

ZÁPADNÉ KARPATY

SÉRIA

paleontológia 8

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Mária Kochanová—Jozef Pevný

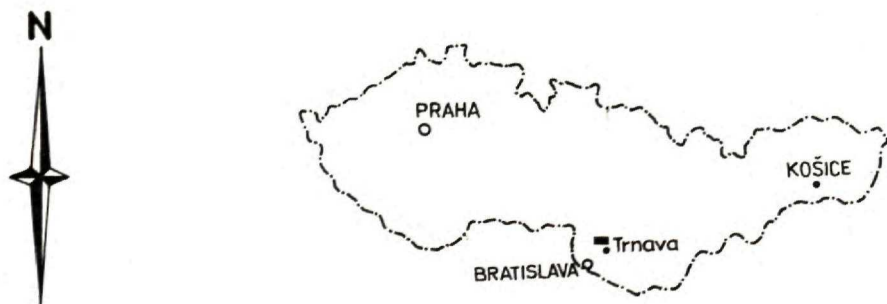
Bivalves and brachiopods from Wetterstein limestones of Ostrý vrch (Malé Karpaty Mts.)

4 text-figs., 7 Pls. (I—VII), Slovak summary

Abstract. Presented are results of the study of an assemblage of bivalves and brachiopods from the Wetterstein limestones of the Havranica nappe in the Malé Karpaty Mts. In older literature they are denoted as Cretaceous and later on as Carnian "Havranica limestones". The fossils found at the locality Ostrý vrch are indicative of the Ladinian, most likely Lower Ladinian age of the limestones.

Introduction

Geological structure of Ostrý vrch in the Havranica nappe of the Malé Karpaty Mts. comprises also the Wetterstein limestones. Since the time of D. ŠTÚR (1860) they were denoted as the "Havranica skála limestones" or the "Havranica limestones" (K. PAUL 1864, F. HAUER 1869, H. BECK—H. VETTERS 1904, D. ANDRUSOV 1935, M. MAHEL 1961, 1967). The term was precised by H. VETTERS who used it for a complex of dark, brownish limestone, with light limestone veinlets and of light limestone getting still more dolomitic to pass into white dolomite. Regarding their age, D. ŠTÚR, K. PAUL and F. HAUER i. c. referred the limestones to the Cretaceous. On the basis of gyroporelles, H. VETTERS regarded them Triassic and according to their position in the overlier of the Lunz beds he took them for equivalent to the Opponitz limestones, i. e. Carnian.



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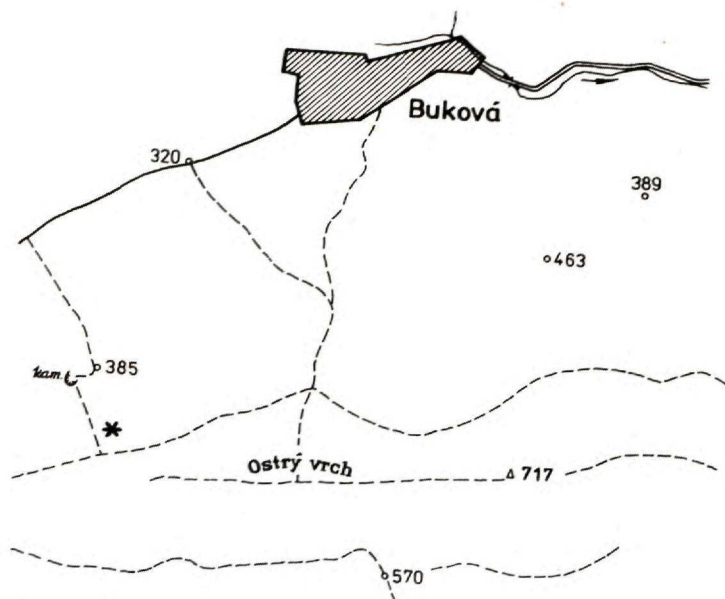


Fig. 1 Situation map of localities.

The term was used until the fossil finds proved that there were two lithostratigraphic units. The lower dark limestones were denoted as Gutenstein limestones, in the upper light limestones they distinguished the Anisian Steinalm limestones and Ladinian Wetterstein limestones (M. PERŽEL 1966, J. BYSTRICKÝ 1965, J. BYSTRICKÝ—A. BIELÝ 1966, M. KOCHANOVÁ 1965).

Here we want to present information about fauna, namely of bivalves and brachiopods from the Wetterstein limestones, most likely Lower Ladinian. They are from two localities on the northwestern slope of the Ostrý vrch SW of the village Buková. The first locality is a rock exposure in the form of a rock wall about 6 m below a forest path called the "grófska cesta". In the basement of dolomites are light-grey limestones with evinosponges and lumachelles of bivalves and brachiopods. The second locality is in white limestones banks in a slope about 4—5 m below the preceding locality. They, too, contain evinosponges and lumachelles of bivalves and brachiopods.

The list of species from the two localities (with the number of the specimens):

	Locality	
	No 1	No 2
<i>Parallelodon</i> cf. <i>beyrichi</i> (STROMBECK)	1	
<i>Protopis</i> sp.		2
<i>Pinna</i> sp.		1
<i>Pteria</i> cf. <i>caudata</i> (STOPPANI)	2	
<i>Pteria</i> sp.		2

<i>Leptochondria separata</i> (REISS)	7	
<i>Leptochondria</i> aff. <i>viezzensis</i> (WILCKENS)	10	
<i>Leptochondria</i> sp.		1
<i>Leptochondria</i> sp. 1		3
<i>Ornithopecten triadicus</i> (SALOMON)	3	
<i>Ornithopecten</i> sp.	1	
<i>Pleuronectites</i> ? sp.		1
<i>Prospondylus</i> ? sp.		1
<i>Daonella</i> sp.	1	3
<i>Entolium discites</i> (SCHLOTHEIM)	1	
<i>Entolium</i> cf. <i>pseudodiscites</i> (BITTNER)		1
<i>Entolium</i> ? sp.		1
<i>Chlamys</i> (<i>Praechlamys</i>) <i>broilii</i> (PHILIPP)		8
<i>Chlamys</i> (<i>Praechlamys</i>) sp. (ex gr. <i>broilii</i>)	3	
<i>Chlamys</i> (<i>Praechlamys</i>) <i>paronai</i> (TOMMASI)		3
<i>Chlamys</i> (<i>Praechlamys</i>) <i>rotai</i> (TOMMASI)		1
<i>Chlamys</i> (<i>Praechlamys</i>) cf. <i>fassaensis</i> (PHILIPP)	2	
<i>Chlamys</i> (<i>Praechlamys</i>) sp.		1
<i>Chlamys</i> (<i>Granulochlamys</i>) ? sp.		1
<i>Chlamys</i> ? sp.		2
<i>Newaagia</i> sp.		1
<i>Newaagia</i> ? sp.	1	
<i>Plagiostoma striatolineatum</i> (SCHLOTHEIM)		12
<i>Plagiostoma</i> sp.		6
<i>Mysidioptera cainalloi</i> (STOPPANI)		6
<i>Schafhaeutlia</i> cf. <i>esinensis</i> (STOPPANI)		2
<i>Schafhaeutlia</i> cf. <i>plana</i> (MÜNSTER)		1
<i>Cardium</i> ? aff. <i>victoriae</i> (DE LORENZO)		4
<i>Euomphalus</i> sp.	1	
<i>Dicosmos</i> sp.		1
<i>Naticopsis</i> sp.		1
<i>Coelostylina</i> sp.		1
<i>Cruratula eudora</i> (LAUBE)	100	80
<i>Cruratula eudora</i> (BITTNER)	5	
<i>Cruratula carinthiaca</i> (ROTHPLETZ)	7	
<i>Angustothyris angustaeformis</i> (BÖCKH)	4	
<i>Aulacothyris angusta</i> (SCHLOTHEIM)	1	
<i>Decurtella devota</i> (BITTNER)	1	
<i>Decurtella vivida</i> (BITTNER)	1	
<i>Spiriferina</i> cf. <i>pia</i> BITTNER		1
<i>Spiriferina pectinata</i> BITTNER	3	
<i>Mentzelia mentzeli mentzeli</i> (DUNKER)	3	
<i>Schwagerospira schwageri</i> (BITTNER)	4	
<i>Punctospirella fragilis</i> (SCHLOTHEIM)	10	
<i>Tetractinella trigonella</i> (SCHLOTHEIM)	1	

Biostratigraphy

The described fossils, mainly bivalves occur at both localities in the form of incomplete, damaged cores, with their surface frequently corroded. Because of few morphological and sculptural characters their species and generic assignment was impossible in many cases. Many were unsuitable for photography.

MOLLUSCA

Parallelodontidae DALL, 1898

Parallelodon MEEK et WORTHEN, 1866

Type species *Macrodon rugosus* BUCKMAN, 1845. Middle Jurassic: England.

Parallelodon cf. beyrichi (STROMBECK, 1849)

1849 *Cucullaea Beyrichi* STROMBECK, p. 451, tab. 7A (non vidi) (fide C. DIENER, 1923).

1923 *Macrodon Beyrichii* — C. DIENER, p. 161 (cum syn.)

1928 *Macrodon Beyrichi* — M. SCHMIDT, p. 176, fig. 395.

Material: A core of the left valve. It is preserved only the upper half.

Remarks: In spite of the absence of the lower half of the valve the typical characters of the species are distinct. It is a horizontally elongated valve, with straight hinge margin and beak near the anterior margin. This is huge, inclined to the hinge line. In the posterior part of the hinge margin the valve is depressed to form the posterior wing. The magnifying glass shows characteristic sculptural elements like huge vertical growth lines and fine tight radial ribs. According to Treatise on Invertebrate Paleontology (1969, N 256) it is ranged to the genus *Parallelodon*.

Stratigraphical and geographical ranges: Upper Scythian — Ladinian; Germany, Southern Alps, Dinarides, Astrakhan,

Occurrence: Ostrý vrch, locality No. 1.

Occurrence in the West Carpathians: Slovak Karst.

Mysidiellidae COX, 1964

Protopis KITTL, 1904

Type species *Opis (Protopis) triptycha* KITTL, 1904. Middle Triassic: Germany.

Protopis sp.

Pl. II, IV, Fig. 8, 1

Material: Two incomplete cores of the right valve. The larger one has a considerably corroded surface.

Dimensions: H = ? 27 mm, L = 23 mm, H = ? 34 mm, L = 30 mm.

Remarks: Our specimens cannot be identified with any of the known species. A characteristic mark of the shape of the asymmetrical valve is its considerable convexity in the middle part and a conspicuous diagonal keel. The keel extends from the beak to the lower margin. The valve inclines steeply to the anterior and the posterior margins. Its inclination to the posterior margin gets more gentle to form a wing-like element. The beak is diagonally curved forward and projects over the hinge margin. In addition to the keel there are also two edges running out of the beak. The shorter one, parallel to the diagonal keel is visible to 1/3 of the total height. It separates the steep wing-like part in the posterior part of the valve. The second edge runs along the upper posterior margin to rim there a narrow area. The sculpture of a smaller specimen shows distinct, the sculpture of a larger one vague traces of concentric wrinkles on the steep anterior part of the valve. The specimens are most resemblant to *Protopis waageni* SCHNETZER. They differ in general shape, as in our specimens the height dimension is dominant, the posterior part of the valve behind the diagonal edge is different in shape, and there are three edges coming out of the beak instead of two.

Occurrence: Ostrý vrch, locality No 2.

Pinnidae LEACH, 1819

Pinna LINNÉ, 1758

Type species *Pinna rudis* LINNÉ, 1758. Recent: Barbados.

Pinna sp.

Pl. III, Fig. 6

Material: A core fragment with corroded surface.

Remarks: According to its general shape and surface sculpture the specimen can only be ranged to the genus *Pinna*. Its valve must have been large because the fragment is 6 cm high and 4 cm wide. The sculpture consists of narrow radial ribs divided by broader flat intercostal spaces.

Occurrence: Ostrý vrch, locality No 2.

Pteriidae GRAY, 1847

Pteria SCOPOLI, 1777

Type species *Mytilus hirundo* LINNÉ, 1758. Recent: Mediterranean Sea.

Pteria cf. *caudata* (STOPPANI, 1858)

Pl. I, Fig. 4

1858 *Avicula caudata* STOPPANI, p. 92, tab. 18, fig. 18—19.

1959 *Avicula caudata* — C. ROSSI RONCHETTI, p. 292—293, tab. 15, fig. 6—7 (cum syn.)

1971 *Pteria caudata* — H. ZORN, p. 59, tab. 15, fig. 2, 9.

Material: A core of the right valve without the anterior auricle, and one core of the small left valve.

Remarks: The valve is comparatively narrow, diagonal. The right valve is gently convex, the left one is more convex. The convexity extends from the beak to the lower margin. In the posterior part the wing-shaped posterior ear is separated by a depression from the body of the shell. The detachment is more conspicuous on the left valve than on the right. The anterior ear is not preserved. The surface sculpture comprises growth lines. On our specimens they are only on the body of the left valve. The right one shows them on the posterior ear as sinusoid growth lamellae. There is a thickened rim at its upper margin. These specimens are most resemblant to those, figured by A. TOMMASI (1911, Pl. 1, Fig. 31) and A. BITTNER (1895, Pl. 8, Fig. 17).

Stratigraphical and geographical ranges: Anisian — Carnian; Southern Alps, Appenines, Sicily and Upper Silesia.

Occurrence: Ostrý vrch, locality No 1.

Occurrence in the West Carpathians: the Strážovské vrchy Mts.

***Pteria* sp.**

Pl. I, Fig. 7

Material: Two incomplete cores of the left valve. They miss the beak and the anterior ear.

Remarks: Diagonal valves remind of the species *Pteria cassiana* (BITTNER), but they cannot be identified because of their incompleteness. The body of the valve is broader, the posterior ear is shorter, sinuated at its end and there are two rims on its upper margin, detached by a narrow groove.

Occurrence: Ostrý vrch, locality No 2.

***Aviculopectinidae* MEEK et HAYDEN, 1864**

***Leptochondria* BITTNER, 1891**

Type species *Pecten (Leptochondria) aeolicus* BITTNER, 1891. Upper Triassic: Asia Minor.

***Leptochondria separata* (REISS, 1926)**

Pl. IV, Fig. 6

1926 *Pecten separatus* REISS, p. 122, tab. 9, fig. 9.

1972 *Leptochondria separata* — A. ALLASINAZ, p. 251—252, tab. 30, fig. 8. (cum syn.)

Material: Three cores and two plaster casts mostly of incomplete left valves and two fragments.

Dimensions: H = 15 mm, L = 13,5 mm, H = 10 mm, L = 9 mm

Remarks: The specimens described agree with the holotype illustrated by A. ALLASINAZ l. c. They are semi-circular, slightly convex in their central part. The

hinge margin is straight, the beak is situated in its centre. The auricles are continuation of the valve body, the anterior one is with a byssal notch. The surface is covered by radial ribs. The primaries commence at the beak and alternate with one thinner inserted secondary rib. Dense, fine growth lines are more distinct on auricles. Besides them there are also two or three radial ribs.

An incomplete left valve agrees in morphology of the body and auricles with the above described specimens. There, however, are differences in sculpture. Radial ribs are separated by broader intercostal spaces and in some of them there is a thinner tertiary rib between the primaries and secondaries. We have denoted it as *Leptochondria* cf. *separata*.

Stratigraphical and geographical ranges: Ladinian; Northern Alps.

Occurrence: Ostrý vrch, Locality No 1.

***Leptochondria* aff. *viezenensis* (WILCKENS, 1909)**

Pl. I, fig. 1, 8

1909 *Pecten viezenensis* WILCKENS, p. 147—148, tab. 5, fig. 25ab

1972 *Leptochondria viezenensis* — A. ALLASINAZ, p. 259—260, tab. 31, fig. 5—9

Material: Cores of six damaged left valves and four fragments.

Remarks: Our specimens can be identified with those figured by A. ALLASINAZ (1972, Pl. 31, Fig. 5) both in general morphology and in sculpture. They have the same semi-circular outline, straight comparatively long hinge margin and vaguely detached auricles. Only our specimens are somewhat larger and less convex. The surface sculpture consists of radial ribs divided according to thickness into primaries, secondaries and tertiaries, the tertiaries commencing in various distances from the beak. The only traces of concentric sculpture on the body of the valve are some processes on the ribs, and dense regular growth lines on auricles.

Stratigraphical and geographical ranges: Upper Ladinian; Southern Alps.

Occurrence: Ostrý vrch, locality No 1.

***Leptochondria* sp.**

Material: A sculptural mould of the left valve, with only the anterior half preserved.

Remarks: The specimen is resemblant to the species *Leptochondria stoppani* ROSSI RONCHETTI (1959, Pl. 16, Fig. 3). The valve is convex and the preserved large anterior auricle is its continuation. Its sculpture is identic with the rest of the surface: dense, radial ribs, thicker ones alternating with thinner. Magnifying glass shows very fine vertical growth lines on the auricle. The described specimen cannot be defined reliably because of its incomplete preservation.

Occurrence: Ostrý vrch, locality No 2.

***Leptochondria* sp. 1**

Pl. I, Fig. 6

Material: Moulds of two incomplete left valves and a fragment.

Remarks: In their general shape and sculpture the specimens resemble the species *Leptochondria inaequistriata* (GOLDFUSS) and *Leptochondria viezzenensis* (WILCKENS). They are semi-circular, one of the valve is more convex than the other. The beak is small, pointed and the auricles are indistinctly divided from the disc. The surface is covered with radial ribs, the thicker ones alternating with the thinner. In this they recall the species *Leptochondria inaequistriata* only the ribs are fewer and the valves are less convex. In their tertiaries they also resemble the species *Leptochondria viezzenensis*, these are, however, not a permanent component of sculpture — they only occur in some intercostal spaces. One specimen shows tiny grains on ribs when observed under magnifying glass.

Occurrence: Ostrý vrch, locality No 2.

***Ornithopecten* Cox, 1962**

Type species *Aviculopecten bosniae* BITTNER, 1903. Middle Triassic (Anisian); Yugoslavia (Bosnia).

***Ornithopecten triadicus* (SALOMON, 1895)**

Pl. I, Fig. 2, 3

1895 *Aviculopecten triadicus* SALOMON, p. 147—152, tab. 4, Fig. 35.

1959 *Aviculopecten* (*Aviculopecten*) *triadicus* — C. ROSSI RONCHETTI p. 294—296, tab. 15, fig. 2 (cum syn.).

1972 *Ornithopecten triadicus* — A. ALLASINAZ, p. 221.

Material: A mould, a plaster cast and a fragment of the left valve.

Dimensions: H = 15 mm, L = 22 mm.

Remarks: The specimens are characterized by an asymmetrical valve with a small anterior auricle, distinctly divided from the valve body and by a broad posterior wing which is its continuation. The beak is in the frontal part of a long straight hinge margin only slightly projecting. The surface sculpture comprises radial ribs. Some of them are thicker primary ribs, other are thinner and inserted in comparatively broad intercostal spaces. On our specimens the difference in ribs is also at the lower margin whereas the author of the species writes that the thickness differences of ribs almost vanish there. There are concentric stripes caused by growth interruptions, crossing the radial ribs and dividing spaces. They are only preserved on a small part at the lower margin of the valve, so their number cannot be found out. According to SALOMON and ROSSI RONCHETTI there are 12—14 concentric stripes. Another small fragment of the lower part of the valve shows a different sculpture. There are radial ribs of equal thickness with comparatively broad, shallow intercostal spaces, crossed by concentric stripes forming knobs on ribs. Or-

nithopecten wissmanni (MÜNSTER) shows this type of sculpture. This, however, cannot be said about such a small fragment of shell. So we denoted it as *Ornithopecten* sp.

Stratigraphical and geographical ranges: Ladinian; Southern Alps.

Occurrence: Ostrý vrch, locality No 1.

***Pleuronectites* SCHLOTHEIM, 1820**

Type species *Pleuronectites laevigatus* SCHLOTHEIM, 1820. Middle Triassic; Germany.

***Pleuronectites* ? sp.**

Pl. II, Fig. 5

Material: An incomplete valve.

Remarks: The preserved middle part of the specimen is of vertical oval shape. Its sculpture consists of dense, narrow radial ribs, covering the whole preserved part of the valve. They are inconspicuous around the umbo and they only get distinct when farther from it. The ribs and narrow intercostal spaces are crossed by narrow, indistinct growth lines spaced regularly in 1/2 to 3/4 mm distance. They form a regular network composed of tiny mesh. The ornament recalls that of the species *Pleuronectites fassaensis* (SALOMON) illustrated by A. ALLASINAZ (1972, Pl. 43, Fig. 9ab) only its sculpture is visible with naked eye. It might also belong to the genus *Mysidioptera* but we do not know the species to which it could belong.

Occurrence: Ostrý vrch, locality No 2.

***Pseudomonotidae* NEWELL, 1938**

***Prospondylus* ZIMMERMANN, 1886**

Type species *Prospondylus liebeanus* ZIMMERMANN, 1886. Upper Permian: Germany.

***Prospondylus* ? sp.**

Pl. III, Fig. 3

Material: A mould of an incomplete right valve without the umbonal part.

Remarks: We cannot determine the shape and dimensions of the specimen. Its form resembles pectinoid shape with the convex upper part. The surface sculpture consists of alternating radial ribs. According to their thickness they may be distinguished into primaries to tertiaries. Their arrangement is irregular. Fine, dense concentric lines are visible under the magnifying glass. The specimen reminds of that figured by F. BROILI (1903, Pl. 19, Fig. 30) as *Prospondylus* (*Hinnites*) sp.

Occurrence: Ostrý vrch, locality No 2.

Posidoniidae FRECH, 1909

Daonella MOJSISOVICS, 1874

Type species *Halobia lommeli* WISSMANN, 1841. Middle Triassic (Ladinian): Austria.

***Daonella* sp.**

Material: Incomplete moulds of four small valves of young specimens.

Remarks: Only generic assignment is possible. The valves are small, horizontally elongated, with long straight hinge margin and somewhat elevated beak. The surface is covered by radial ribs of different thickness. They are absent at the posterior hinge margin.

Occurrence: Ostrý vrch, locality, No 1, 2.

Entoliidae KOROBKOV, 1960

Entolium MEEK, 1865

Type species *Pecten demissus* PHILLIPS, 1829. Middle Jurassic (Bajocian): Germany.

***Entolium discites* (SCHLOTHEIM, 1820)**

Pl. II, Fig. 6

1820 *Pecten discites* SCHLOTHEIM, p. 218

1928 *Pecten (Entolium) discites* — M. SCHMIDT, p. 157, fig. 336

1972 *Entolium discites* — A. ALLASINAZ, p. 285, tab. 35, fig. 8, 9 (cum syn.)

Material: One mould at the margins of an incomplete left valve.

Dimensions: H = 15 mm L = 13 mm

Remarks: With its small dimensions the valve belongs among small specimens, quite frequent in the West Carpathians. It is semi-circular, with gently convex central part. The hinge margin is straight, the posterior auricle is only somewhat smaller than the anterior. Dense, fine growth lines on the surface are only visible under the magnifying glass.

Stratigraphical and geographical ranges: Anisian — Ladinian; Germany, Southern Alps, Sicily, Bakony, Bihar Mts., Upper Silesia, Dobrudja, Ussuri region, Argentina.

Occurrence: Ostrý vrch, locality No 1.

Occurrence in the West Carpathians: the Malé Karpaty Mts., the Strážovské vrchy Mts., the Nízke Tatry Mts., Slovak Karst, the Humenské pohorie Mts., Trábeč, the Zvolenská vrchovina Mts.

***Entolium cf. pseudodiscites* (BITTNER, 1901)**

Pl. IV, fig. 7

1858 *Pecten discites* — STOPPANI, p. 101, tab. 21, fig. 4

1901 *Pecten pseudodiscites* BITTNER, p. 38

1972 *Entolium pseudodiscites* — A. ALLASINAZ, p. 222

Material: Mould of the right valve, without anterior auricle and with incomplete posterior one.

Dimensions: H = 23 mm L = 22 mm, umbonal angle 104°

Remarks: The specimen now recorded is most resemblant to that figured by A. STOPPANI l. c. Its circular outline is slightly disturbed by longer posterior and shorter anterior sides. The valve is flat, only its middle part in the umbonal region is convex. The auricles are not preserved, but the fragment of the posterior one indicates that they are small in relation to the valve size. The surface is smooth, and the structure of one layer of the shell is visible. It consists of hair-fine radial lines of fan-like distribution.

Stratigraphical and geographical ranges: Anisian and Ladinian; Southern Alps.

Occurrence: Ostrý vrch, locality No 2.

Entolium ? sp.

Pl. III, Fig. 1

Material: An incomplete mould without beak and auricles, on the surface corroded.

Remarks: Our specimen has a comparatively large valve, because the height of the preserved part is 48,5 mm. It is circular, almost flat, with traces of occasional incomplete concentric stripes on its surface. Because of the missing umbonal region it is difficult to say whether it represents a large specimen of the species *Entolium discites* or of the genus *Pleuronectites*.

Occurrence: Ostrý vrch, locality No 2.

***Chlamys* RÖDING, 1798**

Type species *Pecten islandicus* MÜLLER, 1776. Recent: cosmopolite.

Praechlamys ALLASINAZ, 1972

Type species *Pecten (Chlamys) inaequalternans* PARONA, 1889. Upper Triassic (Julian): Italy (Lombardia).

***Chlamys (Praechlamys) broilii* (PHILIPP, 1904)**

Pl. II, Fig. 1, 3

1904 *Pecten Broilii* PHILIPP, p. 90—91, tab. 6, fig. 8—12

1972 *Chlamys (Praechlamys) broilii* — A. ALLASINAZ, p. 344—345, tab. 45, fig. 6—9 (cum syn).

Material: Moulds of seven incomplete left and one right valve, mostly with one auricle preserved.

Remarks: All left valves available are characterized by gently convex central area and by a depression at the posterior margin. According to ALLASINAZ l. c. the valves are flat. There are distinctly separated auricles on both sides of the small pointed beak. The surface structure is very typical, grating, composed of radial ribs in three series, commencing in various distances from the beak. They are distributed all over the surface of the valve, with the exception of the posterior depressed region. On this part there are only growth lines. Broader concentric stripes cross the ribs in regular intervals and form knobs on them. There are also fine, dense growth lines, visible only under the magnifying glass. The auricles are ornamented with vertical lamellae. Sculpture of the right valve is slightly different because the radials are missing except in the area at the posterior auricle. They are missing even there on our specimen. The only sculptural element preserved are regular concentric waves. The anterior byssal auricle is large.

Stratigraphical and geographical ranges: Ladinian — Cordevolian; Southern Alps.

Occurrence: Ostrý vrch, locality No 2, and No 1 (ex gr.)

Occurrence in the West Carpathians: The Strážovské vrchy Mts., the Muránska plošina plateau.

***Chlamys (Praechlamys) paronai* (TOMMASI, 1911)**

Pl. III, Fig. 4

1911 *Pecten Paronai* TOMMASI, p. 20—22, tab. 2, fig. 10—11

1972 *Chlamys (Praechlamys) paronai* — A. ALLASINAZ, p. 351—353, tab. 47, fig. 1—3 (cum syn.)

Material: Moulds of two incomplete left valves, and a fragment in the rock.

Remarks: The valves are triangular with their height dominant. They are rather flat. The auricles are not preserved, with the exception of the basal part on one of the valves. The characteristic surface sculpture consists of numerous thick radial ribs on one specimen and thinner radials on the other. The thicker and thinner secondaries and tertiaries alternate mutually. The latter commence in the middle of the total height. In some intercostal spaces they are absent. Dense, regularly arranged growth lines form knobs on ribs and a dense network. Two of the specimens resemble the species *Pecten cislensis* POLIFKA, by fine radial sculpture. But the arrangement of ribs is identic with that of the species *Chlamys (Praechlamys) paronai* and this is why A. ALLASINAZ regards it as its synonym. On the preserved part of the anterior auricle are diagonal growth lamellae and fine radial ribs on the posterior one, visible under the magnifying glass.

Stratigraphical and geographical ranges: Ladinian; Southern Alps.

Occurrence: Ostrý vrch, locality No 2.

Occurrence in the West Carpathians: Slovak Karst.

***Chlamys (Praechlamys) rotai* (TOMMASI, 1911)**

Pl. III, Fig. 2

1911 *Pecten Rotai* TOMMASI, p. 20, tab. 2, fig. 9

1959 *Chlamys (Chlamys) rotai* — C. ROSSI RONCHETTI, p. 300—302, tab. 16, fig. 7

1972 *Chlamys (Praechlamys) rotai* — A. ALLASINAZ, p. 345—355, tab. 47, fig. 6 (cum. syn.)

Material: A mould of incomplete left valve.

Remarks: The described specimen may be identified with the specimen figured by C. ROSSI RONCHETTI. In the dimensions of the valve with partly convex central region the height is dominant. The surface is covered with dense radial ribs. Most conspicuous are primary ribs, the next are thinner to linear inserted ribs of the fourth order. In places there are tiny grains on the ribs as traces of concentric sculpture and visible under the magnifying glass. Poorly preserved growth lamellae are on the auricles.

Stratigraphical and geographical ranges: Ladinian; Southern Alps.

Occurrence: Ostrý vrch, locality No 2.

Occurrence in the West Carpathians: The Strážovské vrchy Mts.

***Chlamys (Praechlamys) cf. fassaensis* (PHILIPP, 1904)**

1904 *Pecten fassaensis* PHILIPP, p. 91—92, tab. 6, fig. 16—17.

1972 *Chlamys (Praechlamys) fassaensis* (PHILIPP) — A. ALLASINAZ, p. 347—348, tab. 46, fig. 4, 5.

Material: A mould of an incomplete left valve with the anterior auricle and one without auricles.

Remarks: In the case of incomplete valves the species ranging may only be based on the characteristic surface sculpture of the valve and the auricle. The sculpture consists of dense radial ribs distinguished into primaries to tertiaries according to their thickness and the place of origin. Together with concentric lines regularly spaced, they form a reticle. There are only dense growth lamellae on the anterior auricle. Our specimens agree with that figured by A. ALLASINAZ (Pl. 46, Fig. 4), only their preservation is poorer.

Stratigraphical and geographical ranges: Ladinian; Southern Alps.

Occurrence: Ostrý vrch, locality No 1.

Chlamys (Praechlamys) sp.

Pl. IV, Fig. 5

Material: A mould of the right valve, damaged on its anterior and lower margins.

Dimensions: H = ? 24 mm L = 21 mm

Remarks: The valve is unidentifiable with the known species. It is triangular, slightly convex in its upper middle part. The beak is in the centre, inclined to the hinge margin without projecting over it. The auricles on its both sides are deepened,

the anterior one is incomplete. The surface is covered by radial ribs separated by broader intercostal spaces. In some of them are indistinct traces of inserted ribs. At the lower margin are regular, dense growth lines crossing both the ribs and the interspaces. The auricular sculpture comprises radial and concentric elements, but their exact number and arrangement cannot be determined.

Occurrence: Ostrý vrch, locality No 2.

Granulochlamys ALLASINAZ, 1972

Type species *Pecten tubulifer* MÜNSTER, 1841. Cordevolian: Southern Alps.

Chlamys (Granulochlamys) ? sp.

Pl. II, Fig. 2.

Material: A mould of the right valve with incomplete anterior margin. Its umbonal part could not have been recovered from the rock.

Remarks: The valve, convex in its middle upper region, is vertically oval. Its beak and auricles are not preserved. The ornament recalls the specimen previously described as *Pleuronectites ? sp.*, only its radial ribs at the lower margin are flat and twinned. The nodules are indistinct because of abrasion. Our specimen reminds of the species *Chlamys (Granulochlamys) nodulifera* (BITTNER) as illustrated by BROILI (1903, Pl. 19, Fig. 24). But its concentric lines are twinned, whereas the specimen now recorded has radial ribs.

Occurrence: Ostrý vrch, locality No 2.

Chlamys ? sp.

Material: Two incomplete moulds of the right valve.

Remarks: Even the generic assignment is difficult for our incomplete valves. They may belong both to the genus *Leptochondria* and *Chlamys*. Their height and width seem almost equal, the middle region is slightly convex, the beak has a central position, the anterior auricle is larger than the posterior one. The sculpture consists of smooth radial primary ribs and one or two inserted in the interspaces. The auricles show traces of two radial ribs and two growth lamellae under the magnifying glass.

Occurrence: Ostrý vrch, locality No 2.

Terquemiidae COX, 1964

Newaagia HERTLEIN, 1952

Type species *Spondylus obliquus* MÜNSTER, 1841. Carnian: South Tyrolia (St. Cassian).

***Newaagia* sp.**

Pl. III, Fig. 5

Material: Fragment of one mould without beak and lower part.

Remarks: The specimen must have been large, because the fragment is 51 mm wide. It is ornamented with alternating thicker and thinner radial ribs, some of them with traces of nodules or spines. The specimen resembles the species *Newaagia noetlingi* FRECH, but it is larger and its general shape is unknown.

Occurrence: Ostrý vrch, locality No 2.

***Newaagia* ? sp.**

Pl. IV, Fig. 3

Material: A mould of a small valve, of which only a half is preserved and the umbo is missing.

Remarks: The preserved part of the valve is indicative of almost circular outline. The auricle is a continuation of the body. The rough surface is covered with dense, partly waved radial ribs. Under the magnifying glass very dense, fine growth lines are visible at the lower and upper margins. They cross the ribs and the intercostal spaces. The both mentioned morphological features are common to the genera *Prospondylus* and *Newaagia*. Further data for reliable generic and species ranging are not available on the species described.

Occurrence: Ostrý vrch, locality No 1.

***Limidae* RAFINESQUE, 1815**

***Plagiostoma* J. SOWERBY, 1814**

Type species *Plagiostoma giganteum* J. SOWERBY, 1814. Liassic: England.

***Plagiostoma striatolineatum* (SCHLOTHEIM, 1823)**

Pl. I, Fig. 9

1823 *Chamites lineatus* SCHLOTHEIM, tab. 35, fig. 1 (non vidi) (fide C. DIENER, 1923)

1923 *Lima (Plagiostoma) striata* var. *lineata* — C. DIENER, p. 108 (cum syn.)

Material: Moulds of seven right and five left valves, mostly incomplete. Preserved are only posterior auricles with the exception of one anterior.

Remarks: It is impossible to find out the proper dimensions of the specimens, but the height is dominant on all of them. Some are more, other less convex. The beak is pointed and projects over the hinge line. The auricles are small, the anterior being smaller. A depressed lunula is at the anterior margin. There is a certain variability in the sculpture. On larger specimens the ribs of the anterior region are narrow, high, separated by equal or somewhat wider intercostal spaces. On the rest of the valve the

ribs are wider, flat and the interspaces are narrow or linear. Under the magnifying glass fine punctate intervals are visible. The middle part of the surface is smooth. Some specimens have another type of sculpture with flat, wider ribs, covering a larger part of the surface with the exception of the lunule. This is ornamented with thin dense radials and growth lines extending to the anterior auricle in the form of vertical lamellae. On the posterior auricle the radial sculpture is more conspicuous and the concentric one may only be seen under the magnifying glass. Our specimens are most similar to that illustrated by A. GOLDFUSS (1838, Pl. 100, Fig. 3), but differ in less convex valves with a lower beak, and in fewer ribs at the lower margin.

Stratigraphical and geographical ranges: Upper Scythian — Anisian; Germany, Southern Alps, Sardinia.

Occurrence: Ostrý vrch, locality No 2.

***Plagiostoma* sp.**

Pl. IV, Fig. 4

Material: Moulds of five damaged left and one right valve with corroded surface.

Remarks: The outline of the valves is diagonal oval. Their anterior side is longer with a narrow depressed lunula. The posterior one is shorter and passes into the rounded lower part. The middle of the valves is slightly convex. The beak is obtuse and the auricles are small. One valve without the umbonal area and auricles is almost circular. The surface of all valves is smooth, with occasional traces after more distinct growth lines, mainly near the lower margin. We do not know any species identical with the described specimens.

Occurrence: Ostrý vrch, locality No 2.

***Mysidioptera* SALOMON, 1895**

Type species *Mysidioptera ornata* SALOMON, 1895. Middle Triassic: South Tyrolia.

***Mysidioptera cainalloi* (STOPPANI, 1858)**

Pl. II, IV, Fig. 4; 8

1858 *Lima Cainalli* STOPPANI, p. 97, tab. 20, fig. 6

1959 *Mysidioptera cainalloi* — C. ROSSI RONCHETTI, p. 314—318, tab. 18, fig. 1-3 (cum syn.)

Material: Moulds of five incomplete left valves and one right valve.

Remarks: The valves are vertically ovate with obtuse beak and more or less convex in the upper part. They correspond to the description of the species by C. ROSSI RONCHETTI, l. c. As only moulds are available, the surface is smooth, with concentric sculpture represented by occasional traces after growth lines at the lower margin of some valves. The fine dense radial ribs at the anterior margin belong to sculptural features of the species, but are preserved only on a small part of the surface of one of the recorded specimens.

Stratigraphical and geographical ranges: Anisian — Upper Silesia; Ladinian — Southern Alps and Appenines; Carnian — Appenines and Israel.

Occurrence: Ostrý vrch, locality No 2.

Occurrence in the West Carpathians: the Strážovské vrchy Mts., the Slovak Karst.

Fimbriidae NICOL, 1950

Schafhaeutlia COSSMANN, 1897

Type species *Gonodon ovatus* SCHAFHAEUTL, 1863. Jurassic: South Appenines.

Schafhaeutlia cf. *esinensis* (STOPPANI, 1858)

Pl. II, Fig. 7

1858 *Cyprina esinensis* STOPPANI, p. 85, tab. 17, fig. 1—6

1923 *Schafhaeutlia esinensis* — C. DIENER, p. 218

1959 *Gonodon esinensis* — C. ROSSI RONCHETTI, p. 327—328, tab. 19, fig. 4—5

Material: Moulds of one incomplete left and right valve.

Remarks: The asymmetrical valve is semi-circular, extremely convex. The small beak inclines above the hinge line, and there is a depressed lunula in its anterior part. From sculpture only traces of some distinct concentric stripes in greater irregular distances are preserved. The specimens of our material can be compared with illustrations by STOPPANI but the H/L ratio cannot be determined because the lower part of the valves is incomplete.

Stratigraphical and geographical ranges: Ladinian; Southern Alps.

Occurrence: Ostrý vrch, locality No 2.

Schafhaeutlia cf. *plana* (MÜNSTER, 1841)

1841 *Isocardia plana* MÜNSTER, p. 87, tab. 18, fig. 23

1923 *Schafhaeutlia plana* — C. DIENER, p. 220 (cum syn.)

1959 *Gonodon planus* — C. ROSSI RONCHETTI, p. 329—330, tab. 19, fig. 8, 9

Material: A mould of the left valve.

Remarks: In contrast to the specimens belonging to the species *Schafhaeutlia esinensis*, this valve is more symmetrical and less convex. Its surface is smooth, only at the lower margin there are indistinct dense growth lines, visible under the magnifying glass. It also resembles *Schafhaeutlia ovata* (STOPPANI), only its length is dominant.

Stratigraphical and geographical ranges. Ladinian; Southern Alps, Anisian; Upper Silesia.

Occurrence: Ostrý vrch, locality No 2.

Cardiidae LAMARCK, 1809

Cardium LINNÉ, 1758

Type species *Cardium costatum* LINNÉ, 1758. Recent: West Africa.

***Cardium* ? aff. *victoriae* (DE LORENZO, 1897)**

1897 *Lima Victoriae* DE LORENZO, p. 142, tab. 18, fig. 1—6

1959 *Cardium* ? *victoriae* — C. ROSSI RONCHETTI, p. 330—332, tab. 20, fig. 1—3

Material: Moulds of three left and one right valve with considerably corroded surface.

Dimensions: H=28,5 mm L=31 mm, H=33 mm L=33 mm

Remarks: The specimens ranged to the above mentioned species have asymmetrical approximately quadrangular valves. They are extremely convex in the umbonal and middle parts. From there they incline steeply to lateral margins, especially to the anterior. At the posterior upper margin they are slightly depressed. The umbo is in the anterior region. It is huge and projects over the hinge line. The sculpture comprises dense, unequal radial ribs, thinner to fading out in the lower middle part. In their narrow intervals are short transverse lines resembling beading under the magnifying glass. Our specimens differ in smaller dimensions from those described by the authors quoted in synonymy. The generic assignment is impossible because the specimens are poorly preserved.

Stratigraphical and geographical ranges: Ladinian; Appenines and Southern Alps.

Occurrence: Ostrý vrch, locality No 2.

***Brachiopoda* DUMERIL, 1806**

***Dielasmatidae* SCHUCHERT, 1913**

***Dielasmatinae* SCHUCHERT, 1913**

***Cruratula* BITTNER, 1890**

Type species *Waldheimia eudora* LAUBE, 1865, Carnian of Southern Alps.

***Cruratura eudora* (LAUBE, 1865)**

Pl. V, Fig. 1—6, 8

1865 *Waldheimia Eudora* — G. C. LAUBE: Die Fauna der Schichten von St. Cassian, p. 8, tab. 11, fig. 2

1884 *Aulacothyris Eudora* LAUBE — A. ROTHPLETZ: Geologisch-paläontologische Monographie etc., p. 84, 127

1890 *Waldheimia (Cruratula) Eudora* LAUBE spec. — A. BITTNER: Brachiopoden der alpinen Trias, p. 67, tab. I, fig. 14, Tab. VII, fig. 27

1920 *Cruratula Eudora* LAUBE — C. DIENER: *Brachiopoda triadica*, p. 95

1964 *Cruratula eudora* (LAUBE) — J. PEVNÝ: Brachiopody severnej časti Malých Karpát, p. 160, tab. 4, fig. 1

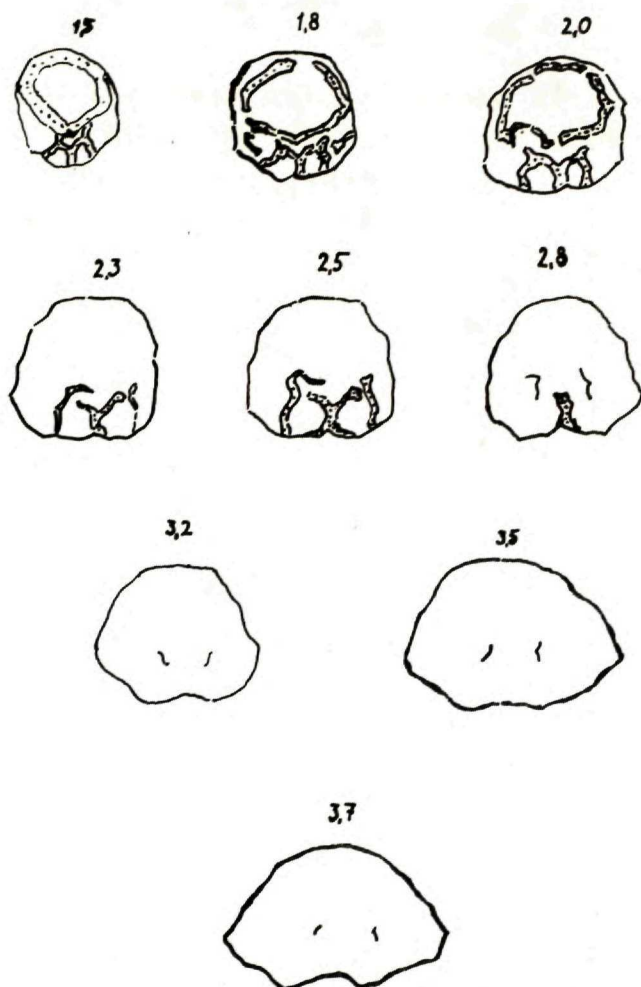


Fig. 2 Serial sections of the species *Cruratula eudora* (LAUBE), Ladinian-Carnian, original length 13 mm, Loc. no. 1, $\times 5$.

Dimensions in mm:

L	W	H
17;	17;	10
16	16	10
17	18	8,5
18	19	10
16	14	7
18	16	8
16	16,5	7
16	16	11
12	12	8
14	15	8

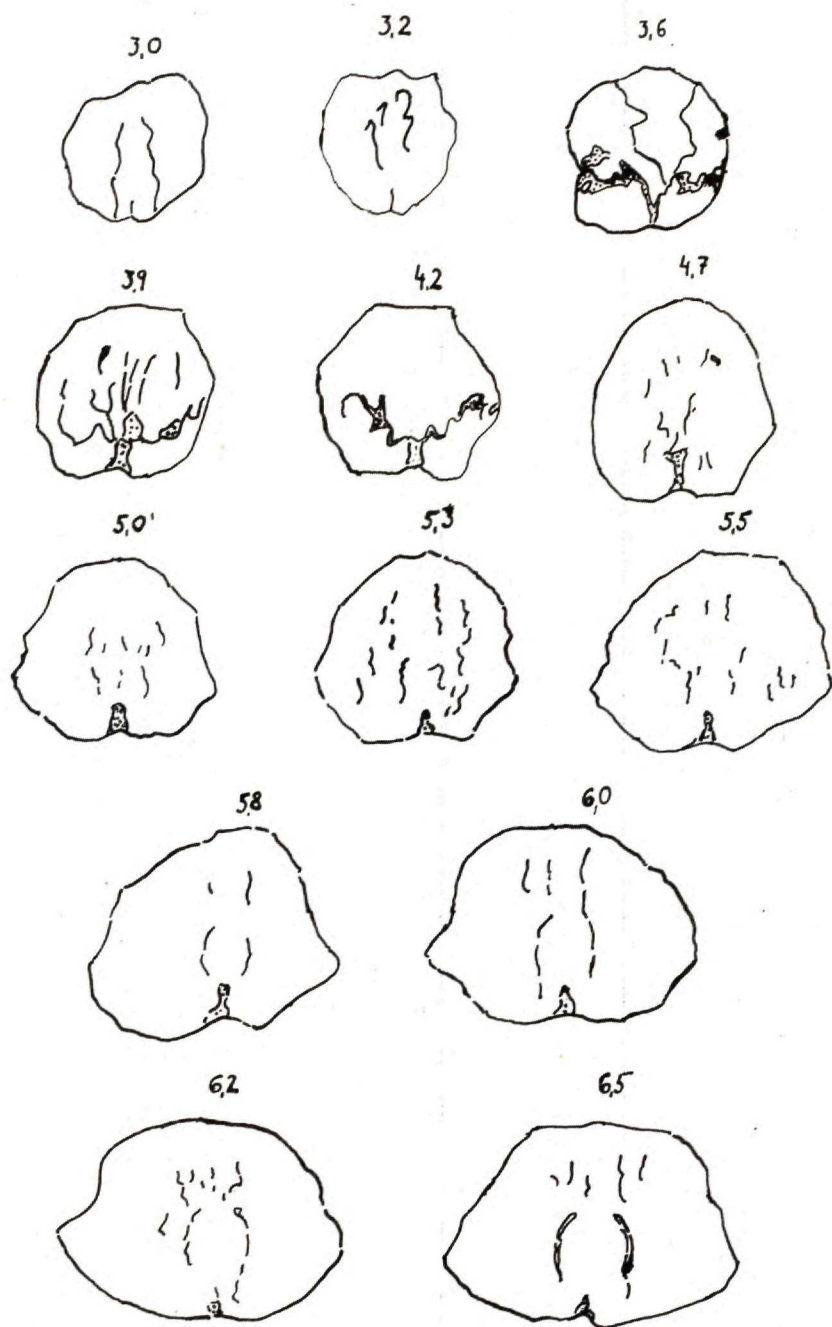


Fig. 3 Serial sections of the species *Crurātula eudora* (LAUBE), Ladinian-Carnian, original length 17 mm, loc. no. 1, $\times 5$.

Material: 180 specimens, 80 of them incomplete, and beside that 80 juvenile ones.

Remarks: Pentagonal outline, length and width approximately equal. The valves are widest in a half of their length, and more convex is the pedicle valve in its posterior part. The pedicle valve is flattened in its middle part. In its lateral parts it inclines more or less steeply to the commissure. Its beak is broad, massive, curved, covering the deltidium, and has rounded beak-ridges. The brachial valve is flatter, more convex in umbonal part. There begins a narrow sulcus broadening and flattening in a half of the valve. It is confined by greater folds. The anterior commissure is slightly sulcate. Growth lines are visible at the margins of valves. Specimens of this species show variable valve convexity, especially on the brachial valve. Less convex brachial valves have wider and shallower sulcus. Up to the present little has been written about the internal structure of the genus *Cruratula*. A. BITTNER (1980, pp. 127—128) described the inner structure of *Waldheimia* (*Cruratula*) *eudoxa* BITTNER and *Waldheimia* (*Cruratula*) *carinthiaca* ROTHPLETZ, on which there is a crural process on each side, running out from deeply incised dental lamellae. The crura are parallel, curved upwards (toward the beak) and get wider before their end or at the end (rather irregularly). The median septum is high. The widened parts of the crural processes correspond to the places of loop attachment. The internal structure of the genus *Cruratula* is also illustrated by R. C. MOORE (1965, p. 771), and CHING YU-KAN (1976, p. 332) showed the internal structure of *Cruratula* cf. *Beyrichii* BITTNER.

Internal structure: in the posterior part the valves are completely recrystallized. The internal structure is visible from the connection of teeth and dental sockets or still lower. In the pedicle valve there are sometimes thin, diagonally inward inclined teeth and denticula. In the brachial valve the dental sockets are wide, shallow, the septalium is deep, the dorsal septum is very long and thick. Crura are extremely long, a loop is visible as well.

Stratigraphical and geographical ranges: Ladinian and Carnian, Southern Alps.

Occurrence: Ostrý vrch, localities no. 1, 2

***Cruratula eudoxa* (BITTNER, 1890)**

Pl. V, Fig. 7, Pl. VII, Fig. 5—7

1890 *Waldheimia* (*Cruratula*) *Eudoxa* nov. spec. — A. BITTNER: Brachiopoden der alpinen Trias, p. 127, tab. 4, fig. 18—23.

1910 *Waldheimia* (*Cruratula*) *Eudoxa* BITTNER—C. RENZ: Stratigraphische Untersuchungen etc., p. 521, tab. 22, fig. 8.

1920 *Cruratula Eudoxa* BITTNER—C. DIENER: *Brachiopoda triadica*, p. 96.

Material: 3 complete and 2 incomplete specimens.

Dimensions in mm: L 15; W 14; H 11
 16 16 10

Remarks: Pentagonal outline; approximately equal width and length. The

valves are widest in a half of their length, markedly convex. The pedicle valve is more convex, higher. The sulcus on the brachial valve is narrow in its posterior part and wider in the anterior. The beak of the pedicle valve is markedly bent and covers the deltidium. The anterior commissure is slightly sulcate. Concentric growth lines are distinct, regularly distributed.

The described species differs from *Cruratula eudora* (LAUBE) in extremely curved beak and more convex valves.

Stratigraphical and geographical ranges: Ladinian and Carnian in Southern Alps, Lower Carnian in Greece.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Strážovské vrchy Mts.

***Cruratula carinthiaca* (ROTHPLETZ, 1886)**

Pl. V, Fig. 9—11

1886 *Terebratula Carinthiaca* n. sp. — A. ROTHPLETZ: Geologisch-palaeontologische Monographie etc., p. 116, tab. 15, fig. 2, 3.

1890 *Waldheimia* (*Cruratula*) *carinthiaca* ROTHPL. spec. — A. BITTNER: Brachiopoden der alpinen Trias, p. 67, 127, tab. 1, fig. 15, tab. 4, fig. 17.

1909 *Waldheimia* (*Cruratula*) *carinthiaca* (BITTNER) — W. WILCKENS: Palaeontologische Untersuchungen etc., p. 117, Textfig. 2.

1920 *Cruratula carinthiaca* ROTHPLETZ—C. DIENER: Brachiopoda triadica, p. 94.

Material: 1 complete and 6 incomplete specimens.

Dimensions in mm:	L 18;	W 14;	H 10
	20	17	8

Remarks: Tri- to pentagonal outline, length dominant over width. The shell is widest in the anterior part, in 1/3 of its length from the anterior margin. The pedicle valve is highly convex, high in the middle; the brachial valve is somewhat less convex, with a distinct, deep sulcus. The beak of the pedicle valve is strongly curved.

The representatives of the species are triangular, with strongly curved beak, less massive than that of *Cruratula eudoxa* BITTNER, and with a deep sulcus on the brachial valve. The sulcus is narrower than that on *Cruratula eudora* (LAUBE).

Stratigraphical and geographical ranges: Ladinian, Carnian; Southern Alps, Bakony.

Occurrence: Ostrý vrch, locality no. 1.

***Angustothyrididae* DAGYS, 1972**

***Angustothyris* DAGYS, 1972**

Type species *Waldheimia angustaeformis*, BOECKH, 1873, Middle Triassic (Anisian), Hungary.

***Angustothyris angustaeformis* (BOECKH, 1872)**

Pl. V, Fig. 12, Pl. VI, Fig. 3

- 1873 *Waldheimia angustaeformis* n. sp. — J. BOECKH: Die geologischen Verhältnisse etc., p. 172, tab. 11, fig. 20.
1890 *Waldheimia angustaeformis* BOECKH.—A. BITTNER: Brachiopoden der alpinen Trias, p. 8, tab. 26, fig. 37—40.
1895 *Waldheimia angustaeformis* BOECKH—W. SALOMON: Geologische und paläontologische Studien etc., p. 104, 141, tab. 3, fig. 29—31, 34.
1895 *Waldheimia angustaeformis* BOECKH *elongata mihi* — W. SALOMON: Geologische und paläontologische Studien etc., p. 104, tab. 3, fig. ? 32, 33.
1903 *Waldheimia angustaeformis* BOECKH—P. VINASSA DE REGNY: Fossili del Montenegro, p. 460, tab. 1, fig. 24.
1920 *Waldheimia angustaeformis* BOECKH—C. DIENER: Brachiopoda triadica, p. 97.
1933 *Waldheimia angustaeformis* BOECKH—M. MILOSAVLJEVIĆ: Sredni trijas na Jadovniku, p. 208, tab. 1, fig. 2.
1972 „*Zeilleria*“ *angustaeformis* (BOECKH)—M. SIBLIK: Spiriferidní a terebratulidní ramenonožci etc., p. 195, tab. 62, fig. 5.

Material: Two complete and two incomplete specimens.

Dimensions in mm: L 16; W 13; H 6
 14 13 6

Remarks: Pentagonal outline; length dominant over width. The valves are widest above a half of their length. They are highest in 1/3 of length from the beak. Both valves are slightly convex; the sulcus of the brachial valve is distinct but shallow, the pedicle valve is slightly heightened, its beak is considerably curved. According to A. BITTNER (1890) the species differs from *Aulacothyris angusta* (SCHLOTH.) in greater size, in wider and less convex pedicle valve, in larger beak and pedicle opening. The differences are not distinct.

Stratigraphical and geographical ranges: Pelsonian — Illyrian in Southern Alps, Bakony, Dinarides, Anatolia; Ladinian in Southern Alps, Carnian in Dobruđa.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Slovak Karst, Veľká Fatra.

***Zeilleriidae* ROLLIER, 1915**

***Aulacothyris* DOUVILLE, 1879**

Type species *Terebratula resupinata* SOWERBY, 1816; Liassic, England.

***Aulacothyris angusta* (SCHLOTHEIM, 1820)**

- 1890 *Waldheimia (Aulacothyris) angusta* — v. SCHLOTH. spec. A. BITTNER: Brachiopoden der alpinen Trias, p. 7, tab. 36, fig. 41—47.
1903 *Waldheimia angusta* v. SCHLOTHEIM—P. VINASSA DE REGNY: Fossili del Montenegro, p. 459, tab. 1, fig. 23.
1920 *Aulacothyris angusta* v. SCHLOTHEIM—C. DIENER: Brachiopoda triadica, p. 98.
1972 *Aulacothyris angusta* (SCHLOTHEIM)—M. SIBLIK: Spiriferidní a terebratulidní ramenonožci etc., p. 197, tab. 62, fig. 2.

Material: One complete specimen.

Dimensions in mm: L 12; W 8,5; H 8.

Remarks: Trapezoid outline; length dominant over width. The valves are widest and highest above a half of their length. The brachial valve is concave, with a deep sulcus running out forward in the anterior part. The pedicle valve is convex into a high keel; the beak is short, erect, with comparatively sharp ridges.

The species is variable in its shape and dimensions. It cannot be clearly distinguished from the externally resemblant species *Angustothyris angustaeformis* (BOECKH). It differs in the lateral view of its shell, in smaller and less curved beak of the pedicle valve with longer and sharper beak ridges.

Stratigraphical and geographical ranges: Pelsonian and Illyrian in Upper Silesia, Northern and Southern Alps, Bakony, Dinarides; Ladinian in Dinarides.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Slovak Karst, Veľká Fatra, Strážovské vrchy Mts.

Praecyclothyrididae MAKRIDIN, 1964

Tetrarhynchiinae AGER, 1965

Decurtella GAETANI, 1966

Type species *Terebratula decurtata* GIRARD, 1843, Anisian, North Italy

Decurtella devota (BITTNER, 1980)

1890 *Rhynchonella decurtata* var. *devota* — A. BITTNER: Brachiopoden der alpinen Trias, p. 10, tab. 32, fig. 8—10.

1909 *Rhynchonella* cf. *decurtata* var. *devota* BITTNER — R. WILCKENS: Paläontologische Untersuchung etc., p. 219, tab. 7, fig. 13.

1920 *Rhynchonella decurtata* var. *devota* BITTNER — C. DIENER: Brachiopoda triadica, p. 25.

1933 *Rhynchonella decurtata* var. *devota* BITTNER — M. MILOSAVLJEVIĆ: Sredni trias na Jadovniku, p. 209, tab. 1, fig. 4.

1969 *Decurtella devota* (BITTNER) — M. GAETANI: Osservazioni paleontologiche e stratigrafiche etc., p. 493, tab. 33, fig. 3—7.

Material: One complete specimen.

Dimensions in mm: L 10; W 10; H 7.

Remarks: Pentagonal outline, equal length and width, the specimen is widest and highest in 1/3 of the length from the anterior margin; the pedicle valve is slightly convex, with a shallow sinus in the anterior part; the brachial valve is more convex and passes into a slightly uplifted fold. The beak of the pedicle valve is erect to suberect, with rounded ridges. There are 9—10 ribs, distinct and sharp, 3 of them are on the fold, 2 in the sinus. They extend to the umbonal part. The anterior commissure is slightly uniplicate, the lateral commissure is bent against the brachial valve.

The described species differs from *Decurtella decurtata* (GIR.) in more convex valves, smaller and less curved beak, and in a distinct suture on the anterior

commissure. The specimen figured by MILOSAVLJEVIĆ (1933) has a more extended anterior part of the pedicle valve.

Stratigraphical and geographical ranges: Anisian and Ladinian, Southern Alps.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Strážovské vrchy Mts.

***Decurtella vivida* (BITTNER, 1890)**

1873 *Rhynchonella altaplecta* n. sp. (partim) — J. BOECKH: Die geologischen Verhältnisse etc., p. 177, tab. 11, fig. 29.

1890 *Rhynchonella decurtata* var. *vivida* m. — A. BITTNER: Brachiopoden der Alpenen Trias, p. 10, tab. 32, fig. 11, 12.

1890 *Rhynchonella decurtata* var. *dalmatina* — A. BITTNER: Brachiopoden der alpenen Trias, p. 10, tab. 32, fig. 13.

1920 *Rhynchonella vivida* BITTNER — C. DIENER: *Brachiopoda triadica*, p. 35.

1933 *Rhynchonella decurtata* var. *vivida* BITTN. — M. MILOSAVLJEVIĆ: Sredni trijas na Jadovniku, p. 212, tab. 1, fig. 6.

1935 *Rhynchonella decurtata* var. *vivida* BITTN. — M. MILOSAVLJEVIĆ: Prilog za poznavanje etc., p. 270, tab. 1, fig. 1.

1964 „*Rhynchonella*“ *vivida* BITTNER — J. PEVNÝ: Brachiopody severnej časti Malých Karpát, p. 163.

1971 *Decurtella vivida* (BITTNER) — M. SIBLÍK: Rhynchonellidní ramenonožci etc., p. 168, tab. 19, fig. 5—6, tab. 20, fig. 4.

Material: One incomplete specimen.

Dimensions in mm: L 11; H 7

Remarks: Pentagonal outline. The specimen is widest in 1/3 of length from the anterior margin and it is highest in 1/3 of length from the beak. The pedicle valve is flat to concave with erect beak. The brachial valve is markedly convex in its posterior part. It has a distinct fold separated by grooves from the lateral parts. The ribs are slightly rounded, visible to 2/3 of the length of valves. They are 8—9, 3 of them on the fold, 2 in the sinus. M. SIBLÍK (1971) ranged there also *Rhynchonella decurtata* var. *dalmatina* BITTNER (with two ribs on the fold of the brachial valve and ribs bordering the sinus of the pedicle valve connecting with one another below the beak) and *Rhynchonella decurtata* var. *vivida excavata* BITTNER (with four ribs on the fold of the brachial valve and a distinct protruding sinus of the ventral valve).

Stratigraphical and geographical ranges: Pelsonian and Illyrian, Northern and Southern Alps.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Slovak Karst.

Spiriferinidae DAVIDSON, 1884

Spiriferininae DAVIDSON, 1884

Spiriferina D'ORBIGNY, 1847

Type species *Spirifer walcotti* SOWERBY, 1823, Liassic, England.

***Spiriferina cf. pia* BITTNER, 1890**

Material: One incompletely preserved specimen.

Remarks: Preserved is one incomplete, wide pedicle valve with two ribs in the sinus, with two thick ribs bordering the sinus, and other five lateral ribs, less distinct farther from the centre of the valve.

Stratigraphical and geographical ranges: Anisian in Southern Alps and in Dinarides.

Occurrence: Ostrý vrch, locality no. 2.

***Spiriferina pectinata* BITTNER, 1890**

Pl. VII, Fig. 1

1890 *Spiriferina pectinata* nov. spec. — A. BITTNER: Brachiopoden der alpinen Trias, p. 31, 51, tab. 35, fig. 24, 25

1909 *Spiriferina pectinata* BITTNER — W. WILCKENS: Palaeontologische Untersuchungen etc., p. 101, tab. 4, fig. 9, 10.

1920 *Spiriferina pectinata* BITTNER — C. DIENER: Brachiopoda triadica, p. 50.

Material: 3 brachial valves

Remarks: In the middle of the valve is a lower fold separated by grooves. There are three branching ribs on the fold. In lateral parts are 7 ribs in each. The ribs branch out of the hinge part. The ribs confining the fold are thickest.

Stratigraphical and geographical ranges: Anisian and Ladinian in Southern Alps and Dinarides.

Occurrence: Ostrý vrch, locality no. 1.

***Punctospirellinae* DAGYS, 1974**

***Punctospirella* DAGYS, 1974**

Type species *Terebratura fragilis* SCHLOTHEIM, 1814, Middle Triassic, Germany.

***Punctospirella fragilis* (SCHLOTHEIM, 1814)**

Pl. VI, Fig. 4, 7, Pl. VII, Fig. 3—4

1871 *Spiriferina fragilis* — F. A. QUENSTEDT: Petrefaktenkunde Deutschlands, p. 500, tab. 53, fig. 39—41.

1890 *Spiriferina fragilis* SCHLOTH. spec. A. BITTNER: Brachiopoden der alpinen Trias, p. 29, tab. 35, fig. 2—5.

1920 *Spiriferina fragilis* SCHLOTHEIM — C. DIENER: Brachiopoda triadica, p. 46.

1958 *Spiriferina fragilis* SCHLOTHEIM — G. SACCHI VIALI — A. VAI: Revisione della fauna triassica etc., p. 46, tab. 4, fig. 1—5.

1967 *Spiriferina fragilis* (SCHLOTHEIM) — P. CASATI — M. GNACCOLINI: Geologia delle Alpi Orobie occidentali, p. 138, tab. 11, fig. 9—10.

1968 *Spiriferina fragilis* SCHLOTHEIM — E. TADDEI RUGGIERO: Brachiopodi triassici etc., p. 363, tab. 5, fig. 1—8, tab. 6, fig. 1—3.

1972 *Spiriferina fragilis* (SCHLOTHEIM) — M. SIBLÍK: Spiriferidní a terebratulidní ramenonožci etc., p. 181, tab. 61, fig. 2.

Material: Ten incomplete specimens, eight of them are brachial and two are pedicle valves.

Remarks: The shell is horizontally elongated. In the middle of the pedicle valve is a conspicuous narrow-depression; on the brachial valve is a thicker central rib and there are four ribs on both sides.

Stratigraphical and geographical ranges: Pelsonian — Illyrian in Germany, Upper Silesia, Southern Alps, Dinarides, Bakony; Ladinian in Southern Alps.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Slovak Karst, Nízke Tatry Mts., Strážovské vrchy Mts.

Retziidae WAAGEN, 1883

Retziinae WAAGEN, 1883

Schwagerispira DAGYS, 1972

Type species *Retzia schwageri* BITTNER, 1890, Middle Triassic, Hungary.

***Schwagerispira schwageri* (BITTNER, 1890)**

Pl. VI, Fig. 5—6

1890 *Retzia Schwageri* nov. spec. — A. BITTNER: Brachiopoden der alpinen Trias, p. 21, tab. 36, fig. 1—4.

1920 *Retzia Schwageri* BITTNER — C. DIENER: Brachiopoda triadica, p. 73.

1957 *Retzia schwageri* BITTNER — M. MAHEL: Geológia Stratsenskej hornatiny, p. 151.

1958 *Retzia schwageri* BITTNER — G. SACCHI VIALLI — A. VAI: Revisione della fauna triassica Bresciana, p. 49, tab. 4, fig. 19.

1972 *Neoretzia* (?) *schwageri* BITTNER — M. SIBLIK: Spiriferidní a terebratulidní ramenonožci etc., p. 186.

Material: One complete and three incomplete specimens.

Dimensions in mm: L 8; W 9; H 6.

Remarks: A small, oval shell with 8 thick, rounded, conspicuous ribs. The central rib of the brachial valve is lowered. The described specimens agree with the illustrations of A. BITTNER (1890), the described specimen of M. SIBLIK (1972) has no lowered central rib of the brachial valve.

Stratigraphical and geographical ranges: Anisian in Northern and Southern Alps, Bakony, Dinarides; Carnian in Dobrudja.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Slovak Karst, Stratsenská hornatina Mts.

Spirigerellidae GRUNT, 1965

Spirigerellinae GRUNT, 1965

Tetractinella BITTNER, 1890

Type species *Terebratulites trigonellus* SCHLOTHEIM, 1820; Middle Triassic — Germany, German Triassic

***Tetractinella trigonella* (SCHLOTHEIM, 1820)**

Pl. VII, Fig. 2

- 1871 *Terebratula trigonelloides* — F. A. QUENSTEDT: Die Brachiopoden, p. 285, tab. 45, fig. 13—21.
1890 *Spirigera trigonella* SCHLOTH.—A. BITTNER: Brachiopoden der alpinen Trias, p. 17, tab. 36, fig. 18—31.
1903 *Spirigera trigonella* SCHLOTH.—P. VINASSA DE REGNY: Fossili del Montenegro, p. 451, tab. 1, fig. 1.
1906 *Spirigera* (*Tetractinella*) *trigonella* SCHLOTH. sp. A. MARTELLI: Contributo al Muschelkalk superiore del Montenegro, p. 117.
1920 *Tetractinella trigonella* v. SCHLOTHEIM—C. DIENER: Brachiopoda triadica, p. 63.
1958 *Tetractinella trigonella* SCHLOTHEIM—G. SACCHI VIALLI—A. VAI: Revisione della fauna triassica etc., p. 49.
1972 *Tetractinella trigonella* (SCHLOTHEIM)—M. SIBLIK: Spiriferidní a terebratulidní ramenonožci etc., p. 189, tab. 61, fig. 1, 6—8.

Material: One complete specimen.

Dimensions in mm: L 19; W 23; H 12.

Remarks: Pentagonal outline, width dominant over length. The valves are widest above the anterior margin and highest in a half of the valves. The pedicle valve is slightly depressed in the anterior part, the brachial valve is slightly raised. On both valves are five thick ribs, rounded on the roof. The anterior margin is rectimarginate. The beak is curved, with conspicuous, sharp ridges. There are depressed, extensive planareas on sides. The described specimen is wider, similar to the specimen figured by F. A. QUENSTEDT (1871) in Fig. 21, and by A. BITTNER (1890) in Fig. 15, 25. The anterior part does not extend forward distinctly.

Stratigraphical and geographical ranges: Pelsonian—Illyrian; Ladinian in Southern Alps and Dinarides. It is known from Austria, Hungary, Italy, Yugoslavia.

Occurrence: Ostrý vrch, locality no. 1.

Occurrence in the West Carpathians: Nízke Tatry Mts., Galmus, Považský Inovec Mts., Slovak Karst.

Biostratigraphical evaluation

The age determination of a macrofaunal assemblage from Wetterstein limestones of the Havranica nappe on the Ostrý vrch hill in the Malé Karpaty Mts. is based on the analysis of stratigraphical range of individual species (Table 2). The assemblage comprises 22 species except those determined as *confer*. Stratigraphical range of three of the species i. e. *Plagiostoma striatolineatum* (SCHLOTHEIM), *Aulacothyris angusta* (SCHLOTHEIM) and *Decurtella vivida* (BITTNER) does not surpass the Anisian. Other six species: *Leptochondria separata* (REISS), *Leptochondria* aff. *viezzenensis* (WILCKENS), *Ornithopecten triadicus* (SALOMON), *Chlamys* (*Praechlamys*) *paronai*

NÁZOV DRUHŮV	LOKALITA č. 1	LOKALITA č. 2	Skyt	Anis	Ladin	Karn	SEV. ALPY	JUŽ. ALPY	APENNIN	SICILIA	SARDINIA	DINARDI	HIMALAJE	BALON	NEMENO	HOR. SLEZSKO	DOBROUZA	USURUSKA ORL.	ASTRACHAN	ARGENTINA	IZRAEL	BIHAR POR.	ZAP. KARPATY
<i>Parallelodon cf. beyrichi</i> (STROMBECK)	1		---	---	---		o																•
<i>Protopsis</i> sp.		2																					
<i>Pinna</i> sp.		1																					
<i>Pteria cf. caudata</i> (STOPPANI)	2		---	---	---		o	o	o														•
<i>Pteria</i> sp.		2																					
<i>Leptochondria separata</i> (REISS)	7						o																
<i>Leptochondria aff. viezenensis</i> (WILKENS)	10						o																
<i>Leptochondria</i> sp.		1																					
<i>Leptochondria</i> sp. 1.		3																					
<i>Ornithopecten triadicus</i> (SALOMON)	3						o																
<i>Ornithopecten</i> sp.	1																						
<i>Pleuronectites</i> ? sp.		1																					
<i>Prospendylus</i> ? sp.		1																					
<i>Daonella</i> sp.	1	3																					
<i>Entolium discites</i> (SCHLOTHEIM)	1		---	---	---		o	o															•
<i>Entolium cf. pseudodiscites</i> (BITTNER)	1		---	---	---		o																
<i>Entolium</i> ? sp.		1																					
<i>Chlamys</i> (<i>Praechlamys</i> <i>broilii</i>) (PHILIPP)		8					o																•
<i>Chlamys</i> (<i>Praechlamys</i>) sp. (ex gr. <i>broilii</i>)	3																						
<i>Chlamys</i> (<i>Praechlamys</i>) <i>paronai</i> (TOMMASI)		3					o																•
<i>Chlamys</i> (<i>Praechlamys</i>) <i>rotai</i> (TOMMASI)		1					o																•
<i>Chlamys</i> (<i>Praechlamys</i>) cf. <i>fassaensis</i> (PHILIPP)	2						o																
<i>Chlamys</i> (<i>Praechlamys</i>) sp.		1																					
<i>Chlamys</i> (<i>Granulochlamys</i>) ? sp.		1																					
<i>Chlamys</i> ? sp.		2																					
<i>Newaagia</i> sp.		1																					
<i>Newaagia</i> ? sp.	1																						
<i>Plagiostoma striatolineatum</i> (SCHLOTHEIM)		12	---	---	---		o		o														
<i>Plagiostoma</i> sp.		6																					
<i>Mysidiaptera cainallai</i> (STOPPANI)		6					o	o															•
<i>Schafhaeutlia cf. esinensis</i> (STOPPANI)		2					o																
<i>Schafhaeutlia cf. plana</i> (MÜNSTER)		1					o																
<i>Cardium</i> ? aff. <i>victoriae</i> (DE LORENZO)		4					o	o															
<i>Euomphalus</i> sp.	1																						
<i>Dicosmos</i> sp.		1																					
<i>Naticopsis</i> sp.		1																					
<i>Coelostylina</i> sp.		1																					
<i>Crurātula eudora</i> (LAUBE)	180	100					o																
<i>Crurātula eudoxa</i> (BITTNER)	5						o																•
<i>Crurātula carinthiaca</i> (ROTHPLETZ)	7						o																
<i>Decurtella devota</i> (BITTNER)	1						o																•
<i>Decurtella vivida</i> (BITTNER)	1						o	o															•
<i>Schwagerospira schwageri</i> (BITTNER)	4						o	o		o													•
<i>Punctospirella fragilis</i> (SCHLOTHEIM)	10						o																•
<i>Spiriferina pectinata</i> BITTNER	3						o																•
<i>Spiriferina cf. pia</i> BITTNER		1					o																•
<i>Mentzelia mentzeli mentzeli</i> (DUNKER)	3						o																•
<i>Aulacothyris angusta</i> (SCHLOTHEIM)	1						o																•
<i>Angustothyris angustaeformis</i> (BOECKH)	4						o																•
<i>Tetractinella trogonella</i> (SCHLOTHEIM)	1						o	o															•

Fig. 4 Table of stratigraphical and geographical ranges of species.

(TOMMASI), *Chlamys* (*Praechlamys*) *rotai* (TOMMASI) and *Cardium* ? aff. *victoriae* (DE LORENZO) are known from the Ladinian only. The other thirteen species have Anisian — Ladinian, Ladinian — Carnian, Anisian — Carnian, Anisian and Carnian stratigraphical range. The first group includes: *Entolium discites* (SCHLOTHEIM), *Decurtella devota* (BITTNER), *Spiriferina pectinata* BITTNER, *Puncto-*

spirella fragilis (SCHLOTHEIM), *Tetractinella trigonella* (SCHLOTHEIM) and *Mentzelia mentzeli mentzeli* (DUNKER). Ladinian — Carnian species: *Chlamys* (*Praechlamys*) *broilii* (PHILIPP), *Cruratula eudora* (LAUBE), *Cruratula eudoxa* (BITTNER) and *Cruratula carinthiaca* (ROTHPLETZ). Stratigraphical range of *Mysidioptera cainalloi* (STOPPANI) and *Angustothyris angustaeformis* (BOECKH) is Anisian — Carnian. The only species from the assemblage, namely *Schwagerispira schwageri* (BITTNER) is known from the Anisian and the Carnian, and not from the Ladinian.

Most of the 22 species, i. e. 18, occur in the Ladinian, so the assemblage should be regarded as Ladinian, more probably Lower Ladinian in respect of 12 species occurring as early as Anisian. As regards geography, we do not know a complete parallel to the described assemblage. Yet it has many elements in common with assemblages from localities Grigne, Ghegna, Predazzo and Marmolata in Southern Alps. It has few species in common with the area of German Triassic. In the West Carpathians there is an assemblage from Wetterstein limestones from the locality "Silička" in the Slovak Karst. There are similar brachiopod genera of similar age diapason. There are also *Cruratula*, frequent in the Ladinian — Carnian, together with Anisian — Ladinian species. Both localities have in common several species of bivalves.

Some of the species occur for the first time in the West Carpathians: *Leptochondria separata* (REISS), *Leptochondria* aff. *viezzenensis* (WILCKENS), *Ornithopecten triadicus* (SALOMON), *Plagiostoma striatolineatum* (SCHLOTHEIM), *Cardium* ? aff. *victoriae* (DE LORENZO), *Cruratula eudora* (LAUBE), *Cruratula carinthiaca* (ROTHPLETZ) and *Spiriferina pectinata* BITTNER.

Notes on living environment

In the macrofaunal assemblage in Wetterstein limestones on the Ostrý vrch in the Malé Karpaty Mts. most frequent are brachiopods, followed by bivalves and occasional gastropods. There are a remarkable variety of species. Morphology of shells shows that most organisms were attached to the basement by byssus fibrils and by the pedicle and thus prevented from transport by tide. The only exception are loosely floating entolias. Most fossils preserved in the form of uni-valve specimens, considerably damaged, especially as regards bivalves. So prior to sedimentation they must have been affected by sea water which caused the division of valves and their mechanical damage. They are accumulated in the rock like lumachelles, the shells are not sorted according to their size or no orientation is visible. So the transport over a greater distance and in a definite direction is excluded. The associated evinosponge structures may indicate that the described organisms belong to the reef environment. According to the species variability they must have lived in pure, lighted water, attached in depressions to the reef walls or to seaweeds in the fore-reef part of the sea.

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Bivalvia a brachiopóda z wettersteinského vápenca na Ostrom vrchu (Malé Karpaty)

Resumé anglického textu

Na Ostrom vrchu v Malých Karpatoch z wettersteinského vápenca havranického príkrovu bolo získané pomerne bohaté spoločenstvo mŕľov a ramenonožcov, ktoré prispeli k spresneniu stratigrafického začlenenia týchto vápencov. V staršej literatúre boli označované ako „havranoskalské“ alebo „havranické“. Predstavovali komplex tmavého, trochu hnedastého vápenca, často prestúpeného svetlými vápencovými žilkami a svetlého vápenca, ktorý sa postupne stáva viac dolomitickým. Stratigraficky boli považované najprv za kriedové. Neskôr, na základe gyroporel, ich začlenili do triasu. Pre ich pozíciu v nadloží lunzských vrstiev bol pre ne stanovený karnický vek, pretože boli považované za ekvivalent oponických vápencov. Na základe fosílií sa zistilo, že ide o dve litostratigrafické jednotky. Spodnejšie, tmavé vápence boli označené ako gutensteinské a vo vrchnejších, svetlých bol rozlíšený aniský steinalmský a ladinský wettersteinský vápenec. Spoločenstvo mŕľov a ramenonožcov zodpovedá najpravdepodobnejšie spodnému ladinu, čo vyplýva z biostratigrafického rozpätia uvedených druhov. Z celkového počtu 22 druhov tvoriacich toto spoločenstvo sa 18 vyskytuje v ladine. Za najvýznamnejšie možno považovať: *Leptochondria separata* (REISS), *Leptochondria* aff. *viezenensis* (WILCKENS), *Ornithopecten triadicus* (SALOMON), *Chlamys (Praechlamys) paronai* (TOMMASI), *Chlamys (Praechlamys) rotai* (TOMMASI), *Cardium* ? aff. *victoriae* (DE LORENZO), *Cruratula eudora* (LAUBE), *Cruratula eudoxa* (BITTNER), *Cruratula carithiaca* (ROTHPLETZ), *Decurtella devota* (BITTNER), *Spiriferina pectinata* BITTNER a *Punctospirella fragilis* (SCHLOTHEIM).

Explanations to plates I—VII

Plate I

- 1 *Leptochondria* aff. *viezenensis* (WILCKENS) — left valve, locality no. 1; $\times 4$.
- 2 *Ornithopecten triadicus* (SALOMON) — plaster cast of left valve; locality no. 1; $\times 2,1$.
- 3 *Ornithopecten triadicus* (SALOMON), left valve, locality no. 1; $\times 2$.
- 4 *Pteria* cf. *caudata* (STOPPANI) — right valve, locality no. 1; $\times 1,8$.
- 5 *Leptochondria* cf. *separata* (REISS), left valve, locality no. 1; $\times 2$.
- 6 *Entolium discites* (SCHLOTHEIM), left valve, loc. no. 1; $\times 2$.
- 7 *Pteria* sp. — left valve, locality no. 2; $\times 1,5$.
- 8 *Leptochondria* aff. *viezenensis* (WILCKENS) — left valve, locality no. 1; $\times 4$.
- 9 *Plagiostoma striatolineatum* (SCHLOTHEIM) — left valve, locality no. 2; $\times 1$.

Figures 1, 3, 5, 6, 7, 8, 9 photographed by F. Martančík.

Figures 2, 4 photographed by H. Jendeková.

Plate II

- 1 *Chlamys (Praechlamys) broilii* (PHILIPP) — left valve, locality no. 2; $\times 1,5$.
- 2 *Chlamys (Granulochlamys)* ? sp. — right valve, locality no. 2; $\times 1,7$.
- 3 *Chlamys (Praechlamys) broilii* (PHILIPP) — left valve, locality no. 2; $\times 1,5$.
- 4 *Mysidiopora cainalloi* (STOPPANI) — left valve, loc. no. 2; $\times 1$.
- 5 *Pleuronectites* ? sp. — locality no. 2; $\times 1,9$.
- 6 *Entolium discites* (SCHLOTTEIM), left valve, loc. no. 1; $\times 2$.
- 7 *Schaffaeutlia* cf. *esinensis* (STOPPANI) — left valve, locality no. 2; $\times 2,0$.
- 8 *Protopis* sp. — right valve, locality no. 2; $\times 1,5$.

Figures 1, 3, 4, 6, 8 photographed by F. Martančík.

Figures 2, 5, 7 photographed by H. Jendeková.

Plate III

- 1 *Entolium* ? sp. — locality no. 2; $\times 1,2$.

- 2 *Chlamys (Praechlamys) rotai* (TOMMASI) — left valve, loc. no. 2, $\times 1,5$.
- 3 *Prospendylus* ? sp. — right valve, loc. no. 2; $\times 1,5$.
- 4 *Chlamys (Praechlamys) paronai* (TOMMASI) — left valve, loc. no. 2; $\times 1,5$.
- 5 *Newaagia* sp. — loc. no. 2; $\times 1$.
- 6 *Pinna* sp. — loc. no. 1; 2; $\times 1$.

Photographed by F. Martančík.

Plate IV

- 1 *Protopsis* sp. — right valve, loc. no. 2; $\times 1,5$.
- 2 *Cardium* ? aff. — *victoriae* (DE LORENZO) — left valve, loc. 2, $\times 1,5$.
- 3 *Newaagia* ? sp. — loc. no. 1; $\times 2$.
- 4 *Plagiostoma* sp. — left valve; loc. no. 2; $\times 1,5$.
- 5 *Chlamys (Praechlamys)* sp. — right valve, loc. no. 2; $\times 1,5$.
- 6 *Leptochondria separata* (REISS) — left valve, loc. no. 1; $\times 2$.
- 7 *Entolium* cf. *pseudodiscites* (BITTNER) — right valve, loc. no. 2; $\times 1,4$.
- 8 *Mysidiopora cainalloi* (STOPPANI) — right valve, loc. no. 2; $\times 1$.

Figures 1—6, 8 photographed by F. Martančík.

Fig. 7 photographed by H. Jendeková.

Plate V

- 1 *Cruracula eudora* (LAUBE), dorsal side, loc. no. 1; $\times 2$.
- 2 *Cruracula eudora* (LAUBE), dorsal side, loc. no. 1; $\times 2$.
- 3 *Cruracula eudora* (LAUBE), dorsal side, loc. no. 1; $\times 2,5$.
- 4 *Cruracula eudora* (LAUBE), dorsal side, loc. no. 1; $\times 2$.
- 5 *Cruracula eudora* (LAUBE), dorsal side, loc. no. 1; $\times 2,5$.
- 6 *Cruracula eudora* (LAUBE), dorsal side, loc. no. 1; $\times 2$.
- 7 *Cruracula eudoxa* (BITTNER), dorsal side, loc. no. 1, $\times 1,5$.
- 8 *Cruracula eudoxa* (LAUBE), dorsal side, loc. no. 1; $\times 1,5$.
- 9 *Cruracula carinthiaca* (ROTHPLETZ), dorsal side, loc. no. 1; $\times 2$.
- 10 *Cruracula carinthiaca* (ROTHPLETZ), dorsal side, loc. no. 1; $\times 1,5$.
- 11 *Cruracula carinthiaca* (ROTHPLETZ), dorsal side, loc. no. 1; $\times 1,5$.
- 12 *Angustothyris angustaeformis* (BOECKH.), dorsal side, loc. no. 1; $\times 2$.

Plate VI

- 1 *Mentzelia mentzeli mentzeli* (DUNKER), brachial valve, loc. no. 1; $\times 2$.
- 2 *Mentzelia mentzeli mentzeli* (DUNKER), pedicle valve, loc. no. 1; $\times 2$.
- 3 *Angustothyris angustaeformis* (BOECKH.), brachial valve, loc. no. 1; $\times 2,5$.
- 4 *Punctospirella fragilis* (SCHLOTH.), brachial valve, loc. no. 1; $\times 2$.
- 5 *Schwagerispira schwageri* (BITTNER), brachial valve, loc. no. 1; $\times 2,5$.
- 6 *Schwagerispira schwageri* (BITTNER), pedicle valve, loc. no. 1; $\times 3$.
- 7 *Punctospirella fragilis* (SCHLOTH.), pedicle valve, loc. no. 1; $\times 2,5$.

Plate VII

- 1 *Spiriferina pectinata* BITTNER, brachial valve, loc. no. 1; $\times 2$.
- 2 *Tetractinella trigonella* (SCHLOTH.), brachial valve, loc. no. 1; $\times 1,5$.
- 3 *Punctospirella fragilis* (SCHLOTH.), brachial valve, loc. no. 1; $\times 2$.
- 4 *Punctospirella fragilis* (SCHLOTH.), brachial valve, loc. no. 1, $\times 2,5$.
- 5 *Cruracula eudoxa* (BITTNER), brachial valve, loc. no. 1; $\times 1,5$.
- 6 *Cruracula eudoxa* (BITTNER), brachial valve, loc. no. 1; $\times 2$.
- 7 *Cruracula eudoxa* (Bittner), brachial valve, loc. no. 1; $\times 2$.

Plates VI—VII photographed by C. Michalíková.

The material of fossils is deposited in the collection of Dionýz Stúr Institute of Geology in Bratislava.

Miloš Siblík

Genus *Austriellula* Strand, 1928 (Brachiopoda) from the Upper Triassic

22 text-figs., 10 pls. (VIII—XVII), Czech summary

Abstract. Upper Triassic representatives of the rhynchonellid genus *Austriellula* STRAND, 1928 from Austria and Slovakia are described including a new species *A. undosa*.

Introduction

A great number of brachiopod species was described from the Tethyan Triassic, but many of them were based only on one or few specimens. They were often coming not from the stratigraphically well-defined layers but from loose blocks. Some exposures provided at that time unique brachiopod assemblages and many of the species have not been found again in the field after their establishing. Brachiopods of the genus *Austriellula* STRAND, 1928 are characteristic faunistic element of the Upper Triassic Hallstatt Limestone of the Alps and a series of species has been known since the last century. At present, it is difficult to be certain of the exact stratigraphical ranges of the respective *Austriellula* species without new collection. This is due to the extremely complicated geological situation only recently recognized at many localities of the Hallstatt Limestone. That being the case, it seems inevitable to rely on the newly made, precisely localized and stratigraphically well-interpreted finds.

In the recent years a good collection of *Austriellula* specimens was made in the Upper Triassic of the South-east Slovakia, in the area of the Slovak Karst. This paper gives not only the descriptions of this Carpathian material but deals also with some selected Alpine *Austriellula* species that are represented in the museum collections by larger material and are thus suitable for the revision. The most specimens from Slovakia studied in the present paper were collected by the author who has also materially benefitted from the cooperation with Dr. J. BYSTRICKÝ (Geological Institute of the Slovak Academy of Sciences in Bratislava) and his collaborators from the Triassic research group. The invaluable discussion with them and a friendly help in the field is especially acknowledged. The study would not have been possible

without the examination of the original or topotypical *Austriellula*-material housed in several institutes the authorities of which kindly made their collections available to the present author and/or supplied him with necessary material suitable for sectioning. Grateful thanks for such help and hospitality are owed to the staffs of following institutes: of the Geologische Bundesanstalt (Museum) in Vienna (where the major part of BITTNER's collection is preserved), of the Paläontologisches Institut der Universität in Vienna (that possesses ARTHABER's collection and new finds made by Dr. L. KRYSŤYN and Dr. B. GRUBER), of the Naturhistorisches Museum-Geolog.-Paläontologische Abteilung in Vienna, of the Oberösterreichisches Landesmuseum in Linz, of the Museum für Naturkunde der Humboldt-Universität in Berlin, and of the Hungarian Geological Survey (Magyar Áll. Földt. Intézet) in Budapest.

Special thanks are given to Prof. Dr. H. ZAPPE (Paläontologisches Institut der Universität, Wien) for promoting revision of the brachiopods coming from the Hallstatt Limestone and for procuring IGCP funds (Project n.4 Triassic of the Tethys Realm) rendering the author's study in Vienna and Linz possible. Stratigraphic data concerning new finds were kindly provided by Dr. L. KRYSŤYN from the same institute, and by Dr. B. GRUBER (now in the Oberösterreichisches Landesmuseum, Linz).

The following species of *Austriellula* are described here in detail: *A. dilatata* (SUESS), *A. angulifrons* (BITTNER), *A. associata* (BITTNER), *A. gomorensis* (BALOGH), *A. halophila* (BITTNER), *A. longicollis* (SUESS), *A. nux* (SUESS), *A. undosa* sp.n. and *A. (?) regilla* (BITTNER).

Slovak localities

In the literature *Austriellula* was mentioned from the Slovak Carpathians only by K. BALOGH (1940) who described *Rhynchonella (Austriella) gömörensis* n.sp. from the village Silická Brezová in the Slovak Karst, and by M. MAHEL' (1957) who mentioned *Rhynchonella (Austriella)* cf. *nux* SUESS, *Rh. (A.) intercurrents* BITTNER and *Rh. (A.)* cf. *lingulina* BITTNER from the Stratenská hornatina Highland. The specimen figured by M. MAHEL' (1957) as *intercurrents* differs, however, in its robust beak of the pedicle valve substantially from Bittner's types.

Recent collections of *Austriellula* were made in the Tisovec Limestone of the Slovak Karst in two areas: on the Silica Plateau near the village Silická Brezová (BALOGH's locality of 1940 and its surroundings, described by J. BYSTRICKÝ 1964) and on the Plešivec Plateau at the localities designated here LB₂ and B₂A in the area of the Ostré vřšky Hill (elevation point 775,0).

The lower part of the section at Silická Brezová [containing *Paratropites phoebus* (DITTMAR)] yielded *Austriellula gomorensis* (BALOGH), the upper part [with *Discotropites quinquepunctatus* (MOJS.)] yielded *Austriellula undosa* sp.n. According to V. KOLLÁROVÁ-ANDRUSOVÁ & J. BYSTRICKÝ (1974) these horizons correspond to the *Subbullatus* Zone (sensu KRYSŤYN 1973). The Tuvalian age is also supposed for the localities Ostré vřšky Hill-LB₂ and B₂A on the base of preliminary study of the accompanying fauna made by V. ANDRUSOVÁ (ammonites), M. KOCHANOVÁ (pelecypods), R. MOCK and J. PEVNÝ (conodonts); personal communications. The

locality LB₂ yielded *Austriellula gomorensis* (BALOGH) and *A. undosa* sp. n., whereas at the locality B₂A *A. halophila* (BITTNER) and *A. angulifrons* (BITTNER) appear.

Preservation of brachiopods

The great part of the Slovak material is recrystallized and making serial sections is extremely time consuming. The preservation of the Alpine specimens is better in this respect but there are problems with the scarcity of the comparative material to be sectioned of most species studied. Also the study of the external and internal variability is precluded in most species because of lack of sufficient material. The muscle-scars are not well preserved and it is impossible to distinguish the individual muscles.

Descriptions

Norellidae AGER, 1959

Norellinae AGER, 1959

Austriellula STRAND, 1928

1890 *Austriella*—A. BITTNER, p. 314.

1920 *Rhynchonella* (subgen. *Austriella*) BITTNER—C. DIENER, p. 36.

1928 *Austriellula* STRAND n.n.—E. STRAND, p. 38 (pro *Austriella* BITTNER, 1890, non TENISON-WOODS, 1881).

1965 *Austriellula* STRAND—D. V. AGER, p. H 604.

1974 *Austriellula* STRAND—A. S. DAGYS, p. 89.

Type-species: *Rhynchonella dilatata* SUESS, 1855. Hallstätter Schichten, Sandling near Aussee.

Diagnosis: Medium-sized smooth rhynchonellids having biconvex valves, sub-trigonal to subpentagonal in outline, with small erect to suberect ventral beak and rectimarginate to uniplicate anterior commissure. Dental lamellae usually underdeveloped if differentiated, or fused by heavy callus to the shell wall. Crura arcuifer.

Remarks: *Austriellula* consists of a series of very variable smooth rhynchonellids mostly characteristic of the Karnian and Norian in the Hallstatt facies. Twenty six nominal *Austriellula*-species apart from the type were listed by C. DIENER (1920) most of which remain to be investigated and confirmed. Later on, the new species of *Austriellula* were added by K. BALOGH (1940-*A. gomorensis* from the Upper Triassic of Slovakia), by A. DAGYS (1974-*A. orientalis* from the Norian of the Caucasus and Pamirs) and by the present author (1975-*A. fuchsi* from the Ladinian-Upper Triassic of Nepal).

The evolution of the rectimarginate and plicate shells in the *Austriellula* group from sulcate ancestors can be traced according to D. V. AGER—A. CHILDS—D. A. B. PEARSON (1972). Nearly all young specimens of *Austriellula* are specifically indeterminable due to their flat and rectimarginate character.

Occurrence: Middle and Upper Triassic of the Alps, Carpathians, Caucasus, Pamirs, Spiti, Nepal and Timor.

***Austriellula dilatata* (Suess, 1855)**

Pl. VIII, Figs. 1—2, 4; Text-figs. 1—2

1855 *Rhynchonella dilatata* SUESS—E. SUESS, p. 29, pl. 2, fig. 1 non fig. 2—3 [fig. 2 = ? *A. halophila* (BITTNER) juv.; fig. 3 = ? *A. halorica* (BITTNER)].

1890 *Rhynchonella dilatata* SUESS—A. BITTNER, p. 212, pl. 8, fig. 1—18.

1892 *Rhynchonella dilatata* SUESS—A. BITTNER, p. 21.

Type-specimen: Derived from the Vorderer Sandling and figured by E. SUESS, 1855 on the plate 2, fig. 1. It was supposed to be located in the Museum für Naturkunde in Berlin but the specimen B 233.19 labelled there as the original SUESS' type-specimen differs substantially in outline and form of plication from the specimen figured in SUESS (1855).

Material: The study was based entirely on museum collections. There were 30 specimens at disposal, deposited in the collections of the Museum für Naturkunde, Berlin, of the Naturhistorisches Museum, Wien and of the Landesmuseum, Linz. The dimensions of the figured specimens: $13.9 \times 17.5 \times 8.3$ mm (Pl. VIII, fig. 1); $12.6 \times 14.8 \times 8.6$ mm (Pl. VIII, fig. 2); $14.2 \times 15.7 \times 10.4$ mm (Pl. VIII, fig. 4).

Description: Equibiconvex smooth shell of elliptical to subpentagonal outline, normally with width exceeding length. The maximum-width situated forward of the mid-length. A slightly noticeable fold to be seen near the anterior commissure in the brachial valve. Anterior commissure usually with broad but low plication. Linguiform extension of remarkably variable size, rising not very steeply from the anterior margin. Beak relatively low and wide, suberect to erect. No posterolateral planareas or flattenings developed. Posterior parts of shell either make an obtuse angle or form a nearly straight cardinal margin. Apical angle of the typical specimens 120—140 degrees. Muscle-scars not clearly visible.

The shell extremely thick. Delthyrial cavity subtriangular or subrounded in cross-section, with deep muscle impressions ventrally. No pedicle collar observed. Lateral umbonal cavities absent or strongly reduced. Dental lamellae short and dorsally divergent. The teeth short, without crenulation. Relatively thick denticula may be developed laterally. No median dorsal septum and no septalium present. Hinge-plates horizontal or slightly inclined dorsally, with dorsally-directed crural bases at their distal ends. Sockets wide with poorly developed outer socket-ridges, hardly any trace of accessory sockets. Crura of the arcuifer type diverging towards the front of shell. Vestigial median ridge present in the bottom of the brachial valve.

Remark: BITTNER's statement (1890) that *dilatata* might be identical with *Terebratula castanea* SCHAFHÄUTL, 1851 is not fully convincing and is not followed by the present author.

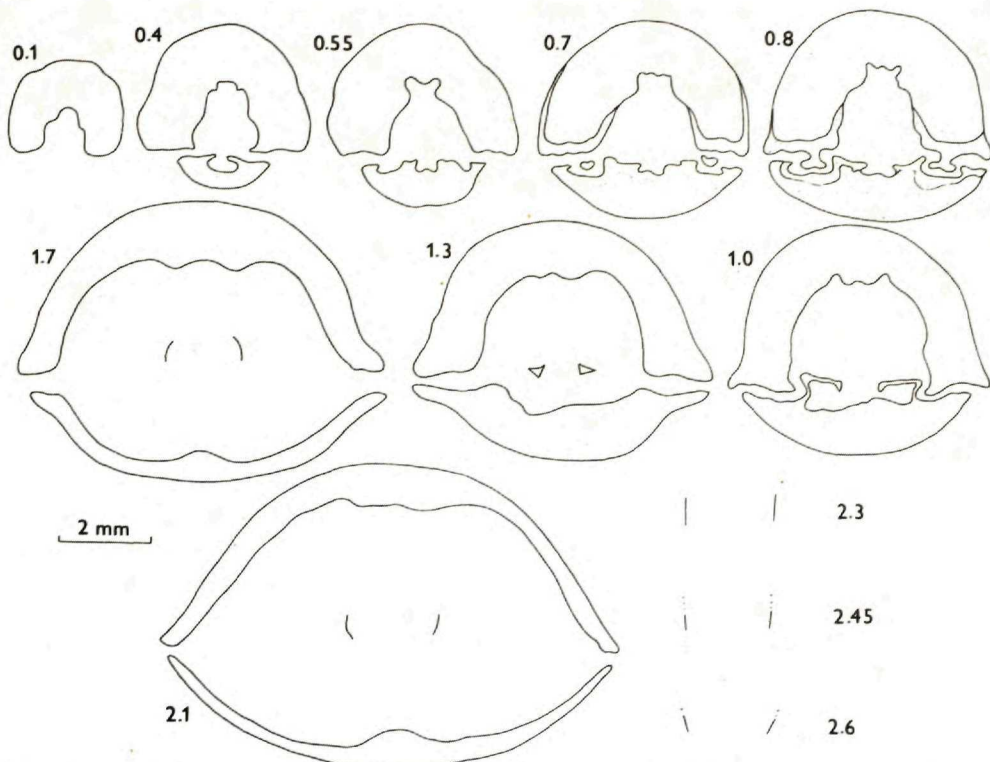


Fig. 1 *Austriellula dilatata* (Suess). Sandling-Millbrunnkogel near Goisern. "Oberkarn", coll. G. ROTH 1911, NMW (for abbreviations see the explanation of plates). Total length of specimen 14.2 mm. Enlarged.

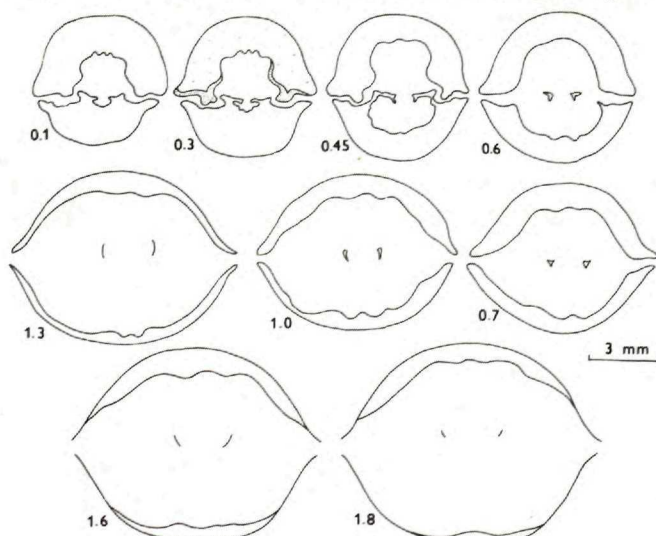


Fig. 2 *Austriellula dilatata* (Suess). Vorderer Sandling near Goisern. Coll. v. FISCHER, MNB B 233.23. Total length of specimen ca. 14.4 mm. Enlarged.

Occurrence: According to BITTNER (1890) this species is derived both from the Karnian and Norian (he mentioned e.g. well-documented finds from the Subbullatus — and Bicrenatusschichten at Sandling). In 1892 the same author referred to the occurrence in the Subbullatusschichten of Rappoltstein near Hallein. Specimens of this species deposited in the Landesmuseum in Linz are labelled "Hallstatt (Sandlinggebiet ? — Norische Stufe)". No stratigraphically well-fixed finds of this species have been made since that time. M. IORDAN (1978) reported this species from the Norian of the Central Perşani Mts. but she provided no accompanying figure.

***Austriellula angulifrons* (BITTNER, 1890)**

Pl. IX, figs. 1, 3, 5; text-figs. 3—4

1890 *Rhynchonella angulifrons* nov. spec. — A. BITTNER, p. 214, pl. 8, fig. 23—26.

?1906 *Rhynchonella angulifrons* BITTNER — C. DIENER, p. 6, pl. 17, fig. 11.

Lectotype (here selected): The specimen depicted by A. Bittner, 1890 on pl. 8, fig. 25 and refigured here on pl. IX, fig. 5. It is derived from Röthelstein and is deposited in the collections of the Geologische Bundesanstalt (Museum), Wien.

Material: 53 mostly uncomplete specimens derived from Slovakia, partly deformed and decorticated. In addition to the lectotype, one another specimen figured by BITTNER (1890, pl. 8, fig. 26) and deposited in the Naturhistorisches Museum, Wien was available to the study. The figured specimens are of the following dimensions: $10.8 \times \text{ca.} 11.0 \times 6.7$ mm (Pl. IX, fig. 1); $12.9 \times 11.2 \times 8.5$ mm (Pl. IX, fig. 3); $15.1 \times 18.1 \times 9.9$ mm (Pl. IX, fig. 5, lectotype).

Description: Medium-sized, equibiconvex, resp. dorsibiconvex smooth *Austriellula*, rounded to subpentagonal in outline. Length approximately equal to width, the maximum-width situated at-or slightly forward of the mid-length. The brachial valve in subpentagonal specimens about twice higher in lateral view than the pedicle one. Flat fold commonly noticeable near the anterior margin of the brachial valve, but no sulcus developed in the pedicle one. Subangular plication more or less undulated, rising steeply from the commissural plane. Initial ribbing may occur. Lateral commissure straight. Beak relatively high, suberect to erect with short beak-ridges and submesothyrid to mesothyrid foramen. Apical angle 90—115 degrees. Muscle-scars indistinct.

Lateral umbonal cavities largely filled with secondary shell material. Dental lamellae short. Hinge-teeth without crenulation, inserted tightly in broad sockets. Short stout denticula developed laterally. Hinge-plates almost horizontal with crural bases distinguishable dorsally at their inner ends. Outer socket-ridges stronger than the inner ones. Short median ridge developed in the brachial valve of some specimens.

Remarks: In despite of the great variability of the specimens in the shell outline and in the character of the linguiform extension, specific independance of *A. angulifrons* seems to be reasonable. Considerable resemblances can be observed especially in some narrower variants of *A. dilatata* (Suess) as was already stated by A. BITTNER (1890) in his original description of *Rhynchonella angulifrons*. Most of the Slovak

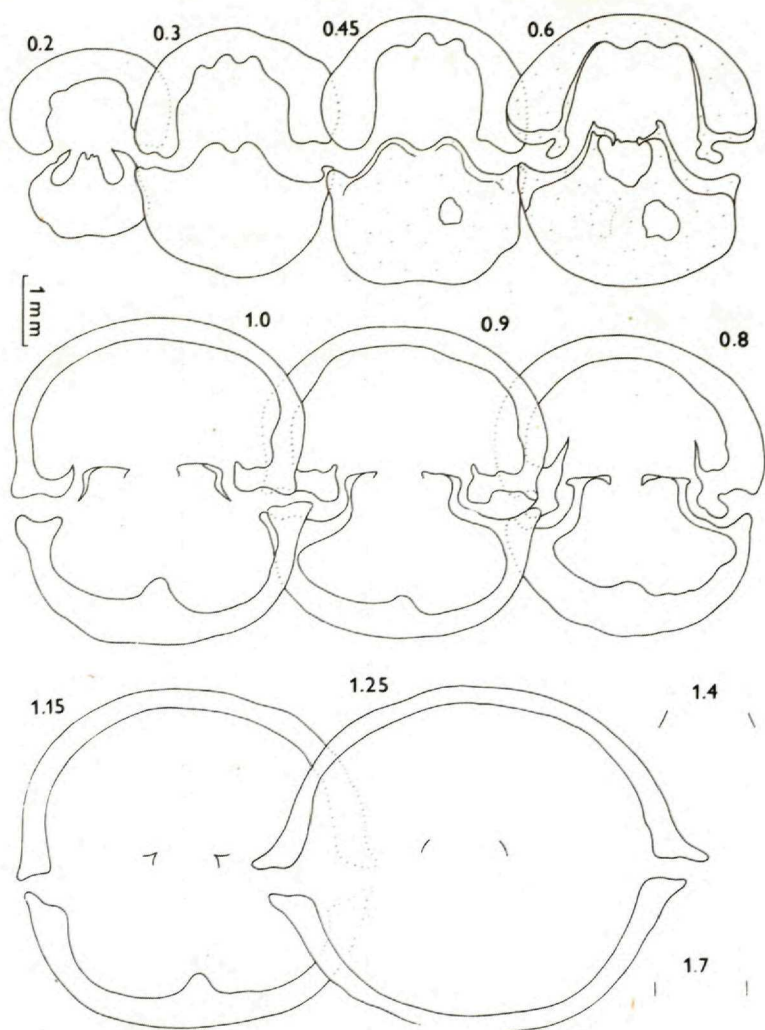


Fig. 3 *Austriellula angulifrons* (BITTNER). Ostré vřšky Hill, loc. B₂A, Tuvanian. Total length of specimen 11.5 mm. Enlarged.

specimens differ by their upright beaks and smaller dimensions from the Austrian specimens of *A. angulifrons* as figured by BITTNER (1890). The specific assignment of the specimen documented with figure by C. DIENER (1906) is dubious, Himalyan specimen having robust beak and lesser angularity of the linguiform extension.

Occurrence: Slovak Karst—Ostré vřšky Hill (locality B₂A). A. BITTNER (1890) reported the species from the Karnian of Vorderer Sandling, Rõthelstein and Raschberg. New collections made by B. GRUBER from the Norian of Balbersteine/Miesenbach yielded 3 specimens determined here as aff. *angulifrons*. The occurrence in New Caledonia (PIROUTET, 1908) seems highly improbable.

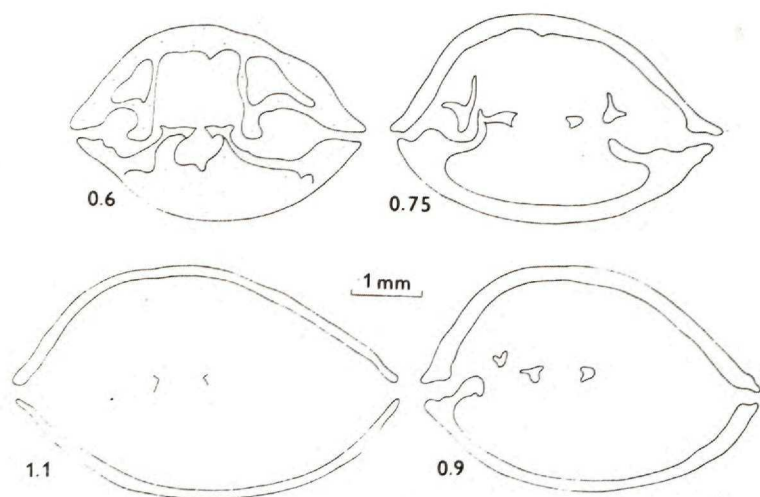


Fig. 4 *Austriellula angulifrons* (BITTNER). Ostré vřšky Hill, loc. B₂A, Tuvanian. Original length of specimen 10.6 mm. Enlarged.

***Austriellula associata* (BITTNER, 1890)**

Pl. X, figs. 2, 5; text-fig. 5

1890 *Rhynchonella associata* nov. spec. — A. BITTNER, p. 214, pl. 8, fig. 27—29.

1890 *Rhynchonella associata* n. sp. var. *angustior* — A. BITTNER, p. 214, 223, pl. 12, fig. 31.

Lectotype (here designated): The specimen figured by A. Bittner, 1890 on pl. 8, fig. 28. It comes from Sandling and is deposited in the collections of the Museum für Naturkunde in Berlin (nr. MB. B. 236.2). Its dimensions are $15.6 \times 21.4 \times 11.4$ mm.

Material: 11 partly fragmentary specimens in possession of the Paläontologisches Institut der Universität in Vienna (coll. KRISTYN). The dimensions of the figured specimens: $16.0 \times 20.4 \times 10.3$ mm (Pl. X, fig. 2); $18.0 \times 24.0 \times 14.1$ mm (Pl. X, fig. 5).

Description: Subtrigonal to subpentagonal medium-sized shells, equibiconvex in profile and with width exceeding length. The maximum width situated in the anterior third of shell. Flat fold either well-distinguishable in the anterior half of the brachial valve, or nearly absorbed in the lateral convexity of this valve. Slight longitudinal sulcation noticeable in the fold of some specimens. Clearly-defined sulcus developed in the pedicle valve, reaching near to the umbo. Lateral commissure straight. Anterior commissure with high and variably broad plication, steeply rising from the commissural plane. Beak relatively wide and low, erect in orientation. Beak-ridges badly marked.

The shell relatively thick. Lateral umbonal cavities filled with secondary shell material and dental lamellae limiting them very short and reduced. Hinge-teeth

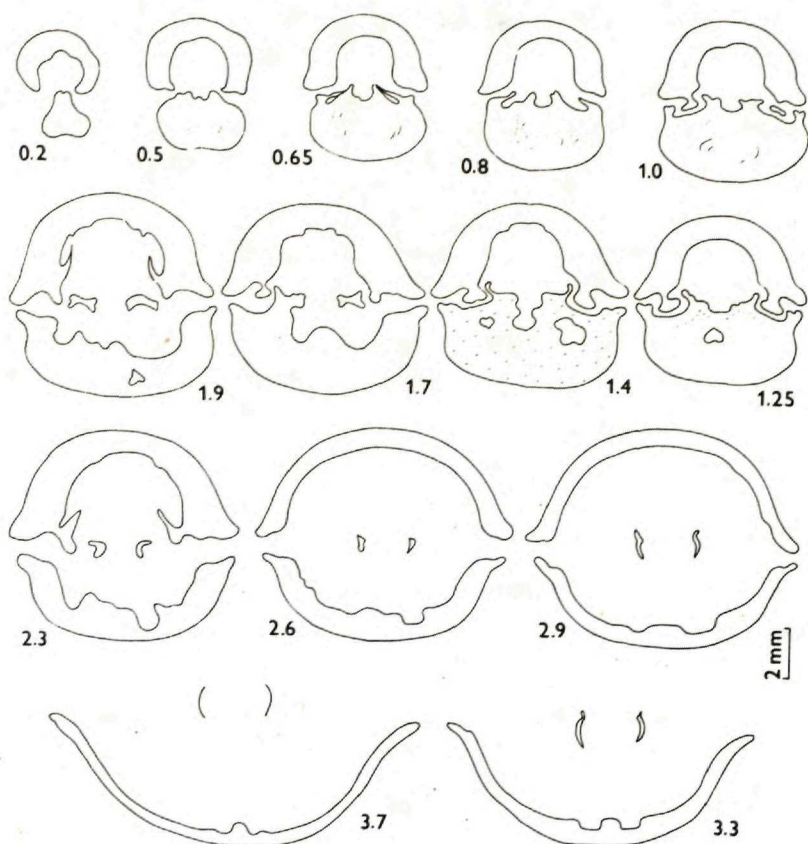


Fig. 5 *Austriellula associata* (BITTNER). Feuerkogel near Bad Aussee, Tuvanian of KRYSTYN's locality F4/B 5. Coll. KRYSTYN, PIW. Total length of specimen 16.2 mm. Numbers indicate the distance from brachial umbo. Crura disappear at 4.7 mm distance. Enlarged.

strong without crenulation, closely inserted into broad sockets. Very thick and massive hinge-plates horizontal in position, carrying slender inner socket-ridges. Crura moderately arcuate and elongated, concave toward each other in cross-section. Dorsal muscle-scars with low myophragm well-marked.

Remarks: Most of our specimens resemble BITTNER's variety *angustior*. This name is not retained here, because it represents the forms of *A. associata* with an extreme development of folding and sulcation. Well-developed sulcation of the pedicle valve distinguishes this species from the large variants of *A. nux*.

Occurrence: *A. BITTNER* (1890) recorded this species from Sandling and from Röthelstein (var. *angustior*). New finds made by L. KRYSTYN come from the Karnian of Feuerkogel, localities F 4/B5 and B 14 (*Dilleri* and *Subbulatus* Zones, resp. *Anatropites*-Bereich according to KRYSTYN's personal communication).

***Austriellula gomorensis* (BALOGH, 1940)**

Pl. X, figs. 3—4

1940 *Rhynchonella* (*Austriella*) *gomorensis* n. sp.—K. BALOGH, p. 170, pl. 1, fig. 13.

Holotype (by monotypy): Derived from Silická Brezová and deposited in the collections of the Hungarian Geological Survey (Magyar Áll. Földt. Intézet) in Budapest. Its dimensions are $12.7 \times 15.5 \times 8.9$ mm.

Material: In addition to the holotype 8 other partly damaged specimens; the topotypes figured here measure $9.9 \times 10.7 \times 4.7$ mm (Pl. X, fig. 3) and $12.2 \times 14.6 \times 8.4$ mm (Pl. X, fig. 4).

Description: Medium-sized, characteristically dorsibiconvex *Austriellula*, sub-pentagonal in outline and uniplicate. The maximum-width situated in the anterior third—to half of the shell. The brachial valve about three times higher in lateral view than the poorly inflated pedicle valve. Very low fold to be noticed near to the anterior margin of the shell. Linguiform extension rising steeply from the anterior commissure is straightly limited on its dorsal side. No undulation ascertained. Beak suberect with short, faintly marked beak-ridges, foramen submesothyrudid. Apical angle 110—115 degrees.

The study of the internal characters was not successful owing to the complete recrystallization of the specimens sectioned.

Remarks: The present author was kindly shown the holotype deposited in Budapest (the only one specimen found by BALOGH). It is nearly identical with our specimen figured on pl. X, fig. 4. *A. gomorensis* resembles some variants of *A. angulifrons* (BITTNER) but can be distinguished from them by its flatter pedicle valve, upright beak and non-undulated plication. Similar *Austriellula* (?) *arcestiphila* (BITTNER 1890) differs in its greater thickness and convexity of the pedicle valve and in having erect beak.

Occurrence: Slovak Karst — Silická Brezová (lower horizon, 4 specimens incl. holotype), Ostré vršky Hill (locality LB₂, 5 specimens).

***Austriellula halophila* (BITTNER, 1890)**

Pl. XI, figs. 1—3; pl. XII, figs. 1—3; pl. XIII, figs. 1—3; pl. XIV, figs. 1, 3; text-figs. 6—13

1890 *Rhynchonella halophila* nov. spec.—A. BITTNER, p. 218, pl. 11, fig. 1—12.

?1890 *Rhynchonella halophila* nov. spec. var. *plicifrons*—A. BITTNER, p. 218, pl. 11, fig. 13—14.

1890 *Rhynchonella halophila* n. sp. var. *nucleus*—A. BITTNER, p. 218, pl. 11, fig. 22.

1892 *Rhynchonella halophila* m.—A. BITTNER, p. 21.

?1978 "*Austriellula*" *halophylla* (BITTNER)—M. JORDAN, pl. 2, fig. 4.

Lectotype: here selected, the specimen depicted by A. BITTNER 1890 on pl. 11, fig. 9 and refigured in the present paper on pl. XI, fig. 3. It is coming from Vorderer Sandling and is deposited in FISCHER's collection in the Museum für Naturkunde in Berlin under register number B 235.9.

Material: 215 specimens preserved as partly decorticated and fragmentary internal moulds. In addition to 170 specimens derived from the Slovak Karst the

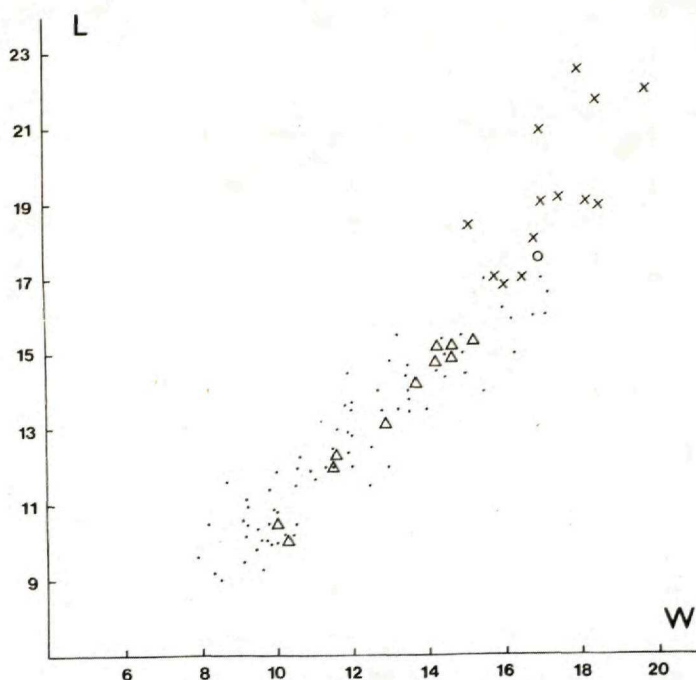


Fig. 6 Length-width scattergram for *Austriellula halophila* (BITTNER), in mm. Specimens derived from the Ostré vršky Hill, loc. B₂A are indicated by dots. Δ specimens from Rappotstein near Hallein, coll. KITTL 1890, NMW; $\times$ specimens from Lacian 1 of Balbersteine/Miesenbach, Lower Austria, coll. GRUBER, PIW; $\circ$ lectotype (BITTNER, 1890, pl. 11, fig. 9).

material deposited in the above mentioned institutes in Berlin, Wien and Linz was at my disposal. The dimensions (in mm) of the figured specimens are as follows:

Length	width	thickness	
21.8	18.6	15.2	Pl. XI, fig. 1
ca. 10.0	9.5	6.3	Pl. XI, fig. 2
17.5	17.0	11.4	Pl. XI, fig. 3, lectotype
22.6	ca. 19.2	16.9	Pl. XII, fig. 1
ca. 17.0	ca. 17.4	11.6	Pl. XII, fig. 2
ca. 13.5	13.4	8.9	pl. XII, fig. 3
15.4	15.4	11.2	Pl. XIII, fig. 1
19.9	18.0	14.2	Pl. XIII, fig. 2
16.7	16.6	12.3	Pl. XIII, fig. 3
15.1	14.6	8.2	Pl. XIV, fig. 1
14.2	13.6	8.6	Pl. XIV, fig. 3

Description: Medium-sized, characteristically ventribiconvex smooth shells, up to 22.5 mm long, 19.8 mm wide and 17.7 mm thick. The range of variation rather

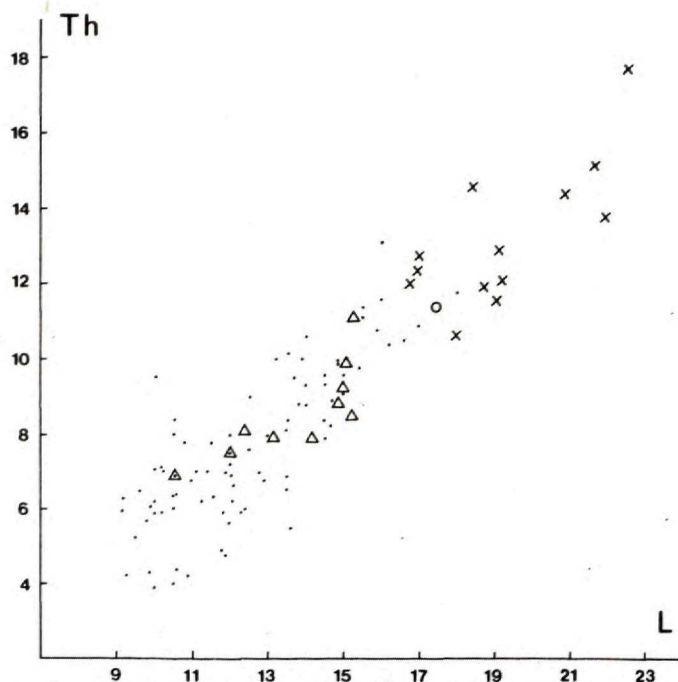


Fig. 7 Thickness-length scattergram for *Austriellula halophila* (BITTNER). Explanation as fig. 6.

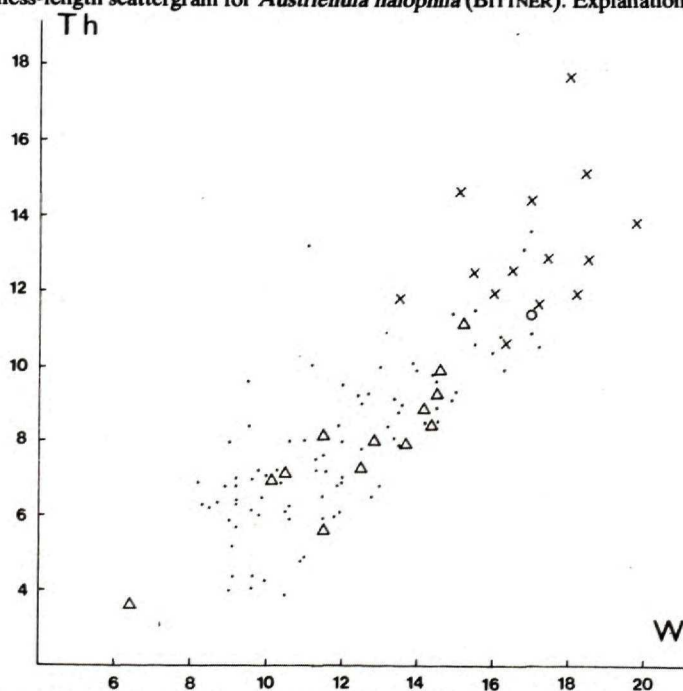


Fig. 8 Thickness-width scattergram for *Austriellula halophila* (BITTNER). Explanation as fig. 6.

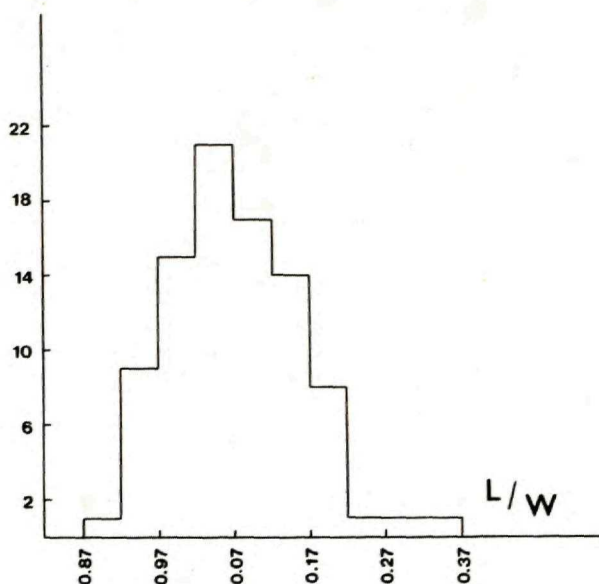


Fig. 9 Length-width frequency histogram for *Austriellula halophila* (BITTNER). Vertically number of specimens. Ostré vřský Hill, loc. B₂A, Tuvanian.

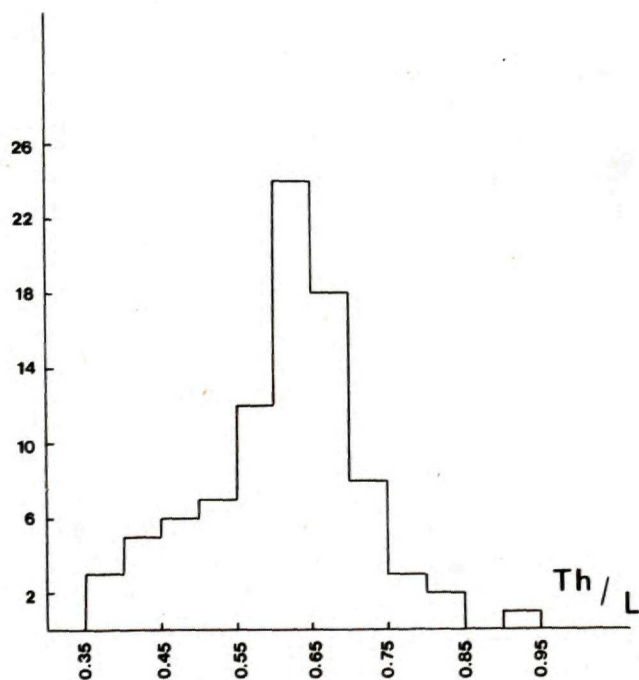


Fig. 10 Thickness-length frequency histogram for *Austriellula halophila* (BITTNER). Locality as fig. 9.

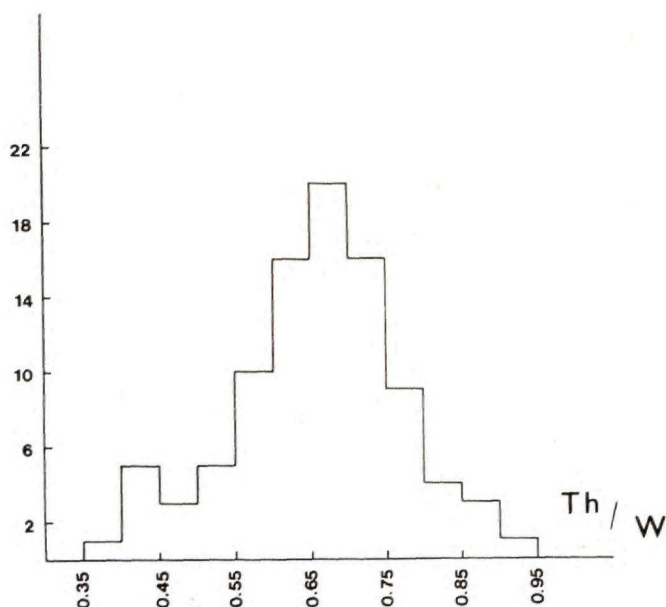


Fig. 11 Thickness-width frequency histogram for *Austriellula halophila* (BITTNER). Locality as fig. 9.

large, showing forms varying in outline from subtrigonal up to rounded pentagonal. The maximum-width situated in the anterior third of the shell. Posterolateral parts of the pedicle valve flattened. Generally no true fold or sulcus developed. Lateral commissure straight, anterior commissure of nearly rectimarginate or parasulcate type. Linguiform extension broad and low, showing slight undulation in some specimens. Apical angle ranges between 80—110 degrees. The relatively narrow and pointed beak shows suberect-erect attitude and is accompanied by badly marked beak-ridges. Foramen small, circular. Muscle-scars area differentiated but due to the unfavourable preservation difficult to interpret.

Both valves extremely thick. Delthyrial cavity characteristically subquadrate in cross-section, with faint (Balbersteine/Miesenbach) or very deep (Sandling, Ostré Vřský — B₂A) muscle-impressions ventrally. Dental lamellae poorly developed. Lateral umbonal cavities, if present, very much reduced. Poorly crenulated hinge-teeth straight and laterally expanded. Denticula distinguishable in specimens from Sandling and Balbersteine/Miesenbach. Hinge-plates flat, deflected anteriorly towards brachial valve (1 specimen from the locality Ostré vřský B₂A revealed ventrally arched hinge-plates). Sockets very large and shallow, with strongly developed inner socket-ridges. Crenulation of sockets may occur. Crura triangular in cross-section, becoming somewhat flattened anteriorly. Adductor muscle-scars deep, divided by a long and low median ridge.

Remarks: In some Austrian localities is the species under consideration represented also by the specimens reaching much more remarkable dimensions than average. Such specimens were reported by A. BITTNER (1890, pl. 11, fig. 12) from

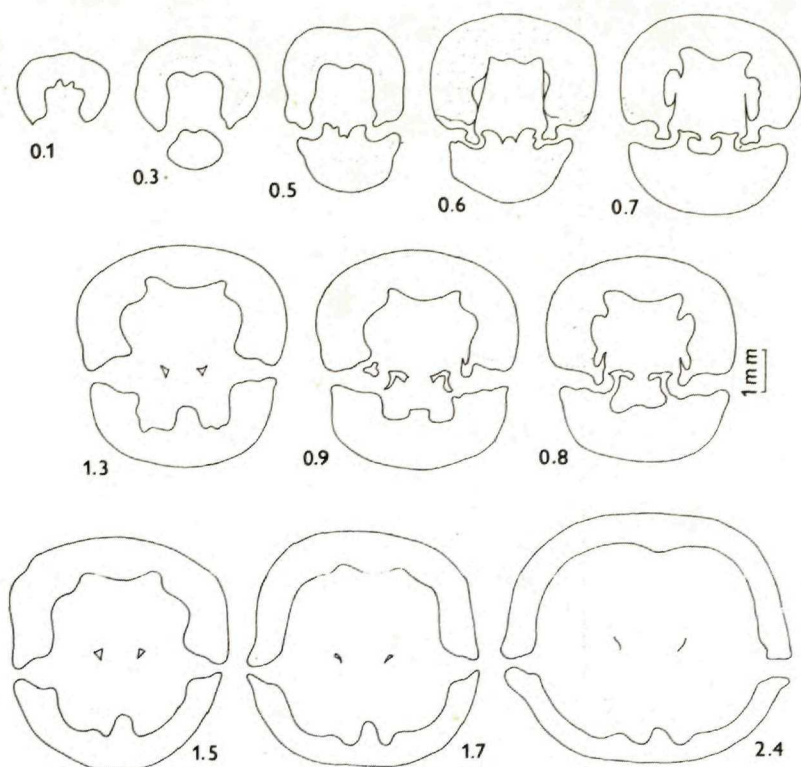


Fig. 12 *Austriellula halophila* (BITTNER). Ostré vršky Hill, loc. B₂A, Tuvalian. Total length of specimen 15.5 mm. Enlarged.

the Norian of Taubenstein and they were collected recently by B. GRUBER in Balbersteine/Miesenbach (Lac. 1 according to GRUBER — personal communication). Some of these larger specimens develop episulcate or undulated anterior commissure. An extreme variant with short and low folding and undulated commissure from Balbersteine/Miesenbach is figured on pl. XI, fig. 1. Similar large specimens have not yet been ascertained in the Karnian and it seems likely that stratigraphy is responsible for this. Some specimens of *A. halophila* from Balbersteine/Miesenbach with starting ribbing differ from *Rhynchonella halophila* var. *plicifrons* BITTNER, 1890 externally only by their greater dimensions and they could thus support the validity of BITTNER's attribution of his variety *plicifrons* into *A. halophila*. The specimen figured as *A. halophila* by M. IORDAN (1978) from the Norian of the Persani Mts. (Roumania) differs from the common Austrian or Slovak representatives of the species by its quadrangular outline and different plication. *Austriellula halorica* (BITTNER 1890; pl. IX, fig. 4) was primarily distinguished from *Rh. halophila* by BITTNER practically on the base of its rectimarginate anterior commissure only. Above-mentioned large variability of the anterior commissure in *A. halophila*, however, suggest the possibility of the identity of both these species.

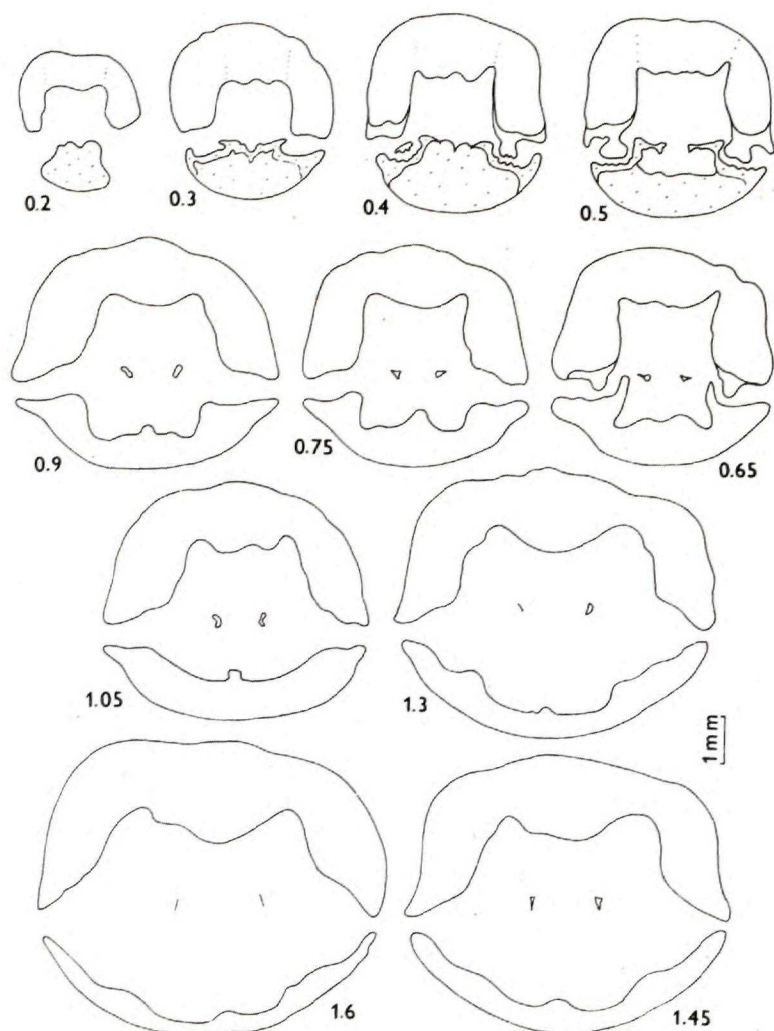


Fig. 13 *Austriellula halophila* (BITTNER). Vorderer Sandling. Coll. v. FISCHER, MNB B 235.14. Total length of specimen ca. 16.5 mm. Crura end at 1.9 mm (broken?). Enlarged.

A decisive solution of the problem is for present made difficult owing to the scarcity of the specimens of *A. halorica*.

Occurrence: Slovak Karst — Ostré vršky Hill (locality B₂A). A. BITTNER (1890) reported this species from the Karnian of Vorderer Sandling, Raschberg, Röthels-tein und Rappoltstein near Hallein, and from the Norian of Sandling (?) and Taubenstein. New collections by B. GRUBER derive from Balbersteine/Miesenbach, N. Ö. (Lac. 1) and by L. KRYSŤYN from Mühlthal (Sevastian) and from Feuerkogel (one plicate specimen found in KRYSŤYN's "Dilleri-Spalte" F3/A23). The specimen reported from Roumania by M. IORDAN (1978) is problematic.

***Austriellula longicollis* (Suess, 1855)**

Pl. XIV, Fig. 2; Pl. XV, Figs. 1—3, Text-figs. 14—18

1855 *Rhynchonella longicollis* SUESS—E. SUESS, p. 30, pl. 2, fig. 4—10.

1890 *Rhynchonella longicollis* SUESS—A. BITTNER, p. 216, pl. 10, fig. 8—18, pl. 39, fig. 11.

1906 *Rhynchonella longicollis* SUESS—G. ARTHABER, pl. 47, fig. 7.

1965 *Rhynchonella (Austriella) longicollis* SUESS—H. ZAPFE, p. 281.

Lectotype (here selected): The specimen depicted by E. SUESS, 1855 on pl. 2, fig. 8 and refigured in the present paper on pl. XV, fig. 1. It derives from Leisling near St. Agatha (orig. coll. of VON FISCHER) and is now in possession of the Museum für Naturkunde in Berlin under registered number B 234.2.

Material: Specimens studied (140 in number) come from all above mentioned institutes in Berlin, Wien and Linz. In addition, 4 well-preserved specimens were collected personally by the present author at Feuerkogel near Bad Aussee. Dimensions of the figured specimens: $24.7 \times 12.8 \times 12.7$ mm (Pl. XIV, fig. 2); $28.0 \times 23.1 \times 15.4$ mm (Pl. XV, fig. 1, lectotype); $14.2 \times 13.0 \times 8.2$ mm (Pl. XV, fig. 2); $26.3 \times 19.0 \times 15.5$ mm (Pl. XV, fig. 3).

Description: Medium-sized to large rectimarginate shells, tear-or pear-like in outline and equibiconvex in profile. Length apparently exceeding width in most specimens. Thickness in younger specimens not rarely exceeding width. The maximum-width situated in the anterior third of shell. Posterolateral flanks of shell

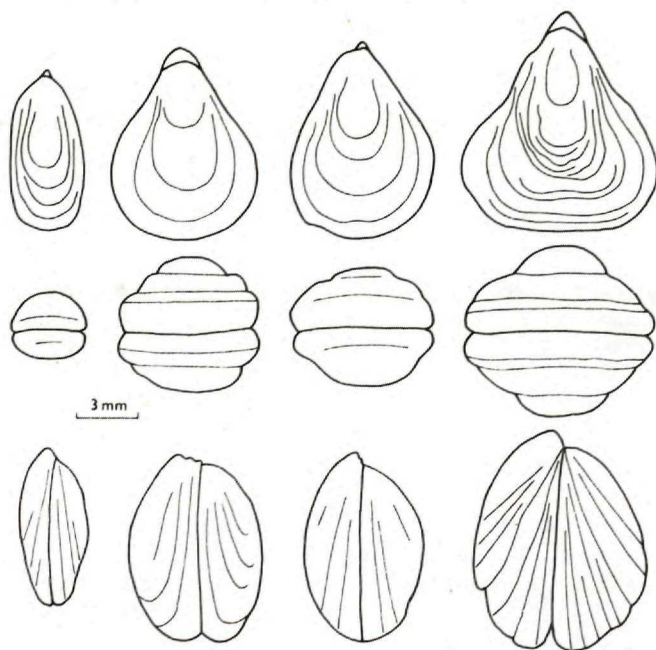


Fig. 14 *Austriellula longicollis* (SUESS). Shell outline of four small specimens. Leisling near Goisern. Coll. KITTL 1897—1900, NMW. Enlarged.

concave in dorsal view. Anterior and lateral margins of shell incurved or with plane flange in each valve. Lateral flanks of shell adjacent to the cardinal margins divided by an acute opposition of the valves forming the little "ears". Beak pointed and suberect to erect in lateral view. Foramen permesothyridid, accompanied by poorly developed beak-ridges. Concentric growth lamellae more conspicuous anteriorly. Muscle-scars badly marked to be defined. The trunks of vascula media well visible in most specimens but fine distal branches of canals obscure.

The shell comparatively thick. Dental lamellae absent. Inwards directed hinge-teeth short and without crenulation. Lateral denticula may occur. Hinge-plates inclined dorsally. No median septum or ridge developed. Crura extremely elongated in cross-sections of some specimens.

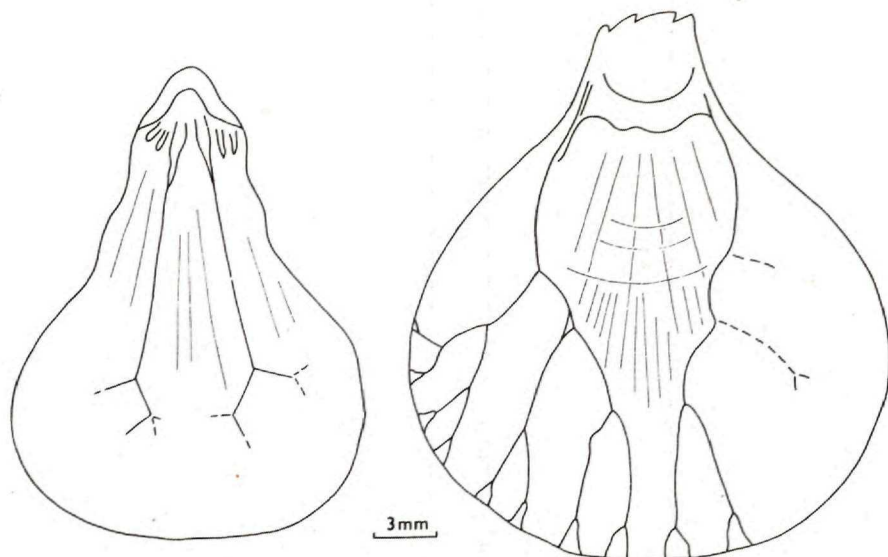


Fig. 15 Mantle canals of *Austriellula longicollis* (Suess). Left: Brachial valve, Feuerkogel, KRISTYN's loc. F 4/8, "Anatropites-Bereich", PIW, right: pedicle valve of another specimen, Feuerkogel, KRISTYN's F 4/S, "Kerri-Spalte", PIW. Enlarged.

Remarks: The large specimen figured by E. SUSS (1855) on pl. 2, fig. 9 and deposited in the Geologische Bundesanstalt (Museum) in Wien was not selected as the lectotype due to its depressed and fragmentary character that is not evident from the SUSS' figure. According to D. V. AGER—A. CHILDS—D. A. B. PEARSON (1972) a new genus is probably needed for *A. longicollis*. Its rather odd external appearance would certainly support the suggestion. However, the present author has not ascertained in *A. longicollis* any serious difference concerning internal characters enabling the separation from *A. dilatata* and other studied *Austriellula* species, and he holds *A. longicollis* for a little peculiar but good *Austriellula*. In addition, *A. longicollis* is extremely variable in shape and some of its variants have a considerable external resemblance to *A. pirum* (BITTNER 1890; pl. VIII, fig. 3), the larger

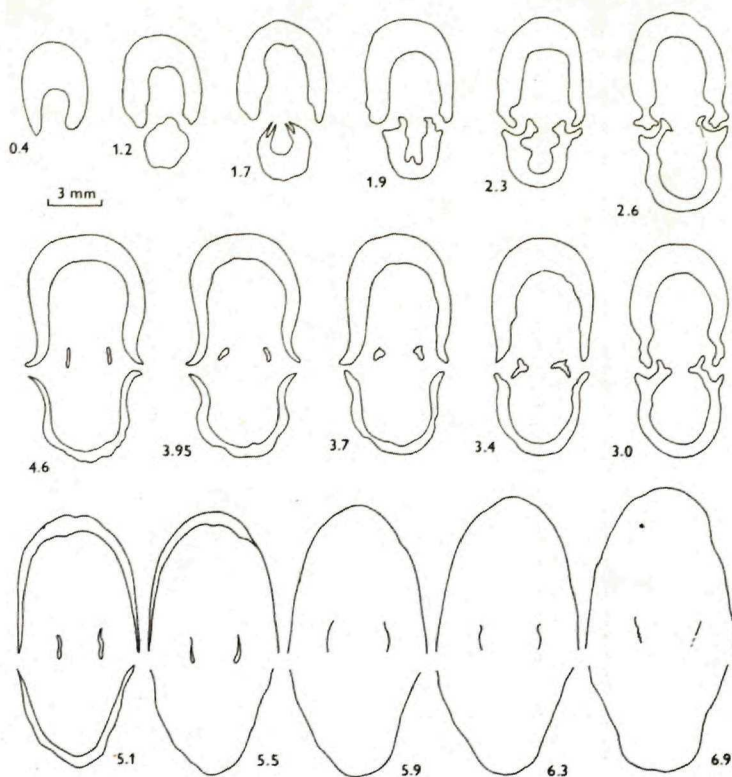


Fig. 16 *Austriellula longicollis* (Suess). Feuerkogel, 100 m E of KRYSŤYN'S F 1, lowermost Norian. Total length of specimen 29.9 mm. Crura disappear at 7.2 mm. Enlarged.

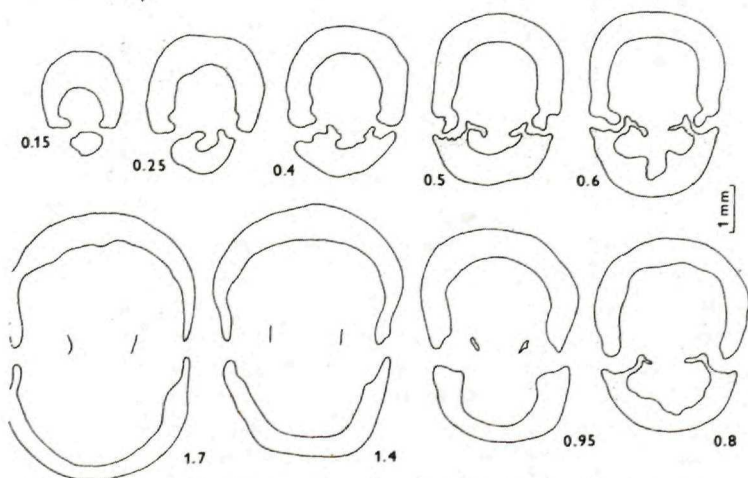


Fig. 17 *Austriellula longicollis* (Suess). Sandling. Coll. v. FISCHER, MNB B 234.15. Young specimen with uncomplete crura. Original length of specimen 14.2 mm. Enlarged.

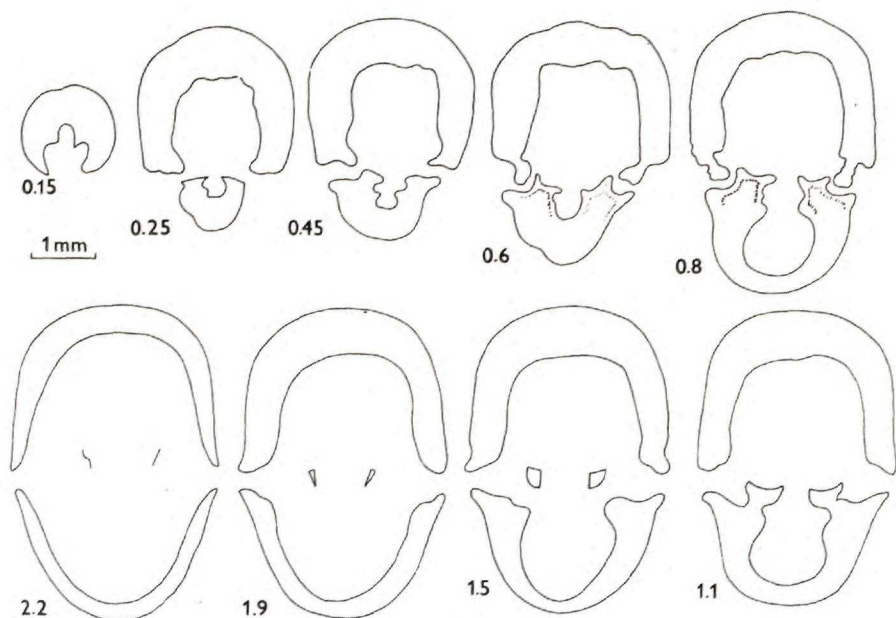


Fig. 18 *Austriellula longicollis* (Suess). Leisling near Goisern. Coll. KITTL 1897—1900, NMW. Young specimen with uncomplete crura. Total length of specimen 11.8 mm. Enlarged.

plicate specimens of which have already *Austriellula*-like appearance. Even if the present author is inclined to believe in possible synonymy of *A. longicollis* and *A. pirum*, the question of the identity of both species could not be decisively solved in this paper. This is due to the fact that the well-preserved specimens of *A. pirum* that seems to be restricted to the Karnian are relatively rare in the collections and practically none comes from the new finds. For instance, *A. pirum* was recently reported from Feuerkogel (Tuvanian) by L. KRISTYN—G. SCHÄFFER—W. SCHLAGER (1971), where it was found also by the present author in 1975. However, there are many specimens identified as transitional forms between *longicollis* and *pirum* in the mentioned institutes.

Occurrence: A. BITTNER (1890) considered this species one of the most frequent brachiopod species of the Hallstatt Limestone and mentioned it from a series of Karnian and Norian Alpine localities and from Seljanopolje in Bosnia. G. ARTHABER (1906) introduced this species from the locality "Ferdinandstolle" at Röthelstein. In addition, several specimens from Suppenhaferlkogel-Rossmoos and Zwergwand-Rossmoos near Ischl are deposited in the Naturhistorisches Museum in Wien. The erratic blocks from Falmbergalm near Gosau yielded specimens described by H. ZAPFE (1965). New collection made by L. KRISTYN derives from Mühlthal (Sevatian) and from Feuerkogel (*Anatropites*-*Kerri*- and *Paulcke*-Zones of KRISTYN's localities F 4 and F 5). Specimens collected by the present author at Feuerkogel derive from the *Halobia austriaca* lumachelle (Lowermost Norian), 100 m E of KRISTYN's locality F 1 ("Austriacum-Lager").

***Austriellula nux* (Suess, 1855)**

Pl. XVI, Figs. 1—5; Text-figs. 19—20

1855 *Spirigera nux* SUESS—E. SUESS, p. 27, pl. 1, fig. 7—8.

1890 *Rhynchonella nux* SUESS spec.—A. BITTNER, p. 223, pl. 12, fig. 18—30; pl. 39, fig. 21—22.

1892 *Rhynchonella nux* SUESS spec.—A. BITTNER, p. 22.

1906 *Rhynchonella nux* SUESS—G. ARTHABER, pl. 47, fig. 8.

Lectotype (selected here): The specimen coming from Sommeraukogel, depicted by E. SEESS, 1855 on pl. 1, fig. 7 and refigured in the present paper on pl. XVI, fig. 2. It is deposited in the collections of the Geologische Bundesanstalt (Museum) in Wien.

Material: The study of this species is based entirely on existing museum collections. At disposal there were 57 mostly well — preserved specimens deposited in all above mentioned institutes in Wien, Linz and Berlin. The figured specimens are of the dimensions:

Length	width	thickness	
12.0	12.8	10.1	Pl. XVI, fig. 1
12.3	13.1	10.8	Pl. XVI, fig. 2, lectotype
15.5	14.0	11.6	Pl. XVI, fig. 3
11.6	11.2	7.9	Pl. XVI, fig. 4
13.4	14.8	11.3	Pl. XVI, fig. 5

Description: Medium-sized rhynchonellid, subtrigonal to subcircular in outline and equibiconvex or dorsibiconvex in profile, grown-up specimens nearly globose. Maximum-convexity of the brachial valve near to the umbo. Shell broadly elliptic to subcircular in the anterior view. Valves slightly folded near the anterior margin. Anterior commissure with strong and relatively narrow plication. The tongue variable in shape, varying from subtrigonal to subquadrate form, and rising steeply from the commissural plane. Slight undulation of the tongue may occur. Beak tiny and suberect in position. Apical angle near to 90 degrees in adult specimens.

Lateral umbonal cavities much infilled with secondary shell material. Dorsally divergent dental lamellae very short and poorly developed. Hinge-teeth strong and wide, blunt denticula present. Hinge-plates subhorizontal, well-separated from inner socket-ridges. Sockets large and in some specimens crenulated. Crural bases distinguishable on dorsal side of distal ends of hinge-plates. Crura flattened and almost parallel, distally curving towards pedicle valve. Muscle-scars deeply impressed in both valves.

Remark: Broader specimens of *A. nux* with better developed folding resemble *Rhynchonella associata* var. *angustior* BITTNER 1890 (= *Austriellula associata*) described from the Lower Karnian, and both taxa are externally difficult to be separated.

Occurrence: A. BITTNER (1890) mentioned this species from various Norian localities. Later on (1892) he added Hallein and made reference also to the finds in the Karnian from Rappoltstein (coll. by E. KITTL) and Bergstein near Landl a. Enns.

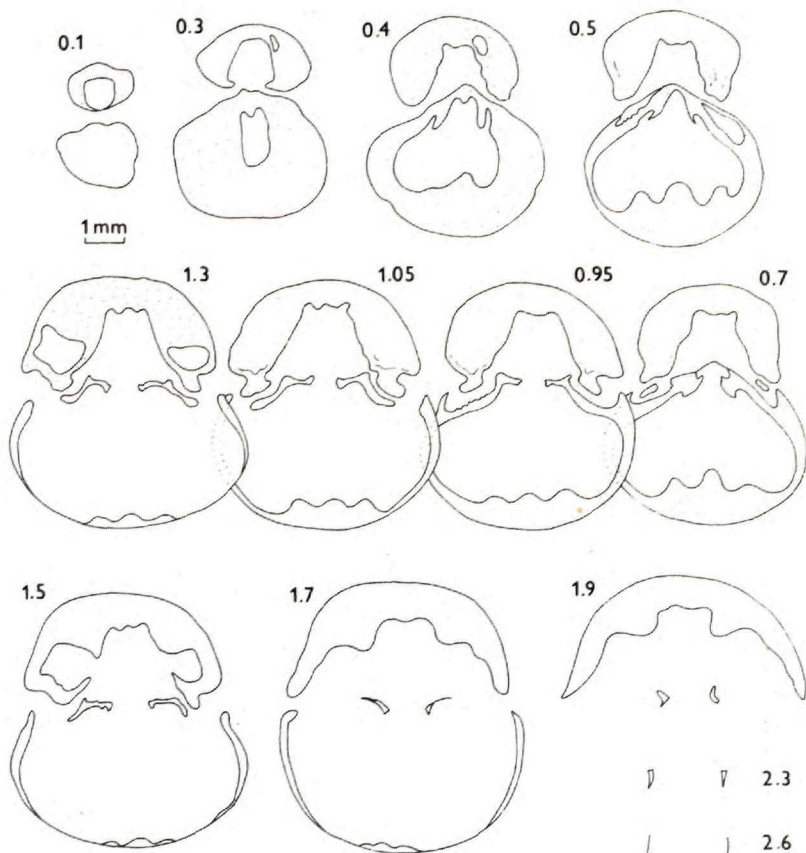


Fig. 19 *Austriellula nux* (Suess). Sommeraukogel. Coll. KITTL 1907, NMW. Total length 13.0 mm. Crura disappear at 2.7 mm from the posterior end (uncomplete ?). Enlarged.

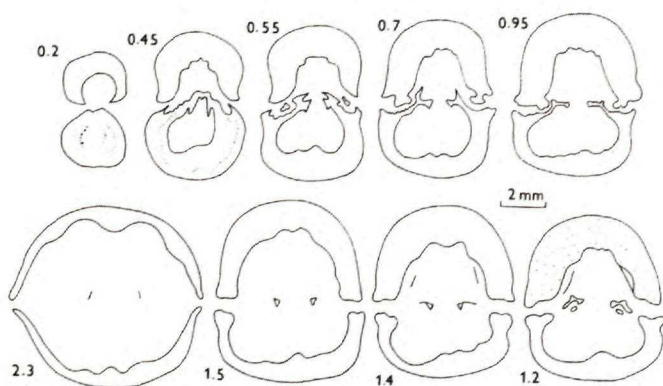


Fig. 20 *Austriellula nux* (Suess). Leisling near Gosau. Coll. KITTL 1897—1900, NMW. Total length of specimen 16.2 mm. Termination of crura unclear. Enlarged.

G. ARTHABER (1906) figured a nice specimen coming from Franzberg near Alt-Aussee (Norian). In addition, the collections of the Naturhistorisches Museum, Wien deposit this species from Leisling (Kuchel), and Breuning. The specimens in the Landesmuseum, Linz are labelled "Aussee — (wohl Sandling-Raschgebiet)". H. ZAPFE (1962) ascertained this species in the Norian of the Gosaukamm. Two specimens described as *Rhynchonella (Austriellula)* cf. *nux* were reported by M. MAHEL (1957) from the Norian of the Stratenská hornatina Highland in Slovakia. New collections were made by L. KRYSŤYN in the Upper Norian of Mühlthal near Piesting and of Taubenstein near Gosau.

***Austriellula undosa* sp. n.**

Pl. XIV, Fig. 4; Pl. XVII, Figs. 1—5; Text-fig. 21

The holotype: Figured on plate XVII, fig. 2 and deposited in the collections of the Slovak National Museum in Bratislava under registered number SNM Z 17065.

Stratum typicum et locus typicus: Karnian; Silická Brezová.

Derivatio nominis: Lat. "*undosus*"-wavy (character of the anterior commissure).

Material: 75 more or less fragmentary internal moulds with shell remains. Dimensions of the figured specimens in mm:

Length	width	thickness	
ca. 12.5	12.7	7.8	Pl. XIV, fig. 4
13.4	13.4	7.9	Pl. XVII, fig. 1
12.2	13.0	8.7	Pl. XVII, fig. 2, holotype
12.3	13.1	8.9	Pl. XVII, fig. 3
9.6	8.3	6.8	Pl. XVII, fig. 4
11.5	9.5	8.4	Pl. XVII, fig. 5

Description: Equibiconvex smooth shells of moderate size and of rounded trigonal outline, with tendency to globosity. Shell nearly elliptic in anterior view. Maximum-length about the same as width. Fold and sulcus absent. Low and wide uniplication frequent, but variants with strong and relatively narrow uniplication also occur. Flanks usually steeply sloping, with flattened or slightly concave posterior surfaces. Anterior and anterolateral commissures zigzagged. Undulation or irregular initial ribbing developed near the anterior margin. Starting ribs (up to 9 in the plication) low and more or less rounded. Beak small, massive and usually erect, beak-ridges hardly discernible. Exact position of the foramen not to be seen. No observations made concerning muscle-scars.

Delthyrial cavity wide, between well-developed and nearly parallel or slightly dorsally diverging dental lamellae. Lateral umbonal cavities subtrigonal or semicircular in cross-section, sometimes infilled with secondary callus. Teeth massive, expanded dorsally and crenulated. Short, squat denticula developed. Hinge-plates

almost horizontal. Sockets wide and crenulated, with outer socket-ridges better developed than the inner ones. Crura dorsally diverging. Muscle-scars in both valves very faint and difficult to observe in cross-section.

Remarks: *A. undosa* sp. n. distinguished from other species of the genus by its rounded to globular shape, by its flat or shallow planareas, and by its wide plication. Considerable external resemblance can be found in some large specimens of *A. halophila* (BITTNER) from Balbersteine/Miesenbach (coll. GRUBER) which have

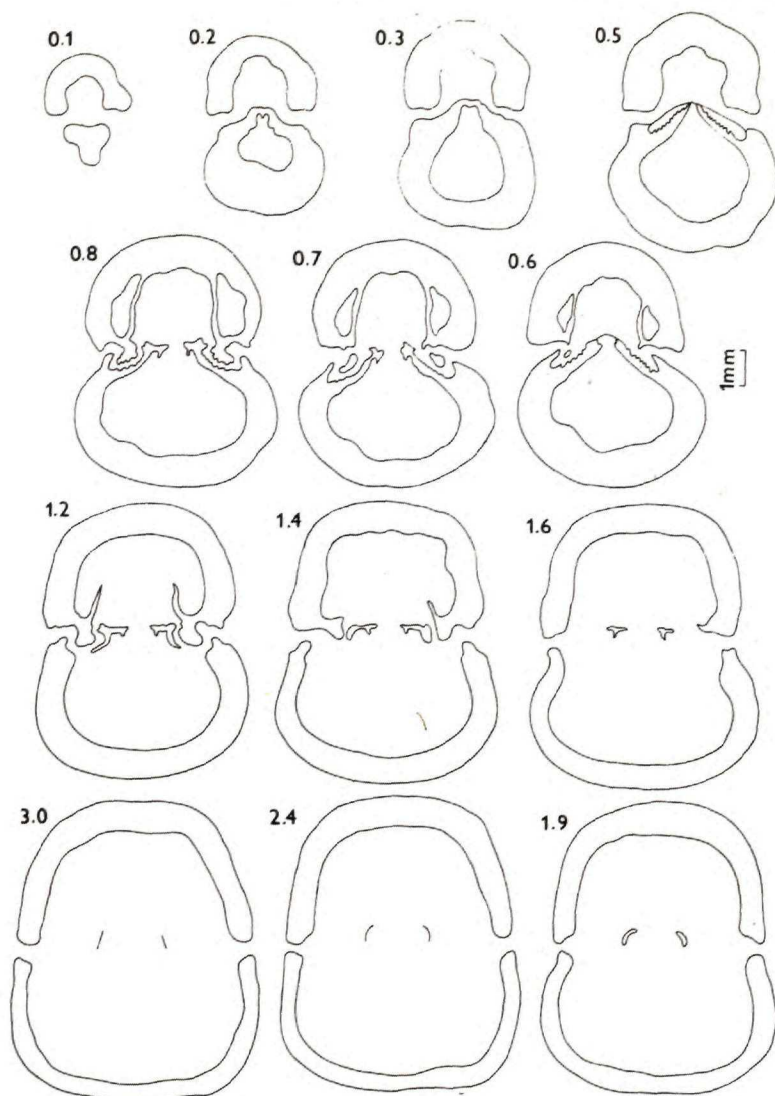


Fig. 21 *Austriellula undosa* sp. n. Silická Brezová, upper horizon, Tuvanian. Topotype. Total length of specimen 14.5 mm. Numbers indicate the distance from brachial umbo. Enlarged.

undulated anterior commissure or starting ribbing. *A. undosa* sp. n. differs from specimens mentioned in smaller dimensions, in missing folding, in developed planareas, and in different character of plication. The specimens of *A. undosa* sp. n. from the Ostré vršky Hill attain smaller size (up to $l = 12.0$ mm, $w = 12.0$ mm) than those from Silická Brezová ($l = 16.0$ mm, $w = 17.5$), and develop higher plication and only badly delimited planareas.

Occurrence: Slovak Karst — Silická Brezová (upper horizon, 60 specimens), Ostré vršky Hill (locality LB₂, 15 specimens).

***Austriellula* (?) *regilla* (BITTNER, 1890)**

Pl. X, Fig. 1; Text-fig. 22

1890 *Rhynchonella regilla* nov. spec. — A. BITTNER, p. 226, pl. 13, fig. 23—24.

1892 *Rhynchonella regilla* m. — A. BITTNER, p. 22.

Lectotype (here designated): The specimen figured by A. BITTNER 1890 on pl. 13, fig. 23. It is derived from Röthelstein and is deposited in the collections of the Naturhistorisches Museum in Vienna. Its dimensions are $16.0 \times 17.0 \times 11.7$ mm.

Material: In addition to the lectotype, there were 4 specimens from the Paläontologisches Institut in Vienna at disposal (coll. KRYSTYN, GRUBER). The figured specimen measures $14.0 \times 15.7 \times 10.9$ mm.

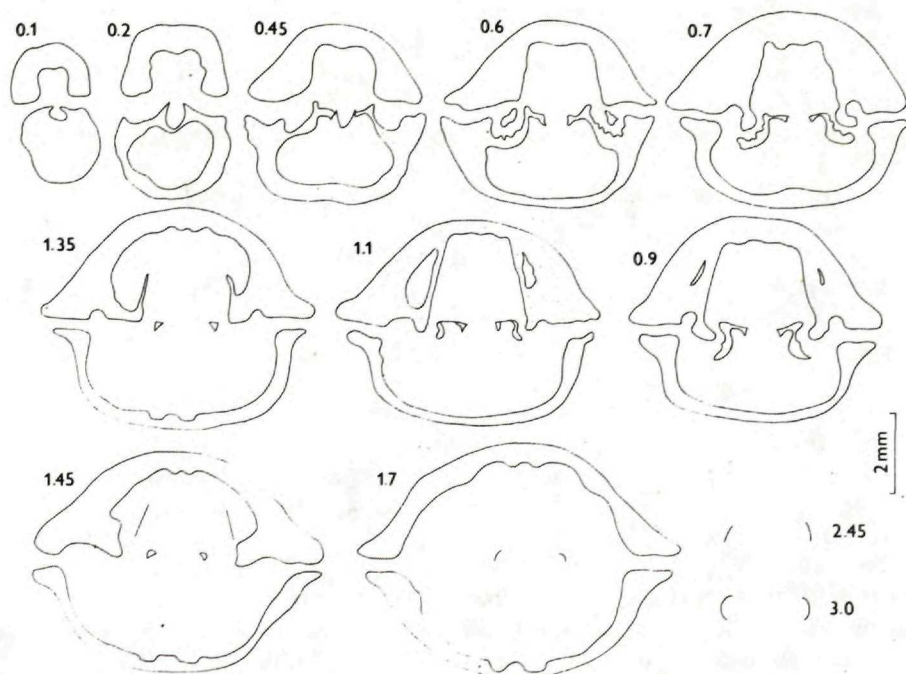


Fig. 22 *Austriellula* (?) *regilla* (BITTNER). Feuerkogel, KRYSTYN's F 1/Z, "Norische Spalte". Total length of specimen 13.6 mm. Numbers indicate the distance from brachial umbo. Enlarged.

Description: Medium-sized, strongly dorsibiconvex smooth shell of subtetragonal to subpentagonal outline. Width equal to or slightly exceeding length. Brachial valve strongly elevated. Uniplication high with converging sides. Fold raised well above the general level of brachial valve, approaching cynocephalous condition. Beak small, erect and sharp, with noticeable beak-ridges. Muscle-scars poorly preserved.

Delthyrial cavity posteriorly subquadrate in cross-section, limited by dorsally divergent dental lamellae. Umbonal cavities filled with callus. Hinge-teeth straight, slightly expanded dorsally and without crenulation. Denticula absent. Dorsal septum or ridge not developed. Inner hinge-plate entire. Outer hinge-plates mostly subhorizontal, well-divided from inner socket-ridges. Sockets wide, crenulated, with well-developed outer socket-ridges. Accessory sockets faint. Crural terminations semicircular, concave toward each other in cross-section. Muscle-scars in both valves strongly impressed.

Remarks: This species represents by its high and relatively narrow uniplication an extreme off-shoot of the genus. Character of its hinge-plates shows certain resemblance to the entire hinge-plate of *Osmarella starhembergica* (ZUGMAYER 1880) from the Norian-Rhaetian. In this respect these hinge-plates can be compared also to those of *A. angulifrons* and *A. halophila* that differ a little from clearly divided inner hinge-plates of *A. dilatata*, *A. longicollis* etc. Not enough specimens were available to investigate the external variability and the internal characters of *regilla* fully. For the time being, the relationship of this species is therefore unclear and *regilla* is referred to *Austriellula* only tentatively.

A. BITTNER (1892) mentioned one specimen of *regilla* coming from Röthelstein and deposited in the collection of the Technical University in Prague. Present author's search there failed to reveal it and it must be presumed lost during the Second World War.

Occurrence: BITTNER's 2 specimens (1890) came from Röthelstein (lectotype) and Sandling. New material includes 2 specimens collected by B. GRUBER in Lician 1 of Balbersteine/Miesenbach and 2 specimens found by L. KRYSYN at Feuerkogel (Lower Karnian in KRYSYN's A 22, and "Norische Spalte" Z in his F1, respectively).

There are several more species described from the Alpine Upper Triassic that were referred to *Austriella* (= *Austriellula*) already by A. BITTNER (1890) or C. DIENER (1920). Their definite attribution to this genus is in some cases probable but owing to the scarcity of material could not yet be verified.

Rhynchonella annexa BITTNER, 1890 was distinguished on the ground of its narrower outline from *A. associata*. It lacks also characteristic sulcation of *associata*, but seems to be a good *Austriellula*. *Rhynchonella arcestiphila* BITTNER, 1890 is discussed under *A. gomorensis* (BALOGH) in the present paper. *Rhynchonella intercurrents* BITTNER, 1890 could be well synonymous with *A. halophila*, representing its young specimens. *Rhynchonella juvavica* BITTNER, 1890 seems to be a distinct *Austriellula*. BITTNER's varieties of *juvavica-brevis* and *porrecta* have no taxonomic

value. *Rhynchonella halorica* BITTNER, 1890 is comparable to *A. halophila* (BITTNER) and is discussed under that species. *Rhynchonella laevis* SUESS, 1855 (holotype refigured here in Pl. IX, fig. 2) is recognized through its subtrigonal outline, flat planareas and wide uniplication, and certainly belongs to *Austriellula*. *Rhynchonella lingulina* BITTNER, 1890 was most probably established on young specimens of *A. pirum* (BITTNER). Generic attribution of two very rare species *Rhynchonella mimula* BITTNER, 1890 and *Rhynchonella synophrys* BITTNER, 1890 and their mutual relation are also not yet clear. *Rhynchonella pirum* BITTNER, 1890 was already dealt with above under *A. longicollis* (BITTNER). *Rhynchonella Schönni* BITTNER, 1890 and *Rhynchonella sublevata* BITTNER, 1890 are small, rare species differing from each other only in the character of shell flanks. The attribution of both these species to *Austriellula* seems doubtful. The same holds for *Rhynchonella Torrenensis* BITTNER, 1890.

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Miloš Siblík

Ramenonožci rodu *Austriellula* Strand, 1928 ze svrchního triasu

Resumé anglického textu

V článku jsou zpracovány hladké rhynchonely rodu *Austriellula* STRAND, 1928 ze svrchního triasu Slovenska a podrobně jsou popsány i běžnější druhy tohoto rodu z Rakouska, kde představují charakteristickou faunistickou složku hallstattských vápenců. V Západních Karpatech byly zjištěny druhy *A. angulifrons* (BITTNER), *A. gomorensis* (BALOGH), *A. halophila* (BITTNER) a *A. undosa* sp. n. Z oblasti alpské jsou kromě typického druhu *A. dilatata* (SUESS) podrobněji studovány ještě *A. associata* (BITTNER), *A. longicollis* (SUESS), *A. nux* (SUESS) a *A. (?) regilla* (BITTNER). U jednotlivých druhů popisovaného rodu byla konstatována extrémně vysoká variabilita vnějších znaků.

Explanation of plates VIII—XVII

All specimens were coated with ammonium chloride before photographing. Photographs by Mrs. M. PARALOVÁ and Mr. J. BROŽEK. Figured specimens are deposited in the collections of the Geologische Bundesanstalt (Museum) in Vienna (GBW), of the Naturhistorisches Museum, Geolog.-Paläont. Abt. in Vienna (NMW), of the Paläontologisches Institut der Universität in Vienna (PIW), of the Museum für Naturkunde der Humboldt-Universität in Berlin (MNB), and of the Slovak National Museum in Bratislava (SNM). The other material derived from Slovakia is housed in the Institute of Geology and Geotechnics, Czech. Akad. Sci., Praha.

Plate VIII

- 1 *Austriellula dilatata* (SUESS). Sandling-Millibrunnkogel near Goisern, „Ober. Karn“. Coll. G. ROTH 1911, NMW, $\times 3$.
- 2 As fig. 1.
- 3 *Austriellula pirum* (BITTNER). Sandling. Lectotype, here selected, specimen figured by BITTNER, 1890 on pl. 9, fig. 13. GBW, $\times 1.5$.
- 4 *Austriellula dilatata* (SUESS). Vorderer Sandling. Coll. v. FISCHER, MNB B 233.19, $\times 2$.

Plate IX

- 1 *Austriellula angulifrons* (BITTNER). Ostré vršky Hill, loc. B₂A, Karnian, SNM Z 17057, $\times 4$.
- 2 *Austriellula laevis* (SUESS). Aussee. Holotype, figured by SUESS, 1855 on pl. 1, fig. 9. GBW, $\times 2$.
- 3 As fig. 1. Globulous specimen with narrow plication. SNM Z 17058, $\times 3$.
- 4 *Austriellula halorica* (BITTNER). „Hallstatt“ (?Röthelstein). Lectotype, here selected, specimen figured by BITTNER, 1890 on pl. 11, fig. 16. GBW, $\times 2$.
- 5 *Austriellula angulifrons* (BITTNER). Röthelstein, „Unterkarn“. Lectotype, here selected, specimen figured by BITTNER, 1890 on pl. 8, fig. 25. GBW, $\times 2$.

Plate X

- 1 *Austriellula* (?) *regilla* (BITTNER). Balbersteine/Miesenbach, Lower Austria, Lacial 1. Coll. GRUBER, PIW, $\times 2$.
- 2 *Austriellula associata* (BITTNER). Feuerkogel near Bad Aussee. KRYSTYN's F 4/B 14, Tuvalian. Coll. KRYSTYN, PIW, $\times 2$.
- 3 *Austriellula gomorensis* (BALOGH). Young specimen? Silická Brezová, Tuvalian. Topotype. SNM Z 17059, $\times 2.5$.
- 4 *Austriellula gomorensis* (BALOGH). Silická Brezová, Tuvalian. Topotype. SNM Z 17060, $\times 2.5$.
- 5 *Austriellula associata* (BITTNER). Feuerkogel, KRYSTYN's F 4/B 5, Tuvalian. Coll. KRYSTYN, PIW, $\times 2$.

Plate XI

- 1 *Austriellula halophila* (BITTNER). Balbersteine/Miesenbach, Lacial 1. Coll. GRUBER, PIW, $\times 3$.
- 2 *Austriellula halophila* (BITTNER) (BITTNER's "var. *placidifrons*"). Feuerkogel, KRYSTYN's F 5/VII/4, Tuvalian 1. Coll. KRYSTYN, PIW, $\times 4$.
- 3 *Austriellula halophila* (BITTNER). Vorderer Sandling. Lectotype, specimen figured by BITTNER, 1890 on pl. 11, fig. 9. Coll. v. FISCHER, MNB B 235.9, $\times 2$.

Plate XII

- 1 *Austriellula halophila* (BITTNER). Taubenstein near Gosau. Figured by BITTNER, 1890 on pl. 11, fig. 12. Coll. v. FISCHER, MNB B 235.12, $\times 2$.
- 2 *Austriellula halophila* (BITTNER). Taubenstein. Figured by BITTNER, 1890 on pl. 11, fig. 11. Coll. v. FISCHER, MNB B 235.11, $\times 2$.
- 3 *Austriellula halophila* (BITTNER). Ostré vršky Hill, loc. B₂A, Karnian. SNM Z 17061, $\times 3$.

Plate XIII

- 1 *Austriellula halophila* (BITTNER). Rappoltstein near Hallein. Coll. KITTL 1890, NMW, $\times 3$.
- 2 *Austriellula halophila* (BITTNER). Mühlthal near Hernstein, KRYSTYN's 69/3, Sevatian. Coll. KRYSTYN, PIW, $\times 2$.
- 3 *Austriellula halophila* (BITTNER). Balbersteine/Miesenbach, Lacial 1. Coll. GRUBER, PIW, $\times 3$.

Plate XIV

- 1 *Austriellula halophila* (BITTNER). Mühlthal, KRYSTYN's 69/3, Sevatian. Coll. KRYSTYN, PIW, $\times 3$.
- 2 *Austriellula longicollis* (SUESS). Feuerkogel, KRYSTYN's F 4/S, "Kerri-Spalte". Coll. KRYSTYN, PIW, $\times 2$.
- 3 *Austriellula halophila* (BITTNER). Rappoltstein near Hallein. Coll. KITTL 1890, NMW, $\times 3$.
- 4 *Austriellula undosa* sp. n. Silická Brezová, upper horizon, Tuvalian. Topotype. SNM Z 17062, $\times 3$.

Plate XV

- 1 *Austriellula longicollis* (SUESS). Leisling near St. Agatha. Lectotype, specimen figured by SUESS, 1855 on pl. 2, fig. 8. Coll. v. FISCHER, MNB B 234.2, $\times 2$.
- 2 *Austriellula longicollis* (SUESS). Sandling. Coll. v. FISCHER, MNB B 234.15, $\times 3$.
- 3 *Austriellula longicollis* (SUESS). Feuerkogel, 100 m E of KRYSTYN's locality F 1, lowermost Norian. SNM Z 17063, $\times 2$.

Plate XVI

- 1 *Austriellula nux* (SUESS). Thörlstein, Salzberg near Aussee. Figured by SUESS, 1855 on pl. 1, fig. 8. GBW, $\times 2$.
- 2 *Austriellula nux* (SUESS). Sommeraukogel near Hallstatt. Lectotype, specimen figured by SUESS, 1855 on pl. 1, fig. 7. GBW, $\times 2$.
- 3 *Austriellula nux* (SUESS). Steinbergkogel near Hallstatt. Coll. KITTL (?), NMW, $\times 3$.
- 4 *Austriellula nux* (SUESS). Taubenstein, Upper Norian fissures. Coll. KRYSTYN, PIW, $\times 3$.
- 5 *Austriellula nux* (SUESS). Leisling (Kuchel). Norian. Coll. KITTL 1897—1900, NMW, $\times 3$.

Plate XVII

- 1 *Austriellula undosa* sp. n. Silická Brezová, upper horizon, Tupalian. Topotype. SNM Z 17064, $\times 2.5$.
- 2 *Austriellula undosa* sp. n. Holotype. Locality as fig. 1, SNM Z 17065, $\times 2.5$.
- 3 As fig. 1. SNM Z 17066.
- 4 *Austriellula undosa* sp. n. Ostré vršky Hill, loc. LB₂, Karnian. SNM Z 17067, $\times 3$.
- 5 As fig. 1. SNM Z 17068, $\times 3$.

Reviewed by J. Michalík.

Translated by the author.

Mária Kochanová

Daonellen aus dem Wettersteindolomit der Kleinen Karpaten

1 Taf. (XVIII), slowakisches Resümé

Abstract. In the Wetterstein dolomite of the Malé Karpaty Mts. a layer with daonell lumachelle has been found. On the basis of their bad preservation they were determined as *Daonella* (*Daonella*) sp. n., *Daonella* (*D.*) sp. n. 1, *Daonella* (*D.*) cf. *longobardica* KITTLE, *Daonella* (*D.*) sp. Stratigraphically they are considered to be of Ladinian age, as they are accompanied by many individuals of *Teutloporella nodosa*. (Determined by J. BYSTRICKÝ).

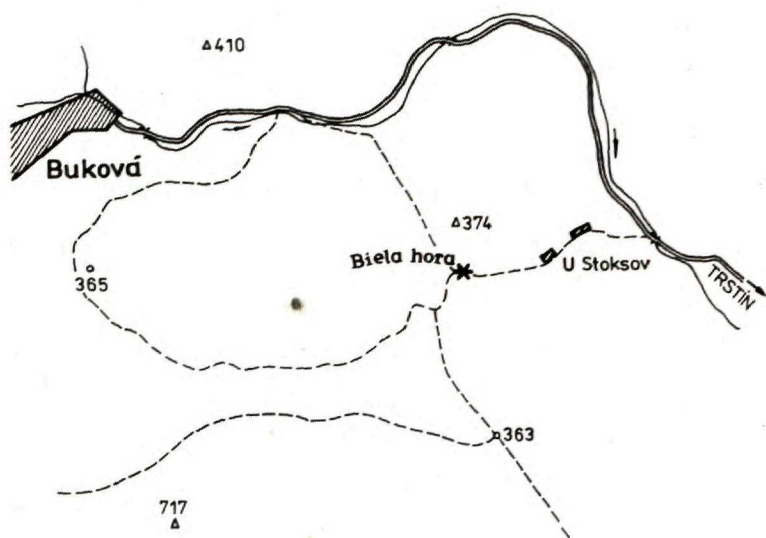
Einleitung

Die aus dem Dolomit stammenden Makrofossilien sind in den Westkarpaten ziemlich selten, gleich ob es sich um mittel- oder obertriassischen Dolomit handelt.

In diesem Beitrag wollen wir kurz über die zum Genus *Daonella* gehörenden Pelecypoden informieren, die wir im Wettersteindolomit der Havranica-Decke in den Kleinen Karpaten gefunden haben.

Die Fundstelle befindet sich in einem Wegeinschnitte zwischen dem Weiler Namens „U Stoksov“ und der Ortschaft Buková. Der massige hellgraue Wettersteindolomit tritt da an grossen felsigen Aufschlüssen auf. Ungefähr 150 m vor dem Scheidewege nach der Ortschaft Smolenice wurde in diesem Dolomit eine reiche Daonellenlumachelle gefunden. Schade doch, dass der grösste Teil des Fauna-Materials konnte nur als Bruchstücke gesammelt werden. Leider ist es uns nicht gelungen





wenigstens einige unbeschädigte und gut erhaltene Exemplare herauszubekommen, deren charakteristische Merkmale die Aufstellung neuer Arten in grösserem Masse ermöglichen könnten. Doch auch die uns zur Verfügung stehenden Individuen machen es klar, dass sie mit keiner bis jetzt bekannten Art identifizierbar sind.

Aus dieser Vergesellschaftung wurden folgende Arten bestimmt: *Daonella* (*Daonella*) sp. n., *Daonella* (*Daonella*) sp. n. 1, *Daonella* (*Daonella*) cf. *longobardica* KITTLE und *Daonella* (*Daonella*) sp.

Was die stratigraphische Einstufung dieser Fossilien betrifft, so konnte man sich auf das Massenvorkommen von *Teutloporella nodosa* in diesen Dolomiten stützen, welche als für die ladinische Stufe charakteristische Kalkalge gilt. (J. BYSTRICKÝ — persönliche Mitteilung). Die beschriebenen *Daonellen* sind dann auch als ladinisch zu betrachten.

Paläontologischer Teil

Posidoniidae FRECH, 1909

Daonella MOJSISOVICS, 1874

Typus-Art *Halobia Lommeli* WISSMANN, 1841. Mittlere Trias: Österreich.

***Daonella* (*Daonella*) sp. n.**

Taf. XVIII, Fig. 2—3, 5

Material: Unvollständige Steinkerne von zwei rechten und einer linken Klappe und Bruchstücke von vier ziemlich grossen Steinkernen.

Beschreibung: Die Abmessungen der beschriebenen Valven können nicht angegeben werden, weil keine von ihnen vollständig erhalten ist. Das grösste Exemplar hat eine Länge von 72 mm. Der Schalenumriss ist länglich oval, mit einem geraden langen Schlossrand und einem etwas exzentrischen dem Vorderrande näher liegendem Wirbel. Die Oberfläche ist mit radialen Rippen bedeckt, welche aber nicht bis zum vorderen Schlossrand reichen. Hier befindet sich ein ziemlich grosses Feld, ohne Radialskulptur, oder ist diese beträchtlich geschwächt. Die Rippen des Vorderteiles sind flach, ziemlich breit, einige durch eine seichte Sekundärfurche geteilt. Zum hinteren Teil werden sie schmaler, dichter, zweimal geteilt und paarweise angeordnet. Beim hinteren Schlossrand befindet sich ein kleines rippenfreies Feld. Zwei Exemplare haben auch konzentrische Streifen bis Wellen, besonders in dem mittleren und hinteren Klappenteil ausgeprägt. Die beschriebenen Individuen können mit der Art *Daonella imperialis* KITTL, 1913 (taf. 5, Fig. 3) verglichen werden. Sie sehen sich ähnlich in den grossen Dimensionen, in der in die Länge gestreckten Klappen, in einem langen geraden Schlossrande ohne irgendeiner Andeutung eines Vorderohres, sowie in der Skulptur der breiten und flachen vorderen und schmalen und dichten hinteren Radialrippen. Unterschiedlich ist die Rippenteilung der beiden Arten, denn bei *Daonella imperialis* ist sie eine mehrfache, bei den beschriebenen Exemplaren höchstens zweifache. Auch die Wirbellage der neuen Art scheint weniger exzentrisch zu sein.

Daonella (Daonella) sp. n. 1

Taf. XVIII, Fig. 4

Material: Unvollständige Steinkerne von drei auf der Oberfläche beträchtlich verwitterten linken Valven.

Beschreibung: Wenn auch uns wieder keine vollständig erhaltene Exemplare zur Verfügung stehen, ihre Gesamtform ist grundsätzlich verschieden von denen, die als *Daonella (D.) sp. n.* beschrieben wurden. In den Abmessungen der *Daonella (D.) sp. n. 1* kommt die Höhe der Länge gleich, oder überschreitet sie sogar. Bei der grössten Klappe erreicht sie 61 mm. Der Schlossrand ist gerade und lang mit etwas nach vorne gerücktem Wirbel. Die Schalenskulptur besteht aus Radialrippen, von denen die vorderen wieder breiter und dünner sind als die hinteren, aber die Unterschiede zwischen ihnen sind nicht so gross wie bei der vorigen Art. Die Rippen reichen bis zum hinteren Schlossrand, bei dem vorderen scheint ein rippenfreies Dreieckfeld zu existieren. Die Spuren der konzentrischen Skulptur sind nur in der Wirbelregion wahrnehmbar.

Die beschriebenen Individuen erinnern an die Art *Daonella indica* BITTNER, 1899. Eine Identifizierung beider Arten kommt aber wegen ihres viel längeren Schlossrandes und einer verschiedenen Skulptur wahrscheinlich nicht in Betracht.

***Daonella (Daonella) cf. longobardica* KITTL, 1912**

Taf. XVIII, Fig. 1

1912 *Daonella longobardica* KITTL, p. 67, tab. 2, fig. 19.

Material: Steinkerne von zwei unvollständigen rechten Valven und vier Bruchstücke.

Bemerkungen: Die Abmessungen und die Gesamtform der unvollkommenen Klappen können nicht überprüft werden. Unsere Individuen repräsentieren ziemlich grosse Valven, weil die Höhe des grössten 63 mm erreicht. Die Zugehörigkeit zur Art *Daonella* (*D.*) *longobardica* wird auf Grund der charakteristischen Oberflächenskulptur beurteilt. Sie zeigt zahlreiche flache, durch schmale Furchen getrennte Radialrippen. Die meisten von ihnen weisen eine Zweiteilung und in dem unteren Klappenteil eine paarige Anordnung auf. Nur die Existenz von einem rippenfreien Hinterfeld kann auf unseren Exemplaren weder bestätigt noch bestritten werden.

Stratigraphische und geographische Verbreitung: Ladin: Südalpen.

***Daonella* (*Daonella*) sp.**

Material: Zahlreiche Bruchstücke von Steinkernen.

Bemerkungen: Ausser der Rippen von *Daonella*-Type, gibt es bei diesen Bruchstücken kein anderes charakteristisches Merkmal, das bei der Artbestimmung behilflich wäre. Deshalb wurde nur ihre Einordnung in den Genus *Daonella* möglich.

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Mária Kochanová

Daonella z wettersteinského dolomitu Malých Karpát

Resumé nemeckého textu

Makrofauna pochádzajúca z dolomitov, či je to už stredotriasový alebo vrchnotriasový hlavný dolomit, je v Západných Karpatoch dosť vzácna. Preto v tomto príspevku chceme podať informáciu o mlžoch, patriacich rodu *Daonella*, ktoré sme našli vo wettersteinskom dolomite havranického príkrovu v Malých Karpatoch. Lokalita sa nachádza v záreze poľnej cesty, ktorá vedie od samoty „U Stoksov“ do Bukovej.

Wettersteinský dolomit tu vytvára veľké skalné odkryvy a asi 150 m pred rázcestím na Smolenice sme v ňom našli bohatú lumachelovú polohu s daonellami. Škoda len, že väčšina získaných fosílií sú len úlomky. Nepodarilo sa tu získať celé a dobre zachované jedince, ktorých charakteristické znaky by poskytovali viac argumentov pre stanovenie nových druhov. Avšak aj na tých exemplároch, ktoré máme k dispozícii, je zrejmé, že ich nemožno identifikovať so žiadnym z doteraz známych druhov. Odlišili sme tu: *Daonella* (*Daonella*) sp. n., *Daonella* (*D.*) sp. n. 1, *Daonella* (*D.*) cf. *longobardica* KITTL a *Daonella* (*D.*) sp.

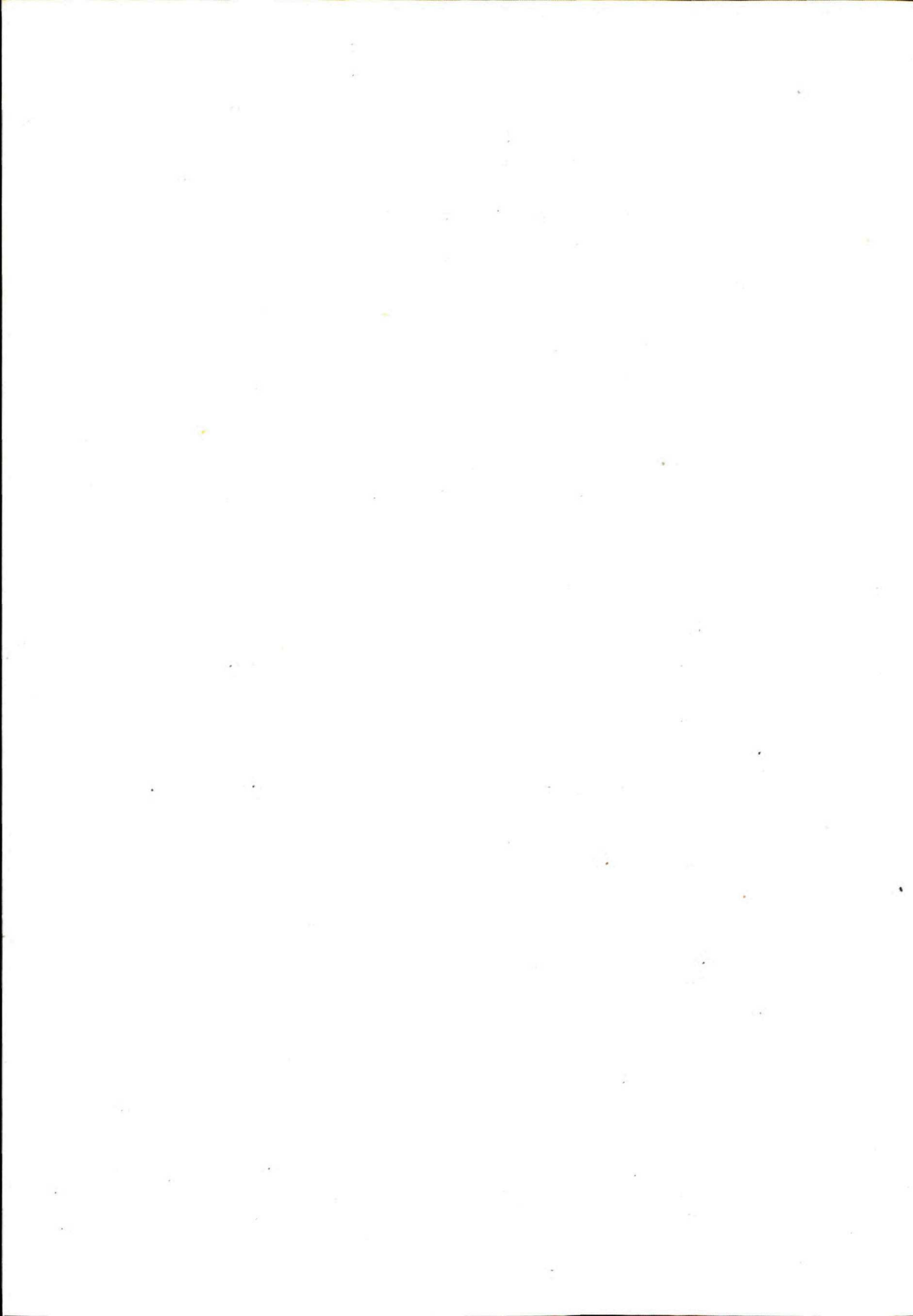
Pokiaľ ide o ich stratigrafické zaradenie, mohli sme sa oprieť o sprievodnú masovo sa tu vyskytujúcu vápnitú riasu *Teutloporella nodosa*, ktorá je charakteristická pre ladin (J. BYSTRICKÝ — ústne oznámenie.) Spoločenstvo uvedených daonell treba teda považovať tiež za ladinské.

Erläuterungen zur Tafel XVIII

- 1 *Daonella* (*Daonella*) cf. *longobardica* KITTL, × 1,2
- 2 *Daonella* (*Daonella*) sp. n., × 1,3
- 3 *Daonella* (*Daonella*) sp. n., × 1
- 4 *Daonella* (*Daonella*) sp. n. 1, × 1
- 5 *Daonella* (*Daonella*) sp. n., × 1

Foto: Fig. 1, 2, 3, 5, H. Jendeková
Fig. 4 F. Martančík

Übersetzt von M. Kochanová



Jarmila Papšová—Jozef Pevný

Finds of conodonts in Reifling limestones of the West Carpathians (the Choč and the Strážov nappes)

4 text-figs., 6 pls. (XIX—XXIV), Slovak summary

Abstract. The authors present the list of conodonts and biostratigraphical analysis of conodont fauna from Reifling limestones of the Choč nappe, in the Nízke Tatry, Mts., the Veľká Fatra Mts., the Choč and the Strážov nappes of the Strážovské vrchy Mts. — from seventeen new localities. The platform and ramiform conodonts found are indicative of the Pelsonian (Middle Anisian) to Cordevolian (Lower Carnian) stratigraphical range of the lithostratigraphic unit.

Introduction

In the years 1976—1980 the authors sampled the Reifling limestones of the Choč and the Strážov nappes for conodonts, holothurians and other microorganisms. Examined were samples from the Choč nappe of the northern slopes of the Nízke

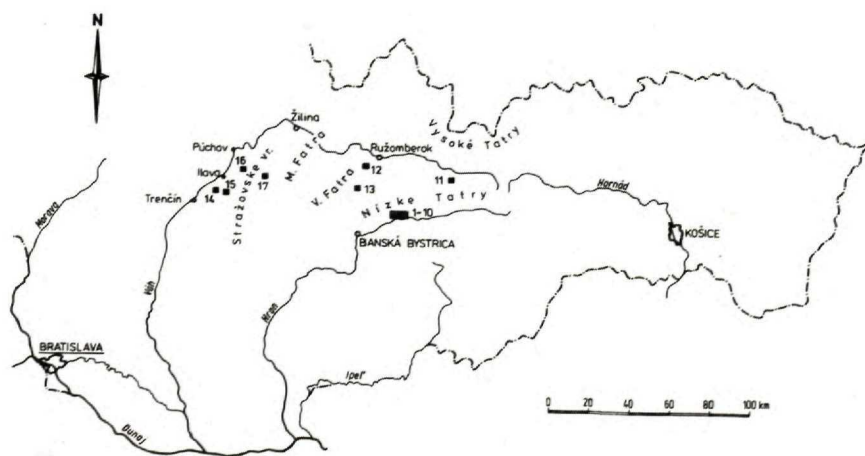


Fig. 1 Sketch map of conodonts and holothurians localities in the Reifling limestones of the West Carpathians

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Tatry Mts. (the Michalovský potok valley, No. 11), of the southern slopes (Ráztoka — No. 1, Zámotie — No. 2, Zámotie in the bend of the road — No. 3, Predajná — No. 7, Jasenie — Čierny diel — No. 4, Jasenie — east of the Lomnístá dolina valley — No. 5, 8, 9, 10, and Valaská — No. 6); the Choč nappe in the Veľká Fatra Mts. (Liptovská Revúca No. 13, Malinô Brdo No. 12), the Strážovské vrchy Mts.

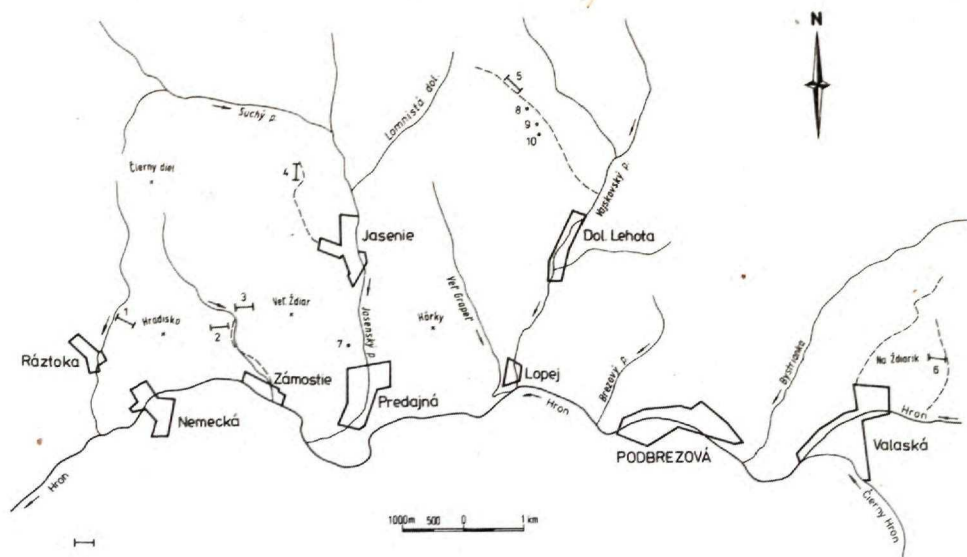


Fig. 2 Sketch-map of conodont and holothurian localities in the southern part of the Low Tatras

Stage	Substage	Conodont Assemblage Zones	Low Tatras			Veľká Fatra Mts	Strážovské hornatina Mts
CARNIAN	CORDEVOLIAN	mostleri A-Z					
LADINIAN	LONGOBARDIAN	mungoensis A-Z					
		hungaricus A-Z					
		truempyi Z					
	FASSANIAN	Middle Fassanian interval					
ANISIAN	ILLYRIAN	pseudolonga A-Z					
		excelsa A-Z					
	PELSONIAN	bifurcata A-Z					
		kockeli Z					

Fig. 3 Stratigraphic range of the Reifling limestones on the basis of conodonts

(Markovica No. 14, Vlčinec No. 15), and Strážov nappe (Jazovčie No. 17, Sokolie No. 16; Fig. 1—3). Of the total number 58 samples nine were negative; the rock material was offered by A. BIELY and A. BUJNOVSKÝ, and collected by the authors.

Besides platform and ramiform conodonts, the assemblages of organisms also contain *Foraminifera*, *Holothuroidea*, *Saurychtiidae*, *Ostracoda*, *Silicispongiae*, *Echinoidea*, *Ophiuroidea*, *Crinoidea* and various problematic forms to be defined. Among macrofauna in the lower parts of profiles are also *Cephalopoda*, *Brachiopoda*, *Gastropoda* and *Bivalvia*.

Geological mapping in the areas mentioned was performed by A. BIELY (1976), M. KRIVÝ (1971, 1975), J. HANÁČEK (1969), A. BUJNOVSKÝ (in A. BUJNOVSKÝ—P. GROSS—E. LUKÁČIK 1978), A. BIELY—O. MIKO (1978); cephalopods were defined by M. RAKÚS (1960), V. KOLLÁROVÁ-ANDRUSOVÁ—J. BYSTRICKÝ (1974), V. ANDRUSOVÁ (1975); brachiopods — by J. PEVNÝ (1971), in M. KOCHANOVÁ — J. PEVNÝ (1976), bivalvia — by M. KOCHANOVÁ (1971, 1979, in M. KOCHANOVÁ — J. PEVNÝ 1976).

The material was treated by 10% acetic acid or by formic acid, very rarely by bromoform.

The purpose of this paper is the general characteristic of the assemblages of conodonts and holothurians from the Reifling limestones, tentative biostratigraphical correlation with the conodont and ammonite zones of the Middle and Upper Triassic according to the division by H. KOZUR (1980) and S. KOVÁCS et H. KOZUR (1980).

Present state of research

The Reifling limestones were distinguished by F. HAUSER 1853, p. 7 on the locality Gross-Reifling in the Northern Limestone Alps. W. WAAGEN—C. DIENER 1895 defined there the Anisian stratotype. Its lithological content was determined more exactly later on by H. SUMMESBERGER, L. WAGNER 1972, R. ASSERETO 1971; then it was described by T. BECHSTÄDT—H. MOSTLER 1974 and J. HOHENNEGER—R. LEIN 1977. T. BECHSTÄDT—H. MOSTLER (1974) defined the Reifling limestones as a lithostratigraphic unit — the uppermost member of the Alpine Muschelkalk. They are nodular cherty limestones with even or wavy sheet surface, with marlstone intercalations, and with intercalations of tuffs and tuffites "petra verde" in the upper part.

The locality Gross-Reifling comprises the lower zone *Paraceratites binodosus* — loc. Rahnbauerkogel and the upper zone *Paraceratites binodosus* — loc. Tiefengraben, the zone *Paraceratites trinodosus* (loc. "Kapelle"). Tuffites in the upper part of the Reifling limestone are regarded as the base of the Ladinian. The profile terminates at the base of the Julian. H. BECHSTÄDT—T. MOSTLER (1974) included also thick-bedded limestones, denoted as the Göstling limestone, in the term Reifling limestones.

In the West Carpathians the Reifling limestones were distinguished by D. ŠTÜR (1868). He compared grey limestones, rich in cherts, north of the village Nemecká to the Reifling type of limestones in the Alps. In the list of lithostratigraphic units of the

West Carpathians, included among the "shell limestone", he did, however, not comprise the Reifling limestone. It was denoted as "the Virglor limestone" (G. STACHE, 1864) or only described petrographically as "dark-grey and light-grey banked and platy-like limestones, sometimes brecciated, with cherts" (A. MATĚJKA 1927, "cherty limestones" R. KETTNER 1927). The term Reifling limestone was only used for the limestones N of Nemecká (A. MATĚJKA—D. ANDRUSOV 1931). E. SPENGLER (1932) found out that they are the basement of the Lunz beds.

A. BIELY (1960) presented a detail characteristic of Reifling limestones in respect of biostratigraphy. The Reifling limestones of the Choč nappe rest partly on subjacent dolomites. They are organodetrital in their lower parts, dark-grey and black, with plentiful macrofauna, silicified foraminifers, conodonts, holothurians and other microfossil groups. The limestones are thick-banked biosparites. They deposited in a shallow-water environment. The upper part of the formation consists of light-grey banked limestones, with sign of deepening of the basin. Macrofauna is vanishing, muddy limestones contain many pink lenticular cherts, with continuous layers of darker pea-sized cherts. Microfauna contains conodonts, holothurians and foraminifers.

Although formerly in the limestones organic remains like sections of halobians and daonelles were found (R. KETTNER—J. KOUTEK 1927, J. KOUTEK 1931) — their exact stratigraphical range was not possible to establish. In the northern part of the Nízke Tatry Mts., near Východná, M. RAKÚS (1960) found and defined the ammonite *Monophyllites aonis* MOJS., indicative of the Cordevolian (formerly referred to as Upper Ladinian). Later on the stratigraphic range was extended on the Anisian-Ladinian (basing upon the occurrence of the species *Piarorhynchella trinodosi* (BITTNER); (Z. ROTH 1939). Anisian bivalves were found by M. KOCHANOVÁ (1979).

Conodonts and holothurians of the Reifling limestones in the West Carpathians were studied by R. MOCK (1971) and H. KOZUR—R. MOCK (1974) in Gombasek on the Silická planina plateau, Berc on the Plešivecká planina plateau, Beckov in the Inovec Mts. In the Turík quarry in the Chočsko-Prosečňanské pohorie Mts. are conodonts and holothurians (H. KOZUR—R. MOCK 1974) indicative of Cordevolian-mostleri A. Z. In the Klippen Belt, M. MIŠTĚK—R. MOCK—R. SÝKORA (1977) found conodonts and holothurians ranging stratigraphically from the Illyrian to the Lower Julian (to Norian). They were found in pebbles of Cretaceous conglomerates from limestones of the Reifling type.

Lithostratigraphical characteristic

1. The Choč nappe of the Nízke Tatry Mts. and the Veľká Fatra Mts.

The Reifling limestones of the Choč nappe, belonging to the so-called Biely Váh Group (A. BIELY 1960), are lying above a formation of underlying dolomite. They are dark-grey and black, or light-grey organodetrital limestones, nodular, muddy limestones with nodules of lenticular or pea-sized cherts. They are organodetrital in lower parts whereas the upper parts contain microfossils only. In the past the



limestones were referred to the Ladinian on the ground of organic remains (R. KETTNER—J. KOUTEK 1927, J. KOUTEK 1931).

D. ANDRUSOV (1938) and Z. ROTH (1939) basing upon the species *Rhynchonella trinodosi* Bittner referred the Reifling limestones of the southern Nízke Tatry Mts. to the Anisian and thus the age diapason of the formation extended to the Anisian-Ladinian.

According to A. BIELY (1976) the Reifling limestones are bedded, nodular, mostly micritic with cherts and intercalations of grey and greenish marlstones. In the lower part of the formation are dark-grey and black limestones, less frequent cherts, in the upper part are lighter, less nodular, with plentiful cherts and occasional dolomite layers. Thickness of limestones ranges from 50—60 m.

In the Veľká Fatra Mts. — in its northeastern part, the Reifling limestones of the Choč nappe are immediately above Ramsau dolomites. They are green, red; nodular, partly cherty limestones with intercalations of variegated shales. Biomicritic and micritic limestones show stable character of microfacies with the filament — and filament-crinoidal microfacies dominant.

In upper parts of the Reifling limestones dominant are intercalations of organodetrital crinoidal limestones with plentiful brachiopods and cephalopods.

2. The Choč and the Strážov nappes in the Strážovské vrchy Mts.

In the Choč nappe of the Strážovské vrchy Mts. are Reifling limestones overlying dolomites. They are dark banded limestones with cephalopods and brachiopods, dark-grey massive or thin-bedded and platy limestones with white calcite veins, nodules of cherts and with brachiopods.

In the Strážov nappe of the Strážovské vrchy Mts. are light-grey crinoidal limestones with brachiopods and bivalves. In some places are grey nodular limestones, crinoidal limestones with brachiopods and bivalves, overlying dolomites. Elsewhere are grey-brownish limestones with grey or pink chert nodules and with brachiopods.

Characteristic of conodont and holothurian microfauna

(For the list of species see Fig. 4)

The Choč nappe

The locality Jasenie — Čierny diel (4) belongs among stratigraphically oldest localities of the Choč nappe (Fig. 3) An assemblage of conodonts and holothurians in a facies of Reifling limestones is indicative of the Pelsonian age of the limestones (sample 1). Fig. 4.

There are the species: *Nicoraella kockeli* (TATGE), *Gondolella bulgarica* (BUDUROV et STEFANOV), *G. bifurcata* (BUDUROV et STEFANOV), *G. hanbulogi* (SUDAR et BUDUROV), *G. excelsa* (MOSHER), ramiform conodonts; among holothurians *Tetravirga* sp., *Theelia patinaformis* MOSTLER, fragments of crinoids and plentiful initial whorls of gastropods.

The Pelsonian age is indicated by the species *Nicoraella kockeli* (TATGE) together

with the species *Gondolella bulgarica* (BUDUROV et STEFANOV) and *G. bifurcata* (BUDUROV et STEFANOV).

On the Pelsonian/Illyrian boundary is locality Jasenie—Čierny diel (4) — samples No. 2 and 3 (Fig. 3, 4). Characteristic species of conodonts: *Gondolella bulgarica* (BUDUROV et STEFANOV), *G. hanbulogi* (SUDAR et BUDUROV), *G. constricta* MOSHER et CLARK, *G. excelsa* (MOSHER), *holothurians*, remains of gastropods, crinoids, ostracodes and foraminifers.

On the localities Zámotie (2) — sample No. 2, Jasenie — east of the Lomníštá dolina valley (5), sample 1, Malinô Brdo (12), Liptovská Revúca (13) Markovica (14) and Vlčinec (15) are deposits with Illyrian fauna (Fig. 3).

They are characterized by the following conodonts and holothurians (Fig. 4): *Gondolella excelsa* (MOSHER), *G. basisymetrica* (BUDUROV et STEFANOV), *G. mombergensis* TATGE, *Chirodella dinodoides* (TATGE); *Ozarkodina tortilis* TATGE.

Sclerites of holothurians: *Theelia undata* MOSTLER, *Priscopodatus staurocunitoides* MOSTLER, *Priscopodatus bartensteini* (DEFLANDRE et RIGAUD), *P. triassicus* MOSTLER; initial whorls of gastropods, fragments of bryozoans, stems of crinoids, teeth and scales of fishes, sponge spicules, ostracodes, foraminifers, rests of echinoderms and skeletons of *Ophiurida*.

The Illyrian age (zone *Paraceratites trinodosus*) was proved by cephalopods from the locality Malinô Brdo — *Beyrichites* (B) cf. *reuthensis* (BEYRICH), *Paraceratites* cf. *multinodosus* HAUSER, (V. KOLLÁROVÁ-ANDRUSOVÁ—J. BYSTRICKÝ 1974) and MARKOVICA-Norites cf. *dieneri* ARTHABER, *Beyrichites* (B) sp., *Longobartites* sp., *Paraceratites* cf. *trinodosus* (MOJŠISOVICS), *Semiorites* cf. *cordevolicus* (MOJŠ.) (V. ANDRUSOVÁ 1975).

It may be said that the Illyrian is characterized by plentiful species *Gondolella excelsa* (MOSHER), *Gondolella constricta* MOSHER et CLARK, many ramiform conodonts and in some places even mass occurrences of holothurians.

The formation passes into Fasnian deposits. Their age is proved by finds from the localities Ráztoka (1) (samples 1—6). Zámotie (2), samples 3, 6, Jasenie—Čierny diel (4), sample 5 and Jasenie— east of the Lomníštá dolina valley (5), samples 2—4 (Fig. 3).

We have defined the following species of conodonts: *Gondolella excelsa* (MOSHER), *G. cf. trammeri* KOZUR, *G. pseudolonga* (MIETTO, KOVÁCS et KOZUR), *G. cornuta* (BUDUROV et STEFANOV), *Gladigondolella tethydis* (HUCKRIEDE) and ramiform conodonts (Fig. 4). Sclerites of holothurians (Fig. 4): *Theelia planorbicula* MOSTLER, *Priscopodatus triassicus* MOSTLER and *Tetravirga perforata* MOSTLER; among other fossils are usually scales and teeth of fish, foraminifers, sponge spicules, less frequent gastropods and ostracodes.

The stratigraphical horizon is characterized by the species *Gondolella pseudolonga* (MIETTO, KOVÁCS et KOZUR), *G. cf. trammeri* (KOZUR), *Gladigondolella tethydis* (HUCKRIEDE) and decreasing species *G. excelsa* (MOSHER).

Stratigraphical profile of Reifling limestones of the Choč nappe terminates in the Upper Ladinian and the Lower Carnian.

Longobardian and Cordevolian conodonts and holothurians are on the localities

Zámotie-2 (samples 7—10), Zámotie in the bend of the road-3 (samples 1—4), Predajná-Kalvária-7 (samples 1—2), Jasenie — east of the Lomnistá dolina valley 5 (samples 9—10), Valaská-6 (samples 5—6) and the valley of Michalovský potok-11 (Fig. 3).

An assemblage of conodonts in the lower part of the profile (Fig. 4): *Gondolella foliata foliata* (BUDUROV), *G. foliata inclinata* (KOVÁCS), *Metapolygnathus mungoensis* (DIEBEL), *Gladigondolella tethydis* (HUCKRIEDE), *G. malayensis* NOGAMI, and plentiful ramiform conodonts.

An assemblage of holothurians (Fig. 4) comprises the species *Eocaudina subhexagona* GUTSCHICK, CANIS et BRILL, *Priscopodatus bartensteini* (DEFLANDRE et RIGAUD), *P. staurocumitoides* MOSTLER; problematics: *Irinella canalifera* (KRISTAN—TOLLMAN); among other fossils are frequent foraminifers, scales and teeth of fish, sponge spicules, echinoderm spicules and crinoid segments.

An assemblage of conodonts in the upper part of the profile comprises the species *Gondolella foliata foliata* (BUDUROV) with transitional species to *Gondolella foliata inclinata* (KOVÁCS), *G. polygnathiformis* BUDUROV et STEFANOV, *Metapolygnathus mungoensis* (DIEBEL), *Gladigondolella tethydis* (HUCKRIEDE), *G. malayensis* NOGAMI and many ramiform conodonts. Holothurians are represented by *Theelia patinaformis* MOSTLER, *Theelia undata* MOSTLER, *Acanthotheelia spinosa* FRIZZELL et EXLINE. There are also micropore problematicum *Irinella canalifera* (KRISTAN—TOLLMAN), plentiful foraminifers, teeth and scales of fish, osteocrines, sponge spicules, ostracodes and ophiuroids.

So far the uppermost horizon of the Reifling limestones has been stratigraphically characterized. The species *G. polygnathiformis* BUDUROV et STEFANOV, *G. foliata foliata* (BUDUROV), *G. foliata inclinata* (KOVÁCS), *Gladigondolella malayensis* NOGAMI, *G. tethydis* (HUCKRIEDE) may stratigraphically range up to the L. Julian.

The assemblage contains the problematicum *Irinella canalifera* (KRISTAN—TOLLMANN).

The Strážov nappe

In the Strážov nappe of the Strážovské vrchy Mts. the Reifling limestones have so far been examined for conodonts and holothurians on the localities Jazovčie and Sokolie. Their age diapason is Pelsonian to Fassanian. (Fig. 3).

The Pelsonian-Illyrian at the locality Jazovčie-17 (4 samples) is characterized by conodonts *Gondolella hanbulogi* (SUDAR et BUDUROV), *G. bulgarica* (BUDUROV et STEFANOV), *G. bifurcata* (BUDUROV et STEFANOV), *G. excelsa* (MOSHER), *G. constricta* MOSHER et CLARK, *Enantiognathus zieglerei* (DIEBEL) and holothurians *Tetravirga perforata* MOSTLER, *Theelia teneromarginata* MOSTLER, *Priscopodatus tyrolensis* MOSTLER (Fig. 4). There are also teeth and scales of fish, small gastropods and crinoid segments.

The Pelsonian-Lower Illyrian is evidenced by *Gondolella bulgarica* (BUDUROV et STEFANOV), *G. hanbulogi* (SUDAR et BUDUROV) and *G. bifurcata* (BUDUROV et STEFANOV). The species *Nicoraella kockeli* (TATGE) indicative unambiguously of the Pelsonian age has not been found as yet.

The Illyrian-Fassanian at the locality Sokolie-16 are represented by conodonts (Fig. 4) *Gondolella constricta* MOSHER et CLARK, *G. excelsa* (MOSHER), *Gladigondolella tethydis* (HUCKRIEDE) juv., *Hindeodella suevica* (TATGE), *H. pectiniformis* (HUCKRIEDE), *Prioniodina muelleri* (TATGE), *P. venusta* (HUCKRIEDE) and *Enantiognathus petraeviridis* (HUCKRIEDE), by teeth and scales of fish, and by foraminifers.

Gladigondolella tethydis (HUCKRIEDE) juv. and its associated ramiform elements are indicative of Fassanian age.

As regard species, the assemblage of conodonts and holothurians from the Reifling limestones of the Strážov nappe, does not differ from coeval assemblages of conodonts and holothurians in the Choč nappe.

Conclusions

The results of the research in the above mountain ranges of the West Carpathians, based upon conodonts, show that stratigraphical range of the Reifling limestones is Pelsonian-Cordevolian. The conodont assemblages were compared to H. KOZUR's (1980) zonal division, and if possible—with ammonite zones.

On the southern slopes of the Nízke Tatry Mts., at the locality Jasenie-Čierny diel the Pelsonian age of the Reifling limestones is evidenced by *Nicoraella kockeli* (TATGE) occurring with *Gondolella bulgarica* (BUDUROV et STEFANOV) and *G. bifurcata* (BUDUROV et STEFANOV). The species *Nicoraella kockeli* (TATGE) indicates the kockeli zone corresponding to the ammonite zone *Balatonites balatonicus* (H. KOZUR 1980). Its upper contact with the zone *Paraceratites binodosus* is conventional.

Pelsonian and Lower Illyrian conodonts were found in the Strážov nappe in the Strážovské vrchy Mts. (loc. Jazovčie). They are *Gondolella bulgarica* (BUDUROV et STEFANOV), *G. bifurcata* (BUDUROV et STEFANOV), *G. hanbulogi* (SUDAR et BUDUROV). In accordance with H. KOZUR's (1980) division, this horizon may be ranged to the zone *P. binodosus*, namely *G. bifurcata* A—Z.

The Illyrian is well characterized by conodonts at the localities Jasenie — the eastern slope of the Lomnistá dolina valley and Zámotie (the Choč nappe in the Nízke Tatry Mts.), Malinô Brdo (the Choč nappe in the Veľká Fatra Mts.), Markovica and Vlčinec (the Choč nappe of the Strážovské vrchy Mts.). Platform conodonts are dominant: *Gondolella mombergensis* TATGE, *G. constricta* MOSHER et CLARK, *G. excelsa* (MOSHER), *G. cornuta* (BUDUROV et STEFANOV) and *G. basisymmetrica* (BUDUROV et STEFANOV). Frequent are holothurians: *Tetravirga perforata* MOSTLER, *Priscopedatus triassicus* MOSTLER, *P. staurocumitoides* MOSTLER, *P. bartensteini* (DEFLANDRE et RIGAUD), *P. tyrolensis* MOSTLER, *Acanthotheelia spinosa* FRIZZELL et EXLINE and *Theelia undata* MOSTLER. Illyrian conodont assemblage from limestones of the Choč nappe of the Nízke Tatry Mts. comprises plentiful *Gondolella excelsa* (MOSHER), whereas in the Veľká Fatra Mts. *Gondolella cornuta* (BUDUROV et STEFANOV) is dominant. This assemblage corresponds to the ammonite zone *Paraceratites trinodosus* (excelsa A—Z).

In the overlying Fassanian is a new conodont assemblage represented by *Gondolella pseudolonga* (MIETTO, KOVÁCS et KOZUR), *Gondolella* cf. *trammeri* KOZUR,

and *Gladigondolella tethydis* (HUCKRIEDE). Typical profiles are at localities Ráztoka and Jasenie-east of the Lomnistá dolina valley in the Choč nappe, at the locality Sokolie in the Strážov nappe — where only juvenile stages of *Gladigondolella tethydis* (HUCKRIEDE) are present.

According to H. KOZUR's (1980) division the assemblage belongs to the zone pseudolonga A.—Z. ranged by H. KOZUR (1980) to the "Kellnerites" or the "Nevadites" zone. Upper parts of the Fassanian and transition into the Upper Ladinian cannot be identified exactly because the conodonts present are stratigraphically vague.

The species *Gondolella foliata foliata* (BUDUROV), *Gondolella foliata inclinata* (KOVACS) and *Metapolygnathus mungoensis* (DIEBEL), Zámotie, Jasenie-east of the Lomnistá dolina valley, Predajná-Kalvária, and the Michalovský potok valley in the Choč nappe are indicative of Longobardian and Cordevolina age of the Reifling limestones. Their upper parts also contain *Gondolella polygnathiformis* (BUDUROV et STEFANOV). The horizon comprises mungoensis and mostleri A.—Z. In the top parts of the Reifling limestones. of the area studied no ammonites have been found so far.

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Nálezy konodontov v reiflinských vápencoch Západných Karpát (chočský a strážovský príkrov)

Resumé anglického textu

V práci autori podávajú celkovú charakteristiku konodontového a holotúriového spoločenstva reiflinských vápencov, pričom sa pokúšajú o možnosti biostratigrafickej korelácie s konodontovými, prípadne amonitovými zónami stredného a vrchného triasu v zmysle členenia H. KOZURA (1980) a S. KOVÁCSA et H. KOZURA (1980). Fauna pochádza zo vzoriek z chočského príkrovu zo severných a južných svahov Nízkyh Tatier, Veľkej Fatry, z chočského a strážovského príkrovu Strážovských vrchov. Celkový počet vzoriek bol 58, z toho 9 bolo negatívnych.

Reiflinské vápence v južnej časti Nízkyh Tatier ležia nad súvrstvom dolomitov, sú vrstevnaté, hľuznaté, zväčša mikritické s rohovcami a vložkami sivých a zelenkastých slieňov (A. BIELY 1976). Spodná časť súvrstvia je zastúpená tmavosivými až čiernymi vápencami, rohovce sú menej hojné, vrchná časť je zastúpená svetlejšími, menej hľuznatými vápencami s hojnejšími rohovcami, občas s dolomitovými polohami. Hrúbka vápencov kolíše v rozmedzí 50—60 m. Vo Veľkej Fatre, jej sv. časti, vystupujú reiflinské vápence bezprostredne nad ramsauskými dolomitmi. Ide o zelené, červené, hľuznaté, čiastočne rohovcové vápence s medzivrstvičkami pestrých bridlíc, v ich vrchných polohách prevládajú vložky organodetrítických krinoidových vápencov s bohatou faunou brachiopódov a cefalopódov. V Strážovs-

kých vrchoch v chočskom príkrove vystupujú reiflinské vápence v nadloží dolomitov ako tmavé lavicovité vápence s faunou cefalopódov a brachiopódov, ako tmavošedé, masívne i tenkovrstevnaté až doskovité vápence, často s hľuzami rohovcov, s faunou brachiopódov; v strážovskom príkrove sa vyskytujú svetlosivé krinoidové vápence s brachiopódmi a bivalviami, miestami sivé alebo hnedasté hľuznaté vápence s rohovcovými hľuzami s faunou brachiopódov v nadloží dolomitov.

Na základe konodontov je stratigrafické rozpätie reiflinských vápencov pelsón až kordevol.

Pelsón bol zatiaľ potvrdený na južných svahoch Nízkyh Tatier na lokalite Jasenie-Čierny diel prítomnosťou druhu *Nicoraella kockeli* (TATGE), spolu s druhmi *Gondolella bulgarica* (BUDUROV et STEFANOV) a *G. bifurcata* (BUDUROV et STEFANOV). Prítomnosť druhu *Nicoraella kockeli* (TATGE) poukazuje na zónu *Kockeli*, zodpovedajúcu amonitovej zóne *Balatonites balatonicus*.

Konodonty pelsónskeho až spodnoilýrskeho veku sú známe zo strážovského príkrovu Strážovských vrchov na lokalite Jazovčie, s druhmi *Gondolella bulgarica* (BUDUROV et STEFANOV), *G. bifurcata* (BUDUROV et STEFANOV), *G. hanbulogi* (SUDAR et BUDUROV). Podľa členenia H. KOZURA (1980) ich možno zaradiť do zóny *P. binodosus* a to *G. bifurcata* A—Z.

Ilýr je zastúpený hlavne platničkovitými konodontmi *Gondolella mombergensis* TATGE, *G. constricta* MOSHER et CLARK, *G. excelsa* (MOSHER), *G. cornuta* (BUDUROV et STEFANOV) a *G. basisymmetrica* (BUDUROV et STEFANOV) v chočskom príkrove Nízkyh Tatier (lokality Jasenie — východný svah Lomnistej doliny a Zámotie), Veľkej Fatry (Malinô Brdo) a Strážovských vrchov (Markovica, Vlčinec). V Nízkyh Tatrách je rozšírený druh *Gondolella excelsa* (MOSHER), kým vo Veľkej Fatre prevláda *Gondolella cornuta* (BUDUROV et STEFANOV); toto spoločenstvo zodpovedá amonitovej zóne s *Paracerasites trinodosus* (*excelsa* A—Z).

Vo fasane sa objavuje nové spoločenstvo konodontov indikované druhmi *Gondolella pseudolonga* (MIETTO, KOVÁCS et KOZUR), *Gondolella cf. trammeri* (KOZUR) a *Gladigondolella tethydis* (HUCKRIEDE). Typické profily sú na lokalitách Ráztoka a Jasenie — východne od Lomnistej doliny v chočskom príkrove Nízkyh Tatier a na lokalite Sokolie v strážovskom príkrove Strážovských vrchov; na posledne menovanej lokalite sú prítomné iba juvenilné štádiá druhu *Gladigondolella tethydis* (HUCKRIEDE).

V zmysle členenia H. KOZURA (1980) asociácia patrí do zóny *pseudolonga* A—Z, ktorú H. KOZUR (1980) kladie do „Kellnerites“ prípadne „Nevadites“ zóny. Vyššie časti fasanu, ako aj prechod do vrchného ladinu nie je možné na základe konodontov dobre identifikovať, nakoľko prítomné druhy sú stratigraficky nevyrazné.

Až objavenie sa druhov *Gondolella foliata foliata* (BUDUROV), *G. foliata inclinata* (KOVÁCS) a *Metapolygnathus mungoensis* (DIEBEL) na lokalitách Zámotie, Jasenie — v. od Lomnistej doliny, Predajná-Kalvária a dolina Michalovského potoka v chočskom príkrove Nízkyh Tatier indikujú longobardský a kordevolský vek reiflinských vápencov, pričom vrchné časti súvrstvia obsahujú už *Gondolella polygnathiformis* BUDUROV et STEFANOV. Horizont zahŕňa zónu *Mungoensis* a *Mostleri* A—Z.

Explanations of plates XIX—XXIV

Pl. XIX

- 1 *Nicoraella kockeli* (TATGE). — Jasenie 1 (4), Pelsonian, 110 ×
- 2 a, b *Gondolella bulgarica* (BUDUROV et STEFANOV). — Jasenie 1 (4), Pelsonian, 40 ×
- 3 a, b *Gondolella bifurcata* (BUDUROV et STEFANOV). — Jasenie 1 (4), Pelsonian, 40 ×
- 4 a, b, c *Gondolella bulgarica* (BUDUROV et STEFANOV) — Jasenie 1 (4), Pelsonian, 65 ×
- 5 *Gondolella cornuta* (BUDUROV et STEFANOV). — Jasenie 2 (5), Fassanian, 90 ×
- 6 *Gondolella bifurcata* (BUDUROV et STEFANOV). — Jazovčie, Pelsonian-Lower Illyrian, 200 ×
- 7 *Gondolella cf. trammeri* KOZUR. — Ráztoka 6 (1), Fassanian, 60 ×
- 8 *Gondolella excelsa* (MOSHER). — Jasenie 2 (5), Fassanian, 110 ×
- 9 a, b *Gondolella excelsa* (MOSHER) — Zámotie 3 (2), Fassanian, 60 ×
- 10 *Gondolella hanbulogi* (SUDAR et BUDUROV). — Jazovčie 2 (17), Pelsonian-Lower Illyrian, 60 ×
- 11 *Gladigondolella malayensis* NOGAMI, — southern slope of the Michalovská dolina valley (11), Cordevolian, 50 ×

- 12 *Gondolella hanbulogi* (SUDAR et BUDUROV). — Jazovčie, Pelsonian-Lower Illyrian, 60 ×
 13 *Gondolella constricta* MOSHER et CLARK. — Jazovčie 2 (17), Pelsonian-Illyrian, 80 ×
 14 *Gondolella constricta* MOSHER et CLARK. — Jazovčie 2 (17), Pelsonian-Illyrian, 70 ×
 15 *Gondolella bulgarica* (BUDUROV et STEFANOV) — in saddle below Jazovčie 2 (17), Pelsonian-Illyrian, 60 ×
 16 a, b *Gladigondolella tethydis* (HUCKRIEDE). — Zámotie 7 (2), Longobardian, a/90 ×, b/75 ×

Pl. XX

- 1 *Gondolella cornuta* (BUDUROV et STEFANOV), Malinô Brdo 1 (12), Upper Illyrian, 40 ×
 2 *Gondolella excelsa* (MOSHER), intermediary form to *Gondolella bulgarica* (BUDUROV et STEFANOV), Vlčinec 2 (15), Illyrian, 110 ×
 3 *Gondolella cornuta* (BUDUROV et STEFANOV), Malinô Brdo 1 (12), Upper Illyrian, 40 ×
 4 *Gondolella excelsa* (MOSHER), Markovica 1 (14), Illyrian, 80 ×
 5 *Gondolella cornuta* (BUDUROV et STEFANOV), Malinô Brdo 3 (12), Upper Illyrian, 300 ×
 6 *Gondolella constricta* MOSHER et CLARK, Markovica 1 (14), Illyrian, 60 ×
 7 *Gondolella constricta* MOSHER et CLARK, Markovica 1 (14), Illyrian, 65 ×
 8 a, b *Gondolella constricta* MOSHER et CLARK. — Jasenie 1 (5), Illyrian, a/100 ×, b/120 ×
 9 a, b *Gondolella constricta* MOSHER et CLARK. — Jasenie 1 (5), Illyrian, 180 ×
 10 *Gondolella constricta* MOSHER et CLARK, Markovica 1 (14), Illyrian, 80 ×
 11 a, b *Gondolella constricta* MOSHER et CLARK. — Jasenie 1 (5), Illyrian, 90 ×
 12 *Gondolella constricta* MOSHER et CLARK. — Jasenie 1 (5), Illyrian, 140 ×
 13 a, b *Gondolella constricta* MOSHER et CLARK. — Zámotie 2 (2), Illyrian, 140 ×
 14 a, b *Gondolella pseudolonga* MIETTO et KOVÁCS—KOZUR. — Ráztoka 1, Fassanian a/50 ×, b/60 ×

Pl. XXI

- 1 a, b *Gondolella cornuta* (BUDUROV et STEFANOV). — Jasenie 4 (4), Fassanian, 50 ×
 2 *Gondolella cf. trammeri* KOZUR. — Jasenie 4 (4), Illyrian, 50 ×
 3 a, b *Gondolella excelsa* (MOSHER) — Zámotie 3 (2), Fassanian, 60 ×
 4 a, b *Gladigondolella tethydis* (HUCKRIEDE). — Ráztoka 3 (1), Fassanian, 100 ×
 5 a, b *Gondolella pseudolonga* MIETTO et KOVÁCS—KOZUR. — Jasenie 4 (5), Fassanian, 75 ×
 6 a, b *Gondolella constricta* MOSHER et CLARK. — Zámotie 3 (2), Fassanian, 170 ×
 7 *Gondolella constricta* MOSHER et CLARK. — Jasenie 2 (5), Fassanian, 110 ×
 8 *Gondolella pseudolonga* MIETTO et KOVÁCS—KOZUR. — Ráztoka 1 (1), Fassanian, 50 ×
 9 a, b *Gladigondolella tethydis* (HUCKRIEDE). — Zámotie 3 (2), Fassanian, 100 ×
 10 a, b *Gondolella pseudolonga* MIETTO et KOVÁCS—KOZUR. — Jasenie 2 (5), Fassanian, 90 ×
 11 a, b *Gondolella cornuta* (BUDUROV et STEFANOV). — Jasenie 4 (5), Fassanian a/140 ×, b/125 ×
 12 a, b *Gondolella pseudolonga* MIETTO et KOVÁCS—KOZUR. — Jasenie 2 (5), Fassanian, 50 ×

Pl. XXII

- 1 a, b *Metapolygnathus mungoensis* (DIEBEL). — Jasenie 10 (5), Longobardian-Cordevolian, 70 ×
 2 a, b *Gondolella polygnathiformis* BUDUROV et STEFANOV. — Predajná 2 (7), Cordevolian, a/120 ×, b/110 ×
 3 *Metapolygnathus mungoensis* (DIEBEL). — Zámotie 7 (2), Longobardian-Cordevolian, 70 ×
 4 a, b *Gondolella polygnathiformis* BUDUROV et STEFANOV. — Predajná 2 (7), Cordevolian, 100 ×
 5 a, b, c *Gondolella inclinata* KOVÁCS, intermediary form to *G. foliata* BUDUROV. — Zámotie 9 (2), Longobardian-Cordevolian, 80 ×
 6 a, b, c *Metapolygnathus mungoensis* (DIEBEL). — Zámotie 7 (2), Longobardian-Cordevolian, 60 ×
 7 a, b, c *Gondolella polygnathiformis* BUDUROV et STEFANOV juv., Intermediary form to *G. foliata* inclinata KOVÁCS. — Jasenie 9 (5), Longobardian-Cordevolian, 70 ×
 8 a, b *Gondolella polygnathiformis* BUDUROV et STEFANOV. — Predajná 2 (7), Cordevolian, 90 ×
 9 a, b *Gondolella foliata inclinata* KOVÁCS. — Zámotie 10 (2), Longobardian-Cordevolian, 50 ×
 10 *Gladigondolella malayensis* NOGAMI. — Predajná 1 (7), Longobardian-Cordevolian, 100 ×
 11 a, b *Gondolella foliata inclinata* KOVÁCS. — Zámotie 10 (2), Longobardian-Cordevolian, a/100 ×, b/90 ×

Pl. XXIII

- 1 *Theelia planorbicula* MOSTLER. — Jasenie 1 (5), Illyrian, 125 ×
- 2 *Theelia immisorbicula* MOSTLER. — Jasenie 1 (5), Illyrian, 225 ×
- 3 *Theelia planorbicula* MOSTLER. — Markovica 2 (14), Illyrian, 140 ×
- 4 *Theelia immisorbicula* MOSTLER. — southern slope of the Michalovská dolina valley (11), Cordevolian, 150 ×
- 5 *Theelia planorbicula* MOSTLER. — Zámotie 3 (2), Fassanian, 150 ×
- 6 *Theelia immisorbicula* MOSTLER. — Jasenie 2 (5), Fassanian, 175 ×
- 7 *Theelia immisorbicula* MOSTLER. — Jasenie 2 (5), Fassanian, 130 ×
- 8 *Theelia undata* MOSTLER. — Zámotie 2, Illyrian, 150 ×
- 9 *Theelia undata* MOSTLER. — Malinô Brdo 1 (12), Upper Illyrian, 140 ×
- 10 *Acanthotheelia spinosa* FRIZZELL — Exline. — Markovica 2 (14), Illyrian, 150 ×
- 11 *Priscopodatus triassicus* MOSTLER. — Jasenie 1 (5), Illyrian, 125 ×
- 12 *Theelia immisorbicula* MOSTLER. — Vlčinec 2 (15), Illyrian, 120 ×

Pl. XXIV

- 1 *Eocaudina subhexagona* GUTSCHICK, Canis-Brill. — Zámotie 8 (2), Longobardian-Cordevolian, 90 ×
- 2 *Tetravirga cf. perforata* MOSTLER. — Malinô Brdo 1 (12), Upper Illyrian, 50 ×
- 3 *Kuehnites spiniperforatus* (ZAWIDZKA). — Jasenie 2 (5), Fassanian, 150 ×
- 4 *Eocaudina subhexagona* GUTSCHICK; Canis-Brill. — Malinô Brdo 1 (2), Upper Illyrian, 90 ×
- 5 *Tetravirga cf. perforata* MOSTLER. — Malinô Brdo 1 (2), Upper Illyrian, 50 ×
- 6 *Acanthotheelia spinosa* FRIZZELL — Exline. — Malinô Brdo 1 (12), Upper Illyrian, 60 ×
- 7 *Priscopodatus bartensteini* (DEFLANDRE—RIGAUD). — Jasenie 2 (5), Fassanian, 225 ×
- 8 *Priscopodatus staurocunitoides* MOSTLER. — Malinô Brdo 1 (2), Upper Illyrian, 130 ×
- 9 *Irinella canalifera* (KRYSTAN—TOLLMANN), southern slope of Michalovská dolina valley (11), Cordevolian, 60 ×
- 10 *Priscopodatus staurocunitoides* MOSTLER, Malinô Brdo 1 (12), Upper Illyrian, 60 ×
- 11 *Priscopodatus tyrolensis* MOSTLER. — Jasenie 1 (15), Illyrian, 110 ×
- 12 *Priscopodatus tyrolensis* MOSTLER. — Jasenie 1 (1/), Illyrian, 100 ×

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Rewieved by R. Mock

Ružena Lehotayová

Miocene nannoplankton zones in West Carpathians

16 pls. (XXV—XL), Slovak summary

Abstract. In the West Carpathian Miocene are 7 nannoplankton biozones distinguished according to the results of the study of calcareous nannoflora by electron microscopy. The characteristic of the biozones is presented with the description of the most significant taxa.

Sampling of cores according to the (DSDP Deep Sea Drilling Project) proved the importance of biostratigraphy based on the study of calcareous nannoplankton for the investigation of deep-sea sediments.

Calcareous nannoflora comprises coccoliths and discoasters, spenoliths, rhabdolites (produced by gold-brown pelagic algae) abundant in both the warm and the cold sea waters. Their extensive horizontal and small vertical distributions serve as reliable data for geological and biostratigraphical interpretations.

The nannofossils were mentioned for the first time by C. G. EHRENBURG in 1836. Biostratigraphy based on the study of calcareous nannoplankton exist since cca 1960 as proved by many works by M. N. BRAMLETTE et SULLIVAN 1961, W. HAY 1964, H. STRADNER 1963, M. N. BRAMLETTE et J. A. WILCOXON 1967, S. GARTNER 1969, D. BUKRY 1978. In the course of time various definitions of individual nannoplankton biozones were made.

D. BUKRY (1978) presented a synthesis of zonal scales: zonation of tropical regions (D. BUKRY 1973b), of subtropical regions (D. WISE 1973, D. BUKRY 1973a) and the standard zonation (E. MARTINI 1971). E. MARTINI (1971) distinguished 12 Miocene nannoplankton biozones:

- NN-1 *Triquetrorhabdulus carinatus*
- NN-2 *Discoaster druggi*
- NN-3 *Sphenolithus belemnoides*
- NN-4 *Helicosphaera ampliaperta*
- NN-5 *Sphenolithus heteromorphus*
- NN-6 *Discoaster exilis*
- NN-7 *Discoaster kugleri*
- NN-8 *Catinaster coalitus*
- NN-9 *Discoaster hamatus*
- NN-10 *Discoaster calcaris*

- NN-11 *Discoaster quinqueramus*
 NN-12 *Ceratolithus tricorniculatus*

The NN-1—NN-4 zones are Lower Miocene, NN-5—NN-9 belong to the Middle Miocene and NN-10—NN-12 to Upper Miocene. The biozones defined by E. Martini may be applied on the Tertiary of the West Carpathians as well.

Lower Miocene biozones:

- NN-1 *Triquetrorhabdulus carinatus*
 NN-2 *Discoaster druggi*
 NN-3 *Sphenolithus belemnus*
 NN-4 *Helicosphaera ampliaperta*

Middle Miocene biozones:

- NN-5 *Sphenolithus heteromorphus*
 NN-6 *Discoaster exilis*
 NN-7 *Discoaster kugleri*

The Middle Miocene biozones NN-8 *Catinaster coalitus*, NN-9 *Discoaster hamatus*, the Upper Miocene biozones NN-10 *Discoaster calcaris*, NN-11 *Discoaster quinqueramus* a. o., defined by E. MARTINI (1971) cannot be distinguished in the Czechoslovak part of the West Carpathians. Sediments which could be equivalent in age to the biozones, are in aqueous environment with decreased salinity or in freshwater where autochthonous calcareous nannoflora cannot occur.

Lower Miocene nannoplankton biozones in West Carpathians

Biozone NN-1 *Triquetrorhabdulus carinatus*

Definition of biozone: The interval between the last occurrence of the species *Helicosphaera recta* HAG and the first occurrence of the species *Discoaster druggi* BRAMLETTE et WILCOXON.

Authors of the biozone: M. N. BRAMLETTE—J. A. WILCOXON 1967: Middle Tertiary calc... etc. Tulane Stud. Geol. 5/3, p. 9—132. Emend. E. MARTINI et T. WORSLEY (1970).

Type locality of the biozone: Ciperó sectia, Trinidad. The species of the biozone, presented by E. MARTINI 1971 are *Triquetrorhabdus carinatus* MARTINI, *Coccolithus abisectus* MÜLLER, *Helicosphaera intermedia* MARTINI, *Discoaster deflandrei* BRAMLETTE et RIEDEL, *Sphenolithus pacificus* MARTINI etc. The biozone could be coeval with the South-Slovakian sediments on the locality Štúrovo (borehole Št-1, see R. LEHOTAYOVÁ—M. BADI—BÉKE 1975). Since the Paleogene/Neogene boundary in Central Paratethys is not known precisely, detailed characteristic of the NN-1 zone will be done later.

Biozone NN-2 *Discoaster druggi*

It is the interval between the first occurrence of the genus *Discoaster druggi* BRAMLETTE et WILCOXON and the last occurrence of the species *Triquetrorhabdulus carinatus* MARTINI. Authors of the biozone: E. MARTINI—T. WORSLEY 1970: Standard Neogene calcareous... etc., Nature, 225, 5, 229, p. 289—290. Type locality: Cipero sectia, Trinidad.

E. MARTINI (1971) quoted the species present in the zone NN-1 as common in the biozone NN-2 together with the representatives of the species like *Discoaster druggi* BRAMLETTE et WILCOXON, *Ortorhabdulus serratus* BRAMLETTE et WILCOXON, *Sphenolithus belemnus* BRAMLETTE et WILCOXON, *Helicosphaera carteri* (WALLICH) KAMPTNER, HAY et MOHLER, *Helicosphaera ampliaperta* BRAMLETTE et RIEDEL. In the Czechoslovak part of the West Carpathians the biozone comprises Eggenburgian sediments. Calcareous nannoplankton of the sediments was studied from Považie, from the Bánovská kotlina (depression), Horné Ponitrie.

In the Bánovská kotlina (depression) the sandy-marly intercalation of basal conglomerates and their overlier contained very poor calcareous nannoflora with the species *Coccolithus pelagicus* (WALLICH) SCHILLER dominant (localities Krásna Ves, Dolné Motešice, Rožňová Neporadza see R. LEHOTAYOVÁ 1980. Samples from the locality Hornáň (borehole DB-15, depth 815.00—815.20 m) were also poor in nannofossils.

Fine sandy clays on the locality Podložany (borehole DB-9, depth 57.00—58.00 m) contained well preserved, comparatively abundant calcareous nannoflora, sufficiently characterizing the regional stage Eggenburgian.

Nannoassemblages comprise the species:

Discoaster aster BRAMLETTE et RIEDEL

Discoaster aulakos GARTNER

Discoaster druggi BRAMLETTE et WILCOXON

Reticulofenestra bisecta (HAY, MOHLER et WADE) ROTH

Reticulofenestra excavata LEHOTAYOVÁ

Calcareous nannoflora characteristic of the biozone NN-2 was in micaceous, grey-green clays in Horné Ponitrie (loc. Veľká Čausa, borehole ČČ-3, depth 237.00—237.60 m, 226.20—226.30 m).

Individual species of the nannoassemblage:

Coccolithus eopelagicus (BRAMLETTE et RIEDEL) BRAMLETTE et SULLIVAN

Coccolithus pelagicus (WALLICH) SCHILLER

Cyclocargolithus floridanus (ROTH et HAY) BUKRY

Cyclococcolithus leptoporus (MURRAY et BLACKMAN) KAMPTNER

Discoaster deflandrei BRAMLETTE et RIEDEL

Helicosphaera ampliaperta BRAMLETTE et WILCOXON

Helicosphaera carteri (WALLICH) KAMPTNER

Microrhabdulus decoratus DEFLANDRE

Pontosphaera multipora (KAMPTNER) ROTH
Reticulofenestra bisecta (HAY, MOHLER, WADE) ROTH
Reticulofenestra excavata LEHOTAYOVÁ
Reticulofenestra minuta ROTH
Reticulofenestra umbilica (LEVIN) MARTINI et RITZKOWSKI

Similar but somewhat poorer is calcareous nannoflora in Považie (loc. Trenčín). It is poorly preserved and there are less species in assemblages, in comparison to the preceding.

Calcareous nannoflora of the biozone NN-2 *Discoaster druggi* in our areas studied is well correlable with nannoflora of the zone from the Carpathian Foredeep in Moravia (R. LEHOTAYOVÁ et V. MOLČÍKOVÁ 1975).

Biozone NN-3 *Sphenolithus belemnus*

Definition of the biozone: The interval between the last occurrence of the species *Triquetrorhabdulus carinatus* MARTINI and the last occurrence of the species *Sphenolithus belemnus* BRAMLETTE et WILCOXON.

Authors of the biozone: M. N. BRAMLETTE—J. A. WILCOXON 1967: Middle Tertiary calcareous... etc. Tulane Stud. Geol. 5/3, p. 93—131.

The species of the zone are identic with those of the biozone NN-2. E. MARTINI (1971) found *Sphenolithus heteromorphus* DEFLANDRE in the Upper part. In the studied area of the Czechoslovak West Carpathians the biozone NN-3 *Sphenolithus belemnus* has not been defined so far, only its lower part is correlated with the biozone NN-2. No calcareous nannoflora was found in the studied levels of sediments regarded as coeval with the upper part of the nannoplankton zone NN-3 *Sphenolithus belemnus* and with the lower part of the zone NN-4 *Helicosphaera ampliaperta*. The sediments belong most likely to the Ottnangian regional stage. Ottnangian sediments from the locality Plesching in Austria contained poor nannoflora with dominant species *Coccolithus pelagicus* (WALLICH) SCHILLER. Carpathian sediments from the Austrian locality Laa and der Thaya contained identic nannoassemblages.

M. BALDI—BÉKE and A. NAGYMAROSY (1979) obtained similar results from the study of Ottnangian and Carpathian nannoflora from the Hungarian territory. They ranged the poor nannoflora of the lower part of the biozone NN-4 to the Ottnangian, and nannoflora of the upper part of the biozone to the Carpathian.

Biozone NN-4 *Helicosphaera ampliaperta*

Definition: The interval between the last occurrence of the species *Sphenolithus belemnus* BRAMLETTE et WILCOXON and the last occurrence of *Helicosphaera ampliaperta* BRAMLETTE et WILCOXON.

Authors: M. N. BRAMLETTE—J. A. WILCOXON 1967. Middle Tertiary calcareous... etc. Tulane Stud. Geol., 5/3, p. 93—131.

According to E. MARTINI (1971) the species are identic with those in the biozone NN-3. The species *Sphenolithus belemnus* BRAMLETTE et WILCOXON is absent. The first occurrence of *Discoaster variabilis* MARTINI et BRAMLETTE is in the uppermost levels of the biozone. In the areas studied the Ottnangian sediments are coeval with the lower of the biozone NN-4. They are a freshwater facies. The upper part of the biozone NN-4 can be well correlated with the Carpathian sediments of the entire Central Paratethys (R. LEHOTAYOVÁ—M. HARMAN 1974, V. MOLČÍKOVÁ 1978, M. BALDI—BÉKE et A. NAGYMAROSY 1979, E. MARTINI—C. MÜLLER 1975). Carpathian nannoflora of the upper part of the biozone NN-4 was found in the Bánovská kotlina (depression), on the extensions of the Podunajská nížina (Danube lowland), around Modrý Kameň, in the Ipľská kotlina (depression), in East Slovakia. Poor nannoassemblages with dominant species *Coccolithus pelagicus* (WALLICH) SCHILLER are in sediments from the Bánovská kotlina (depression; borehole DB-15, loc. Hornýany (from the loc. Bušince in the Ipľská kotlina (depression) and from the loc. Hlinné in East Slovakia. Rich Carpathian nannoflora is in samples from the loc. Pôtor (sandy marls from borehole M-2, depth 21.00—22.00 m) in the area of Modrý kameň and from the loc. Dežerice in the Bánovská kotlina. Among most significant species of the biozone NN-4 from the localities mentioned are:

Coccolithus miopelagicus BUKRY
Coccolithus pelagicus (WALLICH) SCHILLER
Coronosphaera mediterranea (LOHMANN) GAARDER
Cyclicargolithus floridanus (ROTH et HAY) BUKRY
Cyclococcolithus rotula (KAMPTNER) KAMPTNER
Discoaster aster BRAMLETTE et RIEDEL
Discoaster bollii MARTINI et BRAMLETTE
Discoaster druggi BRAMLETTE et WILCOXON
Helicosphaera ampliaperta BRAMLETTE et WILCOXON
Helicosphaera carteri (WALLICH) KAMPTNER
Pontosphaera multipora (KAMPTNER) ROTH
Reticulofenestra excavata LEHOTAYOVÁ
Reticulofenestra pseudumbilica (GARTNER) GARTNER
Syracosphaera pulchra LOHMANN
Thoracosphaera heimi (LOHMANN) KAMPTNER

Calcareous Carpathian nannoplankton studied by V. MOLČÍKOVÁ (1978) in the Carpathian Foredeep in Moravia is poorer than in our region. E. MARTINI—C. MÜLLER (1975) analyzed calcareous nannoflora in the uppermost Carpathian levels on Austrian localities (Wagna, Laa 18). On the ground of abundance of *Sphenolithus heteromorphus* and *Helicosphaera ampliaperta*, the authors ranged the levels studied to the lower part of the nannoplankton biozones NN-5 *Sphenolithus heteromorphus*.

In sediments studied in the West Carpathians are no nannofossils to characterize the uppermost Carpathian levels, neither foraminifers characteristic of the beds,

namely *Globigerinoides sicanus* STEFANI (personal information by E. BRESTENSKÁ, V. KANTOROVÁ). It is because the uppermost Carpathian members which could correspond to the lower part of the biozone NN-5 *Sphenolithus heteromorphus* did not develop in our country or were denuded off.

Middle Miocene nannoplanktonic biozones in West Carpathians **Biozone NN-5 *Sphenolithus heteromorphus***

Definition: The interval between the last occurrence of the species *Helicosphaera ampliaperta* BRAMLETTE et WILCOXON and the last occurrence of *Sphenolithus heteromorphus* DEFLANDRE.

Authors: M. N. BRAMLETTE—J. A. WILCOXON 1967: Middle Tertiary... etc., Tulane Stud., Geol. 5/3, p. 93/132

Type locality: Hermitage Quarry, South Trinidad

E. MARTINI 1971 quoted the species from the biozone: *Sphenolithus heteromorphus* DEFLANDRE, *Discoaster variabilis* MARTINI et BRAMLETTE, *Discoaster exilis* MARTINI et BRAMLETTE, *Discoaster trinidadensis* HAY, *Helicosphaera carteri* (WALLICH) KAMPTNER. The last occurrence of *Discoaster druggi* BRAMLETTE et WILCOXON was in the lower part of biozone, *Discoaster brouweri* TAN SIN HOK in its uppermost part.

In the West Carpathian Neogene areas the upper part of the biozone NN-5 *Sphenolithus heteromorphus* corresponds to the Badenian regional stage. Parallelization of calcareous Badenian assemblages showed that only the Lower Badenian and the lower part of the Middle Badenian belong to the biozone NN-5 *Sphenolithus heteromorphus*. Calcareous nannoflora NN-5 is well preserved, well grown and rich in species. In the Podunajská nížina it was studied on the localities: Salka, Semerovce, Chľaba, Bajtava and on the contact between the Podunajská nížina and the Ipel'ská kotlina on the localities Hrušov, Medovarce, Rykynčice, Ruská Nová Ves and Vranov nad Topľou.

Nannoassemblages of the biozone NN-5 contain the species:

- Braarudosphaera bigelowi* (GRAN et BRAARUD) DEFLANDRE
- Coccolithus miopelagicus* BUKRY
- Coccolithus pelagicus* (WALLICH) SCHILLER
- Coccolithus doricoides* BLACK et BARNES
- Coronocyclus nitescens* (KAMPTNER) BRAMLETTE et WILCOXON
- Discoaster aster* BRAMLETTE et RIEDEL
- Discoaster adamanteus* BRAMLETTE et WILCOXON
- Discoaster brouweri* TAN SIN HOK
- Discoaster druggi* BRAMLETTE et WILCOXON
- Discoaster exilis* MARTINI et BRAMLETTE
- Discoaster formosus* MARTINI
- Discoaster variabilis* MARTINI et BRAMLETTE
- Helicosphaera carteri* (WALLICH) KAMPTNER
- Helicosphaera rhomba* (BUKRY) STRADNER

Helicosphaera obliqua BRAMLETTE et WILCOXON
Helicosphaera wallichi LOHMANN
Holodiscolithus macroporus DEFLANDRE
Micrantholithus vesper DEFLANDRE
Pontosphaera discopora SCHILLER
Pontosphaera multipora (KAMPTNER) ROTH
Reticulofenestra pseudumbilica (GARTNER) GARTNER
Rhabdosphaera clavigera MURRAY et BLACKMANN
Rhabdosphaera sicca STRADNER
Scyphosphaera cf. *pulcherrima* DEFLANDRE
Sphenolithus heteromorphus DEFLANDRE
Syracosphaera dalmatica KAMPTNER
Umbilicosphaera jafari MÜLLER

Since in the analyzed Badenian assemblages are index taxa of the respective biozones, the Middle Miocene nannoflora is well correlable with the areas in our territory and with the adjacent areas of the central and eastern Paratethys.

In the Carpathian Foredeep in Moravia V. MOLČIKOVA (1975) found the same species in nannoassemblages of the upper part of the biozone NN-5 in sediments from the localities (Dražovice borehole 2), Židlochovice, Hrušovany pod Jevišovkou a. o.

In Austria R. FUCHS and H. STRADNER (1977) analyzed calcareous nannoplankton from localities Frättingsdorf, Vöslau, Müldorf im Lavanttal and they found the same nannofossils with the nominate species of the biozone NN-5 — *Sphenolithus heteromorphus*: Interesting is the find of the species *Discoaster musicus* Stradner in nannoassemblages of the Austrian locality Frattingsdorf which was not found in our areas studied. J. BONA (in J. BONA—J. KERNERNÉ—K. SÜMEGI (1964) found nannoflora similar to that in our areas in borehole Tekeres (depth 72.50—136.00 m) in Hungary.

Calcareous nannoflora from the Rumanian locality Breznita is also well parallelizable with our nannoflora of the biozone NN-5. Badenian sediments from the Polish localities Bonarka and Gacký contained nannoassemblages of the biozone NN-5.

Biozone NN-6 *Discoaster exilis*

Definition: The interval between the last occurrence of the Species *Sphenolithus heteromorphus* DEFLANDRE and the first occurrence of *Discoaster kugleri* MARTINI et BRAMLETTE.

Authors: E. MARTINI—T. WORSLEY 1970: Standard Neogene calcareous... etc. Nature, 225/5229, p. 289—290.

Type locality: Golconda, South Trinidad.

The species of biozone according to E. MARTINI (1971): *Discoaster exilis* MARTINI et BRAMLETTE, *Discoaster varibilis* MARTINI et BRAMLETTE, *Helicosphaera carteri* (WALLICH) KAMPTNER, *Discoaster trinidadensis* HAY, *Discoaster nephados* HAY. The

species *Triquetrorhabdulus rugosus* BRAMLETTE et WILCOXON occurred for the first time in the lower part of the biozone.

In the West Carpathian regions the nannoassemblages of the biozone occur in pelites of Badenian localities Salka (borehole K-V, depth 92.00—13.00 m), Lontov (borehole Ži-2, depth 492.00—491.00 m), Borský Mikuláš, Rohožník, Devínska Nová Ves (brick-koln), Stupava. Interestingly, the species *Sphenolithus heteromorphus* DEFLANDRE is absent in calcareous nannoflora of the biozone NN-6, and *Triquetrorhabdulus rugosus* BRAMLETTE et WILCOXON appeared as a new element. There are also current species like *Coccolithus pelagicus* (WALLICH) SCHILLER, *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, *Helicosphaera carteri* (WALLICH) KAMPTNER. There are also representatives of nannoflora of the biozone NN-5 but here they are more abundant and larger, like:

Cyclococcolithus leptoporus (MURRAY et BLACKMANN) KAMPTNER
Helicosphaera wallichi LOHMANN
Rhabdosphaera sicca STRADNER
Scyphosphaera campanula DEFLANDRE
Sphenolithus abies DEFLANDRE
Scapholithus fossilis DEFLANDRE

The nannoassemblages comprise also species for which shallow-water — littoral environments are favourable, for example:

Braarudosphaera bigelowi (GRAN et BRAARUD) DEFLANDRE
Micrantholithus vesper DEFLANDRE
Pontosphaera multipora (KAMPTNER) ROTH
Pontosphaera discopora SCHILLER

Regarding representatives of the genus *Discoaster* in the biozone NN-6, besides the nominate species *Discoaster exilis* MARTINI. There are also *Discoaster brauweri* TAN SIN HOK, *Discoaster variabilis* BRAMLETTE et RIEDEL.

Besides the taxa mentioned, characteristic elements of the biozone NN-6 comprise the following species:

Discosphaera jerkovici MÜLLER
Holodiscolithus challengerii MÜLLER
Rhabdosphaera procera MARTINI
Rhabdosphaera poculi (BONA-KERNERNÉ) MÜLLER
Scyphosphaera apsteini LOHMANN
Syracosphaera cf. *histrica* KAMPTNER
Syracosphaera pulchra SCHILLER
Syracosphaera dalmatica KAMPTNER
Umbilicosphaera jafari MÜLLER

Parallelization of calcareous nannoflora of the biozone NN-6 shows that it is iden-

tic with nannoflora from the locality Walbersdorf in NE Austria (F. RÖGL—C. MÜLLER 1976), from the locality Tekeres (borehole Tekeres-1, depth 72,50 m) in the Mecsek Mts. in Hungary (J. BONA-KERNERNÉ—K. SÜMEGI 1964).

On the Rumanian locality Urei deva is similar calcareous nannoflora differing in a greater amount of ortholite elements. In nannoassemblages dominant are the species *Discoaster exilis* Martini et Bramlette, and *Discoaster variabilis* Bramlette et Riedel.

Biozone NN-7 *Discoaster kugleri*

Definition: The interval between the first occurrence of *Discoaster kugleri* MARTINI et BRAMLETTE and the first occurrence of the species *Catinaster coalithus* MARTINI et BRAMLETTE.

Authors: M. N. BRAMLETTE—J. A. WILCOXON 1967: Middle Tertiary... etc., Tulane Stud. Geol. 5/3, p. 9—132.

Type locality: Ciperó sectia, Trinidad.

E. MARTINI (1971) found there the same species as in the biozone NN-6, and a new species *Discoaster kugleri* MARTINI et BRAMLETTE. There was the last occurrence of *Discoaster trinidadensis* HAY: Other species are *Discoaster challengerii* BRAMLETTE et RIEDEL and *Discoaster pseudovariabilis* MARTINI et WORSLEY.

In the West Carpathians the calcareous nannoflora from the uppermost levels of Badenian sediments without the nominate species might be coeval with the biozone NN-7. Index species of the biozone was defined from tropical areas. It is likely to be scarce or problematic in subtropical areas and in areas of mild climate.

The calcareous nannoflora from the uppermost levels of Upper Badenian sediments was in samples from the localities Lontov (borehole Ži-2, depth 212.00 m), and from some exposures around the locality Devín.

The following species are most frequent in the nannoassemblages:

Coccolithus pelagicus (WALLICH) SCHILLER

Cyclococcolithus leptoporus (MURRAY et BLACKMANN) KAMPTNER

Cyclococcolithus rotula (KAMPTNER) KAMPTNER

Helicosphaera selli BUKRY et BRAMLETTE

Pontosphaera multipora (KAMPTNER) ROTH

Reticulofenestra pseudoumbilica (GARTNER) GARTNER

Sphenolithus abies DEFLANDRE

Sphenolithus neoabies BUKRY

Nannoassemblages, parallelizable with our calcareous nannoplankton of the biozone NN-7, were in samples from the locality Hunedoara in Rumania, localities Machov, Wieliczka-2, Sulkov and Wenglin in Poland, and calcareous nannoflora from the uppermost levels of the profile of the Austrian locality Walbersdorf (F. RÖGL—C. MÜLLER 1976).

Systematical part

Descriptions and remarks on the most significant taxa of individual biozones in West Carpathians

Coccolithaceae KAMPTNER, 1928

Cyclicargolithus BUKRY, 1971

Cyclicargolithus floridanus (ROTH et HAY) BUKRY, 1971

Pl. XXV, Fig. 4, 5; Pl. XXXII, Fig. 2, 3

1967 *Coccolithus floridanus* ROTH et HAY n. sp. — W. W. HAY ET AL: Calcareous nanoplankton zonation... etc., p. 445, tab. 6, fig. 1—4.

1970 *Cyclococcolithus floridanus* (ROTH et HAY) BUKRY—D. BUKRY: Oligocene Calcareous... etc., p. 854, tab. 5, fig. 6.

1971 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY—D. BUKRY: Cenozoic Calc.... etc., p. 311, tab. 2, fig. 11.

A round placolith with its distal disc larger than the proximal. Both discs consist of many narrow radial lamellae (45—50) and are perforated in the central area. The central aperture occupies almost 1/3 of the coccolith size in some cases.

Remark: It is a form of the biozones NN-2 and NN-5 very frequent in the studied sediments of the West Carpathians.

Cyclococcolithus KAMPTNER, 1954

Cyclococcolithus rotula (KAMPTNER) KAMPTNER, 1956

Pl. XXXIII, Fig. 2; Pl. XXXIV, Fig. 1, 3

1948 *Tremalithus rotula* KAMPTNER—E. KAMPTNER: Coccolithen aus dem Torton... etc., p. 8, tab. 2, fig. 15.

1956 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER—E. KAMPTNER: Zur Systematik... etc., p. 7.

A round placolith with its distal disc larger than the proximal. There are 18—26 bended radial lamellae on the proximal side. The large central aperture consists of a tubus connecting the two disc.

Remark: In the West Carpathians the species occurs already in the biozone NN-2. It is small and less frequent. In the biozone NN-5 it grows larger (about 6—8 μ m) and it is exceptionally large in the biozone NN-6.

Cycloperfolithus LEHOTAYOVA et PRIEWALDER, 1978

Cycloperfolithus carlae LEHOTAYOVÁ et PRIEWALDER, 1978

Pl. XXXIX, Fig. 2

- 1974 *Cyclococcolithus macintyreii* BUKRY et BRAMLETTE, 1969 — C. MÜLLER: Nannoplankton aus dem Mittel... etc., tab. 1, fig. 5.
 1978 *Cycloperfolithus carlae* n. sp. — R. LEHOTAYOVÁ—H. PRIEWALDER: Cycloperfolithus eine neue... etc., p. 486—489, Tab. 10, Fig. 1—7; Tab. 11, Fig. 6, 7.

Broad elliptical to round placolith with its distal disc larger than the proximal. Both discs are connected by a central tubus closed by a membrane with regularly distributed pores. On the distal side are about 40 lamellae and there is a crater aperture in the middle of the central area. On the proximal disc are about 3 cycles of lamellae.

Remark: The taxon is resemblant to the species *Cyclococcolithus macintyreii* BUKRY et BRAMLETTE, 1969. It differs in a perforated membrane on the proximal side in the central area, and in a narrowed crater opening on the distal side in the central area.

The species *Cycloperfolithus carlae* is frequent in the biozone NN-6 in the West Carpathians.

***Reticulofenestra* HAY, MOHLER et WADE, 1966**

***Reticulofenestra excavata* LEHOTAYOVÁ, 1975**

Pl. XXVI, Fig. 1, 2; Pl. XXXIII, Fig. 4

- 1975 *Reticulofenestra excavata* n. sp. — R. LEHOTAYOVÁ: *Reticulofenestra excavata*... etc., p. 31—40, Tab. 1, Fig. 1—6.

Remark: Detail description and scanning-electron micrographs of the species were published by R. LEHOTAYOVÁ, 1975.

In the West Carpathians the species is comparatively frequent in biozones NN-2 to NN-4.

***Reticulofenestra pseudumbilica* (GARTNER) GARTNER, 1969**

Pl. XXXIV, Fig. 4; Pl. XXXV, Fig. 2

- 1967 *Coccolithus pseudumbilicus* GARTNER n. sp. — S. GARTNER: Calcareous nannofossils... etc., p. 4, tab. 6, fig. 1—4.
 1969 *Reticulofenestra pseudumbilica* (GARTNER) S. GARTNER: Correlation of Neogene... etc., p. 598, tab. 2, fig. 4.

A broad-elliptical placolith consisting of a larger distal and a smaller proximal discs. The number of lamellae on both discs is smaller (33—40) as quoted by the author of the species. In the central area is a grid with irregularly distributed pores, almost round in shape.

The species *Reticulofenestra pseudumbilica* (GARTNER) GARTNER is one of the most frequent species of the biozone NN-5/NN-6 in the West Carpathians. It is sporadic in the biozone NN-2.

Pontosphaeraccae LEMMERMAN, 1908

Pontosphaera LOHMANN, 1902

***Pontosphaera multipora* (KAMPTNER) ROTH, 1970**

Pl. XXVII, Fig. 1; Pl. XXXIII, Fig. 3, 4; Pl. XXXVIII, Fig. 2

1948 *Discolithus multiporus* KAMPTNER—E. KAMPTNER: Coccolithen aus dem... etc., p. 5, tab. 1, fig. 9a—b.

1970 *Pontosphaera multipora* (KAMPTNER) nov. comb. ROTH—P. H. ROTH: Oligocene Calcareous... etc., p. 860.

Remark: A comprehensive description and depiction of the species were published by R. FUCHS—H. STRADNER, 1977. Our specimens are identic with this species.

In the West Carpathians the species *Pontosphaera multipora* occurs in the biozone NN-2 to NN-7. It is largest and most abundant in the biozone NN-6.

Helicosphaera WALLICH, 1877

***Helicosphaera carteri* (WALLICH) KAMPTNER, 1954**

Pl. XXIX, Fig. 1; Pl. XXXIII, Fig. 1

1941 *Coccolithus carteri* (WALLICH) KAMPTNER—E. KAMPTNER: Die Coccolithineen... etc., p. 93, 111, tab. 13, fig. 136.

1954 *Helicosphaera carteri* (WALLICH) KAMPTNER—E. KAMPTNER: Untersuchungen über... etc., p. 21, fig. 17—19.

1967 *Helicopontosphaera kamptneri* n. sp. HAY et MOHLER—W. HAY et col.: Calcareus... etc., p. 448, tab. 10—11, fig. 5.

Scanning-electron micrographs of the species show that it is helicoid elliptical, with two slits along the long axis on the proximal side in the central elliptic part. Longitudinal calcite segments on the central area are perpendicularly concentrated along the slits. The marginal part is spiral-curved, rimming the central area. The arrangement of calcite on the distal part is similar.

Many authors like W. HAY, W. MOHLER et al. 1967, B. HAQ (1971) a. o. denoted the species as *Helicopontosphaera kamptneri*.

Scanning-electron micrographs of our forms resemble rather an elliptical placolith with its distal disc in the spiral.

Remark: In the West Carpathians the species is frequent almost in all biozones from NN-2.

***Helicosphaera ampliaptera* BRAMLETTE—WILCOXON, 1967**

Tab. XXVIII, Fig. 1, 2; Pl. XXX, Fig. 2

1967 *Helicosphaera ampliaptera* BRAMLETTE—WILCOXON — M. N. BRAMLETTE—J. A. WILCOXON: Middle Tertiary... etc., p. 105, tab. 6, fig. 1—4.

1970 *Helicopontosphaera ampliaperta* (BRAMLETTE et WILCOXON) BUKRY—D. BUKRY: Coccolith age... etc., p. 377.

It is characterized by a large oval central aperture on the proximal side and a reduced terminal flange and the distal shield. A good depiction and a brief description of the species (scanning-electron micrographs) were published by B. V. HAQ 1973 which is identic with our species.

Remark: In the Czechoslovak part of the West Carpathians the taxon occurs in a comparatively short time span in the biozones NN-2 and NN-4

***Rhabdosphaeraceae* LEMMERMAN, 1908**

***Rhabdosphaera* HACCKEL, 1894**

***Rhabdosphaera clavigera* MURRAY et BLACKMANN, 1897**

Pl. XXVI, Fig. 2

1902 *Rhabdosphaera clavige* LOHMANN — H. LOHMANN: Die Coccolithophoridae... etc., p. 143.

1898 *Rhabdosphaera claviger* MURRAY et BLACKMANN — G. MURRAY et V. H. BLACKMANN: On the nature... etc., p. 438, tab. 7, fig. 51, tab. 8, fig. 53.

Remark: According to D. COHEN (1965) there are frequent intermediary forms between the species *Rhabdosphaera claviger* MURRAY et BLACKMANN, 1898 and *Rhabdosphaera styliifer* LOHMANN, 1902. MC INTYRE et BÉ (1967) regarded the species *R. styliifer* as a younger synonym of *R. claviger*.

In the West Carpathian the species occurred as late as the biozone NN-5.

***Rhabdosphaera poculi* (BÓNA—KERNERNÉ) MÜLLER, 1974**

Pl. XXXIX, Fig. 4

1964 *Rhabdolitus poculi* n. sp. — I. BÓNA—K. KERNERNÉ: Micropaleontológiai... etc., p. 113, tab. 5, fig. 15, 16.

1974 *Rhabdosphaera poculi* (BÓNA—KERNERNÉ) nov. comb. — C. MÜLLER: Nannoplankton aus... etc., p. 394, tab. 2, fig. 18; tab. 4, fig. 31—33, 41—42.

Remark: The species is in accordance with the description and depiction of the original species from Upper Badenian sediments of Hungary and with the description of forms of the same species described and depicted by C. MÜLLER from the Austrian Middle Miocene locality Walbersdorf (C. MÜLLER, 1974).

In the West Carpathians the species occurred only in the biozone NN-6.

***Sphenolithaceae* DEFLANDRE, 1952**

***Sphenolithus* DEFLANDRE, 1952**

***Sphenolithus abies* DEFLANDRE, 1954**

Pl. XL, Fig. 1

1953 *Sphenolithus abies* DEFLANDRE — G. DEFLANDRE: Hétérogeneite... etc., p. 1786 (non fig).

1954 *Sphenolithus abies* DEFLANDRE — G. DEFLANDRE—CH. FERT: Observation sur les Coccolithophoridén... etc., p. 164, tab. 10, fig. 1—4.

Remarks: Diagnostic characters agree with the original description of the species by G. DEFLANDRE (1954). Scanning-electron micrographs of our specimens are very similar to the depiction of the species by M. CLOCCHIATTI (1971).

In the West Carpathians, *Sphenolithus abies* is very frequent in the biozones NN-6/NN-7.

***Sphenolithus heteromorphus* DEFLANDRE, 1953**

Pl. XXXIV, Fig. 2

1953 *Sphenolithus heteromorphus* DEFLANDRE — G. DEFLANDRE: Heterogeneite... etc., pp. 1785—1786, Fig. 1, 2.

Remarks: A comprehensive description and detail depiction of the species were published by R. FUCHS et H. STRADNER 1977. Our specimens are described by R. LEHOTAYOVA, 1970.

In the West Carpathians the species *Sphenolithus heteromorphus* occurs only in Lower Badenian sediments of the biozone NN-5.

***Discoasteraceae* VEKSHINA, 1959**

***Discoaster* TAN SIN HOK, 1927**

***Discoaster druggi* BRAMLETTE et WILCOXON, 1967**

Pl. XXXVII, Fig. 1

1967 *Discoaster druggi* BRAMLETTE et WILCOXON — M. N. BRAMLETTE et J. A. WILCOXON: *Discoaster druggi*... etc., p. 220.

A broad asteroolith with 6 rays slightly round-cut at the ends. The central area is broad, almost straight, with distinct sutures. The specimens from the sediments studied are comparable to the originally described specimens by M. N. BRAMLETTE et J. WILCOXON. Scanning-electron micrographs are similar to electronmicrographs of the species as described by M. CLOCCHIATTI (1971).

Remark: In the West Carpathians the species is scarce in the biozone NN-2 and sporadic in the lower part of the Badenian in the biozone NN-5.

***Discoaster exilis* MARTINI et BRAMLETTE, 1963**

Pl. XXXIX, Fig. 1

1963 *Discoaster exilis* MARTINI et BRAMLETTE — E. MARTINI et M. N. BRAMLETTE: Calcareous nannoplankton... etc., p. 852, tab. 104, fig. 1—3.

The specimen has 6 long, narrow arms with narrowed or slightly bifurcate ends. The central area is rather large, with a stellate knob in the middle. Average size: 14—18 μ m.

Remark: In the West Carpathians it is sporadic in the biozone NN-5, very frequent in the biozone NN-6.

***Discoaster variabilis* MARTINI et BRAMLETTE, 1963**

Pl. XXXVI, Fig. 1; Pl. XXXVII, Fig. 2

1963 *Discoaster variabilis* MARTINI et BRAMLETTE — E. MARTINI et M. N. BRAMLETTE: Calcareous nannoplankton... etc., p. 854, tab. 104, fig. 4—8.

1971 *Discoaster variabilis* MARTINI et BRAMLETTE — M. CLOCCHIATTI: Contribution à l'étude... etc., p. 93, tab. 36, fig. 1a, 1b, 1c, tab. 37, fig. 1, 3a, 3b, 3c, 3d, tab. 38, fig. 1a, 1b—c.

The specimen has as a rule 6 long arms with bifurcate and. Some specimens show even double bifurcation. A larger central area has in its centre a stellate knob. Average size: 9—19 μ m.

Remark: The taxon resembles the species *Discoaster exilis* and *Discoaster challengerii* BRAMLETTE—RIEDEL, only its arms are somewhat broader and shorter, terminated with a broader or double bifurcation.

The species *Discoaster challengerii* has the central area smaller than *Discoaster variabilis*.

In the West Carpathians the species *Discoaster variabilis* MARTINI et BRAMLETTE is most frequent in the biozone NN-5, less frequent in biozones NN-6/NN-7.

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Rewieved by H. Bystrická

Nanoplanktonické biozóny miocénu Západných Karpát

Resumé anglického textu

V oblasti Západných Karpát na základe štúdia vápnitého nanoplanktónu (metódou riadkovej elektrónovej mikroskopie) sa dá v miocéne vymedziť 7 nanoplanktonických biozón.

Spodnomiocénne biozóny NN-1 až NN-4, ako i strednomiocénne NN-5 až NN-6/NN-7 sú zhodné so štandardnou zonáciou E. MARTINI 1971.

Ďalšie strednomiocénne biozóny uvádzané E. MARTINIM (1971) ako NN-8 *Catinaster coalitus*, NN-9 *Discoaster hamatus*, ako i vrchnomiocénne NN-10 *Discoaster calcaris* a ďalšie sa v čl. časti Západných Karpát nedajú vymedziť. Sedimenty, ktoré im vekove zodpovedajú sa usadili v prostredí so zníženou salinitou alebo sú v sladkovodnom, prípadne suchozemskom vývoji.

Ak stanovené biozóny aplikujeme na regionálne stupne neogénu Centrálnej Paratethydy, potom v spodnom miocéne regionálny stupeň eger zahŕňa k sebe biozónu NN-1. Regionálny stupeň egerburg biozónu NN-2 a spodnú časť biozóny NN-3. Regionálny stupeň otnang je (vekovo ekvivalent vrchnej časti biozóny NN-3 a spodnej časti biozóny NN-4) v sladkovodnom vývoji. Regionálny stupeň Karpat zahŕňa vrchnú časť biozóny NN-4 a spodnú časť biozóny NN-5. V čl. časti Západných Karpát sa sedimenty karpatu (ktoré by zodpovedali spodnej časti biozóny NN-5) alebo nevyvinuli alebo boli oddenudované.

V strednom miocéne regionálny stupeň bádén zahŕňa v sebe vrchnú časť biozóny NN-5, ďalej biozónu NN-6/NN-7.

Vo vrchnom miocéne regionálny stupeň sarmat obsahuje málo autochtónnych druhov vápnitej nanoflóry — nakoľko sedimenty sú vyvinuté v morskom prostredí so zníženou salinitou.

V elaboráte je uvedená charakteristika vápnitej nanoflóry uvedených biozón jej paralelizácia s nanoflorou príslušných zón mimo nášho územia, ako i opisy a poznámky k najvýznamnejším taxónom pre stanovené biozóny Západných Karpát.

Explanations of plates XXV—XL

Plate XXV

Lower Miocene calcareous nannoflora. Eggenburgian — biozone NN-2/NN-3

- 1 *Coccolithus pelagicus* (WALLICH) SCHILLER, locality Vefká Čausa (borehole ČČ-3, depth 237—237.6 m); proximal view, magnif. 10 000×.
- 2 *Coccolithus pelagicus* (WALLICH) SCHILLER, locality Vefká Čausa (borehole ČČ-3, depth 237—237.6 m); distal view, magnif. 10 000×.
- 3 *Coccolithus pelagicus* (WALLICH) SCHILLER, locality Trenčín (borehole VT-16, depth 10.6 m); distal view, magnif. 5000×.
- 4 *Coccolithus pelagicus* (WALLICH) SCHILLER, locality Trenčín (borehole VT-16, depth 10.6 m), distal view, magnif. 5000×.

Plate XXVI

Eggenburgian — biozone NN-2/NN-3

- 1 *Reticulofenestra excavata* LEHOTAYOVÁ, loc. Vefká Čausa (borehole ČČ-3, depth 237—237.6 m), distal view, magnif. 10 000×.
- 2 *Reticulofenestra excavata* LEHOTAYOVÁ, loc. Vefká Čausa (borehole ČČ-3, depth 237—237.6 m), proximal view, magnif. 4000×.
- 3 *Reticulofenestra* sp., loc. Trenčín, proximal view, magnif. 5000×.
- 4 *Coccolithus pelagicus* WALLICH (SCHILLER), loc. Trenčín, distal view, magnif. 5000×.

Plate XXVII

Eggenburgian — biozone NN-2/NN-3

- 1 *Pontosphaera multipora* (KAMPTNER) ROTH, loc. Veľká Čausa (borehole ČČ-3, 237—237.6 m), distal view; magnif. 10 000 ×.
- 2 *Reticulofenestra bisecta* (HAY, MOHLER, WADE) ROTH, locality Považská Bystrica (borehole P-B-I, depth 8.2—8.3 m), proximal view, magnif. 4000 ×.
- 3 *Reticulofenestra bisecta* (HAY, MOHLER, WADE) ROTH, locality Považská Bystrica (borehole PB-1, depth 8.2—8.3 m), distal view, magnif. 4000 ×.
- 4 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, loc. Hodejov (H-208), prox. view, magnif. 3000x.
- 5 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, loc. Považská Bystrica (borehole PB-1, depth 8.2—8.8 m), distal view, magnif. 5000 ×.

Plate XXVIII

Eggenburgian — biozone NN-2/NN-3

- 1 *Helicosphaera ampliaperta* BRAMLETTE et WILCOXON, loc. Veľká Čausa (borehole ČČ-3, depth 237—237.6 m), proximal view, magnif. 10 000 ×.
- 2 *Helicosphaera ampliaperta* BRAMLETTE et WILCOXON, loc. Veľká Čausa (borehole ČČ-3, depth 237—237.6 m), distal view, magnif. 10 000 ×.
- 3 *Reticulofenestra lockeri* MÜLLER, locality Považská Bystrica (borehole P-B-1, depth 8.2—8.3 m), proximal view, magnif. 3500 ×.
- 4 *Coccolithus pelagicus* (WALLICH) SCHILLER, loc. Veľká Čausa (borehole ČČ-3, 237—237.6 m), fragment of a coccosphaere, distal view, magnif. 5000 ×.

Plate XXIX

Carpathian — biozone NN-4

- 1 *Helicosphaera carteri* (WALLICH) KAMPTNER, loc. Dežerice, proximal view, magnif. 9000 ×.
- 2 *Coronosphaera* sp., loc. Dežerice, proximal view, magnif. 20 000 ×.
- 3 *Coronosphaera Mediterranea* (LOHMANN) GAARDER, loc. Dežerice, lateral view, magnif. 10 000 ×.

Plate XXX

Carpathian — biozone NN-4

- 1 *Coronosphaera mediterranea* (LOHMANN) GAARDER, loc. Dežerice, proximal view, magnif. 18 000 ×.
- 2 *Helicosphaera ampliaperta* BRAMLETTE et WILCOXON, loc. Pôtor (borehole M-2, depth 21—22 m), distal view, magnif. 5000 ×.
- 3 *Coccolithus pelagicus* (WALLICH) SCHILLER, loc. Pôtor (borehole M-2, depth 21—22 m) proximal view, magnif. 5000 ×.
- 4 *Coccolithus pelagicus* (WALLICH) SCHILLER, loc. Pôtor, (borehole M-2, depth 21—22 m) central area, magnif. 10 000 ×.
- 5 *Coccolithus pelagicus* (WALLICH) SCHILLER, loc. Pôtor (borehole M-2, depth 21—22 m), distal view, magnif. 5000 ×.

Plate XXXI

Carpathian — biozone NN-4

- 1 *Coronosphaera mediterranea* (LOHMANN) GAARDNER, loc. Dežerice, dist. view, magnif. 5000 ×.
- 2 *Coronosphaera mediterranea* (LOHMANN) GAARDNER, loc. Dežerice, distal view, magnif. 10 000 ×.
- 3 *Discoaster obtusus* GARTNER, loc. Dežerice, dist. view, magn. 5000 ×.
- 4 *Braarudosphaera bigelowi* (GRAN et BRAARUD) DEFLANDRE, loc. Dežerice, distal view, magnif. 5000 ×.
- 5 *Coccolithus pelagicus* (WALLICH) SCHILLER (a coccosphaere), locality Pôtor (borehole M-2, depth 21—22 m), distal view, magnif. 4000 ×.

Plate XXXII

Carpathian — biozone NN-4

- 1 *Coccolithus pelagicus* (WALLICH) SCHILLER, loc. Dežerice (a coccospaere), distal view, magnif. 4000 ×.
- 2 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, loc. Pôtor (borehole M-2, depth 21—22 m), proximal view, magnif. 4500 ×.
- 3 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, loc. Pôtor (borehole M-2 depth 21—22 m), distal view, magnif. 5000 ×.
- 4 *Thoracosphaera heimi* (LOHMANN) KAMPTNER, loc. Pôtor (borehole M-2, depth 21—22 m), magnif. 2250 ×.
- 5 *Thoracosphaera heimi* (LOHMANN) KAMPTNER, loc. Pôtor (borehole M-2, 21—22 m) a wall detail, magnif. 5000 ×.

Plate XXXIII

Carpathian — biozone NN-4

- 1 *Helicosphaera carteri* (WALLICH) KAMPTNER, loc. Dežerice, prox. view, magnif. 20 000 ×.
- 2 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, loc. Pôtor (borehole M-2, depth 21—22 m), proximal view, magnif. 7000 ×.
- 3 *Pontosphaera multipora* (KAMPTNER) ROTH, loc. Pôtor (borehole M-2, depth 21—22 m, proximal view, magnif. 4500 ×.
- 4 *Reticulofenestra excavata* LEHOTAYOVÁ, loc. Pôtor (borehole M-2, depth 21—22 m), distal view, magnif. 4500 ×.
- 5 *Pontosphaera multipora* (KAMPTNER) ROTH, loc. Pôtor (borehole M-2, depth 21—22 m) distal view, magnif. 4500 ×.

Plate XXXIV

Middle Miocene calcareous nannoflora. Badenian — biozone NN-5

- 1 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, loc. Hrušov, prox. view, magnif. 10 000 ×.
- 2 *Sphenolithus heteromorphus* DEFLANDRE, loc. Hrušov, lateral view, magnif. 10 000 ×.
- 3 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, loc. Hrušov, distal view, magnif. 5000 ×.
- 4 *Reticulofenestra pseudumbilica* (GARTNER), loc. Hrušov, prox. view, magnif. 10 000 ×.

Plate XXXV

Badenian — biozone NN-5

- 1 *Coccolithus pelagicus* (WALLICH) SCHILLER (a coccospaere), loc. Hrušov, distal view, magnif. 7000 ×.
- 2 *Reticulofenestra pseudumbilica* (GARTNER) GARTNER, loc. Hrušov, distal view, magnif. 10 000 ×.

Plate XXXVI

Badenian — biozone NN-5

- 1 *Coccolithus pelagicus* WALLICH (SCHILLER), distal view and *Discoaster variabilis* MARTINI et BRAMLETTE, loc. Ruská Nová Ves (S-39), prox. view, magnif. 6000 ×.
- 2 *Rhabdosphaera clavigera* MURRAY et BLACKMANN, loc. Hrušov, lateral view, magnif. 9000 ×.
- 3 *Cyclococcolithus leptoporus* (MURRAY et BLACKMANN) KAMPTNER, loc. Hrušov, prox. view, magnif. 10 000 ×.

Plate XXXVII

Badenian — biozone NN-5

- 1 *Discoaster druggi* BRAMLETTE et WILCOXON, loc. Salka (K-V, 300—3010 m), prox. view, magnif. 10 000 ×.
- 2 *Discoaster variabilis* MARTINI et BRAMLETTE, loc. Oslavany, prox. view, magnif. 10 000 ×.

Plate XXXVIII

Badenian — biozone NN-6

- 1 *Coronocyclus nitescents* (KAMPTNER) BRAMLETTE et WILCOXON, loc. Rohožník, prox. view, magnif. 10 000 ×.
- 2 *Pontosphaera multipora* (KAMPTNER) ROTH, loc. Devínska Nová Ves, distal view, magnif. 5000 ×.
- 3 *Helicosphaera wallichi* (LOHMAN) LEHOTAYOVÁ, proximal view, magnif. 10 000 ×.

Plate XXXIX

Badenian — biozone NN-6

- 1 *Discoaster exilis* MARTINI et BRAMLETTE, loc. Lontov (borehole Ži-1, depth 412—414 m), proximal view, magnif. 9000 ×.
- 2 *Cycloperfolithus carlae* LEHOTAYOVÁ et PRIEWALDER, loc. Salka (borehole K-V, depth 13—14 m), distal view, magnif. 4000 ×.
- 3 *Triquetrorhabdulus rugosus* BRAMLETTE et WILCOXON, loc. Devínska Nová Ves, prox. view, magnif. 3500 ×.
- 4 *Rhabdosphaera poculi* (BÓNA—KERNERNÉ) MÜLLER, locality Devínska Nová Ves, lateral view, magnif. 5000 ×.

Plate XL

Badenian — biozone NN-6

- 1 *Sphenolithus abies* DEFLANDRE, locality Stupava, lateral view, magnif. 16 000 ×.
- 2 *Acanthaica* sp., loc. Devínska Nová Ves, lateral view, magnif. 5000 ×.

Eva Planderová

The first find of Viséan microflora in Gemerides in Slovakia

4 text-fig., 6 pl. (XLI—XLVI). Slovak summary

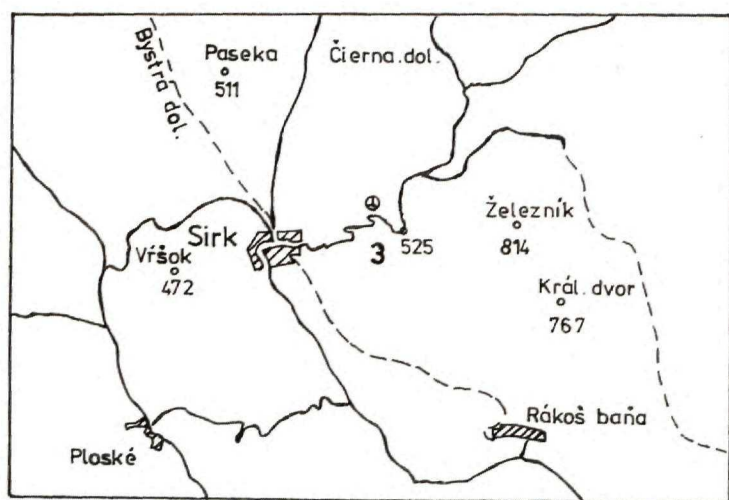
Abstract. Biostratigraphical and systematical studies of sporomorphs from dark schists from the Dobšiná Group (North Gemerides) proved the Viséan age of the sediments studied. 22 spore species are described. One of them is new: *Florinites visendis* n. sp. This is the first find of Lower Carboniferous microflora in the West Carpathians.

In the Gemic Carboniferous, now denoted as the Dobšiná Group (BAJANÍK et al. 1980a), there is a schistose formation between Sirk and Železník (Map 1). I have examined several samples from the formation and here are the results.

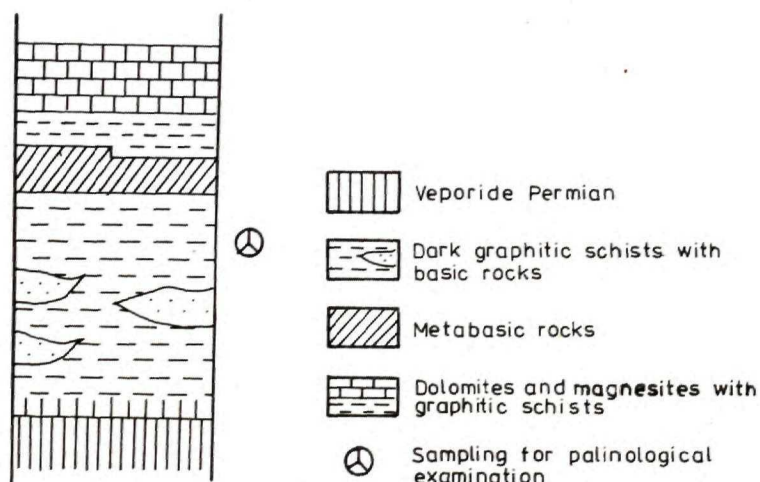
According to FUSAN (1959) it is transgressive marine Carboniferous resting unconformably upon folded and eroded basement. In some places the sedimentation commenced with deposition of psammite-pelite sediments (sandstones, sandy phyllites and phyllites) containing layers of dark and light lydites.

The psammite-pelite formation is overlain by a conglomerate — schistose formation, frequently immediately upon the ancient basement so that it forms the basis of the Carboniferous. It is called the Ochťiná — Podrečany facies by FUSAN (1959). In accordance with him, BAJANÍK et al. (1979) use the term Ochťiná Formation for the Ochťiná — Podrečany facies in the division of the whole Dobšiná Group. A. VOZAROVÁ in BAJANÍK et al. (1980a) regarded it as the Gemic Paleozoic thrust over the Veporic Permian. It is thick sequence of graphite schists with intercalations of basic bodies (Sirk — Železník) overlain by an ultrabasic body. Above the body are dolomites, schists, and magnesites (Ochťiná, Map 2).

ULRICH and BOUČEK (1931) found fauna in the so-called magnesite Carboniferous, denoted by FUSAN (1959) as the Ochťiná — Podrečany facies of the North-Gemic Carboniferous. Among most important localities of Carboniferous fauna are Ratkovská Suchá, Divina, Ružina, Ochťiná, referred to the Uralian by ULRICH and BOUČEK (1931). BOUČEK and PŘIBYL (1958) range the samples from Dobšiná in the Westphalian B Westphalian C on the ground of new faunal finds. BOUČEK and PŘIBYL (1960) revised former faunal finds and revealed older age of the *Carboniferous strata* with magnesites (Namurian B—C) than the Carboniferous near Dobšiná. Later on KOZUR, MOCK and MOSTLER (1976) ranged the strata in the Upper Viséan



1:50 000



Lithological profile of Ochtiná Formation near Sirk according to Vozárová (1980)

— Namurian A on the ground of conodonts from limestones at Ochtiná. There are two localities of Microflora at Sirk and Magnezitovce, revealed by detail palynological investigation of dark schists. The lithologically similar formations at the two localities differ in age. The psammite-pelite formation between Železník and Sirk is Upper Viséan whereas dark graphite schists at Magnezitovce contain poorly preserved palynoflora. Here I shall discuss palynological-systematical study of well

preserved Viséan palynoflora recorded in the West Carpathians for the First time.

About 25 samples were taken from the whole profile of dark schists in the cut of the road between Železník and Sirk. After the usual maceration treatment the samples mostly contained plant debris and spores indeterminate because coated with graphite. Some samples from Locality 3 (Map 1) studied in lab showed slight metamorphosis. The sporomorph assemblage was comparatively rich in species and well correlable with European Viséan microflora and Canadian Upper Mississippian microflora.

SYSTEMATICAL PART

Systematical ranging of sporomorphs is based on their morphology. Determination were done in accordance with systematical works by PLAYFORD (1963), ISCHENKO (1958), HACQUEBARD and BARS (1957), POTONIE and KREMP (1955).

Systematical Ranging of Miospores

Punctatisporites (IBR.) POTONIE, KREMP

Punctatisporites ocellatus SULLIVAN

Punctatisporites cellulosus HACQUEBARD, BARS

Punctatisporites cf. *pseudolevatus* HOFFMAN, STAPLIN, MALOY

Punctatisporites sp. BERTELSEN

Calamospora SCH. W. B.

Calamospora sp. A

Cyclogranisporites POTONIE, KREMP

Cyclogranisporites cf. *commodus* PLAYFORD

Converrucosisporites POTONIE, KREMP

Converrucosisporites parvinodus PLAYFORD

Apiculatisporites IBR.

Apiculatisporites baccatus (HOFFMAN, STAPLIN, MALOY), STAPL.

Lophotriletes (NAUMOVA) POTONIE, KREMP

Lophotriletes clavatus ISCHENKO

Dictyotriletes (NAUMOVA) POTONIE, KREMP

Dictyotriletes sp.

Zonotriletes WALTZ

Murospora SOMERS

Murospora cf. *sublobata* (WALTZ) PLAYFORD

Simonozonotriletes (NAUMOVA), POTONIE, KREMP

Simonozonotriletes cf. *triquetrus* HACQUEBARD, BARS

Anulatisporites (LOOSE) POTONIE, KREMP

Anulatisporites sp. BERTELSEN
Anulatisporites cf. *anulatus* (LOOSE) DYBOVA, JACHOWICZ
Lycospora (SCH. W. B.) POTONIE, KREMP
Lycospora torulosa HACQUEBARD
Densosporites (BERRY) emend. SCH. W. B.
Densosporites sp. B. HACQUEBARD, BARS
Densosporites sp. E
Stenozonotriletes (NAUMOVA) POTONIE
Stenozonotriletes carnosus ISCHENKO
Stenozonotriletes cycloides (ANDREJEVA) ISCHENKO
Stenozonotriletes sp. B
Cingulizonates (DYBOVA, JACHOW.) BUTT., JANS., SMITH., STAPL.
Cingulizonates sittleri DOUBIGNER, RAUCHER
Cingulizonates sp. A
Tumulispora STAPLIN JANS.
Tumulispora sp.
Saccites ERTMAN
Monosaccites (CHITALEY) DYBOVA, JACHOW.
Florinites S. W. B.
Florinites visendis n. sp.

MIOSPORES

Punctatisporites (IBR.) POTONIE, KREMP 1954
 Genotypus *Punctatisporites punctatus* (IBR.) Ibr. 1933

***Punctatisporites ocellatus* SULLIVAN 1964**

Pl. XLII, Fig. 4

Description: A trilete spore, 65 μ in average size, almost circular.

Remark: The description corresponds to that by SULLIVAN (1964). He found the species in the Drybrook sandstone in England. Its age is Upper Viséan (Seminula Zone).

Occurrence: Spores of the species are quite frequent in schists at Sirk.

***Punctatisporites cellulosus* Hacquebard — Bars 1967**

Pl. XLII, Fig. 3

Description: A trilete spore, 40 μ in average size. Irregular punctate-reticulate structure.

Remark: It corresponds to a description of Upper Mississippian specimen by HACQUEBARD and BARS (1957).

Occurrence: Abundant

***Punctatisporites nahannensis* HACQUEBARD—BARS 1957**

PL. XLII, Fig. 2

Description: A trilete round spore; 35 μ in diameter.

Remark: It corresponds to a description by HACQUEBARD and BARS (1957), only it is somewhat smaller than the specimen from the Canadian Upper Mississippian.

Occurrence: Scarce in our material.

***Punctatisporites cf. pseudolevatus* HOFFMAN, STAPLIN, MALOY, 1955**

PL. XLII, Fig. 5

Description: A trilete spore of round, slightly concave form. The Y mark extends to 1/3 of the spore body. The spore exceeds 90 μ in average size.

Remark: The structure and shape of the spore correspond to that described by BERTELSEN (1972) from Denmark with the Viséan to Namurian age diapason. In Europe the species was also described by BUTTERWORTH and WILLIAMS (1958) from Scotland. HOFFMEISTER, STAPLIN and MALOY (1955) described the Upper Mississippian species.

Occurrence: Scarce in our material.

***Punctatisporites* sp. BERTELSEN 1972**

PL. XLIV, Fig. 2

Remark: The spore description corresponds to the description (without species denomination) by BERTELSEN (1972) of a Viséan specimen from Denmark. Size: to 62 μ in average. Its structure is fine punctate. The Y mark extends to 3/4 of the spore body and is in distinct.

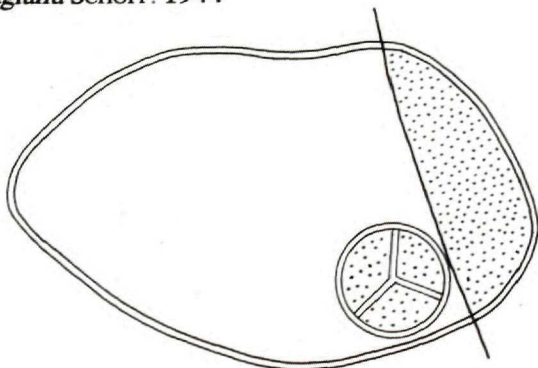
Occurrence: Abundant

***Calamospora* SCH. W. B. 1944**

Genotype *Calamospora hartugiana* SCHOPF. 1944

***Calamospora* sp. "A"**

PL. XLI, Fig. 6, Map 3



Description: A trilete spore, 52 μ in size along longitudinal axis.

Shape: round to oval.

Structure: fine granulate. The Y scar is excentric, confined with darker thickened exine cutting the rays of the Y scar. It ranges from 5 to 7 μ in size. Diameter of the central area is 15 μ .

Remark: The species resembles *Retusotriletes peperatus* PLAYFORD (1976) from the Devonian/Carboniferous boundary and from Tournai. It differs in length of rays of the Y mark and in light central body. Because of the distinct granulate structure of the exine its ranging to the genus *Calamospora* is somewhat dubious. Exines of *Calamospora* are hyaline as a rule, or fine chagrenate.

Occurrence: Frequent.

Cyclogranisporites POTONIE, KREMP 1954

Genotype *Cyclogranisporites leopoldi* (KREMP) POTONIE, KREMP 1954

Cyclogranisporites cf. *commodus* PLAYFORD 1963

PL. XLI, Fig. 5

Description: A trilete spore of round shape.

Size: 40 μ .

Exine: granulate with indistinct Y scar.

Remark: It is analogous with the Viséan specimen described from Denmark (BERTELSEN 1972).

Occurrence: Frequent in schists from Sirk.

Converrucosisporites POTONIE, KREMP 1954

Genotype *C. triquetrus* (IBR.) POTONIE, KREMP 1954

Converrucosisporites parvinodus PLAYFORD 1963

PL. XLII, Fig. 1

Description: A trilete spore of round shape.

Size: 32 μ . Y scar is thin, slightly waved, extending to 5/5 of the spore body. The structure is distinctly fine reticulate and consists of verrucate projections.

Remark: PLAYFORD (1963) described the Upper Mississippian specimen from Canada (Horton, Group).

The Viséan species from Denmark described by BERTELSEN (1972) as *Verrucosisporites nitidus* (NAUM). PLAYFORD 1963 (Pl. III, Fig. 9—10) is very similar to our specimen but differs from it, when compared with the original description by Playford 1963.

Occurrence: Scarce.

***Apiculatisporites* Ibr. 1933 sensu POT. 1960**

Genotype *Apiculatisporites spinulostriatus* (LOOSE) Ibr. 1933

***Apiculatisporites baccaus* (HOOF., STAPL., MALOY 1955) STAPLIN 1960**

PL. XLII, Fig. 6—8

Description: A trilete spore of round shape. The Y mark extends to 5/5 of the spore body.

Structure: apiculate.

Size: 30—35 μ .

Remark: STAPLIN (1960) described the Upper Mississippian and Lower Pennsylvanian species.

Occurrence: Abundant in our material.

***Lophotriletes* (NAUMOVA) POTONIE, KREMP 1954**

Genotype *Lophotriletes gibbosus* (IBR.) POTONIE, KREMP 1954

***Lophotriletes clavatus* ISCHENKO 1958**

PL. XLIII, Fig. 2

Description: A trilete spore of round shape.

Size: 90—95 μ . Distinct exine ranging from 8 to 10 μ in thickness. Projections on the exine form irregular reticulate structure. The Y mark extends to 5/5 the spore body. It is more distinct from the proximal view than from the distal.

Remark: The specimen corresponds to that, described by ISCHENKO (1958) from the upper part of the Viséan C_{1g} zone and from the lower part of the Namurian C₁⁴ zone in the western part of the Don Basin, and from Viséan sediments in the Dneper-Don depression.

Occurrence: Scarce.

***Dictyotriletes* (NAUMOVA) POTONIE, KREMP 1954**

Genotype *Dictyotriletes bireticulatus* (IBR.) POT. KREMP 1954

***Dictyotriletes* sp.**

PL. XLIII, Fig. 1

Remark: In dark schists examined only a fragment of spore preserved. It is ranged to the genus *Dictyotriletes*.

Occurrence: Scarce

Murospora SOMERS 1952

Genotype *Murospora sublobata* PLAYFORD 1963

***Murospora cf. sublobata* (WALTZ) PLAYFORD 1963**

PL. XLI, Fig. 1—2

Description: A triangular trilete spore

Size: 42 μ . The cingulum on the corners of spore is 10 μ wide; and on sides — 5 μ . The Y mark extends to the periphery of the spore body.

Remark: In its shape and size and structure of the central body the spore corresponds to *M. sublobata* (WALTZ) PLAYFORD 1963. It only differs in equal structure of the cingulum and the central body. The species occurs as a rule in the Tournai to Viséan.

Occurrence: Abundant in sediments studies.

***Simonozonotriletes* (NAUMOVA) POTONIE, KREMP 1954**

Genotype *Simonozonotriletes intortus* (WALTZ) POT., KREMP 1954

***Simonozonotriletes cf. triquetrus* HACQUEBARD, BARS, 1957**

PL. XLI, Fig. 3—4

Description: A trilete spore of rounded triangular shape.

Size: to 50 μ . The cingulum breadth: 10 μ , in corners 13 μ . The periphery is waved in contrast to smooth periphery of the specimen described. The Y mark extends to the margin of the cingulum. The structure is granulate, coarser than on the species described. The structure of the central part of the spore and of the cingulum is the same.

Remark: HACQUEBARD and BARS 1957 described the Upper Mississippian species.

Occurrence: Scarce in our material.

***Anulatisporites* (LOOSE) POTONIE, KREMP 1954**

Genotype *Anulatisporites anulatus* (LOOSE) DYBOVÁ, JACH. 1957

***Anulatisporites* sp. BERTELSEN 1972**

PL. XLV, Fig. 3

Remark: A round trilete spore resemblant to that described by BERTELSEN (1972). It differs in size ranging to only 60 μ from the described, not determinated

Viséan species from Denmark, ranging to 118 μ in size.

Occurrence: Scarce.

***Anulatisporites cf. anulatus* (LOOSE) DYB., JACH. 1957**

PL. XLV, Fig. 2; Pl. XLVI, Fig. 1, 2

Description: A trilete zonate spore.

Size: 70—80 μ .

Shape: irregular round. It differs in size from the described species ranging to only 50 μ .

Exine: 30 μ thick, dark brown. The central part of the spore is light, granulate and coarse apiculate, with distinct Y mark. The exine or cingulum is irregularly waved, sometimes segmented. The cingulum is separated from the central part of spore by a narrow light zone.

Occurrence: Abundant in sediments studied.

***Lycospora* (SCH. W. B.) POTONIE, KREMP 1954**

Genotype *Lycospora micropapillata* (WILSON and COE) SCH. W. B. 1944

***Lycospora torulosa* HACQUEBARD and BARS 1957**

PL. XLIII, Fig. 3

Remark: A triangular trilete spore resemblant to the species described by HACQUEBARD and BARS (1957) from the Mississippian.

Occurrence: Abundant in our material.

***Densosporites* (BERRY 1937) emend. SCH. W. B. 1944**

Genotype *Densosporites covensis* BERRY 1937

***Densosporites* sp. "B" HACQUEBARD BARS 1957**

PL. XLVI, Fig. 3—4

Remark: A trilete or alete spore of round irregular shape. It corresponds to the species described by HACQUEBARD and BARS (1957) in its shape, size and breadth of the cingulum. Our spores ranged to this spore are somewhat smaller — only 30—32 μ . The authors described the Mississippian species from Canada.

Occurrence: Abundant.

***Densosporites* sp. E**

PL. XLIII, Fig. 5

Description: A rounded triangular trilete spore.

Size: to 35 μ .

Central part: 15 μ . The Y mark is conspicuous and extends to the cingulum.

Remark: I could not range the species to the described species because it differs in light exine. By its shape and structure it belongs to *Densosporites*.

Occurrence: Scarce in the material studied.

***Stenozonotriletes* (NAUMOVA) POTONIE 1958**

Genotype *Stenozonotriletes conformis* NAUMOVA 1953

***Stenozonotriletes carnosus* ISCHENKO 1958**

PL. XLIV, Fig. 1

Description: A zonotrilete spore.

Size: about 65 μ .

Shape: oval to round.

Size of cingulum: 5—6 μ .

It is broad, separated by a narrow zone from the central part of the spore. The structure is chagrenate to fine reticulate.

Remark: ISCHENKO (1958) described the species as typical of the Viséan of the Dneper—Don region.

Occurrence: Frequent in our material.

***Stenozonotriletes cycloides* (ANDREJEVA/ISCHENKO 1958**

PL. XLIII, Fig. 4

Remark: A trilete spore resemblant to the species described by ISCHENKO (1958). Its size varies in comparison to the maximum spore size to 40 μ . Our species is 50 μ in diameter. The zone is 4—5 μ broad. Its structure is distinctly reticulate with small openings (about 1/2—1 μ). ISCHENKO described the Viséan species from the Dneper—Don region. BERTELSEN (1972) denoted the same species as *Stenozonotriletes* sp. (Pl. XVII, Fig. 1). It is the Viséan species from Denmark.

Occurrence: Abundant in the material studied.

***Stenozonotriletes* sp. B**

PL. XLV, Fig. 1

Description: A zonotrilete spore of round shape, with the average size 75—80 μ . The zone is lighter, about 7—8 μ in width. The central part of the spore is dark, with distinct reticulate structure.

Occurrence: Scarce on the locality studied.

***Cingulizonates* (DYB. JACH.) BUTT., JANS., SMITH et STAP. 1964**

Genotype *Cingulizonates tuberosus* DYBOVA et JACHOWICZ 1957

***Cingulizonates sittleri* DOUBINGER, RAUCHER 1966**

PL. XLIV, Fig. 3, 4

Description: Zonotrilete spore of irregular triangular shape. Size: 65—70 μ . The cingulum is dark, 10—12 μ wide. The central body is distinct, light and extends to the cingulum whose thickness is variable.

Remark: Doubinger and Raucher described the Viséan species from France.

Occurrence: Abundant in our locality.

***Cingulizonates* sp. A**

PL. XLV, Fig. 5

Description: A zonotrilete spore, up to 50 μ in size.

Shape: oval to round.

Exine: dark-brown. The central part of spore is light. The cingulum is 10 μ wide and its thickness is variable. The Y mark is thin and extends to the cingulum.

Occurrence: Abundant on the locality studied.

***Tumulispora* STAPLIN et JANSONIUS 1964**

Genotype *Tumulispora variverrucata* (PLAYF.) STAPLIN, JANS. 1964

***Tumulispora* sp.**

PL. XLIV, Fig. 5

Description: Trilete zone spore of almost round shape.

Size: about 45 μ .

Remark: The spore belongs evidently to *Tumulispora* according to its dark cingulum and large dark verrucata projections. It is poorly preserved and cannot be defined exactly.

Occurrence: Scarce.

Florinites S. W. B. 1944

Genotype *Florinites antiquus* SCHOPF. 1944

***Florinites visendis* n. sp.**

PL. XLVI, Fig. 5, Map 4

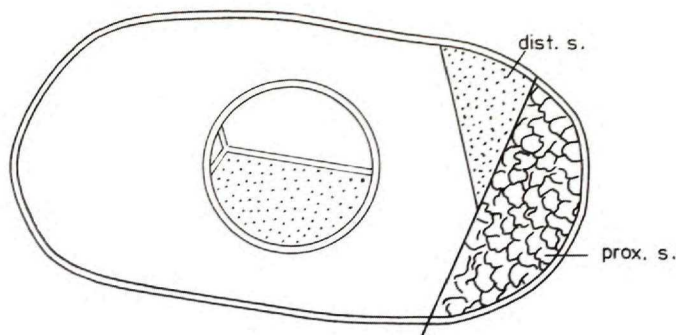
Holotype: prepar. 395, N. 15, Bratislava, D. Štúr Institute of Geology.

Type locality: Sirk in Spišsko-gemerské rudohorie.

Type level: Upper Viséan.

Denomination: According to age of sediments containing the species.

Diagnosis: Monosaccate pollen grains, $50 \times 45 \mu$ in size.



Shape: oval. Diameter of the round central body is 15μ . Structure of the air sac is distinctly granulate from the distal view and fine reticulate from the proximal view. The Y mark is indistinct.

Differential diagnosis: According to basical morphologic characters the pollen grain can be ranged among *Florinites*, especially for the body shape and for round central body. The pollen grain does not correspond to any of the described species, although its size and shape do not differ much from *Florinites antiquus* SCHOPF. There is a difference in its air sac reticulate structure.

A comparison with the genus *Schulzospora* shows that our specimen resembles *Schulzospora* sp. depicted by BUTTERWORTH and WILLIAMS 1957 (Pl. IV, Fig. 14) without description of the Viséan species from England. Our species shows a bilateral shape of the air sac and less distinct fold of the exine in comparison to the air sac.

Occurrence: Scarce in sediments studied.

Biostratigraphical — paleoecological evaluation

The above described microflora from dark schistose sediments is typical of the Upper Viséan. It follows from correlation with the Viséan flora from Danmark (BERTELSEN 1972), France (DOUBINGER—RAUCHER 1966), Scotland (SULLIVAN-

—MARSHALL 1966) and with the Upper Mississippian flora from Canada (PLAYFORD 1963). The described species may be indicative of the Late Viséan since there are already monosaccate pollen usually occurring by the end of the Lower Carboniferous and at the base of the Namurian. I still do not range the schistose sediments to the Namurian since no species typical exclusively of the Namurian did occur.

As for paleoecology, the well preserved microflora, rich in species is indicative of the nearness of the sea to dry land, i. e. short transport of spores to the locality studied. Spores of *Spermophyta* are indicative of sufficiently humid climate and climatic conditions favourable for hydrophilous vegetation on dry land. The lack of kerogen, i. e. plant debris and other organic remains show that there was not lagoonal environment but marine environment with dry land close to the locality studied.

According to literature the flora belongs to the Ordo *Filicales*, class, *Lycopside*, ? *Psilophopsida*, Family *Sigillariaceae*. Botanical range of some morphological species is unknown so far.

Conclusion

Among many samples of dark, partly graphitic schists were some whose organic content remained unaffected by thermal metamorphosis. Well preserved species proved the Upper Viséan age of schists of the Ochtiná Formation of the Dobšiná Group in the Spišsko-gemerské rudohorie. This is the first date on the age of the schistose formation and the first find of microflora in the West Carpathians.

I have defined 22 species, one of them new. They comprised marine plankton of the Acritarcha group.

The microflora is unambiguously indicative of the Upper Viséan age of the schists forming — together with basical bodies — the base of the Dobšiná Group near Sirk.

Regarding paleoecology, the warm humid climate is presumed to have existed in the time of deposition. It was favourable for hydrophilous vegetation of *Pre-ridophyte* and *Lycopside* on dry land.

The good preservation of sporomorphs proves nearness of the locality examined to dry land and favourable fossilization conditions as well as minimal influence of metamorphosis upon organic remains.

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Reviewed by P. Snopková

Prvý nález visénskej mikroflóry v gemeridách na Slovensku

Resumé anglického textu

Spracovaním veľkého množstva vzoriek sa podarilo z tmavých, miestami až grafitických bridlíc získať niekoľko takých, ktorých organický obsah nebol postihnutý tepelnými premenami. Určením dobre zachovaných druhov som zistila, že ide o vrchnovisénsky vek bridlíc ochtinského súvrstvia dobšinskej skupiny v Spišsko-gemerskom rudohorí. Tento nález mikroflóry poskytol prvý raz údaj o veku tohto bridličnatého súvrstvia a prvý nález visénskej mikroflóry z oblasti Západných Karpát.

Určila som 22 druhov, z tohto jeden nový. Prítomný bol aj morský planktón patriaci do skupiny Acritarcha. Zistila som viaceré druhy rodov *Punctatisporites*, *Calamospora*, *Cyclogranisporites*, *Converrucosporites*, *Apiculatisporites*, *Lophotriletes*, *Dictyotriletes*, *Murospora*, *Simonozonotriletes*, *Anulatisporites*, *Lycospora*, *Densosporites*, *Stenozonotriletes*, *Cingulizonates*, *Tumulispora*, *Florinites*.

Mikroflóra poukazuje jednoznačne na vrchnovisénsky vek bridlíc, ktoré s základnými telesami tvoria bázu dobšinskej skupiny pri Sirkú.

Z paleoekologického hľadiska usudzujeme na teplú vlhkú klímu v období sedimentácie, ktorá vytvorila dobré podmienky pre rozvoj vlhkomilnej papradovitej a plavúňovitej vegetácie na suchej zemi.

Zachovanosť spórormf poukazuje na blízkosť skúmanej lokality k suchej zemi, ako aj dobré fosilizačné podmienky a minimálny vplyv metamorfózy na organické zvyšky.

Explanations to plates XLI—XLVI

Plate XLI

- 1—2 *Murospora* cf. *sublobata* (WALTZ) PLAYF. 1962
- 3—4 *Simonozonotriletes* cf. *triquetrus* HACQUEBARD, BARS 1957
- 5 *Cyclogranisporites* cf. *commodus* PLAYFORD 1963
- 6 *Calamospora* sp. "A"

Plate XLII

- 1 *Converrucosporites parvinodus* PLAYFORD 1963
- 2 *Punctatisporites nahannensis* HACQUEBARD, BARS 1957
- 3 *Punctatisporites cellulosus* HACQUEBARD, BARS 1957
- 4 *Punctatisporites ocellatus*, SULLIVAN 1964
- 5 *Punctatisporites* cf. *pseudolevatus* HOFFMAN, STAPLIN, MALOY 1955
- 6—8 *Apiculatisporites baccatus* (HOFFMAN, STAPLIN, MALOY 1955) STAPLIN 1960

Plate XLIII

- 1 *Dictyotriletes* sp.
- 2 *Lophotriletes clavatus* ISCHENKO 1958
- 3 *Lycospora torulosa* HACQUEBARD 1957
- 4 *Stenozonotriletes cycloides* (ANDREJEVA), ISCHENKO 1958
- 5 *Densosporites* sp. E

Plate XLIV

- 1 *Stenozonotriletes carnosus* ISCHENKO 1958
- 2 *Punctatisporites* sp. BERTELSEN 1972
- 3—4 *Cingulizonates sittleri* DOUBINGER, RAUCHER 1966
- 5 *Tumulispora* sp.

Plate XLV

- 1 *Stenozonotriletes* sp. "B"
- 2 *Anulatisporites* cf. *anulatus* (LOOSE) DYB., JACH. 1957
- 3 *Anulatisporites* sp. BERTELSEN 1972
- 4 *Densosporites* sp.
- 5 *Cingulizonates* sp. "A"

Plate XLVI

- 1—2 *Anulatisporites* cf. *anulatus* (LOOSE) DYB., JACH. 1957
- 3—4 *Densosporites* sp. "B" HACQUEBARD, BARS 1957
- 5 *Florinites visendis* n. sp.
- 6—8 *Acritarcha* indet.

(all photographs are magnified 1000×)

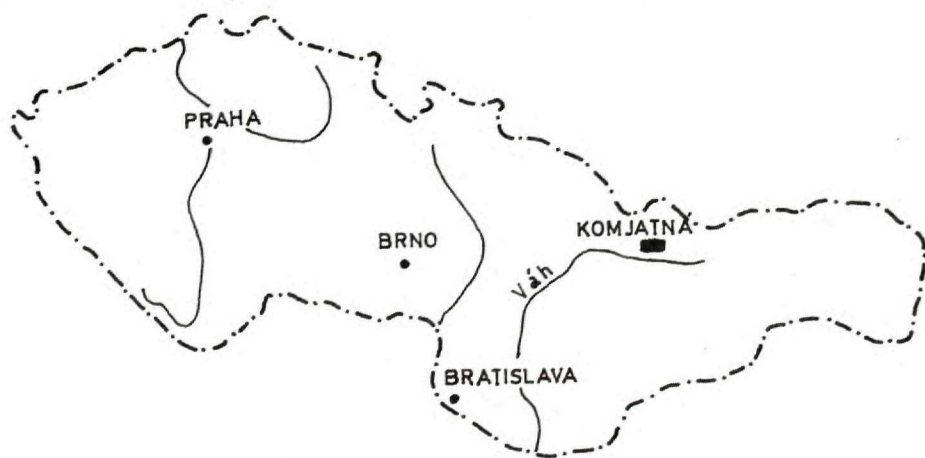
Paulína Snopková—Mária Peterčáková

**Periporopollenites komjatensis —
a new Upper Eocene species from Oravská vrchovina Mts.**

1 text-fig., 1 pl. (XLVII), Slovak summary

Abstract. Described is a new species *Periporopollenites komjatensis* from the rocks of claystone lithofacies of the Oravská vrchovina Mts.

Palynological investigations of the Paleogene of the Oravská vrchovina Mts. (sheet Kraľovany) revealed- in a sample taken north of the village Komjatná (documentation point 52 M — claystone lithofacies) in an Upper Eocene microfloral assemblage — a pollen grain undefined in the existing literature. Basing upon morphological characters of the exine the pollen grain is ranged to the genus *Periporopollenites* and described as the new species *Periporopollenites komjatensis*. Geological conditions of the locality Komjatná are described in detail by M. PETERČÁKOVÁ (1981).



Sketch-map of locality Komjatná (*Periporopollenites komjatensis* nov. sp.)

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Periporopollenites Thomson et Pflug, 1953 emend Krutzsch, 1966
Type species *Periporopollenites stigmatosus* Potonie

***Periporopollenites komjatensis* nov. sp.**

Holotype: prepar. 1, cross table (23,7) (98,7), loc. Komjatná, docum. point 52 M.

Denomination: after the loc. Komjatná.

Type locality: Oravská vrchovina Mts., north of Komjatná, Central-Carpathian Paleogene, claystone lithofacies.

Type level: Priabonian.

Diagnosis: Round pollen grains; 18 μ in size, liquidambar type. Characteristic is a triangular pore in the centre of the exine.

Description: The pollen grain is round. Pores (5) are distinctly fringed. Four of them are subequatorial, round, ranging from 2 to 4 μ in size. The fifth pore is larger (6 μ) triangular, situated in the centre. The exine surface is covered with tight granules.

Remark: In its shape, pore arrangement and sculpture elements the described species reminds of pollen grains of the liquidambar type. It is, however, smaller, with a triangular pore in the centre of the exine.

Occurrence: Scarce in the claystone lithofacies.

Botanical range: cf. *Hamamelidaceae*.

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P. Snopková—M. Peterčáková

***Periporopollenites komjatensis* — nový druh z vrchného eocénu Oravskej vrchoviny**

Resumé anglického textu

Pri palinologickom výskume paleogénu Oravskej vrchoviny sme zistili vo vrchnom eocéne — ílovcová litofácia (vzorka 52M, list Kľačany) na lokalite Komjatná, nový taxón, ktorý doteraz nebol v literatúre opísaný.

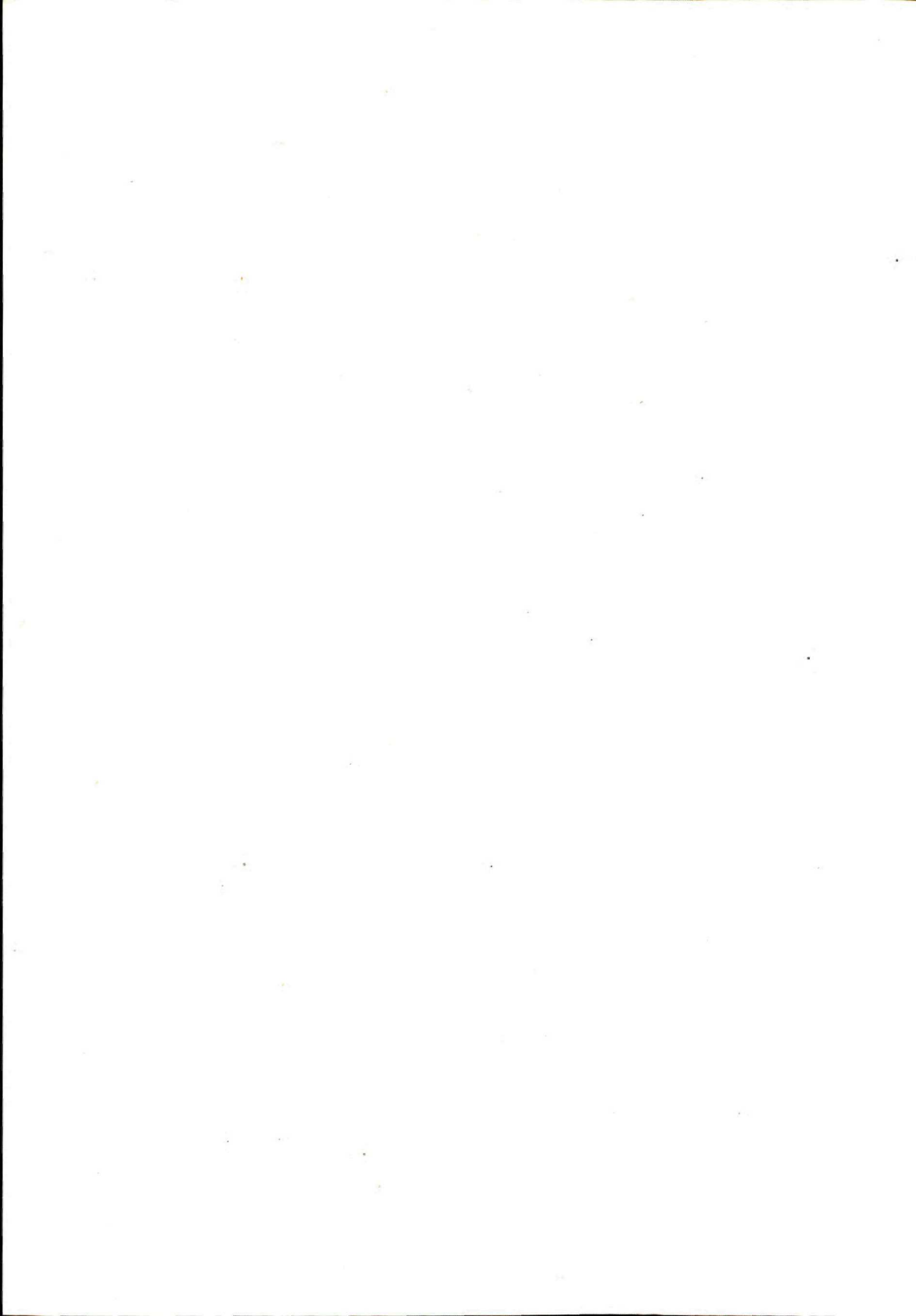
Podľa morfológických znakov exiny zodpovedá peľovým znám liquidambarovitého typu. Preto sme nový taxón zaradili k rodu *Periporopollenites* a pomenovali ako *P. komjatensis* nov. sp.

Nový taxón sa vyskytol v asociácii druhov *Cupuliferoipollenites oviformis* (R. POT.) R. POT., *Tricolporopollenites microhenrici* (R. POT.) W. KR., *Polycolporopollenites* sp., *Caryapollenites simplex* (R. POT.) R. POT., *Triatriopollenites bituites* (R. POT.) TH. et PF., *Alnipollenites verus* (R. POT.) a pod. (porov. M. PETERČÁKOVÁ 1981).

Explanations of plate XLVII

- 1—4 *Periporopollenites komjatensis*, Priabonian, Komjatná — claystone lithofacies, magn. 1000×.
- 5—10 *Periporopollenites komjatensis*, Priabonian, Komjatná — claystone lithofacies, magn. 2000×.
- 5—8 detail of structure and pores
- 9—10 detail of pores

Rewieved by E. Planderová



Paulína Snopková—Ondrej Samuel

**Pentagonium obidum nov. gen. et nov. sp. (incertae sedis)
from the Upper Eocene of the West Carpathians
(the Podunajská nížina lowland)**

1 text-figs., 3 pls. (XLVIII—L), Slovak Summary

Abstract. A new taxon *Pentagonium obidum* nov. gen. et nov. sp. of uncertain systematic position is described from the Upper Eocene of the West Carpathians (the eastern part of the Podunajská nížina lowland).

The study of microplankton from the Paleogene of the West Carpathians revealed a new, so far undefined taxon in the Upper Eocene of the eastern part of the Podunajská nížina lowland (the Buda Paleogene in the sense of D. ANDRUSOV 1965). The new taxon appeared in the assemblage of species *Thalasiphora pelagica* (EISENACK) GOCHT, *Preurozonaria concinna* (COOKSON et MANUM) MÄDLER, *P. cooksoni* (KRIVÁNNÉ—HUTTER) SNOPKOVÁ et SAMUEL, *P. minor* (KRIVÁNNÉ—HUTTER) RAKOSI, *P. kedvesi* SNOPKOVÁ et SAMUEL and *P. fusani* SNOPKOVÁ—SAMUEL. Detail biostratigraphical characteristic of sediments in the studied area was presented by O. SAMUEL—M. VAŇOVÁ (1967), O. SAMUEL—J. SALAJ (1968), P. SNOPKOVÁ—O. SAMUEL (1981).



Sketch map of locality Obid (*Pentagonium obidum* nov. sp.)

RNDr. P. SNOPKOVÁ, CSc., RNDr. O. SAMUEL, DrSc., Geologický ústav Dionýza Štúra, Mlynská dolina 1, Bratislava.

Pentagonium nov. gen.

Denomination: according to pentagonal shape of the described taxon.

Diagnosis: A pentagonal body with five short ($1-2\ \mu$) knobs. The surface is fine granulate. A globular element (? archeopyle) is granulate as well. Six folds of variable size come out of it.

Type genus *Pentagonium obidum* n. sp.

Pl. XLVIII, fig. 1, 2, 3, Pl. XLIX, Fig. 1, 2, Pl. L, Fig. 1

Holotype: The species described and depicted in Pl. XLVIII, Fig. 1, 3, Pl. XLIX, Fig. 1—2, and Pl. L, Fig. 1 is in the preparation 1; cross table ($116.8; 46.9$) in the D. Štúr Institute of Geology.

Denomination: after the loc. Obid where the taxon was found.

Type locality: eastern part of the Podunajská nížina (Danube lowland); bore hole Obid-6, 335.0 m — marls and marly sandstones.

Type level: Priabonian, the Buda Paleogene.

Diagnosis: the same as genus diagnosis.

Description: Pentagonal body with short knobs in the corners due to thinning of film. Size of the body: $30 \times 40\ \mu$. The knobs range from $1-2\ \mu$ in size. Sometimes they look as pores (Pl. L, Fig. 1). The surface of the body is distinctly granulate. On the distal part of the body is the characteristic globular element (size: $10\ \mu$) corresponding most likely to archeopyle like in Dinoflagellata. There are smaller apertures on the surface of the body too (size: $1-4\ \mu$, Pl. L, Fig. 1). The globular element is surrounded by folds. Some of them remind of undivided projections like in hystrichospheres.

Remark: In its shape the new genus and species described correspond to the type depicted by E. SONTAG (1966) as Planctonites fsp. 11 from the "Niederlausitzer Flözhorizont". Its surface is smooth, without the distinct globular element present on the new taxon.

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P. Snopková—O. Samuel

**Pentagonium obidum nový rod a nový druh (incertae sedis) z vrchného eocénu
Západných Karpát
(oblasť Podunajskej nížiny)**

Resumé

Pri štúdiu mikroplanktónu (P. SNOPKOVÁ—O. SAMUEL) z paleogénnych sedimentov sme zistili vo vrchnom eocéne budinského (neflyšového) vývoja východnej časti Podunajskej nížiny (vrt Obid 6) nový taxón neistého systematického postavenia (incertae sedis). Pomenovali sme ho ako *Pentagonium obidum* nov. gen. et nov. sp. Podľa morfológických znakov najväčšiu afinitu má s formou, ktorú uvádza E. SONTAG (1966) ako *Planctonites* fsp. 11 z „Niederlausitzer Flözhorizontu“. Vyskytuje sa v populácii druhov *Thalasiphora pelagica* (EISENACK) GOCHT, *Pleurozonaria concinni* (COOKSON et MANUM) MÄDLER, *P. cooksoni* (KRIVANNÉ—HUTTER) SNOPKOVÁ et SAMUEL, *P. minor* (KRIVANNÉ—HUTTER) RAKOSI, *P. kedvesi* SNOPKOVÁ et SAMUEL, *P. fusani* SNOPKOVÁ et SAMUEL (porov. P. SNOPKOVÁ — O. SAMUEL 1981).

Explanations of plates XLVIII—L

Plate XLVIII

- 1—2 *Pentagonium obidum* nov. sp., magn. 1000×.
3 *Pentagonium obidum*, detail of globular element, magnif. 4000×.

Plate XLIX

- 1—2 *Pentagonium obidum* nov. sp., magn. 2000×, detail of sculpture of the body surface.

Plate L

- 1 *Pentagonium obidum* nov. sp. magn. 4000×, detail of knobs and sculpture element.

Reviewed by E. Pländerová



Milan Mišík

Recentné onkolity (riasové hľuzky) z potokov Malých Karpát

2 obr. v texte, 4 fotogr. tab. (LI—LIV), anglické resumé

Abstract. Holocene and recent oncolites formed by cyanophytes in the uppermost parts of brooks flowing from calciumcarbonate springs are described. The oncolites range to 5 cm in size and the SS-C type is dominant. Their shape is controlled by the core (debris fragments, fragments of sinter crust, tiny twigs, freshwater gastropods).

Úvod

Onkolity predstavujú vlastne špeciálny prípad stromatolitov (stromatolity typu SS = sphaeroidal structure v označovaní B. W. LOGANA et al. 1964). Termín onkolit zaviedol J. PÍLA (1927). Ide o koncentrické, najčastejšie elipsoidné a guľovité útvary až niekoľko cm veľké, z CaCO_3 ukladaného za spoluúčasti siníc a rias okolo jadra pohybovaného po dne. Na rozdiel od iných typov riasových hľuziek, napr. rhodolitov (hľuzky vytvárané koncentrickým obrastaním červených rias), sa na tvorbe onkolitov podieľajú neskelatálne zelené riasy, najmä sinice (*Cyanophyta*). Koncentrická štruktúra onkolitov vzniká mechanickým prilepovaním jemného vápneného detritu na slizovitý povrch cyanofytových povlakov — podušíek a tiež biochemickým vyžrážaním CaCO_3 , pretože sinice odoberajú z vody CO_2 . V sladkovodných onkolitoch prevláda biochemické vyžrážanie nad mechanickým prichycovaním.

Od onkolitov treba rozlišovať pizolity a jaskynné perly patriace medzi speleotémy. Tvarom sú podobné onkolitom, vznikajú však takmer výhradne anorganickou cestou; na rozdiel od onkolitov sa vyznačujú oveľa pravidelnejšou koncentrickou stavbou a prítomnosťou radiálno-lúčovitej štruktúry.

Keďže sa onkolity vyskytujú v morských aj sladkovodných faciách, nemôžu slúžiť na rozlišovanie vápencov sladkovodného a morského pôvodu. Sú však zreteľným príznakom plytkovodnosti (z morských facií sú najpríznačnejšie pre sublitorál) a energeticky bohatého prostredia (vlnenie alebo prúdenie dostatočne silné na pohybovanie onkolitov po dne).

Vo vápencoch morského pôvodu v mezozoiku Západných Karpát, sú onkolity miestami významnou zložkou a to v strednotriasových vápencoch najmä wetter-

steinskej fácie (napr. R. KUŠIK 1972), ďalej v réte a liase tatrika (girvanelové hľuzky — A. SCHALEKOVÁ 1959, A. RADWAŃSKI 1968). V hetanžu-sinemúre krížnanskej jednotky Veľkej Fatry a Nízkych Tatier boli opísané tzv. cyanofytové vápence, zložené (pod 2 mm), najmä z mikroonkolitov a z drobných onkolitov (do 4 mm), (M. MIŠÍK 1964). Rovnako v malme vysokotatranskej jednotky vystupujú mikroonkolitové vápence, predtým označované ako pseudoolitické (J. LEFELD 1968). Onkolity až cm veľkosti sú známe z malmu flyšového pásma pri Mikulove (hľuzky s *Girvanella* a *Marinella* — D. ANDRUSOV 1950), z valúnov plytkovodného malmu silickej jednotky (M. MIŠÍK—M. SÝKORA 1980), z malmu pieninskej kordiliery a ojedinele aj zo strednokriedových zlepcov pieninskej kordiliery, kde valúniky tvoria jadrá onkolitov (M. MIŠÍK—M. SÝKORA 1981, str. 51, 72, tab. XXVI, obr. 2).

Sladkovodné onkolitové vápence vrchnej kriedy sú známe zo Stratenskej hornatiny od Betlanoviec a z valúnov v senónskych zlepcoch od Dobšinskej ľadovej jaskyne (M. MIŠÍK—M. SÝKORA 1980). Sladkovodný pôvod pripisujeme aj typickému onkolitovému vápencu, ktorý opísal J. HANAČEK (1956) pod názvom schizofytový vápenec z Čachtického pohoria; predpokladám, že je senónskeho alebo egerského veku.

Recentné onkolity neboli doteraz zo Slovenska známe; zasluhujú si zmienku ako zaujímavý prípad karbonátovej sedimentácie. Analogický výskyt recentných onkolitov z poľskej časti Vysokých Tatier z potoka Lejowej doliny opísal J. GLAZEK (1965).

Opis výskytov

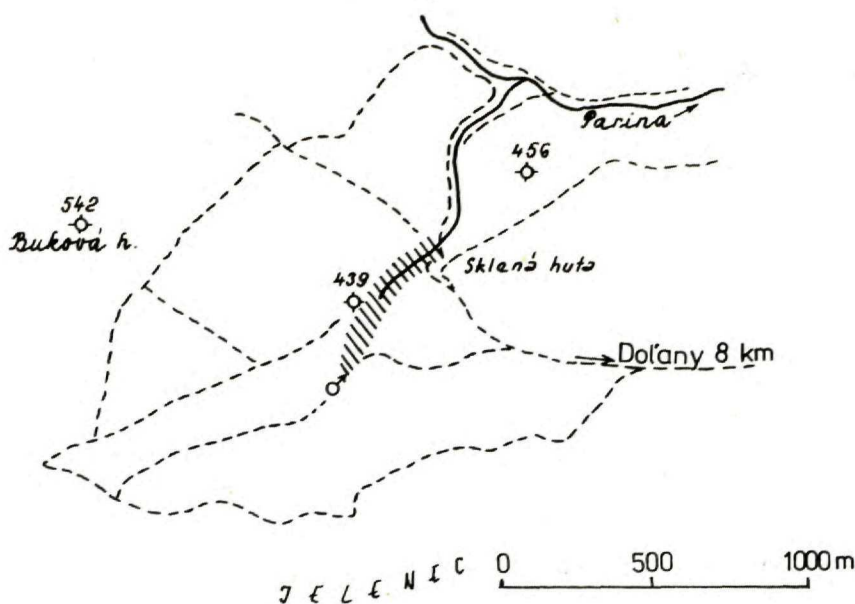
V Malých Karpatoch sa zatiaľ podarilo nájsť recentné onkolity v najvyšších častiach potokov na troch lokalitách: Sklená huta, pod Devínskou Kobylou a nad obcou Kuchyňa. Ďalej sa našli na dvoch lokalitách pod kaskádami v nižších častiach toku.

1. Sklená huta, 8 km západne od Dolných Orešian (obr. 1)

Rozsiahly výskyt nespevnených vápnitých sedimentov, sypkých penovcov v klasifikácii J. LOŽEKA (1973), tvorených takmer výhradne voľnými onkolitmi, sa nachádza pri niekdajšej horárni Sklená huta. Prístup je cestou od Dolian (asi 8 km szs. smerom) alebo od Sološnice (asi 7 km vjv. smerom). Penovce tvoria výstielku rozsiahlej depresie na albe tatrika pokrytej lúkami na ploche najmenej 10 000 m². Pri výkope na vodovodné potrubie roku 1975 bolo vidieť, že ich hrúbka presahuje 2 až 3 m. Celkovú kubatúru týchto holocénných nespevnených vápnitých sedimentov možno odhadnúť nad 20 000 m³. Spomenuté ložisko sa nenachádza v súpise ložísk kvartérnych vápencov ČSSR, zhotovených J. KOVANDOM (1971).

Priemerná veľkosť onkolitov je 2—3 cm, maximálna 5 cm. Prevládajú elipsoidné a nepravidelné tvary, zriedkavé sú diskovité a valčekovité onkolity (tab. LI obr. 1, 2; tab. LIV obr. 1). Ich povrch je zväčša hladký, po navetrávaní v pôdnom profile sa stáva jemne bradavičnatý. Sčasti ide o zložené onkolity s dvojítm (tab. LIII obr. 1) alebo aj viacnásobným jadrom. Štruktúra je koncentrická, jednotlivé prírastkové vrstvičky sú nepravidelne zvlnené a často vyklíňujú. Vo výbruse pri väčších zväčšeniach vidno stopy vláken siníc (tab. LII obr. 2) radiálne orientovaných,

zhruba kolmo k povrchu onkolitu. J. KOMÁREK (Třeboň) zistil v nich *Schizotrix calcicola* (AGARDH), *Pleurocapsa fluviatilis* LAGERH. a chlorobaktérie; za určenie mu vyslovujem touto cestou vďaku.



Obr. 1 Schematický náčrt lokality Sklená huta, 8 km západne od obce Dolné Orešany

Genéza onkolitov je zrejme viazaná na prameň „Adamová“ s vodou kalcium-bikarbonátového typu, ktorý vyviera na hornom konci lúky, hydrologické údaje o ňom mu poskytol J. KULLMAN. Výdatnosť prameňa meraná HMÚ v týždenných intervaloch v rokoch 1957—1960 kolísala v rozmedzí 9,6—71,5 l.s⁻¹. Kontrolné meranie, ktoré vykonali pracovníci GÚDŠ dňa 18. 8. 1963 malo hodnotu 26,0 l.s⁻¹. Teplota vody 8 °C je stála. Chemickú analýzu vyhotovil S. GAZDA. Dátum odberu: 23. 7. 1974 o 10,45 hod., teplota vody 8 °C, teplota vzduchu 14,3 °C. Celková mineralizácia 484,3 mg/l. Alkalita na metyloranž 5,30 m val/l, na fenolftalein 0,00. Acidita m val/l 0,50. Viazaný CO₂ mg/l — 116,60 (tvrdosť prechodná 14,84°n, stála 2,44°n, celková 17,28°n, vápenatá 12,35°n, horečnatá 4,93°n). Voľný CO₂ 22,0 mg/l, rovnovážny CO₂ 42,30 mg/l. Agresívny CO₂ neprítomný. SiO₂ (kyslíčnik kremičitý, kolor.) 6,25 mg/l. Sírovodík negatívny.

Semikvantitatívna spektrálna analýza z odparku:

nad 1	1—0,1	0,1—0,01	0,01—0,001	0,001—0,0001
Ca, Si, Mg	Al	B, Na, Sr	Fe, Zr, Ti, K	Li, Cu, Ba

Chemická analýza:

mg/l		mg/l	
Li ⁺	0,07	Cl ⁻	4,61
Na ⁺	0,90	Br	—
K ⁺	1,00	J	—
NH ₄ ⁺	0,00	F	—
Mg ⁺²	21,40	H ₂ S	—
Ca ⁺²	88,38	NO ₂	0,00
Sr ⁺²	0,17	NO ₃	0,20
Mn ⁺²	0,00	SO ₄ ⁻²	37,85
Fe ⁺²	0,00	HPO ₄ ⁻²	stopy
Al ⁺³	—	H ₂ SO ₄	—
Zn ⁺²	0,0296	HCO ₃	323,41
Cu	0,0024	CO ₃	0,00
spolu	111,95	spolu	336,07

Čiastočnú chemickú analýzu onkolitov vykonala J. POLAKOVIČOVÁ roku 1975: CaO — 53,20 %, Fe₂O₃ — 0,53 %, nerozpustný zvyšok 0,90 %, z toho SiO₂ 0,62 %. V kvalitatívnej spektrálnej analýze onkolitov bolo zistené v ppm: Ba — 49; Co — st.; Cr — 2,1; Cu — 4,1; Mn — 72; Ni — 1,7; Pb — 2,8; Sr — 123; Ti — 40; V — 17,0; Zr — st. Výsledky nedávajú dostatočný podklad na porovnávanie prípadného obohacovania onkolitov o niektoré chemické prvky s odparkom vody v dôsledku činnosti organizmov. Obohatenie o Fe a Mn je zapríčinené skôr diagenetickými procesmi. Pre zaujímavosť uvádzame, že G. MÜLLER (1968) zistil v onkolitoch z jazera Constance (Gnadensee NSR) vysoký obsah stroncia 832 ppm (priemer z 21 vzoriek), čo bolo však zapríčinené hlavne vysokým obsahom Sr vo vode tohto jazera — 0,42 mg/l. V nami skúmanom výskyte na lokalite Sklená huta pri obsahu Sr — 0,17 mg/l vo vode bolo v onkolite zistené 123 ppm Sr.

Tvorba onkolitov prebieha v potoku v prvých 200—300 m od prameňa. Prameň je v súčasnosti už zachytený.

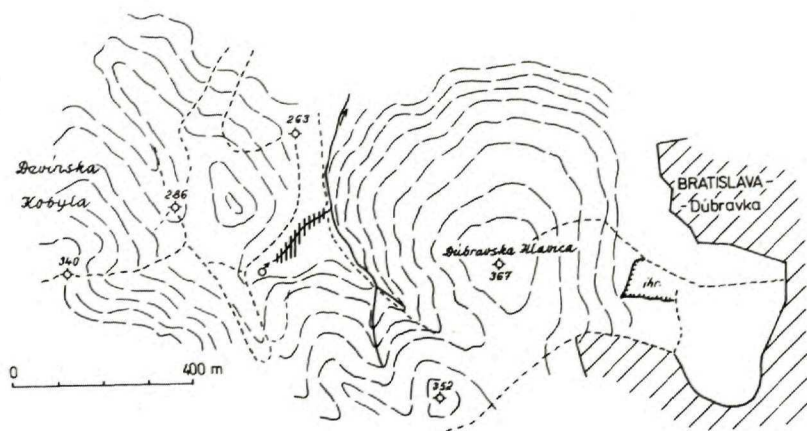
2. Západný svah Devínskej Kobyly, v údolí 1 km západne od sídliska Dúbravka — Bratislava (obr. 2). Malý prameň (v období sucha pod 11.s⁻¹) vyviera na rozhraní neogénnych vápencov a kryštalinika. V potôčiku, ktorý z neho vyteká barinatým terénom, možno sledovať v úseku asi 200 m recentnú tvorbu onkolitov (tab. LIII obr. 1). Na tejto lokalite prevládajú onkolity valčekovitého tvaru (tab. LIII obr. 2), keďže ich jadrá tvoria drobné úlomky konárikov. Menšia časť onkolitov má platničkovitý tvar (obrástanie okolo úlomkov kôry) a približne guľovitý tvar (jadro tvoria ulity gastropódov a iné izometrické objekty). Guľovité a nepravidelné onkolity dosahujú veľkosť 2,5 cm, tenké valčekovité onkolity dosahujú dĺžku až 5 cm. Na tejto lokalite by bolo možné sledovať rýchlosť rastu onkolitov avšak musela by sa použiť taká značkovacia látka, ktorá by neovplyvňovala rast siníc.

3. Kuchyňa, 900 m vsv. od obce. Potok pretekajúci lúkou eroduje nánosy silne hlinitého penovca s onkolitmi zväčša nepravidelného tvaru, pretože ich jadrá tvoria

ostrohranné úlomky vápencov gutensteinského typu (tab. LIV obr. 2). Onkolity dosahujú veľkosť 4 cm. V zárezoch v spodnej časti lúky vzdialených od seba asi 250 m bolo vidno, že hrúbka nespevneného, silne hlinitého onkolitového penovca presahuje 0,5 m.

4. V potoku 1,5 km od vrchu Vysoká a 2,5 km od vrchu Vajarská (obec Rohožník) vyskytujú sa tiež nahromadenia onkolitov.

5. Holbagrunty — najväčšie ložisko penovcov v Malých karpatoch, opísané V. LOŽEKOM (1960) v dvoch susedných údoliach 1100 m a 1400 m od vrchola Bukovej (kataster obce Sološnica), tvorené je v značnej miere onkolitmi. Ložisko sa skladá z viacerých kaskád. V. Ložek odhadol jeho kubatúru na 250 000 m³ a uvádza z penovcov holocénnu malakofaunu.



Obr. 2 Schematický náčrt lokality na západnom svahu Devínskej Kobyly v údolí 1 km západne od štvrte Dúbravka, Bratislava

Porovnanie

Na rozdiel od onkolitov morského pôvodu bývajú onkolity sladkovodných sedimentov skúmané oveľa zriedkavejšie a aj to takmer výlučne z fosílnych sedimentov. Spomeniem iba niektoré. P. FREYTET—J. C. PLAZIAT (1965) ich skúmal z kontinentálnej vrchnej kriedy a z eocénu južného Francúzska. Podľa nich sú pre riečne korytá typické onkolity, ktorých jadrá tvoria hlavne valúny a ulity; v pokojnejších periférnych častiach koryt a na okrajoch jazier sú hlavne valčekovité onkolity, ktorých jadrá tvoria konáriky. Rovnako P. ANADON—I. ZAMARREÑO (1979) uvádzajú z kontinentálneho paleogénu panvy Ebro valčekovité onkolity ako typické pre barinné oblasti a aluviálne kužele. Z uvedených lokalít sú valčekovité onkolity typické pre lokalitu pod Devínskou Kobylou pre barinné, husto zalesnené prostredie.

M. SCHÖTTLER—G. MÜLLER (1968) detailne opisujú recentné onkolity z litorálnych sedimentov jazera Constance (Gnadensee, NSR), kde ich už roku 1911 zistil E. BAUMANN. Onkolity dosahujú veľkosť 2,5 cm, sú diskovité, zriedkavejšie guľaté.

Z recentných potokov a riek sú len ojedinelé zmienky o výskytoch onkolitov. J. GLÁZEK (1965) ich uvádza z Poľska a Vietnamu (v uvedenej práci sú citované aj niektoré staršie práce o nálezoch z územia Francúzska a USA). Onkolity, ktoré opisuje z Vysokých Tatier, sú nepravidelných, netypických tvarov, obvykle sploštené; guľaté formy celkom chýbajú. Povrch je pokrytý výrastkami. Priemerná veľkosť je 3—5 cm (max. 10 cm). Majú zelenú farbu, na rozdiel od mnou opísaných lokalít, kde sa nachádzajú výhradne biele a žltkasté onkolity.

Súhrn

V pramennej časti troch potokov v Malých Karpatoch (obvykle v úseku do 200 m od prameňa s kalciovo-bikarbonátovým typom vody) boli zaznamenané akumulácie holocénnych a taktiež recentných onkolitov maximálnej veľkosti do 5 cm. Tento karbonátový sediment, zložený hlavne z voľných onkolitov, možno označovať ako sypké penovce v klasifikácii V. LOŽEKA (1973). Onkolity v zmysle klasifikácie W. LOGANA et al. (1964) patria typu SS-C = „concentrically stacked spheroids“.

Na jednotlivých lokalitách z potokov Malých Karpát prevládajú buď elipsoidné, valčekovité alebo nepravidelné tvary. Tvar je diktovaný jadrom, ktoré predstavujú ostrohranné úlomky hornín, konárikov, zriedkavo ulity gastropódov. Časť onkolitov je dutá (vyhnutie úlomku konárika v jadre). V niektorých onkolitoch je jadro bezštruktúrne, silne pórovité, z uhličitanu vápenatého. Časť onkolitov je zložitá, pozostávajúca z viacerých jadier. Prevažujú onkolity s hladkým povrchom; zriedkavejšie sú pokryté drobnými bradavičkami. Na výbrusoch štyroch onkolitov bolo možné odhadnúť 3—6 najvýraznejších koncentrických vrstvičiek (pravdepodobne ročných prírastkov). Hrúbka týchto lamín prvého rádu sa pohybovala okolo 0,3—0,8 mm. Koncentrické vrstvičky druhého rádu nebývajú dostatočne zreteľné; v rámci jedného azda ročného (sezónneho) prstenca sa dalo napočítať maximálne 14 vrstvičiek druhého rádu.

Poznámka: Keďže v skutočnosti väčšina onkolitov nie je sférického — guľovitého tvaru, navrhol M. SZULCZEWSKI (1966) odôvodnene zmeniť symbol SS = spheroidal structure na DS = detached structure; termín sa však neujal.

Ako pôvodcov sladkovodných fosílnych onkolitov z výskytov vo Francúzsku J. FREYTET—J. C. PLAZIAT (1965) uvádzajú sinicu *Rivularia hematites* (D. C.) Ag. Onkolity z potoka Lejowej doliny v poľskej časti Tatier vytvára *Plectonema tomasinianum* (KUETZ) BORN. V nami skúmaných onkolitoch z Malých Karpát je to *Schizotrix calcicola* (AGARDH) podľa určenia J. KOMÁRKA.

Do tlače odporučila A. Schaleková

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Recent oncolites (algal nodules) from brooks in the Malé Karpaty Mts.

Summary

In the Czechoslovak part of the Carpathians we have only known marine oncolites from the Middle Trias, Rhaetian, Lias and Malmian of various tectonic units, and freshwater oncolites from Senonian limestones (for authors quoted see the Slovak text). Here I describe occurrences of Holocene and recent oncolites from brooks in the Malé Karpaty Mts. (usually in the uppermost part to 300 m from the spring, sometimes on cascades, distant from the spring). There are several localities with oncolites as a dominant component of loose travertines (occurrences in tens of thousand m³).

The oncolites are white and yellowish, ranging to 5 cm in size. The form of the oncolites is controlled by the core composition: rock fragments from debris cause irregular forms; tiny twigs cause strongly elongated ellipsoid and cylindrical forms, fragments of sinter crusts — discoid form (Pl. LI—LIV). Well developed oncolites usually belong to the SS-C type in accordance with B. W. LOGAN'S et al. (1964) classification. The oncolites are formed by *Schizotrix calcicola* (AGARDH) and other cyanophytes so far undetermined precisely. Channels after cyanophyte fibres may also be traced in thin-sections (Pl. LII, Photo 2). There are usually 3—6 distinct concentric laminae ranging from about 0,3 to 0,8 mm in thickness (seasonal growth laminae?). Within the first order laminae there were at most 14 second order laminae visible. The genesis of oncolites is associated with calcium bicarbonate waters. At the Sr concentration 0,17 mg/l there were 123 ppm of Sr in an oncolite. Recent freshwater oncolites are more frequently found in lakes (M. SCHÖTTE—G. MÜLLER, 1968; J. R. EGGLESTON—W. E. DEAN, 1976). They are infrequent in brooks and rivers (J. GLÁZEK, 1965 from Poland and Vietnam) as is the case described here.

Translation: E. Jassingerová

Explanations of photographic plates

Pl LI

Fig. 1 Loose travertines composed of oncolites. Holocene sediments near Sklená huta, Malé Karpaty Mts. Photo: M. Mišík.

Fig. 2 Locally bound oncolites. As above. Minimized. Photo: L. Osvald.

Pl LII

Fig. 1 Subrecent oncolite, Sklená huta. Thin section, magn. 5×.

Fig. 2 *Cyanophyta* fibres relict, approt. radial-oriented. As above. Magn. 136×. Photo: L. Osvald.

Pl LIII

Fig. 1 Recent creation of oncolites in a brook on the western slope of Devínska Kobyla near Bratislava. Photo: M. Mišík.

Fig. 2 On the locality Devínska Kobyla cylindrical oncolites dominate. Their cores consist of small twig fragments. Natural size.

Fig. 3 Thin section of recent oncolite from a locality below Devínska Kobyla. Magn. 4,5×. Photo: L. Osvald.

Pl. LIV

Fig. 1 Oncolites — *Cyanophyta* nodules from the locality Sklená huta. Minimized.

Fig. 2 On the left: oncolite of irregular shape. Its core consists of Guttenstein limestone fragment from

debris. On the right: strongly elongated oncolite with a void in its centre (its core consisted of a twig which decomposed). Kuchyňa, 900 m ENE from the village Malé Karpaty Mts. Polished sections; magn. 1,6. Photo: L. Osvald.

Text-figures:

Fig. 1 Schematic sketch of the locality Sklená huta, 8 km W of the village Dolné Orešany.

Fig. 2 Schematic sketch of the locality on the western slope of Devínska Kobyla in a valley 1 km W of Dúbravka, Bratislava.

Vysvetlivky k fotografickým tabuľkám I—IV

Tab. LI

Obr. 1 Sypké penovce zložené z onkolitov. Holocénne sedimenty pri Sklenej huti, Malé Karpaty. Foto: M. Mišík.

Obr. 2 Lokálne stmelené onkolity. Ako v predošlom, mierne zmenšené. Foto: L. Osvald.

Tab. LII

Obr. 1 Subrecentný onkolit, Sklená huta. Výbrus, zväčšenie 5 ×.

Obr. 2 Relikty cyanofytových vlákien orientované zhruba radiálne. Ako v predošlom. Zväčšenie 136 ×. Foto: L. Osvald.

Tab. LIII

Obr. 1 Recentná tvorba onkolitov v potoku na západnom svahu Devínskej Kobyly pri Bratislave. Foto: M. Mišík.

Obr. 2 Na lokalite Devínska Kobyla prevládajú valčekovité onkolity, ktorých jadrá tvoria drobné úlomky konárikov. Prirodzená veľkosť.

Obr. 3 Výbrus recentného onkolitu z lokality pod Devínskou Kobylou. Zväčšenie 4,5 ×. Foto: L. Osvald.

Tab. LIV

Obr. 1 Onkolity — hľuzky síníc z lokality Sklená huta. Mierne zmenšené.

Obr. 2 Vlavo onkolit nepravidelného tvaru, ktorého jadro tvorí úlomok gutensteinského vápenca zo suti. Vpravo silne pretiahnutý onkolit s dutinou v strede (jadrom bol drobný konárik, ktorý sa rozložil). Kuchyňa, 900 m vsv. od obce, Malé Karpaty. Nábrusy, zväčšenie 1,6 ×. Foto: L. Osvald.



Zoltán Schmidt

A find of mastodon *Tetralophodon longirostris* (Kaup, 1832) in Nitra

1 text-fig., 2 pls. (LV—LVI), Slovak summary

Abstract. The report on the find of *Tetralophodon longirostris* (KAUP, 1832) is a contribution to stratification of freshwater limnic sediments in a sandy formation (Dacian) in the Nitrianska pahorkatina hilly country. In connection with former occurrence of tapir it is indicative of the humid marshy forest biotope.

In 1971, Ľudovít GUGH found a mandible of mastodon in the sand-pit in the NW part of Nitra, in the peripheral part of the Nitrianska pahorkatina hilly country (E. MAZÚR—M. LUKNIŠ, 1980). The sand pit is on the eastern periphery of Kynek, about 350 m from the left side of the road from Nitra to Bratislava. The unique paleontological material was kept by Anna Kaluzová in the Institute of Archeology in Nitra. Now it is in the collection of Dionýz Štúr Institute of Geology in Bratislava. Together with R. HALOUZKA we studied the sediments exposed in the profile of the southern wall of the sand-pit. The study resulted in the following lithological-genetical characteristic.

From the land surface to the depth of 1 m there is dark-brown loam (chernosem).



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Below (1.00—2.50 m) is light, grey-brown, silty, calcareous loam horizon. The loess and loessy loam are separated from a complex of sandy sediments (3.00—10.00 m) by a fossil soil horizon (2.50—3.00 m) a composed of brown, silty loam. In its basement (3.00—10.00 m) is a complex of sandy sediments: Sands, mostly medium-grained, brown-grey, with rusty limonitized small beds (mostly in higher levels) or intercalations, schliers and spots (in lower evels); lenses and layers of coarse-grained sands and fine sandy gravels (up to 5 mm in average), occasionally with pebles of well rounded gravels (2—3 cm); infrequent thin intercalations of grey clays (up to 1 cm in thickness). More frequent were layers with black granular coagulations (not films) of Fe Mn in fine-grained sandy horizons. The entire formation is highly muscovitic. The sand complex is cross-bedded (limnic sediment). On the base of the profile is a thicker layer of grey, fine grained aleuritic sands (fine sandy silts).

The mastodon mandible was found about 1.50 m above the floor of the sand-pit, 10 m below the land surface, i. e. at the livel of about 8.50 m below the land surface.

Proboscidea ILLIGER, 1811 — *Mastodontoidea* OSBORN 1921

Tetralophodontidae VAUFREY, 1958

Tetralophodontinae VAN DER MAAREL, 1932

Tetralophodon FALCONER, 1857

Tetralophodon longirostris (KAUP, 1832)

Locality: Nitra (Kynek)

Sediment: Freshwater limnic sediment in sandy formation.

Material: Mandible with incomplete M_3 sinister and M_3 dexter.

Description: The fossil remains of the mastodon are mechanically damaged. The left and the right lower mandibles with incomplete molars were found separately. Because of their considerable damage. I only present metric data in relative values. The total length of the Partly preserved left part of the mandible is 375 mm, the right part is 180 mm long. The maximal height of the left mandible is 145 mm, of the right — 155 mm. The maximal length of M_3 dexter is 225 mm; the left molar is unmeasurable, it is broken off in the third yoke. The maximum width of M_3 dexter (III) is 91 mm. The molars have $5\frac{1}{2}$ yokes, the yokes are broken, and strongly bit down. The height of M_3 dexter (III) is 43 mm. Thickness of enamel of both molars is about 6,8 mm.

Translation: E. Jassingerová

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Zoltán Schmidt

Nález mastodonta *Tetralophodon longirostris* (Kaup, 1832) v Nitre

Resumé anglického textu

Nitriansky (kynecký) tetralofodont nie je ojedinelým nálezom na území slovenských Karpát. K. SILNICKÝ (1930, 1931) publikoval fosilné zvyšky (palatum) tetralofodonta s obidvoma vrchnými druhými a tretími molármi, tiež s I 2 sup. sin., ktoré sa našli v Topoľčanoch v sedimentoch hrubozrnných pieskov. Podľa neho patril spécií *Tetralophodon grandincisivus* SCHLESINGER 1917. Z. SCHMIDT (1963) uverejnil nález vrchnej časti kostry lebky mastodonta toho istého druhu s čiastkove zachovaným M² sup. sin. a zachovaným I 2 sup. sin. a I 2 sup. dexter. Fosilné zvyšky sa našli v Kuzmiciach pri Topoľčanoch, na báze vrstvy sivožltých škvrnitých pieskov rôznej zrnitosti (4,50—5,10 m p. t.). Obidva nálezy, topoľčiansky a kuzmický, zaradili uvedení autori do pliocénu (pontu). SCHMIDT (1967, 1969, 1975) spomína aj nedávny dobre zachovaný nález mandibuly mastodonta tohto druhu z hnedosivých sludnatých pieskov v katastri obce Biskupová pri Topoľčanoch. Jediné nálezy mastodontov čelade tetralofodontovitých spolu s nálezmi nosorožcov rodu *Aceratherium* KAUP (1832) z pliocénnych sedimentov v Slepčanoch pri Zlatých Moravciach determinoval, podľa oznámenia S. RAKOVSKÉHO, O. FEJFAR.

Z uvedeného vidieť, že tetralofodonty (*Tetralophodontinae* VAN DER MAAREL, 1932) žili v oblasti slovenských Karpát na konci vrchného miocénu, hlavne však v spodnom pliocéne, najmä na území stredného Ponitria, podhoria Trábeča v Podunajskej nížine. Usudzujeme tak z toho, že tento druh, ktorého rod (*Tetralophodon* FALCONER, 1857) siaha všeobecne až na rozhranie miocén-pliocén, sa vyskytuje v Eurázii často v priebehu celého obdobia pliocénu. Napríklad niektoré ázijské druhy sa uvádzajú vo vrchnom pliocéne až v ilirsku, ojedinele až v interglaciáloch (OSBORN H. F. 1936, R. WAUGREY 1968). Z toho uzatvárame, že i časť európskych zástupcov rodu *Tetralophodon* FALCONER 1857 môže zasahovať aj do mladšieho veku ako pont. Už aj preto, že túto domnienku vyvolávajú pri slovenských nálezoch určité geologické náznaky v nálezových vrstvách. V ich intencii, t. j. z aspektu súčasných stratigrafických a paleogeografických výsledkov neogénu Slovenska (J. GAŠPARIK, 1979) patria sedimenty v sladkovodnom limnickom vývoji v pieskovni na v. okraji Kyneku v Nitre, daku. Ich stratifikáciu potvrdzuje ústnou informáciou aj E. BRESTENSKÁ (1981), najmä však opísaný nález tetralofodonta — *Tetralophodon longirostris* (KAUP, 1832). Pod pojmom dák sú označované sedimenty vrchnej časti panónu s. l., ktoré staršia literatúra spomína ako pliocénnu pestrú sériu; v prehľadných geologických mapách označovanú ako pont (J. GAŠPARIK, 1979). A tak v súhlase súčasných stratigrafických a paleogeografických, tiež paleovertebratologických výsledkov neogénu, bude treba revidovať nálezové okolnosti doteraz objavených tetralofodontov na Slovensku. Naviac, preveriť aj ich determináciu.

Diagnózu biotopu vlhkého bažinného lesa, ktorý tetralofodonty s obľubou vyhľadávali potvrdzuje aj nález spodnej čelusti tapíra v kyneckej pieskovni v Nitre (Z. SCHMIDT, 1969).

Explanations of the plates LV—LVI

Plate LV

Sand-pit on the eastern margin of Kynek in Nitra L. GUGH shows the position of the mastodon in the Dacian sediments.

Photographed by Z. Schmidt.

Plate LVI

Tetralophodon longirostris (KAUP) from the sande-pit in Kynek in Nitra.

Photographed by M. Švec.

Vysvetlivky k tabuľkám na kriede LV—LVI

Tab. LV

Pieskováňa na v. okraji Kyneku v Nitre. Bagrista L. GUGH ukazuje polohu mastodonta v sedimentoch dáku.

Tab. LVI

Tetralophodon longirostris (KAUP) z kyneckej pieskovni v Nitre.

Foto M. Švec.

Rewieved by P. Holec

Miroslav Plička

**Belonidopsisichnium carpaticum n. ichnogen. n. sp.
from the Outer Carpathian Flysch in East Slovakia,
Czechoslovakia**

3 text-figs., 4 pls. (LVII—LX), Czech summary

Abstract. The author describes a new genus and a fossil trace in the Carpathian flysch—*Belonidopsisichnium carpaticum* n. ichnogen. n. sp. In the Magura flysch the trace was in the sandstone of the Zborov beds (Middle Eocene) in East Slovakia, and in sandstones of the Solán beds in Western Slovakia and in Moravia (Paleocene). It is evidently a trace after beak-like mandible of fish resemblant to those living at present, like *Belone belone* (LINNÉ) of the family *Belonidae*.

Introduction

In the course of geological mapping in the Magura Flysch of East Slovakia in 1954, E. MENČÍK and V. PESL found extremely interesting traces of organisms on the top bedding plane of a sandstone fragment. The sample is deposited in ÚÚG in Brno. Since I collect and study the fossil traces from the Carpathian Flysch (M. PLIČKA 1974, 1978, 1981), I—with the consent of E. MENČÍK and V. PESL described in detail also the traces on the sandstone sample from East Slovakia. The sandstone originates from the Zborov beds of the Rača unit of the Magura Flysch (Middle Eocene). The irregularly curved, depressed trace on the sandstone surface represents the genus *Scolicia* DE QUATREFAGES 1849. Another trace in the form of thrusts into sea floor, is new. It may be a thrust made by fish whose heads are provided with beak-like, pointed mandibles. Such jaws are at present characteristic of sea fish of the family *Belonidae*. So the new trace was denoted by a term indicating representatives of the family.

In 1962 I found similar, somewhat smaller traces on the upper bedding plane of the sandstone of the Solán beds in Western Slovakia near Makov, 2,5 km SE of Bumbalka and in a quarry in Hostýn near Bystřice pod Hostýnem in Moravia. They are both from Paleocene beds of the Magura flysch. The sandstone sample from Makov is deposited in ÚÚG in Brno.

Systematical description

Ichnogenus Belonidopsisichnium n. ichnogen.

Type specimen: *Belonidopsisichnium carpaticum* n. ichnosp.

Denomination: according to resemblance with the recent genus of fish *Belone* CUVIER 1817.

Diagnosis: Single traces of circular, elliptical or elongated shape. Elliptical and elongated traces (thrusts) have smooth walls, V-shaped in cross section. The end of the trace (thrust) is gently curved upwards.

Remark: So far the trace has not attracted the attention of geologists and paleontologists because of its isolatedness and accidental occurrence of the thrusts which need not be noticed at all on fragments with smaller, bedding plane. An isolated thrust may be easily overlooked. The trace (thrust) resulted from the activity of sea fish with beak-like mandible, looking for food on the sea floor surface. The nature of thrusts is resemblant to the existing sea fish of the genus *Belone* CUVIER 1817.

Belonidopsisichnium carpaticum n. ichnosp.

Plate LVII—LX, Fig. 2

Holotype: Sample 1, ÚÚG Brno. Pl. LVII—LX, Fig. 2 in text.

Type locality: Vyšná Olšava, NW of Humenné.

Type level: Sandstone beds of the Zborov belt of the Rača unit of the Magura Flysch, Middle Eocene.

Denomination: According to the area — Carpathian Flysch.

Material: Two samples. The sample from East Slovakia is representative of a sea floor surface 55 × 90 cm in size, and it has 71 traces (thrusts). The sample is in the collection of ÚÚG Brno (sample 2).

Diagnosis: Single traces of circular, elliptical or elongated shape; 1,5—44 mm in size. Oval or elongated traces are V-shaped in cross section, the walls are smooth, dipping at 35°. A sharp edge is curved upwards at its end.

Description: Epichnial traces after beak-shaped mandible of fish. The traces are oval or elongated. Circular traces have a diameter of 1,5—3 mm (vertical thrust), oval traces are 2 × 4—4 × 8 cm in size (diagonal thrust at about 35°—45° angle), and elongated traces ranging up to 44 mm in length (diagonal thrust at about 20° angle). Oval and elongated traces (diagonal thrust) are characterized by a thrust surface V-shaped in cross section, with smooth walls. A sharp furrow on the base of the thrust is arching upward at its end.

Remark: Besides traces (thrusts) distributed irregularly on the top bedding plane of the sandstone there are some thrusts most likely restricted to the central cylindric part of the trace *Scolicia prisca* DE QUATREFAGES. The thrust is oriented either to the basal part of the cylinder or close to it. There were ten such cases on the studied

sample (thrust 1, 3, 5, 16, 33, 36, 39, 50, 70 and 71). In one case the thrust Nr. 71 is partly covered by sandy material and by a trace after an organism from the genus *Scolicia* DE QUATREFAGES. It smoothed the traces in the place of crossing and covered the central cylinder of the trace *Scolicia prisca*. (The organism moved toward 180°, and the formerly oval trace narrowed to a furrow transversal to the course of the thrust.)

Two thrusts (Nr. 36 and 71) on the crossing with the trace *Scolicia prisca* show that thrust 71 running toward the cylinder of the trace *Scolicia prisca* is partly wiped out and narrowed, and the younger thrust 36 is preserved. Sandy material covering the opening of the thrust 71 downward shows that arches of the trace *Scolicia prisca* running from the central cylinder are oriented backward at the movement of organism and indicate thus the movement direction.

Similar traces were on the top bedding plane of sandstone from an abandoned quarry 2.5 km SE of Bumbalka near Makov. In the place of thrusts the sandstone is fine-grained, partly convolute-laminated. The thrusts are smaller than on the sample from East Slovakia. There were branched chondrites near the thrusts on the top bedding plane. Analogous traces (thrusts) were found on the top bedding plane of sandstone of the Solán beds in a quarry in Hostýn at Bystřice pod Hostýnem.

Sediment: The holotype trace is on the top bedding plane of green-grey, fine-grained, calcareous sandstone, finely micaceous, slab-like, with straight indistinct lamination. The sandstone fragment is irregular, 90 × 55 cm in size, 5 cm thick (incomplete thickness). The bottom bedding plane of the sandstone is straight and represents the bedding joint.

Association: On the top bedding plane of the Sandstone there is — together with a new fossil trace — a meandering trace of *Scolicia prisca* DE QUATREFAGES on

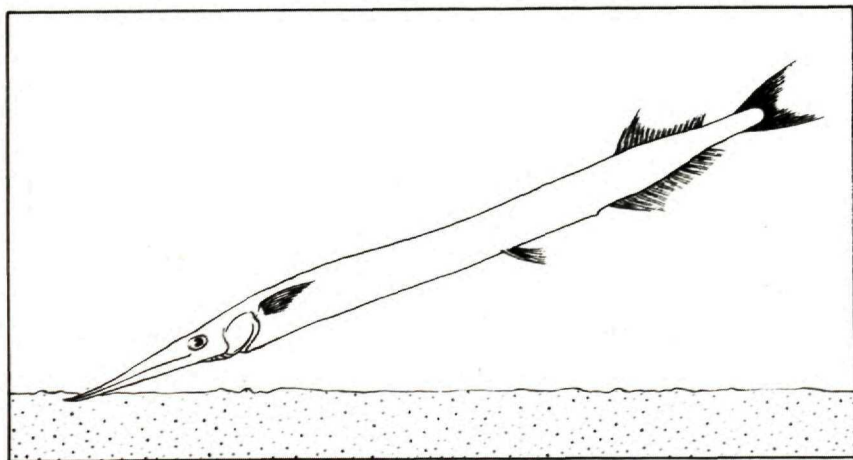


Fig. 1 Reconstruction of the origin of the thrust in sandy sea floor surface on the basis of data on recent sea fish of the family *Belonidae*. The figure shows a representative of the family *Belonidae* — *Belone belone euxini*, living in the Black Sea (A. N. SVETOVIDOV 1964, p. 155, Fig. 42).

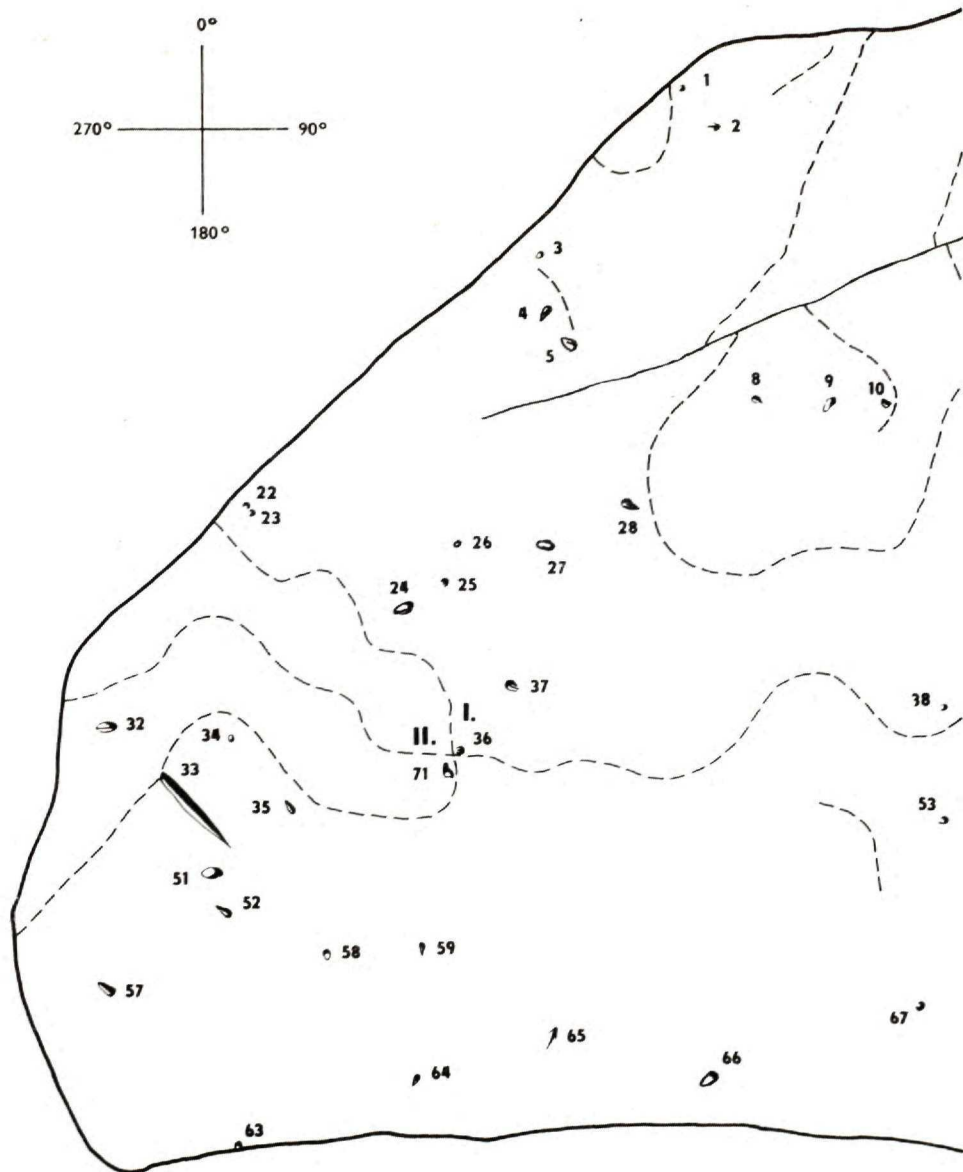
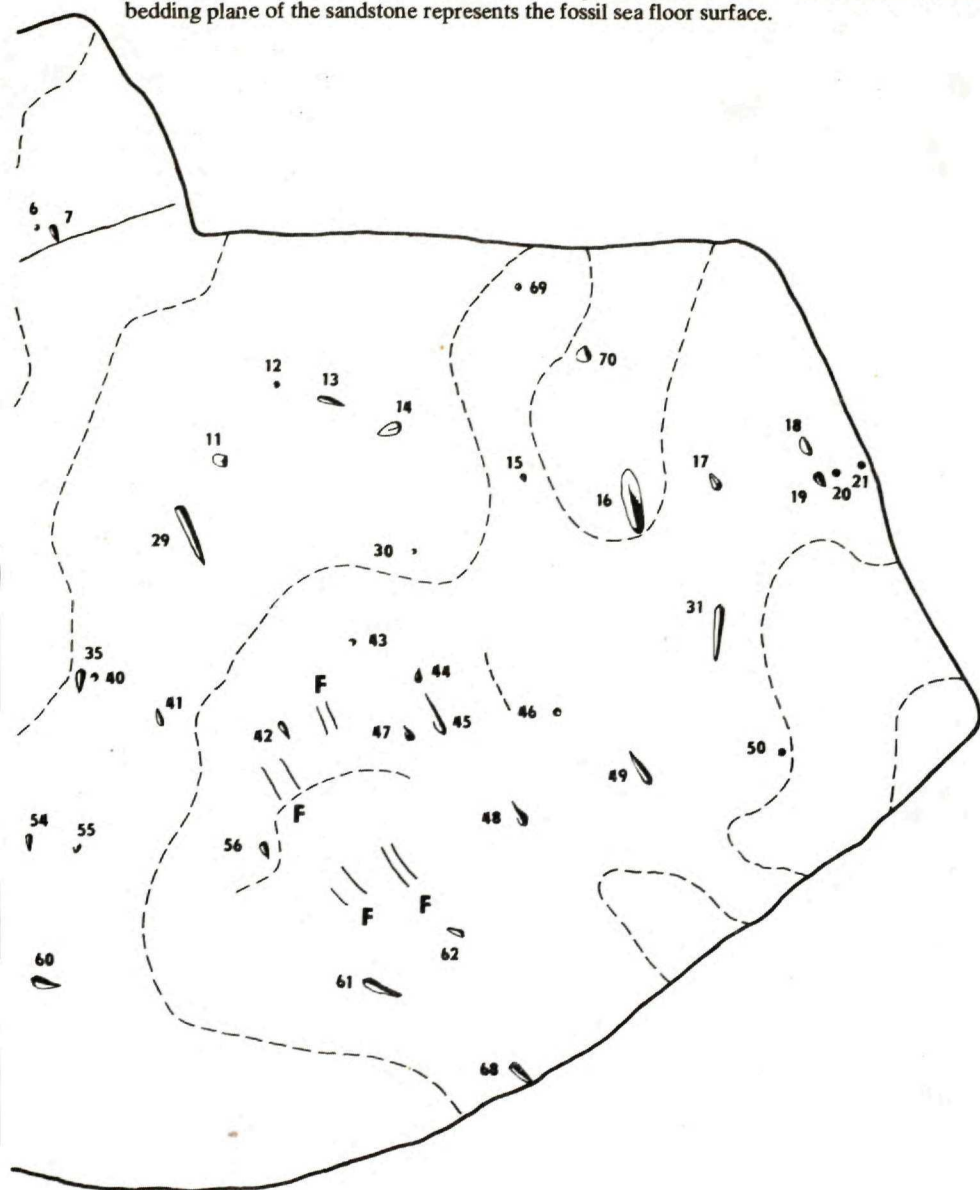


Fig. 2 A schematic outline of the fossil trace of *Belonidopsisichnium carpaticum* n. ichnogen. n. sp. and *Scolicia prisca* DE QUATREFAGES on the top bedding plane of the Zborov beds sandstone (Eocene), Vyšná Olšava. Single thrusts of the new fossil trace are marked with numerals, the course of the trace *Scolicia prisca* is marked with dashed line; I, II — time sequence of the trace, 0°—360° is relative orientation. The bedding plane of the sandstone represents the fossil sea floor surface.



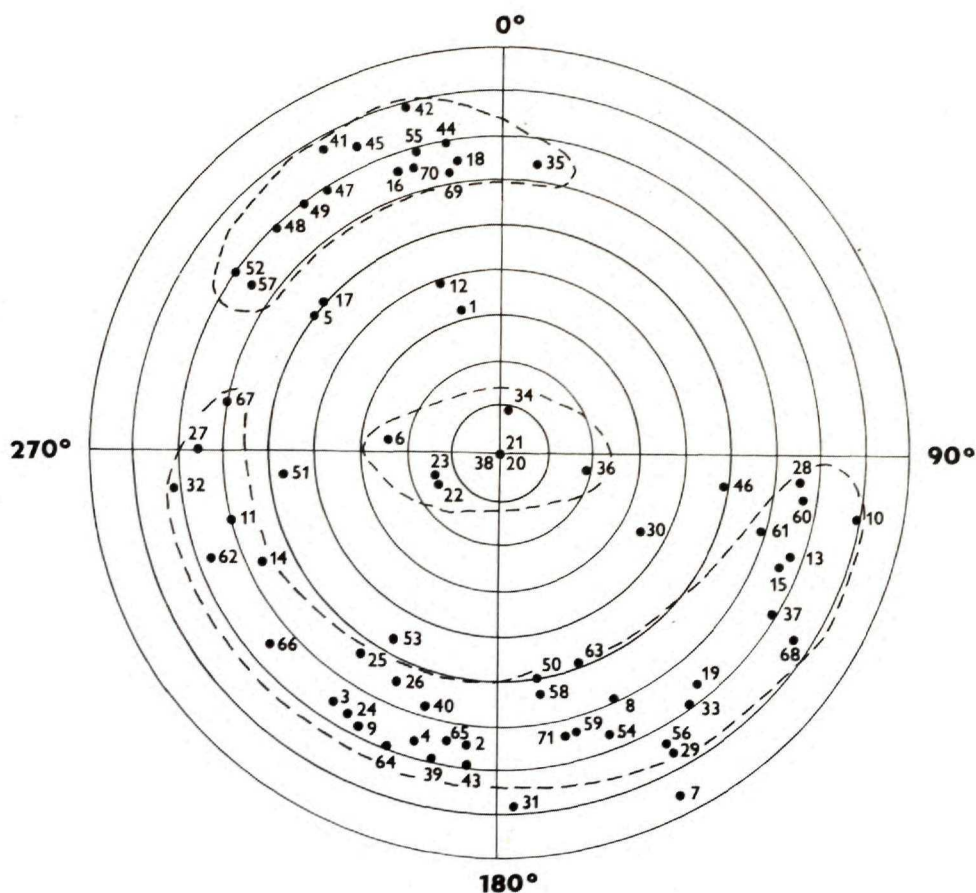


Fig. 3 Point diagram of thrusts into fossil sea floor surface (top bedding plane of sandstone). Poles are on the upper hemisphere, single thrusts on the rock surface are marked with numerals (see scheme in Fig. 2 in text, and photographs in Plates II—IV). Orientation of thrusts is relative.

almost the whole surface of the sandstone fragment. In one case the trace on crossing wiped out its central cylindrical part. There are some double furrows — most likely an impact of the ventral fish fin (Fig. 1 in text) which made the thrust 29 (Fig. 2 in text). The double furrows are marked by letter F in Fig. 2 in text.

On the sandstone sample from the Solán beds at makov in Western Slovakia there are branched chondrites near the thrusts.

Origin: The new trace is a result of the activity of organisms floating above the sea floor and looking for food. The shape of thrusts into the sea flow at variable angles are indicative of sea fish resembling to the living representatives of the family Belonidae, mostly to the recent genus *Belone* CUVIER 1817 (A. N. SVETOVIDOV, 1964). The form of the thrust, its size and gentle upward arching of the furrow at the base of the thrust are indicative of fish related to this family. Their length varied

Table 1 Spatial orientation and dimensions of single thrusts after beak-like mandibles of fish, in the fossil sea floor surface. Compiled on the basis of reconstruction of the fossil traces. Explanations: A — number of thrust; B — orientation of thrust (in degrees); C — angle of thrust dip; D — size of thrust in mm on bedding plane.

A	B	C	D	A	B	C	D
1	165	58	2×3	36	280	70	4×5
2	96	25	2×4	37	300	20	6×11
3	34	24	4×6	38	—	90	1,5
4	16	24	5×11	39	12	20	3×11
5	127	40	5×10	40	17	32	4×6
6	198	65	2×3	41	150	12	3×10
7	332	4	3×10	42	165	10	3×15
8	334	30	2×5	43	5	20	2×6
9	27	22	4×10	44	170	20	2×9
10	280	10	3×8	45	155	15	5×25
11	75	30	7×7	46	278	40	3×7
12	160	50	2×3	47	147	20	5×10
13	290	22	6×17	48	135	20	5×15
14	65	33	6×9	49	142	20	3×25
15	293	23	4×5	50	350	40	2×2
16	160	23	6×32	51	85	43	4×8
17	130	40	3×5	52	125	20	3×10
18	172	23	4×10	53	30	43	3×5
19	320	22	3×7	54	338	23	3×8
20	—	90	1,5	55	165	20	5×5
21	—	90	1,5	56	330	15	5×10
22	65	75	3×3	57	125	24	3×9
23	70	75	3×3	58	350	36	3×6
24	30	23	4×8	59	345	25	2×8
25	35	37	2×3	60	278	22	5×13
26	25	35	2×3	61	287	30	5×16
27	90	24	4×8	62	70	30	5×16
28	275	24	6×7	63	340	40	2×3
29	330	14	6×35	64	20	20	2×7
30	300	55	3×3	65	10	25	3×17
31	357	11	6×20	66	50	25	7×12
32	83	19	6×8	67	100	30	5×7
33	322	20	6×44	68	312	14	7×17
34	185	80	2×3	69	170	25	3×3
35	167	24	3×7	70	163	23	5×8
				71	207	26	3×12

within 70—90 cm, which is characteristic of the subgenus of the recent fish *Belone belone* (LINNÉ). They range up to 94 cm in length, and live in the Atlantic ocean near European coast southward to Biskaya bay, and northward to Iceland. They also occur in the Baltic and northern sea (A. N. SVETOVIDOV 1964, p. 153). Beak-like mandibles of the fish occupy 1/6 of the whole body length, the lower mandible partly overlaps the upper one and is slightly curved upward, as shown in Fig. 1 in text (A. N. SVETOVIDOV 1964, Fig. 42, p. 155). Other groups of fish living at present — like the families *Scombresocidae* or *Fistularidae* (R. RIEDL 1963) are not considered because of the different shape of their beak-like mandibles.

The fish whose traces are on the sandstone surface, picked up at different angles various organisms living on the sea floor. As shown by statistical data in a point diagram, most thrusts were done at an angle of about 20°, less thrusts at 35°—45°, and the minimum of thrusts are almost vertical (Fig. 3 and Table 1 in text).

Ecology and paleoecology

The existing data on the way of living of recent fish with beak-shaped mandible like the family *Belonidae* show that their food consists of minor organisms living on the sea floor (worms, crabs, larvas of organisms a. o.). Sometimes they pick up smaller fish or eat insects from the water table (K. DECKERT 1967). They use their beak-shaped mandible as tweezers for taking out microorganisms from the sea floor surface (W. LUTHER—K. FIEDLER 1961). A. N. SVETOVIDOV (1964) mentions 6 genera of the family *Belonidae* and more than 60 fish species spread all over the world: in tropical seas, in the mild Atlantic zone, in the Indian and Pacific Oceans, and even in cooler waters like in the Baltic and the North Seas. They live in a shallow-water environment (W. LUTHER—K. FIEDLER 1961).

Besides that, the fossil traces of this kind on sediments may also be indicative of the shallow-water environment of the origin of sediments. This concerns first of all the Eocene Zborov beds, and some sandstone layers in the Solán beds. This may be also indicative of depth conditions in respect to other traces associated with the newly identified traces, like *Scolicia* DE QUATREFAGES 1849. The possible existence of the fish of this type in deep environment may be somewhat doubtful. The oceanographic researches in respect of the study of sea fauna are actually performed in marginal zones of seas and oceans whereas the deep parts of oceans are investigated more or less accidentally. The way of living of the fish and their collection of food from the sea floor surface are rather indicative of a shallow-water environment with many small organisms.

Conclusions

The newly found fossil trace of *Belonidopsisichnium carpaticum* n. ichnogen n. sp. resulted from thrusts of beak-shaped mandibles of sea fish related to the recent family *Belonidae*. The fish collected small organisms from the sea floor surface by their beak-shaped mandible. Analogous to the recent fish of the family *Belonidae*, they are indicative of a shallow-water environment but not of its temperature because they are spread all over the world in almost all temperature zones. As regards depth conditions of the depositional environment, the data are also significant for the examination of other traces associated with the newly identified ones, like *Scolicia prisca* DE QUATREFAGES.

The traces after thrusts of beakshaped mandibles of fish on the Carpathian Flysch sediments prove the existence of fish related to the recent family *Belonidae* already in the Early Tertiary.

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Miroslav Plička

***Belonidopsisichnium carpaticum* n. ichnogen. n. sp. z vněkarpatského flyše na východním Slovensku, Československo**

Na svrchní vrstevní ploše velkého úlomku pískovce zborovských vrstev magurského flyše (eocén) na lokalitě Vyšná Olšava sz. od Humenného byly zjištěny fosilní stopy v podobě vpichů do povrchu mořského dna. Vzorek našli Dr. E. MENČÍK, a Dr. V. PESL, v r. 1954 při geologickém mapování na v. Slovensku a je uložen ve sbírkách Ústředního ústavu geologického, pobočka Brno. Vzhledem k povaze vpichů se dá usuzovat, že se jedná o vpichy, které pocházejí od ryb, majících na hlavě vyvinuté zobákovité čelisti se špičatým zakončením. V současné době mají zobákovité čelisti této povahy ryby z čeledi *Belonidae*. Byl proto pro nově zjištěnou stopu zvolen název, upozorňující na zástupce této čeledi.

Stopy podobné povahy byly zjištěny v r. 1962 na svrchní vrstevní ploše pískovce soláňských vrstev magurského flyše na z. Slovensku u Makova a to v jejich nejsvrchnější části. Rovněž nález těchto stop v r. 1981 v lomu na Hostýnu u Bystřice pod Hostýnem pochází ze soláňských vrstev.

U vzorku z východního Slovenska od Vyšné Olšavy v asociaci s nově zjištěnou stopou je stopa *Scolicia prisca* DE QUATREFAGES, u vzorku ze soláňských vrstev od Makova na z. Slovensku jsou v těsné blízkosti vpichů rozvětvené keříčkovité chondrity.

Z analogie k recentním rybám náležejícím k čeledi *Belonidae* lze uvažovat o mělkovodním prostředí při vzniku sedimentů (K. DECKERT et al. 1967, W. LUTHER—K. FIEDLER 1961, A. N. SVETOVIDOV 1964), nelze však posoudit teplotní poměry vodního prostředí sedimentační pánve, protože ryby recentní čeledi *Belonidae* jsou rozšířené po celém světě skoro ve všech teplotních pásmech (W. LUTHER—K. FIEDLER 1961, A. N. SVETOVIDOV 1964).

Poznatky, pokud se týká hloubkových poměrů při vzniku sedimentů mohou mít značný význam při posuzování ostatních stop, vyskytujících se v asociaci s fosilními stopami nově identifikovanými, jak je tomu například u stopy *Scolicia prisca* DE QUATREFAGES.

Zjištění vpichů po zobákových čelistech ryb v sedimentech karpatského flyše dokládá zároveň existenci ryb, blízkých recentní čeledi *Belonidae* již ve starších třetihorách.

Vysvětlivky k tabulkám LVII—LX
(Foto M. Plička)

Tab. LVII

Belonidopsisichnium carpaticum n. ichnogen. n. sp. a *Scolicia prisca* DE QUATREFAGES na svrchní vrstevní ploše pískovce zborovských vrstev (eocén). Vzorek má rozměry 90 × 58 cm a je uložen pod č. 1 u Ústředního ústavu geologického, pobočka Brno.

Tab. LVIII

Belonidopsisichnium carpaticum n. ichnogen. n. sp. a *Scolicia prisca* DE QUATREFAGES na svrchní vrstevní ploše pískovce zborovských vrstev (eocén). Detail vpichů po zobákovité čelisti mořských ryb. Vzorek č. 1, Ústřední ústav geologický, pobočka Brno. $\times 0,5$.

Tab. LIX

Belonidopsisichnium carpaticum n. ichnogen. n. sp. a *Scolicia prisca* DE QUATREFAGES na svrchní vrstevní ploše pískovce zborovských vrstev (eocén). Detail vpichů po zobákovité čelisti mořských ryb. Vzorek č. 1, Ústřední ústav geologický, pobočka Brno. $\times 0,7$.

Tab. LX

Belonidopsisichnium carpaticum n. ichnogen. n. sp. a *Scolicia prisca* DE QUATREFAGES na svrchní vrstevní ploše pískovce zborovských vrstev (eocén). Detail vpichů po zobákovité čelisti mořských ryb. Vzorek č. 1, Ústřední ústav geologický, pobočka Brno. $\times 0,7$.

Vysvětlivky k obrázkům

Obr. 1 Rekonstrukce vzniku vpichu do písčitého povrchu mořského dna na základě poznatků o recentních mořských rybách z čeledi *Belonidae*. Na obrázku je jeden ze zástupců čeledi *Belonidae* — *Belone belone euxini*, žijící dnes v Černém moři (A. N. SVETOVIDOV 1964, p. 155, obr. 42).

Obr. 2 Schematický nákres fosilní stopy *Belonidopsisichnium carpaticum* n. ichnogen. n. sp. a *Scolicia prisca* DE QUATREFAGES na svrchní vrstevní ploše pískovce zborovských vrstev (eocén), Vyšná Olšava. Jednotlivé vpichy nové fosilní stopy jsou označeny čísly, průběh stopy *Scolicia prisca* je vyznačen přerušovanou čarou, I, II — časová souslednost stopy, 0° — 360° je relativní orientace. Vrstevní plocha pískovce představuje fosilní povrch mořského dna.

Obr. 3 Souhrnný bodový diagram vpichů do bývalého mořského dna (svrchní vrstevní plocha pískovce). Póly jsou promítnuty na svrchní polokouli, jednotlivé vpichy na povrchu horniny jsou označeny čísly (viz schematický nákres na obr. 2 v textu a fotografie na tab. II—IV). Orientace vpichů je relativní.

Tab. 1 Prostorová orientace a rozměry jednotlivých vpichů mořských ryb se zobákovitými čelistmi do bývalého povrchu mořského dna. Sestaveno na základě rekonstrukce vzniku těchto fosilních stop. Vysvětlivky: A — číslo vpichu; B — orientovaný směr vpichu (ve stupních); C — úhel sklonu vpichu; D — rozměr vpichu v milimetrech na povrchu vrstvy.

Explanations of plates LVII—LX

Plate LVII

Belonidopsisichnium carpaticum n. ichnogen. n. sp. and *Scolicia prisca* DE QUATREFAGES on the top bedding plane of sandstones of the Zborov beds (Eocene). The sample is 90×58 cm in size, deposited as Nr 1 in ÚÚG, Brno.

Plate LVIII

Belonidopsisichnium carpaticum n. ichnogen. n. sp. and *Scolicia prisca* DE QUATREFAGES on the top bedding plane of sandstones of the Zborov beds (Eocene). Detail of traces after beak-like mandible of sea fish. Sample Nr. 1, ÚÚG Brno; $\times 0.5$.

Plate LIX

Belonidopsisichnium carpaticum n. ichnogen. n. sp. and *Scolicia prisca* DE QUATREFAGES on the top bedding plane of sandstones of the Zborov beds (Eocene). Detail of traces after beak-like mandible of sea fish. Sample 1, ÚÚG Brno; $\times 0.7$.

Plate LX

Belonidopsisichnium carpaticum n. ichnogen. n. sp. and *Scolicia prisca* DE QUATREFAGES on the top bedding plane of sandstones of the Zborov beds (Eocene). Detail of traces after beak-like mandible of sea fish. Sample 1, ÚÚG Brno; $\times 0.7$.

Photographed by author

Viera Gašpariková

Liassic calcareous nannoflora from Klippen Belt (Czorsztyn Unit)

1 text-fig., 4 pl. (LXI—LXIV), Slovak summary

On the locality Vršatec in the Czorsztyn Unit, A. BEGAN and V. GAŠPARIKOVÁ (1979) found plentiful Liassic calcareous nannoflora in spotty marls and dark-grey schists with sphaeroidites. On the ground of the calcareous nannoflora the stratigraphical range of both facies was precised. It is the first find of calcareous nannoflora in Jurassic sediments of the West Carpathians. Distinguished are two Liassic nannoplankton zones.

In the past twenty years more authors used nannoflora for stratigraphical division of the Jurassic. It is in works by P. BRÖNNIMANN (1955), H. STRADNER (1963), D. NOËL (1965), P. REINHARDT (1965), B. PRINS (1969), T. R. WORSLEY (1971), H. R. THIERSTEIN (1971), A. W. MEDD (1971), J. A. WILCOXON (1972) and A. AMEZIEUX (1972). Details on the works were presented by T. BARNARD and W. W. HAY (1974). They studied coccoliths in Southern England and Northern France to determine twenty-two coccolith zones in the Jurassic, correlated with the existing ammonite zones.

Two nannoplankton zones — *Crepidolithus crassus* and *Podorhabdus cylindratus* were distinguished on the locality Vršatec. In this article I shall deal with stratigraphical position of the zones, their correlation with Liassic nannoplankton zones from other parts of Europe, and with their correlation with ammonite zones. In the systematic part are descriptions of species examined by optical and scanning electron microscope.

My stratigraphical ranging of the determined zones is done in accordance with the authors who made zonation of the Lias in Western Europe. H. STRADNER (1963) distinguished two zones in the Lias. The lower one is characterized by the "Liasicus" assemblage and corresponds to the Sinemurian. The species *Parhabdolithus liasicus* DEFLANDRE and *Schizosphaerella punctulata* DEFLANDRE are dominant. The upper zone corresponds to the Pliensbachian-Bajocian. It is characterized by the "Opacus" assemblage. *Discolithus crassus* DEFLANDRE and *Coccolithus opacus* STRADNER are dominant species.

P. REINHARDT (1966) distinguished the assemblage *Parhabdolithus liasicus* in the Sinemurian, the assemblage "Opacus" with the dominant species *Watznaueria opaca* STRADNER and *Discolithus crassus* DEFLANDRE for the Pliensbachian-Bajocian.

Stage	Ammonite zone	B. Prins (1969)		T. Barnard-W.W. Hay (1974)	this paper (1982)
		Coccolith zone	Subzones	Coccolith zone	Coccolith zone
Toarcian	D. levesquei	Striatococcus zone	S. opacus	Podorhabdus cylindricus	Podorhabdus cylindricus
	Gr. thourasense				
	H. variabilis				
	H. bifrons				
	H. falciferum				
	D. tenuicostatum				
Pliensbachian	Pl. spinatum	Crepidolithus zone	C. crassus	Crepidolithus crassus	Crepidolithus crassus
	Am. margaritatus		C. cavus		
	Pr. dawoei				
	Tr. ibex				
	Upt. jamesoni				
Sinemurian	Ech. raricostatum	Parhabdololithus zone	P. liasicus	Paleopontosphaera dubia	
	Ox. oxynotum				
	Ast. obtusum				
	C. turneri		P. marthae	Parhabdololithus liasicus	
	Am. semicostatum			Parhabdololithus marthae	
	Ar. bucklandi			Crucirhabdus primulus	
Hettangian	Schl. angulata	Crucirhabdus zone		Annulithus arkelli	
	Als. liasicus				
	Ps. planorbis				
	Ost. liasica				

Correlation of liassic nannoplankton and ammonite zones.

Detailed division of the Lias was presented by D. NOËL (1965). The Lias is characterized by "massive" coccoliths represented by the species *Parhabdololithus liasicus* DEFLANDRE, *Parhabdololithus marthae* DEFLANDRE, *Parhabdololithus robustus* NOËL, *Crepidolithus crassus* NOËL.

B. PRINS (1969) presented detailed zonation of the Lower and Middle Lias. He distinguished four zones and five subzones, and correlated them with ammonite zones. The zone *Crucirhabdus* corresponds to the Hettangian, the zone *Parhabdololithus* with subzones *Parhabdololithus marthae* and *Parhabdololithus liasicus*— to the Sinemurian. The author distinguished the zone *Crepidolithus* with subzones *Crepidolithus cavus* and *Crepidolithus crassus* for the Pliensbachian, and the zone *Striatococcus* with the subzone *Striatococcus opacus* for the Lower Toarcian.

T. BARNARD and W. W. HAY (1974) distinguished eight zones in the Lias: the zone *Annulithus arkelli* in the Hettangian, the zone *Crucirhabdus primulus* — on the Hettangian/Sinemurian boundary, the zones *Parhabdololithus marthae*, *Parhab-*

dolithus liasicus and *Paleopontosphaera dubia* in the Sinemurian. The zone *Crepidolithus crassus* commences in the Uppermost Sinemurian. It extends to the central part of the Lower Pliensbachian to be followed by the zone *Podorhabdus cylindratus* ending in the Uppermost Toarcian. The zones are correlated with the ammonite zones.

On the locality Vršatec are zones *Crepidolithus crassus* and *Podorhabdus cylindratus*, each associated with an independent lithological unit.

The zone *Crepidolithus crassus* was determined in the formation of greenish marly limestones and spotty marls. They also contain a relatively rich Lias assemblage of foraminifers. It is a formation corresponding to ammonite zones *Uptonia jamesoni* to *Pleuroceras spinatum*, i. e. to the Lower and Upper Pliensbachian. So the stratigraphical range of the zone *Crepidolithus crassus* is proved. Similar range of the zone was determined by B. PRINS (1969). T. BARNARD et W. W. HAY (1974) put the zone only in the middle part of the Lower Pliensbachian, i. e. on the boundary of the ammonite zone *Prodactylloceras dawoei*.

The zone *Crepidolithus crassus* is characterized by the first occurrence of the species *Crepidolithus crassus* (DEFLANDRE) NOËL up to the first occurrence of the species *Podorhabdus cylindratus* NOËL.

Most frequent are species *Crepidolithus crassus* (DEFLANDRE) NOËL and *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILL. Less frequent are species *Cyclagerosphaera margereli* NOËL, *Calolithus martelae* NOËL, *Podorhabdus* sp. and *Zeugrhabdus* sp.

A comparison of the character of assemblages of this zone with assemblages quoted by other authors, showed some differences. For example, the species *Crepidolithus cavus* was only found in the overlying zone *Podorhabdus cylindratus* on the locality Vršatec, whereas some authors like T. BARNARD et W. W. HAY (1974) found it frequently in the zone *Crepidolithus crassus*. B. PRINS (1969) placed the subzone with the index species *Crepidolithus cavus* lower than the subzone *Crepidolithus crassus*. The assemblages also differ in the presence of "massive" coccoliths. These were not found on the locality Vršatec, but in assemblages from other areas the representations of the genus *Parhabdolithus* are very frequent also in the zone *Crepidolithus crassus*. There is a question whether the calcareous nannoflora lived in the area of the Klippen Belt, in the Lowermost lias, i. e. in the time of the boom of "massive" coccoliths. Thus the absence of thick-walled forms could be explained.

In the overlier of green-grey limestones and spotty marls are dark schists with sphaeroiderites — *Murchisonia* beds. With those the overlying nannoplankton zone *Podorhabdus cylindratus* is associated. It commences in the lowermost Toarcian — zone *Dactylloceras tenuicostatum*. Its upper boundary is not determined because it does not link with the next nannoplankton zone. In the overlier of the Murchisonian beds are grey and red crinoidal limestones, the nodular Czorsztyn limestones and Calpionelle limestones without nannofossils. The zone is likely to extend to the Lower Aalenian.

The zone *Podorhabdus cylindratus* is characterized by the first occurrence of the species *Podorhabdus cylindratus* NOËL. As regards species it is a varied zone. Most frequent species are *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILL, *Crepidolithus*

cavus PRINS and *Podorhabdus* sp. Most forms of the genus have disturbed central structure, so they could not have been identified as for species. In isolated cases the species *Podorhabdus cylindratus* NOËL was determined. The assemblage also comprises the species *Ellipsagelosphaera* sp., *Lotharingius barozi* NOËL, *Cyclagelosphaera margereli* NOËL, *Calolithus martelae* NOËL, *Calculus* sp., *Crepidolithus crassus* (DEFLANDRE) NOËL, *Vekshinella* ex gr. *dibrachiata* GARTNER, *Vekshinella* sp. and *Zeugrhabdus* sp. The character of the zone is very similar to the zone *Podorhabdus cylindratus*, described by T. BARNARD et W. W. HAY (1974). There are no massive coccoliths anymore, and the assemblages comprise similar forms like those on the locality Vršatec.

Systematic part

Biscutaceae BLACK, 1971

Biscutum BLACK in BLACK et BARNES 1959

Biscutum dubium (NOËL, 1965) GRÜN, 1974, emend. GRÜN et ZWEILI

(Pl. LXI, Fig. 1—5)

1965 *Palaeopontosphaera dubia* n. sp. — D. NOËL: Sur les coccolithes du Jurassique etc., p. 76, pl. 7, fig. 1, 3, 5, 7—12

1974 *Biscutum dubium* (NOËL, 1965) n. comb. — W. GRÜN, B. PRINS et F. ZWEILI: Coccolithophoriden aus dem Lias elipson etc., p. 297, pl. 14, fig. 1—3.

Description: Elliptical to almost circular forms with variable size. Distal and proximal disc are monocyclic, composed of 20—30 calcite crystals, aligned tightly along each other. The central aperture is usually filled with tiny accumulated granules. It is empty, most frequently.

Stratigraphical range: the zone *Crepidolithus crassus*, the zone *Podorhabdus cylindratus*.

Ellipsagelosphaeraceae NOËL, 1965

Ellipsagelosphaera NOËL, 1965

? *Ellipsagelosphaera* sp.

(Pl. LXI, Fig. 6)

Description: Problematic elliptical forms, markedly recrystallized. All examples observed from distal view. In the centre of the central aperture is an indication of a septum.

Stratigraphical range: the zone *Podorhabdus cylindratus*.

Lotharingius NOËL, 1972

Lotharingius barozi NOËL, 1972

(Pl. LXI, Fig. 7—11)

1972 *Lotharingius barozi* n. sp. — D. NOËL: Nannofossiles calcaires de sediments etc., p. 114, fig. 9, pl. 11, fig. 1—7.

Description: Elliptical forms with their proximal disc distinctly protruding over the distal disc. The central aperture shows a characteristic structure. It is divided by two massive septa parallel to the axes of the ellipse. Ten to twelve tiny, secondary septa are perpendicular to the long axis.

Stratigraphical range: the zone *Podorhabdus cylindricus*.

Cyclagelosphaera NOËL, 1965

Cyclagelosphaera margereli, NOËL, 1965

(Pl. XLI, Fig. 12)

1965 *Cyclagelosphaera margereli* n. sp. — D. NOËL: Sur les coccolithes du Jurassique etc., p. 130, fig. 44—46, pl. 17, fig. 4—9, pl. 18, fig. 1, 2, pl. 20, fig. 2—4.

Description: Relatively large, circular coccoliths, with their central part considerably damaged. All examples found are recrystallized.

Stratigraphical range: the zone *Crepidolithus crassus*.

Calolithus NOËL, 1965

Calolithus martelae NOËL, 1965

(Pl. LXII, Fig. 1—4)

1965 *Calolithus martelae* n. sp. — D. NOËL: Sur les coccolithes du Jurassique etc., p. 135, fig. 50—52, pl. 14, fig. 1—10, pl. 15, fig. 1—6.

Description: Elliptical coccoliths composed of two discs resting on each other. Characteristic is regular perforation on the internal margin, distinct on both the distal and the proximal sides. It has a large central aperture.

Stratigraphical range: the zone *Crepidolithus crassus*, the zone *Podorhabdus cylindricus*.

Podorhabdaceae NOËL, 1965

Podorhabdus NOËL, 1965

***Podorhabdus cylindratu* NOËL, 1965**

(Pl. LXII, Fig. 5—11)

1965 *Podorhabdus cylindratu* n. sp. — D. NOËL: Sur les coccolithes du Jurassique etc., p. 103, fig. 30, pl. 9, fig. 3,7.

Description: Elliptical coccoliths composed of two equal discs, resting on each other. The large central aperture is divided by septa parallel to the axes of ellipse into four openings. The structure of the central aperture is damaged in the most part.

Stratigraphical range: the zone *Podorhabdus cylindratu*.

***Calyculaceae* NOËL, 1972**

***Calculus* NOËL, 1972**

? *Calculus* sp.

(Pl. LXIII, Fig. 3,6)

Description: Problematic forms with only the distal side. Massive crystals forming the distal disc and the deep central aperture closed by a "lattice" facilitate ranging of these forms to the genus *Calculus*.

Stratigraphical range: the zone *Podorhabdus cylindratu*.

***Crepidolithaceae* BLACK, 1971**

***Crepidolithus* NOËL, 1965**

***Crepidolithus crassus* (DEFLANDRE, 1955) NOËL, 1965**

(Pl. LXIII, Fig. 1, 2, 4, 5, 8)

1955 *Discolithus crassus* n. sp. — G. DEFLANDRE in G. DEFLANDRE et C. FERT: Observations sur les Coccolithophoridés etc., p. 144, textfig. 49, pl. 15, fig. 12, 13

1965 *Crepidolithus crassus* (DEFLANDRE, 1955) n. comb. — D. NOËL: Sur les coccolithes du Jurassique etc., fig. 17—21, pl. 2, fig. 3—7, pl. 3, fig. 1—5.

Description: Elliptical massive coccoliths consisting of vertically emplaced rhombohedral calcite crystals. Central aperture on the proximal side is covered by horizontal plates.

Stratigraphical range: the zone *Crepidolithus crassus* — very frequent, the zone *Podorhabdus cylindratu*.

***Crepidolithus cavus* PRINS, 1969**

(Pl. LXIII, Fig. 7, 9—12)

1969 *Crepidolithus cavus* n. sp. — B. PRINS: Evolution and stratigraphy etc., p. 549, pl. 1, fig. 4.

Description: Massive elliptical coccoliths differing from the species *Crepidolithus crassus* in a large central aperture. On its proximal side it is fringed with horizontally emplaced plates.

Stratigraphical range: the zone *Podorhabdus cylindricus*.

***Zygothaceae* NOËL et BLACK, 1968**

***Vekshinella* LOEBLICH et TAPPAN, 1963**

***Vekshinella* sp.**

(Pl. LXIV, Fig. 1—5, 7, 10, 11)

Description: The forms cannot be determined as for species because of damaged structure of the central aperture on almost all the species found. In two cases they may be *Vekshinella dibrachiata* GARTNER, 1968 (Pl. , Fig.).

Stratigraphical range: the zone *Podorhabdus cylindricus*.

***Zeugrhabdotus* REINHARDT, 1965 emend., 1973**

***Zeugrhabdotus* sp.**

(Pl. LXIV, Fig. 8, 9, 12)

Description: The species determination is problematic because of the damaged membrane in the central aperture.

Stratigraphical range: the zone *Crepidolithus crassus*, the zone *Podorhabdus cylindricus*.

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Viera Gašpariková

Vápnitá nanoflóra liasu bradlového pásma (čorštýnska jednotka)

Resumé anglického textu

Na lokalite Vršatec v čorštýnskej sukcesii bola A. BEGANOM a V. GAŠPARIKOVOU (1979) zistená v škvrnitých slieňoch a tmavosivých bridliciach so sférosideritmi bohatá vápnitá nanoflóra liasu, na základe ktorej bolo upresnené stratigrafické rozpätie oboch facií. Ide o prvý nález vápnitej nanoflóry v jurských sedimentoch Západných Karpát a o vyčlenenie dvoch liasových nanoplanktónových zón.

V intervale posledných desiatich rokov nanoflóru použili k stratigrafickému rozčleneniu jury niekoľkí autori. Ide o práce P. BRONNIMANNA (1955), H. STRADNERA (1963), D. NOËLA (1965), P. REINHARDA (1965), B. PRINSA (1969), T. R. WORSLEYA (1971), H. R. THIERSTEINA (1971), A. W. MEDDA (1971), J. A. WILCOXONA (1972) a A. AMEZIEUXA (1972). Všetky tieto práce sú podrobne rozvedené v práci T. BARNARDA et W. W. HAYA (1974). Títo autori na základe štúdia kokolitov v južnom Anglicku a severnom Francúzsku stanovili v jure 22 kokolitových zón, ktoré korelovali s existujúcimi amonitovými zónami.

Na lokalite Vršatec boli vyčlenené dve nanoplanktónové zóny — zóna *Crepidolithus crassus* a zóna *Podorhabdus cylindricus*. V predloženej práci sa zameriavam na stratigrafické postavenie týchto zón, ich koreláciu s nanoplanktónovými zónami liasu z iných oblastí Európy, ako i na koreláciu s amonitovými zónami. V systematickej časti sú opísané druhy, ktoré boli študované optickým i riadkovacím elektrónovým mikroskopom.

Pri stratigrafickom začleňovaní stanovených zón nadväzujem na niekoľkých autorov, ktorí sa zaoberali problémom zónovania liasu v západnej časti Európy.

H. STRADNER (1963) vyčlenil v liase dve zóny. Spodná je charakterizovaná spoločenstvom „*Liasicus*“ a zodpovedá sinemúru. Prevláda v nej druh *Parhabdolithus liasicus* DEFLANDRE a *Schizosphaerella punctulata* DEFLANDRE. Vrchná zóna zodpovedá pliensbachu až bajoku a je charakterizovaná spoločenstvom „*Opacus*“. Hlavné druhy tejto zóny sú *Discolithus crassus* DEFLANDRE a *Coccolithus opacus* STRADNER.

P. REINHARDT (1965) v sinemúre vyčlenil spoločenstvo *Parhabdolithus liasicus*, pre pliensbach až bajok spoločenstvo „*Opacus*“ s prevládajúcim druhom *Watznaueria opaca* STRADNER a *Discolithus crassus* DEFLANDRE.

Podobné rozčlenenie liasu predkladá vo svojej práci D. NOËL (1965), v ktorej lias charakterizuje

„masívnymi“ kokolitmi, zastúpenými druhmi *Parhabdolithus liasicus* DEFLANDRE, *Parhabdolithus marthae* DEFLANDRE, *Parhabdolithus robustus* NOËL, *Crepidolithus crassus* NOËL.

Detailné zónovanie spodného a stredného liasu podáva B. PRINS (1969), ktorý v tomto stratigrafickom rozpätí stanovil štyri zóny a päť subzón a koreluje ich s amonitovými zónami. Hétanžu zodpovedá zóna *Crucirhabdus*, sinemúr zóna *Parhabdolithus* s podzónami *Parhabdolithus marthae* a *Parhabdolithus liasicus*. Pre plienschbach vymedzil autor zónu *Crepidolithus* s podzónami *Crepidolithus cavus* a *Crepidolithus crassus* a pre spodný toark zónu *Striatococcus* s podzónou *Striatococcus opacus*.

T. BARNARD et W. W. HAY (1974) vyčlenili v liase osem zón. V hétanži je to zóna *Annulithus arkelli*, na hranici hétanž — sinemúr zóna *Crucirhabdus primulus*. Sinemúr charakterizuje zóna *Parhabdolithus marthae*, *Parhabdolithus liasicus* a *Paleopontosphaera dubia*. V najvyššom sinemúre sa začína zóna *Crepidolithus crassus*, ktorá siaha do strednej časti spodného plienschbachu a po nej nasleduje zóna *Podorhabdus cylindratus*, ktorá sa končí v najvyššom toarku zónou *Discorhabdus tubus*. Uvedené zóny sú korelované s amonitovými zónami.

Na spracúvanej lokalite bola stanovená zóna *Crepidolithus crassus* a zóna *Podorhabdus cylindratus*, pričom každá zóna je viazaná na samostatnú litologickú jednotku.

Zóna *Crepidolithus crassus* bola stanovená v súvrství zelenkastých slienitých vápencov a škvrnitých slieňov. Tieto obsahujú i pomerne bohaté liasové spoločenstvo foraminifer. Ide o súvrstvie ktoré zodpovedá amonitovým zónam *Uptonia jamesoni* až *Pleuroceras spinatum* t. j. spodnému a vrchnému plienschbachu, čím je potvrdený stratigrafický rozsah zóny *Crepidolithus crassus*. Obdobné rozpätie tejto zóny vymedzil B. PRINS (1969). T. BARNARD et W. W. HAY (1974) kladú túto zónu len do strednej časti spodného plienschbachu, t. j. na hranicu amonitovej zóny *Prodactylloceras dawoei*.

Zóna *Crepidolithus crassus* je charakterizovaná prvým objavením sa druhu *Crepidolithus crassus* (DEFLANDRE) NOËL do prvého objavenia sa druhu *Podorhabdus cylindratus* NOËL. Najhojnejšie je zastúpený druh *Crepidolithus crassus* (DEFLANDRE) NOËL a *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILL. Menej hojne sú v spoločenstve zastúpené druhy *Cyclagelosphaera margereli* NOËL, *Calolithus martelae* NOËL, *Podorhabdus* sp. a *Zeughrabdus* sp.

Pri porovnaní charakteru spoločenstiev tejto zóny so spoločenstvami, ktoré uvádzajú iní autori, boli zistené určité rozdielnosti. Napr. druh *Crepidolithus cavus* bol na lokalite Vršatec stanovený len v nadložnej zóne *Podorhabdus cylindratus*, zatiaľ čo niektorí autori napr. T. BARNARD et W. W. HAY (1974) uvádzajú tento druh v zóne *Crepidolithus crassus* ako častý. B. PRINS (1969) kladie subzónu s vedúcim druhom *Crepidolithus cavus* nižšie ako subzónu *Crepidolithus crassus*. Ďalej spoločenstvá sa líšia prítomnosťou „masívnych“ kokolitov. Na spracúvanej lokalite tento typ kokolitov nebol zistený, naproti tomu v spoločenstvách z iných oblastí sú zástupcovia rodu *Parhabdolithus* veľmi hojné i v zóne *Crepidolithus crassus*. Natíska sa otázka, či v oblasti bradlového pásma v najspodnejšom liase, keď bol rozkvet masívnych kokolitov, vápnitá nanoflóra vôbec žila. To by vysvetľovalo neprítomnosť hrubostených foriem v zóne *Crepidolithus crassus*.

V nadloží zelenosivých vápencov a škvrnitých slieňov vystupujú tmavé bridlice so sférosideritmi — murchisoniové vrstvy, na ktoré je viazaná nadložná nanoplanktónová zóna *Podorhabdus cylindratus*. Začína sa v najspodnejšom toarku — zóna *Dactylioceras tenuicostatum* — avšak jej horná hranica nie je vymedzená, nakoľko nenadväzuje na ďalšiu nanoplanktónovú zónu. V nadloží murchisoniových vrstiev vystupujú sivé a červené krinoidové vápence, čorštýnske hľuznaté vápence a kalcionelové vápence, ktoré neobsahujú nanofosílie. Možno predpokladať, že jej rozpätie siaha až do spodného álenu.

Zóna *Podorhabdus cylindratus* je charakterizovaná prvým objavením sa druhu *Podorhabdus cylindratus*. Ide o zónu kvalitatívne pestrú. Najhojnejšie je zastúpený druh *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILL, *Crepidolithus cavus* PRINS a *Podorhabdus* sp. Prevažná časť foriem zodpovedajúca tomuto rodu má porušenú centrálnu štruktúru a preto ju nebolo možno identifikovať na druhy. Len v jednotlivých prípadoch bol určený druh *Podorhabdus cylindratus* NOËL. Ďalej v spoločenstve sú zastúpené druhy *Ellipsagelosphaera* sp., *Lotharingius barozi* NOËL, *Cyclagelosphaera margereli* NOËL, *Calolithus martelae* NOËL, *Calyculus* sp., *Crepidolithus crassus* (DEFLANDRE) NOËL, *Vekshinella* ex gr. *dibrachiata* GARTNER, *Vekshinella* sp. a *Zeughrabdus* sp. Táto zóna má veľmi podobný charakter so zónou *Podorhabdus cylindratus*, opísanou T. BARNARDOM et W. W. HAYOM (1974). Masívne kokolity sa už neobjavujú a spoločenstvá sú tvorené obdobnými formami ako spoločenstvá z lokality Vršatec.

Explanations of plates LXI—LXIV

Plate LXI

- 1 *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILI, distal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 2 *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILI, distal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 3 *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILI, distal view, 5000×, Vršatec 229/78, zone *Podorhabdus cylindricus*
- 4 *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILI, proximal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 5 *Biscutum dubium* (NOËL) GRÜN, PRINS et ZWEILI, distal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 6 *Ellipsagelosphaera* sp., distal view, 10 000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 7 *Lotharingius barozi* NOËL, distal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 8 *Lotharingius barozi* NOËL, distal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 9 *Lotharingius barozi* NOËL, distal view, 5000×, Vršatec 219/78, zone *Podorhabdus cylindricus*
- 10 *Lotharingius barozi* NOËL, distal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 11 *Lotharingius barozi* NOËL, distal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 12 *Cyclagelosphaera margereli* NOËL, distal view, 5000×, Vršatec 46/79, zone *Crepidolithus crassus*

Plate LXII

- 1 *Calolithus martelae* NOËL, proximal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 2 *Calolithus martelae* NOËL, proximal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 3 *Calolithus martelae* NOËL, proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 4 *Calolithus martelae* NOËL, distal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 5 *Podorhabdus* sp., proximal view, 7500×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 6 *Podorhabdus* sp., proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 7 *Podorhabdus cylindricus* NOËL, proximal view, 7500×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 8 *Podorhabdus* sp., proximal view, 5000×, Vršatec 229/78, zone *Podorhabdus cylindricus*
- 9 *Podorhabdus* sp., proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 10 *Podorhabdus ex gr. cylindricus* NOËL, proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 11 *Podorhabdus* sp., proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 12 *Podorhabdus* sp., proximal view, 7000×, Vršatec 223/78, zone *Podorhabdus cylindricus*

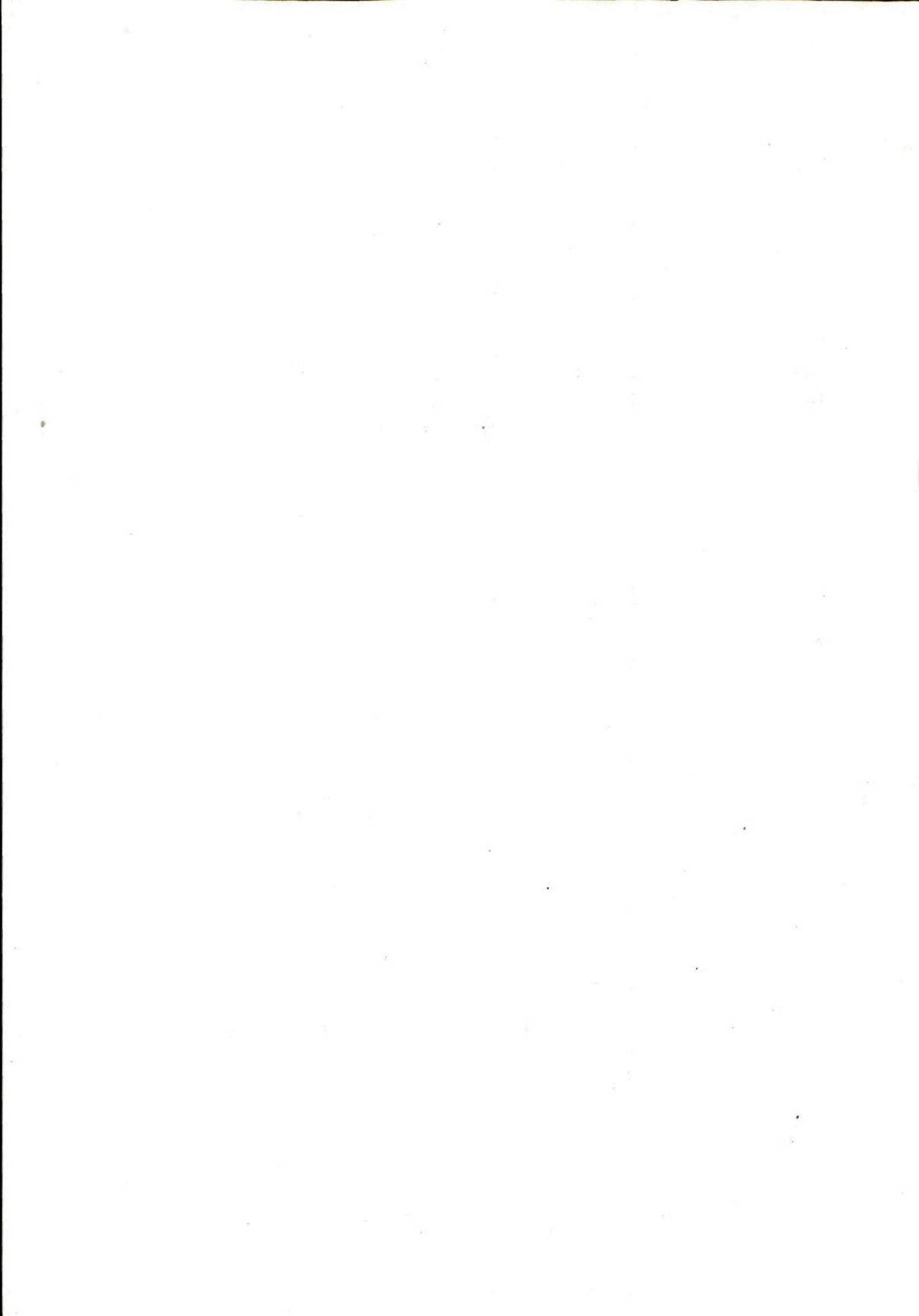
Plate LXIII

- 1 *Crepidolithus crassus* (DEFLANDRE) NOËL, proximal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 2 *Crepidolithus crassus* (DEFLANDRE) NOËL, proximal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 3 ? *Calculus* sp., distal view, 5000×, Vršatec 229/78, zone *Podorhabdus cylindricus*
- 4 *Crepidolithus crassus* (DEFLANDRE) NOËL, distal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 5 *Crepidolithus crassus* (DEFLANDRE) NOËL, distal view, 5000×, Vršatec 407/77, zone *Crepidolithus crassus*
- 6 ? *Calculus* sp., distal view, 5000×, Vršatec 229/78, zone *Podorhabdus cylindricus*
- 7 *Crepidolithus cavus* PRINS, distal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 8 *Crepidolithus crassus* (DEFLANDRE) NOËL, distal view, Vršatec 407/77, zone *Crepidolithus crassus*
- 9 *Crepidolithus cavus* PRINS, proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 10 *Crepidolithus cavus* PRINS, proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 11 *Crepidolithus cavus* PRINS, proximal view, 5000×, Vršatec 223/78, zone *Podorhabdus cylindricus*
- 12 *Crepidolithus cavus* PRINS, proximal view, 4500×, Vršatec 223/78, zone *Podorhabdus cylindricus*

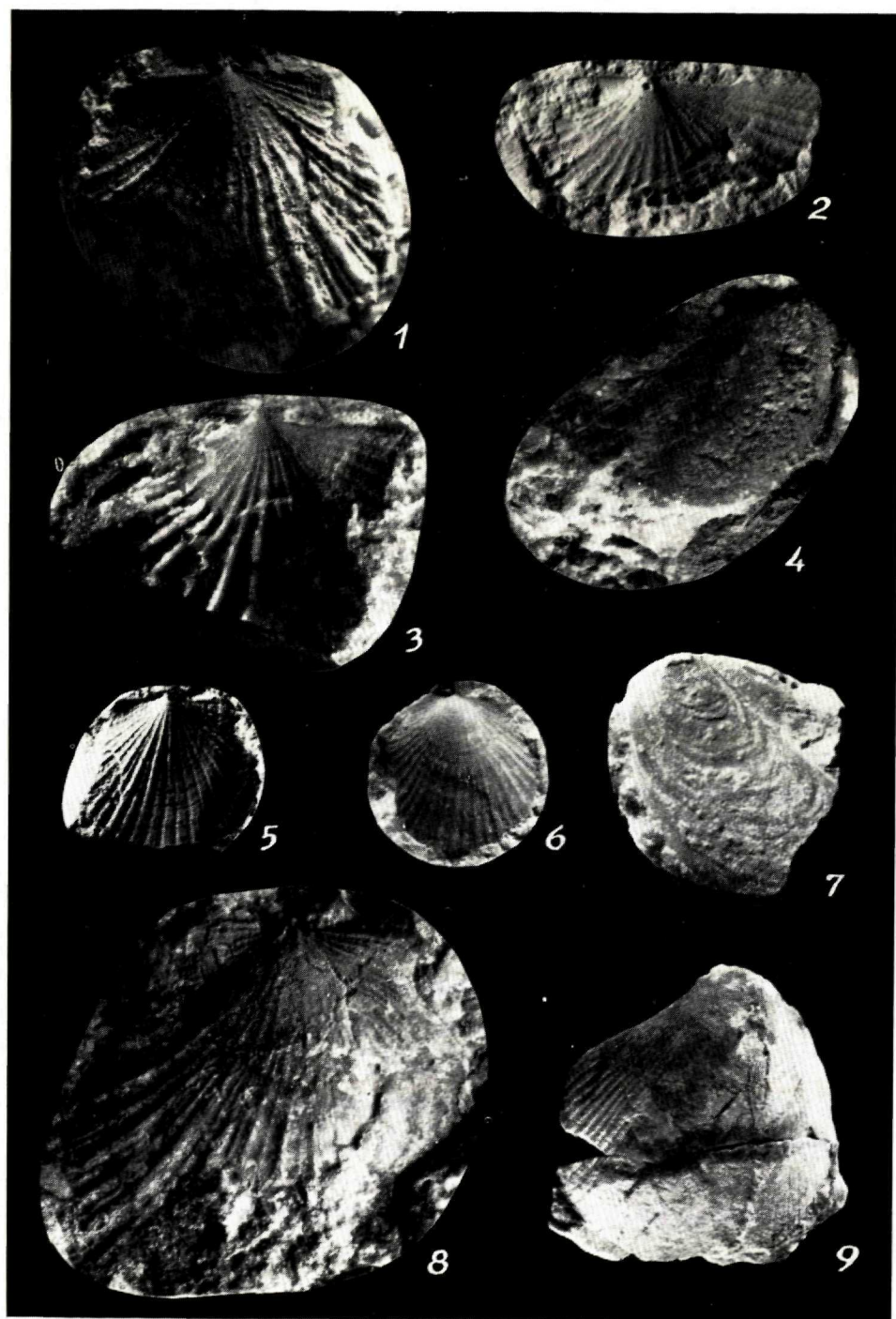
Plate LXIV

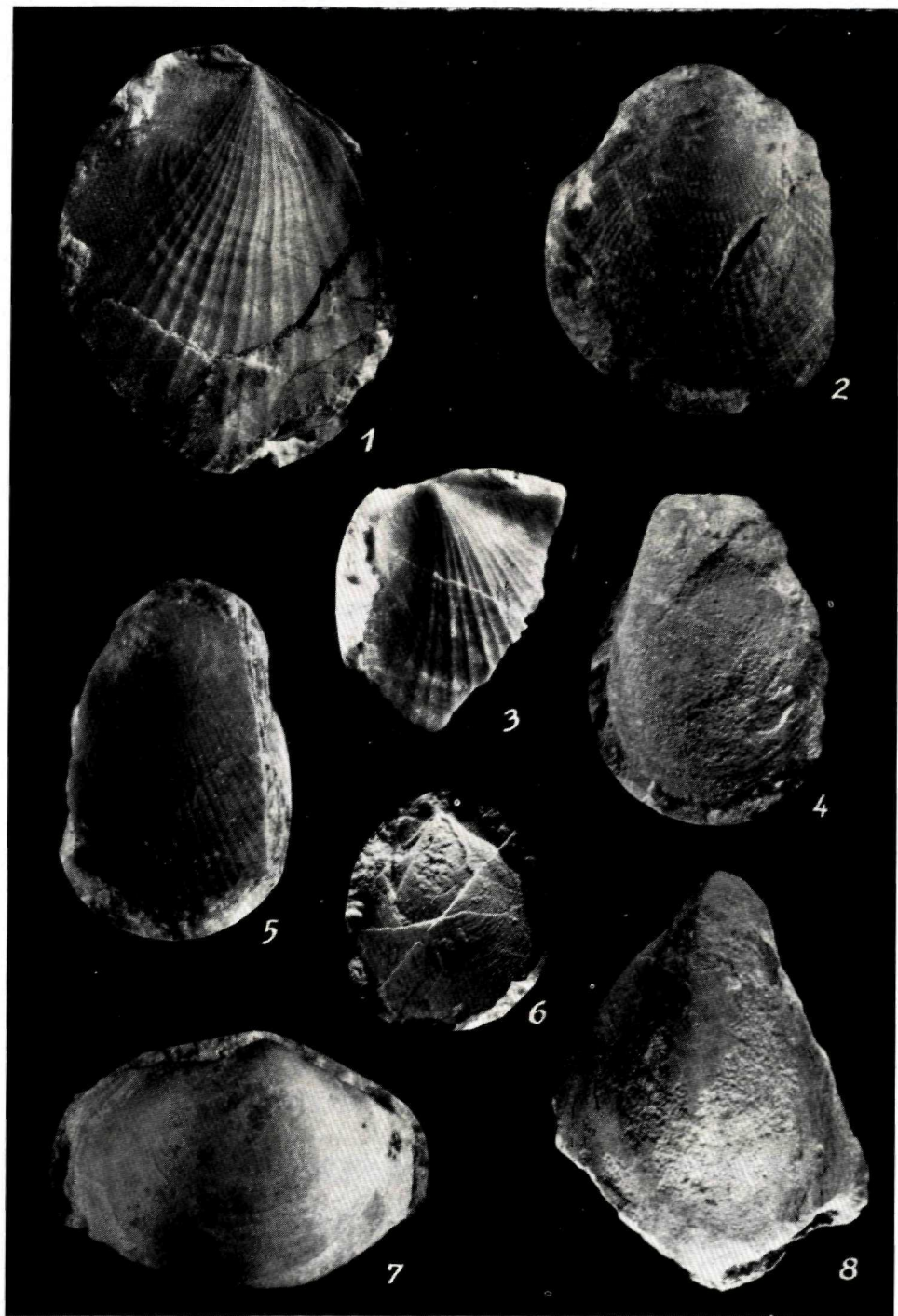
- 1 *Vekshinella* ex gr. *dibrachiata* GARTNER, distal view, 5000 $\times$, Vršatec 223/78, zone *Podorhabdus cylindrat*
- 2 *Vekshinella* sp., distal view, 7500 $\times$, Vršatec 223/78, zone *Podorhabdus cylindrat*
- 3 coccolith group, 5000 $\times$, Vršatec 223/78, zone *Podorhabdus cylindrat*
- 4 *Vekshinella* ex gr. *dibrachiata* GARTNER, distal view, 5000 $\times$, Vršatec 216/78, zone *Podorhabdus cylindrat*
- 5 *Vekshinella* sp., distal view, 5000 $\times$, Vršatec 219/78, zone *Podorhabdus cylindrat*
- 6 coccolith group, 5000 $\times$, Vršatec 223/78, zone *Podorhabdus cylindrat*
- 7 ? *Vekshinella* sp., proximal view, 5000 $\times$, Vršatec 223/78, zone *Podorhabdus cylindrat*
- 8 *Zeugrhabdotus* sp., distal view, 7000 $\times$, Vršatec 94/79, zone *Crepidolithus crassus*
- 9 *Zeugrhabdotus* sp., proximal view, 5000 $\times$, Vršatec 407/77, zone *Crepidolithus crassus*
- 10 *Vekshinella* sp., proximal view, 5000 $\times$, Vršatec 223/78, zone *Podorhabdus cylindrat*
- 11 *Vekshinella* sp., distal view, 5000 $\times$, Vršatec 95/79, zone *Podorhabdus cylindrat*
- 12 *Zeugrhabdotus* sp., distal view, 5000 $\times$, Vršatec 407/77, zone *Crepidolithus crassus*

Rewieved by O. Samuel

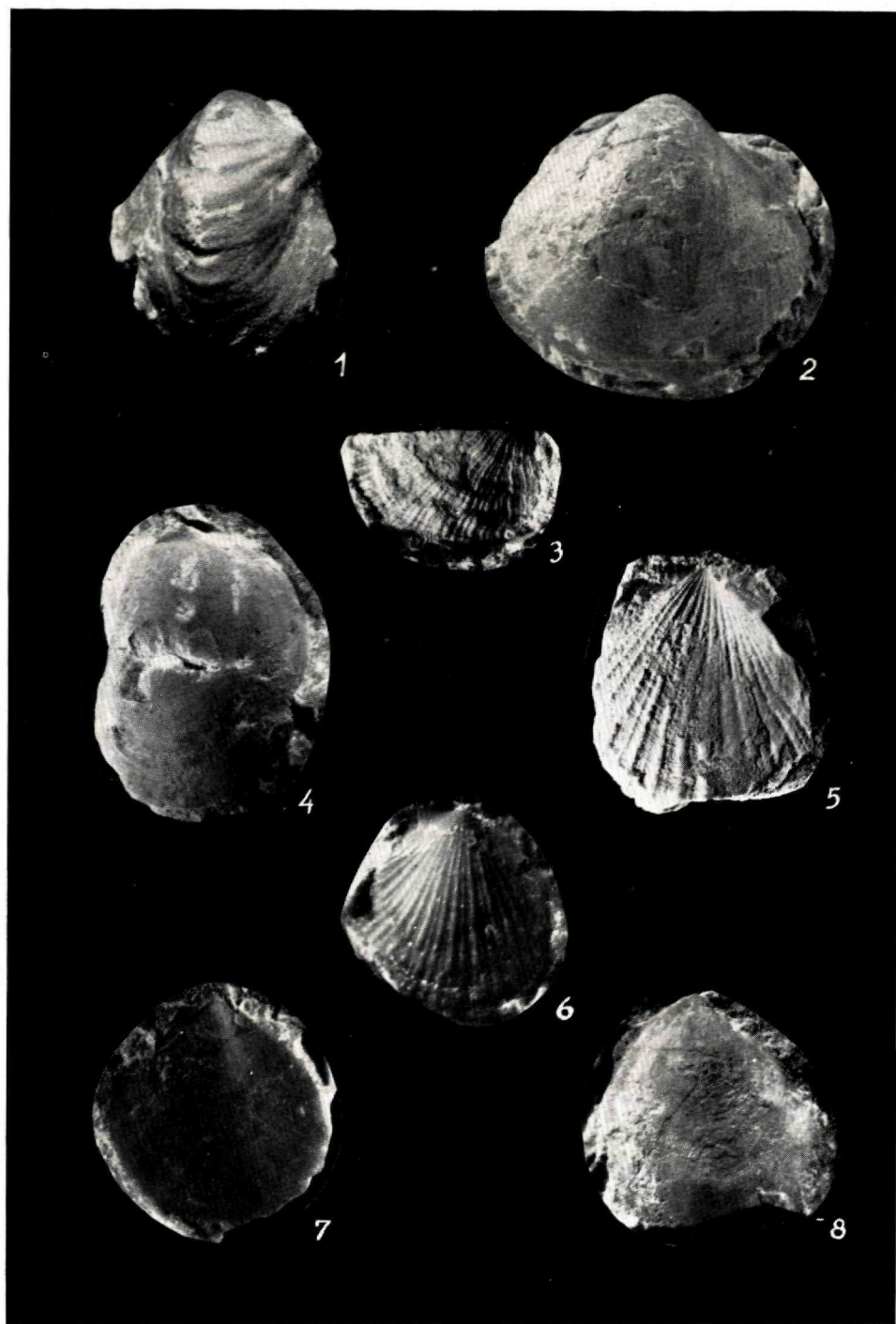


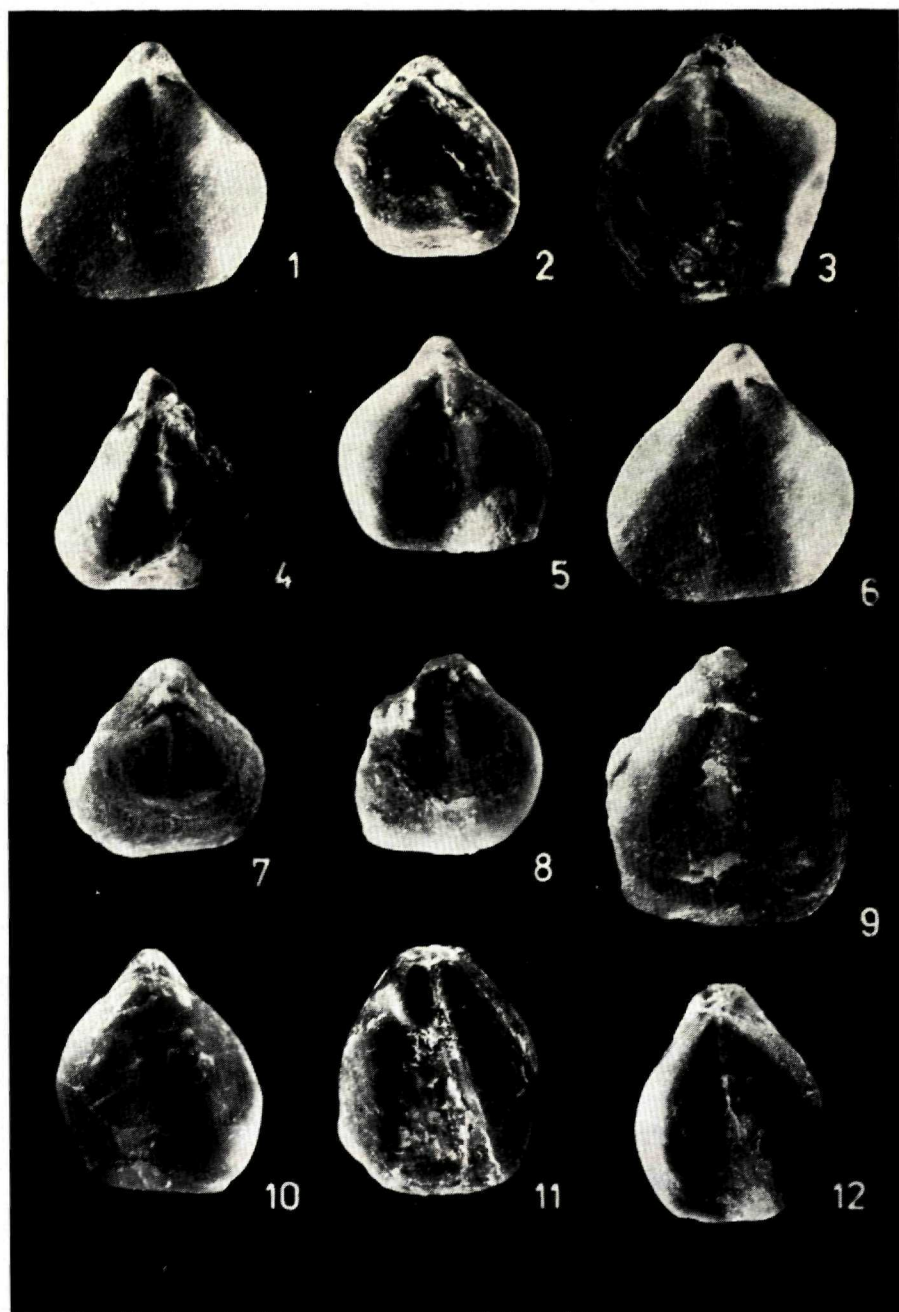
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I—LXIV

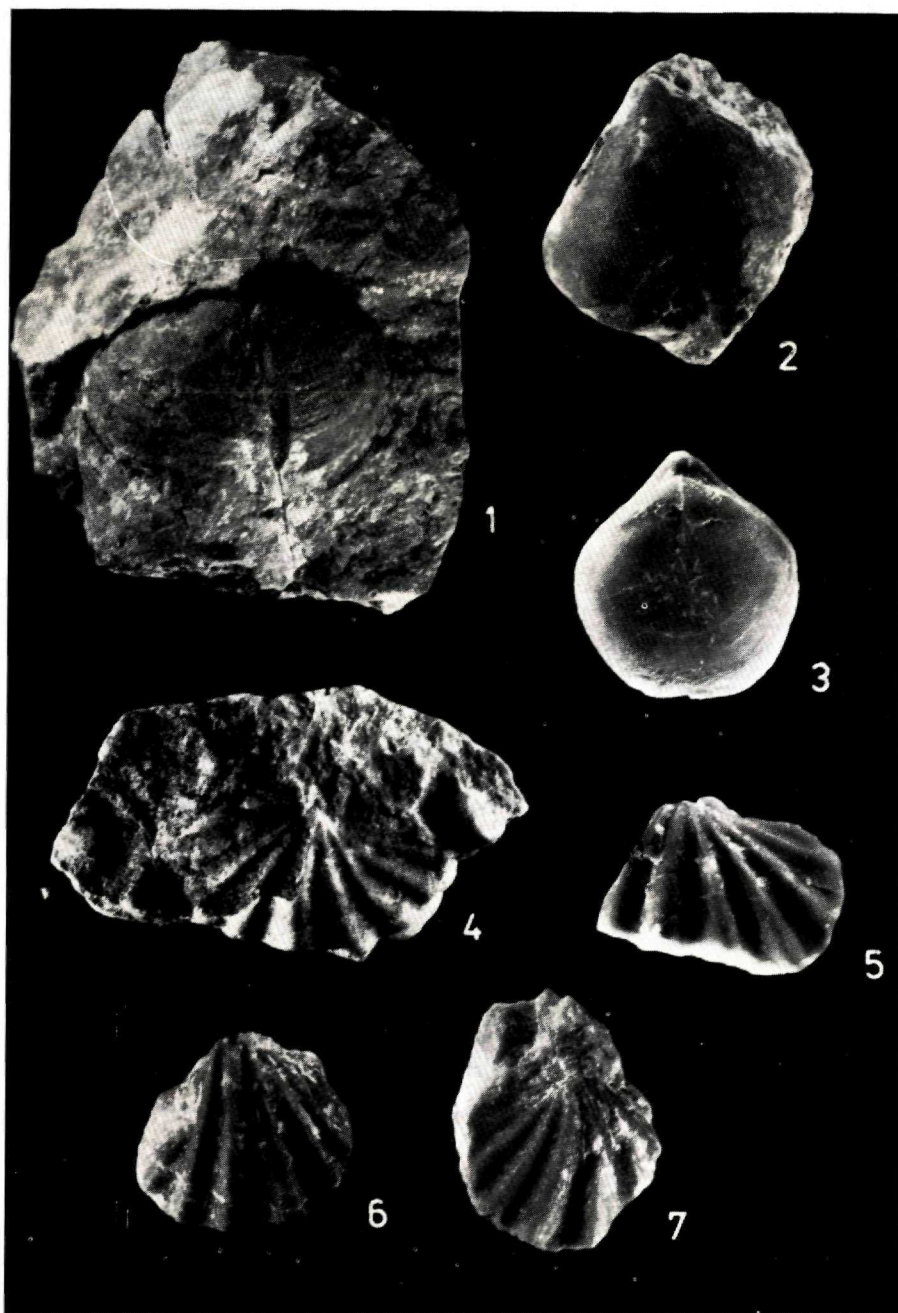


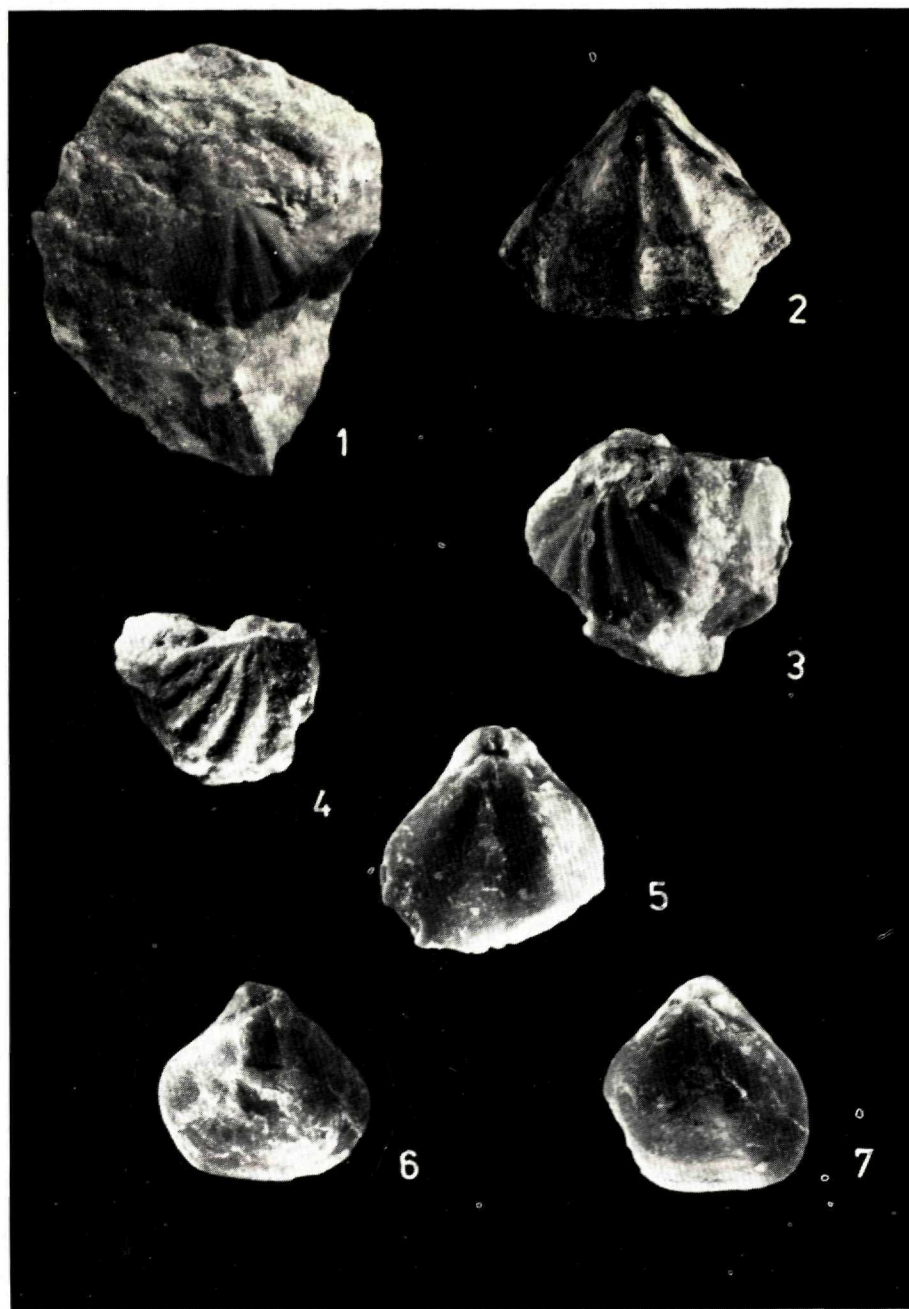


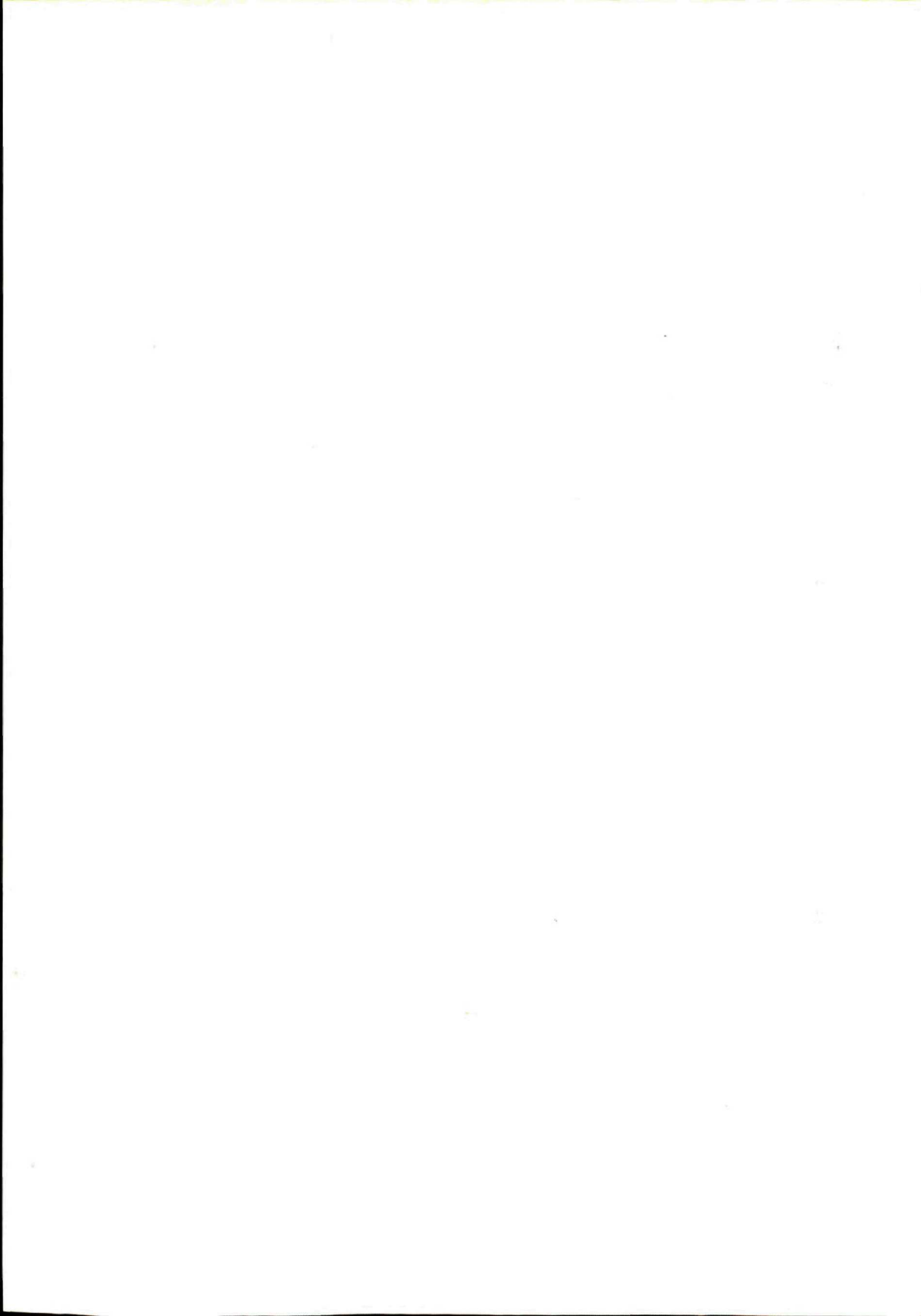




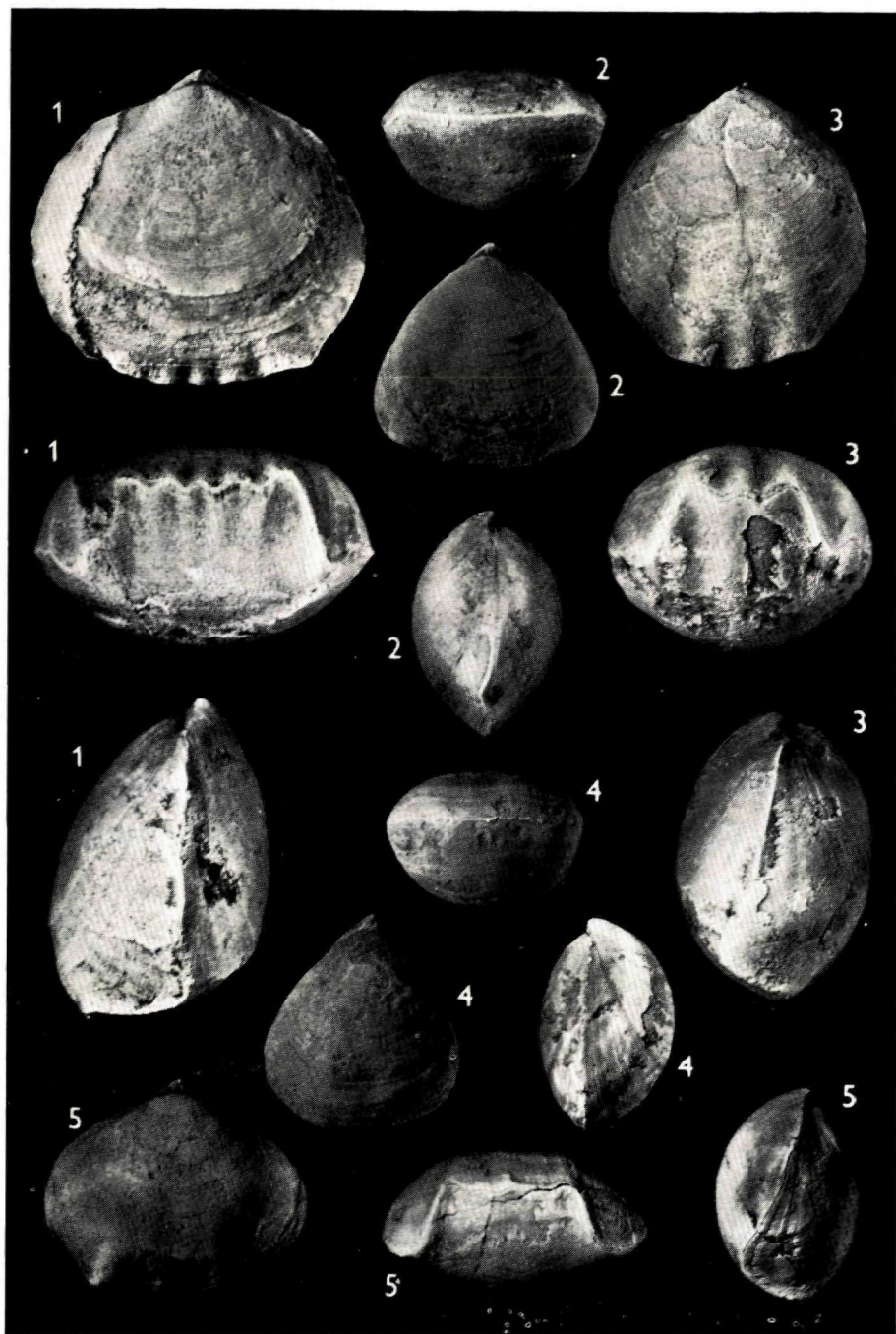


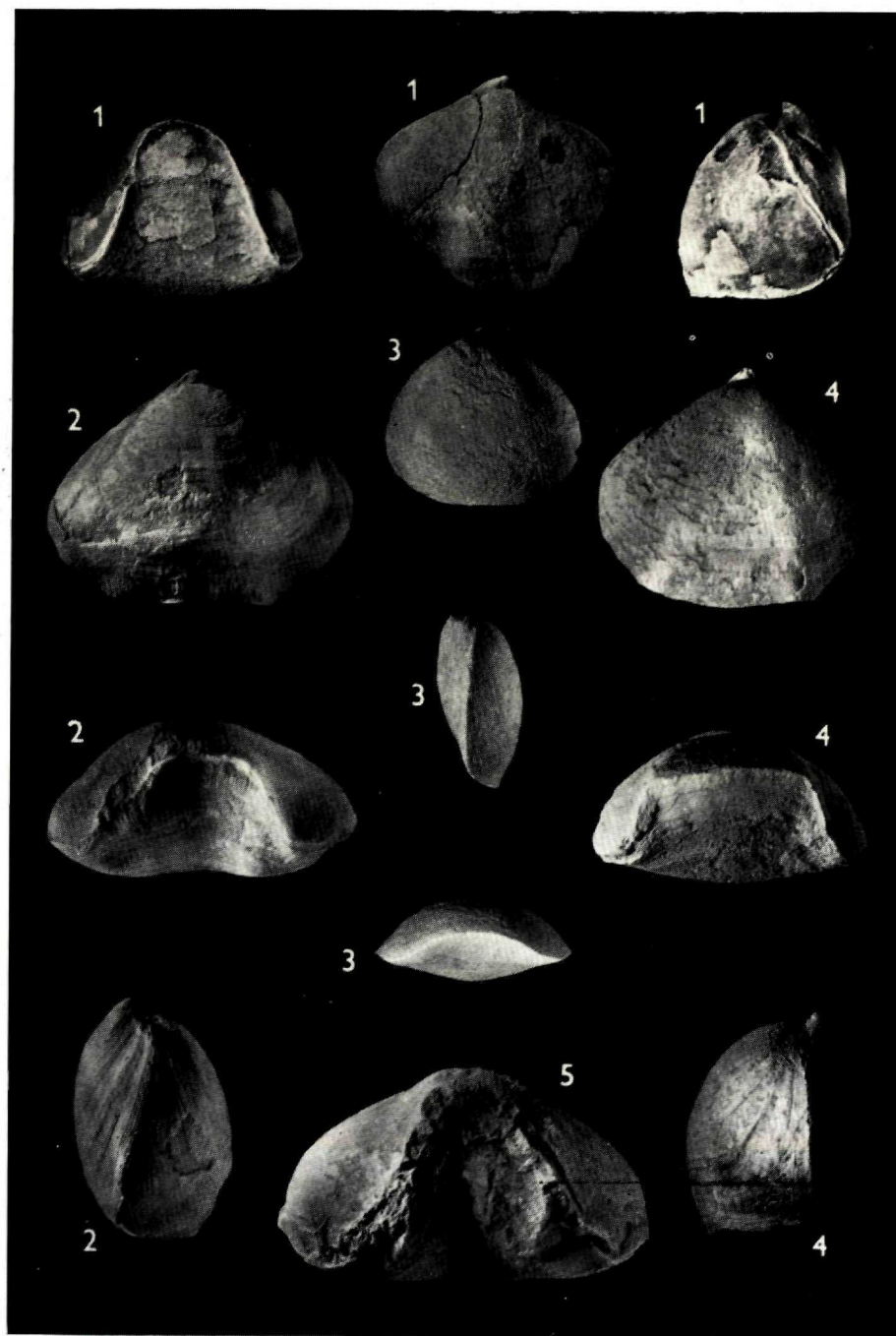






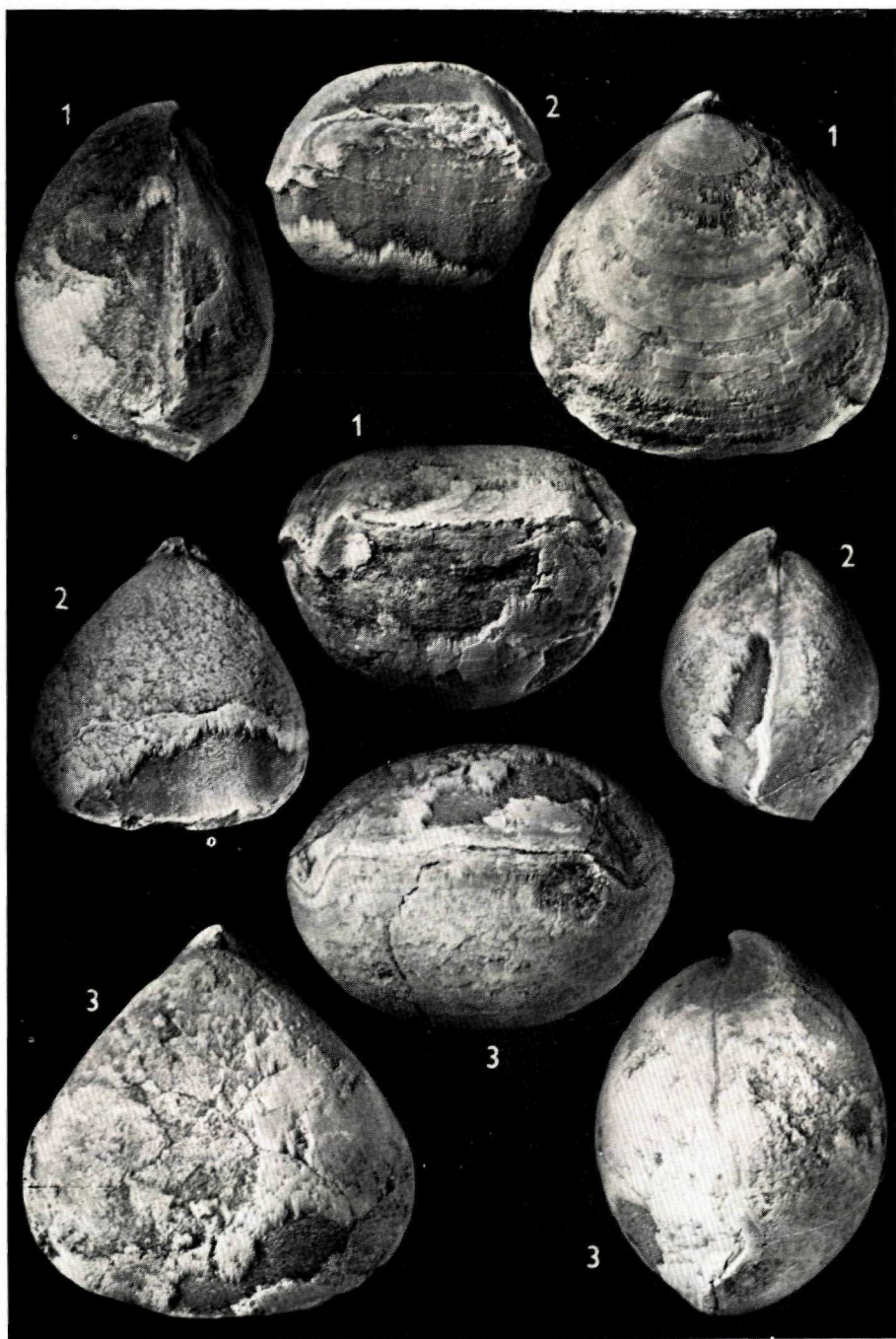


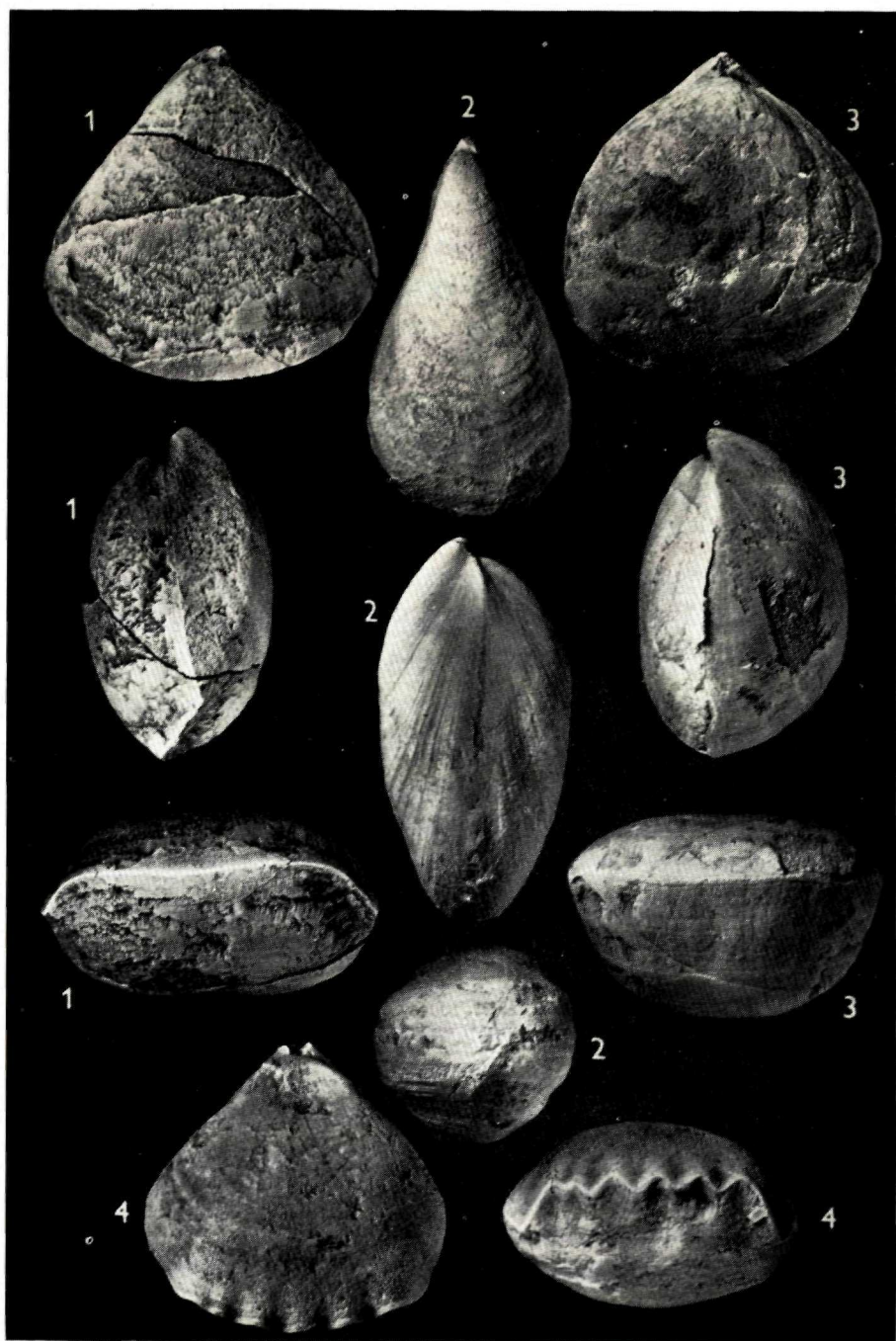






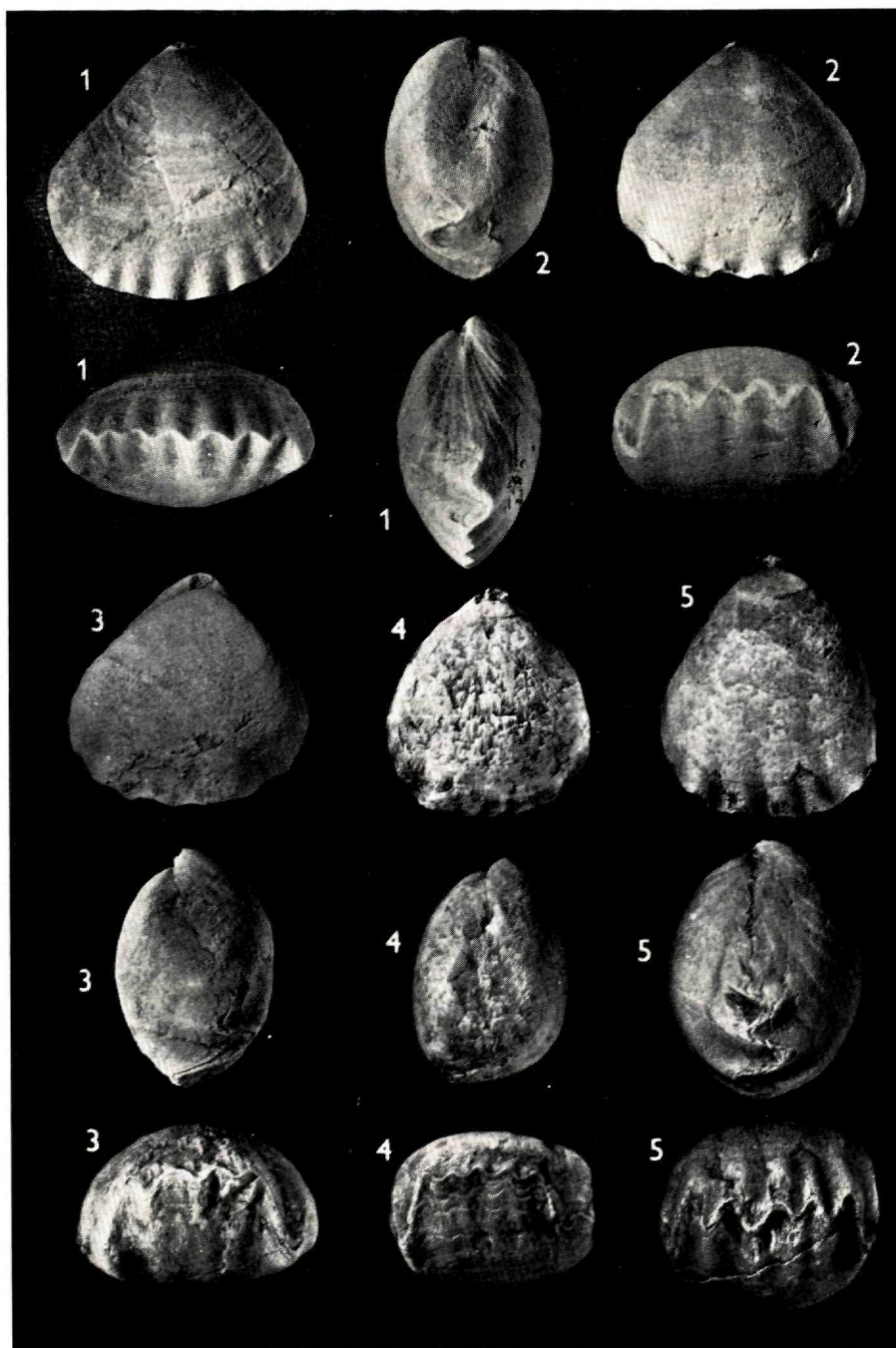






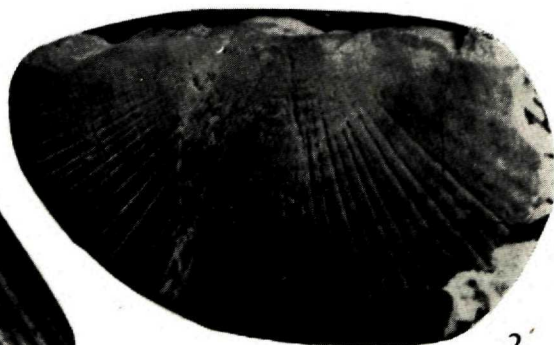




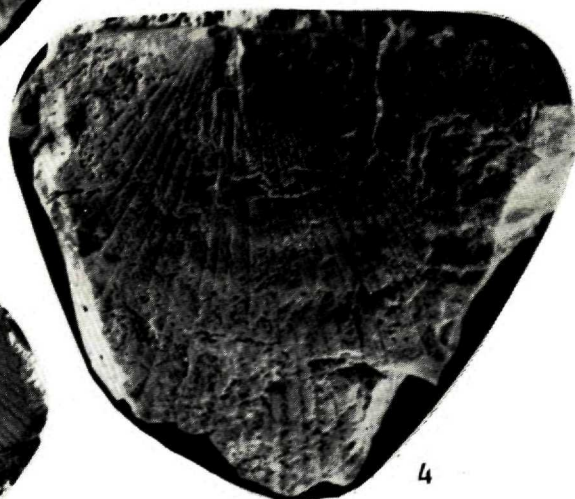




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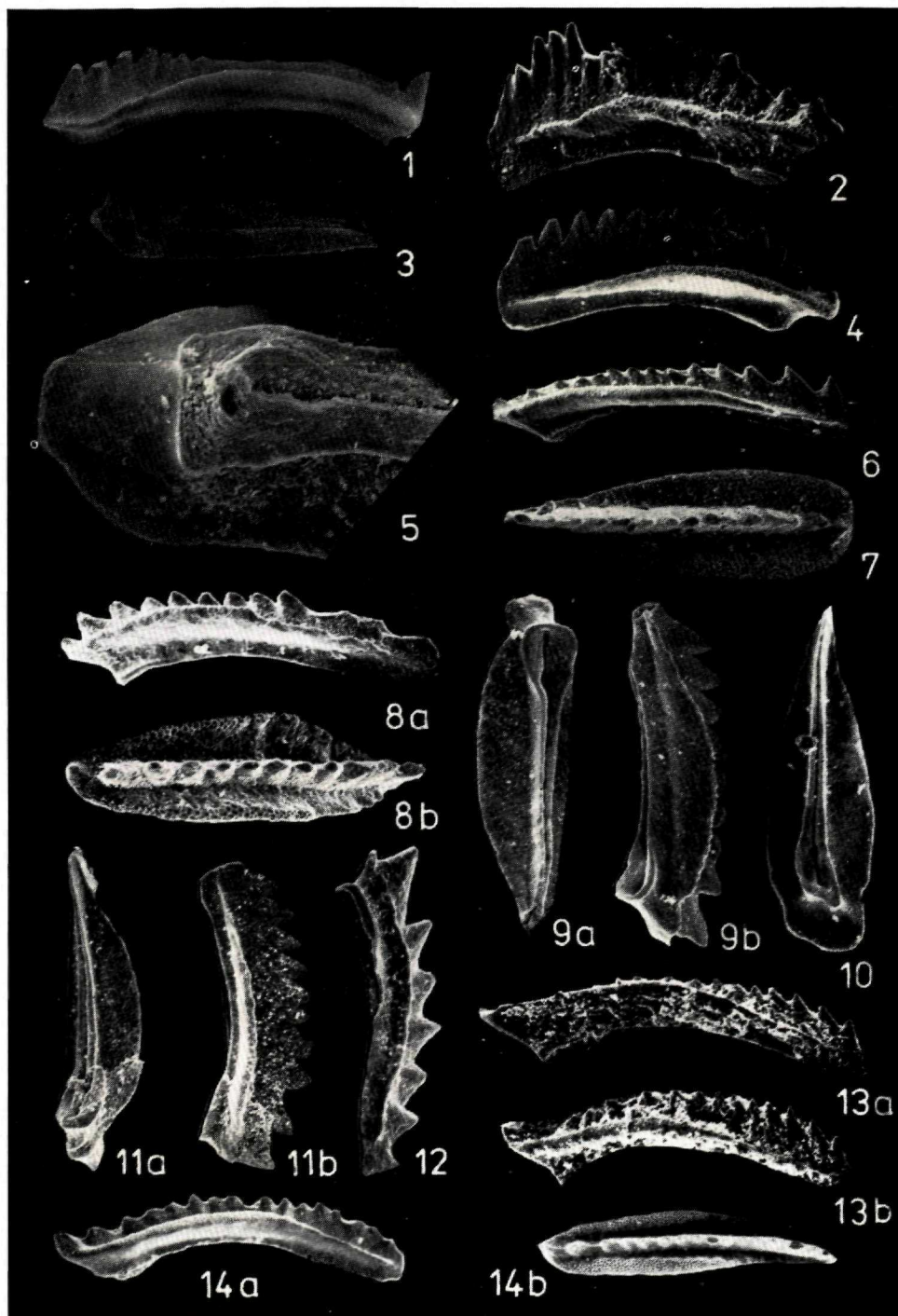


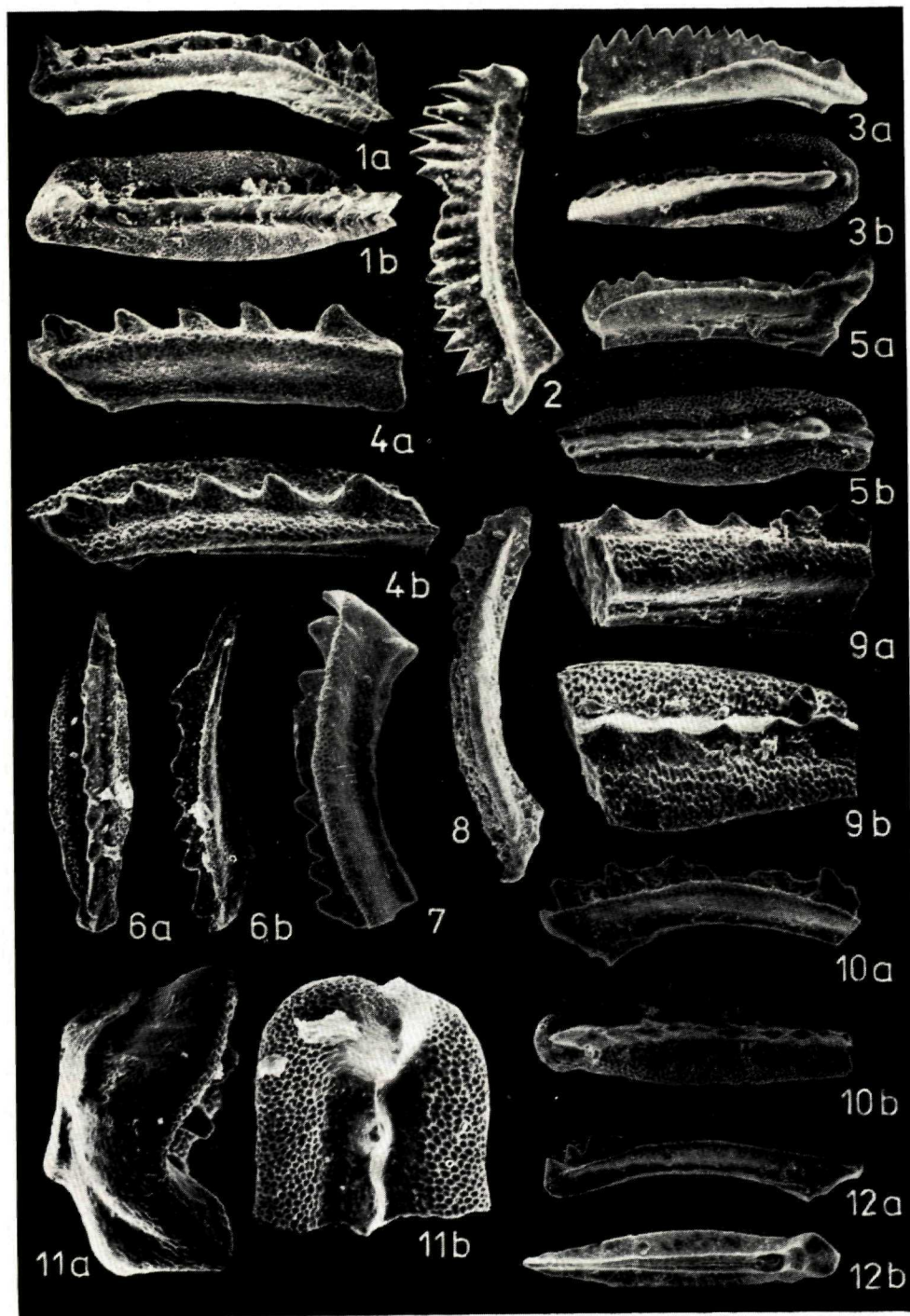
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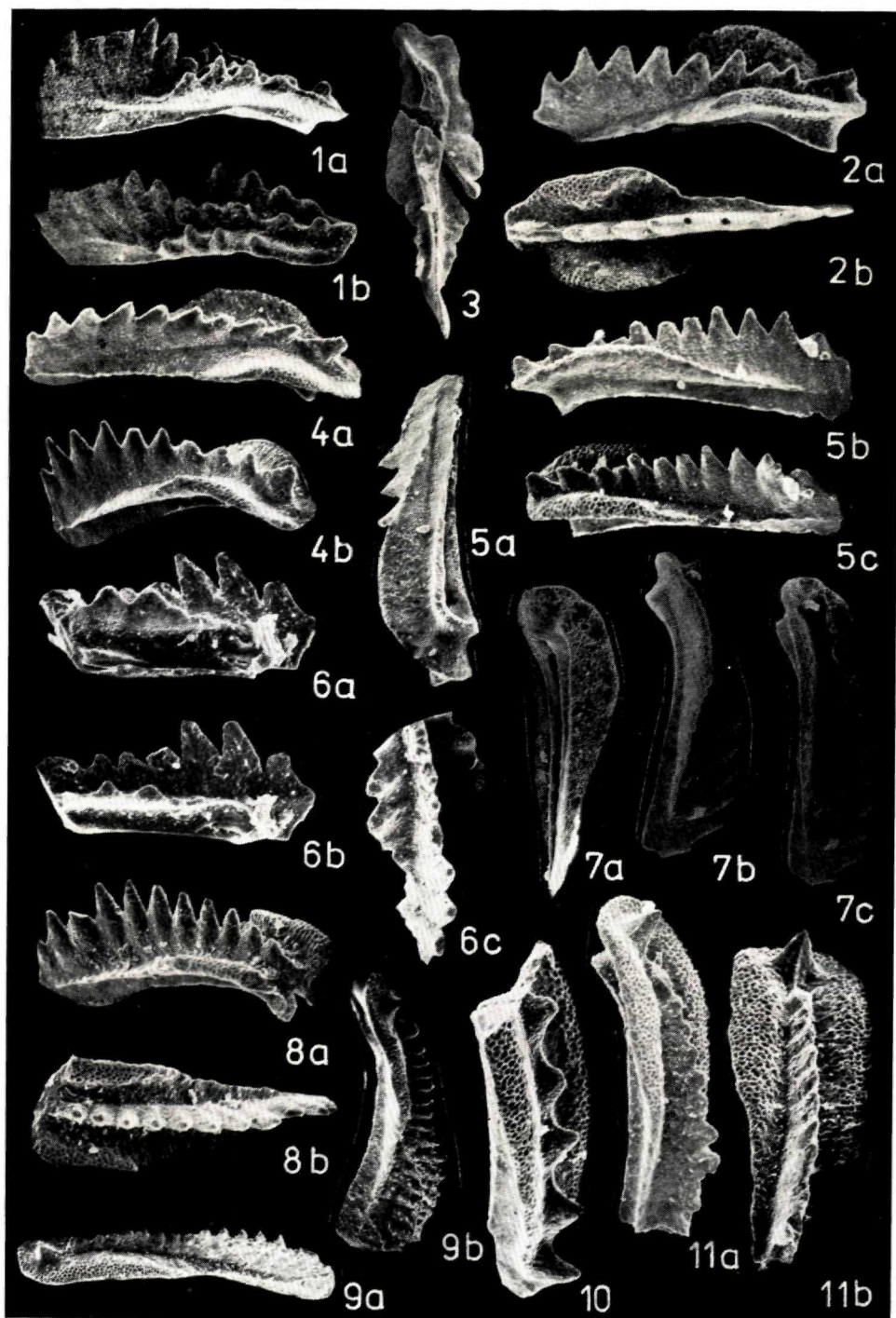


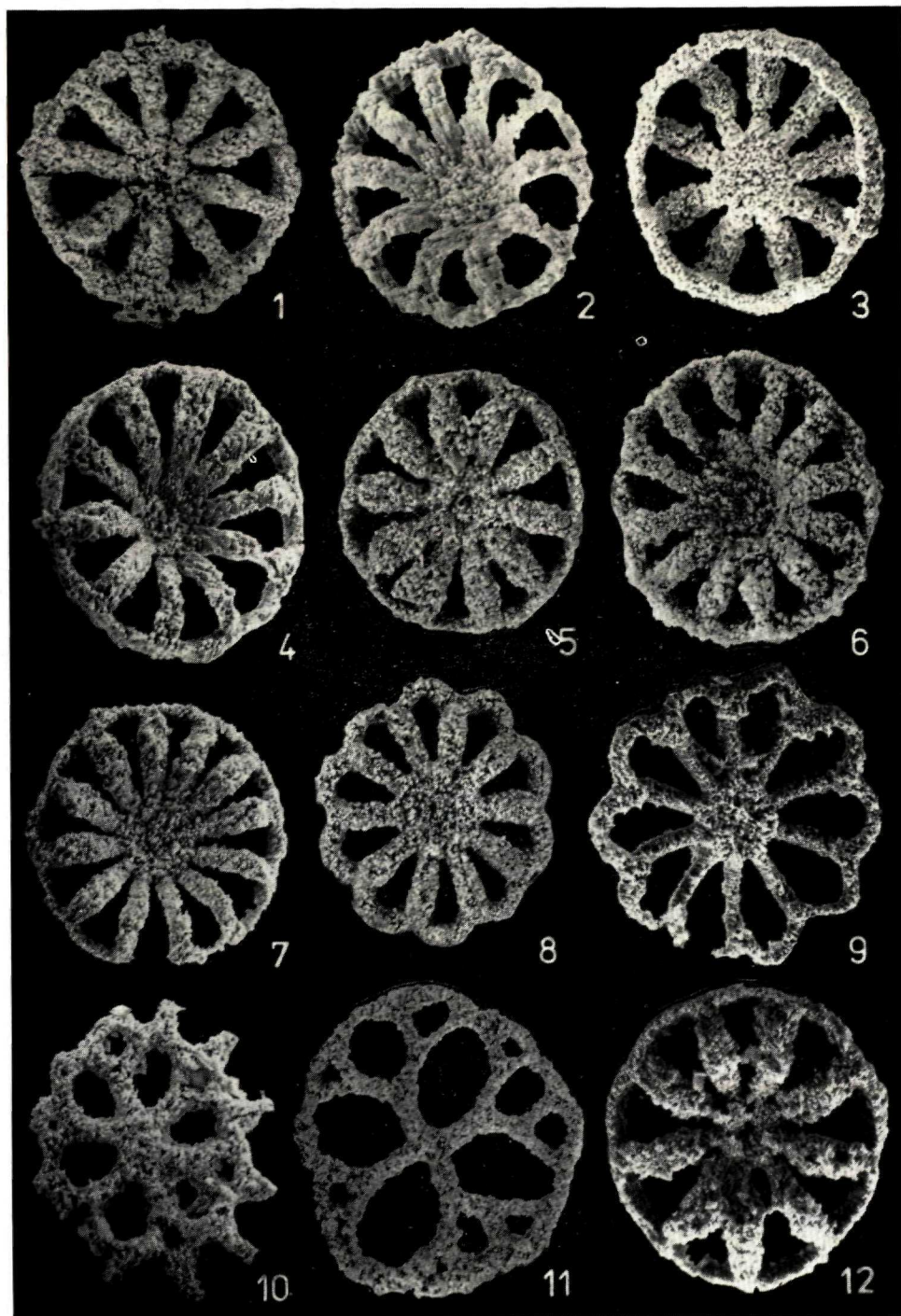
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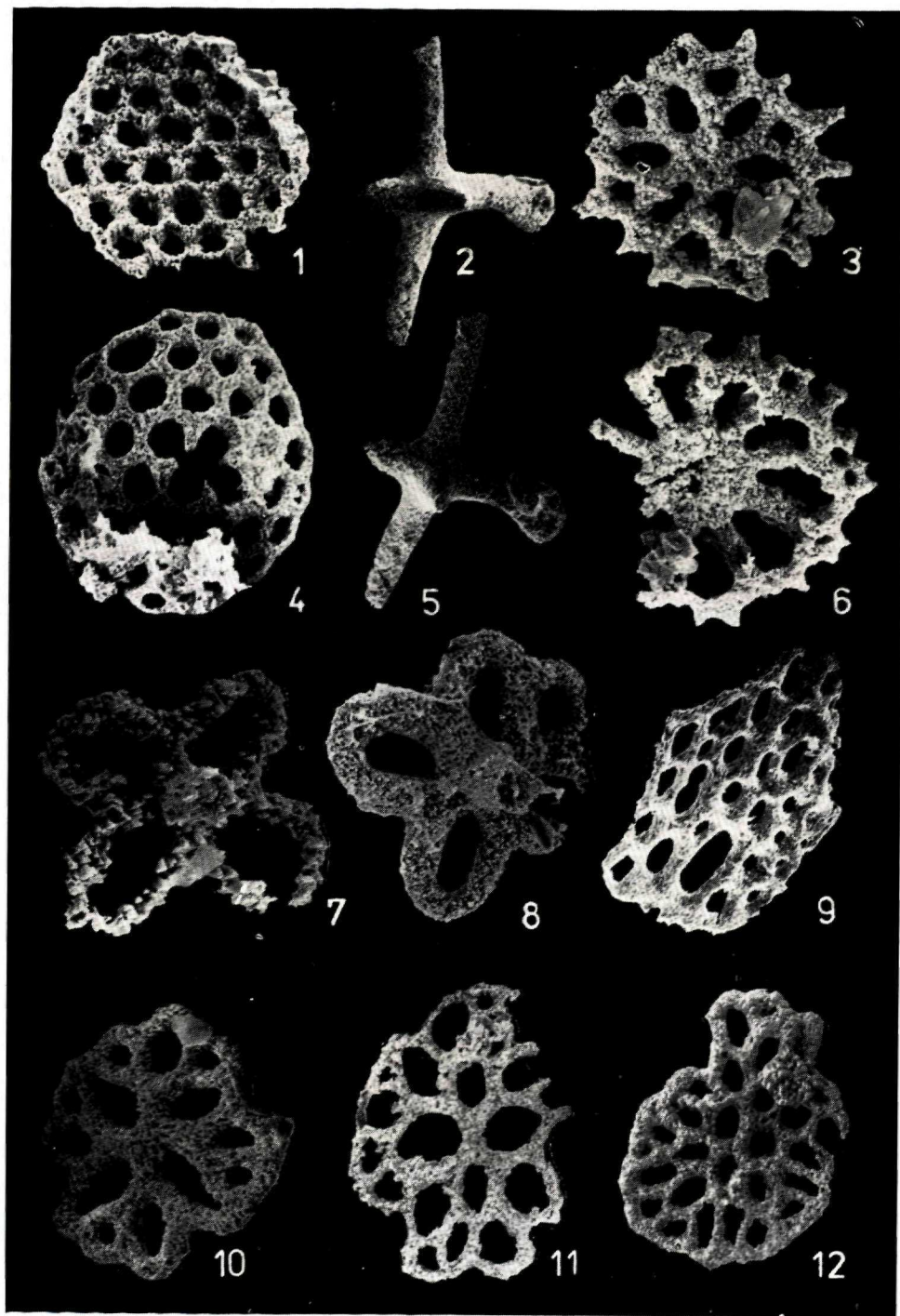


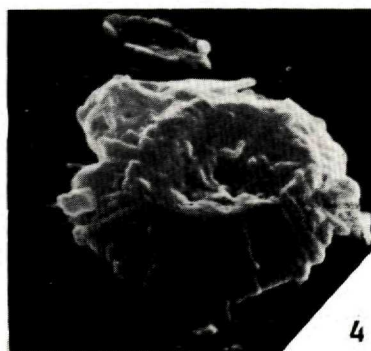
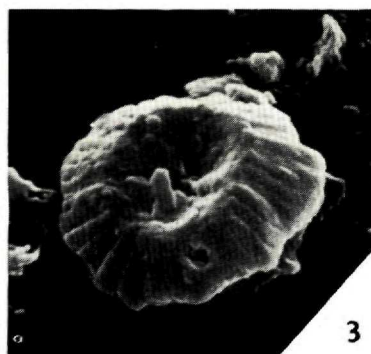


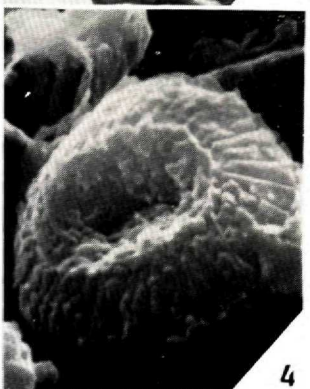
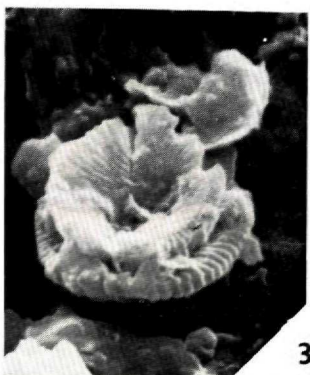
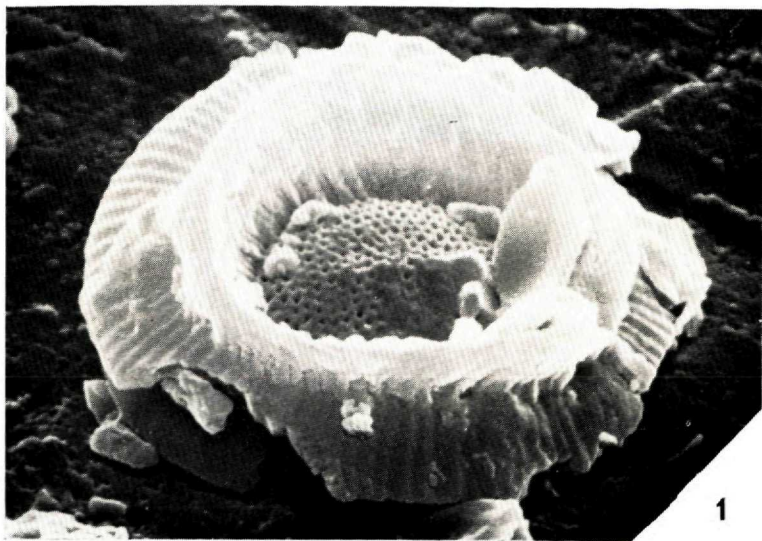


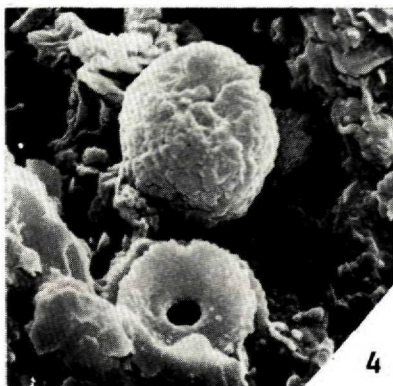
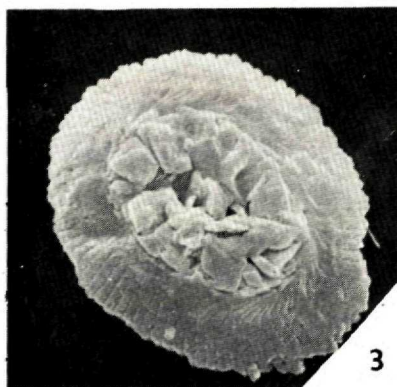
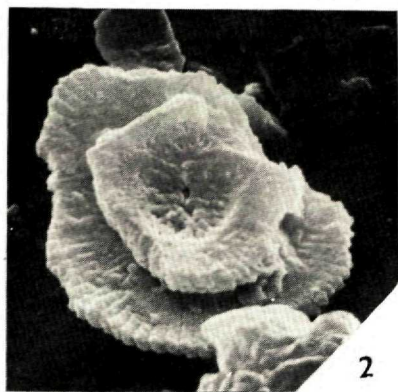
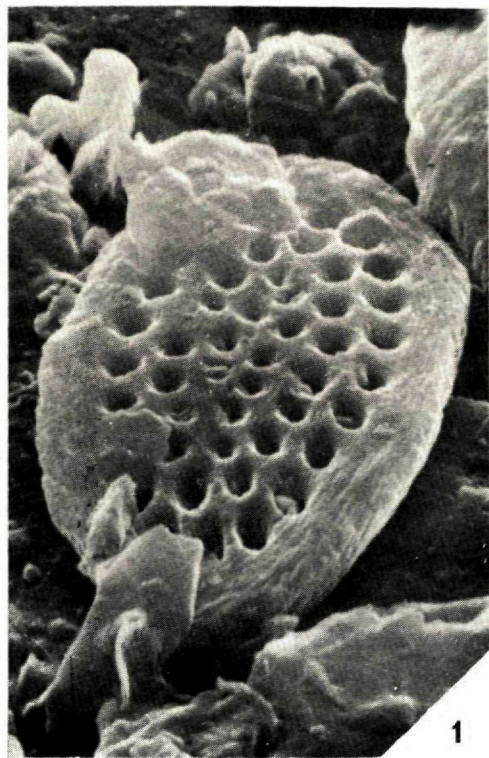


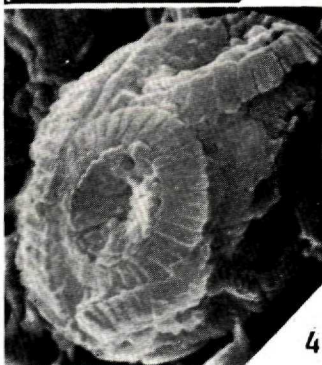
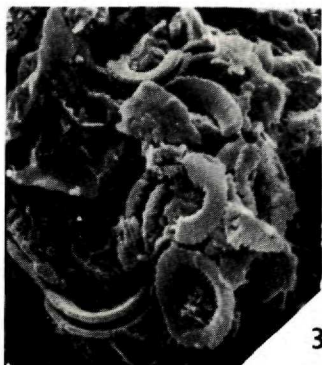
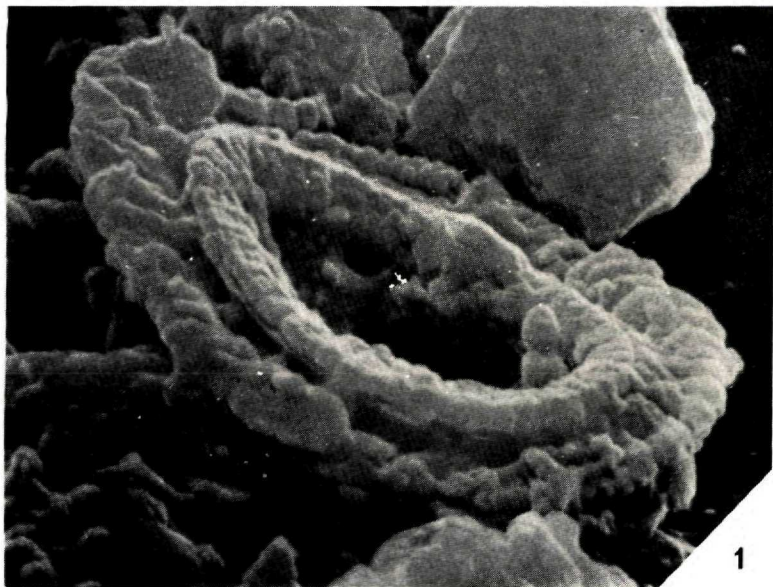


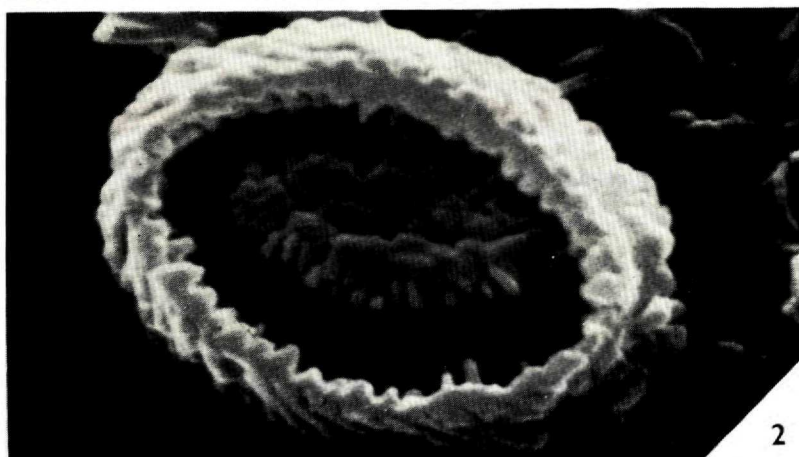
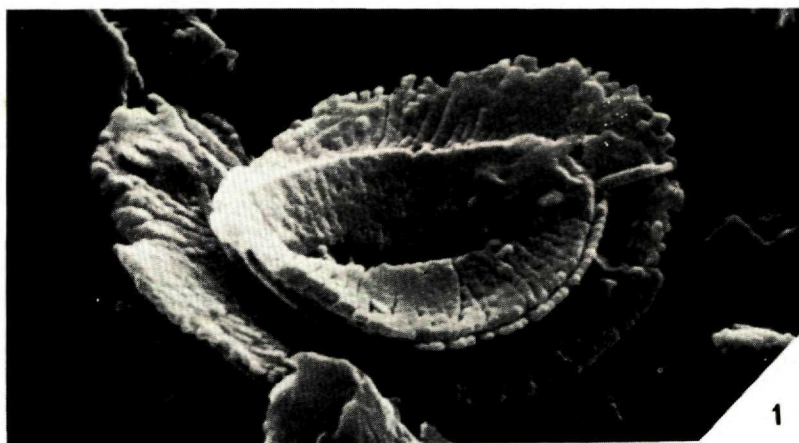


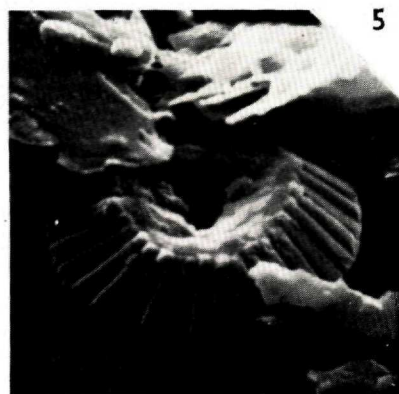
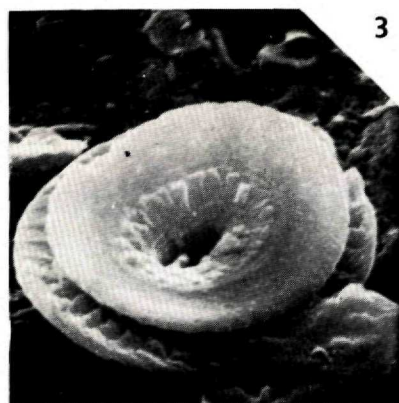
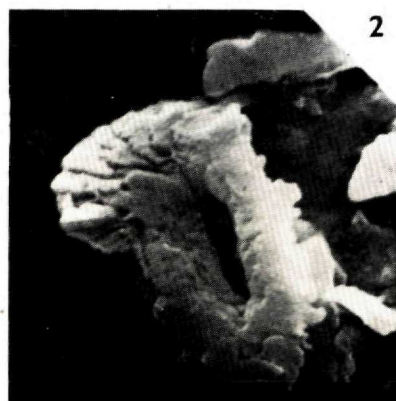


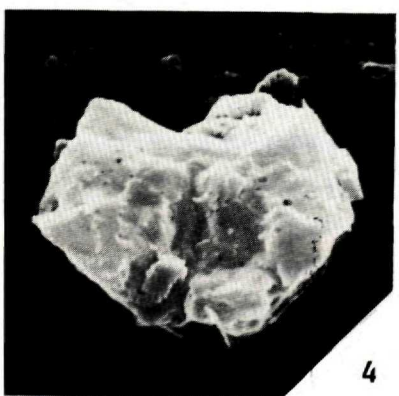
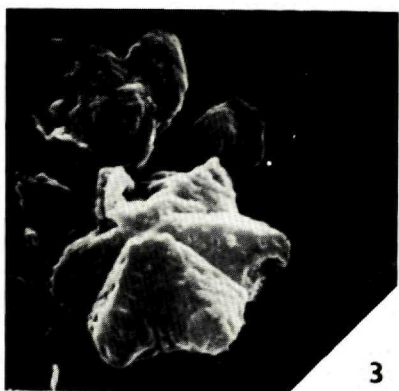
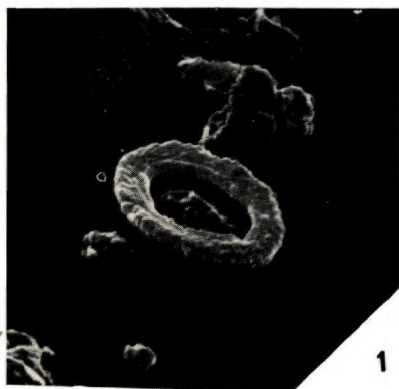


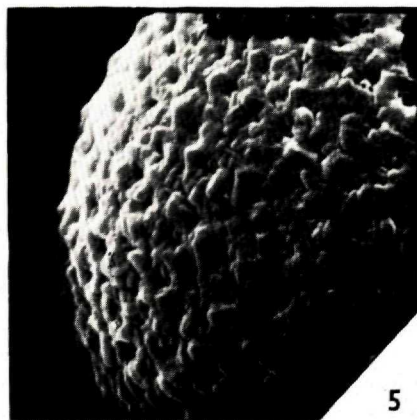
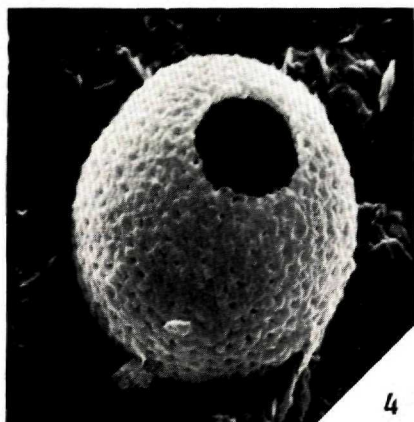
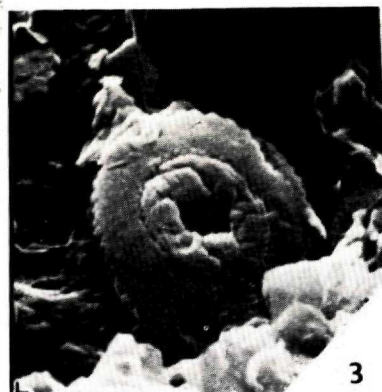
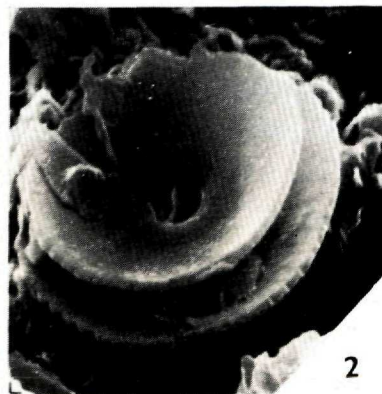
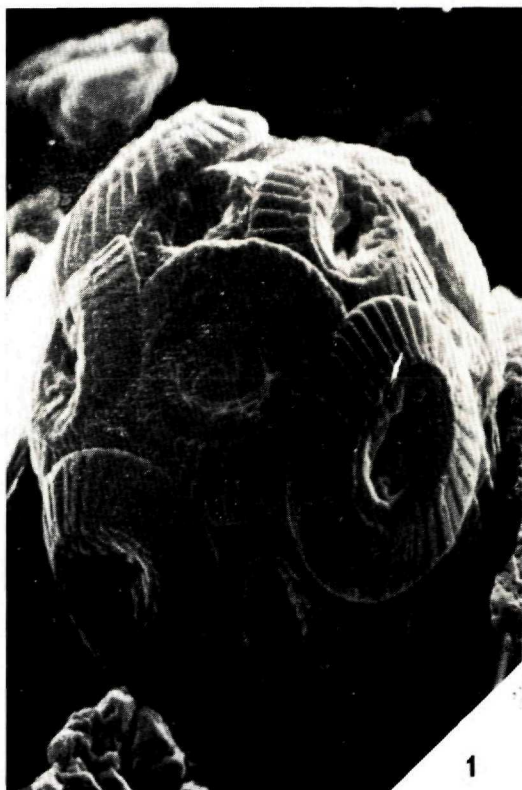


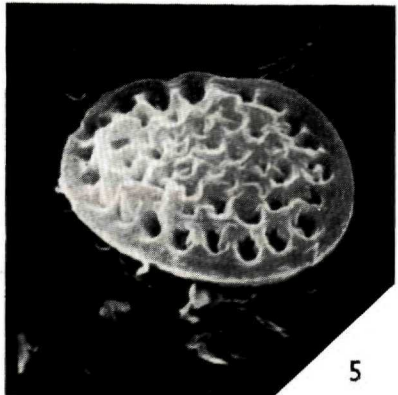
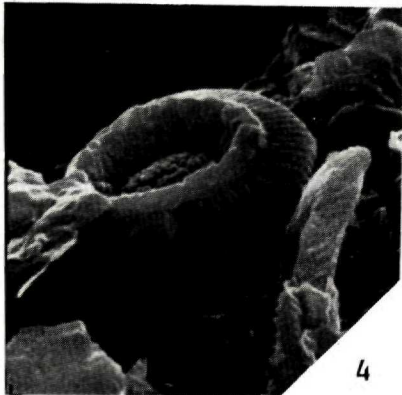
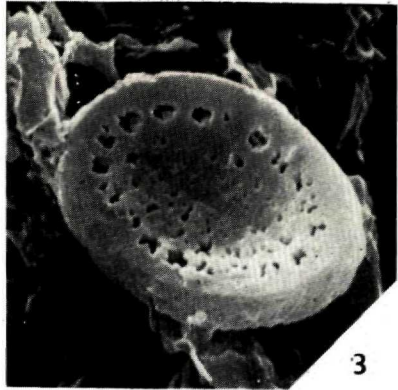
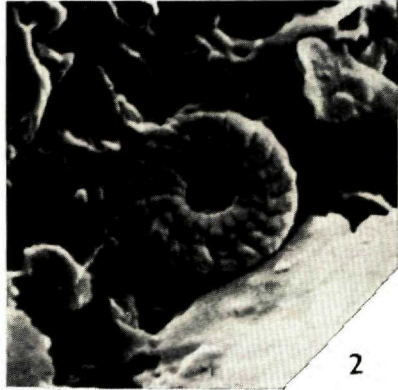


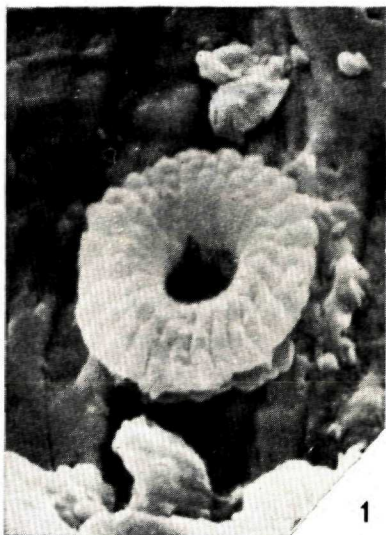




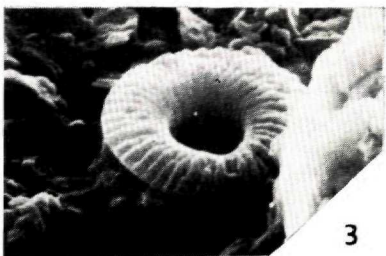








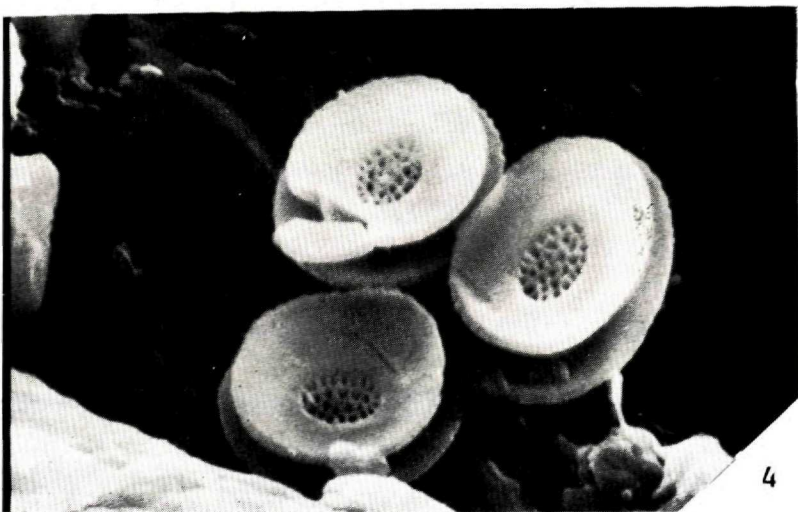
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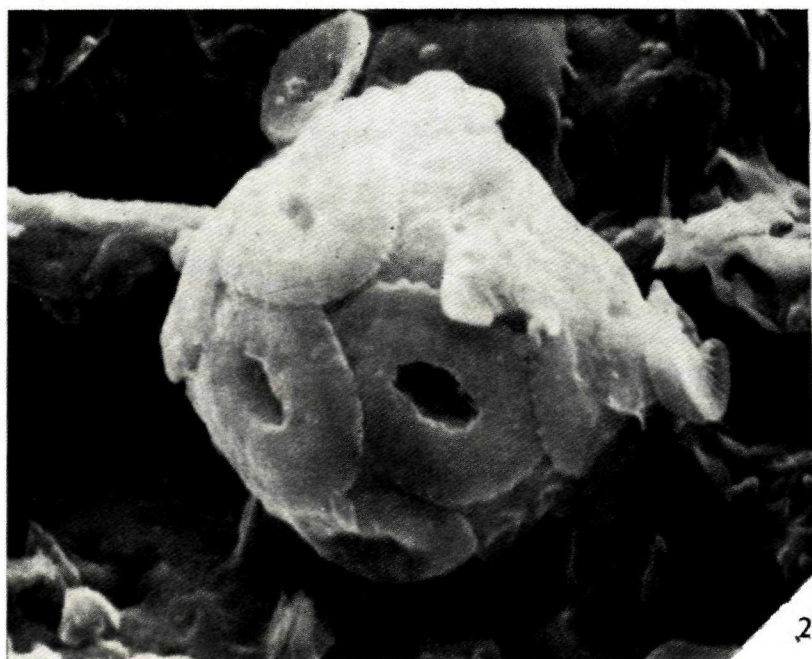
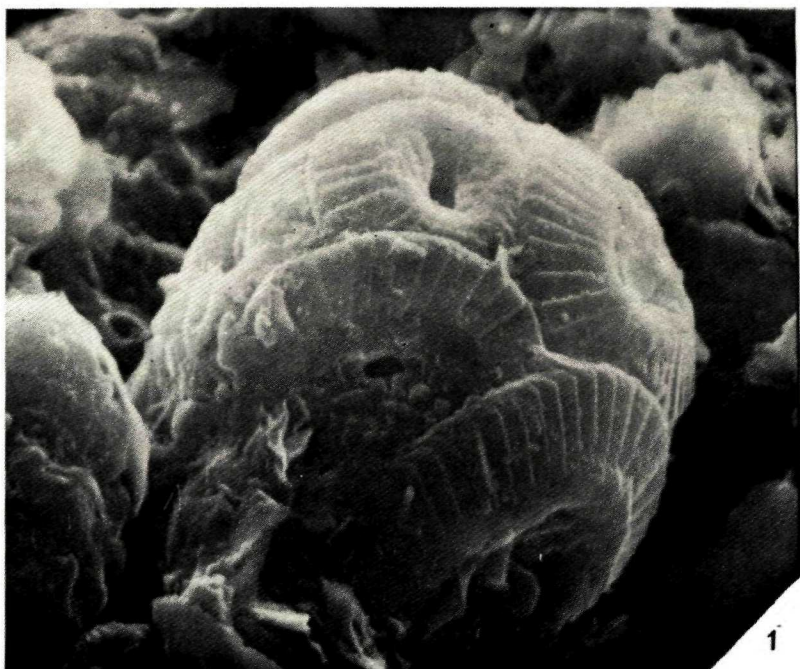
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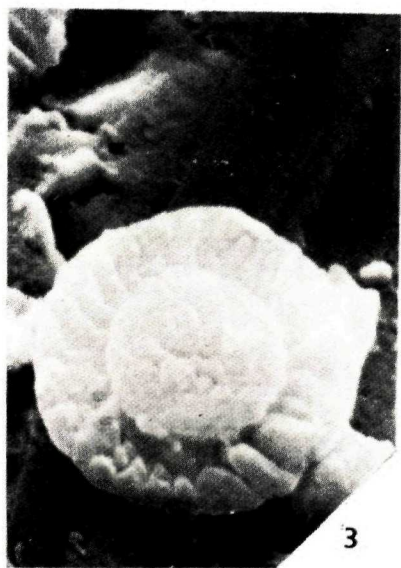
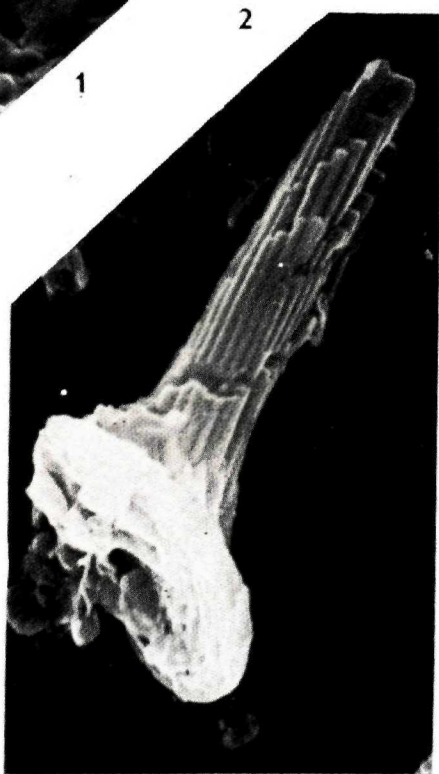


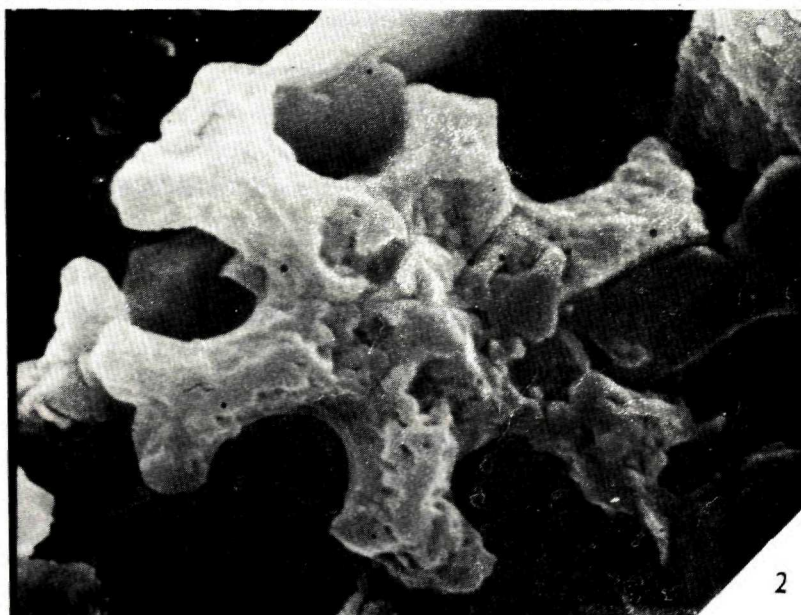
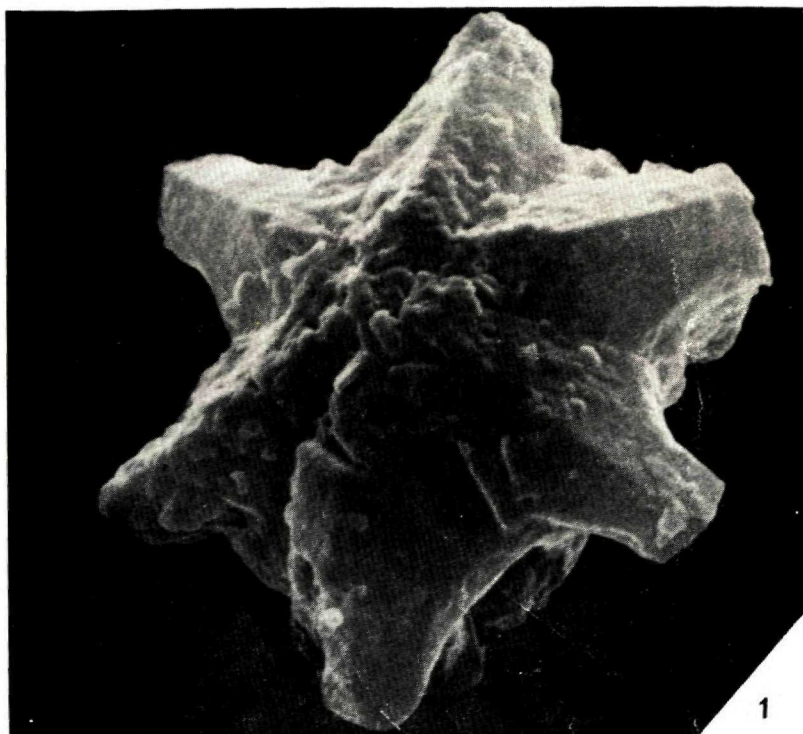
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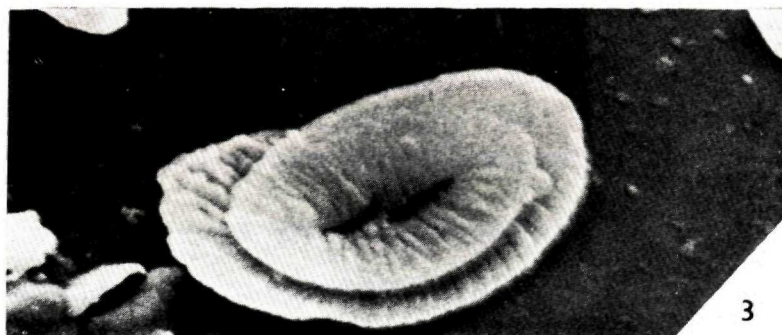
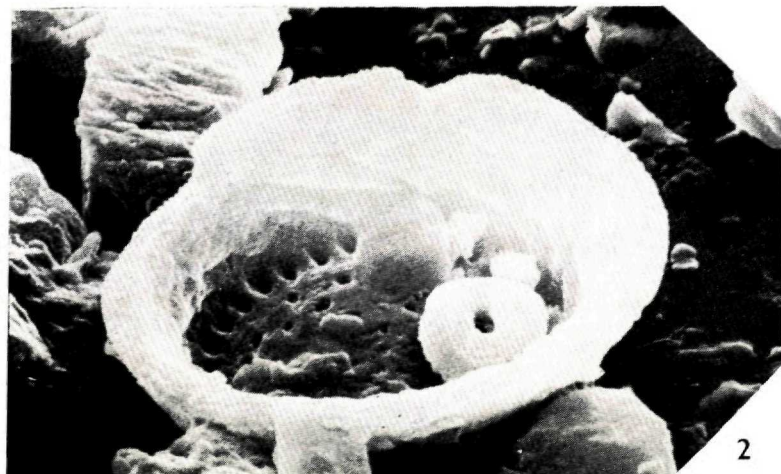
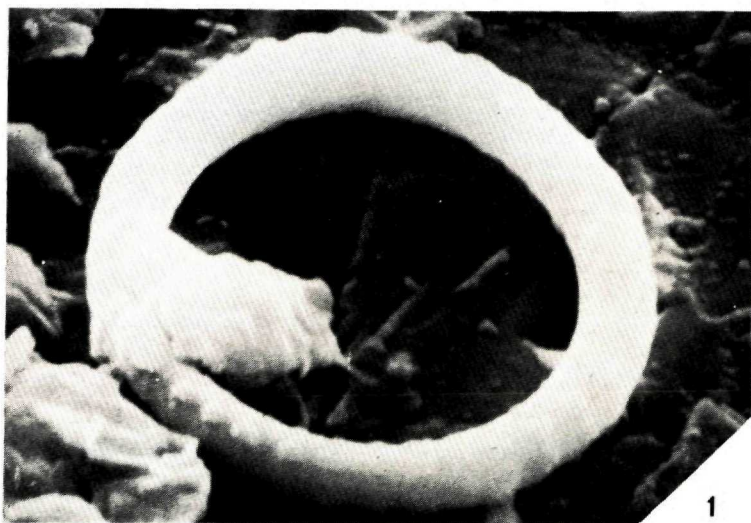


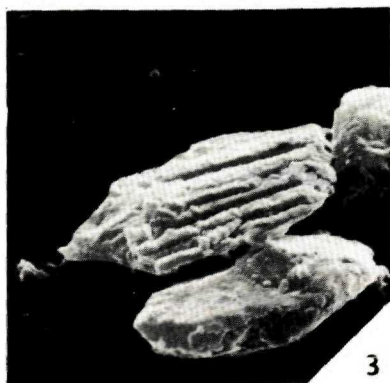
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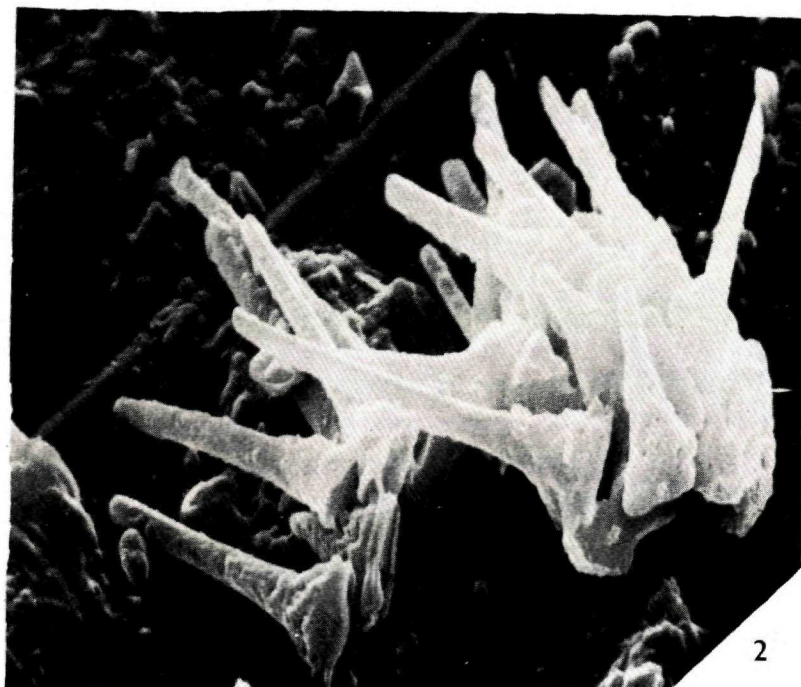
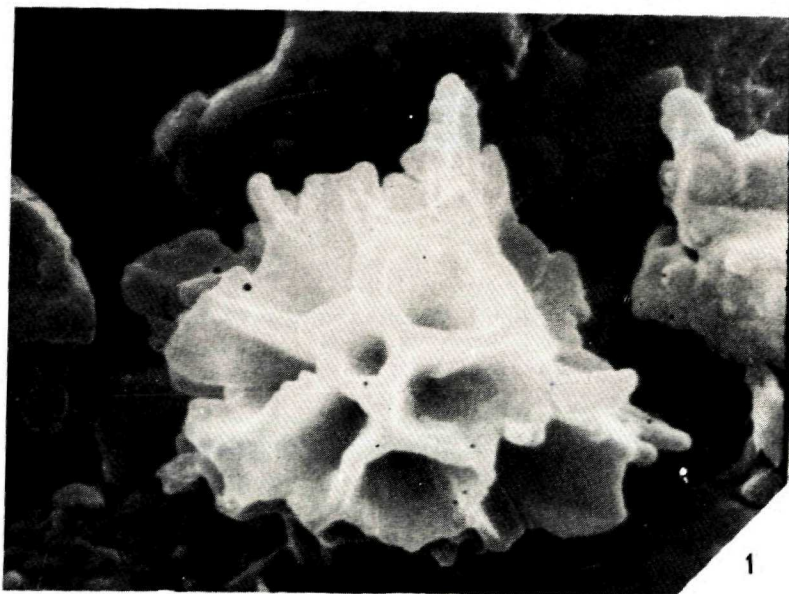


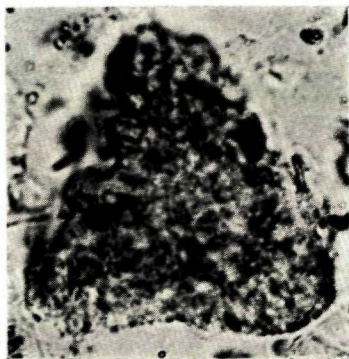




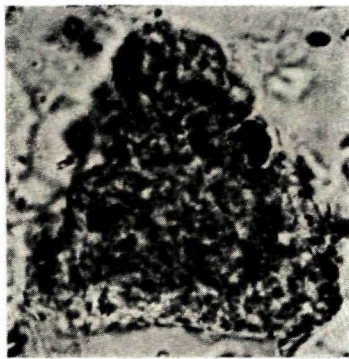








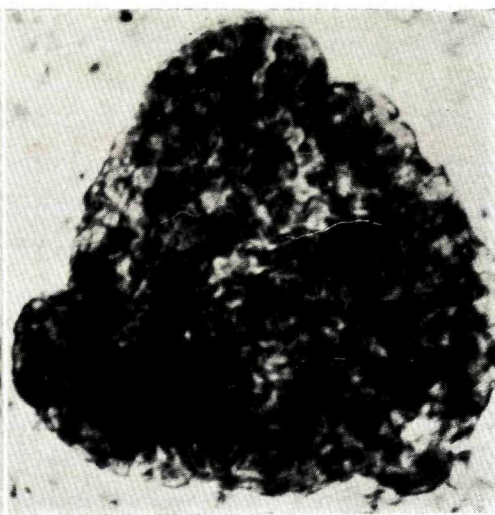
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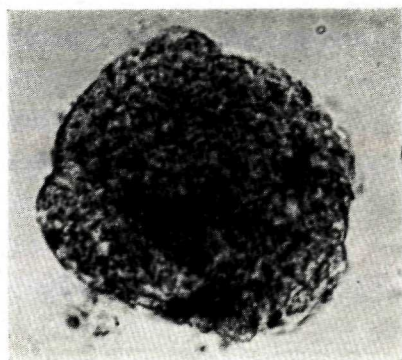


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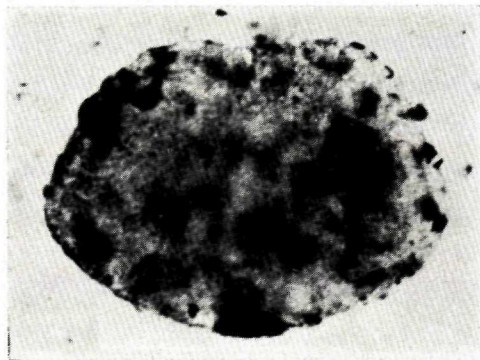


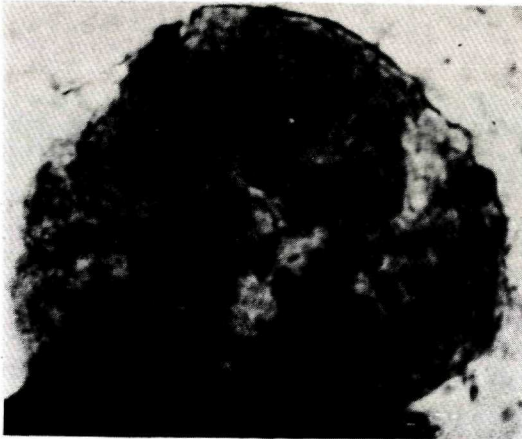
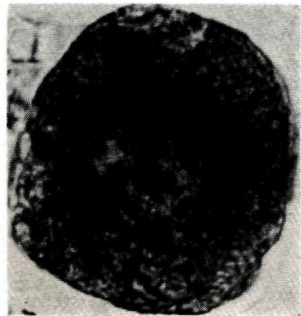
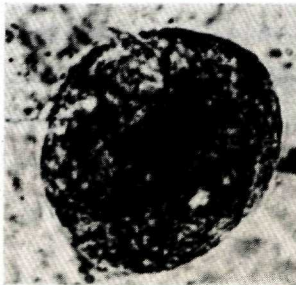
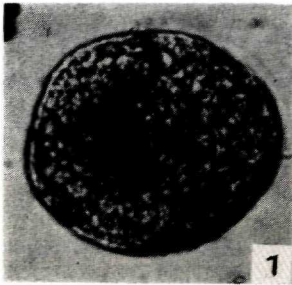
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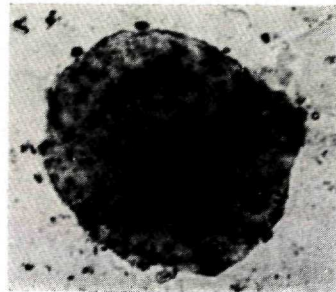
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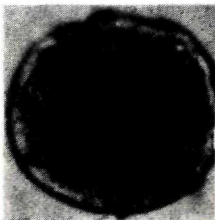
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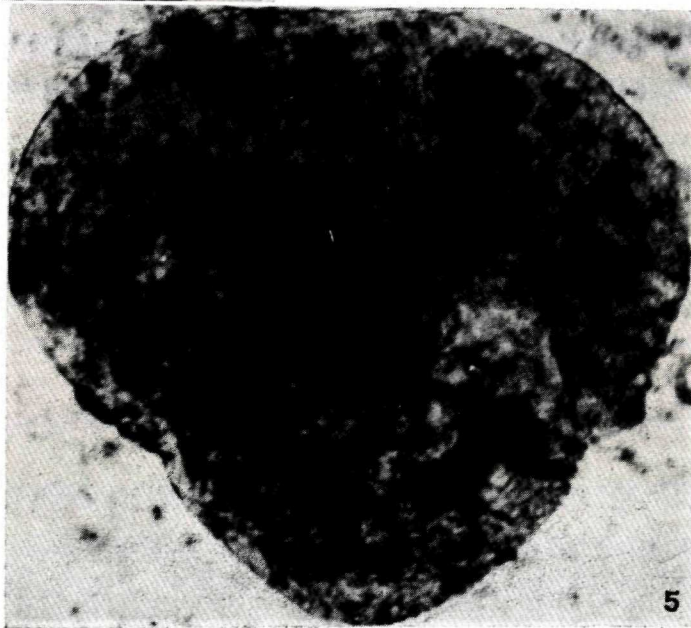
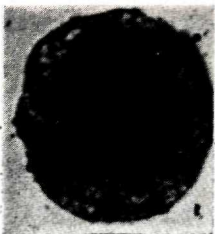
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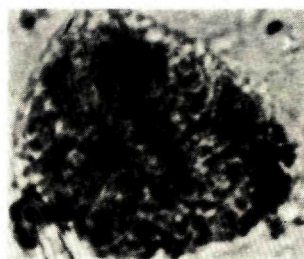
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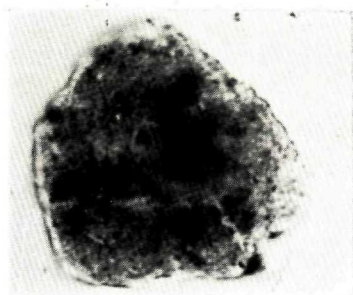
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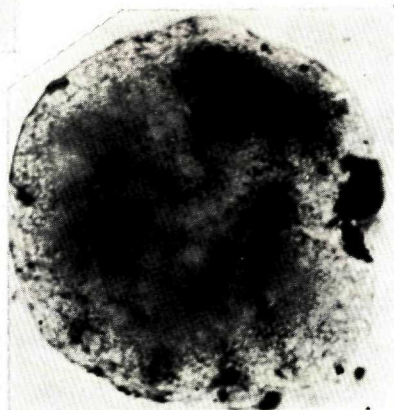
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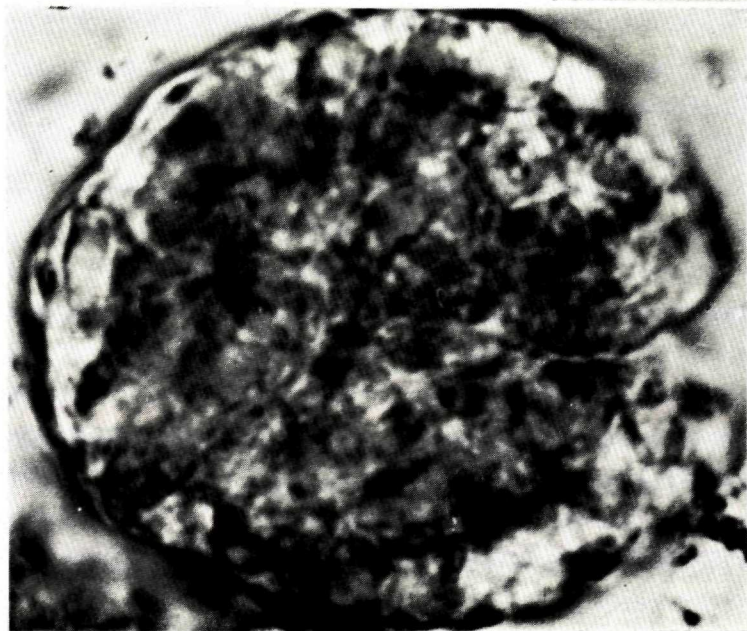
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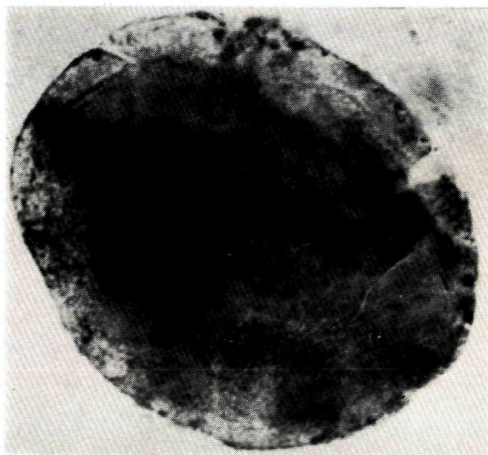
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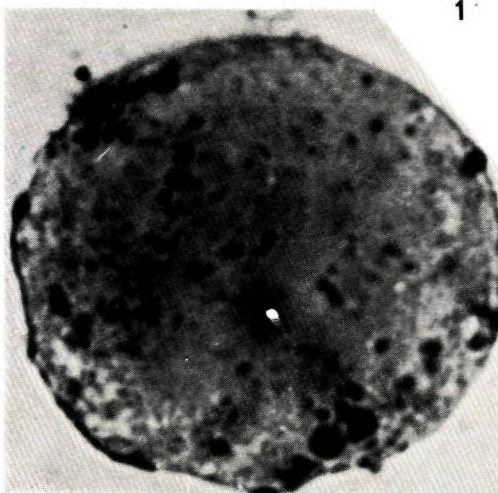
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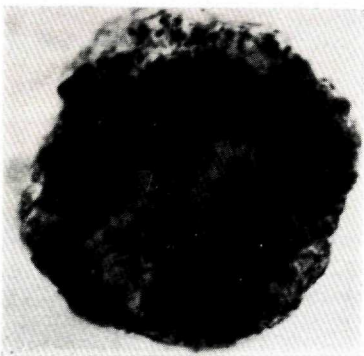


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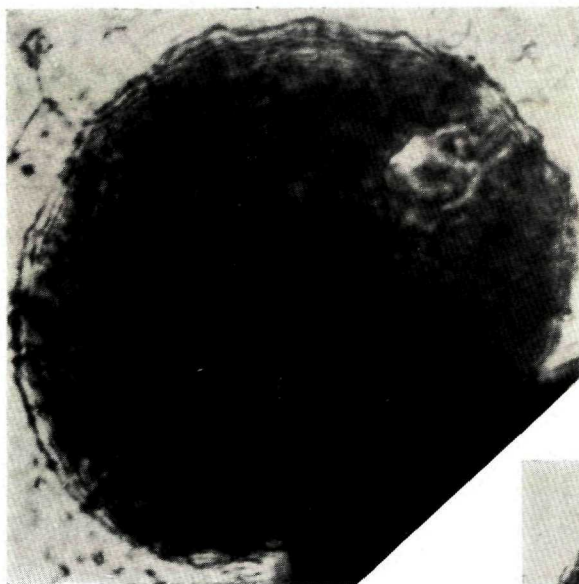
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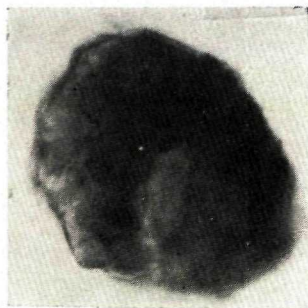


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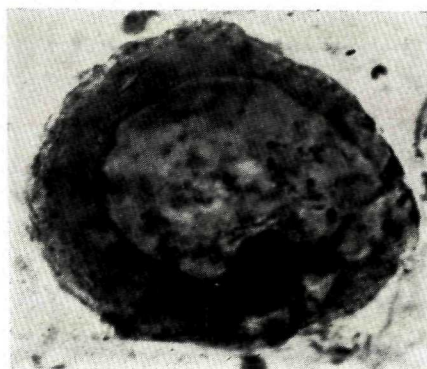


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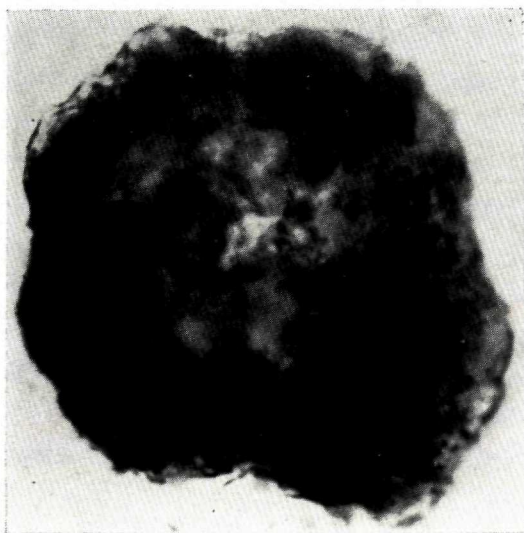


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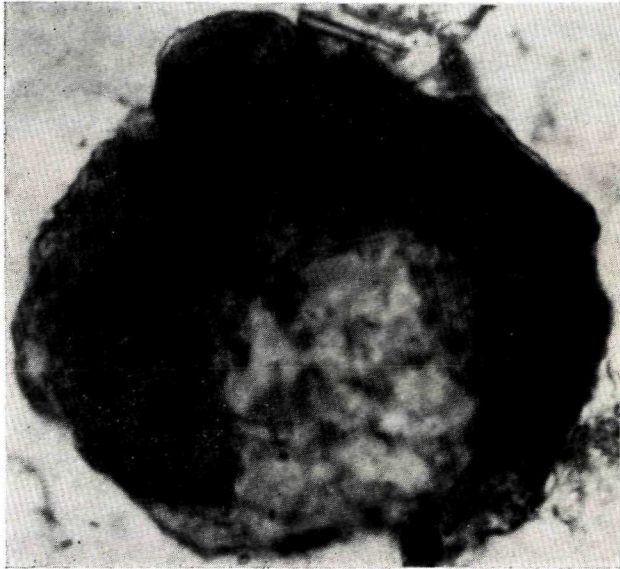


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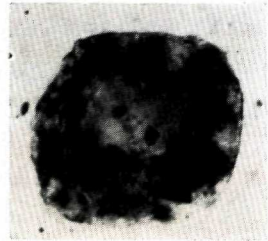


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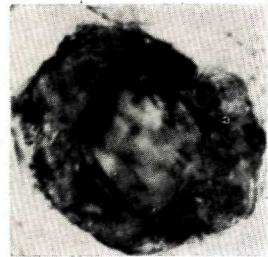




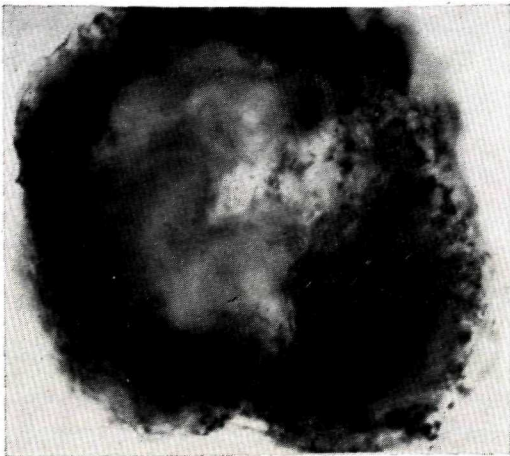
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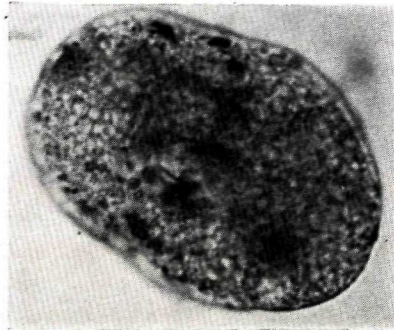
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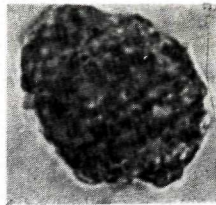
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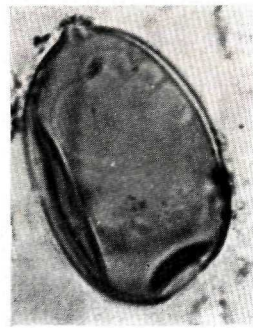
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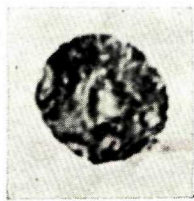
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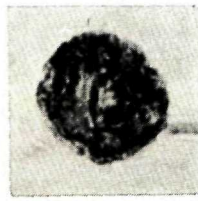
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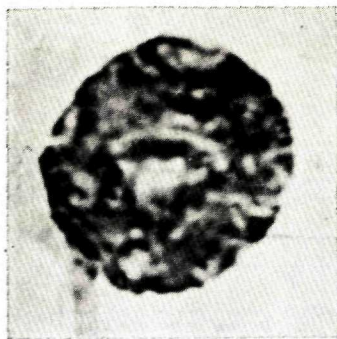
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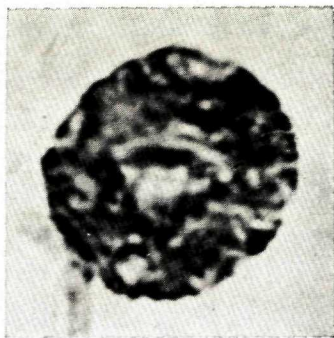
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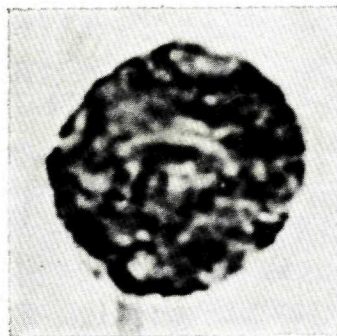
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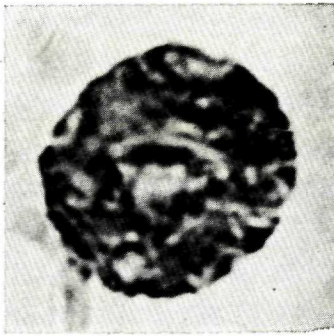
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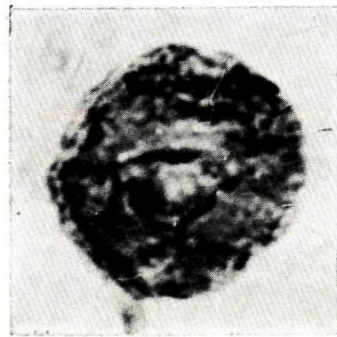
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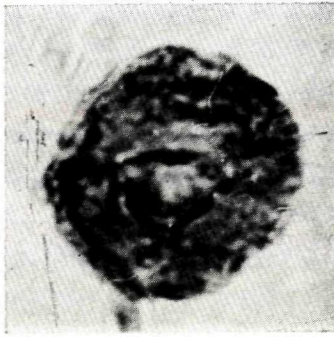
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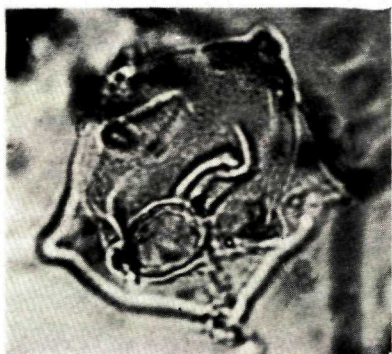


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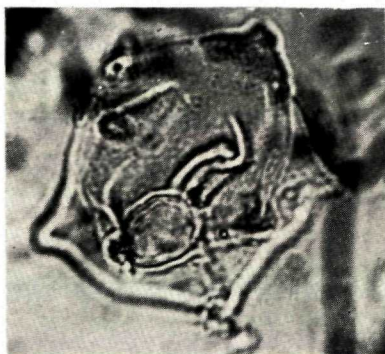


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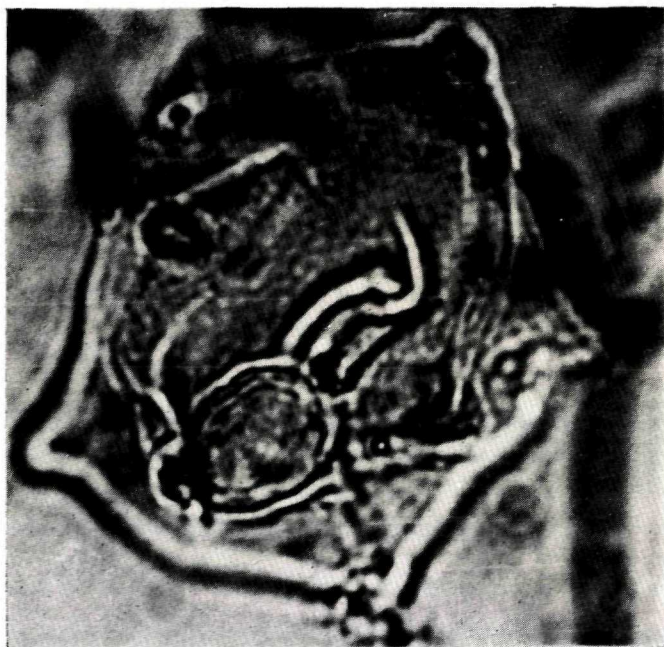
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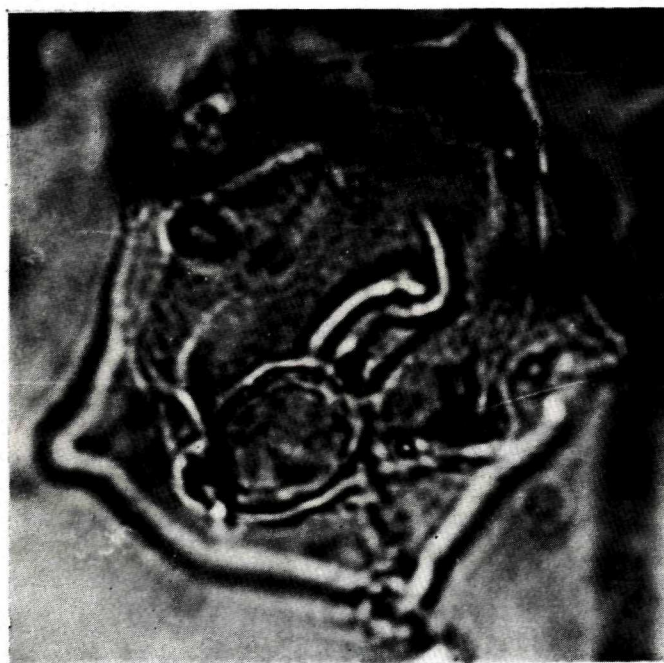
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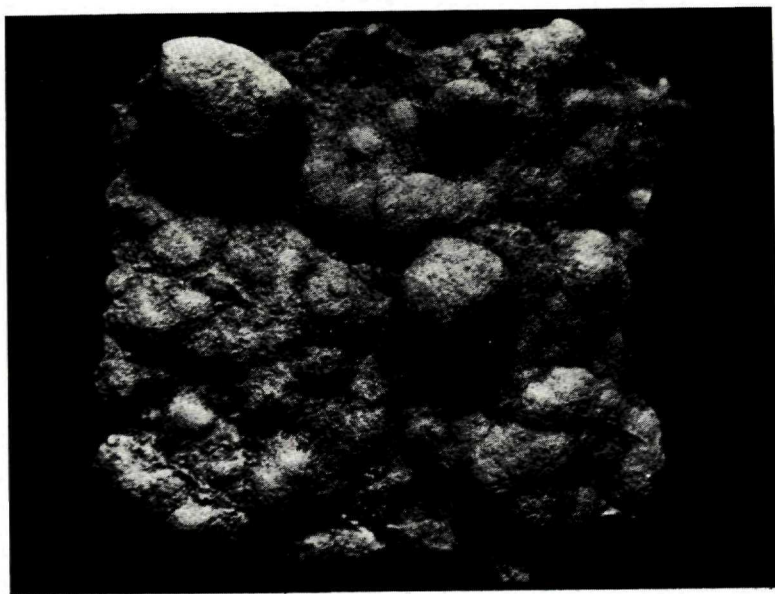
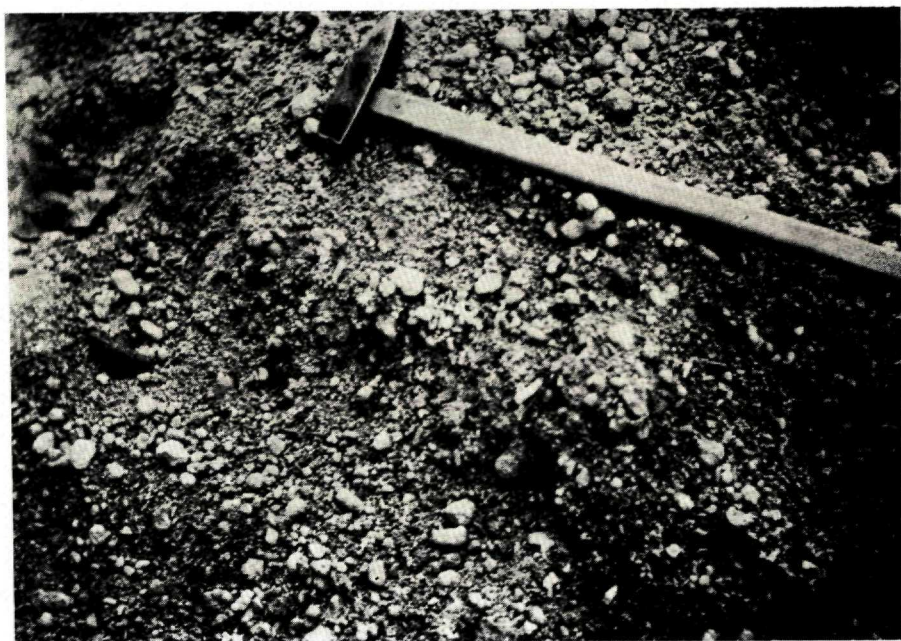
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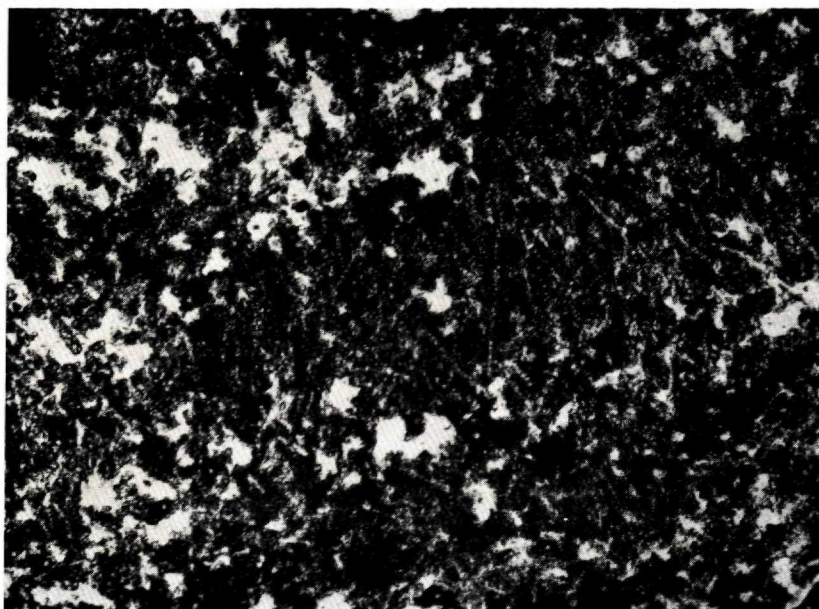


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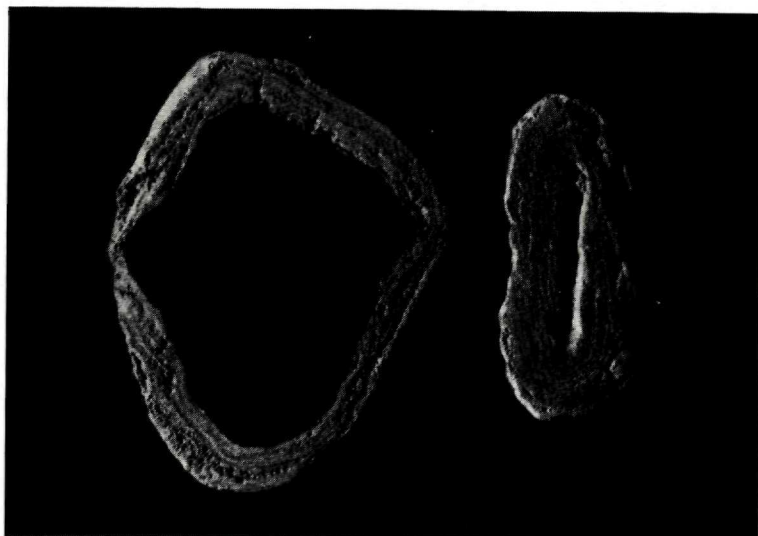
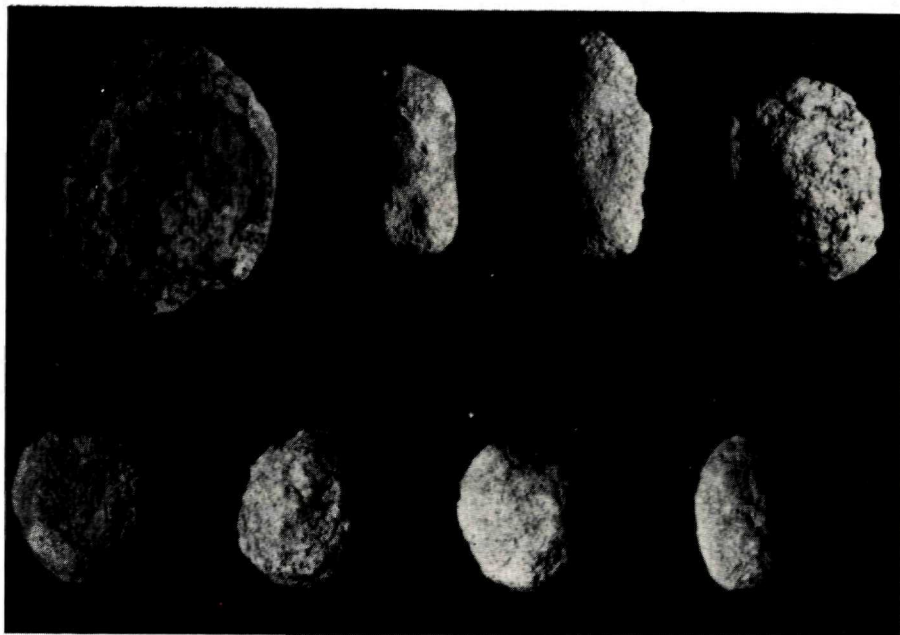
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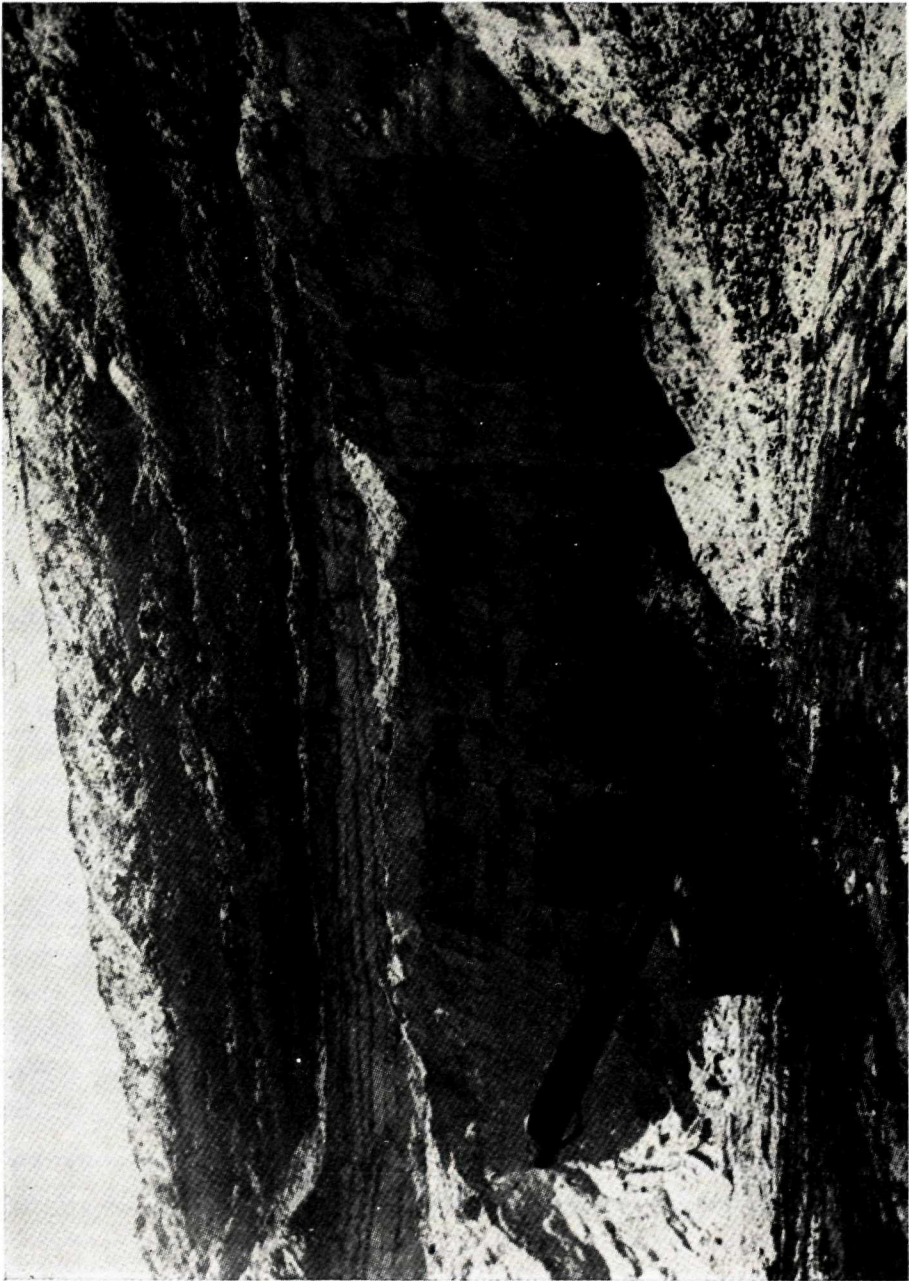


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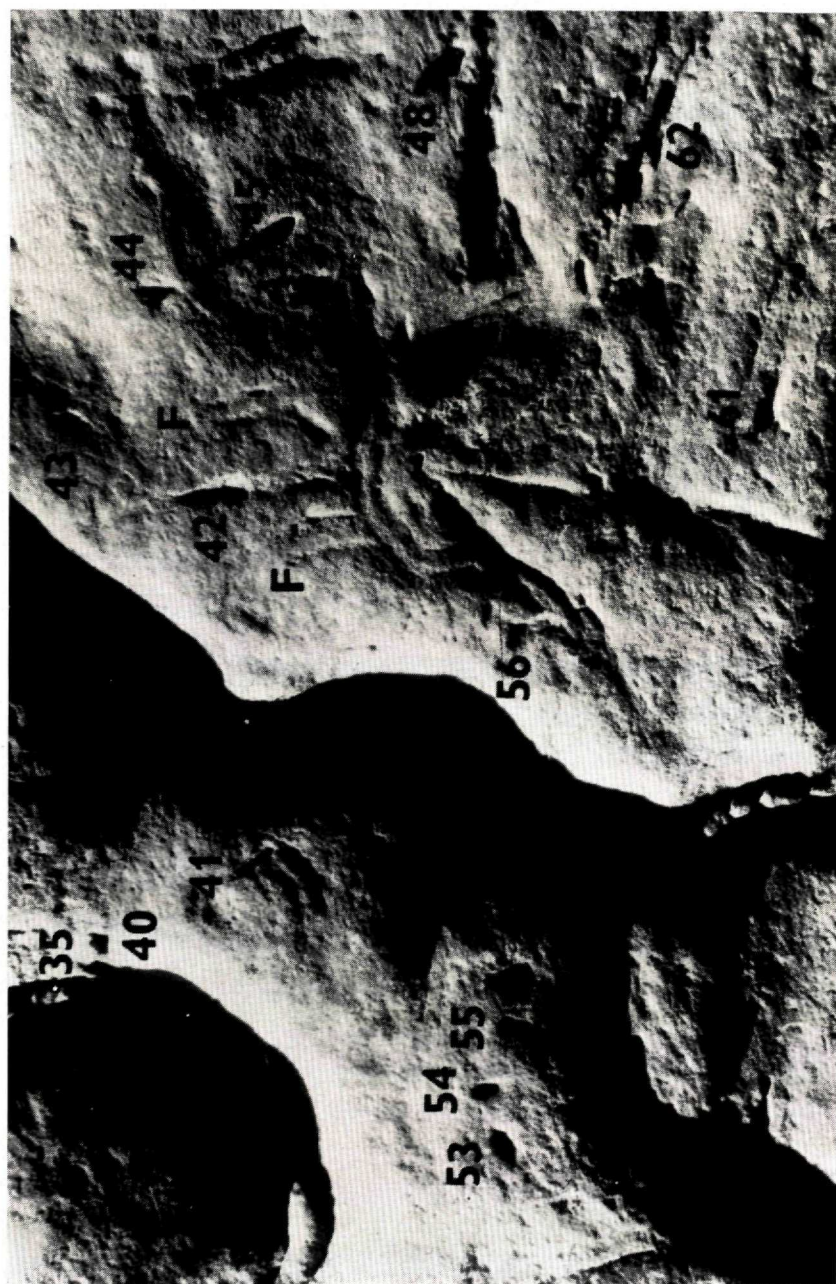


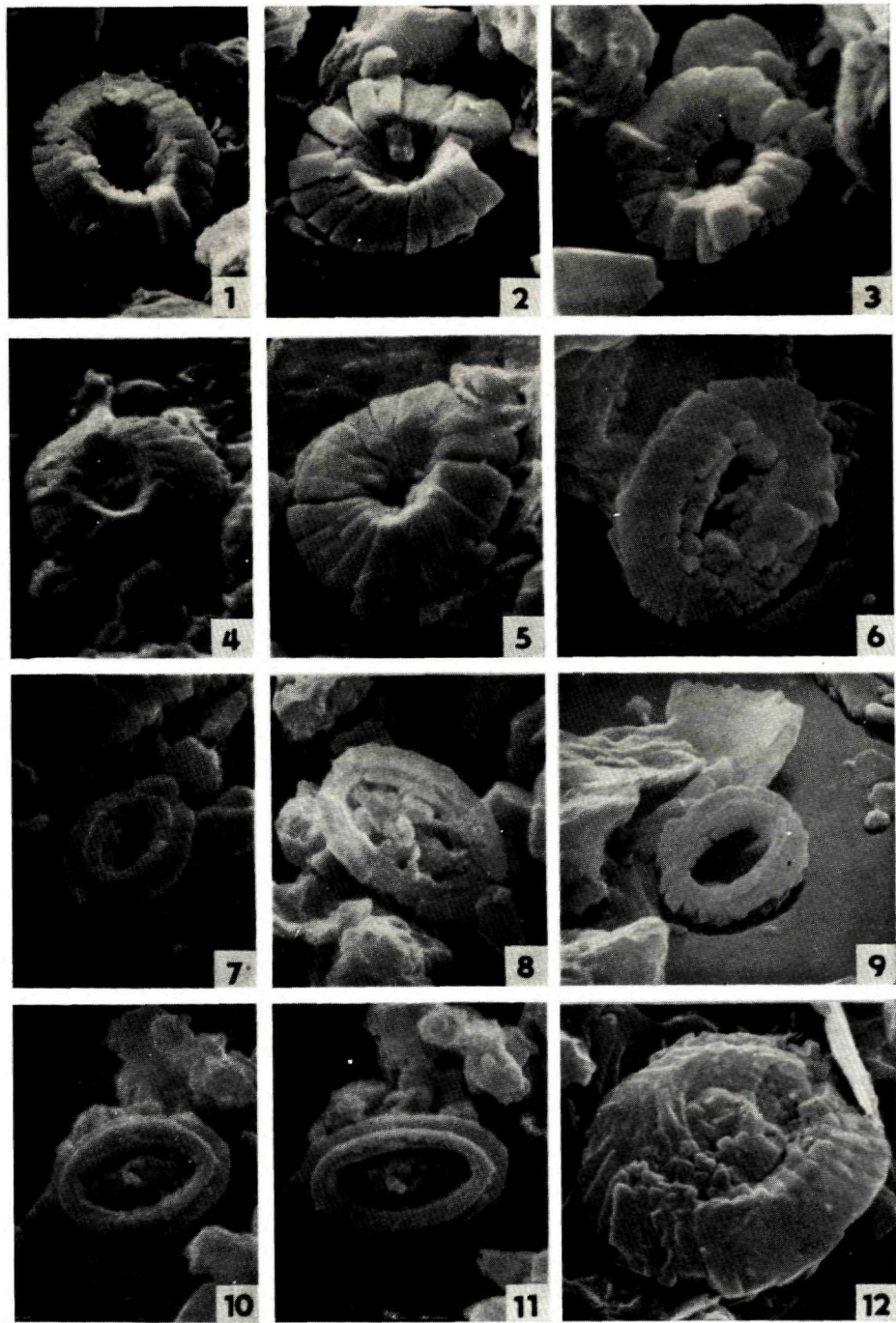


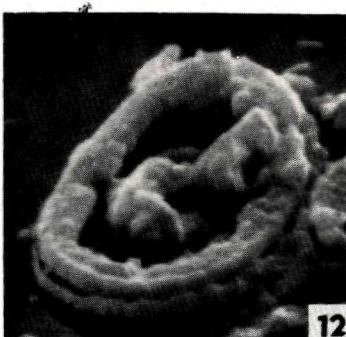
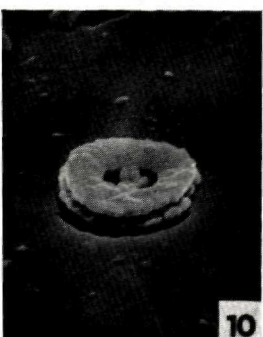
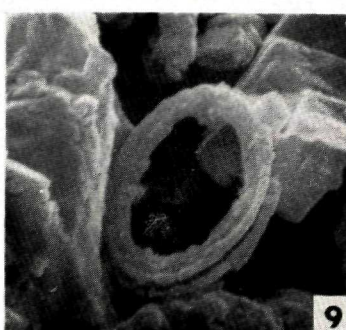
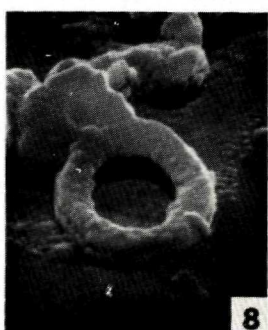
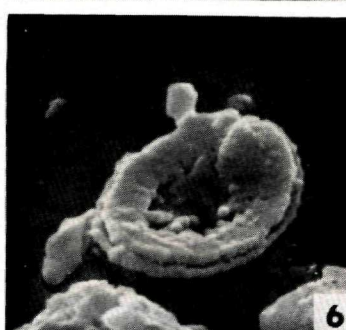
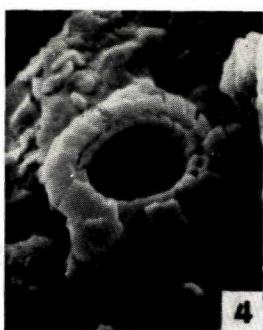
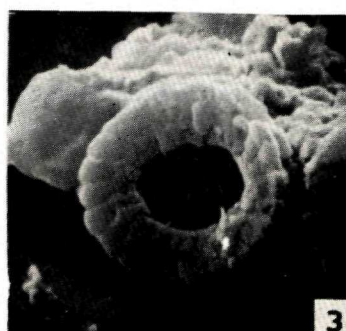
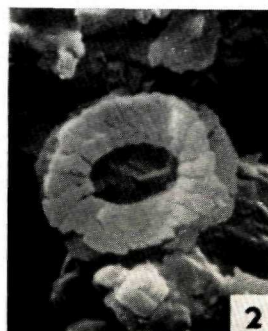
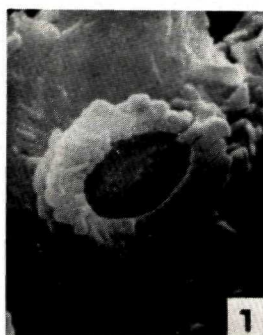


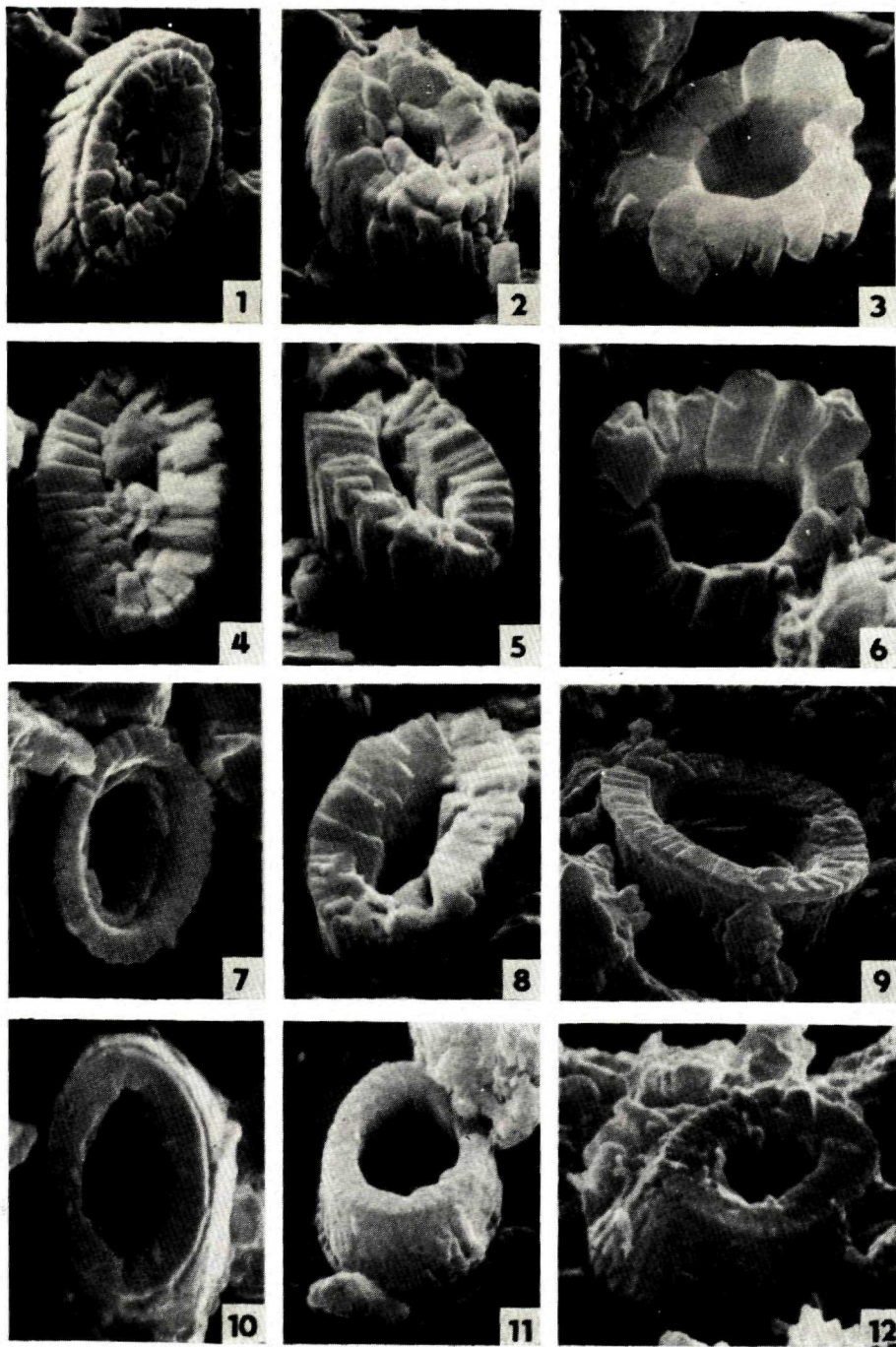


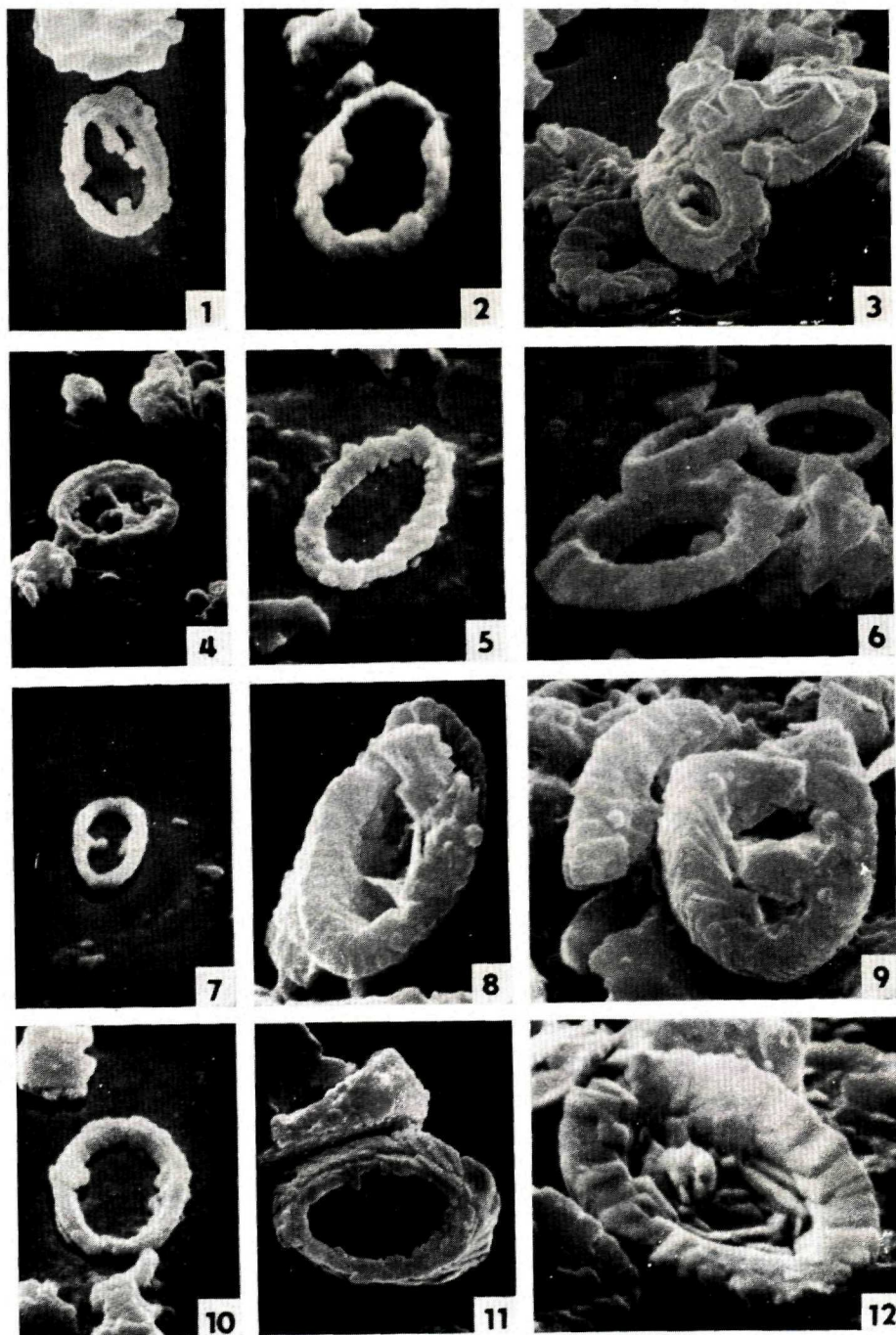














ZÁPADNÉ KARPATY

séria

paleontológia 8

Vydal Geologický ústav Dionýza Štúra vo vydavateľskom oprávnení Vedy, vydavateľstva Slovenskej akadémie vied v Bratislave v roku 1982

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