

Barremian and Early Aptian ammonites from the Godula Facies of the Silesian Unit in the Outer Western Carpathians, Czech Republic

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ABSTRACT:

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The Early Cretaceous ammonites from the Hradiště Formation (Wernsdorfer Schichten in original concept) in the Czech part of the Silesian Unit of the Outer (Flysch) Western Carpathians are described. This rich material, collected over more than 40 years, includes many usually fragmentarily preserved ammonites. The majority of specimens are preserved as “half-ammonoids”; a small portion of them have pyritized inner whorls with preserved suture lines. 15 species-level taxa are described, partly in open nomenclature. One species, *?Valdedorsella hoheneggeri*, is described as new; albeit its generic classification remains uncertain. The ammonites described span the late Early Barremian (*Niclesia pulchella* ammonite Zone) to basal Aptian (*Deshayesites ogranlensis* ammonite Zone).

Key words: Outer Western Carpathians, Silesian Unit, Lower Cretaceous, Ammonites, Biostratigraphy.

INTRODUCTION

The present paper reports on ammonites from the Lower Cretaceous of the Silesian Unit in the territory of the Czech Republic. Most of the material was collected in the years 1962-74, primarily from nineteenth century spoil heaps left during the extraction of low grade, nodular sedimentary iron ores (clay ironstones). Only exceptionally are any of these spoil heaps still accessible. The ammonites were yielded by dark-grey pelitic sediments of the Hradiště Formation (VAŠÍČEK 1971, 1972; VAŠÍČEK & *al.* 2004). The geographical location and geological setting of ammonite source localities is shown in Text-fig. 1; more details are to be found in VAŠÍČEK (1971, 1972, 1981a, 1990) and VAŠÍČEK & *al.* (2004).

Clay ironstone mining spoil heaps were left after the historical iron industry in the Podbeskydí area

(ROTH & MATĚJKA 1953). In the Czech Republic, the centres of the industry and mining were situated in the Oder River Basin (e.g. near Frýdlant n. O.); in Poland they were in the Vistula River Basin (near Ustron).

UHLIG (1883) was the first worker to monograph the cephalopods yielded by the associated rocks. However, he did not provide details of the locations of the mining sites but merely stated the name of the closest municipality. VAŠÍČEK (1971) plotted on base maps the spoil heaps with Lower Cretaceous ammonites in the Czech Republic and pinpointed the sites of mining at that time.

The material studied herein supplements significantly the knowledge of the overall composition and distribution of Barremian–Early Aptian ammonite faunas in the Silesian Unit of the Outer (Flysch) Western Carpathians and in the Tethyan Realm.

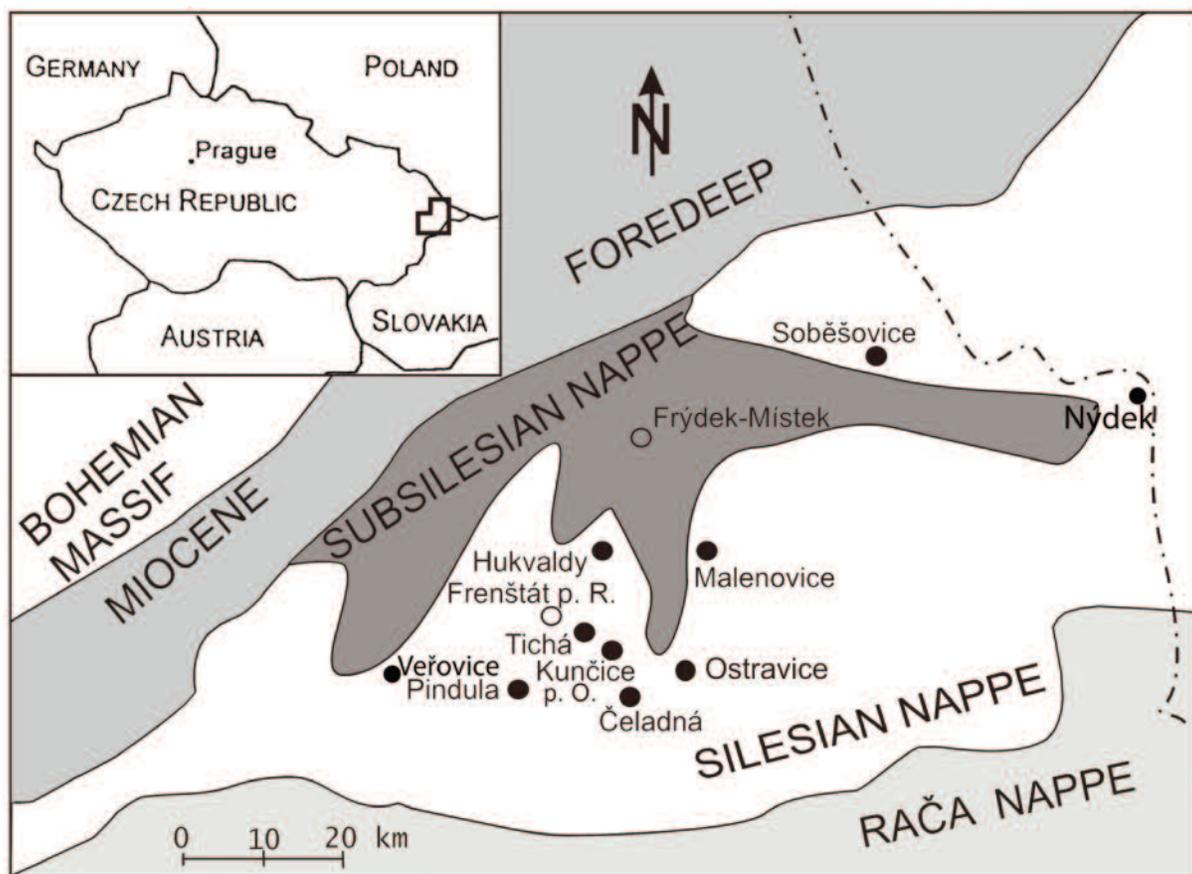


Fig. 1. Geographical and geological position of places of occurrence of Lower Cretaceous ammonites referred to in the text

PRESERVATION OF THE MATERIAL

The most characteristic feature of the majority of the ammonites from the dark grey, usually calcareous claystones of the upper Hradiště Formation (as defined by ELIÁŠ & *al.* 2003) is their half preservation with regard to the plane of symmetry. This is the “half-ammonite preservation” or the “half-ammonoids” of MAEDA & SEILACHER (1996, fig. 13). Half-ammonoids from the Beskydy Mts. have the original calcareous shells preserved only on the side immersed in the dysoxic sediment.

Because of the strong compaction of the clay sediment, up to as much as two-thirds of the original thickness, the majority of the buried shells were subsequently pressed into the surface of the bedding plane. In the course of this process, the shells were usually crushed (see e.g. figs 5 and 6 in VAŠIČEK 1972), which is why the original whorl width has not been preserved.

A small percentage of the spirally-coiled shells have the inner whorls partially pyritized. In contrast to other specimens, such shells have their suture lines partly preserved, mostly the juvenile sutures. The adult

suture may, however, also be observed by removing the original phragmocone shell.

The basic elements of the suture lines are designated herein by the usual symbols: E – external lobe, L – lateral lobe, U – umbilical lobe. Other dimensions (in mm) are as follows:

D – shell diameter, H – whorl height, U – umbilicus width. Also given are simple ratios: H/D – whorl height to shell diameter, U/D – and umbilicus width to shell diameter.

TAXONOMIC PART

The taxonomic classification applied herein follows that of the Treatise (WRIGHT & *al.* 1996) and of the Fossilium Catalogus (KLEIN 2005, VERMEULEN & KLEIN 2006). The exceptions are the pulchelliids, which, in accordance with VERMEULEN (1996) and VERMEULEN & KLEIN (2006), are referred to the superfamily Endemoceratoidea; and the Macroscaphitidae, which, in accordance with BUSNARDO (in FISCHER & GAUTHIER 2006), is placed within the superfamily Lytoceratoidea.

Order Ammonitida AGASSIZ, 1847
 Suborder Phylloceratina ARKELL, 1950
 Superfamily Phylloceratoidea ZITTEL, 1884
 Family Phylloceratidae ZITTEL, 1884
 Subfamily Phyllopachyceratinae COLLIGNON, 1937

Genus *Phyllopachyceras* SPATH, 1925

TYPE SPECIES: *Ammonites infundibulum* D'ORBIGNY, 1841.

Phyllopachyceras vergonsense DELANOY & JOLY,
 1995
 (Pl. 1, Fig. 1)

1995. *Phyllopachyceras vergonsense* nov. sp.; G. DELANOY
 & B. JOLY, pp. 132-133, pl. 2, figs 2, 3 a, b.

MATERIAL: Single specimen M5/193 = B13808, from spoil heap M5 near Malenovice. The final half of the shell comprises the body chamber, with a partly corroded ventral area.

DESCRIPTION: The shell is involute, with a very narrow umbilicus. The body chamber possesses strong main ribs beginning at the umbilicus. The ribs may bifurcate on the outer half of the flanks. One to two thinner ribs are inserted between the main ribs, approximately at the bifurcation points of the main ribs. Secondary ribs may also bifurcate.

REMARKS. The number of inserted ribs and the bifurcation of the ribs are characteristic features of the species, distinguishable even in poorly preserved specimens.

DISTRIBUTION: Besides the specimen studied, *P. vergonsense* is known from a single specimen from the *Gerhardtia sartousiana* ammonite Zone of the Late Barremian, in southeast France (DELANOY & JOLY (1995).

Suborder Lytoceratina HYATT, 1889
 Superfamily Lytoceratoidea NEUMAYR, 1875
 Family Macroscaphitidae HYATT, 1900

Genus *Macroscaphites* MEEK, 1876

TYPE SPECIES: *Scaphites Yvani* PUZOS, 1836.

The opinion of AVRAM (1976, 1978, 1984) (ac-

cepted in the new Treatise – WRIGHT & *al.* 1996) and of KAKABADZE (2004) that the genera *Costidiscus* UHLIG, 1882, and *Macroscaphites* MEEK, 1876, form a dimorphic pair, and that consequently the former is a synonym of the latter, is not followed herein (see also BUSNARDO in FISCHER & GAUTHIER 2006, p. 153).

The hook-like morphotypes of non-uniform size illustrated and referred to *Macroscaphites* can be divided into two basic morphological groups. The first includes shells with weak umbilical tubercles only or shells that do not bear any tubercles on the ribs. The second group contains shells with one or two rows of tubercles, including the ventrolateral ones, which never appear in the first group. The dominant species of the first group is *Macroscaphites yvani* (PUZOS); it reaches a size of about 100 mm, the diameter of the coiled part being about 45 mm, and it possesses constrictions (see e.g. UHLIG, 1883) [Uhlig's specimens of *M. yvani*, regarded by AVRAM (1984) as belonging to the species *M. perforatus*, have, in my opinion, nothing in common with the smaller shells of *M. perforatus* AVRAM, 1984].

Besides typical representatives of *M. yvani*, there occur similar, but markedly smaller, constricted forms, which are also usually referred to this species (DIMITROVA, 1967, pl. 11, fig. 5) or to a separate subspecies, *M. y. striatisulcatus* D'ORBIGNY (e.g. AVRAM, 1976, pl. 1, fig. 12). These smaller shells may represent microconchs of *M. yvani*, as already stated by KILIAN (1913).

Macroscaphites cf. abchasiensis M. KAKABADZE,
 2004
 (Pl. 1, Fig. 2)

2004. *Macroscaphites abchasiensis* M. KAKABADZE, sp. nov.;
 M. V. KAKABADZE, p. 362, pl. 1, fig. 3 (cum syn.).

2005. *Macroscaphites abchasiensis* KAKABADZE; M. V. KAKABADZE in E. V. KOTETISHVILI & *al.*, p. 292, pl. 47, fig. 2.

MATERIAL: Two incomplete shells, in which only a section of the coiled part with the transition into the shaft is preserved (K3/003 = B13809 and M1/267 = B13810). The size of the specimen illustrated is estimated to reach about 55 mm. The shells are from the spoil heaps of Malenovice (M1) and Kozlovice (K3) respectively.

DESCRIPTION: The shells are evolute, small. The sculpture is composed of simple ribs, somewhat stronger on the shaft than on the coiled part and arched convexly towards the aperture. Constrictions do not occur.

REMARKS: The incomplete specimens studied herein are very close in size and ribbing to the Georgian species. The only marked difference is a striking arcuation of the shaft in *M. abchasiensis*.

UHLIG (1883, p. 207) mentioned an interesting specimen from the locality of Veřovice, which reached a size of less than 51 mm. He stated that this specimen was either a dwarf *M. yvani* (typical representatives of which also occur here), an independent species, or an individual affected by a disease.

DISTRIBUTION: The Georgian specimens of *M. abchasiensis* are from the Lower Aptian (KAKABADZE 2004). The spoil heaps, from which the studied material comes, yielded Late Barremian and Early Aptian ammonites, including *M. yvani*.

Suborder Ammonitina HYATT, 1889
 Superfamily Desmoceratoidea ZITTEL, 1895
 Family Desmoceratidae ZITTEL, 1895
 Subfamily Puzosiinae SPATH, 1922

Genus *Melchiorites* SPATH, 1923

TYPE SPECIES: *Ammonites Melchioris* TIETZE, 1872.

Melchiorites blayaci (KILIAN, 1900)
 (Pl. 1, Figs 3, 4; Text-fig. 2)

1900. *Desmoceras Blayaci*; W. KILIAN in J. BLAYAC, p. 22.
 1972. *Melchiorites blayaci* (KILIAN in BLAYAC); Z. VAŠÍČEK,
 pp. 76-77, pl. 13, figs 4, 5, pl. 16, fig. 4 (cum syn.).

MATERIAL: 15 shells, laterally compressed (e.g. T9/56, T5/260, 314). In three specimens it was possible to expose the pyritic internal mould, with



Fig. 2. *Melchiorites blayaci* (KILIAN); B13812. The greater part of the outer suture line at H = 9.5 mm

partly preserved sutures (T5/60, T5/333 = B13811, T5/409 = B13812). All specimens are from the spoil heap T5 and the outcrop T9, near the municipality of Tichá.

DESCRIPTION: The shells are semi-involute, with slightly arched whorl flanks and a relatively wide umbilicus. The sculpture is variable. The outer shell surface bears slightly S-shaped main ribs with shallow constrictions on their posterior sides. The main inter-rib spaces bear growth lines (in juveniles) or thin ribs (in adults), which are sometimes well developed. Marked constrictions on external moulds correspond to the main ribs and their accompanying slight constrictions. The constrictions are quite abundant, 8 to 11 per whorl, and start already in juveniles, at a shell diameter about 10 mm.

SUTURE LINE: The most complete outer suture lines (B13812) are similar to those illustrated by UHLIG (1883) (Text-fig. 2). The suture lines are complex. The lateral lobe is deep, somewhat asymmetrically trifid. The subsequent lobe towards the line of coiling is also trifid. The next umbilical lobe does not have this character any more. Saddles are asymmetrically two-branched.

MEASUREMENTS: The shells are variable not only in sculpture but also in size. The measured values encompass, on the one hand, biological variability in the species and, on the other hand, the results of shell deformation. Biological variability is here heavily overprinted by post-mortem deformation. Besides forms with a whorl height greater than their umbilicus width (see e.g. VAŠÍČEK 1972, p. 77), there also occur shells in which the whorl height and the umbilicus width are approximately equal, as e.g. B13812, where at D = 36 mm, H = 13.0 (0.36) and U = 13.3 (0.37). The diameter of the largest preserved shells is about 45 mm.

REMARKS: The present description amplifies the characteristics of the species given by VAŠÍČEK (1972), which were based mostly on the holotype. The material studied revealed a considerable variability of *M. blayaci* in sculpture and measured parameters. Accordingly, in contrast to the synonymy in VAŠÍČEK (1972), it is possible to refer to *M. blayaci* some of the shells included by UHLIG (1883) in *Haploceras charrierianum*.

A species close to *M. blayaci* is *M. melchioris* (TIETZE, 1872), which is, however, usually preserved as internal moulds. The latter differs especially in the

shape of the constrictions, which are not S-shaped, and in their later appearance, at a diameter of about 25 mm. The two species differ also in their relative ages: *M. melchioris* is a Late Barremian species whereas *M. blayaci* is Early Barremian.

OCCURRENCE: So far the species is known exclusively from the Lower Barremian (*K. compressissima* Zone, based on the co-occurrence of *Kotetishvilia* cf. *compressissima* in the studied section) of the Silesian Unit.

Genus *Valdedorsella* BREISTROFFER, 1947

TYPE SPECIES: *Desmoceras akuschaense* ANTHULA, 1899.

?*Valdedorsella hoheneggeri* sp. nov.
(Pl. 1, Fig. 5)

1883 *Lytoceras* n. sp. aff. *Agassizianum* PICT. (?); V. UHLIG, pp. 200-201, pl. 14, fig. 8

TYPE: The holotype is the original of UHLIG (1883, pl. 14, fig. 8), referred by him to *Lytoceras* n. sp. aff. *Agassizianum*. It is deposited in the collections of the Bayerische Staatssammlung für Paläontologie und historische Geologie in Munich, under collection number AS III 93 (in the set "Belegmaterial Uhlig, 1883, Wernsdorfer Schichten").

STRATUM TYPICUM and LOCUS TYPICUS: ?Barremian, Hradiště Formation, Straconka locality, Poland.

DERIVATIO NOMINIS: In honour of the eminent Austrian geologist Ludwig HOHENEGGER, who first recognized the Silesian Unit succession of the Outer Western Carpathians and defined its basic lithostratigraphy. From his ammonite collection, studied subsequently by V. UHLIG, comes a single incomplete shell of the species described herein.

DIAGNOSIS: Shell evolute, with irregularly arranged S-shaped bulged ribs.

MATERIAL: A single semi-juvenile specimen, of which less than half is preserved as original shell. The area near the aperture is largely incomplete. The other half of its ultimate whorl is indicated only by its outer contour (spec. KZ2/65-52 = B13813). The specimen

comes from spoil heap KZ2 in the vicinity of Kozlovice.

DESCRIPTION: The specimen is evolute to semi-evolute, rather small, with continuously arched flanks on the ultimate whorl. On the oldest preserved part only fine and dense growth lines are present on the surface of the original shell. Irregularly arranged S-shaped bulged ribs with convex curvature toward the aperture appear close to them. On the posterior side the ribs are cut more clearly; a depression occurs behind them, to which an indistinctly limited constriction on the internal mould could correspond in some cases. The anterior side of the rib passes continuously into an intercostal space.

MEASUREMENTS: On the holotype, at the maximum shell diameter, H. IMMEL measured: D = 71 mm, H = 26.0 (0.37), U = 39.0 (0.39). On the imperfectly preserved specimen B13813, at D = 29.0 mm, H = 12.0 (0.41) and U = 10.3 (0.355).

REMARKS: Besides UHLIG's (1883) specimen, referred to *Lytoceras* n. sp. aff. *Agassizianum*, the specimen described herein represents the second find of the species. As the suture line, which is important for accurate genus- and family-level classification, is not known in either of the specimens, assignation of this species to the genus *Valdedorsella* is left in open nomenclature.

UHLIG (1883, p. 200) referred his specimen to the genus *Lytoceras* and, in open nomenclature, to the species *L. agassizianum* PICTET, 1847 or *L. ventrocinctum* QUENSTEDT, 1849. Based on the illustrations in PICTET & ROUX (1847, fig. 4), the former certainly appears to be morphologically close to the Silesian material. However, both *L. agassizianum* and *L. ventrocinctum* are, according to their authors, of Albian (Gault) age, and belong to the genus *Kossmatella* JACOB, 1907.

Neither the holotype nor the second specimen studied herein is well preserved. The umbilicus in the holotype is not clean, so the measurements were taken on the smaller specimens. The umbilicus width (U/D) of the smaller specimen indicates a semi-evolute than rather than an evolute shell, a feature which is also characteristic of the Albian *Kossmatella*, including PICTET's *K. agassiziana*. The latter are, however, clearly distinct stratigraphically from the Silesian specimens.

The S-shaped ribs resemble somewhat the ribbing pattern in *Silesites vulpes* (COQUAND in MATHERON, 1880). However, in contrast to silesitids, accentuated constrictions are missing in the newly described species.

DISTRIBUTION: UHLIG's (1883) specimen comes from the locality of Straconka, Poland. The specimen studied herein comes from the latest Barremian of spoil heap KZ2 in the vicinity of Kozlovice.

?Family Silesitidae HYATT, 1900

Genus *Haplobrancoceras* AVRAM, 1990

TYPE SPECIES: *Haplobrancoceras subquadratum* AVRAM, 1990.

Haplobrancoceras subquadratum AVRAM, 1990
(Pl. 1, Figs 6-8; Text-fig. 3)

1990. *Haplobrancoceras subquadratum* n. gen., n. sp.; E. AVRAM, pp. 29-31, pl. 1, figs 1-6, text-fig. 1 a, b.

1995. *Haplobrancoceras subquadratum* AVRAM; E. AVRAM, pl. 19, figs 8 a, b.

MATERIAL: Three specimens represented by original shells, the smallest of which (M5/046 = B13816) has the whorls filled with pyrite. After removing the original shell, several outer, incomplete suture lines were exposed. The remaining two shells (T1/81 = B13817 and the largest one T1/137 = B13818) are laterally compressed.

DESCRIPTION: The shells are semi-involute, with slightly arched whorl flanks and a narrow, flat outer side that is distinctly separated from the flanks. The umbilicus is relatively wide and, similarly to the outer side, separated from the flanks by a low and steep umbilical wall. The shell surface bears fine, S-shaped growth lines. At the termination of the largest shell (T1/137), remains of three blunt ribs are clearly seen on the flanks. Weak, periodical constrictions probably occur on the moulds.

MEASUREMENTS: The least deformed juvenile specimen B13816 has $H = 5.0$ (0.36) and $U = 5.4$ (0.37) at $D = 13.7$ mm. The largest specimen, with a



Fig. 3. *Haplobrancoceras subquadratum* AVRAM; B13816.
A substantial part of the outer suture line at $H = 4.2$ mm

strongly deformed body chamber, has $H = 10.7$ (0.36) and $U = 11.1$ (0.38) at $D = 29.5$ mm. Its maximum diameter affected by deformation reaches 34 mm. The body chamber begins at a shell diameter of 24 mm.

SUTURE LINE: The suture line in B13816, does not have preserved an external lobe and is imperfectly preserved on the outer flank. However, it is evident that the suture line is quite simply and faintly articulated (Text-fig. 3). The lateral lobe is simple, trifid, and the saddles are only slightly articulated. A similarly simple suture line is also preserved in the largest shell studied.

REMARKS: *H. subquadratum* is characterised by rather evolute coiling and relatively simple suture lines. The material from the Beskydy Mts. extends Avram's knowledge of the species, through preservation of the surface sculpture of the original shell and of the external morphology of the shell, in spite of being affected by strong deformation of the body chamber. Several ribs preserved on the termination of the largest specimen resemble secondary ribs of *Silesites vulpes* (COQUAND). From *H. subquadratum* the latter species differs, however, in better developed constrictions on the juvenile whorls as well as in the ribbing of the shell between them. The Beskydy Mts. specimens differ slightly from AVRAM's (1990) types in a narrower umbilicus; however, this may have resulted from secondary deformation of the Silesian shells.

Because of the relatively evolute coiling and, first of all, because of its simple suture line, AVRAM (1990) regarded *Haplobrancoceras* to be the oldest representative of the Late Cretaceous subfamily Brancoceratinae SPATH, 1934 (superfamily Acanthoceratoidea GROSSOUVRE, 1894). He (AVRAM 1990) derived his *Haplobrancoceras* from haploceratids (and this is included as the first half in its name), based on the form of the suture line in the umbilical area in *Neolissoceras* (formerly *Haploceras*) *grasianum* (see WIEDMANN, 1966, text-fig. 42). This interpretation is no longer supported by the present stratigraphical knowledge of both lineages. Namely, the last haploceratids (*N. subgrasianum*) disappeared in the latest Hauterivian (*Pseudothurmannia ohmi* Zone), whereas *H. subquadratum* did not appear before the late Early Barremian. The first true brancoceratids appeared with the beginning of the Albian. Any transitional representatives are not known. Consequently (M. Company, personal communication), *Haplobrancoceras* is not considered a representative of the superfamily Acanthoceratoidea. Based on the presence of constrictions in the juveniles and especially on the silesitid rib type, preserved in the largest shell of the material studied, I regard *Haplo-*

brancoceras to be a representative of the family Silesitidae (superfamily Desmoceratoidea), with a simplified suture line.

DISTRIBUTION: In Romania, according to AVRAM (1990), *H. subquadratum* occurs in the *K. compressissima* to *Barrancyloceras barremense* ammonite Zones of the late Early to early Late Barremian. The Beskydy specimens are from spoil heap T1 (late Early Barremian) and M5 (early Late Barremian).

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

Genus *Kotetishvilia* VERMEULEN, 1997

TYPE SPECIES: *Pulchellia changarnieri* SAYN, 1890.

Kotetishvilia cf. *compressissima* (D'ORBIGNY, 1841)
(Pl. 1, Figs 9, 10)

1841. *Ammonites compressissimus*, D'ORBIGNY; A. D'ORBIGNY, pp. 210-211, pl. 61, figs 4, 5.
2003. *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.
2006. *Kotetishvilia compressissima* (ORBIGNY); J. VERMEULEN & J. KLEIN, pp. 202-204 (cum syn.).

MATERIAL: A single external mould of a juvenile specimen (T9/77 = B13814), with the ventral region missing, from the T9 outcrop.

DESCRIPTION: The shell is involute, small. The umbilicus is very narrow, with flat flanks. Wide and flat ribs separated by narrow and deep intercostal furrows occur on more than a half of the ultimate whorl. The furrows disappear at about mid-height of the ultimate whorl. 11-12 ribs occur on a half whorl at the maximum shell diameter.

MEASUREMENTS: At the maximum diameter $D = 18$ mm, the whorl height is 10.3 mm ($H/D = 0.57$).

REMARKS: The morphology of the ventral region, which is very important for taxonomic determination, is not known. The presence of wide, flat ribs on the circumference of the shell, and the overall morphology of the specimen, suggest that it belongs to the genus *Kotetishvilia*. It most resembles the juvenile of *K.*

compressissima figured by VERMEULEN (2003, pl. 22, figs 1-3).

DISTRIBUTION: The species *K. compressissima*, the index of the eponymous zone, is known widely from the Lower Barremian of the Mediterranean area, mainly in France.

Kotetishvilia ex gr. *sauvageaui* (HERMITE, 1879)
(Pl. 1, Figs 11, 12)

2003. *Kotetishvilia sauvageaui* (HERMITE); J. VERMEULEN, pp. 133-136.
2003. *Kotetishvilia* sp. gr. *sauvageaui* (HERMITE); J. VERMEULEN, pl. 19, figs 11, 12, pl. 28, figs 5-7.
2006. *Kotetishvilia sauvageaui* (HERMITE); J. VERMEULEN & J. KLEIN, pp. 206-207 (cum syn.).

MATERIAL: A single specimen, preserved as an almost complete outer mould and part of its original shell, embracing a 45° sector of a single whorl (T3/106 = B13815), from spoil heap T3, where it occurs together with Late Barremian *Silesites seranonis*, *Eulytoceras phestum*, and other taxa.

DESCRIPTION: The shell is involute, small. On the circumference, part of the ventral area is preserved in the form of a narrow, smooth zone delimited by a conspicuous marginal edge against the sides. The shell surface bears growth lines, initially fine and dense, S-shaped, which strengthen somewhat in the final half near the circumference. As demonstrated by the original shell, it is evident that the strengthened ribs diverge slightly in the vicinity of the shell termination. The maximum shell diameter reaches about 21 mm.

REMARKS: The specimen is a juvenile with well preserved sculpture. Initially uniform fine growth lines strengthen later into stronger ribs near the circumference. The fine sculpture and the marginal edge that separates the whorl flanks from the outer side, and the fact that it is a juvenile, make its taxonomic interpretation uncertain. It is very similar to, and possibly conspecific with, either *Subpulchellia oehlerti* (NICKLÈS, 1894) or *Kotetishvilia savageaui*. The assignment to *K. ex gr. savageaui*, suggested herein, is based on stratigraphical grounds: the Beskydy Mts. specimen is dated as Late Barremian, and thus a determination as the Early Barremian *S. oehlerti* does not fit. The specimens illustrated by VERMEULEN (2003, pl. 19, figs 11, 12 and pl. 28, figs 5-7) as *Kotetishvilia* sp. gr. *sauvageaui* are very close to the the specimen described here.

DISTRIBUTION: According to VERMEULEN (2003), *K. sauvageaui* occurs in an interval near the Lower/Upper Barremian boundary, and is known from the *Coronites darsi*, *Holcodiscus uhligi* and *Toxancyloceras vandenheckii* ammonite Zones. The specimen studied comes from the Upper Barremian.

Suborder Ancyloceratina WIEDMANN, 1966
 Superfamily Ancyloceratoidea GILL, 1871
 Family Ancyloceratidae GILL, 1871
 Subfamily Ancyloceratinae GILL, 1871

Genus *Audouliceras* THOMEL, 1964

TYPE SPECIES: *Ancyloceras audouli* ASTIER, 1851.

?*Audouliceras* sp.
 (Pl. 2, Fig. 4)

?1955. *Jauberticeras* cf. *dubius* (forme no1); S. S. SARKAR, p. 99, pl. 4, fig. 10, pl. 8, fig. 2.

?1970. *Crioceratites* aff. *elegans* D'ORBIGNY; E. V. KOTETIŠVILI, pp. 69-70, pl. 5, fig. 3.

MATERIAL: A single, badly preserved and deformed whorl fragment (only the flanks are preserved) loosely coiled in a spiral (M1/012 = B13819), from spoil heap M1.

DESCRIPTION: The specimen is represented by approximately a quarter of a whorl, with a rapidly increasing, albeit strongly deformed whorl height. Strong, trituberculate main ribs occur on the whorl flanks. Their shape is heavily obscured by deformation, so that all the tubercles seem to fuse with each other. Almost straight secondary ribs occur between the main ribs. It cannot be excluded that some, otherwise simple ribs, bifurcate in the vicinity of the line of coiling (in one case they bifurcate on the flank). On the circumference, 5 to 6 secondary ribs occur in the intervals between the main ribs. The deformed maximum whorl height is about 27 mm.

REMARKS: The fragment is probably a part of a loosely coiled spiral followed by the hook of a large shell. According to the ribbing and literature data (above all in DELANOY 1992), it can be deduced that the fragment could belong to the genus *Audouliceras*. Among the most characteristic features of the specimen are the rapid growth in whorl height and the fact that the main ribs, between which a relatively high number of shorter secondary ribs can be found, are

equally strong. Similar fragments figured by DELANOY (1992) as *Audouliceras* sp. (forme 4) appear to be morphologically close. However, in these specimens the ribbing is poorly preserved and I have consequently excluded them from the synonymy.

DISTRIBUTION: According to KOTETIŠVILI (1970) and DELANOY (1992), *Audouliceras* (forme 4) occurs in the Late Barremian, probably in the *Imerites giraudi* Zone. In the study area ?*Audouliceras* sp. occurs within assemblages dated as Late Barremian to earliest Aptian.

Subfamily Helicancyliinae HYATT, 1894

Genus *Lytocrioceras* SPATH, 1924

TYPE SPECIES: *Ancyloceras jauberti* ASTIER, 1851.

Lytocrioceras cf. *jauberti* (ASTIER, 1851)
 (Pl. 2, Fig. 5)

1851. *Ancyloceras Jauberti*, ASTIER; J.-E. ASTIER, pp. 455-456, pl. 23, fig. 17.

1992. *Lytocrioceras jauberti* (ASTIER); G. DELANOY & A. POUPON, pp. 368-372, pl. 1, figs 1-3, pl. 2, figs 1-4, pl. 3, fig. 1.

1999. *Lytocrioceras jauberti* (ASTIER); L. EBBO & al., pp. 2-4, pl. 2, fig. 2, pl. 4, fig. 2, pl. 5, figs 1, 3, pl. 6, fig. 3 (cum syn.).

MATERIAL: Five fragments of strongly deformed adult hook-like parts represented by either original shells or their external moulds (M5/162, 165, 250, M1/317, M1/320 = B13820); in none of them has the juvenile spiral part been preserved. M1/320 = B13820 is the largest and most complete specimen. All are from spoil heaps M1 and M5.

DESCRIPTION: The largest fragment represents an about 10 cm long, negligibly arcuate, i.e. almost straight shaft passing into a hooked part (flexus). This passes into a short, probably incomplete shaft of the terminal part of the shell forming with the foregoing shaft an angle of about 40 degrees. The longer (first) shaft is covered with dense and thin, slightly S-shaped, proverse ribs. Sporadically, some of the ribs bifurcate somewhere at about shaft mid-height. Near and on the flexus the ribs are slightly convex towards the aperture. Ribs on the terminal shaft are straight. On the transition from the first shaft to the hook, a single rib occurs

that is markedly stronger than the others. The deformed shell height in the flexus axis is 16.5 mm.

REMARKS: The sculpture, size and overall shape of the hook-like fragments are closest to those of *Lytocrioceras jauberti*. However, in contrast to the Early Barremian age of the type material of this species, the fragments described herein are of Late Barremian age. Although no apparent morphological differences can be identified, I designate the Silesian specimens on stratigraphical grounds only as *L. cf. jauberti*.

DISTRIBUTION: According to EBBO & al. (1999), the type material of *L. jauberti* comes from the Lower Barremian (*Kotetishvilia nicklesi* Zone) of southeast France. The specimens studied herein come from assemblages dated as *Toxancyloceras vandenheckii* to *Imerites giraudi* ammonite Zones of the Late Barremian (spoil heap M5) and as Late Barremian to earliest Aptian (spoil heap M1).

Family Heteroceratidae SPATH, 1922

Genus *Heteroceras* D'ORBIGNY, 1850

TYPE SPECIES: *Turrilites Emericianus* D'ORBIGNY, 1842.

Heteroceras aff. *coulleti* DELANOY, 1994
(Pl. 2, Fig. 2)

1994. *Heteroceras coulleti* sp. nov.; G. DELANOY, p. 547, text-fig. 2.

1998. *Heteroceras coulleti* DELANOY; G. DELANOY, pp. 44-51, pl. 10, figs. 1-4, pl. 11, figs. 1-5, pl. 12, figs. 3, 4, 6, pl. 13, figs. 1, 2, pl. 14, figs. 1-3, pl. 40, fig. 2, pl. 48, fig. ?1, 3 (cum syn.).

MATERIAL: A single fragment of a straight to slightly arcuate shaft (KZ2/65-15 = B13821) from spoil heap KZ2.

DESCRIPTION: The shaft has strong, relatively sparsely arranged, slightly arcuate simple ribs. The shaft height is 19 mm.

REMARKS: In spite of its fragmentary preservation, it is possible to assume that the shaft fragment with its strong ribs, which follows the trochospiral juvenile part, belongs to the group of *H. coulleti* (compare with the synonymy).

DISTRIBUTION: According to DELANOY (1998), *H. coulleti* is known only from the Upper Barremian of southeast France, namely from the uppermost part of the *Hemihoplites feraudianus* Zone and the lower part of the *Imerites giraudi* Zone. The specimen is from the Upper Barremian of the area of Kozlovica-Žáry.

?*Heteroceras* ex gr. *emerici* (D'ORBIGNY, 1842)
(Pl. 2, Fig. 1)

1842 *Turrilites Emericianus* D'ORBIGNY, pp. 580-582, pl. 141, figs 3-6

1998 *Heteroceras emerici* D'ORBIGNY; G. DELANOY, pp. 51-78 (cum syn.)

MATERIAL: A single strongly deformed shaft fragment (M5/375 = B13822) from spoil heap M5 near Malenovice.

DESCRIPTION: The shaft is slightly arcuate, with a small increase in height. The fragment bears medium-strong, rather dense ribs of uniform type. They are slightly prorsiradiate, straight to finely S-shaped. The fragment is about 100 mm long and 52.5 mm high.

REMARKS: In its overall morphology and, among other features, slight arcuation of the shaft, the Silesian specimen resembles *H. emerici*, especially specimens designated by DELANOY (1998) to as *H. emerici* morphé *tardieui*. The fragmentary preservation of the specimen does not allow an unequivocal determination (see DELANOY 1998 for detailed discussion on the concept and variability of *H. emerici*).

Similar fragments of arcuate shafts were referred by NIKOLOV (1964) to *Anahamulina silesiaca* (UHLIG) (his pl. 4, fig. 4) and *A. picteti* (EICHWALD) (his pl. 4, fig. 5; pl. 5, fig. 3; see also DIMITROVA, 1967, pl. 40, figs. 3, 4). All these specimens may be conspecific with the Silesian form.

DISTRIBUTION: Unequivocal reports of *H. emerici* are known only from France and Georgia. According to DELANOY (1998), it occurs in the Late Barremian *Imerites giraudi* Zone.

?*Heteroceras* sp.
(Pl. 2, Fig. 3)

1972. *Ptychoceras morloti* OOSTER; Z. VAŠÍČEK, pp. 65-66, pl. 10, figs. 4, 5.

?1933. *Heteroceras vermiforme* n. sp.; I. ROUCHADZÉ, p. 233, pl. 13, fig. 5.

?1938. *Ptychoceras* sp. ind.; I. M. RUCHADZE, p. 163, pl. 1, fig. 5.

?1998. *Heteroceras baylei* REYNES; G. DELANOY, pp. 95-99, pl. 16, fig. 3, pl. 50, fig. 3.

MATERIAL: Three incomplete shelly specimens, in which the most juvenile parts are missing (Ce3/12 = B13823; KN10/2, 34). They come from small outcrops in the Bílý potok stream near Čeladná (Ce3) and from Kunčice p. O. (KN10). The finds of VAŠÍČEK (1972) are from the old spoil heaps K5 and V5 near Kozlovice and Veřovice respectively.

DESCRIPTION: The specimens are relatively small, characterized by hook-like shells with straight shafts in contact. The first shaft (proversum) bears simple proversal oblique ribs; the terminal shaft (retroversum) bears simple, sparser retroversal ribs. The flexus that connects the shafts is covered with ribs that bifurcate at the base or, at the termination of the flexus, somewhat higher. The shell illustrated has a length of 36 mm; the flexus height is about 8 mm.

REMARKS: The specimen described as *Ptychoceras morloti* by VAŠÍČEK (1972) is very similar to the ones described herein. Also very similar is OOSTER's specimen of *P. morloti* (OOSTER, 1860), which, however, is far larger. *P. morloti*, which has never been found complete, has three shafts. The specimens from the Beskydy Mts. would thus represent the first and the second shaft of this species.

In size, shape and sculpture, the small specimens from the Beskydy Mts. resemble some shells designated by DELANOY (1998) as *H. baylei*; only shells with shafts in contact with each other are included into the synonymy. The most complete specimen of DELANOY (illustrated in his pl. 50, fig. 3) has an initial turrilitic juvenile stage. However, no such juvenile stage has been found preserved in the material from the Beskydy Mts.

In the size and sculpture of the first shaft (proversum), *H. vermiforme* ROUCHADZÉ also appears to be close. It has the helically-coiled beginning of the shell, but the second shaft (retroversum) has not been preserved. Thus, it is not known if both shafts are in contact or form an open flexus. *Ptychoceras* sp. ind. (in RUCHADZE 1938) is similar in both size and sculpture of both shafts; however, the juvenile part of the shell is not preserved.

Because the juvenile part of the specimens from the Beskydy Mts. is not known, their generic classification

remains problematic. Nevertheless, I believe that my material does not belong to the genus *Ptychoceras* but represents instead a small form of the genus *Heteroceras*. It probably represents a new species but, in the absence of the juvenile part, it must remain in open nomenclature as ?*Heteroceras* sp.

DISTRIBUTION: The type of *Ptychoceras morloti* comes from the Veveysse section, spanning the uppermost Valanginian to the lowermost Barremian (BUSNARDO & al. 2003). No ammonites of Late Barremian age are known from this locality. French specimens of *Heteroceras baylei* come from the Late Barremian *Imerites giraudi* ammonite Zone (DELANOY 1998). ROUCHADZÉ (1933) gave an Early Aptian age for *H. vermiforme* but, from the data of KAKABADZE (1989, p. 556), its age can be inferred to be approximately latest Barremian. The Silesian material is dated as Late Barremian.

Family Hemihoplitidae SPATH, 1924

Genus *Pachyhemihoplites* DELANOY, 1992

TYPE SPECIES: *Pachyhemihoplites thomeli* DELANOY, 1992.

Pachyhemihoplites sp. (Pl. 3, Fig. 2)

?1992 *Pachyhemihoplites contei* sp. nov.; G. DELANOY, pp. 105-107, pl. 9, figs. 2 – 5, 7

?2002 *Spinocrioceras* sp.; Z. VAŠÍČEK & P. SKUPIEN, p. 69, pl. 2, fig. 2

MATERIAL: A single incomplete and deformed original shell with part of the penultimate and ultimate whorls preserved (M5/105 = B13824). Both this specimen and the specimen referred to *Spinocrioceras* sp. in VAŠÍČEK & SKUPIEN (2002), come from spoil heap M5 near Malenovice.

DESCRIPTION: The shell is evolute, small (maximum diameter about 50 mm). The whorl section is unknown. On the penultimate whorl, trituberculate main ribs alternate with one to two secondary ribs. The main ribs of this whorl are remarkable in that a narrow furrow occurs in their axes between the umbilical and lateral tubercles, giving the the impression of the eye of a needle (fibulation). In a single case, a shorter inserted rib starts at the level of the umbilical tubercle. The other inserted ribs begin already on the line of coiling.

On the ultimate whorl, the main trituberculate ribs alternate with one or, exceptionally, two simple inserted (secondary) ribs. Both the umbilical tubercles, which lie rather high above the line of coiling, and the lateral tubercles, which lie close to the ventrolateral tubercles, are conical. The ventrolateral tubercles are clavate. The secondary ribs usually lack umbilical tubercles. Ventrolateral tubercles are usually indicated on them; in one case a lateral tubercle is developed.

REMARKS: The imperfect preservation and the unknown whorl section make both species and generic determination difficult. With regard to the characteristic arrangement of the tubercles on the main ribs (the lower row may be designated as periumbilical tubercles, the lateral tubercles are well separated from the lower ones, and the ventrolateral tubercles are clavate), *Pachyhemihoplites* is the most appropriate genus. The Silesian specimen appears to be close, but not identical, to *P. contei* DELANOY. A similar tubercle spacing can also be observed in the phragmocone that was figured by VAŠÍČEK & SKUPIEN (2002, pl. 2, fig. 2) and designated as *Spinocrioceras* sp. However, in this specimen periumbilical tubercles are also indicated on the usually bituberculate secondary ribs.

DISTRIBUTION: Representatives of *Pachyhemihoplites* were known so far only from southeast France (DELANOY 1992), from the upper *Barrancyloceras barremense* Zone (= *Toxancyloceras vandenheckii* and *Gerhardtia sartousiana* Zones) of the Late Barremian (actually *Pachyhemihoplites* is mostly characteristic of the latter Zone - VERMEULEN 2003). The Silesian specimen comes from an assemblage dated roughly as *Toxancyloceras vandenheckii* to *Imerites giraudi* ammonite zones of the Late Barremian.

Family Hamulinidae GILL, 1871

Genus *Dueyina* VERMEULEN, 2005

TYPE SPECIES: *Anahamulina glemmbachensis* IMMEL, 1987.

Dueyina aff. *glembachensis* (IMMEL, 1987)
(Pl. 3, Fig. 1)

1987. *Anahamulina glemmbachensis* n. sp.; H. IMMEL, pp. 124-125, pl. 14, fig. 1.

2005a. *Dueyina glemmbachensis* (IMMEL); J. VERMEULEN, p. 164.

MATERIAL: A single incomplete shelly specimen with a corroded and, on the internal side, unpreserved part of the proversum (spec. K7/3 = B123825), from a Barremian ammonite assemblage collected from spoil heap K7, between the municipalities of Kozlovice and Tichá.

DESCRIPTION: The specimen possesses two shafts in contact. Both the proversum and the retroversum bear wide and blunt simple ribs. Ribs on the proversum are oblique, those on the retroversum subhorizontal. On the retroversum the ribs are rather sparsely arranged. The flexus is covered with different, i.e. thinner ribs, some of which bifurcate at the base of the flexus. Others are shorter, split or inserted on the outer half of the flexus. The shaft height in the flexus reaches 12 mm. The distance between the preserved beginning of the proversum and the circumference of the flexus is 60 mm.

REMARKS: The specimen from the Beskydy Mts. is very close to the holotype of IMMEL (1987) in dimensions, close distance between both shafts, and in sculpture. IMMEL's species *glembachensis* differs, however, in having oblique ribs on the holotype retroversum; the ribs in the Beskydy Mts. specimens are subhorizontal. A close species is *Dueyina boutini* (MATHERON, 1880), from which the described specimen differs in having the shafts in contact and in having bifurcated or inserted ribs in the area of the flexus. *D. boutini* also resembles *Dueyina kleini* VERMEULEN, 2005.

DISTRIBUTION: IMMEL (1987) reported the species from the Upper Barremian of the Northern Calcareous Alps; VERMEULEN (2005 a, p. 162) from the uppermost part of *Subsaynella sayni* Subzone and the *Gerhardtia sartousiana* Zone states of the Late Barremian of France; and VERMEULEN (2005 b) from only the Late Barremian *Toxancyloceras vandenheckii* Zone.

Superfamily Deshayesitoidea STOYANOW, 1949
Family Deshayesitidae STOYANOW, 1949

Genus *Paradeshayesites* KEMPER, 1967

TYPE SPECIES: *Hoplites laevisculus* von KOENEN, 1902.

Paradeshayesites semenovi (BOGDANOVA, 1999)
(Pl. 3, Fig. 3)

1999. *Deshayesites semenovi* BOGDANOVA, sp. nov.; T. N. BOGDANOVA, p. 47-49, pl. 1, figs 1-3.

MATERIAL: A single strongly deformed shelly specimen (Os/1 = B13826) from an outcrop of the upper Hradiště Formation on the left bank of the Ostravice River besides the sports field in the municipality of Ostravice.

DESCRIPTION: The shell is semi-involute, large, with high whorls and a relatively narrow umbilicus. The umbilical wall is low and steep, and passes continuously into the flanks of the ultimate whorl. The strong, slightly S-shaped ribs pass across the outer side without interruption and weakening. The ribs begin in concavely arched bulges on the umbilical wall on the line of coiling. The majority of ribs are simple, bifurcating rarely at about whorl mid-height. Between the simple ribs traversing the whole whorl, single ribs are inserted, beginning at about whorl mid-height.

MEASUREMENTS: The maximum shell diameter in the axis of elongation reaches 125 mm. At a shell diameter of 123.5 mm (measured between the major axes of deformation), H = 54 mm (0.44) and U = 29 (0.235). At this diameter, there are 29 ribs at the umbilicus and 65 ribs at the the circumference per whorl.

REMARKS: The narrow umbilicus and character of the ribbing make the specimen very similar to *Paradeshayesites weissi* (NEUMAYR & UHLIG, 1881). However, on the basis of the rare rib bifurcation, the higher position of the inserted ribs and the rib density, it is referred to *Paradeshayesites semenovi*.

DISTRIBUTION: Besides the studied specimen, from the *Deshayesites ogranlensis* ammonite Zone [dating based on the co-occurring *Paradeshayesites weissi-formis* (BOGDANOVA, 1983)] the species *P. semenovi* is known from the Lower Aptian of Mangyshlak.

DISCUSSION

The incompleteness and bad preservation of the material studied make final determination of several taxa impossible. There were considerable problems with the ancyloceratids, in which the juvenile parts were usually not preserved. Similarly, the turriliticone juvenile whorls are missing in the case of the heteroceratids (the only exception is represented by a fragment referred to as *?Heteroceras* sp. juv. by VAŠÍČEK & SKUPIEN 2002, pl. 1, fig. 3), which makes their generic classification uncertain.

Very interesting but also highly problematic is the form described herein as *Pachyhemihoplites* sp. This genus which, for unknown reasons, was not included

in the new Treatise (WRIGHT & al. 1996), is characterised by arched whorls. The laterally strongly compressed Silesian specimen bears several ribs with so-called fibulation (“needle eye”) on the penultimate whorl, a feature so far unknown in representatives of this genus.

Of significance among the ammonites from the Beskydy Mts. is the genus *Kotetishvilia*, and especially *K. compressissima*. A juvenile specimen, determined in this work as *K. ex gr. sauvageaui*, resembles in its sculpture *Subpulchellia oehlerti* (NICKLES). Another specimen from the Beskydy Mts., determined earlier as *Psilotissotia* aff. *chalmasi* by VAŠÍČEK (1972, p. 83, pl. 14, fig. 6), also probably belongs to *S. oehlerti*.

Pulchelliids occur in the Silesian Lower Cretaceous only sporadically, but several species have been recorded. According to the survey of VERMEULEN (2003) and others, in addition to the above-presented species, the Silesian Unit also yielded *Kotetishvilia brevicostata* (KOTETISHVILI, 1980) [= *Psilotissotia* sp. ind. in VAŠÍČEK 1972, pl. 14, fig. 5], *Nicklesia pulchella* (D’ORBIGNY, 1841) [from VAŠÍČEK 1979, pl. 1, fig. 5; and probably *Pulchellia Karsteni* of UHLIG, 1883, pl. 20, fig. 1], and possibly also *Gerhardtia provincialis* (D’ORBIGNY) [most probably *Pulchellia lindigi* KARSTEN in UHLIG 1883, pl. 20, fig. 6].

Besides the forms described herein and those reported by VAŠÍČEK (1972), there are several additional problematic fragments in my collection which extend the taxonomic composition of the Early Cretaceous ammonite assemblage of the Beskydy Mts. Among these is *Rugacrioceras martinsi* (REYNES), which is probably the correct name for the fragmentary specimen illustrated by VAŠÍČEK (1972, pl. 3, fig. 3) as *Acrioceras* (*A.*) aff. *tabarelli*. Another species is *Manoloviceras saharievae* (MANOLOV, 1962), based on the specimen referred formerly to *Veleziceras uhligi* (VAŠÍČEK, 1972) and re-interpreted subsequently by VAŠÍČEK & WIEDMANN (1994) [I do not agree with WRIGHT & al. 1996, p. 226, fig. 177 a, b, who put *Manoloviceras* into the synonymy of *Orbignyceras* ROYO Y GOMEZ, 1945 b].

Many of UHLIG’s species from the Barremian of the Silesian Unit, described in his monograph of 1883 and not re-studied for many years, recently became types of a number of newly-defined genera, especially those established by Jean VERMEULEN (2000, 2005, 2006). These are: *Barrancyloceras* VERMEULEN, 2000 (type-species *Crioceras hammatoptychum* UHLIG, 1883), *Ptychhamulina* VERMEULEN, 2005 (type-species *Hamulina ptychocerooides* UHLIG, 1883), *Vasicekina* VERMEULEN, 2005 (type-species *Hamulina paxillosa* UHLIG, 1883), *Leroyoceras* VERMEULEN, 2006 (type-

species *Crioceras Hoheneggeri* UHLIG, 1883), *Terrestri- rina* VERMEULEN, 2006 (type-species *Hamulina Quen- stedti* UHLIG, 1883) and *Leptohamulina* VERMEULEN, 2006 (type-species *Hamulina* n. f. ind. UHLIG, 1883 = *Hamulina distans* HOHENEGGER).

STRATIGRAPHIC CONTRIBUTION

The ammonites from the upper Lower Cretaceous of the Godula (basinal) facies of the Silesian Unit de-

scribed so far belong to the Mediterranean bioprovince. Consequently, the Barremian ammonite zonation as defined in this area (after REBOULET, HOEDEMAEKER & al. 2006) is here applied (see Text-fig. 4). Nevertheless, with the exception of *Nicklesia pulchella*, known from Ostravice, or *Kotetishvilia* cf. *compressissima*, from Tichá, the majority of the zonal/subzonal ammonite indexes of the Mediterranean scheme do not occur in the Silesian Unit. However, indirect biostratigraphical correlations are possible based on complete ammonite assemblages.

STAGES		ZONES	SUBZONES	HORIZONS
APTIAN	Lower	<i>Dufrenoyia furcata</i> <i>Deshayesites deshayesi</i>	<i>Deshayesites grandis</i>	
		<i>Deshayesites weissii</i> <i>Deshayesites oglanlensis</i>		
BARREMIAN	Upper	<i>Martelites sarasini</i>	<i>Pseudociroceras waagenoides</i>	
				<i>Leptoceratoides puzosianum</i>
		<i>Imerites giraudi</i>		<i>Heteroceras emerici</i>
				<i>I. giraudi</i>
		<i>Hemihoplites feraudianus</i>		
		<i>Gerhardtia sartousiana</i>	<i>Gerhardtia provincialis</i>	
			<i>G. sartousiana</i>	
		<i>Toxancyloceras vandenheckii</i>	<i>Barrancyloceras barremense</i>	
	<i>Holcodiscus uhligi</i>	<i>Heinzia sayni</i>		
	Lower	<i>Coronites darsi</i>		
		<i>Kotetishvilia compressissima</i>		
		<i>Nicklesia pulchella</i>		
		<i>Kotetishvilia nicklesi</i>		
<i>Taveraidiscus hugii auctorum</i>				
HAUTERIVIAN	Upper	<i>Pseudothurmannia ohmi</i>	<i>Pseudothurmannia picteti</i> <i>Pseudothurmannia catulloi</i> <i>Pseudothurmannia ohmi</i>	
		<i>Balearites balearis</i> <i>Plesiospididiscus ligatus</i> <i>Subsaynella sayni</i>		
				<i>Cruasicerus cruasense</i>

Fig. 4. Uppermost Hauterivian, Barremian and lowermost Aptian ammonite zonation (according to REBOULET & al. 2006)

The stratigraphically oldest finds described here come from the the *Kotetishvilia compressissima* ammonite Zone of the late Early Barremian. These are *Kotetishvilia* cf. *compressissima* and *Melchiorites blayaci* from the Tichá 9 outcrop. From the same or approximately the same stratigraphical level, comes *Haplobrancoceras subquadratum*, known from spoil heap T1 near Tichá, and from spoil heap M5, near Malenovice. Spoil heap M5 is characterised by a rich ammonite assemblage (e.g. *Eulytoceras phestum*, *Costidiscus reticostatus*, *Macroscaphites yvani*, *Leptohamulina distans*) which, together with *Phyllopachyceras vergonense*, *Heteroceras* ex gr. *emerici*, and *Pachyhemioplites* sp., indicates its early Late Barremian age (*Toxancyloceras vandenheckii*, *Gerhardtia sartousiana* up to a lower part of the *Imerites giraudi* ammonite Zones).

According to its stratigraphical position in France, the species *Heteroceras* aff. *couleti*, known from spoil heap KZ2, near Kozlovice, indicates the boundary interval of the *Hemioplites feraudianus* and the *I. giraudi* zones.

Particularly noteworthy is the occurrence of *Paradeshayesites semenovi* (not reported in my former reports). It comes from an outcrop near a sports field in the Ostravice River bank in the municipality of the same name. It was found co-occurring with *P. weissiformis* (BOGDANOVA) (see VAŠÍČEK & al. 2004), a species characteristic of the Early Aptian oglanlensis ammonite Zone.

UHLIG (1883), on the basis of the rich collection of L. HOHENEGGER and those of his other collaborators, described more than 70 ammonite species from equivalent strata of the Silesian Unit (Wernsdorfer Schichten in the original conception). These were largely new genera and species, usually without accurate stratigraphical positions. On the basis of the revision of UHLIG's material, supplemented by my own collections (VAŠÍČEK, 1972, 1973), as well as other collections from the Silesian Unit in the Czech Republic (given e.g. in VAŠÍČEK, 1979, 1981 a, 1990, VAŠÍČEK & KLAJMON, 1998, VAŠÍČEK & SKUPIEN, 2002, VAŠÍČEK & al. 2004), and this paper, it can be stated that in the Hradiště Formation of the Silesian Unit in the Czech Republic more than 30 species of ammonites occur, including three new genera and ten new species that were unknown to UHLIG.

CONCLUSIONS

The ammonite-bearing deposits of the Hradiště Formation in the Silesian Unit, in the Godula facies, belong to an interval spanning the Early Barremian to

Early Aptian. The oldest fossiliferous deposits correspond to the Early Barremian *Nicklesia pulchella* Zone and the youngest to the Early Aptian *Deshayesites oglanlensis* Zone. Above a macrofaunally barren interval, another ammonite horizon, dated as the Late Aptian *Acanthoplites nolani* Zone (VAŠÍČEK, 1981 b), was found in the uppermost part of the Hradiště Formation in the late 1980s.

The 15 species level taxa described in this paper are largely species that were previously unrecorded from the Silesian Unit. Some Late Barremian ancyloceratids, especially *Lytocieroceras* cf. *jauberti*, and larger representatives of the genus *Heteroceras*, preserved only in fragments, appear to be the most interesting.

The generic affiliation of the newly described species *Valdedorsella hoheneggeri* remains uncertain.

In the Western Carpathians, as well as in the whole Mediterranean Tethys, the Silesian Unit represents a specific Early Cretaceous sedimentation area, in which a more than 1 km thick set of dark coloured, dysoxic, largely pelitic deposits have accumulated. The Barremian and Early Aptian part of it has been famous for rich and specifically diverse ammonite assemblages for a long time.

A dysoxic environment in the Hradiště Formation is indicated by its dark colour, often with an increased content of pyrite in the sediment or with the pyritization of inner whorls of ammonite shells, by usually higher TOC content and above all by the fact that the ammonite assemblages are usually accompanied by no or only sporadic benthos. The ammonites usually occur in thin, about 10-15 cm thick fossiliferous horizons. This, together with the frequent fragmentary preservation of the ammonite shells, indicates that shells from the deep shelf environment were redeposited by distal turbidite currents into deeper-water parts of the basin where there was a lack of oxygen at the bottom. Here, the unburied upper halves of shells were often dissolved, leading to their designation as "half-ammonoids".

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PLATE 1

- 1 – *Phyllopachyceras vergonsense* DELANOY & JOLY; B13808. Heavily deformed original shell with corroded ventral area. Spoil heap M5, Malenovice. Late Barremian.
- 2 – *Macroscephites* cf. *abchasiensis* M. KAKABADZE; B13810. A small part of shell coiled evolutely and its transition to the shaft. Spoil heap M1, Malenovice. Late Barremian – earliest Aptian.
- 3, 4 – *Melchiorites blayaci* (KILIAN); 3 – B13812, 4 – B13811; On the phragmocone in both specimens the original shell is partly removed; body chambers with original shells. In 4 the body chamber is dissolved, incomplete on the circumference. Spoil heap T5, Tichá. Early Barremian.
- 5 – *Valdorsella hoheneggeri* sp. nov.; B13813. Original shell preserved imperfectly mainly in the area of the body chamber. Spoil heap KZ2, Kozlovice – Žáry; late Late Barremian.
- 6-8 – *Haplobrancoceras subquadratum* AVRAM; 6 – B13816, juvenile shell best preserved; 7 – B13817, enlarged deformed original shell with growth lines preserved on the last whorl, $\times 2$; 8 – B13818, deformed shell, in the area of the aperture, with three incomplete ribs. Early and Late Barremian, spoil heap T1, Tichá and spoil heap M5, Malenovice.
- 9, 10 – *Kotetishvilia* cf. *compressissima* (D'ORBIGNY); B13814; 9 – $\times 1$, 10 – $\times 2$. External mould of juvenile specimen. Outcrop T9 near the municipality of Tichá; Early Barremian.
- 11, 12 – *Kotetishvilia* ex gr. *sauvageaui* (HERMITE); B13815; 11 – $\times 1$, 12 – $\times 2$. External mould with the remains of the original shell. Spoil heap T3, Tichá; Late Barremian.

All figures natural size unless otherwise stated

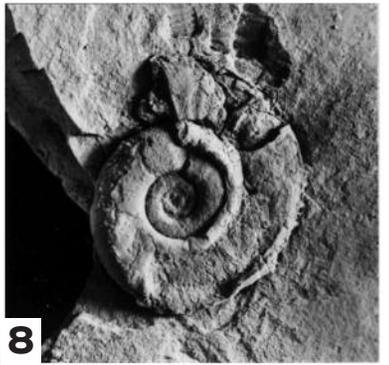
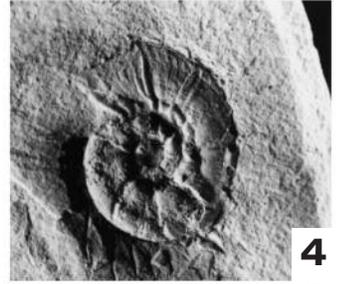


PLATE 2

- 1 – ?*Heteroceras* ex gr. *emerici* (D'ORBIGNY); B13822. Fragment of deformed shaft. Spoil heap M5, Malenovice; Late Barremian.
- 2 – *Heteroceras* aff. *couleti* DELANOY; B1313821. Small fragment of the shaft. Spoil heap KZ2, Kozlovice – Žáry; late Late Barremian.
- 3 – ?*Heteroceras* sp.; B13823. Straight shafts and flexus. Outcrop in the Bílý potok stream near the municipality of Čeladná; late Late Barremian.
- 4 – ?*Audouliceras* sp.; B13819. A fragment of the coiled part of the shell. Spoil heap M1, Malenovice; Late Barremian or earliest Aptian.
- 5 – *Lyticoceras* cf. *jauberti* (ASTIER); B13820. A hook-like fragment of the adult shell with characteristically diverging shafts. Location as for fig. 4.

All figures natural size

1



4



2



3



5

PLATE 3

- 1 – *Duyeyina* aff. *glembachensis* (IMMEL); B13825. Incomplete proversum, retroversum and flexus. Spoil heap K7 between Kozlovice and Tichá; Barremian.
- 2 – *Pachyhemihoplites* sp.; B13824. Fragments of a penultimate and ultimate whorls. Spoil heap M5, Malenovice; Late Barremian.
- 3 – *Paradeshayesites semenovi* (BOGDANOVA); B13826. Strongly deformed original shell. Outcrop on the right bank of Ostravice River near the municipality of Ostravice; Early Aptian.

All figures natural size

Photos taken by K. Mezihoráková (Ostrava). All specimens were coated with ammonium chloride before photography. Specimens are deposited in the Ostrava Museum in Ostrava under inventory numbers which are referred to in the text

