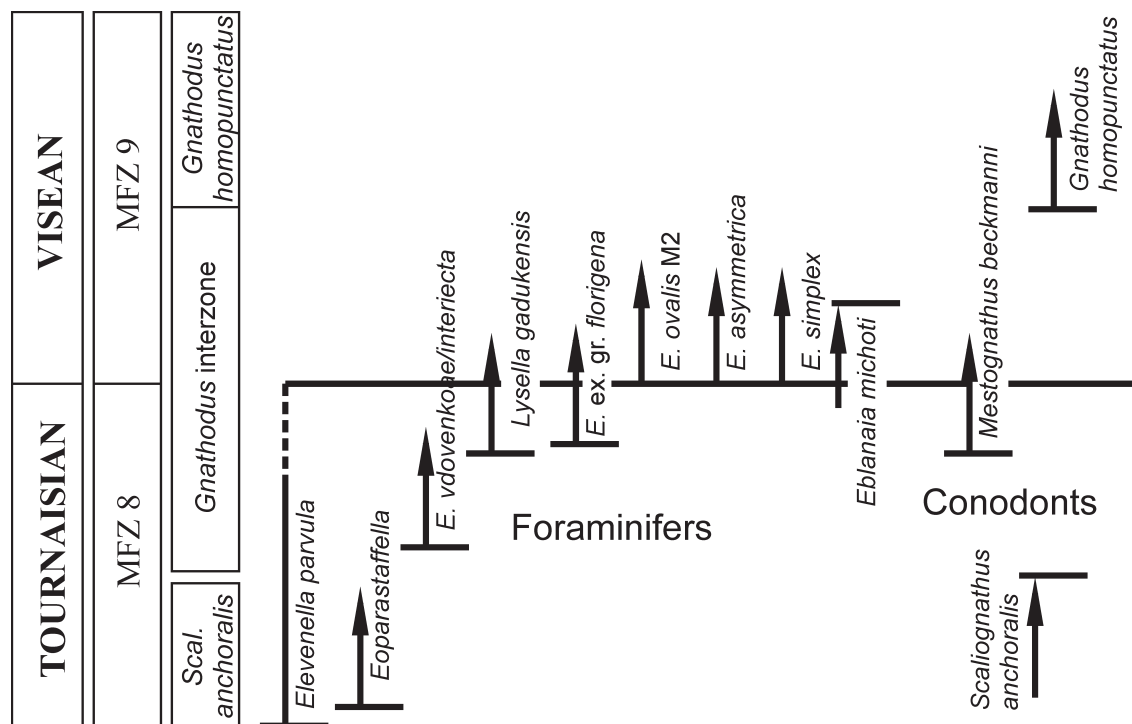


Fig. 3. Important conodont and foraminifer bioevents close to the Tournaisian–Visean boundary. MFZ 8 and MFZ 9 are foraminiferal biozones of Devuyst & Hance (in Poty et al. 2006).

the foraminiferal fauna. The search for a new stratotype of the T–V boundary in the last decade contributed to the substantial refinement of the biostratigraphical resolution by Devuyst (2006) and Devuyst & Kalvoda (2007). In the zonation of Devuyst & Hance (2006) the T–V boundary is placed at the base of MFZ9 which is characterized by the appearance of *Eoparastaffella simplex*. The base of MFZ8 coincides then with the appearance of the first fusulinid *Eoparastaffella* (Fig. 3). Higher in the sequence, the first occurrence of *Eoparastaffella vdoenkoae* and closely related species *E. interiecta* and *E. macdermoti* (*Eoparastaffella* ex gr. *interiecta*), *Lysella gadukensis* and *Eoparastaffella* ex gr. *florigena* represent an important biostratigraphic marker (Fig. 3). As the first *E. simplex* are not always very common, the appearance of *Eoparastaffella ovalis* Morphotype 2 and *Eoparastaffella asymmetrica* represent additional guides of the MFZ9 (Devuyst 2006; Devuyst & Kalvoda 2007). In the Pengchong stratotype, transitional forms between *E. ovalis* M2 and *E. simplex* occur shortly before the first *Eoparastaffella simplex* (Devuyst 2006). The disappearance of *Elevenella parvula* in late MFZ8 or close to the T–V boundary represents another important bio-event.

In terms of conodont zonation, the disappearance of *Scalognathus anchoralis* below the base of the Visean represents the most reliable event at this stratigraphical level that can be traced worldwide. The stratigraphic interval between the last appearance datum of *S. anchoralis* and the first appearance datum of *Gnathodus homopunctatus*, an index species of the first Visean conodont zone, commonly contains abundant *Gnathodus* (in particular *G. pseudosemiglaber*) and was recently named the *Gnathodus* Interzone

(Devuyst & Kalvoda 2007). The additional important bio-events are represented by the appearance of *Mestognathus beckmanni* from its ancestor *M. praebeckmanni* slightly below the T–V boundary.

Material and methods

During the first author's thesis research, focused on systematical investigation of the Mokrá Quarry, highly fossiliferous levels of the Březina Formation were discovered. All fragments of fossils were documented and photographed, then restored using CorelDRAW computer programme with axis cross to establish the original shape of trilobite remains. At the same time, the tectonic processes in layers of sections can be studied according to the type of their deformation. Limestones in the upper and lower layers of reddish shales of the Březina Formation were dissolved by using acetic acid. The main goal of this research was to establish the occurrence and stratigraphy of found conodont taxa. The study of the newly found trilobite assemblage will enable a correlation with other fauna from the W European occurrences, such as the Erdbacher Kalken (Harz; Hahn G. 1967), which show a close affinities to taxa from the Mokrá Quarry. A thorough functional morphological analysis of trilobite fragments (see Thomas & Lane 1984; Fortey & Owens 1999) can show us their feeding habits. The taphonomic conditions in pelitic sediments — dorsoventral and lateral deformation — made difficult the final determination of trilobite taxa.

Among the associated faunal components, isolated columns of crinoids were also collected. It consists of the fol-

lowing taxa: *Laudonomphalus* sp., *Cyclocaudex plenus* Moore & Jeffords, 1968, *Cyclocaudiculus* cf. *longus* Gluckowski, 1986, *Cyclocaudiculus edwardi* Prokop & Pek, 1998, *Stenocrinus* sp., *Heterosteichus* sp.

The brachiopod fauna of the Mokrá Formation is remarkably diverse. Two discrete but very probably mixed brachiopod associations can be tentatively differentiated. The first is probably subautochthonous, of deep-water origin and comprises large smooth rhynchonellids similar to *Ilopsyrhynchus*, small chonetids *Rugosochonetes* sp. and arhipidomellid *Aulacella* sp. These taxa are mostly deformed but commonly complete with valves articulated; a minute discinacean *Orbiculoidea* sp. is very rare but probably belongs to the same association.

The second fossil association is represented by brachiopod fragments, commonly associated with coarse biotrititic and clastic material. It includes the spiriferid genera *Prospira* and *Tylothyris*, medium-sized reticulariid *Reticularia*, large chonetoids referable to *Rugosochonetes*, a rhipidomellid *Rhipidomella* sp. and two or three poorly preserved productids, of which *Plicatifera* is characteristic. These taxa are probably allochthonous, and represent fauna of the shallower shelf. There were also poor remains of deformed goniatites, corals and other groups of fossils.

Description of sections and occurrences of trilobites and other fauna

All studies about the autecology of trilobites from the Czech Republic until today were focused on the Barrandian area. The major studies about the Cambrian and Ordovician trilobite autecology was published by Šnajdr (1978), Havlíček & Vaněk (1990), Fusco G. et al. (2004), Budil et al. (2007), Mergl et al. (2007) concentrated on the autecology of Silurian trilobites but also studied a Devonian trilobite assemblage and their autecology from the Chýnec Limestones.

Chlupáč (1983) and Chlupáč et al. (1985) concentrated on a trilobite assemblage from the Lochkovian–Pragian interval in the Prague Basin. Havlíček & Vaněk (1998) studied brachiopod and trilobite assemblages and the main Pragian biofacies of the Prague Basin. Surprisingly, there has been no work about the autecology of Lower Carboniferous trilobites from the Moravian Karst. In the last few years Lower Carboniferous shales of the Březina Formation with very common fragments of trilobites were uncovered in the Mokrá Quarry. After comparison with foreign material and modern literature (Hahn G. & Hahn R. 1988; Hahn G. 1990; Hahn G. et al. 1996), twelve taxa of trilobites were distinguished and knowledge of Lower Carboniferous trilobites was extended. The occurrence of the typical conodont and foraminiferal taxa makes these trilobite finds the youngest found in the Březina Formation from the entire Moravian Karst. Eleven species of trilobites have been identified from the Mokrá Quarry, of which the majority originate from the Moravian Karst for the first time (Rak 2004). All specimens from pelitic shales show clear evidence of dorsoventral and lateral deformations. However, preservation is sufficient to enable comparison with the type material of these species

from coeval carbonate sequences (Erdbach Limestone) in the Harz Mountains. Later investigations at the Mokrá Quarry concentrated mainly on the T–V boundary and study of foraminiferal and conodont fauna (Kalvoda & Ondráčková 1999, 2003; Ondráčková 2000, 2001).

At present 978 fragments of trilobites (241 kranidia, 47 librigena, 9 cephal, 197 pygidia, 11 articulated exoskeletons and 6 exuviae, etc.) of eleven taxa have been found. Activities have to be done in an active quarry, therefore it has a strong aspect of preservation work.

Systematics of Trilobita

Family: **Proetidae** Hawle & Corda, 1847

Subfamily: **Archegoninae** Hahn G. & Brauckmann, 1984

Genus: *Archegonus* Burmeister, 1843

Subgenus: *Archegonus* (*Archegonus*) Burmeister, 1843 [non (*Phillibole*) Richter & Richter, 1937]

Type species: *Archegonus* (*Angustibole*) *winterbergensis* Hahn G., 1965.

Archegonus (*Archegonus*) *aequalis* (H. v. Meyer, 1831)

Archegonus (*Archegonus*) *aequalis philliboloides* R. Hahn, 1967

Fig. 4.1

1967 *Archegonus* (*Archegonus*) *aequalis philliboloides* — R. Hahn, 101, 102

1968 *Archegonus* (*Archegonus*) *aequalis philliboloides* — R. Hahn, 208–210

1975 *Archegonus* (*Archegonus*) *aequalis philliboloides* — Hahn & Hahn, 43

Holotype: Cranidium SMF (Senckenberg Museum Frankfurt) 22002.

New material and horizon: Three articulated exoskeletons preserved in shale, (SR 10). Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Description: Three large articulated exoskeletons preserved in a row, on one slab of shale (see Fig. 4.1).

Despite dorsoventral deformation, all characteristic features are preserved and comparable to the type material (see R. Hahn, 1968).

Subfamily: **Bollandiinae** Hahn & Brauckmann, 1988

Bollandia Reed, 1943

Type species: *Asaphus globiceps* Phillips, 1836.

Bollandia persephone (Hahn & Hahn, 1970)

1966 *Griffithides* sp. — Hahn, p. 349–350

1967 *Griffithides* sp. — Hahn, p. 183–184

1970 *Griffithides* (*Bollandia*) *persephone* sp. n. — Hahn & Hahn, p. 211–212

1971 *Griffithides* (*Bollandia*) *persephone* — Hahn & Hahn, p. 136–141

1975 *Griffithides* (*Bollandia*) *persephone* — Hahn & Hahn, p. 60

1977 *Griffithides* (*Bollandia*) *persephone* — Gandl, p. 190

2003 *Bollandia persephone* — Hahn et al. p. 60



Fig. 4. 1 — *Archegonus (Archegonus) aequalis philliboloides* R. Hahn, 1967, exoskeletons of three specimens, dorsal view, Mokrá Quarry, SR10. 2 — *Cummingella (Cummingella)* cf. *auge* Hahn & Hahn, 1968, two pygidia, dorsal view, Mokrá Quarry, SR11. 3 — *Liobole (Panibole)* cf. *jugovensis* (Osmólska, 1968), nearly articulated exoskeleton, dorsal view, Mokrá Quarry, SR12. 4 — *Proliobole vigilax* (Chlupáč, 1961), two nearly articulated exoskeletons, dorsal view, Mokrá Quarry, SR13. 5 — *Cyrtoproetus (Cyrtoproetus) cracoensis cracoensis* (Reed, 1899), cranidium, dorsal view, Mokrá Quarry, SR14. 6 — *Semiproetus (Macrobole) drewerensis latipalpebratus* (Osmólska, 1973), cranidium, dorsal view, Mokrá Quarry, SR15. 7 — *Tawstockia (Beleckella) milleri* (Hahn & Hahn, 1971), cephalon, dorsal view, Mokrá Quarry, SR16. Scale bars represent 5 mm.

New material and horizon: Two incomplete cranidia, five incomplete pygidia (Figs. 2A–K, 244 Fig. 3), SR 3–9. *S. anchoralis* Zone.

Remarks: All the specimens are assigned to *Bollandia persephone* (Hahn & Hahn, 1970) because they correspond to the type specimens especially in the sculpture of the glabella, the straight, broad, shallow S1, the proportions, convexity and general outline of the pygidium (see Rak & Aubril 2009).

Bollandia cf. *megaira* (Hahn & Hahn, 1970)

New material and horizon: A single poorly preserved weathered pygidium. *S. anchoralis* Zone.

Description: Sculpture as far as can be determined, pygidium entirely smooth with very convex axis and rings (see Rak & Aubril 2009).

Remarks: Because only one incomplete specimens is available, it is left in open nomenclature; additional material is required for confident specific determination.

Genus: *Liobole* Richter & Richter, 1949

Subgenus: *Liobole* (*Panibole*) Gröning, 1985

Type species: *Phillipsia glabra* Holzapfel, 1889.

Liobole (*Panibole*) cf. *jugovensis* (Osmólska, 1968)
Fig. 4.3

1843 Schwanzschild von Altwasser — Burmeister, 121

1900 *Phillipsia* aff. *aequalis* — Scupin, 2–5, pl. 1, fig. 10 (cranidium)

1968 *Archegonus* (*Phillibole*) *culmicus* cf. *jugovensis* — Osmólska, 133–136

1986 *Liobole* (*Panibole*) cf. *jugovensis* — Gröning, 60–62

Holotype: Cranidium IG 442, II. (Osmólska, 1968: 4a, Abb. 23a,b).

New material and horizon: Articulated exoskeleton and incomplete cephalon (SR 12). Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Subgenus: *Liobole* (*Sulcubole*) Gröning, 1985

Type species: *Phillibole* (*Liobole*) *glabroides* Richter & Richter, 1949.

Liobole (*Sulcubole*) *glabroides* (Richter & Richter, 1949)

1921 *Phillipsia* cf. *glabra* — R. & E. Richter in H. Schmidt, Ober-de-von-Culm von Warstein und Beleck, 297

1949 *Phillibole* (*Liobole*) *glabroides* — Richter & Richter, 71, 79, 82–84

1961 *Liobole glabroides* — Erben, Blinding Proetidae, 90

1962 *Liobole glabroides glabroides* — Osmólska, 169

1966 *Liobole glabroides* — Chlupáč, 62

1971 *Liobole* cf. *glabroides glabroides* — H. Zakowa, Zone *Goniates granosus* in the Galezice syncline (Góry Swietokrzyskie), 70

1975 *Liobole glabroides* — Hahn & Hahn, 9, 44

1985 *Liobole* (*Sulcubole*) *glabroides* — Gröning, 142

2000 *Liobole* (*Sulcubole*) *glabroides* — Hahn, Hahn & Müller, 166–167

Holotype: Cranidium SMF X 1336a (Richter & Richter, 1949: pl. 3, fig. 30).

New material and horizon: Four cranidia. Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Genus: *Semiproetus* Reed, 1943

Subgenus: *Semiproetus* (*Macrobole*) Richter & Richter, 1951

Semiproetus (*Macrobole*) *drewerensis* Richter & Richter, 1951

Type species: *Proetus* (*Semiproetus*) *twistonensis* Reed 1943.

Semiproetus (*Macrobole*) *drewerensis latipalpebratus*
(Osmólska, 1973)

Fig. 4.6

1973 *Phillibole drewerensis latipalpebratus* — Osmólska, 61, 65–66, 67, tab. 1, pl. 1, figs. 7–9, text-fig. 1C

1975 *Archegonus* (*Phillibole*) *drewerensis longipalpebratus* — Hahn & Hahn, 42

1977 *Archegonus* (*Phillibole*) *latipalpebrata* — Gandl, Tril. Alba-Schichten, 155, 159

1981 *Archegonus* (*Phillibole*) *drewerensis latipalpebrata* — Brauckmann, Kulm-Tril. cul, 99

1985 *Archegonus* (*Macrobole*) *drewerensis latipalpebrata* — Oliveira et al., 116

1988 *Archegonus* (*Phillibole*) *drewerensis latipalpebratus* — Flajs & Feist, 75, 77–78, pl. 11, figs. 1–3, 5, 6 (non pl. 11, fig. 4)

1989 *Archegonus* (*Phillibole*) *drewerensis latipalpebrata* — Xiang in Ji Qiang et al., 121, pl. 35, fig. 7a–b

1991 *Archegonus* (*Phillibole*) *drewerensis latipalpebratus* — Archinal, 194

1992 *Archegonus* (*Phillibole*) *drewerensis latipalpebratus* — Archinal, 46–47, fig. 34a–b (cr) (with further synonymy)

Holotype: Cranidium Z. Pal. No. Tr. III/9a (Osmólska 1973: pl. 1, fig. 8).

New material and horizon: One cranidium (SR 15). Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Description: Lateral furrows on glabella are not clear, convexity of glabella and occipital ring as preglabellar field and border are typical for this taxon.

Genus: *Prolibole* Archinal, 1991

Type species: *Phillipsia nitida* Holzapfel, 1889.

Prolibole vigilax (Chlupáč, 1961)
Fig. 4.4

1961 *Cyrtosymbole* (*Macrobole*) *vigilax* — Chlupáč, 230, pl. 2, fig. 1

1965 *Archegonus* (*Phillibole*) *vigilax* — G. Hahn, 251

1966 *Cyrtosymbole* (*Macrobole*) *vigilax* — Chlupáč, 45

1969 *Archegonus* (*Phillibole*) *vigilax* — Hahn & Hahn, 106

1987 *Archegonus* (*Phillibole*) *vigilax* — Hahn et al., Tril. Belg. Kohlenkalk, 9, 144

1991 *Prolibole vigilax* — Archinal, 195

1992 *Prolibole vigilax* — Archinal, 67–69, figs. 47–48 (with further synonymy)

Holotype: Cranidium ICh 1092 (Chlupáč 1961: pl. 2, fig. 1; 1966: pl. 8, fig. 5, text-fig. 13).

New material and horizon: Two incomplete exoskeletons in one slab of shale (SR 13). Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Description: Preserved are just incomplete cranidia with remarkable branches in occipital convex ring, L3 convex. Occipital tubercle is not preserved. Axis flat and wide, composed of eight tight flat pleuras. Interpleural furrows deep and narrow. Pygidium of semicircular outline, with remarkably wide axis and border. Interpleural furrows not visible.

Genus: *Cyrtoproetus* Reed, 1943

Subgenus: *Cyrtoproetus* (*Cyrtoproetus*) Reed, 1943

Type species: *Phillipsia cracoensis* Reed, 1899.

Cyrtoproetus (*Cyrtoproetus*) *cracoensis* (Reed, 1899)

Cyrtoproetus (*Cyrtoproetus*) cf. *cracoensis cracoensis* (Reed, 1899)
Fig. 4.5

1899 *Phillipsia cracoensis* — Reed, 241–245, pl. 10, figs. 1–7

1943 *Cyrtosymbole* (*Cyrtoproetus*) cf. *cracoensis* — Reed, 64

1959 *Cyrtoproetus* cf. *cracoensis* — J.M. Weller, 413

1968 *Archegonus* (*Cyrtoproetus*) cf. *cracoensis* — Osmólska, 142–144

1969 *Cyrtoproetus* cf. *cracoensis* — Hahn & Hahn, 54–55

1987 *Cyrtoproetus* (*Cyrtoproetus*) cf. *cracoensis cracoensis* — Brauckmann & Tilsley, 148–149, pl. 1, figs. 1–3, text-figs. 1–2 (with further synonymy)

1998 *Cyrtoproetus* (*Cyrtoproetus*) cf. *cracoensis cracoensis* — Hahn et al., 175

Lectotype: Cranidium Sedgwick Museum, Cambridge, E3532 (Reed 1899: pl. 10, fig. 1; Osmólska 1968: pl. 5, fig. 3).

New material and horizon: One cranidium (SR 14). Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Description: A complete cranidium with badly preserved glabella furrows and branches in occipital convex, wide, ring. Occipital tubercle is well preserved. Preglabellar border is flat and narrow.

Genus: *Carbonocoryphe* Richter & Richter, 1950

Subgenus: *Carbonocoryphe* (*Carbonocoryphe*) Richter & Richter, 1950

Type species: *Carbonocoryphe bindemanni* Richter & Richter, 1950.

Carbonocoryphe (*Carbonocoryphe*) *bindemanni* Richter & Richter, 1950

1950 *Carbonocoryphe bindemanni* — Richter & Richter, 278–280, pl. 1, fig. 1–7

1975 *Carbonocoryphe bindemanni* — Hahn & Brauckmann, 329, fig. 20a–b

Holotype: Cranidium SMF X 1333a (Richter & Richter 1950: pl. 1, fig. 1a–b).

New material and horizon: One incomplete pygidium. Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Description: Only the incomplete right half of the pygidium is preserved. It has deep and characteristic pleural furrows. Axis with wide and flat axis.

Subfamily: *Cystispinae* Hahn & Hahn, 1982

Genus: *Tawstockia* Brauckmann, 1974

Subgenus: *Tawstockia* (*Beleckella*) Hahn, Hahn & Brauckmann, 1992

Type species: *Phillibole?* (*Cytispina*) *nasifrons* Richter & Richter, 1949.

Tawstockia (*Beleckella*) *milleri* (Hahn & Hahn, 1971)

Fig. 4.7

1971 *Spatulina spatulata milleri* — Hahn & Hahn, 485–487, pl. 2, fig. 16–20, text-fig. 10

1972 *Spatulina spatulata milleri* — Hahn & Hahn, 432–433

1973 *Tawstockia milleri* — C. Brauckmann, Kulm-Trilobiten von Aprath, 165

1992 *Tawstockia* (*Beleckella*) *milleri* — Hahn et al., 104, 114, 116, tab. 1

1993 *Tawstockia* (*Beleckella*) *milleri* — Hahn & Hahn, 87–89, fig. 68 (with further synonymy)

Holotype: Librigena SMF 22766 (Hahn & Hahn 1971: pl. 2, fig. 16, text-fig. 10).

New material and horizon: One cephalon with hypostoma (SR 16). Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Remarks: Cephalon with both complete genal spines and with hypostoma displaced to the left side from its position *in situ* is preserved. Preglabellar field is wider than in the type species. Well preserved duplicature on ventral side and the 3-dimensional terminal part of left genal spine. Glabella field is broken off and displaced anteriorly.

Subfamily: *Cummingellinae* Hahn & Hahn, 1967

Genus: *Cummingella* Reed, 1942

Subgenus: *Cummingella* (*Cummingella*) Reed, 1942

Type species: *Phillipsia jonesii* Portlock, 1843.

Cummingella (*Cummingella*) cf. *C. auge* Hahn & Hahn, 1968
Fig. 4.2

1968 *Cummingella* cf. *C. auge* — Hahn & Hahn, 450–453, text-figs. 2–3, pl. 1, figs. 6–7

1998 *Cummingella* (*Cummingella*) cf. *C. auge* — Hahn, Hahn & Müller, 191–192, pl. 4, figs. 11–12

New material and horizon: Two pygidia preserved on one slab of a shale (SR 11). Latest Tournaisian *S. anchoralis* conodont Zone, foraminiferal Zone MFZ8.

Description: Two incomplete semicircular convex pygidia are preserved. Pleural and interpleural furrows are not favourably preserved.

Remarks: Based on typical outline of pygidium, pygidial axis and reduction of pleurae it seems to be a representative of this species. Pygidium of semicircular outline, with convex lateral lobes and axis. Rhachis convex, wide, com-

posed of eleven convex rings. Interpleural furrows are not visible, pygidial border narrow. Despite dorsoventral deformation, all characteristic features are preserved and comparable to the type material (see Hahn R. 1968).

Conclusion

The discovery of a new trilobite assemblage in the Březina Shales (Březina Formation) in the Mokrá Quarry complements Chlupáč's research from 1966 on Lower Carboniferous trilobite taxa derived from pelitic facies of the Březina Formation. It significantly enriches our knowledge concerning Moravian Carboniferous trilobite fauna, its diversity and the occurrence of different taxa. In this work, the biostratigraphic position of discovered trilobite fauna in Moravian Karst is documented for the first time. The obvious paleogeographical affinities of Moravian trilobite assemblages with other European Carboniferous faunas, especially that of the Harz Mountains (Hahn et al. 1998, 2003) are proved.

The large diversity of trilobite, brachiopod and other associated fauna shows the importance of the Mokrá Quarry in the cosmopolitan context of Mississippian sites.

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