GEOLOGICKY ZBORNÍK — GEOLOGICA CARPATHICA, 41, 2, BRATISLAVA, APRIL 1990, Pp. 137—154

LADISLAVA OŽVOLDOVÁ*

OCCURRENCE OF ALBIAN RADIOLARIA IN THE UNDERLIER OF THE VIENNA BASIN

(1 Fig., VI Pls.)

Abstract: In the drillhole Smolinské 17 at a depth of 1399—1605 m, marlstones, marly shales and limestones of Albian age with radiolarian, ostracod and foraminifer microfauna have been found under Neogene sediments of the Vienna Basin (Biely et al., 1973). The composition of the foraminifer microfauna determined by Samuel (ibidem) suggests its Albian age. The analysis of the well-preserved pyritized radiolarian microfauna from a depth of 1498—1499 m indicates also the Albian, probably its middle to upper part.

Резюме: В буровой скважине Смолинске 17 под неогеновыми осадками Венской впадины на глубине 1399—1605 м были найдены глинистые известняки, мергелистые сланцы и известняки альбского возраста с радиоляриевой, остракодовой и фораминиферовой микрофауной (Biely et al., 1973). Состав фораминиферовой фауны, определенной О Самуелом (l.c.) указывает на альб. Анализ хорошо сохраненной пиритизованной радиоляриевой микрофауны из глубины 1498—1499 и также указывает на альб, вероятно на его среднюю по верхнюю часть.

Introduction

The drillhole Smolinské 17 aimed at the exploration of the Vienna Basin basement discovered Albian beds underlying Neogene formations at a depth of 1399—1605 m. The geological investigation of the drillcore (Biely et al., 1973) has proved that these beds have a character of pelagic sediments without any clastic admixture. They are represented by dark-grey, grey, greenish, tectonically fractured marlstones and marly shales with thin intercalations of spotted grey-green limestones. The limestones contain the same, predominantly radiolarian, microfaunistic assemblage with less abundant ostracods and small globigerina foraminifers (Kullmanová, ibidem).

The foraminifer microfauna determined by Samuel proves Albian age - *Ticinella roberti* (GANDOLFI), *T. primula* LUTERBACHER, *T. raynaudi* SIGAL, *Hedbergella trocoidea* (GANDOLFI), *Epistomina* ex gr. *spinulifera* (REUSS), *Discorbis wassoevici* DJAFF. et AGAR, *Glomospirella gaultina* (BERTHELIN), *Haplophragmoides nonioninoides* (REUSS). The beds are assigned to Pienid successions of the Klippen Belt, namely to the Kysuca succession (ibidem).

Results of the radiolarian microfauna analysis

The radiolarian microfauna has been separated from green-grey limestones from a depth of 1498—1499 m by means of known preparational methods for calcareous-argillaceous rocks (Kummel—Raup, 1965; Schaaf, 1984 and others).

* RNDr. L. Ožvoldová, Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University, Mlynská dolina 1, 842 15 Bratislava.

All the forms were perfectly preserved, pyritized and were associated almost exclusively with *Nassellaria*. *Spumellaria* occurred in insignificant amounts. The specimens were mostly small-sized.

The following genera and species have been identified in the association: *Acanthocircus amissus* (SQUINABOL), *Amphipyndax stocki* (CAMPBELL et CLARK), *Archaeodictyomitra puga* SCHAAF, *Cryptamphorella dumitricai* SCHAAF, *Cryptamphorella macropora* DUMITRICA, *Cryptamphorella* sp.,

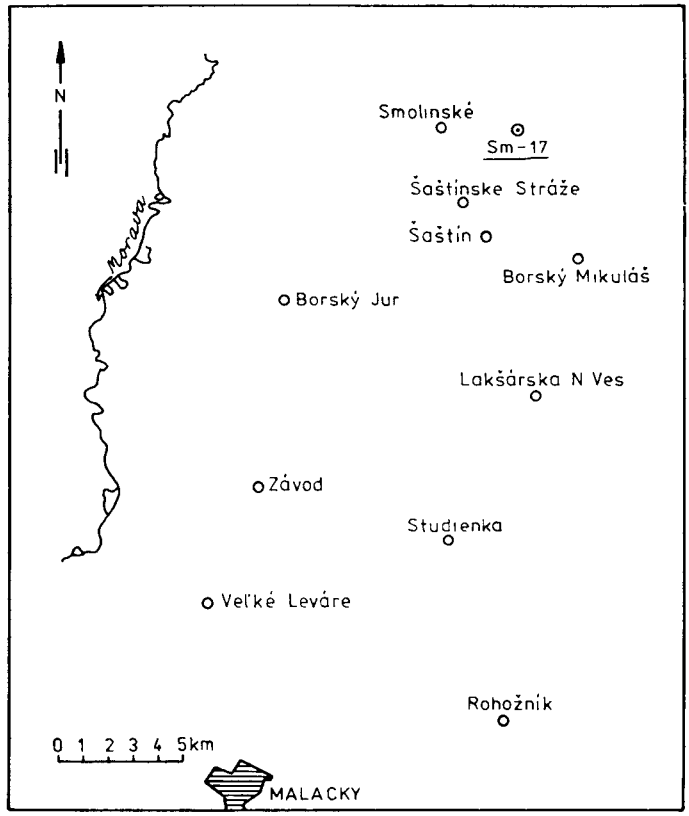


Fig. 1. Situation map of the studied area.

Cyrtocapsa grutterinki TAN SIN HOK, *?Cyrtocapsa* sp., *Diacanthocapsa* sp., *?Halesium sexangulum* PESSAGNO, *Hemicryptocapsa tuberosa* DUMITRICA, *Holocryptocanium barbui* DUMITRICA, *Holocryptocanium* sp., *?Holocryptocapsa cryptodon* (DUMITRICA), *Orbiculiforma* sp., *Praeconocaryomma lipmanae* PESSAGNO, *Praeconocaryomma* sp. A, *Protunuma* sp., *Pseudodictyomitra lepticonica* (FOREMAN), *Thanarla conica* (ALIEV), *Thanarla* aff. *conica* (ALIEV), *Thanarla* sp. A, *Thanarla* sp. B, *Xitus spicularius* (ALIEV), *Xitus* sp.

The association comprised species and specimens which occur in the Lower Cretaceous (Berriasian—Albian) — *Archaeodictyomitra puga* SCHAAF, *Acan-*

thocircus amissus (SQUINABOL), *Cyrtocapsa grutterinki* TAN SIN HOK, *Cryptamphorella* sp., *Cryptamphorella dumitricai* SCHAAF, *Praeconocaryomma* sp. A, *Pseudodictyomitra leptoconica* (FOREMAN), *Thanarla conica* (ALIEV), *Thanarla* aff. *conica* (ALIEV), *Xitus spicularius* (ALIEV) as well as genera and species assigned to the Albian and Upper Cretaceous - *Amphipyndax stocki* (CAMPBELL et CLARK), *?Holocryptocapsa cryptodon* (DUMITRICA), *Hemicryptocapsa tuberosa* DUMITRICA, *Praeconocaryomma lipmanae* PESSAGNO, *Cryptamphorella macropora* DUMITRICA, *Diacanthocapsa* sp.

The species *Holocryptocanium barbui* DUMITRICA, the stratigraphic range of which is Albian — Lowermost Cenomanian (Sanfilippo — Riedel, 1985), is of prime importance for this association. According to Schaaf (1985) the first occurrence of this species determines the zone *Holocryptocanium barbui* in the Middle Albian. Because more than a half of the species of this association do not occur as late as in the Upper Cretaceous (Cenomanian) we do not assume its Cenomanian age.

From this analysis it results that the association can be assigned to the Albian, most probably to its middle to upper part.

If we compare the analysed association with the only Albian radiolarian association published so far from the West Carpathians, from the Tissal beds of the Kysuca succession, klippe Rochovica near Brodno (Ožvoldová, 1979) where the foraminifer association determined by Samuel (Haško, 1974) suggests Middle to Upper Albian age, we may state that their specific composition is different. This is due to the fact that the analysed association bore signs of sorting. Unlike the association of the Tissal beds, our association consisted almost exclusively of spherical, oval or conical specimens. Those with rugged surface were found only exceptionally, in the form of fragments.

Systematic part

Genus *Acanthocireus* SQUINABOL, 1903, sensu DONOFRIO et MOSTLER, 1978

Typical species: *A. irregularis* SQUINABOL, 1903
Acanthocircus amissus (SQUINABOL, 1914)
Pl. V, Fig. 2

1898 ? *Saturnulus dizonius* n. sp. — D. Rüst, p. 8, Tab. 2, Fig. 3.
1898 ? *Saturnulus trizonalis* n. sp. — D. Rüst, p. 9, Tab. 2, Fig. 4.
1914 *Saturnalis amissus* n. sp. — S. Squinabol, p. 296, Tab. 23, Figs. 2—5.
1978 *Acanthocircus amissus* (SQUINABOL) — D. A. Donofrio — H. Mostler, p. 23, Tab. 1, Figs. 1, 10, Tab. 5, Figs. 1—4, 6, 9, Tab. 6, Figs. 4, 6, 8, 11 (cum syn.).

Remark: Some authors assign these species to the species *Acanthocircus trizonalis* (RÜST) (Schaaf, 1984 and others). We agree with the authors Donofrio — Mostler (1978) that the specimen illustrated by Rüst (1898) probably represents a ring fragment connected with a complete specimen of the species *A. amissus* during sedimentation. The unclear diagnosis of the species *A. trizonalis* therefore justifies the assignation of these specimens to the species *A. amissus* (SQUINABOL).

As regards the species *Saturnulus dizonius* RÜST, it is also an imperfectly preserved specimen which may be either the species *A. amissus* or *A. dicrana-*

canthos (SQUINABOL). The assignation of the species *S. dizonius* to synonymity is therefore questionable.

Stratigraphic range: The species occurs from the Upper Jurassic to, according to Sanfilippo—Riedel (1985), the Middle Aptian.

Genus *Amphipyndax* FOREMAN, 1966
Typical species: *A. enesseffi* FOREMAN, 1966
Amphipyndax stocki (CAMPBELL et CLARK, 1944) emend. FOREMAN, 1968
Pl. II, Fig. 3

1944 *Stichocapsa* (?) *stocki* n. sp. — A. Campbell, B. Clark, p. 44, Tab. 8, Figs. 31—33.
1968 *Amphipyndax stocki* (CAMPBELL and CLARK) — H. P. Foreman, p. 78, Tab. 8, Fig. 12a—c.
1982 *Protostichocapsa stocki* (CAMPBELL and CLARK) emend. Foreman—Empson—Morin, p. 516, Tab. 4, Figs. 1—12.

Remark: To distinguish the specimens, that unlike the genus *Amphipyndax*, have a simple meshwork of the test wall, Empson—Morin (1982) excluded the genus *Protostichocapsa* from the group of specimens of the genus *Amphipyndax*. The reasons for the formation of the new genus, however, are questionable.

Stratigraphic range: The species is described from the Upper Albian to Upper Cretaceous.

Genus *Archaeodictyomitra* PESSAGNO, 1976
Typical species: *A. squinaboli* PESSAGNO, 1976
Archaeodictyomitra puga SCHAAF, 1981
Pl. III, Figs. 8, 9, Pl. IV, Fig. 7

1981 *Archaeodictyomitra puga* SCHAAF, n. sp. — A. Schaaf, p. 432, Tab. 3, Fig. 7, Tab. 21, Fig. 11ab.

Remark: The species was described by the author from the Barremian.

Genus *Cryptamphorella* DUMITRICA, 1970
Typical species: *Hemicryptocapsa conara* FOREMAN, 1968
Cryptamphorella macropora DUMITRICA, 1970
Pl. V, Figs. 4—7

1970 *Cryptamphorella macropora* n. sp. — P. Dumitrica, p. 81, Tab. 10, Figs. 64—65, Tab. 11, Figs. 67, 69—72, Tab. 20, Fig. 132, Tab. 21, Figs. 137. 140, 141.

Stratigraphic range: The species was described by the author from the Lower Campanian.

Cryptamphorella sp.
Pl. II, Figs. 2, 7, 8

1981 *Cryptamphorella* sp. indet. — A. Schaaf, Tab. 2, Fig. 4a, b.
1982 *Cryptamphorella* (?) sp. — H. Okado, A. Hatakenaka, K. Nakaseko, p. 357, Tab. 1, Fig. 2.

Remark: Our specimens equal that described by Schaaf (1981) from a Barremian association and Okada et al. (1982) from the Valanginian.

Genus *Cyrtocapsa* HAECKEL, 1881
Typical species: *C. ovalis* RÜST, 1885
Cyrtocapsa grutterinki TAN SIN HOK, 1927
Pl. III, Figs. 1, 2

1927 *Cyrtocapsa Grutterinki* spec. nov typ. — Tan Sin Hok, p. 64, Tab. 13, Fig. 110.
1981 *Cyrtocapsa grutterinki* TAN SIN HOK — A. Schaaf, p. 433, Tab. 6, Fig. 6a, b.

Stratigraphic range: The species has so far been described from the Lower Cretaceous only.

Genus *Diacanthocapsa* SQUINABOL, 1903, emend. DUMITRICA, 1970
Typical species: *D. euganea* SQUINABOL, 1903
Diacanthocapsa sp.
Pl. I, Fig. 4

Remark: Our specimens cannot be reliably assigned to the known species of this genus. From the species *D.* cf. *ancus* (FOREMAN) described by Dumitrica (1970) from the Upper Cretaceous (Cenomanian — Campanian) they differ in the shape and elevation of the suture pore as well as in the fact that the pores on their thorax and abdomen are not arranged.
Stratigraphic range: This genus is so far known from the Upper Cretaceous only.

Genus *Halesium* PESSAGNO, 1971
Typical species: *H. sexangulum* PESSAGNO, 1971
?*Halesium sexangulum* PESSAGNO, 1971
Pl. V, Fig. 3

1971 *Halesium sexangulum* PESSAGNO, n. sp. — E. A. Pessagno, p. 25, Tab. 1, Figs. 5—6, Tab. 2, Figs. 1—6.

Remark: In the association there were only preserved remains of one ray which probably belongs to the species *H. sexangulum* PESSAGNO.
Stratigraphic range: According to Pessagno (1971) the stratigraphic range of this species is? Albian — Cenomanian — Middle Turonian.

Genus *Hemicryptocapsa* TAN SIN HOK, 1927, emend. DUMITRICA, 1970
Typical species: *H. capita* TAN SIN HOK, 1927
Hemicryptocapsa tuberosa DUMITRICA, 1970
Pl. III, Figs. 3, 4; Pl. IV, Fig. 8

1970 *Hemicryptocapsa tuberosa* n. sp. — P. Dumitrica, p. 71, Tab. 12, Fig. 78a, Tab. 13, Figs. 78b, c, 79a, b, Tab. 21, Fig. 135.

Stratigraphic range: The species was described by the author from the Cenomanian.

Genus *Holocryptocanium* DUMITRICA, 1970
Typical species: *H. tuberculatum* DUMITRICA, 1970
Holocryptocanium barbui DUMITRICA, 1970
Pl. IV, Figs. 1—6

1970 *Holocryptocanium barbui* n. sp. — P. Dumitrica, p. 76, Tab. 17, Figs. 105—108a, b, Tab. 21, Fig. 136.
1979 *Holocryptocanium japonicum* NAKASEKO et NISHIMURA n. sp. — K. Nakaseko, A. Nishimura, K. Sugano, Tab. 5, Figs. 8, 10.
1981 *Holocryptocanium barbui japonicum* NAKASEKO et NISHIMURA n. subsp. — K. Nakaseko, A. Nishimura, p. 154, Tab. 3, Figs. 5a, b, 6, 7a, b, Tab. 14, Fig. 10.

Remark: Nakaseko—Nishimura (1981) determined two subspecies: *H. barbui barbui* DUMITRICA for specimens without pore frames and *H. barbui japonicum* NAKASEKO et NISHIMURA for those with pore frames.

Our sample contained both the forms of this species. Fracturing of the smooth surficial layer of the test wall indicated that fine pores without pore frames on the surface increase their size in the subsurficial layers and are limited by the pore frames (Pl. VI, Figs. 3—5).

Stratigraphic range: According to Sanfilippo—Riedel (1985) - Albian — Lowermost Cenomanian. According to Schaaf (1985) the first occurrence of this species determines the zone *Holocryptocanium barbui* in the Middle Albian.

Holocryptocanium sp.
Pl. I, Figs. 5, 7, 8

Description: Spherical test with markedly elevated irregular pore frames on the abdomen. One pore in the centre of each pore frame is small, rounded, situated in a conical cavity. Pore frames around small circular opening are radial.

Genus *Holocryptocapsa* TAN SIN HOK, 1927, emend. DUMITRICA, 1970
Typical species: *H. fallax* TAN SIN HOK, 1927
? *Holocryptocapsa cryptodon* (DUMITRICA, 1970)
Pl. I, Fig. 6; Pl. V, Fig. 1

1970 *Hemicryptocapsa cryptodon* n. sp. — P. Dumitrica, p. 73, Tab. 14, Figs. 90, 91 a—c.
1972 *Holocryptocapsa* (?) cf. *cryptodon* (DUMITRICA) — P. Dumitrica, p. 841, Tab. 2, Figs. 3—6.

Stratigraphic range: According to Dumitrica (1970, 1972) the stratigraphic range of this species is Albian — Lower Turonian.

Genus *Orbiculiforma* PESSAGNO, 1973
Typical species: *O. quadrata* PESSAGNO, 1973
Orbiculiforma sp.
Pl. I, Fig. 1

Remark: Meshwork of the test consists of pore frames of irregular shape and size. Central cavity is oval with a slightly elevated margin.

Genus *Praeconocaryomma* PESSAGNO, 1976
Typical species: *P. universa* PESSAGNO, 1976
Praeconocaryomma lipmanae PESSAGNO, 1976
Pl. I, Fig. 3

1976 *Praeconocaryomma lipmanae* PESSAGNO, n. sp. — E. A. Pessagno, p. 41, Tab. 4, Figs. 12—13.

Stratigraphic range: The species was described by the author from the Upper Cenomanian to Lower Turonian.

Praeconocaryomma sp. A
Pl. I, Fig. 2

1977 *Praeconocaryomma* sp. A — E. A. Pessagno, p. 34, Tab. 3, Fig. 23.

Remark: Our specimens equal the specimen illustrated by Pessagno (1977) discovered in a Hauterivian association.

Genus *Protunuma* ICHIKAWA et YAO, 1976
Typical species: *P. fusiformis* ICHIKAWA et YAO, 1976
Protunuma sp.
Pl. II, Figs. 4, 5

Remark: Our specimens differ from the other species of the genus *Protunuma* in a larger number of longitudinal lines of pores between individual plicae and in their higher density.

Genus *Pseudodictyomitra* PESSAGNO, 1977
Typical species: *P. pentacolaensis* PESSAGNO, 1977
Pseudodictyomitra leptoconica (FOREMAN, 1973)
Pl. II, Fig. 6

1973 *Dictyomitra leptoconica* FOREMAN, new species — H. P. Foreman, p. 264, Tab. 10, Fig. 4, Tab. 16, Fig. 6.
1981 *Pseudodictyomitra leptoconica* (FOREMAN) group — A. Schaaf, p. 437, Tab. 3, Fig. 3, Tab. 18, Fig. 3a, b.

Stratigraphic range: According to Schaaf (1984) the stratigraphic range of this species is Upper Tithonian — Lowermost Aptian.

Genus *Thanarla* PESSAGNO, 1977
Typical species: *Phormocyrtis veneta* SQUINABOL, 1903
Thanarla conica (ALIEV, 1965)
Pl. IV, Fig. 2

1965 *Cornutana conica* Kh. ALIEV, sp. n. — Kh. Aliev, pp. 34—35, Tab. 6, Fig. 1.
1973 *Dictyomitra* (?) *lacrimula* FOREMAN, new species — H. P. Foreman, p. 263, Tab. 10, Fig. 11.
1977 *Thanarla conica* (ALIEV) — E. A. Pessagno, p. 45, Tab. 7, Figs. 1, 13, 15.

Stratigraphic range: The species is described from the Lower Cretaceous.

Thanarla aff. conica (ALIEV, 1965)
Pl. IV, Figs. 3, 4, 6

1977 *Thanarla* sp. aff. *T. conica* (ALIEV) — E. A. Pessagno, p. 46, Tab. 7, Figs. 8, 14.

Remark: Our specimens equal those described by Pessagno (1977) denominated as *Thanarla* sp. *aff. T. conica* (ALIEV) from the Lower Cretaceous of California.

Thanarla sp. A
Pl. IV, Fig. 1

Remark: Our specimens differ from the other specimens of the genus *Thanarla* in a number and arrangement of pores between longitudinal costae. The pores are arrayed in 5 horizontal lines.

Thanarla sp. B
Pl. IV, Fig. 5

Remark: The specimens differ from the species *Thanarla* aff. *conica* (ALIEV) in large, sparsely deposited, horizontally arranged pores between longitudinal costae.

Genus *Xitus* PESSAGNO, 1977
Typical species: *X. plenus* PESSAGNO, 1977
Xitus spicularius (ALIEV, 1961)
Pl. III, Figs. 5, 6, 7

1961 *Dictyomitra spicularia* Kh. ALIEV, sp. n. — Kh. Aliev, p. 34, Tab. 2, Figs. 1, 2.
1977 *Xitus spicularius* (ALIEV) — E. A. Pessagno, p. 56, Tab. 9, Fig. 7, Tab. 10, Fig. 5.
1984 *Xitus spicularius* (ALIEV) — A. Schaaf, pp. 140—141.

Stratigraphic range: According to Schaaf (1984) the stratigraphic range of this species is Upper Valanginian — Albian.

Xitus sp.
Pl. II, Fig. 9

Remark: Our specimens differ from the species *Xitus plenus* PESSAGNO in the shape of the test as well as structure of the outer test wall.

Translated by L. Böhmer

Plate I

Fig. 1. — *Orbiculiforma* sp. — 5830, 215× magn.; Fig. 2. — *Praeconocaryomma* sp. A — 5840, 190× magn.; Fig. 3. — *Praeconocaryomma lipmanae* PESSAGNO — 5838, 200× magn.; Fig. 4. — *Diacanthocapsa* sp. — 5860, 460× magn.; Fig. 5. — *Holocryptocanium* sp. — 5871, 465× magn.; Fig. 6. — ? *Holocryptocapsa cryptodon* DUMITRICA — 6250, 280× magn.; Fig. 7. — *Holocryptocanium* sp. — 5912, 430× magn.; Fig. 8. — *Holocryptocanium* sp. — 5913, 430× magn.

Plate II

Fig. 1. — *Cryptamphorella dumitricai* SCHAAF — 5792, 480× magn.; Fig. 2. — *Cryptamphorella* sp. — 6234, 300× magn., apical view, showing the prominent sutural pore from Fig. 7. Fig. 3. — *Amphipyndax stocki* (CAMPBELL et CLARK) — 5817, 230× magn.; Fig. 4. — *Protunuma* sp. — 5836, 315× magn.; Fig. 5. — *Protunuma* sp. — 5796, 270× magn.; Fig. 6. — *Pseudodictyomitra leptoconica* (FOREMAN) — 5842, 465× magn.; Fig. 7. — *Cryptamphorella* sp. — 5829, 330× magn.; Fig. 8. — *Cryptamphorella* sp. — 5859, 365× magn.; antapical view from Fig. 7. Fig. 9. — *Xitus* sp. — 5835, 315× magn.

Plate III

Fig. 1. — *Cyrtocapsa grutterinki* TAN SIN HOK — 5857, 260× magn.; Fig. 2. — *Cyrtocapsa grutterinki* TAN SIN HOK — 5812, 265× magn.; Fig. 3. — *Hemicryptocapsa tuberosa* DUMITRICA — 5808, 315× magn.; Fig. 4. — *Hemicryptocapsa tuberosa* DUMITRICA — 5907, 365× magn.; Fig. 5. — *Xitus spicularius* (ALIEV) — 5843, 265× magn.; Fig. 6. — *Xitus spicularius* (ALIEV) — 5803, 265× magn.; Fig. 7. — *Xitus spicularius* (ALIEV) — 5843, 265× magn.; Fig. 8. — *Archaeodictyomitra puga* SCHAAF — 5790, 230× magn.; Fig. 9. — *Archaeodictyomitra puga* SCHAAF — 5854, 240× magn.

Plate IV

Fig. 1. — *Thanarla* sp. A — 5856, 365× magn.; Fig. 2. — *Thanarla conica* (ALIEV) — 5813, 330× magn.; Fig. 3. — *Thanarla aff. conica* (ALIEV) — 5833, 330× magn.; Fig. 4. — *Thanarla aff. conica* (ALIEV) — 5834, 300× magn.; Fig. 5. — *Thanarla* sp. B — 5787, 265× magn.; Fig. 6. *Thanarla* aff. *conica* (ALIEV) — 5788, 250× magn.; Fig. 7. — *Archaeodictyomitra puga* SCHAAF — 5849, 300× magn.; Fig. 8. — *Hemicryptocapsa tuberosa* DUMITRICA — 5853, 325× magn.; Fig. 9. — ?*Cyrtocapsa* sp. — 5800, 300× magn.

Plate V

Fig. 1. — ? *Holocryptocapsa cryptodon* (DUMITRICA) — 6251, 290× magn.; Fig. 2. — *Acanthocircus amissus* (SQUINABOL) — 6452, 280× magn.; Fig. 3. — ?*Halesium sexangulum* PESSAGNO — 5864, 300× magn.; Fig. 4. — *Cryptamphorella macropora* DUMITRICA — 6258, 450× magn.; Fig. 5. — *Cryptamphorella macropora* DUMITRICA — 6259, 480× magn.; apical view showing the large sutural pore from Fig. 4. Fig. 6. — *Cryptamphorella macropora* DUMITRICA — 6261, 465× magn.; Fig. 7. — *Cryptamphorella macropora* DUMITRICA — 6260, 600× magn.; antapical view from Fig. 4.

Plate VI

Fig. 1. — *Holocryptocanium barbui* DUMITRICA — 6443, 330× magn.; Fig. 2. — *Holocryptocanium barbui* DUMITRICA — 5918, 280× magn.; Fig. 3. — *Holocryptocanium barbui* DUMITRICA — 6457, 1660× magn.; detail from pore frames. Fig. 4. — *Holocryptocanium barbui* DUMITRICA — 6453, 290× magn.; removed external layer of the smooth wall of the shell; note increased pores with pore frames. Fig. 5. — *Holocryptocanium barbui* DUMITRICA — 6455, 1660× magn.; detail from Fig. 4. Fig. 6. — *Holocryptocanium barbui* DUMITRICA — 6454, 600× magn.; detail from Fig. 4.

Photographed by SEM, Geological Inst. of the Centre of Geoscience Research, Slov. Acad. Sci., Bratislava (photo: I. Holický).

Plate I

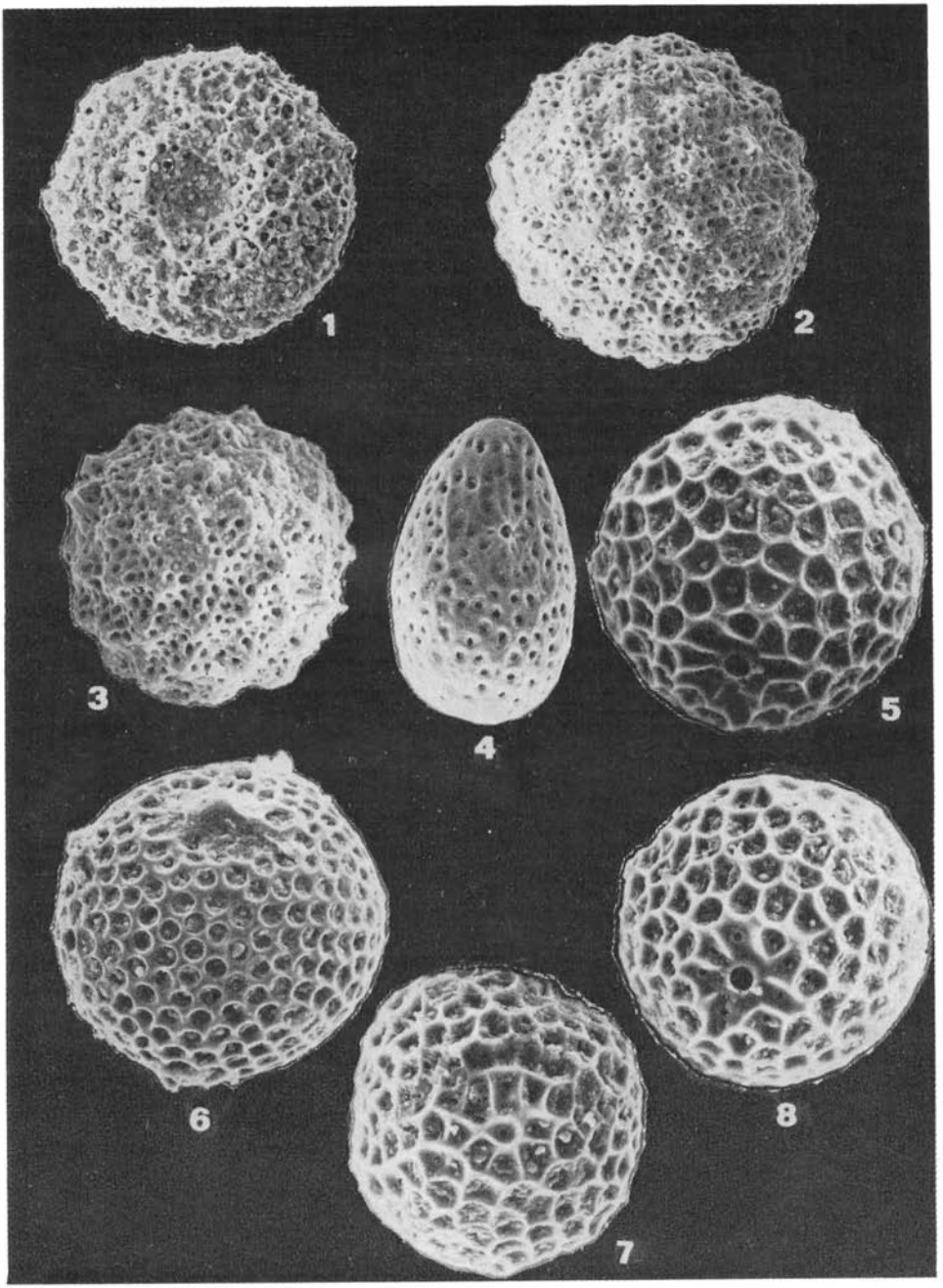


Plate II

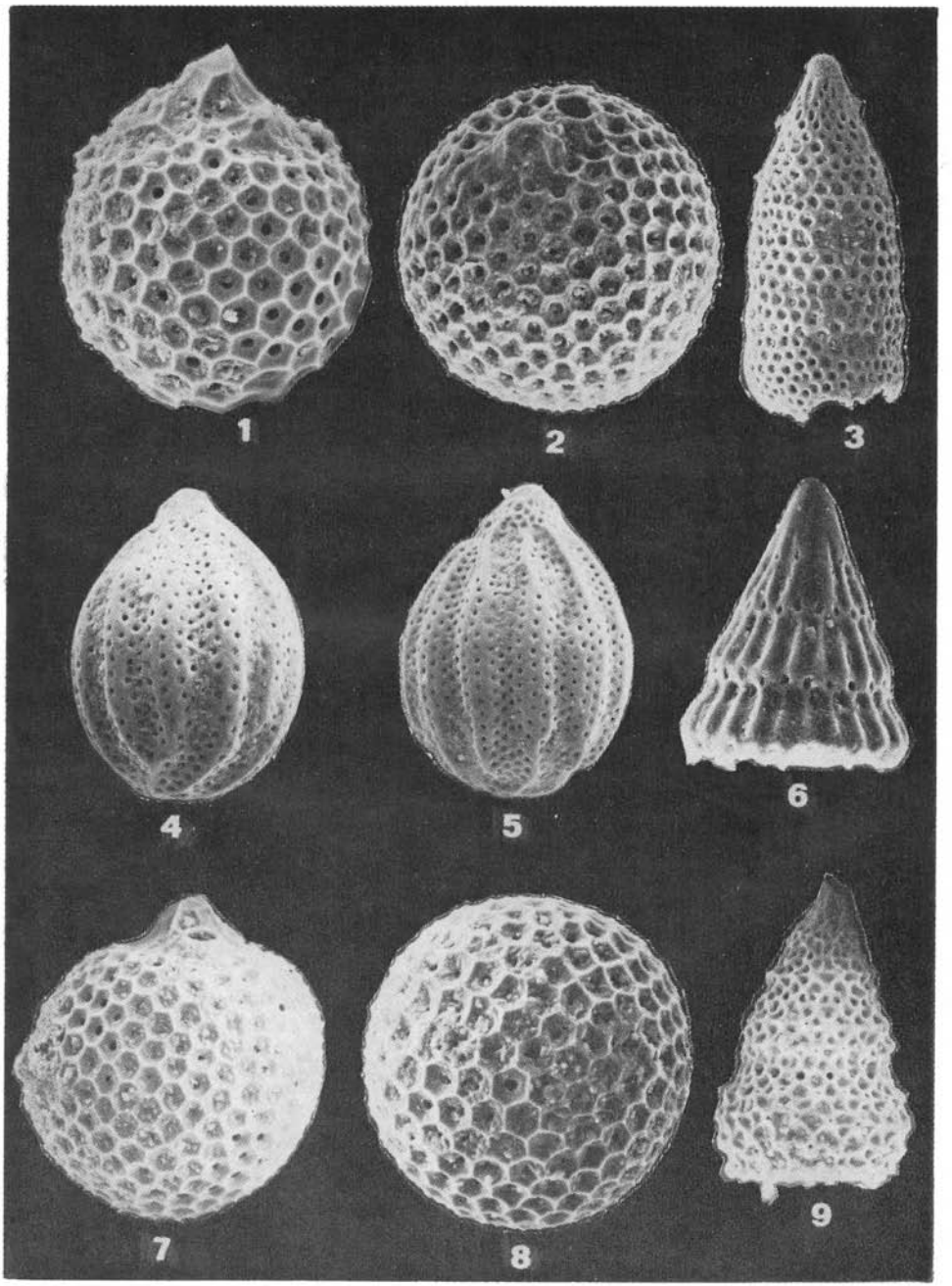


Plate III

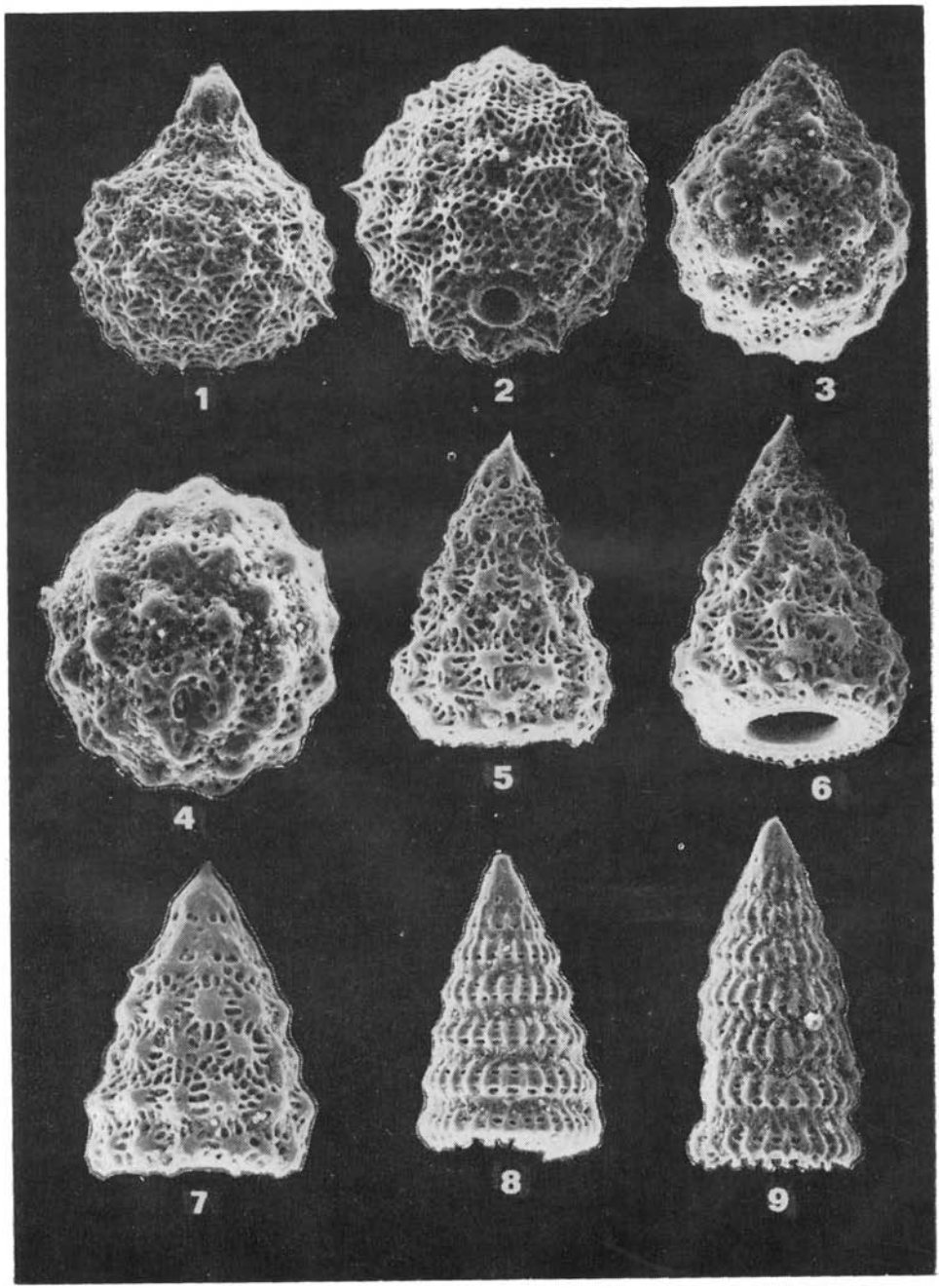


Plate IV

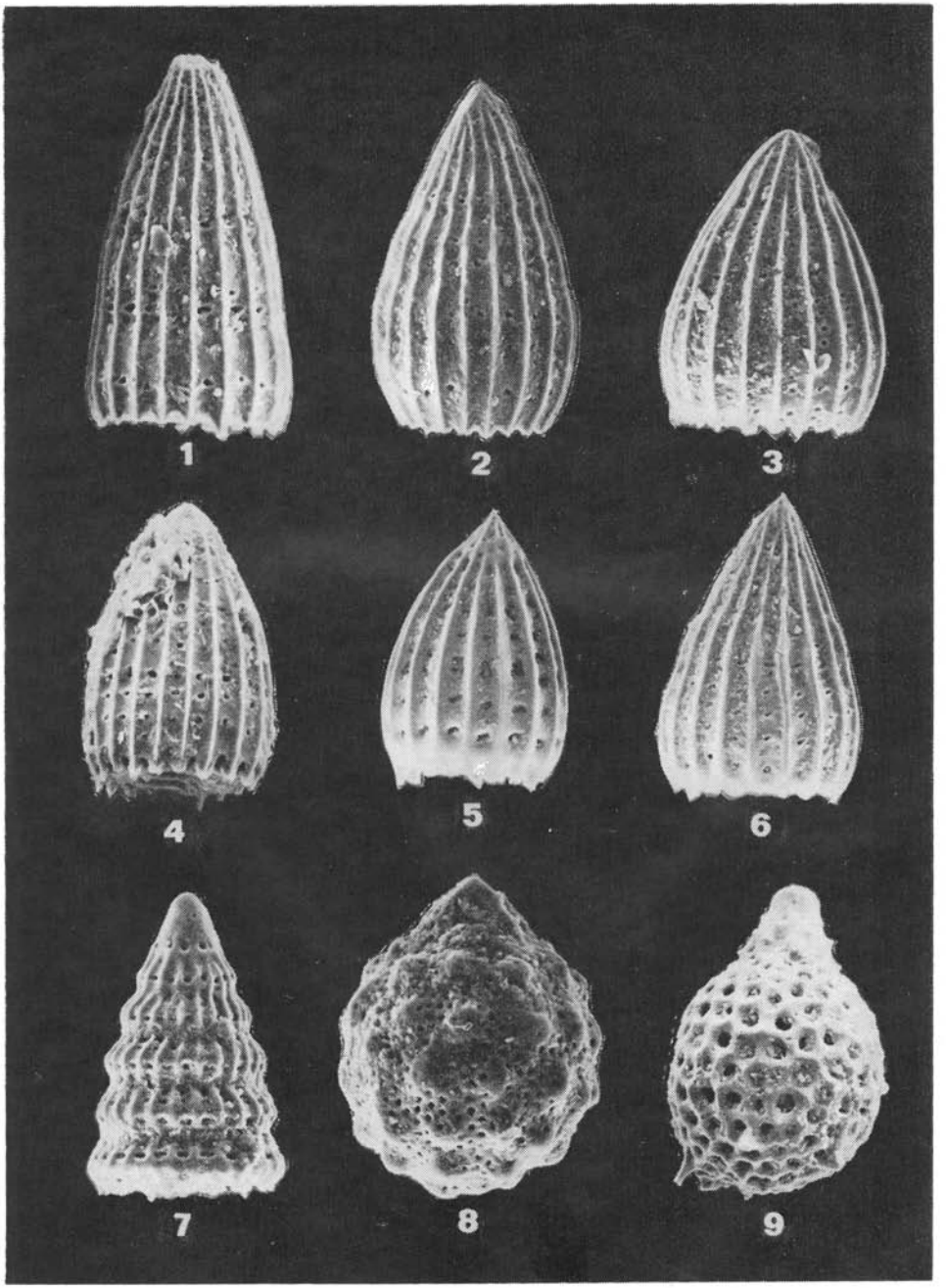


Plate V

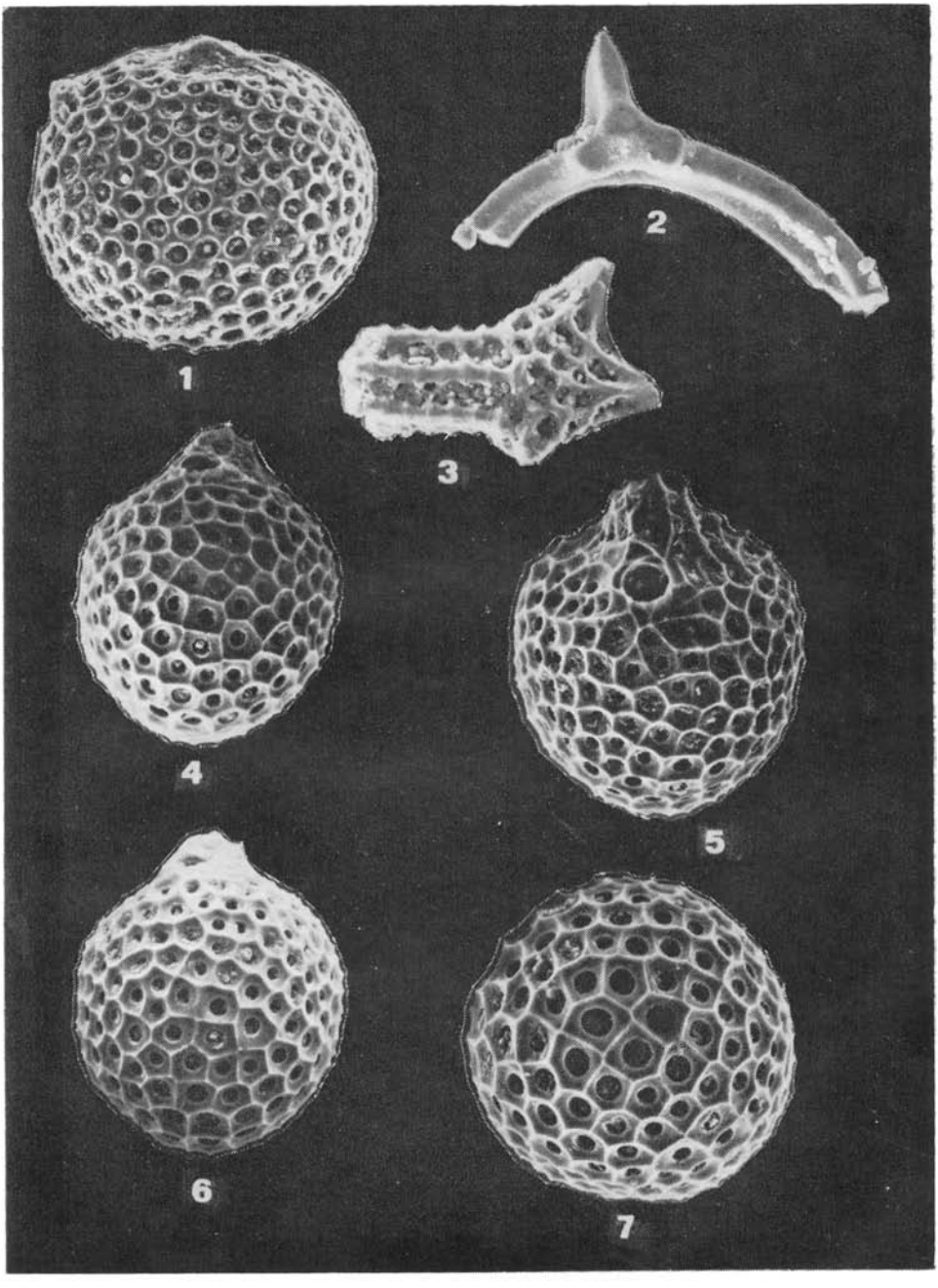
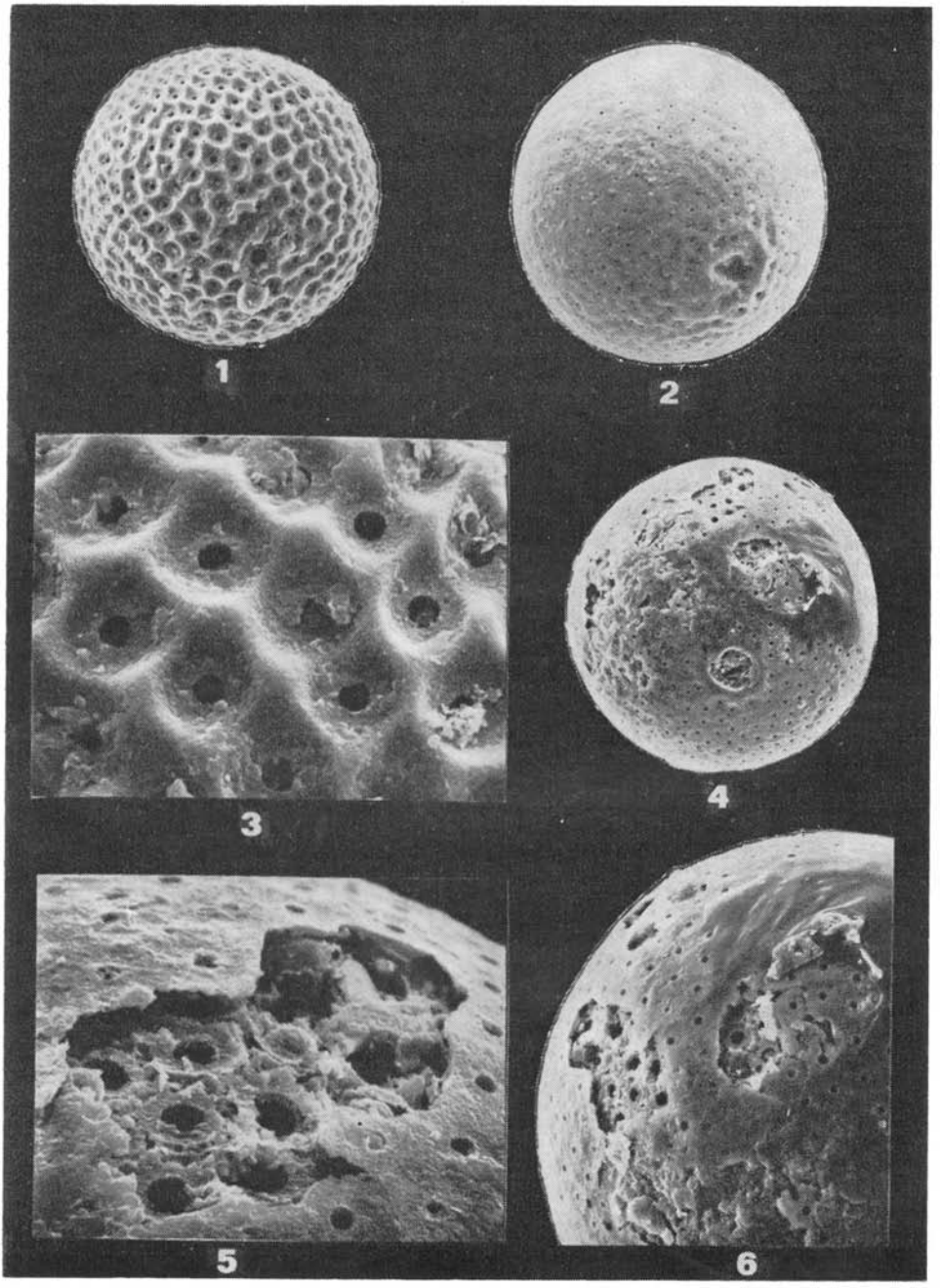


Plate VI



REFERENCES

ALIEV, K. S., 1961: Noviye vidy radiolyariy nizhnego mela Severo-Vostochnogo Azerbaydzhana. *Izvest. Akad. Nauk. Azerb. SSR, Ser. geol-geograf. nauk i nefti* (Baku), 2, pp. 28—41

ALIEV, K. S., 1965: Radiolyarii nizhnemelovykh otlozheniy Severo-Vostochnogo Azerbaydzhana i ikh stratigraficheskoye znacheniye. *Izvest. Akad. Nauk Azerb. SSR* (Baku), 3, pp. 3—125.

BIELY, A. et al., 1973: Geologické vyhodnotenie podložia viedenskej panvy. Čiastková záv. správa za rok 1973. *GÚDŠ*, Bratislava.

CAMPBELL, A. — CLARK, B., 1944: Radiolaria from Upper Cretaceous of Middle California. *Geol. Soc. Amer., Spec. Pap.* (Berkeley), 57, pp. 1—61.

DONOFRIO, D. A. — MOSTLER, H., 1978: Zur Verbreitung der Saturnalidae (Radiolaria) im Mesozoikum der Nördlichen Kalkalpen und Südalpen. *Geol.-paläont. Mitt. Innsbruck* (Innsbruck), 7, pp. 1—55.

DUMITRICA, P.: 1970: Cryptocephalic and cryptothoracic Nassellaria in some Mesozoic deposits of Romania. *Rev. roum. Géol., Géophys., Géogr., Sér. Géol.* (Bucharest), 14, 1, pp. 45—124.

DUMITRICA, P., 1972: Cretaceous and Quaternary radiolaria in deep sea sediments from the north east Atlantic ocean. *Initial Rep. DSDP* (Washington), 13, 2, pp. 829—901.

EMPSON-MORIN, K., 1982: Reexamination of the Late Cretaceous radiolarian genus Amphipyndax Foreman. J. Paleont. (New York), 56, 2, pp. 507—519.

FOREMAN, H. P., 1968: Upper Maastrichtian radiolaria of California. *Paleont. Assoc., Spec. Pap.* (London), 3, pp. 1—82.

FOREMAN, H. P., 1973: Radiolaria from DSDP Leg 20. *Init. Rep. DSDP* (Washington), 20, pp. 249—305.

FOREMAN, H. P., 1973: Radiolaria from the North Pacific Deep Sea Drilling Project, Leg 32. *Init. Rep. DSDP* (Washington), 32, pp. 579—676.

HAŠKO, J., 1974: Geológia a tektonika západnej časti varínskeho úseku bradlového pásma. Thesis, Fac. of Natur. Sci., Comenius Univ., Bratislava.

KUMMEL, B. — RAUP, D., 1965: Handbook of Paleontological Techniques. San Francisco, London, pp. 1—835.

NAKASEKO, K. — NISHIMURA, A. — SUGANO, K., 1979: Cretaceous radiolaria in the Shimanto Belt, Japan. *News of Osaka Micropaleont.* (Osaka), Spec. 2, pp. 1—49.

NAKASEKO, K. — NISHIMURA, A., 1981: Upper Jurassic and Cretaceous radiolaria from Shimanto Group in Southwest Japan. *Sci. Rep., Col. Gen. Educ. Osaka Univ.* (Osaka), 30, 2, pp. 133—203.

OKADO, H. — HATAKENAKA, K. — NAKASEKO, K., 1982: Age of the Sorachi Group in its type area in Hokkaido. Proc. of the First Japan Radiolarian Symposium. *News of Osaka Macropaleont.* (Osaka), Spec. 5, pp. 353—357.

OŽVOLDOVÁ, L., 1979: Radiolarians from Rudina beds of the Kysuca series in the Klippen Belt from locality Brodno. *Annot. zool. et botan.* (Bratislava), 128, pp. 1—15.

PESSAGNO, E. A., 1971: Jurassic and Cretaceous Hagiastridae from the Blake — Bahama Basin (Site 5A, JOIDES Leg I) and the Great Valley Sequence, California. *Bull. Amer. Paleont.* (New York), 60, 264, pp. 5—83.

PESSAGNO, E. A., 1976: Radiolarian zonation and stratigraphy of the Upper Cretaceous portion of the Great Valley Sequence, California Coast Ranges. *Micropaleontology* (New York), Spec. Publ., 2, pp. 1—95.

PESSAGNO, E. A., 1977: Lower Cretaceous radiolarian biostratigraphy of the Great Valley Sequence and Franciscan Complex, California Coast Ranges. *Cushman Found. foram. Res. spec. Publ.* (New York), 15, pp. 5—87.

RÜST, D., 1898: Neue Beiträge zur Kenntniss der fossilen Radiolarien aus Gesteinen des Jura und der Kreide. *Palaeontographica, Abt. A; B* (Stuttgart), 45, pp. 1—67.

SANFILIPPO, A. — RIEDEL, W., 1985: Cretaceous radiolaria. In: H. M. Bolli: Plankton stratigraphy, Washington, pp. 573—630.

SCHAAF, A., 1981: Late Early Cretaceous radiolaria from Deep Sea Drilling Project, Leg 62. *Init. Rep. DSDP* (Washington), 62, pp. 419—470.
SCHAAF, A., 1984: Les Radiolaires du Crétacé inférieur et moyen: Biologie et systematique. *Sci. Géol. Mem.* (Strasbourg), 75, pp. 1—189.
SCHAAF, A., 1985: Radiolaries crétacés: Biochronologie et Paléoenvironement. *Sci. Geol. Bull.* (Strasbourg), 38, 3, pp. 191—271.
SQUINABOL, S., 1914: Contributo alla conoscenza dei Radiolarii fossilli del Veneto. Appendice-Di un genere di Radiolari caratteristico del Secondario. *Mem. Inst. Geol. R. Univ. Padova* (Padova), 2, pp. 249—306.
TAN SIN HOK, 1927: Over de samenstelling en het onstaan van krijten Mergelgesteenten de Molukken. *Jaarb. Mijnw. Ned.-Vost.-Indie,* Jahr. 1926, Verhandl. 3, pp. 5—165.

Manuscript received June 22, 1988.