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TRILOBITE ASSEMBLAGE OF *CALCEOLA*-BEARING BEDS IN ACANTHOPYGE LIMESTONE (CHOTEČ FORMATION, MIDDLE DEVONIAN, EIFELIAN, PRAGUE BASIN, THE CZECH REPUBLIC)

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Abstract: The trilobite assemblage of *Calceola*-bearing beds in the upper part of Acanthopyge Limestone (Choteč Formation, Eifelian) in the Koněprusy area, the Czech Republic, is described. Together with occurrence of *Calceola*, it indicates absence of significant palaeogeographic barriers restricting the distribution of the Rhenish-Type faunas in the Middle Devonian. The generic composition of the gathered trilobite assemblage somewhat differs from typical *Acanthopyge-Phaetonellus* assemblage characteristic for the Acanthopyge Limestone facies in possible absence and/or very rare occurrence of *Phaetonellus*, and only infrequent occurrence of *Acanthopyge*. Phacopid *Chotecops* cf. *hoseri* (Hawle et Corda, 1847) distinctly dominates; all other taxa are rather rare. Important is an occurrence of scutelluids of the *Scutellum* sensu lato group (preservation of remains does not enable more precise determination) and *Longiproetus*(?). Trilobite remnants are generally poorly preserved and very fragmented (only minute shields are not affected), which support a high-dynamic, shallow-water original environment.

Key words: trilobites, upper Eifelian, Barrandian area, the Czech Republic

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Introduction

Several years ago, the second author (Mergl 2014) described a unique assemblage of taxonomically diverse ribbed brachiopods with first confirmed findings of *Calceola sandalina* (Linnaeus, 1771) in the Prague Basin (Barrandian area, the Czech Republic). This assemblage was described from the Acanthopyge Limestone facies (Choteč Formation, Eifelian) exposure in a small quarry at Zadní Kobyla in the Koněprusy area. This occurrence of *Calceola sandalina* in the Barrandian area in Eifelian time is very important, as it indicates an absence of significant palaeogeographic barriers restricting distribution of this tetracoral in the Middle Devonian (Mergl 2014). The above-discussed coral-brachiopod assemblage has been interpreted by Mergl (2014) as representing a higher-energy reef environment, different from a somewhat deeper and calmer environment characterized by smooth-shelled, small to medium sized spire-bearing brachiopods. A moderately diverse trilobite assemblage from the same locality has been subsequently studied. It also somewhat differs from the typical *Acanthopyge-Phaetonellus* assemblage characteristic for Acanthopyge Limestone (Chlupáč 1983: 60). In addition, this trilobite assemblage also contains some Rhenish-type elements (for discussion see, for example, Flick 1999, 2018, Van Viersen and Prescher 2009, 2011, Weiner et al. 2018 a. o.)

Geological settings

The Acanthopyge Limestone is a local member of the Choteč Formation (Middle Devonian), and represents shallow-water marine deposits of the peri-reef environment at the top of the Koněprusy submarine elevation (Chlupáč 1998, Mergl 2014 a. o.). The member is built of generally well-washed grainstone/rudstone, crinoidal limestone and possibly also bahamites (Havlíček and Kukal 1990, Galle and Hladil, 1991). The topmost sequence of dark bedded limestone has been correlated with the Kačák Member and the Kačák event by some authors (Hladil et al. 1992, Hladil 1993, Budil 1995); for further discussion see especially Berkyová (2004) and Mergl and Budil (2019). An Eifelian age for Acanthopyge Limestone is proved by goniatites (Chlupáč and Turek 1983), conodonts (Zikmundová and Kalvoda in Galle and Hladil, 1991, Berkyová 2009) and by

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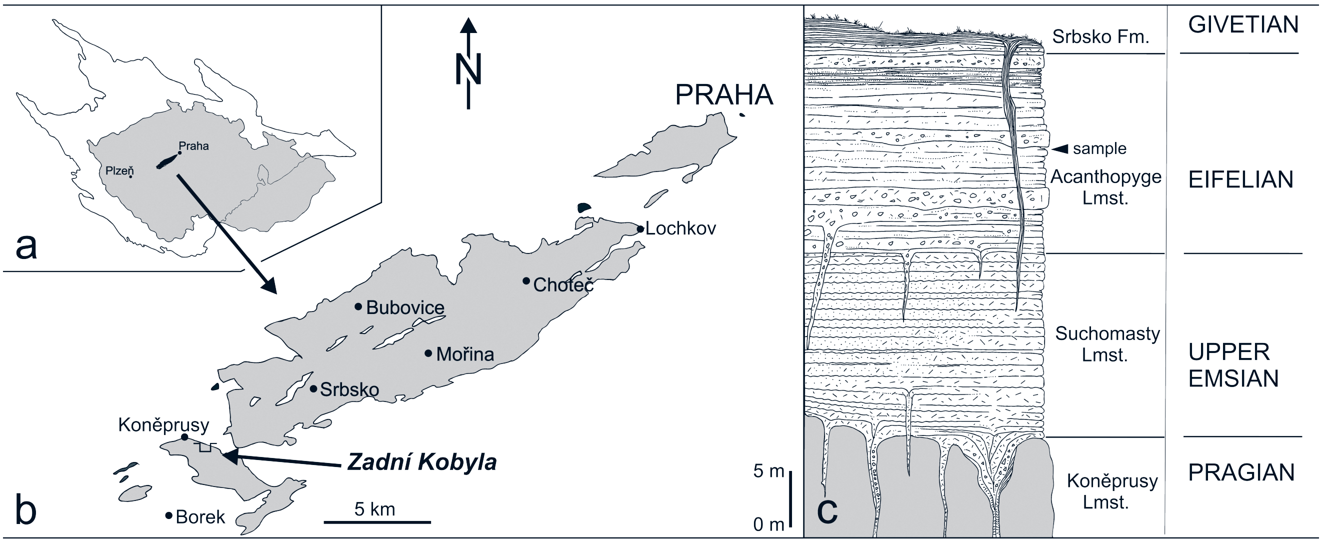
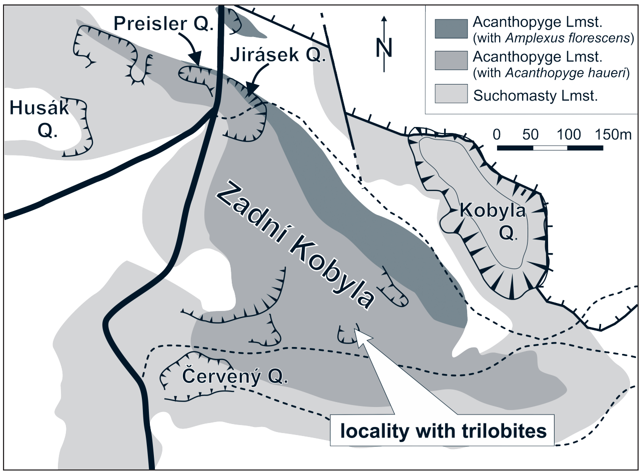


Text-fig. 1. Sketch map of the Devonian of the Prague Basin, and generalised stratigraphy of the Koněprusy Limestone (Pragian), Suchomasty Limestone (Upper Emsian), Acanthopyge Limestone (Eifelian) and the top of the Acanthopyge Limestone and the Srbsko Formation (transition Eifelian-Givetian) in the Koněprusy area (with marked neptunian dykes and approximate positions of *Calceola*-bearing limestone beds). Modified after Chlupáč et al. (1986), Hladil et al. (1992) and Mergl (2014).

other invertebrates. A supposed Eifelian/Givetian transitional interval above the dark interval of the Acanthopyge Limestone is supported by index tabulatomorphs and stromatoporoids (Hladil 1993). Mergl (2014) pointed out preservational and taxonomic similarities between the biotas from older Koněprusy Limestone (Pragian in age) and some parts of younger Acanthopyge Limestone (Eifelian). Such similarities can indicate at least short-time restoration of a similar reef environment in the upper Eifelian (at least for *Calceola*-bearing beds containing trilobite faunas discussed herein).

All trilobite specimens discussed in this contribution were collected in the upper part of the Acanthopyge Limestone outcropping in a small, shallow, abandoned quarry in Zadní Kobyla ridge near Koněprusy (Mergl 2014; see also Text-figs 1, 2). Fossiliferous limestone rich in brachiopods, crinoids and corals, with only infrequent findings of minute, fragmented trilobite remains form small outcrops along the low NE slope of the quarry (Mergl 2014). This bed of crinoidal white limestone bed incorporated in a several metres thick succession of white limestone in the upper one-third of the Acanthopyge Limestone, in the *Tortodus kockelianus* Zone of the upper Eifelian (for details, see Mergl 2014). Remains of trilobites are generally poorly to very poorly preserved, fragmentary (only minute shields of proetids are less affected). Especially internal moulds are heavily corroded, with partially dissolved surface. On some negative counterparts, remains of the original exoskeleton and/or imprints of the original external exoskeleton surface are present, but also in these samples, preservation is not favourable, also because of partial re-crystallisation of the rock. Despite this, at least part of specimens is determinable, although mostly on a generic level only.



Text-fig. 2. General geological map of the Emsian (Suchomasty Limestone) and Eifelian (Acanthopyge Limestone) rocks at Zadní Kobyla ridge with marked *Calceola*- and trilobite-bearing locality. Modified after Svoboda and Prantl (1949) and Mergl (2014).

Material and methods

All figured and discussed specimens are housed in the collections of the Czech Geological Survey, Prague, Klárov 3, 11821, Praha 1, the Czech Republic (abbreviation CGS MM). The methods used to analyse all trilobite specimens include standard light microscopy of external and internal surfaces (Microscope NIKON SMZ 1500). Photographs were taken using NIKON digital cameras D 300 and D 7500, after coating the samples with ammonium chloride, see Parsley et al. (2018). For vector illustrations, Corel Draw X3 was used; photographs were enhanced with Corel Photopaint X3.

Systematic palaeontology

Terminology follows Whittington and Kelly (1997) for morphological features of the exoskeleton. Classification largely follows Treatise, i.e. Fortey (1997).

Order Phacopida Salter, 1864
Suborder Phacopina Struve, 1959
Superfamily Phacopoidea Hawle et Corda, 1847
Family Phacopidae Hawle et Corda, 1847
Subfamily Phacopinae Hawle et Corda, 1847

Genus *Chotecops* Chlupáč, 1971

Chotecops cf. *hoseri* (Hawle et Corda, 1847)

Text-fig. 3a–f

Material. Eight incomplete cephala, six pygidia, numerous isolated fragments of cephala, pygidia and thoracic segments, two incomplete cheeks with preserved visual surface of the eye. Internal moulds and their counterparts, twenty five total remnants.

Remarks. Preservation of even the best-preserved remains of phacopid exoskeletons does not allow positive determination of material to the species level, but it shares most features with *Chotecops hoseri* (Hawle et Corda, 1847). The angle of divergence in axial furrows is, however, slightly larger in the studied material (67°), but this value is barely larger than the upper limit of the variation range (60–65°) previously known in this species (Chlupáč 1977: 53); this feature may have also been slightly affected by deformation. In the studied samples, the maximal number of lenses in the dorso-ventral row of the eye reaches 6 (5) ommatidia (in two young holaspid specimens, see Text-fig. 3d and younger unfigured specimen CGS MM 575), which fits well with description of *Chotecops hoseri* by Chlupáč (1977: 53). A lesser maximal number of ommatidia in a dorso-ventral row in the younger specimen can be explained by its early ontogenetic stage. In the largest specimen, the number of dorso-ventral rows in an eye is 17, and some are clearly missing (broken off). Following Chlupáč (1977), specimens of *Chotecops hoseri* should reach 18 dorso-ventral rows. Pygidia correspond with *C. hoseri* in number of ribs (4–5, 6 in large specimens only; see Chlupáč 1977)), by their PL/PW ratios, and by prominent effacement of pleural furrows, except for the first one (two) pairs. The exact number of axial rings in studied specimens remains unknown because of poor preservation, but certainly exceeds four well-expressed rings. The studied remains differ from *Chotecops auspex* Chlupáč, 1971, also rarely occurring in the Acanthopyge Limestone (Chlupáč 1971, 1977, 1983), in having slightly larger eyes with more dorsoventral files of ommatidia, and by better expressed pygidial segmentation (much effaced in *C. auspex*). However, the observed angle of divergence in cephalic axial furrows fits better to the latter-mentioned species.

Chotecops ? sp.

Text-fig. 3g

Material. Fragment of pygidium, internal mould.

Remarks. One pygidium, tentatively assigned to the *Chotecops*, has slightly more pronounced segmentation on lateral lobes. Relatively wide 4–5 pleural furrows are well distinguishable, and ribs seem to be more vaulted, narrower than in other *Chotecops* specimens coming from the locality. This may be artefact of different preservation, but also the axis seems to be slightly narrower and more vaulted. Axial rings are, however, imperceptible because of poor preservation.

Family Cheiruridae Salter, 1864

Genus *Crotalocephalus* Salter, 1864
Subgenus *Crotalocephalus* (*Crotalocephalus*) Salter, 1864

Crotalocephalus (*Crotalocephalus*) cf. *affinis* (Hawle et Corda, 1847)

Text-fig. 3i

Material. Fragment of cranidium, internal mould.

Remarks. Only one specimen available – an incomplete cranidium (internal mould) is not sufficiently preserved to enable definite affiliation to the species. Despite this, in most of its features (shape of glabella, glabellar furrows and occipital ring), it fits well with the diagnosis of *Crotalocephalus affinis* (Hawle et Corda, 1847) done by Přibyl and Vaněk (1973).

Order Lichida Moore, 1959
Family Lichidae Hawle et Corda, 1847
Subfamily Trochurinae Phleger, 1936

Genus *Acanthopyge* Hawle et Corda, 1847
Subgenus *Acanthopyge* (*Acanthopyge*) Hawle et Corda, 1847

Acanthopyge (*Acanthopyge*) cf. *haueri* (Barrande, 1846)

Text-fig. 3j–k, with some doubts also Text-fig. 3l

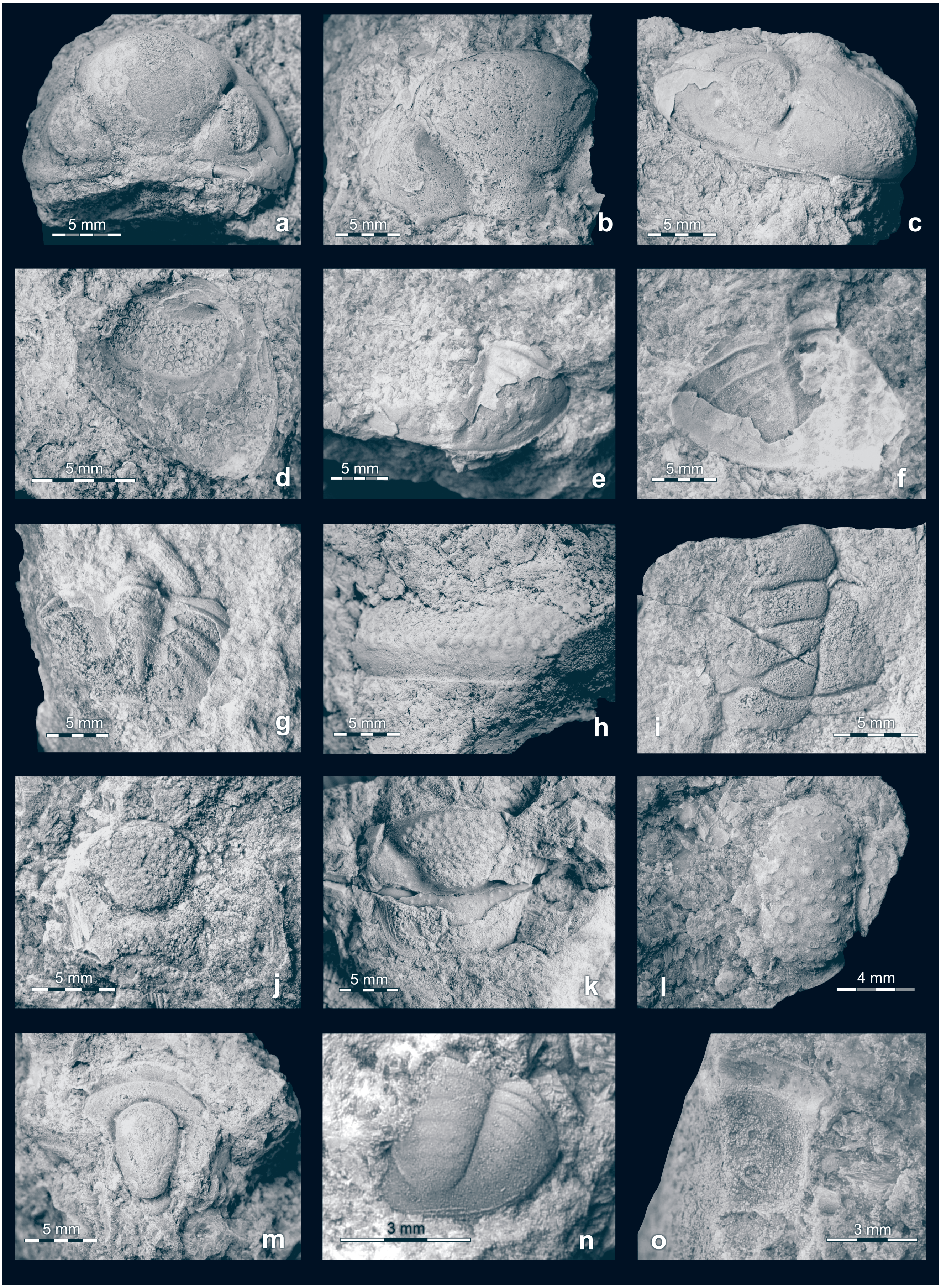
Lectotype. Cranidium NM-L 15148 selected by Šnajdr (1984: 169), figured by Hawle and Corda (1847: pl. 1, fig. 5) as *Acanthopyge Leuchtenbergii*. Refigured by Barrande (1852: pl. 28, figs 40, 41), Šnajdr (1984: pl. 5, fig. 13) and discussed by Thomas and Holloway (1988: 221–222).

Type locality. Koněprusy near Beroun, the Czech Republic, Acanthopyge Limestone (Middle Devonian, Eifelian).

Material. Two juvenile hypostomes, internal moulds, one fragment of cranidium, one small fragment of pygidium.

Remarks. Two hypostomes enables positive determination as belonging to the juvenile (early holaspid) specimens of *Acanthopyge* (*Acanthopyge*) *haueri* (Barrande, 1846), which is a common, eponymous species of Acanthopyge Limestone facies. Both hypostomes show all features typical for juvenile specimens of this species – especially coarse, prominent granulation of the middle body and prominent terrace lines on lateral and posterior margin.

One fragment of cranidium (Text-fig. 3l) possibly also belongs to this species. Only a median glabellar lobe covered by coarse tubercles and spinose tubercles is observable, with a very narrow fragment of supposed bullar lobe. It could not be entirely excluded, however, that this fragment may be a remnant of odontopleurid *Ceratocephala* Warder, 1838 – the median lobe does not widen anteriorly, but such a feature is also present in some specimens of *Acanthopyge* (*Acanthopyge*).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Order Corynexochida Kobayashi, 1935
Suborder Illaenina Jaanusson, 1959
Family Styginidae Vogdes, 1890

Genus *Scutellum* Pusch, 1833

Scutellum? sp.
Text-fig. 4e–g

Material. 2 fragments of pygidia, internal moulds and their counterparts.

Remarks. Among trilobite remains from the locality, apart from ubiquitous phacopids and very fragmentary but common harpetids, remains of scutelluid trilobites are distinctive. They do not enable determination at the species level, and barely at the generic level. Despite this, it is apparent that they do not represent remains of *Thysanopeltis* Hawle et Corda, 1847, or *Scabriscutellum* Richter et Richter, 1956 (the only scutelluid genera mentioned in Acanthopyge Limestone by Chlupáč 1983; see also discussion below). Pygidial fragments are characterised by wide, only moderately vaulted paired ribs, middle rib possessing coarse granulation (large granules, pustules), and very narrow inter-rib furrows. The axis is not preserved, with the exception of a narrow fragment figured in Text-fig. 4e; also, the pygidial outline is barely determinable, possibly semi-elliptical. Because of insufficient preservation, affiliation of all these samples to the *Scutellum* sensu lato seems to be the most parsimonious solution. Occurrence of *Scutellum* Pusch, 1833 and allied taxa (for example, *Torleyiscutellum* Basse, Koch et Lemke, 2016, *Goldius* de Koninck, 1841; see also Weiner et al. 2018) is characteristic for the Middle and Upper Devonian of Laurussia (current France, Germany, Belgium or Poland), see, for example, Archinal (1994), Van Viersen and Prescher (2011) and Basse et al. (2016).

Genus *Scabriscutellum* Richter et Richter, 1956

Scabriscutellum sp.
Text-fig. 4d

Material. One fragment of pygidium, internal mould; (?) minute fragment of cranidium.

Remarks. One fragment of scutelluid pygidium possesses typically narrow ribs and wide inter-rib furrows, but lacks the pygidial marginal spines (pygidial posterolateral margin is smooth). It corresponds to the *Scabriscutellum* (*Scabriscutellum*) and/or *Scabriscutellum* (*Cavetia*) Pillet, 1973. As no other material is available, the specimen is left in open nomenclature. It is, however, most probable that the specimen belongs to the *S.* (*S.*) *caelebs caelebs* (Barrande, 1852), known from the Acanthopyge Limestone (see Vaněk and Valíček 2002 but not Šnajdr 1960 and Chlupáč 1983 – these authors affiliated occurrence of this taxon to the older Suchomasty Limestone; original and supplementary material of Šnajdr stored in Czech Geological Survey collections is nonetheless correctly affiliated to the Acanthopyge Limestone by author himself). Chlupáč (1983: 60, pl. 5), has mentioned a rare occurrence of *Scabriscutellum* (different than *S.* (*S.*) *caelebs caelebs*?) in Acanthopyge Limestone. The middle rib of the studied specimen slightly widens anteriorly, while in *S.* (*S.*) *caelebs caelebs* it narrows anteriorly (Šnajdr 1960: pl. 26, figs 4, 8–9)

Order Ptychopariida Swinnerton, 1915
Suborder Harpina Whittington, 1959
Family Harpetidae Hawle et Corda, 1847
Subfamily Harpetinae Hawle et Corda, 1847

Genus *Lioharpes* Whittington, 1950
Subgenus *Lioharpes* (*Fritchaspis*) Vaněk, 1963

? *Lioharpes* (*Fritchaspis*) sp.
Text-fig. 3h

Material. Four fragments of fringe, internal moulds and their counterparts.

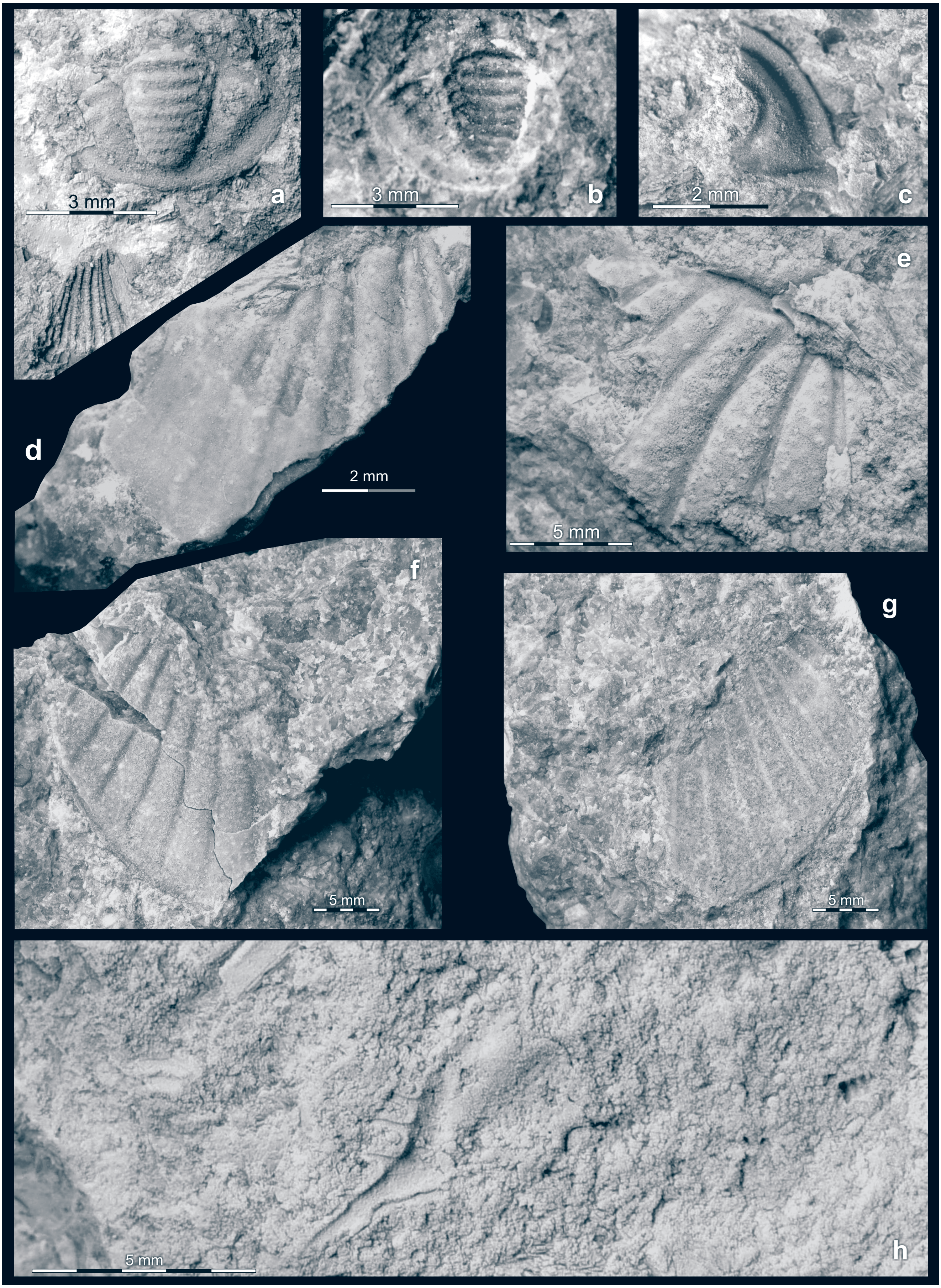
Remarks. Remains of harpetid trilobites are too much fragmentary to enable even generic affiliation. Chlupáč (1983), Přibyl and Vaněk (1986: 37–38) and Vaněk and Valíček (2002) report from the Acanthopyge Limestone common occurrence of *Lioharpes* (*Fritschaspis*) *montagnei* (Hawle et Corda, 1847), rare occurrence of *Reticuloharpes reticulatus* (Hawle et Corda, 1847) and very rare findings of *Kielania kayseri* (Novák, 1890). Relatively prominent perforation of fringe together with its vaulting seems to support the affiliation to the first mentioned taxon. Alternatively, occurrence of *Helioharpes* could also be assessed, but this genus was not previously known from the Acanthopyge Limestone.

Order Proetida Fortey et Owens, 1975
Superfamily Proetoidea Hawle et Corda, 1847
Family Proetidae Hawle et Corda, 1847
Subfamily Proetinae Hawle et Corda, 1847

Genus *Longiproetus* Cavet et Pillet, 1958

Longiproetus? sp.
Text-fig. 4a–b, ?c

Text-fig. 3. Trilobite assemblage at Zadní Kobyla small quarry outcrop (*Calceola*-bearing locality). a–f – *Chotecops* cf. *hoseri* (Hawle et Corda, 1847); a, c – almost complete cephalon, CGS MM 556, internal mould, a – dorsal view, c – right frontolateral view; b – incomplete cephalon, CGS MM 557, internal mould, dorsal view; d – left free cheek with visual surface of eye, CGS MM 558, internal mould with remains of exoskeleton, lateral view; e – incomplete pygidium, CGS MM 559, dorsal view; f – incomplete pygidium, CGS MM 560, dorsal view. g – *Chotecops* ? sp., incomplete corroded pygidium, CGS MM 561, dorsal view. h – ?*Lioharpes* (*Fritchaspis*) sp., fragment of fringe, internal mould, lateral view, CGS MM 562. i – *Crotalocephalus* cf. *affinis* (Hawle et Corda, 1847), incomplete cranidium, CGS MM 563, internal mould, dorsal view. j–k – *Acanthopyge* (*Acanthopyge*) cf. *haueri* (Barrande, 1846), incomplete hypostomes, dorsal views, j – CGS MM 564, k – CGS MM 565. l – *Acanthopyge*? sp., fragment of cranidium, internal mould with remains of exoskeleton, CGS MM 566, dorsal view. m – *Otarion* cf. *lacrimarum* Přibyl et Vaněk, 1981, incomplete corroded cranidium, internal mould, CGS MM 567, dorsal view. n – *Orbitoproetus* cf. *angelini* (Hawle et Corda, 1847), juvenile pygidium, internal mould with exoskeleton, CGS MM 568, dorsal view. o – *Eremiproetus*? sp., negative counterpart of poorly preserved fragment of cranidium, CGS MM 569, dorsal view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Material. One pygidium (internal mould and its counterpart), isolated free cheek (?).

Remarks. One isolated pygidium apparently belongs to the subfamily Proetinae – it is prominently vaulted, with a semi-elliptical outline, wide, robust axis and well developed, moderately vaulted posterior margin with shallow, wide border furrow. However, its generic affiliation is uncertain. The above-discussed features, together with well-developed axial rings and deep pleural furrows on lateral pygidial lobes preclude its determination as *Orbitoproetus*, commonly occurring in Acanthopyge Limestone in the Kobyla area. An affiliation to *Longiproetus*? sp. seems to be most suitable (note also a similar number of axial rings – at least 7, plus short terminal part, for *Longiproetus* 8(7) axial rings is a diagnostic feature). From *Erbenites* Přibyl, 1964, typical for this part of Acanthopyge Limestone, a different number of axial rings (only 4, plus long terminal part in *Erbenites*), wider and deeper pleural furrows and different vaulting of pygidium with much deeper and wider border furrow clearly distinguish the described pygidium. From *Coniproetus* (*Tropiconiproetus*) Šnajdr, 1980, the discussed pygidium differs especially by much deeper and wider pleural furrows. With some uncertainty, an incomplete isolated free cheek figured in Text-fig. 4c is also affiliated to *Longiproetus*.

Genus *Orbitoproetus* Pillet, 1969

Orbitoproetus cf. *angelini* (Hawle et Corda, 1847)

Text-fig. 3n

Material. One juvenile pygidium, internal mould.

Remarks. One isolated juvenile pygidium bears all principal features of *Orbitoproetus* – relatively compact, partially effaced pygidium with suppressed axial lobation and prominent two first pairs of pleural furrows. With some uncertainty, this specimen is determined as *Orbitoproetus* cf. *angelini* (Hawle et Corda, 1847).

Subfamily Eremiproetinae G. Alberti, 1967

Genus *Eremiproetus* Richter et Richter, 1919

Eremiproetus? sp.

Text-fig. 3o

Material. One incomplete juvenile cranidium, internal mould and its counterpart.

Remarks. This incomplete juvenile cranidium is very poorly preserved, both the internal mould and its counterpart. It is barely determinable, because all details are effaced by re-crystallization. Only preliminary affiliation to the *Eremiproetus* is possible, based on overall (slightly violin-shaped) outline of glabella and, especially, the course of the preocular facial suture, diverging slightly anteriorly. The medium-vaulted frontal border is less arched and narrower than in *E. eremita* (Barrande, 1852). An indistinct median tubercle is present on the anterior part of the occipital lobe. On much of the fragmentary internal mould, indistinct coarse granulation on the surface of the glabella is present. Fragment of the cranidium, possibly because of its heavy corrosion, is somewhat reminiscent of the invalid species *E. hornyi* Přibyl, 1965 (established on corroded specimen, encompassed by Šnajdr (1977, 1980) into the synonymy of *E. eremita*), and by some features, especially by narrower and less vaulted anterior border and glabellar granulation, also reminiscent of *E. notabilis* (G. Alberti, 1966) sensu Feist and Belka (2018: text-fig. 3R, S). Due to some of above-discussed characters, the cranidium is also reminiscent of cornuproetid *Tafilaltaspis* G. Alberti, 1966 which, however, has not yet been described from the Acanthopyge Limestone, but is known from underlying Suchomasty Limestone facies, upper Emsian in age. From *Nagaproetus* Šnajdr, 1977, a fragment of the cranidium differs by a diverging preocular branch of the facial suture, and from *Proetopeltis* Přibyl, 1965 and *Buchiproetus* Pillet, 1969, by the outline of the cranidium and the shape of the frontal border.

Proetidae indet.

Material. Three fragments of free cheeks.

Remarks. Two remnants of free cheeks are strongly vaulted; eyes are broken off. Lateral border furrow is wide, deep, lateral border strongly vaulted, narrow in one specimen but these features are almost indistinct in second specimen (its morphology is effaced). The third, most doubtful fragment may be a remnant of a tropidocoryphid free cheek with a long spine. All these remains are too much fragmentary to enable any more precise affiliation.

Family Aulacopleuridae Angelin, 1854
Subfamily Otarioninae Richter et Richter, 1926
Tribe Otarionini Richter et Richter, 1926

Otarion Zenker, 1833

Remarks. *Conoparia* Hawle et Corda, 1847 is considered to be congeneric with *Otarion* Zenker, 1833 by Adrain and Chatterton (1994), and this approach is shared here.

Otarion cf. *lacrimarum* Přibyl et Vaněk, 1981

Text-fig. 3m

Material. One incomplete exfoliated cranidium.

Remarks. Only one poorly preserved cranidium with corroded glabella does not enable safe affiliation within the tribe Otarionini Richter et Richter, 1926, but its general morphology corresponds well with the overall body

Text-fig. 4. Trilobite assemblage at Zadní Kobyla small quarry outcrop (*Calceola*-bearing locality). a–c – *Longiproetus*? sp., a, b – poorly preserved pygidium, CGS MM 570, dorsal view, a – internal mould, b – counterpart of the same specimen, c – incomplete free cheek, questionably affiliated to *Longiproetus*? sp., CGS MM 571, internal mould, dorsal view. d – *Scabriscutellum* sp., fragment of pygidium, internal mould, CGS MM 572, dorsal view. e–g – *Scutellum* sp., e – fragment of pygidium, internal mould, CGS MM 574, lateral view, f–g – fragment of pygidium, CGS MM 573, dorsal view, f – internal mould, g – negative counterpart. h – *Kettneraspis* sp., incomplete free cheek, negative counterpart, CGS MM 576.

morphology of *Otarion lacrimarum* Přibyl et Vaněk, 1981, previously described from the Acanthopyge Limestone. The specimen has been compared with the type material of this species, which is housed in collections of the Czech Geological Survey (prefix CGS), not in the Museum of Senckenberg Institute (prefix SMP) as has been published (unfortunately with low quality of photographs) in Přibyl and Vaněk (1981). The glabella of the studied specimen is relatively elongated, widening slightly anteriorly, medium-vaulted, covered by sparse distinct granules. It differs from the *Cyphaspis* Burmeister, 1843 in having a relatively longer preglabellar field, and markedly lesser convexity of the glabella (Van Viersen and Prescher 2007, Van Viersen and Holland 2016). This convexity of glabella is, on the other hand, more prominent than in *Harpidella* McCoy, 1849 (sensu Adrain and Chatterton 1995). By some features (sparse granulation, sag. length of occipital ring+glabella/ sag. length of cranidium ratio; see Adrain and Chatterton 1995: 308), the studied cranidium is similar to the above-discussed genus. L1 are not preserved (they are broken off, but the remains of left L1 indicate its large sag. length). Affiliation of the specimen as *Otarion* cf. *lacrimarum* seems to be the most likely, although typical elevation at the sag. axis of the preglabellar field (cf. Přibyl and Vaněk 1981: 194) is indistinct in the studied specimen, probably due its corrosion.

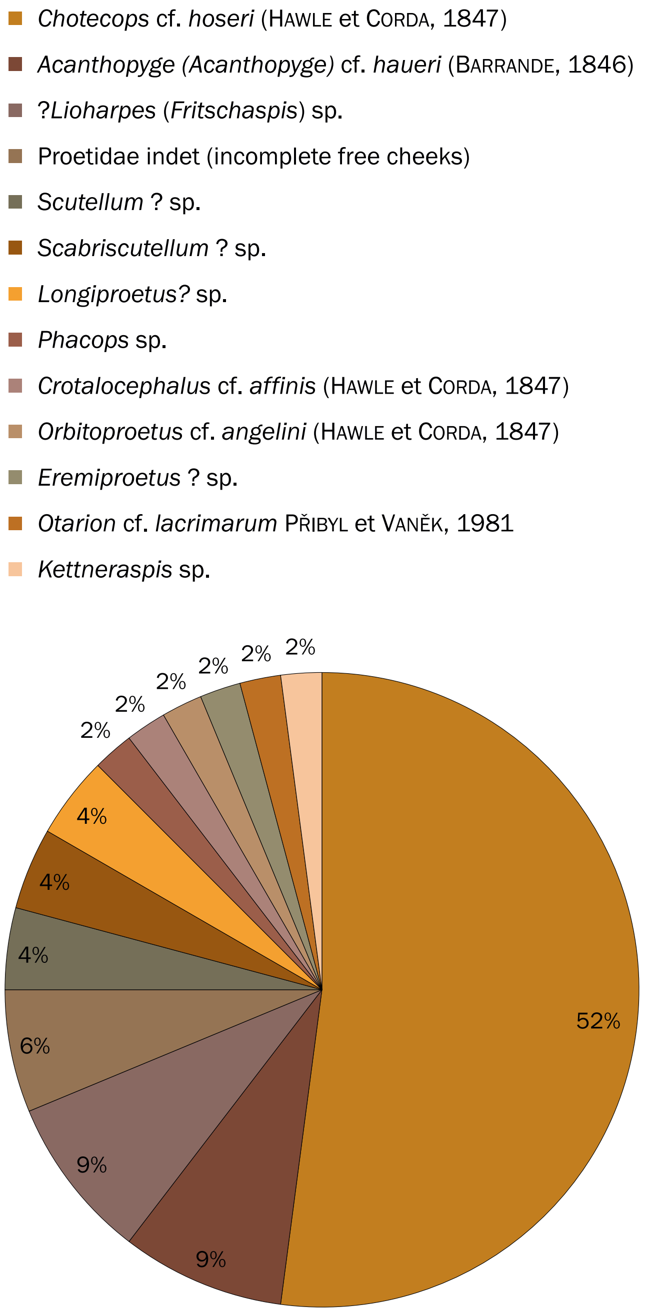
Family Odontopleuridae Burmeister, 1843
Subfamily Odontopleurinae Burmeister, 1843

Genus *Kettneraspis* Prantl et Přibyl, 1949

Kettneraspis sp.
Text-fig. 4h

Material. One isolated free cheek, negative counterpart.

Remarks. One isolated free cheek does not enable exact affiliation, but most probably belongs to *Kettneraspis pigra* (Barrande, 1872). Genal spine is long, with robust base. Ten to eleven marginal spines are relatively slender and pointed (rather blunt in *K. pigra*). The surface of the free cheek has fine granulation; the eye is broken off. Preservation of the specimen makes precise determination impossible.



Text-fig. 5. A pie chart of trilobite taxa abundance at Zadní Kobyla – small quarry outcrop (*Calceola*-bearing locality).

Conclusions

The studied trilobite assemblage (48 total determinable specimens gathered) is characterised by the dominant occurrence of phacopid *Chotecops* cf. *hoseri* (about 52 % of total assemblage; see Text-fig. 5). Relatively infrequent occurrence of *Acanthopyge* (*A.*) cf. *haueri* (about 9 %) and the possible absence (or very rare occurrence besides the sampling) of scutelluid *Thysanopeltis speciosa* (Hawle et Corda, 1847) and significant tropidocoryphid *Phaetonellus* make the assemblage somewhat unusual for Acanthopyge Limestone facies. The above-discussed taxa present key representatives of *Acanthopyge-Phaetonellus* Assemblage defined by Chlupáč (1983) (see also Havlíček and Kukal (1990) – these authors used *Karbous-Acanthopyge* Community instead). In *Calceola*-bearing beds, several other typical taxa of *Acanthopyge-Phaetonellus* Assemblage are also very rare or entirely missing (Tab. 1). This somewhat unusual character is enhanced by infrequently (4 %) occurring remains of scutelluids with coarse granulation on the wide and flat pygidial ribs (preliminarily affiliated here into the *Scutellum* sensu lato group represented by *Scutellum*, *Torleyscutellum* and *Goldius* = *Calycoscutellum* Archinal, 1994 sensu Basse 2007; see also Van Viersen and De Wilde 2010), *Scabriscutellum* (4 %), *Longiproetus*? (4 %), and by only very rare occurrence (about 2 % for each taxon) of *Orbitoproetus* cf. *angelini*, *Eremiproetus*, *Crotalocephalus* cf. *affinis*, *Otarion* cf. *lacrimarum* and *Kettneraspis*. Fragments of harpedids are quite frequent (9 %), but so poorly preserved that only open determination as ?*Lioharpes* (*Fritchaspis*) is possible. Such a trilobite assembly is not typical for the *Acanthopyge-Phaetonellus*

Table 1. Comparison of typical *Acanthopyge-Phaetonellus* Assemblage sensu Chlupáč (1983) with trilobite assemblage at Zadní Kobyla small quarry outcrop (*Calceola*-bearing locality). A list of taxa in *Acanthopyge-Phaetonellus* Assemblage follows Chlupáč (1983: 60). r = rare, c = common, vc = very common.

Acanthopyge-Phaetonellus Assemblage		*Calceola*-bearing beds trilobite assemblage	
Chotecops hoseri (Hawle et Corda, 1847)	**c**	**_Chotecops_ cf. _hoseri_ (Hawle et Corda, 1847)**	**vc**
Chotecops auspex Chlupáč, 1971	r		
Erbenites fallax (Barrande, 1846)	**c**		
Orbitoproetus angelini (Hawle et Corda, 1847)	**c**	*Orbitoproetus* cf. *angelini* (Hawle et Corda, 1847)	r
Orbitoproetus fornicatus (Přibyl, 1971)	r		
Tropidocoryphe (*T.*) *p. pseudofilicostata* Přibyl, 1965	r		
Alberticoryphe chemazur Šnajdr, 1980	r		
Benesovella emarginata (Barrande, 1852)	r		
Eremiproetus eremita (Barrande, 1852)	r	*Eremiproetus* ? sp.	r
Phaetonellus planicaudus (Barrande, 1846)	**c**		
Phaetonellus hergetianus Šnajdr, 1980	r		
Trautensteinproetus kandahar Šnajdr, 1980	r		
Nagaproetus ferentarius agnatus (Přibyl, 1946)	r		
Nagaproetus pumilis Šnajdr, 1980	r		
Nagaproetus subscribus Šnajdr, 1980	r		
Buchiproetus postcomplanatus Šnajdr, 1980	r		
Proetopeltis neglecta neglecta (Barrande, 1852)	**c**		
Proetopeltis merkur Šnajdr, 1980	r		
Ignoproetus ignotus Šnajdr, 1980	**c**		
Ignoproetus? *caprona* Šnajdr, 1980	r		
Koneprusites moestus (Barrande, 1852)	**c**		
Koneprusites insons (Barrande, 1852)	**c**		
Otarion lacrimarum Přibyl et Vaněk, 1981	r	*Otarion* cf. *lacrimarum* Přibyl et Vaněk, 1981	r
Cyphaspides holynensis Růžička, 1939	**c**		
Aulacopleurina peltata (Novák, 1890)	r		
Aulacopleura bohemica Přibyl, 1947	**c**		
Crotalocephalus (_C._) _affinis_ (Hawle et Corda, 1847)	**c**	*Crotalocephalus* (*C.*) cf. *affinis* (Hawle et Corda, 1847)	r
Kettneraspis pigra (Barrande, 1872)	**c**	*Kettneraspis* sp.	r
Koneprusia fuscina (Novák, 1890)	r		
Isoprusia mydlakia Bruton, 1966	r		
Thysanopeltis speciosa Hawle et Corda, 1847	**c**		
Scabriscutellum sp.	r	*Scabriscutellum* sp.	r
Acanthopyge (_A._) _haueri_ (Barrande, 1846)	**c**	**_Acanthopyge_ (_A._) cf. _haueri_ (Barrande, 1846)**	**c**
Lioharpes (_Fritchaspis_) _montagnei_ (Hawle et Corda, 1847)	**c**	**? _Lioharpes_ (_Fritchaspis_) sp.**	**c**
		Scutellum sp.	**c**
		Longiproetus sp.	**c**

Assemblage (= *Karbous-Acanthopyge* Community sensu Havlíček and Kukal 1990). Also older, upper Emsian (occurring in Suchomasty Limestone) *Orbitoproetus-Scabriscutellum* Assemblage sensu Chlupáč 1983 (= *Karbous-Orbitoproetus* and *Orbitoproetus-Scabriscutellum* communities according to the concept of Havlíček and Kukal 1990: 122–128) was confined to somewhat different, calmer and possibly also slightly deeper environments than the studied fauna from *Calceola*-bearing beds (following Mergl 2014). Local changes in the trilobite fauna of Acanthopyge Limestone were already discussed by Chlupáč (1983). Besides a specific assemblage from sedimentary (neptunic) dykes characterised by dominance of *Acanthopyge* (*A.*) *haueri* and *Chotecops auspex*, also a shallower-water assemblage different from the typical *Acanthopyge-Phaetonellus* Assemblage was distinguished by this author. Namely, Chlupáč (1983: 59) mentioned the accumulations of *Chotecops hoseri*, *Crotalocephalus affinis*, *Erbenites fallax* and *Lioharpes* (*Fritchaspis*) in yellow to reddish biomicrites within the biostromes, with dominant "*Amplexus*" *fluorescens* – this assemblage strongly resembles the above-discussed assemblage from Zadní Kobyla. Both assemblages probably reflect shallower-water conditions in a protected (lagoon?) environment; the specific composition of the trilobite assemblage from a small quarry at Zadní Kobyla may reflect a shallow-water, but much higher-energy environment (indicated especially by prominent disintegration and fragmentation of all trilobite remains). An occurrence of the *Scutellum* sensu lato group and possibly also *Longiproetus* (known from the Pragian in the Barrandian area, but also occurring elsewhere up to the lower Givetian; see Šnajdr 1980, Vaněk and Valíček 2002, Van Viersen et al. 2012 a. o.) is important for this trilobite assemblage. Such findings indicate that trilobite faunas in the upper portion of Acanthopyge Limestone (*Tortodus kockelianus* Zone below the "dark interval" sensu Hladil 1993) in Koněprusy area were also enriched by at least short-time immigrations of some "Rhenish-Type" taxa from other areas (current France, Germany, Belgium, Poland or Moravia); for such faunal exchanges within Devonian faunas, see also Havlíček (1994), Galle et al. (1995), Flick (1999, 2018), Chlupáč and Kolář (2001), Budil and Kolář (2004), Budil et al. (2009, 2014), Van Viersen and Prescher (2009, 2011), Mergl (2014), Weiner et al. (2018) a. o. Together with the previously described occurrence of *Calceola* in Acanthopyge Limestone (Mergl 2014), such faunal exchanges in the Eifelian indicate an absence of significant palaeogeographic barriers restricting the distribution of the "Rhenish-Type" and "Bohemian-Type" faunas within the closing Rheic Ocean.

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