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SOME HETEROMORPHIC AMMONITES FROM POLOMEC (HAUTERIVIAN — BARREMIAN, CENTRAL WESTERN CARPATHIANS, CZECHOSLOVAKIA)

(Figs. 4, Pls. 3)

A b s t r a c t: The authors are dealing with heteromorphic ammonites which represent a striking component of ammonite fauna in the Hauterivian—Lower Barremian sediments of the Krížna Nappe of the Western Carpathians. Their distribution is well correlated with shallowing of sedimentary areas. The species *Acrioceras (A.)* aff. *puzosianum* (d'ORB.), *A. (A.) mulsanti* (ASTIER), *A. (A.) seringei* (ASTIER), *A. (Hoplocrioceras) pulcherrimum* (d'ORB.) and a new species *Euptychoceras borzai* n. sp. are described in systematic part. Stratigraphic distribution of the given heteromorphic types is briefly discussed.

Р е з ю м е: Авторы занимаются гетероморфными аммонитами, которые в готеривско—нижнебарремских осадках крижнянского покрова Западных Карпат представляют яркий компонент аммонитовой фауны. Их распределение хорошо коррелируется с умелчением осадочных пространств. В систематической части описаны виды *Acrioceras (A.)* aff. *puzosianum* (d'ORB.), *A. (A.) mulsanti* (ASTIER), *A. (A.) seringei* (ASTIER), *A. (Hoplocrioceras) pulcherrimum* (d'ORB.) и новый вид *Euptychoceras borzai* n. sp. Коротко обсуждено стратиграфическое распределение вышеприведенных гетероморфных типов.

Introduction

Heteromorphic are those ammonite shells whose coiling was gradually deviated from usual flat spiral with touching whorls during ontogeny. During phylogenetic evolution, ammonites passed through three periods of frequent occurrence of heteromorphic types: the Upper Triassic, the Middle Jurassic till the beginning of Malm, the Tithonian till the end of the Cretaceous.

Though the latter of the groups originated already in the Uppermost Jurassic, its representatives became more frequent as late as during the Hauterivian, especially thanks to origin and development of the genus *Crioceratites* LÉVEILLÉ with amply sculptured shells. During the Upper Hauterivian, shells of acrioceratiform type were possibly developed just from crioceratiform ancestors: juvenile stage of the former was planispirally coiled

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with untouching whorls, whilst gerontic part of the shell was irregular, hook-shaped.

Near the boundary of the Lower and Upper Hauterivian also another type of heteromorphic shells occurs: smooth or little sculptured shells with three straight touching limbs connected with each other by knee-like curves denoted as ptychocerate shells. Our paper is devoted to morphology and stratigraphic position of the mentioned types of heteromorphic shells in the Lower Cretaceous sediments of the Western Carpathians.

Distribution of the Lower Cretaceous heteromorphs in the Western Carpathians

During the Upper Valanginian, sedimentation of eupelagic nannocone limestones (Ladce Formation, Padlá Voda Formation, biancone, majolica, etc.) was replaced for the greater part by sedimentation of hemipelagic spotted limestones from Mráznica and Hlboká Formations (Michalík, 1987). Though sedimentation rate grew to 40—50 mm per thousand years (Michalík — Vašíček, 1987), surface of sediment started to be colonized by assemblages of benthic animals (polychaetes, sea urchins, brachiopods). Real benthic colonies were formed at stabilized parts of the sea floor (Kalište Formation, Borza et al., 1987) as late as during the Hauterivian: they were represented by infauna (*Zoophycos*, *Chondrites*, *Planolites*) and epifauna (brachiopods, crinoids, sea urchins). They were accompanied also by abundant fish and cephalopods, particularly belemnites and heteromorphic ammonites. Associations of ichnofossils indicate the upper bathyal *Zoophycos* Zone.

The most distinct accumulations of skeletons of benthic organisms started to be formed in shallow waters during the Upper Hauterivian. From the Barremian till the Lower Aptian, large "Urgonian" carbonate platforms covering up the slopes of adjacent basins with their detritus were formed here. However, shallower basins were inhabited by frequent associations of organisms too. Lower Barremian "Pseudothurmannia Beds" are a typical example (Adamíková et al., 1983). They were formed probably on edge of pelagic carbonate bank as accumulations of postmortem flotating shells of crioceratiform ammonites (consequence of mass mortality in reproductive seasons?) formed by sea currents.

Sequence characterizing development near the edge of pelagic carbonate bank is well exposed in the quarries of the cement works Lietavská Lúčka on Polomec hill near Žilina (Fig. 1). The lowermost part of the sequence is formed by Mráznica Formation of the Lower Hauterivian age. Intercalations of allodapic limestones occur in its higher part. Strážovce Turbidite Formation is represented by calcareous sandstones, calcarenites, limestone breccia, marly limestones with intraclasts and marls. Its overlying strata are built of relatively thick complex (30—50 m) of violet-grey marly limestones with marl intercalations containing frequently only shells of aberrant ammonite *Euptychoceras borzai* n. sp. Shells of other ammonites or other macrofauna are quite rare: most frequently there are poorly-preserved remnants of *Haploceras* ZITTEL, *Crioceratites* LÉVEILLÉ, *Plesiospitidiscus* BREISTROFFER, *Phylloceras* SUESS. *Acrioceras (A.) mulsanti* and *A. (Hoplocrioceras) pulcherrimum* occurred rarely (the only finding each).

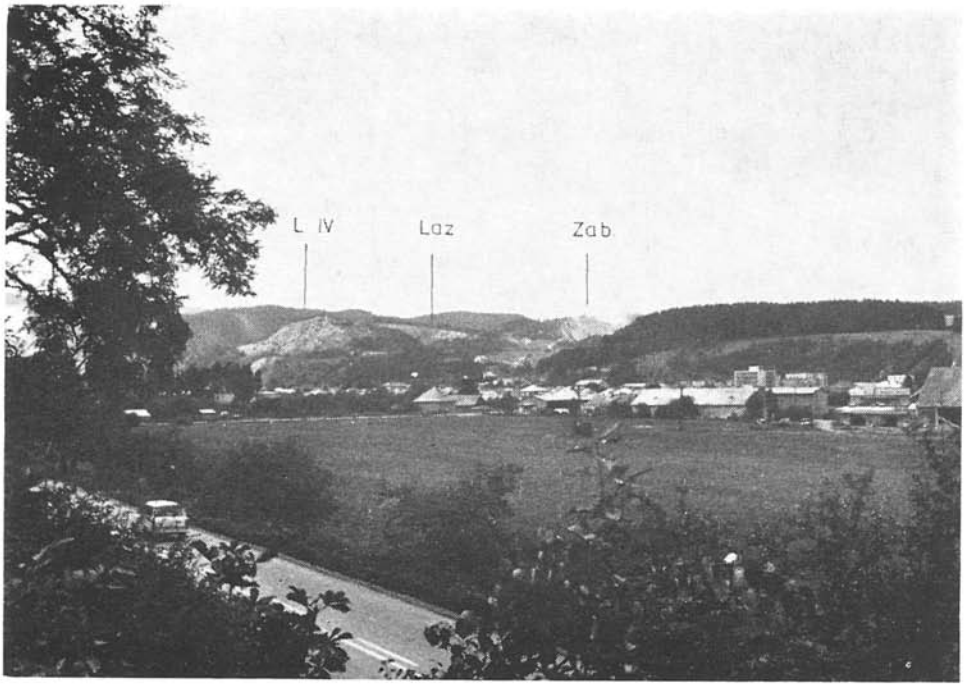


Fig. 1. View of the quarries on Polomec hill near Lietavská Lúčka from the northeast. LIV — quarry Polomec, 4th level, Laz — quarry Laz, Zab — quarry Zabukovinské (see Fig. 2). Photo J. Michalík.

These amonite-poor Upper Hauterivian sediments are suddenly replaced by varycoloured limestones (grey to violet-red with greenish spots), in some beds full of *Crioceratites* LÉVEILLÉ and *Pseudothurmannia* SPATH shells. First representatives of *Anahamulina* HYATT, rare representatives of *Lytoceras* SUESS and frequent representatives of *Barremites* KILLIAN and *Haploceras* together with the heteromorphic species *Acrioceras (A.) seringei* occur here. Specimen of *Acrioceras (H). pulcherrimum* was found at the base of this part of the sequence. The following representatives of benthic organisms are represented in association of fauna: brachiopods (*Terebratulina, Pygites, Moutonithyris*), bivalves, sporadically also sea urchins and gastropods. These sediments in which remnants of crioceratiform cephalopods form almost 90 % of fossils belong to the basal Barremian.

Monotonous "ringy spotted limestones" with poor fauna overlie fossiliferous Pseudothurmannia Beds. Besides dominating representatives of *Barremites*, the assemblage was characterized by dwarfy species of *Karsteniceras* ROYO Y GOMEZ and *Hamulinites* PAQUIER. In addition to this, *Partschiceras infundibulum* (d'ORBIGNY) and *Holcodiscus* cf. *perezianus* (d'ORBIGNY) represent "regularly coiled" forms. Heteromorphic species *Hamulina lorioli* UHL. and *Acrioceras (A.)* aff. *puzosianum* occurred only rarely.

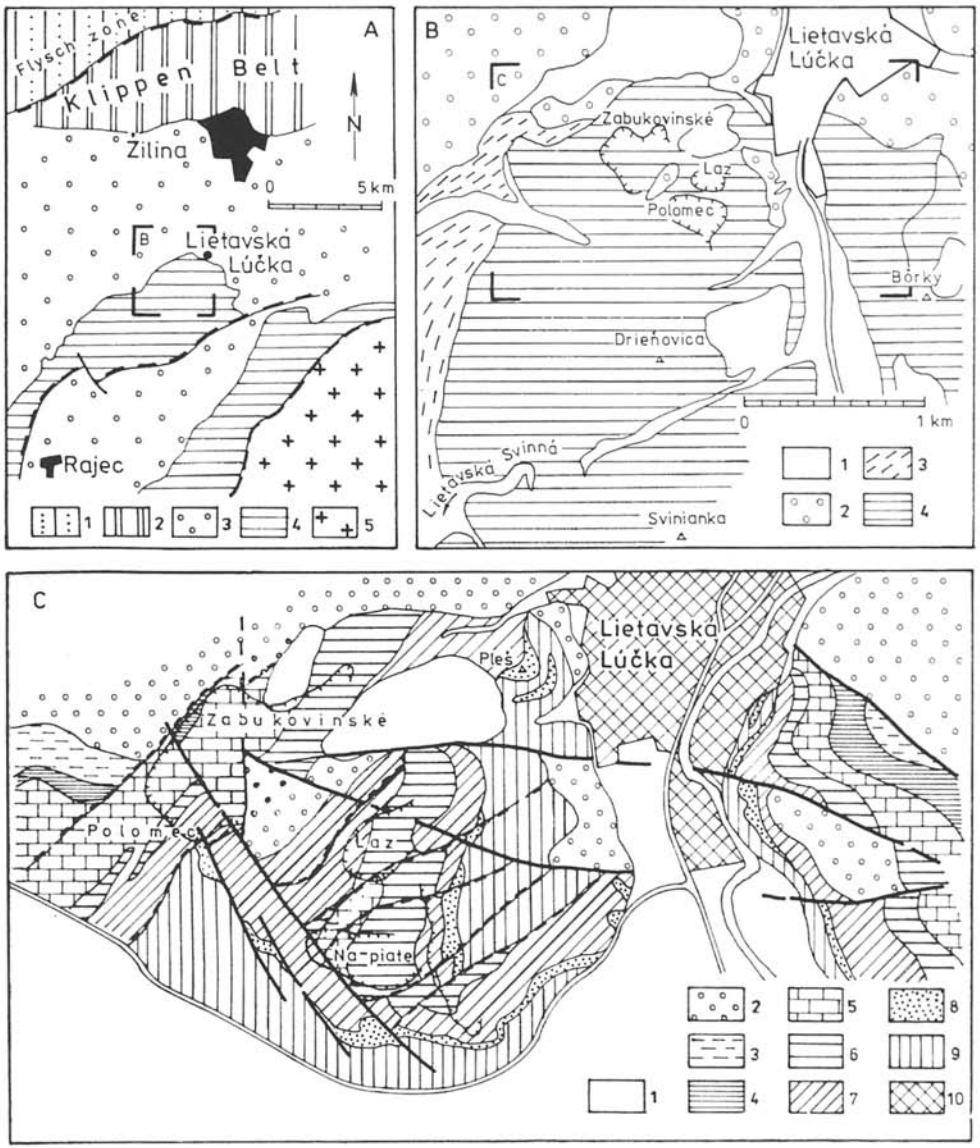


Fig. 2. Location scheme of the studied area with occurrences of aberrant ammonites. *Explanatory notes:* A: 1 — zone of flysch nappes of the Outer Carpathians, 2 — Klippen Belt; 3 — Palaeogene sediments of intra-Carpathian depressions; 4 — Mesozoic sequences of the Central Carpathian nappes; 5 — crystalline complexes of the Malá Fatra Mts. B: 1 — Quaternary cover; 2 — Palaeogene cover; 3 — Albian shales; 4 — Lower Cretaceous limestones. C: 1 — Quaternary cover; 2 — Palaeogene cover; 3 — Poruba Formation (Albian); 4 — black-grey marls (Aptian); 5 — "ringy" spotted limestones (Barremian); 6 — Pseudothurmannia Beds; 7 — Ptychoseras Beds; 8 — turbiditic beds; 9 — Mráznica Formation (Valanginian—Hauterivian); 10 — urbanized area.

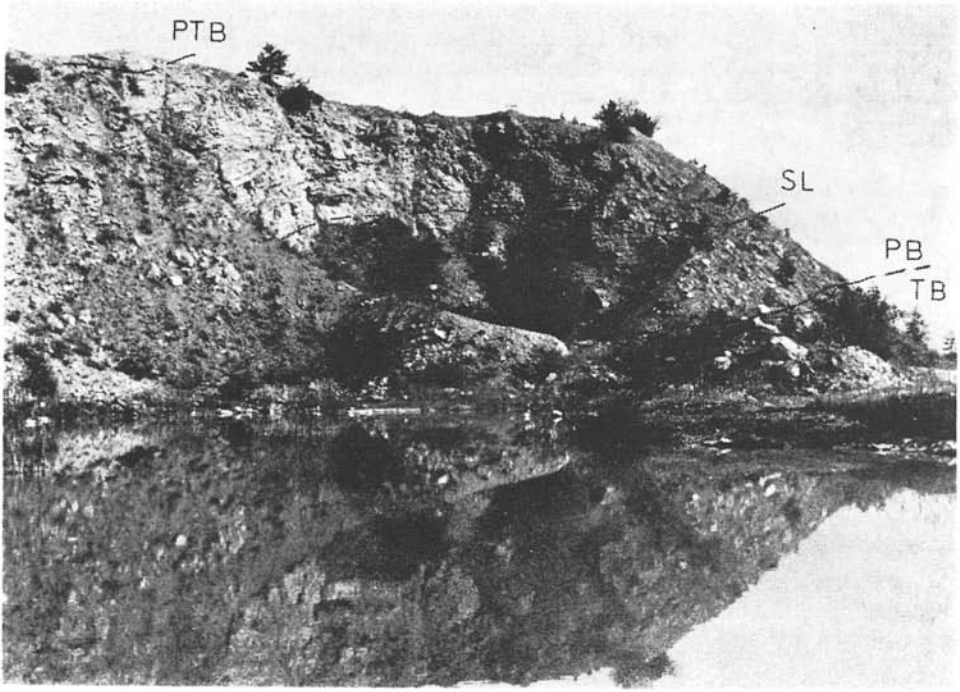


Fig. 3. View of northern wall of the quarry Polomec (4th level). TB — turbiditic beds, PB — Phychoceras Beds, SL — spotted limestones with abundant traces of submarine sumping and limestone breccia, PTB — Pseudothurmannia Beds. Photo J. Michalík.

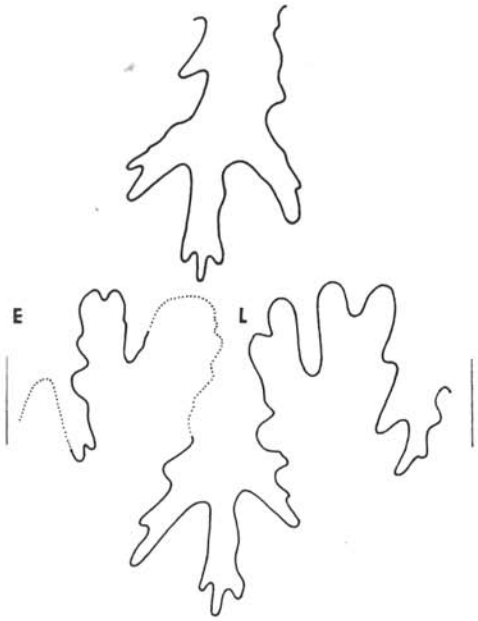


Fig. 4. Suture of the species *Euptychoceras borzai* n. sp. at limb height of 9.5 mm. Specimen SNM Z—20034. Road-cut in the village Lietavská Svinná.

The latter species differs from morphologically related *A. tabarelli* (ASTIER) especially in narrower spire and aspinoceratelly developed mature part of the shell. Aptychi usually occurring in Pseudothurmannia Beds are totally missing in association of fossils from this sequence.

Systematic part

Suborder *Ancyloceratina* WIEDMANN, 1966
Superfamily *Ancyloceratilea* MEEK, 1876
Family *Ancyloceratidae* MEEK, 1876
Subfamily *Ancyloceratinae* MEEK, 1876

Genus *Acrioceras* HYATT, 1900

Range of the genus *Acrioceras* is comprehended in accordance with Kakabadze (1981, pp. 94—96) who refuses classification of the genus to subgenera *Acrioceras* HYATT, 1900, *Protacrioceras* SARKAR, 1955, *Aspinoceras* ANDERSON, 1938 and *Paraspinoceras* BREISTROFFER, 1952 (sensu Sarkar, 1955 or Dimitrova, 1967; the latter considers these subgenera as independent genera). Kakabadze (l.c.) distinguished within the genus *Acrioceras* a typical subgenus characterized by trituberculate ribs (this genus includes also forms classed by Breistroffer, 1952 with the subgenus *Paraspinoceras*) and the subgenus *Aspinoceras* (though Rawson, 1975 considered this term as a junior synonym of the subgenus *Hoplocrioceras* SPATH, 1924). This simplified comprehension may be, however, artificial, because some morphologically related pairs of species are thus placed to two different subgenera: the pair *Acrioceras mulsanti* (ASTIER) and *A. dilatatum* belongs to the subgenus *Acrioceras* or the pair *A. seringei* (ASTIER) and *A. jourdani* (ASTIER) belongs to the subgenus *Hoplocrioceras*. This shortcoming is avoided by Thomel — Delanoy — Autran (1987) not mentioning different views of Rawson (1975) and Kakabadze (1981). For stratigraphic reasons, they refuse to use generic name *Aspinoceras* ANDERSON for morphologically related European forms and, in fact, they adhere to Sarkar's (1955) and Thomel's (1964) classification of acrioceratiform ammonites. The authors raised the subgenus *Paraspinoceras* BREISTROFFER to an independent genus and they established new genus *Subspinoceras* comprising typical species *Ancyloceras mulsanti* ASTIER and *A. dilatatum* d'ORBIGNY.

Definite natural classification of the mentioned forms would be possible perhaps after recognizing of suture ontogeny of (at least) typical species.

Subgenus *Acrioceras* HYATT, 1900
Typical species: *Ancyloceras tabarelli* ASTIER, 1851, Lower Barremian, France.

Characteristic sculpture of early evolutionary stage is represented by major trituberculate ribs usually alternating with non-tuberculate intermediary ribs.

Acrioceras (Acrioceras) aff. *puzosianum* (d'ORBIGNY, 1842)
Pl. I, Figs. 3, 4

? 1955 *Acrioceras* cf. *puzosianum* d'ORB. sp. (form no. 1): Sarkar, p. 116. Pl. 8, Fig. 4.
? 1964 *Acrioceras (Acrioceras* cf. *puzosianum* (d'ORBIGNY): Thomel, p. 45, Pl. 7, Fig. 12 (non Fig. 1).
? 1987 *Acrioceras (Protacrioceras)* cf. *puzosianum* (d'ORBIGNY): Thomel, Delanoy and Autran, Pl. 1, Fig. 5 (non Fig. 6).

Material: Cast and sculptural mould of incomplete aberrant shell with missing most juvenile and gerontic parts (specimen No. SNM Z—20027).

Description: Aberrant shell with juvenile part (spire) coiled in open planispiral passing to open curved limb. Planispiral part has relatively small diameter. Sculpture is formed by thicker trituberculate major ribs and simple intermediaries. The both types of ribs are concavely curved towards the aperture. In the most juvenile part of the whorl there are 2—3 simple intermediary ribs per one major rib: before straightening of the spiral part this ratio increases to 1 : 9. Middle rib from the group of intermediaries, though not thickened, has indistinct peripheral and very small ventrolateral tubercles. Limonitized contour of ca. 2 mm long spine is rarely preserved near this tubercle. Major ribs on the straightened part are at first trituberculate, there are 4 intermediaries per one major rib. Major ribs become thinner towards gerontic part of the shell, their tubercles become indistinct and disappear. Maximum diameter of the spiral part is about 20 mm, total height of incomplete shell reaches 45 mm.

Notes and relations: Though incomplete preservation impedes to make univocal species determination, morphology of our specimen agrees in fact with the forms referred to the species *Acrioceras puzosianum* (d'ORB.). It differs from d'Orbigny's holotype of this species in much lower number of intercalated ribs between major ribs on the curved limb. Even the specimens mentioned in synonymy seeming to resemble our material have distinctive limb sculpture. Therefore it is probable that *A. puzosianum* is morphologically very variable and it is connected with *A. tabarelli* (ASTIER) by transitions. The latter species differs from our material in more distinct and stable trituberculate major ribs, usually more straight limb arising from the spire of larger diameter and probably in absence of bituberculate secondary ribs.

The species *A. fromageti* SARKAR, *A.* cf. *fromageti* in Thomel (1964) and *A. ornatum* (d'ORBIGNY) characterize more markedly aspinocerately coiled shells of larger diameter of the spire. The latter species, in addition, lacks bituberculate secondary ribs.

Distribution: According to Thomel et al. (1987), French specimens occur in the sediments of Hauterivian/Barremian boundary (*Sayni* and *Angulicostata* Zones). Our Western Carpathian specimen comes from debris of 5th level of the quarry Polomec (section at 320th meter) from close overlier of the Pseudothurmannia Beds (Lower Barremian).

Acrioceras (Acrioceras) mulsanti (ASTIER, 1851)
Pl. I, Fig. 2, Pl. II, Fig. 1

1851 *Ancyloceras Mulsanti* ASTIER; Astier, p. 448, Pl. 20, Fig. 8.
1955 *Protacriocears mulsanti* ASTIER sp., Sarkar, p. 131, Pl. 7, Fig. 17.
1964 *Acrioceras (Protacrioceras) mulsanti* (ASTIER); Thomel, p. 52, Pl. 10, Fig. 2.
non 1902 *Crioceras Mulsanti* ASTIER; Sarasin and Schöndelmayer, p. 138, Pl. 18, Figs. 1, 2 (= *Hoplocrioceras dilatatum* d'ORB.).
1987 *Subaspinoceras mulsanti* (ASTIER); Thomel, Delanoy and Autran, Pl. I, Fig. 3.

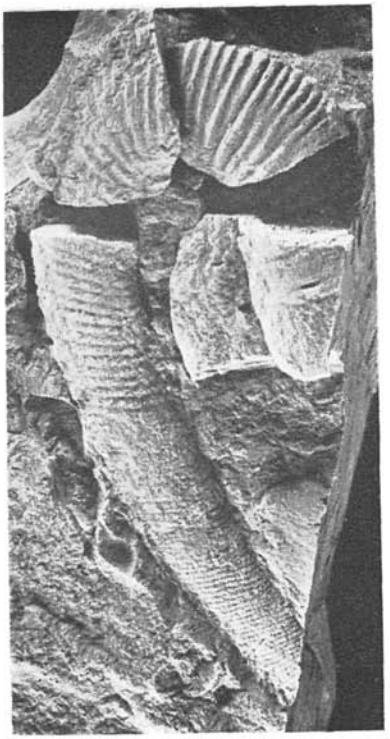
Material: Specimen with incomplete juvenile spirally coiled part. Preserved sculptural and outer cast (SNM Z—20028).

Description: Hook-shaped aberrant shell with juvenile part coiled in free crioceratiform spiral. About 1.5 of the whorl was preserved. The most juvenile ribs of the shell (diameter of ca. 11 mm) are divided to major and intermediary. Major ribs are quite thick and tuberculate, intermediaries are thread-like. The lowest (umbilical) row from three rows of tubercles on major ribs lies relatively high. Central row shifts gradually throughout ontogeny from the half of whorl height to its perimeter. The third, imperfectly preserved row of tubercles on the perimeter have shape of short spines (at whorl height of 9 mm, spine is about 3 mm long). All tubercles are quite faint, indistinct, usually only central row is marked. There are about 6 thread-like ribs between straight to slightly curved major ribs: this ratio increases to 1 : 12 throughout ontogeny, whereby thickness of major ribs and distinct character of tubercles are decreasing. The last major rib is distinguishable at transition of the spiral part to curved limb (whorl diameter of ca. 45 mm), limb itself is covered by simple uniform ribs. New thickened rib appears again on transition of the limb to terminal hook-shaped part. It is bifurcated roughly at the half of limb height, its front part is bordered by slight constniction. Section of simple ribs is followed by a zone with alternating simple and dichotomic ribs and by goosenecked thicker rib. Short riblet penetrating the lower half of whorl height follows. Shell margin is bordered by the zone with six slightly goosenecked, relatively thin simple ribs.

Measurements: Height of the whole shell reaches 82 mm, it is coiled in free planispiral to diameter of ca. 50 mm. At a diameter of the spiral

Plate I

Fig. 1 — *Acrioceras (Hoplocrioceras) pulcherrimum* (d'ORBIGNY), specimen SNM Z—20031, 4th level of the quarry Polomec, section at 40th meter, bed No. 9. Uppermost Hauterivian. Fig. 2 — *Acrioceras (Acrioceras) mulsanti* (ASTIER), specimen SNM Z—20028 with imprint of the spiral part. Hook and limb are preserved as sculptural mould. Quarry Laz, section at 175th meter, debris. Upper Hauterivian. Figs. 3, 4 — *Acrioceras (Acrioceras)* aff. *puzosianum* (d'ORBIGNY), specimen SNM Z—20027. In Fig. 3 spiral part is preserved as an imprint, limb as a sculptural mould, in Fig. 4 vice versa. 5th level of the quarry Polomec, section at 320th meter, debris of the Lower Barremian limestones. Fig. 5 — *Acrioceras (Acrioceras) seringei* (ASTIER). Specimen SNM Z—20029 with well preserved sculpture on the spiral part. 5th level of the quarry Polomec, section at 250th meter. Basal Barremian, Pseudothurmannia Beds. All specimens figured in natural size.



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part D = 44 mm, H = 15 mm (0.34), U = 22.5 mm (0.51). Height of hook-shaped part near terminal constriction equals to 22.5 mm.

Notes and relations: According to Sarkar (1955), holotype of the species *P. mulsanti* is figured inaccurately in the work of Astier (1851), because its spire bears in fact periodic trituberculate ribs. Since the specimens in Sarasin—Schöndelmayer (1902) have not such ribs (in the figure), it is apparent that they do not belong to the mentioned species. On the other hand, our specimen related to the specimen in Thomel (1964, Pl. 10, Fig. 2) corresponds well to classical diagnosis of the species. The species *Acrioceras (Hoplocrioceras) dilatatum* (d'ORBIGNY) related to our specimen as far as shape is concerned lacks also trituberculate major ribs on the spire.

Distribution: Classical specimens (Thomel, 1964) come from French Upper Hauterivian sediments. The only specimen which is at our disposal comes from the limestones of the same age of the Laz quarry on Polomec hill near Lietavská Lúčka (175th meter of documented section).

Acrioceras (Acrioceras) seringei (Astier, 1851)
Pl. I, Fig. 5; Pl. II, Figs. 3, 4

1851 *Ancyloceras Seringei* ASTIER; Astier, p. 455, Pl. 22, Fig. 16.
1860 *Ancyloceras Picteti* OOSTER; Ooster, p. 57, Pl. 50, Figs. 1—6.
? 1902 *Crioceras Seringei* ASTIER; Sarasin and Schöndelmayer, p. 140, Pl. 19, Fig. 3, Pl. 20, Fig. 1.
1902 *Crioceras Picteti* OOSTER; Sarasin and Schöndelmayer, p. 131, Pl. 16, Figs. 1, 2.
1955 *Acrioceras picteti* OOSTER; Sarkar, p. 112.
1955 *Acrioceras seringei* ASTIER; Sarkar, p. 113, Pl. 10, Fig. 13.
1967 *Acrioceras picteti* (OOSTER); Dimitrova, p. 54, Pl. 20, Fig. 3.
1987 *Ancyloceras seringei* ASTIER; Delanoy, Autran and Thomel, Pl. 1, Fig. 5.

Material: 14 incomplete sculptural, partly only stone moulds. Half of them have incomplete spiral part with transition to curved limb, the rest represents fragments of arched limb of various size.

Description: Shells of medium size with juvenile part coiled in free planispiral. Juvenile part passes to straight, curved limb.

Sculpture of spiral part was preserved only in the section thicker than 14 mm of diameter. It is formed by dense thin straight ribs, usually paired. They end

▶▶

Plate II

Fig. 1 — *Acrioceras (Acrioceras) mulsanti* (ASTIER). Negative imprint of the specimen figured in Pl. I, Fig. 2. Fig. 2 — *Acrioceras (Hoplocrioceras) pulcherrimum* (d'ORBIGNY). Specimen SNM Z—20032, 4th level of the quarry Polomec, section at 50th meter, debris of basal part of the Pseudothurmannia Beds (basal Barremian). Fig. 3 — *Acrioceras (Acrioceras) seringei* (ASTIER). Specimen figured in Pl. I, Fig. 5, magn. 2 x. Fig. 4 — *Acrioceras (Acrioceras) seringei* (ASTIER). Specimen SNM Z—20030. First constrictions appear on higher part of the limb. 5th level of the quarry Polomec, section at 250th meter. Debris of the higher part of the Pseudothurmannia Beds, Lower Barremian. Except Fig. 3 all specimens are figured in natural size.

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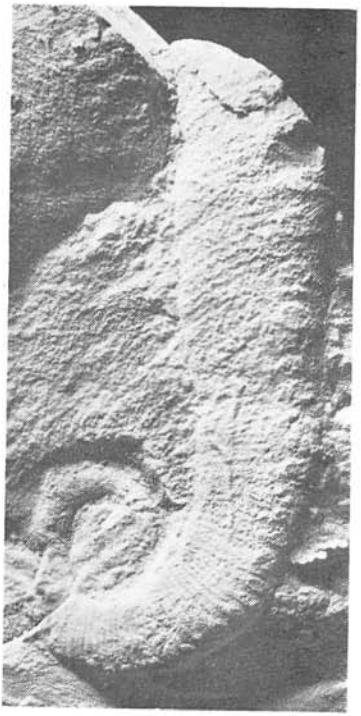

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with relatively large flat peripheral tubercles which gradually acquire elongated-eliptical shape in gerontic section of the spiral part. At the same time, sporadic intercalated ribs appear between the tubercles. On transition to straightened part they occur regularly and even in pairs, peripheral tubercles gradually disappear here. Major ribs are very distinct here, on perimeter they pass to short, poorly preserved spines. Roughly 30 mm from base of the spiral part there is an implication of slight constriction on the curved limb, ribs start to be convexly curved towards the aperture. In ontogenetically older part there are further distinct constrictions along the both sides delimitated by thickened ribs, between which there used to be 15 or more simple ribs. Terminal hook-shaped part was not preserved in any of our specimens.

Measurements: Spirally coiled part reaches diameter of ca. 18—21 mm. The specimen from Pl. I, Fig. 5 has whorl height H = 6.5 mm (0.38) and umbilical diameter 7 mm (0.41) at a diameter of the spiral part of 17 mm. The greatest preserved length of the limb is 125 mm at height of ca. 19 mm.

Notes and relations: Peripheral tubercles on the juvenile spire correspond to diagnosis of the species *Acrioceras picteti* OOSTER, 1860). From Sarkar's (1955, Pl. 10, Fig. 13) illustration of holotype of *A. seringei* (ASTIER, 1951) it is evident that its juvenile spire has tubercles identical with *A. picteti*'s spire. Therefore it seems that Sarkar's identification of the both taxa is justifiable (Sarkar, 1955, p. 113).

Morphology and arrangement of constrictions of *A. seringei* is similar as in the shell of *Hoplocrioceras jourdani* (ASTIER, 1851) which have not any tubercles.

Distribution: According to literary data, *A. seringei* occurs in the Lower Barremian sediments in France, Switzerland and Bulgaria. In the Western Carpathian locality Polomec near Lietavská Lúčka the species occurs sporadically in the base of Pseudothurmannia Beds (4th level), but more often in their upper part (Lower Barremian, 5th level).

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Plate III

Fig. 1 — *Euptychoceras borzai* n. sp., paratype. Specimen SNM Z—20033. Juvenile and middle limbs connected by knee-like curve. 4th level of the quarry Polomec, section at 280th mater, debris. Fig. 2 — *E. borzai* n. sp., paratype. Juvenile and middle limbs of the specimen SNM Z—20034 preserved as a simple mould. Sculpture figured in Textfig. 4 is preserved on the juvenile limb. Exposure in road-cut near Lietavská Svinná. Fig. 3 — *E. borzai* n. sp., paratype. Specimen SNM Z—20035 with preserved sculpture of the middle limb. 4th level of the quarry Polomec, section at 465th meter, debris of the Upper Hauterivian limestones. Fig. 4 — *E. borzai* n. sp., holotype. Specimen SNM Z—20036, middle and terminal limbs with characteristic sculpture. Location and bedding plane identical with specimen figured in Fig. 1, Upper Hauterivian. All specimens are figured in natural size.

Figured material is deposited in collections of the Slovak National Museum in Bratislava (Natural Science Department). Photographs made by K. Mezihorákova from Pedagogical College in Ostrava (except Pl. I, Fig. 1 and Pl. III, Fig. 1 which were made by M. Grmelová from Mining University in Ostrava). All specimens were whitened by ammonium chloride before photographing.

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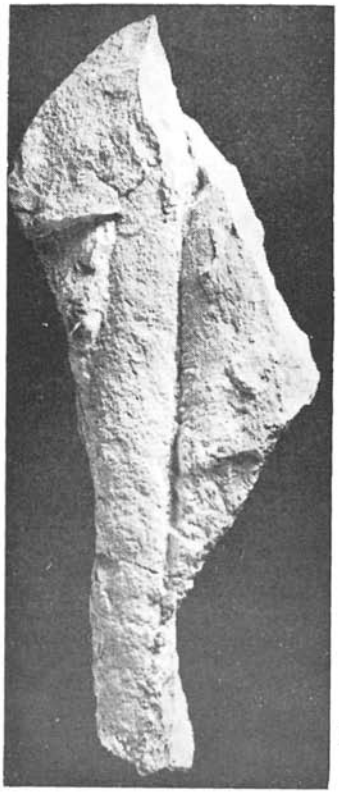

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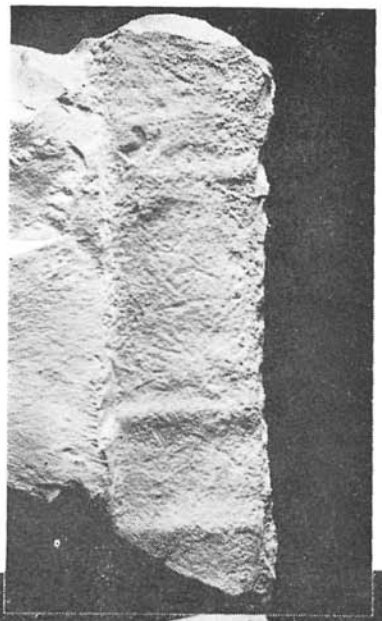

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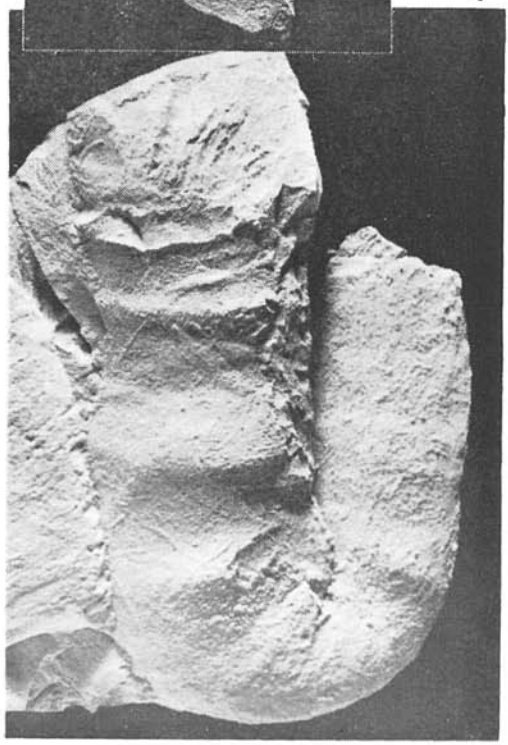

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Hoplocrioceras SPATH, 1924

Typical species: *Hamites Phillipsi* BEAN in PHILLIPS, 1829, Lower Barremian sediments in England.

Sculpture of hook-shaped shell misses trituberculate major ribs in each evolutionary stage.

Acrioceras (Hoplocrioceras) pulcherrimum (d'ORBIGNY, 1842)
Pl. I, Fig. 1, Pl. II, Fig. 2

1842 *Ancyloceras pulcherrimus* d'ORB.; d'Orbigny, p. 495, Pl. 121, Figs. 3—7.
1851 *Ancyloceras Fourneti* ASTIER; Astier, p. 450, Pl. 21, Fig. 10.
1860 *Ancyloceras Fourneti* ASTIER; Ooster, p. 22, Pl. 34, Fig. 9, non Fig. 10 (= *Hamulinites parvulus* UHLIG), non Fig. 11.
1860 *Ancyloceras pulcherrimum* d'ORBIGNY; Ooster, p. 23, Pl. 35, Figs. 1—5, Pl. 36, Figs. 1—6.
1902 *Ancyloceras pulcherrimum* d'ORB.; Sarasin and Schöndelmayer, p. 137, Pl. 17, Fig. 5, Pl. 18, Fig. 3.
1907 *Crioceras (Ancyloceras) pulcherrimum* d'ORB.; Karakash, p. 140, Pl. 4, Fig. 13.
1955 *"Paraspinoceras" fourneti* ASTIER; Sarkar, p. 125, Pl. 6, Fig. 18.
1955 *Paraspinoceras pulcherrimum* d'ORB.; Sarkar, p. 126.
1964 *Acrioceras (Paraspinoceras) pulcherrimum* (d'ORB.); Thomel, p. 47, Pl. 7, Fig. 6.
1976 *Acrioceras (Paraspinoceras) pulcherrimum* (d'ORB.); Patrulius and Avram, p. 166, Pl. 3, Fig. 1.
1981 *Acrioceras (Hoplocrioceras) pulcherrimum* (d'ORB.); Kakabadze, Pl. 19, Fig. 2.
1987 *Paraspinoceras pulcherrimum* (d'ORB.); Thomel, Delanoy and Autran, Pl. 1, Fig. 4.

Material: Two sculptural moulds with missing juvenile and incomplete crushed terminal part (SNM Z 20 031 — 20 032).

Description: Hook-shaped aberrant shells of medium size with curved juvenile limb and short, quite remote opposite limb; the both are connected with each other by wide hook-shaped part. Formerly fine and dense ribs covering the juvenile limb near hook-shaped curve suddenly become thicker and thinner. They are oblique, slightly concave towards the aperture. The ribs are often bifurcated in curve of the limb from the half of its height to its basal third at the aperture, in place of bifurcation there are indistinct tubercles. Intercalated ribs appear between the regular ones. In one place of the curve there is a slight constriction delimitated by thickened ribs (front of them is intercalated). Area of the aperture is characterized by wider smooth zone (at least on inner side, the outer one being not preserved).

Measurements: Incomplete juvenile limb of larger specimen is 83 mm long up to perimeter of the curve, mature limb has length of 37 mm. Height of poorly preserved curve is ca. 17 mm, peripheral length of hook-shaped part between the both limbs on the level of aperture is about 47 mm.

Notes and relations: Determination of the Slovak specimens is complicated by absence of the spire. In spite of different size, their morphology is in fact identical. Type of ribbing, size and shape are identical with diagnosis of the species.

Distribution: According to Thomel (1964), the species *H. pulcherrimum* occurs in Hauterivian—Barremian boundary sediments in France and Switzerland, Karakash (1907) mentions occurrence in the Barremian sediments in the Crimea and Georgia. In the Western Carpathians, two specimens were found in the quarry Polomec near Lietavská Lúčka. The larger one (Pl. I, Fig. 1) comes from the latest Hauterivian sediments (section IV—40, bed 9), the smaller one is from wall of the upper part of the 4th level (IV/50) together with the first representatives of the genus *Pseudothurmannia* (Lowermost Barremian).

Family *Bochianitidae* SPATH, 1922
Genus *Euptychoceras* BREISTROFFER, 1952
Typical species: *Ptychoceras Meyrati* OOSTER, 1860 (Breistroffer, 1952, p. 50). Barremian, Switzerland.

Outer morphology of three-limb shells of the genus *Euptychoceras* is very close to the genus *Ptychoceras* d'ORB., 1842 (cf. Breistroffer, 1952, p. 48; Egoyan, 1968, 1969 and Hollis, 1971). The both genera differ especially in shape of lateral lobe of the suture. Lateral lobe of the genus *Euptychoceras* is trifid (*E. meyrati*, cf. SARASIN and SCHÖNDELMAYER 1902, p. 173; *E. teschenense* — UHLIG 1902, Pl. 8, Fig. 2; *E. borzai* n. sp. — Fig. 3 in the present work), in the genus *Ptychoceras* it is bifid (Egoyan 1969, Pl. 22, Fig. 22, Mikhailova 1974, Textfig. 2, 1983, Textfig. 54).

Euptychoceras is known from the upper Lower Hauterivian till the Barremian (Valanginian occurrence of *E. teschenense* mentioned by Hohenegger in Uhlig 1902 is probably a mistake). *Ptychoceras* lived from the Aptian till Albian. Mutual systematic relation of the both genera is unclear: ontogeny of suture of the genus *Euptychoceras* is, for the time being, unknown, trifid stage characterizing this genus in ontogeny of the suture is not developed in some species of *Ptychoceras* (cf. Mikhailova 1974, 1983).

We suppose that trifid lateral lobe indicates reference of the genus *Euptychoceras* to the superfamily *Ancyloceratacea* and provisionally to the family *Bochianitidae*. This genus might have been developed from relatively large forms of *Bochianites* LORY 1898 (similar to large shell of *B. oosteri* SAR. and SCHÖND. in Immel 1987, Pl. 11, Fig. 11 or in our hitherto unpublished findings) as implied with doubts already by Breistroffer (1952, p. 51). On the other hand, Mikhailova (1983) places the genus *Ptychoceras* to the superfamily *Turrilitacea* GILL, 1871 and this to the suborder *Turrilitina* BEZNOSOVA anl MIKHAILOVA, 1983 and the order *Lytoceratida* HYATT, 1889.

Euptychoceras borzai n. sp.
Pl. III, Figs. 1—4, Textfig. 3

? 1868 *Ancyloceras Meyrati* OOSTER; Winkler, p. 21, Pl. 3, Fig. 6.
? 1987 *Ptychoceras meyrati* OOSTER; Immel, p. 127, Pl. 14, Fig. 9.

Holotype: Aberrant shell formed by two incomplete limbs (middle and terminal) connected by knee-like curve. It is figured in Pl. III, Fig. 4 housed in collections of the Slovak National Museum in Bratislava, No. SNM Z—20 033.

Paratypes: Shell with preserved juvenile and middle limbs (Pl. III, Fig. 1) comes from the same bedding plane as holotype (presumption that it may be its juvenile part cannot be excluded). Its number in collections of the Slovak National Museum in Bratislava is SNM Z—20 034, other paratypes SNM Z—20 035 and Z—20 036.

Stratum typicum: Upper Hauterivian spotted limestones with intercalations of marls ("*Ptychoceras* marls") in Strážovce Formation overlier.

Locus typicus: Abandoned quarry on the hill Polomec near Lietavská Lúčka (near Žilina), 4th level, section at 280th m.

Derivatio nominis: In honour of RNDr. K. Borza, Dr. Sc., our close co-worker and friend (suddenly died in December 1985).

Diagnosis: Shell with three parallel, touching limbs connected with each other by two knee-like curves. Juvenile part of the shell is covered by thin oblique ribs; ribs in adult part are ridge-like, slightly curved, separated by wide furrows.

Material: Besides type material, ca. 40 further incomplete, mostly juvenile parts of the shells. Sculptural moulds prevail, simple moulds with sculpture remnants, more or less compressed to bedding plane are less frequent.

Description: Juvenile limb is usually smooth, indistinct thin cross tubercles are evident only in some specimens (Z—20 034). Juvenile limb is connected with the middle limb by knee-like curve; the both are tightly close, having subparallel course. Only some specimens have short interlimb slot on inner side of the curve. Middle, just very moderately thickening limb known only from the fragments has at first sculpture similar to the juvenile one, distinct, but thin oblique ribs appear later. Ridge-like, transversal ribs characterizing the third terminal limb appear near the second wide curve. Six of the mentioned ribs are slightly concavely arched towards the aperture being separated by wide shallow depressions. There is a shallow constriction beyond the last rib. Terminal limb lies in distinctive level than the juvenile shell: though its axis is slightly convergent with the middle limb axis, it does not touch it.

Measurements: Total length of complete shells might have reached ca. 250—300 mm. Height of the shell in the juvenile curve is about 10 mm, in the second curve in holotype it reaches 25 mm. Cross-section of the limb (today mostly compressed) was oval. The specimen Z—20 035 has breadth of 8.8 mm (measured between the ribs) at limb height of 19.5 mm, so that $B/H = 0.45$.

Suture is not complete in any of available specimens. Outer lobe (E) of the suture is not fully preserved (the specimen figured in Pl. III, Fig. 2). First saddle (E/L) is asymmetrically bifurcated with coarser inner branch in comparison with the other specimens. The second lateral saddle (L) is markedly trifid, it represents evidently the deepest suture element. Umbilical lobe is shallow, asymmetrical.

Notes and relations: Though complete shells are totally missing in the Slovak findings, coiling in three almost subparallel limbs and suture with trifid lateral lobe prove their reference to the genus *Euptychoceras*. Large dimensions make our material related to the Barremian species *Euptychoceras meyrati* (OOSTER, 1860) which, however, has indistinct sculpture (cf. Sarasin—Schöndelmayer, 1902). On the other hand, Winkler's (1868) probably Hauterivian specimen (re-figured in Immel, 1987) has marked

sculpture remnants, so that it might belong to our new species. Probably the oldest representative of the genus, the upper Lower Hauterivian *E. curnieri* (Thieuloy, 1972) has, in contrast to our specimens, oblique constrictions and it lacks the ribs. Shells of the Lower Barremian *E. inostranzewi* KARAKASH, 1907 have distinct ribs on the adult limbs. These limbs are, however, very robust and they do not touch each other in the area of the curve along a considerable length (taxonomic reference to the genus *Euptychoceras* is, for incompleteness of material, doubtful). *Euptychoceras teschenense* HOHENEGGER, in UHLIG 1902 is another species related to our forms. But its stratigraphic position is doubtful, holotype is lost and new material is, for the present, missing. According to original description, this species differs from our material in robustness, more dense oblique ribs on the both limbs (including the terminal one) and in presence of intercalated ribs on the middle limb.

Poorly preserved fragments of juvenile limbs of *E. borzai* resemble the representatives of stratigraphically older species *Bochianites oosteri* SARASIN and SCHÖND., 1902. However, the middle limb of *E. borzai* is much more robust than shell diameter of any *Bochianites*.

Occurrence: *E. borzai* n. sp. often occurs in the Upper Hauterivian sediments in the environs of Lietavská Svinná and Lietavská Lúčka (Polomec), less frequently near Ladce (Mt. Butkov) and Košeca (Kamenná hill) in the Strážovské vrchy Mts. It was found also near the village Vrzávka (Chrasť hill) and near Melčice (Dolné Bradlo hill) in the Biele Karpaty Mts. *E. borzai* n. sp. has been never found in the Lower Hauterivian sediments, it occurs usually in close basement of the Pseudothurmannia Beds. Therefore, we suppose that range of this species is represented by the Upper Hauterivian *Subsaynella sayni*- and *Plesiospitidiscus ligatus* Zones.

Stratigraphic range of described ammonites

In agreement with Borza et al. (1984), the first occurrence of *Pseudothurmannia* SPATH, 1923 is placed to the Hauterivian—Barremian boundary. Besides microfaunal reasons, it is supported also by the fact that simultaneously with the genus *Pseudothurmannia* also *Barremites* KILIAN, 1913 appears*. *E. borzai* n. sp. is usually accompanied with rare findings of *Subsaynella sayni* (PAQUIER) and *Plesiospitidiscus* ex *gr. ligatus* (d' ORB.) which represent zonal species of the Late Upper Hauterivian in France (Vocont Trough, cf. Thieuloy, 1977). Thus, our species is their stratigraphic equivalent and it might be used as a zonal indicator.

Representatives of the genus *Acrioceras* occur sporadically in the sediments

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* *Reviewer's note:* Coming out from literary data and personal experience from the Jurassic and Lower Cretaceous ammonite successions on the North African shelf (mainly Tunisia) I may state that some taxa appeared in the Tethys Realm much earlier than on the North European Platform. Regarding the fact that the Central Carpathians neighboured palaeogeographically the Apulian promontory of the African Plate in that time, I adhere rather to an assumption of the Upper Hauterivian age of the Pseudothurmannia Beds.

with *E. borzai* n. sp. The only finding of *A. (A.) mulsanti* (ASTIER) comes from debris what impedes to make its accurate stratigraphic levelling. *A. (Hoplocrioceras) pulcherrimum* (d'ORB.) was found in the upper part of sediments with *E. borzai.*, another specimen — in the base of Pseudothurmannia Beds. Thus, this species lived in the Western Carpathian area from the Late Hauterivian till the Earliest Barremian. Base of the Pseudothurmannia Beds contains the first *A. (A.) seringei* (ASTIER). This species accompanied with *Pseudothurmannia mortilleti* PICT. and LOR. often occurs mainly in the highest section of the mentioned stratigraphic unit. *A. seringei* findings charecterize the whole sequence of the Pseudothurmannia Beds (the lowermost part of the Lower Barremian) and they may be applied in stratigraphy too.

The only finding of incomplete shell determined as *A. (A.)* aff. *puzosianum* (d'ORB.) comes from the Pseudothurmannia Beds overlier (the higher part of the Lower Barremian).

Translated by O. Mišániová

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