Kainops chlupaci sp. n. from the Lower Devonian (Zlíchovian Stage) of the Prague Basin

Kainops chlupaci sp. n. ze spodního devonu (stupeň Zlíchov) pražské pánve

(2 figs, 1 plate)

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A description of the *Kainops chlupaci* sp. n. showing close affinities to the late representatives of the *Paciphacops – Kainops* clade is presented. Although this trilobite belongs to rare species in the Prague Basin, it is important, especially because of its palaeogeographic significance.

Key words: Trilobita; Phacopida; Lower Devonian; Prague Basin

Introduction

Trilobites are studied in the Prague Basin for more than 200 years, but many species still remain only insufficiently described and discussed, especially because of the lack of well-preserved material. The study of newly collected specimens and revision of the old material represent the basis for description of a new species *Kainops chlupaci* sp. n. (discussed by Chlupáč, 1977 under open nomenclature). The set of available exoskeleton fragments, especially in the material stored in the palaeontological collections of the Czech Geological Survey (CGS) and National Museum, Prague (NML), have been used. Since these specimens are generally poorly preserved, several paratypes supplementing the holotype were established. Some other specimens, described under open nomenclature because of their poor preservation, are also discussed. Since some of the specimens represent late meraspid to the late holaspid stages, some ontogenetic changes in configuration of the exoskeleton can be briefly evaluated.

Order P h a c o p i d a Salter, 1864
Family P h a c o p i d a e Hawle – Corda, 1847
Subfamily P h a c o p i n a e Hawle – Corda, 1847

Genus *Phacops* Emmrich, 1839
Subgenus *Kainops* Ramsköld – Werdelin, 1991

T y p e s p e c i e s : *Paciphacops microps* Chatterton et al., 1979

Kainops chlupaci sp. n.
Pl. 1, figs 1–4, 6–16

1977 *Phacops (Paciphacops)* sp. I.; Chlupáč, p. 68–69, Pl. 28, figs 15–19
1989 *Phacops (Paciphacops)* sp.; Pek – Vaněk, p. 22
2001 *Paciphacops* sp. I.; Chlupáč – Kolář, p. 182
2002 *Phacops (Paciphacops)* sp.; Vaněk – Valíček, p. 28

D e r i v a t i o n o m i n i s : To the memory of Prof. Ivo Chlupáč, distinguished geologist and palaeontologist, who described this species under open nomenclature.

H o l o t y p e : CGS ICh 4615, figured by Chlupáč (1977) on Pl. 28, figs 15–16, re-figured here on Pl. I, figs 1, 7.

P a r a t y p e s : CGS ICh 4616, figured by Chlupáč (1977) on Pl. 28, figs 17–19, re-figured here on Pl. 1, figs 2–4, CGS ICh. 6424 a–e (ICh 6424a figured here on Pl. 1, figs 6), ICh 6425a–g (ICh 6425a figured here on Pl. 1, fig. 9), CGS ICh 6490-4964, NM Ls 663/1,2,3 (figured here on Pl. I, figs 11–16)

T y p e h o r i z o n : The lowermost part of the Zlíchov Formation, so called "chapel horizon", lower Zlíchovian (lower Emsian)

T y p e l o c a l i t y : "U kapličky Quarry", Praha-Hlubočepy.

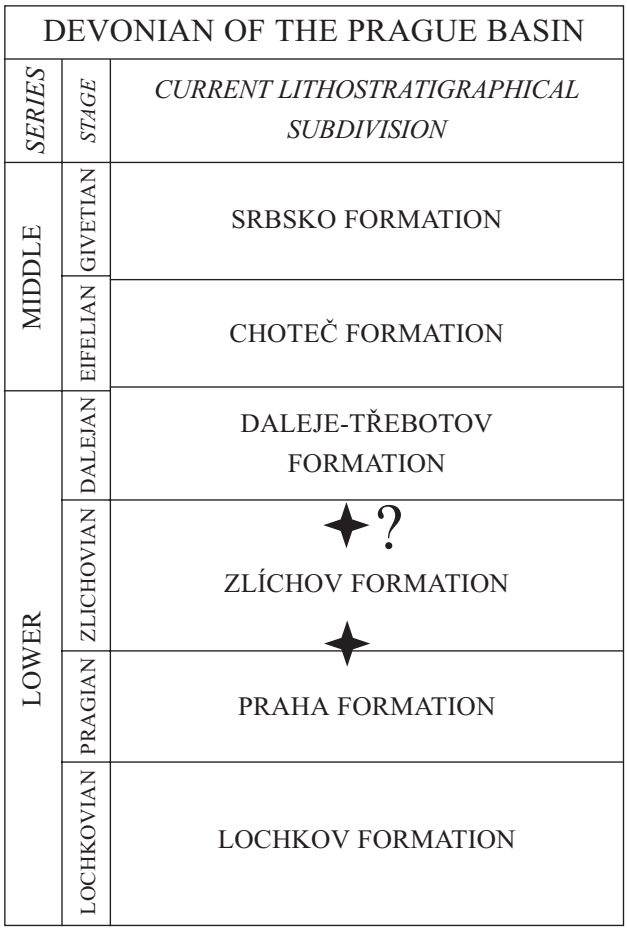

Fig. 1. Stratigraphy of the Devonian of the Prague Basin with marked occurrence of *Kainops chlupaci* sp. n.

M a t e r i a l : Nineteen incomplete cephala preserved as internal moulds, in some cases with remains of exoskeleton, and/or as negatives in decalcified limestone. Another problematical, incomplete, disarticulated specimen comes from biodetritic limestone.

D i a g n o s i s : Cephalon with glabella rapidly broadening anteriorly. Not truncated anterolateral corners, breadth (CL:CW = 1:1.8–2). Axial furrows with divergence angle of about 70°. Strongly reduced median part of preoccipital ring, on internal mould preserved as slight depression. Lateral preoccipital lobes small, but convex both on internal and external moulds. Occipital ring slightly overtops glabella in lateral view. Eyes large, visual surface kidney-shaped, inclined laterally at about 65°, (16)17–18 dorsoventral rows with up to 6–7 lenses in one row. Palpebral area transversally broad and convex, its convexity exceeding the palpebral lobe in adult specimens. Palpebral furrow sharp, palpebral lobe strongly curved abaxially. Postocular ridge convex, broad (1/4–1/5 of the sag. eye length). Eye socle concave but low. LB strongly broadened posterolaterally, outer margin in genal angle without spine in adult specimens, parabolical. LBF uninterrupted in genal angle. Vincullar furrow deep medially, sharply confined by ridges, but without distinct notches laterally. External surface of glabella with tubercles and dense smaller granules in the interspaces. Palpebral area and palpebral lobes tuberculated, without pits, lateral border with densely packed expressive granules. Anterioral doublure with short small scaly ridges dying out posteriorly. Thorax and pygidium unknown.

The most distinguishable from the type species and other representatives of the genus is the unique combination of the following features: considerable breadth of the cephalon, palpebral area without pits, finer glabellar sculpture, coarser sculpture on the PB and LB, strongly reduced median part of the preoccipital ring preserved as slight depression on internal moulds, medially deep vincular furrow sharply delimited by ridges.

R e m a r k s : Chlupáč (1977) described this species under open nomenclature, especially because of the lack of material necessary for a proper description of the new species. After the findings of the new specimens (some of them are negatives of holaspid stage with well-preserved external surface of the exoskeleton) and after revision of the all already described and studied samples, this available material as a whole is considered as sufficient for this description. From the nineteen available specimens, only one almost complete, but weathered cephalon was found by Chlupáč in the upper part of the Zlíchov Formation in the neighborhood of the Hostim village. This sample corresponds with the concept of the newly established species and should be considered as probably belonging to it, but it was left in the open nomenclature because of a stratigraphic position different from that of the other material studied. Another sample (see Fig. 2), an incomplete specimen that can be probably assigned to this species, but with some doubts, has been found by Mr. P. Kolář at Černá rokle near Kosoř,

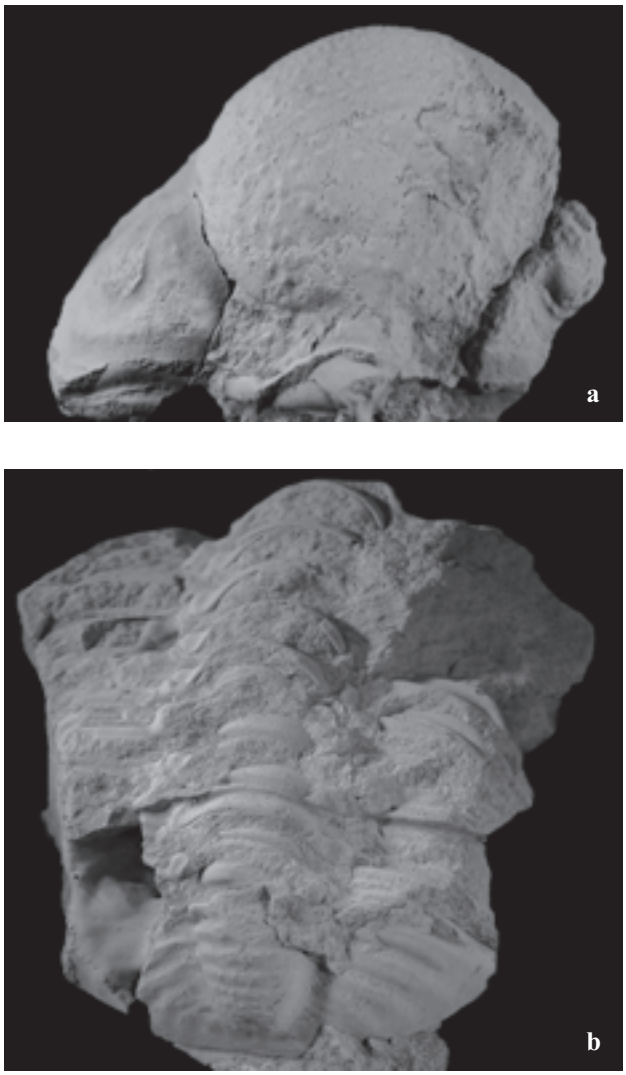

Fig. 2. *Kainops* ? sp., an incomplete, disarticulated specimen, CGS PB 137, in some features resembling *Kainops chlupaci* sp. n., but poorly preserved for the exact determination. a – cephalon, ×2, b – displaced thorax with the pygidium, ×2. Černá rokle at Kosoř, layers with *Parahomalonotus*? *novaki* Chlupáč – Kolář, 2001.

together with the *Parahomalonotus*? *novaki* Chlupáč – Kolář, 2001. This specimen resembles *Kainops chlupaci* sp. n. in the general configuration of the cephalon, especially in the dimensions and anterior position of the eyes, vaulting of the palpebral area, similar sculptation and convexity of the glabella but differs in the probably more pronounced medial part of the preoccipital ring and preservation is not sufficient for the exact affiliation. Therefore, the determination as the *Kainops* ? sp. is most appropriate.

Kainops chlupaci sp. n. shows close affinities to the *Paciphacops* Maksimova, 1972 because of the presence of some distinctive features (strongly reduced, but still slightly vaulted medial part of the preoccipital ring, great divergence of the axial furrows, medially deep vincular furrow but without distinct notches laterally etc.) and in the sculpture on palpebral area without pits. However, it differs in some important features, including especially

thin sclera in the visual surface of the eyes, vaulting of the palpebral area, entire absence of the spinosity of the exoskeleton in adult specimens including genal spines. A wide discussion of *Paciphacops* and related genera see in Maksimova (1972, 1978), Eldredge (1972, 1973), Chlupáč (1977), Struve (1990), Ramsköld – Werdelin (1991), De Carvalho – Moody (2000), Whiteley et al. (2002) and in Jell – Adrain (2003).

Nevertheless, type species of the genus *Kainops* Ramsköld – Werdelin, 1991, Australian *Kainops microps* (Chatterton et al., 1979) from the Pragian Garra Formation seems to be closest to the new species. It differs especially in slightly larger eyes (18 dorsoventral files with maximum number of lenses reaching 7–8 per file), but with almost identical structure of the sclera that is considered as the most important feature for the generic affiliation of the new species (see also Ramsköld – Werdelin, 1991, p. 66). The eyes of *Kainops microps* are, however, less elongated (sag.); it differs also in coarser granulation on glabella, finer sculpture on PB and LB, medially shallower vincular furrow, and by more circular outline of the cephalon. *Kainops veles* (Chlupáč, 1972) from the Koněprusy Limestone of Pragian age of the Barrandian area differs especially in more circular outline of the cephalon, larger eyes, pitted surface of the palpebral area and more vaulted preoccipital ring. The stratigraphic occurrence of *Kainops veles* and *Kainops chlupaci* is, however, also different.

From the *Burtonops cristatus* group, with similarities pointed out by Chlupáč (1977), it differs especially in the configuration of the eyes (lower eye socle, thinner sclera), but the granulation of the cephalon is also strongly different from the *Burtonops cristatus*, without spiny processes, genal spines are present in holaspid, but not in the adult specimens.

The young specimen CGS ICh 6425 (Pl. 1, fig. 10) possesses relatively denser, finer granulation without expressive tubercles, that perhaps could resemble *Eldredgops* ? *iowensis* (Delo, 1935) in some aspect, but the short fine spiny granules are absent. This specimen also differs from the latter in the shape of the preoccipital ring (that is more vaulted in *Eldredgops* ? *iowensis*) and especially in the posterior part of the PB that is not so sharply inclined backward, although it also strongly broadens posteriorly.

Ontogeny: The studied specimens belong to the late meraspid up to the adult stages and enable certain interpretation of the morphological changes during the ontogenetic development. The most remarkable is the change in the relative length (sag.) of the eyes. They are relatively large, if compared with the length of the glabella in the young holaspid (? or late meraspid – see discussion in Chlupáč, 1977), but they are substantially shorter and situated more anteriorly in the adult specimens. Younger specimens are characteristic by the relatively coarser granulation especially on the glabella (see Pl. 1, figs 13–16), also the vaulting of the glabella is more pronounced (Pl. 1, figs 11–12).

Stratigraphic occurrence: Lower and upper (?) part of the Zlíchov Limestones

Localities: "U kapličky" Quarry, Praha-Hlubočepy, Praha-Kosoř (see Chlupáč – Kolář, 2001), Hostim.

Conclusions

The appearance of the distinctively Australian and North American faunal element in the lower and probably also upper parts of the Zlíchov Formation (which correspond with lower Emsian) of the Prague Basin is very interesting, especially in relation to the appearance of another strange elements such as *Parahomalonotus*? *novaki* Chlupáč – Kolář, 2001 with strong Rhenish affinities. These rare but important trilobites, together with some of the Rhenish-type and Uralian plus Australian-like brachiopod fauna and with analogous changes in some other groups as ostracods and crinoids in the Prague basin (a wide discussion see in Havlíček, 1994 and Chlupáč – Kolář, 2001) imply extensive, but probably time-limited faunal exchanges (caused perhaps by palaeogeographic changes) in the Peri-Gondwana realm at the Pragian/Emsian boundary, or possibly during the lower Emsian. From this point of view, the probable re-appearance of the *Kainops chlupaci* sp. n. in the upper part of the Zlíchov Formation should be considered as questionable, but very interesting, perhaps suggesting limited communication between Peri-Gondwana, Australia, Laurentia and/or Kazakhstania (or other Central or Eastern Asia microcontinents) also at that time.

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Kainops chlupaci sp. n. ze spodního devonu (stupeň Zlíchov) pražské pánve

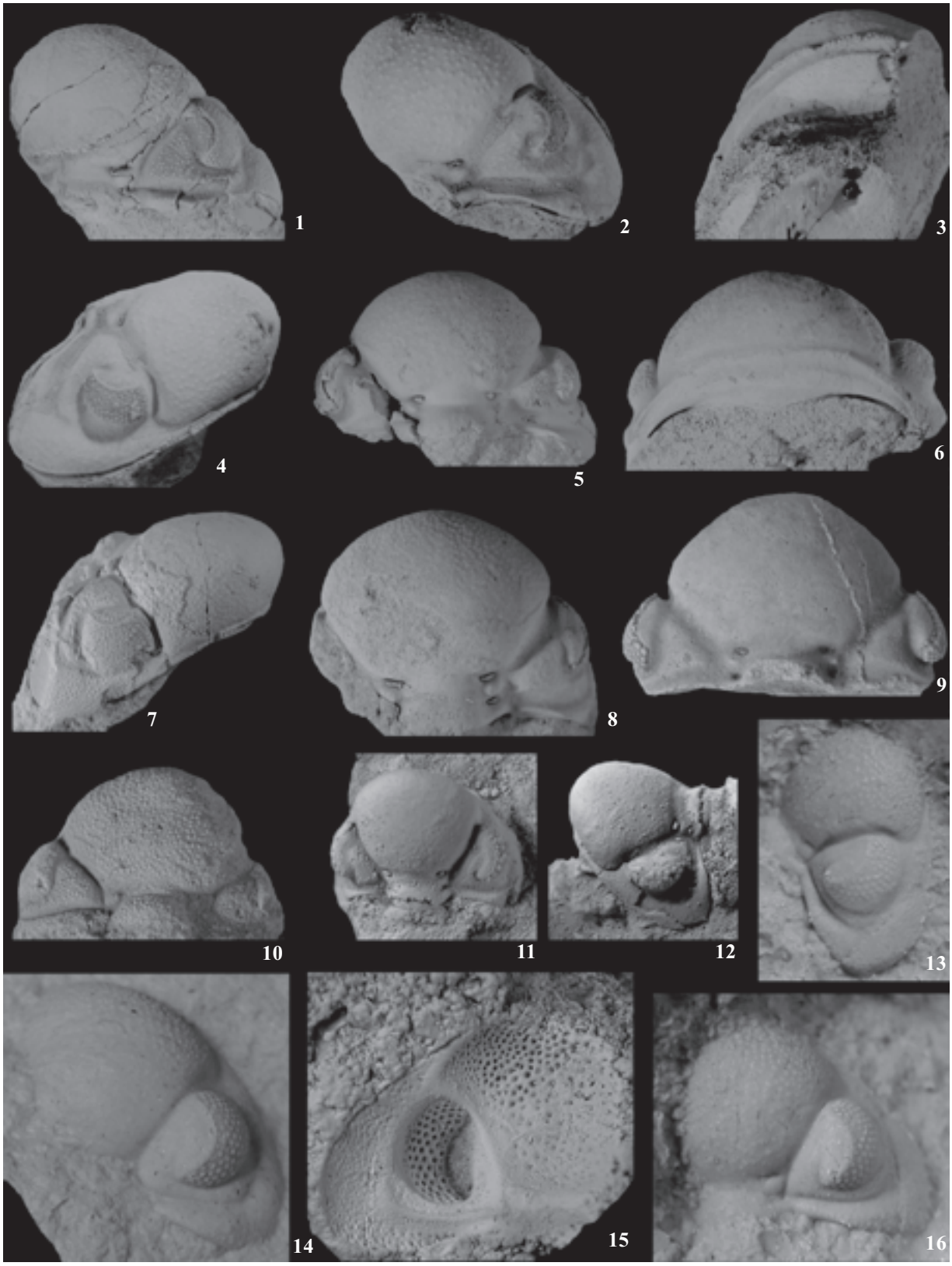
Podán je popis nového druhu *Kainops chlupaci* sp. n. Jeho vzácný výskyt, vázaný takřka výlučně na spodní polohy zlíchovského souvrství (tzv. „korálový obzor od Kapličky“) indikuje spolu s výskytem dalších prvků známých z oblasti Austrálie, Severní Ameriky, Střední a Východní Asie, ale i Porýní období zřejmě krátkodobé, ale intenzivní výměny fauny v oblasti Perigondwany v průběhu spodního emsu (regionální stupeň zlíchov).

Explanation of Plate

Kainops chlupaci sp. n.
1–4, 6–16 – Lower parts of the Zlíchov Formation, so called “Chapel horizon”), Praha-Hlubočepy, U kapličky Quarry
1 – Incomplete cephalon, internal mould with relicts of the exoskeleton, holotype CGS ICh 4615, figured by Chlupáč (1977) on the Pl. 28, figs 15–16, dorsal view, ×1.5
2 – Incomplete cephalon, internal mould, paratype CGS ICh 4616, figured by Chlupáč (1977) on the Pl. 28, figs 17–19, dorsal view, ×1.8
3 – Dtto, ventral view, ×1.9
4 – Dtto, lateral view, ×1.8
6 – Incomplete weathered cephalon, internal mould, paratype CGS ICh 6424a, ×2.29
7 – Incomplete cephalon, internal mould with relicts of the exoskeleton, holotype CGS ICh 4615, figured by Chlupáč (1977) on the Pl. 28, figs 15–16, lateral view, ×1.5
8 – Incomplete weathered cephalon, internal mould, paratype CGS ICh 6424a, dorsal view, ×2.29
9 – Incomplete holaspid cephalon, internal mould, paratype CGS ICh 6425a, dorsal view, ×3.76
10 – Almost complete late holaspid cephalon, deformed, but with preserved exoskeleton, paratype CGS ICh 6425b, dorsal view, ×3.3
11 – Almost complete, early holaspid/late meraspid cephalon, paratype NMLs 663/3, dorsal view, ×5.4
12 – Dtto, lateral view, ×5.4
13 – Holaspid cephalon, replica of the negative counterpart, paratype NMLs 663/2, dorsolateral view, ×5.2
14 – Late holaspid cephalon, replica of the negative counterpart, paratype NMLs 663/1, slightly dorsolateral view, ×4.5
15 – Dtto, negative counterpart, dorsal view, ×4.5
16 – Holaspid cephalon, replica of the negative counterpart, paratype NMLs 663/2, dorsal view, ×5.3

Kainops cf. *chlupaci* sp. n.
5 – Upper parts of the Zlíchov Formation, Hostim, Incomplete cephalon, internal mould, CGS ICh 4965, dorsal view, ×2.4

P. Budil – P. Kolář: *Kainops chlupaci* sp. n. from the Lower Devonian (Zlíchovian Stage) of the Prague Basin



For explanation see p. 144