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RADIOLARIA FROM CHERTS OF THE KALIŠČO LIMESTONE FORMATION OF THE MANÍN UNIT (BUTKOV, WEST CARPATHIANS)

(1 Fig., IV Pls., 1 Tab.)

Abstract: The work deals with the first occurrence of radiolarians in the Lower Cretaceous pelagic sediments of the Manín unit of the West Carpathians. The radiolarians come from cherts of Kališčo Limestones that in the past were stratigraphically investigated by means of ammonites and tintinnoid organisms (Vašíček—Michalík, 1986; Borza et al., 1987). Radiolarian species characterizing the zone *Mirifusus chenodes* (sensu SCHAAF, 1984) were identified, which stratigraphically corresponds to the uppermost part of the Lower Hauterivian.

Резюме: В статье рассматривается первое появление радиолярий в нижнемеловых пелагических осадках манинской единицы Западных Карпат. Радиолярии были получены из роговиков неокомских известняков, которые были в прошлом изучены биостратиграфически с помощью аммонитов и тинтиноидных организмов (Vašíček—Michalík, 1986; Borza et al., 1987). Были определены виды радиолярий, характерные для зоны *Mirifusus chenodes* (sensu SCHAAF, 1984), которая стратиграфически отвечает самой верхней части нижнего готерива.

Introduction

The studied territory is situated on the western foothills of the Strážovské vrchy Mts. The rock complex of the area concerned was first distinguished as an independent tectonic unit of the West Carpathians by Andrusov (1938). He delineated, denominated and classified the Manín unit as a zone of klipps of the Manín facies situated between the fronts of the Carpathian nappes in the south-east and Klape unit in the north-west. He supposed that the Manín unit and its sedimentation area had been situated north of the Tatricum. Maheľ (1956, 1962, etc.) in his works regards the Manín unit as part of the fronts of the Inner Carpathian nappes (Belá series of the Krížna Nappe) incorporated into the structural plan of the Klippen Belt by the Laramian orogeny.

The formations of the Manín unit that occur also by the eastern margin of the Ilavská kotlina Basin on the NW slope of the Butkov Mt. (see Fig. 1) and from a deposit of cement raw materials have been studied by several authors (Rakús, 1977; Vašíček—Michalík, 1986; Borza et al., 1986, 1987). The individual bed members are represented by red cherty limestones, „complexion-coloured" limestones (Ladce Limestones), spotted limestones

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(Mráznica Limestones), cherty limestones (Kališčo Limestones), belemnite limestones (Lúčkov Limestones) and organodetrital limestones (Podhorie Limestones). Their stratigraphic range is Malm — Lower Albian.

This work has been aimed at the study of the cherty limestones of the lower part of the Kališčo Formation which differs from the under- and overlying formations only in an increased content of cherts.

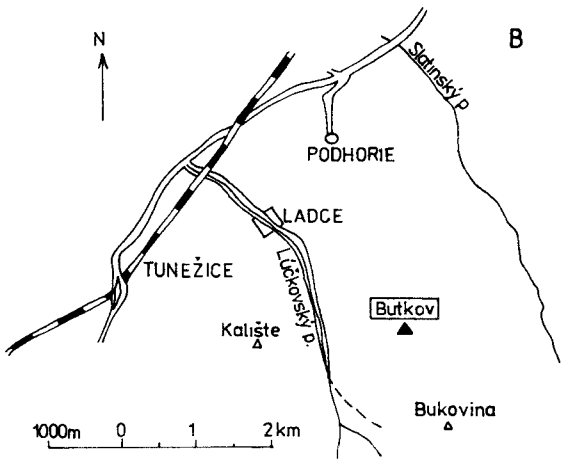

Fig. 1. Situation map of the studied area.

The cherty limestones - so-called „Neocomian nannocons limestones with cherts" should have represented Berriasian to Barremian. As late as Vašíček — Michalík (1986) and Borza et al. (1987) have determined, by means of ammonites and microfossils, a more accurate stratigraphic range of the formation: Hauterivian — ? Lower Barremian (see Tab. 1). Limestones of the lower part contained the ammonites *Lytoceras subfimbriatum, Crioceratites duvali, Crioceratites loryi, Acanthodiscus* sp. etc. Of microfossils, the foraminifers *Spirillina* sp., *Patellina* sp. as well as microproblematic *Tintinopsella carpathica, Colomisphaera vogleri, Colomisphaera heliosphaera, Stomiosphaera echinata, Globochaeta alpina* and nannocons were abundant.

According to Borza et al. (1986) the cherts represent the first stage of silicification. Their surface is silicified, whereas the core frequently is not affected by silicification. This fact as well as perfect preservation of brachiopods and ammonites amidst often evidently compressed rock prove early pre-diagenetic silicification. In the silicified parts of the rock there occur plentiful radiolarians and sponges suggesting that in the other parts of the rock these fossils were dissolved and their test yielded silica. The supposed autochthonous origin of SiO_2 is evidenced also by its total contents determined by chemical analyses which, on average, do not exceed the content in the underlying chert-free limestones.

Evaluation of the radiolarian associations

Of samples collected on the seventh bench of the quarry from cherty limestones of the lower part of the Kališčo Formation, cherts of the samples B-9 and B-10 contained radiolarian microfauna with the following genera and species:

Sample B-9: *Acanthocircus dicranacanthos* (SQUINABOL), *Alievium helenae* SCHAAF, *Archaeodictyomitra* sp., *Cecrops septemporatus* (PARONA), *Crucella* sp., *Orbiculiforma* sp., *Tritrabs worzeli* PESSAGNO, *Sethocapsa uterculus* (PARONA), *Thanarla* sp., *Triactoma* sp.

Sample B-10: *Acanthocircus dicranacanthos* (SQUINABOL), *Alievium helenae* SCHAAF, Alievium sp., *Archaeodictyomitra pseudoscalaris* (TAN SIN HOK), *Archaeodictyomitra rigida* PESSAGNO, *Archaeodictyomitra puga* SCHAAF, *Archaeodictyomitra* sp., *Cecrops septemporatus* (PARONA), *Crucella* sp., *Cyclastrum* sp., *Orbiculiforma* sp., *Ditrabs sansalvadorensis* (PESSAGNO), *Mirifusus* sp., *Sethocapsa uterculus* (PARONA), *Sphaerostylus hastatus* CAMPBELL et CLARK, *Thanarla conica* (ALIEV), *Thanarla* sp., *Triactoma echiodes* FOREMAN, *Triactoma* sp., *Tritrabs worzeli* PESSAGNO.

The compositions of the associations of the positive samples were approximately the same and may be correlated with U.A. 14 sensu Baumgartner's (1984, 1987) zoning indicates the Upper Valanginian to Hauterivian.

According to the biostratigraphic zoning of Schaaf (1981) and San-

Table 1

Lithologic-biostratigraphic correlation table.

AGE	STAGES	LITOLOGY	RADIOLARIANS	AMMONITES (Vašíček, 1987)	MICROFOSSILS (Borza 1986)
BARREMIAN	LOWER UP	LUČKOV FORMATION — „belemmite" limestone			
HAUTERIVIAN	UPPER	KALIŠČO FORMATION — cherty limestone	Acanthocircus dicranacanthos, Alievium helenae, Alievium sp, Archaeodictyomitra pseudoscalaris, A puga, A rigida, Sphaerostylus hastatus, Cecrops septemporatus, Crucella sp., Cyclastrum sp, Ditrabs sansalvadorensis, Mirifusus sp, Orbuliforma sp., Tritrabs worzeli, Sethocapsa uterculus, Thanarla conica, Thanarla sp, Triactoma echiodes, Triactoma sp.	Crioceratites duvali, Acanthodiscus sp, Crioceratites loryi	Colomisphaera heliosphaera, C. vogleri, Globochaeta alpina, Spirrilina sp., Patelina sp, Stomiosphaera echinata, Tintinopsella carpatica
	LOWER	MRAZNICA FORMATION — spotted limestone			

filippo—Riedel (1985) the obtained associations are characteristic of the zone *Cecrops septemporatus* corresponding to the Lower Hauterivian.

Schaaf (1984) has redefined the zone *Cecrops septemporatus* and established its upper part as the zone *Mirifusus chenodes*. Its base is defined by the first occurrence of the genus *Sethocapsa uterculus* (PARONA).

Because of the presence of the species *Sethocapsa uterculus* (PARONA) and absence of the species *Dibolachras tytthopora* (SCHAAF) whose first occurrence defines the base of the following zone, the associations obtained from the cherts of the lower part of the Kališčo Limestones can be correlated with the zone *Mirifusus chenodes* stratigraphically corresponding to the uppermost part of the Lower Hauterivian.

Systematic part

Genus *Acanthocircus* SQUINABOL, 1903 sensu DONOFRIO et MOSTLER, 1978
Typical species: *Acanthocircus irregularis* SQUINABOL, 1903
Acanthocircus dicranacanthos (SQUINABOL, 1914)
Pl. I, Fig. 2

1914 *Saturnalis dicranacanthos* SQUINABOL — S. Squinabol, p. 289, Fig. 1, Pl. 22, Figs. 4—6, Pl. 22, Fig. 8.
1914 *Saturnalis novalensis* SQUINABOL — S. Squinabol, p. 268, 297, Pl. 20, Fig. 1, Pl. 23, Fig. 7.
1916 *Saturnulus* sp. — H. Fischli, p. 46, Fig. 53.
1969 *Spongosaturnalis dicranacanthos* (SQUINABOL) — E. A. Pessagno, p. 610, Pl. 4, Fig. A, B.
1973 *Acanthocircus dizonius* (RÜST) — H. P. Foreman, p. 260, Pl. 4. Figs. 4, 5.
1975 *Acanthocircus dicranacanthos* (SQUINABOL) emend. — H. P. Foreman, p. 610, Pl. 2D, Figs. 5—6.
1978 *Acanthocircus dicranacanthos* (SQUINABOL) emend. — D. A. Donofrio et H. Mostler, p. 28, Pl. 2, Fig. 3, Pl. 4, Figs. 4, 7—9, Pl. 5, Figs. 10, 11.

Stratigraphic range: Baumgartner (1984) notes the first occurrence of this species in U.A. 9 which, according to his new chronostratigraphic correlation (Baumgartner, 1987), corresponds to the Kimmeridgian — — lower part of the Lower Tithonian. Schaaf (1984) and Sanfilippo et Riedel (1985) regard the Hauterivian as the upper limit of its occurence. Ožvoldová—Sýkora (1984), Ožvoldová—Peterčáková (1987), Ožvoldová (1988) have identified this species at the localities Šípkovský Háj, Bzince pod Javorinou and Turá Lúka ranging from the Kimmeridgian to Lower Berriasian.

Genus *Alievium* PESSAGNO, 1972
Typical species: *Theodiscus superbus* SQUINABOL, 1914
Alievium helenae SCHAAF, 1981
Pl. I, Fig. 1

1973 *Alievium* sp. — H. P. Foreman, p. 262, Pl. 9, Figs. 1, 2.
1975 *Alievium* sp. — H. P. Foreman, p. 613, Pl. 2D, Figs. 7, 8, Pl. 5, Fig. 14.
1977 *Alievium* sp. — E. A. Pessagno, p. 29, Pl. 3, Figs. 10, 18.

1981 *Alievium helenae* SCHAAF, n. sp. — A. Schaaf, p. 431, Pl. 7, Fig. 9, Pl. 10, Fig. 2a, b.

Stratigraphic range: According to Schaaf (1984) - Valanginian to Barremian.

? *Alievium* sp.
Pl. I, Fig. 3

Description: Triangular test with relics of three spines. The structure of the test meshwork is indistinct. The overall shape of the test resembles the genus *Alievium*.

Stratigraphic range: In the West Carpathians the species has been found in Lower Berriasian sediments at the locality Šípkovský Háj (Ožvoldová — Sýkora, 1984).

Genus *Archaeodictyomitra* PESSAGNO, 1976 sensu PESSAGNO, 1977
Typical species: *Archaeodictyomitra squinaboli* PESSAGNO, 1976
Archaeodictyomitra pseudoscalaris (TAS SIN HOK, 1927)
Pl. I, Fig. 4

1927 *Stichomitra pseudoscalaris* spec. nov. — Tan Sin Hok, p. 56, Pl. 11, Fig. 84.
1981 *Archaeodictyomitra pseudoscalaris* (TAN SIN HOK) — A. Schaaf, p. 432, Pl. 4, Fig. 5, Pl. 21, Fig. 13a, b.

Stratigraphic range: Schaaf (1981) notes the occurrence of this species in the Upper Barremian. In the West Carpathians the species has not been identified.

Archaeodictyomitra puga SCHAAF, 1981
Pl. II, Fig. 1

1973 *Dictyomitra* (?) sp. — P. Dumitrica, Pl. 4, Fig. 7.
1981 *Archaeodictyomitra puga* SCHAAF, n. sp. — A. Schaaf, p. 432—433, Pl. 3, Fig. 7, Pl. 21, Fig. 11a, b.

Stratigraphic range: Schaaf (1981) notes this species in the Upper Barremian along with the species *A. pseudoscalaris*. It has not been described in West Carpathian sediments.

Archaeodictyomitra rigida PESSAGNO, 1977
Pl. I, Fig. 5

1977 *Archaeodictyomitra rigida* PESSAGNO, n. sp. — E. A. Pessagno, p. 81, Pl. 7, Figs. 10, 11.

Stratigraphic range: Pessagno (1977) states the occurrence of the species in Lower Kimmeridgian to Berriasian, possibly even younger sediments. In the West Carpathians the species has not been identified so far.

Genus *Cecrops* PESSAGNO, 1977
Typical species: *Staurosphaera septemporata* PARONA, 1890
Cecrops septemporatus (PARONA, 1890)
Pl. III, Figs. 3—5

1890 *Staurosphaera septemporata* n. f. — C. F. Parona, p. 151, Pl. 2, Fig. 4, 5.
1916 *Staurolonche robusta* RÜST — H. Fischli, Fig. 36.
1916 *Staurolonche* sp. — H. Fischli, Fig. 37.
1977 *Cecrops septemporatus* (PARONA) — E. A. Pessagno, p. 33, Pl. 3, Fig. 11.

Stratigraphic range: Baumgartner (1984) notes the first occurrence of this species in U.A.14 - Upper Valanginian to Hauterivian. Schaaf (1984) gives the stratigraphic range of the species: the Uppermost Valanginian to the lower part of the Upper Barremian. In the West Carpathians it has not been described so far.

Genus *Crucella* PESSAGNO, 1971
Typical species: *Crucella messinae* PESSAGNO, 1971
Crucella sp.
Pl. III, Fig. 6

Description: Test composed of 4 rays with slightly elevated central area. The rays are thicker in the proximal part, with relics of spines at the end. The meshwork of the central area as well as that of the rays is indistinct.
Stratigraphic range: Representatives of the genus *Crucella* except for the species ? *C. Contorta* OŽVOLDOVÁ and *C.* cf. *cachensis* PESSAGNO (Ožvoldová—Sýkora, 1984 - Lower Berriasian) have been found in the West Carpathians only in Upper Jurassic sediments.

Genus *Cyclastrum* RÜST, 1898
Typical species: *Cyclastrum infundibuliforme* RÜST, 1898
Cyclastrum sp.
Pl. III, Fig. 1

1980 *Cyclastrum* sp. A — H. L. Holzer, p. 163, Pl. 2, Figs. 3, 4.

Description: Test composed of three cudgel-shaped rays with indications of spine relics at the end. In the outer half, the rays are connected by a subtriangular spongy patagium which forms three oval openings in the inner part of the test.
Remark: Our specimens equal *Cyclastrum* sp. of Holzer (1980).
Stratigraphic range: Holzer (1980) describes this form in Lower Cretaceous limestones (Neocomian).

Genus *Ditrabs* BAUMGARTNER, 1980
Typical species: *Amphibrachium sansalvadorensis* PESSAGNO, 1971
Ditrabs sansalvadorensis (PESSAGNO, 1971)
Pl. III, Fig. 3

1971 *Amphibrachium sansalvadorensis* PESSAGNO, n. sp. — E. A. Pessagno, p. 21, Pl. 19, Figs. 9—10.
1980 *Ditrabs sansalvadorensis* (PESSAGNO) — P. O. Baumgartner et al., p. 52, Pl. 2, Fig. 9.

Stratigraphic range: Baumgartner (1984) states the occurrence of this species from U.A.11 to U.A.14 which corresponds, according to Baumgartner's (1987) zoning, to the Uppermost Tithonian to Hauterivian. It has not been described from the West Carpathian sediments.

Genus *Mirifusus* PESSAGNO, 1977 sensu BAUMGARTNER, 1984
Typical species: *Mirifusus guadalupensis* PESSAGNO, 1977
Mirifusus sp.
Pl. III, Fig. 4

Remark: Shape of the test is typical of the genus *Mirifusus*. A more accurate specific assignation has not been possible because of the indistinct structure of the test wall. In the West Carpathians the genus is noted by Ožvoldová (1975, 1987, 1988) and Ožvoldová—Sýkora (1984) from the Upper Callovian to Lower Berriasian.

Genus *Orbiculiforma* PESSAGNO, 1973
Typical species: *Orbiculiforma quadrata* PESSAGNO, 1973
Orbiculiforma sp.
Pl. III, Fig. 2

Description: Disc-shaped test with central cavity representing about a half of the test diametre. In the centre the central cavity is slightly raised.
Stratigraphic range: In the West Carpathians, Ožvoldová—Sýkora (1984) and Ožvoldová (1988) note the genus in Upper Jurassic to Lower Berriasian sediments.

Genus *Sethocapsa* HAECKEL, 1881
Typical species: *Sethocapsa cometa* (PANTANELLI) in RÜST, 1885
Sethocapsa uterculus (PARONA, 1890)
Pl. IV, Figs. 1, 2

1890 *Theocapsa uterculus* n. f. — C. F. Parona, p. 168, Pl. 5, Fig. 17.
1975 *Sethocapsa* sp. cf. *Theocapsa uterculus* PARONA — H. P. Foreman, p. 749, Pl. 2, Fig. 8.
1981 *Sethocapsa uterculus* (PARONA) — A. Schaaf, p. 437, Pl. 5, Fig. 8a, b, Pl. 26, Fig. 5a, b.

Stratigraphic range: Schaaf (1984) notes the occurrence of this species from the middle of the Lower Hauterivian to the end of the Barremian. It has not been identified in West Carpathian sediments.

Genus *Sphaerostylus* HAECKEL, 1882
Typical species: *Sphaerostylus zittelii* RÜST, 1885
Sphaerostylus hastatus CAMPBELL et CLARK, 1944
Pl. II, Fig. 2

1944 *Sphaerostylus (Sphaerostylantha) hastatus*, n. sp. — A. S. Campbell — B. L. Clark, p. 5, Pl. 1, Figs. 1, 6.

Stratigraphic range: Campbell—Clark (1944) describe this species from Upper Cretaceous sediments. Similarly, Ožvoldová (1979) notes the species in the Albian of the Tissal beds of the Kysuca succession of the West Carpathian Klippen Belt.

Genus *Thanarla* PESSAGNO, 1977
Typical species: *Phormocyrtis veneta* SQUINABOL, 1903
Thanarla conica (ALIEV, 1963)
Pl. IV, Fig. 3

1965 *Cornutana conica* KH. ALIEV, sp. n. — Ch. Aliev, p. 35—35, Pl. 6, Fig. 1.
1973 *Dictyomitra* (?) *lacrimula* FOREMAN, new species — H. P. Foreman, p. 263, Pl. 10, Fig. 11.
1977 *Thanarla conica* (ALIEV) — E. A. Pessagno, p. 45, Pl. 7, Figs. 1, 13, 15.

Stratigraphic range: The species is described from the Lower Cretaceous. In the Czechoslovak territory it is noted by Ožvoldová (in press) in Albian limestones underlying the Vienna Basin.

Thanarla sp.
Pl. IV, Fig. 4

Description: In the proximal part the test is conical, slightly thinning in the distal part. On the test surface are longitudinal costae running throughout the surface. The number of the costae on one half of the test is 9 to 10. Between costae there is a longitudinal row of pores with indistinct density and size.

Stratigraphic range: In the West Carpathians the occurrence of the specimens of the genus *Thanarla* is noted in Oxfordian radiolarites (Ožvoldová, 1988)

Genus *Triactoma* RÜST, 1885
Typical species: *Triactoma tithonianum* RÜST, 1885
Triactoma echiodes FOREMAN, 1973

1973 *Triactoma echiodes* FOREMAN, new species — H. P. Foreman, p. 260, Pl. 3, Fig. 1, Pl. 16, Fig. 21.

Stratigraphic range: Baumgartner (1984) notes the occurrence of this species from U.A.9 to U.A.14, which corresponds according

Plate I

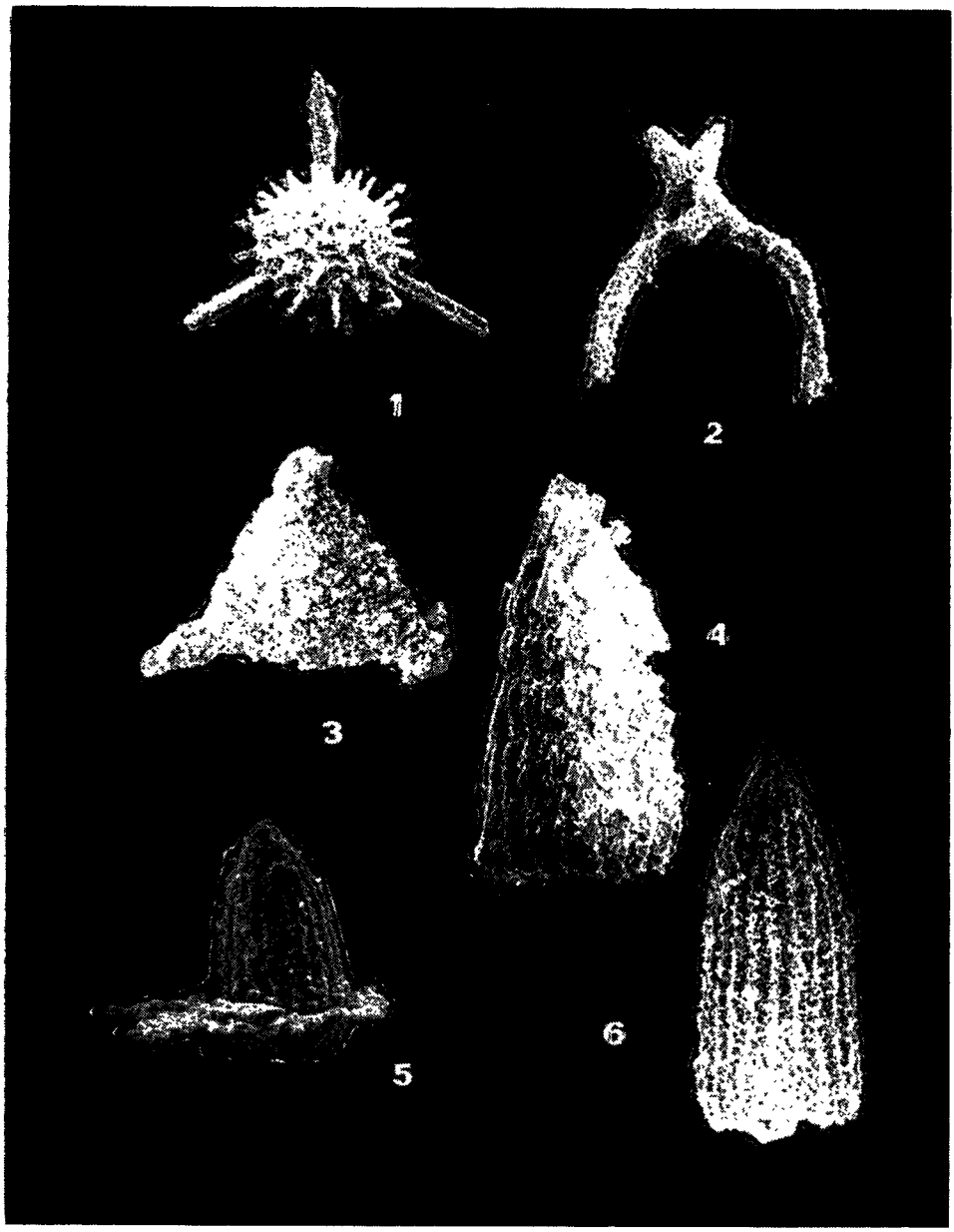

Fig. 1. - *Alievium helenae* SCHAAF, × 130; Fig. 2. - *Acanthocircus dicranacanthos* (SQUINABOL), × 160; Fig. 3. - ? *Alievium* sp. × 135; Fig. 4. - *Archaeodictyomitra pseudoscalaris* (TAN SIN HOK), × 220; Fig. 5. - *Archaeodictyomitra rigida* PESSAGNO, × 170; Fig. 6. - *Archaeodictyomitra* sp. × 220.

Plate II

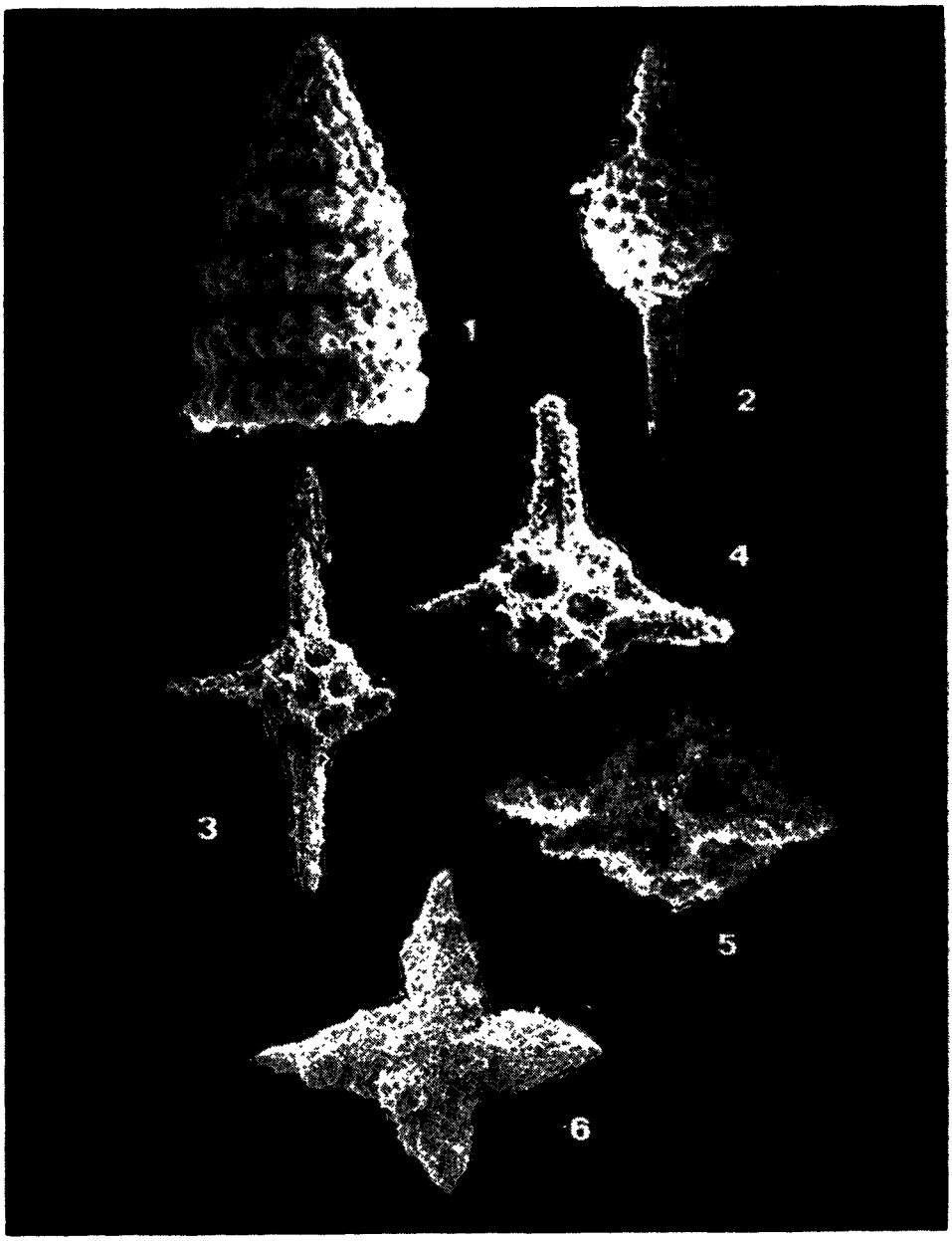

Fig. 1. - *Archaeodictyomitra puga* SCHAAF, × 300; Fig. 2. - *Sphaerostylus hastatus* CAMPBELL et CLARK, × 220; Fig. 3. - *Cecrops septemporatus* (PARONA), × 200; Fig. 4. - *Cecrops septemporatus* (PARONA), × 240; Fig. 5. - *Cecrops septemporatus* (PARONA), × 275; Fig. 6. - *Crucella* sp. × 100.

Plate III

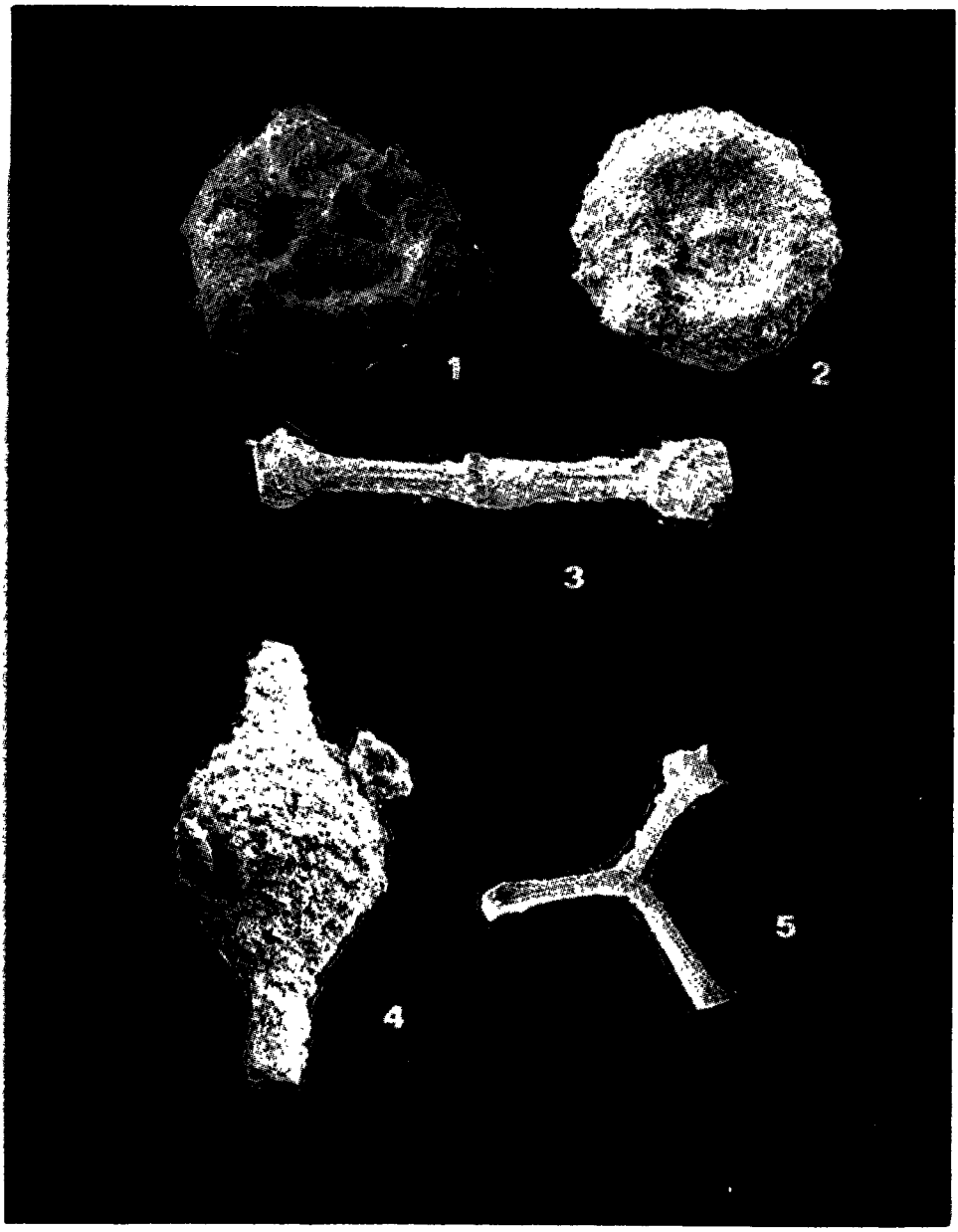

Fig. 1. - *Cyclastrum* sp. × 85; Fig. 2. - *Orbiculiforma* sp. × 100; Fig. 3. - *Ditrabs sansalvadorensis* (PESSAGNO), × 80; Fig. 4. - *Mirifusus* sp. × 160; Fig. 5. - *Tritrabs worzeli* PESSAGNO, × 50.

Plate IV

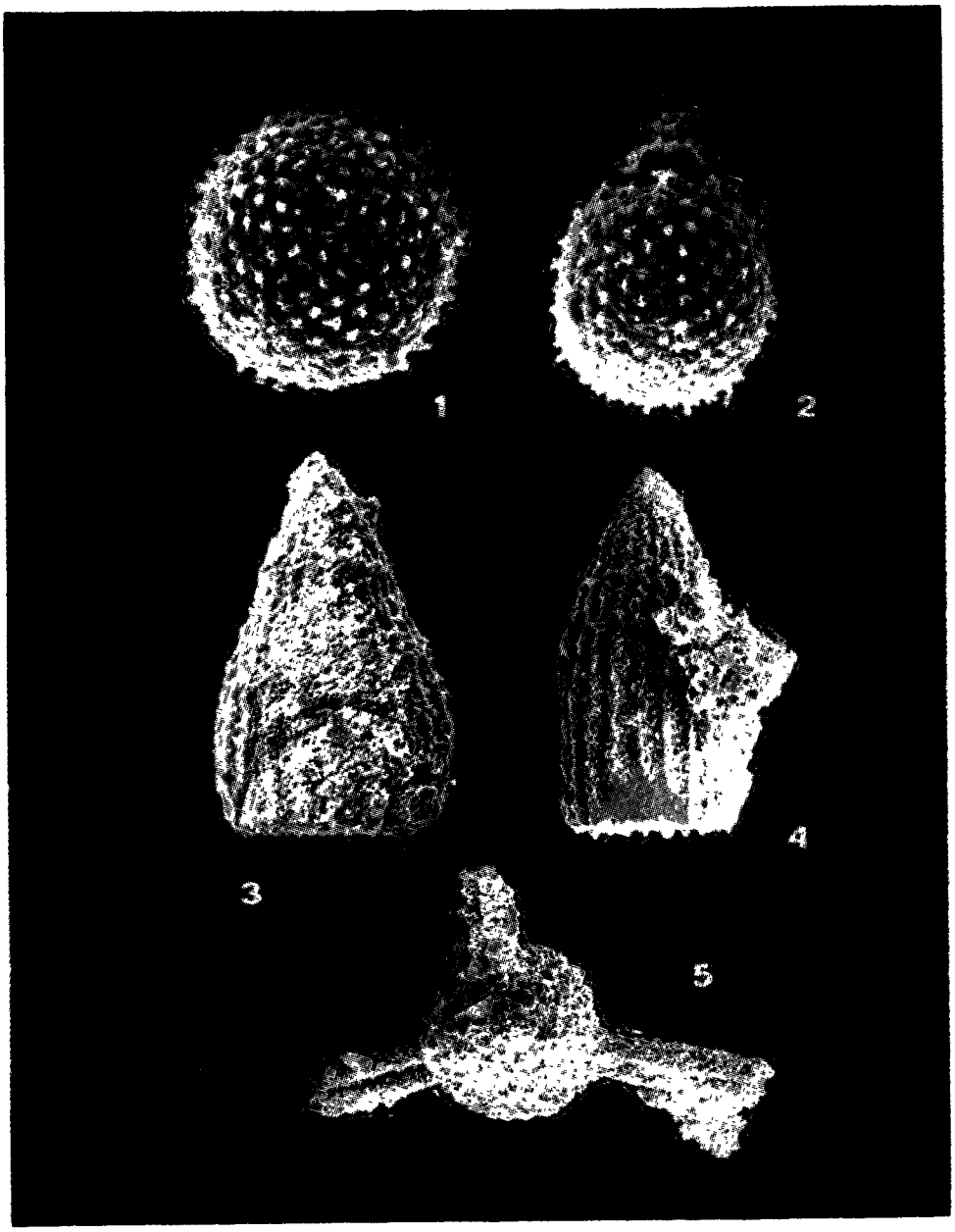

Fig. 1. - *Sethocapsa uterculus* (PARONA), × 335; Fig. 2. - *Sethocapsa uterculus* (PARONA), × 270; Fig. 3. - *Thanarla conica* (ALIEV), × 350; Fig. 4. - *Thanarla* sp. × 300; Fig. 5. - *Triactoma* sp. × 180.

All microphotos by dr. I. Holický.

to Baumgartner's (1987) zoning to the Kimmeridgian to Hauterivian. It has not been identified in the West Carpathians.

Triactoma sp.
Pl. IV, Fig. 5

Description: Lattice spherical test with three thick spines.

Remark: A more accurate specific identification has been impossible due to imperfect preservation.

Stratigraphic range: Specimens of this genus have so far been noted in the West Carpathians from the Upper Callovian to Lower Berriasian.

Genus *Tritrabs* BAUMGARTNER? 1980

Typical species: *Paronella* (?) *casmaliaensis* PESSAGNO, 1977
Tritrabs worzeli (PESSAGNO, 1971)
Pl. III, Fig. 5

1971 ? *Paronella worzeli* PESSAGNO, n. sp. — E. A. Pessagno, p. 50, Pl. 19, Fig. 6.
1980 *Tritrabs worzeli* (PESSAGNO) — P. O. Baumgartner, p. 294, Pl. 4, Fig. 8.

Stratigraphic range: According to Baumgartner (1980) - Oxfordian—Tithonian. Holzer (1980) notes this species in the Lower Cretaceous (Neocomian limestones). In the West Carpathians it has been identified by Ožvoldová (1975, 1979) in Upper Callovian to Upper Oxfordian sediments (U.A.5 to U.A.8 sensu Baumgartner, 1984, 1987).

Translated by L. Böhmer

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