GEOLOGICKÝ ZBORNÍK — GEOLOGICA CARPATHICA, 38, 3, BRATISLAVA, JUNE 1987, Pp. 305—322

JIŘÍ ŽÍTT*

LOWER CRETACEOUS CRINOIDS OF THE VRŠATEC CASTLE KLIPPE (KLIPPEN BELT, SLOVAKIA, ČSSR)

(Figs. 6, Pls. 4, Tab. 1)

Abstract: Some cyrtocrinids, among them the hitherto unknown forms are described from the Vršatec castle klippe (? Berriasian, ? Upper Valanginian). They are *Torynocrinus andrusovi* sp. n., *Hemicrinus* cf. *thersites* (JAEKEL), *Apsidocrinus* cf. *yanini* (AREND T), *Phyllocrinus malbosianus* d'ORBIGNY, problematic hemibrachiocrinids (*Hemibrachiocrinidae* AREND T), and a new type of isolated axillars. Paleogeographic distribution of the fauna and its relations to the Lower Cretaceous of the Crimea and Hungary are discussed. Some observations of sedimentological character are included.

Резюме: Из западословацкой части зоны утесов описывается фауна криноидей, происходящая из местонахождения Вршатец (Vršatec) (?берриас, ?верхний валанжин). Остатки криноидей принадлежат к видом *Torynocrinus andrusovi* sp. n., *Apsidocrinus* cf. *yanini* (AREND T), *Hemicrinus* cf. *thersites* (JAEKEL) и *Phyllocrinus malbosianus* d'ORBIGNY. Интересные экземпляры проблематических репрезентантов семейства *Hemibrachiocrinidae* AREND T и новый тип аксилярных элементов тоже дискутируются. Результаты значительно расширяют наше знания о нижнемеловых тетидных фаунах и их палеогеографическом распространении.

Introduction

The knowledge of the Carpathian Mesozoic crinoids is so far rather unsatisfactory. The history of investigation of the extra-Štramberk Carpathian crinoids is very poor (Zareczny, 1876; Zittel, 1870; Jekelius, 1915). Recently only Pisera—Dzik (1979), Gluchowski et al. (1983) and Žítt—Michalík (1984) were dealt with them. In the last mentioned paper the Slovak part of the Klippen Belt appeared to be especially promising in the finds of new well preserved crinoid faunas.

In the paper presented the first results of the study of Vršatec crinoids are summarized. The rich crinoid fauna was discovered and reported by Mišík (1979; 1980). All the collections were realized on the locality demonstrated to me by this author (excursion of the 23rd conference of the Slovak geological society, 1980). In spite of the great number of specimens, the study proved to be very difficult owing to the unfavourable mode of their preservation. Not only the very long torynocrinid spoons, but also the isometric elements (e. g. brachials) were practically impossible to loos them from the rock. For that reason the great majority of fossils could only be studied on weathered sur-

* RNDr. J. Žítt, CSc., Institute of Geology and Geotechnics of the Czechoslovak Academy of Sciences, in Holešovičky 41, 182 09 Praha 8.

faces of rock. The complete recognition of taxonomic constitution of the association was, therefore, probably considerably influenced by this fact. Nevertheless, the investigation of Vršatec crinoids is not yet finished and new data are to be expected.

Geological and geographical setting

The Vršatec castle klippe (the name according to Mišík, 1979) is situated north of Vršatecké Podhradie village, about 10 kilometers northwest of the town Ilava, western Slovakia. The klippe body is elongated in approx. south-southwest-northnortheast direction and consists of two parts, separated by a depression through which goes a road (general situation see Mišík op. cit., p. 9, Fig. 1).

There are two to three slices of Jurassic and Lower Cretaceous rocks present in the klippe. All crinoids came from the deepest slice of the greater (i. e. northeast) part of the klippe. The locality is situated on the foot of a section, close to the pathway, ca. 900 metres in a bee-line to the northeast from the road mentioned above. Crinoids were collected in the red limestone exposed in the thickness of about 1.5 meter. This limestone forms a part of undivided carbonate complex of the Tithonian to Neocomian age. The brachiopod associations collected and described by Siblík (1979) from various localities of this complex indicate either Tithonian or probable Berriasian age (? *Pygites diphyoides*). The localisation of brachiopod sites is, however, in not a single case identical with that of crinoids. The brachiopods occuring on the crinoid locality were indeterminable owing to their poor preservation. Although some strongly weathered valves show a similarity with Siblík's (op. cit.) ? *Pygites diphyoides* from his localities Nos. 23 and 47, they can hardly demonstrate the Berriasian age of the sample. Unfortunately, the crinoids of above mentioned Siblík's localities were not studied, but their similarity to my present materials is probable (see Mišík, 1979, p. 28). The crinoids mentioned by Mišík (op. cit., p. 24) as great columnals from Siblík's brachiopod locality No. 6 (Upper Tithonian) remain unknown for the present.

Mišík (1979) mentioned the Birkenmajer's (1963) stratigraphic scheme of Polish part of the Klippen Belt, where similar Tithonian—Neocomian complex is interpreted as complex facial substitution of the same members in different levels. As for the red crinoidal limestones, they were compared by Mišík (1979, 1980) with the Lysa formation of Birkenmajer (op. cit.) of the Upper Tithonian—Berriasian age.

The crinoid species can hardly serve for the exact age determinations. However, no *Torynocrinus* is known from the Jurassic and the morphological type of Vršatec *Apsidocrinus witnesses* rather the post-Jurassic also.

Directly in the limestone samples with crinoids the fragments of *Lamellaptychus angulocostatus* were identified by dr. V. Houša (personal communication). In his view, their evolutionary stage corresponds most probably to the Upper Valanginian.

Notes to the preservation and occurrence

The investigated crinoids form the main volume of all macrofossils in rock samples. In addition to the echinoderms only brachiopods and aptychi are present. Although the brachiopod shells are greatly damaged by pressure, the echinoderms remain nearly intact in spite of the great length of some of them (*Torynocrinus*).

The orientation of echinoderm remains by current action was only rarely observed. The long axes of torynocrinid spoons are directed parallely to the bedding planes. The great and flat valves of ? *Pygites diphyoides* rest also approx. parallely with bedding. The infillings of brachiopods shells, if studied macroscopically, are comparable to the surrounding sediment. Great calices of *Apsidocrinus* cf. *yanini* lie mostly on their flanks. In some cases, however, the orientation roughly perpendicular to the bedding planes was ascertained.

The majority of crinoid remains is not mechanically broken. That does not hold for just two *Apsidocrinus* remnants. One of these specimens is represented by calyx with broken and slightly shifted interradial process; the narrow space between the two parts is filled with sediment, which proves the synsedimentary "in situ" fragmentation. The second remain is represented by a broken solitary process. In addition, both cases manifest a prominent cleavage planes. As known, the echinoderm skeleton does not exhibit any macroscale cleavage in the fresh break. The cleavage developes only after a certain period of diagenesis. The time interval necessary for the diagenetic recrystallisation, is not known. The above mentioned cleavage in *Apsidocrinus* seems to indicate the redeposition at least of some part of the older sediment to the indentical sedimentary environment with unaltered faunal composition. The wide size range of echinoderm elements not mechanically worn shows that their transport was short and nonselective.

Taxonomic and paleobiogeographic features of the assemblage

The species *Apsidocrinus* cf. *yanini* and *Torynocrinus andrusovi* sp. n. highly prevail in the fauna studied.

The oldest known species of *Apsidocrinus*, *A. moeschi* from the Tithonian occurs in the Alpes (see Loriol, 1879) and in the Carpathians (Rogoznik; see Pisera—Dzik 1979). In the Lower Cretaceous the genus was found in the Carpathians, Hungary, and Crimea but in the Alpes it was completely absent (if *Phyllocrinus oosteri* from the Swiss Neocomian does not belong to *Apsidocrinus*). More about the distribution of the species see Tab. 1. *Torynocrinus, on the* other hand, confined itself to the Carpathians and Crimea during almost its entire existence and only the latest species of this genus ranges to the Albian of England (*T. canon*).

For all the Carpathian localities and for the Manester locality of Crimea a common occurrence of *Apsidocrinus* and *Torynocrinus* taxa is typical. In the other two Crimean localities (see Tab. 1), however, only *Apsidocrinus* occurs. In the Tithonian of Rogoznik no *Torynocrinus was* found possibly only because it has not existed before the Lower Valanginian. In the Barremian *Apsidocrinus* became extinct and therefore it could not occur in the Albian of England even in the case when the environmental conditions were favourable. Although

Table 1
Stratigraphic and geographic distribution of *Torynocrinus* and *Apsidocrinus*

Taxa	L.-Middle Tithonian, Rogoznik, Poland	Tithonian, St. Gallen, Switzerland	L. Valanginian, Manester, Crimea, U.S.S.R.	U. Valanginian, Kopřivnice f. (incl. redeposited Berriasian), Štramberk, Czechoslovakia	?Berr., ?U. Valanginian, Vršatec, Czechoslovakia	Hauterivian, Plaňava f. (incl. redeposited U. Valanginian), Štramberk, Czechoslovakia	U. Hauterivian, Kujbyševo, Crimea, U.S.S.R.	L. Barremian, V. Stroganovka, Crimea, U.S.S.R.	Valanginian, Zirc-Borzavar, Hungary	Albian, Red Chalk of Hunstanton, England
Torynocrinus										
T. canon SEELEY										+
T. andrusovi sp. n.					+					
T. variabilis (ARENDT)			+			+				
T. cristatus ŽÍTT				+						
Apsidocrinus										
A. cyclamen (REMEŠ)				+						
A. remesi JAEKEL				+						
A. skalkyensis ŽÍTT						+				
A. yanini (ARENDT)			+				+	+		
A. cf. yanini (ARENDT)					+					
A. moeschi (ZITTEL)	+	+								
A. sp.									+	

the majority of data seem to agree well with possible closer paleoecologic relations of both genera, they are too scarce for the present to confirm such a possibility.

Within the genus *Apsidocrinus* only *A. skalkyensis* from Plaňava formation of Štramberk seems to be more different from the other species of the genus from the Carpathians and Crimea owing to the distal non-pointed endings (thorns) of its interradial processes. The other species (see below) including *A. moeschi* always have the thorns developed, but *A. moeschi* differs from them distinctly in their from. The main group of species composed of *A. cyclamen*, *A. remesi*, *A. yanini* and *A.* cf. *yanini* shows relatively uniform morphology in the majority of features. This type of crinoids is exclusively Lower Cretaceous and it ranges geographically from the Carpathians via Hungary as far as the Crimea (see Tab. 1). Unfortunately, the morphology of Hungarian species (see Sieverts-Doreck, 1961) is not known but it might belong to this type too (Sieverts-Doreck's recognition of *Apsidocrinus* and *Pyramidocrinus* proves her opinion on a similarity with Štramberk representatives). As regards *Torynocrinus andrusovi* sp. n. it is not possible to relate it to other known taxa. Its resemblance to the problematical *Torynocrinus (Labiocrinus) labiatus* SZÖRÉNYI from the Hungarian Lower Valanginian is probably only superficial. From all the facts it follows, that the data available do not permit a satisfactory solution of the relations among the Lower Cretaceous *Apsidocrinus* and *Torynocrinus* species of the regions mentioned. The same concerns the problematical Vršatec hemibrachiocrinids.

Closest to Vršatec, both geographically and stratigraphically, is the Štramberk Kopřivnice formation (Upper Valanginian with some redeposition from the Berriasian, see Houša, 1976). The species similarity of both sites is, however, rather limited. The only well determined species in common with Štramberk is extremely rare in Vršatec (= *Phyllocrinus malbosianus*). The same concerns the other species (= *Hemicrinus* cf. *thersites*, ? *Hemibrachiocrinidae* gen. et sp. indet.). On the contrary, the main bulk of fossils in Vršatec belongs to the indigenous species of *Torynocrinus*, *Apsidocrinus*, and to unknown species with swollen axillars.

The investigation of Vršatec crinoids is, however, not yet finished and acquiring new data important for their better understanding is probable.

Systematic part

Cyrtocrinida SIEVERTS-DORECK
Hemicrinidae RASMUSSEN
Torynocrinus SEELEY, 1866

Type species: *Torynocrinus canon* SEELEY, 1866; Albian, Red Chalk of Hunstanton, England.

Diagnosis: See Žitt (1983).

Stratigraphic range: Lower Valanginian—Albian.

Torynocrinus andrusovi sp. n.

Pl. 2, Figs. 1, 2; Pl. 4, Figs. 1—3, Text—fig. 1

Holotype: Specimen illustrated in Pl. 4, Figs. 1—3, deposited in the collections of the Slovak National Museum in Bratislava under the No. SNM Z-18 772.

Paratype: Specimen No. SNM Z-18 774/1, figured in Pl. 2, Fig. 1, deposited along with the holotype.

Derivation of name: *andrusovi-* in honour of late outstanding Slovak geologist and paleontologist, prof. dr. Dimitrij Andrusov.

Type horizon and locality: ?Berriasian (according to Siblík, 1979 and Mišík, 1979, 1980); Upper Valanginian (personal communication dr. V. Houša, see chapter on the geology). Czorsztyn series, Vršatec castle klippe near Ilava, western Slovakia.

Material: 5 spoons and some fragments in the rock.

Description: Spoon with distinct calyx and stem parts. Sutures between radials indistinct. Calyx part dorsally flattened with slightly developed growth lines. Calyx outline rounded to irregularly angular. Ventral part of calyx with small ventral cavity and large labium-like lower interradial process. Upper part of calyx very thin. Radial facets irregularly arranged regarding bilateral symmetry of spoon. Their size also variable. Lower labium-like process and its lateral parts bear the most distinct facets with great and shallow muscle fossae. Ligament fossa also very shallow. Facets of upper calyx part and partly also lateral facets vertically oriented or obliquely inclined to ventral cavity. Atypical muscle fossae in form of large elongated depressions (see Text—fig. 1). Ligamentary part of facet indistinct, but probably very shallow and narrow. Ventral furrows directed to ventral cavity bottom non expressive. Stem part of spoon slender and of circular cross section. Its complete length unknown.

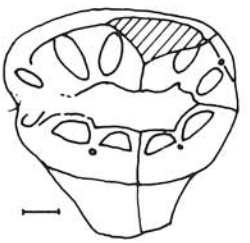


Fig. 1. Radial facets of *Torynocrinus andrusovi* sp. n. (holotype). Scale bar 1 mm.

Notes and relations: This species is the first representative of *Torynocrinus* not only in Slovakia but also in the Klippen Belt and in the Inner Carpathians at all. Considering the whole Carpathian region, the genus was found for the first time in Štramberk (Upper Valanginian?Hauterivian) by Žitt (1983). *Torynocrinus andrusovi* sp. n. differs, however, highly from both Štramberk species (*T. variabilis* (ARENDT), *T. cristatus* ŽÍTT, see Tab. 1).

Torynocrinus canon SEELEY from England is also very different (see ŽÍTT op. cit.).

By the type of calyx and especially by the development of labium-like parts the new species resembles most closely *Torynocrinus (Labiocrinus) labiatus* SZÖRÉNYI from the Lower Cretaceous of Hungary (see Szörényi, 1959; pp. 254—256, Pl. 3, Figs. 9—15). Szörényi's figures show, however, that the upper part of calyx is more massive and facets are normally developed. Real constitution of spoon skeleton as for the type of elements included is unknown in this species. Szörényi's assignment of the species to *Torynocrinus* based on more external morphology is, therefore, uncertain. A detail comparison of both genera and their diagnoses are given in Žítt (1983).

Hemicrinus d'ORBIGNY, 1850

Type species: *Hemicrinus astierianus* d'ORBIGNY, 1850; Neocomian, Les Lattes, Var (France).

Diagnosis: See Žítt (1983).

Stratigraphic range: Lower or Middle Tithonian—Lower Aptian. ?Albian.

Hemicrinus cf. *thersites* (JAEKEL, 1891)

Pl. 4, Fig. 4

Horizon and locality: Identical with *T. andrusovi* sp. n.

Material: The only fragment of spoon.

Description: Calyx and stem parts oriented roughly perpendicularly to each other. Calyx part bilaterally symmetrical, lower interradial process weakly developed. Radial facets arranged circularly around small and rounded ventral cavity. Size of facets depends on size of respective radials. Greatest facets is situated on uppermost radial, two smaller lie laterally of it and the smallest are on lateral parts of lower interradial process. Articular structures of uppermost three facets distinct, muscle fossae wide and deep, ligament fossa shallow, transverse ridge expressive. Ventral furrows slight. Lowermost two facets have no articular elements preserved. Dorsal part of calyx with slightly developed depressions on interradial sutures. Stem part of spoon preserved in length of ca. 1.0 mm only. It is monocrystalline and its connection with calyx part is without distinct suture.

Notes: The fragment of spoon described above is very ill-preserved. Its stem part is missing in the most length. In the true *H. thersites* such a great difference in size of radials is unknown. On the other hand, this feature is most pronounced in the juveniles of various species (including *H. thersites)* (see Žítt, 1983, Pl. 9, Figs. 5—10; Arendt, 1974, Pl. 23, Figs. 4 a, b, Pl. 24, Figs. 2, 3, Pl. 26, Figs. 1—4; Szörényi, 1959, Pl. 4, Fig. 13). Owing to poor Vršatec material the unambiguous identity of the species cannot be confirmed, although it is probable.

Phyllocrinidae JAEKEL
Phyllocrinus d'ORBIGNY, 1850

Type species: *Phyllocrinus malbosianus* d'ORBIGNY, 1850; Neocomian of Orgon, B. du Rhone, France.
Diagnosis: See Rasmussen (1961, p. 227).
Stratigraphic range: Upper Jurassic—Neocomian.

Phyllocrinus malbosianus d'ORBIGNY, 1850
Pl. 3, Fig. 1

Lectotype: Specimen deposited in d'ORBIGNY's collection in Paris, No. 5557 a, figured by Rasmussen (1961, Pl. 33, Fig. 1).
Type horizon and locality: Neocomian, Orgon, B. du Rhone, France.
Material: Two cups from the same locality as preceding species.
Description: Calyx of medium size, its diameter ca. 6.0 mm (No. SNM Z-18 773/2) and ca. 4.8 mm (No. SNM Z-18 773/3). Hight unmeasurable but always greater than diameter of calyx. Calyx roundedly pentagonal under interradial processes. Radial lobes increasing in size distally. Interradial depressions between lobes not too deep. They continue distally on interradial processes. These are probably higher than dorsal part of cup. Their bases are wide, processes narrow slightly distally and shallow saddles are developed in their endings. Here are present two rows of great granules which join on the inner edges of processes and sink down to ventral cavity. In about one-third hight of process this edge begins to divide by shallow and narrow proximally widening depression transferring to shallow pockets below the processes. Side edges of this depression transfer radially to septa separating the bottom of radial notch from ventral cavity. Proper radial notch deep, distally widening. Its bottom bear a pair of concave elliptical depressions, separated by low longitudinal ridge. Septa between bottoms of radial notches and the ventral cavity very pronounced. Dorsal cavity observed in specimen No. SNM Z-18 773/3. It is circular and deep, its diameter ca. 1.8 mm.
Notes: Nearly all features observed correspond to the species variation range known from other regions (see Žítt, 1978a). Only the unusually large dorsal cavity makes an exception. Very fragmentary material does not, however, offer the possibility of reliable evaluation of this deviation.

Apsidocrinus JAEKEL, 1907

Type species: *Apsidocrinus remesi* JAEKEL, 1907; Upper Valanginian, Kopřivnice formation, Libhošťská hůrka Hill near Štramberk, Czechoslovakia.
Diagnosis: see Žítt (1978b).
Stratigraphic range: Lower Tithonian—Lower Barremian.

Apsidocrinus cf. *yanini* (ARENDT, 1974)
Pl. 1, Figs. 1, 2; Pl. 3, Figs. 2, 4, Text-figs. 2, 3

Horizon and locality: Identical with preceding Vršatec species.

Material: 6 more or less damaged calices on the surface of weathered rock fragments, other specimens in cross sections in the rock.

Description: Large calices with H_c = ca. 13.0 mm, H_{proc} including thorns = ca. 8.5 mm (No. SNM Z-18 775/2) and H_c = ca. 15.0 mm, H_{proc} = ca.

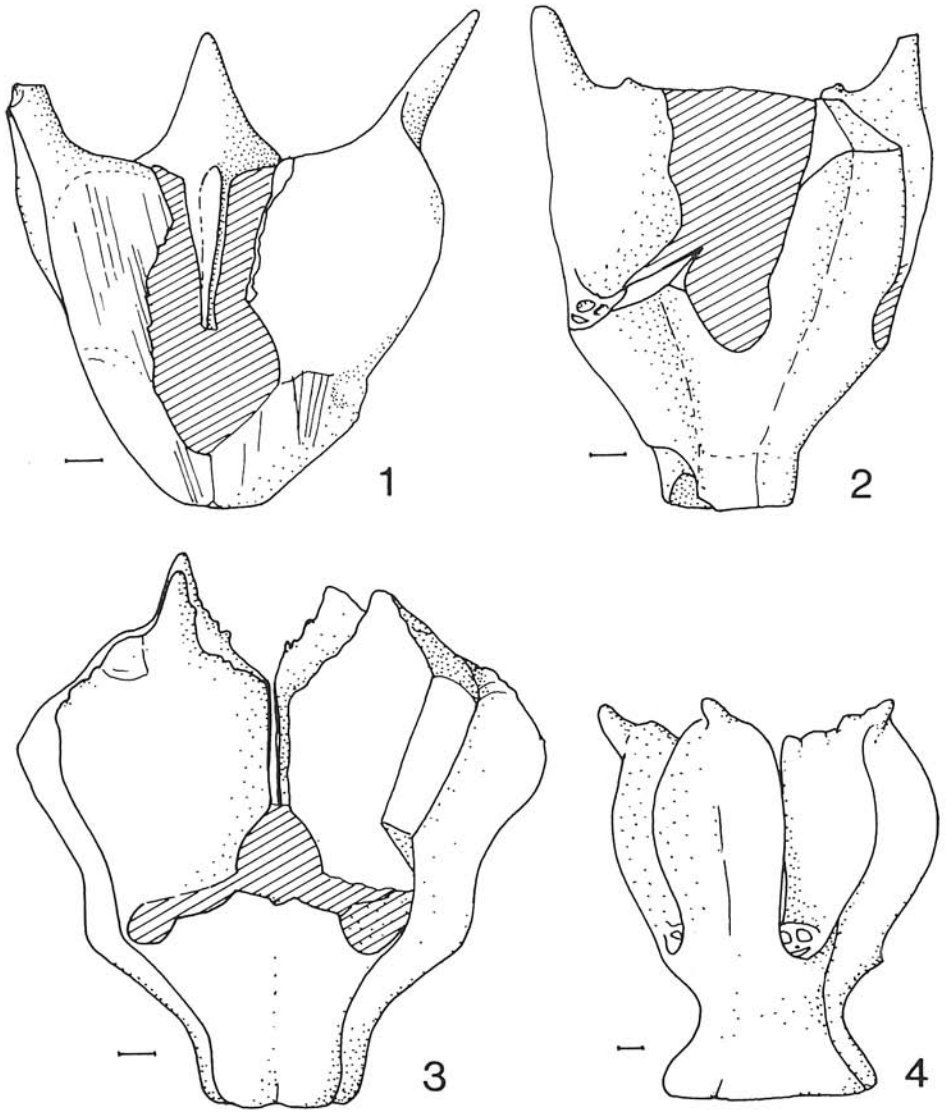


Fig. 2. Comparison of apsidocrinid calices.
Explanations: 1 — *A.* cf. *yanini* (ARENDT) from Vršatec. No. SNM Z-18 775/2; 2, 3 — *A. cyclamen* (REMEŠ) and *A. remesi* JAEKEL from Štramberk (see Žítt, 1978 b, Pl. 1, Figs. 15, 3); 4 — *A. moeschi* (ZITTEL) (see Pisera—Dzik, 1979, Fig. 10). Scale bar 1 mm.

8.0 mm (No. SNM Z-18 774/3). Diameter of calyx unmeasurable. Calyx narrows proximally (down) but near its base the walls can be vertical or can widen a new, so that a slightly inflated collar borders the dorsal cavity. Distinct lobes are developed at the level of radial facets. These proximally decrease in hight and dissappear almost completely in their lower third. Interradial depressions also proximally dissappear but they continue distally on interradial processes. These processes are higher than dorsal part of calyx. They are robust and have lateral wings directed in continuation of radial notch sides. The processes are distally furnished with long thorns, directed slightly laterally and extend to central parts in the form of slender edges. They reach the calyx centre, where they nearly contact each other. Lower thirds of processes not extended centrally and form a vaulting above ventral cavity. Radial notches widen distally, and their bottoms are slightly obliquely inclined to ventral cavity margin. No elliptical imprints as in *Phyllocrinus* (see above) are present nor the septum between bottom and ventral cavity is developed. Radial facets small but very distinct. Muscle fossae deep, ligamentary structures not preserved (see Pl. 3, Fig. 4). Dorsal cavity of circular outline, very deep, with its walls conically narrowing to a small circular articular facet on its bottom. Articular structures not preserved.

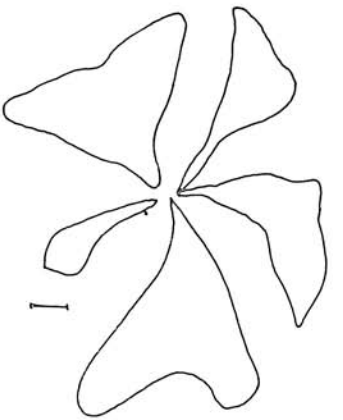


Fig. 3. *Apsidocrinus* cf. *yanini* (ARENDT). No. SNM Z-18 774 4. Outlines of distal parts of interradial processes in ventral view. The same orientation as in Pl. 1, Fig. 1, A_2. Scale bar 1 mm.

Notes and relations: Owing to the rather fragmentary material the identity of this species with the Lower Cretaceous Crimean *A. yanini* could not be confirmed exactly. The main difference consists in the angle made by thorn and the process (which is smaller in true *A. yanini*) and in the development of the lateral parts of processes facing to the radial notches.

The Štramberk species *A. remesi* and *A. cyclamen* differ fundamentally above all in the number of distal thorns. Whereas there exists only one thorn in *A.* cf. *yanini*, Štramberk species bear one smaller thorn (*A. cyclamen*) or yet

a greater number of thorns and tubercles (*A. remesi*). In *A. moeschi*, the form of thorns is yet more different (for all the species mentioned see Text-fig. 2).

All apsidocrinids known up to date are included in Tab. 1. For some other information see the above chapter on the taxonomic and paleobiogeographic relations.

? *Hemibrachiocrinidae* ARENDT, 1968
Gen. et sp. indet.
Pl. 4, Figs. 8—12

Horizon and locality: As in preceding species.

Material: 2 specimens.

Description: Calyx of rather irregular shape and subelliptical cross section, composed of five approximatelly sized radials. Ventral cavity small, rounded to irregular. Radial facets differ in size. Regarding the poor preservation it is impossible to say whether some of them were reduced in specimen No. SNM Z-18 776 (see Pl. 4, Figs. 10—12). Preserved facets have distinct muscle fossae; ligamentary part shallow, transverse ridges non-expressive. Probable niches for lodgement of arms on calyx margins have the form of ill-defined curved planes. Calyx part proximally joins with monocrystalline element similar to part of a columnal, as it widens distally (down). In specimen No. SNM Z-18 775/3) (see Pl. 4, Figs 8, 9) the only radial facet seems to be present on calyx margin. Basal part of specimen looks like a continuation of calyx with only a little depressed suture between both parts. Impression of massive and monolithic element similar to that of *Brachiomonocrinus* ARENDT is present.

Notes and relations: The adult hemibrachiocrinids are typically of monolithic nature, with all radials and even lower elements (if primarily present) completely fused (see Arendt, 1974, p. 152). The sutures between radials and between radials and lower element, are preserved only in the juveniles. Only two specimens of such a nature were found in Manester (Crimea, Lower Valanginian) and conspecified with *H. manesterensis* ARENDT. These two specimens are minute (their height about 2.5—3.5 mm) (see ARENDT op. cit., Pl. 34, Figs. 4, 5). The probable incorrectness of their species determination was discussed in Šitt (1979).

The two specimens described here are of much larger size, corresponding rather to the adults. Nevertheless, all their skeletal elements are separated. The independent subradial element presents, however, the main taxonomic problem. Did it serve for the direct attachment of crinoid or does it represent a fragment of some stem-like structure? Unfortunately, the fragmentary material cannot answer this question, and thus its attribution to the family *Hemibrachiocrinidae* remains open.

? *Cyrtocrinida* SIEVERTS-DORECK
Gen. et sp. indet.
Pl. 4, Figs. 5, 6, Text-fig. 4

Horizon and locality: As in preceding species.

Material: 4 well preserved specimens, great numbers of fragments in the rock.

Description: Robust axillary elements, swollen dorsally to a hump-like shape (see Pl. 4, Fig. 6, Text-fig. 4). Ventral surface with ambulacral furrows lying in deep and sometimes pocket-like depressions. Central part between both branches of ventral furrows is distinctly developed. All three facets inclined towards ventral part of element. Wide muscle fossae very pronounced but ligamentary structures very weak.

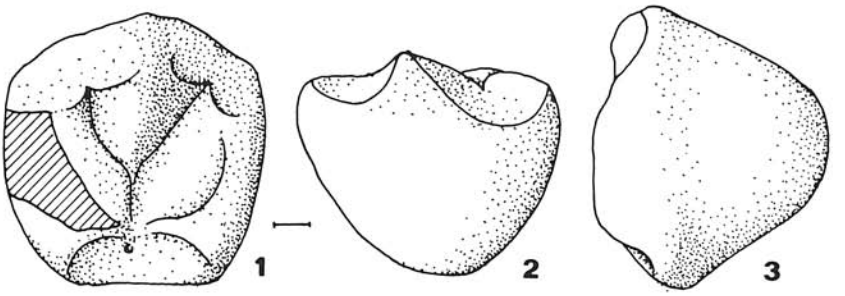


Fig. 4. Axillary element of unknown crinoid in ventral, distal, and lateral views (1, 2, 3). No. SNM Z-18 779. Scale bar 1 mm.

Notes: The above mentioned axillars could not be a part of the arm-apparatus of any species described herein. Their occurence in Vršatec is not rare but, on the contrary, they are very abundant. The position of its proximal facets gives evidence to the presence of some primibrachs. A direct articulation with calyx seems not to be possible under the supposition of usual radial facets type.

Other echinoderm remains

Crinoidea

The rock is overcrowded with a quantity of dissociated echinoderm remains. Among them, very minute strongly weathered and thus undeterminable brachials highly prevail. One of the best preserved specimens is figured in Text-fig. 6. As for the columnal elements, they are much more rare in the sample. Their shape is mostly stick-like to low cylindrical (see Text-fig. 6).

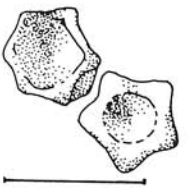


Fig. 5. Juvenile phyllocrinids. Nos. SNM Z-18 773/5, 6. Upper cup-ventral position, lower cup-dorsal position. Scale bar 1 mm.

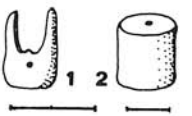


Fig. 6. 1 — minute brachial element. No. SNM Z-18 778/2. 2 — columnal element. No. SNM Z-18 773/4. Scale bar 1 mm.

Minute phyllocrinid calices were also found in the association (see Text-fig. 5) but it has not been possible to determine their generic assignment. Theoretically, they could belong both to *Phyllocrinus (P. malbosianus)* and *Apsidocrinus (A.* cf. *yanini).* However, all the calices are too small for as certain the type of radial notch (differentiating criteria of juveniles see Žítt, 1978b).

The ill-preserved and indeterminable isocrinid columnals were also found in a very limited number.

Echinoidea

The spines of echinoids, mainly their proximal parts were found in some cases (see Pl. 4, Fig. 7). Their determination is, however, very difficult.

No remains of *Asterozoa* or *Holothuroidea* were ascertained.

Acknowledgement: It is my pleasure to thank to prof. dr. M. Mišík from the Faculty of Natural Sciences, Comenius University, Bratislava, for showing me the locality and for some constructive comments. I'm indebted also to dr. V. Houša from the

Plate 1

Fig. 1. Two specimens of *Apsidocrinus* cf. *yanini* (ARENDT). A_1 — No. SNM Z-18 774/2, A_2 — No. SNM Z-18 774/4. Scale bar 5 mm. Fig. 2. *Apsidocrinus* cf. *yanini*, more magnified. No. SNM Z-18 774/2. Scale bar 2 mm.

Plate 2

Fig. 1. Spoon of *Torynocrinus andrusovi* sp. n., viewed posterioly (paratype, No. SNM Z-18 774/1). Scale bar 4 mm. Fig. 2. Fragment of spoon (stem part) of *Torynocrinus andrusovi* sp. n. No. SNM Z-18 773/1. Scale bar 5 mm.

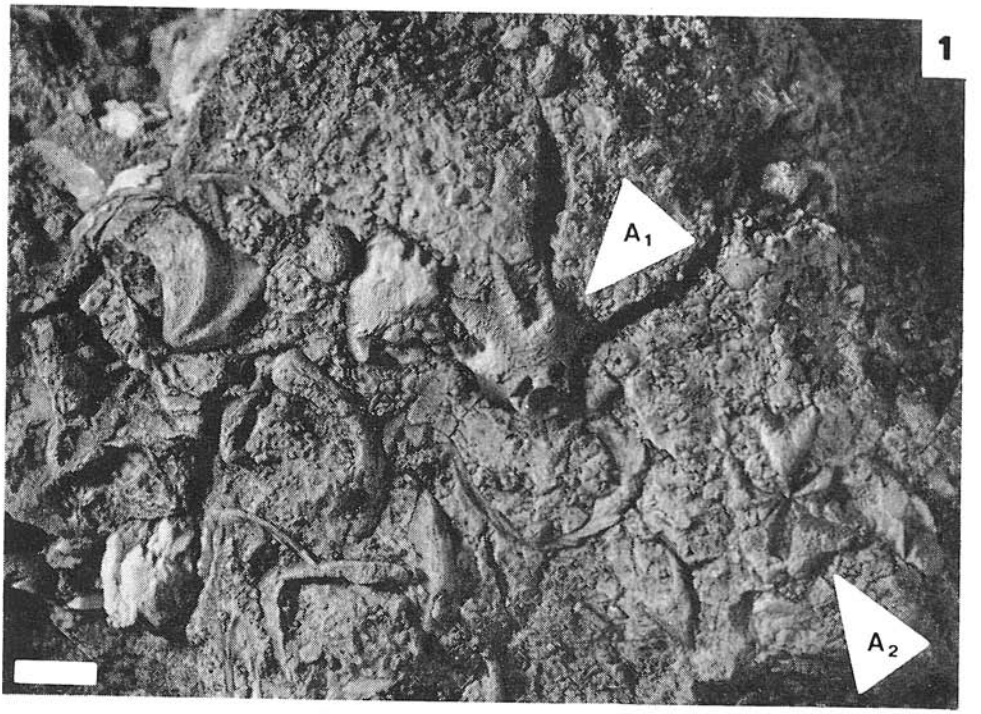
Plate 3

Fig. 1. *Phyllocrinus malbosianus* D'ORBIGNY, viewed vetrolaterally. No. SNM Z-18 773/2. Scale bar 2 mm. Fig. 2. A — *Apsidocrinus* cf. *yanini* in lateral position. No. SNM Z-18 778/1. Scale bar 4 mm. Fig. 3. Radial facet of *A.* cf. *yanini.* No. SNM Z-18 774/2. Scale bar 2 mm. Fig. 4. A — *A.* cf. *yanini* in lateral view. No. SNM Z-18 774/5. Scale bar 5 mm.

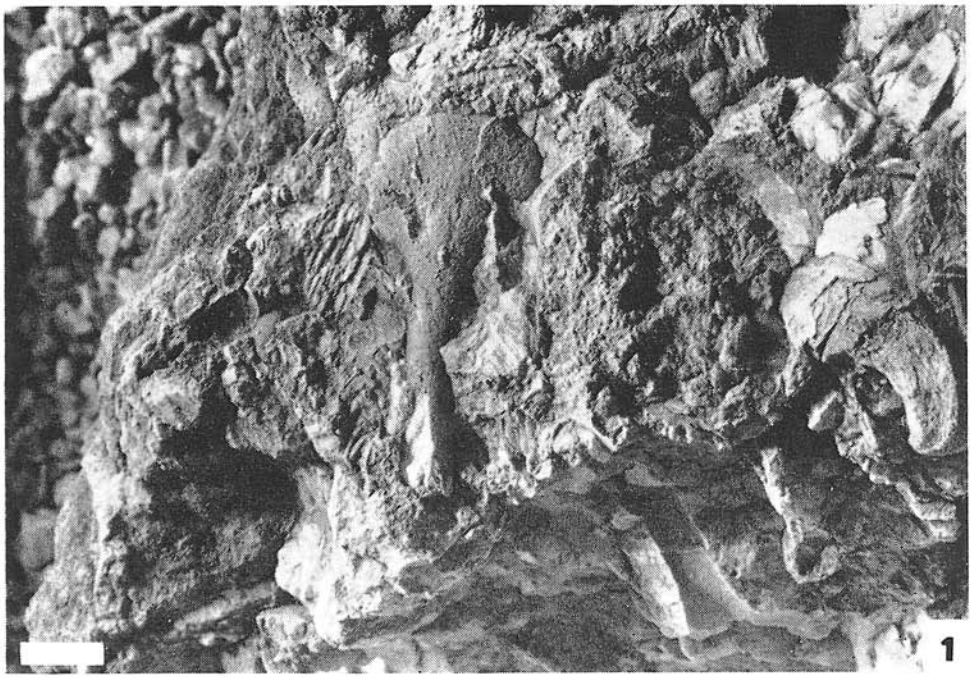
Plate 4

Figs. 1—3. Holotype of *Torynocrinus andrusovi* sp. n. in anteroventral and lateral views. Stem part of spoon non preserved. Fig. 3. — sutures designated. No. SNM Z-18 772. Scale bar 1 mm. Fig. 4. *Hemicrinus* cf. *thersites* (JAEKEL) in anterior view. No. SNM Z-18 775/1. Scale bar 1 mm. Figs. 5, 6. Axillary element of unknown crinoid in ventral and lateral views. No. SNM Z-18 777. Scale bar 1 mm. Fig. 7. Spine of an echinoid. No. SNM Z-18 775/4. Scale bar 1 mm. Figs. 8, 9. Hemibrachiocrinid (?) of *Brachiomonocrinus* ARENDT type. Fig. 9. — sutures designated. No. SNM Z-18 775/3. Scale bar 1 mm. Figs. 10—12. Hemibrachiocrinid (?) of *Hemiobrachiocrinus* ARENDT type. Ventral and lateral views. Fig. 12. — sutures designated. No. SNM Z-18 776. Scale bar 1 mm.

All photographs by J. Brožek, Institute of Geology and Geotechnics, Czechoslovak Academy of Sciences, Prague. All specimens are deposited in the collections of Slovak National Museum, Bratislava (SNM).


1
A1
A2

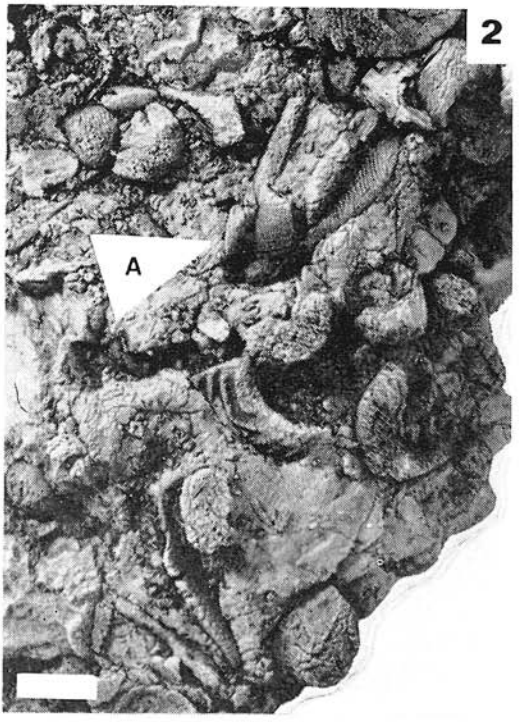

2

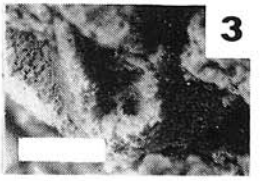


1

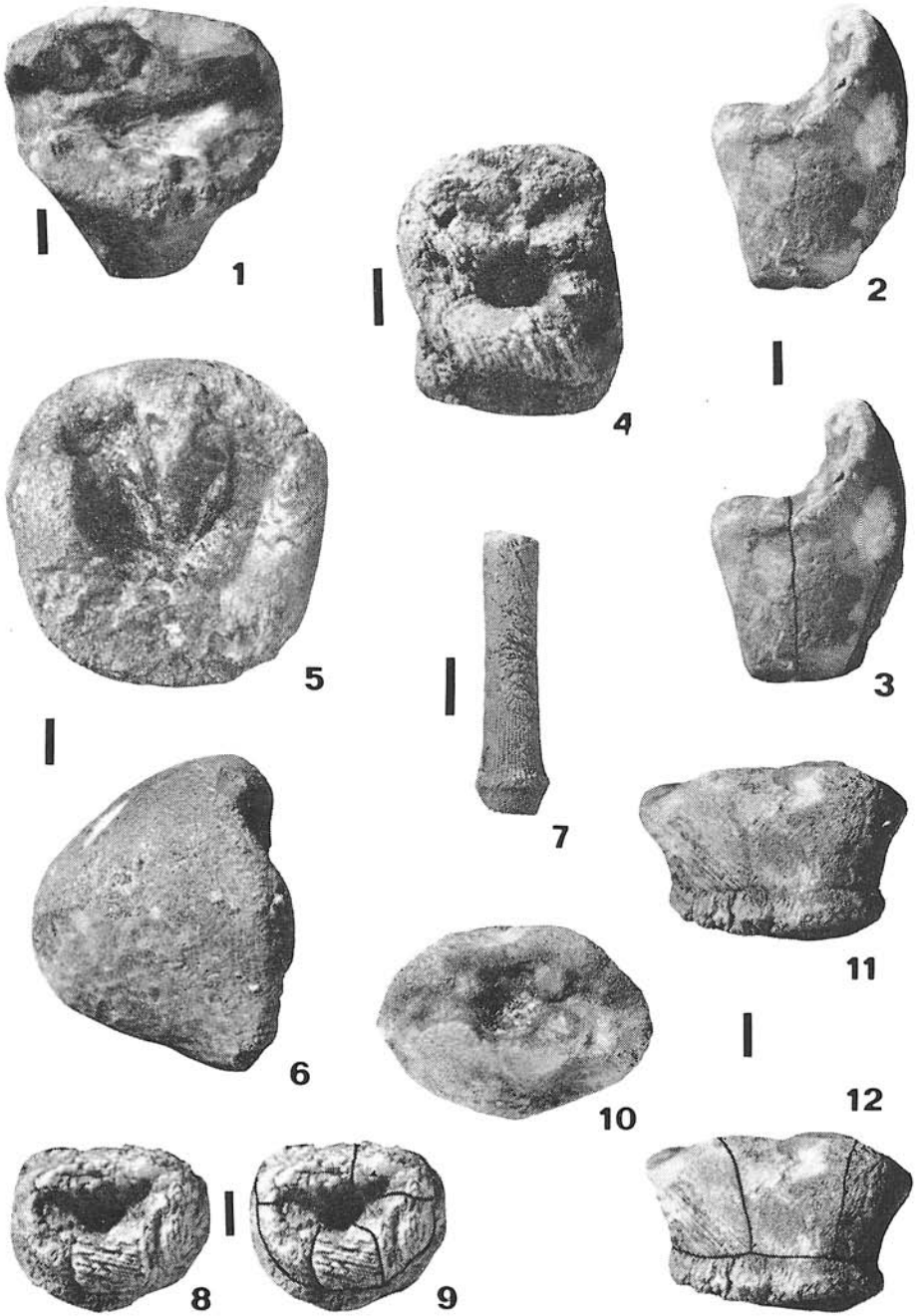
2


1


2
A


3

A
4


1
2
4
5
3
7
6
11
10
12
8
9

Institute of Geology and Geotechnics, Czechoslovak Academy of Sciences, Prague, for helping me during my first collection works and for age determination of aptychi. To dr. M. Siblík from the same institute I'm obliged for lending some literature. My thanks are also due to dr. J. Michalík, CSc. from the Geological Institute, Slovak Academy of Sciences, Bratislava, and to dr. R. Prokop from the National Museum, Prague. Mr. J. Brožek from the Institute of Geology and Geotechnics kindly made the photographs.

Translated by Č. Nekovařík

REFERENCES

ARENDT, Ju. A., 1974: Morskije liliji cirtokrinidy. Trudy Paleont. Inst. Akad. Nauk SSSR (Moskva), 144, pp. 1—250.

BIRKENMAJER, K., 1963: Stratygrafia i paleogeografia serii czorsztynskiej pieninskiego pasa skalkovego Polski. Stud. geol. pol. (Warszawa), 9, pp. 1—380.

GLUCHOWSKI, E. et al., 1983: Isocrinida from the Szlachtowa formation (Jurassic) of the Pieniny Klippen Belt, Carpathians, Poland. Stud. geol. pol. (Warszawa), 77, 4, pp. 83—88.

HOUŠA, V., 1976: Spodnokřídové formace doprovázející tělesa tithonských vápenců u Štramberka. Čas. Slez. Mus., Vědy přír. (Opava), 25, pp. 63—85, 119—131.

JEKELIUS, E., 1915: Die mesozoischen Faunen der Berge von Brassó, 1. Mitt. Jb. Ung. geol. Anst. (Budapest), 23, pp. 27—135.

DE LORIOL, P., 1879: Monographie des crinoides fossiles de la Suisse, 3éme partie. Abh. Schweiz. paläont. Gesell. (Genf), 6, pp. 125—300.

MIŠÍK, M., 1979: Sedimentologické a mikrofaciálne štúdium jury bradla vršateckého hradu (neptunické dajky, biohermný vývoj oxfordu). Západ. Karpaty, Sér. Geol. (Bratislava), 5, pp. 7—56.

MIŠIK, M., 1980: Vršatec (defilé profilu vršateckým bradlom, jura-krieda). In: Materiály XXIII. celoštátnej geologickej konferencie Slovenskej geologickej spoločnosti. Prednášky a exkurzný sprievodcovia (GÚDŠ, Bratislava), pp. 115—123.

PISERA, A. — DZIK, J., 1979: Tithonian crinoids from Rogoznik (Pieniny Klippen Belt, Poland) and their evolutionary relationships. Eclogae geol. Helv. (Basel), 72, 3, pp. 805—849.

RASMUSSEN, W. H., 1961: A monograph on the Cretaceous Crinoidea. Biol. skr. Kgl. danske rid. selskab. (Kobenhavn), 12, 1. pp. 1—428.

SIBLÍK, M., 1979: Brachiopods of the Vršatec Castle Klippen (Bajocian—? Berriasian) near Ilava (Slovakia). Západ. Karpaty, Sér. Paleont. (Bratislava), 4, pp. 35—64.

SIEVERTS-DORECK, H., 1961: Neokomskije krinoidy iz gor Bakoň. Ežegod. Vengr. geol. Inst. (Budapest), 49, 3, pp. 916—919.

SZÖRENYI, E., 1959: Les Torynocrinus (Crinoidea) du Crétacé inférieur de la Hongrie. Acta geol. Acad. Sci. hung. (Budapest), 6, 1—2, pp. 231—271.

ZARECZNY, S., 1876: Dodatek do fauny warstw tytonskich w Rogozniku i w Maruszynie. Spraw. Kom. fizjogr. Akad. Umiejet. Krakow), 10, pp. 180—215.

ZITTEL, K. A., 1870: Die Fauna der älteren cephalopodenführenden Tithonbildungen. Paläont. Mitt. Mus. bayr. Staat. (München), 2, pp. 119—310.

ŽÍTT, J., 1978 a: Phyllocrinus d'Orbigny, 1850 (Crinoidea, Cyrtocrinida) from the Lower Cretaceous of Štramberk (Czechoslovakia). Čas. Mineral. Geol. (Praha), 23, 1, pp. 39—51.

ŽÍTT, J., 1978 b: Apsidocrinus Jaekel, 1907 and Psalidocrinus Remeš, 1913 (Crinoidea, Cyrtocrinida) from the Lower Cretaceous of Štramberk, Czechoslovakia. Sbor. geol. Věd, Ř. P. (Praha), 21, pp. 107—124.

ŽÍTT, J., 1979: Hemibrachiocrinidae Arendt, 1968 (Crinoidea, Cyrtocrinida) from the Lower Cretaceous of Štramberk (Czechoslovakia). Věst. ústř. Úst. geol. (Praha), 54, 6, pp. 341—348.

ŽÍTT, J., 1983: Spoon-like crinoids from Štramberk (Lower Cretaceous, ČSSR). Sbor. Nár. Muz. (Praha), Ř. B, 39, 2, pp. 69—114.

ŽÍTT, J. — MICHALÍK, J., 1984: Upper Jurassic crinoids in the West Carpathian Klippen Belt. Geol. Zbor. Geol. carpath. (Bratislava), 35, 5, pp. 601—629.

Manuscript received June 26, 1985.