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ADDENDA TO THE AMMONITE ASSOCIATION OF THE ŠTRAMBERK LIMESTONE (J/K BOUNDARY, OUTER WESTERN CARPATHIANS)

DOPLŇKY K AMONITOVÉ ASOCIACI ŠTRAMBERSKÉHO VÁPENCE
(J/K HRANICE, VNĚJŠÍ ZÁPADNÍ KARPATY)

ZDENĚK VAŠÍČEK, ONDŘEJ MALEK

Abstract

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Addenda to the ammonite association of the Štramberk Limestone (J/K boundary, Outer Western Carpathians).

This paper presents a taxonomic study of a small collection of Jurassic/Cretaceous ammonites housed at the Silesian Museum in Opava. The material originates from historical collections in the Štramberk Limestone, mainly from the Kotouč Quarry (Baška Subunit of the Silesian Unit, Outer Western Carpathians). All favourably preserved specimens are undeformed external moulds. Six species are described; with the exception of *Micracanthoceras microcanthum*, all were previously unknown from the Štramberk Limestone. *Kutekiceras steinbergense, Oloriziceras schneidi,* and *Franconites (Tithonosphinctes) stephanovi*, together with *M. microcanthum* – a zonal index species of the lower upper Tithonian – are of Tithonian age. *Hegaratia busnardoi* and *Kilianiceras ambiguum* are assigned to the Berriasian (lowermost Cretaceous). Well-preserved ribbed specimens permitted the number of primary ribs per half-whorl to be counted at successive shell diameters. Rib counts are not constant during ontogeny: the phragmocone and the body chamber exhibit different rib densities. Furthermore, within the body chamber itself, the number of ribs changes with increasing shell diameter.

Key words: Ammonoidea, Tithonian, Berriasian, Štramberk, Czech Republic.

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INTRODUCTION

During a visit to the palaeontological depository of the Silesian Museum in Opava in 2016, together with P. Skupien (VŠB Ostrava), we recorded a dozen favourably preserved ammonites originating from the Štramberk Limestone. According to the attached labels with inventory numbers, part of them had been transferred between 1980 and 1987 from the Museum in Lešná near Zlín to Opava, while the other part came from the Kotouč Quarry in Štramberk. The specimens from Lešná were catalogued by E. Purkyňová (Opava); others, also catalogued, came from the collections of V. Houša (Prague) and originate from the Kotouč Quarry. These older specimens were identified to species level by V. Houša. Between 1980 and 1985, he transferred his finds to the Silesian Museum. The most completely preserved catalogued specimens were borrowed in August 2016 for study at the then

Department of Geology and Mineralogy of the Technical University of Ostrava (VŠB). Their final processing, however, has been completed only recently.

The borrowed ammonites, taxonomically revised in accordance with current scientific literature and owing to their favourable preservation, have provided supplementary morphological data on species previously unknown from the Štramberk Limestone. The original generic and specific names on the labels, as determined by V. Houša, no longer correspond to current taxonomic understanding.

A limitation of the material studied is the lack of more detailed provenance data for the studied specimens. On the basis of current international ammonite zonation, it can be inferred that the ammonites examined belong not only to the Tithonian but also to the Berriasian chronostratigraphic stage. The favourable preservation of ribbed species further permitted quantification of changes in the character and density of primary ribs during shell growth measured on the terminal half of the last whorl.

GEOLOGICAL SETTING

For the complex of reef limestones in Upper Silesia, HOHENEGGER (1849, 1861) introduced the term Štramberk Limestone. Fossiliferous limestones with a rich ammonite fauna enabled OPPEL (1865) to propose the highest stage of the Jurassic – the Tithonian. This proposal was based on a collection of ammonites accumulated through the lifelong fieldwork of the German geologist, palaeontologist, and mineralogist L. Hohenegger, who spent the latter part of his life in Teschen city, where he died. Many of these ammonites originated from the Štramberk Limestone of the formerly exploited Zámecký (Castle) Hill Quarry, as well as from other sites of the Silesian Unit in the Outer Western Carpathians (HOHENEGGER, 1861) – see Fig. 1. His collection of cephalopods from the Štramberk Limestone, housed in Munich, was subsequently not only taxonomically revised in detail but also illustrated by ZITTEL (1868). For species provenance, he used the designation Štramberk or "exotic limestones" combined with the names of nearby villages.

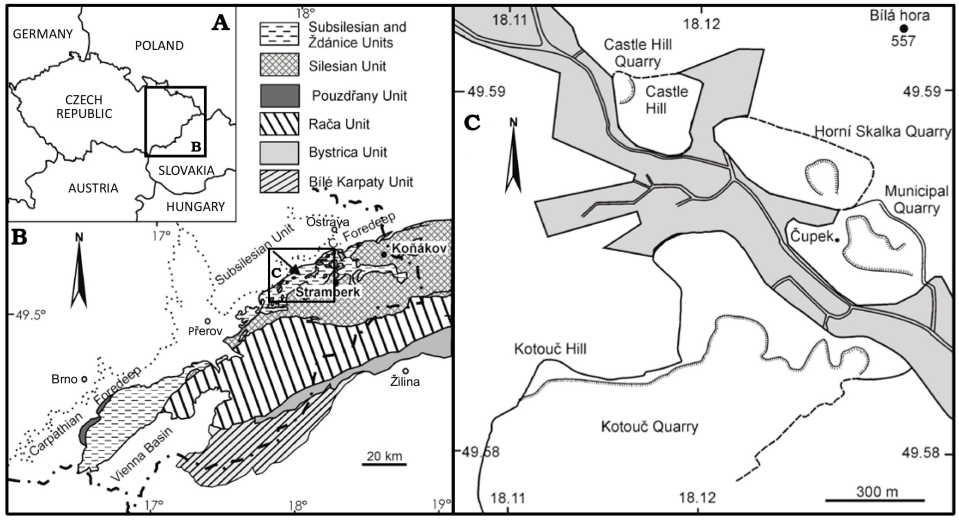

Fig. 1. A: Geographic location of the studied area. B: Tectonic map of the Outer Western Carpathians in the Czech Republic. C: Geographical setting of Štramberk Limestone in the vicinity of Štramberk.

Obr. 1. A: Geografická pozice studované oblasti. B: Tektonická mapa Vnějších Západních Karpat v České republice. C: Geografická lokalizace štramberských vápenců v okolí Štramberka.

The history of geological and palaeontological research at Štramberk was reviewed by Vašíček and Skupien (2004, 2005) and is based on papers from the nineteenth and twentieth centuries. The still inconsistent interpretations and stratigraphic position of the Štramberk Limestone within the Baška development of the Silesian Unit are discussed, for example, by Picha *et al.* (2006, Baška Subunit) and Stráník *et al.* (2021). One of the principal problems–apart from the absence of bedding in the reef limestones–is the fact that these limestones occur in a tectonically complex area along the thrust plane of the Silesian Nappe. Their main classical occurrences are situated around the town of Štramberk. As mentioned above, tectonic slices of similar limestones also occur in a number of other localities of the unit. All of this considerably complicates the reconstruction of a detailed stratigraphy. According to recent microfacies, micropalaeontological and ammonite research, the Štramberk Limestone is not restricted to the Tithonian but extends into the lower Berriasian (Boorová *et al.*, in prep.).

MATERIAL AND METHODS

The ammonites taxonomically treated in the present paper are stored in the palaeontological collections of the Silesian Museum in Opava. All specimens bear their original catalogue numbers, which carry the prefix Z.

The studied specimens are preserved as undeformed external moulds. Their favourable preservation allowed a precise measurement of all standard dimensional parameters, i.e. shell diameter (D or Dmax), corresponding whorl height (H), umbilicus width (U), and whorl breadth (B). Ratios of the parameters H, U, and B to shell diameter D are given in parentheses. The determination and taxonomic assignment of the studied species are based primarily on advances in the literature of the present century (e.g. Zeiss, 2001; Klein, 2005; Frau *et al.*, 2016).

The favourable preservation of ribbed specimens also generally made it possible to count the number of primary ribs near the umbilicus (IR), thereby allowing their density to be expressed numerically as the number of ribs per half-whorl or per complete whorl at the corresponding measured shell diameter.

SYSTEMATIC PALAEONTOLOGY

Order Ammonitida Zittel, 1884
Suborder Ammonitina Hyatt, 1900
Superfamily Perisphinctoidea Steinmann, 1890
Family Lithacoceratidae Zeiss, 1968
Subfamily Sublithacoceratinae Zeiss, 1968

Genus ***Kutekiceras*** Zeiss, 2001
Type species: *Perisphinctes pseudocolubrinus* Kilian, 1895 (Donze et Enay, 1961, p. 180).

Kutekiceras steinbergense Zeiss, 2001
Fig. 2 a,b
2001 *Kutekiceras steinbergense* n. sp.; Zeiss, p. 46, pl. 16, figs. 5–7, 9, 10.
?2001 *Kutekiceras* aff. *steinbergense* n. sp.; Zeiss, pl. 18, fig. 2.

Material. Two specimens of approximately the same size. Specimen Z 2936 has three-quarters of the final whorl preserved in favourable condition. Part of the preceding half-whorl is also preserved. The juvenile (inner) whorls are not exposed. Specimen Z 7358 has almost the entire final whorl preserved. The inner whorls are not exposed.
Description. Evolute shells with low whorls, a fairly wide umbilicus, and whorls that are somewhat narrower than their height. The flanks are weakly convex, reaching their maximum

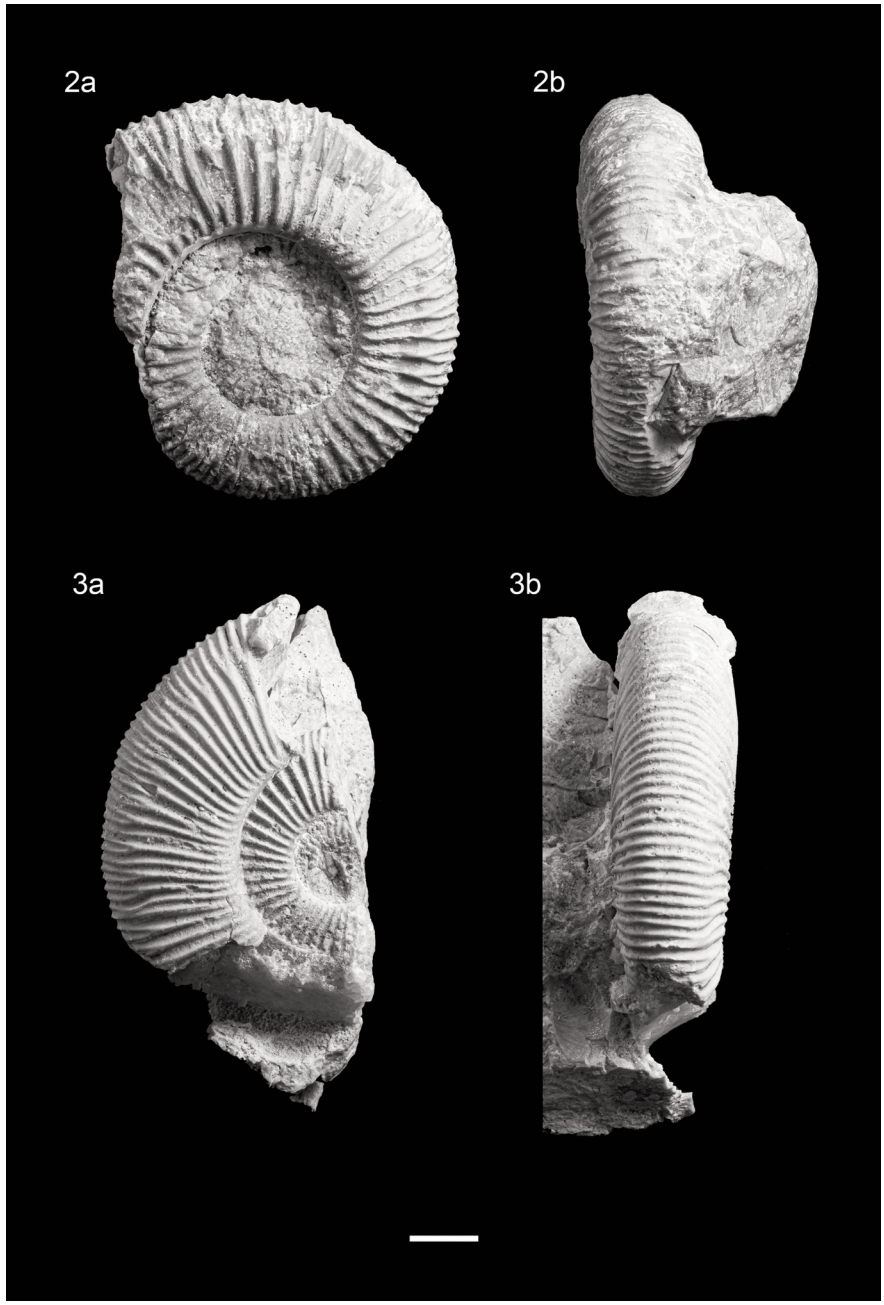

Fig. 2. *Kutekiceras steinbergense* Zeiss, 2001. Spec. Z 7358, a – lateral view, b – ventral view. The last rib is trifurcate.
Obr. 2. *Kutekiceras steinbergense* Zeiss, 2001. Ex. Z 7358, a – boční pohled, b – ventrální pohled. Poslední žebro je trojité.
Fig. 3. *Oloriziceras schneidi* Tavera Benítez, 1985. Spec. Z 2948, a – lateral view, b – ventral view. Scale bar 10 mm.
Obr. 3. *Oloriziceras schneidi* Tavera Benítez, 1985. Ex. Z 2948, a – boční pohled, b – ventrální pohled. Měřítko 10 mm.

width near the base. The basal part of the whorl is low, falling towards the line of coiling with a slight rounding. Ribbing is uniform. In the lower part of the final half-whorl, simple primary ribs are present. On the low umbilical wall, these ribs are slightly concavely curved towards the aperture. On the flanks of the whorl, the ribs are weakly convex. At about two-thirds of the whorl height, the ribs bifurcate uniformly and tightly. The posterior member of the rib pair sometimes continues in the original direction of the primary rib, while the anterior one bends towards the aperture; in other cases, it is the opposite. At the point of bifurcation, a weak to more distinct lateral tubercle is present. The ribs pass straight across the venter. In the ventral area of specimen 2936, a siphonal groove is indicated. The final rib of specimen 7358 is tripartite. Constrictions are not discernible.
Measurements. Spec. Z 2936: at Dmax = 49.6 mm; H = 17.0 (0.34); U = 21.2 (0.43); B = 15.3 (0.31). On the half-whorl at the maximum diameter of the specimen, 26 primary ribs are present. Spec. Z 7358: at D = 59.0 mm; H = 18.0 (0.305); U = 27.6 (0.47); B = 19.0 (0.32). On half of the final whorl, 26 primary ribs are present. It cannot be determined whether the entire shell belongs to the phragmocone or whether at least the terminal part corresponds to the body chamber.
Remarks. The imperfectly preserved lectotype of the type species *Kutekiceras pseudocolubrinum* differs from *K. steinbergense*, according to the measurements in Zeiss (2001), by its much wider umbilicus, its somewhat lower rib density (approx. 22 primary ribs per half-whorl), and its uniform ribbing, since only bifurcating ribs are present. On the holotype of *K. steinbergense*, alongside the more common bifurcating ribs, tripartite ribs also occur. One such tripartite rib is likewise present on the Štramberk specimen Z 7358.
Occurrence. According to Zeiss (2001), *K. steinbergense* occurs at the Ernstbrunn locality in Austria, in the lower Tithonian.

Subfamily Lithacoceratinae Zeiss, 1968

Genus ***Oloriziceras*** Tavera Benitez, 1985
Type species: *Oloriziceras salarensis* Tavera Benitez, 1985, p. 63.

Oloriziceras schneidi Tavera Benítez, 1985
Fig. 3 a,b
1985 *Oloriziceras schneidi* n. sp.; Tavera Benitez, p. 68, pl. 6, figs. 2–3, text-fig. 6/C.

Material. Incomplete specimen Z 2948 with one quarter of the final whorl and half of the preceding whorl preserved. At the preserved beginning of the terminal whorl, a weak constriction is visible, which probably marks the boundary between the phragmocone and the body chamber.
Description. Evolute shell with relatively high, narrow whorls and a wider umbilicus. The whorl flanks are weakly convex, achieving their maximum width at about one-third of the whorl height. The relatively narrow venter is distinctly convex. The umbilical wall is low and rounded.
Uniform primary ribs begin just above the line of coiling. In the lowest part they are concavely curved towards the aperture. On the flanks, the ribs are weakly S-shaped and somewhat inclined towards the aperture. At two-thirds of the whorl height, most ribs bifurcate tightly; the remainder persist as single ribs. Of the bifurcate ribs, the anterior member continues in the direction of the primary ribbing, while the posterior bends back. At the point of bifurcation, a faint lateral tubercle is usually present. On the final quarter-whorl, all ribs pass across the venter uninterrupted and of equal strength, gently curved towards the aperture. In the preceding part, a weak siphonal groove is visible.
Measurements. The specimen attains a diameter of approximately 76 mm. At this diameter: H = 26.0 (0.34), U = 32.0 (0.42), B = 17.0 (0.22). On the well-preserved final quarter-

whorl, 21 primary ribs occur at the umbilicus (i.e., approx. 42 ribs per half-whorl). On the venter, this amounts to 35 ribs (i.e., approx. 70 ribs per half-whorl). On the penultimate whorl of the phragmocone, at D ≈ 40 mm: H = 14.0 (0.39), U = 15.0 (0.38), B ≈ 11.5 (0.29). On half a whorl, 24 primary ribs occur at the umbilicus.
Remarks. The Spanish holotype is coincidentally of the same size as the specimen from the Štramberk Limestone. Moreover, all measured parameters essentially match. The same applies to the whorl cross-sections (Tavera Benitez, 1985, text-fig. 6/C).
Occurrence. *O. schneidi* was previously known with certainty only from Spain. The author of the species records it from the Simplisphinctes ammonite Zone (lowermost upper Tithonian).

Subfamily Franconitinae Zeiss, 1968

Genus ***Franconites*** Zeiss, 1968
Subgenus *Tithonosphinctes* Zeiss, 1968
Type species: *Tithonosphinctes stephanovi* Zeiss, 1968 (pl. 17, fig. 1).

Franconites (Tithonosphinctes) stephanovi Zeiss, 1968
Fig. 4 a,b
1968 *Franconites (Tithonosphinctes) stephanovi* n. sp., Zeiss, p. 85, pl. 17, fig. 1 (holotype), fig. 4.

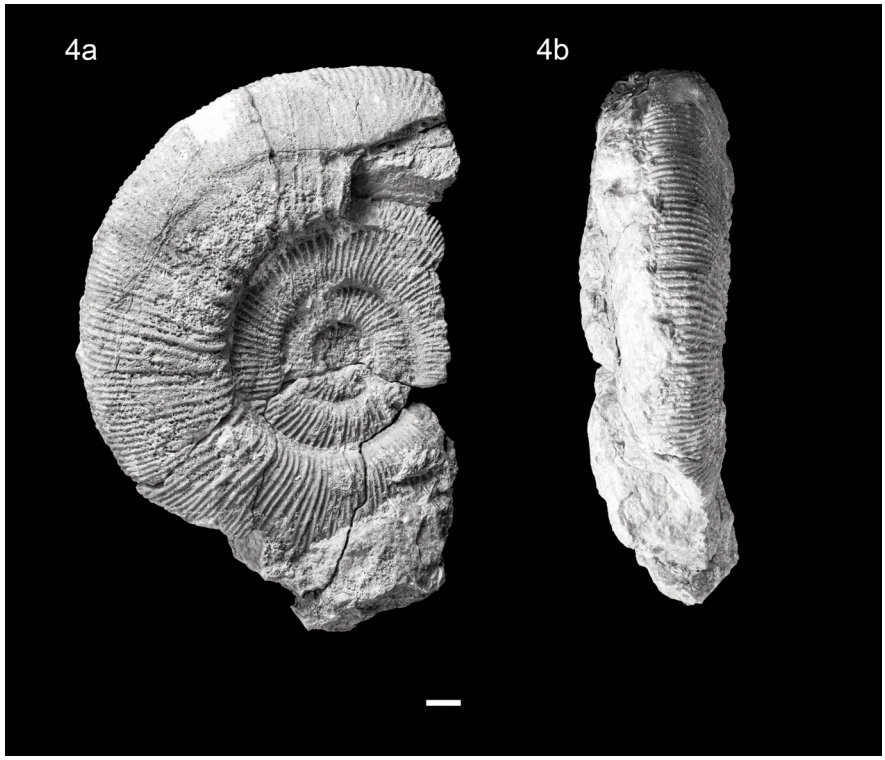

Fig. 4. *Franconites (Tithonosphinctes) stephanovi* Zeiss, 1968. Spec. Z 4196, a – lateral view, b – ventral view. At the beginning of the final quarter-whorl, the rib density near the umbilicus changes. Scale bar 10 mm.
Obr. 4. *Franconites (Tithonosphinctes) stephanovi* Zeiss, 1968. Ex. Z 4196, a – boční pohled, b – ventrální pohled. Měřítko 10 mm. Na počátku koncové čtvrtiny závitu se mění hustota žebrování u umbiliku.

Material. Specimen Z 4196 with an almost complete but somewhat corroded final half-whorl and with just under two preceding whorls.
Description. A semi-evolute specimen with moderately high, fairly narrow whorls, a narrower venter and a rather wide umbilicus. The venter is moderately convex, the flanks only very weakly so. Maximum width is attained near the whorl base. On the low and steep umbilical wall, the whorl descends to the line of coiling.
On the earlier (inner) whorls, ribbing is dense. In the umbilical region, uniformly strong, thin, simple ribs—slightly concavely curved towards the aperture—are present. Occasionally, some of the ribs bifurcate tightly in the lower half of the whorl height. More frequently, and particularly on later whorls, ribs bifurcate at various heights. Across the venter, all thin, uniformly strong, dense ribs pass straight across without interruption.
On the final quarter-whorl, beginning with a faint constriction, the character of the ribbing changes. Near the umbilicus, stronger and more widely spaced primary ribs appear, beginning with incipient longitudinally elongated umbilical tubercles. Due to the poor preservation in this area, it is unclear whether thinner intercalatory ribs occur between them. Around mid-whorl height, the dense thin secondary ribs bifurcate. They pass over the venter without interruption as uniformly strong ribs.
Measurements. Dmax approx. 129.0 mm, H = 41.5 (0.32), U = 57.0 (0.44), B ≈ 34.0 (0.26). At around D ≈ 105 mm, a faint constriction is indicated, beyond which the ribbing near the umbilicus changes markedly towards the aperture (beginning of the body chamber). Up to D = 105 mm, approx. 56 primary ribs occur per half-whorl (i.e., on the phragmocone). With an umbilical width U = 53 mm, 42 ribs occur per half-whorl on the inner whorl of the phragmocone. Beyond D = 105 mm, only approx. 28 primary ribs occur per half-whorl (i.e., on the body chamber). At D ≈ 125 mm, around 70 ribs occur on the venter on a quarter-whorl of the body chamber.
Remarks. Species of the type subgenus of genus *Franconites* established by Zeiss (1968) show more involute whorls (U/D = 0.35–0.40), greater whorl height (H/D = 0.33–0.38), and a different style of ribbing. In view of the considerable dimensions of the Štramberk specimen we cannot accept the possibility that this specimen represents a microconch of the genus *Ernstbrunnia* Zeiss, 2001 rather than the subgenus *Franconites (Tithonosphinctes)*. The Štramberk specimen determined as *Franconites (Tithonosphinctes) stephanovi* reaches a diameter of about 130 mm. Most species of the genus *Ernstbrunnia* identified in Zeiss (2001) belong to macroconchs. According to measurements by Zeiss, they reach a diameter of over 200 mm in adult stage; meaning the macroconchs are considerably larger. Within microconchs, *Ernstbrunnia magnum* Zeiss, 2001 is relative with the dense ribbing. Although the Štramberk specimen and *E. magnum* have comparable diameters, it is clear that the Štramberk specimen differs by sparser ribbing on the body chamber.
Occurrence. Zeiss (1968) reported *Franconites (Tithonosphinctes) stephanovi* from the higher part of the lower Tithonian of the Southern Frankenalb Mountains.

Superfamily Perisphinctoidea Steinmann, 1890
Family Himalayitidae Spath, 1925
Subfamily Himalayitinae Spath, 1925

Genus ***Micracanthoceras*** Spath, 1925
Type species: *Ammonites microcanthus* Oppel, 1865 in Zittel 1868, pl. 17, fig. 3a, b (by original designation of Spath, 1925, p. 144).

Micracanthoceras microcanthum (Oppel, 1865)
Fig. 5 a,b
1865 *Ammonites microcanthus* Opp.; Oppel, p. 555.
1868 *Ammonites microcanthus* Opp.; Zittel, p. 93, pl. 17, figs. 3–5, non figs. 1, 2 (= *Himalayites* sp.).

1979 *Himalayites (Micracanthoceras) microcanthus* (Opp.); Sapunov, p. 193, pl. 58, fig. 4.
1985 *Micracanthoceras (Micracanthoceras) microcanthum* (Oppel); Tavera Benítez, p. 169, pl. 21, figs. 1–4, pl. 22, figs. 1–6, figs. 13 A–E, G (cum syn.).
1995 *Micracanthoceras microcanthum* (Oppel); Vašíček and Eliáš, pl. 1, figs. 3, 4.
2005 *Micracanthoceras microcanthum* (Oppel, 1865); Klein, p. 19 (cum syn.).
2016 *Micracanthoceras microcanthum* (Oppel in Zittel); Frau, Bulot, Wimbledon and IFRIM, p. 545, figs. 2A–C, 3A, B, 4A, U (cum syn.; macroconchs p. 545, microconchs p. 548).

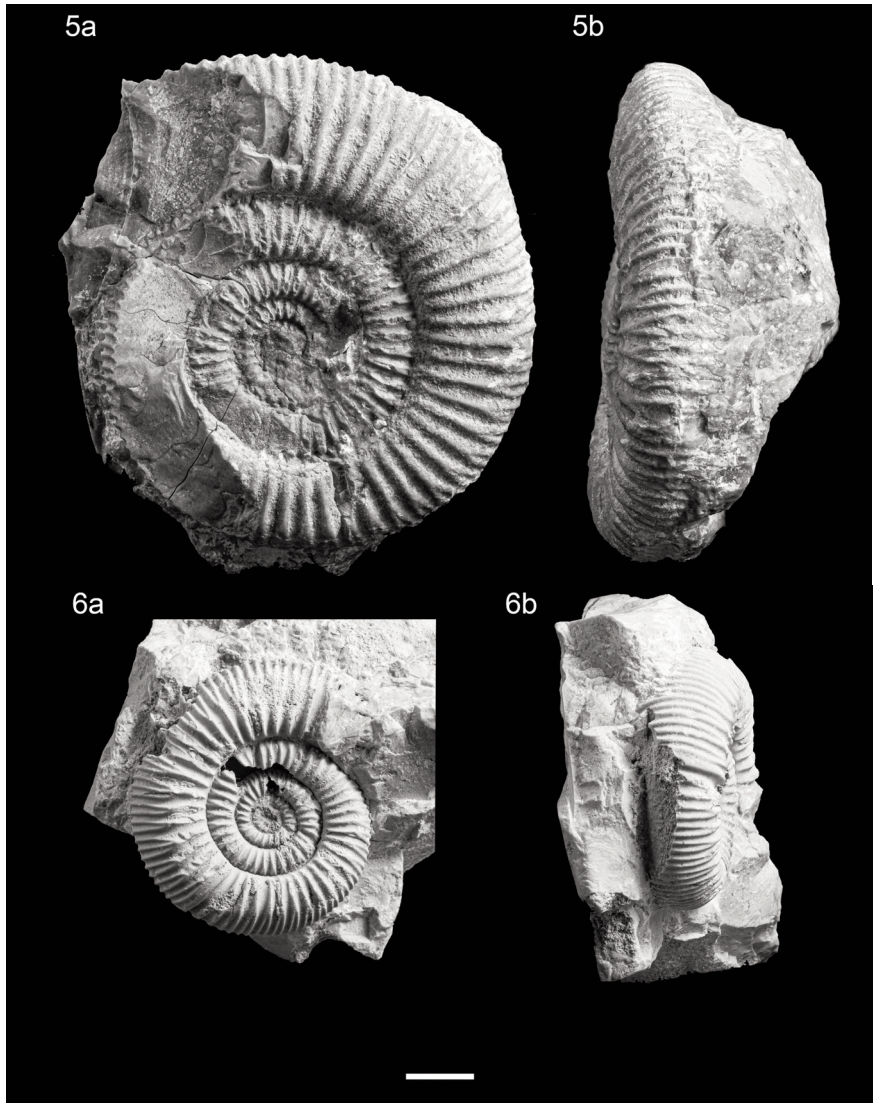

Fig. 5. *Micracanthoceras microcanthum* (Oppel, 1865). Spec. Z 2934, a – lateral view, b – ventral view.
Obr. 5. *Micracanthoceras microcanthum* (Oppel, 1865). Ex. Z 2934, a – boční pohled, b – ventrální pohled.
Fig. 6. *Hegaratia busnardoi* Patrulius and Avram, 1976. Spec. Z 7345, a – lateral view, b – ventral view. The last constriction probably corresponds to the boundary between the phragmocone and the body chamber. Scale bar 10 mm.
Obr. 6. *Hegaratia busnardoi* Patrulius a Avram, 1976. Ex. Z 7345, a – boční pohled, b – ventrální pohled. Poslední zaškrcenina patrně odpovídá rozhraní mezi fragmokonem a obývací komůrkou. Měřítko 10 mm.

Material. Two fairly well-preserved external moulds. The smaller specimen, Z 14639, has about three quarters of the final whorl and two inner whorls preserved in good condition. Specimen Z 2934 has three final whorls preserved, but the initial third of the terminal whorl lacks a substantial lateral portion.
Description. Evolute specimens. The whorls are low, the flanks weakly convex. Maximum width is attained near the umbilicus. The umbilical wall is low, rounded, and slopes smoothly towards the line of coiling. The venter of spec. 2934 is relatively narrow and quite convex. The venter on the body chamber of spec. 14639 is wider and only gently convex. The umbilicus is wide.
All ribs of equal strength begin at the line of coiling as single ribs. On the flanks they are subradial or only very slightly concavely curved towards the aperture. At roughly two-thirds of the whorl height, the majority of ribs normally bifurcate tightly. On spec. Z 14639, in the terminal part of the last whorl, some ribs may remain simple. Most posterior branches of bifurcated ribs continue in the direction of the primary ribbing, whereas the anterior branch may bend towards the aperture. At the point of bifurcation a lateral tubercle is indicated. On the venter, the ribs are weakly convex.
On approximately the terminal half-whorl of spec. 14639 (D ≈ 45 mm), a distinct constriction is present, which likely represents the boundary between the phragmocone and the body chamber. This constriction is bordered on both sides by a pronounced rib, each of which bifurcates near the venter. Whereas all ribs of spec. Z 2934 pass across the venter without interruption or weakening, the earlier specimen displays a weak siphonal groove on the venter of the inner whorls up to the last constriction. On the remaining part of the whorl, ribs cross the ventral side uninterrupted.
Measurements. Spec. 14639: Dmax = 58.5 mm, H = 18.4 (0.31), U = 28.0 (0.48), B ≈ 17.2 (0.29). The former H value is measured on the body chamber, the latter on the phragmocone. Approx. 35 ribs occur per half-whorl (mostly on the body chamber). On the terminal quarter-whorl (from D = 49 mm), 26 primary ribs occur, corresponding to approx. 52 ribs per half-whorl of the body chamber. On the inner half-whorl of the phragmocone at D ≈ 42 mm, there are 28 primary ribs. Spec. 2934: Dmax = 73 mm. At D = 71.8 mm, H = 19.4 (0.27), U = 38.4 (0.53), B = 18.0 (0.25). There are 29 primary ribs per half-whorl at D = 71 mm. On the preceding portion on the inner whorl at the same radius, 23 primary ribs occur. Measurements of the illustrated lectotype of *M. microcanthum* in Zittel (1868): D = 77.5 mm, H = 21.5 (0.28), U = 38.0 (0.49), B = 25.0 (0.32).
Remarks. The specimens described here likely represent the microconch (m – spec. Z 14639) and macroconch (M – spec. Z 2934). Measurements of the Štramberk specimens complement those of the lectotype housed in Munich. This frequently cited index species has been discussed in detail by Tavera Benítez (1985), who demonstrated considerable morphological variability in both microconchs and macroconchs. A characteristic feature of the many morphotypes he described is the pronounced width of the umbilicus (U/D = 0.48–0.53).
Occurrence. *M. microcanthum* has long been regarded in the international Tithonian ammonite zonation as an index species of the lower part of the upper Tithonian (e.g., Szives and Főzy, 2022). It is known from the entire Mediterranean region of the Tethys.

Family Neocomitidae Salfeld, 1921
Subfamily Berriasellinae Spath, 1922

Genus ***Hegaratia*** Patrulius and Avram, 1976
Type species: *Corongoceras? (Hegaratia) busnardoi* Patrulius and Avram, 1976 (p. 183, pl. 8, figs. 2a-d).

Hegaratia busnardoi Patrulius and Avram, 1976
Fig. 6 a,b

1976 *Corongoceras? (Hegaratia) busnardoi* n. sp.; PATRULIUS and AVRAM, p. 183, pl. 8, figs. 2a–d, 3–5, text-fig. 9.
1982 *Thurmanniceras (Kilianella) busnardoi* (Patrulius and Avram); HOEDEMAEKER, p. 80.
non 1982 *Corongoceras (Hegaratia) busnardoi* Patrulius and Avram; NIKOLOV, p. 218, pl. 78, fig. 3.
?1983 *Balkites balkensis* BOGDANOVA and KVANTALIANI n. sp., p. 76, pl. 1, figs. 1–5.
?1999 *Hegaratia balkensis* (Bogdanova and Kvantaliani); KVANTALIANI, p. 122, pl. 21, fig. 4, pl. 22, figs. 1–4, pl. 32, fig. 1.
2005 *Hegaratia busnardoi* Patrulius and Avram; KLEIN, p. 285.

Material. A single small well-preserved specimen Z 7345, in which only the innermost whorls are not visible. Since on the last whorl at D = 28.5 mm there is a pronounced constriction, in front of which the weak siphonal groove of the preceding part ends, it can be assumed that this point corresponds to the boundary between the phragmocone and the body chamber.
Description. A small evolute specimen with a phragmocone and less than half a whorl of the body chamber, with low whorls and a wide umbilicus. The whorls are wider than their height. The venter and flanks of the whorls are rounded. The flanks slope smoothly towards the line of coiling. Above the penultimate constriction, the character of the ribbing changes, presumably marking the beginning of the body chamber.
The specimen bears rather sparse ribs. All ribs begin as single ribs at the line of coiling. Initially, up to the last constriction, all ribs bifurcate at about mid-whorl height. At the point of bifurcation, a slight but distinct lateral tubercle is present. Non-bifurcating ribs are absent. Beyond the penultimate constriction, only bifurcating ribs appear initially on the flank. As a new element, widely spaced trifurcating ribs appear. At each rib division, a weak but distinct lateral tubercle is present. The last constriction is deep. On its anterior side there is a single strong rib. The posterior side is bounded by a bifurcating rib, whose division occurs higher above the umbilicus than usual. On each earlier whorl, two constrictions are present.
Measurements. Spec. Z 7345 at D = 39.0 mm: H ≈ 12.0 (0.31), U = 19.0 (0.49), B ≈ 13.2 (0.34); Dmax ≈ 41.0 mm. At Dmax (mostly body chamber) 20 primary ribs per half-whorl. At D′ = 34.2 mm: H′ = 10.5 (0.31), U′ = 17.2 (0.50), B′ = 12.8 (0.37). At this diameter, 22 ribs per half-whorl.
Remarks. This species – especially the somewhat problematic representatives from Crimea – is characterised by small, often dwarfish specimens (maximum diameter approximately 25 mm). *H. busnardoi* is distinguished by pronounced constrictions, trifurcating ribs, and a wide umbilicus. The specimen illustrated by NIKOLOV (1982) is strongly affected by lateral deformation, showing many non-bifurcating ribs at the beginning, and most probably does not belong to *H. busnardoi*.
Occurrence. According to HOEDEMAEKER (1982, Enclosure 4), *H. busnardoi* occurs at the Río Argos section in Spain in the uppermost part of the Subthurmannia occitanica Zone, i.e. around the lower Berriasian. In Romania, the species is recorded from the Berriasian (Eastern Carpathians) as well.

Family Olcostephanitidae HAUG, 1910
Subfamily Spiticeratinae SPATH, 1924

Genus ***Kilianiceras*** DJANÉLIDZÉ, 1922
Type species: *Stephanoceras Damesi* STEUER, 1897, p. 193, pl. 20, figs. 1–4 (ROMAN, 1938, p. 382) in KLEIN, 2005, p. 62.

Kilianiceras ambiguum DJANÉLIDZÉ, 1922
Fig. 7 a,b
non 1868 *Ammonites Groteanus* Opp.; ZITTEL, p. 90, pl. 16, figs. 1–4.

1922 *Spiticeras (Kilianiceras) ambiguum* n. sp.; DJANÉLIDZÉ, p. 87, pl. 4, fig. 9 a, b, text-fig. 18.
1976 *Spiticeras (Spiticeras) orientale* KILIAN, 1910; PATRULIUS and AVRAM, p. 185, pl. 8, fig. 10 a, b.
2005 *Kilianiceras ambiguum* (Djanélidzé); KLEIN, p. 63 (cum syn.).

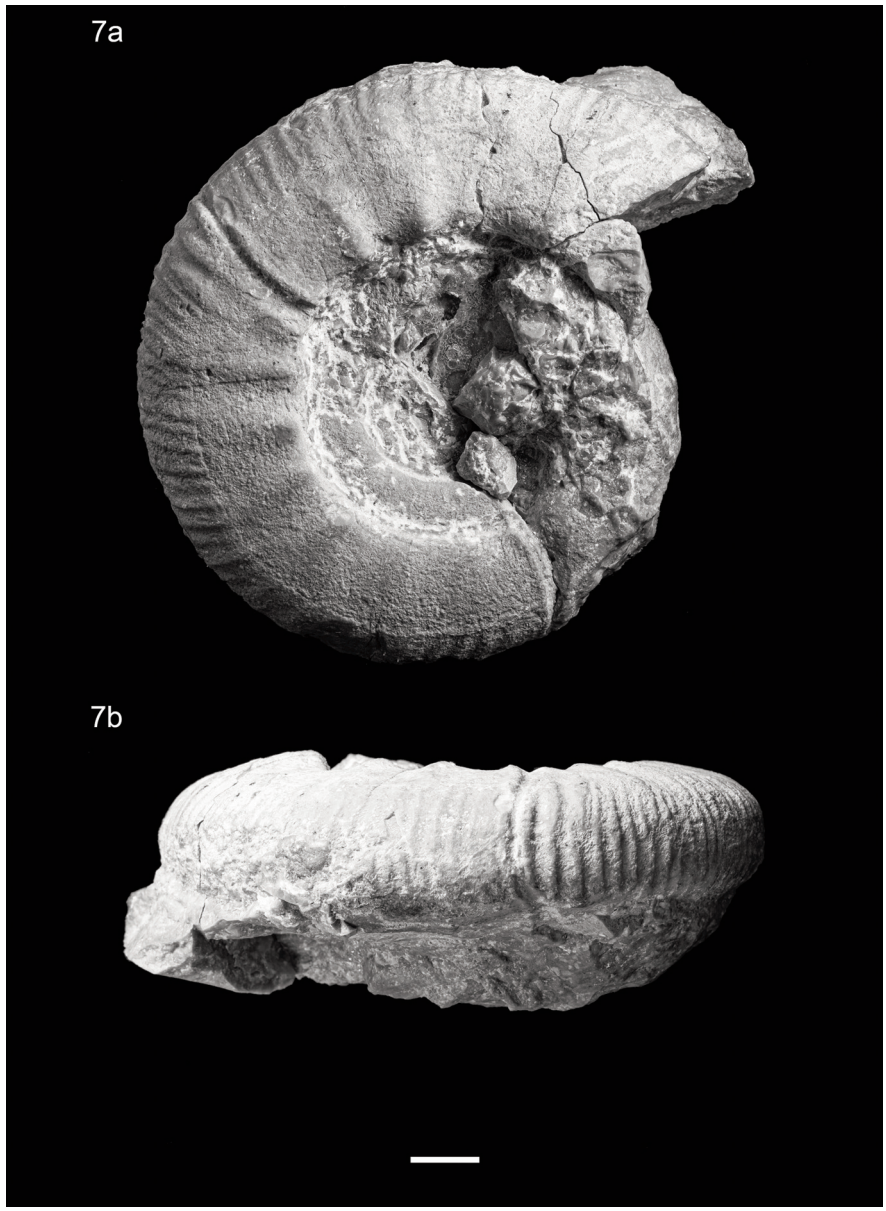

Fig. 7. *Kilianiceras ambiguum* DJANÉLIDZÉ, 1922. Spec. Z 5540, a – lateral view, b – ventral view. Scale bar 10 mm. All photos by O. Malek.
Obr. 7. *Kilianiceras ambiguum* DJANÉLIDZÉ, 1922. Ex. Z 5540, a – boční pohled, b – ventrální pohled. Měřítko 10 mm. Všechna foto O. Malek.

Material. Spec. Z 5540 with the larger half of the last whorl preserved. The inner whorls are not exposed.
Description. An evolute specimen with whorls slightly lower than their width. The venter is distinctly arched. The flanks of the whorl are only weakly convex, expanding towards the umbilicus. Maximum width occurs near the umbilicus. Close to the umbilicus, the whorl after a short rounded area descends vertically to the line of coiling. On the preserved part, two distinct constrictions are visible. The earlier constriction, at the preserved start of the specimen, is relatively simple. The later one is a fairly deep constriction, anteriorly bounded by a single stronger rib starting from an umbilical tubercle. On the posterior side of the constriction, a broader rib is present, which bifurcates around mid-whorl height. This rib also starts from an umbilical tubercle.
The more juvenile part of the whorl, defined by the first constrictions, exhibits weakened or weathered ribbing. At the umbilicus, blunt tubercles are initially prominent. The tubercles gradually strengthen. From the tubercles, thinner double or triple ribs arise. In the lower part of the whorl, ribs are indistinct. In the upper half of the whorl and continuing onto the venter, these ribs are much more distinct and somewhat inclined towards the aperture. On the venter, ribs continue uninterrupted, convexly arched in the direction of the aperture. Umbilical tubercles become more robust from the last constriction to the end of the specimen. In the section defined by the two umbilical tubercles, there are 5–6 ribs on the venter in the constriction area. In other intervals, 4–5 ribs are usually present.
Measurements. Spec. Z 5540 at D = 84.5 mm (approx. Dmax), H = 24.0 (0.28), U = 41.5 (0.49), B ≈ 28.0 (0.33). 11 umbilical tubercles per half-whorl. *K. ambiguum* in Djanélidzé (1922) at D = 87 mm: H/D = 25.0 (0.29), U/D = 45.0 (0.52), B/D = 26.0 (0.30).
Remarks. The holotype of *K. ambiguum*, approximately of the same size as the Štramberk specimen, demonstrates similar dimensions and morphology to the Štramberk specimen. Patrulius and Avram (1976) described, based on a specimen in Retowski, 1893 (originally labelled *Holcostephanus Theodosiae* Deshayes, 1837), the species *Kilianiceras orientale* Kilian, 1910. According to measurements in Retowski (1893, p. 250) H/D = 0.30, U/D = 0.45, B/D = 0.27, this holotype clearly differs by having slimmer whorls and lacking constrictions. The morphology and dimensions of the Romanian specimen labelled as *K. orientale* closely correspond to *K. ambiguum*.
Occurrence. Typical specimens of *K. ambiguum* occur in the lower Berriasian of France (Ardèche and Isère regions), in Romania, and now also at Štramberk in the Kotouč Quarry.

DISCUSSION

The foregoing descriptions of the identified species are accompanied by a measurement section providing the values of all recorded parameters. An important complement to these data is the number of primary ribs occurring on half of the last whorl. In recent years, dimensional data have frequently been published only as online supplementary material in ammonite papers. We consider this practice inappropriate, as numerical measurements are far more informative than qualitative descriptions (e.g. broader, higher, semi-involute).

The studied material demonstrates that the number of primary ribs on the examined portion of the whorl is not constant during shell growth. The phragmocone and the body chamber of the shell exhibit different rib densities. In cases where the body chamber occupies an entire whorl, the number of primary ribs increases with increasing shell diameter. This observation is meaningful only when the number of primary ribs near the umbilicus (IR) is accompanied by the shell diameter at which it was measured. In studies involving larger numbers of specimens, it is therefore essential that such data be compared only on shells of approximately equal size, a requirement that has not been consistently observed in previous publications. To our knowledge, no such systematic study of rib-density variation has been undertaken for any individual species.

CONCLUSION

The unprocessed portion of the collection comprises eight specimens belonging to six ammonite species: *Kutekiceras steinbergense, Oloriziceras schneidi, Franconites (Tithonosphinctes) stephanovi, Micracanthoceras microcanthum, Hegaratia busnardoi* and *Kilianiceras ambiguum*. With the exception of *M. microcanthum*, these species were previously unknown from the Štramberk Limestone. *K. steinbergense, M. microcanthum, O. schneidi* and *F. (T.) stephanovi* are assigned to the Tithonian. *Hegaratia busnardoi* and *Kilianiceras ambiguum* are assigned to the Berriasian. These findings further confirm that the Štramberk Limestone is not confined to the Jurassic but extends into the lowermost Cretaceous. The stratigraphic placement of the taxa assigned to the Tithonian follows the framework of Szives and Főzy (2022). The Berriasian assignment respects the international ammonite zonation of the lower Cretaceous established by the Kilian Group (Reboulet *et al.*, 2018; Szives *et al.*, 2024).

SOUHRN

Vysokoprocentní rifové vápence bohaté na makrofosilie odkryté ve Štramberku byly v předminulém století označené L. Hoheneggerem jako štramberské vápence. Na základě v nich se vyskytujících amonitů Oppel (1865) tehdy předložil nejvyšší stratigrafický stupeň jurského útvaru tithon. Z hlediska regionální geologie zmíněné uloženiny náleží k bašskému vývoji slezského příkrovu (Vnější Západní Karpaty).

Bohaté nálezy amonitů ze štramberských vápenců jsou mimo jiné deponované ve sbírkách Slezského muzea v Opavě. Zpracovaná kolekce těchto amonitů byla z muzea vypůjčená. Výsledky taxonomického zpracování jsou uvedeny v předloženém příspěvku.

Amoniti určení na úroveň druhů jsou příznivě zachováni jako nedeformovaná vnější (skulpturní) jádra. Detailně je popsáno 6 druhů. S výjimkou druhu *Micracanthoceras microcanthum* druhy *Kutekiceras steinbergense*, *Oloriziceras schneidi* a *Franconites (Tithonosphinctes) stephanovi* reprezentují druhy z jurské části štramberských vápenců dosud neznámé. Pocházejí z tithonu. Druhy *Hegaratia busnardoi* a *Kilianiceras ambiguum* patří berriasu, tj. nejspodnější křídě. Spolu s několika dalšími dříve popsanými druhy potvrzují, že stratigrafické rozpětí štramberských vápenců není omezeno jen na juru, ale že vápence pokračují až do nejspodnější křídy.

Dokonalé zachování štramberských žebrovaných amonitů umožnilo vyčíslit počet primárních žeber (IR), která připadají na polovinu závitu. Počet těchto žeber během růstu schránky nezůstává konstantní. Rozdílnou hustotu žeber vykazuje juvenilní přepážková část schránky (fragmokon) a pak následná obývací komůrka. Taktéž na ní se hustota žebrování během růstu schránky mění. Při proměnlivosti hustoty žeber připadajících na půl závitu (IR) je nezbytné, aby k počtu žeber byl rovněž připojen údaj o velikosti příslušného průměru schránky (D). Číselné studium vývoje žebrování snad zatím nebylo dosud realizováno.

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