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Stratigraphically significant, sporadic Early Cretaceous ammonites in Butkov Quarry (Central Western Carpathians, Slovakia)

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ABSTRACT:

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Butkov Quarry provides the best exposed stratigraphic sequence of marly limestones with Early Cretaceous ammonites in the Manín Nappe of the Central Western Carpathians. The presented paper deals with the sporadically occurring zonal ammonites, or ammonites of guiding character, from the Lower Valanginian to Upper Hauterivian. Sixteen species are taxonomically elaborated here in detail. More attention is given to the basic taxonomy of the Subfamily Crioceratitinae Gill, 1871. The species described here, like most of the previously published species from Butkov Quarry, are representatives of the Mediterranean bioprovince and are close to the ammonite association from the Vocontian Basin.

Key words: Early Cretaceous; ammonites; taxonomy; stratigraphy; Manín Nappe; Carpathians.

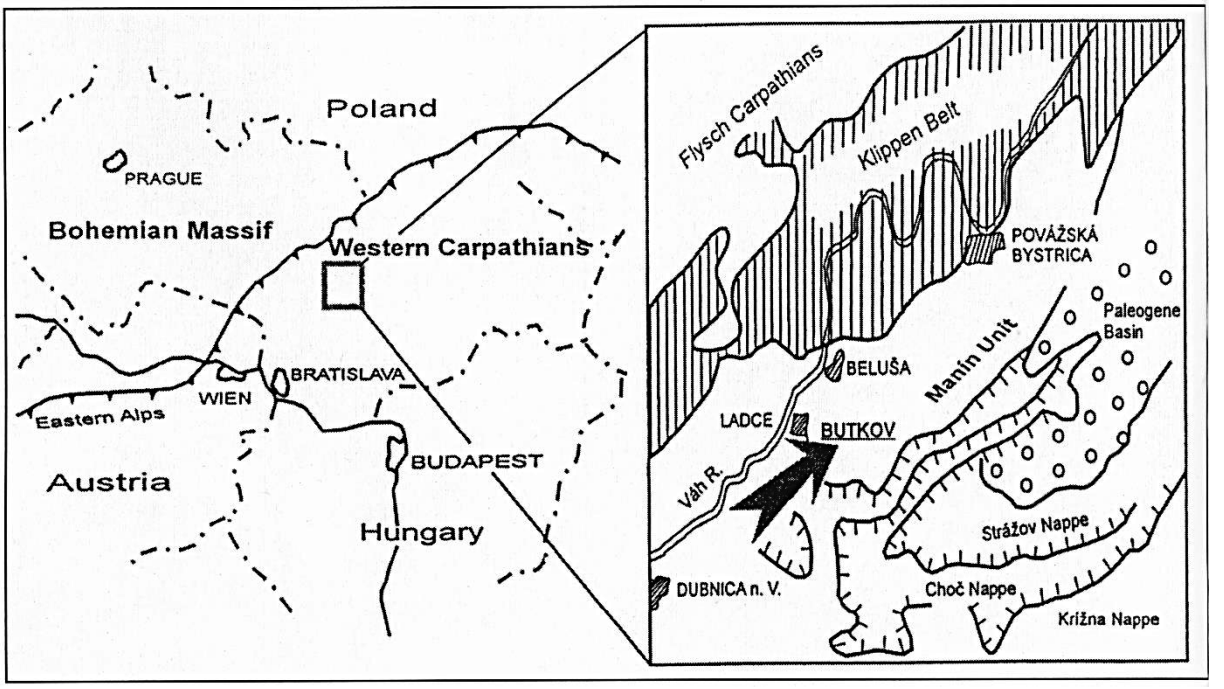
INTRODUCTION

The succession mined in Butkov Quarry near Ladce is one of the richest Slovak localities for Jurassic and Lower Cretaceous cephalopod fossils in the Western Carpathians. In the last 40 years of fauna collecting in this locality, a considerable number of fossils has been collected, out of which the Lower Cretaceous ammonites were analysed frequently. At first, preference was given to favourably preserved specimens and abundantly represented species. Since the work of Vašíček and Michalík (1986), the knowledge of the stratigraphic position of many ammonite species has considerably increased, as it is evidenced by numerous publications on internationally valid ammonite zones in the Lower Cretaceous and the taxonomy of Early Cretaceous ammonites (e.g., Reboulet *et al.* 2018).

With respect to the developments described above, I have returned to the systematic classification of other ammonites, and to the revision of the Valanginian and Hauterivian ammonites described previously (Vašíček *et al.* 1994; Vašíček 2005, 2006, 2010). Most of the recent finds from Butkov Quarry have already been published (Vašíček 2020a, b; Vašíček and Klein 2021). This contribution is focused on the sporadically occurring, less favourably preserved but stratigraphically important species, and on several other ammonite species, which provide new data on the morphology or taxonomy.

GEOLOGICAL SETTING

Butkov Quarry (Text-fig. 1) is situated near the municipality of Ladce, approximately 10 km NE of the town of Dubnica upon Váh in Slovakia. The exposed Jurassic and Cretaceous succession belongs to the Manín Unit (also Nappe) of the western margin of the Central Western Carpathians. The unit is in an al-



Text-fig. 1. Geographic and geological position of Butkov Quarry. Small circles illustrate conglomerates and sandstones in the post-tectonic basin.

lochthonous position and in tectonic contact with the Pieniny Klippen Belt. The structural interpretation and position of the Manín Nappe in the Carpathian System were discussed by Michalík and Vašíček (1987). Vašíček and Michalík (1999) identified the palaeogeography of the Manín Unit in the Carpathian terminology as part of the Fatric Superunit of the Central Western Carpathians. A detailed sedimentologic study in Butkov Quarry is hampered by nappe tectonics (see Michalík and Vašíček 1987).

Borza *et al.* (1987) subdivided the Lower Cretaceous succession exposed in Butkov Quarry into several lithostratigraphic units. Cretaceous pelagic deposits bearing ammonites start with the beige-coloured marly limestones of the Ladce Formation. In its uppermost part, the formation is affected by multiple finger-like interlacing with the grey-coloured marly-calcareous, usually spotted deposits of the succeeding Mráznica Formation. Sandy-calcareous turbiditic deposits overlain by pale grey limestones with 'contour cherts' passing into brown-grey limestones with black cherts belong to the Kališčo Formation. Above occur thin beds of grey marly limestones with marlstone intercalations, occasionally with black-grey cherts, representing the Lúčková Formation.

MATERIAL AND METHODS

The marly Lower Cretaceous deposits of Butkov Quarry generally yield considerably crushed and deformed ammonites. Their external moulds are usually rather unfavourably preserved. The original shells show several types of deformation. Better preserved finds include specimens that are compressed onto the bedding plane by overburden pressure. Among them, the values of measured parameters, e.g., whorl height, increase continuously with growth. Species descriptions of favourably preserved specimens include the following measurements: *D* – shell diameter (*Dmax* – maximum preserved diameter), *H* – whorl height, *U* – umbilicus width. The whorl breadth *B* is usually not measurable. For biometric characteristics, ratios *H/D* and *U/D* were calculated.

More frequently, the flattened specimens are affected by lateral compression to a varied degree. Their size parameters do not reflect the increasing natural growth of the shell. Measurements on these specimens are of a doubtful value as diagnostic features serving species determination; see below for examples of several measurements of shell diameter *D* (marked as *D*1, *D*2, *D*3), as well as measurements of *H*, *U* and the calculated ratios *H/D* and *U/D*. Due to

the deformation of the examined specimens, the measurements given here reflect only the dimensional reality.

PREVIOUS RESEARCH IN BUTKOV QUARRY

Our first palaeontological collections supported by detailed sedimentologic documentation and micropaleontological sampling in Butkov Quarry began in cooperation with the late K. Borza in 1982. At the time, the Butkov Quarry succession was exposed on eight levels. The basic taxonomic interpretation of the collected ammonites was published by Vašíček and Michalík (1986). Other findings concerning the composition of the cephalopod assemblage from Butkov Quarry were documented by Vašíček *et al.* (1994). Biostratigraphic research continued within several research projects (in cooperation with J. Michalík, D. Reháková, L. Kratochvílová and P. Skupien). New results were published, e.g., by Vašíček (2005, 2006, 2010) and Michalík *et al.* (2005). A comprehensive summary of the geology, stratigraphy, micro- and macropalaeontology of the deposits in Butkov Quarry were published in a book by Michalík *et al*. (2013).

SYSTEMATIC PART

In this contribution, in many cases, the description of species is preceded by discussions concerning the previous and especially recent systematic concepts of the studied species in higher taxonomic categories. The most recent findings and suggestions were summarised by Klein and his co-authors in several parts of the Fossilium Catalogus I (e.g., Klein 2005; Klein and Vašíček 2011), Hoedemaeker (2013), and Vermeulen and his associates (Vermeulen and Klein 2006; Vermeulen and Bulot 2007; Vermeulen *et al.* 2009, 2012, 2018, 2019a, b, 2020a, b), and are applied herein. The concept of the genera *Lyticoceras* Hyatt, 1900 and *Binelliceras* Sarkar, 1977 are discussed in detail. In particular, the subfamilies Leopoldiinae Thieuloy, 1971, Crioceratitinae Gill, 1871 and the Family Pulchelliidae H. Douvillé, 1890 are described in this contribution. The Order Ammonitida Haeckel, 1866 respects the newest concept by Hoffmann *et al.* (2022).

Individual species have been described based on detailed synonymy with regard to previous works where the particular species was established, as well as contributions presenting the species illustrations. In addition, I have cited the papers dealing with the geographic distribution and the stratigraphic position of the species presented within the internationally accepted contemporary ammonite zonation (Reboulet *et al*. 2018).

The specimens are deposited in the Slovak National Museum in Bratislava, under the prefix SNM Z (40224–40241) and also by symbols that refer to the exact position of the specimens in the documented sections of the quarry (e.g., BK10-20 refers to Butkov Quarry, Level 10, from 20 m in the succession). Photographs were made by K. Mezihoráková, Ostrava. All figured specimens were coated with ammonium chloride before photographing.

Order Ammonitida Haeckel, 1866
Suborder Haploceratina Beznosov and Mikhailova, 1983

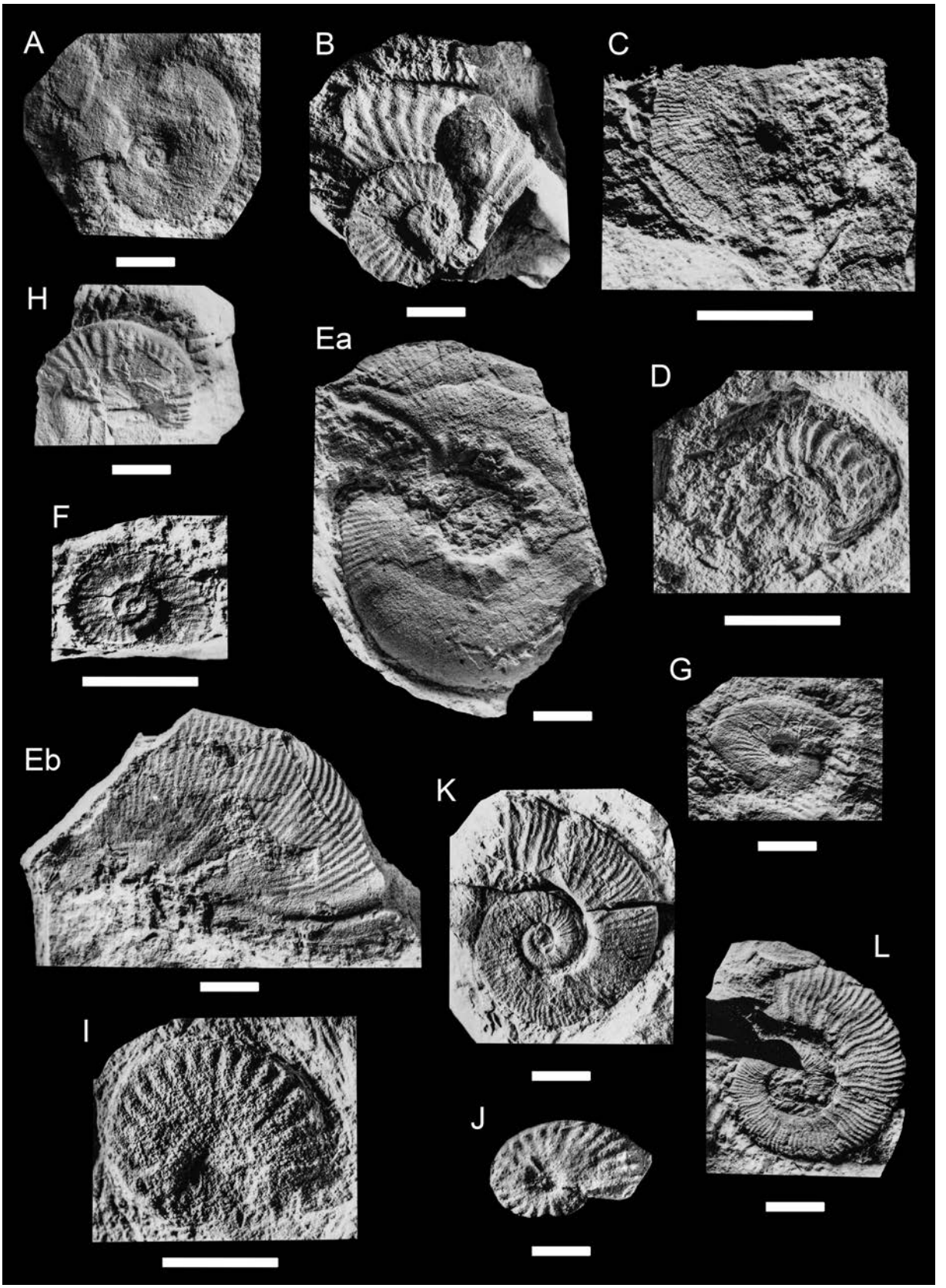
REMARKS: According to the significant form of the suture line of haploceratids in agreement with Beznosov and Mikhailova (1983) published in Russian, or Besnosov and Mikhailova (1991) published in English, I place the haploceratids in the sense of basic taxonomy in the Suborder Haploceratina Beznosov and Mikhailova, 1983, a view that is in contrast to older concepts.

Superfamily Haploceratoidea von Zittel, 1884
Family Haploceratidae von Zittel, 1884
Genus *Vergoliceras* Atrops and Reboulet, 1996
[new name for *Neolissoceras* (*Carinites*) Atrops and Reboulet, 1995, p. 1207, non *Carinites* Wiedmann, 1973, p. 609]

TYPE SPECIES: *Haploceras salinarium* Uhlig, 1888.

Vergoliceras salinarium (Uhlig, 1888)
(Text-fig. 2A)

1882. *Haploceras grasianum* Orb.; Uhlig, text-fig. on p. 393.
1888. *Haploceras salinarium* n. sp.; Uhlig, p. 104, pl. 5, figs 1–3.
1902. *Haploceras salinarium* Uhl.; Uhlig, p. 28, pl. 2, fig. 10.
1987. *Haploceras* (*Neolissoceras*) *salinarium* Uhlig; Company, p. 99, pl. 3, figs 1a, b, 2–4, pl. 18, fig. 3.
1993. *Haploceras* (*Neolissoceras*) *salinarium* Uhlig; Bujtor, p. 116, figs 5H, G, 7F, G.
1995. *Haploceras* (*Neolissoceras*) *salinarium* Uhlig; Michalík *et al.*, p. 290, pl. 4, figs 1, 2.


A
B
C
H
Ea
D
F
G
Eb
K
L
I
J

1995. *Neolissoceras* (*Carinites*) *salinarium* (Uhlig); Atrops and Reboulet, p. 1207, photo 15.
1996. *Neolissoceras salinarium* (Uhlig); Reboulet, p. 166, pl. 33, figs 16–33.
1996. *Haploceras* (*Neolissoceras*) *salinarium* Uhlig; Vašíček and Faupl, p. 106, pl. 1, fig. 7, pl. 4, fig. 2.
1997. *Neolissoceras salinarium* (Uhlig); Faraoni *et al.*, pl. 2, figs 1, 2, 6, 9.
2004. *Vergoliceras salinarium* (Uhlig); Houša and Vašíček, p. 13, pl. 2, figs 3–8, text-fig. 7.
2004. *Neolissoceras salinarium* (Uhlig); Pszczółkowski and Myczyński, p. 181, fig. 17.9.
2009. *Vergoliceras salinarium* (Uhlig); Klein *et al.*, p. 264 (cum syn.).

MATERIAL: Flatly deformed internal mould with unfavourably preserved suture lines (SNM Z 40224 = BK10/11B-3). Less than half of the ultimate whorl belongs to the body chamber.

DESCRIPTION: A semi-involute smooth specimen with high, slightly arched whorl, narrow umbilicus and a low keel at the venter.

MEASUREMENTS: *Dmax* is approximately 27 mm. At $D = 24.9$ mm, $H = 12.6$ (0.51) and $U = 4.0$ (0.16).

REMARKS: The specimen is characterised by a keel on the ventral side. The taxonomic interpretation was derived from the above-mentioned synonymy.

OCCURRENCE: According to Company (1987), *V. salinarium* is abundant in Spain, in a wide stratigraphic distribution and as the index species of the Valanginian *salinarium* Zone. It occurs from the Lower Valanginian (*pertransiens* Zone) to the base of the Upper Valanginian (*verrucosum* Zone). The species has been reported in Italy (*campylotoxus* Zone and especially in the *verrucosum* Zone; Faraoni *et al.* 1997), France (*otopeta* Zone, uppermost Berriasian; Bulot and Thieuloy 1995), Morocco, Eastern Alps, Hungary and Romania. It is known from the Lower Valanginian in the Outer Western Carpathians (Kotouč Quarry near Štramberk), the Pieniny Klippen Belt in Poland and the Central Carpathians in Slovakia. I consider the information published by Kvantaliani (1999) about the occurrence of this species in the Lower Berriasian in Crimea to be unreliable. In Butkov Quarry, *V. salinarium* occurs in deposits within the transition of the Ladce to Mráznica formations, on Level 13, and in the exit road from Level 10 to Level 11 (Lower Valanginian).

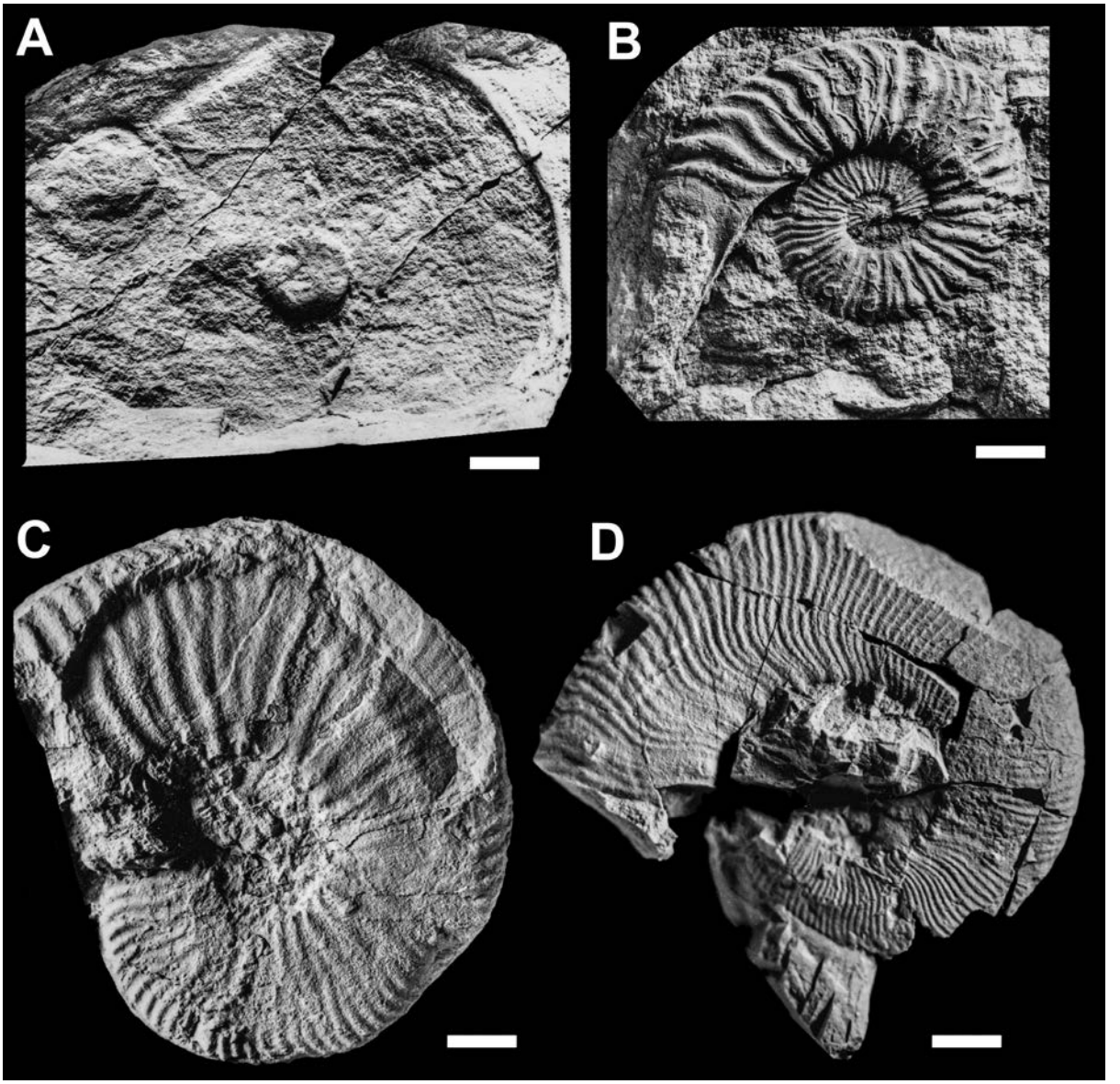
Suborder Ammonitina Hyatt, 1889
Superfamily Perisphinctoidea Steinmann in Steinmann and Döderlein, 1890
Family Neocomitidae Salfeld, 1921
Subfamily Neocomitinae Salfeld, 1921
Genus *Neocomites* Uhlig, 1905

TYPE SPECIES: *Ammonites neocomiensis* d'Orbigny, 1841.

Neocomites cf. *peregrinus* (Rawson and Kemper, 1978)
(Text-fig. 3D)

1978. *Varlheideites peregrinus* n. gen., n. sp.; Rawson and Kemper, p. 167, pl. 1, figs 1a, b, 2, 3a, b, pl. 2, figs 1, 2a, b, 3a, b, pl. 3, figs 1a, b, 2a, b, pl. 4, figs 1a, b, pl. 5, figs 1a, b, 2a, b, 3a, b [holotype].
1981. *Varlheideites peregrinus* Rawson and Kemper; Kemper *et al.*, p. 282, pl. 44, figs 3–5.
1987. *Varlheideites peregrinus* Kemper and Rawson; Kemper and Wiedenroth, pl. 12, fig. 1, pl. 13, figs 1a, b, 2a, b, 3, pl. 14, figs 1, 2, 3a, b [new figure of holotype].

← Text-fig. 2. Examples of stratigraphically significant, sporadic Lower Cretaceous ammonites from Butkov Quarry, Slovakia. **A** – *Vergoliceras salinarium* (Uhlig, 1888), SNM Z 40224. Transition of the Ladce Formation to the Mráznica Formation, exit road from Level 10 to Level 11, Lower Valanginian. **B** – *Lyticoceras kiliani* Reboulet and Atrops, 1999, SNM Z 40229. Upper part of the Mráznica Formation, Level 7 East, uppermost part of the Lower Hauterivian. **C** – *Subsaynella mimica* Thieuloy and Bulot, 1993, SNM Z 40230. Mráznica Formation, Level 7 East, base of the Upper Hauterivian. **D** – *Parastieria* cf. *hispanica* (Mallada, 1882), SNM Z 40233. Transition of the Ladce Formation to the Mráznica Formation, Level 7 West, 63 m of the succession, base of the Hauterivian. **E** – *Olcostephanus drumensis* (Kilian, 1910), SNM Z 40231, a – view of the peristome, b – lateral view of the opposite side. Base of the Ladce Formation, exit road from Level 10 to Level 11 near the Sanctuarium, 20 m of the succession, Lower Valanginian. **F** – *Oosterella cultrata* (d'Orbigny, 1841), SNM Z 40234. Note imperfectly preserved keel visible only in the lower part of the picture. Debris at the west end of the beginning of Level 6. **G** – *Barremites* cf. *primitivus* Cecca, Faraoni and Marini, 1998, SNM Z 40235. Lúčková Formation, Level 7 East, uppermost Hauterivian. **H** – *Discoidellia couratieri* Vermeulen, 1995, SNM Z 40236. Lúčková Formation, Level 8, 200 m of the succession, Upper Hauterivian. **I** – *Discoidellia mariolae* (Nicklés, 1890), SNM Z 40238. Lúčková Formation, Level 10, 170 m of the succession, Upper Hauterivian. **J** – *Discoidellia pouponi* Vermeulen, 1999, SNM Z 40237. Probably Lúčková Formation, Level 8 East, Upper Hauterivian. **K** – *Binelliceras binelli* (Astier, 1851), SNM Z 40239. Lúčková Formation, Level 5, 50 m of the succession, uppermost Hauterivian. **L** – *Binelliceras ibizense* (Wiedmann, 1962), SNM Z 40241. Lúčková Formation, Level 1, 245 m of the succession, uppermost Hauterivian. Scale bar equals 10 mm.



Text-fig. 3. Examples of stratigraphically significant, sporadic Lower Cretaceous ammonites from Butkov Quarry, Slovakia. **A** – *Neocomites* cf. *praediscus* Reboulet, 1996, SNM Z 40227. Mráznica Formation, Level 5, 240 m of the succession, Lower Hauterivian. **B** – *Rodighieroites belimelensis* Mandov, 1976, SNM Z 40226. Transition of the Ladce Formation to the Mráznica Formation, section on the exit road from Level 10 to Level 11, debris on the bottom, lower part of the Upper Valanginian. **C** – *Lyticoceras nodosoplicatum* (Kilian and Reboul, 1915), SNM Z 40228. Mráznica Formation, Level 7 East, upper part of the Lower Hauterivian. **D** – *Neocomites* cf. *peregrinus* (Rawson and Kemper, 1978), SNM Z 40225. Level 7, 520 m, debris of the Ladce Formation, probably Upper Valanginian. Scale bar equals 10 mm.

1991. *Varlheideites peregrinus* Rawson and Kemper; Thieuloy *et al.*, p. 69, p. 3, figs 1–4.
1996. *Neocomites peregrinus* (Rawson and Kemper); Reboulet, p. 95, pl. 7, figs 1–6.
1996. *Neocomites* (*Varlheideites*) *peregrinus* (Rawson and Kemper); Wright *et al.*, p. 60, fig. 2a–e.
2004. *Neocomites peregrinus* (Rawson and Kemper); Ettachfini, p. 133, pl. 14, figs 4–6.
2005. *Neocomites* (*Varlheideites*) *peregrinus* (Rawson and Kemper); Klein, p. 314 (cum syn.).

MATERIAL: Broken but rather complete ultimate whorl preserved as an external mould with a limonite coating (SNM Z 40225 = BK7-520/1).

DESCRIPTION: A semi-involute specimen with a

low, rounded umbilical wall transitioning via a narrow, rounded section into the faintly arched sides of the whorl. The separate ventral side is narrow and highly arched. The ultimate whorl starts with rather thin and dense S-shaped ribs, which cross the ventral side uninterruptedly. There are indistinct umbilical tubercles, out of which two ribs arise. Simple inserted ribs without tubercles can be found between them, reaching to the base of the umbilical tubercles. The uniform ribs are distributed evenly on the sides. In the final section of the ultimate whorl the ribs are slightly thicker and less densely distributed. Ribs arising from the stronger umbilical tubercles are discernible there. A more favourably preserved section shows umbilical tubercles rising into short spikes. Some ribs starting in the umbilical tubercles show obvious bullate ventrolateral tubercles tilted towards the peristome. Between the ribs with umbilical tubercles there are 3–5 (or more in the ultimate section of the whorl) ribs inserted without tubercles, which are the same thickness as the ribs connected with the tubercles. At the end of the whorl, before the ribs which start in the tubercles, there are two shallow constrictions. All ribs cross the venter without interruption.

MEASUREMENTS: *Dmax* reaches 75.5 mm. At *D*1 = 74.5 mm, *H*1 = 25.6 (0.34), *U*1 = 30.0 (0.40). At *D*2 = 69.0 mm, *H*2 = 25.3 (0.37), *U*2 = 27.1 (0.39).

REMARKS: The Butkov specimen differs from the typical material by its wider umbilicus; the ribs pass over the venter without interruption and bifurcated ribs are almost absent. German specimens reach the *U/D* value of around 0.32. *Neocomites peregrinus* was originally determined as a type species for the genus *Varlheideites* Rawson and Kemper, 1978, or as a subspecies of the genus *Neocomites.* Currently, *Varlheideites* is included in the synonymy of *Neocomites.*

OCCURRENCE: *Neocomites peregrinus* has been recognised as a zonal taxon in the middle part of the Upper Valanginian (*peregrinus* Zone). It occurs in a substantial part of Europe – in Germany, France, Spain, and also in Morocco. The sole finding of *N.* cf. *peregrinus* in Butkov Quarry comes from the 520 m in the section of Level 7, in debris of the Ladce Formation at the bottom of the level with no accompanying species in its surroundings.

Neocomites cf. *praediscus* Reboulet, 1996
(Text-fig. 3A)

1996. *Neocomites praediscus* n. sp.; Reboulet, p. 89, pl. 6, figs 10–16.
1999. *Neocomites praediscus* Reboulet; Vašíček and Michalík, p. 252, fig. 5.6.
2005. *Neocomites* (*Neocomites*) *praediscus* Reboulet; Klein, p. 309.

MATERIAL: A single poorly preserved adult external mould, corroded on the surface and deformed by lateral pressure (SNM Z 40227 = BK5-240/2).

DESCRIPTION: A semi-involute mid-size specimen with a narrow umbilicus and high, faintly arched whorls. A very narrow umbilical wall ends with an edge which separates the umbilicus from the sides. On the surface of the specimens only very short, indistinct ribs are visible around the umbilicus and around the ventral area, where there are short, thick ribs tilted towards the peristome. On the circumference of the specimen every fourth or fifth rib is slightly thicker than the other ribs.

MEASUREMENTS: The maximum diameter of the deformed specimen is around 85 mm in the axis of elongation. At *D* = 61 mm, *H* = 30.0 (0.49), *U* = 13.5 (0.22).

REMARKS: *Neocomites praediscus* is characterised by a flat disc-shape shell and narrow umbilicus.

OCCURRENCE: *Neocomites praediscus* occurs in France in the Upper Valanginian (especially in the *furcillata* Zone) of the Vocontian Basin (Reboulet 1996). The species occurs in Poland, Crimea, Morocco and also in the Central Carpathians. In Butkov Quarry, *N.* cf. *praediscus* occurs on Level 5 at 240 m in the Mráznica Formation (Lower Hauterivian).

Genus *Rodighieroites* Company, 1987

TYPE SPECIES: *Rodighieroites cardulus* Company, 1987.

Rodighieroites belimelensis Mandov, 1976
(Text-fig. 3B)

1976. *Distoloceras belimelensis* sp. n.; Mandov, pp. 81 and 98, pl. 19, fig. 1.
non 1996. *Rodighieroites belimelensis* (Mandov); Reboulet, p. 99, pl. 5, fig. 1 [macroconch], figs 2, 3 [microconch] (= *R. cardulus*).

1997. *Rodighieroites belimelensis* (Mandov); Faraoni *et al*., pl. 1, fig. 1.
2001. *Rodighieroites belimelensis* (Mandov); Wippich, p. 111, pl. 23, fig. 1.
2005. *Rodighieroites belimelensis* (Mandov); Klein, p. 297 (cum syn.).

MATERIAL: The external mould (SNM Z 40226 = BK11-debris) is, except for the earliest whorls, favourably preserved, but flattened and slightly deformed by lateral pressure. Part of the peristome is imperfectly visible.

DESCRIPTION: An almost evolute whorled specimen with a not very high, faintly arched ultimate whorl and wider umbilicus. The sides of the whorl slope in a short section towards the line of coiling; on the opposite side they slope slightly towards the venter. The earliest sculpture is preserved at a diameter *D* of about 6 mm. At that point, the ribs are differentiated into thicker main ribs, and inserted ribs. All ribs reach up to the line of coiling. The main ribs bear visible umbilical tubercles, and lateral tubercles near the line of the coiling. One rib is inserted between each of the main ribs. Beyond a short, unfavourably preserved part of the whorl, 2–3 ribs are inserted between the main ones. When there are three ribs, one is slightly shorter, or the corresponding rib and the following one bifurcate near the umbilicus. In the ultimate whorl, the s-shaped ribs bear three rows of tubercles: less prominent umbilical tubercles, then in 2/3 of the whorl more prominent lateral tubercles, and less prominent ventrolateral tubercles. In a favourably preserved part of the whorl on the ventrolateral tubercle there are fairly wide spikes about 5 mm long. Between the main ribs at the start of the ultimate whorl are three and then two inserted ribs. The first of the inserted ribs is shorter than the following rib. On the inserted ribs there are faintly indicated lateral tubercles. On some inserted ribs (or indeed on all of them) there are less prominent spikes on ventrolateral tubercles. In the final section of the ultimate whorl all ribs thicken and are more thinly distributed. The whorl is concluded by a narrow s-shaped constriction, before which there is an imperfectly preserved part of the smooth peristome.

MEASUREMENTS: *Dmax* = 52 mm. On the axis of elongation situated on the phragmocone at *D*1 = 40.5 mm, *H*1 = 15.2 (0.375), *U*1 = 14.5 (0.36). On the axis of shortening in the body chamber at *D*2 = 44.5 mm, *H*2 = 17.5 (0.39), *U*2 = 16.0 (0.36). Between the main axis of at *D*3 = 41.5 mm, *H*3 = 16.5 (0.40), *U*3 = 14.7 (0.36). At *D* = 40.5 mm (phragmocone) half of the whorl has around 17 ribs near the umbilicus (out of which 8 ribs are main), and there are 21 ribs on the circumference (out of which 7 ribs are main).

REMARKS: *Rodighieroites cardulus* primarily differs in adult whorls from *R. belimelensis* by more frequently inserted ribs (4–5). In contrast to evolute to slightly free-coiled whorls of *R. cardulus*, the whorls of *R. belimelensis* overlap slightly.

OCCURRENCE: *Rodighieroites belimelensis* was placed by Mandov (1976) at the base of Hauterivian together with *Teschenicerasa pachydicranum* (Thieuloy, 1977). Company (1987) previously indicated *T. pachydicranum* as a zonal species of the uppermost Valanginian in Spain. Faraoni *et al.* (1997) and Wippich (2001) stated its occurrence in the Upper Valanginian (*verrucosum* Zone). It is likely that *R. belimelensis* is an Upper Valanginian species. It also occurs in Bulgaria, Italy and Morocco. In Butkov Quarry, *R. belimelensis* was found in the debris at the bottom of the exit road from level 10 to 11 in strata corresponding to the Mráznica Formation (most likely *peregrinus* Zone).

Subfamily Leopoldiinae Thieuloy, 1971

REMARKS: The suture lines of the Hauterivian genera of the Subfamily Leopoldiinae described below such as *Leopoldia* Mayer-Eymar, 1887 and *Lyticoceras* (see e.g., Busnardo in Fischer and Gauthier 2006, text-figs 1b, 3) are akin to the suture line of the type species of the genus *Neocomites* (see Busnardo in Fischer and Gauthier 2006, text-fig. 50). Following Busnardo in Fischer and Gauthier (2006), the genera described below belong to the Subfamily Leopoldiinae in the Neocomitidae, and not, according to the former classification, to the Subfamily Endemoceratinae Schindewolf, 1966 of the Endemoceratidae Schindewolf, 1966. This subfamily includes also the genus *Subsaynella* Spath, 1923 since the suture line of a type species of this genus is similar (see Busnardo 1970, text-fig. 5).

Genus *Lyticoceras* Hyatt, 1900

TYPE SPECIES: *Ammonites cryptoceras* d'Orbigny, 1840.

REMARKS: The long-running discussion about the position of *Lyticoceras* began by Neumayr and Uhlig

(1881, p. 170), who stated that the type species of *Lyticoceras*, i.e., *Ammonites cryptoceras* d'Orbigny, 1840, is morphologically very close to *Hoplites amblygonium* Neumayr and Uhlig, 1881, i.e., the type species of *Endemoceras* Thiermann, 1964, the main difference being the suture line. Based on his thorough analysis, Wright (1975) came to a conclusion that *Endemoceras* with the type species *E. amblygonium* is a synonym of *Lyticoceras.* The only difference was the different density of ribbing on the ventral side, with a higher number of ribs on the ventral side in *L. cryptoceras*. The holotype of *L. cryptoceras,* idealistically depicted by d'Orbigny (1840, pl. 24, figs 1, 2; ×1/2), shows this feature. According to a new photograph of the holotype by Busnardo in Fischer and Gauthier (2006, pl. 13, fig. 1a, b; ×1), it is, however, obvious that the type specimen is rather poorly preserved, making an unambiguous determination of the real number of ribs difficult. The same is true for the suture line, which is completely idealised in d'Orbigny's depiction (1840, pl. 24, fig. 5). These circumstances were probably known to Sarasin (1897, p. 771, fig. 7), who published the suture line of another specimen from the Escragnolles locality under the name "*Hoplites* aff. *cryptoceras* Neum. et Uhlig." However, the specimen that this suture line originates from was not depicted by Sarasin. Busnardo in Fischer and Gauthier (2006, fig. 3) introduced this suture of Sarasin (1897) when revising *Lyticoceras cryptoceras*, depicted the holotype (see their pl. 13, fig. 1a, b) and stated its measurements.

In a detailed study of the ontogenesis of ammonite suture lines, Schindewolf (1966, p. 375) stated that the Endemoceratidae can be defined according to the position of the umbilical lobe U_1 (which is part of the internal suture) in *Endemoceras*. This feature was probably left unconfirmed.

Since its determination by Hyatt (1900), the history of *Lyticoceras* was recapitulated by Busnardo in Busnardo *et al.* (1966) along with an emended diagnosis. Among others, the suture line with asymmetric lobes was stated to resemble the suture line of *Leopoldia*. The ribs on the venter, in comparison to *Endemoceras* do not tend to form chevrons. *Lyticoceras* and other related genera were studied by Thieuloy (1971).

Lyticoceras nodosoplicatum (Kilian and Reboul, 1915)
(Text-fig. 3C)

1915. *Neocomites nodosoplicatus* Kil. et Reb.; Kilian and Reboul, p. 235, pl. 11, fig. 4 [lectotype], ?pl. 13, fig. 1, ?pl. 10, fig. 3.
1973. *Lyticoceras nodosoplicatum* (Kilian et Reboul); Mandov, p. 3, pl. 2, fig. 1, pl. 3, fig. 1.
1993. *Lyticoceras* gr. *nodosoplicatum* (Kilian et Reboul); Autran, pl. 12, figs 8, ?9.
1996. *Lyticoceras nodosoplicatum* (Kilian et Reboul); Reboulet, p. 134, pl. 15, figs 1, 3, pl. 16, fig. 1.
2004. *Lyticoceras nodosoplicatum* (Kilian et Reboul); Ettachfini, p. 147, pl. 20, figs 3–5.
2005. *Lyticoceras nodosoplicatum* (Kilian & Reboul); Klein, p. 342 (cum syn.).
2014. *Lyticoceras nodosoplicatum*; Garcia *et al*., fig. 4A, B, F, G, I.

MATERIAL: Flattened and partially deformed by lateral pressure ultimate whorl of a specimen preserved as an external mould (SNM Z 40228 = BK7-C/13). The larger part of the whorl belongs to the body chamber.

DESCRIPTION: A semi-involute specimen with whorls of middle height and a fairly wide umbilicus. Relatively thick ribs start in less prominent bullate umbilical tubercles. One or two ribs arise from each tubercle. Some ribs bifurcate at about half of the height of the whorl. Indistinct ventrolateral tubercle tilted towards the peristome occur at the end of the ribs. The ribs cross the venter uninterrupted, and they are all of the same thickness.

MEASUREMENTS: The specimen maximum size is around 85 mm. Phragmocone ends at around *D* = 55 mm. At *D*1 = 82 mm, *H*1 = 33.0 (0.40), *U*1 = 25.4 (0.31). At *D*2 = 80.2 mm, *H*2 = 33.6 (0.42), *U*2 = 25.0 (0.31). At *D*3 = 61.0 mm, *H*3 = 26.4 (0.43), *U*3 = 17.4 (0.285). The *H*/*D*1 and *U*/*D*1 values are equal to the parameters taken from the measurements of the depicted lectotype by Kilian and Reboul (1915, pl. 11, fig. 4). There are 16 umbilical tubercles on the body chamber in the middle of the whorl, which correspond to 42 ribs on the venter.

REMARKS: All ribs of *L. nodosoplicatum* start from fairly prominent umbilical tubercles; there are no ribs inserted between them. In contrast with the species of the genus *Teschenicera*s Vašíček, 2020a, the whorls of *L. nodosoplicatum* are lower. Kilian and Reboul (1915) described and depicted three specimens of *Neocomites nodosoplicatus* (the specimen in their pl. 10, fig. 3 is very fragmentary). In a rather unclear discussion, it was initially stated that *L. nodosoplicatum* is close to specimens categorised by Uhlig (1902, pl. 4, figs 1, 2) as *Hoplites campylotoxus.* Kilian and Reboul then considered their specimens of *L. nodosoplicatum* to be transitional towards the specimens

of Uhlig (1902, pl. 3, figs 1, 2), identified by Uhlig as *Hoplites neocomiensis* d'Orb. var. (*A. neocomiensiformis* Hohenegger msc.), currently *Neocomites neocomiensiformis.*

The specimen of *N. neocomiensiformis* (Hoh.) in Uhlig (1902, pl. 3, fig. 2), reaching approximately the same size as the specimen of *L. nodosoplicatum* from Butkov has on a half of the whorl 12 ribs near the umbilicus and 27 ribs on the circumference. Even though the measurements of both specimens are roughly the same, Uhlig's specimen, dating back to the Valanginian, is ribbed more thinly.

OCCURRENCE: *Lyticoceras* occupies a stratigraphic position in the upper part of the Lower Hauterivian in the *nodosoplicatum* Zone. The index species *L. nodosoplicatum* has so far been known in France, Spain, Bulgaria and Morocco. The sole specimen of this species in Butkov Quarry originates from Level 7 of the Mráznica Formation.

Lyticoceras kiliani Reboulet and Atrops, 1999
(Text-fig. 2B)

1915. *Leopoldia Dubisiensis*, var. *Bargemensis* Kil.; Kilian and Reboul, p. 244, pl. 11, fig. 1 [in the explanation to pl. 11, *Leopoldia Bargemensis* Kil. = *Acanthod. Dubisiensis* Baumb., variété]; pl. 12, figs 5, 6 [in the explanation to pl. 12, *Leopoldia Bargemensis* Kil. = *Acanthod. Dubisiensis* Baumb., p. parte, var.].
1995. *Lyticoceras* cf. *cryptoceras* (d'Orbigny); Avram, pl. 9, fig. 6.
1996. *Lyticoceras bargemensis* (Kilian); Reboulet, p. 136, pl. 15, figs 2, 4, pl. 16, fig. 2.
1999. *Lyticoceras bargamense sensu* Reboulet, 1995; Klein and Hoedemaeker, p. 106.
1999. *Lyticoceras kiliani* n. sp; Reboulet and Atrops, p. 192, fig. 5.
2005. *Lyticoceras kiliani* Reboulet and Atrops; Klein, p. 342 (cum syn.).

MATERIAL: Incomplete, fairly imperfectly preserved, deformed external mould of a small size (SNM Z 40229 = BK7-A/12).

DESCRIPTION: A juvenile evolute specimen with low, weakly arched whorls and a wide umbilicus. Inner whorls bear primarily simple, fairly thinly distributed ribs. Only exceptionally some ribs arise in a pair from the line of the coiling. Sporadically, some ribs bifurcate at 2/3 of the whorl height. At the end of an incomplete specimen there are simple, thinly distributed ribs which bear weak, point-like umbilical tubercles near the line of coiling. The ribs are faintly tilted towards the peristome. In about 2/3 of the whorl height there are indistinct lateral tubercles of a bullate shape on all the ribs. The outer side is not favourably preserved.

MEASUREMENTS: *Dmax* = c. 37 mm. At *D* c. 34.5 mm, *H* = c. 12.2 (0.35), *U* = 14.0 (0.41). Half-way on the penultimate whorl (*D* c. 23 mm) there are about 23 ribs on the circumference.

REMARKS: Based on the finding of the specimen in Butkov Quarry in deposits of the Lower/Upper Hauterivian boundary interval, I revise herein the historical interpretation of the specimens that were identified as *Lyticoceras bargemensis* Kilian in the works of Kilian and Reboul (1915) and Reboulet (1996). The synonymous determinations of this genus in papers are quite complex and unclear. *Lyticoceras bargemensis* was taxonomically categorised with several genera (*Breistrofferella* Thieuloy, 1971; *Neohoploceras* Spath, 1939; *Lyticoceras*; *Suboosterella* Spath, 1924), and specimens of large size were included in *Lyticoceras kiliani* and *L. claveli* Busnardo and Thieuloy, 1989, representing macroconchs. Reboulet and Atrops (1999, p. 192), similarly as Klein and Hoedemaeker (1999, p. 106), stated that *Hoplites* (*Leopoldia*) *bargemensis* Kilian, 1910 is an objective synonym of *Breistrofferella* var. *varappensis* Baumberger, 1906, and thus belongs to *Breistrofferella*. Kilian and Reboul (1915) also used the name *Leopoldia dubisiensis* in connection with var. *bargemensis*, which led to further misinterpretations. This paper considers the finding from Butkov Quarry to be a juvenile specimen of *L. kiliani*, equivalent to the specimens illustrated by Reboulet (1996, pl. 15, fig. 4a, pl. 16, fig. 2).

OCCURRENCE: *Lyticoceras bargemensis* has so far been only listed from French localities. Reboulet (1996) originally used this species to establish the leading horizon *bargemensis*, which occurs in the highest part of the Lower Hauterivian (*nodosoplicatum* Zone), but not in the basal Hauterivian with *Breistrofferella*. Reboulet and Atrops (1999) renamed this horizon in the light of the discussion mentioned above as the *kiliani* Horizon. According to Avram (1995), *L. kiliani* occurs also in Romania. The only specimen in Butkov Quarry originates from Level 7, from the uppermost part of the Mráznica Formation with species that are of low stratigraphic importance. The horizon with *L. kiliani* belongs therefore to the uppermost part of the Lower Hauterivian.

Genus *Subsaynella* Spath, 1923

TYPE SPECIES: *Desmoceras Sayni* Paquier, 1900.

Subsaynella mimica Thieuloy and Bulot, 1993
(Text-fig. 2C)

1993. *Subsaynella mimica* n. sp.; Thieuloy and Bulot, p. 92, pl. 4, figs 1–5, 11, 12, ?figs 6, 7.
?2002. *Subsaynella sayni* (Paquier); Vašíček, p. 193, pl. 3, fig. 2.
2003. *Subsaynella mimica* Thieuloy and Bulot; Vermeulen, p. 80, pl. 3, figs 5, 6, ?7, ?8; pl. 4, figs 4, 6.
2006. *Subsaynella mimica* Thieuloy & Bulot; Vermeulen and Klein, p. 188 (cum syn.).

MATERIAL: Small, poorly preserved as external mould sculptural core (SNM Z 40230 = BK7-c/1a).

DESCRIPTION: Almost involute specimen with a high whorl and narrow umbilicus. On the outer part of the ultimate half of the whorl there are very thin, dense ribs tilted towards the peristome, which fade out in the direction of the umbilicus. They are replaced by less densely distributed, thicker ribs reaching up to the line of coiling. The circumference probably bears an indistinct keel.

MEASUREMENTS: At almost *Dmax* = 18 mm, *H* = 8.6 (0.48), *U* = 3.0 (0.17).

REMARKS: Based on Busnardo's (1970) data about the similarity of suture lines in the genera *Subsaynella*, *Torcapella* Busnardo, 1970 and *Barremites* Kilian, 1913 (*s. l.*), Breskovski (1977) defined the Subfamily Torcapellinae. This view was followed by Thieuloy and Bulot (1993), when they placed *Subsaynella* within the Torcapellinae (and the Family Endemoceratidae), in agreement with the opinion of Busnardo (1970) that the related genus *Saynella* is the final result of the evolution of *Leopoldia.* The suture line of the type species of *Subsaynella* is close to *Leopoldia.* Its suture line is not of the pulchelliid type, therefore this genus cannot belong to the Subfamily Buergliceratinae Vermeulen, 1995, where it was placed by him (Vermeulen 1995).

The specimen with a narrow umbilicus identified as *Subsaynella sayni* in Vašíček (2002) has a diameter of about 50 mm, which is in conflict with the data in Thieuloy and Bulot (1993), who state that *S. mimica* reaches a maximum of 40 mm in diameter.

OCCURRENCE: *Subsaynella mimica* is a species known from many localities in the Vocontian Basin in France, Spain, and Algeria, in the *sayni* Zone and in the base of the *ligatus* Zone (Upper Hauterivian). In Butkov Quarry, the only specimen was found in Level 7 representing the Mráznica Formation, *sayni* Zone (base of the Upper Hauterivian).

Family Olcostephanidae Haug, 1910
Subfamily Olcostephaninae Haug, 1910
Genus *Olcostephanus* Neumayr, 1875

TYPE SPECIES: *Ammonites astierianus* d'Orbigny, 1840.

Olcostephanus drumensis (Kilian, 1910)
(Text-fig. 2Ea, b)

1910. *Holcostephanus* (*Astieria*) *Drumensis* Sayn; Kilian, p. 193, pl. 3, fig. 2a, b.
1987. *Olcostephanus drumensis* Kilian; Company, p. 163, pl. 14, figs 1–12, pl. 19, fig. 5.
1990. *Olcostephanus drumensis* Kilian; Bulot *et al*., p. 406, pl. 1, figs 1–5, text-fig. 3.
1993. *Olcostephanus drumensis* Kilian; Bujtor, p. 119, fig. 8B.
1995. *Olcostephanus drumensis* (Pictet et Campiche); Gonzáles-Arreola *et al.*, pl. 1, fig. 8.
?2000. *Olcostephanus drumensis* Kilian; Aguado *et al*., fig. 6i.
2001. *Olcostephanus* (*Olcostephanus*) *drumensis* (Sayn in Kilian); Wippich, p. 68, pl. 10, fig. 1.
?2004. *Olcostephanus* (*Olcostephanus*) *drumensis* Kilian; Ettachfini, pl. 23, fig. 1.
2005. *Olcostephanus drumensis* Kilian; Klein, p. 86 (cum syn.).

MATERIAL: An incomplete, flattened and heavily deformed by lateral pressure ultimate whorl preserved as an external mould (SNM Z 40231 = BKsankt. 20/1a, b). Both sides of the specimen and an imprint of one of the sides were preserved in part. The sculpture on one of the sides is better preserved than on the opposite side. The second specimen (SNM Z 40232 = BKsankt. 20/2) consists only of a half of a whorl.

DESCRIPTION: Semi-involute shells with a high, initially probably strongly arched whorl and relatively narrow umbilicus. The more complete specimen has thin, very dense ribs that are convex near the peristome. The ribs rise from the line of coiling as somewhat bullate umbilical tubercles. The number

of thin uniform ribs arising from the tubercles is indeterminable, as the specimen was only preserved partially. Near the supposed but not preserved peristome, there are two thick ribs separated by a distinct constriction. The rear rib in the pair is more prominent and thicker than the front rib. The constriction between them in the shorter section near the umbilicus is concave, later taking on a wide convex arch, tilting backward on the ventral side.

MEASUREMENTS: SNM Z 40231 has a deformed diameter of about 65 mm. Owing to the lateral deformation causing the ultimate part of the whorl to be lower than the start, it is impossible to take measurements. There are 8–9 primary ribs per half a whorl.

OCCURRENCE: *Olcostephanus drumensis* occurs in the *pertransiens* and *campylotoxus* zones (Lower Valanginian) in France, Spain, Hungary, Morocco, and Mexico. The only specimen from Butkov was found at 20 m in the section at the sanctuary at the exit road from Levels 10 and 11, in the Ladce Formation (Lower Valanginian).

Genus *Parastieria* Spath, 1923

TYPE SPECIES: *Acantoceras? peltoceratoides* Pavlow, 1892.

Parastieria cf. *hispanica* (Mallada, 1882)
(Text-fig. 2D)

1882. *Ammonites hispanicus*, nov. sp.; Mallada, pl. 9, figs 8–10.
?1889. *Holcostephanus Bigueti*, nov. sp.; Sayn, p. 681, pl. 17, figs 3a, b, 4a, b.
1890. *Holcostephanus hispanicus* Mallada sp.; Nicklés, p. 22, pl. 2, figs 3, 3a, 5, 6, 8, 9, *non* figs 4, 7, 10, 11 [= *Olcostephanus nicklesi* Wiedmann and Dieni, 1968].
1993. *Capeloides? hispanicus* (Mallada); Autran, p. 155, pl. 3, fig. 11a–c, pl. 10, fig. 2a, b.
1994. *Olcostephanus hispanicus* (Mallada); Vašíček *et al*., p. 60, pl. 18, fig. 4.
2005. *Parastieria? hispanica* (Mallada); Klein, p. 120 (cum syn.).

MATERIAL: Juvenile, imperfectly preserved, deformed external mould (SNM Z 40233 = BK7Z-63/13).

DESCRIPTION: A semi-involute specimen, primarily with arched whorls. The specimen has thinly distributed, relatively thick ribs arising individually, or less frequently, in pairs, form umbilical tubercles. The ribs are weakly convex toward the peristome and apparently weakly proverse.

MEASUREMENTS: Since the specimen is unfavourably preserved, the measurements are only approximate. At D = 14.5 mm, H = 7.0 (0.48), U = 4.0 (0.27). The shell continues further by a quarter of a whorl, but diameter D is impossible to measure.

REMARKS: An unambiguous species but also generic determination of the juvenile specimen described above is problematic due to its poor preservation. The only visible feature is the individual thin ribbing, corresponding to the '*hispanicus*' type. The same applies to a somewhat more favourably preserved specimen illustrated in Vašíček *et al.* (1994). The character of the ribbing, however, changes in following ontogenetic stages in the related species or genera.

OCCURRENCE: Specimens of *P. hispanica* are known from the Valanginian/Hauterivian boundary interval in Spain, France, and the Western Carpathians in Slovakia. In Butkov, *P.* cf. *hispanica* was found in Level 7 west in deposits located at the transition between the Ladce and Mráznica formations in the ammonite association of the Lower Hauterivian (*radiatus* Zone). An older finding of this species was documented by Vašíček *et al.* (1994) in the Mráznica Formation in the Košeca locality in the Košecké Valley, NE of Nozdrovice in the Považí region, not far away from the Butkov Quarry (Vašíček and Michalík 1981), probably from the younger *loryi* Zone.

Family Oosterellidae Breistroffer, 1940
Genus *Oosterella* Kilian, 1911

TYPE SPECIES: *Ammonites cultratus* d'Orbigny, 1841 (p. 145, pl. 46, figs 1, 2).

Oosterella cultrata (d'Orbigny, 1841)
(Text-fig. 2F)

1841. *Ammonites cultratus*, d'Orbigny; d'Orbigny, p. 145, pl. 46, figs 1, 2.
1996. *Oosterella cultrata* (d'Orbigny); Reboulet, p. 142, pl. 27, figs 7–16, ?17a, b.
2004. *Oosterella cultrata* (d'Orbigny); Főzy, p. 53, pl. 1, figs 6, 14, 15, pl. 2, figs 2, 3.
2005. *Oosterella cultrata* (Orbigny); Klein, p. 381 (cum syn.).

MATERIAL: Juvenile external mould, flattened and partially deformed by lateral pressure with two preserved whorls (SNM Z 40234 = BK6-minus 4/6s).

DESCRIPTION: A semi-evolute specimen with not very high, flat whorls and a wide umbilicus. A keel is indicated on the venter. The specimen has ribs of average thickness which are distributed with an average density. Ribs directed away from the line of coiling usually arise from the indicated umbilical tubercles in pairs. On the circumference, the ribs are slightly thicker than at the base of the whorl, with an indication of ventrolateral tubercles. The ribs are slightly convex toward the peristome. The ventral side bears an unfavourably preserved keel.

MEASUREMENT: Due to deformation, the values measured are only approximate. At almost *Dmax* = 13 mm near the axis of elongation, *H* = 4.5 (0.35) and *U* = 5.0 (0.38).

REMARKS: *Oosterella cultrata* is a species close to *O. cultrataeformis* (Uhlig, 1882). The latter species differs in the constrictions on the inner whorls.

OCCURRENCE: According to Főzy (2004), *O. cultrata* occurs in the Mediterranean region in the *peregrinus* and *furcillata* zones (Upper Valanginian) and might reach to the base of the Hauterivian. The only specimen from Butkov is from the western entrance to Level 6 in the Mráznica Formation (uppermost Valanginian).

Superfamily Barremitoidea Breskovski, 1977

REMARKS: The history of determining the Superfamily Barremitoidea and Family Barremitidae is discussed in detail in Vašíček and Klein (2021).

Family Barremitidae Breskovski, 1977
Subfamily Barremitinae Breskovski, 1977
Genus *Barremites* Kilian, 1913

TYPE SPECIES: *Ammonites difficilis* d'Orbigny, 1841.

Barremites cf. *primitivus* Cecca, Faraoni and Marini, 1998
(Text-fig. 2G)

1998. *Barremites primitivus* n. sp.; Cecca *et al.*, p. 77, pl. 3, figs 1–20, text-figs 10a–g, 11a–g.

2011. *Barremites primitivus* Cecca, Faraoni et Marini; Klein and Vašíček, p. 16.

MATERIAL: A single, more complete juvenile specimen (SNM Z 40235 = BK7A-5/2) unfavourably preserved as an external mould heavily deformed by lateral pressure.

DESCRIPTION: A semi-involute specimen with a narrow umbilicus. The sides of the ultimate whorl bear faint, slightly S-shaped striae.

MEASUREMENTS: The specimen is around 20 mm in diameter *D.*

REMARKS: Even though the specimen is poorly preserved, it most probably belongs to *B. primitivus.*

OCCURRENCE: According to Cecca *et al.* (1998), *B. primitivus* originates from the uppermost Hauterivian from central Italy (*catulloi* Subzone). In Butkov Quarry, the specimen originates from Level 7, in the Lúčková Formation, Upper Hauterivian (*balearis* and *ohmi* zones).

Superfamily Pulchellioidea H. Douvillé, 1890
Family Pulchelliidae H. Douvillé, 1890

REMARKS: The notion of the category of superfamily for pulchelliid ammonites, e.g., Pulchelliaceae H. Douvillé, 1890, was introduced by Luppov and Drushchits (1958, p. 106). Their opinion was adopted by some other authors, including Wright *et al.* (1996). The specific suture line with frequent lobes in the umbilical area attains the form of a simple ceratitid suture in more advanced developmental stages (e.g., suture lines close to *Ceratites* De Haan, 1825).

Pulchelliid ammonites have been the long-term focus of Jean Vermeulen. Vermeulen (1995) divided the Family Pulchelliidae Douvillé, 1890 (emend. Vermeulen) into three subfamilies: Buergliceratinae nov. subfam., Psiloceratinae nov. subfam. and Pulchelliinae R. Douvillé, 1911 (emend. Vermeulen). Vermeulen (1996, p. 62) placed the Family Pulchelliidae under the Superfamily Endemoceratacea nov. superfam. Later, he again focused on the classification of the Barremian Subfamily Pulchelliinae R. Douvillé, 1911 (Vermeulen 1997), and placed it again under the Superfamily Endemoceratacea. Vermeulen (1999, p. 444) attributed the authorship of the Superfamily Endemoceratacea to Schindewolf, 1966 (nom. transl. Vermeulen, 1996). Afterwards, he studied the concept

and history of the Pulchelliidae (Vermeulen 2003). That work, as in Vermeulen and Klein (2006), still categorises the Pulchelliidae under the Endemoceratacea. Not long afterwards, Vermeulen and Bulot (2007) used the determination of the Superfamily Pulchellioidea Douvillé, 1890 nom. transl., which includes the three subfamilies described above.

Three species of the Subfamily Buergliceratinae described below occur in the material from Butkov Quarry.

Subfamily Buergliceratinae Vermeulen, 1995
Genus *Discoidellia* Vermeulen, 1995

TYPE SPECIES: *Discoidellia couratieri* Vermeulen, 1995.

REMARKS: Involute discoidal shells bearing more or less prominent ventrolateral tubercles on the circumference. A subcarinate keel, which is indiscernible owing to the deformation of the specimens from the Butkov Quarry, is supposed on the ventral side.

Discoidellia couratieri Vermeulen, 1995
(Text-fig. 2H)

1994. *Psilotissotia favrei* Ooster; Vašíček *et al.*, p. 63, pl. 20, fig. 10.
1995. *Discoidellia couratieri* nov. sp.; Vermeulen, p. 67, pl. 1, figs 1–4.
2006. *Discoidellia couratieri* Vermeulen; Vermeulen and Klein, p. 191 (cum syn.).
?2006. *Discoidella couratieri* Vermeulen; Főzy and Janssen, p. 48, fig. 5D.

MATERIAL: About a half of a larger specimen preserved as an external mould (SNM Z 40236 = BK8-200/2).

DESCRIPTION: An involute middle-sized specimen with flatly arched sides of the whorl, with a high whorl and a point-like umbilicus. A narrow subcarinate ventral side. The outer half of the whorl bears not very densely distributed concave ribs tilted slightly towards the peristome, which are initially weaker and sharper, and at the end they are wider and flatter. Every third or fourth rib reaches up to the umbilicus, while the ribs between them fade out within the half of the height of the whorl. The ribs disappear almost completely toward the umbilicus, but some reach all the way to it. The complete ribs are s-shaped. All ribs are concluded by indistinct ventrolateral tubercles.

MEASUREMENTS: An incomplete specimen reaching the diameter of about 33 mm.

REMARKS: The Hungarian specimen in Főzy and Janssen (2006) has thicker and less densely distributed ribs than the classic *D. couratieri*.

OCCURRENCE: Vermeulen's type material is supposed to come from the *ligatus* Zone (Upper Hauterivian) from SW France. The species occurs also in the Central Carpathians, in the Lietavská Lúčka locality from deposits lying below beds with pseudothurmanniids (*balearis* Zone). The sole specimen from Butkov was found at 200 m in the section of Level 8 in the Lúčková Formation (Upper Hauterivian).

Discoidellia pouponi Vermeulen, 1999
(Text-fig. 2J)

1999. *Discoidellia pouponi* sp. nov.; Vermeulen, p. 445, pl. 1, figs 1–4.
2003. *Discoidellia pouponi* Vermeulen; Vermeulen, p. 86, pl. 5, figs 12–17.
2006. *Discoidellia pouponi* Vermeulen; Vermeulen and Klein, p. 193.
2013. ?*Discoidellia vermeuleni* (Cecca, Faraoni et Marini); Michalík *et al.*, p. 121, fig. 106/2.

MATERIAL: A small external mould, somewhat corroded in the umbilical area (SNM Z 40237 = BK7A-02/8).

DESCRIPTION: An involute specimen with a high, slightly arched whorl and a point-like umbilicus. The sculpture is formed by simple ribs of one kind, slightly concave in the direction of the peristome. The ribs end by indistinct ventrolateral tubercles.

MEASUREMENTS: The specimen diameter is about 19 mm. At D = 17.2 mm, H = 9.6 (0.56), U = c. 1 mm. At *Dmax* there are 17 ribs per half the whorl.

REMARKS: *Discoidellia pouponi* has uniform ribs in comparison to *D. couratieri*.

OCCURRENCE: Vermeulen's species come from France, from the base of the *ligatus* Zone (Upper Hauterivian). The sole specimen from Butkov was found on Level 7 West in deposits resembling the Lúčková Formation, most likely in the *ligatus* Zone. Another Slovakian specimen comes from deposits in the bedrock of the so-called pseudothurmanniid beds in Laz Quarry near Lietavská Lúčka.

Discoidellia mariolae (Nicklès, 1890)
(Text-fig. 2I)

1890. *Pulchellia* (*Stoliczkaia?*) *Mariolae* n. sp.; Nicklès, p. 11, pl.1 (8), figs 7–9, pl. 10, fig. 5, 5a, text-figs 8, 9.
1999. *Discoidellia mariolae* (Nickles); Vermeulen, p. 448, pl. 1, figs 5–7.
2003. *Discoidellia mariolae* (Nicklés); Vermeulen, p. 95, pl. 1, fig. 1, pl. 9, figs 3–5 (neotype).
2006. *Discoidellia mariolae* (Nicklés); Vermeulen and Klein, p. 192 (cum syn.).

MATERIAL: A small specimen heavily flattened and deformed by lateral pressure (SNM Z 40238 = BK10-170/2).

DESCRIPTION: An involute specimen with almost point-like umbilicus. On the circumference occur relatively thick, wide ribs terminated by slightly clavate ventrolateral tubercles. The ribs fade out in the direction to the umbilicus, even though some reach it.

MEASUREMENTS: In the axis of elongation, the specimen reaches the diameter of 24 mm. There are 16 ribs per half a whorl at this diameter.

REMARKS: *Discoidellia mariolae* differs from the specimen described herein by the clavate shape of the ventrolateral tubercles. *Discoidellia vermeuleni* (Cecca *et al.* 1998) differs in distinctly developed lateral tubercles.

OCCURRENCE: The exact stratigraphic level at which the type material of *D. mariolae* described by Nicklès (1890) was collected remains unknown. The material comes from SE Spain from deposits representing the uppermost Hauterivian (*balearis* Zone)/Lower Barremian. Vermeulen (1999, 2003) states *D. mariolae* from the *Psilotissotia colombiana* Zone, from the stratotype of the Barremian at Anglés (France). In Butkov Quarry, the sole specimen comes from Level 10, representing the Upper Hauterivian in the Lúčková Formation, probably the *balearis* Zone.

Suborder Ancyloceratina Wiedmann, 1966
Superfamily Ancyloceratoidea Gill, 1871
Family Crioceratitidae Gill, 1871
Subfamily Crioceratitinae Gill, 1871

REMARKS: The taxonomic position of the Family Crioceratitidae has been modified since 2000. A brief overview should mention the multiple concepts of Vermeulen (2004), Vermeulen *et al.* (2009, 2012, 2018, 2019a, b, 2020a, b), Hoedemaeker (2013), Leroy *et al.* (2017), Vašíček and Malek (2017), and Matamales-Andreu and Company (2019). The unified taxonomy has been affected by the character of the studied material and its frequently unfavourable preservation, with specimens deformed in the plane of bedding, inaccuracies of stratigraphic data of historical findings, and by different points of view on the selection of the relevant basic criteria.

Following the concept of Klein *et al.* (2007) and Matamales-Andreu and Company (2019), and in contrast with other opinions, the family adhered to here is the Crioceratitidae, not the Ancyloceratidae Gill, 1871. I have reached this conclusion by the analysis specified below, namely with respect to the basic morphology of the genera from the range of the species assigned to *Balearites* Sarkar, 1954.

Some older knowledge on the taxonomy and the conclusions of Vermeulen and his collaborators had received criticism in the footnotes in Klein *et al.* (2007, pp. 34–67).

Hoedemaeker (2013) considered the related taxa *Balearites* and *Binelliceras* to be the subgenera of the genus *Crioceratites* Léveillé, 1837, which he placed into the Family Ancyloceratidae. His classification is based on the ontogenesis of juvenile whorls. The earliest whorls of these subgenera bear trituberculate ribs, which then subdivide into main ribs and less numerous secondary ribs (without tubercles). The lateral tubercles on the main ribs in *Balearites* disappear at shell diameter of 7–11 mm and in *Binelliceras* at the diameter of 11–23 mm.

Following Hoedemaeker (2013), Vašíček and Malek (2017) raised the subgenera *Balearites* and *Binelliceras* to genus rank. By contrary, Leroy *et al.* (2017) considered Hoedemaeker's (2013) differentiation criteria based on the occurrence of lateral tubercles at the beginning of their ontogenesis and the moment of their disappearance as erroneous.

The variability of a statistically significant collection of specimens representing the genera *Balearites* and *Pseudothurmannia* Spath, 1923 was studied by Matamales-Andreu and Company (2019), using the method of component analysis. Leaving the genus *Pseudothurmannia* aside, the results of their study include a statement concerning the categorisation of five morphologically related genera (*Balearites*, *Binelliceras*, *Rouviericeras* Vermeulen, Duyé, Lazarin, Leroy and Mascarelli, 2009, *Biniceras* Vermeulen, Duyé, Lazarin, Leroy and Mascarelli, 2009, and *Ropoloceras* Vermeulen, Lazarin, Lépinay, Leroy, Mascarelli, Meister and Menkveld-Gfeller, 2012),

which they include in the synonymy of *Balearites* (Matamales-Andreu and Company 2019, p. 875).

Most studies devoted to the Family Crioceratitidae are based on external phylogenetic, i.e., morphological features, which lack information about the formation of suture lines. Those are usually not preserved as a result of fossilisation. The form of the suture line is nevertheless one of the basic criteria of the natural system of ammonites. For this reason, I therefore consider it improbable that the Crioceratitidae should be considered to be a part of the Superfamily Neocomitoidea Salfeld, 1921 (nom. transl. Vermeulen and Bulot, 2007), as indicated by Vermeulen *et al.* (2020b). The suture lines of both taxa differ considerably (4 elementary lobes in the crioceratitids and 5 lobes in the neocomitids).

The findings from Butkov described herein document the occurrences of representatives close to the related genera *Balearites* and *Binelliceras*. They include evolute or even slightly uncoiled, usually thinly ribbed specimens. Hoedemaeker's (2013) criterion of lateral tubercles in the earliest developmental stage applies here. Representatives of *Rouviericeras*, *Biniceras* and *Ropoloceras* have more distinctly uncoiled and ribbed shells. Their juvenile whorls are unknown. As the Butkov Quarry does not provide material for studying juvenile whorls of the three genera mentioned above, this contribution adheres to the taxonomy according to Vašíček and Malek (2017), preferring the genus *Binelliceras.*

Genus *Binelliceras* Sarkar, 1977

TYPE SPECIES: *Ancyloceras Binelli* Astier, 1851.

REMARKS: By contrast to *Crioceratites* and related genera (mainly linked with *Balearites*), and in accordance with the subgeneric identification of Hoedemaeker (2013), *Binelliceras* involves species with faintly or slightly uncoiled shells. Their earliest ontogenetic stage has individual trituberculate ribs which soon divide into main and less numerous secondary ribs. Lateral tubercles on the main ribs vanish at a shell diameter of 11–23 mm. Their indistinctly uncoiled shells are usually deformed along the bedding plane. This deformation combines with a considerable morphological variability, which is reflected in a generic variability (as documented, for example, by Matamales-Andreu and Company 2019). What is more, an unambiguous stratigraphic position of these historical type specimens is usually not known.

Hoedemaeker (2013) proposed the distinctive feature of the group of related genera, which can *sensu lato* be included into *Balearites*, to be the development of the sculpture on juvenile whorls as mentioned above, primarily based on the developed lateral tubercles and the stage or moment when they start vanishing. Leroy *et al.* (2017, p. 2) considers this criterion as misleading. On the other hand, this feature could be also applied on the related genus *Loyezia* Leroy, Vermeulen, Lazarin, Lepinay and Mascarelli, 2017. All these circumstances in the studied group of ammonites lead to the over-splitting of the genus on one hand, or to its lumping on another.

Following to the conclusions of Vašíček and Malek (2017), I maintain that *Binelliceras* is a independent and valid genus.

Leroy *et al.* (2017) removed *Binelliceras krenkeli* Sarkar, 1955 from the genus *Binelliceras* and included it in the new genus *Loyezia* (type species *Loyezia coluccii* Leroy, Vermeulen, Lazarin, Lépinay and Mascarelli, 2017). However, the typical specimens of *Loyezia* differ from *B. krenkeli*, apart from other features, in the thin and dense ribbing of juvenile whorls without lateral tubercles, which only bear umbilical tubercles.

Binelliceras binelli (Astier, 1851)
(Text-fig. 2K)

1851. *Ancyloceras Binelli*; Astier, p. 444, pl. 16, fig. 2.
1894. *Crioceras Picteti* var. *majoricensis* nobis; Nolan, p. 195, pl. 10, fig. 1c, non figs 1a, b [= *Rouviericeras majoricensis* (Nolan, 1894)], non fig. 1d (= *Binelliceras* sp.).
?1907. *Crioceras duvali* Léveillé; Karakasch, p. 131, pl. 16, fig. 3a, b.
1955. *Crioceras binelli* Astier sp.; Sarkar, p. 57, pl. 2, fig. 4 [lectotype].
1960. *Crioceratites honnoratii* Léveillé; Drushchits and Kudryavtsev, p. 289, pl. 31, fig. 2, non fig. 3 (= ?*Balearites balearis* Nolan, 1894).
1964. *Balearites balearis* (Nolan); Fülöp, pl. 27, fig. 7.
1965. *Crioceratites* (*Crioceratites*) *binelli* (Astier); Thomel, p. 28, pl. 3, figs 2, 3.
1977. *Binelliceras binelli* Astier; Sarkar, p. 258.
1981. *Crioceratites honnoratii* Leveille; Kakabadze, p. 86, pl. 1, fig. 4a, b.
1982. *Crioceratites krenkeli* Sarkar; Braga *et al.*, p. 684, pl. 1, fig. 3.
1983. *Crioceratites* (*Crioceratites*) *quenstedti* (Ooster); Adamiková *et al.*, p. 604, pl. 1, fig. 2.
1989. *Crioceratites binelli* (Astier); Michalík and Vašíček, pl. 1, fig. 3.
1989. *Crioceratites binelli* (Astier); Vašíček, p. 118, pl. 1, fig. 3.

1993. *Binelliceras binelli* (Astier); Autran, pl. 13, fig. 2.
1994. *Crioceratites binelli* (Astier); Vašíček *et al*., p. 64, pl. 20, fig. 1, non fig. 2 (= *Binelliceras rotundatus* Sarkar, 1955).
1995. *Crioceratites binelli* (Astier); Vašíček, pl. 4, fig. 2, non fig. 3 (= *Binelliceras rotundatus*).
1995. *Crioceratites binelli* (Astier); Hoedemaeker, p. 234, pl. 4, fig. 7.
?1995. *Pseudothurmannia* (*Balearites*) "*binelli*" Thomel, non Astier; Hoedemaeker, p. 232, pl. 13, figs 5–9 (= ?*Balearites theodomirensis* Hoedemaeker, 2013).
?1995. *Crioceratites* "*krenkeli*" Braga *et al.* non Sarkar; Hoedemaeker, p. 234, pl. 4, figs 1–4.
1996. *Crioceratites* (*Crioceratites*) *binelli* Astier; Wright *et al*., p. 211, fig. 164/5e.
1999. *Crioceratites binelli* sensu Thomel, non Astier; Vašíček and Michalík, fig. 7/5.
2000. *Pseudothurmannia* (?*Balearites*) "*binelli*" Thomel, 1964, non Astier; Vašíček and Faupl, p. 605, pl. 6, fig. 7.
2002. ?*Pseudothurmannia* "*binelli*" Thomel, 1964, non Astier; Vašíček, p. 194, pl. 2, fig. 6, non fig. 7 (= *Balearites oicasensis* Hoedemaeker, 2013).
2003. *Crioceratites binelli* (Sarkar); Company *et al*., p. 689, fig. 5.4.
part 2003. *Binelliceras* gr. *binelli* (Astier); Busnardo *et al*., p. 65, pl. 8, figs 7, 8 (only).
?2006. *Crioceratites krenkeli* (Sarkar); Főzy and Janssen, fig. 3F.
2007. *Binelliceras binelli* (Astier); Klein *et al*., p. 50.
2013. *Crioceratites* (*Binelliceras*) *binelli* (Astier); Hoedemaeker, p. 110, text-fig. 61A–D, tab. 21.
2017. *Binelliceras krenkeli* (Sarkar); Vašíček and Malek, p. 623, figs 4D, 5F, 6D.

MATERIAL: Two flatly deformed specimens (SNM Z 40239 = BK5-50/2, SNM Z 40240 = BK1) preserved as external moulds belonging to the penultimate and ultimate whorls. The juvenile part belongs to the phragmocone, the rest to the body chamber.

DESCRIPTION: Evolute or weakly uncoiled specimens with a low umbilical wall, which drops sharply toward the line of coiling without a sharp border. The sides of the whorl are rather flat. The greatest width is around the base of the whorl, from where the sides slope gently towards the venter. The umbilicus is wide.

On the penultimate whorl at D = 5.5–7.5 mm uniform, sparsely spaced ribs are developed, bearing 3 rows of tubercles, including lateral tubercles. At D c. 10 mm one or two ribs without lateral tubercles are inserted between the ribs with tubercles. At the start of the ultimate whorl (at D c. 21 mm) slightly thicker s-shaped main ribs are discernible, starting in obvious umbilical tubercles. Two ribs protrude from the tubercles, the anterior being slightly thicker. At 2/3 of whorl height there are final very faint lateral tubercles. All ribs bear indistinct ventrolateral tubercles. The thicker ribs out of the pair have more prominent ventrolateral tubercles than the other ribs. The main ribs in the more mature part of the ultimate whorl are accompanied by thin constrictions. Main ribs are intercalated by 4–7 inserted ribs, whose number decreases to 1–2 in the final section. Occasionally, there are shorter inserted ribs, not reaching the umbilicus.

MEASUREMENTS: The larger specimen (SNM Z 40240) reaches *Dmax* = c. 40 mm. At $D1$ = 38.5 mm, $H1$ = 14.8 (0.38), $U1$ = 14.0 (0.36). At $D2$ = 34.3 mm, $H2$ = 13.0 (0.38), $U2$ = 12.9 (0.38). Half a whorl bears nine main ribs. For SNM Z 40239, at D = 34.5 mm, H = 13.2 (0.38), U = (0.385). The end of phragmocone is probably at around D = 34 mm. At D = 34.5 mm half a whorl bears eight main ribs.

REMARKS: *Binelliceras binelli* is typical for its medium sized shells with an s-shaped, less prominent ribbing. Juvenile whorls show the main ribs relatively early, starting in the umbilical tubercles, out of which two ribs extend – a weaker and a stronger one. The stronger rib is accompanied by a faint constriction. The height of the whorl and the width of the umbilicus are approximately the same.

So far, *B. krenkeli* has dominated the classification of the species for a long time. The lectotype of that species was recently illustrated again, in relation to establishing the new genus *Loyezia* by Leroy *et al.* (2017). The diagnosis of type species of this genus , i.e., *L. coluccii*, contradicts the concept of the above authors that *B. krenkeli* belongs to the genus *Loyezia.* Based on the detailed characteristics of the genus, which lacks lateral tubercles on the juvenile whorl, this generic classification can be accepted. On the other hand, I believe that the specimen illustrated in Braga *et al*. (1982, pl. 1, fig. 3), which was considered as the holotype of *Loyezia jaenensis* by Vermeulen *et al.* (2018), does not correspond to the generic characteristic of *Loyezia.*

With reference to the presence of the lateral tubercles in the juvenile stage we have, in the presented contribution after re-evaluating the Slovakian material from Lietavská Lúčka (Vašíček and Malek 2017),

returned to our original species classification, i.e., to *Binelliceras binelli.*

OCCURRENCE: According to Hoedemaeker (2013), *B. binelli* occurs in the Upper Hauterivian in the *balearis* Zone in France, Spain, Hungary, Romania, and in Crimea (Ukraine), with the addition of Slovakia and the Eastern Alps. Company *et al.* (2003) cites the occurrence of *B. binelli* in the lower part of the *balearis* Zone in Spain, whereas Leroy *et al*. (2017) – as a horizon in the middle part of the *balearis* Zone. According to Reboulet *et al*. (2018), the occurrence is in the *binelli* Subzone (lower part of the *balearis* Zone). The uppermost Hauterivian species occurs more frequently in other similar Slovakian localities: Polomec Quarry near Žilina, Kamenná hora near Ladce (Central Western Carpathians) and the Podbranč Quarry near Myjava (Pieniny Klippen Belt).

Binelliceras ibizense (Wiedmann, 1962)
(Text-fig. 2L)

1894. *Crioceras angulicostatus* d'Orbigny; Nolan, p. 195, pl. 10, fig. 3a, non fig. 3b [= ?*Balearites rotundatus* (Sarkar, 1955)], non fig. 3c [= *Spathicrioceras remanei* (Wiedmann, 1962)].
1962. *Crioceratites* (*Pseudothurmannia*) *balearis ibizensis* n. ssp.; Wiedmann, p. 130.
?1967. *Balearites ibizensis* (Wiedmann); Dimitrova, p. 78, pl. 36, fig. 1.
1995. *Crioceratites ibizensis* Wiedmann; Hoedemaeker, p. 233, pl. 5, figs 1–7, 10.
2007. *Binelliceras ibizense* (Wiedmann); Klein *et al*., p. 51.
2009. *Binelliceras ibizense* (Wiedmann); Vašíček *et al*., p. 136, fig. 4/1.
2013. *Crioceratites* (*Binelliceras*) *ibizensis* (Wiedmann); Hoedemaeker, p. 114, text-figs 63, 64, pl. 38, figs 1–14, tab. 23.

MATERIAL: A flatly deformed, relatively favourably preserved final whorl and a minute part of the penultimate whorl of the external mould with limonite cover (SNM Z 40241 = BK1-245A).

DESCRIPTION: A faintly developed smaller sized specimen. On the incomplete penultimate whorl there are equally thick, densely distributed ribs, even at 18 mm in diameter. The ultimate whorl bears ribs divided into main and secondary ones. The main ribs start differing in thickness only in the final half of the whorl. The main ribs start in the umbilical tubercles. Pairs of ribs typically extend from the umbilical tubercles, the rear rib being somewhat weaker. Stronger ribs, up to the 25 mm in diameter, bear faint lateral tubercles. All ribs are S-shaped, with ventrolateral tubercles on the ventral edge. The tubercles on the inserted ribs are very faint. At the start of the second quarter of the ultimate whorl, there is a ventral spine of about 1.5 mm in length. The final part of the specimen indicates faint constrictions in front of the main ribs. There are 4–5 weaker inserted ribs in between the main ones. Because of the deformation it is not possible to see whether all ribs cross the venter continuously, or with interruptions.

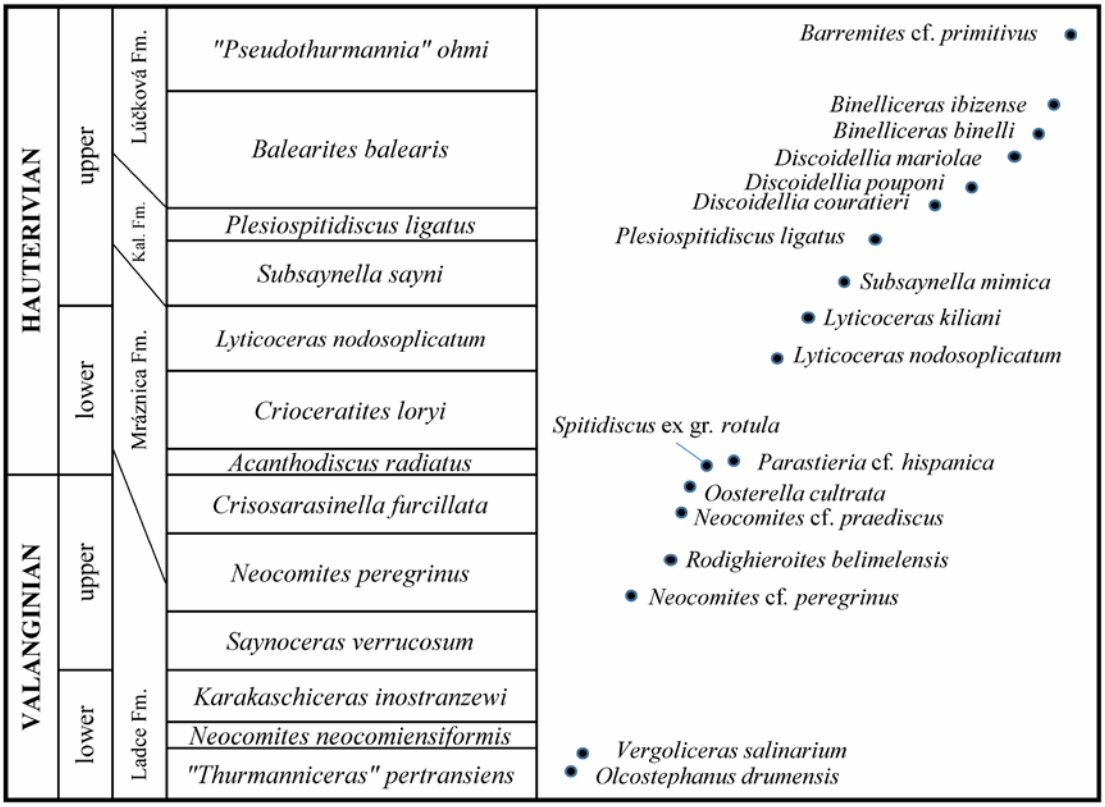
MEASUREMENTS: For SNM Z 40241, at *D*1 (almost max.) = 34.5 mm, *H*1 = 13.1 (0.38), *U*1 = 14.2 (0.41). At *D*2 = 30.6 mm is *H*2 = 12.0 (0.39), *U*2 = 12.0 (0.42). Half a whorl bears nine main ribs.

REMARKS: In contrast to *B. binelli*, the ribbing of *B. ibizense* is more prominent and more vigorous. The whorls of the first species are wound more closely (*U/D* in *B. binelli* is c. 0.38, in *B. ibizense* – c. 0.41). *Binelliceras rotundatus* is also a related species, which is in contrast with the larger *B. ibizense* (*D* at 127 mm against *D* up to 64 mm).

OCCURRENCE: According to Hoedemaeker (2013), *B. ibizense* occurs in the *balearis* and *ohmi* zones. It is known in Spain, France, Austria, and Serbia. The sole specimen in Butkov was found at 245 m in the section of Level 1 in the Lúčková Formation (Upper Hauterivian).

DISCUSSION

The distribution of the species described here is illustrated in a compiled scheme (Text-fig. 4). The list of sporadic specimens begins with *Neocomites* cf. *peregrinus,* whose typical representatives characterise the zonal species of the Upper Valanginian, and *N.* cf. *praediscus*. The taxonomically complicated category includes the genera *Leopoldia*, *Lyticoceras* and *Subsaynella*, categorised in the Subfamily Leopoldinae. This association shows a notable morphological closeness of the genera *Lyticoceras* and *Endemoceras.* Both these genera differ only in the details of the formation of the inner suture line in the area of the lobes. However, the inner suture lines which enable the checking of this attribute, are preserved only exceptionally. The unclarities in the classification of both mentioned genera (?synonyms) are also evident in their taxonomical classification,



Text-fig. 4. Distribution of zonal and guide ammonites in the Valanginian and Hauterivian succession of Butkov Quarry, Slovakia described herein. Added is also the position of the first occurrences of *Spitidiscus* Kilian, 1910 marking the base of the Hauterivian (after Vašíček and Klein 2021). The left side shows lithostratigraphic units in Butkov Quarry (after Borza *et al.* 1987) and the amonite zonation according to Reboulet *et al*. (2018), the right side shows the stratigraphic position of particular species.

whether they belong to the Subfamily Leopoldinae or the Subfamily Endemoceratinae. Based on the analysis of a similar species, *Lyticoceras bargemensis*, listed in the collection of the species of *Lyticoceras*, I have reached the same conclusions as previous authors that the Butkov Quarry finding is a juvenile specimen of *L. kiliani*. The suture lines of *Subsaynella* correspond to the suture lines of *Leopoldia* and *Lyticoceras.* According to the suture line, the genus cannot therefore belong to the category of pulchelliid ammonites, as stated by Vermeulen (2005).

Olcostephanus drumensis (Family Olcostephanidae) is one of the recently found sporadic ammonites from the base of the layered sequence (Ladce Formation). *Parastieria* cf. *hispanica* is related, albeit problematic as far as the generic relation is concerned.

The first pulchelliid ammonites appear in the upper part of the layered sequence, as a new feature. Three species of the genus *Discoidellia* sporadically occur in Butkov Quarry.

The Family Crioceratitidae is another taxonomically complicated group. Its representatives have been primarily studied phylogenetically, which leads to various taxonomic conclusions. The systematic chapter indicates that the natural ammonite system based on the formation of the suture lines can result in them being classified into the Family Crioceratitidae, Superfamily Neocomitoidea (see Vermeulen and Bulot 2007), which is in contrast with the current classification of this family into the Superfamily Ancyloceratoidea. In the highest part of the layered sequence in Butkov Quarry the array of ammonites lessens. More frequently occurring are only unfavourably preserved fragmented barremitid ammonites out of which only *Barremites* cf. *primitivus* has been determined.

Exceptions from the sporadically occurring ammonites described here are *Vergoliceras salinarium*, known from the Lower Valanginian in the Central Western Carpathians and in the Outer Western

Carpathians, and the Upper Valanginian *Rodighieroites belimelensis.*

With respect to the sporadic occurrence of most of the ammonites described here the systematic part focuses primarily on the overview of the current state of the taxonomy of the determined species. The main asset of the work presented lies in the stratigraphic importance of the described species and their palaeogeography. The larger proportion of the species determined in this paper represents, on the international stratigraphic scale, zonal taxa (see Reboulet *et al*. 2018), or species which used to be zonal taxa in the past.

The studied layered sequence in Butkov Quarry starts with the Ladce Formation (Borza *et al.* 1987). According to the most recent collections, *Olcostephanus drumensis* occurs at its base. Even though it does not belong to the zonal taxa category, it represents one of the stratigraphically oldest Lower Valanginian species. *Vergoliceras salinarium* follows it. Company (1987) used this species to identify the *salinarium* ammonite Zone (Lower Valanginian to the base of Upper Valanginian). In the Lower Valanginian on the exit from Level 10 to 11 occurs *Busnardoites campylotoxus* (Uhlig, 1902). Specimens of this species were illustrated and described in Vašíček (1997, 2010). *Busnardoites campylotoxus* was previously considered as a zonal species for the upper part of the Lower Valanginian (according to the international ammonite zonation presented in Hoedemaeker *et al.* (1993), and according to other consecutive zonations e.g., Reboulet *et al.* (2011). It is peculiar that representatives of *Karakaschiceras* Thieuloy, 1971, or the zonal species *Saynoceras verrucosum* (d'Orbigny, 1841) have not been found either in Butkov Quarry or elsewhere in the Central Carpathians.

An important finding in the Upper Valanginian is *Neocomites* cf. *peregrinus,* accompanied by *Rodighieroites belimelensis.* The former species is a zonal taxon of the eponymous ammonite zone. In the part of the layered sequence, where the uppermost Ladce Formation interlaces with the lowermost Mráznica Formation, occur species indicating the base of the Hauterivian. Considering that *Acanthodiscus radiatus* (Bruguière, 1789), a zonal species of the Lower Hauterivian, does not occur in Butkov Quarry, the base of the Hauterivian is determined based on the first occurrences of the genus *Spitidiscus* Kilian, 1910 (Vašíček and Klein 2021; see Text-fig. 4). The accompanying species are *Parastieria* cf. *hispanica* and possibly also *Oosterella cultrata.*

The upper part of the Lower Hauterivian is documented by the occurrence of the zonal species *Lyticoceras nodosoplicatum* and *Lyticoceras kiliani* which are present in the upper part of the *nodosoplicatum* Zone. Reboulet and Atrops (1999) used this species in the Vocontian Basin to define the leading *kiliani* horizon. Near to the top of the Mráznica Formation is the occurrence of *Subsaynella mimica*, which indicates the basal *sayni* Zone in the base of the Upper Hauterivian.

The following lithostratigraphic unit, i.e., the Kališčo Formation, is abundant in the zonal species *Plesiospitidiscus ligatus* (d'Orbigny, 1841) described in Vašíček and Klein (2021). It is accompanied by the first representative of pulchelliid ammonites, i.e., *Discoidellia pouponi*. The following *balearis* Zone (Lúčková Formation) is documented by the sporadic occurrence of *Discoidellia couratieri*, *D. mariolae*, *Binelliceras binelli* and *B. ibizense.* According to Reboulet *et al*. (2018), *B. binelli* is a subzonal species in this zone. In the uppermost Hauterivian there are only fragments, albeit very numerous, of barremitid ammonites belonging to the *Barremites primitivus* group. The end of the Hauterivian is indicated by the final occurrence of thickly walled shells of the ribbed aptychi of the genus *Didayilamellaptychus* Turculet, 1994 described in Měchová *et al.* (2010).

CONCLUSIONS

This contribution extends the knowledge of an ammonite association occurring in Butkov Quarry in the Lower Valanginian to Upper Hauterivian, and gives a detailed taxonomic description of 16 other species. It deals with sporadic and usually less favourably preserved species, which means that 1/3 of them has been determined only at the *cf.* level. Most of the species described here are of high stratigraphic importance because they belong to the category documenting global Lower Cretaceous ammonite zones.

The study of ammonites in the layered sequence of the Manín Nappe mined on many levels in Butkov Quarry is based on collections from nine quarry sections. Documenting the sections and faunal collections was troublesome due to the complex tectonics of the rocks in the quarry.

The ammonite assemblage from Butkov Quarry proves an association with the Mediterranean bioprovince, which is supplemented by several boreal species, following the earlier finds in the Upper Valanginian. The deposits in Butkov Quarry are similar to strata from the Vocontian Basin in France with regard to their lithology and ammonite content.

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