

A remarkable assemblage of Early Barremian ammonites in the Central Western Carpathians (Butkov Quarry, Slovakia)

ZDENĚK VAŠIČEK

*Institute of Geological Engineering, VŠB – Technical University of Ostrava, 17. listopadu 15,
CZ-70833 Ostrava-Poruba, Czech Republic.
E-mail: Zdenek.Vasicek@vsb.cz*

ABSTRACT:

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A remarkable fossiliferous horizon dominated by ammonites has been recorded in Lower Barremian clayey limestones of the Butkov Quarry in the Slovak Central Carpathians. The rich ammonite assemblage yielded 16 genera and 21 species. The 15 species are described in detail; four of these are new. Numerous barremitids are accompanied by biostratigraphically significant pulchelliids, some heteromorphs and particularly by representatives of the family Holcodiscidae. The composition of the ammonite assemblage, which contains only taxa belonging to the Mediterranean faunal province, is characteristic of the Early Barremian *Kotetishvilia compressissima* ammonite Zone.

Key words: Early Barremian, Ammonites, Butkov Quarry, Manín Unit, Lúčkovská Formation.

INTRODUCTION

Fieldwork within the grant project supervised by P. SKUPIEN (post-doc grant project No. 205/00/D030 with the Grant Agency of the Czech Republic) was carried out in the Butkov Quarry in the Central Western Carpathians in 2001–2002. During the fieldwork, we succeeded in discovering an exceptional macrofaunal horizon, particularly rich in cephalopods, in the Lower Barremian deposits of the Lúčkovská Formation.

The faunal horizon was exposed in the eastern part of Level 7 of the quarry, where the main quar-

ry face bends sharply to the northwest (Text-fig. 1). The fossiliferous sediments resemble a faunal lumachelle and are 50–70 cm thick. At the time of their discovery, they were incorporated into a large isolated block of brownish light grey clayey limestone locally passing to marl-sandy limestone. This block slid from a higher part of the quarry wall along a bedding plane inclined towards the quarry floor. This whole block was taken to pieces in the present study, and yielded more than 140 Early Barremian fossils, mostly ammonites. Most of the ammonites are species that have not been recorded previously in the Western Carpathians.



Fig. 1. Eastern part of Level 7 in the Butkov Quarry. The position of the former fossiliferous limestone block in the of Lúčkovská Formation is indicated by two persons standing on the base of the quarry wall

GEOLOGICAL SETTING

The Butkov Quarry near Ladce (ca. 7 km NE of Ilava) exploits marlstone- and limestone-dominated sediments of the Manín Unit of the Carpathians. This nappe unit lies at the western margin of the Central Western Carpathians at the contact with the Pieniny Klippen Belt of the Outer Western Carpathians (see Text-fig. 2).

A review of the former ideas on the position of the Manín Nappe, its geological position in the Western Carpathians, the lithostratigraphic units defined in its Lower Cretaceous succession, and its detailed topographic location and geological setting, was provided by BORZA & *al.* (1987), MICHALÍK & VAŠÍČEK (1987), MICHALÍK & *al.* (2005) and others. The Lower Cretaceous cephalopod fauna from this unit has been previously treated especially by

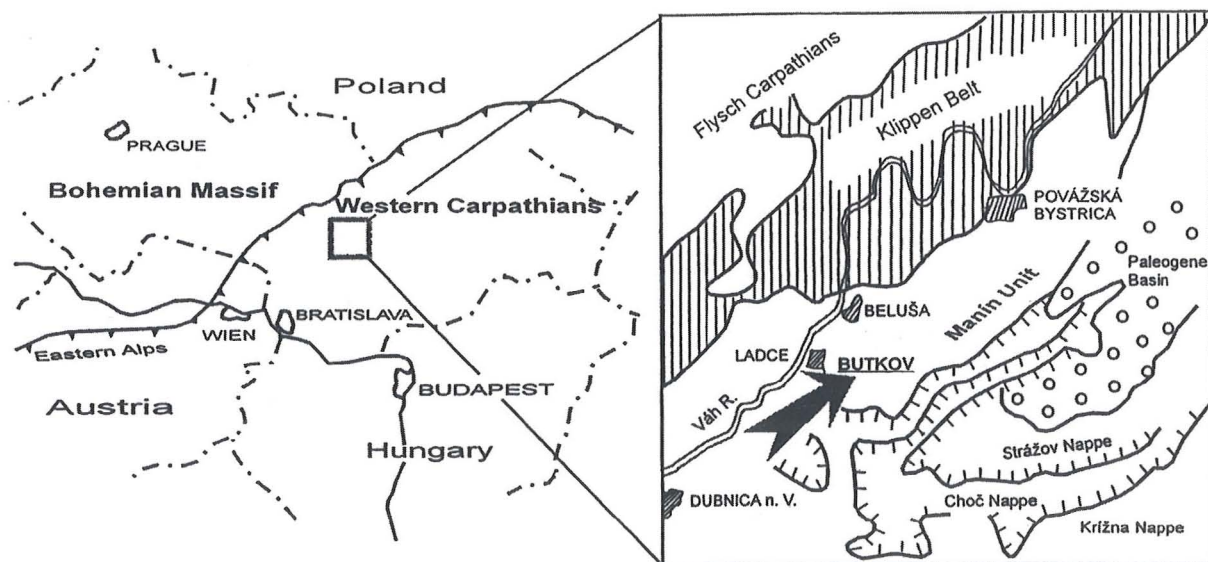


Fig. 2. Geographical and geological situation of the Butkov Quarry

VAŠÍČEK & MICHALÍK (1986), VAŠÍČEK & *al.* (1994) and VAŠÍČEK (2005). The microfossils found in the Cretaceous sediments of the Butkov Quarry and their correlation with ammonite zones were reviewed in SKUPIEN & *al.* (2003).

Fossiliferous limestone deposits of the Lúčkovská Formation pass continuously into the underlying fossiliferous deposits of the Kališče Formation (Hauterivian). The underlying formation, with calciturbidite beds at its base, is represented by light grey to brownish-grey thick-bedded pelagic limestones with "contour" cherts.

The base of the Lúčkovská Formation lies in the Late Hauterivian *Balearites balearis* ammonite Zone. Most of the formation is formed by grey, thick-bedded micritic limestone with marlstone intercalations, yellow in colour when weathered. Black-grey cherts are present in places. Successions produced by gravitational slumping of mud and thin horizons of intra-formational breccias are commonly observed.

The top of the Lúčkovská Formation is sharp, defined by the erosive contact with the Podhorie Formation. It marks the onset of progradation of the slope deposits of the Urganian carbonate platform, which led to the destruction of the pelagic environment of the Lúčkovská Formation. The Podhorie Formation starts with a breccia member with indistinctly graded rhythms. Its upper part is formed by dark grey organodetrital cherty limestones. The slope limestones of the Podhorie Formation pass upwards into the shallow marine carbonate-platform limestones of the Manín Formation.

PRESERVATION OF FOSSILS

Most of the fossils collected are deformed to a greater or lesser extent (see plates). Planar compaction of the ammonites onto the bedding plane is often combined with strong lateral compression, which precludes the measurement of size parameters in most cases. Some extremely deformed ammonites lie on the bedding plane on their ventral side. The cephalopod shells are generally preserved in the form of sculptured external moulds. Some sporadic steinkerns (internal moulds) are coated with limonite to a variable degree, others are coated with bluish-green clay. The latter coloration is caused by the presence of glauconite, as revealed by

clay material analysis in our laboratory. A significant proportion of the shells are preserved as fragments. The shells collected are therefore small (around 25 mm in diameter), but also medium (40–70 mm) and large (max. diameter 170 mm) sizes are represented. The original calcite shells of the brachiopods are not recrystallized.

TAXONOMIC PART

The taxonomy of the ammonites in this paper follows the Treatise on Invertebrate Paleontology (WRIGHT & *al.* 1996).

In those ammonites, where size parameters could be measured in millimetres with reasonable precision, D denotes shell diameter, Wh denotes whorl height and Uw denotes the width of umbilicus. Whorl widths either could not be measured or were irrelevant due to the strong deformation. The measured values are followed by the proportions of the parameters relative to shell diameter given in parentheses.

Suborder Ammonitina HYATT, 1889

Superfamily Perisphinctoidea STEINMANN, 1890

Family Holcodiscidae SPATH, 1923

Subfamily Holcodiscinae SPATH, 1923

REMARKS: In agreement with the detailed analysis of the generic composition and systematic position of the family Holcodiscidae carried out by AGUIRRE-URRETA & RAWSON (2003), the Holcodiscidae are herein ranked within the superfamily Perisphinctoidea and not in the superfamily Desmoceratoidea, as suggested e.g. by CECCA & *al.* (1998) or VERMEULEN & THIEULOY (1999) after the publication of the new Treatise (WRIGHT & *al.* 1996). Most recently, holcodiscids have also been placed within the superfamily Perisphinctoidea by KLEIN (2005).

AGUIRRE-URRETA & RAWSON (2003) proposed a useful subdivision of the family Holcodiscidae into two subfamilies: Holcodiscinae and Spiti-discinae VERMEULEN & THIEULOY, 1999.

Genus *Holcodiscus* UHLIG, 1882

TYPE SPECIES: *Ammonites Caillaudianus* D'ORBIGNY, 1850.

Shells with whorls circular to rectangular in cross section, and with prominent ventrolateral tubercles.

Holcodiscus aff. *decorus* AVRAM, 1995
(Pl. 1, Fig. 1, Text-fig. 3)

1995a. *Holcodiscus decorus* n. sp.; E. AVRAM, pp. 20-21, pl. 4, figs 2-4; pl. 6, fig. 3; pl. 7, figs 6, 15

MATERIAL: A single imperfectly preserved external mould (BK7V/30 = SNM Z 24239).

DESCRIPTION: Shell semi-involute, of medium size. Last whorl with 10 constrictions marked on the terminal half-whorl only, accompanied by characteristic, pairwise-arranged major ribs. The anterior ribs of each pair start near the umbilicus and bear a bullate lateral tubercle at around whorl mid-height. The posterior major ribs are thin in the lower part of the whorl but thicken around the bases of the lateral tubercles. The anterior ribs continue towards the venter as a normal thin rib, the posterior ribs being already markedly thicker in this interval; both these ribs meet at a strong ventrolateral tubercles. The ventrolateral tubercles are connected by two closely spaced ribs on the venter. Two intercalatory ribs reaching the umbilicus occur between the paired major ribs; these are sometimes bifurcated, especially in the juvenile part of shell. Shorter inserted ribs are also sometimes present in the proximity of the major ribs.

MEASUREMENTS: The measured values are affected by deformation. At $D = 31$ mm (close to the maximum diameter), $Wh = 13.0$ (0.42), $Uw =$

9.0 (0.29). On the terminal half-whorl, 18 ribs reach the umbilicus and 32 ribs are present on the venter. The same half-whorl bears 6 ventrolateral tubercles.

REMARKS: The pairwise-arranged major ribs, accompanied by constrictions, are reminiscent of *H. decorus*, especially the larger specimen figured by AVRAM (1995a, pl. 4, fig. 4). Typical representatives of *H. decorus*, however, differ in the higher number of ventrolateral tubercles, and their major ribs do not meet at a common ventrolateral tubercle; only a single pair of ventrolateral tubercles appears in the holotype of *H. decorus*. The Butkov specimen compares well with the strongly deformed shell from the Early Barremian of the Silesian Unit, which was figured by VAŠÍČEK (1972, pl. 14, fig. 7) under the name *Holcodiscus* sp. ind.

DISTRIBUTION: Typical representatives of *H. decorus* have been hitherto reported only from the Early Barremian of Romania.

Genus *Parasaynoceras* BREISTROFFER, 1947

TYPE SPECIES: *Ammonites horridus* D'ORBIGNY, 1850.

REMARKS: Shells with broad, arched whorls, or with whorls whose width equals their height. The ventral side is usually broader. The major ribs bear lateral and ventrolateral tubercles.

Parasaynoceras tzankovi (AVRAM, 1995)
(Pl. 1, Figs 2, 3, Text-fig. 4)

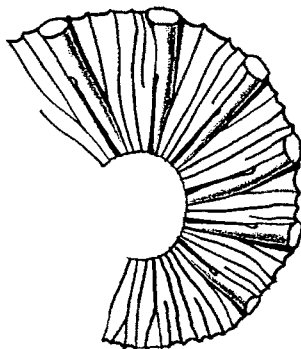


Fig. 3. A scheme of the sculpture on flanks of *Holcodiscus* aff. *decorus*

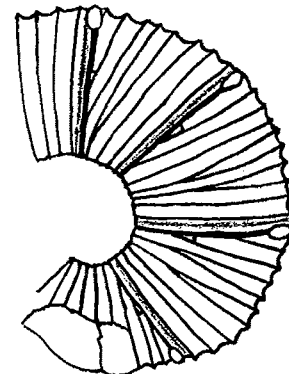


Fig. 4. A scheme of the sculpture on flanks of *Parasaynoceras tzankovi*

1883. *Holcodiscus Caillaudianus* ORB.; V. UHLIG, pp. 243-244, pl. 19, figs 2-4, 6, 7, 13, 14 (non 8, 9)
- 1995a. *Holcodiscus tzankovi* n. sp.; E. AVRAM, pp. 17-18, pl. 3, figs 8, 9, 10 a-c, 11 a-b, 12 a-b; pl. 6, fig. 2; pl. 7, fig. 13 (cum syn.)
1999. *Parasaynoceras tzankovi* (AVRAM); J. VERMEULEN & J.-P. THIEULOY, p. 365
2005. *Parasaynoceras tzankovi* (AVRAM); J. KLEIN, pp. 133-134 (cum syn.)

MATERIAL: A single weakly deformed juvenile shell (BK7V/23 = SNM Z 24241) and a considerably deformed subadult shell (BK7V/111 = SNM Z 24240).

DESCRIPTION: Shells semi-involute, with arched flanks. Dense ribs differentiated into major ribs and intercalatory ribs. Major ribs are accompanied by a shallow constriction on their anterior side and bear rather indistinct lateral tubercles at about whorl mid-height. Stronger ventrolateral tubercles are visible on the circumference, especially in adult specimens. Four to five intercalatory ribs lie between the major ribs; two of these usually bifurcate at around whorl mid-height or higher. Two short secondary (inserted) ribs are usually present on the posterior side of the major ribs around the circumference. All ribs cross the venter without interruption.

MEASUREMENTS: At D = 21.0 mm (almost preserved maximum diameter of specimen Z 24241), Wh = 8.6 (0.41) and Uw = 6.3 (0.30). Four major ribs per half-whorl, 19 ribs extend to the umbilicus; 33 ribs are present on the circumference. A larger, strongly deformed shell reaches a diameter of 33 mm.

REMARKS: The size parameters and ornament correspond to the species defined by AVRAM (1995a).

DISTRIBUTION: AVRAM (1995a) reported this species from the Early Barremian of Romania, Bulgaria and the Silesian Unit. As suggested by the material of UHLIG (1883), *P. tzankovi* also occurs in France.

Parasaynoceras butkoviensis sp. nov.
(Pl. 1, Figs 4, 5, Text-fig. 5)

HOLOTYPE: Specimen SNM Z 24242 figured in Pl. 1, Figs 4, 5.

DERIVATIO NOMINIS: After the name of the Butkov Quarry, where the specimen was found.

LOCUS TYPICUS: Butkov Quarry, Level 7, eastern end.

STRATUM TYPICUM: Lower Barremian, Lúčkovská Formation.

DIAGNOSIS: Shell with prominent and complicated ornament. Major ribs bituberculate, accompanied by constrictions. Some intercalatory ribs also bituberculate. Lateral tubercles weak, ventrolateral tubercles strong. Ventrolateral tubercles arranged asymmetrically, connected by "zig-zag" ribs across venter. Some pairs of ribs meet at same ventrolateral tubercle.

MATERIAL: A single somewhat deformed sculptured mould (BK7V/92 = SNM Z 24242) with last whorl preserved. The sculpture is somewhat weathered but is favourably preserved in a short interval on the opposite side to the side photographed.

DESCRIPTION: Shell small, semi-involute, with moderately high, probably strongly arched whorls and a weakly arched venter. Ribbing irregular; relatively sparse. Major and simple intercalatory ribs appear on the whorl-flanks. Major ribs are accompanied by constrictions on their posterior side; constrictions are particularly distinct on the lower half of the whorl. Major ribs, and usually also simple intercalatory ribs, bear two tubercles: a weak lateral one, which appears above whorl mid-height, and a prominent ventrolateral one. Major ribs occasionally bifurcate at the lateral tubercles. There are usually two to three inserted ribs which appear between two major ribs.

The ventral side is characterised by asymmetrically "zig-zag" arranged ventrolateral tubercles.

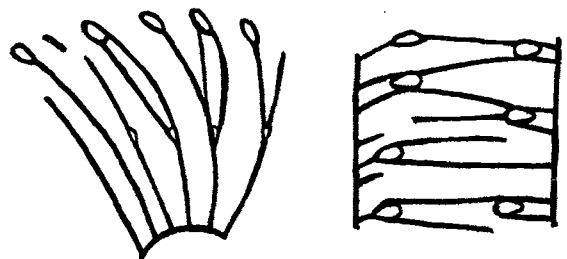


Fig. 5. A scheme of the sculpture on flanks and ventral side of *Parasaynoceras butkoviensis*

A V-shaped pair of ribs usually extends from each ventrolateral tubercle onto the venter; one rib of the pair meets a different ventrolateral tubercle on the opposite side of the venter. Here and there, however, one rib of a pair continues on the opposite whorl-flank, where it appears as a simple intercalatory rib. Occasionally it may become blunt; and even fades away from the venter before reaching the opposed ventrolateral tubercle.

MEASUREMENTS: Maximum diameter of the deformed shell reaches 26 mm. At $D = 24.4$ mm, $Wh = 10.0$ (0.41) and $Uw = 7.1$ (0.29). At this diameter, 14 ribs per half-whorl reach as far as the umbilicus; 13 ventrolateral tubercles are present on the circumference. The last whorl bears 6 constrictions.

REMARKS: The venter of *P. butkoviensis*, with its ribbing of "zig-zag" type, suggests some relationship to *Holcodiscus ziczac* (KARAKASCH, 1890). The ribbing on the flanks of the latter species, however, differs in many features: the absence of lateral tubercles, the absence of constrictions, frequent meeting of three ribs at the ventrolateral tubercles etc. These features show that *P. butkoviensis* and *H. ziczac* represent two different species.

Parasaynoceras tenuicostatum sp. nov.
(Pl. 1, Figs 6-8, Text-fig. 6)

?1960. *Holcodiscus diverse-costatus* COQUAND; V.V. DRUŠČIC & M.P. KUDRIJAVCEV, p. 305, pl. 46, figs 8 a, b

HOLOTYPE: Specimen SNM Z 24243, figured in Pl. 1, Figs 6-8.

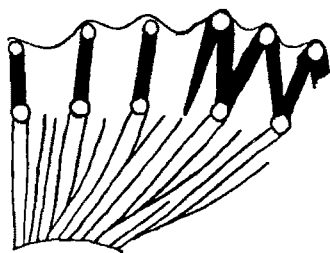


Fig. 6. A scheme of the sculpture of *Parasaynoceras tenuicostatum*

DERIVATIO NOMINIS: From Latin *tenuis* – after thin ribs on shell flanks.

LOCUS TYPICUS: Butkov Quarry, Level 7, eastern end.

STRATUM TYPICUM: Lower Barremian, Lúčkovská Formation.

DIAGNOSIS: Shell semi-involute, with thin, dense ribs on whorl flanks. Some ribs bifurcated at slight periumbilical tubercles, ending at strong ventrolateral tubercles. The ventrolateral tubercles connected by simple, blunt ribs which are replaced by ribbing of "zig-zag" type near mouth.

MATERIAL: A single incomplete sculptured mould, strongly deformed, somewhat corroded on flanks (BK7V/71 = SNM Z 24243).

DESCRIPTION: Shell semi-involute. Whorl width probably exceeding height: whorl height ratio unknown due to deformation. Sculpture on whorl flanks formed by dense, very thin ribs. Ribs start as simple or bifurcated ribs near umbilicus; they either maintain the character of thin, simple ribs ending at the ventrolateral edge or they bifurcate a short distance above the umbilical edge. Most of the bifurcated ribs end at prominent ventrolateral tubercles, thus forming structures resembling the eye of a needle (fibulation). Shallow constrictions occur periodically near the venter. Relatively broad, simple, blunt ribs extend from the ventrolateral tubercles across the relatively broad venter, passing to "zig-zag" ribbing near the aperture.

MEASUREMENTS: Due to the strong deformation of the shell, it can be only stated that the maximum preserved shell diameter lies in the axis of maximal elongation and reaches 23 mm.

REMARKS: The dense and thin ribbing on the flanks, with occasional fibulation, suggests some relationship to the group of *M. diversecostatus* (COQUAND), hence also with the genus *Meta-hoplites*. The broad whorl section and especially the ribbing of "zig-zag" type on the venter are, however, features that are not found in this group. The morphologically similar Crimean specimen in the synonymy (*H. diverse-costatus*) differs somewhat in the more regular occurrence of fibulated ribs on its

whorl flanks and especially in the presence of only simple ribs crossing the venter at an equivalent maximum shell diameter.

Genus *Avramidiscus* VERMEULEN, 1996

TYPE SPECIES: *Ammonites gastaldianus* D'ORBIGNY, 1850.

Avramidiscus gastaldianus (D'ORBIGNY, 1850)
(Pl. 2, Fig. 4; Pl. 3, Figs 2, 5)

1850. *Ammonites Gastaldianus* D'ORBIGNY; A. D'ORBIGNY, p. 99, n. 601
1937. *Ammonites Gastaldianus* D'ORB.; J. COTTREAU, pp. 58-59, pl. 77, figs 27-29
1995a. *Spitidiscus gastaldianus* (D'ORBIGNY); E. AVRAM, p. 28, pl. 5, figs 10 a-c, 11, 12, 13 a, b, pl. 6, figs 7-9, pl. 7, fig. 19 (cum syn.)
1996. *Avramidiscus gastaldianus* (d'Orbigny); J. VERMEULEN, pp. 60-61, pl. 1, figs 4-7
2005. *Avramidiscus gastaldianus* (ORBIGNY); J. KLEIN, p. 142 (cum syn.)

MATERIAL: Three strongly deformed moulds (BK7V/6 = SNM Z 24248, BK7V/73 = SNM Z 24249, BK7V/112 = SNM Z 24250).

DESCRIPTION: Shells semi-involute, with whorl width probably exceeding height. Ornament formed by straight, relatively thin, usually bifurcated ribs, interspersed with constrictions accompanied by stronger ribs on their posterior sides. The stronger (i.e. major) ribs bear minute lateral tubercles at which the original, primary ribs bifurcate. The last whorl bears 7-8 constrictions. Five to eight intercalatory ribs, mostly bifurcated, are usually present between constrictions near the umbilicus. An additional 8-12 ribs are usually present on the ventral side. The largest deformed specimen (Z 24250) is about 35 mm in diameter.

REMARKS: The numerous straight constrictions, with stronger ribs behind them on the ventral side, and the bifurcation of the intercalatory ribs, correspond to the diagnosis of *A. gastaldianus*. The related species *A. vandeckii* (D'ORBIGNY) and *A. kiliani* (PAQUIER) have a higher number of constrictions per whorl; *A. vandeckii* has more flexuous ribbing.

A. intermedius (D'ORBIGNY) is also a closely related species but it bears a higher number of ribs between constrictions at a diameter corresponding to the size of the largest Slovak specimen.

DISTRIBUTION: According to literature data, *A. gastaldianus* has been recorded from Crimea, France, Bulgaria and Romania. According to VERMEULEN (1996), this species occurs in France in the Early Barremian condensed horizon, corresponding approximately to the *Coronites darsi* Zone.

Genus *Metahoplites* SPATH, 1923

TYPE SPECIES: *Ammonites henoni* COQUAND, 1880.

REMARKS: Representatives of the semi-involute genus *Metahoplites* are characterized by a narrow, flat venter, whorl height exceeding whorl width, numerous ventrolateral tubercles, and by merging – at least periodically – of two or even three ribs at the ventrolateral tubercles (fibulation). For the representatives of the genus *Metahoplites*, TZANKOV & BRESKOVSKI (1982) proposed to establish a new family Metahoplitidae. However, in subsequent work on holcodiscids (TZANKOV & BRESKOVSKI, 1985) they did not mention this family any more.

Metahoplites cf. *nicklesi* (KARAKASCH, 1907)
(Pl. 2, Figs 2, 3)

1890. *Holcodiscus diverse-costatus* COQUAND; R. NICKLÈS, pp. 26-30, pl. 1, figs 21-24, pl. 2, figs 14-19, pl. 4, figs 1 a,b
1907. *Holcodiscus Nicklesi*; N.I. KARAKASCH, p. 119
1999. *Metahoplites nicklesi* (KARAKASCH); J. VERMEULEN & J.-P. THIEULOY, p. 366

MATERIAL: A single deformed mould (BK7V/83 = SNM Z 24244) preserved in sandy limestone. This granular material obscures some details of the shell sculpture.

DESCRIPTION: Shell semi-involute, with relatively high and flat flanks. Sculpture formed by relatively sparse ribs: slightly stronger major ribs and intercalatory ribs. The major ribs are accompanied

by a secondary rib on their posterior sides; this rib usually starts only some distance above the umbilicus. Both ribs meet at a common ventrolateral tubercle. A short and thin intermediate rib is inserted in the space between the two above-mentioned ribs, in one case terminating at a ventrolateral tubercle. The major ribs are usually interspersed with 3 intercalatory ribs that reach as far as the umbilicus. Some intercalatories are bifurcated at about whorl mid-height. Lateral tubercles are possibly present at sites of bifurcation in some cases. Secondary ribs occasionally merge with primary ribs at ventrolateral tubercles. Most of the secondary ribs end at ventrolateral tubercles that are somewhat weaker than those of the major ribs.

MEASUREMENTS: Maximum diameter of the deformed shell is about 29 mm. At $D = 24.5$ mm, $Wh = 11.5$ (0.47), $Uw = 6.6$ (0.27). The last whorl bears 7 major ribs. On the terminal half-whorl, 16 ribs reach the umbilicus (at $D = 24.5$ mm). Twenty-two ribs and 18 ventrolateral tubercles are present on the circumference.

REMARKS: The shell collection of NICKLÈS (1890) designated as *Holcodiscus diversecostatus* (COQUAND) represents a heterogeneous set, of which only one figured shell (pl. 1, fig. 20) belongs to the group of that species. This was already recognized by KARAKASCH (1907), who erected *H. nicklesi*. However, even the reduced set of shells listed in the synonymy is heterogeneous. This fact was indicated by NICKLÈS (1890) himself: he figured three different types of sculpture (e.g., with and without lateral tubercles) and also differentiated between shells with arched whorls and flattened whorls. Subsequently, the species *H. nicklesi* was treated only by several Bulgarian authors (lately TZANKOV & BRESKOVSKI 1985), using the same synonymy as the present paper. The specimen figured by NICKLÈS (1890) on pl. 1, figs 22, 23 with lateral tubercles and rather arched whorls was designated as the type of *H. nicklesi* by DIMITROVA (1967). As an example from the Bulgarian material, she re-figured the specimen of BRESKOVSKI (1966, pl. 10, fig. 4), which was also re-figured by TZANKOV & BRESKOVSKI (1985, pl. 9, figs 3, 4). The ribs on this specimen are, however, sparser and thicker than in the case of NICKLÈS' original material.

The specimen from Butkov belongs to the category of flat-whorled shells. The ventral region is not

preserved, and the possible presence of lateral tubercles is unclear. It somewhat resembles the specimen figured by NICKLÈS (1890) on pl. 2, fig. 19, which, *inter alia*, lacks major ribs. It may represent a new species; however, this cannot be confirmed until more and better preserved specimens are found.

DISTRIBUTION: *Metahoplites nicklesi* is present at the base of the *Kotetishvilia compressissima* ammonite Zone at the Barremian stratotype in France (VERMEULEN 2005).

Metahoplites misiki sp. nov.
(Pl. 1, Figs 9-12, Text-fig. 7)

HOLOTYPE: Specimen SNM Z 24245, figured in Pl. 1, Figs 9-12.

DERIVATIO NOMINIS: In honour of the outstanding Slovak geoscientist Prof. RNDr. Milan Mišík, DrSc.

LOCUS TYPICUS: Butkov Quarry, Level 7, eastern end.

STRATUM TYPICUM: Lower Barremian, Lúčkovská Formation.

DIAGNOSIS: Shell semi-involute, with dense, thin ribs. Ribs bifurcating at mid-flank at weak lateral tubercles. Rib pairs terminating at more prominent ventrolateral tubercles, both ending either at the same tubercle (fibulation) or the second rib of the pair ending at a neighbouring tubercle. Venter narrow, densely ribbed. Ventrolateral tubercles interconnected by three ribs. One inserted rib occasionally present between rib triplets.

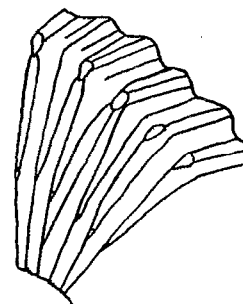


Fig. 7. A scheme of the sculpture of *Metahoplites misiki*

MATERIAL: A single mould, strongly obliquely deformed (BK7V/110 = SNM Z 24245).

DESCRIPTION: Shell semi-involute, with high whorls, a narrow and flat venter and a narrow umbilicus. Sculpture formed by dense, thin ribs. The ribs start near the umbilicus as simple ribs, straight or gently inclined towards aperture, and then bifurcate at weak lateral tubercles at about whorl mid-height. A simple intercalatory rib is occasionally present between bifurcated ribs. The majority of the ribs terminate in pairs at stronger ventrolateral tubercles. The ventrolateral tubercles variably unite pairs of ribs extending from different lateral tubercles or paired ribs extending from the same lateral tubercle. A small number of bifurcated ribs do not terminate at the ventrolateral tubercles, but continue uninterruptedly between the tubercles across the venter, and finally terminate at the position of the opposite row of ventrolateral tubercles, thus not continuing to the opposite side of shell.

The ventrolateral tubercles are interconnected by 3 thin ribs on the narrow venter. One inserted rib is often present between these rib triplets.

MEASUREMENTS: The shell has a deformed diameter of 20.0 mm. At this diameter, 16 ventrolateral tubercles are present on the terminal half-whorl.

REMARKS: The new species is close to the poorly understood *Metahoplites diversecostatus* (COQUAND 1880). The very small type specimen of COQUAND was subsequently figured by HEINZ (1886). The original specimen is now missing. Bulgarian authors (DIMITROVA 1967; TZANKOV & BRESKOVSKI 1985) erroneously identified the holotype with the specimen of SAYN (1891, pl. 3, fig. 2) who designated this specimen as the "type".

The densely ribbed shells of *M. diversecostatus*, probably highly variable in the details of their sculpture (see synonymy of *Holcodiscus diversecostatus* in AVRAM 1995a), are mostly documented by low-quality figures in the literature. An exception is the large specimen in COMPANY & al. (1995, fig. 8 c) or in VERMEULEN (2005, pl. 44, fig. 3). Taking into account all figures and the description by AVRAM (1995a), we conclude that the specimen from Butkov differs from the set of shells formerly referred to as *Holcodiscus diversecostatus* (now *Metahoplites diversecostatus*) in several features,

which precludes their placement in the same species. The contrasting features include lateral tubercles and the ornament on the ventral area of the newly described species.

DISTRIBUTION: The poorly understood related species, *M. diversecostatus*, has been reported from the Early Barremian over a relatively broad geographic area stretching from Crimea, to the east, to western Europe and northern Africa. According to COMPANY & al. (1995), *M. diversecostatus* occurs in Spain in the *Toxoceras moutonianum* (latest Early Barremian) to *Toxancyloceras vandenheckii* (early Late Barremian) ammonite zones. The specimen of *M. diversecostatus* figured by VERMEULEN (2005) comes from the *Kotetish vilia compressissima* Zone.

Metahoplites rakusi sp. nov.

(Pl. 1, Fig. 13; Pl. 2, Fig. 1, Text-fig. 8)

HOLOTYPE: Specimen SNM Z 24246, figured in Pl. 1, Fig. 13, and in Pl. 2, Fig. 1

DERIVATIO NOMINIS: Dedicated to the recently (2005) deceased Slovak significant geologist and palaeontologist RNDr. Miloš Rakús, CSc.

LOCUS TYPICUS: Butkov Quarry, Level 7, eastern end.

STRATUM TYPICUM: Lower Barremian, Lúčkovská Formation.

DIAGNOSIS: Shell semi-involute, with narrow venter. Ribs dense, sigmoidal, bifurcating somewhat above the umbilical edge. Bifurcation accompanied by weak tubercles. Rib pairs re-uniting at ventrolateral tubercles. Ventrolateral tubercles mutually interconnected by a pair of ribs.

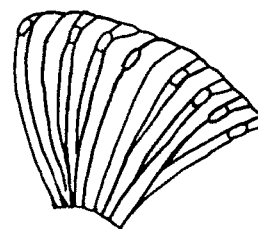


Fig. 8. A scheme of the sculpture of *Metahoplites rakusi*

MATERIAL: Two strongly deformed sculptured moulds (BK7V/61 = SNM Z 24246, BK7V/104 = SNM Z 24247).

DESCRIPTION: Shells semi-involute, with weakly arched flanks and a narrow venter. The shell bears relatively dense, sigmoidal ribs that mostly bifurcate well above the umbilical edge. Some ribs are somewhat stronger than others in the lower half of the flank. Ribs bear tubercles. These, presumably lateroumbilical ones, appear in the terminal part of the shell on the lower one-third of the whorl height, and thus higher than on the earlier part of the whorl. Also on the major ribs and some other ribs in the terminal part of the shell in the lower one-third of the whorl height. From every lateroumbilical tubercle arises a pair of ribs. They pass across the whorl-flank and usually join each other at the ventrolateral tubercle. A simple, continuous rib without a ventrolateral tubercle, but with a constriction indicated on its anterior side at the circumference, is occasionally present in the juvenile part of shell. Two, rarely three, ribs start at the ventrolateral tubercles, cross the venter and end at the opposite ventrolateral tubercles. When the ventral side of the last whorl first appears, ribs and tubercles? are of equal thickness. In the terminal part of shell some of them, but also ventrolateral tubercles, change and become stronger than the others. Pairs of ribs interconnecting these tubercles on the venter near the aperture are markedly stronger than in the juvenile part of the shell.

MEASUREMENTS: The large specimen (Z 24246) has a deformed diameter of around 25 mm. At this diameter, the ventral side of the terminal half-whorl bears 21 ventrolateral tubercles.

REMARKS: The determination is complicated by the incompleteness of the shells and their very strong deformation. The sculpture suggests a certain relationship to *M. diversecostatus* (COQUAND), much like to *M. misiki* sp. nov. The ribbing of the present species differs in the sigmoidal course of the ribs, in the almost regular fibulation of ribs on the flanks, and in the interconnection of the majority of ventrolateral tubercles by pairs of ribs.

Superfamily Desmoceratoidea ZITTEL, 1895
Family Barremitidae BRESKOVSKI, 1977

REMARKS: HOEDEMAEKER (1995, p. 244) proposed and justified the replacement of the subfamily Eodesmoceratinae WRIGHT, 1955 by the family Barremitidae BRESKOVSKI, 1977 (nom. transl. ex Barremitinae BRESKOVSKI, 1977). Apart from the new Treatise (WRIGHT & al. 1996), the family Barremitidae was recently accepted by VERMEULEN (2003, 2005).

Genus *Davidiceras* VERMEULEN, 2003

TYPE SPECIES: *Ammonites potieri* MATHERON, 1879.

Davidiceras cf. *potieri* (MATHERON, 1879)
(Pl. 2, Fig. 5)

1879. *Ammonites potieri* MATHERON; PH. MATHERON, pl. B-20, figs 6 a, b
?1966. *Pseudohaploceras incertum* (RIEDEL); S. BRESKOVSKI, pp. 96-97, pl. 8, fig. 7
2003a. *Davidiceras potieri* (MATHERON); J. VERMEULEN, pp. 94-97, pl. 2, fig. 1, pl. 3, fig. 1, pl. 5, figs 1-3

MATERIAL: A single, strongly deformed mould (BK7V/11 = SNM Z 24238).

DESCRIPTION: Shell semi-involute, originally with broad whorl section. Sculpture with prominent weakly sigmoidal major ribs, accompanied by a broad, shallow constriction along their anterior sides. Ten major ribs are present on the last whorl. Six to seven intermediate ribs are visible among the stronger major ribs on the last quarter of the shell on the ventral side of whorl only, some of them being probably bifurcated. Shell diameter in the elongation axis 57 mm.

REMARKS: The character of the Slovak specimen and its sculpture suggest its possible placement into three genera: *Pseudovaldedorsella* CECCA, FARAONI & MARINI, 1998, *Pseudohaploceras* HYATT, 1900 or *Davidiceras* VERMEULEN, 2003. Unambiguous generic and specific determination of the specimen is complicated by the strong deformation of all size parameters of the shell.

In the first mentioned genus, *Ps. inca* (FORBES) seems to be a close species. The synonymy of this species includes, according to BOGDANOVA &

HOEDEMAEKER (2004), also the specimen of *Pseudohaploceras incertum* (RIEDEL) reported from the Bulgarian Lower Barremian by BRESKOVSKI (1966), although referred to as *Valdedorsella inca* (FORBES). Typical representatives of *Ps. inca* differ from the described specimen in the lower number of somewhat differently shaped constrictions and in only weakly arched ribs on the ventral side.

In its higher number of constrictions compared to *Ps. inca*, the Slovak specimen is close to *Pseudohaploceras douvillei* (FALLOT). According to DELANOY (1992), however, the latter species bears a higher number of intermediary ribs (10–12) in the interval between two constrictions and comes from younger, Late Barremian deposits. It has to be also stated that DIMITROVA (1967) and DELANOY (1992) considered that the above-mentioned specimen of BRESKOVSKI (1966) belonged to *Ps. douvillei*. This is, however, contradicted by a somewhat more prominent sculpture, the higher number of inserted ribs and especially by the stratigraphic position of the last mentioned species.

The third, and the most probable, possibility is the placement of the Slovak specimen within the proximity of *Davidiceras potieri*. The synonymy of this species high probably also includes *Ps. incertum* in BRESKOVSKI (1966).

DISTRIBUTION: VERMEULEN (2003a) reported *D. potieri* from the boundary deposits between the *Kotetishvilia nicklesi* and *Nicklesia pulchella* zones.

Family Silesitidae HYATT, 1900
Genus *Patruliuseras* AVRAM, 1990

TYPE SPECIES: *Patruliuseras crenelatum* AVRAM, 1990.

Patruliuseras lateumbilicatum AVRAM, 1990
(Pl. 2, Fig. 6)

1990. *Patruliuseras lateumbilicatum* n. sp.; E. AVRAM, p. 76, text-fig. 2/13, pl. 1, fig. 4, pl. 2, figs 18, 19
1995b. *Patruliuseras lateumbilicatum* AVRAM; E. AVRAM, pl. 17, figs 14 a,b, 15 a,b

MATERIAL: A single weakly deformed steinkern with imperfectly preserved suture-lines (BK7V/42 = SNM Z 24237) and additional 4 incomplete shells.

DESCRIPTION: Shell semi-evolute, with relatively low, weakly arched whorls and a broad umbilicus. Shell smooth, with the exception of shallow, relatively straight constrictions, each accompanied by an indistinct rib. The ribs and constrictions are markedly inclined towards the aperture on the venter. There are seven constrictions on the last whorl and six on the penultimate whorl. Body chamber is approximately half a whorl.

MEASUREMENTS: Maximum preserved shell diameter is 52 mm. At this diameter, Wh = 17.7 (0.34), Uw = 20.0 (0.38). The body chamber starts at a diameter of ca. 33 mm.

REMARKS: The genus *Patruliuseras* was erected, above all, on the basis of a collection of juvenile shells. The herein described shell, with the at least partly preserved body chamber, exceeds 50 mm in diameter.

DISTRIBUTION: AVRAM (1990) reported this species from the *Kotetishvilia compressissima* Zone (Lower Barremian), Romania. However, the age of the type material of *P. lateumbilicatum* is not clear (personal communication of M. Company).

Superfamily Endemoceratoidea SCHINDEWOLF, 1966
Family Pulchelliidae DOUVILLÉ, 1890
Subfamily Psilotissotiinae VERMEULEN, 1995

REMARKS: In contrast with the Treatise (WRIGHT & al. 1996), VERMEULEN (1996, p. 62) placed pulchelliid ammonites in the superfamily Endemoceratoidea (or Endemocerataceae, in his paper erroneously designated as a new superfamily authored by Vermeulen), and not to the superfamily Pulchelliioidea DOUVILLÉ, 1890. For this purpose, he raised the family Endemoceratidae SCHINDEWOLF, 1966 to the rank of a superfamily. Only later did VERMEULEN (2003b) specify that the family Endemoceratidae SCHINDEWOLF, 1966, was erected on the basis of suture-line development by SCHINDEWOLF (1966), and that the erection of superfamily Endemoceratoidea was based on phyletic reasons. Besides the type family Endemoceratidae, this superfamily also includes the family Pulchelliidae. The family Pulchelliidae was further subdivided into three subfamilies by VERMEULEN (2003b).

Genus *Kotetishvilia* VERMEULEN, 1997

TYPE SPECIES: *Pulchellia changarnieri* SAYN, 1890.

Kotetishvilia compressissima (D'ORBIGNY, 1841)
(Pl. 3, Fig. 3)

1841. *Ammonites compressissimus*, D'ORB.; A. D'ORBIGNY, pp. 210-211, pl. 61, figs 4, 5
2003b. *Kotetishvilia compressissima* (D'ORBIGNY); J. VERMEULEN, pp. 123-126, pl. 2, figs 7, 8, pl. 20, figs 1-12, pl. 21, figs 1-11, pl. 22, figs 1-7 (cum syn.)

MATERIAL: A single strongly deformed, relatively complete mould (BK7V/107 = SNM Z 24251) and two fragments of smaller shells (BKV7/25 = SNM Z 24252, BK7V/67 = SNM Z 24253).

DESCRIPTION: Shell involute, with broad and flat ribs. The ribs start as simple ribs near the umbilicus and bifurcate near the venter. Unpaired inserted ribs are occasionally present between the paired ribs, but terminate at about half of the shell height. The venter of the larger specimen is weakly arched, and crossed by ribs without interruption. The inner side of the flanks of the last whorl are separated from the venter more distinctly than in the terminal part of the shell. The shell is deformed due to the compression; rather ellipsoidal than circular. The longest shell diameter, measured along the longer axis, reaches 50 mm diameter. About 24 ribs are present on the shell circumference. On one of the smaller specimens the venter is partially preserved: it is flat to slightly concave, and is clearly delimited from the flanks.

REMARKS: The venter of the specimen illustrated (Z 24251) is heavily effected by deformation. Its shape is reminiscent of *Nicklesia pulchella* (D'ORBIGNY, 1841). The venter of the undeformed, smaller whorl fragment (specimen Z 24253) shows features that are characteristic of *K. compressissima*.

DISTRIBUTION: Zone species *K. compressissima* occurs in the Early Barremian in the zone of the same name. VERMEULEN (2003b) stated that this species is known especially from France, Spain, Hungary and Romania.

Suborder Ancyloceratina WIEDMANN, 1966
Superfamily Ancyloceratoidea GILL, 1871
Family Ancyloceratidae GILL, 1871
Subfamily Ancyloceratinae GILL, 1871
Genus *Toxancyloceras* DELANOY, 2003

TYPE SPECIES: *Ancyloceras Vanden-heckii* ASTIER, 1851.

Toxancyloceras vandenheckii (ASTIER, 1851)
(Pl. 3, Fig. 6; Pl. 4, Fig. 1)

1851. *Ancyloceras Vanden-Heckii*; J.-E. ASTIER, pp. 451-452, pl. 16, fig. 11
1955. *Ancyloceras van den heckii* ASTIER; S. S. SARKAR, p. 136
?1995. "*Ancyloceras*" *vandenheckei* (ASTIER); F. CECCA & al., pl. 3, fig. 1
2003. *Toxancyloceras vandenheckii* (ASTIER); G. DELANOY, pp. 3-5, text-fig. 1 B, pl. 1, figs 1, 2, pl. 2, fig. 2, pl. 3, fig. 1, pl. 4, fig. 2 (cum syn.)

MATERIAL: A half-whorl of a steinkern belonging to an initial part of shell coiled in an open planar spiral with imperfectly preserved suture-lines, and a deformed fragment of a straight shaft, one half of which belongs to the end of the phragmocone and the other half to the body chamber (BK7V-ns = SNM Z 24254 a, b). The boundary between them is marked by a prominent sudden change in the shaft height on the circumference.

DESCRIPTION: Spiral part incomplete, loosely coiled, about 110 mm in diameter. Whorl height 11.2 mm at the beginning of the preserved whorl, terminal height 34 mm. The entire coiled part bears prominent trituberculate major ribs. The umbilical tubercles are weaker than the lateral tubercles, which are located at about two-thirds of the whorl height. The ventrolateral tubercles are clavate, and the most prominent. A narrow furrow is present in the siphuncular zone between corresponding pairs of ventrolateral tubercles. Simple, thin intercalatory ribs inserted between the major ribs cross the venter without interruption; there are most commonly one and occasionally two intercalatory ribs in each interval between the major ribs. In two intervals, the intercalatory ribs are missing. All ribs are weakly arched and retro-

verse. Short, thin, arched dense ribs are present on the dorsal side of the whorl, starting below the bases of the umbilical tubercles. Three to four short ribs are visible in the intervals between two major ribs, at least where these are perfectly preserved. The preserved half-whorl bears 15 major ribs.

The shaft, representing a transition between the phragmocone and the hooked body chamber shows a similar style of ribbing, with one thin intercalatory rib in each interval between the major ribs. The deformed whorl height is 48.3 mm at the end of the phragmocone.

REMARKS: The specimen from Butkov is close to the holotype of *T. vandenheckii* and to the material reported from France by DELANOY (2003). The latter author also provides a closer comparison with morphologically related species.

DISTRIBUTION: This zone species of the lower part of the Late Barremian has been reported from France, Spain, Italy and Colombia.

OCCURRENCE: The specimen was found in debris from the Lúčkovská Formation in the eastern part of Level 7 in the Butkov Quarry.

Genus *Toxoceras* D'ORBIGNY, 1842

TYPE SPECIES: *Toxoceras Requierianum* D'ORBIGNY, 1842.

Toxoceras nodosum (D'ORBIGNY, 1850)
(Pl. 3, Fig. 1; Pl. 4, Fig. 2)

1937. *Toxoceras nodosus* D'ORB.; J. COTTREAU, pp. 67-68, pl. 79, fig. 7

1991. *Moutoniceras nodosum* (D'ORBIGNY); G. DELANOY & al., pp. 230-233, pl. 1; pl. 2; pl. 3, figs 1, 2; text-figs 1, 2, 4-6 (cum syn.)

1995. *Moutoniceras nodosum* (D'ORBIGNY); M. COMPANY & al., p. 249, fig. 7 I

1999. *Toxoceras nodosum* (D'ORBIGNY); L. EBBO & G. DELANOY, p. 85

MATERIAL: A fragment of a spiral part of a compressed steinkern with poorly preserved suture-lines, belonging to a phragmocone (BK7V/109 =

SNM Z 24255) and a fragment of a crushed sculptured mould, probably belonging to a body chamber (BK7V/105 = SNM Z 24256). One side of the whorl, has only about the outer half preserved, albeit with the sculpture perfectly preserved; the opposite side, with the lower part of the whorl also visible, is only indistinctly preserved.

DESCRIPTION: Shell loosely coiled. Fragment of an arcuate phragmocone starting at whorl height of 22 mm and ending at 29 mm, bearing numerous simple ribs that are relatively thin, roughly equal, and arched concavely towards the aperture. The ribs disappear near the base of the whorl. Each rib bears a ventrolateral tubercle on its outer side. The ribs cross the venter without interruption, but with a slight depression in the siphuncular zone.

The body chamber fragment, about 80 mm in deformed height, shows only several prominent major and intercalatory ribs. All the ribs thin around the base of the whorl. The major ribs are broader, bearing prominent clavate ventrolateral tubercles and somewhat weaker conical lateral tubercles at about 2/3 of the whorl height. Three thinner intercalatory ribs are present in the interval between the major ribs: two of them are simple; the intermediate rib bears a ventrolateral tubercle that is slightly weaker than the equivalent tubercles on the major ribs. All ribs cross the venter without interruption.

REMARKS: The related species *T. moutonianum* (D'ORBIGNY) is more sparsely ribbed and lacks tubercles in the adult stage.

DISTRIBUTION: According to the data of COMPANY & al. (1995), *T. nodosum* in Spain first appears around the boundary between the *Nicklesia pulchella* and *Kotetishvilia compressissima* zones. Its last occurrence lies below the top of the latter zone. A specimen from the Barremian strato-type was found at the base of the *Kotetishvilia compressissima* Zone by VERMEULEN (2005).

Subfamily Helicancyliinae HYATT, 1894
Genus *Dissimilites* SARKAR, 1954

TYPE SPECIES: *Hamites dissimilis* D'ORBIGNY, 1842.

Dissimilites dissimilis (D'ORBIGNY, 1842)
(Pl. 3, Fig. 4)

1842. *Hamites dissimilis* D'ORB.; A. D'ORBIGNY, p. 529, pl. 130, figs 4-7
1883. *Crioceras dissimile* ORB.; V. UHLIG, pp. 269-270, pl. 25, figs 2-4
1955. *Dissimilites dissimilis* D'ORBIGNY; S.S. SARKAR, p. 137 (cum syn.)
2002. *Dissimilites dissimilis* (D'ORBIGNY); E. AVRAM, pl. 1, fig. 1, pl. 2, fig. 1

MATERIAL: A single incomplete, compressed specimen preserved in the form of a sculpture mould (BK7V/106 = SNM Z 24257).

DESCRIPTION: Shell incomplete, with two sub-parallel shafts and a bend (flexus). The first shaft (proversum) is preserved only as a short length bearing thick trituberculate major ribs, interspersed with one to two thinner inserted ribs starting at around the level of the umbilical tubercles in the case of a single rib or near the umbilical tubercles and around the lateral tubercles in the case of two ribs. Ribs arcuate, concave towards aperture, markedly inclined towards aperture on ventral side. Thin and dense ribs are present on the inner side of the proversum, with no distinct connection to the ribs on the shell flanks. Four such ribs are usually present in the intervals between the major ribs.

The lateral tubercles disappear quickly at the beginning of the bend (flexus). Mostly two ribs extend from the umbilical tubercles; three ribs or one rib was encountered in one case only. All ribs bear a weak ventrolateral tubercle. The ribs cross the venter without interruption but thin slightly, indicating a weak furrow between the ventrolateral tubercles.

The ribs straighten on the terminal shaft (retroversum). They are of equal thickness; one or two at a time extending from the umbilical tubercles. The ribs cross the venter without interruption or thinning, all show indications of weak ventrolateral tubercles only.

MEASUREMENTS: The preserved retroversum is over 50 mm in length. The incomplete proversum is only 21 mm in length. The shell height in the flexus is 11.4 mm, which gives 61.5 mm for the maximum length of the preserved shell.

REMARKS: *D. dissimilis* is somewhat variable in its morphology (see UHLIG 1883 or SARKAR 1955). The specimen from Butkov corresponds well to the holotype of D'ORBIGNY.

DISTRIBUTION: *D. dissimilis* has been reported from France, Spain, Romania, also Italy (personal communication of A. Lukeneder) and from the Silesian Unit of the Outer Western Carpathians. According to COMPANY & al. (1995), it occurs in Spain from the base of the ammonite *Kotetishvilia compressissima* Zone (Early Barremian) up to the whole of the *Toxancyloceras vandenheckii* Zone (early Late Barremian).

Family Ptychoceratidae GILL, 1871
Genus *Ptychoceras* D'ORBIGNY, 1842

TYPE SPECIES: *Ptychoceras emericianum* D'ORBIGNY, 1842.

Ptychoceras sp. juv.
(Pl. 3, Fig. 7)

MATERIAL: A single minute, incomplete shell preserved as a mould (BK7V/108 = SNM Z 24258).

DESCRIPTION: Shell small, hook-like, with shafts in mutual contact. First, juvenile shaft smooth, second shaft smooth at beginning but with a constriction near the shaft end bounded by distinct ribs on both sides. Another similar constriction is present in an even more adapertural position, after a short smooth interval. Here the posterior rib is stronger than the anterior rib.

MEASUREMENTS: The preserved length of the shell is 11 mm. Shell height ca. 2.5 mm at the flexus, around 4 mm near the mouth.

REMARKS: The sculpture preserved only on the end of the second shaft of the juvenile and incomplete shell from Butkov somewhat resembles that of the first (thinner) shaft of a larger shell figured by AVRAM (1995b, pl. 15, fig. 8) and designated as *Ptychoceras* sp. aff. *laevigatum* EGOIAN. The completely preserved type specimens of the latter species (EGOIAN 1969) represent somewhat larger shells.

Although the median shaft of the complete three-shafted shell (probably corresponding to the thinner shaft of AVRAM's specimen) bears occasional visible circumferential ribs, identification of AVRAM's or EGOIAN's material with the Slovak specimen seems to be impossible. Other similar shells of small size but devoid of any sculpture were reported, for example, by ROUCHADZÉ (1933) under the name *Ptychoceras minimum*. WIEDMANN (1962) considered *P. minimum* as a synonym of *P. laeve* MATHERON.

DISTRIBUTION: *Ptychoceras* is a genus with a wide stratigraphic range (Hauterivian to Albian). The occurrence of *P. sp. aff. laevigatum* in the Late Barremian was reported by AVRAM (1995). Small, smooth shells mentioned in section "Remarks" are characteristic of the Late Aptian.

Superfamily Douvilleiceratoidea PARONA & BONARELLI, 1897

Family Douvilleiceratidae PARONA & BONARELLI, 1897

REMARKS: Based on a loosely coiled initial whorl and suture-line differentiation, WIEDMANN (1966) placed the paraspticeratids among the cheloniceratids, hence in the family Douvilleiceratidae. In his subdivision of that family into subfamilies, WRIGHT (in WRIGHT & *al.* 1996), respecting the concept of WIEDMANN, incorporated the genus *Paraspticeras* into the subfamily Roloboceratinae CASEY, 1961 based on the whorl section. BUSNARDO & *al.* (2003), considering the time gap between the last occurrence of the paraspticeratids in the Barremian and the appearance of the first cheloniceratids in the Early Aptian, placed *Paraspticeras* with some doubt within the Boreal family Polyptychitidae WEDEKIND, 1918.

Genus *Paraspticeras* KILIAN, 1910

TYPE SPECIES: *Aspidoceras percevali* UHLIG, 1883.

Paraspticeras percevali (UHLIG, 1883)
(Pl. 4, Figs 3, 4)

1883. *Aspidoceras Percevali* n. sp.; V. UHLIG, pp. 238-239, pl. 26, figs 2, 3, pl. 27, fig. 2

2003. *Paraspticeras percevali* (UHLIG); R. BUSNARDO & *al.*, pp. 54-55, pl. 28, fig. 3 (cum syn.)

MATERIAL: A rather juvenile mould, laterally strongly deformed (BK7V/103 = SNM Z 24259), another, somewhat larger, compressed mould without preserved juvenile whorls (BKV7/8 = SNM Z 24260) belonging to a phragmocone, and a less intensively deformed subadult shell with the last whorl preserved (specimen BK7V/p = SNM Z 24261), all of which belongs to the phragmocone.

DESCRIPTION: Shells evolute, small to medium in size; broad whorl section altered by intensive deformation. Shells with rather prominent, relatively dense retroverse ribs. Most ribs are simple, straight, and cross the venter in a broad arch. The ribs on the inner whorls bear prominent lateral tubercles that serve as bases for rather broad spines reaching ca. 4 mm in length on the most strongly deformed shell. Two to three simple ribs are present between the ribs with tubercles. Two ribs usually extend from the lateral tubercles, as visible on last whorl. The last tubercle on the medium-sized shell occurs at a deformed shell diameter of 65 mm. Shorter inserted ribs are occasionally present on the terminal quarter of this shell, reaching approximately to the level of the tubercles. Two of these ribs that are somewhat stronger are possibly accompanied by a shallow constriction along their anterior sides. Tubercles on the largest shell are preserved up to a diameter of about 90 mm. The last tubercles are broader and blunter than those on the inner whorls; they are followed only by simple ribs devoid of tubercles. Some ribs occasionally bifurcated in lower 1/3 of whorl height.

MEASUREMENTS: The largest shell Z 24261 reaches a maximum diameter of 103 mm. At D = 86 mm (measured between principal axes of deformation), Wh = 38.0 (0.44) and Uw = 28 (0.325).

REMARKS: The dense ribbing of the shell and the 2-3 simple ribs on the inner whorls between tuberculate ribs distinguish *P. percevali* from other representatives of the genus. The largest shell bears lateral tubercles up to the diameter of 90 mm.

DISTRIBUTION: *P. percevali* has been reported from France, Morocco and Switzerland. The exact stratigraphic position of previous finds is

unknown. The stratigraphic range given in literature is latest Hauterivian to Early Barremian. The subadult specimens from Butkov come from the Early Barremian, from the *Kotetishvilia compressissima* Zone. The largest specimen was found in debris obviously derived from sediments several metres below the described main fossiliferous horizon.

DISCUSSION

The relatively rich collection of macrofossils ($n = 143$), which would certainly be richer in the number of individuals were it not for the limited source of material, includes several different faunal groups. It is dominated by ammonites (77%), the remaining 23% comprising other invertebrate groups. 17% of the latter consists of brachiopods, and the remaining 6% are individual finds of sponges, gastropods, bivalves, nautiloids, belemnites (guards of the genus *Mesoholites*) and minute calyxes of crinoids (see Text-fig. 9).

The genera and species determined are: *Lytoceras* sp. (smooth shells), *Eulytoceras anisoptychum* (UHLIG), *Phylloceras* sp. (smooth shells), *Phylloceras* (*Hypophylloceras*) ex gr. *thetys* (D'ORBIGNY), *Holcodiscus* aff. *decorus* AVRAM, *Parasaynoceras tzankovi* (AVRAM), *P. butkoviensis* sp. nov., *P. tenuicostatum* sp. nov., *Metahoplites* cf. *nicklesi* (KARAKASCH), *M. misiki* sp. nov., *M. rakusi* sp. nov., *Avramidiscus gastaldianus* (D'ORBIGNY), *Davidiceras* cf. *potieri* (MATHERON), *Barremites* ex gr. *tschuprenensis* DIMITROVA (Pl. 2, Fig. 7), *Patrulusiceras lateumbilicatum* AVRAM, *Kotetishvilia compressissima* (D'ORBIGNY), *Toxoceras nodosum* (D'ORBIGNY), *Dissimilites dissimilis* (D'ORBIGNY), *Ptychoceras* sp. juv., *Karsteniceras* sp. and *Paraspiitoceras percevali* (UHLIG).

The whole ammonite collection (111 specimens in total) is dominated by shells of barremitids (31%) – see Text-fig. 9. Some of them reach as much as 170 mm in diameter. Relatively smooth barremitids are accompanied by largely ribbed shells. Among the latter, heteromorph shells (24%), dominated by fragments of loosely coiled whorls of *Karsteniceras*, are relatively abundant. In contrast to mass accumulations of Early Barremian karsteniceratids in dark grey pelites at some localities in the Northern Calcareous Alps, which are associated with sedimentation in dysoxic conditions (LUKENEDER 2003, 2005), the numerous karsteniceratids at Butkov are found in sediments of normal oxic environments.

The holcodiscids (25%) constitute a similar proportion of the collection to the heteromorphs. The low proportion of lytoceratids and phylloceratids (only 2.7% each) is noteworthy. The remaining taxa are other representatives of the suborder Ammonitina, which are commonly represented by only one to two specimens. Among these, pulchellids are important for stratigraphy.

The diversity and species composition of the ammonites (20 species), the predominance of sculptured forms in the horizon studied, the higher proportion of benthic organisms, and also the presence of glauconite, indicate a shallower marine environment than in the lower portions of the Lúčkovská Formation. The mode of preservation of the macrofaunal remains, their chaotic to lumachelle-like accumulation, and the variable deformations of the shells suggest gravitational slumping of unconsolidated sediment to deeper parts of the basin. Primary fragmentation, particularly that of heteromorph shells, was further enhanced by this transport.

The use of literature data on the stratigraphic range of the ammonites in an attempt to date the

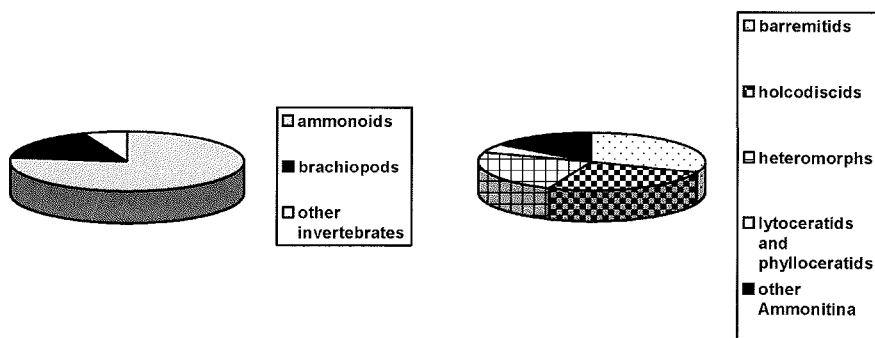


Fig. 9. Percentage composition of macrofauna and ammonoids spectrum in the fossiliferous horizon studied

fossiliferous deposits suggests that these sediments represent a single ammonite zone. The presence of the Early Barremian zonal index *Kotetishvilia compressissima* indicates the *Kotetishvilia compressissima* Zone (in the sense of the ammonite zonation adopted in Lyon – see HOEDEMAEKER & al. 2003).

This zonal assignment is also supported by the occurrence of *Dissimilites dissimilis*, *Toxoceras nodosum* and some holcodiscids. The other species present do not contradict this conclusion.

In terms of sequence stratigraphy (HOEDEMAEKER 2002 and later HOEDEMAEKER & WALDEMAR HERNGREEN 2003, resp. 2004), the fossiliferous deposits studied correspond to the depositional sequences BA1' and BA1". It is probable that the slumping of older deposited sediments to the basin occurred during the deposition of the lowstand system tract of depositional sequence BA1".

Rock debris derived from a level overlying the fossiliferous horizon yielded, besides abundant barremitids, also *Ancyloceras vandenheckii*. Based on the results of DELANOY (2003) and those of the "Kilian Group" meeting in Neuchatel (8th September 2005), the generic name of *A. vandenheckii* and also the existing name for the *Ancyloceras vandenheckii* Zone has been changed to *Toxancyloceras vandenheckii*. The position of the zone has been shifted somewhat upwards, to the Late Barremian, because the zonal index first appears above the Early/Late Barremian boundary. The *Holcodiscus uhligi* Zone was accepted as the basal zone of the Late Barremian (REBOULET & al. 2006). This zone is located between the *Coronites darsi* Zone (uppermost Early Barremian) and the overlying *Toxancyloceras vandenheckii* Zone.

Toxancyloceras vandenheckii is the youngest stratigraphically significant species of the Lúčkovská Formation. It documents that this formation passes from the Early Barremian to the Late Barremian. This zonal index species has not been previously reported from the Western Carpathians.

CONCLUSIONS

Limestone deposits of the Lúčkovská Formation exposed in the Butkov Quarry were found to contain a Lower Barremian fossiliferous horizon that is exceptional for the Western

Carpathians. It is rich not only in the number of fossils collected but also in its species diversity. More than three-quarters of all the specimens are ammonites. Among them, 16 genera were determined containing 21 species. Of these, 15 species are taxonomically described in more detail.

This ammonite assemblage, never previously described from the Western Carpathian deposits, included numerous species belonging to the family Holcodiscidae. Of the eight holcodiscid species identified, four are new: *Parasaynoceras tenuicostatum*, *P. butkoviensis*, *Metahoplites misiki* and *M. rakusi*. Some of them could be endemic species.

Heteromorph shells are almost as abundant as holcodiscids. They are most commonly represented by fragments of minute whorls of *Karsteniceras*.

Species of the genera *Toxoceras*, *Dissimilites* and *Ptychoceras* are rare. *Hamulina* and *Anahamulina* are not present at all. The proportion of phylloceratids and lycoceratids in the Butkov association is conspicuously low; these species are considered representatives of oceanic environments.

The biostratigraphically most significant species are *Kotetishvilia compressissima*, *Toxoceras nodosum* and *Dissimilites dissimilis*. This assemblage, consisting of Mediterranean ammonites only, can be attributed to the Early Barremian *Kotetishvilia compressissima* ammonite Zone.

The identification of the stratigraphic position of the faunal horizon enables the stratigraphic position of *Paraspiticeras percevali*, previously uncertain, to be inferred.

This study provided new taxonomic information on some poorly known or hitherto unknown Early Barremian species. In addition, new stratigraphic and palaeogeographic information was obtained on the ammonite distribution in the whole Mediterranean faunal province.

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PLATES 1-4

PLATE 1

- 1 – *Holcodiscus* aff. *decorus* AVRAM; SNM Z 24239, × 1.
2, 3 – *Parasaynoceras tzankovi* (AVRAM); 2 – SNM Z 24240, × 1; 3 – SNM Z 24241, × 2.
4, 5 – *Parasaynoceras butkoviensis* sp. nov.; SNM Z 24242. Holotype, 4 – lateral view, × 1; 5 – a view of ventral side, × 1.
6-8 – *Parasaynoceras tenuicostatum* sp. nov.; SNM Z 24243. Holotype, 6 – lateral view, × 1; 7 – lateral view, × 2; 8 – a view of ventral side, × 2.
9-12 – *Metahoplites misiki* sp. nov.; SNM Z 24245. Holotype, 9 – a view of ventral side, × 1, 10 – lateral view, × 1; 11 – lateral view, × 2; 12 – a view of ventral side, × 2.
13 – *Metahoplites rakusi* sp. nov. SNM Z 24246. Holotype, lateral view, × 1.

Photos taken by K. Mezihoráková, Ostrava; all specimens bleached with ammonium chloride. All shells figured or referred to in the text will be deposited in the Slovak National Museum in Bratislava under inventory numbers SNM Z 24237 – 24262

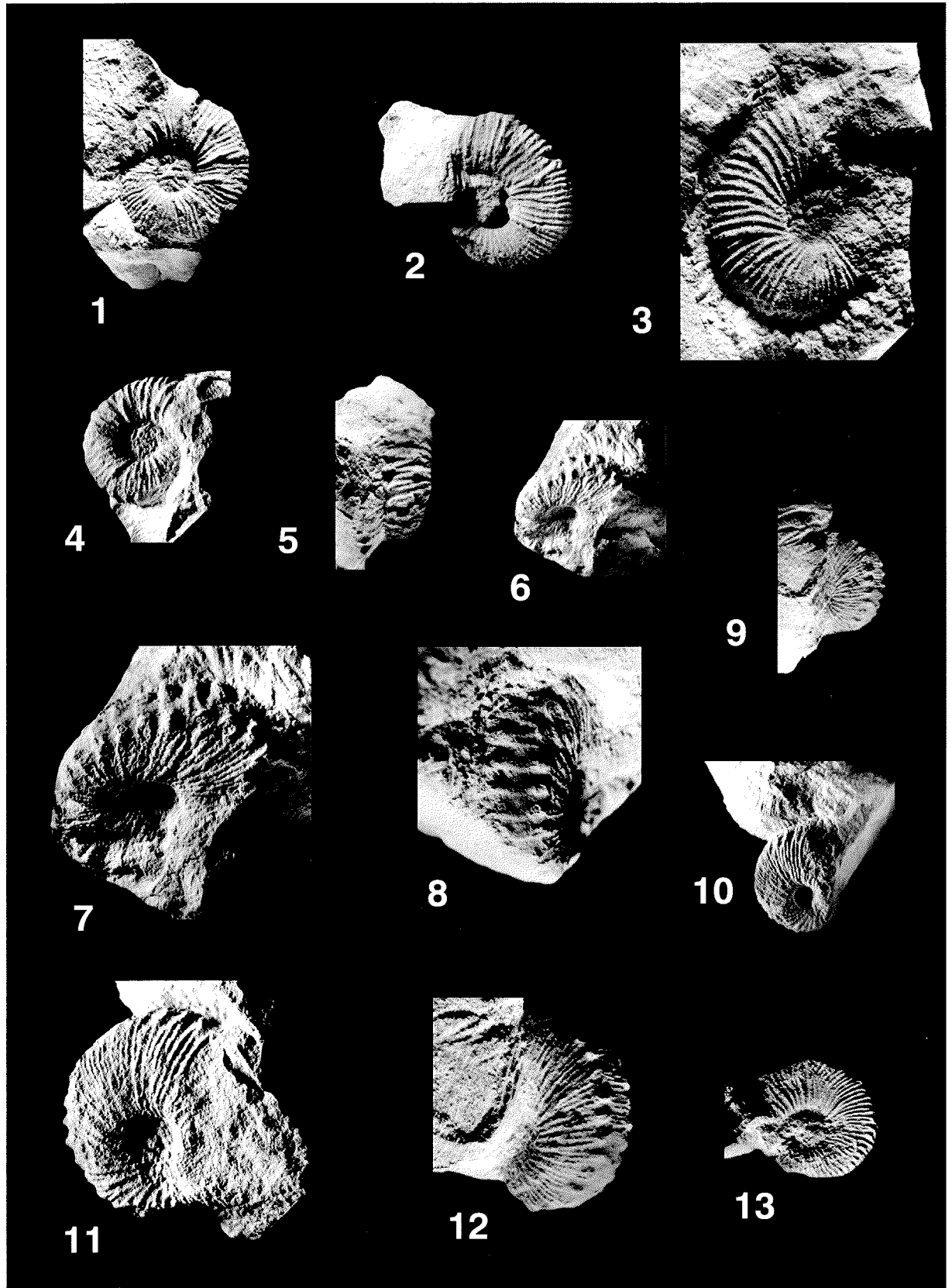


PLATE 2

- 1 – *Metahoplites rakusi* sp. nov.; SNM Z 24246. Holotype, lateral view, × 2.
2, 3 – *Metahoplites* cf. *nicklesi* (KARAKASCH); SNM Z 24244; 2 – × 1, 3 – × 2.
4 – *Avramidiscus gastaldianus* (D'ORBIGNY); SNM Z 24248, strongly deformed shell, × 1.
5 – *Davidiceras* cf. *potieri* (MATHERON); SNM Z 24238, × 1.
6 – *Patriliusiceras lateumbilicatum* AVRAM; SNM Z 24237, × 1.
7 – *Barremites* ex gr. *tschuprenensis* DIMITROVA; SNM Z 24262, × 1.

Photos taken by K. Mezihoráková, Ostrava; all specimens bleached with ammonium chloride. All shells figured or referred to in the text will be deposited in the Slovak National Museum in Bratislava under inventory numbers SNM Z 24237 – 24262

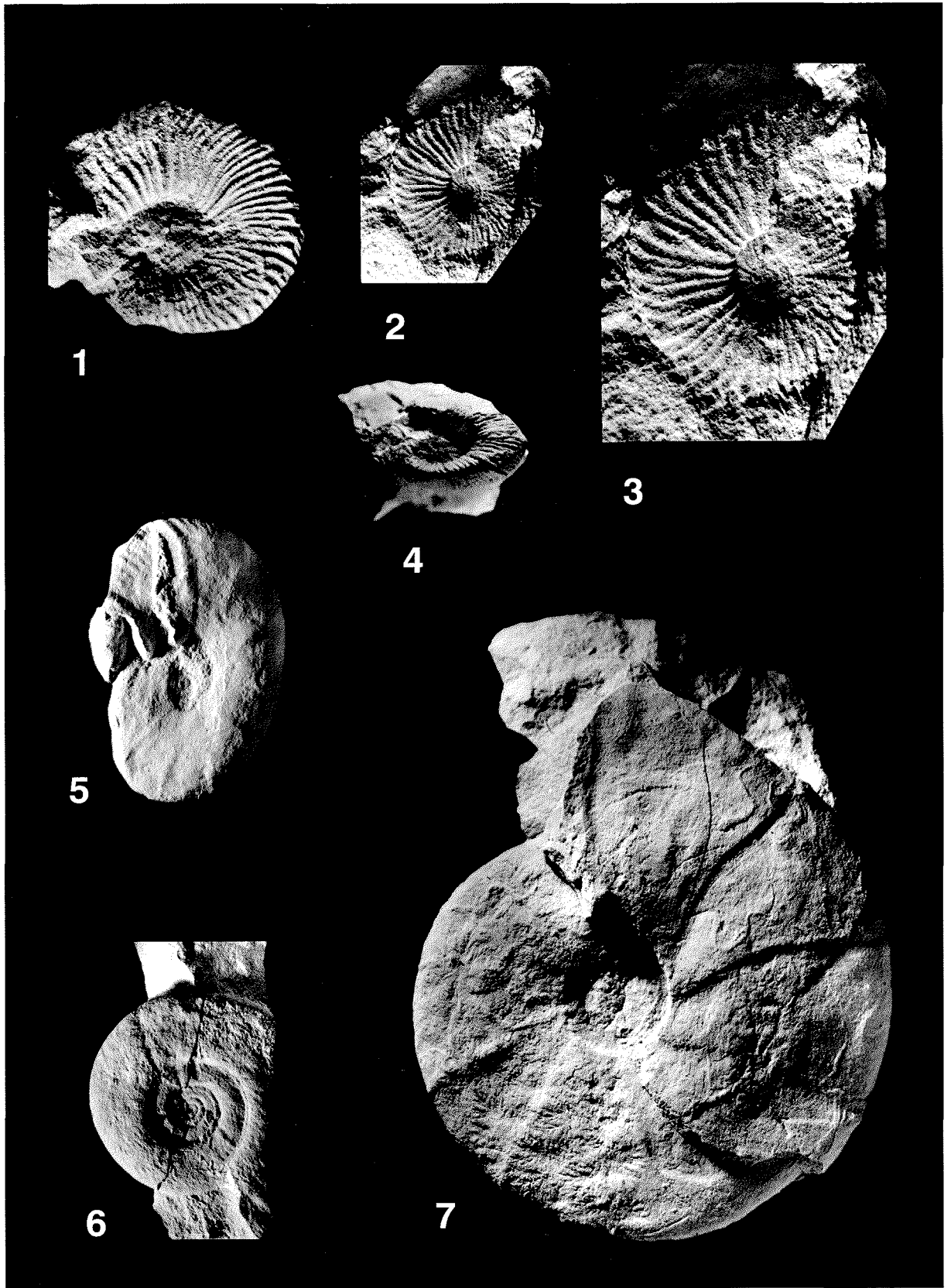


PLATE 3

- 1 – *Toxoceras nodosum* (D'ORBIGNY); SNM Z 24255, × 1.
- 2, 5 – *Avramidiscus gastaldianus* (D'ORBIGNY); SNM Z 24250, 2 - × 1; 5 - × 2.
- 3 – *Kotetishvilia compressissima* (D'ORBIGNY); SNM Z 24251, × 1.
- 4 – *Dissimilites dissimilis* (D'ORBIGNY); SNM Z 24257, × 1.
- 6 – *Toxancyloceras vandenheckii* (ASTIER); SNM Z 24254a, a fragment of the spiral part, × 1.
- 7 – *Ptychoceras* sp. juv.; SNM Z 24258, × 2.

Photos taken by K. Mezihoráková, Ostrava; all specimens bleached with ammonium chloride. All shells figured or referred to in the text will be deposited in the Slovak National Museum in Bratislava under inventory numbers SNM Z 24237 – 24262

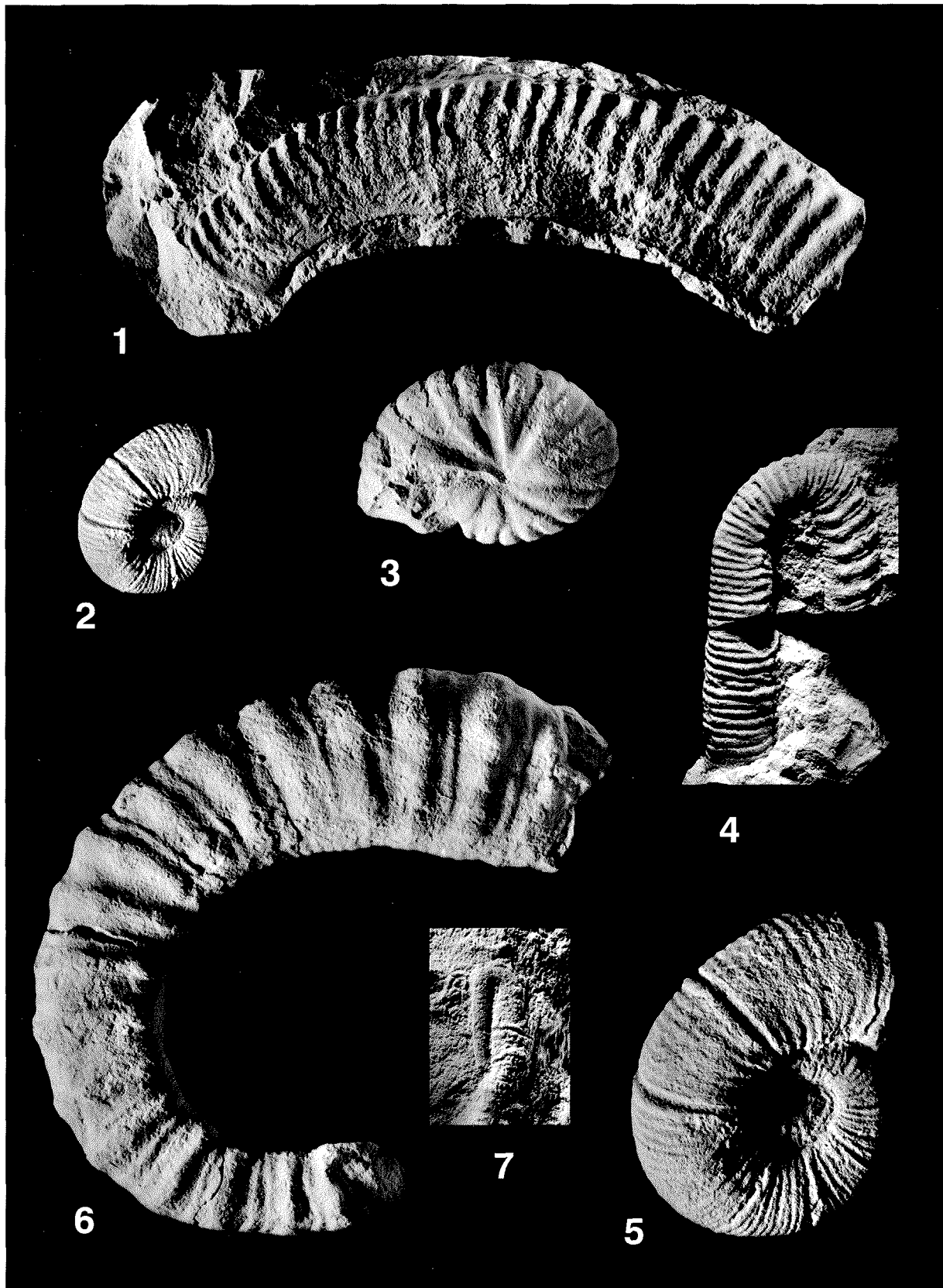


PLATE 4

- 1 – *Toxancyloceras vandenheckii* (ASTIER); SNM Z 24254b, a fragment of a straight shaft in the continuation of the spiral part figured on Pl. 3, Fig. 3, × 1.
2 – *Toxoceras nodosum* (D'ORBIGNY); SNM Z 24256, × 1.
3, 4 – *Paraspiticerias percevali* (UHLIG); 3 – SNM Z 24261; 4 – SNM Z 24260, × 1.

Paraspiticerias percevali (Pl. 4, Fig. 3) comes from debris under the fossiliferous interval, *Toxancyloceras vandenheckei* comes from debris above the described fossiliferous interval; all other specimens come from the described fossiliferous layer.

Photos taken by K. Mezihoráková, Ostrava; all specimens were bleached with ammonium chloride. All shells figured or referred to in the text will be deposited in the Slovak National Museum in Bratislava under inventory numbers SNM Z 24237 – 24262

