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Ondrej Samuel

Agglutinated foraminifers from Paleogene flysch formations in West Carpathians of Slovakia

3 text-fig., 32 plates (I-XXXII), Slovak summary

Abstract. 87 species of agglutinated foraminifers are described. Besides by classical methods, they also were partially examined under SEM. The author mostly deals with agglutinated foraminifers from Eeast Slovakian Paleogene flysch formations, from the periklippen (Považie — Hanušovce) and the Inner-Carpathian Paleogene.

Introduction

One of significant stages in geotectonic history of the West Carpathians is represented by the Cretaceous and Paleogene. From the lithofacial view these formations (except Lower Cretaceous) are mostly composed of flysch sediments. Only in the Klippen Belt these are — besides flysch — more extensive nearly lithofacies, and at the base of the Central — Carpathian Paleogene a coarse — detrital basal transgressive lithofacies. Stratigraphical research based on calcareous foraminifers (associated with the marly facies and with some flysch sequences) is fairly successful as proved by the fact that some stages can be divided into more zones, particularly on the basis of planktonic foraminifers. This is, however not the case with agglutinated foraminifers mostly associated with the outer and inner flysch sedimentation zones.

In stratigraphical research of the flysch it is necessary to consider the genetical aspect. The nature of the flysch (great thickness, rhytmicity, frequent submarine slump bodies — olistostromes a. o.) indicates that the flysch deposited in orogenetically highly active geosynclines.

Extensive dynamics of movements (primary — tectonic movements, and secondary — turbidite novements) had evidently unfavourable influence upon ecologic conditions of the sedimentation environment, and in connection with that also upon the development of organisms and upon postmortal composition of thanatocenoses. It is one of the main causes of frequent differences in biotopes of one lithotype. As regards synchronous biotopes, they are

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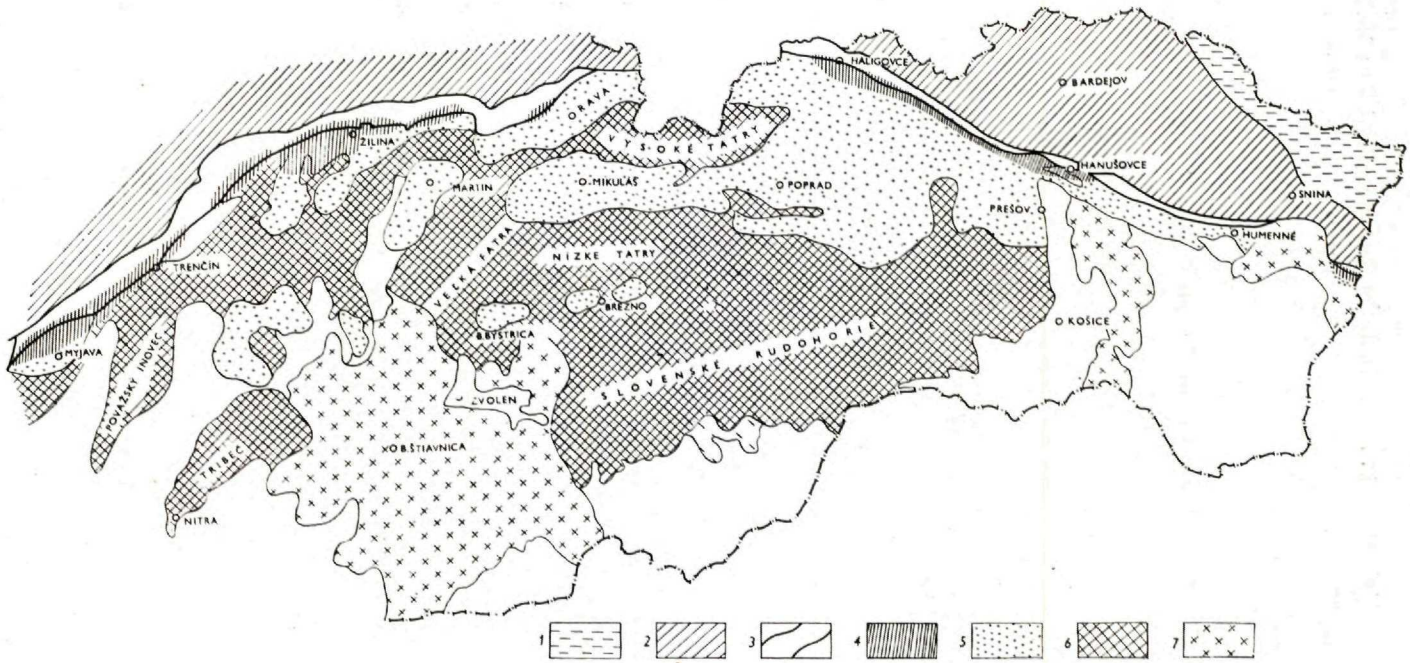


Fig. 1 Schematic geological-tectonic division of the Slovakian part of the West Carpathians (according to O. Samuel — K. Borza — E. Köhler 1972). Explanations: 1 — Dukla unit; 2 — Magura unit; 3 — Klippen Belt; 4 — Inner „Periklippen" Paleogene (= Považie — Hanušovce zone); 5 — Inner Carpathian Paleogene; 6 — Paleozoic and Mesozoic of Inner West Carpathian units; 7 — Neovulcanics.

negligible from the view of stratigraphy. Besides such cases, the flysch also contains associations with autochthonous (and/or „primary allochtonous" — pelagic forms) species as well as older redeposited forms. Interestingly, the agglutinated foraminifers mostly do not show traces of redeposition. For this reason the stratigraphical significance of agglutinated foraminifers in the Carpathian Flysch has not been known for quite a long time.

To avoid erroneous stratigraphical conclusions due to the factors mentioned, it is necessary to analyze more samples. Sampling is another important factor in successful stratigraphical research of the Carpathian Flysch and of flysch generally. The results of detailed study of distribution of fossil microorganisms show that comparatively rich associations are in pelitic (sometimes only some mm in thickness) material deposited — according to the turbidite hypothesis on the origin of flysch — in a calm environment and was more favourable for development and preservation of organisms.

Lithological-facial and stratigraphical characteristics of flysch formations studied

The autor studied only agglutinated foraminifers from the East—Slovakian flysch zone, from the periklippen Považie — Hanušovce zone and from the Inner-Carpathian Paleogene. Almost all tectonic units in these areas consist mostly of flysch formations of the Paleogene age. This is why here only agglutinated foraminifers from Paleogene lithofacial units are described. Cretaceous agglutinated foraminifers, particularly those from flysch formations of the Klippen Belt, are a subject of detailed study at present.

East-Slovakian Flysch Zone

The East-Slovakian Flysch zone consists of the Dukla unit and of the Magura tectonic Unit.

The Dukla tectonic unit

The Lupkov beds are the oldest member of the Dukla unit. Generally they may be characterized as claystone-sandstone flysch with predominant dark, rather hard, shale-disintegrating sandstones. The ratio of claystones and sandstones is 6 — 9: 1 in some places. The sandstones increase in amount toward the overlier. Based on the results of microstratigraphical research by the author, the age of the Lupkov beds was determined as Turonian — Lower Senonian with possible extension into the Upper Senonian (cf. B. Leško — O. Samuel, 1968, p. 34). These results are practically in accordance with the research of Polish (cf. F. Bieda — S. Geroch et al. 1963) and Ukrainian authors (cf. S. S. Kruglov et V. V. Gluško 1971; V. V. Danyš,

1973, a. o.) in the same unit extending on their territories (Poland, Transcarpathian Ukraine). Stratigraphical range of the Lupkov beds was precised by V. Gašpariková — T. Koráb (1977) to the Cenomanian — Lower Paleocene.

The Lupkov beds are generally poor in fossil organic remains. Macrofauna found in our country (J. Nemčok 1960) and in the adjacent Transcarpathian region (S. S. Kruglov et V. V. Gluško, 1971) comprises inocerams and pollen and spores among sporomorphs (cf. T. Koráb — P. Snopková 1972); nannoplankton (V. Gašpariková — T. Koráb 1977). Pelagic foraminifers are very scarce in the sequence. Comparatively most frequent are agglutinated foraminifers. These were studied in our contry by E. Hanzlíková (in Buday et al. 1967), V. Gašpariková (in V. Gašpariková — T. Koráb 1977), and by the author (in B. Leško et al. 1964; B. Leško — O. Samuel 1968). Detailed microfaunistic descriptions are given by B. Leško — O. Samuel (1968).

The Cisna beds represent thick sandstone flysch diminishing towards W and SW to be replaced by other lithofacial group (Inoceramian beds). Thick sandstone beds mostly of claystones, several cm thick.

According to the results of T. Koráb's (cf. references) latest research, the Veľký Bukovec sandstones are only a narrow local facies of the Cisna beds, distinguishable only in the anticlinal zone of Nová Sedlica. This is why the Veľký Bukovec sandstones are not regarded as an independent lithostratigraphic unit by the author mentioned. With regard to the general nature of the sequence, foraminifers are very scarce there. Among stratigraphically significant species *Hormosina ovulum* (Grzybowski), *Kalamopsis grzybowskii* (Dylążanka) have been found. Scarce planktonic microfauna from the lower part of the beds indicates the Danian age (cf. T. Koráb — J. Nemčok — O. Samuel 1966). When considering the stratigraphical range of the Cisna beds on the one hand and the opinion of V. Gašpariková — T. Koráb (1977) about the deposition of the Lupkov beds extending up to the Paleocene on the other hand, we must admit that the highest part of the Lupkov beds alternates with the lowermost part of the Cisna beds. The author's researches show that the deposition of the Cisna beds commences as early as the Uppermost Senonian and most likely does not surpass the Middle Paleocene.

A detailed list of foraminifers from these beds is given by B. Leško et O. Samuel (1968).

The Submenilite beds are a thick flysch complex consisting of grey, green and red claystones alternating with thin-bedded sandstones of diverse types (cf. T. Ďurkovič 1968, 1969). Among fossil organic remains only agglutined foraminifers and sporomorphs (P. Snopková) have been recorded from the Submenilite beds.

The Papín beds are characterized by calcareous finegrained sandstones and claystones of light-grey and grey-green colours. In the upper part of the

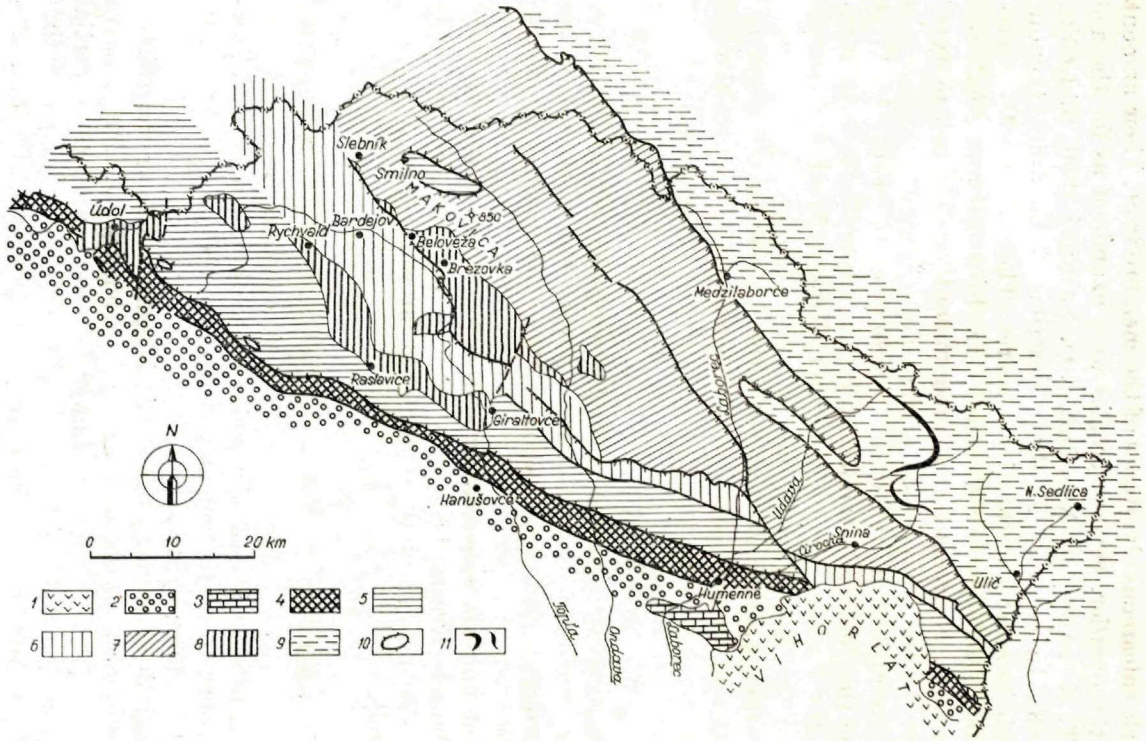


Fig. 2 Schematic geological-tectonic division of the Flysh zone in East Slovakia (according to O. Samuel et J. Salaj 1968). Explanation: 1 — Neovulcanics; 2 — Inner Carpathian Paleogene; 3 — Mesozoic of the Humenské pohorie Mts.; 4 — Klippen Belt; 5 — Kochanovce (= Čerhov = Krinica) unit; 6 — Bystrica unit; 7 — Rača unit; 8 — syncline of Brezovka and Richvald — Raslavice; 9 — Dukla unit and Smilno tectonic inlier; 10 — sigmoid bend of folds of the Dukla unit.

Papín beds are dark calcareous claystones of the menilite type. Their amount increases towards the overlier. Several profiles were examined as for the age of the claystones (T. Koráb — J. Nemčok et O. Samuel 1966, B. Leško et O. Samuel 1968). In contrast to above described beds, autochthonous agglutinated foraminifers are comparatively scarce. They are mostly represented by thin-walled *Dendrophrya* (*D. excelsa* Grzybowski) and *Rhabdammina*. More frequent are calcareous forms, predominantly of the pelagic type. The abrupt change, in the composition of the biotope reflects conspicuous paleogeographical alterations in the entire flysch geosyncline of the West Carpathians. From the biofacial standpoint it has many features in common with the Menilite Krosno group of the outer (Krosno) flysch zone on the one hand, and with the Malcov beds and the upper Zlín beds of the Inner (Magura) zone on the other hand, and with the Upper Eocene members of the periklippen and Inner-Carpathian Paleogene. The composition of planktonic foraminifers corresponds in essential to associations from the lower Globigerinous marls. Since the globigerinous marls have not been found in the Dukla Unit so far (B. Leško et O. Samuel 1968, p. 107 state that the Papín beds are equivalent to the upper hieroglyphic beds of the Polish authors and of the globigerinous marls). Basing upon the distinct biofacies alteration mentioned and upon some common lithofacial features of the Papín beds (dark calcareous clay, stones of the menilite type) with the menilite beds and upon their uniform paleocurrent system (cf. T. Koráb et al. 1962) with overjacent Menilite-Krosno beds, it is more proper to range the Papín beds to the Krosno-Menilite group (the Ombron group sensu O. S. Vialov — D. Andrusov 1963).

Magura tectonic unit

The Magura unit in eastern Slovakia is divided into three partial facial-tectonic units. From south to north they are: a) Kochanovce (= Čerhov = Krinica) unit; b) Bystrica unit; c) Rača unit.

From the lithological-facial viewpoint in the Magura flysch we may distinguish two units different in lithostratigraphy (compare D. Andrusov, 1965). The lower part (Upper Paleocene-Lower Lutetian) in all three partial unit is marked by a fine-rhythmical flysch with claystones predominating over sandstones (= Beloveža formation). In the upper part (Upper Lutetian-Priabonian) distinct refinement of facies from south to north is to be observed. Characteristic of the southern Kochanovce unit is a mighty coarse-rhythmical flysch sequence with sandstones predominating (= Strihov formation) whilst in the more northern partial Bystrica unit is the Lackov formation. In these sequences the pelitic and psammitic components alternate vertically. In the outer (northern) partial Rača unit the upper part is represented by the Zlín formation, which is mostly composed of claystones alternating with finegrained sandstones.

The youngest member (uppermost Priabonian-Lower Oligocene) of the Magura Flysch Belt is the Malcov formation. Its lithological character in the pelitic and psammitic component and equally also in the diagenesis has many features common with the Menilite-Krosno group of the Outer (Dukla) Flysch Belt. In the lower part of the Malcov formation scattered menilite shales are developed.

Beloveža beds mostly formed by fine-rhythmical flysch with claystones predominating over sandstones. The claystones are prevailingly green, bluish-grey to greyishbrown. In places also horizons of red claystones are present. The claystones are noncalcareous or slightly calcareous.

Sedimentation of the Beloveža beds started in the Upper Paleocene, the bulk deposited in the Lower Eocene. Fading out of sedimentation of this sequence coincides with the lowermost Lutetian. In general, the Beloveža beds poor in fossil organisms. So far only agglutinated foraminifers are and very rare nontypical microfloristic assemblages have been identified. In the lowermost parts of the Beloveža formation from most important forms are found: *Saccammina placenta* (Grzybowski), *Hormosina ovulum ovulum* (Grzybowski), *Rzehakina epigona* (Rzehak), *Trochamminoides irregularis* White etc. (compare B. Leško et O. Samuel 1968). According to data from literature and our investigations in the West Carpathians the majority of the species mentioned do not exceed the boundary of the Paleocene; due to this fact the lower part of the Beloveža formation may be assigned to the Upper Paleocene.

As mentioned above, the bulk of the Beloveža beds deposited in the Lower Eocene. It is characterized by an association with distinct representation of the „*Glomospira-Ammodiscus* component", in places recurvoid. The Lower Eocene associations are most commonly composed of the species *Rhabdammina discreta* Brady, *R. cylindrica* Glaessner, *Dendrophrya latissima* Grzybowski, *D. excelsa* Grzybowski, *Ammodiscus hoernessi* (Karrer), *Glomospira charoides* (Jones et Parker), *G. gordialis* (Jones et Parker), *Trochamminoides coronatus* (Brady), *Haplophragmoides walteri* (Grzybowski), *Recurvoides* div. sp., *Thalmannammina subturbinata* (Grzybowski), *Trochammina* div. sp., *Karreriella (Karrerulina) coniformis* (Grzybowski), *Plectina conversa* (Grzybowski), *P. fallax* (Grzybowski) *etc.*

The upper stratigraphic boundary is determined by associations corresponding to the lower part of the Biozone *Cyclammina amplectens.*

The Strihov beds is prevailingly composed of sandstones with layers of exotic and tilloid conglomerates. The claystones are represented subordinately only. They are mostly sandy, noncalcareous, bluishgrey. Rarely also intercalations of red claystones and locally of Lackov-type marlstones occur in them. The mostly coarse-rhythmical Strihov beds are very poor in microfauna. The red claystones yielded mostly associations typical of the biostratigraphic zone *Cyclammina amplectens* (compare B. Leško et O. Samuel 1968). On the basis of micropaleontological investigations the Strihov for-

mation mainly corresponds to the Middle Eocene. The Lower Eocene associations were obtained from medium-rhythmical beds at the boundary of the Beloveža and Strihov formations. The presence of the Eocene association is an evidence of the Strihov formation reaching the lower parts of the Priabonian.

The Lackov beds includes medium to coarse-rhythmical flysch. The psammitic component is represented by greywacke or arkose, grey, calcareous, siliceous-calcareous sandstones. The latter are alternating with grey and greenishgrey claystones (of Rača type) and intercalations of marlstones from Lackov. The sequence described is also very poor in microfauna. In contrast to the Beloveža beds, in the Lackov beds, besides agglutinated foraminifers, also calcareous benthos starts to appear and in some sandstone layers also larger foraminifers, in the pelitic component nannoplankton are found. On the basis of the investigation of foraminifers the sequence under study corresponds to the Lutetian [*Cyclammina amplectens* Grzybowski, *Turborotalia (A.) crassata densa* (Cushman)]. This agrees also with the data from microbiostratigraphic investigations of coccolitophorids (H. Bystrická in B. Leško et O. Samuel 1968, p. 68), of larger foraminifers (J. Nemčok et M. Vaňová (1977), pollen and spores (P. Snopková 1970).

The Makovica beds are formed by medium — to coarse-rhythmical flysch in the lower part of the sequence with a distinct predominance of sandstones. This sequence is very poor in microfauna. On the basis of superposition B. Leško et O. Samuel (1968) ascribed Lower Lutetian age to it whereas near Zborov (where a lateral and consequently also stratigraphic equivalent of the Zlín beds is present) it corresponds to the Lutetian to Priabonian.

Zlín beds. Typical of this sequence are grey, brownishgrey calcareous claystones alternating with layers of fine — to medium-grained, siliceous-calcareous glauconite sandstones. The bulk of the typical Zlín formation deposited in the Upper Eocene (Priabonian). Their age was determined on the basis of planktonic foraminifers as agglutinated foraminifers are almost absent in this sequence.

Variegated beds (red, green claystones) are mainly bound to the synclinal zone Richvald-Osikov and Vyšné Raslavice-Giraltovce. They are richest in microfauna from the flysch sequences. The lower layers contain associations prevailingly composed of agglutinated foraminifers. In variable amounts, however, also calcareous benthos and rarely even plankton appear. In stratigraphy these beds are equivalent to the highest part of the Biozone *Cyclammina amplectens* (Upper Lutetion) to the Lower Priabonian.

The Globigerina marls are gradually passing from the preceding variegated beds. They contain rich planktonic associations of the Lower to Middle Priabonian.

The Malcov beds are characterized by a predominance of pelites. As to the lithofacial side, it has many features common with the Menilite-Krosno

group of the Outer Flysch Belt (compare M. Książkiewicz et B. Leško 1959). In the lower part of these beds are scattered menilite shales; in the profile of Lopúchov with a layer of laminated limestones (Tylawa limestones, sensu S. Jucha 1969). From foraminifers they prevailingly contain plankton, which makes possible to determine their age as the uppermost Priabonian to Lower Oligocene.

Periklippen Paleogene

Detailed microbiostratigraphic investigations in eastern Slovakia (B. Leško et O. Samuel 1960; 1968) as well as in the middle Považie and Myjavská pahorkatina upland (J. Salaj 1962, D. Andrusov et E. Köhler 1963, O. Samuel et J. Salaj 1968; O. Samuel — K. Borza — E. Köhler 1972), have shown that Paleogene sediments developed in the strip extending linearly on the inner side od the Klippen Belt deposited in a particular sedimentation zone, which was founded after the Laramide orogenic phase, in places on the southern structures of the Klippen Belt and on that units adjacent to it. The stratigraphic range of sediments of this zone is Paleocene to Upper Eocene. Facially it is much variegated and laterally changing rapidly. Just this great facial variegatedness led the individual authors to distinguish various local lithological-facial developments (Inovce development in eastern Slovakia: Haligovce development in the Pieniny area, Hričov — Žilina development in the middle Považie and Myjava development in the Myjavská pahorkatina upland area). Sediments from the shallow littoral through the neritic to the bathyal may be distinguished there. The latter bathymetric type is represented by flysch sediments with layers of red and green marls whereas neritic and littoral coarse clastic sediments are present with bioherm limestones. For correlation of the stratigrafic value of purely agglutinate associations with calcareous benthos and plankton just the flysch sediments with layers of red and green marls are very valuable as they contain both foraminifer components. It is just this circumstance that made us possible to trace vertical distribution of agglutinated foraminifers in the West Carpathians. The detailed microbiostratigraphic analysis of associations from profiles in eastern Slovakia is mentioned in the work by B. Leško et O. Samuel (1968) whereas that from the western part of Slovakia in the works by O. Samuel and J. Salaj (1968) and O. Samuel — K. Borza — E. Köhler 1972); on their base Stratigraphical table-fig. 4 is compiled.

Inner Carpathian Paleogene

Although the Inner Carpathian Paleogene is variegated in facies, three main sequences may be distinguished essentially:

a) The basal transgressive sequence; predominantly built up of a coarse clastic nonflysch sequence. Predominating are conglomerates and breccias

of the Súľov type. In places their lateral equivalent are sandstones, locally with layers of claystones or marls. Stratigraphically they correspond to the Lutetian to Lower Priabonian.

b) Zakopane sequence present in the overlier of the basal sequence. It is formed by typical flysch with predominance of claystones. In general, it is poor in foraminifers. The agglutinated species are bound to some horizons only. Stratigraphic assignment of this sequence was foraminifers, according to which it corresponds to the Upper Lutetian to Upper Eocene.

c) The uppermost member of Inner Carpathian Paleogene is the Bielopotocke sequence. It is mostly formed by coarse rhytmical flysch with sandstones predominating. From among agglutinated foraminifers seldom the Rhabdammina and Dendrophria components are present only. According to planktonic foraminifers it corresponds to the Upper Eocene to Lower Oligocene.

Paleontological description

Genus *Nodellum* Rhumbler, 1931

Nodellum velascoense (Cushman, 1926)

Pl. IV, Fig. 8; Pl. XV, Fig. 4—5

1926 *Nodosinella velascoensis* Cushman — fide B. F. Ellis et A. R. Massine: Catalogue of Foraminifera.

1972 *Nodellum velascoensis* (Cushman) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 21, pl. 1, fig. 1—6

1972 *Nodellum velascoense* (Cushman) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 30, pl. 1, fig. 1 (cum syn.).

A large, uniserial test; mostly preserved in the form of one-to three-cameral fragments. Primary chambers are subcylindric, secondary-compressed on sides. The test wall is composed of cryptocrystalline and fine-grained quartz, the outer and inner wall-surfaces are smooth (cf. Pl. XV, Fig. 4—5 SEM).

Occurrence: In Upper-Cretaceous and Paleocene sediments of Mexico, U. S. A., the Alps, Caucasus. Most data on its occurrences come from the flysch zone of the Carpathians (ČSSR: V. Homola—E. Hanzlíková 1955, V. Pokorný 1960, B. Lešku—O. Samuel 1968, E. Hanzlíková 1972; Poland: J. Liszkova 1959, S. Geroch 1960; U. S. S. R.: N. I. Maslakova 1955; Rumania: J. Săndulescu 1972, a. o.). In the area studied the species was found in Upper—Senonian and Paleocene beds of the Dukla and the Magura units; and together with planktonic forms in the periklippen Paleogene.

Genus *Rhabdamina* Sars, 1896

Rhabdamina annulata Grzybowski, 1896

Pl. I, Fig. 9; Pl. IX, Fig. 1–4

1896 *Rhabdammina annulata* Rzehak — J. Grzybowski: Otwornice czerwonych ilów etc., p. 16 (276), pl. 8, fig. 89.
1953 *Rhabdammina annulata* Grzybowski — V. Pokorný: Mikrofauna eocénneho zeleného ílu etc., p. 6, pl. 1, fig. 4.
1955 *Rhabdammina annulata* Grzybowski — V. Homola et E. Hanzlíková: Biostratigrafické, tektonické etc., p. 377, pl. 3, fig. 4
1961 *Rhabdammina subdiscreta* Rzehak 1887 — H. Bystrická: Mikrofauna pestrých vrstiev etc., p. 130, tab. 15, fig. 3.
1969 *Psammosiphonella annulata* (Andree) 1892 — W. Grün: Flysch Microfauna etc. p. 307–308 (cum syn.).

The test is tubular, primarily-bent; subcircular to circular in section. For the species various distinct constructions, differently spaced are characteristic. The test wall consists of regular quartz grains cemented by quartzose cement.

The species differs from *Rhabdammina discreta* Brady 1881 in smaller quartz grains and thus in less coarse test-surface, in irregularly spaced and diversely distinct constrictions, and in a bent test.

Occurrence: It is the most sporadic form among representatives of the genus *Rhabdammina* Sars 1896 occuring in the Carpathian flysch zone. In the area studied it occurs in the Cisna, Beloveža, Submenilite and Proč beds. Among stratigraphically equivalent beds it was found in the Polish part of the Flysch Carpathians and in the western part of the Czechoslovak Carpathians.

Rhabdamina cylindrica Glaessner, 1937

Pl. I, Fig. 6a–c; Pl. VIII, Fig. 5–6

1937 *Rhabdammina cylindrica* Glaessner — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1955 *Rhabdammina cylindrica* Glaessner — N. I. Maslakova: Stratigrafiya i fauna myelkih foraminifer etc., p. 36–37, pl. 1, fig. 1–2.
1955 *Rhabdammina cylindrica* Glaessner — V. Homola et E. Hanzlíková- Biostratigrafické, tektonické etc., p. 377–378, pl. 3, fig. 1.
1969 *Psammosiphonella cylindrica* (Glaessner) 1937 — W. Grün: Flysch Microfauna etc., p. 307, pl. 60, fig. 1–8 (cum syn.).

The test is straight, tubular; circular in section. The test wall consists of thickly agglutinated quartz grains cemented by quartzose cement. The test surface is coarse. The inner side of the test wall is smooth. It differs from the species *Rhabdammina discreta* Brady 1881 in a coarser surface, in larger usually non-rounded quartz grains and in absence of constrictions.

Occurrence: It is not so frequent as *R. discreta* Brady. So far it has been recorded from Cretaceous and Paleogene sediments of Caucasus, Bulgaria, Rumania, Poland, ČSSR and Austria. It is sporadically present in all flysch formations studie.

Rhabdamina discreta Brady, 1881

Pl. I, Fig. 1–5; Pl. VIII, Fig. 2–3

1881 *Rhabdammina* ex gr. *discreta* Brady – fide B. F. Ellis et A. Messina: Catalogue of Foraminifera.
1950 *Rhabdammina* ex gr. *discreta* Brady – V. Pokorný: Mikrofauna eocénneho zeleného etc., p. 5 (XV), pl. 1, fig. 1–3.
1953 *Rhabdammina discreta* Brady – V. Pokorný: Mikrostratigrafická pozice heršpických štěrku – etc., pl. 1, fig. 1–2.
1960 *Rhabdammina* ex gr. *discreta* Brady – S. Geroch: Zespoły mikrofauny etc., p. 36, pl. 1, fig. 12–15, pl. 10, fig. 17.
1972 *Rhabdammina discreta* Brady – J. Săndulescu: Étude micropaléontologique et Stratigraphique etc., p. 21, pl. 1, fig. 8–10.

The test is tubular, straight; circular in section. The test wall consists of regular angular and subangular quartz grains cemented by quartzose cement. The test surface is coarse; smooth on the inner side. The species is characterized by various thickenings or constrictions. At the constrictions the test is usually broken off.

Occurrence: The species is quite common particularly in Paleogene associations of flysch beds. So far it has been described from Cretaceous and Paleogene beds of diverse flysch formations from the Alpine – Carpathian and Caucasian zonal mountain ranges.

Rhabdamina linnearis Grzybowski (non Brady, 1884)

Pl. I, Fig. 7–8; Pl. VIII, Fig.4

1896 *Rhabdammina linnearis* Brady – J. Grzybowski: Otwornice czerwonych ilów etc., p. 15–16 (275–276), pl. 8, fig. 7.
1961 *Rhabdammina abyssorum* Sars 1869 – H. Bystrická: Mikrofauna pestrých vrstiev etc. p. 130, tab. 15, fig. 2.
1972 *Rhabdammina linearis* Brady – J. Săndulescu: Étude micropaléontologique et stratigraphique etc. p. 21–22, pl. 1, fig. 7.

Forms ranged among *R. linnearis* have straight non-deformed tubular test; circular in section; without constrictions or thickenings. Size and morphological deformation of quartzose grains is similar like in *R. discreta* Brady, 1881. Diameter of tubes is smaller than in *R. discreta*; they are, however, longer. Form, description and depiction of our specimens are in accordance with those presented by J. Grzybowski (1896) as *R. linearis* Brady, 1884.

Occurrence: The species is known from analogous stratigraphical and geographical positions as *R. discreta* Brady, only in agglutinated associations is less frequent.

Genus *Rhizammina* Brady, 1879

Rhizammina cf. *indivisa* Brady, 1884

Pl. I, Fig. 10–11; Pl. VIII, Fig. 1

1884 *Rhizammina indivisa* Brady – fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1955 *Rhizammina indivisa* Brady – V. Homola et E. Hanzlíková: Biostratigrafické, tektonické etc., p. 378.

The test is tubular; circular in sections, and variably bent. The test wall is thin, composed of tiny subangular grains cemented by quartzose cement. The test surface examined under optical microscope is almost smooth; the internal wall is smooth.

Occurrence: The form belongs among very scarce species. It was recorded by V. Homola et E. Hanzlíková (1955) from the Lower Eocene. The author found it in Upper Senonian to Middle Eocene beds of the Dukla and Magura units.

Genus *Bathysiphon* Sars, 1872

Bathysiphon microrhaphidus nov. sp.

Pl. XI, Fig. 3–6; Pl. XII, Fig. 1–4; text-fig. 1a

Holotypus: the form in text-fig. 1a; at the depository of Dionýz Štúr Institute of Geology, Bratislava (ČSSR).

Locus typicus: Hrabkov (East Slovakia, ČSSR).

Stratum typicum: Upper Eocene (Priabonian)

Derivatio nominis: according to the material composition of the test (micro-rhaphids).

Material: more than 100 specimens from the Inner-Carpathian Paleogene between the mountain ranges Branisko and Čierna Hora.

Diagnosis: The test is elongated, tubular, compressed on sides. The test wall consists of tiny quartzose sponge spicules and of quartz grains, less of calcite grains. Its surface is coarse, the inner wall is smooth.

Description: The test is elongated tubular. It seems compressed on sides. The test margins are suboval, projecting above the middle — longitudinal part of the test. In the central part is a shallow groove formed of both sides of the flattened test. The test wall consists of very fine, microscopical tightly aligned sponge spicules oriented along the horizontal axis of the test. The share of sponge spicules in the structure of the test is variable from several selective fragments, to such an amount as to become the main component of the test structure. Proportionally to the increasing amount of sponge spicules, the angular and subangular quartzose (scarcely also carbonate) grains decrease in amount. Cement is quartzose. In forms with predo-

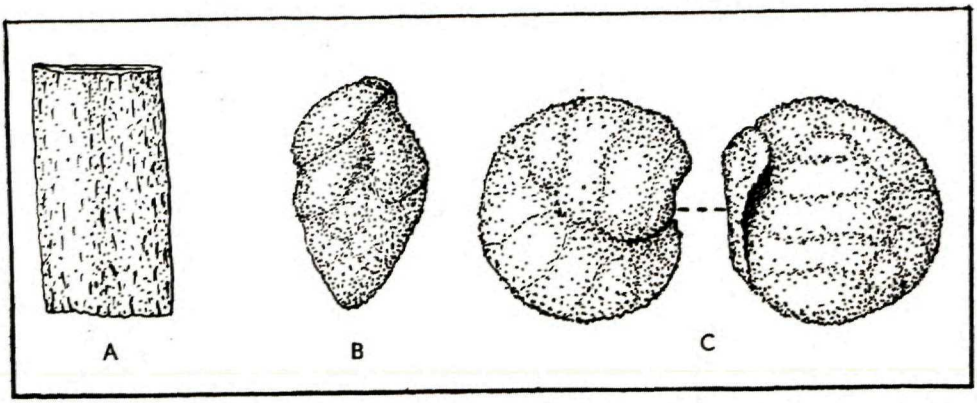


Fig. 3 A — *Bathysiphon microrhaphidus* nov. sp. Upper Eocene; Flysh Beds — Inner Carpathian Paleogene (Hrabkov); Magn. 70. x — Holotype. B — *Uvigerinammina jankoi* Majzon, 1943 emend. Geroch 1960. Lower to Middle Paleocene; Red clays — Paleogene of the Klippen belt (Lednické Rovné); Magn. 70 x. C — *Recurvoides imperfectus* Hanzlíková 1966; Lower to Middle Paleocene; Red clays — Paleogene of the Klippen belt; Magn. 70 x. (Fig. B—C are reillustrated according O. Samuel et J. Salaj 1968).

minant share of sponge spicules the test surface is „grooved" in horizontal sense. In the vertical section of the test are traces after inner channels of sponge spicules (Pl. XI, Fig. 5). Thus the wall acquires a spongy („perforated") character.

Dimensions: lenght 0,2—2 mm; width 0,28—0,40 mm; thickness 0,07—0,1 mm.

The newly described species differs in its structural material consisting of sponge spicules from morphologically similar forms *Dendrophrya robusta* Grzybowski, 1897, *D. latissima* Grzybowski, 1897 occuring commonly in Cretaceous to Middle Eocene Flysch beds.

Occurrence: In the Slovak part of the West Carpathians the species was recorded in Upper Eocene beds of the Inner Carpathian Paleogene. At the type locality, in an association of the species described, these forms have been found: *Globigerina officinalis* Subbotina, *G. danvillensis* Howe et Wallace, *Elphidium* sp., *Cibicides lopjanicus* Mjatlyuk, *Cyclammina* sp.

Genus *Hyperammina* Brady, 1878

Hyperammina elongata, 1878

P. X, Fig. 1—2

1878 *Hyperammina elongata* Brady — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1950 *Hyperammina elongata* Brady, 1878 — V. Pokorný: Mikrofauna eocénneho zeleného jílu etc., p. 9 (XV), pl. 1, fig. 5 (cum syn).

The test consists of an oval proloculum usually flattened by pressure, and of a straight cylindrical tube. The test wall is finely agglutinated; with abundant quartzose cement. The surface is slightly coarse.

Occurrence: In the Carpathian flysch zone. It belongs among very scarce species. V. Pokorný (1950) described the species from the Eocene. In the area studied it was found in Paleocene sediments of the Klippen Belt Paleogene.

Hyperammina karpatica Maslakova, 1955

Pl. I, Fig. 15 a–b

1955 *Hyperammina karpatica* sp. n. — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p, 38, pl. 1, fig. 5–6.

The proximal part of the test forms a subspherical proloculum passing into a thickwalled tube. The tube is circular to subcircular in section. The wall is coarsely agglutinated. It consists of quartzose angular to subangular grains cemented by quartzose cement.

It differs from *Hyperammina elongata* Brady, 1878 in subspherical prolocum, in a larger test, a thicker wall and in coarser agglutination.

Occurrence: The species *H. karpatica* was described from Paleocene and Eocene sediments of the Ukrainian Carpathians. In Slovakia it is associated with coarse-rhythmical flysch (the Proč and the Strihov beds) of Paleocene to Lower Eocene age.

Hyperamina nodata Grzybowski, 1896

Pl. II, Fig. 1a–b, 2

1896 *Hyperammina nodata* n. sp. — J. Grzybowski: Otwornice czerwonych ilów etc., p. 15 (275), pl. 9, fig. 16.
1896 *Hyperammina vagans* Brady — J. Grzybowski: Otwornice czerwonych ilów etc., p. 15 (275), pl. 8, fig. 18.
1950 *Hyperammina nodata* Grzybowski — V. Pokorný: Mikrofauna eocénneho zeleného jílu etc., p. 7 (XV), pl. 1, fig. 6–8.
1961 *Hyperammina nodata* Grzybowski 1896 — H. Bystrická: Mikrofauna pestrých vrstiev etc., p. 131, tab. 15, fig. 4–5.

The test is tubular, usually flattened and secondary-deformed. The test wall is thin; smooth on the inner and outer sides when examined under optical microscope. The test wall is composed of tiny quartzose grains. Cement is quartzose.

Occurrence: The species is known from the entire flysch zone of the Carpathians (Poland, U.S.S.R., Rumania, C.S.S.R.). In the area studied it occurs in Paleocene and Eocene sediments in all tectonic units.

Hyperammina rara nov. sp.

Pl. IX, Fig. 5–6

Holotypus: the form in Plate IX, fig. 1–2; in the depository of Dionýz Štúr Institute of Geology, Bratislava (CSSR).

Locus typicus: Stakčín (East Slovakia), Czechoslovakia.

Stratum typicum: Lower Eocene (Cuisian)

Derivatio nominis: rara — Lat. very scarce, rare,

Material: 13 specimens from various beds of the Dukla and the Magura units.

Diagnosis: The test is composed of a flattened proloculum passing into a narrow tubular test. The test wall is fine agglutinated, thin; smooth under optical microscope.

Description: The proximal part of the test consists usually of a flattened proloculum. The margin of the proloculum is suboval, the periphery is subcircular. The central part of the flattened sides of the proloculum is depressed. The proloculum passes into the narrow tubular part whose profile is circular to subcircular in section. The tubular part of the test is not too long. Most frequently it is broken off. The wall is thin and brittle, consisting of very tiny, mostly angular quartzose grains cemented with quartzose cement. The surface is smooth when examined under optical microscope. Under scanning electron microscope it is somewhat coarser. The aperture is at the end of the tubular part.

Occurrence: It is a very sporadical species. So far it has been known from Paleocene and Lower Eocene sediments (the Submenilite and Beloveža beds) of the Dukla and Magura units.

Hyperammina subnodosiformis Grzybowski, 1897

Pl. I, Fig. 16–17

1897 *Hyperammina suhnodosiformis* n. sp. — J. Grzyowski: Otwornice pokladow naftonósnych etc., p. 18 (274), pl. 10, fig. 5–6.

1960 *Hyperammina subnodosiformis* Grzybowski — S. Geroch: Zespoly mikrofauny etc., 38–39, pl. 1, fig. 21.

1972 *Hyperammina subnodosiformis* Grzybowski — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 22–23, fig. 1–5.

The test is tubular; markedly narrowed in its distal side so that it gets character of a neck. The test is most frequently flattened, especially in the central part. In irregular intervals are constrictions of variable intensity. At the constrictions the test is usually broken off. The wall is finely agglutinated, smooth on its surface.

Occurrence: The species was recorded from the Cretaceous and Paleogene of the Polish (S. Geroch, 1960), Rumanian (J. Săndulescu, 1972) and Czechoslovak Carpathians. It is a very scarce species.

Genus *Dendrophrya T. S.* Wright, 1861

Dendrophrya excelsa Grzybowski, 1897

Pl. II, Fig. 3–8; Pl. X, Fig. 4

1897 *Dendrophrya excelsa* n. sp. — J. Grzybowski: Otwornice predpokladów naftonósnych etc., p. 16 (272), pl. 10, fig. 1–4.
1972 *Dendrophrya excelsa* Grzybowski, 1897 — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 32, pl. 2, fig. 6
1972 *Dendrophrya excelsa* Grzybowski — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 22 , pl. 1, fig. 13 (cum syn).

The test is tubular; most frequently flattened. Fragments are mostly straight, dichotomically branched. They are very scarce. The test wall is thick, consisting of quartzous grains of diverse fraction; the cement is quartzose; the surface coarse.

Non-branched fragments may be confused with the species *D. robusta* Grzybowski, 1897. It differs from the latter in less thick test wall.

Occurrence: It is known from the Middle Cretaceous to the Middle Eocene throughout the flysch zone of the Carpathians. In the Slovak part of the Carpathians it is present in all Upper Cretaceous to Eocene flysch sediments.

Dendrophrya latissima Grzybowski, 1897

Pl. II, Fig. 10a–b; Pl. X, Fig. 5

1897 *Dendrophrya latissima* n. sp. — J. Grzybowski: Otwornice pokladów naftonósnych otc., p. 17 (273), pl. 10, fig. 8.
1972 *Dendrophrya latissima* Grzybowski — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 22, pl. 1, fig. 14 (cum syn.).

The test is tubular, flattened. Its wall is thin, fine agglutinated; cement is quartzose; surface somewhat coarser.

The species differs from *D. robusta* Grzybowski, 1897 and *D. excelsa* Grzybowski, 1897 in a thinner wall and smaller size. Our specimens are conformable with the description and depiction of the holotype.

Occurrence: The holotype described is from the flysch of the Polish Carpathians. It is known from the Upper Cretaceous up to the Eocene. In Slovakia it was found in all flysch sequences of the units studied (the Dukla, Magura units, the Klippen Belt, the Inner-Carpathian Paleogene).

Dendrophrya robusta Grzybowski, 1897

Pl. II, Fig. 9a–b; Pl. XI, Fig. 1–2

1897 *Dendrophrya robusta* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 17 (273), pl. X, fig. 7.
1955 *Rhabdammina robusta* (Grzybowski) — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 37–38, pl. 1, fig. 3–4.

1960 *Dendrophrya robusta* Grzybowski — S. Geroch: Zespoly mikrofauny etc., p. 40, pl. 1, fig. 20; pl. 10, fig. 14.
1972 Dendrophrya robusta Grzybowski — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 22, pl. 1, fig. 11—12 (cum syn.).

D. robusta belongs among the most frequent species of the genus *Dendrophrya* Wright, 1861. Our species are conformable with descriptions and depictions by J. Grzybowski (1897). Fragments of the species have thick walls, most frequently flattened. The wall is not always composed of constant fraction of quartzose grains. Their size is controlled by the character of sediments. Forms occuring in more sandy layers have walls composed of coarser grains. Thus also their surface gets coarser.

Occurrence: The species is known from the Middle Cretaceous up to the Middle Eocene from the entire area of the flysch zones in the Carpathians and the Alps (N. I. Maslakova, 1955; S. Geroch 1960; J. Săndulescu 1972, W. Grün et all. 1964 a. o.). It occurs in analogous stratigraphic position in the area studied.

Genus *Psammosphaera* Schulze, 1875

Psammosphaera laevigata White, 1928

Pl. II., Fig. 11

1928a *Psammosphaera laevigata* White-fide B. F. Ellis et A. R. Messina: Some index Foraminifera etc., p. 183, pl. 27, fig. 1.
?1970 *Saccammina scabrosa* sp. n. — E. V. Myatlyuk: Foraminiferi flishevikh otlozheniy etc., p. 50, pl. 7, fig. 10—11, pl. 14, fig. 3, pl. 15, fig. 1.
1972 *Psammosphaera laevigata* White — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 33, pl. 1, fig. 7—8 (cum syn.).

The test is large, unicameral, lenticular in shape; with circular periphery. The test-wall is thick, composed of coarse-grained angular guartz.

Occurrence: The holotype described is from America. According to literary data, its age diapason is Turonian-Paleocene. In flysch sequences of the Slovak part of the Carpathians, the species occurs within the Senonian — Lower Eocene. It is quantitatively most abundant in the Upper Senonian and in the Paleocene.

Genus *Saccammina* Sars, 1869

Saccammina placenta (Grzybowski, 1897)

Pl. II, Fig. 12a—b, 13a—b; Pl. XIV, Fig. 1—2; 5—6

1897 *Reophax placenta* n. sp. — J. Grzybowski: Otwornice pokladow naftonośnych etc., p. 20 (276), pl. 10, fig. 9—10.
1943 *Placentammina placenta* (Grzybowski) — L. Majzon Beiträge zur Kenntnis einiger Flysch — Schichten etc., p. 152, pl. 2, fig. 7a—c.

1953 *Saccammina placenta* (Grzybowski) — V. Pokorný: Mikrostratigrafická pozice heršpických štěrků etc., p. 8—9, (cum syn.).

1970 *Bogdanowiczella complanata* (Franke) — E. V. Myatlyuk: Foraminiferi flishevikh otlozheniy etc., p. 31—32, pl. 7, fig. 12; pl. 8, fig. 5—10, pl. 15, fig. 3—4 (partim).

1972 *Saccammina placenta* (Grzybowski, 1897) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 33, pl. 1, fig. 9 (cum syn.).

The test is large, unicameral, disc-shaped; its periphery is circular; margin suboval. The test-wall is thin, finely agglutinated; cement is quartzose. When examined under optical microscope it is smooth. The aperture has a tiny neck; it is situated either at the periphery or excentrically in the centre of the test.

Deformed forms of the species *Hormosina ovulum gigantea* S. Geroch (1960) sometimes acquire very similar or identical morphological character-like *S. placenta* (cf. Pl. IV, fig. 1, 3, 5). They differ in very finely developed neck in the proximal part of the test (pl. XIV, fig. 3).

Occurrence: The form is of very frequent species. Most data concern the Alpine — Carpathian region (cf. E. Hanzlíková, 1972) where the form occurs in the Cretaceous through Paleocene sediments. In the area studied the species was recorded from Senonian and Paleocene flysch beds in the Klippen Belt and in the Dukla and Magura units.

Genus *Crithionina* Geös, 1894

Crithionina moravica Pokorný, 1953

Pl. XIII, Fig. 5

1953 *Crithionina moravica* nov. sp. — V. Pokorný: Mikrobiostratigrafická posice heršpických štěrků etc., p. 6—7, text. — fig. 1.

Remark: The forms studied are conformable with the holotype of the species described from Eocene sediments of the Moravian Flysch zone.

Occurrence: *C. moravica* belongs among very scarce species. In the East-Slovakian flysch zone the author has only found it in the biostratigraphical zone *Cyclammina amplectens* (Middle Eocene) of the Magura Unit.

Genus *Ammodiscus* Reuss, 1861

Ammodiscus glabratus Cushman et Jarvis, 1928

Pl. XX, Fig. 4—5, 6—7

1928 *Ammodiscus glabratus* Cushman et Jarvis — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1972 *Ammodiscus glabratus* Cushman — Jarvis, 1928 — E. Hanzlíková: Carpathian Upper Creataceous Foraminiferida etc., p. 35, pl. 3, fig. 7 (cum syn.).

The test consists of 9—14 whorls. The proloculum is very small, the umbilicus is shallow. The wall is finely agglutinated, the cement is quartzose. It differs from the Paleocene forms *A. hoernessi* (Karrer) in a larger test and in a deeper umbilicus.

Occurrence: The holotype described is from the Upper Cretaceous sediments in Trinidad. E. Hanzlíková (1972) recorded it from the Upper Cretaceous — Paleocene of Moravia. In the Dukla and Magura units it is present in the same stratigraphic position.

Ammodiscus latus Grzybowski, 1897

Pl. III, Fig. 17; Pl. XXI, Fig. 1—2

1897 *Ammodiscus latus* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 26—27 (282—283), pl. 10, fig. 27—28.
1897 *Ammodiscus umbonatus* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 283, pl. 10, fig. 29—30.
1955 *Ammodiscus latus* Grzybowski — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 43—44, pl. 2, fig. 3—5.
1960 *Lituotuba lata* (Grzybowski) — S. Geroch: Zespoły mikrofauny etc., p. 48, pl. 4, fig. 8.
1970 *Ammodiscus latus* Grzybowski — E. V. Myatlyuk: Foraminiferi flishevikh otlozheniy etc., p. 69—70, pl. 13, fig. 4—5, 7—9; pl. 14, fig. 5; pl. 15, fig. 27—28.

The test is large, composed of two chambers; the initial chamber (proloculum) is large, subspherical; the next is a long, gently broadening tube, coiled into 3—4 whorls. The end of the tube declines from the last whorl. It is perpendicular to the plane of coiling. The test-wall consists of fine angular to subangular quartzose grains. Cement is quartzose.

The distal, declining part of the tube is frequently broken off (Pl. XXI, fig. 1). Such forms are morphologically similar to the species *Glomospirella biedai* nov. sp. They differ in a larger proloculum and whorls coiled in one plane.

Occurrence: The holotype described is from the Eocene of the Polish flysch Carpathians. N. I. Maslakova (1955) found it in the same position in the Ukrainian part of the Carpathians; while S. Geroch (1960) regards it as an index form of the Middle Eocene. Our results show very scarce occurrences in thanatocenoses with the Middle Eocene species *Cyclammina amplectens* Grzybowski, 1897.

Genus *Arenoturrispirillina* Tairov, 1956

Arenoturrispirillina concavata Samuel et Salaj, 1962

Pl. IV, Fig. 7

1962 *Areonoturrispirallina concavata* nov. sp. — O.Samuel et J. Salaj: Nové druhy foraminifer etc., p. 315, pl. 9, fig. 3a—c.

The test is large, composed of two chambers. The initial chamber is small, spherical; the next forms a long, slightly broadening tube with 4—4 ½ trochospiral-coiled whorls. Spiral sutures are simple and conspicuous. The test-wall is thick; rough on the surface. It is composed of approximately equal sandy grains. Cement is quartzose.

In the Central-Carpathian Paleogene in East Slovakia are forms secondarily compressed into horizontal level. Such specimens are well distinguishable from planispiral-coiled amodiscs according to the first whorl which is always declined from the plane by about 45°. It also differs in the test size and in wall thickness occupying approx. 2/3 of the tube diameter.

Our specimen resembles most the recent form *Arenoturspillina catina* (Höglund 1947) from which it differs in less whorls, in a larger test and in thickness of the second chamber. The number of whorls is the same as with *A. japonica* (Asano et Inomata 1952). Besides in stratigraphical range it also differs in being almost thrice as large and in less conical structure. From a stratigraphically similar horizon comes also *A. micra* Subbotina, differing from our specimen mostly in a smaller test, in more whorls and a more conspicuous conical structure.

Dimensions: diameter 0,9—1,3 mm, height 0,35—0,5 mm.

Occurrence: *A. concavata* belongs among scarce species. So far it has been found in Upper Eocene (Upper Priabonian) beds of the Inner-Carpathian Paleogene. At the type locality of planktonic foraminifers were found: *Globigerina officinalis* Subbotina 1953, *G. variabiliformis* Khalilov 1962, *G.* ex gr. *praebulloides* Blow 1959, *G. gnaucki* Blow et Banner 1962.*

Genus *Glomospira* Rzehak, 1888

Glomospira charoides (Jones et Parker, 1860)

Pl. IV, Fig. 6; Pl. XXIII, Fig. 5—6; Pl. XXIV, Fig. 1

1860 *Trochammina squamata* var. *charoides* Jones et Parker — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1960 *Glomospira charoides* (Jones et Parker) — S. Geroch: Zespoly mikrofauny etc., p. 45—46, pl. 4, fig. 3—4 (cum syn.).

1970 *Glomospira corona* Cushman et Jarvis — E. V. Myatlyuk: Foraminiferi flishevikh otlozhenyi etc., p. 67—68, pl. 6, fig 20; pl. 16, fig. 1a, b, v; 3a—b; 4—9 (partim).

The test is large, subspherical. It consists of a long tube, regularly coiled around the initial part of the test. The wall consists of cryptocristalline and very fine quartz grains; the surface is smooth.

* Authentical translation of the Slovak description of the holotype.

Occurrence: The species belongs among cosmopolitan species with broad age diapason (Cretaceous — Recent). In the Carpathian flysch it is known practically from all Cretaceous through Oligocene lithostratigraphic units (cf. S. Geroch 1960; E. Y. Krayeva et B. F. Zernickiy, 1969; J. Săndulescu 1972; E. Hanzlíková 1972).

Glomospira gordialis (Jones et Parker, 1860)

Pl. IV, Fig. 4, 5a—b

1860 *Trochammina squamata* var. *gordialis* Jones et Parker — fide B. F. Ellis et A. R. Messina: Catalogue odf Foraminifera.

1972 *Glomospira gordialis* (Jones et Parker) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 24, pl. 2, fig. 11—12 (cum syn.).

Differs from the species *G. charoides* (Jones et Parker 1860) in irregularly coiled last two — three whorls. The initial part of the test is coiled similarly like *G. charoides*. Also the composition of the test-wall is the same. Both species show great phylogenetic affinity; evoking a supposition about *G. gordialis* being an ancestral form of the species *G. gordialis*.

Occurrence: Stratigraphical and geographical distributions are identic with the above species. Usually they occur together in flysch formations of the Carpathians.

Glomospira glomerata (Grzybowski, 1897)

Pl. XXIII, Fig. 1—2

1897 *Ammodiscus glomeratus* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 285, pl. 11, fig. 4.

The test is coiled more-or-less in one level in the form of an S. The test wall consists of subangular quartzose grains. Its surface is rough. It differs from *G. irregularis* in S-coiled part of the test.

Occurrence: The form belongs among very scarce occurrences. The holotype was described from Paleogene sediments around Krosno. In Slovakia it was identified from the Inoceramian beds (Upper Senonian — Paleocene) and from the lower part of the Beloveža beds (Upper Paleocene — Lower Eocene).

Glomospira irregularis (Grzybowski, 1897)

Pl. IV, Fig. 3

1897 *Ammodiscus irregularis* n. sp. — J. Grzybowski: Otwornice pokladów naftonosnych etc., p. 29 (285), pl. 11, fig. 2—3.

1972 *Glomospira irregularis* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 24—25, pl. 2, fir. 13 (cum syn.).

The species is considerably variable as regards morphology. It is very irregulary coiled. Its shape is similar to that of *G. glomerata* (Grzybowski, 1897). Forms morphologically resembling the species *G. glomerata* differ in irregularly coiled initial part of the test. Scanning-electron microscope showed the same test-wall composition in both species (cf. Pl. XXIII, fig. 1—2, 3—4).

Occurrence: The species is known from the Middle Cretaceous up to the Eocene (cf. V. Pokorný, 1953, S. Geroch 1960; E. Hanzlíková 1972; M. Pflaumann 1967, E. Y. Krayeva — B. F. Zernickij 1969, J. Săndulescu 1972, a. o.). In Slovakia it is known from the Inoceramian, Cisna, Submenilite, Beloveža and Proč beds ranging from the Senonian to the Middle Eocene.

Genus *Glomospirella* Plummer, 1945

Glomospirella biedai nov. sp.

Pl. III, Fig. 16a—b; Pl. XXI, Fig. 3

1968 Glomospira grzybowskii Jurkiewicz — A. Jednorowska: Zespoly otwornicowe zewnetrznych strefach etc., p. 40—41, pl. 2, fig. 1a—b (non fig. 2).

Holotypus: The form in Plate III, Fig. 16 a-b; in the depository of Dionyz Štúr Institute of Geology, Bratislava (ČSSR).

Locus typicus: Snina (East Slovakia, ČSSR).

Stratum typicum: Lower Eocene (Cuisian).

Derivatio nominis: In honour of Prof. Bieda (Professor of paleontology at the Academy of Mining and Metallurgy in Krakow, Poland).

Material: 30 specimens from submenilite beds of the Dukla unit and various (red) beds of the Magura units.

Diagnosis: The test consists of 4 ½ whorls. The first whorl is inclined from the equatorial plane at 45°. The other whorls have ammodiscoidal coiling. The wall is composed of fine quartz grains cemented by quartzy cement. The aperture is circular at the end of the tube.

Description: The test consists of a small subspherical proloculum and from a long planispiral-coiled tube. There are 4—5 whorls, very scarcely 5 ½—6. The first whorl is diagonally declined (at 45—70°) to the equatorial plane. The composition and the surface of the test wall is identic with that of the species *G. gorayskii* Grzybowski, 1897 or *G. serpens* Grzybovski, 1897.

Based on the composition of walls, on biometrical data and on forms intermediate between *G. grzybowskii* — *G. gorayskii* and *G. serpens*, the first form is regarded as the ancestral form of the species *G. gorayskii*, and *G. serpens* as the descendant of the phylogenetic line mentioned.

Remarks: *Glomospirella biedai* nov. sp. differs from the species *Glomospira gorayskii* (Grzybowski 1897) in having a larger number of planispirally

coiled whorls with orientation of the first whorl, which is inclined to the equatorial plane at the angle 45—70°.

Occurrence: In Slovakia it is known from the Paleocene through Middle Eocene of the Submenilite and the Beloveža beds.

Glomospirella gorayskii (Grzybowski, 1897)

Pl. IV, Fig. 1a—b; Pl. XXI, Fig. 4—6; Pl. XXII, Fig. 1—3

1897 *Ammodiscus gorayskii* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 27 (283), pl. 11, fig. 5.
1950 *Glomospira gorayskii* (Grzybowski) — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 46, pl. 3, fig. 1—2.
1970 *Glomospira rostokiensis* n. sp. — E. V. Myatlyuk: Foraminiferi flishevikh otlozheniy etc., p. 68—69, pl. 11, fig. 19—21 (non 17, 18a—b — *Glomospirella serpens* Grzybowski, 1897).

The test is large, composed of a subspherical proloculum and of a long tube coiled into 3—4 whorls. The first whorl is either perpendicular (Pl. XXI, fig. 4—6) or at 45—50° angle oriented to the coiling plane of further 2—3 whorls whose plan of test structure is ammodiscoid. In some forms also the second whorl is slightly declined from the equatorial plane (Pl. XXII, fig. 1—2). The test is medium-agglutinated, cement is quartzose and the surface finely rough.

Occurrence: The first description of the species is from Paleogene beds around Krosno. From the Soviet part of the Carpathians, from the Paleocene and Eocene it was recorded by V. I. Maslakova (1955), from the Polish part — by J. Jednorowska (1968), and from the Rumanian — by J. Sandudulescu (1972). The last author recorded it from the Senonian and the Paleocene. In the Slovak part of the Carpathians it was recorded in Paleocene and Eocene beds in the Dukla and Magura units in the Klippen Belt Paleogene.

Glomospirella serpens (Grzybowski, 1897)

Pl. IV, Fig. 2, 4; Pl. XXII, Fig. 4—5

1897 *Ammodiscus serpens* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 29 (285), pl. 10, fig. 31—33.
1960 *Glomospira serpens* (Grzybowski) — S. Geroch: Zespoly mikrofauny etc., p. 47, pl. 4, fig. 13 (cum syn).

The test consists of 2—3 elliptically coiled whorls. The first whorl is inclined under variable angles to the equatorial plane. Our forms correspond to the depiction in Pl. X, fig. 31 (non fig. 32—33) by Grzybowski. In their composition, surface and tube dimensions they agree with the preceding two species.

Occurrence: S. Geroch (1960) recorded the species from the Polish Carpathians — from the Senonian and Paleogene; W. Grün (1969) found it in the same stratigraphical position in the Alps. In our country it is in the

Inoceramian beds of the Dukla unit, in the Beloveža beds of the Magura unit, and in the Proč beds of the Klippen Belt Paleogene (Upper Senonian — Middle Eocene).

Genus *Turritellella* Rhumbler, 1904

Turritellella shoneana (Siddal, 1878)

Pl. II, Fig. 14

1878 *Trochammina shoneana* Siddal — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1953 *Turritellella shoneana* (Siddal) — V. Pokorný: Mikrostratigrafická posice heršpických štěrků etc., p. 10 (XXXVIII), text, fig. 2.

The test is large, tubular, non-segmented, circular to non-circular, irregularly bent. Constrictions of variable intensity are irregularly spaced. Composition and aspect of the test-wall are the same as with *T. fallax* (Grzybowski 1897).

Occurrence: Like the above mentioned species, this one, too, is very scarce in the Carpathian flysch. V. Pokorný (1953) described it from Eocene sediments of Moravia. In Slovakia, in the area studied, it has been found in the Submenilite and the Beloveža beds.

Genus *Tolypammina* Rhumbler, 1895

Tolypammina ? fallax (Grzybowski, 1897)

Pl. II, Fig. 15

1896 *Ammodiscus fallax* Rzk. — J. Grzybowski: Otwornice czerwonych ilów etc., p. 21 (281), pl. 8, fig. 47.

The test is large, composed of a U-bent tube. On the whole tube are irregularly spaced constrictions of variable intensity. The test wall is thin, composed of quartzose grains. Cement is quartzose. The surface is finely rough.

Occurrence: The first description is from red clays around Vadovice. It is a scarce form. So far it has only been found in the upper and Submenilite beds of the Dukla unit (Paloecene — Lower Eocene).

Genus *Ammolagena* Einer et Tickert, 1899

Ammolagena clavata (Jones et Parker, 1860)

Pl. XV, Fig. 1

1860 *Trochammina irregularis* var. *clavata* Jones et Parker — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1960 *Ammolagena clavata* (Jones et Parker) — S. Geroch: Zespoły mikrofauny etc., p. 48, pl. 3, fig. 12 (cum syn)..

It is a common sessile form. It consists of an egg-shaped or cylindrical chamber passing into a long, narrow, cylindrical tube. Its surface is smooth when examined under scan-electron microscope.

Occurrence: It is a cosmopolitan species of a broad stratigraphical diapason (Cretaceous — Recent). It was recorded in the Polish (S. Geroch 1960) and Czechoslovak flysch Carpathians (E. Hanzlíková 1955).

Genus *Kalamopsis* de Follin, 1883

Kalamopsis grzybowskii (Dylążanka, 1923

Pl. I, Fig. 12—14; Pl. XV, Fig. 2, 3

1923 *Hyperammina grzybowskii* nov. sp. — M. Dylążanka: Warstwy inoceramowe etc., p. 65—66.
1960 *Hyperammina grzybowskii* Dylążanka — S. Geroch: Zespoly mikrofauny etc., p. 39, pl. 1, fig. 22—23, pl. 10, fig. 7 (cum syn.).
1972 *Kalamopsis grzybowskii* (Dylążanka) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 36, pl. 2, fig. 8.
1972 *Kalamopsis grzybowskii* (Dylążanka) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 25, pl. 2, fig. 22—24 (cum syn.).

Among the specimens studied were uni- and bicameral, mostly flattened cylindrical fragments. Our forms are conformable with those described and depicted by M. Dylążanka (1923) and S. Geroch (1960) from Poland. The holotype described comes from the Inoceramian beds near Szymbarg.

Occurrence: In the Alpine-Carpathian mountain system the species occurs in Cretaceous and Paleocene sediments. In Slovakia it is known from Senonian and Paleocene flysch sediments of the Dukla and Magura units, and from the Jarmuta (Upper Senonian) and Proč (Paleocene) beds in the Klippen Belt.

Genus *Hormosina* Brady, 1879

Hormosina excelsa (Dylążanka, 1923)

Pl. III, Fig. 12—13; Pl. XV, Fig. 6; Pl. XVI, Fig. 1—2

1923 *Hyperammina excelsa* nov. sp. — M. Dylążanka: Warstwy inceramove z lomu Szymbarku etc., p. 66, pl. 1, fig. 3.
1960 *Hormosina excelsa* (Dylążanka) — V. Pokorný: Microstratigraphie et Biofácies du Flysch., etc pl. 2, fig. 6—8.
1972 *Hormosina excelsa* (Dylążanka) — F. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc. p. 36—37, pl. 3, fig. 5.

Most frequently the test is preserved in the form of unicameral, scarcely bi- and tricameral fragments. The individual chambers are cylindrical, mutually

connected by narrow cylindrical neck. At the neck they usually break. The test-wall is thin, smooth when examined under optical microscope. It consists of very tiny grains. Cement is quartzose.

Occurrence: The holotype described comes from the Inoceramian beds in Poland (Szymbark). It is known from the Upper Cretaceous and Paleocene of the Alps (W. Grün 1969), and from the Eastern and Western Carpathians (cf. S. Bukowy et S. Geroch, 1957, V. Pokorný 1960, E. Hanzlíková 1972, J. Săndulescu 1972, a. o.). In the area studied it is known from Upper Senonian and Paleocene beds in the Dukla and Magura units, and the Paleogene of the Klippen Belt.

Hormosina ovuloides (Grzybowski, 1901)

Pl. III, Fig. 14–15; Pl. XVI, Fig. 3–4

1901 *Reophax ovuloides* nov. sp. — J. Grzybowski: Otwornice warstw inoceramowych etc., p. 268, pl. 7, fig. 3.
1972 *Hormosina ovuloides* (Grzybowski) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 37, pl. 3, fig. 3–4.

Among the specimens studied are isolated unicameral tests pear-shaped, with a thin wall and smooth surface. They differ from *H. excelsa* (Dylążanka, 1901) in more spherical chambers and a longer neck.

Occurrence: The holotype described comes from the Inoceramian beds of the Polish Carpathians (around Gorlice). In the Czechoslovak part it was recorded in the Upper Cretaceous and Paleocene (cf. E. Hanzlíková 1972). Its position is similar also in the East-Slovakian flysch (the Inoceramian, Cisna and Proč beds).

Hormosina ovulum ovulum (Grzybowski, 1896)

Pl. III, Fig. 11; Pl. XVI, Fig. 5; Pl. XVII, Fig. 1–6; Pl. XVIII, Fig. 1–4

1896 *Reophax ovulum* n. sp. — J. Grzybowski: Otwornice czerwonych ilow etc., p. 16 (276), pl. 8, fig. 8–9.
1955 *Hormosina ovulum* (Grzybowski) — V. Homola et E. Hanzlíková: Biostratigrafické, tektonické etc., p. 65 (381), pl. 1, fig. 1–3.
1955 *Hormosina ovulum* (Grzybowski) — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 41, pl. 1, fig. 9.
1960 *Hormosina ovulum* (Grzybowski) — S. Geroch: Zespoły mikrofauny etc., p. 43, pl. 2, fig. 20–22, pl. 10, fig. 8–9 (cum syn.).
1972 *Pelosina caudata* (Montanaro — Gallitelli, 1958) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 34, pl. 1, fig. 2–6 (partim).
1972 *Hormosina ovulum ovulum* (Grzybowski) — J. Săndulescu: Étude mikropaléontologique et stratigraphique etc., p. 25, pl. 2, fig. 16–17 (cum syn.).

The test is preserved only in unicameral fragments. The chambers preserved are subspherical, with two extremely thin chambers at poles. Frequent are

secondarily deformed-flattened chambers. The test-wall is thick, composed of tiny to cryptocristalline grains with quartzose cement. The outer and inner sides are smooth. On the inner side there is no pseudochitinose layer.

Occurrence: It is known from the Middle Cretaceous up to the Paleocene. Most data concern the flysch zone of the Alps and the Carpathians (cf. syn.). In the area studied it was found in the Upper Cretaceous and Paleocene sediments of the Dukla and Magura unit, and in the Klippen Belt.

Hormosina ovulum gigantea Geroch, 1960

Pl. III, Fig. 9–10; Pl. XIV, Fig. 3, 4; Pl. XVIII, Fig. 5, 6; Pl. XIX, Fig. 1–3

1960 *Hormosina ovulum* (Grzybowski) var. *gigantea* n. var. — S. Geroch: Zespoły mikrofauny etc., p. 43, pl. 2, fig. 18–19.
1972 *Hormosina ovulum gigantea* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 25, pl. 2, fig. 14–15; 18–20 (cum syn).

Differs from *H. ovulum ovulum* (Grzybovski 1896) in a larger test (0,6 až 1,1 mm).

Occurrence: The species occurs together with the former species, only it is more frequent in the Cretaceous, while *H. ovulum ovulum* (Grzybowski 1896) in the Paleocene.

Genus *Reophax* Montfort, 1808

Reophax duplex Grzybowski, 1896

Pl. III, Fig. 3

1896 *Reophax duplex* n. sp. — J. Grzybowski: Otwornice czerwonych iłów etc., p. 16–17 (276–277), pl. 8, fig. 23–24.
1972 *Reophax duplex* Grzybowski — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 26, pl. 3, fig. 4–11 (cum syn.).

The test is large; consisting of two, most frequently flattened partially embracing chambers. Chambers differ in size: the proximal chamber is by a half larger. The test wall is thick, composed of uneven quartzose cement. The surface is coarse.

Occurrence: J. Grzybowski described the species from Eocene sediments from the vicinity of Wadowice, and later on from other Polish regions. N. I. Maslakova (1955) recorded the species from the Paleogene of the East Carpathians. T. Neagu 1970 and J. Săndulescu (1972) from the Sennonian and the Paleocene of Rumania; and W. Grün et al. (1964), W. Grün (1969) from the Alps. In Slovakia it is known from the Paleocene and Eocene of the Dukla and Magura units, and from the Paleogene of the Klippen Belt.

Reophax elongatus Grzybowski, 1897

Pl. III, Fig. 8

1897 *Reophax elongata* n. sp. — J. Grzybowski: Otwornice pokladów naftonósnych etc., 23 (279), pl. 10, fig. 19—20.
1955 *Reophax elongata* Grzybowski — S. Geroch — R. Gradziński: Stratigrafya serii podślaskiej etc., pl. 6, fig. 5.
1960 *Reophax elongata* Grzybowski — S. Geroch: Zespoly mikrofauny etc., p. 42, pl. 3, fig. 8—9.

The test is uniserial, consisting of 2—3 chamber fragments. The chambers are of cylindric or subcylindric shape. Adjacent chambers differ slightly in size. The test wall is medium-grained, the cement is quartzose; the surface — rough.

Occurrence: The holotype described comes from Paleocene sediments of Poland (around Krosno). S. Geroch (1960) recorded it from Middle Eocene beds. In the area studied it is sporadically present throughout the Paleocene, Lower and Middle Eocene (Submenilite and Beloveža beds).

Reophax pilulifer Brady, 1884

Pl. III, Fig. 2

1884 *Reophax pilulifera* Brady — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera
1950 *Reophax pilulifera* Brady — V. Pokorný: Mikrofauna eocénneho zeleného jílu etc., p. 8 (XV); (cum syn.).

The test is large; composed of three spherical, rapidly enlarging chambers. The test-wall is coarse-grained, with rough surface. It differs from the species *R. trinitatensis* Cushman et Renz, 1946 in coarse-agglutinated test and in more rough test surface.

Occurrence: The species mostly occurs in the Paleogene of the Dukla and Magura units, and in the Paleogene of the Klippen Belt.

Reophax scalaria Grzybowski, 1896

Pl. III, Fig. 6a—b; Pl. XIX, Fig. 4

1896 *Reophax guttifera* Brady var. *scalaria* — J. Grzybowski: Otwornice czerwonych ilów etc., p. 17 (277), pl. 8, fig. 26.

The test is uniserial, usually deformed into disc-shaped, partially embracing chambers. A mature specimen consists of 10—13 chambers, enlarging slowly to 1/3 of the test. The chambers are mutually connected through a short neck. The wall is medium-grained, composed of quartzose grains. The cement is guartzose. The surface is rough.

Occurrence: Like the preceeding species it belongs among sporadical

forms. The first description concerns a form recorded from the Paleogene sediments of Poland (Wadowice). In our country it was found in beds analogous to that containing *R. elongatus* Grzybowski, 1897.

Reophax pseudoscalaria nov. sp.

Tab. III, Fig. 4a—b

1955 *Reophax* sp. — S. Geroch et R. Gradziński: Stratigrafia serii podslaskiej etc., p. 38—39, pl. 6, fig. 7a—c, 8a—c

Holotypus: the form in Tab. III, fig. 4a—b; at the depository of Dionýz Štúr Institute of Geology. Bratislava (ČSSR).

Locus typicus: Upper Senonian — Paleocene — Rzehakina epigona zone (Cisna beds).

Derivatio nominis: pseudo- Lat. false.

Material: about 15 specimens from the East-Slovakian flysch.

Diagnosis: A large test composed of 3 diagonally embracing chambers. Agglutinated test-wall; aperture not found.

Description: The test is large, consisting of 2—5 „placentoid", diagonally embracing chambers, with moderate growth-rate. The chambers are connected with a narrow neck. The test-wall is rough on the surface; it consists of quartzose grains variable in size. Cement is quartzose. Neither aperture, nor the initial chamber were distinguished, since the test is usually preserved only in fragments.

Size: 1—2,2 mm

Occurrence: The species described belongs among very scarce forms. So far it has been found in the Cisna beds and in the lower part of the Beloveža beds corresponding to the Carpathian zone Rzehakina epigona, correlable with the Upper Senonian through the Paleocene.

The species differs from a morphologically related species *Reophax scalaria* Grzybowski in at least triple size of the individual chambers and in less distinct differences in the size of adjacent chambers and in their stratigraphical position.

Reophax splendidus Grzybowski, 1897

Pl. III, Fig. 5a—b; Pl. XIX, Fig. 5

1897 *Reophax splendidus* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 22—23 (278—279), pl. 10, fig. 16.

1972 *Reophax splendidus* Grzybowski — J. Săndulescu: Étude mikropaléontologique et stratigraphique etc., p. 26, pl. 3, fig. 12—13 (cum syn.).

The test is large, composed of 3—5 flattened suboval chambers, with only slight differences in size. The test wall is sandy, composed of medium-grained sandy grains cemented by quartzose cement.

Occurrence: The form is described from the Polish Paleogene. As regards Europe, it is known from the Cretaceous and the Paleogene, particularly from the Flysch beds of the Alpine-Carpathian area: the Alps (W. Grün et al. 1964, W. Grün 1969;); the Carpathians (E. Hanzlíková 1953, N. I. Maslakova 1955; T. Neagu 1970; J. Săndulescu 1972 a. o.). In Slovakia it is sporadically present in the Upper Senonian through Middle-Eocene beds in the Dukla and Magura units.

Reophax subnodulosus Grzybowski, 1897

Pl. III, Fig. 7; Pl. XIX, Fig. 6

1897 *Reophax subnodulosa* n. sp. — J. Grzybowski: Otwornice pokladów naftonósnych etc., p. 23 (297), pl. 10, fig. 17—18.
1960 *Reophax subnodulosa* Grzybowski — S. Geroch: Zespoly mikrofauny etc., p. 41, pl. 3, fig. 11.

The test is mostly preserved only in fragments. It consists of 4—6 subspherical, uniserial and slowly enlarging chambers. The test wall is composed of medium-grained sandy grains cemented by quartzose cement. The surface is rough.

Occurrence: After S. Geroch (1960), in Poland it is only in the Paleogene (hieroglyphic beds). In the area studied it is in Submenilite and Beloveža beds (Paleocene — Middle Eocene).

Reophax trinitatensis Cushman et Renz, 1946

Pl. III, Fig. 1

1946 *Hormosina globulifera* var. *trinitatensis* — fide B. F. Ellis et A. R. Messina Catalogue of Foraminifera.
1960 *Reophax* cf. *trinitatensis* Cushman et Renz — S. Geroch: Zespoly mikrofauny etc., p. 42 (cum syn.).

The test is large; uniserial; composed of 3—4 spherical or subspherical, rapidly enlarging chambers. The test wall is coarse — agglutinated with rough surface.

Occurrence: the form described is from U.S.A. In Europe it occurs in the Cretaceous and Paleogene (cf. E. Hanzlíková 1972).

Genus *Rzehakina* Cushman, 1927

Rzehakina complanata (Grzybowski, 1901)

Pl. IV, Fig. 12, 14

1901 *Spiroculina complanata* n. sp. — J. Grzybowski: Otwornice warstw inoceramowych etc., p. 45 (261); pl. 7, fig. 26.

1960 *Rzehakina complanata* (Grzybowski)— V. Pokorný: Microstratigraphie et biofacies du flysch etc., pl. 2, fig. 1.

The test is subquadrate to elliptical, flat; subangular on both poles. The central — umbilical part is slightly depressed. In inverse oil chambers consisting of three whorls are well visible. Each whorl consists of two chambers alternately bent in the distal and proximal parts. The chambers of the last whorl in the peripheral part have pseudokeel. Aperture is at the end of the last chamber.

Occurrence: The species *R. complanata* belongs among very sporadical forms, occuring mostly in the upper part of the Cisna and Inoceramian beds of the Dukla unit. In the Carpathians the species was recorded in the Upper Cretaceous and Paleocene (V. Pokorný 1960; E. Hannzlíková 1972). W. Grün (1969) recorded the species in the same stratigraphic position in the Alps.

Rzehakina epigona (Rzehak, 1895)

Pl. IV, Fig. 13; Pl. XXIV, Fig. 5—6

1895 *Silicina epigona* Rzehak — fide B. F. Elis et A. R. Messina: Catalogue of Foraminifera.
1972 *Rzehakina epigona* (Rzehak) — J. Săndulescu: Étude micropaleontologique et stratigraphique etc., 27, pl. 3, fig. 15—16.
1972 *Rzehakina epigona* (Rzehak, 1895) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 38, pl. 4, fig. 1—4 (cum syn.).

The test is in good accordance with the original descriptions and depictions by other authors.

Occurrence: Among the four species of the genus *Rzehakina* described, *R. epigona* is the most frequent species (cf. syn. W Grün 1969, E. Hanzlíková 1972, J. Săndulescu 1972). Generally it is quoted from the Upper Cretaceous. In the East-Slovakian flysch it is in Upper Cretaceous and Paleocene flysch beds of the Dukla and Magura units, and in the Klippen Belt.

Rzehakina fissistomata (Grzybowski, 1901)

Pl. IV, Fig. 9; XXIV, Fig. 3—4

1901 *Spiroloculina fissistomata* n. sp. — J. Grzybowski: Otwornice warstw inoceramowych etc., p. 45 (261), pl. 7, fig. 21
1972 *Rzehakina fissistomata* (Grzybowski, 1901) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 39, pl. 4, fig. 6—10.
1972 *Rzehakina fissistomata* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 27, pl. 3, fig. 19—20 (cum syn.).

Differs from the above described, morphologically nearest species *R. complanata* (Grzybowski 1901) in a broader and more flat test, and in more whorls.

Occurrence: Usually the species occurs together with *R. complanata* (Grzybowski) in Paleocene beds of the flysch in the area studied. The existing literary data on its stratigraphical range are contradictory. Some authors quote the species only from the Cretaceous (M. J. Serova 1969; E. Hanzlíková 1972), others from the Paleocene (J. Săndulescu 1972), or from the Cretaceous through Paleocene (S. Geroch 1960).

Rzehakina inclusa (Grzybowski, 1901)

Pl. IV, Fig. 10–11; Pl. XXIV, Fig. 2

1901 *Spiroloculina inclusa* n. sp. — J. Grzybowski: Otwornice warstw inoceramowych etc., p. 44–45 (260–261), pl. 7, fig. 20.
1972 *Rzehakina inclusa* (Grzybowski, 1901) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminferida etc., p. 39, pl. 4, fig. 14.
1972 *Rzehakina inclusa* (Grzybowski) — J. Săndulescu Étude micropaléontologique et stratifraphique etc., p. 26–27, pl. 3, fig. 14 (cum syn.).

Differs from the species *R. epigona* (Rzehak, 1895) in slightly convex sides of the test, in a shallow umbilical depression and in broad chambers in the last whorl, overlapping the preceding whorls.

Occurrence: The author found the species in Upper-Senonian and Paleocene flysch beds of the Dukla and Magura units and in the Klippen Belt. It was described from the Inoceramian beds of Poland (Gorlice). It is known from Upper Senonian and Paleocene sediments (cf. S. Geroch 1960, V. Pokorný 1960, E. Hanzlíková 1960) from the Polish and the western parts of the Czechoslovak Carpathians. From the Soviet part of the Carpathians it is quoted by N. V. Dabagyan (1969) from the Upper Senonian; and from Rumania by J. Săndulescu (1972) from Upper Senonian through Paleocene.

Genus *Haplophragmoides* Cushman, 1910

Haplophragmoides horidus (Grzybowski, 1901)

Pl. XXIX, Fig. 1

1901 *Haplophragmium horridum* n. sp. — J. Grzybowski: Otwornice warstw inoceramowych etc., p. 54–55, pl. 7, fig. 12.

The test is involute, the last whorl consists of five slowly enlarging chambers. From lateral view the chambers are triangular, on the periphery — suboval, the umbilicus is on both sides; the sutures are deep. The test wall is agglutinated, composed of angular quartz grains. The surface is rough; cement quartzose. The aperture is on the base of last chamber.

Occurrence: The holotype described comes from the Inoceramian beds (Upper Cretaceous) near Gorlice. In the area studied it is sporadically present in the Beloveža beds (the Magura unit), in the upper Inoceramian beds (the Dukla unit).

Haplophragmoides kirki Wickended, 1932

Pl. XXIX, Fig. 2–4

1932 *Haplophragmoides kirki* nov. sp. – R. T. Wickenden: New species of foraminifera etc., p. 85, pl. 1, fig. 1.
1972 *Haplophragmoides kirki* Wickenden – E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 41, pl. 5, fig. 4 (cum syn.).

The species differs from *H. suborbicularis* (Grzybowski, 1869) in less chambers (4–5), a shallower umbilicus, inconspicuous sutures; rough coarse-sandy wall and in stratigraphical position.

Occurrence: It was recorded in the Upper Cretaceous of North America, and in the Upper Senonian of Moravia (E. Hanzlíková 1972). In the area studied are sporadical occurrences in Upper Senonian red clays of the Magura unit.

Haplophragmoides latidorsatus (Bornemann, 1855)

Pl. XXVIII, Fig. 4–5

1855 *Nonionina latidorsata* Bornemann – fide B. F. Ellis et A. R. Messina: Cataloque of Foraminifera
1875 *Haplophragmium rotundidorsatum* Hantk. – M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 12–13, pl. 1, fig. 2.
1969 *Haplophragmoides rotundidorsatus* Hantken, 1875 – E. Ya. Krayeva et B. F. Zernickiy: Foraminifery paleogena Ukrayiny p. 20, pl. 5, fig. 10a–b.

The test is large, involute; equatorial section circular. In the last whorl are 6–8 chambers, suboval on the periphery. Sutures are inconspicuous, umbilicus deep. Aperture is on the base of the last chamber.

Occurrence: In the area studied it is very scarce in the Upper Eocene of the Inner-Carpathian Paleogene. L. Majzón (1966) recorded the species in the Upper Eocene and Oligocene in Hungary.

Haplophragmoides mjatliukae Maslakova, 1955

Pl. VI, Fig. 2a–b

1955 *Haplophragmoides mjatliukae* sp. n. – N. I. Maslakova: Stratigrafija i fauna mjelkich foraminifer etc., p. 48, pl. 3, fig. 7–8.
1972 *Haplophragmoides retroseptus* (Grzybowski, 1896) – E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 41, pl. 5, fig. 5.

The forms occuring in the East-Slovakian flysch show most characters in common with the species *H. mjatliukae* described by N. I. Maslakova (1955) from the adjacent part of the Ukrainian Carpathians. They differ from the holotype in more suboval chambers on the outer periphery of the test, and in a larger umbilicus.

Occurrence: The holotype described comes from the Paleocene of the East Carpathians. In Slovakia it was found in the Paleocene and Lower Eocene in the Submenilite, Beloveža and Proč beds.

Haplophragmoides porrectus Maslakova, 1955

Pl. VI, Fig. 3a—b

1955 *Haplophragmoides porrectus* sp. n. — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 47—48, pl. 3, fig. 5—6.

Our forms show greatest affinity to the species *H. porrectus* described from the adjacent part of the Ukrainian Carpathians. They differ from the holotype only in more oval chambers and in a larger test.

Occurrence: The species is very scarce in the Upper Paleocene and Lower Eocene part of the Submenilite and Beloveža beds.

Haplophragmoides suborbicularis (Grzybowski, 1896)

Pl. VI, Fig. 5a—b

1896 *Cyclammina suborbisularis* Rzk. — J. Grzybowski: Otwornice czerwonych ilów etc., p. 24 (284), pl. 9, fig. 5—6.

1950 *Haplophragmoides suborbicularis* (Grzybowski) — V. Pokorný: Mikrofauna eocénneho zeleného jílu etc. p. 12—14, text-fig. 2. pl. 1, fig. 13-partim (cum syn.-non *Cyclammina retrosepta* Grzybowski).

The test is large, spherical, involute. In the last whorl are 5—6 chambers. The umbilicus is deep on both sides; sutures are slightly depressed. The test wall is coarse-grained, composed of quartzose grains. Cement is quartzose. The wall suface is finely rough. The aperture is on the base of the last chamber.

Occurrence: It is known from the Middle — Upper Eocene beds of the West Carpathian flysch zone (cf. V. Pokorný 1950, V. Homola et E. Hanzlíková 1955). In Slovakia it is in the same stratigraphical position in all tectonic units.

Haplophragmoides walteri (Grzybowski, 1897)

Pl. XXIX, Fig. 5—6

1897 *Trochammina walteri* n. sp. — J. Grzybowski: Otwornice pokladow naftonośnych etc., p. 34 (290), tab. 11, fig. 31.

1972 *Haplophragmoides walteri* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 28, pl. 3, fig. 23—24 (czm syn. -non *Trochammina tenuissima* Grzybowski 1897).

The test is large, involute. In the last whorl are 5—7 chambers flattened on sides, subangular on periphery. In the equatorial plane the test is subcircular, slightly lobate. Sutures are deep, conspicuous. The wall is finely agglutinated; cement is quartzose, surface smooth. The umbilicus is shallow. The aperture is at the base of the last chamber.

Occurrence: The species is current in Upper Senonian-Eocene, mostly flysch sediments of the Alpine-Carpathian region (cf. V. Pokorný 1950, N. I. Maslakova 1955, J. Morgiel 1959, W. Grün et al. 1964, J. Săndulescu 1972, a. o.). The species *H. walteri* (Grzybowski 1897) is known in Slovakia in the flysch Upper Senonian-Eocene beds of all tectonic units.

Haplophragmoides sp.

Pl. VI, Fig. 4a—b

The test is involute, composed of 6—7 chambers in the last whorl. From lateral view the chambers are triangular; subangular on the periphery. The equatorial profile is hexagonal to septagonal. The wall is finely agglutinated with much quartzose cement. The surface is finely rough. The umbilicus is shallow; the aperture is on the base of the last chamber; it is slot-like.

Occurrence: The species occurs sporadically only on the Submenilite beds of the Lower and Middle Eocene.

Genus *Recurvoides* Earland, 1934

Recurvoides imperfectus (Hanzlíková, 1966)

Text-Fig. 1 C

1966 *Haplophragmoides imperfectus* (Hanzlíková) — E. Hanzlíková: Die Foraminiferen etc., p. 111—112, pl. 5, fig. 1—8.

1972 *Recurvoides imperfectus* Hanzlíková — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 28—29, pl. 4, fig. 10—16 (cum syn.).

The test is large; subspherical, with recurvoid structure. In the last whorl are 10-13 small chambers. Intracameral sutures are shallow, yet conspicuous. The test wall is finely agglutinated, with much quartzose cement. Its surface is smooth under optical microscope. The aperture is at the base of the last chamber.

Occurrence: It is known from the Czechoslovak (E. Hanzlíková 1966), Polish (S. Geroch 1966), Ukrainian (N. V. Dabagyan 1969) and Rumanian

(T. Neagu 1970, J. Săndulescu 1972) Carpathians, from the Cretaceous and the Paleocene. In the area studied it was recorded from the Upper Cretaceous and Paleocene flysch sequences of the Klippen Belt.

Recurvoides nucleolus (Grzybowski, 1897)

Pl. VI, Fig. 1a–c; Pl. XXVII, Fig. 4–6

1897 *Trochammina nucleolus* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 35 (291), pl. 11, fig. 28–29.
1955 *Trochammina nucleolus* Grzybowski — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 53–54, pl. 5, fig. 1–3.

The test is flat on sides; the equatorial plane is circular or subcircular. Initial whorls are recurvoid; the terminal whorl is in one planispiral plane, with 7–9 chambers. Intracameral sutures are shallow, inconspicuous. The test wall is medium — or coarsely agglutinated, composed of angular quartz grains. Cement is quartzose; surface rough. The aperture is at the base of the last chamber.

Occurrence: The first specimen described is from the Paleogene beds near Krosno. N. I. Maslakova (1955) recorded it in the Eocene beds. In the area studied it is known from the Upper Paleocene — Middle Eocene beds of all tectonic units.

Recurvoides sp.

Pl. XXVIII, Fig. 2–3

In the Upper Senonian through Paleocene beds of the Dukla unit are very scarce forms with their initial whorls recurvoid, and with the last one or two whorls distinctly trochospiral. In the last whorl are 5–6 spherical or subspherical chambers, with conspicuous intracameral sutures. The test — wall is medium-agglutinated, the surface rough. The aperture is at the base of the last chamber. The species differs from *Recurvoides walteri* (Grzybowski, 1897) in higher trochospiral structure of the test and in more spherical chambers.

Genus *Thalmannammina* Pokorný, 1951

Thalmannammina subturbinata (Grzybowski, 1897) emend Pokorný 1951

Pl. XXVII, Fig. 3

1897 *Haplophragmium subturbinatum* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 280, pl. X, fig. 23.
1960 *Thalmannammina subturbinata* (Grzybowski) Pokorný emend. — S. Geroch: Zespoły mikrofauny etc., p. 53–54.

1972 *Thalmannammina subturbinata* (Grzybowski 1897) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 43—44, p. 7, fig. 5.
1972 *Thalmannammina subturbinata* (Grzybowski) Pokorný — J. Săndulescu: Étude micropaleéontologique et stratigraphique etc., p. 31, pl. 8, fig. 12—14 (cum syn.).

The test is small, compact, subspherical, composed of unevenly developed whorls. Our specimens are conformable with forms described in detail by V. Pokorný (1971).

Occurrence: The species is current in the Upper Cretaceous and especially Paleogene flysch sequences of the Carpathians (cf. V. Pokorný l. c., S. Geroch 1962, E. Hanzlíková 1972, J. Săndulescu 1972). In Slovakia it is known from the Upper Senonian and Paleogene beds of all tectonic units.

Genus *Trochamminoides* Cushman, 1910

Trochamminoides acervulatus (Grzybowski, 1897)

Pl. V, Fig. 1a—b

1896 *Trochammina acervulata* n. sp. — J. Grzybowski: Otwornice czerwonych ilów etc., p. 24 (284), pl. 9, fig. 4.

The test is large, trochospiral. It consists of 2—3 ½ whorls. In the last whorl are 6—8 deformed chambers. The ventral part is flat or concave. The test wall is medium-sandy; cement quartzose. Surface slightly rough.

Occurrence: The holotype described is from the Upper Cretaceous red clays of Wadowice. In Slovakia it is known from the Inoceramian beds of the Dukla unit (Upper Senonian-Paleocene).

Trochamminoides coronatus (Brady, 1879)

Pl. V, Fig. 4; Pl. XXV, Fig. 1—4

1897 *Trochammina subcoronata* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 31 (287), pl. 11, fig. 11.
1950 *Trochamminoides subcoronatus* (Grzybowski) — V. Pokorný: Mikrofauna eocénneho zeleného jílu etc., p. 11 (XV), pl. 1, fig. 10—11 (cum syn.).
1972 *Trochamminoides coronatus* (Brady) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 35, pl. 13, fig. 14—15 (cum syn.).

It is one of the most frequent species of the genus *Trochamminoides* in the Carpathian flysch zone. Due to deformation, the shape of the test is variable. In the last whorl are 4 1/5—6 very slowly enlarging chambers. The central part of the test is depressed. The test wall is medium-sandy; surface slightly rough.

Occurrence: The species is mostly known from the Alpine-Carpathian area (W. Grün et al. 1964, J. Morgiel 1959, F. Huss 1966, A. Jednorowska 1968, J. Săndulescu 1972, a. o.); from the Upper Cretaceous to Eocene. In the area studied its stratigraphical position is analogous in all flysch sequences (the Dukla and Magura units, the Klippen Belt, the Inner-Carpathian Paleogene).

Trochamminoides dubius (Grzybowski, 1901)

Pl. V, Fig. 6; Pl. XXV, Fig. 5–6

1901 *Ammodiscus dubius* n. sp. — J. Grzybowski: Otwornice warstw inoceramowych etc., p. 274, pl. 8, fig. 12, 14.
1972 *Trochamminoides dubius* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 33, pl. 12, fig. 11–13 (cum syn.).

The test is tubular, irregularly coiled. The dissection of the tube into chambers is irregular and the individual segments are indistinct. Somewhere the chambers are separated only by constrictions (Pl. XXV, fig. 5–6) of variable intensity. The test-wall is finely sandy; the surface smooth.

The species differs from morphologically similar species *Glomospirella serpens* (Grzybowski 1897) and *G. gorayskii* (Grzybowski 1897) in its segmented test or in conspicuous constrictions.

Occurrence: The species described is from the Inoceramian beds near Krosno. T. Neagu (1970) and J. Săndulescu (1972) recorded it from the Senonian and Paleocene of the Rumanian Carpathians. In the area studied it is very scarce in the Inoceramian and Submenilite beds of the Dukla unit and in the Beloveža beds of the Magura unit (Upper Senonian — Lower Eocene).

Trochamminoides elegans (Grzybowski, 1897)

Pl. IV, Fig. 17

1897 *Trochammina elegans* Rzk. — J. Grzybowski: Otwornice pokladow naftonośnych etc., p. 31–32 (287–288), pl. 11, fig. 10.
1950 *Haplophragmoides* cf. *elegans* (Grzybowski) — V. Pokorný: Mikrofauna eocénneho zeleného jílu etc., p. 14 (XV), text-fig. 4 (recte 3).
1969 *Trochamminoides elegans* (Rzehak) 1887 — W. Grün: Flysch Microfauna of the Hagenbach etc., p. 318–319, pl. 65, fig. 4a–b (cum syn.).

The test is evolute, coiled into 2 ½–3 whorls. In the last whorl are 10–13 subspherical, more-or-less equal chambers. Somewhere they are gently compressed on sides. Intracameral sutures are distinct, slightly depressed. The test wall is fine-sandy; slightly rough on the surface.

Occurrence: The species was described for the first time from the Paleo-

gene near Krosno. V. Pokorný (1950) recorded it from the Eocene sediments of Moravia. In Slovakia it is very scarce in the Submenilite and Beloveža beds (Paleocene — Middle Eocene).

Trochamminoides heteromorphus (Grzybowski, 1897)

Pl. XXVI, Fig. 1—2

1897 *Trochammina heteromorpha* n. sp. — J. Grzybovski: Otwornice pokladów naftonośnych etc., p. 286, pl. 11, fig. 16.
1972 *Trochamminoides heteromorphus* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 34, pl. 13, fig. 12—13 (cum syn.).

The test is large. The initial 2—3 whorls are trochospiral. The last 2—4 chambers are upright. The test wall is medium-sandy; the surface slightly rough.

Occurrence: J. Grzybowski (1897, 1901) recorded the species from the Cretaceous and Paleogene beds. In the Turonian and Senonian it is known in Rumania (cf. J. Săndulescu 1972). In Slovakia it was scarcely found in the Inoceramian beds (Upper Senonian-Paleocene) of the Dukla unit and in red clays (Upper Senonian — Paleocene) of the Magura unit.

Trochamminoides irregularis White, 1928

Pl. V, Fig. 3a—b; Pl. XXVI, Fig. 3

1928 *Trochamminoides irregularis n.* sp. — M. P. White: Some index Foraminifera etc., p. 307, pl. 42, fig. 1.
1960 *Trochamminoides irregulatis* White — S. Geroch: Zespoly mikrofauny etc., p. 49 (cum syn.).
1972 *Trochamminoides irregularis* White — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 34, pl. 13, fig. 10—11 (cum syn.).

The test is large, coiled in irregular planes. On the dorsal side are some chambers of the two initial whorls and all (6—8) chambers of the last whorl. The dorsal side is slightly concave.

Occurrence: Many authors recorded the species in the Turonian-Senonian and Paleocene from the whole Alpine-Carpathian region (cf. syn.). In the Slovak part of the Carpathians it is known from the Senonian and Paleocene beds of the Dukla and Magura units, from the Klippen Belt and from the Inner-Carpathian Paleogene.

Trochamminoides proteus (Karrer, 1866)

Pl. V, Fig. 5a—b

1895 *Trochammina proteus* Karrer — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1928 *Trochamminoides proteus* (Karrer) — M. P. White: Some index Foraminifera etc., p. 308, pl. 42, fig. 2.

Forms included in the species, are characterized by their large test composed of 2,5—3 whorls. In the last whorl are 7—9 flattened chambers. The test wall is medium-sandy; the surface finely rough.

Occurrence: In the area studied it occurs sporadically in the Inoceramian beds of the lower part of the Submenilite and Beloveža beds.

Trochamminoides vermetiformis (Grzybowski, 1897)

Pl. V, Fig. 2

1897 *Trochammina vermetiformis* n. sp. — J. Grzybowski: Otwornice pokladów naftonósnych etc., p. 30 (286), pl. 11, fig. 19.
1972 *Trochamminoides vermetiformis* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 34, pl. 13, fig. 3—4.

In its early stage the test is evolute. In the terminal growth stage the last chambers are upright. The test wall is medium-sandy; surface slightly rough.

Occurrence: The species is frequent in the Senonian and Paleocene beds of Rumania (J. Săndulescu 1972). In our country it is known in the Dukla and Magura unit from the Senonian up to Lower Eocene.

Genus *Cyclammina* Brady, 1876

Cyclammina amplectens Grzybowski, 1897

Pl. VII, Fig. 4a—b, Pl. XXX, Fig. 1—3

1897 *Cyclammina amplectens* n. sp. — J. Grzybowski: Otwornice pokladów naftonośnych etc., p. 36 (292), pl. 12, fig. 1—3.
1950 *Cyclammina amplectens* Grzybowski — V. Pokorný: Mikrofauna eocénneho zeleného jílu etc., p. 16—17 (cum syn).
1953 *Cyclammina amplectens* Grzybowski — V. Pokorný: Mikrostratigrafická posice heršpických štěrků etc., p. 15.
1955 *Cyclammina amplectens* Grzybowski — V. Homola et R. Hanzlíková: Biostratigrafia, tektonika etc., p. 390.
1955 *Cyclammina amplectens* Grzybowski — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 49—50, pl. 4, fig. 1—3.
1960 *Cyclammina amplectens* Grzybowski — S. Geroch: Zespoly mikrofauny etc., p. 55—56, pl. 10, fig. 11.

Our forms fit exactly the original descriptions and figures by J. Grzybowski and by other authors describing the species from the Carpathians (cf. syn.).

Occurrence: *C. amplectens* belong among very frequent and significant index species of the Middle Eocene. Data from the Upper Eocene (O. S. Vyalov — N. V. Dabagyan — O. V. Myatlyuk 1963) shall have been revised, in our opinion. In the Paleogene of the Klippen Belt the species always

occurs with planktonic foraminifers of Middle Eocene age. It is particularly rich in variegated (red and green) claystones of the Magura unit, less in the Dukla unit.

Cyclammina sp.

Pl. VII, Fig. 5a–b

1943 *Cyclamimna* aff. *suborbicularis* Grzybowski — H. Hiltermann: Zur Stratigraphie und Mikrofossilführung etc. p. 12–13, pl. 1, fig. 2.
1955 *Cyclammina rotundidorsata* (Hantken) — S. Geroch et R. Gradziński: Stratigrafia serii podślackiej etc., p. 40, pl. 4, fig. 4–9, pl. 5, fig. 9a–d.
1955 *Cyclammina rotundidorsata* (Hantken) — V. Homola et E. Hanzlíková: Biostratigrafické, tektonické etc., p. 74.
1968 *Cyclammina rotundidorsata* (Hankten) — B. Leško et O. Samuel: Geológia východoslovenského flyšu, p. 103, text-fig. 13 CH.
1971 *Cyclammina rotundidorsata* (Hatken) — G. Popescu et M. Iva: Contribution à la connaissance de la microfauna etc. p. 39, pl. 1, fig. 6.

In Upper Eocene sediments of the Magura and Dukla units are sporadical occurrences of forms which — in their external morphology — resemble the species *Haplophragmoides suborbicularis* Grzybowski 1896. The internal structure of their chambers is, however, different: it is characteristic of the genus *Cyclammina*. In a publication by S. Geroch et R. Gradziński (1955), V. Homola et E. Hanzlíková (1955) and B. Leško et O. Samuel (1968) etc. denoted the species as *Cyclammina rotundidorsata* (Hantken 1875). Comparative material from the Eocene of Hungary did however, show that the species depicted by M. Hantken (l. c.) did not belong to the genus *Cyclammina* and that it was a synonym to the species *Haplophragmoides latidorsatus* (Bornemann, 1855). Most likely, it is a new species. Preliminarily, it will be denoted as *Cyclammina* sp.

Genus *Bolivinopsis* Jakovlev, 1891

Bolivinopsis costidorsatus (Grzybowski, 1897)

Pl. VII, Fig. 2a–b, 3

1897 *Spiroplecta constidorsata* n. sp. — J. Grzybowski: Otwornice pokladow naftonośnych etc., p. 38 (294), pl. 12, fig. 11.
1950 *Bolivinopsis* cf. *costidorsata* (Grzybowski) — V. Pokorný: Makrofauna eocénneho zeleného jílu etc., p. 17 (XV).

The species described differs from *B. spectabilis* (Grzybowski, 1897) in conspicuous spines in distal parts of chambers.

Occurrence: In the area studied the species was recorded in Paleocene and Eocene beds of the Dukla and the Magura units.

Bolivinopsis spectabilis (Grzybowski, 1897)

Pl. VII, Fig. 1; Pl. XXXI, Fig. 1–2

1897 *Spiroplecta spectabilis* n. sp. — J. Grzybowski: Otwornice pokladow naftonośnych etc., p. 37 (293), pl. 12, fig. 12.
1972 *Bolivinopsis spectabilis* (Grzybowski) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 48, pl. 10, fig. 8 (cum syn.).

Both the micro- and the macrospheric forms may be distinguished. The species is morphologically variable. Owing to that J. Grzybowski (1897) described the species *Spiroplecta brevis* n. sp. and *S. foliacea* n. sp. in the same work, and in 1901 — *S. clotho* n. sp. V. Pokorný (1950) and later S. Geroch (1960) regarded the first two of these species as synonyms of *B. spectabilis* which is right. Further synonyms of this species are *S. clotho* n. sp. and *Spiroplectammina grzybowskii* described by L. Fritzel in 1943.

Occurrence: The species is quite common in the Carpathian Flysch. Besides from the Carpathians it was recorded in the Alps (Hillebrandt, 1962), W. Siberians (N. N. Subbotina, 1964), in America (J. Cushman, 1946) a. o. In the area studied it is in Upper Senonian and Paleogene sediments (Upper Campanian — Middle Eocene) in the Dukla and the Magura units, in the Klippen Belt and in the Inner-Carpathian Paleogene.

Genus *Vulvulina* Orbigny, 1826

Vulvulina haerigensis (Gümbel, 1826)

Pl. XXX, Fig. 4

1868 *Venelina haerigensis* Gümbel — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera
1975 *Vulvulina haerigensis* (Gümbel) 1868 — G. Braga et al.: Foraminiferi bentonice etc., p. 102, pl, 4, fig. 5 (cum syn.).

The infrequent Carpathian forms show most features in common with *V. haerigensis* (Gümbel, 1826).

Occurrence: In the Slovak part of the West Carpathians are sporadical occurrences in the Eocene sediments of the Inner Carpathian Paleogene.

Genus *Textularia* Defrance, 1824

Textularia calix Grzybowski, 1896

Pl. XXXI, Fig. 3

1896 *Textularia calix* n. sp. — J. Grzybowski: Otwornice czerwonych ilów etc., p. 27 (287), pl. 9, fig. 17.

1969 *Textularia calix* Grzybowski 1896 — E. Y. Krayeva et B. F. Zernickiy: Foraminiferi paleogena etc., p. 25, pl. 8, fig. 2 (cum syn.).

Our forms agree with description and figure of the holotype.

Occurrence: The holotype described is from Paleogene red clays (Wadowice). In the U.S.S.R. it is known from the Upper Eocene. In area studied it was found in the Paleocene and in the Lower Eocene of the Klippen Belt.

Genus *Trochammina* Parker et Jones, 1859

Trochammina boehmi Franke, 1928

Pl. XXVIII, Fig. 1

1929 *Trochammina boehmi* Franke: Die Foraminiferen der oberen Kreide etc., p. 174, pl. 15, fig. 24.
1972 *Trochammina boehmi* Franke — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 50, pl. 10, fig. 13.

Our forms agree with the species described from the Moravian Flysch by E. Hanzlíková (1972).

Occurrence: *T. boehmi* is one of very rare species. E. Hanzlíková recorded it from Campanian-Maastrichtian sediments. It was found in an analogous stratigraphic position in the flysch beds of the Klippen Belt.

Trochammina deformis Grzybowski, 1897

Pl. XXVI, Fig. 4

1897 *Trochammina deformis* n. sp. — J. Grzybowski: Otwornice pokladow naftonosnych etc., p. 32 (288), pl. 11, fig. 20—22.
1972 *Trochamminoides deformis* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 35, pl. 14, fig. 2—4.

Our forms show most features in common with the species described by J. Grzybowski (l. c.) as *T. deformis*. Some authors include it in the genus *Trochamminoides* Cushman 1910 (cf. J. Sandulescu 1972). Primary undeformed forms have subspherical trochospiral chambers. On the ventral side only 4—4 ½ chambers of the last whorl are visible. In absolute majority of forms their tests are secondary-depressed.

Occurrence: In the East-Slovakian flysch the species occurs in Upper-Senonian to Eocene sediments of the Dukla and the Magura units. Sporadical occurrences are in Paleocene — Lower Lutetian sediments of the Inner Carpathian Paleogene.

Trochammina intermedia Grzybowski, 1896

Pl. VI, Fig. 6a–b

1896 *Trochammina intermedia* n. sp. — J. Grzybowski: Otwornice czerwonych ilów etc., p. 22 (282), pl. 8, fig. 53.

Our specimens have most features common with the forms determined as *T. intermedia* by J. Grzybowski (1. c.).

Occurrence: In variable amounts mainly found in Paleocene and Eocene populations of the Dukla and Magura units.

Trochammina lamella Grzybowski, 1897

Pl. XXVI, Fig. 5–6

1897 *Trochammina lamella* n. sp. — J. Grzybowski: Otwornice pokladow naftonośnych etc., p. 34 (290), pl. 11, fig. 25.

The test is usually secondary-depressed. It consists of 2—2 ½ whorls with four depressed chambers in the last whorl. The chamber wall is thin. It consists of fine-grained quartz with quartzose cement.

Occurrence: The specimen belongs among common species in the Carpathian flysch geosyncline. They write in Polish, Russian and Rumanian literature about its Senonian — Eocene stratigraphical range. Its stratigraphical position is the same in the Czechoslovak part of the Flysch Carpathians.

Trochammina quadriloba (Grzybowski, 1896)

Pl. XXVII, Fig.1

1986 *Haplophragmiun (Reussina) quadrilobum* n. sp. — J. Grzybowski: Otwornice czerwonych ílów etc., p. 18 (278), pl. 8, fig. 31.

1960 *Trochammina quadriloba* (Grzybowski) — S. Geroch: Zespoly mikrofauny etc . p. 64, pl. 7, fig. 1 (cum syn).

Our species are conformable with forms described by S. Geroch (1960).

Occurrence: The species was described for the first time from the Paleogene near Krosno. S. Geroch (1960) recorded it from the Middle Eocene sediments of Poland (Sliezské Beskydy). In Slovakia it is very scarce in Middle Eocene of the Dukla and Magura units.

Genus *Cystammina* Neumayr, 1889

Cystammina pauciloculata (Brady, 1879)

Pl. XXVII, Fig. 2

1879 *Trochammina pauciloculata* Brady — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1960 *Cystammina pauciloculata* (Brady) — S. Geroch: Zespoły mikrofauny etc., (cum syn.).

The test is agglutinate, smooth at the surface. It consists of 4 chambers, usually compressed, of which the first one is of small dimensions and the last three exceed the first chamber several times in size. The aperture is found at the base of the last chamber in the shape of an indistinct opening, which is often to be observed in translucent medium only.

Occurrence: S. Geroch (1960) mentioned this species from the Ciezkowice and Hieroglyph beds in the Polish part of the Flysch Carpathians. In the area studied it is found sporadically in Paleocene and Lower to Middle Eocene sediments.

Genus *Gaudryina* Orbigny, 1839

Gaudryina subcylindrica Nuttall, 1928

Pl. VII, fig. 6a—b

1928 *Gaudryina subcylindrica* Nuttall — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

Infrequent Carpathian specimens agree well with the description of the holotype.

Occurrence: In the East-Slovakian flysch zone the species was only found in variegated beds of the Magura unit (Middle Eocene).

Genus *Tritaxia* Reuss, 1860

Tritaxia alpina (Cushman, 1936)

Pl. XXXII, Fig. 4—5

1936 *Clavulinoides alpina* Cushman — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera

1975 *Tritaxia alpina* (Cushman), 1936 — Braga, G. et al.: Foraminiferi Bentonici del Paleocene et Eocene etc., p. 91, pl. 1, fig. 12.

The forms from the Carpathians are identical with the original description of the holotype.

Occurrence: The mentioned species has been described from Paleogene sediments of America and Europe so far. In flysch sediments of the area studied it belongs among scarcely found forms of the Paleocene and Eocene.

Genus *Uvigerinammina* Majzon, 1943

Uvigerinemmina jankoi Majzon, 1943 emend Geroch, 1957

Text — Fig. 1b

1943 *Uvigerinammina jankoi* nov. sp. — L. Majzon: Adatok egyes Karpátai flis etc., p. 68, pl. 2, fig. 15a, b.
1957 *Uvigerinammina jankoi* Majzon — S. Geroch: Zespoly mikrofauny z kredy i paleogena etc., p. 61 (cum syn.).
1972 *Uvigerinammina jankoi* Majzon — J. Săndulescu: Étude micropaléontologique et stratigraphique, etc. p. 37, pl. 15, fig. 11—12 (cum syn.).

Our specimens are identical with the emended description of S. Geroch (1957).

Occurrence: According to data of Polish authors (cf. S. Geroch 1960 etc.) the mentioned species is characteristic of the Middle Cretaceous. From the Rumanian Carpathians J. Săndulescu (1972) mentioned it from the Upper Senonian. In the area studied, except the Upper Cretaceous, it was also found in Paleocene sediments of the Klippen Belt proved by planktonic foraminifers.

Arenobulimina ? gerochi Samuel et Salaj, 1962

Pl. IV, Fig. 15

1962 *Arenobulimina ? gerochi* nov. sp. — O. Samuel et J. Salaj: Nové druhy foraminifer etc., p. 316, pl. 9, fiig. 3a—b.

An agglutinated test, smooth on surface, obtusely conical to about 1/3 of its size. The next part is approximately cylindrical, with 4 ½—5 whorls coiled in a spiral, with 5 chambers per whorl, connected by short channels running out of top parts of the chambers. Sutures are slightly depressed, distinct in the last three whorls. Eliptical or oval aperture is immediately above the lower part of the last chamber.

Occurrence: The species is very scarce in populations with *Cyclammina amplectens* in the Magura and the Dukla units.*

Genus *Plectina* Marsson, 1878

Plectina conversa (Grzybowski, 1901) emend Jedlitschka, 1935

Pl. XXXII, Fig. 1—2

1901 *Gaudryina conversa* n. sp. — J. Grzybowski: Otwornice warstw inoceramowych etc., p. 69 (285), pl. 7, fig. 15—16.

* Authentical translation of the Slovak description of the holotype.

1972 *Plectina conversa* (Grzybowski, 1901) — E. Hanzlíková: Carpathian Upper Cretaceous Foraminiferida etc., p. 59—60, pl. 13, fig. 10, 14 (cum syn.).

Test of elongate shape. The initial part of test is composed of more than 3 chambers. These are rapidly passing into triseriate and then into biseriate spirally coiled stage, which occupies almost one half of the test length. The chambers of the initial and triseriate stage are visible in inverse medium only. Under the optical microscope the wall is rough. It consists of small quartz grains cemented by quartz cement. The aperture is simple located in the basal and terminal part of the last chamber.

Occurrence: According to literature from the Carpathians the age diapason of this species is Turonian to Middle Eocene.

Genus *Karreriella* Cushman, 1933

Karreriella (Karrerulina) coniformis (Grzybowski, 1987)

Pl. XXXII, Fig. 3

1897 *Gaudryina coniformis* n. sp. — J. Grzybowski: Otwornice pokladow naftonośnych etc., p. 39 (295), pl. 12, fig. 7.
1972 *Plectina coniformis* (Grzybowski) — J. Săndulescu: Étude micropaléontologique et stratigraphique etc., p. 38—39, pl. 15, fig. 20 (cum syn.).

The test shape is elongate — barrel-like. The initial chambers in trochoidal spiral (visible in inverse medium only), which rapidly passes into spirally coiled triseriate and then biseriate stage. The aperture is terminal with weakly developed neck. The test wall is rough under the optical microscope. It is composed of fine quartz grains cemented by quartz cement.

Occurrence: The holotype was described from the area of Krosno (Poland), from where it was mentioned by numerous authors (S. Geroch 1960, A. Jednorowska 1968; J. Liszkowa 1972 etc.) from the Upper Cretaceous to the Eocene. From a similar stratigraphic position it was also described in the Soviet (M. Mjatlyuk 1970) and Rumanian (J. Săndulescu 1972) parts of the Carpathians. In the Czechoslovak part it has been found from the Upper Senonian to the Middle Eocene so far.

Genus *Ataxophragmium* Reuss, 1861

Ataxophragmium cf. *compactum* Brotzen, 1936

Pl. IV, Fig. 16a—b

1936 *Ataxophragmium compactum* n. sp. — F. Brotzen: Foraminiferen aus dem schwedischen untersten Senon etc., p. 44—46, pl. 2, fig. 3a, b; 10a, b; text-fig. 8

The species was only recorded at one locality in Lower-Paleocene beds of the Dukla unit. It shows closest affinity to the Brotzen's species *A. compactum*.

Genus *Matanzia* Palmer, 1936

Matanzia varians (Glaessner, 1937)

Pl. IV, Fig. 18

1937 *Textulariella? varians* Glaessner — fide B. F. Ellis et A. R. Massina: Catalogue of Foraminifera.

1972 *Matanzia varians* (Glaessner, 1937) — E. Hanzlíková: Carpathian upper Cretaceous foraminiferida etc., p. 61, pl. 12, fig. 10—14 (cum syn.).

Carpathian specimens agree well with the original description.

Occurrence: *M. varians* occurs sporadically in Upper Cretaceous and Paleocene beds of the Dukla unit in the East-Slovakian Flysch, and in the Klippen Belt Paleogene.

Reviewed by J. Salaj.

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O. Samuel

Aglutinované foraminifery z paleocénnych flyšových formácií Západných Karpát Slovenska

3 obr., 32 tab. (I—XXXII), resumé anglického textu

Veľkú časť územia Západných Karpát vytvárajú flyšové formácie, ktoré sa usadzovali prevažne v paleogéne. Z biofaciálneho hľadiska charakteristickým znakom flyšu je nedostatok fosílnych organizmov. Relatívne najhojnejšie sa vyskytujú foraminifery, ktorých dominujúce postavenie majú práve primitívne aglutinované formy. Predovšetkým na ich základe je spracovaná stratigrafia flyšových formácií nielen u nás, ale v celom flyšovom pásme Karpát a čiastočne i Álp. Nakoľko presnosť stratigrafického rozčlenenia mocných flyšových komplexov, ako aj ich intraregionálna, resp. interregionálna korelácia je priamo závislá od hĺbky poznania jednotlivých taxónov, a tým aj ich priestorového rozšírenia, autor v práci opisuje 87 druhov (z toho 4 nové: *Bathysiphon microraphidus* nov. sp., *Hyperammina rara* nov. sp., *Glomospirella biedai* nov. sp. a *Reophax pseudoscalaria* nov. sp.) aglutinovaných foraminifér, ktoré patria k 38 rodom. Prevažná väčšina druhov bola študovaná i metódou SEM. Táto metóda umožňuje presnejšie charakterizovať jednotlivé taxóny, z ktorých prevládajúcu časť opísal už v minulom storočí v poľskej časti flyšových Karpát J. Grzybowski (1. c.). Zo Západných Karpát Slovenska neboli však doteraz, až na malé výnimky, faktologicky ani paleontologicky dokumentované. Predbežné výskumy pomocou nových metód (SEM, orientované rezy, biometria, štatistika) ukazujú, že aj aglutinované foraminifery po ich komplexnom spracovaní môžeme použiť na podrobnejšie mikrobiostratigrafické členenia, na rozdiel od doterajšieho pomerne hrubého členenia porovnaním napr. s biozonáciou pomocou planktonických foraminifér.

Na základe niekoľkých tisícov mikrobiostratigrafických analýz môžeme konštatovať, že vrchnokriedové až spodnolutétske flyšové formácie dukelskej a magurskej jednotky obsahujú buď výlučne, alebo prevažne (95 %) aglutinované foraminifery, čo bezprostredne súvisí s genézou a batymetriou flyšu. V pribradlovom (považsko-hanušovskom) paleogéne aglutinované foraminifery už nemajú dominujúce postavenie. Vyskytujú sa väčšinou spolu s vápnitým bentósom, zriedkavo i planktónom, ktorý má v niektorých

litofáciách úplnú prevahu. Vo vnútrokarpatskom paleogéne aglutinované foraminifery sa bežnejšie vyskytujú len v niektorých typoch bazálnej fácie. Vo vyšších súvrstviach (vrchný lutét-priabón) sú spravidla zastúpené len sporadicky.

Explanation of plates 1—XXXII

Plate I*

Fig. 1—5 *Rhabdammina discreta* Brady, 1881
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Mang. 40 x; No: 1— 10261; 2 — 10258; 3 — 10257; 4 — 10259; 5 — 10260.
Fig. 6a—c *Rhabdammina cylindrica* Glaessner, 1937
Middle Eocene; Reed clays — Paleogene of the Klippen belt (Inovec). Magn. 40 x; No: 10264.
Fig. 7—8 *Rhabdammina linearis* Brady, 1884
Lower Eocene; Submenilite Beds — Dukla Unit (Zbudská Belá). Magn. 40 x: No: 7 — 10262; 8 — 10263.
Fig. 9 *Rhabdammina annulata* Grzybowski, 1896
Middle Eocene; Reed clays — Rača Unit (Hažlín); Magn. 40 x; No: 10265.
Fig. 10—11 *Rhizammina* cf. *indivisa* Brady, 1884
Lower Eocene; Submenilite Beds — Dukla Unit (Smilno Inlier — Cigla). Magn. 60 x; No: 10 — 10266; 11 — 10267.
Fig. 12—14 *Kalamopsis grzybowskii* (Dylążanka, 1923)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 60 x; No: 10268 a—c.
Fig. 15 a—b *Hyperammina karpatica* Maslakova, 1955
Lower Eocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 40 x; No: 10269.
Fig. 16—17 *Hyperammina subnodosiformis* Grzybowski, 1897
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 40 x; No: 16 — 10271; 17 — 10270.

Plate II

Fig. 1a—b, 2 *Hyperammina nodata* Grzybowski, 1896
Paleocene; Proč Beds — Paleogene of the Klippen Belt (Skrabské). Magn. 40 x; No: 1a—b — 10272; 2 — 10273.
Fig.3 *Dendrophrya excelsa* Grzybowski, 1897
Lower Eocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 40 x; No: 10272.
Fig. 4—6 *Dendrophrya excelsa* Grzybowski, 1897
Lower Eocene; Submenilite Beds — Dukla Unit (Smilno Inlier — Cigla). Magn. 40 x; No: 10274.
Fig. 7 *Dendrophrya excelsa* Grzybowski, 1897
Lower Eocene; Submenilite Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 40 x; No: 10275.
Fig. 8 *Dendrophrya excelsa* Grzybowski, 1897
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Miková). Magn. 40 x; No: 10276.

* All the figures in Pls. I—VII are reillustrated according to B. Leško et O. Samuel (1968).

Fig. 9a—b *Dendrophrya robusta* Grzybowski, 1897
Lower Eocene; Beloveža Beds — Rača Unit (Beloveža). Magn. 40 x; No: 10278.
Fig. 10a—b *Dendrophrya latissima* Grzybowski, 1897
Paleocene; Cisna Beds — Dukla Unit (Topoľa). Magn. 40 x; No: 10279,
Fig. 11 *Psammosphaera laevigata* White, 1928
Lower Eocene; Submenilite Beds — Dukla Unit (Fedorová Lúka). Magn. 40 x; No: 10254.
Fig. 12a—b; 13a—b *Sacacmmina placenta* (Grzybowski, 1897)
Upper Senonian-Paleocene; Lower Inoceramus Beds — Dukla Uhnit (Medzilaborce). Magn. 40 x; No: 12a—b — 10255, 13a—b — 10256.
Fig. 14 *Turitellella shoneana* (Siddal, 1878)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 60 x; No: 10300
Fig. 15 *Tolypammina? fallax* (Grzybowski, 1896)
Paleocene; Submenilite Beds — Dukla Unit (Snina). Magn. 30 x; No: 10301.

Plate III

Fig. 1 *Reophax trinitatensis* Cushamn et Renz, 1946
Paleocene; Cisna Beds — Dukla Unit (Nová Sedlica). Magn. 30 x; No: 10280.
Fig. 2 *Reophax pilulifer* Brady, 1884
Middle Eocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 30 x; No: 10281.
Fig. 3 *Reophax duplex* Grzybowski, 1896
Lower Eocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 30 x; No: 10282.
Fig. 4a—b *Reophax pseudoscalaria* nov. sp.
Upper Senonian — Paleocene; Cisna Beds — Dukla Unit (Uličˇ). Magn. 35 x; No: 10283.
Fig. 5a—b *Reophax splendidus* Grzybowski, 1897
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Magn. 35 x; No: 10284.
Fig. 6a—b *Reophax scalaria* Grzybowski, 1896
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Magn. 35 x; No: 10287.
Fig. 7 *Reophax subnodulosus* Grzybowski, 1897
Lower Eocene; Submenilite Beds — Dukla Unit (Smilno Inlier — Cigla). Magn. 35 x: No: 10285.
Fig. 8 *Reophax elongatus* Grzybowski, 1897
Lower Eocene; Submenilite Beds — Dukla Unit; (Zbudská Belá). Magn. 35 x; No: 10286.
Fig. 9 *Hormosina ovulum gigantea* Geroch, 1960
Upper Senonian — Paleocene; Cisna Beds — Dukla Unit (Topoľa). Magn. 50 x; No: 10294.
Fig. 10 *Hormosina ovulum gigantea* Geroch, 1960
Upper Senonian — Paleocene; Lower Inoceramus Beds (Medzilaborce). Magn. 50 x; No: 10295,.
Fig. 11 *Hormosina ovulum ovulum* Grzybowski, 1896
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce): Magn. 50 x; No: 10296.
Fig. 12—13 *Hormosina excelsa* (Dylążanka, 1923)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 35 x; No: 12 — 10289, 13 — 10288.
Fig. 14 *Hormosina ovuloides* (Grzybowski, 1901)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Cigľa). Magn. 50 x; No: 10292.
Fig. 15 *Hormosina ovuloides* (Grzybowski, 1901)
Paleocene — Paleogene of the Klippen belt (Skrabské). Magn. 50x; No: 10293.

Fig. 16a—b *Glomospirella biedai* nov. sp.
Lower Eocene; Submenilite Beds — Dukla Unit (Snina). Magn. 40 x; No: 10297-holotype
Fig. 17 *Ammodiscus latus* Grzybowski, 1897
Middle Eocene; Reed clays — Rača Unit (Brezovka). Magn. 40 x; No: 10299.

Plate IV

Fig. 1a—b *Glomospirella gorayskii* (Grzybowski, 1897)
Lower Eocene; Submenilite Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 30 x; No: 10303.
Fig. 2, 4 *Glomospirella serpens* (Grzybowski), 1897)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 30 x; No: 2 — 10305; 4 — 10304.
Fig. 3 *Glomospira irregularis* (Grzybowski, 1897)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 30 x; No: 10306.
Fig. 4, 5a—b *Glomospira gordialis* (Jones et Parker, 1860)
Lower Eocene; Submenilite Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 50 x; No: 10307.
Fig. 6 *Glomospira charoides* (Jones et Parker, 1860) Lower Eocene; Proč Beds — Paleogene of the Klippen Belt (Ujak). Magn. 50 x; No: 10308.
Fig. 7 *Arenoturrispirillina concavata* Samuel et Salaj, 1962 Upper Eocene; Šariš Beds — Inner Carpathian Paleogene (Prešov). Magn. 50 x; No: 10750.
Fig. 8 *Nodellum valescoense* (Cushman, 1926)
Paleocene; Proč Beds — Paleogene of the Klippen Belt (Skrabské). Magn. 50 x; No: 10302.
Fig. 9 *Rzehakina fissistomata* (Grzybowski, 1901)
Paleocene; ? Cisna Beds — Dukla Unit (Topoľa). Magn. 50 x; No: 10314.
Fig. 10—11 *Rzehakina inclusa* (Grzybowski, 1901)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 50 x; No: 10 — 10309; 11 — 10310.
Fig. 12, 14 *Rzehakina complanata* (Grzybowski, 1901)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 50 x; No: 12 — 10312; 14 — 10313.
Fig. 13 *Rzehakina epigona* (Rzehak, 1895)
Upper Senonian — Paleocene. Cisna Beds — Dukla Unit (Uličˇ). Magn. 50 x; No 10311.
Fig. 15 *Arenobulimina? gerochi* Samuel et Salaj, 1962
Middle Eocene; Reed clays — Rača Unit (Bardejov). Magn. 50 x; No: 10332.
Fig. 16a—b *Ataxophragmium* cf. *compactum* Brotzen, 1936
Upper Senonian — Paleocene; Cisna Beds — Dukla Unit (Uličˇ). Mag. 50 x; No: 10331.
Fig. 17 *Trochamminoides elegans* (Grzybowski, 1897)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Papín). Magn. 30 x; No: 10318.
Fig. 18 *Matanzia varians* (Glaessner, 1937)
Paleocene; Proč Beds — Paleogene of the Klippen Belt (Skrabské). Magn. 35 x; No: 10334.

Plate V

Fig. 1a—b *Trochamminoides acervulatus* (Grzybowski, 1897)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 35 x; No: 10315.

Fig. 2 *Trochamminoides vermetiformis* (Grzybowski, 1897)
Lower Eocene; Beloveža Beds — Rača Unit (Dubová). Magn 35 x; No: 10316.
Fig. 3a—b *Trochamminoides irregularis* White, 1928
Paleocene; Beloveža Beds — Rača Unit (Vyšný Mirošov). Magn. 35 x; No: 10230.
Fig. 4 *Trochamminoides coronatus* (Brady, 1879)
Middle Eocene; Submenilite Beds — Dukla Unit (Smilno Inlier — Cigla). Magn. 35 x; No: 10321.
Fig. 5a—b *Trochamminoides proteus* (Karrer, 1866)
Paleocene; Proč Beds — Paleogene of the Klippen Belt (Prosačov). Magn. 35 x; No: 10317.
Fig. 6 *Trochamminoides dubius* (Grzybowski, 1901)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Kurimka). Magn. 35 x; No: 10319.

Plate VI

Fig. 1a—c *Recurvoides nucleolus* (Grzybowski, 1897)
Lower Eocene; Submenilite Beds — Dukla Unit (Papín). Magn. 60 x; No: 10326.
Fig. 2a—b *Haplophragmoides mjatliukae* Maslakova, 1955
Lower Eocene; Beloveža Beds — Rača Unit (Jedlinka). Magn. 60 x; No: 10323.
Fig. 3a—b *Haplophragmoides porrectus* Maslakova, 1955
Middle Eocene; Reed clays — Bystrica Unit (Kalnište). Magn. 50 x; No: 10325.
Fig. 4a—b *Haplophragmoides* sp.
Lower Eocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 50 x; No: 10324.
Fig. 5a—b *Haplophragmoides suborbicularis* (Grzybowski, 1896)
Middle Eocene; Variegated clays — Paleogene of the Klippen belt (Inovec). Magn. 60 x; No: 10322.
Fig. 6a—b *Trochammina intermedia* Grzybowski, 1896
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Miková). Magn. 60 x; No: 10327.

Plate VII

Fig. 1 *Bolivinopsis spectabilis* (Grzybowski, 1897)
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Magn. 50 x; No: 10328.
Fig. 2a—b, 3 *Bolivinopsis costidorsatus* (Grzybowski, 1897)
Middle Eocene; Reed clays — Rača Unit (Bardejov). Magn. 50 x; No: 2a—b — 10329; 3 — 10330.
Fig. 4a—b *Cyclammina amplectens* Grzybowski, 1897
Middle Eocene; Reed marls — Paleogene of the Klippen belt (Medzianky). Magn. 40 x; No: 10335.
Fig. 5a—b *Cyclammina* sp.
Middle Eocene; Reed clays — Rača Unit (Kalnište). Magn. 40 x; No: 10336.
Fig. 6a—b *Gaudryina subcylindrica* Nuttall, 1928
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Magn. 50 x; No: 10333.

Plate VIII

Fig. 1 *Rhizammina* cf. *indivisa* Brady, 1884
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Magn. 120 x; No: 2152/72.
Fig. 2 *Rhabdammina discreta* Brady, 1881
Lower Eocene; Beloveža Beds — Rača Unit (Giraltovce). Magn. 80 x; No: 3525/72.

Fig. 3 *Rhabdammina discreta* Brady, 1881
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 120 x; No: 9762/75.
Fig. 4 *Rhabdammina linearis* Brady, 1884
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Magn. 80 x; No: 3530/72.
Fig. 5 *Rhabdammina cylindrica* Glaessner, 1937
Middle Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole RK—10, Šuja 117—119 m). Magn. 120 x; No: 4340/75.
Fig. 6 *Rhabdammina cylindrica* Glaessner, 1937
Upper Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole P—16, Závadka nad Hronom 43—44 m). Magn. 120 x; No: 9753/75.

Plate IX

Fig. 1 *Rhabdammina annulata* Grzybowski, 1896
Lower Eocene; Submenilite Beds — Dukla Unit (Ubľa). Magn. 120 x; No: 5277/75.
Fig. 2—4 *Rhabdammina annulata* Grzybowski, 1896
Lower Eocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 120 x; No: 2 — 2171/72; 3 — 2172/73; 4 — 3102/72 (detail from fig. 2).
Fig. 5—6 *Hyperammina rara* nov. sp.
Paleocene; Upper Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 200 x; No: 5 — 5286/75; 6 — 5300/75.

Plate X

Fig. 1—2 *Hyperammina elongata* Brady, 1878
Paleocene; Reed clays — Klippen Belt (Lednické Rovné). Magn. 150 x; No: 1 — 3122/72; 2 — 2153/72.
Fig. 3 *Hyperammina* sp.
Lower Eocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 80 x; No: 9737/75.
Fig. 4 *Dendrophrya excelsa* Grzybowski, 1897
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 120 x; No: 9717/75.
Fig. 5 *Dendrophrya latissima* Grzybowski, 1897
Upper Eocene; Grey-green marls — Inner Carpathian Paleogene (Ľubietova). Magn. 120 x; No: 9732/75.

Plate XI

Fig. 1—2 *Dendrophrya robusta* Grzybowski, 1897
Upper Senonian; Inoceramus Beds — Dukla Unit (The river Výrava). Magn.: fig. 1 — 80 x; 2 — 160 x; No: 1 — 5285/75; 2 — 5274/75.
Fig. 3 *Bathysiphon microrhaphidus* nov. sp.
Upper Eocene; Flysch Beds — Inner Carpathian Paleogene (Hrabkov). Magn. 80 x; No: 4335/75 — Paratype.
Fig. 4 *Bathysiphon microrhaphidus* nov. sp.
Upper Eocene; Flysch Beds — Inner Carpathian Paleogene (Hrabkov). Magn. 80 x; No: 2159/72 — Paratype.
Fig. 5 *Bathysiphon microrhaphidus* nov. sp.
Upper Eocene; Flysch Beds — Inner Carpathian Paleogene (Hrabkov). Magn. 80 x; No: 3103/72 — Paratype.
Fig. 6 *Bathysiphon microrhaphidus* nov. sp.
Upper Eocene; Flysch Beds — Inner Carpathian Paleogene (Hrabkov). Magn. 200 x; No: 2164/72 — Paratype.

Plate XII

Fig. 1—2 *Bathysiphon microrhaphidus* nov. sp.
Flysch Beds — Inner Carpathian Paleogene (Hrabkov). Magn.: fig. 1 — 80 x; 2 — 150 x; No: 3523/72 — Paratype.
Fig. 3—4 *Bathysiphon microrhaphidus* nov. sp.
Upper Eocene; Flysch Beds — Inner Carpathian Paleogene (Hrabkov). Magn.: fig. 3 — 300 x; 4 — 80 x; No: 3524/72 — Paratype.

Plate XIII

Fig. 1—4 *?Thurammina* sp.
Middle Eocene; Lacko marls — Bystrica Unit (Kochanovce); Magn.: fig. 1,2 — 120; 3,4 — 350 x; No: 1 — 3099/72; 2 — 2166/72; 3 — 2165/72; 4 — 3104/72.
Fig. 5 *Crithionina moravica* Pokorný, 1953
Middle Eocene; Reed clays — Bystrica Unit (Giraltovce). Magn. 50 x (Photographs taken under optical microscope in translucent medium).

Plate XIV

Fig. 1—2 *Saccammina placenta* (Grzybowski)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn.: fig. 1 — 80 x; 2 — 250 x; No: 1 — 3119/72; 2 — 3120/72.
Fig. 3—4 *Hormosina ovulum gigantea* Geroch, 1960
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn.: fig. 3 — 80 x; 4 — 250 x; No: 3 — 3105/72; 4 — 3107/72.
Fig. 5—6 *Saccammina placenta* (Grzybowski, 1897)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn.: fig. 5 — 80 x; 6 — 500 x; No: 5 — 2157/72; 6 — 2158/72.

Plate XV

Fig. 1 *Ammolagena clavata* (Jones et Parker, 1860) and *Rhabdammina discreta* Brady, 1881
Middle Eocene; Strihov Beds — Kochanovce Unit (Kobylnica). Magn. 80 x; No: 3522/72.
Fig. 2 *Kalamopsis grzybowskii* (Dylążanka, 1901)
Paleocene; Proč Beds — Paleogene of the Klippen Belt (Skrabské). Magn. 100 x; No: 9724/75.
Fig. 3 *Kalamopsis grzybowski* (Dylążanka, 1901)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 80 x; No: 3520/72.
Fig. 4—5 *Nodellum velacoense* (Cushman, 1926)
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 150 x; No: 4 — 9763/75; 5 — 9805/75.
Fig. 6 *Hormosina excelsa* (Dylążanka, 1901)
Upper Senonian; Reed marls — Klippen Belt (Zázrivá). Magn. 80 x; No: 9765/75.

Plate XVI

Fig. 1—2 *Hormosina excelsa* (Dylążanka, 1901)
Upper Senonian — Paleocene; Lower Inoceramus Beds (Medzilaborce). Magn.: fig. 1 — 150 x; 2 — 80 x; No: 1 — 2168/72, 2 — 2167/72.

Fig. 3—4 *Hormosina ovuloides* (Grzybowski, 1901)
Paleocene; Proč Beds — Paleogene of the Klippen Belt (Skrabské). Magn.: fig. 3 — 80 x; 4 — 250 x; No: 3 — 3527/72, 4 — 3531/72.
Fig. 5 *Hormosina ovulum ovulum* (Grzybowski, 1896)
Upper Senonian; Reed marls — Klippen Belt. Magn. 150 x; No: 9775/75.

Plate XVII

Fig. 1—3 *Hormosina ovulum ovulum* (Grzybowski, 1896)
Lower Paleocene; Reed clays — Klippen Belt (Lednické Rovné). Magn.: fig. 1,3 — 150 x; 2 — 330 x; No: 1 — 3112/72, 2 — 3113/72, 3 — 2176/72.
Fig. 4—6 *Hormosina ovulum ovulum* (Grzybowski, 1896)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn.: fig. 4 — 360 x; 5 — 180 x; 6 — 750 x; No: 4 — 3106/72, 5 — 2154/72, 6 — 2155/72.

Plate XVIII

Fig. 1—2 *Hormosina ovulum ovulum* (Grzybowski, 1896)
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 300 x; No: 1 — 9789/75, 2 — 9790/75.
Fig. 3—4 *Hormosina ovulum ovulum* (Grzybowski, 1896)
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn.: fig. 3 — 200 x; 4 — 300 x; No: 9785/75.
Fig. 5—6 *Hormosina ovulum gigantea* Geroch, 1960
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. fig. 5 — 150 x; 6 — 110 x; No: 9770/75.

Plate XIX

Fig. 1—3 *Hormosina ovulum gigantea* Geroch, 1960
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. fig. 1 — 200 x; 2 — 600 x; 3 — 700 x; No: 1 — 9792/75, 2 — 9794/75, 3 — 9793/75 (fig. 2—3 detail from fig. 1).
Fig. 4 *Reophax scalaria* Grzybowski, 1896
Lower Eocene; Beloveža Beds — Rača Unit (Beloveža). Magn. 80 x; No: 3295/75.
Fig. 5 *Reophax splendidus* Grzybowski, 1896
Lower Eocene; Strihov Beds — Kochanovce Unit (Kobylnica). Magn. 80 x. No: 3519/72.
Fig. 6 *Reophax subnodulosus* Grzybowski, 1897
Paleocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 120 x; No: 3518/72.

Plate XX

Fig. 1—3 *Reophax* sp.
Paleocene; Submenilite Beds — Dukla Unit (Stakčín). Magn. 100 x; No: 1 — 9746/75, 2 — 9744/75, 3 — 9745/75.
Fig. 4—5 *Ammodiscus glabratus* Cushman et Jarvis, 1928
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 120 x; No: 4 — 9780/75, 5 — 9779/75.

Fig. 6—7 *Ammodiscus glabratus* Cushman et Jarvis, 1928
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 200 x; No: 6 — 9782/75, 7 — 9781/75.

Plate XXI

Fig. 1—2 *Ammodiscus latus* Grzybowski, 1897
Middle Eocene; Reed clays — Paleogene of the Klippen Belt (Inovec). Magn.: fig. 1 — 150 x; 2 — 600 x; No: 1 — 5268/75, 2 — 5269/75 (detail from fig. 1).
Fig. 3 *Glomospirella biedai* nov. sp.
Middle Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole RK—10, Šuja 5—7 m). Magn. 120 x; No: 4342/75 — Paratypy.
Fig. 4—6 *Glomospirella gorayskii* (Grzybowski, 1897)
Lower Eocene; Beloveža Beds — Rača Unit (Beloveža). Magn. 200 x; No: 4 — 5294/75, 5 — 5301/75, 6 — 2288/72.

Plate XXII

Fig. 1—3 *Glomospirella gorayskii* (Grzybowski, 1897)
Lower Eocene; Beloveža Beds — Rača Unit (Beloveža). Magn. fig. 1—2 — 120 x; 3 — 360 x; No: 1 — 3108/72, 2 — 2156/72, 3 — 3109/72.
Fig. 4—5 *Glomospirella serpens* (Grzybowski, 1897)
Lower Eocene; Beloveža Beds — Rača Unit (Ubľa). Magn. 150 x; No: 4 — 5273/75, 5 — 5272/75.

Plate XXIII

Fig. 1—2 *Glomospira glomerata* (Grzybowski, 1897)
Lower Eocene; Beloveža Beds — Rača Unit (Beloveža). Magn.: fig. 1 — 150 x; 2 — 600 x; No: 1 — 2161/72, 2 — 2163/72.
Fig. 3—4 *Glomospira diffundens* Cushman et Renz, 1946
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 150 x; No: 1 — 9711/7 2 — 9729/75.
Fig. 5—6 *Glomospira charoides* (Jones et Parker, 1860)
Middle Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole RK—10, Šuja 5—7 m). Magn. 150 x; No: 5 — 4338/75, 6 — 4337/75.

Plate XXIV

Fig. 1 *Glomospira charoides* (Jones et Parker, 1860)
Upper Sennonian; Reed clays — Magura Unit (Zázrivá). Magn. 150 x; No: 9773/75.
Fig. 2 *Rzehakina inclusa* (Grzybowski, 1901)
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 120 x; No: 5271/75.
Fig. 3—4 *Rzehakina fissistomata* (Grzybowski, 1901)
Paleocene; ? Cisna Beds — Dukla Unit (Topoľa). Magn. 120 x; No: 3 — 5304/75, 4 — 5289/75.
Fig. 5—6 *Rzehakina epigona* (Rzehak, 1895)
Paleocene; Upper Inoceramus Beds — Dukla Unit (Smilno Inlier — Kurimka). Magn. 120 x; No: 5 — 5290/75, 6 — 5302/75.

Plate XXV

Fig. 1—2 *Trochamminoides coronatus* (Brady, 1879)
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 120 x; No: 1 — 9720/75, 2 — 9715/75.
Fig. 3—4 *Trochamminoides coronatus* (Brady, 1879)
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 120 x; No: 3 — 9719/75, 4 — 9722/75.
Fig. 5—6 *Trochamminoides dubius* (Grzybowski, 1901)
Lower Eocene; Beloveža Beds — Rača Unit (Beloveža). Magn. 120 x; No: 5 — 5287/75, 6 — 5298/75.

Plate XXVI

Fig. 1—2 *Trochamminoides heteromorphus* (Grzybowski, 1897)
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 100 x; No: 1 — 9723/75, 2 — 9743/75.
Fig. 3 *Trochamminoides irregularis* White, 1928
Upper Senonian — Paleocene; Lower Inoceramus Beds — Dukla Unit (Medzilaborce). Magn. 70 x; No: 2196/72.
Fig. 4 *Trochammina deformis* Grzybowski, 1897
Middle Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole RK—22, Rajec 211—212 m). Magn. 150 x; No: 4336/75.
Fig. 5—6 *Trochammina lamella* Grzybowski, 1897
Middle Eocene; Basal transgresive lithofacies of the Inner Carpathian Paleogene (borehole RK—22, Rajec 1063—1064 m). Magn. 150 x; No: 5 — 5276/75.

Plate XXVII

Fig. 1 *Trochammina quadriloba* (Grzybowski, 1896)
Middle Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole RK—22, Rajec 211—212 m). Magn. 150 x.
Fig. 2 *Cystammina pauciloculata* (Brady, 1879)
Lower Eocene; Beloveža Beds — Bystrica Unit (Čertižné). Magn. 200 x; No: 3528/72.
Fig. 3 *Thalmannammina subturbinata* (Grzybowski, 1897)
Paleocene; Reed marls — Paleogene of the Klippen Belt (Žilina). Magn. 200 x; No: 5299/75.
Fig. 4—6 *Recurvoides nucleolus* (Grzybowski, 1897)
Lower Eocene; Beloveža Beds — Rača Unit (Beloveža). Magn. 120 x; No: 4 — 5293/75, 5 — 5291/75, 6 — 5292/75.

Plate XXVIII

Fig. 1 *Trochammina boehmi* Franke, 1928
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn. 80 x; No: 5305/75.
Fig. 2—3 *Recurvoides* sp.
Upper Senonian — Lower Inoceramus Beds (Smilno Inlier — Cigľa). Magn.: fig. 2 — 120 x; 3 — 70 x; No: 2—3 — 9754—5/75.
Fig. 4—5 *Haplophragmoides latidorsatus* (Bornemann, 1855)
Upper Priabonian; Inner Carpathian Paleogene (borehole P—8, Ľubietová 27,5 m). Magn. 80 x; No: 4 — 9731, 5 — 9730/75.

Plate XXIX

Fig. 1 *Haplophragmoides horridus* (Grzybowski, 1901)
Middle Eocene; Reed clays — Bystrica Unit (Raslavice). Magn. 80 x; No: 5297/75.
Fig. 2—4 *Haplophragmoides kirki* Wickenden, 1932
Upper Senonian; Reed clays — Magura Unit (Zázrivá). Magn.: fig. 2—3 — 120 x; 4 — 80 x; No: 2 — 9748/75, 3—4 — 9714/75.
Fig. 5—6 *Haplophragmoides walteri* (Grzybowski, 1897)
Middle Eocene; Reed clays — Rača Unit (Bardejov). Magn. 80 x; No: 5 — 3517/72, (fig. 6 — detail from fig. 5 = 3518/72).

Plate XXX

Fig. 1—3 *Cyclammina amplectens* Grzybowski, 1897
Middle Eocene; Reed clays — Bystrica Unit (Giraltovec). Magn.: fig. 1—2 — 80 x; No: 1 — 2173/72, 2 — 3118/72 (fig. 2 detail from fig. 1).
Fig. 4 *Vulvulina haerigensis* (Gümbel, 1826)
Middle Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole RK—10, Šuja 117—119 m). Magn. 80 x; No: 9742/75.

Plate XXXI

Fig. 1—2 *Bolivinopsis spectabilis* (Grzybowski, 1897)
Middle Eocene; Reed clays — Paleogene of the Klippen Belt (Inovec). Magn.: fig. 1—2 — 80 x; No: 1 — 5270/75, 2 — 5278/75.
Fig. 3 *Textularia calix* Grzybowski, 1896
Paleocene; Proč Beds — Paleogene of the Klippen Belt (borehole V—6, Skrabské 10 m). Magn. 80 x; No: 9751/75.
Fig. 4 *Cycloculina* sp.
Lutetian; Basal transgresive Lithofacies of the Inner Carpathian Paleogene (Bojnice). Magn. 80 x; No: 9757/75.

Plate XXXII

Fig. 1 *Plectina conversa* (Grzybowski, 1901)
Middle Eocene; Flysch Beds — Inner Carpathian Paleogene (borehole RK—10, Šuja 5—7 m). Magn. 120 x; No: 4344/75.
Fig. 2 *Plectina conversa* (Grzybowski, 1901)
Middle Eocene; Basal transgresive Lithofacies of the Inner Carpathian Paleogene (borehole RK—22, Rajec 221—222 m). Magn. 120 x; No: 9740/75.
Fig. 3 *Karreriella (Karrerulina) coniformis* (Grzybowski, 1897)
Upper Senonian; Reed marls — Magura Unit (Zázrivá). Magn. 120 x; No: 9718/75.
Fig. 4—5 *Tritaxia alpina* (Cushman, 1936)
Middle Eocene; Basal transgresive Lithofacies of the Inner Carpathian Paleogene (Bojnice). Magn. 80 x; No: 4 — 9749/75, 5 — 9750/75.

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Jozef Salaj — Ondrej Samuel

A propos du Cénomanien supérieur — Turonien de la zone des Klippes des Carpates occidentales slovaques

Project
MID-CRETACEOUS EVENTS

14 planches (XXXIII—XLVI), résumé slovaque

Résumé. Dans la plupart de la zone des Klippes le Turonien est représenté par le faciès de „couches rouges" et par places dans le Turonien supérieur aussi par le faciès flyschoide. Le faciès de couches rouges présente un faciès très profond de la Téthys. A côté des foraminifères planctoniques nous notons la présence des Radiolaires et des foraminifères benthiques agglutinées. Dans la partie supérieure de la zone à *Helvetoglobotruncana helvetica* on a constaté la présence de la sous-zone à *Globotruncana sigali*. *Praeglobotruncana fusani* n. sp. du Turonien moyen représente une forme intermédiaire entre *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj) et Globotruncana turona sigali Reichel.

Introduction

Le Cénomanien supérieur et le Turonien des Carpates occidentales ont été subdivisés par J. Salaj et O. Samuel (1966).

Le sommet de la zone à *Rotalipora* ex gr. *cushmani* ainsi que la zone à *Praeglobotruncana imbricata* correspondent au Turonien inférieur. La zone à *Praeglobotruncana helvetica* avec la sous-zone à *Praeglobotruncana oraviensis trigona* et la sous-zone à *Praeglobotruncana biconvexa biconvexa* correspondent au Turonien moyen et à la base du Turonien supérieur; et enfin la zone à *Globotruncana schneegansi* correspond au Turonien supérieur.

Stratigraphie

Tenant compte du progrès dans la phylogénie des foraminifères planctoniques au cours des dix dernières années nous complétons la microbiostratigraphie du Cénomanien et du Turonien de façon suivante:

a) La partie supérieure du Cénomanien moyen — la partie

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inférieure du Turonien inférieur sont caracterisées par la zone à *Rotalipora* ex gr. *cushmani* définie par J. Salaj et O. Samuel (1966) et correspondent bien à la zone à *Rotalipora cushmani* de A. M. Borsetti (1962). En se basant sur le principe taxinomique appuyé sur la phylogénie nous avons considéré *Rotalipora montsalvensis* (Mornod) et *Rotalipora turonica* Brotzen non seulement somme sous-espèces de *Rotalipora cushmani cushmani* mais aussi comme les fossiles index de sous-zones du même nom. En se basant sur les résultats d'une étude phylogénetique du genre *Rotalipora Brotzen* 1942 il est évident qu'il s'agit de trois lignes évolutives indépendantes (cf. J. Salaj 1970):

1. *Rotalipora bicarinata* (avec syn.: *Pseudoticinella biconvexa* Longoria) → *Rotalipora montsalvensis* (Mornod)
2. *Rotalipora evoluta* (Sigal) → *Rotalipora cushmani* (Morrow)
3. *Rotalipora globotruncanoides* → *Rotalipora turonica* Brotzen

Ces résultats ont éte prouvés non seulement par un excellent matériel provenant d'hypostratotype du Cénomanien en Tunisie, mais nous avons pu constater la même chose aussi dans les Carpates occidentales de la Slovaquie.

Notons cependant que *Rotalipora montsalvensis* (Mornod) ainsi que *Rotalipora cushmani* (Morrow) font leur apparition en même temps.

C'est pour cette raison que dans les Carpates occidentales nous proposons d'utiliser la zone à *Rotalipora cushmani* au lieu de la zone à *Rotalipora* ex. gr. *cushmani* et dans le cas de la subdivision plus detaillé nous proposons d'y distinguer:

a) la sous-zone (ou bien la zone) à *Rotalipora montsalvensis* dont la base serait définie par l' apparition de *Rotalipora montsalvensis* (Mornod) et *Rotalipora cushmani* (Morrow) et le sommet par l'apparition de *Rotalipora turonica Brotzen*. Cette sous-zone est caracterisée aussi par l'extrême richesse des Radiolaires (cf. J. Salaj 1961, p. 87 et 92).

b) la sous-zone (on bien la zone) à *Rotalipora turonica* dont la limite inférieure serait définie par l'apparition de *Rotalipora turonica* Brotzen tandis que la limite supérieure serait définie par l'apparition de *Praeglobotruncana imbricata* (Mornod). Notons cependant que, p. ex., dans le Sillon tunisien (l'hypostratotype du Turonien-Fgira Salah près de Pont du Fahs) où le faciès des couches rouges est inexistant, la limite supérieure de cette sous-zone est fixée en plus aussi par l'apparition de *Rotundina cretacea* (d'Orbigny).

Sur le stratotype du Turonien (cf. J. P. Bellier 1971) ainsi que sur le néotype du Cénomanien (J. Marks 1976; J. Salaj 1974) on ne peut pas établir la limite entre la zone à *Rotalipora cushmani* s. l. et la zone à *Rotundina cretacea — Praeglobotruncana imbricata.*

b) Turonien inférieur. La partie supérieure du Turonien inférieur dans les Carpates occidentales est définie par la zone à *Praeglobotruncana inbricata.* Dans l'association microfaunique de cette zone on trouve *Helvetoglobotruncana praehelvetica* (Trujillo), *Praeglobotruncana hagni* Scheibnerová et *Rugloglobigerina hoelzli* Hagn et Zeil, associée aussi aux Radiolaires et

des foraminifères benthiques aglutineés. représentées surtout par l'espèce *Uvigerinammina jankoi* Majzon bien connue aussi dans le Crétacé supérieur de la zone des Klippes en Pologne (cf. S. Geroch 1957).

En ce qui concerne la composition de l'association des foraminifères planctoniques de cette zone, nous constatons qu'elle est la même, que dans les Alpes (alle a été décrite pour la première fois par H. Hagn et W. Zeil (1954) ainsi qu'en Californie, ou elle a été réconnue par R. G. Douglas (1969). Ce dernier auteur l'a nommée comme la zone à *Globotruncana roddai* dont le fossile index *Globotruncana roddai* (Marianos et Zingula) nous considérons comme synonyme de *Praeglobotruncana hagni* Scheibnerová (cf. aussi R. G. Douglas 1969, p. 135).

Cette association microfaunistique se diffère de celle des régions bordant la Téthys au Nord ainsi qu'au Sud. Il s'agit de la zone à *Rotundina cretacea — Praeglobotruncana imbricata* (cf. J. Salaj 1970, 1972; J.-M. Massin et J. Salaj 1970) reconnue même dans le stratotype du Turonien (cf. J.-P. Bellier 1971).

Cette différentiation microfaunistique comme consénquence de la différentiation paléogeographique, ainsi que paléoclimatique (le réfroidissement général a causé la mort des biotopes des thalmanninelles et rotalipores; cf. J. Salaj 1974) ainsi que l' adaptation immédiate de *Rotundina cretacea* (d'Orbigny) a permis de former une nouvelle espéce d'*Helvetoglobotrucana praehelvetica* (Trujillo); l'espèce très semblable à *Helvetoglobotruncana helvetica* (Bolli). Présenté de ce point de vue nous pouvons mieux comprendre que par exemple dans la Californie et dans le Mexique la zone à *Helvetoglobotruncana helvetica* peut être developpée immédiatement au dessus de la zone à *Rotalipora cushmani* comme c'était récemment publié par E. J. Pessagno (1969).

Il faut tenir compte de cette différentiation paléogéographique également dans la stratigraphie baseé, p. ex., sur les nannofossiles et surtout dans leur corrélation avec les foraminifères planctoniques. Récemment H. Manivit (1971), n'a pas tenu compte d'une zone existante, c'est à dire de la zone à *Rotundina cretacea — Praeglobotruncana imbricata*. En regardant son tableau nous pouvons voir qu'immédiatement au dessus de la zone à *Rotalipora cushmani* elle a établi la zone à *Helvetoglobotruncana helvetica*.

c) Turonien moyen — base du Turonien supérieur. Dans les Carpates occidentales en accord avec V. Schneibnerová (1958) nous avons établi pour la zone à *Globotruncana helvetica* du *Sigal* (1952, p. 38) du Turonien moyen et la partie basale du Turonien supérieur, le nom de la zone à *Praeglobotruncana helvetica*. Par contre dans le Sillon tunisien cette zone a été dénommée (J. Salaj 1970) comme la zone à *Helvetoglobotruncana helvetica* dont le fossile index ainsi que le genre *Helvetoglobotruncana* Reiss, 1957 a été emendé par l'un de nous (J. Salaj 1972).

Après avoir fait la révision du matériel des Carpates occidentales, lequels nous avons eu à notre disposition, nous avons retrouvé chez „notre" *Praeglo-*

botruncana helvetica (Bolli) deux faibles carènes pustuleuses caractérisent le genre *Helvetoglobotruncana* Reiss, emend. Salaj 1972; donc en conséquence nous acceponts cette dénomination de la zone à *Praeglobotruncana helvetica* comme la zone à *Helvetoglobotruncana helvetica* aussi pour les Carpates occidentales. Elle est comprise dans le sens de la définition originelle de J. Sigal (1952, 1955) et du F. Dalbiez (1955).

Dans la partie occidentale de la zone des Klippes dans le Turonien moyen et supérieur à côte du faciès des „couches rouges" on a constaté aussi la présence du faciès flyschoïde contenant par places les niveaux conglomératiques (cf. J. Salaj et O. Samuel 1966). Par contre dans la partie orientale de la zone des Klippes (les Pienines y comprises) le faciès des couches rouges (les marnes de Púchov) prédomine presque en totalité sur le faciès flyschoïde lequel est ici développé plutôt rudimentairement et sans conglomérats. Les intercalations des marnes rougeâtres y sont abondantes. Nous le considerons comme un faciès très profond parce que nous y constatons la présences des radiolaires, représentés surtout par les espèces: *Dictyomitza malleola* Aliev, *Spongodiscacea* et *Melitosphaera sphaeroconus* Rust ainsi que par la présence des foraminifères benthiques aglutinés avec la prédominance d' *Uvigerinammina jankói* Majzon. Notons que par places on ne trouve que les niveaux à Radiolaires.

En ce qui concerne l' *Helvetoglobotruncana helvetica* Bolli de fossile-index de la même zone nous savons bien qu'elle n'a pas été trouvée dans le Turonien type de la Tourraine (J.-P. Bellier, 1971) qui représentant une coupe plutôt typique pour la biogéoprovince boréale. Dans cette biogéoprovince *Helvetoglobotruncana helvetica* Bolli est presque inexistante. On ne peut expliquer sa présence dans certaines régions boréales que par la penétration des régions de la Téthys par l'intermédiaire des courants d'eaux chaudes. En plus notons que la subdivision detaillée de la zone à *Helvetoglobotruncana helvetica* dans la biogéoprovince boréale n'a pas été realisée à cause de l'absence totale de *Praeglobotruncana biconvexa* (Samuel et Salaj) et *Globotruncana sigali* Reichel. En ce qui concerne l'espèce *Praeglobotruncana oraviensis* Scheibnerová elle a été trouvée en Pologne (cf. E. Gawor — Biedowa 1972).

La zone à *Helvetoglobotruncana helvetica* sur l'hypostratotype (Dj. Fgira Salah près de Pont du Fahs) ainsi que sur le parahypostratotype du Turonien (Djebel Abid près d'Enfidaville) a été subdivisée (cf. J. Salaj 1972, 1974) en trois sous-zones à savoir:

1. le sous-zone a *Praeglobotruncana oraviensis trigona* (= la partie inférieure de la zone à *Helvetoglobotruncana helvetica*)

2. la sous-zone à *Praeglobotruncana biconvexa* (= la partie moyenne de la zone à *Helvetoglobotruncana helvetica*)

3. la sous-zone à *Globotruncana turona* (= la partie supérieure de la zone à *Helvetoglobotruncana helvetica*).

1. La sous-zone à *Praeglobotruncana oraviensis trigona*. Les deux premiè-

res sous-zones du Turonien moyen ont été originallement définies dans les Carpates occidentales par J. Salaj et O. Samuel (1966). Bien que la première sous-zone ait été définie comme la sous-zone à *Praeglobotruncana oraviensis trigona*, nous préférons d'en parler simplement comme de la sous-zone à *Praeglobotruncana oraviensis* dont les espèces *Praeglobotruncana oraviensis oraviensis* Scheibnerová et *Praeglobotruncana oraviensis trigona* Scheibnerová sont fossiles-index. *Praeglobotruncana oraviensis trigona* Scheibnerová est plutôt rare. La base de cette sous-zone est définie par l'apparition de *Helvetoglobotruncana helvetica* (Bolli) et *Praeglobotruncana oraviensis trigona* Scheibnerová tandis que le sommet de cette sous-zone est fixé par l'apparition de *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj) et *Praeglobotruncana biconvexa gigantea* (Samuel et Salaj). Dans cette sous-zone notons encore l'abondance des espèces *Praeglobotruncana imbricata* (Mornod) et *Praeglobotruncana hagni* Scheibnerová.

Remarque: Nous ne sommes pas d' accord avec l'oppinion de P. Donze, B. Porthauld, G. Thomel et O. Villoutreys (1970, p. 70—71) que la *Praeglobotruncana hagni* Scheibnerová est synonyme de *Praeglobotruncana (Dicarinella) indica* (Jacob et Sastri). En plus l'un de nous (J. S.) a eu de l'occasion de voir à Tunis *Praeglobotruncana indica* (Jacob et Sastri) provenant de la localité-type de la collection de Mme V. Scheibnerová. Ces exemplaires sont identiques avec *Praeglobotruncana indica* (Jacob et Sastri) retrouvé aussi dans l'*hypostratotype* du Cénomanien. Cette espèce s' est développée successivement de la ligne évolutive: *Praeglobotruncana delrioensis* (Plummer) → *Praeglobotruncana marginaculeata* (Loeblich et Tappan) → *Praeglobotruncana indica* (Jacob et Sastri) dans le Cénomanien, et elle est déjà inexistante dans le Turonien, où nous avons par contre *Praeglobotruncana hagni* Scheibnerová qui s'est développée de *Praeglobotruncana imbricata* (Mornod).

Les espèces du genre *Praeglobotruncana* Bermúdez 1952 du Cénomanien sont au point de vue phylogénetique étroitement liées avec celles du Turonien. Nous sommes persuadés que le sous-genre *Praeglobotruncana (Dicarinella)* Donze, Porthault, Thomel et O. Villoutreys 1970 dont l' espèce type *Globotruncana indica* (Jacob et Sastri) provient de *Praeglobotruncana marginaculeata* (Loeblich et Tappan). Elle e peut pas être suffisemment caractéristique comme éspèce-type pour un nouveau sous-genre et en plus le genre *Praeglobotruncana Bermúdez* 1952 est bien établi pour toutes les formes bicarenées provenant du Cénomanien et du Turonien.

2. La sous-zone à *Praeglobotruncana biconvexa* dont la limite inférieure a été définie par l'apparition de *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj) et de *Praeglobotruncana biconvexa gigantea* (Samuel et Salaj) tandis que la limite supérieure est ici comprise dans le sens de la définiton de J. Salaj (1972), c'est à dire par l'apparition de *Globotruncana turona turona* (Olbertz) et de *Globotruncana turona sigali* Reichel.

Notons dans cette zone non seulement la présence des Radiolaires et des

foraminifères aglutinées mais aussi la présence de *Praeglobotruncana hagni* Scheibnerová et de *Praeglobotruncana ex* gr. *oraviensis* Scheibnerová.

Il faut noter qu'il est mentionné parfois dans la bibliographie que *Praeglobotruncana biconvexa* (Samuel et Salaj) a apparu avant la base de la zone à *Helvetoglobotruncana helvetica* (cf. G. Tronchetti 1971). *Praeglobotruncana biconvexa* (Samuel et Salaj) peut être confuse avec *Praeglobotruncana hagni* Scheibnerová. Ces deux espèces se ressemblent beaucoup, mais elles se diffèrent par la morphologie du côte ventral er surtout par la morphologie de la dernière loge. Soulignons que l'apparition de *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj) et de *Praeglobotruncana biconvexa gigantea* (Samuel et Salaj) s'est faite plus tard, donc après l'apparition de *Praeglobotruncana hagni* Scheibnerová ainsi qu' après l'apparition de *Helvetoglobotruncana helvetica* (Bolli).

3. La sous-zone à *Globotruncana turona* reconnue dans l'hypostratotype ainsi que dans le parahypostratotype du Turonien (J. Salaj 1972, 1974) a été originellement définie comme la zone à *Globotruncana sigali* (cf. E. A. Pessagno 1969; R. G. Douglas 1969; F. T. Barr et O. S. Hammuda 1971).

Après avoir fait la révision du matériel nous pouvons bien distinguer également dans les Carpates occidentales cette sous-zone et la séparer de la partie supérieure de la sous-zone à *Praeglobotruncana biconvexa* de J. Salaj et O. Samuel (1966).

La base de la sous-zone à *Globotruncana turona* est définie par l'apparition de *Globotruncana turona turona* (Olbertz) et de *Globotruncana turona sigali* Reichel, tandis que le sommet est défini par l'apparition de *Globotruncana angusticarinata* Gandolfi et de *Globotruncana concavata* (Brotzen) prise dans le sens de J. Salaj et O. Samuel (1966).

Il faut souligner qu'en Tunisie ainsi que dans les Carpates occidentales l'espèce de *Globotruncana turona turona* (Olbertz) et de *Globotruncana turona sigali* Reichel strictement unicarénées ont apparu dans la partie supérieure de la zone à *Helvetoglobotruncana helvetica*.

Notons cependant que dans la sous-zone à *Praeglobotruncana biconvexa* de la coupe-type du Turonien (loc.: Dj. Fgira Salah) proposé comme l'hypostratotype ainsi que le stratotype pour la biogéoprovince de la Téthys (cf. J. Salaj 1974) nous avons trouvé dans le matériel bien conservé même dans les Carpates occidentales les formes intermédiaires entre l'espèce de *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj) et de *Globotruncana turona sigali* Reichel. Nous proposons de les appeler comme *Praeglobotruncana fusani* n. sp. Cette forme intermédiaire nous permet d' éclaircir l'origine d'un groupe des *Globotruncanes unicarénées* du Turoenien dont la ligne évolutive est la suivante:

1. *Praeglobotruncana hagni* Scheibnerová → *Praeglobotruncana algeriana* Caron

2. *Praeglobotruncana hagni* Schneibnerová → *Praeglobotruncana bicon-*

vexa (Samuel et Salaj) → *Praeglobotruncana fusani* n. sp. → *Globotruncana turona sigali* Reichel → *Globotruncana marianosi* Douglas.

La zone planctonique de Helvetoglobotruncana helvetica correspond à la zone benthique à Globorotalites hangensis bien dévelopée et retrouvée seulement dans la partie occidentale de la zone des Klippes. Cette zone originellement définie par N. N. Vassilenko (1961) a été reconnue dans le Turonien inférieur de Mangyschlak.

d) Turonien supérieur. Dans la partie occidentale de la zone des Klippes le Turonien supérieur est représenté surtout par le faciès flyschoïde et par places aussi par les conglomérats qui ne sont pas présents dans la partie orientale de la zone des Klippes. Les intercalations des marnes rougeâtres sont présentes dans le faciès flyschoïde.

En ce qui concerne le contenu microfaunistique du Turonien supérieur il est représenté par la zone à *Globotruncana schneegansi* définie par F. Dalbiez (1955) et dénommée comme la zone à *Marginotruncana schneegansi* (J. Salaj 1974). Elle est comprise ici aussi dans ce sens. La limite inférieure est définie par l'apparition de *Marginotruncana schneegansi* (Sigal) emend. Salaj 1974 tandis que la limite supérieure est fixé par l'apparition de *Globotruncana angusticarinata* Gandolfi. L'association des foraminifères de cette zone est caracterisée par les espèces suivantes: *Marginotruncana schneegansi* Sigal emend. Salaj, *Globotruncana schneegansi* Sigal, emend. Caron dont l'origine est de *Praeglobotruncana imbricata* (Mornod) (cf. J. Salaj 1974), *Globotruncana coldreriensis* Gandolfi, *Triplasia murchisoni* Reuss, *Tritaxia pyramidata* Reuss, *Gaudryina subserrata* Vassilenko, *Stensioeina praeexculpta* (Keller), *Stensioeina pokornyi* Scheibnerová, *Anomalina* (*Valvulineria*) *moniliformis* (Reuss), *Gaudryina pyramidata* Cushman, *Spiroplectammina praelonga* Reuss, *Tappannina costifera* Cushman, *Tappannina eouvigeriniformis* (Keller) et *Eouvigerina serrata* (Chapman).

En ce qui cencerne l'espèce *Globotruncana renzi* Gandolfi (la forme plano-convexe a été designée comme type de cette espèce par J. Salaj et O. Samuel (1966), par E. A. Pessagno (1967) et par P. Donze, D. Porthault, G. Thomel et O. de Villoutreys (1970). Il faut ajouter que cette espèce n'existe pas dans le Turonien supérieur comme nous l'avons constaté (J. Salaj et O. Samuel 1966) mais elle se trouve seulement dans sa partie sommitale et surtout dans le Coniacien. Ici elle est associée à *Globotruncana angusticarinata* Gandolfi comme cela a été bien prouvé sur l'hypostratotype du Coniacien dont la base est datée par les Echinides.

Dans les régions types la limite entre le Turonien et le Coniacien ne peut pas être établie, parce que le Turonien supérieur de Tourrains est sous faciès très néritique et sans fossiles caractéristiques (cf. J.-P. Bellier 1971; P. Donze, B. Porthault, G. Thomel et O. de Villoutreys 1970) et de plus il comporte des interruptions de sédimentation avec formation de „hard-grounds" (G. Lecointre 1959) et en ce qui concerne le Coniacien de Cognac une limite

d'érosion le sépare des termes sous-jacents (cf. P. Donze, B. Porthault, G. Thomel et O. de Villoutreys 1970, p. 94).

C'est pour cette raison que nous avons fixée la limite entre le Turonien et le Coniacien dans les Carpates occidentales en se basant sur les résultats stratigraphique obtenus sur les hypostratotypes du Turonien et du Coniacien, représentant les coupes types pour la région de la Téthys.

Notons cependant que dans le Coniacien inférieur des Carpates occidentales nous avons trouvé aussi *Globotruncana coronata* Bolli ainsi que *Globotruncana tarfayensis* (Lehman) et *Globotruncana sinuosa* Donze, Porthault, Thomel et Villoutreys. Ces deux dernières espèces ayant l'origine dans *Globotruncana schneegansi* Sigal, 1952 amend. Caron 1974 nous ne pouvons admettre qu' elles soient placées dans le genre *Marginotruncana* Hofker 1957, emend. Pessagno 1969, emend. Donze, Porthault, Thomel et Villoutreys 1970, étant donné que *Globotruncana schneegansi* Sigal emend. Caron a l'origine dans *Praeglobotruncana imbricata* Mornod. Donc pour le groupe des espèces de „Globotruncana" du Coniacien — Santonien ayant l'origine dans *Globotruncana schneegansi* Sigal, emend. Caron, il y a un nouveau genre à envisager: on peut faire cela plus tard quand l'origine de toutes les espèces de *Globotruncana* Cushman, 1927 sera éclaircie.

Systématique

gengre *Praeglobotruncana* Bermúdez 1952

Praeglobotruncana fusani n. sp.

Planche XXXIV, fig. 4—6

L'espèce-type: elle est figurée sur la planche XXXIV, fig. 4—6 et se trouve dans la collection de l'Institut Géologique Dionýz Štúr à Bratislava.

Derivatio nominis: En l'honneur de Monsieur le Directeur de L'Institut Géologique Dionýz Štúr, Dr. O. Fusán.

Stratum typicum: Les marnes provenant des alternances de marnes et de calcaires de l'hypostratotype du Turonien. Le sommet de la sous-zone à *Praeglobotruncana biconvexa.*

Locus typicus: Djebel Fgira Salah près de Pont du Fahs, Tunisie, échant. N° 132 h.

Matériel: 5 exemplaires de coupe du Djebel Fgira Salah et 3 exemplaires du Turonien moyen de la sous-zone à *Praeglobotruncana biconvexa* de la coupe de Beňatína de la Slovaquie orientale, mais les secondes ne sont pas typiques, étant donné qu'elles sont encore assez proche de l'espèce de *Praeglobotruncana biconvexa* (Samuel & Salaj).

Diagnose: forme intermédiaire entre la *Praeglobotruncana biconvexa biconvexa* (Samuel & Salaj) et la *Globotruncana sigali* Reichel. Les premiers trois chambres du dernier tour ont deux carènes, tandis que les derniers trois-quatres chambres du dernier tour sont unicarénées.

Description: test calcaire, grand et biconvexe. Sur le côté spiral il y a de 2,5 à 3 tours avec 6—7 chambres à chaque tour. Les trois premières chambres du dernier tour possèdent deux carènes pustuleuses et elles sont assez raprochées, tandis que les 3—4 dernières chambres dans le dernier tour sont seulement et clairement unicarénées. L'ouverture intériomarginale forme une fissure à la base de la dernière chambre.

Les dimensions: diamètre 0,65—0,80; l'épaisseur 0,35—0,40 mm. L'espèce *Praeglobotruncana fusani* n. sp. présente une forme intermédiaire dans la ligne évolutive entre l'espèce *Praeglobotruncana biconvexa biconvexa* (Samuel — Salaj) et *Globotruncana sigali* Reichel.

La répartition stratigraphique: l'espèce *Praeglobotruncana fusani* n. sp. se trouve dans l'association de foraminifères dans la partie sommitale de la sous-zone à Praeglobotruncana biconvexa (la partie moyenne de la zone à *Helvetoglobotruncana helvetica*) du Turonien moyen de l'hypostratotype du Turonien de Tunisie (= stratotype de la région de Tethys) ainsi que dans le Turonien moyen de la Slovaquie orientale.

Expertise de travail: V. Gašpariková.

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Jozef Salaj — Ondrej Samuel

Poznámky k vrchnému cenomanu — turónu bradlového pásma Západných Karpát

14 tab. (XXXIII—XLVI), resumé francúzskeho textu

Cenoman a turón v bradlovom pásme sú reprezentované hlavne fáciou „couches rouges" a miestami vo vrchnom turóne aj flyšoidnou fáciou. „Couches rouges" v období cenomanu — turónu v karpatskej časti tetýdnej oblasti reprezentovali veľmi hlbokú fáciu. Okrem planktonických foraminifér sa v nej nachádzajú nielen aglutinované foraminifery, ale aj radiolárie.

Stratigrafické členenie cenomanu — turónu je založené na základe planktonických foraminifér, predovšetkým však na ich fylogenetickom vývoji, čo umožňuje spresnenie definícií jednotlivých zón, hlavne vrchného cenomanu a turónu. Pre Západné Karpaty Slovenska ich pôvodne definoval J. Salaj — O. Samuel (1966).

Vrchný cenoman až bazálny turón definuje zóna *Rotalipora cushmanni* s podzónami *Rotalipora montsalvensis* a *Rotalipora turonica*. Vrchná časť spodného turónu je definovaná zónou *Praeglobotruncana imbricata*. Stredný turón a bázu vrchného turónu charakterizuje zóna *Helvetoglobotruncana helvetica* s podzónami: a) podzóna *Praeglobotruncana oraviensis trigona;* b) podzóna *Praeglobotruncana biconvexa;* c) podzóna *Globotruncana turona*, z ktorých posledná novostanovená podzóna je charakterizovaná druhmi *Globotruncana turona turona* (Olbertz) a *Globotruncana turona sigali* Reichel. Tieto druhy sú striktne jednokýlové a objavujú sa po prvý raz v najvrchnejšej časti zóny *Helvetoglobotruncana helvetica*. Literárne údaje o ich výskyte v spodnom turóne, prípadne v bazálnej časti zóny *Helvetoglobotruncana helvetica* sú neopodstatnené, čo potvrdzuje aj tento fylogenetický rad: *Praeglobotruncana hagni* Scheibnerová → *Praeglobotruncana biconvexa biconvexa* (Samuel — Salaj) → *Praeglobotruncana fusani* n. sp. → *Globotruncana turona sigali* Reichel → *Globotruncana marianosi* Douglas.

Novostanovený druh *Praeglobotruncana fusani* n. sp. reprezentujúci prechodnú formu medzi *Praeglobotruncana biconvexa biconvexa a Globotruncana turona sigali* je charakterizovaný redukciou jedného kýlu na posledných 3 komôrkach posledného závitu, ktoré majú už len jeden kýl, kým prvé tri komôrky posledného závitu majú ešte dva kýly, ktoré sú u druhu *Praeglobotruncana biconvexa biconvexa* (Samuel — Salaj) prítomné ešte na všetkých komôrkách.

Vrchný turón je reprezentovaný zónou *Marginotruncana schneegansi*. Jej vrchná hranica, ako aj hranica medzi turónom a koniakom je definovaná objavením druhov: *Globotruncana angusticarinata* Gandolfi, *Globotruncana concavata* (Brotzen) a *Globotruncana cachensis* Douglas.

Explanation de planches XXXIII–XLVI

Planche XXXIII

Fig. 1 *Praeglobotruncana imbricata* (Mornod)
No 25 — Vieska Bezdedov. La sous-zone à *Globotruncana turona turona* du Turonien (100 x); 0301
Fig. 2 *Praeglobotruncana imbricata* (Mornod)
No 25 Vieska Bezdedov (100 x); 0299
Fig. 3 *Praeglobotruncana hagni* Scheibnerová
B–8 Beňatina. La sous-zone à *Praeglobøtruncana biconvexa* du Turonien (80 x); 0779
Fig. 4 *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj) B–8 Beňatina. La localité-type de la sous-zone à *Praeglobotruncana biconvexa* du Turonien (60 x); 0790
Fig. 5 *Praeglobotruncana biconvexa gigantea* (Samuel et Salaj)
B–8 Beňatína. La sous-zone à *Praeglobotruncana biconvexa* du Turonien (60 x); 0799
Fig. 6 *Praeglobotruncana biconvexa gigantea* (Samuel et Salaj)
B–8 Beňatína (90 x); 0800

Planche XXXIV

Fig. 1 *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj)
B–8 Beňatína (70 x); 0803
Fig. 2 *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj)
Forme intermédiaire B–8 Beňatína (70 x); 0804
Fig. 3 *Praeglobotruncana biconvexa biconvexa* (Samuel et Salaj)
Forme intermédiaire, le détail; les deux carènes sont réunies par place à une seule carène (70 x); 0805
Fig. 4 *Praeglobotruncana fusani* n. sp.
l'espèce-type
16-Djebel Abid, la région d'Enfidaville, Tunisie. La sous-zone à *Praeglobotruncana biconvexa* de parahypostratotype du Turonien (70 x); 0754
Fig. 5 *Praeglobotruncana fusani* n. sp.
L'espéce-type
E–16 Djebel Abid, la région d'Enfidaville-détail (250 x); 0755
Fig. 6 *Praeglobotruncana fusani* n. sp.
l'espèce-type
E–16 Djebel Abid, la région d'Enfidaville; 0765

Planche XXXV

Fig. 1 *Globotruncana turona sigali* Reichel
No 25 Vieska Bezdedov. La sous-zone à *Globotruncana turona* du Turonien (100 x); 0266
Fig. 2 *Globotruncana turona sigali* Reichel
Détail — la structure du côte dorsal. No 25 Vieska Bezdedov (300 x); 0267
Fig. 3 *Globotruncana marianosi* Douglas
No 28/60 — Beňatina, la zone à *Marginotruncana schneegansi* du Turonien (75 x); 1476
Fig. 4 *Globotruncana turona sigali* Reichel
No 25 Vieska Bezdedov (75 x); 0295

Fig. 5 *Globotruncana turona sigali* Reichel
No 25 Vieska Bezdedov (90 x); 0268
Fig. 6 *Globotruncana turona turona* (Olbertz)
No 25 Vieska Bezdedov (80 x); 0269

Planche XXXVI

Fig. 1 *Globotruncana turona sigali* Reichel
No 25 Vieska Bezdedov (80 x); 0310
Fig. 2 *Globotruncana turona sigali* Reichel
La structure de la bande carènale; No 25 Vieska Bezdedov (50 x); 0312
Fig. 3 *Globotruncana turona sigali* Reichel
No 25 Vieska Bezdedov (75 x); 0271
Fig. 4 *Praeglobotruncana hagni* Scheibnerová
B 11a—51/59 — Beňatina. Zone à *Praeglobotruncana imbricata du* Turonien (70 x); 1446
Fig. 5 *Schackoina multispinata* (Cushman et Wickenden) B—17 Beňatina. Zone à *Marginotruncana schneegansi* du Turonien (150 x); 2255
Fig. 6 *Schackoina multispinata* (Cushman et Wickenden) B—17 Beňatina. Zone à *Marginotruncana schneegansi* du Turonien supérieur (125 x); 2231

Planche XXXVII

Fig. 1 *Praeglobotruncana hagni* Scheibnerová
11 c — 51/59 Beňatína. Zone à *Praeglobotruncana imbricata* du Turonien inférieur (120 x); 1452
Fig. 2 *Praeglobotruncana hagni* Scheibnerová
11 a — 51/59 Beňatína (300 x); 1454
Fig. 3 *Praeglobotruncana fusani* n. sp.
B—28/60 Beňatína. Zone à *Marginotruncana schneegansi* (110 x); 1466
Fig. 4 *Helvetoglobotruncana praehelvetica* (Trujillo)
11 a — 51/59 Beňatína. Zone á *Praeglobotruncana imbricata* du Turonien inférieur (110 x); 1441
Fig. 5 *Helvetoglobotruncana helvetica* (Bolli)
17 — Beňatína. Zone à *Marginotruncana schneegansi* (la partie basale) du Turonien supérieur (70 x); 2606
Fig. 6 *Helvetoglobotruncana praehelvetica* (Trujillo)
B—8 Beňatína, sous-zone à *Praeglobotruncana biconvexa* du Turonien moyen (90 x); 0785

Planche XXXVIII

Fig. 1 *Helvetoglobotruncana helvetica* (Bolli)
B—8 Beňatína (120 x(; 0784
Fig. 2 *Praeglobotruncana hagni* Scheibnerová
11 a — 51/59 Beňatína. Zone à *Praeglobotruncana imbricata* du Turonien inférieur (90 x); 1449
Fig. 3 *Praeglobotruncana imbricata* (Mornod)
B—11 — 51/59 Beňatína. Zone à *Praeglobotruncana imbricata* du Turonien inférieur (130 x); 1443
Fig. 4 *Helvetoglobotruncana* aff. *helvetica* Bolli B—8 Beňatína; sous-zone à *Praeglobotruncana biconvexa* du Turonien moyen (130 x); 0777

Fig. 5 *Helvetoglobotruncana praehelvetica* (Trujillo)
B—11 — 51/59 Beňatína Zone à *Praeglobotruncana imbricata* du Turonien inférieur (120 x); 1455
Fig. 6 *Helvetoglobotruncana praehelvetica* (Trujillo)
La structure.
B—11 — 51/59 Beňatína (350 x); 1456

Planche XXXIX

Fig. 1 *Praeglobotruncana* aff. *imbricata* Mornod
25 Vieska Bezdedov. La sous-zone à *Globotruncana sigali* du Turonien moyen (120 x); 0287
Fig. 2 *Globotruncana tricarinata desioi* Gandolfi
B—28/60 Beňatína. La zone à *Globotruncana angusticarinata* du Coniacien inférieur (la partie basale); (50 x); 1485
Fig. 3 *Globotruncana tricarinata tricarinata* (Quereau)
Beňatína — 28/60 (50 x); 1477
Fig. 4 *Globotruncana angusticarinata* Gandolfi
B—28/60 Beňatína (60 x); 1482
Fig. 5 *Globotruncana tricarinata tricarinata* (Quereau)
B—28/60 Beňatína (50 x); 1484
Fig. 6 *Marginotruncana marginata* (Reuss)
25 Vieska Bezdedov. La sous-zone à *Globotruncana sigali* du Turonien moyen (120 x); 0304

Planche XL

Fig. 1 *Globotruncana tricarinata tricarinata*
B—28/60 Beňatína; 1478
Fig. 2 *Globotruncana* aff. *renzi* Gandolfi
B—61/59 Beňatína. La zone à *Globotruncana angusticarinata* (125 x); 2251
Fig. 3 *Globotruncana renzi* Gandolfi
B—61/59 Beňatína. La zone à *Globotruncana angusticarinata* (la partie basale); (70 x); 2621
Fig. 4 *Globotruncana renzi* Gandolfi
B-61/59 Beňatína (130 ×); 2607
Fig. 5 *Globotruncana renzi* Gandolfi
B-61/59 Beňatína (80 ×); 2618
Fig. 6 *Globotruncana renzi* Gandolfi
B-61/59 Beňatína (70 ×); 2620

Planche XLI

Fig. 1 *Glomospira charoides* (Parker et Jones)
B-17 — 58/59 Beňatína. La zone à *Marginotruncana schneegansi* du Turonien supérieur (275 ×); 2227
Fig. 2 *Ammodiscus hoernesi* Karrer
B-17 — 58/59 Beňatína. La zone à *Marginotruncana schneegansi* du Turonien supérieur (70 ×); 2224
Fig. 3 *Spiroplectammina* aff. *baudouiniana* (d'Orbigny)
B-17 — 58/59 Beňatína (175 ×); 2228

Fig. 4 *Verneuilina cretacea* (Karrer)
B-28/60 Beňatína. La zone à *Marginotruncana schneegansi* du Turonien supérieur (70 ×); 1460
Fig. 5 *Gaudryina subserrata* Vassilenko
No 25 Vieska Bezdedov (50 ×); 0291
Fig. 6 *Gaudryina subserrata* Vassilenko
No 25 Vieska Bezdedov (55 ×); 0286

Planche XLII

Fig. 1 *Ammobaculites* aff. *agglutinans* (d'Orbigny)
(140 ×); 2225
Fig. 2 *Gaudryina subserrata* Vassilenko
No 25 Vieska Bezdedov (80 ×); 0315
Fig. 3—4 *Dendrophrya robusta* Grzybowski
(100 ×); 167 — Lednické Rovné. Zona *Rotalipora turonica*. Cénomanien supérieur.
Fig. 5 *Clavulina gaultina* Morozova
B-28/60 — 58/59 Beňatína (100 ×); 1475
Fig. 6 *Gaudryina subserrata* Vassilenko
No 25 Vieska Bezdedov (55 ×); 0290

Planche XLIII

Fig. 1 *Globorotalites hangensis* Vassilenko
No 25 Vieska Bezdedov (80 ×); 0305
Fig. 2 *Globorotalites hangensis* Vassilenko
No 25 Vieska Bezdedov (80 ×); 0317
Fig. 3 *Globorotalites hangensis* Vassilenko
No 25 Vieska Bezdedov (100 ×); 0309
Fig. 4 *Triplasia bronni* (Reuss)
No 25 Vieska Bezdedov (100 ×); 0275
Fig. 5 *Triplasia bronni* Reuss
No 25 Vieska Bezdedov (90 ×); 0276
Fig. 6 *Gaudryina laevigata* Franke
No 25 Vieska Bezdedov (60 ×); 0795

Planche XLIV

Fig. 1 *Valvulineria laevis* Brotzen
No 25 Vieska Bezdedov (140 ×); 0282
Fig. 2 *Valvulineria laevis* Brotzen
No 25 Vieska Bezdedov (120 ×); 0238
Fig. 3 *Valvulineria laevis* Brotzen
No 25 Vieska Bezdedov (130 ×); 0279
Fig. 4 *Cenosphaera* sp. 1
B-17 — 58/59 Beňatína (150 ×); 2267
Fig. 5 *Liosphaera* sp.
B-17 — 58/59 Beňatína (125 ×); 2266
Fig. 6 *Melitosphaera* aff. *sphaeroconus* Rust
B-17 — 58/59 Beňatína (200 ×); 2263

Planche XLV

Fig. 1 *Cenosphaera* sp.
B-17 — 58/59 Beňatína (275 ×); 2245
Fig. 2 *Liosphaera* sp.
B-17 — 58/59 Beňatína (100 ×); 2248
Fig. 3 *Liosphaera* sp.
B-17 — 58/59 Beňatína (350 ×); 2249
Fig. 4 *Liosphaera* sp.
B-17 — 58/59 Beňatína (100 ×); 2268
Fig. 5 *Cenosphaera* sp.
B-17 — 58/59 Beňatína (110 ×); 2611
Fig. 6 *Cenellipsis* sp.
B-6 — 6/60 Beňatína. La zone à *Thalmanninella appenninica* du Cénomanien; 2615

Planche XLVI

Fig. 1 *Cenellipsis* sp.
B-6 — 6/60 Beňatína. La zone à *Thalmanninella appenninica* du Cénomanien; 2612
Fig. 2 *Dictyomitza malleola* Aliev
B-17 — 58/59 Beňatína (120 ×); 2616
Fig. 3 *Dictyomitza malleola* Aliev
B-17 — 58/59 Beňatína (425 ×); 2617
Fig. 4 *Dictyomitza malleola* Aliev
B-17 — 58/59 Beňatína (90 ×); 2258
Fig. 5 *Cromyomma* sp.
B-17 — 58/59 Beňatína (200 x); 2610
Fig. 6 *Hagiastrum crux* Lipman
B-17 — 58/59 Beňatína (125 ×); 2257

Západné Karpaty, sér. paleontológia, 2—3, P. 87—96, Geol. Úst. D. Štúra Bratislava, 1977

O. Samuel — E. Köhler — K. Borza

Haddonia praeheissigi and Miliola? andrusovi, two new species from Upper—Senonian and Paleocene bioherm limestones of West Carpathians (Slovakia)

2 text-fig., 6 pl. (XLVII—LII), Slovak summary

Abstract. The authors describe two new species of foraminifers. One of them *Haddonia praeheissigi* nov. sp. belongs among agglutinated sessile to libero-sessile forms, while the second, *Miliola? andrusovi* nov. sp. among calcareous shallow-water benthonic forms. Both species are associated with bioherm and arenaceous limestones of the Klippen Belt and of the periklippen (Považie — Hanušovce) Paleogene. The first one of the species has been recorded in the Senonian and Paleocene so far, the second in the Paleocene.

Introduction

In our lithological-facial and stratigraphical research of Upper-Cretaceous and Paleogene sediments of the Klippen Belt and of the Paleogene extending linearly along its internal side (the Považie — Hanušovce sedimentation sensu O. Samuel 1972), particular attention was paid to bioherm and arenaceous limestones. They were, however, treated by more authors during the past decades (D. Štúr 1860; P. Lemoine 1933, J. Pia 1934; O. Kühn et D. Andrusov 1930, 1937, 1942; D. Andrusov 1938, 1959, 1965; O. Samuel — J. Salaj 1963; D. Andrusov — E. Köhler 1963; A. Schaleková 1963, 1964; A. Began — K. Borza — J. Salaj — O. Samuel 1965; E. Scheibner 1968; A. Began — K. Borza — E. Köhler — O. Samuel 1970, a. o.). Here we shall not deal in detail with historical and present state of research of this tectonically and stratigraphically very intricate region. These aspects were thoroughly discussed in a book by the authors (O. Samuel — K. Borza — E. Köhler 1972). There were also mentioned the forms (*Haddonia* sp., *Miliola* sp.) described here as new taxons.

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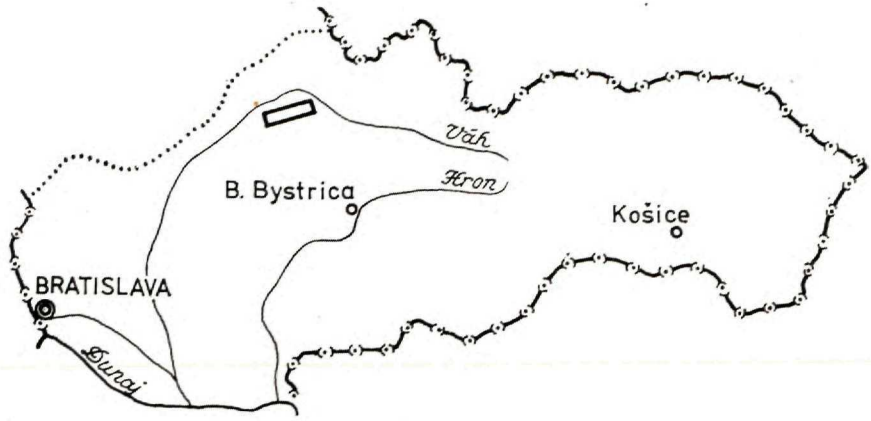


Fig. 1 Location of the studied area (oblong).

Paleontological discription

Subfamilia *Placopsiliniae* Rhumbler, 1913
Genus *Haddonia* Chapman, 1898

Haddonia praeheissigi nov. sp.

Pl. XLVII, Fig. 1–2; Pl. XLVIII, Fig. 1–2; Pl. XLIX, Fig. 1–2; Pl. L, Fig. 1–2
Haddonia sp. — E. Scheibner: Contribution to the knowledge of the Paleogene etc., p. 90, tab. 6, fig. 5.

Holotypus: The specimen figured in plate XLVII, fig. 2 (thin section 16/K), deposited in Geological Institute of the Slovak Academy of Sciences in Bratislava (ČSSR).

Locus typicus: Southwest of Považská Bystrica; Localities „Pod Húštím" (West Carpathians, Slovakia).

Stratum typicum: Upper Senonian.

Derivatio nominis: prae (heissigi) = the Latin preposition meaning before (preceding).

Material: more than 30 specimens from the thin sections bioherm and arenaceous limestones of the Klippen Belt and of the periklippen Paleogene.

Diagnosis: The test is large, multiserial, agglutinated. The initial stage displays indications of planispiral coiling of chambers. In the subsequent growth stage the chambers get branched. The test wall mostly consists of quartzose grains of variable size. The grains are cemented by calcareous cement. Along the inner side of chambers is thin yet conspicuous pseudochitinose layer. The shape of the test is irregular.

Description: The initial stage shows indications of planispiral structure

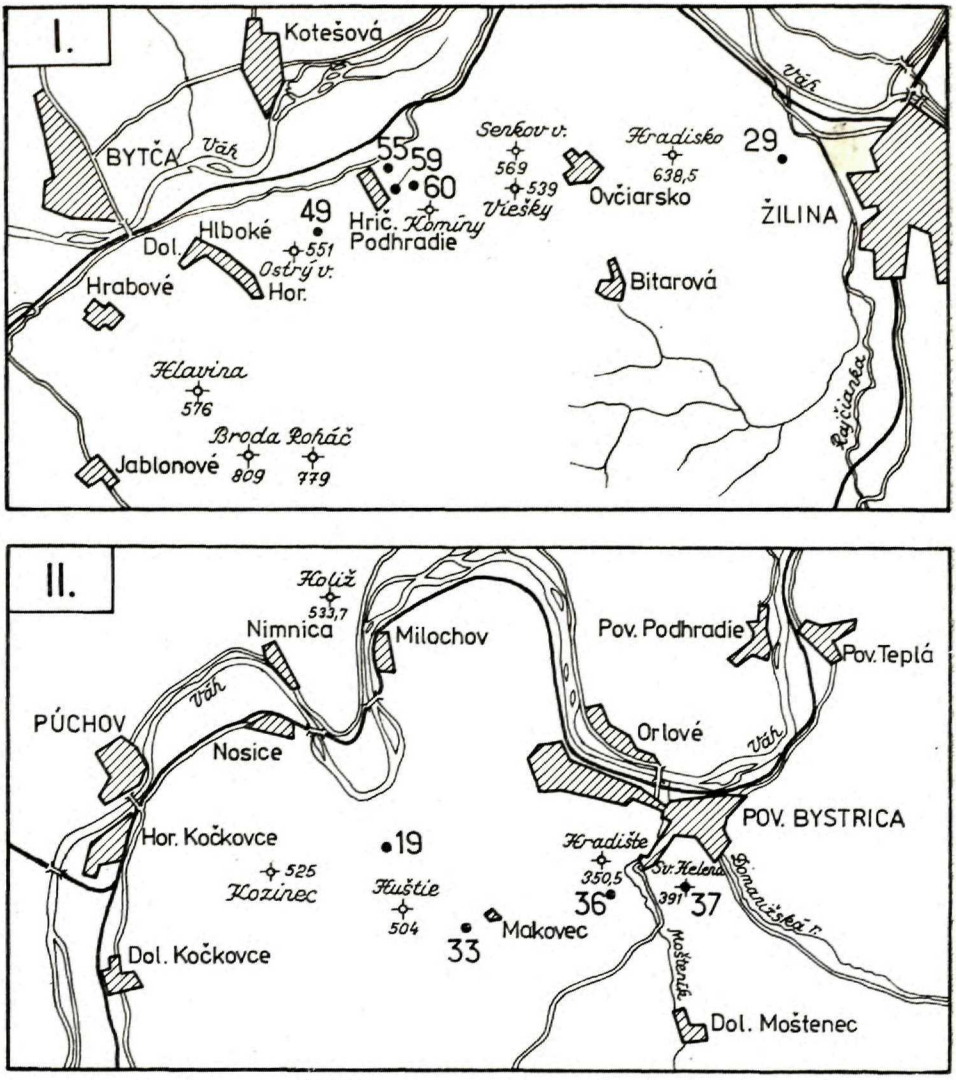


Fig. 2 Location of studied occurrences of the area of Žilina—Súľov (I) and Púchov—Považská Bystrica (II).

of the test. Regretfully, absolute lack of free specimens, and insufficient amount of sections through the juvenile stage of the test prevent detailed reconstruction of its initial part. We therefore cannot say unambiguously whether the structure of the initial part of the test is planispiral or slightly trochospiral. Interestingly, besides specimens with indications of planispirae structure of the initial part of the test, in two cases we found forms with their chambers passing immediately from the proloculum to the uniserial

stage (Pl. XLVII, fig. 1). The phenomenon is either in connection with the generation cycle or it is a natural intraspecific phenomenon within the scope of morphological variability of a newly described taxon. Most forms described show branching chambers in the next growth stage and the test gets an intricate multiserial shape. Since these are sessile forms, the general habitus of the test is to a considerable extent affected by morphology of the substrate to which the specimens are fitted. Uneven substrate surface may cause changed direction of the growth of the test. Owing to these facts, some forms in thin sections show very intricate, combined internal structure of the test (Pl. L, fig. 1). Such case was also mentioned by H. Hagn (1969) in connection with the study of the species *Haddonia heissigi*, described by himself.

In the initial part of the test the first chamber (proloculum) is large, with circular section. Other succesive chambers are not quite equal in shape. Generally we may state that they are suboval in section, their width exceeding their height. Septa representing continuation of the test wall, are thick, bent, occasionally interrupted. In such cases is mutual communicases septa get completely fused, so that individual chambers are quite separated from one another. Where the septa are not fused completely, an opening of simple shape forms. No other morphological characters (lip, cribrose form of aperture) were found in the forms studied.

The test wall is biserial. The outer series is agglutinated, thick and compact (without perforation). Grains of very slightly rounded quartz are the principal structural element of the outer test series. The size of quartz grains is variable, unsorted, fluctuating within the size of the clastic fraction of the surrounding rocks (10—140 μ). Limestone grains are very scarce. The cementing matrix consists of micrite and microsparite.

The test wall may be doubled in parts where another chamber joins the preceding one or the place of test branching. In the part where the test fits to the substrate, the external agglutinate layer is absent. The test fits to the substrate directly with the internal pseudochitinose layer developed along the entire internal side of chambers. Under microscope the pseudochitinose layer is black, thin and smooth. In some parts of chambers the pseudochitinose layer is not preserved owing to secondary processes. Very scarcely there is a fine layer of fibrous calcite (Pl. XLIX, fig. 1) on the internal sides of chambers. Detailed examination of the inner test-wall shows that this layer formed as late as after the postmortal stage. Consequently, it has no primary morphogenetic significance.

Comparison: The species *Haddonia preaheissigi* nov. sp. differs from the morphologically similar species H. *heissigi*, described by H. Hagn (1969) from the Upper Eocene of the Bavarian Limestone Alps, especially in the fact that the Carpathian forms have compact and not perforated wall. According to H. Hagn's (l. c., p. 11, 16) data the species *H. heissigi* shows uniserial arrangement in its adult stage. In the Carpathian species *H. praeheissigi* nov. sp. the ratio of the branched forms to the uniserial is reversed. Among

the specimens studied, the uniserial forms are very scarce. Neither our forms did not show the inner primary perforated calcite layer. As regards *H. heissigi*, carbonate grains are the principal agglutinating component of the matrix. Quartz grains are very scarce. In contrast to the species mentioned, our *H. praeheissigi's* test is almost exclusively composed of quartz grains. Another difference is in the size tests. Although the size of our tests varies between certain values, generally they do not reach such dimensions as quoted by H. Hagn (max. 22 mm, aver. 10 mm) in the description of the species *H. heissigi*. Some morphological characters indicate close phylogenetic relationships. It is likely that *Haddonia praeheissigi* nov. sp. represents an ancestral form of te species *H. heissigi* Hagn. The first scarce occurrences of the newly described form in the Carpathians were recorded in the Campanian. In the Paleocene bioherm limestones it is more common. As mentioned above, the Hagn's species originated from a stratigraphically higher level — the Upper Eocene.

Remark: *Haddonia praeheissigi* nov. sp. lived in the littoral to neritic zone. The species belongs among sessile or libero-sessile forms. Generally it is found in a facies rich in coralline algae and other shallow-water sessile or benthonic forms.

Stratigraphical range: As mentioned above, the first occurrences of the newly described species in the Carpathians have so far been found in bioherm limestones of the Campanian and the Paleocene ages. In the Eocene the species has not been found. In the area under study, *H. praeheissigi* was found at the localities Pod Húštím (loc. 19), Hričovské Podhradie (loc. 55, 29), southwest of Považská Bystrica (loc. 29, 36, 37). Their detailed lithological-facial description and the complete list of fauna are given in the author's book published in 1972.

Subfamily *Miliolinae* Ehrenberg, 1839
Genus *Miliola* Lamarck, 1804

Miliola? andrusovi nov. sp.

Pl. LI, Fig. 1—3; Pl. LII, Fig. 1—2

1970 *Quinqueloculina* nov. sp. — A. Began — K. Borza — E. Köhler — O. Samuel: Stratigrafical-lithological characteristics etc., p. 11, Fig. 1; Pl. 13, Fig. 13, Fig. 2—3.

Holotypus: the specimen figured in Pl. LI, fig. 3 deposited et Dionýz Štúr Institute of Geology, Bratislava (ČSSR)

Lucus typicus: Moštenec (loc. 36) central Považie (West Carpathians).

Stratum typicum: reef limestone — Montian—Thanetian

Derivatio nominis: in honour of Academician D. Andrusov, founder and the first director of D. Štúr Institute of Geology and of the Geological Institute of the Slovak Academy of Sciences, Bratislava.

Material: different sections of about 30 specimens

Diagnosis: The test is calcareous, porcelain-like, imperforate, of quinqueloculinoid structure. In equatorial section it is subpentagonal to circular.

Description: The test is ball-shaped, with typically quinqueloculinoid structure of chambers. On the exterior sides of free forms all the five chambers are visible. Equatorial profile of the test is subpentagonal to circular. In thin-section, the alternating chambers form a radial five-axial cross (regular with 72°) running out from the middle. The wall of the chamber is calcareous porcelain-like, imperforate; with a very fine speudochitinose layer on its interior side. On the outer side the chambers are smooth, without ornamentation and agglutinated layer. Because of the lack of free specimens, and of favourably oriented sections through aperture it was not possible to determine unambiguously the character of the aperture. Only in one case found were traces of a cribrate aperture according to which the newly described taxon should belong to the genus *Miliola* Lamarck, 1804 and not to *Quinqueloculina* Orbigny, 1826.

Remark: On the basis of microfacial analysis and of the general character of thanatocenosis it may be stated, that the species *Miliola? andrusovi* nov. sp. lived in the littoral and neritic zones.

Stratigraphical range: The newly described species occurs in bioherm and sandy limestones of Montian—Thanetian and Ilerdian ages. So far the species has not been recorded in younger organogenic sediments. It was found at the localities 33 (Makovec); 36 (NE of Považská Bystrica); 49 (NE of elev. point Ostrý vrch); 59—60 (Hričovské Podhradie) and in the vicinity of Myjava. Detailed lithological-facial and stratigraphical descriptions of sediments from these localities are in a publication by the authors from 1972.

Reviewed by J. Salaj.

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O. Samuel — E. Köhler — K. Borza

Haddonia praeheissigi a Miliola? andrusovi, dva nové druhy z vrchného senónu a paleocénu biohermných vápencov Západných Karpát

2 obr., 6 tab. (XLVII—LII), resumé anglického textu

Pri litofaciálnom a stratigrafickom výskume vrchnokriedových sedimentov bradlového pásma a pribradlového paleogénu (= považsko-hanušovského v zmysle O. Samuela 1972) zistili sme prakticky vo všetkých typoch biohermných a piesčitých vápencov

(resp. vápnitých pieskovcoch) prierezy foraminifér, ktoré neboli doteraz v literatúre opísané. Opísali sme ich ako nové taxóny — *Haddonia praeheissigi* nov. sp. a *Miliola? andrusovi* nov. sp.

Na základe mikrofaciálnej analýzy a celkového zloženia tanatocenózy môžeme konštatovať, že obidva druhy žili v plytkovodnom prostredí v litorálnom až neritickom pásme, pričom *Haddonia praeheissigi* nov. sp. žila sesilným až libero-sesilným spôsobom života.

Podľa doterajších výskumov *Hoddonia praeheissigi* nov. sp. sa vyskytuje od vrchného senónu až do paleocénu. Kým vo vrchnom senóne sa vyskytuje pomerne vzácne, zatiaľ v paleocéne patrí už medzi bežne sa nachádzajúce formy. Druh *Miliola? andrusovi* nov. sp. bol doteraz konštatovaný len v paleocéne. Ani jeden z novoopísaných druhov v mladších biohermných resp. piesčitých vápencoch ako paleocén nebol zatiaľ zistený.

Explanations of plates XLVII—LII

Plate XLVII

Fig. 1 *Haddonia praeheissigi* nov. sp.
Loc. 36 — SW of Považská Bystrica (near the river Jelšava); reef limestone; thin section 4/K; magn. 75 ×. Montian — Thanetian.
Fig. 2 *Haddonia praeheissigi* nov. sp.
Loc. 29 — SW of Považská Bystrica (Pod Húštím — 3); reef limestones; thin section 16/K; magn. 75 ×. Upper Senonian. Holotype.

Plate XLVIII

Fig. 1 *Haddonia praeheissigi* nov. sp.
Loc. 36 — SW of Považská Bystrica (near the river Jelšava); reef limestone; thin section 4/K; magn. 75 ×. Montian — Thanetian. Holotype.
Fig. 2 *Haddonia praeheissigi* nov. sp.
Loc. 37 — S of Považská Bystrica (Sv. Helena); reef limestone; thin section 19/K; magn. 75 ×. Montian — Thanetian. Paratype.

Plate XLIX

Fig. 1 *Haddonia praeheissigi* nov. sp.
Loc. 55 — Hričovské Podhradie (big reef limestone); thin section 20/K; magn. 80 ×. Montian — Thanetian.
Fig. 2 *Haddonia praeheissigi* nov. sp.
Loc. 29 — SW of Považská Bystrica (Pod Húštím — 3); reef limestone; thin section 16/K; magn. 80 ×. Upper Senonian.

Plate L

Fig. 1—2 *Haddonia praeheissigi* nov. sp.
Loc. 29 — SW of Považská Bystrica (near the river Jelšava); reef limestone; thin section 7/K; magn. 40 ×. Upper Senonian (fig. 1 detail from fig. 1).

Plate LI

Fig. 1 *Miliola? andrusovi* nov. sp.
Loc. 33 — Makovec; reef limestone; thin section 12/K; magn. 75 ×. Montian — Thanetian

Fig. 2 *Miliola? andrusovi* nov. sp.
Loc. 33 — Makovec; reef limestone; thin section 19/K; magn. Montian — Thanetian. Paratype.

Fig. 3 *Miliola? andrusovi* nov. sp.
Loc. 36 — SW of Považská Bystrica (Moštenec); reef limestone; thin section 4/K; magn. 60 ×. Montian — Thanetian. Holotype.

Plate LII

Fig. 1 *Miliola? andrusovi* nov. sp.
Loc. 36 — SW of Považská Bystrica; reef limestone; thin section 6/K; magn. 75 ×. Montian — Thanetian.

Fig. 2 *Miliola? andrusovi* nov. sp.
Loc. 49 — NE of elev. point Ostrý vrch; reef limestone; thin section 10/K; Magn. 75 ×. Ilerdian.

Západné Karpaty, sér. paleontológia 2—3, P. 97—118, Geol. Úst. D. Štúra Bratislava 1977

Viera Kantorová

Planktonic foraminifers of Oncophora beds in the Ipeľská kotlina (depression)

3 text-fig., 10 pl. (LIII—LXII), Slovak summary

Abstract. Formerly, the Oncophora beds in the Ipeľská kotlina (depression) were regarded as brackish and referred to the Ottnangian as for age. I did, however, find marine foraminiferal microfauna indicative of the Karpathian age. By examination under scanning electron microscope I distinguished 8 species and subspecies of globigerines including a new one: *Globigerina praeglobigerinoides* n. sp. A detailed study will facilitate description of further five forms, perhaps as new subspecies. Based on *Globigerina woodi connecta*, the beds may be stratigraphically ranged in D. G. Jenkins' (1973) Zone *Globigerina woodi connecta*.

Introduction

In the West Carpathians, the Oncophora beds occur in a comparatively small area around M. Kameň in the Ipeľská kotlina on approximately 400 sqkm. Their thickness ranges between 30 and 40 m, in the northeastern part of the depression — even more. Formerly, the beds were regarded as Ottnangian (i. e. Lower-Helvetian according to earlier stratigraphical division of the area) brackish sediments. But I have found there foraminiferal microfauna comprising small benthonic and planktonic species indicative of their marine origin and of their Karpatian age (Upper-Helvetian according to former stratigraphical division; V. Kantorová — A. Ondrejíčková — D. Vass 1968). Examined were samples from a sand-pit near the town Krtíš, and from boreholes near the villages — Stredné Plachtince, Pôtor, and Suché Brezovo. All samples contained characteristic thanatocenoses of foraminifers. Most abundant thanatocenoses were recovered from Oncophora beds in the borehole M-88 near Suché Brezovo.

Foraminifers from the Oncophora beds in the Ipeľská kotlina are too small to be exactly referred to the proper taxon after examination under optical microscope. Not even the greatest magnification possible reveals the significant details of the test structure, the test diameter of spherical or

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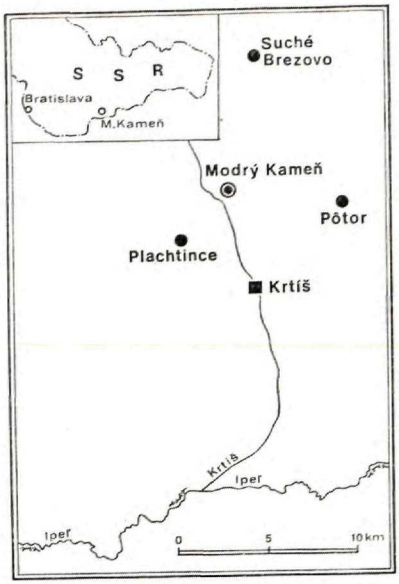


Fig. 1 Situation sketch

disc-shaped forms being 80 — 220 μ, or the length of linear tests being 120 — 300 μ.

When examined by scanning electron microscope (SEM), the delicate foraminifers display highly variable shapes.

In this paper I shall only deal with foraminiferal plankton because it suits best for a more exact determination of stratigraphic position of these beds. Although the tests are a half or even the third of test size of the same species from other geographical areas or from open-sea Miocene sediments of the area under study, I have found species appliable in stratigraphical correlation of these beds. The species diversity of planktonic foraminifers as shown by SEM is really striking in this initial phase of investigation by modern devices.

Our electron scan-micrographs are not so complete yet as necessary. For example, some species presented could not have been depicted from spiral and umbilical views or from lateral view. In some cases we have got micrograph of the spiral side of a dextrogyre individual, while a sinistrogyre individual of the same species was scanned from the umbilical side.

In spite of the above lacks I regard it suitable to publish the results of my preliminary observations as soon as possible because they are important for the stratigraphy of the south-Slovakian Miocene. I shall continue in treating this problem in my research of planktonic foraminifers from Tertiary sediments of South-Slovakian depressions.

Morphological characters of test of planktonic foraminifers, significant for taxonomic classification

Since the beginning of the second half of this century, many authors mentioned difficulties in taxonomical classification of planktonic foraminifers. Among earlier authors, particularly A. Bé (1959) should be mentioned.

G. and J. J. Bizon (1972), in the introduction of their atlas of Cenozoic planktonic foraminifers of the Mediterranean basin, based upon electron scan-micrographs, did already mention chaos in classification of planktonic foraminifers. The chaos is mostly due to subjective approach to morphological properties observed by classical methods and devices preventing exact determination inevitable for stratigraphical division. These authors forecast establishment of a new classification resulting from examination of planktonic foraminifers by SEM.

The initial study of planktonic foraminifers from the Tertiary filling of South-Slovakian depressions, made by SEM in 1972, inspired me similar ideas. I was surprised by Mr. and Mrs. Bizon based their modern descriptions on equal morphological properties, as by myself without having known their work (V. Kantorová 1973). I regard it as a proof of gradual unification of criteria with completion of observation devices, and perhaps we are not far from completely removing the present chaos.

My descriptions and taxonomic classification of the tests of planktonic foraminifers under SEM are mostly based upon the following morphological characters:

The general form, particularly number of chambers in the last whorl, direction of test coiling, the outline and periphery of the test, cross-section, maximum diameter.

On the spiral side: number of whorls, chamber growth rate in direction of coiling, shape and mode of arrangement of chambers, shape and depth of sutures.

On the umbilical side: shape of umbilicus, shape and mode of arrangement of chambers; shape, depth and direction of sutures.

On the aperture: shape, position, presence of rim or lip; presence of supplementary apertures.

Surficial ornamentation and pore character

Surficial ornamentation and pore character are morphological properties also mentioned in former descriptions of planktonic foraminifers, but data on the properties are either confused or distorted. The morphological properties and many particularities may be exactly described after examination under SEM. Most likely they will get significance for modern classification of planktonic foraminifers. On one and the same test we may frequently find different perforation of individual chambers, and some diversities may also be observed on different parts of the same chamber. Some species show variable pore size on chambers of the last whorl and in the course of ontogenetic evolution of a test (cf. P. LVII, figs. 3, 4). On earlier chambers are pores enlarged, surface knobs lower with the tendency of growing together. On later chambers pores are usually narrow, surrounded with well-confined knobs.

Recently many papers appeared in paleontological literature, concerning wall ultrastructure of foraminifers, with particular attention paid to planktonic foraminifers. The problems are summarized in a paper by A. R. Loeblich jr. and H. Tappan (1974, cum lit.). Modern devices bring some doubts about the actual radial structure of walls of planktonic foraminifers. Bilamellar and multilamellar wall structures were found, walls with granular structure with intricately arranged calcite crystals. The arrangement and shape of crystals seem typical of lamelles of the same individual. Among lamelles were found thin layers of organic matter.

Still the new phenomena are explained rather sujectively.

Subfamilia *Globigerininae* Carpenter, Parker et Jones, 1862
Genus *Globigerina* d' Orbigny, 1826

Globigerina woodi woodi Jenkins, 1960

1960 *Globigerina woodi* Jenkins, new species — D. G. Jenkins: Planktonic foraminifera from the Lakes Entrance etc., p. 352, tab. 2, fig. 2 a—c.
1971 *Globigerina (Globigerina) woodi woodi* Jenkins — D. G. Jenkins: New Zealand Cenozoic Planktonic Foraminifera, p. 159, tab. 18, fig. 548—50.

Stratigraphical range (after the author of the subspecies): Zone *G. (G.) woodi woodi* — Zone *G. (T.) mayeri mayeri* (Lower — Middle Miocene).

Test descriptions by means of SEM (Pl. LIII, figs. 1—2, Pl. LIV fig. 1):

A. General shape
- a) Number of chambers in the last whorl: 4 (Specimens investigated here are sinistrogyre)
- b) Equatorial profile: slightly lobate
  - bb) Periphery: rounded, perforated
- c) Axial profile: loaf-shaped
- d) Maximum diameter: 164 μ (atypical but in proportion to the growthparameters of the other foraminifers from the beds studied)

B. Spiral side
- a) Number of whorls: 2 ½
  - aa) Growth rate in the coiling direction: continuous
- b) Chambers: subspherical
  - bb) Arrangement: in a low trochospire
- c) Sutures:
  - ca) intercameral: broad, cicatricose
  - cb) spiral: broad, cicatricose; especially on the contact of the penultimate and ultimate whorls.

C. Umbilical side
- a) Shape of umbilicus: medium-broad, open
- b) Chambers: subspherical
- c) Sutures: broad, cicatricose

D. Aperture
- a) Shape: arcuate
- b) Position: interiomarginal, umbilical to slightly extraumbilical
- c) Rim or lip: small lip
- d) Supplementary apertures: indications only, in sutures on spiral side

E. Surface ornamentation and pore character

coarse-reticulate, distinctly projecting above the test surface: pores deep, funnel-shaped.

Globigerina woodi connecta Jenkins, 1964

1964 *Globigerina woodi* Jenkins subsp. *connecta* Jenkins, new subspecies — D. G. Jenkins: A new planktonic foraminiferal subspecies etc., p. 72, text fig. 1 a—c.

Stratigraphical range (after the author of the subspecies — D. G. Jenkins, 1971): Zone *G. (G.) woodi connecta* — lower part of zone *G. trilobus trilobus* (Lower Miocene). D. G. Jenkins (1971) named the Lower Miocene zone corresponding to the zone N_4 according to *H. W.* Blow's (1969) index zonation, after the above planktonic foraminifers — Zone *G. (G.) woodi connecta.* The results of our latest research show that the Oncophora beds of the Ipeľská kotlina (depression) may be correlated with this zone of the Australian region.

This is why Jenkins's original description of the index planktonic foraminifers is given here in full:

Globigerina woodi Jenkins subsp. *connecta* Jenkins, n. sp.

Text-figure 1 a—c

Description: Test a compact trochospiral, equatorial periphery trilobate, axial periphery rounded. Wall calcareous, perforate, coarsely pitted. Initial whorls indistinct due to the thickening of the test wall, about 10—12 chambers arranged in 2—3 whorls, free parts of the chambers spherical in outline, increasing slowly in size, with the final chamber tending to overlap slightly upon the previous chambers. Aperture a low arch with a liplike margin. Greatest diameter of holotype: 0.34 Age of type sample: Otaian Stage.

Stratigraphic range: Otaian-Awamoan (Lower Miocene).

Locality and types: Parengarenga section, North Auckland, sample N 2/554, F 14851. Holotype in the collections of the New Zealand Geological Survey, No. TF 1483.

Remarks: *Globigerina woodi connecta* differs from *Globigerina woodi woodi* in having a much lower arched aperture and a more compact test. There are intermediate forms joining the two subspecies within the range of *G woodi connecta.* The separation of, *G. woodi connecta* from the forms assigned to *Globigerinoides trilobus* is more easily made the difference being that the latter species has a supplementary aperture on the spiral side at the inner margin of the final chamber. All tree forms have indentical wall ornamentation.

G. woodi connecta evolved from the *G. woodi woodi* populations in the lower part of the Otaian Stage in New Zealand and in the *G. woodi* zone in southeast Australia (Jenkins 1960). From the evidence of the ranges of the other planktonic foraminifera, it appears that this evolution occurred at about the same time in the two areas. In terms of Trinidad zones, the lower Otaian is equivalent to the lower part of the *Globorotalia kugleri* zone or slightly earlier.

Test description by means of SEM (Pl. LIII, figs. 3—4; Pl. LIV, fig. 2):

A. General shape

a) Number of chambers in the last whorl: 3 (Specimens investigated here are dextrogyre)

b) Equatorial profile: trilobate

bb) Periphery: rounded, perforate

c) Axial profile: loaf-shaped
d) Maximum diameter: 150—180 μ (atypical but in proportion to the growthparameters of the other foraminifers from the beds studied

B. Spiral side
a) Number of whorls: 2 ½
aa) Growth rate in the coiling direction: rapid
b) Chambers: small in initial stage, thickened, then reniform
bb) Arrangement: in a low trochospire
c) Sutures: narrow, deep, occasionally cicatricose

C. Umbilical side
a) Shape of umbilicus: narrow, shallow
b) Chambers: reniform
c) Sutures: cicatricose, deep, radial

D. Aperture
a) Shape: low arcuate
b) Position: interiomarginal, extraumbilical-umbilical
c) Rim or lip: not observed
d) Supplementary apertures: indications only, on spiral side

E. Surface ornamentation and pore character
reticulate, not projecting distinctly above test surface; pores deep, funnel-shaped.

Most likely, the 3 forms depicted in Pl. LV and LVI are also related with the species *Globigerina woodi* Jenkins 1960. I failed in trying to determine them according to the literature available. Based on cicatricose intercameral sutures and on spiral suture at the base of the final whorl, looking as indications of supplementary apertures, we may presume that they also are members of lineage tending toward representatives of the genus *Globigerinoides*. They also show further important characters of the group: medium — to coarse-reticulate ornamentation and proportional size of funnel-shaped pores. I shall study representatives of the lineage from the Lower Miocene of South-Slovakian depressions later.

At present I will only give here description of spiral sides of the three forms mentioned, examined under SEM.

1. *Globigerina* ex gr. *woodi* Jenkins, 1960
micrograph 4337/1972

Pl. LV, fig. 1, Pl. LVI, fig. 1

A. General shape
a) Number of chambers in the last whorl: 5 (Specimen investigated here is dextrogyre.)

b) Equatorial profile: deltoid; periphery slightly lobate
bb) Periphery: rounded, perforate
c) Axial profile: loaf-shaped
d) Maximum diameters: 185 μ (atypical but in proportion to the growthparameters of the other foraminifers from the beds studied).

B. Spiral side
a) Number of whorls: 3
aa) Growth rate in the coiling direction: continuous
b) Chambers: subspherical, reniform
bb) Arrangement: in not too high trochospire
c) Sutures: broad, shallow; occasionally cicatricose.

C. Umbilical side
not scanned

D. Aperture
not scanned

E. Surface ornamentation and pore character
fine reticulate, slightly projecting above the test surface; pores numerous, deep.

2. *Globigerina* ex gr. *woodi* Jenkins, 1960
micrograph 4327/1973

Pl. LV, fig. 2; Pl. LVI, Fig. 2

A. General shape
a) Number of chambers in the last whorl: 5 (The specimens investigated here is sinistrogyre.
b) Equatorial profile: irregular pentagon
bb) Periphery: rounded, perforate
c) Axial profile: loaf-shaped
d) Maximum diameter: 190 μ (atypical but in proportion to the growthparameters of the other foraminifers from the beds studied)

B. Spiral side
a) Number of whorls: 3
aa) Growth rate in the coiling direction: continuous
b) Chambers-reniform
bb) Arrangement: in a low trochospire
c) Sutures: both spiral and intercameral; broad, deep, cicatricose

C. Umbilical side: not scanned

D. Aperture: not scanned

E. Surface ornamentation and pore character
medium-coarse reticulate, not projecting above test surface, pores proportional in size, funnel-shaped.

3. *Globigerina* ex gr. *woodi* Jenkins, 1960
micrograph 4055/1973

Pl. LV, Fig. 3–4

A. General shape
- a) Number of chambers in the last whorl: 5 (Specimen investigated is dextrogyre.)
- b) Equatorial profile: petaloid, lobate
  bb) Periphery: rounded, perforate
- c) Axial profile: loaf-shaped
- d) Maximum diameter: 150 μ (atypical, but in proportion to the growthparameters of the other foraminifers from the beds studied)

B. Spiral side
- a) Number of whorls: 3
  aa) Growth rate in the coiling direction: continuous
- b) Chambers: subspherical
  bb) Arrangement: in a low trochospire
- c) Sutures: broad, shallow, cicatricose

C. Umbilical side: not scanned

D. Aperture: not scanned

E. Surface ornamentation and pore character

Chambers of the initial whorl are smooth, polygonal. Ornamentation of chambers in the last whorl consists of coarse reticules composed of distinctly hexagonal mesh. The mesh is markedly larger than in other specimens observed from the group distinctly projecting above the test surface still more at the points of meeting mesh. Pores are broad, deep.

Globigerina cf. *angulisuturalis* Bolli, 1957

1957 *Globigerina ciperoensis angulisuturalis* Bolli, new subspecies — H. M. Bolli: Planktonic Foraminifera from the Oligocene-Miocene Cipero etc., p. 109 tab. 22, fig. 11 a–c.

? *Globigerina angulio fficialis* Blow, 1969

1969 *Globigerina angulio fficialis* n. sp. — W. H. Blow: Late middle Eocene to Recent etc., p. 379, Pl. II, fig. 1–5.

1971 *Globigerina angulisuturalis* Bolli — J. A. Postuma: Manuel of Planktonic Foraminifera, p. 260–261.

Stratigraphical range (after J. A. Postuma 1971) zone *Globigerina angulisuturalis* (N 2) — lower part of the zone *Globorotalia kugleri* (N 4).

Test description by means of SEM (Pl. LVII, fig. 1–3):

A. General shape
- a) Number of chambers in the last whorl: 5 (Specimen investigated here are sinistrogyre and dextrogyre).
- b) Equatorial profile: petaloid, slightly lobate
  bb) Periphery: rounded, perforate

c) Axial profile: loaf-shaped
d) Maximum diameter: 150 μ (atypical but in proportion to the growth-parameters of the other foraminifers from the beds studied)

B. Spiral side
a) Number of whorls: 3
aa) Growth rate in the coiling direction: slow
b) Chambers: subspherical
bb) Arrangement: in a low trochospire
c) Sutures: deep, with U-profile; intercameral ones are radial

C. Umbilical side
a) Shape of umbilicus: deep, medium-broad, open
b) Chambers: subspherical
c) Sutures: deep, with indistinct U-profile, radial

D. Aperture
a) Shape: low-arcuate
b) Position: interiomarginal, umbilical to slightly extraumbilical
c) Rim or lip: indistinct lip
d) Supplementary apertures: not observed

E. Surface ornamentation and pore character

The surface is covered by more or less conspicuous papilles, pores are narrow to medium-broad, deep.

Remark: In its morphological characters it resembles mostly *Globigerina anguli-officinalis* Blow, 1969; but after the author of the species this should not surpass the Zone N 2.

Globigerina ciperoensis ottnangiensis Rögl, 1969

1969 *Globigerina ciperoensis ottnangiensis* n. ssp. — F. Rögl: Die Foraminiferenfauna aus den Phosphoritsanden von Plesching etc., p. 221, tab. 2, fig. 7—10 c; tab. 4, fig. 1—7.

1973 *Globigerina ciperoensis ottnangiensis* Rögl, 1969 — F. Rögl et I. Cícha: Die Foraminiferen des Ottnangien, p. 315, tab. 9, fig. 46—48; tab. 10, fig. 56—58.

Stratigraphical range (according to the author of subspecies, 1973): throughout the Ottnangian to Lower Karpatian.

Test description by means of SEM (Pl. LVII, fig. 4):

A. General shape
a) Number of chambers in the last whorl: 5 (Specimen investigated here is dextrogyre.)
b) Equatorial profile: petaloid
bb) Periphery rounded, perforate
c) Axial profile loaf-shaped
d) Maximum diameter: 160 μ (atypical but in proportion to the growth-parameters of other foraminifers from the beds studied).

B. Spiral side
a) Number of whorls: 3
aa) Growth rate in the coiling direction: slow

b) Chambers: subspherical
bb) Arrangement: in a low trochospire
c) Sutures: incised, medium-broad

C. Umbilical side: not scanned

D. Apertures: not scanned

E. Surface ornamentation and pore character
The surface is covered by low papillae, smoothed on previous chambers; pores are medium-broad, deep,

Globigerina cf. *falconensis* Blow, 1959

1959 *Globigerina falconensis* Blow, sp. nov. — W. H. Blow: Age, correlation and biostratigraphy etc. (Eastern Falcón), p. 177, tab. 9, fig. 40a—c, 41
1971 *Globigerina (G.) falconensis* Blow — D. G. Jenkins: New Zealand Cenozoic Planktonic Foraminifera, p. 148, tab. 16, fig. 463—465.
Stratigraphical range (after D. G. Jenkins, 1971): Upper part of the zone *Globigerina woodi connecta* — Pliocene.

Test description by means of SEM (Pl. LVIII, fig. 1, 2):

A. General shape
a) Number of chambers on the last whorl: 3 ½ (Specimen investigated here is sinistrogyre.)
b) Equatorial profile: trilobate
bb) Periphery: rounded, perforate
c) Axial profile: loaf-shaped
d) Maximum diameter: 150 μ (atypical but in proportion to the growth-parameters of the other foraminifers from the beds studied).

B. Spiral side
a) Number of whorls: 3 (?)
aa) Growth rate in the coiling direction: rapid
b) Chambers: spherical
bb) Arrangement: in a low trochospire
c) Sutures: depressed, partially incised, narrow; intracameral ones are radial

C. Umbilical side
a) Shape of umbilicus: broader, open
b) Chambers: spherical
c) Sutures- depressed, slightly incised, narrow, radial

D. Aperture
a) Shape: medium-sized, high-arcuate,
b) Position: interiomarginal; mostly umbilical
c) Rim or lip: distinct, thick
d) Supplementary apertures: not observed

E. Surface ornamentation and pore character
The surface is covered with conspicuous papilles; irregularly dispersed pores are medium-broad, deep.

Globigerina cf. *eamesi* Blow, 1959

1959 *Globigerina eamesi* Blow, sp. nov. — W. H. Blow: Age, correlation and biostratigraphy etc. (Eastern Falcón), p. 176, tab. 9, fig. 39 a—c.
1969 *Globigerina eamesi* Blow — W. H. Blow: Late middle Eocene to Recent etc., p. 318, tab. 15, fig. 1—4, ideotype.
1971 *Globigerina (G.) eamesi* Blow — D. G. Jenkins: New Zealand cenozoic Planktonic Foraminifera, p. 146, tab. 15, fig. 454—456.

Stratigraphical range: W. H. Blow (1959, 1969) — the author of the species — found it in Upper Miocene zones *G. menardii/G. nepenthes* to *G. seminulina* (N 14 — N—18), whereas D. G, Jenkins (1971) recorded it in southeastern Australia with in the Oligocene and Upper Miocene.

Test description by means of SEM (Pl. LIX, fig. 1, 2):

A. General shape
- a) Number of chambers in the last whorl: 4 ½ (Specimen investigated here is dextrogyre.)
- b) Equatorial profile: petaloid
  bb) rounded, perforate
- c) Axial profile: trochoidal, rounded
- d) Maximum diameter: 160 μ (atypical but in proportion to the growth-parameters of the other foraminifers from the beds studied).

B. Spiral side
- a) Number of whorls: 3
  aa) Growth rate in the coiling direction: rapid, continouos
- b) Chambers: subspherical, inflated
  bb) Arrangement: in a slightly elevated trochospire
- c) Sutures: depressed; intercameral ones are radial, moderately curved

C. Umbilical side
- a) Shape of umbilicus: medium-broad, deep
- b) Chambers: subspherical, inflated
- c) Sutures: depressed, radial

D. Aperture
- a) Shape: low-arcuate
- b) Position: interiomarginal, umblical to slightly extraumbilical
- c) Rim or lip: small lip
- d) Supplementary apertures: not observed

E. Surface ornamentation and pore character

The test surface-besides the chambers of the first whorl is richly ornamented with thorn-like papilles; pores are dense, medium-broad, deep.

Remark: the specimen shown in Pl. LIX, fig. 1, 2 has 4 ½ chambers in the last whorl. In the general distribution of chambers, in the shape of aperture with a small lip and with surficial ornamentation it corresponds to *G. eamesi* Blow, 1959, Yet it differs from a variety with three chambers, whose micrograph is presented by W. H. Blow (1969, Pl. 15, fig. 2—3).

Globigerina cf. *praebulloides* Blow, 1959

1959 *Globigerina praebulloides* Blow, sp. nov. — W. H. Blow: Age, correlation and biostratigraphy etc. (Eastern Falcón), p. 180, Pl. 8, fig. 47a—c. P. 9, fig. 48.
1962 emended by — W. H. Blow and F. T. Banner: The Mid-Tertiary (Upper Eocene to Aquitanian) Globigerinaceae, p. 92—94.
1962 *Globigerina praebulloides praebulloides* Blow — W. H. Blow and F. T. Banner: ibid., p. 92, Pl. IX, fig. O—Q.
1962 *Globigerina praebulloides leroyi* Blow and Banner subsp, nov. — W. H. Blow and F. T. Banner: ibid., p. 93, tab. Pl. IX, fig. R — T, text. fig. 9 (V).
1962 *Globigerina praebulloides occlusa* Blow et Banner subsp. nov. — W. H. Blow and F. T. Banner: ibid., p. 93, Pl. IX, fig. U — W, text. fig. 14 (i—ii).

Stratigraphical range (after J. A. Postuma 1971). From the base of the zone *Globigerina ampliapertura* to the upper part of the zone *Globorotalia dutertrei* (N 1 — N 17).

W. H. Blow and F. T. Banner (1962, p. 138, text fig. 14) regard subspecies *Globigerina praebulloides occlusa* as a possible ancestor of the species *Globigerinoides primordius*.

Test description by means of SEM (Pl. LIX, fig. 3, 4):

A. General shape
- a) Number of chambers in the last whorl: 4 (Specimen investigated here are sinistrogyre and dextrogyre.)
- b) Equatorial profile: triangular, lobate
  bb) Periphery: rounded, perforate
- c) Axial profile: loaf-shape
- d) Maximum diameter: 225 μ (atypical but in proportion to the growth-parameters of the other formaminifers from the beds studied)

B. Spiral side
- a) Number of whorls: 2 ½
  aa) Growth rate in the coiling direction: rapid
- b) Chambers: reniform
  bb) Arrangement: in a short trochospire
- c) Sutures: broad, shallow

C. Ubmilical side
- a) Shape of umbilicus: broad, open
- b) Chambers: reniform
- c) Sutures: broad, shallow, radial

D. Aperture
- a) Shape: low-arcuate
- b) Position: interiomarginal, umbilical to slightly extraumbilical
- c) Rim or lip: not observed
- d) Supplementary apertures: not observed

E. Surface ornamentation and pore character

Indistinctly reticulate; pores are very broad and deep (partiallly also secondarily broadened).

The specimen differs from all the three subspecies of the species *Globigerina*

praebulloides emended by W. H. Blow and F. T. Banner (1962) in lacking hispidity.

Globigerina praeglobigerinoides n. sp.

Denomination: The specific name expresses the intermediary character of a new species among the genera *Globigerina* and *Globigerinoides*.

Test description by means of SEM (Pl. LX, fig. 1—3):

A. General shape
   a) Number of chambers in the last whorl: 5 (Specimens investigated here are sinistrogyre and dextrogyre.)
   b) Equatorial profile: trilobate
      bb) Periphery: rounded, perforate
   c) Axial profile: loaf-shaped
   d) Maximum diameter: 265 μ

B. Spiral side
   a) Number of whorls: 2 3/4
      aa) Growth rate in the coiling direction: rapid
   b) Chambers: subspherical to reniform
      bb) Arrangement: in a low trochospire
   c) Sutures: cicatricose; spiral suture shows lobular course, intercameral being approximately radial, slightly curved

Remark to A. — B.: When looking from the spiral side (see Pl. LX, fig. 1) a tiny chamber appears between the first and antepenultimate chamber of the last whorl; it is situated mainly on the umbilical side (Pl. LX, fig. 2) and is somehow underdeveloped. Unfortunately on our micrograph it is broken off, but we can notice its remnants.

C. Umbilical side
   a) Shape of umbilicus: medium-broad, open
   b) Chambers: subspherical
   c) Sutures: depressed, medium-deep, radial

D. Aperture
   a) Shape: low-arcuate
   b) Position: interiomarginal, umbilical to extraumbilical
   c) Rim or lip: a thin lip
   d) Supplementary apertures: distinct indications on sutures of spiral side

E. Surface ornamentation and pore character
   Surface resembles fine lace. On the spiral side, chambers of the initial whorl are not perforate, at multiple magnification (x 1 000) extremely fine perforation is visible though. The surface of the chambers is finely semolinous. Ornamentation in the second and third whorls is quite regular. It consists of thickly dispersed fine papillae, with finely semolinous surface among them, perforated with evenly distributed medium-broad deep pores. In the centre of each papilla is a small opening.

Depository of holotype: Photo-archives in Dionýz Štúr Institute of Geology, Bratislava, Micrographs No. 4187/1972, 4188/1972, 4178/1972.

Type locality: Stredné Plachtince in the Ipeľská kotlina depression, drillhole S-174, 252—253 m.

Type level: Oncophora beds of the Lower Miocene

Stratigraphical range: Unestablished so far.

Remark: The new species is derived in evolution from the species *Globigerina praebulloides* Blow, 1959 in a broader sense (not from *G. praebulloides occlusa* Blow et Banner, 1962). On its spiral side are more indications of supplementary apertures arranged differently from itermediary forms *Globigerina praebulloides occlusa — Globigerinoides quadrilobatus primordius* mentioned by W. H. Blow and F. T. Banner (1962).

By its surficial ornamentation, perforation and by the presence of apertural lip it resembles the subspecies *Globigerina praebulloides praebulloides* Blow, 1962 (emended in the above mentioned paper) from which it differs mostly in indications of supplementary apertures.

Globigerina sp. 1

Test description by means of SEM (Pl. LXI, fig. 1—4):

A. General shape
   a) Number of chambers in the last whorl: 4 ½ (specimen investigated here is sinistrogyre.)
   b) Equatorial profile: approximately trilobate
      bb) Periphery: rounded, perforate
   c) Axial profile: loaf-shaped
   d) Maximum diameter: 142 μ (proportionable to the growthparameters of the other foraminifers from the beds studied)

B. Spiral side
   a) Number of whorls: almost 3
      aa) Growth rate in the coiling direction: continuous
   b) Chambers: subspherical to reniform
      bb) Arrangement: in a short trochospire
   c) Sutures: shallow, slightly depressed; intercameral ones are radial, slightly curved.

C. Umbilical side
   a) Shape of umbilicus: quadrangular, open, medium-broad
   b) Chambers: subspherical
   c) Sutures: slightly depressed, radial

D. Aperture
   a) Shape: asymmetric arch
   b) Position: interiomarginal, umbilical-extraumbilical
   c) Rim or lip: not observed
   d) Supplementary apertures: not observed

E. Surface ornamentation and pore character

In the first whorl and almost in the whole second whorl, on otherwise smooth walls are pores situated along sutures on the internal side of the spiral. On the transitory chamber between the second and the third whorl (the 9 th chamber) are fine pores and thorns. On the next 3 chambers of the last whorl are broader pores arranged in polygonal forms by fusing papillae. On the last chamber are distinct, separately confined thorns with small pores among them.

Locality: Suché Brezovo, drillhole M-88, 302 — 303 m.

Remark: By its morphological characters the specimen described is best related with the subspecies *Globigerina praebulloides occlusa* Blow et Banner 1962, mostly as regards its quadrangular umbilicus, asymmetrical aperture without lip, coarse perforated wall, distinctly hispid. Our specimens frequent in the beds studied, have 4 ½ to 5 chambers in the last whorl.

When we look at Fig. 4 in Pl. LXI, showing 1.200 x magnified initial part of the test, and compare the right side of the figure with its left side, then mainly on the contact between the 3rd and 8th chambers we notice some lamination of the wall.

Globigerina sp. 2

The specimen is scanned from the umbilical side only, not determined exactly as yet, so it is only presented to illustrate the shape variableness of planktonic foraminifers of the beds under study. Its test is also interesting by different changing ornamentation of chambers in the last whorl.

Test description by means of SEM (Pl, LVIII, fig. 3).

A. General shape

a) Number of chambers in the last whorl: 5 (Specimen investigated here is sinistrogyre.)

b) Equatorial profile: petaloid

bb) Periphery: rounded, perforate

c) Axial profile: cannot be determined according to micrograph

d) Maximum diameter: 221 μ

B. Spiral side: not scanned

C. Umbilical side

a) Shape of umbilicus: deep, narrow

b) Chambers: subspherical, markedly inflated the last one is spherical

c) Sutures very depressed, broader among subspherical chambers, the last suture is narrow, radial

D. Aperture

a) Shape: small

b) Position: interiomarginal, umbilical — extraumbilical

c) Rim or lip: indistinct lip

d) Supplementary apertures: not observed

E. Surface ornamentation and pore character

On the lst — 3rd chambers of the last whorl are broadened pores, surrounded by polygonal „interpore ridges" (J. Herman 1971); on the 4th and 5th (the last) chambers are conspicuous, separately confined papillae, and deep narrow pores. In the centre of some papillae are small openings.

Locality: Stredné Plachtince, drillhole S-174, 252 — 253 m.

Remark: The same surficial ornamentation and perforation is in fig. 4 in Pl. LVIII. The specimen comes from the same locality. Test shape and growth-parameters are identic also. Differences are in morphology of umbilicus and in apertures.

Genus *Cassigerinella* Pokorný, 1955
Cassigerinella boudecensis Pokorný, 1955

1955 *Cassigerinella boudecensis* n. gen., n. sp. — V. Pokorný: Cassigerinella boudecensis etc., p. 139—140, text fig. ??. Pl. 10, fig. 1

In Oncophora beds of the Ipeľská kotlina depression the specimen was recorded at the locality Suché Brezovo, drillhole M-88, 302 — 303 m. The test shown in P. LXII, fig. 1 vas originally covered with thorns broken off during fossilization. Thus irregular larger openings in the test formed. Pores are circular smaller openings. Maximum test diameter: 162 μ.

Conclusions

Some remarks on the stratigraphical position of the Oncophora beds in the Ipeľská kotlina.

1. According to the species *Globigerina woodi connecta* Jenkins and other associate planktonic foraminifers, the beds may be best correlated with the zone *Globigerina woodi connecta* described by D. G. Jenkins (1971).

The author of the subspecies and of the Lower Miocene zone *G. woodi connecta* (Aquitanian to Burdigalian in the sense of European stratigraphical units) regards the subspecies as a possible ancestor of *Globigeinoides trilobus trilobus* (Reuss). This does, however, concern only the Lower Miocene of New Zealand, where *G. woodi connecta* most likely developed from *G. woodi woodi* — as postulated by D. G. Jenkins.

Based on my preliminary research I think that the development was similar in our country as well. Such parallel development is also reasoned by geographical position of New Zealand and of our country. The area investigated by D. G. Jenkins is in austral latitude zone, i. e. southwards of 30° parallel, whereas our country is in the boreal area i. e. in the northern hemisphere, northwards of the 30°N parallel. Although the Tertiary paleogeographic conditions on the globe might had been different from the present, analoguos history of foraminiferal plankton is evident.

2. According to foraminiferal microfauna, the Oncophora beds of the Ipeľská kotlina are closely related with the Karpatian microfauna of the area under study. I think they are a component of the Karpatian sedimentation cycle being its facial variety (V. Kantorová, A. Ondrejíčková, D. Vass 1968). When referred to the zone *Globigerina woodi connecta*, they correspond — according to W. H. Blow's index zonation — to the zone N4 below the zone *Globigerinoides trilobus trilobus* (N5). Some specimens examined are already close to the type *Globigerinoides trilobus trilobus*, and *Globigerinoides sicanus*.

3. Within the world stratigraphical scale based on planktonic foraminifers the local stages for Paratethys — M2 Ottnangian + M3 Karpatian — are to be regarded as Lower Miocene as already mentioned W. H. Blow (1969) placing Karpatian in his stratigraphic scale as follows (cf. W. H. Blow l. c., text fig. 19, p. 288):

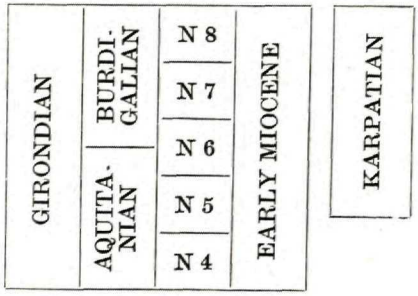


Fig. 2

According to foraminiferal plankton the beds are still older — I was mentioned above.

I. Cicha and J. Seneš (1973) ranged the beds — in accordance with W. H. Blow (l. c.) — into the zone N6 and NN4 — the nannoplanktonic zone of E. Martini (1971).

The Oncophora beds of the Ipeľská kotlina may be stratigraphically correlated with the zone *Globorotalia kugleri* of H. M. Bolli, O. L. Bandy and J. A. Postuma, and with the zone *Globigerinoides primordius* of W. H. Blow, I. Cicha and J. Seneš (cf. text fig. 3).

After O. L. Bandy, the Oligocene/Miocene boundary is on the upper confinement of the zone *Globorotalia kugleri* and (or *Globigerinoides primordius* and) or *Globigerina woodi connecta*. After H. M. Bolli, W. H. Blow, J. A. Postuma and D. G. Jenkins it is on the lower confinement, whereas I. Cicha and J. Seneš put it deep below, at the base of the zone *Globigerina ampliapertura*. N. B. Hornibrook and A. R. Edwards dealing with planktonic foraminifers and with calcareous nannoplankton of the Cenozoic in New Zealand, refer the zone *Globigerina woodi connecta* marked with Nr. 71 still to the Oligocene, whereas the zone *Globorotalia kugleri* is considered stratigraphically younger, marked with Nr. 73—74 and ranged in the Lower Miocene.

In spite of stratigraphical and taxonomical contradictions quoted, there is actual hope for future accordance between these and other stratigraphical schemes to be gained on the basis of international cooperation. V. A. Krasheninnikov (1973) tries successfully for unification of the zonal scheme of the

Fig. 3 Oligocene/Miocene boundary
Based on zonal scheme of planktonic foraminifers

W. H. Blow's index zonation	International units	TRINIDAD H. M. Bolli 1957	Substantially 30°S – 35°N latitude		N. ZEALAND D. G. Jenkins 1973	CENTRAL PARATETHYS I. Cicha – J. Seneš 1973		CALIFORNIA O. L. Bandy – J. C. Ingle jr. 1970
			W. H. Blow 1969	J. A. Postuma 1971				
N_5	↑ Miocene	*G. dissimilis*	*G. dehiscens praedehiscens*	*G. trilobus trilobus*	*G. trilobus trilobus*	*G. trilobus*	NEOGÉN	*C. dissimilis*
N_4		*G. kugleri*	*G. guadrilobatus primordius*	*G. kugleri*	*G. woodi connecta*	*G. primordius*		*G. kugleri*
$N_3 = P_{22}$	Oligocene	*G. ciperoensis ciperoensis*	*G. angulisuturalis*	*G. angulisuturalis*	*G. woodi woodi*	*G. opima opima*		earlier zones not treated in the paper quoted
					G. dehiscens			
$N_2 = P_{21}$		*G. opima opima*	*G. opima opima*		*G. euapertura*			
$N_1 = P_{19/20}$	↓	*Globigerina ampliapertura*			*G. angiporoides angiporoides G. brevis*	*G. ampliapertura*		

Oligocene/Miocene boundary marked with thick line

Miocene based on planktonic foraminifers and for uniform conception concerning the Oligocene/Miocene boundary.

Recently, investigations and micrographs taken by means of Scanning electron microscopes facilitate international cooperation. This cooperation is promising. It is promising for solving many world and regional stratigraphical problems including our own.

Reviewed by O. Samuel.

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Viera Kantorová

Planktonické foraminifery onkofórových vrstiev v Ipeľskej kotline

3 obr., 10 tab. (LIII—LXII), Resumé anglického textu

V onkofórových vrstvách Ipeľskej kotliny sa vyskytujú tanatocenózy foraminifér veľmi drobného vzrastu. Popri bentonických, sú v nich pomerne značne zastúpené i planktonické druhy, čo dokazuje ich morský pôvod a vekovú spätosť s karpatienskými (vrchnohelvétskymi v klasickom ponímaní) sedimentmi tejto oblasti.

Pomocou SE mikroskopu autorka v nich rozoznala 8 druhov a poddruhov globigerín, z toho jeden nový — *Globigerina praeglobigerinoides* n. sp., 5 ďalších foriem bude možné po dokonalejšom preskúmaní opísať, pravdepodobne ako nové subspecie.

Druh *Globigerina woodi connecta* Jenkins 1964 umožňuje tieto vrstvy stratigraficky

korelovať s rovnomennou zónou austrálnej oblasti D. G. Jenkinsa (1973). Poloha tejto zóny je vyznačená na obr. 3 v anglickom texte.

Z uvedeného je zrejmé, že onkofórové vrstvy, a teda i karpat sú staršie, ako sa doteraz predpokladalo.

Explanations of plates LIII—LXII

Plate LIII

Fig. 1, 2 *Globigerina woodi woodi* Jenkins, 1 — umbilical side, 2 — spiral side, × 300, Locality: Suché Brezovo, drillhole M-88, 281—282

Fig. 3, 4 *Globigerina woodi connecta* Jenkins, 1 — spiral side, 2 — umbilical side, × 375, Locality: Suché Brezovo, drillhole M-88, 308—309 m.

Plate LIV

Surface details of the specimen from precedent plate.

Fig. 1 *G. woodi woodi.* Funnelshaped pores surrounded with projecting reticulations. × 1.600.

Fig. 2 *G. woodi connecta.* Funnelshaped pores piercing nearly plain wall surface. × 3.000.

Plate LV

Globigerina ex gr. woodi Jenkins, 3 different representatives (see pp. 102—104)

Fig. 1 Spiral side of a finely reticulated specimen, × 300. Locality: M. Krtíš, sand pit.

Fig. 2 Spiral side of a more coarsely reticulated specimen with cicatricose sutures, × 300. Locality; Suché Brezovo, drillhole M-88, 308—309 m.

Fig. 3, 4 Spiral side and lateral view of very coarsely reticulated specimen, reticulations with distinct projections, × 450. Locality: Suché Brezovo, drillhole M-88, 281—282 m.

Plate LVI

Surface details of the specimen from precedent plate.

Fig. 1 belongs to fig. 1, x 1.000

Fig. 2 belongs to fig. 2, × 1.300

Plate LVII

Fig. 1—3 *Globigerina* cf. *angulisuturalis* Bolli, 1 — spiral side of a sinistrogyre specimen, × 400, 2 — umbilical side of a dextrogyre specimen, × 375. Locality: Suché Brezovo, drillhole M-88, 301—302 m, 3 — spiral side of a dextrogyre specimen, x 300. The same drillhole, 308—309 m.

Fig. 4 *Globigerina ciperoensis ottnangiensis* Rögl, spiral side, × 375. The same drillhole, 302—303 m.

Plate LVIII

Fig. 1—2 *Globigerina* cf. *falconensis* Blow, 1 — lateral view, × 400, 2 — detail of precedent, × 2.400. Locality: Suché Brezovo, drillhole M-88, 301—302 m.

Fig. 3 *Globigerina* sp. 2, umbilical side, × 270 M-88, 301—302 m.
Fig. 4 Another globigerina from umbilical side with similar surface ornamentation but different umbilical structure, × 225. Locality of 3; 4: Stredné Plachtince. drillhole S-174, 252—253 m.

Plate LIX

Fig. 1—2 *Globigerina* cf. *eamesi* Blow, 1 — spiral side of a small specimen, × 450, 2 — umbilical side of a larger specimen, × 375. Locality: Suché Brezovo, drillhole M-88, 302—303 m.
Fig. 3—4 *Globigerina* cf. *praebulloides* Blow, 3 — spiral side of a dextrogyre specimen, × 300, 4 — umbilical side of a dextrogyre specimen, × cca 300 m. Locality: Suché Brezovo, drillhole M-88, 302—303 m.

Plate LX

Fig. 1—3 *Globigerina praeglobigerinoides* n. sp., 1 — spiral side of the holotype (sinistrogyre), × 240, 2 — umbilical side of a paratype (dextrogyre), × 240, with missing „tiny chamber" (see description on p.), 3 — surface detail of the holotype showing the suture between first and last chamber with indications of supplementary apertures; we can notice also 3 chambers of initial whorl. Locality: Stredné Plachtince, drillhole S-174, 252—253 m.

Plate LXI

Fig. 1—4 *Globigerina* sp. 1 (aff. *praebulloides occlusa* Blow et Banner) 1 — spiral side of a sinistrogyre specimen, × 400, 2 — umbilicolateral view of the same specimen, × 400, 3 — spiral side of the same specimen turned aside, × 400, 4 — early stage of the preceeding, × 1.200. Locality: Suché Brezovo, drillhole M-88, 302—303 m.

Plate LXII

Fig. 1 *Cassigerinella boudecensis* Pokorný, × 375, Locality: Suché Brezovo, drillhole M-88, 302—303 m.
Fig. 2—4 ? *Globigerina* sp. Two specimens belonging apparently to the same species; extremely rare. Contamination of umbilical regions causes artefact effects which do not allow a proper determination. They are figured here to give a more complete idea of planktonic foraminiferal microfauna of the oncophora beds studied. Locality: Suché Brezovo, drillhole M-88, 299—300 m.

Západné Karpaty, sér. paleontológia, 2—3 P. 119—124, Geol. úst. D. Štúra Bratislava 1977

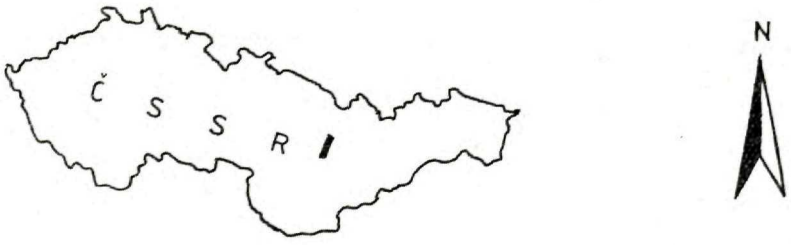
Edita Brestenská

Thekamöben (Protozoa) des Neogens vom Kessel Turiec

2 Tafeln (LXIII—LXIV)

Abstrakt. V neogénnej výplni Turčianskej kotliny, vo vrte GT-6 (Turčiansky Peter) a BJ-2 (Záturčie pri Martine) sa našli schránky tekamöb, ktoré sa javia byť novým rodom *Calcisacculus*, s dvoma druhmi *piriformis* a *amphoraeformis*.

In der Bohrung GK-6, geteuft im Jahre 1974 bei der Gemeinde Turčiansky Peter, wurden in dem mittleren Teil des Kessels Turiec Gehäuse von Thekamöben vorgefunden. Die Tiefe der Bohrung beträgt 300 m und in mehreren Lagen von 130—267 m kommen Thekamöben in hellgrauen kalkigen Tonen mit sandiger Beimenge vor, am häufigsten sind sie in der Probe von 188 m vertreten. Sie wurden auch en einer Lage, und zwar in der Tiefe von 189—200 m in der Bohrung BJ-2, geteuft im Kessel Turiec im Vorort von Martin, vorgefunden. Es handelt sich um den ersten Fund, nicht nur in der neogenen



Ausfüllung des Kessels Turiec, sondern der intramontanen Depressionen der Karpaten überhaupt, obzwar die neogenen Ablagerungen des Kessels Turiec von mehreren Bohrungen und Aufschlüssen mikropaläontologischen Analysen unterzogen wurden (V. Pokorný 1960, E. Brestenská 1974). Gemeinsam mit den Thekamöben kommen von Mikroorganismen noch Ostrakoden vor, die fast ausschliesslich zu den Vertretern der Familie *Cyprididae*,

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haupsächlich der Unter-Familie *Candoninae* gehören, von der Familie *Cytheridae* handelt es sich nur um die Vertreter der Unter-Gattung *Leptocythere (Amnicythere)*. Übereinstimmende oder sehr ähnliche Vergesellschaftungen von Ostrakoden wurden auch in anderen Bohrungen und Aufschlüssen der neogenen Ablagerungen im Kessel Turiec vorgefunden und laut ihnen können wir auf ein limnisches Süsswasser — oder höchstens auf ein oligohalines — Sedimentationsmillieu schliessen (Salinität 0,5—3 %), in gutem ökologischen Einklang ist das Vorkommen von Thekamöben damit zu bringen.

Die Thekamöben bilden eine künstliche Gruppe einzelliger Lebewesen (*Protozoa*) zu welchen alle beschalte *Rhizopoda*, ausser den Foraminiferen, gehören. Das System der rezenten Rhizopoden ist bei fossilen Funden nicht anwendbar, da dieses auf den Charakter der Pseudopodien beruht. Die Thekamöben leben und lebten auch wahrscheinlich vorwiegend im Süsswasser, Vorkommen im Brackwasser oder Meereswasser ist selten (G. Deflandre 1952).

Funde von fossilen Thekamöben sind zur Zeit selten, die ältesten sind vom Karbon des Ostrau-Karwiner Gebietes (M. Vašiček — B. Růžička 1957). In der neogenen Zentral-Paratethys wurden Thekamöben in mehreren Lagen des unteren Miozäns gefunden (I. Cicha et al. 1971) und dann im Pannon. Bei allen diesen unseren neogenen Vorkommen handelt es sich um Vertreter der Gattung *Silicoplacentina*, erstmals vom Pannon Ungarns beschrieben (J. Kövåry 1956).

Bis zurzeit bekannte rezente und fossile Thekamöben haben ein tektinöses, agglutiniertes oder kieselig-sekretorisches Gehäuse, nur die Gattung *Paraquadrulina* ist die einzige, die das Gehäuse aus kalkigen Plättchen gebildet hat (V. Pokorný 1958). Die Thekamöben vom Neogen des Kessels Turiec unterscheiden sich dadurch, dass ihr Gehäuse von kleinen $CaCO_3$ Körnchen gebildet ist und dies führte mich zur Bestimmung der neuen Gattung *Calcisacculus*. Ich habe anhand des Grundformtypus der Schale nur zwei neue Arten ausgegliedert, weil bei manchen rezenten Arten der Thekamöben die Form des Gehäuses sehr variiert. Der grösste Teil der gefundenen Formen war ausserdem noch postmortal zusammengedrückt und auch mannigfaltig anders deformiert, was aus den Raster-Elektronen Mikrographen ersichtlich is (Taf. LXIII und Taf. LXIV).

Künstliche Gruppe *Thekamöben*
Calcisacculus n. gen.

Typische Art: *Calcisacculus piriformis* n. sp.

Derivatio nominis: Nach dem kalkigen beutelförmigen Gehäuse.

Diagnosis: Das Gehäuse ist von kleinen $CaCO_3$ Körnchen zusammengesetzt, hellbrauner Farbe, einkammerig, beutelförmig ohne weiterer inneren Gliederung. Ersichtlich ist dies von Bruchflächen der häufig beschädigten

Exemplare, wo auch die Stärke der Wand sichtbar ist. Diese ist meist von der Grösse des Gehäuses abhängig — meist 0,02—0,04 mm stark. Die Wände der Schalen waren ursprünglich nachgiebig, biegsam, wahrscheinlich mit organischem Bindemittel, es weisen darauf verschiedene Deformationen. Die Oberfläche des Gehäuses ist feinkörnig ohne beachtenswerte Fortsätze und Öffnungen, bis auf die einzige Mündung. Die Mündung ist einfach, rund oder mit einer lippenartigen Verstärkung versehen. Die Grösse des Gehäuses, eigentlich die Länge bewegt sich zwischen 0,33—1,25 mm.

Beziehungen: *Calcisacculus* n. gen. weist der Form seines Gehäuses nach die grösste Ähnlichkeit mit rezenten Formen auf, welche zur Gattung *Difflugia* s. l. zugereiht wurden, unterschieden sich aber durch das Material ihres Gehäuses. Difflugien haben ein tektinöses oder agglutiniertes Gehäuse, wobei *Calcisacculus* n. gen. es von $CaCO_3$ Körnchen zusammengesetzt hat. Von den Vertretern der Gattung *Silicoplacentina* Kövàry, 1956 mit kieseligem Gehäuse unterscheiden sie sich nicht nur durch das Material, sondern auch durch ihre Form. Silicoplacentinen haben ein mehr sphärisches Gehäuse, während die Vertreter der Gattung *Calcisacculus* ein längliches besitzen.

Calcisacculus piriformis n. sp.

Taf. LXIII, Fig. 1—8.

Derivatio nominis: Nach dem birnenförmigen Gehäuse.

Holotypus: Taf. LXIII, Fig. 1 — Aufbewahrt auf dem Geologischen Institut d. D. Štúr in Bratislava.

Paratypoide: Einige Zehner von Exemplaren.

Locus typicus: Bohrung GT-6 Turčianský Peter (Mittelslowakei) Teufe 130—267 m.

Stratum typicum: Oberes Süsswasser — Miozän.

Diagnosis: Thekamöben mit Gehäusen von kleinen kalkigen Körnchen zusammengesetzt, birnenförmig mit einfacher runden Mündung.

Alle gefundenen Exemplare haben verschieden durch Druck deformierte Gehäuse, wenn wir aber ihre ursprüngliche Form rekonstruieren, erhalten wir eine niedrige Birnenform. Die meisten Exemplare sind längs verflacht, so dass die Mündung als eine Ellipse oder eine Spalte am verengten Umfang des Gehäuses erscheint (Taf. LXIII, Fig. 1—3, 6). Auf den mehr oder weniger senkrecht zur Längsachse verflachten Exemplaren (Taf. LXIII, Fig. 5) sieht man, dass die Mündung ursprünglich rund war. Der Durchmesser der Mündung ist verschieden gross und ist direkt von der Grösse des Gehäuses abhängig — 0,05 bis 0,10 mm.

Die Grösse der Gehäuse ist sehr variabel. Länge 0,33 bis 0,56 mm, die grösste Breite von 0,26 bis 0,52 mm.

An beschädigten Exemplaren sehen wir, dass manche Gehäuse teilweise mit dem umgebenden Gestein gefüllt sind.

Calcisacculus amphoraeformis n. sp.
Taf. LXIV, Fig. 1—10.

Derivatio nominis: Nach amphorenähnlicher Form des Gehäuses.

Holotypus: Taf. LXIV, Fig. 1 — Aufbewahrt auf dem Geologischen Institut d. D. Štúr in Bratislava.

Paratypoide: Einige Zehner von Exemplaren.

Locus typicus: Bohrung GT-6 Turčiansky Peter (Mittelslowakei) Teufe 130—267 m.

Stratum typicum: Oberes Süsswasser — Miozän.

Diagnosis: Thekamöben mit einem Gehäuse aus kleinen kalkigen Körnchen zusammengesetzt, amphorenförmig mit runder Mündung, welche eine lippenartige Verstärkung hat und durch eine mehr oder weniger ausgeprägte Halsverengung getrennt ist.

Die Länge des Gehäuses erreicht meistens das vierfache seiner grössten Breite, diese befindet sich beiläufig in der Entfernung von der Mündung im ¼ der gesamten Länge.

Die Gehäuse sind meistens nur längs seitlich verflacht (Taf. LXIV, Fig. 1, 2, 4, 9), es kommen aber auch andere Deformationen vor, wie verschiedene Biegungen (Taf. LXIV, Fig. 8), oder auch wie ein faltenartiges Zusammenhäufen der Wand (Taf. LXIV, Fig. 5).

Die Mündung ist durch eine mehr oder weniger ausgeprägte Halsverengung getrennt und hat eine lippenartige Verstärkung am Rand. Ausserdem ist das Gehäuse bei der Mündungsöffnung trichterförmig nach innen gebogen, welches an manchen längsverflachten Exemplaren sichtbar wird, wobei dieser Teil nach der Deformation sich manchmal von der Mündung herausschiebt (Taf. LXIV, Fig. 9—10).

Die Länge der gefundenen Exemplare variiert zwischen 0,50 bis 1,25 mm, die grösste Breite von 0,20—0,35 mm. Der Durchmesser der Mündung samt Lippenverstärkung misst 0,10—0,13 mm.

Reviewed by O. Samuel.

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Elräuterungen zu den Tafeln LXIII—LXIV

Taf. LXIII

Calcisacculus piriformis n. sp., Bohrung GT-6 Turčiansky Peter 188,5 m
Fig. 1—6 Verschieden deformierte Exemplare; 80 ×
Fig. 7—8 Bruchfläche eines beschädigten Exemplares, Fig. 7; 80 ×, Fig. 8; 120 ×

Taf. LXIV

Calcisacculus amphoraeformis n. sp., Bohrung GT-6 Turčiansky Peter, 188,5 m
Fig. 1, 2, 4, 9 Längs seitlich verflachte Exemplare; 40 ×
Fig. 3 Mündung der Fig. 2; 200 ×
Fig. 5 Deformiertes Exemplar mit faltenartiger Zusammenhäufung der Wand; 40 ×
Fig. 6—7 Quere Bruchfläche eine beschädigten Exemplares, Fig. 6; 40 ×, Fig. 7; 300 ×
Fig. 8 Verflachtes und gebogenes Exemplar; 40 ×
Fig. 10 Mündung der Fig. 9; 200 ×

Alle Aufnahmen wurden auf dem Geologischen Institut d. D. Štúr in Bratislava verfertigt — Raster-Elektronenmikroskop JSM — U 3.

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A new subspecies of nummulites from the locality Lopúchov

1 pl. (CXI), Slovak summary

Abstract. The article deals with Nummulites anomalus lopuchovensis ssp. n. a small nummulites found in a slump body at Lopúchov in East Slovakian flysch. In this rich assemblage of larger foraminifers occur two interesting specimens which might indicate polymorphism of nummulites.

By the study of larger foraminifers from the Flysch zone in East Slovakia, in a slump body at Lopúchov (The locality description and valuation of the assemblage are in the paper by J. Nemčok — M. Vaňová 1976: „Redeposition of Larger Foraminifers in East Slovakian Flysch Belt") found was a rich assemblage of larger foraminifers containing small nummulites. With the outlook of their test they resemble the species *Nummulites anomalus anomalus Harpe*. But in equatorial section their shape and number of septae are different as well as the thickness of the marginal cord and the space of the spiral. For the different characters they are classified in the new subspecies.

To facilitate a comparison between the subspecies *Nummulites anomalus lopuchovensis* ssp. n. and the species *Nummulites anomalus anomalus* Harpe represented is paleontological description of specimens of the latter also recorded at Lopúchov.

Nummulites anomalus lopuchovensis ssp. n.

Form A

pl. CXI, fig. 1—6

Holotype: the specimen nr. 51 (from a slump body at Lopúchov deposited at Dionýz Štúr' Institute of Geology, Bratislava; pl. CXI, fig. 1

Paratypes: specimens Nr. 29, 33, 36, 44, 49, 62 from the slump body in Lopúchov, deposited at Dionýz Štúr Institute of Geology, Bratislava.

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Stratum typicum: Upper Lutetian — Upper Priabonian.

Locus typicus: Lopúchov, northeastern Slovakia, Czechoslovakia.

Derivatio nominis: the village Lopúchov, finding place.

Material: tests of Nummulites.

Diagnosis: A small convex test with straight septal filaments sinousus-bent at the periphery. A small protoconch. Chambers in internal whorls are diagonal, with a very deep upper-back angle. In the last whorl the chambers are less oblique, with a shallower upper-back angle.

Shape of the test: The test is identic with that of *Nummulites anomalus* Harpe. It is convex, flattening toward the periphery. Its edge is sharp. From the polar region straight septal filaments run out to get sinuous-bent at the periphery. On the holotype and paratypes, the course of septal filaments is not conspicuous because their colour blends with the test surface. The test dimensions are $\frac{1.1 - 1.9}{0.6 - 1}$ mm. The ratio of the test diameter to its thicknes varies between 1 . 2 and 3, and the ratio of the test thicknes to its diameter — between 0 . 33 and 0 . 8.

Internal structure of the test: the nucleoconch is isolepidine in shape. Protoconch dimensions:

	LP*	HP
WW	0.048 — 0.087 mm	0.061 — 0.098 mm
WI	0.073 — 0.129 mm	0.092 — 0.177 mm

Other parts of the test: In the first two whorls the spiral growth rate is great, in the third whorl the space diminishes. In the specimen Lopúchov 62, the height of the third whorl is not up to the height of the preceding one: The values of L in the individual whorls vary as follows:

Whorl	I	II	III	IV
	0,092 — 0.148	0.096 — 0.143	0.042 — 0.092**	
	1.51 — 2.04	0.81 — 1.48***		

In the first whorl the thickness of the marginal cord occupies 1/6 — 1/2 of the chamber height, in the second 1/9 — 1/4, in the third 1/10 — 2/5, in the fourth 1/9 of the chamber height. In the inner whorls the upper-back angle of chambers is deep, elongated. In the fourth whorl are chambers with less oblique course and a less elongated angle. The shape of the chambers is controlled by the form of septa. In the inner whorls, septa are knee-curved in the middle part, in the fourth whorl the bent shifts into the upper part of their

* LP — Lenght of the Protoconch, HP — Height of the protoconch, WW — without walls, WI — walls including

** L value in the sense of R. Pavlovec (1967)

*** L value in the sense of P. Rozlozsnik (1924)

course, and becomes less distinct. The number of septa in the individual whorls varies as follows:

Whorl	I	II	III	IV
	7—9	10—13	14—16	17—

Remarks and comparisons: The specimens described differ from the species *Nummulites anomalus anomalus* Harpe — besides the form of septa and chambers in the last whorl — in lower growth rate of the spiral, in its thinning toward the test periphery. The smallest number of septa in the individual whorls is somewhat higher than in the species *Nummulites anomalus anomalus* Harpe.

Occurrence: The subspecies *Nummulites anomalus lopuchovensis* ssp. n. was recorded in a slump body at Lopúchov. It occurs together with species of varied stratigraphical range including the Eocene and Lower Oligocene, such as *Nummulites rotularius* Deshayes, *Nummulites variolarius* (Lamarck), *Numulites aturicus* Joly-Leymerie, *Numulites puschi* Archiac, *Nummulites striatus pannonicus* (Rozlozsnik), *Nummulites anomalus* Harpe, *Numulites pulchellus* Harpe, transitional form from *Nummulites fabianii* (Prever) to *Nummulites fichteli fichteli* Michelotti, *Nummulites bouillei* Harpe and *Nummulites budensis* Hantken. Since the species living in the Cuisian — Lower Lutetian and in the Oligocene are missing here, its stratigraphical range may comprise the Upper Lutetian — Upper Priabonian. It is hardly possible to determine its age more exactly, because it is an assemblage found in a replaced sediment.

Nummulites anomalus anomalus Harpe, 1877

Form A 1

pl. CXI, fig. 7—10

1877 *Numulites anomalus* de la Harpe — Ph. de la Harpe: Nummulites des environs de Nice et Menton, p. 827—828, tab. 17, fig. 12—18 (non 15) (AB) (non vidi) (fide N. N. Barchatova — G. I. Nemkov, 1965)

1879 *Nummulites anomalus* m. partim — Ph. de la Harpe: Nummulites du comté de Nice, etc., p. 211, tab. 10, fig. 13, 16, 18

1957 *Nummulites anomalus* de la Harpe, forma A — F. Bieda: Fauna veľkých foraminifer etc., p. 51, tab. 4, fig. 3—4

1963 *Nummulites anomalus* de la Harpe, forma A — F. Bieda: Duże otwornice eocenu tatrzańskiego, p. 75—77, tab. 7, fig. 4—5, 11—12

1965 *Nummulites anomalus* de la Harpe, 1877, forma A — N. N. Barchatova — G. I. Nemkov: Krupnye foraminifery Mangyšlaka etc., p. 73—74, tab. 12, fig. 1—6

1967 *Numulites anomalus* de la Harpe, 1879 — forma A — E. Köhler: Grossforaminiferen und Stratigraphie etc., p. 42, tab. 4, fig. 5—7

1972 *Nummulites anomalus* de la Harpe, 1879, forma A — M. Vaňová: Nummulites from the area of Bojnice etc., p. 30—32, pl. 2, fig. 8—11, pl. 3, fig. 9—12, text. tab. 7

The shape of the test: A small test, convex in its middle part with a sharp flat periphery, covered by straight septal filaments sinuosus — curved near the periphery. Dimension: $\frac{1-1.4}{0.5-0.9}$ mm. The ratio between the diameter of the test and its breadth varies between 1,44—2.4, and the ratio between the thickness of the test and the diameter between 0.38—0.69.

Internal structure of the test: Nucleoconch is isolepidine in shape. Protoconch dimensions:

	LP	HP
WW	0.039—0.098 mm	0.042—0.112 mm
WI	0.067—0.132 mm	0.070—0.162 mm

Other parts of the test: A spiral in the first two whorls grows rapidly. In the third whorl the space diminishes (besides the specimen Nr. 28 — Lopúchov) in the fourth whorl it almost stops growing. The L values in isolated whorls vary in a comporatively broad range:

Whorl	I	II	III	IV
	0.092—0.017	0.036—0.168	0.011—0.154	0.003
	1.28—2.33	1.03—1.7		1.34

The thickness of the marginal cord in the first whorl occupies 1/6—1/2, in the second 1/7—3/5, and in the third whorl 1/7—1/3 of the chamber height. The upper-back angle of the chambers is sharp, deep. In the middle part of the test the chambers are separated by knee-curved and markedly diagonal septa. The number of septa in the individual whorls varies as follows:

Whorl	I	II	III	IV
	5—8	9—12	11—16	19

Remarks and comparisons: When the specimens described are compared with those recovered from the Central-Carpathian Paleogene and from the Tatran Eocene (F. Bieda 1957, 1963; E. Köhler 1967, M. Vaňová 1972), the specimens described show smaller dimensions. Found were also specimens with a smaller protoconch (Lopúchov 48, Papín 4). A comparison of the lengths of radius in the individual whorls (M. Vaňová 1972) shows that most specimens are identic with those described in 1972. Shorter is radius of the specimen Lopúchov 140 (in the first to third whorls), Lopúchov 48 (in the first whorl). Radii of the specimens Papín 8 (in the second whorl) and Lopúchov 45 (in the third whorl) are longer.

In 1965, N. N. Barchatova and G. I. Nemkov found larger tests and differently shaped septa and chambers in the last whorl of the specimens

Table of statistical data measured on the equatorial section of *Nummulites anomalus anomalus* Harpe A_1 A_2 and *Nummulites anomalus lopuchovensis* Vaňová ssp. n. A

Locality	Number of the specimen	dimensions	Protoconch				Length of the nucleoconch walls including	Lenght of the radius in whorls				Diameter of the test in whorls				L value in whorls							Number of septa in whorls				Species	Form
			Length		Height											in the sense of R. Pavlovec (1967)				in the sense of P. Rozlozsnik (1924)									
			without walls	walls including	without walls	walls including		1	2	3	4	1	2	3	4	1	2	3	4	1–2	2–3	3–4	1	2	3	4		
Lopúchov	140	1,2 / 0,8	0,025	0,045	0,020	0,048	0,067	0,070	0,213	0,459	0,790					0,070	0,073	0,104	0,084	2,04	1,72	1,34					*Nummulites anomalus anomalus* Harpe	B ? A
	48	1,3 / 0,8	0,039	0,067	0,048	0,076	0,106	0,092	0,260	0,484		0,249	0,543	1,005		0,092	0,076	0,056		1,81	1,33		8	10	12			
	28	1,4 / 0,7	0,076	0,104	0,076	0,123	0,151	0,104	0,244	0,482		0,298	0,577	0,972	1,420	0,104	0,036	0,098	0,003	1,28	1,7	1,01		11	15	19		
	45	1,8 / 0,8	0,081	0,120	0,092	0,140	0,179	0,126	0,420	0,868		0,468	1,028	1,795		0,126	0,168	0,154		2,33	1,52			11	16			A_1
	27	1,2 / 0,5	0,098	0,129	0,106	0,157	0,212	0,151	0,417							0,151	0,115			1,75			5	9				
	85	3,8 / 1,6	0,174	0,216	0,190	0,255	0,350	0,302	0,798	1,588		0,952	1,798	2,467		0,302	0,194	0,294		1,64	1,59		8	10	11			A_2
Papín	4	1 / 0,5	0,039	0,067	0,042	0,070	0,098																6	9				
	8	1,3 / 0,5	0,092	0,132	0,112	0,162	0,210	0,171	0,443			0,227				0,171	0,087			1,51			7	10				A_1
Osadné	3	1,3 / 0,9	0,070	0,095	0,073	0,118	0,143	0,106	0,330	0,672		0,356	0,717	1,299		0,106	0,118	0,011		2,10	1,03			12	15			
Lopúchov	49	1,8 / 1	0,048	0,092	0,064	0,115	0,179	0,115				0,361				0,115							7	13	14		*Nummulites anomalus lopuchovensis* ssp. n.	A
	44	1,8 / 0,6	0,050	0,073	0,061	0,092	0,148	0,143	0,386	0,680		0,375	0,818	1,361		0,143	0,101	0,050		1,71	1,20		7	10	15	17		
	33	1,1 / 0,6	0,056	0,098	0,084	0,129	0,190	0,133	0,347			0,361	0,759			0,133	0,101			1,81			7	11	13			
	51	1,9 / 0,8	0,064	0,106	0,081	0,132	0,165	0,106	0,302	0,638		0,347	0,666	1,239		0,106	0,090											
	36	1,7 / 1	0,067	0,095	0,070	0,177	0,185	0,120	0,316			0,378	0,728			0,120	0,076			1,62			9	13	16			
	29	1,2 / 0,6	0,070	0,115	0,087	0,137	0,176	0,143	0,358							0,143	0,073			1,51			9	11	16			
	62		0,087	0,129	0,098	0,146	0,193	0,115	0,336	0,515		0,414	0,790	1,202		0,115	0,106	−0,042		1,92	0,81		8	13				
Hostovice	10	1,8 / 0,9	0,053	0,090	0,067	0,112	0,154	0,092	0,280	0,560		0,325	0,624	1,127		0,092	0,096	0,092		2,04	1.48		8	12	14			
	21		0,059	0,084	0,078	0,106	0,157	0,174				0,454											7	13				

from the U.S.S.R. In the bottom part of their height they are straight, and in the 2nd third they are abruptly curved backward. The height of chambers is 1.5 times greater than their width; occasionally isometric. In the material from the East-Slovakian flysch occurred some specimens of a similar character. They differ from the specimens quoted by G. I. Nemkov in less diagonal chambers, in less elongated and shallower upper — back angle. The specimens are quoted as *Nummulites anomalus lopuchovensis* ssp. n.

Form A 2

pl. CXI, fig. 11, 12

Shape of the test: The test is flat, from the polar region slim septal filaments run out. They are sinuous-bent at the periphery. The test diameter is 3.8 mm; its thickness is 1.6 mm. The ratio between the test diameter and its thickness is 2.3; the ratio of the test thickness to its diameter is 4.2.

Internal structure of the test: the nucleoconch is isolepidine-shaped. It is necessary to note that the wall between the protoconch, the deuteroconch and the first chamber is very thin. This is why in the figure the shape of the nucleoconch is distorted: it looks as if the deuteroconch were higher than the protoconch. Actually, it is lover. Its size without the walls is 0.143 mm with the walls 0.204 mm.

Dimensions of the protoconch:

	LP	HP
WW	0.174 mm	0.190 mm
WI	0.216 mm	0.255 m

Other parts of the test: The spiral grows rapidly up to the third whorl. In the third whorl the growth is slightly slower — according to the L value sensu P. Rozlozsnik (1924).

Whorl	I		II		III
	0.302		0.193		0.294
		1.64		1.59	

The thickness of the marginal cord is invariable — up to 1/6—1/7. Chambers are diagonal with an extremly deep upper-back angle. Septa in the lower part are abruptly knee-curved and run diagonally backwards. They are thicker in the lower part than in the upper. In the first whorl are 8, in the second 10 and in the third 11 septa.

Remarks and comparisons: The specimen described (Lopúchov 85) comes from a slump body at Lopúchov. It differs from typical A forms of the specimens of the species *Nummulites anomalus anomalus* Harpe in approximately twice such dimensions of the test, radius and chambers.

Found was also another interesting specimen (Lopúchov 140). Its test and equatorial section were identic with the species *Nummulites anomalus anomalus* Harpe. It only had a smaller protoconch and a tightly coiled spiral. According to the coiling of the spiral it could be the form B, but the protoconch is rather large for the form B. A more detailed description of the specimen cannot be presented since it has been damaged when prepared for photographing. It is mentioned here only because it is difficult to say whether it is form A or B. It could be, however, supposed that together with the specimen Lopúchov 85 they might indicate polymorphism of Nummulites*.

Stratigraphical range: The species *Nummulites anomalus anomalus* Harpe is known from the Middle and Upper Eocene of France, Albania, Hungary, Czechoslovakia and U.S.S.R.

Reviewed by O. Samuel.
Translated by E. Jassingerová.

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* In 1925 J. Hofker introduced the term trimorphism for Nummulites. On the grounds of various stages of ontogenetic evolution distinguished were forms B and forms A 1 and A 2. J. A. Cushman (1950) mentions trimorphism in the species *Idalina antiqua* (d'Orbigny) and *Marginulina aculeatea* (d'Orbigny). He suggests the term to be replaced by „polymorphism", considering possible existence of more than two megaspherical generations. According to O. V. Okropiridze (1957) it is possible to distinguish more macrospherical generations among Nummulites. B. T. Golev — J. V. Sovčik (1971) described the species *Nummulites arcanus* and distinguished two generations: A_1 and A_2. In our description by Form A_1 the form commonly denoted as Form A is meant.

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Explanation of plate CXI:

1—6 *Nummulites anomalus lopuchovensis* ssp. n.
1 A form, number of the specimen 51, holotype, Lopúchov, × 19.4
2 A form, number of the specimen 44, paratype, Lopúchov, × 21
3 A form, number of the specimen 36, paratype, Lopúchov, × 18.2
4 A form, number of the specimen 29, paratype, Lopúchov, × 21.6
5 A form, number of the specimen 10, Hostovice, × 16.6
6 A form, number of the specimen 10, Hostovice, × 17.8

7—12 *Nummulites anomalus anomalus* Harpe
7 A_1 form, number of the specimen 28, Lopúchov, × 25.7
8 A_1 form, number of the specimen 28, Lopúchov, × 18.6
9 A_1 form, number of the specimen 48, Lopúchov, × 18.5
10 A_1 form, number of the specimen 45, Lopúchov, × 20.6
11 A_2 form, number of the specimen 85, Lopúchov, × 12.6
12 A_2 form, number of the specimen 85, Lopúchov, × 12,6
Photo M. Vaňová

Margita Vaňová

Nový poddruh numulita z lokality Lopúchov

I tabuľka (CXI) resumé anglického textu

Pri štúdiu veľkých foraminifér z flyšového pásma na východnom Slovensku sa v sklzovom telese v Lopúchove* našli drobné numulity, ktoré vzhľadom schránky pripomínajú druh *Nummulites anomalus anomalus* Harpe. V ekvatoriálnom reze sa však líšia tvarom a počtom sept, komôrok a hrúbkou a rastom špirály. Pre tieto odlišné vlastnosti sme sa rozhodli ich vyčleniť ako poddruh *Nummulites anomalus lopuchvensis* ssp. n. V bohatom spoločenstve vystupujú spolu s druhmi s rôznym stratigrafickým rozpätím spadajúcim do eocénu až spodného oligocénu. Nakoľko tu chýbajú druhy žijúce v cuise až spodnom lutéte a v oligocéne, možno uvádzať, že jeho stratigrafický diapozón spadá medzi vrchný

* Opis lokality a vyhodnotenie spoločenstva je uvedené v práci: Nemčok, J.—Vaňová, M. 1977: Redeposition of Larger Foraminifers in East Slovakian Flysch Belt. — Geol. Práce Správy 66. Geol. Úst. D. Štúra, Bratislava.

lutét a vrchný priabón. Presnejšie stanoviť jeho vek nemožno, pretože tu ide o spoločenstvo v premiestenom sedimente.

Tiež v tomto spoločenstve sa našiel jeden exemplár, ktorý sa od typických A foriem exemplárov druhu *Nummulites anomalus anomalus* Harpe odlišuje približne raz tak veľkými rozmermi schránky, rádia a komôrok a exemplár, ktorý sa od druhu *Nummulites anomalus anomalus* Harpe líši menšou protokonchou a užšie vinutou špirálou. Tieto exemplâre by mohli nasvedčovať výskytu polymorfizmu u numulitov.

Západné Karpaty, sér. paleontológia 2—3, P. 133—142, Geol. úst. D. Štúra Bratislava, 1977

Eduard Köhler—Karol Borza—Ondrej Samuel

Genus Hellenocyclina from West Carpathian Maastrichtian

1 text-fig., 4 pl. (LXV—LXVIII), Slovak summary

Abstract. The authors give a detailed description of the species *Hellenocyclina beotica* Reichel from the Maastrichtian of the West Carpathians. This is the first description of the genus *Hellenocyclina* from the Carpathians.

The genus *Hellenocyclina* belongs among the scarcest genera of orbitoid foraminifers with uncertain phylogenetic position. So far it has only been described in detail from Greece, France and the Netherlands. According to the existing results — also confirmed by our data — the genus represents a significant fossil of the uppermost Cretaceous — the Maastrichtian (even the Upper Maastrichtian in M. Neumann's 1958 opinion).

Examining Maastrichtian rocks of diverse areas of Slovakia we found frequent small test axial sections in thin-sections. They were denoted as *Linderina* sp. (O. Samuel — K. Borza — E. Köhler 1972, Pl. LXX, Figs. 1—2; Pl. LXXI, Figs. 1—4). Examination of further material, compared with descriptions and pictures presented by M. Reichel (1949) and H. J. Gillavry (1963) proved identity of our forms with those of the genus *Hellenocyclina*. Since descriptions of the genus are scarce, its stratigraphic significance being considerable, we shall give a detailed description of Carpathian specimens. Regretfully, they could only be studied in thin-sections of hard rocks.

Familia *Orbitoididae* Schwager, 1876
Genus *Hellenocyclina* Reichel, 1949

Formerly, representatives of the genus were denoted as *Linderina* (e. g. *Linderina douvillei* Silvestri in a monograph by A. M. Visser 1950). Based on cross-sections of Maastrichtian limestones of Greece, M. Reichel (1949)

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defined the genus *Hellenocyclina*. The author did also depict and describe an extraordinary nepiont consisting of 6 cross-arranged chambers, and its axial section was denoted as holotype.

The genus *Hellenocyclina* differs from the similar genus *Monolepidorbis* defined by G. Astre in 1927, in lacking vacuoles in the lateral thickening, in the distinct lateral layer, an in the type of embryonic apparatus. M. Reichel pointed to close relationship between the genera *Hellenocyclina* and *Orbitocyclina* Vaughan, 1929. *Orbitocyclina* have, however, well developed lateral chambers which are absent in *Hellenocyclina* (cf. J. T. Van Gorsel 1972).

Whereas Vl. Pokorný (1958, p. 390) regards the genus *Hellenocyclina* as independent, W. Storrs Cole (Treatise on Invertebrate Paleontology, 1964, p. C 711) refers the genus among *Orbitoides* in rather broad a sense. Doubtlessly, the absence of lateral chambers is a character sufficient for distinguishing the genus *Hellenocyclina* from *Orbitoides*. Up to now only two species have been known, viz.: *Hellenocyclina beotica* Reichel, 1949 (from Greece and France) and *Hellenocyclina visserae* (Hofker, 1958) (from the Netherlands and from France). H. J. Mac Gillavry (1963) found out that the species only differ from each other in the type of embryonic apparatus and in nepiontic arrangement. M. Reichel (1949) described a particular nepiont of *H. beotica*. The nepiont consists of 6 chambers. Nepiontic arrangement of *H. visserae* is biserial. Frequently, the wall of the first auxiliary chamber is thickened and the arrangement seems trilocular. H. J. Mac Gillavry saw *H. beotica* in M. Reichel collection and admitted that the only embryonal apparatus of *H. beotica* in equatorial section by M. Reichel (1949, textfig. 7, 8, 10) was either abnormal or distorted by somewhat oblique section. Axial sections through embryonic apparatus and comparison between figures by M. Reichel (e. g. holotype in textfig. 2), H. J. Mac Gillavry (Pl. IV., fig. 2) and our axial sections (Pl. XVII, figs. 1—6) show evident resemblance. Presumably, in all cases recorded is bilocular embryonic apparatus with biserial nepiontic arrangement, and then the only embryonic apparatus described by M. Reichel (1949) is abnormal*. In such case also the species *H. visserae* (Hofker) may by included in synonymy of the species *H. beotica* Reichel (it is also admitted by H. J. Mac Gillavry 1963).

Uncertain is still the phylogenetic position of the genus *Hellenocyclina*. Logically it could be in phylogenetic relation with the Campanian genus *Monolepidorbis*, but H. J. Mac Gillavry (1963) denies the relationship because of a more primitive nepiontic stage of the genus *Hellenocyclina* than of the stratigraphically older genus *Monolepidorbis*. Mac Gillavry also regards the relationship between the Maastrichtian genus *Hellenocyclina* and the Eocene genus *Linderina* as almost improbable. We do not agree, because the

* In our collections are several abnormal embryonic apparatuses in orbitoid foraminifers. So it is no extraordinary phenomenon.

literature studied (for example M. Neumann 1954, M. Kaever 1970, J. Hofker Sr. 1975) leads us to admitting phylogenetic relationships between the genera *Hellenocyclina* and *Linderina*.

Hellenocyclina beotica Reichel, 1949

Pl. LXV–LXVIII

1949 *Hellenocyclina beotica* n. sp. — M. Reichel: Sur un nouvel Orbitoidé du Crétacé supérieur hellénique, p. 482–484, textfigs. 1–10.
1958 *Hellenocyclina beotica* Reichel — M. Neumann: Révision des Orbitoididés du Crétacé et de l'Éocène en Aquitaine occidentale, p. 67–68, Pl. IV, fig. 7, 8.
1972 *Linderina* sp. — O. Samuel — K. Borza — E. Köhler: Microfauna and lithostratigraphy, etc. Pl. LXX, fig. 1–2, Pl. LXXI, fig. 1–4.

Material: 63 axial sections in thin-sections of hard limestones and sandstones. The thin-sections are in the depository at the Institute of Geology of the Slovak Academy of Science in Bratislava.

External features: Shells are lenticular or disc-shaped, considerably variable: bilaterally evenly convex (Pl. LXV, fig. 3, Pl. LXVI, figs. 4–6 Pl. LXVII, figs. 1,5), either more convex on one side (Pl. LXV, figs. 1, 4) or flattened (Pl. LXV, fig. 2, Pl. LXVII, fig.2). Symmetrically curved shells are infrequent (Pl. LXVI, figs. 1, 2) or some are only curved on periphery (Pl. LXVI, fig. 3).

The shell diameter varies between 0.47 and 1.27 mm, smaller specimens predominating:

diameter in mm:	0.50–0.70	0.70–0.90	0.90–1.10	1.10–1.30	
number of specimens:	13	7	6	4	(30)

The central shell thickness varies between 0.20 and 0.45 mm.

As far as the axial sections may show, the shell surface is smooth, only equatorial chambers are shining through the thin lateral layer at the periphery.

Internal structure in sections: Oriented equatorial sections are very rare, predominate oblique and axial sections.

The sections show that the embryonic apparatus is bilocular and consists of two approximately equal chambers. The large primary auxiliary chamber with thickened wall gives a trilocular appearance of the centre (Pl. LXVIII, figs. 3–6). The inner diameter of the protoconch is 0.030–0.045 mm, the diameter of embryonic apparatus is 0.075–0.090 mm; the protoconch wall is 0.008–0.012 mm thick. Nepiontic arrangement is biserial.

Equatorial chambers in equatorial sections (Pl. LXVIII, figs. 3–6) are ogival or short spatulate (according to M. G. Rutten's 1941 classification). The size of equatorial chambers is quite constant (0.030 × 0.030 mm)

and it does not increase markedly towards periphery. Axial sections show that the equatorial layer is slightly thickening from the middle towards periphery (in the central part the thickness is 0.03—0.04 mm, at the periphery 0.05—0.07 mm). The equatorial chambers are mutually connected by stolons which are scarcely visible in sections (Pl. LXVIII, fig. 1,2). One or two stolons are in the central part of the chamber, at its base. The stolon diameter is 0.004 — 0.007 mm. The presence of stolons indicates genetical relationship between the genera *Hellenocyclina* and *Orbitoides*. It follows that they are to be placed next to each other in the system (Vl. Pokorný 1958 ranged the genus *Hellenocyclina* among *Lepidorbitoidae*). No traces of communication between equatorial chambers and the lateral layer have been observed.

The equatorial layer is surrounded by compact lateral layers on both sides. The thickness of the lateral layer is considerably variable: 0.10 — 0.23 mm (usually 0.15 — 0.20 mm) in the centre, 0.02 — 0.04 mm at the periphery. M. Reichel (1949) found a channel system formed by very fine vertical (after M. J. Mac Gillavry 1963 also slightly diagonal) canals, in the lateral layer. Traces of such canals are on some of our specimens (Pl. LXVII, figs. 3, 6; Pl. LXVIII, figs. 1, 2). In Pl. LXVI, fig. 4 the dissection of the lateral layer in the form of lamelles resembles the cross-section of the genus *Linderina*. Since it is an extraordinary phenomenon, it is supposed to be a secondary product of fossilization and recrystallization of the shell.

Variability: Considerably variable are the shape, size and thickness of the lateral layer. This variability is not controlled by the stratigraphic level of the specimens studied. In contrast to that very stable are size of embryonic chambers, shape and size of equatorial chambers.

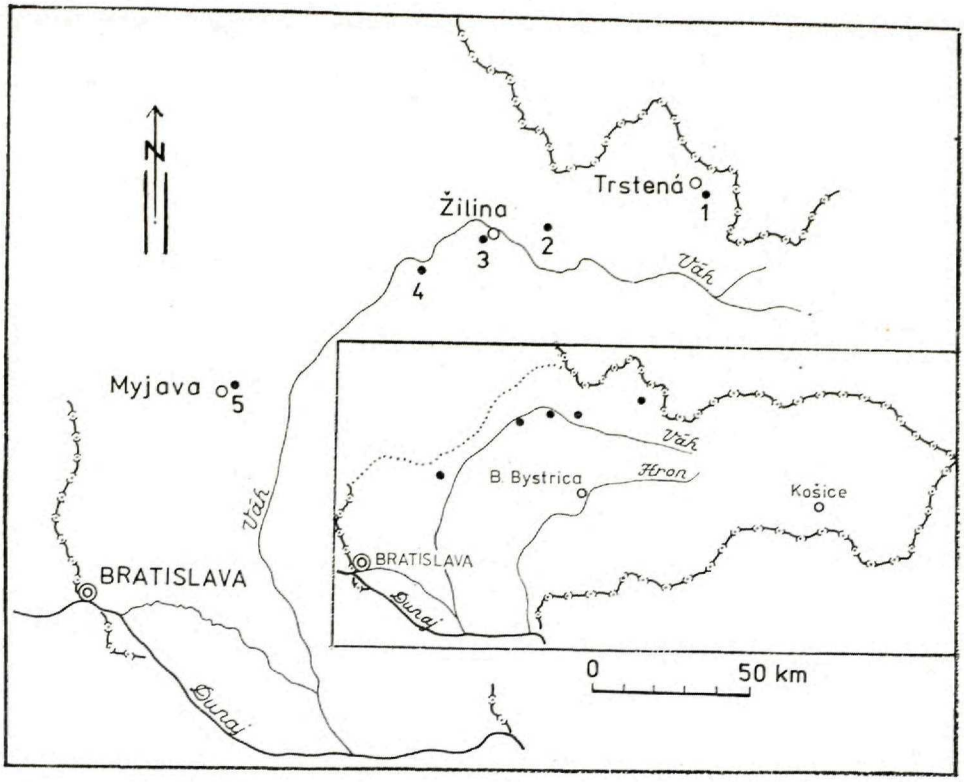
Dimorphism: No dimorphism observed.

Occurrence and associations: The genus *Hellenocyclina* is described from the Carpathians for the first time. In the West Carpathians it occurs in the so-called orbitoid facies of the Upper Cretaceous in Western Slovakia. It was recorded from the Lower and Upper Maastrichtian (Fig. 1).

Lower Maastrichtian rocks with *H. beotica* are only known from pebbles:

1. Locality Brezovica (Northern Orava) — pebbles of carbonate organogenic sandstones in Upper Eocene conglomerates. In the sandstones the species described is in an association with *Orbitoides media media* (d'Archiac), *O. media megaloformis* Papp et Küpper, *O. apiculata plana* Köhler, *Lepidorbitoides minor* (Schlumb.), *L. socialis* (Leymerie), *Siderolites calcitrapoides* Lamarck, *Omphalocyclus macroporus* (Lamarck), *Miscellanea* sp., „*Operculina*" aff. *fleuriasi* (d'Orbigny). Present are also small foraminifers, *Calcisphaerula innominata* Bonet, coralline algae, *Pieninia oblonga* Borza et Mišík, ostracods, bryozoans, crinoidal segments, echinoderm spines, fragments of lamellibranchiate shells, hippurites, fosphatized fish scales.

2. Locality Berešíci near Terchová. In Lower-Lutetian conglomerates are pebbles of grey microsparite and biohem limestones of the Maastrichtian age.



Text-fig. 1. Locality map showing the distribution of *Hellenocyclina beotica* Reichel in West Carpathians. Localities: 1 — Brezovica (Northern Orava), 2 — Berešíci near Terchová, 3 — Na Skale (west of Žilina), 4 — Svätá Helena near Považská Bystrica, 5 — Stará Turá.

Hellenocyclina beotica occurs there with *Orbitoides media media* (d' Archiac), *Lepidorbitoides socialis* (Leymerie), *Siderolites calcitrapoides* Lamarck; present are also small foraminifers, *Planorbulina cretae* (Marsson), *Cadosina* aff. *spinosa* Borza, *Pithonella ovalis* (Kaufmann), ostracods, coralline algae, *Pieninia oblonga* Borza et Mišík, dasycladacea, *Acicularia* sp.; bryozoans, crinoidal segments, echinoderm spines, fragments of lamellibranchiate tests, a. o.

The rest of occurrences are from Upper Maastrichtian:

3. Locality Na Skale (west of Žilina, below the elevation point Hradisko). In an indistinct tectonic position below conglomerates of Lower Eocene is an exposed bed of sandy limestone, containing — besides the species described — frequent shells of *Orbitoides apiculata apiculata* Schlumb., *Orbitoides apiculata plana* Köhler, *O. gensacicus gensacicus* (Leymerie), *Siderolites calcitrapoides* Lamarck, *Lepidorbitoides socialis* (Leymerie), *Omphalocyclus macroporus* (Lamarck), as well as agglutinated and rotalid forami-

nifers, coralline algae, „*Solenomeris*" sp., bryozoans, shell fragments of lamellibranchiates and rudists.

4. Locality Svätá Helena near Považská Bystrica. Pebbles of gray sandy limestones and/or calcareous sandstones are in conglomerates of Ilerdian age. In pebbles *H. beotica* occurs together with *Orbitoides apiculata apiculata* Schlumb., *O. apiculata plana* Köhler, *O. media media* (d'Arch.), *O. gensacicus gensacicus* (Leymerie), *O. gensacicus praevius* Köhler, *Lepidorbitoides socialis* (Leymerie), *Siderolites calcitrapoides* Lamarck and *Sulcoperculina globosa* Cizancourt. There are also shells of small foraminifers, *Planorbulina cretae* (Marsson), *Pithonella ovalis* (Kaufmann), coralline agae, *Pieninia oblonga* Borza et Mišík, serpules, corals, crinoidal segments and fragments of lamellibranchiate, gastropod and rudist shells.

5. Locality Stará Turá. Pebbles of sandy limestones in Paleogene conglomerates. The species described occurs in association with *Orbitoides apiculata apiculata* Schlumb., *O. gensacicus gensacicus* (Leymerie), *O. gensacicus preavius* Köhler, *Lepidorbitoides socialis* Leymerie, *Omphalocyclus macroporus* (Lamarck), *Siderolites calcitrapoides* Lamarck, small foraminifers, bryozoans, echinoderm spines, crinoidal segments and fragments of shells of lamellibranchiates and rudistes.

Living environment: The nature of sediments indicates that the species *Hellenocyclina beotica* Reichel lived in shallow-water litoral-neritic zones of very warm Maastrichtian seas.

Reviewed by M. Vaňová.
Translated by E. Jassingerová.

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Rod Hellenocyclina z maastrichtu Západných Karpát

1 obr., 4 tab. (LXV—LXVIII), resumé anglického textu

Medzi najvzácnejšie rody orbitoidných foraminifér s nejasným fylogenetickým postavením patrí rod Hellenocyclina, ktorý bol doteraz podrobnejšie opísaný iba z Grécka, Francúzska a Holandska a podľa doterajších výskumov — ostatne potvrdených aj našími poznatkami — je tento rod významnou fosíliou najvyššej kriedy — maastrichtu (podľa M. Neumann 1958 dokonca vrchného maastrichtu).

Pri štúdiu maastrichtských hornín z rôznych oblastí Slovenska sme už dlhšiu dobu nachádzali vo výbrusoch prierezy drobných schránok, ktoré sme pôvodne označili ako *Linderina* sp. (O. Samuel — K. Borza — E. Köhler 1973, tab. LXX, fig. 1—2, tab. LXXI, fig. 1—4). Po získaní ďalšieho materiálu a porovnaní s opismi a zobrazeniami v prácach M. Reichela (1949) a H. J. Mac Gillavryho (1963) sme sa presvedčili o identite našich foriem s formami patriacimi do rodu *Hellenocyclina*.

Podľa charakteru sedimentov možno usudzovať, že druh *Hellenocyclina beotica* Reichel obýval plytkovodné litorálno-neritické zóny veľmi teplých maastrichtských morí.

Opísaný druh bol zistený väčšinou vo valúnoch paleogénnych zlepencov (lok. 1—2, 4—5). Jedine pri Žiline (lokalita „Na Skale") vystupuje v nejasnej tektonickej pozícii lavica piesčitého vápenca, o ktorej sa domnievame, že predstavuje primárny odkryv vrchnokriedovej orbitoidovej fácie.

Spodnomaastrichtské horniny a *H. beotica* sú známe iba z valúnov:

1. Lokalita Brezovica (severná Orava) — valúny karonátových organogénnych pieskovcov v zlepencoch vrchného eocénu. V pieskovcoch sa opisovaný druh nachádza v asociácii s *Orbitoides media media* (d'Archiac), *O. media magaloformis* Papp et Küpper, *O. apiculata plana* Köhler, *Lepidorbitoides minor* (Schlumb.), *L. socialis* (Leymerie), *Siderolites calcitrapoides* Lamarck, *Omphalocyclus macroporus* (Lamarck), *Miscellanea* sp., *„Operculina"* aff. *fleuriasi* (d'Orbigny), prítomné sú i malé

foraminifery, *Calcisphaerula innominata* Bonet, koralinné riasy, *Pieninia oblonga* Borza et Mišík, strakódy, machovky, krinoidové články, ostne ježoviek, úlomky schránok lamelibranchiátov a hipuritov, fosfátizované šupiny rýb.

2. Lokalita Berešíci pri Terchovej. V zlepencoch spodnolutétskeho veku sa nachádzajú valúny sivých mikrosparitových i biohermných vápencov maastrichtského veku. *Hellenocyclina beotica* sa v nich vyskytuje spolu s *Orbitoides media media* (d'Archiac), *Lepidorbitoides socialis* (Leymerie), *Siderolites calcitrapoides* Lamarck, prítomné sú i malé foraminifery, *Planorbulina cretae* (Marsson), *Cadosina* aff. *spinosa* Borza, *Pithonella ovalis* (Kaufmann), ostrakódy, koralinné riasy, *Pieninia oblonga* Borza et Mišík, dasycladacea, *Acicularia* sp., machovky, krinoidové články, ostne ježoviek úlomky schránok lamelibranchiátov a i.

Vrchnomaastrichtské sú ostatné výskyty:

3. Lokalita Na Skale (západne od Žiliny, pod kótou Hradisko). V nejasnom tektonickom postavení pod zlepencami spodného eocénu je odkrytá lavica piesčitého vápenca, ktorý popri opisovanom druhu obsahuje časté schránky *Orbitoides apiculata apiculata* Schlumb., *Orbitoides apiculata plana* Köhler, *O. gensacisus gensacicus* (Leymerie), *Siderolites calcitrapoides* Lamarck, *Lepidorbitoides socialis* (Leymerie), *Omphalocyclus macroporus* (Lamarck), ako aj aglutinované a rotalidné foraminifery, koralinné riasy, „*Solenomeris*" sp., machovky, úlomky schránok lamelibranchiátov a rudistov.

4. Lokalita Svätá Helena pri Považskej Bystrici. Valúny sivých piesčitých vápencov až vápnitých pieskovcov sa nachádzajú v zlepencoch ilerdského veku. Vo valúnoch sa sa *H. beotica* vyskytuje spolu s *Orbitoides apiculata apiculata* Schlumb., *O. apiculata plana* Köhler, *O. media media* (d' Arch.), *O. gensacicus gensacicus* (Leymerie), *O. gensacicus praevius* Köhler, *Lepidorbitoides socialis* (Leymerie), *Siderolites calcitrapoides* Lamarck a *Sulcoperculina globosa* Cizancourt. Prítomné sú i schránky malých foraminifér, *Planorbulina cretae* (Marsson), *Pithonella ovalis* (Kaufmann), koralinné riasy, *Pieninia oblonga* Borza et Mišík, serpuly, koraly, krinoidové články a úlomky schránok lamelibranchiátov, gastropódov a rudistov.

5. Lokalita Stará Turá. Valúny sivých piesčitých vápencov v paleogénnych zlepencoch. Opisovaný druh sa vyskytuje v asociácii s *Orbitoides apiculata apiculata* Schlumb. *O. gensacicus gensacicus* (Leymerie), *O. gensacicus praevius* Köhler, *Lepidorbitoides socialis* Leymerie, *Omphalocyclus macroporus* (Lamarck), *Siderolites calcitropoides* Lamarck, prítomné sú i malé foraminifery, machovky, ostne ježoviek, krinoidové články a úlomky schránok lamelibranchiátov a rudistov.

Explanations of plates LXV—LXVIII

Plate LXV

Hellenocyclina beotica Reichel — non-oriented axial sections. Fig. 1. Locality Brezovica, thin-section 6195, magn. 30 ×. Fig. 2. Locality Na Skale, thin-section 6256, magn. 30 ×. Fig. 3. Locality Berešíci, thin-section 6202, magn. 30 ×. Fig. 4. Locality Berešíci, thin-section 6211, magn. 75 ×. Fig. 5. Locality Brezovica, thin-section 6195, magn. 75 ×. Fig. 6. Locality Brezovica, thin-section 6198, magn. 75 ×.

Plate LXVI

Hellenocyclina beotica Reichel — non-oriented axial sections. Fig. 1. Locality Na Skale, thin-section 6257, magn. 75 ×. Fig. 2. Locality Brezovica, thin-section 6196, magn.

75 ×. Fig. 3. Locality Brezovica, thin-section 6193, magn. 75 ×. Fig. 4. Locality Berešíci, thin section 6214, magn. 75 ×. Fig. 5. Locality Na Skale, thin-section 4635, magn. 75 ×. Fig. 6. Locality Stará Turá, thin-section 383/K, magn. 75 ×.

Plate LXVII

Hellenocyclina beotica Reichel — oriented axial sections. Fig. 1. Locality Na Skale, thin-section 6256, magn. 75 ×. Fig. 2. Locality Stará Turá, thin-section 398/K, magn. 75 ×. Fig. 3. Locality Brazovica, thin-section 6196, magn. 75 ×. Fig. 4. Locality Na Skale, thin-section 4635, magn. 75 ×. Fig. 5. Locality Na Skale, thin-section 4634, magn. 75 ×. Fig. 6. Locality Na Skale, thin-section 4634, magn. 75 ×.

Plate LXVIII

Hellenocyclina beotica Reichel — axial, oblique and equatorial sections. Fig. 1. Locality Na Skale, thin-section 6251, magn. 75 × (stolon is marked with arrow-head). Fig. 2. Locality Na Skale, thin-section 6255, magn. 75 × (stolon marked with arrow). Fig. 3. Locality Na Skale II, thin-section 6266, magn. 40 ×. Fig. 4. Same specimen as in 3, magn. 115 ×. Fig. 5. Locality Na Skale II, thin-section 6263, magn. 115 ×. Fig. 6. Locality Na Skale II, thin-section 6266, magn. 115 ×.

Západné Karpaty, sér. paleontológia, 2—3, P. 143—150, Geol. úst. D. Štúra Bratislava, 1977

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Paratintinnina tintinniformis and P. tulipaformis nov. gen. et nov. sp. (incertae sedis) from Upper Triassic limestones of West Carpathians (Czechoslovakia)

3 text-fig., 2 pl. (LXIX—LXX), Slovak summary

Abstract. Described are a new genera (*Paratintinnina*) and two species *P. tintinniformis* and *P. tulipaformis* from Upper Triasic Tisovec (Carnian) limestones of the Stratenská hornatina (mountains).

Introduction

By lithological-microfacial and stratigraphical research of Upper Triassic — Tisovec limestones at more localities found were unique crosssections of fossil organisms. Since they have not been mentioned in the existing literature, we shall denote them as a new taxons. By their morphologic characters they are related with the group *Tintinnina* Bonet, 1956. *Paratintinnina tintinniformis* nov. sp. differs from group *Tintinnina* in size of the test and in the structure of the test. The genus was recorded in the Raming limestones (Cordevolian) of the Choč and the Krížna nappes (? the Raming limestones; the Ladinian? — Cordevolian) in the West Carpathians.

Paratintinnina tintinniformis nov. sp.

Pl. LXIX, Fig. 1—4; Pl. LXX, Fig. 1

Holotypus: The specimen figured in Tab. LXIX, Fig. 1, in the depository at the Institute of Geology Slov. Akad. Sc.; thin section Nr. 5604

Derivatio nominis: According to morphology of the group Tintinnina

Stratum typicum: The Tisovec limestones — carnian.

Locus typicus: The Stratenská hornatina (mountains), at the crossroad between Hrabušice and Stratená. (Text fig. 2, sample Nr. 1).

Material: 8 sections from thin-sections

Diagnosis: A one-chamber test, tintinoid in shape. Its walls are of dark

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micrite calcite. On the distal part is a funnel-like border. In the proximal part of the test is a short caudal projection (Pl. LXIX, Fig. 1—4)

Description: A small, single-chambered, tintinoid test. Its diameter is broadest at ½ of the test height. Then it is slowly narrowing into a neck. On the distal side of the neck is a broad oral aperture. The neck is funnelshaped, with a conspicuous collar on its outer periphery. In the terminal part the collar is slightly concave. Its outer periphery surpasses the diameter of the upper part of the test. In the proximal part of the test is a delicate thorn — the caudal projection. It is not preserved on all forms. The wall of the test is thin, with a smooth outer side; composed of dark micrite calcite. Chitinose matter was not found out. Morphological variability of the test is very low in this species. Only the size of the test, lenght and breadth of the neck are slightly variable. Variable shape and variable collar diameter of the forms depicted are mostly due diverse cross-sections through the test.

Test dimensions in μ:

Number of thinsection	Number of sample	Locality	L	B	CB	CS	Plat. an fig.
5604	1	1 — cross-road between Stratená and Hrabušice	216	133	150	83	I,1
6289	30	2 — cross-road between Stratená and Hrabušice	215	95	123	65	I, 2
6294	30	2 — cross-road between Stratená and Hrabušice	174	93	100	77	I, 3
6299	30	2 — cross-road between Stratená and Hrabušice	205	107	142	81	I, 4
6321	17	2 — cross-road between Stratená and Hrabušice	247	85	139	67	II, 1

Explanations: L = test length; B = test breadth; CB = collar breadth; CS = collar size.

Occurrence: The new species described was recorded in the Carnian of the Tisovec limestones in the Stratenská hornatina mountains in the West Carpathians in Slovakia.

Remark: The new species resembles most *Cucurbita infundibuliforme* Jablonský 1973 in its test morphology. Our taxon differs in single-walled test in the collar part, and in the test surface which is — in contrast to *C. infundibuliforme* — smooth, without uneven projections (except the caudal projection). *Paratintinnina tintinniformis* nov. sp. differs from a morphologically semilar species *Chitinoidella boneti* Doben, 1963 mainly in the composition of its test.

Paratintinnina tulipaformis nov. sp.

Pl. LXX, Fig. 2—4

Holotypus: The specimen figured in Pl. LXX, Fig. 2, in the depository at the Institute of Geology Slov. Akad. Sc.; thin-section Nr. 6326.

Derivatio nominis: According to morphology of the test; lat. tulipa = tulip.

Stratum typicum: The Tisovec limestones — carnian.

Locus typicus: the Stratenská hornatina (mountains); at the cross-roud between Hrabušice and Stratená (Text-fig. 2, sample Nr. 2).

Material: 7 sections from thin-sections.

Diagnosis: The test is unilocular, of ovuloid shape, with a neck and funnel-like collar. The test wall is composed of micritic calcite.

Description: The test is small unilocular, calixshaped in cross-section, which is suboval in the proximal part. The test is slightly widening from the proximal part and attains largest width at about 2/3 of test length. In the next part it either is slightly narrower or the walls have a more or less parallel course. In the distal part a distinct-collar is found, its width does not surpass test length. In the proximal part of test no caudal processus has been observed.

Test dimensions in μ:

Number of thinsection	Number of sample	Locality	L	B	CB	Plat. and fig.
6326	24	2 — cross-road between Stratená and Hrabušice	115	54	170	II, 2
6326	24	3 — cross-road between Stratená and Hrabušice	162	78	185	II, 3
6303	1	3-SW of Havrania skala	138	47	168	II, 4

Explanations: L = test length; B = test breadth; CB = collar breadth.

Occurrence: The newly described species was found in the Tisovec limestones at the crossing of the Stratená and Hrabušice roads Text fig. 2, locality 2) and in the Tisovec limestones SW of Havrania skala Text — fig. 3, locality 3).

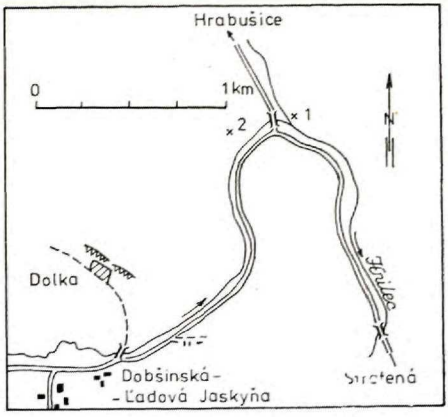
Remarks: The newly described species differs from *Paratintinnina tintinniformis* nov. sp. in having lesser dimensions of the test and wider dimension of the collar.

Finds and microfacial characteristics

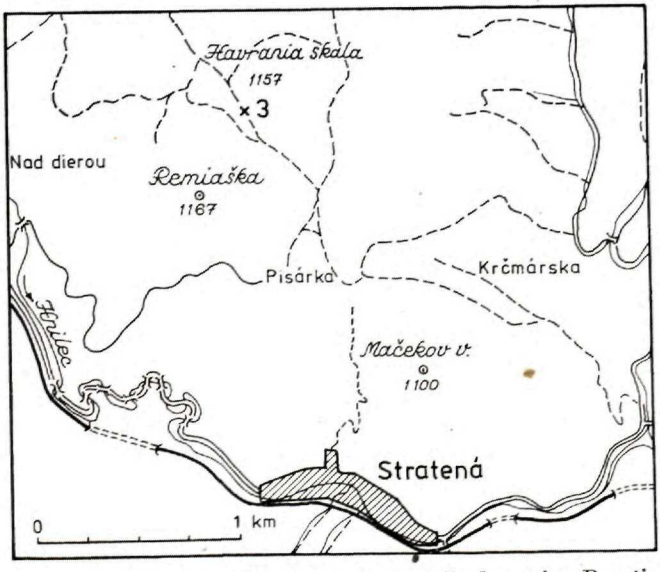
1. The Stratená hornatina (mountains) at the cross-road between Stratená and Hrabušice; the Tisovec limestones — the Carnian (Text — fig. 2, sample Nr. 1). The limestones are grey, with sponges on their weathered surface; recrystallized, surrounded by dark micritic borders composed of algae. Infreguently the limestones contain intraclasts up to 3 mm in size. Most frequent are micrite pellets. The limestones are pelsparitic or intrabiosparitic. In addi-



Text-fig. 1 Profiles studied



Text-fig. 2 A map of locality (1, 2) with the new described species *Paratintinnina tintinniformis* nov. sp. (loc. 1, 2) and *Paratintinnina tulipaformis* nov. sp. (loc. 2).



Text-fig. 3 A map of locality (3) with the new described species *Paratintinnina tulipaformis* nov. sp.

tion to sponges, among organic remains are *Baccanella floriformis* Pantić, *Muranella sphaerica* Borza; foraminifers (*Vidalina* sp., *Ophtahlmidium* sp., *Tetrataxis* sp. and sessile foraminifers), crinoidal segments, fragments of lamellibranchite shells, uniserial bryozoans, ostracods and *Calcisphaera* sp. 1 and *Paratintinnina tintinniformis* nov. sp. Intraclasts are partially micritis of strikingly even oval shape; up to 0,85 mm in size. We cannot say for sure that they are not coprolites.

2. Stratenská hornatina Mts., at the crossing of the Stratená and Hrabušice roads, Tisoves limestones — Carnian (Text — fig. 2, locality 2). The limestones are light-grey, organogenic, on the weathered surface sponges, almost completely recrystallized, are to be observed. Around them are sometimes dark-coloured borders formed by algae or sessile foraminifers are attached to them. The limestones are of biosparite, intrabiosparite character. Besides sponges they very often contain *Muranella sphaerica*, Borza more rarely *Baccanella floriformis* Pantić, *Microtubus communis* Flügel fragments of lamellibranchiate shells, foraminifers, ostracodes, hydrozoans?, *Aeolisaccus* sp., *Paratintinnina tintinniformis* nov. sp. and *Paratintinnina tulipaformis* nov. sp.

3. SE of Havrania skala N of the village Stratená (Text — fig. 3, locality 3), in the cutting of the forest path grey organogenic limestones — the Tisovec limestones of Carnian age occur. At the weathered sufrace abundant organic remains are to be observed, which are much recrystallized. They are mostly sponges, more rarely gastropods. Around sponges are often micrite borders. The limestones are of biopelsparite to intrabiosparite character. Besides the already mentioned organic remains are commonly found *Baccanella floriformis* Pantić, *Muranella sphaerica* Borza, more rarely crinoid stems, ostracodes, foraminifers, serpules, *Thaumatoporella parvovesiculifera* (Raineri), solenopores, *Aeolisaccus gracilis* Pantić, fragments of lamellibranchiate shells, sporadically echinoid spines and *Paratintinnina tulipaformis* nov. sp.

Microfacial analyses show that *Paratintinnina tintinniformis* nov. sp. and *Paratintinnina tulipaformis* nov. sp. occurs in shallow-water, reef and near-reef sediments like *Cucurbita imfundibuliforme* Jablonský, 1973, and most likely it also is referable to sessile forms.

Reviewed by V. Gašpariková.

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Karol Borza — Ondrej Samuel

Paratintinnina tintinniformis nov. sp. a P. tulipaformis n. sp. (incertae sedis) z vrchnotriasových vápencov Západných Karpát (Československo)

3 obr., 2 tab. (LXIX—LXX), resumé anglického textu

Pri litoligicko-mikrofaciálnom a stratigrafickom výskume vrchnotriasových tisovských vápencov v Stratenskej hornatine sme zistili na viacerých lokalitách ojedinelé prierezy fosílnych mikroorganizmov, ktoré neboli doteraz v literatúre opísané. Opísali sme ich ako nové taxóny *Paratintinnina tintinniformis* nov. sp. a *Paratintinnina tulipaformis* nov. sp., ktoré javia určitú afinitu ku skupine tintinoidných fosílií na strane jednej a rodu *Cucurbita* Jablonský 1973 (typ rodu *C. infundibuliforme* Jablonský 1973) neistého systematického postavenia (incertae sedis) na strane druhej.

Od foriem zo skupiny *Tintinnina* Bonnet 1956 sa novoopísané taxóny odlišujú veľkosťou a zložením schránky, kým od rodu *Cucurbita* Jablonský 1973 jednokomôrkovou schránkou a nezdvojeným golierikom.

Podľa mikrofaciálnej analýzy možno konštatovať, že novoopísané druhy sa vyskytujú v plytkovodných — rífových a prirífových sedimentoch. Pravdepodobne patria k sesílnym formám, podobne ako *Cucurbita infundibuliforme* Jablonský 1973, ktorý bol taktiež opísaný z plytkovodných sedimentov. Podľa doterajších výskumov autorov druh *Paratintinnina tintinniformis* nov. sp. a *P. tulipaformis* nov. sp. sa vyskytujú v karne.

V študovanom materiáli sa veľmi vzácne vyskytujú formy, ktoré nie je možné pričleniť k novoopísaným druhom. Ide zrejme o nové taxóny, ktoré bude možné opísať až po získaní väčšieho počtu jedincov.

Explanations of plates LXIX—LXX

Plate LXIX

Fig. 1 *Paratintinnina tintinniformis* nov. sp.
Locality: 1. cross-roud between Stratená and Hrabušice; thin-section 5604 (sample Nr. 1). Tisovec limestones — Carnian; magn. 115 ×. Holotype.
Fig. 2—4 *Paratintinnina tintinniformis* nov. sp.
Locality: 2 cross-roud between Stratená and Hrabušice; thin-section 6289 (sample Nr. 30). Tisovec limestones — Carnian; magn. 115 ×. Paratype.

Plate LXX

Fig. 1 *Paratintinnina tintinniformis* nov. sp.
Locality: 2 cross-roud between Stratená and Hrabušice; thin-section 6321, (sample Nr. 17). Tisovec limestones — Carnian; magn. 115 ×.
Fig. 2—3 *Paratintinnina tulipaformis* nov. sp.
Locality: 2. cross-roud between Stratená and Hrabušice; thin-section 6326, (sample Nr. 24) Tisovec limestones — Carnian; mag. 115 ×, Fig. 2 = holotype; Fig. 3 = paratype.
Fig. 4 *Paratintinnino tulipaformis* nov. sp.
Locality: 3 SW of Havrania skala; thin-section 6303, (sample Nr. 1). Tisovec limestones — Carnian; magn. 115 ×. Paratype.

Západné Karpaty, sér. paleontológia, 2—3, P. 151—174, Geol. úst. D. Štúra Bratislava, 1977

Viera Gašpariková

Correlation of nannoplankton associations with Upper Cretaceous foraminiferal biozones of West Carpathians

10 pl. (LXXI—LXXX), Slovak summary

Abstract. The paper contains the first results of the research of calcareous nannoplankton in Upper Cretaceous sediments of the West Carpathians. Associations of coccoliths are correlated with Upper Cretaceous foraminiferal zones: the zones *Globotruncana angusticarinata, Sigalia carpatica, Globotruncana arca, Globotruncana rugosa, Globotruncana falsostuarti.* In the systematic part 29 species are described, based on the results of examination of individual taxons under scanning electron microscope (SEM).

Introduction

Stratigraphical division of Cretaceous sediments in the West Carpathians is mostly based on planktonic foraminifers facilitating determination of foraminiferal zones and subzones (J. Salaj — O. Samuel 1966), within the range of the Hauterivian — Maastrichtian. In the last years the research of calcareous nannoplankton was aimed at more exact biostratigraphy of the Cretaceous and relationship of zones to individual Cretaceous stages.

I want to give here the first survey of Upper Cretaceous coccoliths of the West Carpathians. Orientational researches show most abundant nanoplankton associations in sediments of the Klippen Belt and of the Myjavská pahorkatina (upland). In these areas ten localities have been chosen to be stratigraphically exactly ranged into the following foraminiferal zones:

zone *Globotruncana angusticarinata*
zone *Sigalia carpatica*
zone *Globotruncana arca*
zone *Globotruncana rugosa*
zone *Globotruncana falsostuarti*

Microfaunistic characteristics of the localities under study.

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Locality 1 — Dohňany, an exposure at the north of the village, southward of elevation, point 370,7

Foraminiferal associations determined by O. Samuel (in D. Andrusov — O. Samuel 1971) correspond to the zone *Globotruncana angusticarinata*, and they are represented by the species: *Globotruncana angusticarinata* Gandolfi, *Globotruncana coronata* Bolli, *Globotruncana linneiana linneiana* (Orbigny), *Globotruncana sigali* Reichel, *Globotruncana tricarinata tricarinata* (Quereau).

Locality 2 — Praznov, an exposure at the west of the village, northward of elevation, point 385,0

A foraminiferal association (O.Samuel in D. Andrusov — O. Samuel 1971) characteristic of the zone *Globotruncana angusticarinata* is represented by the following species: *Globotruncana angusticarinata* Gandolfi, *Globotruncana coronata* Bolli, *Globotruncana linneiana linneiana* (Orbigny), *Globotruncana linneiana marginata* (Reuss), *Globotruncana tricarinata tricarinata* (Quereau), *Globotruncana ventricosa primitiva* Dalbiez, *Stensioeina praeexsculpta* (Keller), *Stensioeina praeexsculpta gracilis* Brotzen.

Locality 3 — Horné Sŕnie, a quarry near Salaš

Rich associations of planktonic foraminifers (V. Gašpariková 1971) represent the zone *Globotruncana angusticarinata*. The associations comprise: *Globotruncana angusticarinata* Gandolfi, *Globotruncana coronata* Bolli, *Globotruncana linneiana linneiana* (Orbigny), *Globotruncana linneiana spinea* Kikoine, *Globotruncana tricarinata tricarinata* (Quereau), *Gyroidina praeglobosa* Brotzen, *Stensioeina praeexscuplta* (Keller), *Heterohelix globulosa* (Ehrenberg).

Locality 4 — Hatné, the right bank of a creek at the northwest of elevation, point 332,8

Foraminifers determined by O. Samuel in D. Andrusov — O. Samuel (1971) represent the zone *Sigalia carpatica*. They are as follows: *Globotruncana coronata* Bolli, *Globotruncana tricarinata tricarinata* (Quereau), *Sigalia carpatica* Salaj — Samuel, *Stensioeina praeexsculpta* (Keller).

Locality 5 — Myjavská pahorkatina (Upland), a road-cut at the northwest of Brezová pod Bradlom, point 276

Foraminiferal associations (J. Salaj 1961) representing the zone *Sigalia carpatica*, contain: *Rhizammina* cf. *indivisa* Brady, *Loxostomum* sp., *Gy-*

roidina cf. *nitida* (Reuss), *Stensioeina praeexsculpta* (Keller), *Reussella szajnochae szajnochae* (Grzybowski), *Globotruncana linneiana linneiana* (Orbigny).

Locality 6 — Koňhora, north of Varín, a cut of a field path

Foraminiferal microassociations (O. Samuel in D. Andrusov — O. Samuel 1971) correspond to the zone *Globotruncana arca*. They contain *Globotruncana arca* (Cushman), *Globotruncana elevata elevata* (Brotzen), *Globotruncana ventricosa ventricosa* White, *Aragonia sotchica* (Keller), *Ventilabrella bipartita* Klasz, *Heterohelix globulosa* (Ehrenberg).

Locality 7 — Malá Udiča, a cut of the road to Jasenica, southward of elevation, point 465,1 (Hradište)

Rich foraminiferal associations (O. Samuel in D. Andrusov — O. Samuel 1971) correspond to the zone *Globotruncana rugosa*. They contain the following species: *Globotruncana arca* (Cushman), *Globotruncana elevata elevata* (Brotzen), *Globotruncana elevata stuartiformis* Dalbiez, *Globotruncana rugosa* (Marie), *Globotruncana fornicata* (Plummer), *Stensioeina diction* Pokorný, *Heterohelix nuttali* (Voorwijk), *Heterohelix tessera* (Ehrenberg), *Ventilabrella eggeri* Cushman, *Reussella szajnochae szajnochae* (Grzybowski).

Locality 8 — Gbelany, at the north of the village, 500 m far from elevation, point 544,2

This is a classical locality of abundant foraminiferal fauna. According to O. Samuel's revision (in D. Andrusov — O. Samuel 1971) the age of the microfauna is Upper Campanian and it corresponds to the zone *Globotruncana rugosa*. It is represented by *Globotruncana arca* (Cushman), *Globotruncana elevata stuartiformis* Dalbiez, *Globotruncana rugosa* (Marie), *Globotruncana fornicata* (Plummer), *Heterohelix tessera* (Ehrenberg).

Locality 9 — Ihrište, an exposure at the east of the village, south-west of the elevation, point 541,2

Foraminiferal associations represent the Lower Maastrichtian zone *Globotruncana falsostuarti*. They contain *Globotruncana falsostuarti* Sigal, *Globotruncana contusa contusa* (Cushman), *Globotruncana stuarti* (Lapparent), *Globotruncana calcarata* Cushman, *Pseudotextularia elegans* Rzehak, *Racemiguembelina varians* (Rzehak), *Steinsioeina exsculpta exsculpta* (Reuss).

Locality 10 — Dolný Hričov, a road cut at the Ovčiarisko

Rich foraminiferal associations correspond to the zone *Globotruncana falsostuarti*. Foraminifers are represented by these species: *Globotruncana falsostuarti* Sigal, *Globotruncana contusa contusa* (Cushman), *Globotruncana stuarti* (Lapparent), *Globotruncana calcarata* Cushman, *Pseudotextularia elegans* Rzehak, *Racemiquembelina varians* (Rzehak), *Ventilabrella glabrata* Cushman, *Reussella szajnochae szajnochae* (Grzybowski), *Stensioeina pommerana* Brotzen.

Here I shall only give composition of nannoplankton associations of Cretaceous foraminiferal zone, representing stratigraphically Coniacian, Santonian, Lower and Upper Campanian and Maastrichtian. The relationships between these associations and the standard Cretaceous nanoplankton zones will be studied later.

Zone *Globotruncana angusticarinata* is characterized by the following species of calcareous nannoflora:

Zygolithus bussoni Noël
Zygolithus compactus (Bukry) Noël
Eiffelithus eximius (Stover) Perch-Nielsen
Eiffelithus turriseiffeli (Deflandre) Reinhardt
Tranolithus orionatus (Reinhardt) Reinhardt
Chiastozygus cuneatus (Lyuleva) Čepek — Hay
Cretarhabdus conicus Bramlette — Martini
Cretarhabdus crenulatus Bramlette — Martini
Praediscosphaera cretacea (Arkhangelsky) Gartner
Cylindralithus serratus Bramlette — Martini
Watznaueria barnesae (Black) Perch-Nielsen
Marthasterites furcatus Deflandre
Micula decussata Vekshina

Most abundant associations were recorded at the locality Horné Sŕnie. There are all species characteristic of the zone. Among them biostratigraphically most significant are *Cylindralithus serratus, Chiastozygus cuneatus* and *Marthasterites furcatus.*

In comparison with the subjacent zone, the *zone Sigalia carpatica* is impoverished in the species *Chiastozygus cuneatus* and *Marthasterites furcatus.* There appear new species: *Tranolithus exiguus, Gartnerago obliquum* and scarcely *Cribrosphaera ehrenbergi.* In the Myjavská pahorkatina (Upland) in the sample Nr. 310/73 was recorded a problematic form *Carpatochitinoides cretaceus.*

The zone *Sigalia carpatica* is characterized by the following species:

Zygolithus bussoni Noël
Zygolithus compactus (Bukry) Noël

Eiffelithus eximius (Stover) Perch-Nielsen
Eiffelithus turriseiffeli (Deflandre) Reinhardt
Tranolithus exiguus Stover
Tranolithus orionatus (Reinhardt) Reinhardt
Cretarhabdus conicus Bramlette — Martini
Cretarhabdus crenulatus Bramlette — Martini
Praediscophaera cretacea (Arkhangelsky) Gartner
Cribrosphaera ehrenbergi Arkhangelsky
Gartnerago obliquum (Stradner) Reinhardt
Watznaueria barnesae (Black) Perch-Nielsen
Markalius circumradiatus (Stover) Perch-Nielsen
Micula decussata Vekshina
Carpatochitinoides cretaceus Gašpariková

Associations of coccoliths in the *zone Globotruncana arca* differ from associations of the zone *Sigalia carpatica* in the extinction of the species *Eiffelithus turriseiffeli* and in new species like abundant *Cribrosphaera ehrenbergi* and *Biscutum constans*. Most common species characterizing this zone are:

Zygolithus compactus (Bukry) Noël
Eiffelithus eximius (Stover) Perch-Nielsen
Tranolithus exiguus Stover
Tranolithus orionatus (Reinhardt) Reinhardt
Cretarhabdus conicus Bramlette — Martini
Cretarhabdus crenulatus Bramlette — Martini
Praediscosphaera cretacea (Arkhangelsky) Gartner
Cribrosphaera ehrenbergi Arkhangelsky
Gartnerago obliquum (Stradner) Reinhardt
Biscutum constans (Gorka) Black
Watznaueria barnesae (Black) Perch-Nielsen
Markalius circumradiatus (Stover) Perch-Nielsen
Micula decussata Vekshina

Zone *Globotruncana rugosa* is characterized by the appearance of the species *Ahmuellerella octoradiata, Arkhangelskiella cymbiformis, Cylindralithus laffittei, Cyclagelosphaera margereli*. Sporadically also appear the species *Bipodorhabdus tesselatus*. The significant Upper-Campanian form *Kamptnerius magnificus* was not found in the sediments studied. Neither species *Zygolithus compactus* abundant in previons zones, nor the species *Tranolithus orionatus* appear anymore.

In this zone most frequent are the following species:

Zygolithus bussoni Noël
Eiffelithus eximius (Stover) Perch-Nielsen
Tranolithus exiguus Stover

Ahmuellerella octoradiata (Gorka) Reinhardt
Bipodorhabdus tesselatus Noël
Cretarhabdus conicus Bramlette — Martini
Cretarhabdus crenulatus Bramlette — Martini
Arkhangelskiella cymbiformis Vekshina
Gartnerago obliquum (Stradner) Reinhardt
Praediscosphaera cretacea (Arkhangelsky) Gartner
Cribrosphaera ehrenbergi Arkhangelsky
Cylindralithus laffittei (Noël) Black
Biscutum constans (Gorka) Black
Watznaueria barnesae (Black) Perch-Nielsen
Markalius circumradiatus (Stover) Perch-Nielsen
Cyclagelosphaera margereli Noël
Micula decussata Vekshina

Zone *Globotruncana falsostuarti* is the uppermost zone studied. Here the nannoplankton associations are impoverished in the species *Zygolithus bussoni, Tranolithus exiguus, Eiffelithus eximius,* and *Gartnerago obliguum.* The species *Ahmuellerella octoradiata, Arkhangelskiella cymbiformis, Bipodorhabdus tesselatus, Bipodorhabdus granulatus, Helicolithus* sp., *Cribrosphaera laughthoni, Cribrosphaera pelta* are significant for this zone characterized by the following association:

Ahmuellerella octoradiata (Gorka) Reinhardt
Arkhangelskiella cymbiformis Vekshina
Helicolithus sp.
Bipodorhabdus tesselatus Noël
Bipodorhabdus granulatus (Reinhardt) Noël
Cretarhabdus conicus Bramlette — Martini
Cretarhabdus crenulatus Bramlette — Martini
Praediscosphaera cretacea (Arkhangelsky) Gartner
Cribrosphaera ehrenbergi Arkhangelsky
Cribrosphaera laughthoni (Black) Bukry
Cribrosphaera pelta (Gartner) Bukry
Biscutum constans (Gorka) Black
Watznaueria barnesae (Black) Perch-Nielsen
Markalius circumradiatus (Stover) Perch-Nielsen
Cyclagelosphaera margereli Noël
Micula decussata Vekshina
Tetralithus aculeus (Stradner) Gartner

Systematical description

The classification of coccoliths according to systematical order (D. Noël, 1970):

Familia *Zygolithaceae* Noël. 1965
Genus *Zygolithus* Kamptner, 1954
Ahmuellerella Reinhardt, 1964
Eiffelithus Reinhardt, 1966
Helicolithus Noël, 1970
Tranolithus Stover, 1966
Chiastozygus Gartner, 1968
Familia *Podorhabdaceae* Noël, 1965
Genus *Bipodorhabdus* Noël, 1970
Cretarhabdus Bramlette — Martini, 1964
Praediscosphaera Vekshina, 1959
Cribrosphaera Arkhangelsky, 1912
Familia *Arkhangelskiellaceae* Bukry, 1969
Genus *Arkhangelskiella* Vekshina, 1959
Gartnerago Bukry, 1969

Familia *Stephanolithionaceae* Black, 1968
Genus *Cylindralithus* Bramlette — Martini, 1964
Familia *Coccolithaceae* Kamptner, 1928
Genus *Biscutum* Black, 1959
Watznaueria Reinhardt, 1964
Markalius Bramlette — Martini, 1964
Cyclagelosphaera Noël, 1965

Incertae sedis
Genus *Marthasterites* Deflandre, 1959
Micula Vekshina, 1959
Tetralithus Gardet, 1955
Carpatochitinoides Planderová, 1975

Zygolithus bussoni Noël, 1959
Pl. LXXI, Fig. 1

1956 *Zygolithus bussoni* nov. spec. — D. Noël: Coccolithes des terrains jurassiques etc., p. 321, pl. 2, fig. 13, 14
1971 *Zygodiscus bussoni* (Noël) nov. comb. — H. Manivit: Nannofossiles calcaires etc., p. 78, pl. 29, fig. 4, 15; pl. 13, fig. 1

Description: An elliptical coccolith, with a high marginal ring consisting of 34—36 narrow, markedly inclined overlapping lamellae. On the internal side is a series of radiall arranged rectangular lammellae inclined toward the centre of the coccolith. Above the central aperture is a bridge parallel with the short axis of the ellipse. The bridge consists of two series of parallel-aligned lamellae.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana rugosa*.

Zygolithus compactus (Bukry, 1969) Noël, 1970

Pl. LXXI, Fig. 2, 3, 4, 6

1969 *Zygodiscus compactus* nov. spec. — D. Bukry: Upper cretaceous coccoliths etc., p. 59, pl. 34, fig. 1, 2
1970 *Zygolithus compactus* (Bukry) nov. comb. — D. Noël: Coccolithes crétacés, p. 26, pl. 2, fig. 2—8, pl. 3, fig. 1—3

Description: Elliptical zygolith with a peripheral ring consisting of 32 or more massive, markedly inclined lamellae. A transversal bridge dividing the central aperture consist of irregularly oriented crystals. Electronmicrographs of the material examined show considerably variable structure of the bridge. In some cases in the middle of the bridge is a distinct furrow owing to which the bridge seems to consist of two series of crystals.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana arca*

Ahmuellerella octoradiata (Gorka, 1957) Reinhardt, 1967

Pl. LXXI, Fig. 5

1957 *Discolithus octoradiatus* nov. spec. — H. Gorka: *Coccolithophoridae* z gornego mastrychtu etc., p. 259, pl. 4, fig. 10
1964 *Ahmuellerella limbitenuis* nov. spec. — P. Reinhardt: Einige Kalkflagellaten Gattungen etc., p. 751, pl. 2, fig. 6
1967 *Ahmuellerella octoradiata* (Gorka) nov. comb. — P. Reinhardt: Fossile Coccolithen etc., p. 166, fig. 1, pl. 7, fig. 1, 2, 3
1969 *Valagapilla octoradiata* (Gorka) nov. comb. — D. Bukry: Upper Cretaceous Coccoliths etc., p. 58, pl. 33, fig. 5—7

Description: All electronmicrographs show the proximal side. The high peripheral ring consists of narrow inclined lamellae. The central aperture is rimmed with a tier of radially arranged lamellae close to one another. The aperture is secondarily filled and therefore its microstructure is indistinct. In is inconspicuously dissected in 8 parts.

Stratigraphical range: zone *Globotruncana rugosa* — zone *Globotruncana falsostuarti*.

Eiffelithus eximius (Stover, 1966), Perch — Nielsen, 1968

Pl. LXXII, Fig. 1, 3, 4

1966 *Clinorhabdus eximius* nov. spec. — L. Stover: Cretaceous coccoliths and associated nannofossils etc., p. 138, pl. 2, fig. 15, 16, pl. 8, fig. 15
1968 *Eiffelithus eximius* (Stover) nov. comb. — K. Perch — Nielsen: Der Feinbau und die Klassifikation etc., p. 30, pl. 3, fig. 8—10

Description: Elliptical coccolith whose peripheral ring on the proximal side consists of narrow, gently inclined lamellae aligned closely side by side. A series of radially arranged horizontal lamellae rim the central aperture covered with irregular granulae. These are oriented toward the centre of the aperture. On the distal side is a bridge composed of elongated granulae. It has a form of a cross passing into the central stem in its centre. The arms of the cross are branching toward the peripheral ring.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana rugosa*.

Eiffelithus turriseiffeli (Deflandre, 1954) Reinhardt, 1965

Pl. LXXII, Fig. 2

1954 *Zygolithus turriseiffeli* nov. spec. — G. Deflandre — Ch. Fert: Observations sur les Coccolithophoridés etc., p. 149, fig. 65, pl. 13, fig. 15, 16
1963 *Rhabdolithus turriseiffeli* (Deflandre) nov. comb. — H. Stradner: New contributions to Mesozoic stratigraphy etc., p. 9, pl. 5, fig. 9
1965 *Eiffelithus turriseiffeli* (Deflandre) nov. comb. — P. Reinhardt: Neue Familien für fossile Kalkfagellaten, p. 32

Description: Electronmicrographs of the material studied show only the distal side. The peripheral ring consists of narrow overlapping lamellae. The central aperture is covered by thick, irregular crystals. Below them in the middle is the central stem.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Sigalia carpatica*.

Helicolithus sp.

Pl. LXXII, Fig. 5, 6

Description: Elliptical coccolith, with its peripheral ring closing the central aperture. The aperture is almost half of the coccolith. The ring consists of 60 or more markedly overlapping radial lamellae. On the distal side is a prominent stem connected with the marginal wall by four arms oriented diagonally. The arms and the stem are composed of delicate elongated crystals.

Stratigraphical range: zone *Globotruncana falsostuarti*.

Tranolithus exiguus Stover, 1966

Pl. LXXIII, Fig. 1

1966 *Tranolithus exiguus* nov. spec. — L. Stover: Cretaceous coccoliths etc., p. 146, pl. 4, fig. 21 a, b, c
1968 *Zygolithus diplogrammus* (Deflandre) nov. comb. — H. Stradner et al.: Electron Microscope Studies etc. p. 35, pl. 26, fig. 3—7, pl. 27, fig. 1, 2
1968 *Glaukolithus diplogrammus* (Deflandre) nov. comb. — S. Forchheimer: Coccolithen des Gault-Cenoman etc., p. 50, pl. 5, fig. 1 a, b
1972 *Tranolithus exiguus* Stover emend. — S. Forchheimer: Scanning Electron Microscope studies etc., p. 60, pl. 9, fig. 6, pl. 16, fig. 2, 4, pl. 17, fig. 1—4.

Description: Elliptical coccolith with the peripheral ring broad on the distal side and composed of rectangular lamellae overlapping. They are radially arranged and inclined toward the centre of the aperture. The aperture is small, divided along the long axis of the ellipse — by a poorly preserved transversal bridge — into two hemispherical openings, whereas along the short axis there are indications of small pores.

Stratigraphical range: zone *Sigalia carpatica* — zone *Globotruncana rugosa*.

Tranolithus orionatus (Reinhardt, 1966) Reinhardt, 1966

Pl. LXXIII, Fig. 3

1966 *Discolithus orionatus* nov. spec. — P. Reinhardt: Zur Taxonomie und Biostratigraphie etc., p. 42, pl. 23, fig. 22, 31, 32
1966 *Tranolithus orionatus* (Reinhardt) nov. comb. — P. Reinhardt: Fossile Vertreter etc., p. 522

Description: Elliptical coccolith whose marginal wall on the distal side consists of inclined, markedly overlapping lamellae. The central aperture is filled with large irregular crystals oriented in direction of both axes.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana arca*.

Chiastozygus cuneatus (Lyul'eva, 1967) Čepek — Hay, 1969

Pl. LXXVII, Fig. 1

1967 *Zygolithus cuneatus* nov. spec. — S. A. Lyul'eva: Kokolitoforidi turonskich vidkladiv etc., p. 93, pl. 1, fig. 13
1969 *Chiastozygus cuneatus* (Lyul'eva) nov. comb. — P. Čepek — W. W. Hay: Calcareous nannoplankton and biostratigraphic etc., p. 325, fig. 4

Description: Elliptical coccolith with a marginal ring on its distal side. The ring consists of narrow, inclined, markedly overlapping lamellae. The central aperture is divided by an X-shaped bridge forming four openings

oriented both along the long and short axes. The bridge consists of delicate crystals and broadens distinctly from the middle to the marginal wall.

Stratigraphical range: zone *Globotruncana angusticarinata.*

Bipodorhabdus tesselatus Noël, 1970

Pl. LXXIII, Fig. 2, 4

1970 *Bipodorhabdus tesselatus* nov. spec. — D. Noël: Coccolithes crétacés, p. 50, pl. 13, fig. 7, 8, pl. 14, fig. 1—4, pl. 15 fig. 1

Description: Elliptical coccolith with its marginal wall composed of massive rectangular lamellae, about 35 in number, partially overlapping. On the distal side their surface seems almost straight. The central aperture is crossed by a transversal, markedly arched bridge consisting of elongated crystals. Toward the margins the bridge broadens and joins with a series of delicate crystals rimming the internal wall of the proximal side. In the middle is the central stem.

Stratigraphical range: zone *Globotruncana rugosa* — zone *Globotruncana falsostuarti.*

Bipodorhabdus granulatus (Reinhardt, 1965) Noël, 1970

Pl. LXXIII, Fig. 5, 6

1965 *Ahmuellerella? granulata* nov. spec. — P. Reinhardt: Neue Familien für fossile Kalkflagellaten etc., p. 39, pl. 3, fig. 2

1966 *Cretarhabdus granulatus* (Reinhardt) nov. comb. — P. Reinhardt: Zur Taxonomie und Biostratigraphie etc., p. 27, pl. 8, fig. 1

1969 *Podorhabdus granulatus* (Reinhardt) nov. comb. — D. Bukry: Upper Cretaceous Coccoliths etc., p. 37, pl. 16, fig. 4—6

1970 *Bipodorhabdus* cf. *Bipodorhabdus granulatus* (Reinhardt) nov. comb. — D. Noël: Coccolithes crétacés, p. 52, fig. 11, pl. 14, fig. 5, 6

Description: Elliptical coccolith with its marginal ring is conformable with the periphery of the species *B. tesselatus* in number and shape of lamellae. The central aperture on the distal side is characterized by a transversal bridge, which is better developed than on the species *B. tesselatus.* In the middle the bridge consists of several series of rectangular crystals. It branches towards the periphery without forming openings. On the proximal side, the marginal ring joins several series of minute, horizontally elongated crystals filling a part of the central aperture, to join the bridge. Openings along the long axis are predominantly secondary-filled.

Stratigraphical range: zone *Globotruncana falsostuarti*

Cretarhabdus conicus Bramlette — Martini, 1964

Pl. LXXIV, Fig. 4, pl. LXXV, Fig. 3

1964 *Cretarhabdus conicus* nov. spec. — M. N. Bramlette — E. Martini: The great change calcareous nannoplankton etc., p. 299, fig. 5—8

Description: Broad elliptical coccolith with its central aperture rimmed by three series of radially arranged lamellae. The middle series projects above both the proximal and the distal. The central aperture is of granulose character, pores among granulae being concentrically arranged. On the distal side is the characteristic bridge. It is cross-shaped, situated in the direction of both axes. It forms a thick central stem in the middle.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana falsostuarti*.

Cretarhabdus crenulatus Bramlette — Martini, 1964

Pl. LXXIV, Fig. 1, 5, Pl. LXXV, Fig. 1, 2, 4

1964 *Cretarhabdus crenulatus* nov. spec. — M. N. Brammlete — E. Martini: The great change in calcareous nannoplankton etc., p. 300, pl. 2, fig. 21—24
1968 *Polypodorhabdus crenulatus* (Bramlette — Martini) nov. comb. — K. Perch — Nielsen: Der Feinbau und die Klassifikation etc., p. 48, fig. 18, pl. 11, fig. 2—5
1970 *Stradneria crenulata* (Bramlette — Martini) nov. comb. — D. Noël: Coccolithes crétacés, p. 55, pl. 12, fig. 5, pl. 17, fig. 3 a, b

Description: Elliptical coccolith with its marginal ring composed of three series of radially arranged lamellae. The proximal and the distal series are smaller than the middle one. The central area has a structure coarser than *C. conicus*. The bridges are radially oriented from the central stem from the bridge in direction of the long axis. They join the marginal wall to form 8, 10—12 radially arranged openings. On the distal side, the structure of the central aperture is considerably variable.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana falsostuarti*.

Praediscosphaera cretacea (Arkhangelsky, 1912), Gartner, 1968

Pl. LXXV, Fig. 5, 6

1912 *Coccolithophora cretacea* nov. spec. — A. D. Arkhangelsky: Verchnemelovye otloženja vostoka etc., p. 410, pl. 6, fig. 12, 13
1957 *Discolithus cretaceus* (Arkhangelsky) nov. comb. — H. Gorka: Coccolithophoridae z gornego mastrychtu etc., p. 274, pl. 2, fig. 11
1959 *Praediscosphaera decorata* nov. spec. — V. N. Vekshina: Kokolitoforidi maastrichtskich otloženij etc., p. 73, pl. 1, fig. 8, 9
1968 *Praediscosphaera cretacea* (Arkhangelsky) nov. comb. — S. Gartner: Coccoliths and related calcareous nannofossils etc., p. 19, pl. 2, fig. 10—14, pl. 3, fig. 8, pl. 4, fig. 19—24 etc.

Description: Elliptical coccolith with a broad marginal ring composed of 16—18 tight radially arranged segments. It is broader on the distal side than on the proximal. The central aperture is divided by a ridge in direction of diagonal axes of the ellipse.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana falsostuarti*

Cribrosphaera ehrenbergi Arkhangelsky, 1912

Pl. LXXIV, Fig. 2, Pl. LXXVI, Fig. 1, 2

1912 *Cribrosphaera ehrenbergi* nov. spec. — A. D. Arkhangelsky: Verchnemelovye otloženija vostoka etc., p. 412, pl. 16, fig. 19, 20

Description: Elliptical coccolith with its peripheral ring consisting of two series of massive lamellae aligned side by side. The distal series is larger than the proximal. The central aperture is filled by crystals with concentrically arranged pores among them. The thickness of the crystals varies from fine to thick.

Stratigraphical range: zone *Sigalia carpatica* — zone *Globotruncana falsostuarti*.

Cribrosphaera laughthoni (Black, 1964), Bukry, 1969

Pl. LXXVI, Fig. 3, 4, 6

1964 *Favocentrum laughthoni* nov. spec. — M. Black: Cretaceous and Tertiary coccoliths etc., p. 313, pl. 53, fig. 1, 2

1969 *Cribrosphaera laughthoni* (Black) nov. comb. — D. Bukry: Upper Cretaceous coccoliths etc., p. 45, pl. 23, fig. 1—9

Description: Elliptical coccolith with its marginal wall composed of three series of very massive lamellae enlarging from the proximal to the distal series. A comparatively small central aperture is granulose. Pores among granulae are arranged concentrically.

Stratigraphical range: zone *Globotruncana falsostuarti*.

Cribrosphaera pelta (Gartner, 1968), Bukry, 1969

Pl. LXXVI, Fig. 5

1968 *Cribrosphaerella pelta* nov. spec. — S. Gartner: Coccoliths and related calcareous etc., p. 41, pl. 10, fig. 24, 25

1969 *Cribrosphaera pelta* (Gartner) nov. comb. — D. Bukry: Upper Cretaceous Coccoliths etc., p. 45, pl. 23, fig. 10—12

Description: Elliptical coccolith with its marginal ring consisting of three series of tetrahedral, very massive, radially arranged lamellae. The proximal series is smallest, they anlarge markedly toward the distal one. The central aperture is small, secondary — filled in all specimens studied.

Stratigraphical range: zone *Globotruncana falsostuarti*.

Arkhangelskiella cymbiformis Vekshina, 1959

Pl. LXXVII, Fig. 2

1959 *Arkhangelskiella cymbiformis* nov. spec. — V. N. Vekshina: Kokolitoforidi maastrichtskich otloženij etc., p. 66, pl. 2, fig. 3 a, b

Description: Elliptical coccolith with its marginal ring composed of four series above each other. Radially arranged lamellae are close to each other. All electronmicrographs show central apertures recrystallized, with furrows in direction of the long axis of the ellipse.

Stratigraphical range: zone *Globotruncana rugosa* — zone *Globotruncana falsostuarti*.

Gartnergo obliquum (Stradner, 1963), Reinhardt, 1970

Pl. LXXVII, Fig. 3, 4

1963 *Arkhangelskiella obliqua* nov. spec. — H. Stradner: New contributions to mesozoik etc., p. 176, pl. 1, fig. 2

1968 *Laffitius obliquus* nov. spec. — D. Noël: Arkhangelskiella (Coccolithes crétacés) etc., p. 197, fig. 3 a, b, pl. 3, fig. 1—5.

1970 *Gartnerago obliquus* (Stradner) nov. comb. — D. Noël: Coccolithes crétacés, p. 79, fig. 19, 20, pl. 26, fig. 1—7

1970 *Gartnerago obliquum* (Stradner) nov. comb. — P. Reinhardt: Synopsis der Gattungen etc., p. 66, fig. 58, 59

Description: Electronmicrographs of the material studied show only the distal sides. Narrow marginal rings consist of thin, radially oriented lamellae close to one another. On the internal side of the ring is a series of radially arranged elongated crystals overlapping partially the crystals of the central aperture.

The central aperture is larger, granulose. In direction of both axes runs a furrow dividing the aperture into four quadrants. Crystals are oriented along the furrow.

Stratigraphical range: zone *Sigalia carpatica* — zone *Globotruncana rugosa*.

Cylindralithus serratus Bramlette — Martini, 1964

Pl. LXXVIII. Fig. 1, 3

1964 *Cylindralithus serratus* nov. spec. — M. N. Bramlette — E. Martini: The great change etc., p. 310, pl. 5, fig. 18—20

Description: Coccolith of large structure composed of a cylindrical wall and a flat plate. The cylindrical wall consists of some vertical, pointed segments, broadening and joining a circular plate-shaped segment. Its marginal wall is formed of radially arranged lamellae with jagged periphery. The broad central aperture is secondary — filled and its microstructure is inconspicuous.

Stratigraphical range: zone *Globotruncana angusticarinata*.

Cylindralithus laffittei (Noël, 1957) Black, 1973

Pl. LXXVIII, Fig. 2

1957 *Stephanolithion laffittei* nov. spec. — D. Noël: Coccolithes des terrains jurassiques etc., p. 318, pl. 2, fig. 5

1968 *Corrolithion octoradiatum* nov. spec. — S. Gartner: Coccoliths and related calcareous nannofossils etc., p. 35, pl. 6, fig. 5, pl. 10, fig. 14, 15 etc.
1973 *Cylindralithus laffittei* (Noël) nov. comb. — M. Black: British lower Cretaceous Coccoliths etc., p. 95, pl. 29, fig. 1—6, text. fig. 46

Description: Cylindrical coccolith with cylindrical wall. A flat plate-shaped segment is fitted to the wall. The segment represents the proximal side of the coccolith. The proximal side is broadened and consists of the peripheral ring closing the central aperture. The marginal lamellae are comparatively broad, flat, radially arranged close to one another. Like on the species *C. serratus*, the cylindrical wall consists of vertical lamellae. Some of them are conspicuously pointed and prominent. The central aperture is divided by eight bridges consisting of longitudinal crystals.

Stratigraphical range: zone *Globotruncana rugosa*.

Biscutum constans (Gorka, 1957) Black, 1967

Pl. LXXVIII, Fig. 4

1957 *Discolithus constans* nov. spec. — H. Gorka: Kokolitoforidi maastrichtskich otloženij etc, p. 279, pl. 4, fig. 7
1967 *Biscutum constans* (Gorka) nov. comb. — M. Black: New names for etc., p. 139

Description: Elliptical coccolith with a broad marginal wall. The proximal and distal discs consist of radial lamellae close to one another. In direction of the long axis the lamellae are broader. The small central aperture is secondary — filled on most part.

Stratigraphical range: zone *Globotruncana arca* — zone *Globotruncana falsostuarti*.

Watznaueria barnesae (Black, 1959) Perch — Nielsen, 1968

Pl. LXXVIII, Fig. 6, Pl. LXXIX, Fig. 1, 2, 3, 4

1959 *Tremalithus barnesae* nov. spec. — M. Black — B. Barnes: The structure of coccoliths etc., p. 325, pl. 9, fig. 1, 2
1964 *Tergestiella barnesae* (Black) nov. comb. — P. Reinhardt: Einige Kalkflagellaten — Gattungen etc., p. 753, pl. 2, fig. 2, text-fig. 4
1968 *Watznaueria barnesae* (Black) nov. comb. — K. Perch — Nielsen: Der Feinbau und die Klassifikation etc., p. 68, pl. 22, fig. 1—7, pl. 23, flg. 1, 4, 5, 6, text-fig. 32

Description: Elliptical coccolith with two equal discs, with broad peripheral wall and small central opening. The margin of the distal disc is — on the outer side — formed of rectangular, overlapping lamellae, on the internal side — by radially arranged lamellae, oriented in an opposite direction to the outer series. The central aperture shows variable structure. It is most fre-

quently granulose. The granulae are arranged concentrically. Sometimes crystals are missing in the central aperture.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana falsostuarti*.

Markalius circumradiatus (Stover, 1966) Perch — Nielsen, 1968

Pl. LXXVIII, Fig. 5

1966 *Coccolithes circumradiatus* nov. spec. — L. Stover: Creataceous Coccoliths and associated etc., p. 138, pl. 5, fig. 2—4, pl. 9, fig. 10

1968 *Markalius circumradiatus* (Stover) nov. comb. — K. Perch — Nielsen: Der Feinbau und die Klassifikation etc. p. 73, fig. 36, 37, pl. 25, fig. 2—7, pl. 26, fig. 1—7.

Description: Circular coccolith with the distal disc larger than the proximal. Both discs consist of about 27 trapezoid, radially arranged lamellae. The central aperture is covered by granulae or the granulae are missing. Electronmicrographs show the proximal side.

Stratigraphical range: zone *Sigalia carpatica* — zone *Globotruncana falsostuarti*.

Cyclagelosphaera margereli Noël, 1965

Pl. LXXIX, Fig. 5

1965 *Cyclagelosphaera margereli* nov. spec. — D. Noël: Sur les Coccolithes du Jurassique etc., p. 130, fig. 46, pl. 17, fig. 7, 10

Description: Circular coccolith with its distal disc larger than the proximal. It is formed of a broad marginal ring consisting of two concentrical series of lamellae. In the outer series the lamellae are markedly inclined, overlapping, in the inner series the lamellae are radially arranged, partially overlapping. They are oriented in an opposite direction to the outer series. The central aperture is covered by granulae with small openings in their centres. This part is frequently secondary — filled and its structure becomes indistinct. Most characteristic features of the species are circular shape of the coccolith and distinct internal series of lamellae of the marginal ring.

Stratigraphical range: zone *Globotruncana rugosa* — zone *Globotruncana falsostuarti*.

Marthasterites furcatus Deflandre, 1954

Pl. LXXX, Fig. 4

1954 *Discoaster? furcatus* nov. spec. — G. Deflandre — Ch. Fert: Observations sur les Coccolithophoridés etc., p. 168, pl. 13, fig. 14

1959 *Marthasterites furcatus* (Deflandre) nov. comb. — G. Deflandre: Sur les nannofossiles calcaires etc., p. 139, pl. 2, fig. 3—12, pl. 3, fig. 1, 5

Description: A three-arm form with a 120° angle among the arms. At the end of the arms are indications of depression.

Stratigraphical range: zone *Globotruncana angusticarinata.*

Micula decussata Vekshina, 1959

Pl. LXXX, Fig. 1, 2

1959 *Micula decussata* nov. spec. — V. N. Vekshina: Kokolitoforidi maastrichtskich otloženij etc., p. 71, pl. 1, fig. 6, pl. 2, fig. 11

1963 *Micula staurophora* (Gardet) nov. comb. — H. Stradner: New contribution etc., p. 13, fig. 12

1955 *Discoaster staurophorus* nov. spec. — M. Gardet: Contribution a l'étude etc., p. 534, pl. 10, fig. 96

Description: A form reminding of a cube. Each surface is depressed in the middle. Some electronmicrographs show depressed edges.

Stratigraphical range: zone *Globotruncana angusticarinata* — zone *Globotruncana falsostuarti.*

Tetralithus aculeus (Stradner, 1961) Gartner, 1968

Pl. LXXX, Fig. 3

1961 *Zygrhrablithus aculeus* nov. spec. — H. Stradner: Vorkommen von Nannofossilien etc., p. 81, fig. 53—57

1968 *Tetralithus sp. aff. Tetralithus aculeus* (Stradner) nov. comb. — S. Gartner: Coccoliths and related calcareous nannofossils etc., p. 43, pl. 9, fig. 5, pl. 13, fig. 5

Electronmicrographs of the material studied agree with figures by S. Gartner (1968) and H. Manivit (1971).

Stratigraphical range: zone *Globtruncana falsostuarti.*

Carpatochitinoides cretaceus Gašpariková, 1975

Pl. LXXX, Fig. 5

1975 *Carpatochitinoides cretaceus* nov. spec. — V. Gašpariková: *Carpatochitinoides cretaceus* n. sp. from etc., p. 250, pl. 1, fig. 1—6

Description: Symmetrical, flatly conical asteroid form with dissected structure. Its systematical classification and chemical composition are problematic. Its basical ground-plan is square. In direction of diagonals are petals with distinct furrows in their centres. Among them are smaller petals, lowarched, oriented in the form of a cross. The centre of the asteroid is covered with a leaf-like segment with pyramidal termination.

Stratigraphical range: zone *Sigalia carpatica.*

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Viera Gašpariková

Korelácia nanoplanktónových spoločenstiev s biozónami foraminifér vrchnej kriedy Západných Karpát

10 tab. (LXXI—LXXX), resumé anglického textu

V práci sú podané prvé poznatky o vápnitej nanoflóre vrchnej kriedy Západných Karpát. Najbohatšie nanoplanktónové spoločenstvá boli zistené v sedimentoch bradlového pásma a Myjavskej pahorkatiny, odkiaľ bolo vybratých desať lokalít so známou mikrofaunou stratigraficky zodpovedajúcu piatim foraminiferovým zónam:

zóne *Globotruncana angusticarinata*
zóne *Sigalia carpatica*
zóne *Globotruncana arca*
zóne *Globotruncana rugosa*
zóne *Globotruncana falsostuarti*

Spoločenstvá vápnitej nanoflóry zistené v stratigrafickom rozmedzí jednotlivých foraminiferových zón sú kvalitatívne odlišné a obsahujú výrazné vedúce formy, na základe ktorých bude možné vymedziť nanoplanktónové zóny vrchnej kriedy.

Systematická časť, v ktorej je opísaných 29 druhov, je založená na štúdiu jednotlivých taxónov pomocou scanning-elektrónového mikroskopu.

Explanations of plates LXXI—LXXX

Plate LXXI

Fig. 1 *Zygolithus bussoni* Noël, 10000 ×, proximal view, locality Horné Sŕnie; Nr. 441/74; zone *Globotruncana angusticarinata*
Fig. 2 *Zygolithus compactus* (Bukry) Noël, 10000 ×; proximal view, Horné Sŕnie, Nr. 441/74, zone *Globotruncana angusticarinata*
Fig. 3 *Zygolithus compactus* (Bukry) Noël, 10000 ×; proximal view, Hatné, Nr. 43/74, zone *Sigalia carpatica*
Fig. 4 *Zygolithus compactus* (Bukry) Noël, 10000 ×; proximal view, Horné Sŕne, Nr. 441/74zone *Globotruncana angusticarinata.*
Fig. 5 *Ahmuellerella octoradiata* (Gorka) Reinhardt, 10000 ×; proximal view, Ihrište, Nr. 170/72, zone *Globotruncana falsostuarti.*
Fig. 6 *Zygolithus compactus* (Bukry) Noël, 10000 ×; proximal view, Myjavská pahorkatina (Upland), Nr. 310/73, zone Sigalia *carpatica.*

Plate LXXII

Fig. 1 *Eiffelithus eximius* (Stover) Perch — Nielsen, 9000 ×; proximal view, Horné Sŕnie, Nr. 441/74, zone *Globotruncana angusticarinata.*
Fig. 2 *Eiffelithus turriseiffeli* (Deflandre) Reinhardt, 10000 ×; distal view, Myjavská pahorkatina, Nr. 310/73, zone *Sigalia carpatica*

Fig. 3 *Eiffelithus eximius* (Stover) Perch — Nielsen, 9000 ×; distal view, Horné Sŕnie, Nr. 440/74, zone *Globotruncana angusticarinata*
Fig. 4 *Eiffelithus eximius* (Stover) Perch — Nielsen, 5000 ×; distal view, Myjavská pahorkatina Nr. 310/73, zone *Sigalia carpatica*
Fig. 5 *Helicolithus sp.*, 5000 × magn., distal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 6 *Helicolithus sp.*, 10000 ×; distal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*

Plate LXXIII

Fig. 1 *Tranolithus exiguus* Stover, 10000 ×; distal view, Hatné; Nr. 43/74, zone *Sigalia carpatica*
Fig. 2 *Bipodorhabdus tesselatus* Noël, 5000 ×; distal view, Dolný Hričov; Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 3 *Tranolithus orionatus* (Reinhardt) Reinhardt, 5000 ×; distal view, Koňhora; Nr. 464/73, zone *Globotruncana arca*
Fig. 4 *Bipodorhabdus tesselatus*, Noël, 10000 ×, distal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 5 *Bipodorhabdus granulatus* (Reinhardt) Noël, 10000 ×; distal view; Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 6 *Bipodorhabdus granulatus* (Reinhardt) Noël, 5000 x; proximal view; Dolný Hričov; Nr. 36/74, zone *Globotruncana falsostuarti*

Plate LXXIV

Fig. 1 *Cretarhabdus crenulatus* Bramlette — Martini, 10 000 ×; distal view, Horné Sŕnie, Nr. 441/74, zone *Globotruncana angusticarinata*
Fig.2 *Cribrosphaera ehrenbergi* Arkhangelsky; 10000 ×; proximal side, Koňhora. Nr. 464/73; zone *Globotruncana arca*
Fig. 3 *Cribrosphaera laughthoni* (Black) Bukry, 10000 ×; proximal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 4 *Cretarhabdus conicus* Bramlette — Martini, 10000 ×; Hatné, Nr. 43/73, zone *Sigalia carpatica*
Fig. 5 *Cretarhabdus crenulatus* Bramlette — Martini, 10000 ×; distal view, Dolný Hričov; Nr. 36/74; zone *Globotruncana falsostuarti*

Plate LXXV

Fig. 1 *Cretarhabdus crenulatus* Bramlette — Martini; 5000 ×; distal side, Horné Sŕnie; nr. 441/74, zone *Globotruncana angusticarinata*
Fig. 2 *Cretarhabdus crenulatus* Bramlette — Martini, 9000 ×; distal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 3 *Cretarhabdus conicus* Bramlette — Martini, 10000 ×; proximal view, Myjavská pahorkatina, Nr. 310/73; zone *Sigalia carpatica*
Fig. 4 *Cretarhabdus crenulatus* Bramlette — Martini, 10000 ×; distal view, Hatné; 43/73; zone *Sigalia carpatica*
Fig. 5 *Praediscosphaera cretacea* (Arkhangelsky) Gartner, 10000 ×; distal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 6 *Praediscosphaera cretacea* (Arkhangelsky) Gartner, 10000 ×; proximal view, Dolný Hričov; Nr. 36/74, zone *Globotruncana falsostuarti*

Plate LXXVI

Fig. 1 *Cribrosphaera ehrenbergi* Arkhangelsky, 10000 ×; distal view, Ihrište, Nr. 170/72, zone *Globotruncana falsostuarti*
Fig. 2 *Cribrosphaera ehrenbergi* Arkhangelsky, 10000 ×; proximal view, Dolný Hričov; Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 3 *Cribrosphaera laughthoni* (Black) Bukry; 10000 ×; proximal view, Dolný Hričov; Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 4 *Cribrosphaera laughthoni* (Black) Bukry, 10000 x; proximal view, Ihrište, Nr. 170/72, zone *Globotruncana falsostuarti*
Fig. 5 *Cribrosphaera pelta* (Gartner) Bukry, 5000 ×; proximal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 6 *Cribrosphaera laugthoni* (Black) Bukry, 10000 ×; proximal view, Dolný Hričov, Nr. 36/74; zone *Globotruncana falsostuarti*

Plate LXXVII

Fig. 1 *Chiastozygus cuneatus* (Luylteva) Čepek — Hay; 10000 ×; distal view, Horné Sŕnie, Nr. 441/74, zone *Globotruncana angusticarinata*
Fig. 2 *Arkhangelskiella cymbiformis* Vekshina 10000 x; proximal view, Gbelany, Nr. 414/74; zone *Globotruncana rugosa*
Fig. 3 *Gartnerago obliquum* (Stradner) Reinhardt, 10000 ×; distal view, Malá Udiča; Nr. 101/73, zone *Globotruncana rugosa*
Fig. 4 *Gartnerago obliguum* (Stradner) Reinhardt, 10000 ×; distal view, Hatné, Nr. 43/74, zone *Sigalia carpatica*

Plate LXXVIII

Fig. 1 *Cylindralithus serratus* Bramlette — Martini, 10000 ×; proximal view, Horné Sŕnie, Nr. 441/74; zone *Globotruncana angusticarinata*
Fig. 2 *Cylindralithus laffittei* (Noël) Black, 10000 ×; proximal view; Gbelany, Nr. 414/74; zone *Globotruncana rugosa*
Fig. 3 *Cylindralithus serratus* Bramlette — Martini, 8000 ×; cross-section; Horné Sŕnie, Nr. 441/74, zone *Globotruncana angusticarinata*
Fig. 4 *Biscutum constans* (Gorka) Black, 10000 ×; distal side, Gbelany, Nr. 414/74, zone *Globotruncana rugosa*
Fig. 5 *Markalius circumradiatus* (Stover) Perch — Nielsen, 10000 ×; proximal view, Dolný Hričov, Nr. 36/74; zone *Globotruncana falsostuarti*
Fig. 6 *Watznaueria barnesae* (Black) Perch — Nielsen, 6000 ×; distal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*

Plate LXXIX

Fig. 1 *Watznaueria barnesae* (Black) Perch — Nielsen, 10000 ×; proximal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 2 *Watznaueria barnesae* (Black) Perch — Nielsen, 10000 ×; proximal view, Ihrište, Nr. 170/74; zone *Globotruncana falsostuarti*
Fig. 3 *Watznaueria barnesae* (Black) Perch — Nielsen, 10000 ×; distal view, Dolný Hričov, Nr. 36/74; zone *Globotruncana falsostuarti*

Fig. 4 *Watznaueria barnesae* (Black) Perch — Nielsen; 5000 ×; distal view, Dolný Hričov, Nr. 36/74, zone *Globotruncana falsostuarti*
Fig. 5 *Cyclagelosphaera margereli* Noël, 5000 x; distal view; Dolný Hričov; Nr. 36/74 zone *Globotruncana falsostuarti*

Plate LXXX

Fig. 1 *Micula decussata* Vekshina, 10000 ×; Horné Sŕnie; Nr. 441/74; zone *Globotruncana angusticarinata*
Fig. 2 *Micula decussata* Vekshina, 10000 ×; Hatné, Nr. 43/74; zone *Sigalia carpatica*
Fig. 3 *Tetralithus aculeus* (Stradner) Gartner, 10000 ×; Dolný Hričov. Nr. 36/74; zone *Globotruncana falsostuarti*
Fig. 4 *Marthasterites furcatus* Deflandre, 9000 ×; Horné Sŕnie; Nr. 441/74; zone *Globotruncana angusticarinata*
Fig. 5 *Carpatochitinoides cretaceus* Gašpariková, 4000 ×; Myjavská pahorkatina; Nr. 310/73; zone *Sigalia carpatica.*

Západné Karpaty, sér. paleontológia 2—3, P. 175—188, Geol. úst. D. Štúra, Bratislava, 1977

Ružena Lehotayová

New data on calcareous nannoflora in pelites of the brick-kiln at Devínska Nová Ves

1 text-fig., 10 pl. LXXX—XC, Slovak summary

Abstract. The results of recent investigations concerning calcareous nannoflora in Badenian pelitic sediments of the brick-kiln in Devínska Nová Ves show their appurtenance to the nannoplankton zone *Discoaster exilis* (NN-6) in accordance with standard nannoplankton scale.

Introduction

The locality — the brick-kiln — is on the northern margin of the village Devínska Nová Ves near Bratislava. Samples are from the southwestern wall of the clay pit. The wall is 15 m long, 4 m high. Calcareous nannoassociations examined under electron scanning microscope in 1970, 1971 are referred to the upper part of the Badenian (Tortonian s. s.). Based on foraminifers examined by E. Brestenská (1970), pelites of the locality discussed are regarded as an age equivalent of the zone *Spiroplectammina carinata* of the Vienna basin (sensu R. Grill 1941).

Since in the last time opinions on stratigraphical range of the pelites have been contradictory, it is necessary to examine further material of calcareous nannoflora.

This paper contains new results of the study of *Coccolithophorides* (under electron scanning microscope) in addition to the material of the locality discussed. In the rich associations of calcareous nannoflora most frequent are heliolith forms, like *Cyclicargolithus floridanus* Roth et Hay, *Prinsius minutus* Hay, *Cyclococcolithus rotulus* (Deflandre) Roth, *Pontosphaera multipora* (Kamptner) Roth, *Helicosphaera carteri* (Wallich) Kamptner, *Helicosphaera wallichi* (Lohmann) Boudreaux et Hay, *Holodiscolithus solidus* (Deflandre) Roth, *Litostromation perdurum* Deflandre, *Reticulofenestra pseudoumbilica* (Gartner) Gartner, *Reticulofenestra minuta* Roth, *Rhabdosphaera clavigera* Murray-Blackmann, *Scapholithus fossilis* Deflandre, *Sphenolithus abies* Deflandre, *Syracosphaera pulchra* Schil-

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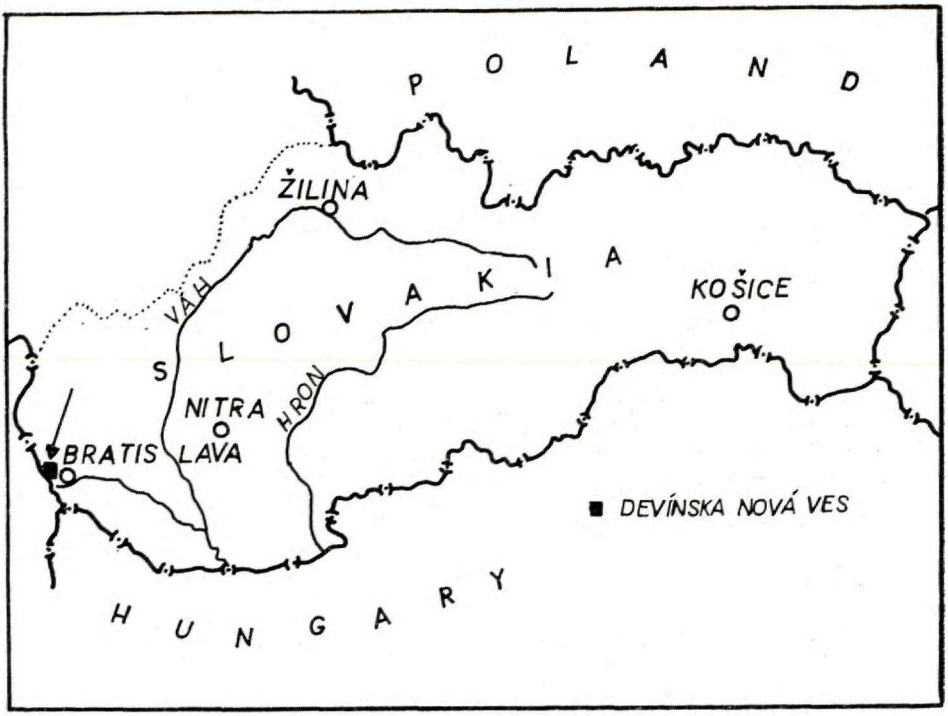


Fig. 1. Situation sketch

ler, *Syracosphaera* sp. Ortholith forms like Discoasterides and Sphenoliths are scarce. Besides these species determined formerly (R. Lehotayová 1970, 1971) from fine-pelitic sediments of the brick-kiln, found were further species so far unknown in the Badenian sediments of our region. Such are: *Cyclococcolithus macintyrei* Bukry-Bramlette, *Discosphaera jerkovici* Müller, *Discosphaera* sp., *Helicosphaera* cf. *walbersdorfensis* Müller, *Helicosphaera* sp., *Nannocorbis challengeri* Müller, *Rhabdosphaera procera* Martini, *Rhaabdosphaera poculi* (Bóna — Kernerné) Müller, *Scyphosphaera apsteini* Lohmann, *Syracosphaera* cf. *historica* Kamptner, *Syracosphaera* cf. *pulchra* Schiller, *Syracosphaera* sp., *Syracosphaera dalmatica* Kamptner, *Umbilicosphaera jafari* Müller.

These are taxons from sediments of younger horizons of the Middle Miocene from the area of Central Paratethys (Hungary, Austria, Rumania) and out of the area (Africa, Indonesia), as quoted by J. Bóna — K. Kernerné 1964, E. Martini 1969, C. Müller 1974, N. Gheta in P. Dumitrica — N. Gheta — Ch. Popescu 1974, S. A. Jafar 1975, a. o.

These finds facilitate correlation of calcareous nannoplankton of the Badenian pelites at the locality Devínska Nová Ves — the brick-kiln with the nannoplankton zone *Discoaster exilis* (NN 6) in the sense of the standard nannoplankton scale (E. Martini 1970, 1971).

These data are significant for both paleontology and biostratigraphy.

Whereas Lower Badenian sediments of Central Paratethys — the lower and the upper lagenide zones according to foraminifers — belong to the upper part of the nannoplankton zone *Sphenolithus heteromorphus* (NN 5), the sediments corresponding to the age equivalent of the zone *Spiroplectammina carinata*, are to be referred to the nannoplankton zone *Discoaster exilis* (NN-6).

In sediments of upper horizons of the Badenian according to foraminifers, in the zone *Bulimina — Bolivina* no calcareous nannoflora has been found so far.

Systematic descriptions and notes on some significant species

Familia *Calciosoleniaceae* Kamptner, 1927
Genus *Scapholithus* Deflandre, 1954

Scapholithus fossilis Deflandre, 1954

Pl. LXXXIV, Fig. 1

1954: *Scapholithus fossilis* Deflandre, cent. nov. — G. Deflandre: in G. Deflandre — Ch. Fert: Coccolithophorides etc., p. 165, Pl. 8, fig. 12, 16, 17

1969 *Scapholithus fossilis* Deflandre — J. Boudreaux et W. Hay: Calcareous nannoplancton... etc., vol. 1, p. 280—281, Pl. 7, figs. 17—20.

Remark: Forms of the species S- fossilis are 5 — 6,5 μ in avrerage size among the specimens examined. They are longitudinally rhomboid in shape. Their diagnostic characters are in accordance with the original species described by G. Deflandre (1954).

Stratigraphical range: Eocene, Miocene — Pliocene „Sahelian" of North Africa. Its Upper Badenian form is frequent in Central Paratethys.

Familia *Calyptrosphaeraceae* Boudreaux et Hay, 1969
Genus *Holodiscolithus* Roth, 1970

Holodiscolithus macroporus (Deflandre) Roth, 1970

Pl. LXXXI, Fig. 1

1954 *Discolithus macroporus* Deflandre — G. Deflandre — Ch. Fert: Observation sur les Coccolithophorides etc., p. 138, tab. 11, fig. 5.

1970 *Holodiscolithus macroporus* (Deflandre) nov. comb. — P. H. Roth: Oligocene Calcareous Nannoplancton etc., p. 866, Pl. 11, fig. 6.

Remarks: Forms of the species H. Macroporus are very frequent in pelites from the locality studied. Its test is oval, with the ultrastructure of a holcolith. Pores range between 7 and 10 in number. Individual pores are irregularly distributed. Their shape is subcircular.

Stratigraphical range: Eocene, Oligocene. In Central Paratethys they are most frequent in Badenian and Sarmatian sediments.

Familia *Coccolithaceae* Kamptner, 1928
Genus *Coccolithus* Schwarz, 1894

Coccolithus pelagicus (Wallich) Schiller, 1930

Pl. LXXXIII, Fig. 2, 5; Pl. LXXXIV, Fig. 5

1877 *Coccosphaera pelagica* Wallich — G. C. Wallich: Observation on the Coccosphaera... etc., p. 342—350.
1930 *Coccolithus palagicus* (Wallich) Schiller — J. Schiller: Coccolithineae... in Rabenshorst' etc., p. 246, fig. 123.
1970 *Cruciplacolithus tenuiforatus* — M. Clocchiatti et L. Jerkovič: Crusiplacolithus tenuiforatus, nouvelle espèce... etc., p. 1—6, Pl. 1, fig. 1a—d, 2, 3, Pl. 2, fig. 1a—c, 2c—d.
1970 *Cruciplacolithus devinensis* nov. sp. — R. Lehotayová: Electron microscopic Examination... etc., p. 163, Pl. 19, fig. 1, 2, Pl. 20, fig. 1.

Remarks: This form is predominant in pelites of the locality studied. Its size and number of lamelles on the distal and proximal discs are variable. Ultrastructure of the central area is also variable. Based on that, some authors -like C. Müller (1974) — refer the species *Cruciplacolithus tenuiforatus* Clocchiatti — Jerkovič to *C. pelagicus*.

Stratigraphical range: Tertiary, Recent.

Genus *Cyclococcolithus* Kamptner, 1954

Cyclococcolithus macintyrei Bukry — Bramlette, 1969

Pl. XC, Fig. 2

1969 *Cyclococcolithus macintyrei* Bukry et Bramlette n. sp. D. Bukry — M. N. Bramlette: Some new and stratigraphically... etc., p. 132, Pl. 1, fig. 1—3.
1975 *Cyclococcolithus macintyrei* Bukry et Bramlette — S. A. Jafar: Calcareous nannoplankton from the miocene of Rotti... etc., p. 71, Pl. 8, figs. 10—11.

Description: Forms of the species are circular placcoliths composed of two discs connected by a straight central tube. There are 38—40 lamelles on each disc. Individual lamelles are diagonally arranged. The proximal disc is somewhat smaller than the distal one. On the proximal side of the central area is a fine grill.

Remark: The specimens are resembling the species *Cyclococcolithus leptoporus*. They only differ in more lamelles and in finer test structure. According to some authors (C. Müller 1974, S. A. Jafar 1975) *C. macintyrei* is most frequent in Middle Miocene to Upper Pliocene sediments.

Cyclococcolithus rotulus (Kamptner) Kamptner, 1956

Pl. LXXXIX, Fig. 1

1948 *Tremalitus rotula* Kamtner — E. Kamtner: Coccolithen aus dem... etc., p. 8, Pl. 2, fig. 15
1956 *Cyclococcolithus rotula* (Kamptner) — E. Kamptner: Systematic Nomenklatur... etc., p. 7
1974 *Cyclococcolithus rotula* (Kamptner) — C. Müller: Nannoplankton aus dem Mittel Miozän... etc., p. 391, Pl. 1, fig. 7, 8.

Remark: Scan electronmicrographs of the species show considerable variableness of test as regards its size and number of lamelles on both the proximal and the distal discs. On the proximal side, the large central opening is sometimes provided with a collar.

Stratigraphical range: most frequently Middle Miocene of Central Paratethys (Badenian).

Genus *Helicosphaera* Kamptner, 1954

Helicosphaera carteri (Wallich) Kamptner, 1954

Pl. LXXXVI, Fig. 3—5

1877 *Coccosphaera carteri* Wallich — G. Wallich: Observation on... etc., p. 348, Pl. 17, fig. 3, 6, 7
1954 *Helicosphaera carteri* (Wallich) — E. Kamptner: Untersuchungen über... etc., p. 21, fig. 17—19

Remark: The forms are cosmopolitis. Occurrences are most abundant at the beginning of the Miocene.

Helicosphaera wallichi (Lohmann) Boudreaux et Hay, 1962

Pl. LXXXVI, Fig. 1, Pl. LXXXVII, Fig. 2

1902 *Coccosphaera wallichi* Lohmann — H. Lohmann: Die Coccolithophoridae... etc., p. 138, Pl. 5, fig. 58—60
1969 *Helicopontosphaera wallichi* (Lohmann) n. comb. — J. E. Boudreaux — W. W. Hay: Calcareous nannoplankton... etc., p. 272—273, Pl. 6, fig. 9.

Remark: Scan electronmicrographs of the species show diagonal arrangement of longitudinal slit-like openings on the central area of the proximal

disc. In this the species differs from individuals of the species *H. carteri* (Wallich) Kamptner.

Stratigraphical range: Badenian of Central Paratethys

Helicosphaera cf. *walbersdorfensis* Müller, 1974

Pl. LXXXVI, Fig. 6

1974 *Helicosphaera walbersdorfensis* n. sp. — C. Müller: nannoplankton aus dem Mittel—Miozän... etc., p. 392—393; Pl. 2, fig. 15; Pl. 4, fig. 35—37, 45—46.

Remark: Scan electronmicrorograph of the species is not quite distinct. Some diagnostic characters (tighter coiling of test, arrangement of slits) remind of the original species described by C. Müller (1974) as *H. walbersdorfensis* from Middle Miocene sediments of the Austrian locality Walsbersdorf.

Stratigraphical range: Middle Miocene of Central Paratethys (Badenian) — scarce forms.

Familia *Lithostromationaceae* Haq, 1967
Genus *Lithostromation* Deflandre, 1942

Lithostromation perdurum Deflandre, 1942

Pl. LXXXVII, Fig. 1

1942 *Lithostromation perdurum* n. sp. Deflandre — G. Deflandre Foss. morf. Lithostromation etc., p. 917—919, fig. 1—9.

1974 *Lithostromation perdurum* Deflandre — C. Müller: Nannoplankton aus dem Mittel-Miozän etc., p. 401, Pl. 2, fig. 10

Remark: Representatives of the species *L. perdurum* were only found in Badenian sediments in some levels of the zone *Spiroplectammina carinata*.

Familia *Pontosphaeraceae* Lemmermann, 1908
Genus *Scyphosphaera* Lohmann, 1902

Scyphosphaera apsteini Lohmann, 1902

Pl. LXXXIX, Fig. 2

1902 *Scyphosphaera apsteini* n. sp. Lohmann — H. Lohmann: Die Coccolithophoridae... etc., p. 132, Pl. 4, fig. 26—30 (fide A. Farinacci 1969)

1975 *Scyphosphaera apsteini* Lohmann — S. A. Jafar: Calcareous Nannoplankton from... etc., p. 27, Pl. 1, figs. 1, 4—7, 9.

Remark: I have got the only scan electronmicrograph of the species from the sediments studied. It is a test of lopadolite type. Diagnostic characters are identic with those described originally by H. Lohmann (1902), only its test is smaller.

Stratigraphical range: The species *S. apsteini* was originally recorded from the Mediterranean sea and from Atlantic ocean. It was recovered from Eocene sediments in Austria, and from the Late Tertiary (Algeria, Gabon).

Familia *Prinsiaceae* Hay et Mohler, 1967
Genus *Reticulofenestra* Hay, Mohler et Wade, 1966

Reticulofenestra pseudoumbilica (Gartner) Gartner, 1969

Pl. LXXXII, Fig. 1, 2; pl. LXXXIV, Fig. 2

1967 *Coccolithus pseudoumbilicus* Gartner n. sp. — S. Gartner: Calcareous Nannofossils... etc., p. 4, Pl. 6, fig. 1

1969 *Reticufofenestra pseudoumbilica* (Gartner) nov. comb. — S. Gartner: Correlation of Neogene... etc., p. 598, Pl. 2, fig. 4

Remark: *R. pseudoumbilica* belongs among the most frequent species in pelites of the D. Nová Ves brick-kiln. It is encountered in well-developed coccosphaeras. S. A. Jafar regards it a younger synonym of *R. ampla* (Kamptner 1948). According to the author mentioned, stratigraphical range of the species is from the nannoplankton zone NN-5 to NN-15. As long as I do not see the comparative material from the original locality of the species described by E. Kamptner (1948), neither from sediments studied by S. A. Jafar (1975), I shall use the species name *R. pseudoumbilica* (Gartner) Gartner for the forms examined.

Familia *Rhabdosphaeraceae* Lemmermann, 1908
Genus *Discosphaera* Haeckel, 1894

Discosphaera jerkovici Müller, 1974

Pl. LXXXV, Fig. 3

1974 *Discosphaera jerkovici* n. sp. — C. Müller: Nannoplankton aus dem Mittel-Miozän etc., p. 392, Pl. 4, fig. 34

Remark: Description and photograph of the species discussed are in agreement with description and photograph of the original species by C. Müller (1974) from the sediments of the Austrian Middle Miocene locality

Walbersdorf. The two species have the same size and morphological characters.

Stratigraphical range: Middle Miocene of Central Paratethys; a form very frequent in the pelites of the Devínska N. Ves brick-kiln.

Discosphaera sp.

Pl. XC, Fig. 3

Remark: In its test structure the form examined reminds of the species D. jerkovici Müller (1974); only its disclike laths on both ends of the central tube are smaller. The tube is straight without trumpetbroadening toward larger basal disc.

Stratigraphical range: Badenian, Sarmatian sediments of Central Paratethys.

Genus *Rhabdosphaera* Haeckel, 1894

Rhabdosphaera poculi (Bóna — Kernerné) Müller, 1974

Pl. LXXXV, Fig. 1, 2

1964 *Rhabdolithus poculi* n. sp. — J. Bóna — K. Kernerné: Micropaleontológiai vizsgálatok a Tekeres 1... etc., p. 113, Pl. 5, fig. 15, 16

1974 *Rhabdosphaera poculi* (Bóna — Kernerné) nov. comb. — C. Müller: Nannoplankton aus dem Mittel-Miozän... etc., p. 394, Pl. 2, fig. 18; Pl. 4, fig. 31—33, 41—42.

Remark: The species is identic with the original species from the Upper Badenian sediments of Hungary (Bóna — Kernerné 1964). C. Müller (1974) recorded it from the Austrian Middle Miocene under the name Rhabdosphaera poculi.

Scan electronmicrographs prove the occurrence of the species in the Badenian sediments at the locality D. Nová Ves.

Stratigraphical range: Badenian of Central Paratethys (Czechoslovakia, Hungary, Rumania). C. Müller (1974) presents the species from Trinidad, from the sediments of the nannoplankton zone *Discoaster kugleri* (NN 7) to *Discoaster hamatus* (NN 9).

Rhabdosphaera procera Martini, 1969

Pl. XC, Fig. 4

1969 *Rhabdosphaera procera* n. sp. — E. Martini: Nannoplankton aus dem Miozän von Gabon... etc., p. 289, Pl. 26, fig. 10—11.

1974 *Rhabdosphaera procera* Martini — C. Müller: Nannoplankron aus dem mittel-Miozän etc., p. 394, Pl. 4, fig. 38—39

Remark: The species examined is identic with the descriptions and photographs by E. Martini (1969), C. Müller (1974), and by S. A. Jafar (1975). C. Müller (1974) points out the great variability of the test structure and relation with the species *R. stilifer* (Lohman 1904).

Stratigraphical range: Middle Miocene of Austria, Miocene of Africa and Indonesia.

Familia *Sphenolithaceae* Deflandre, 1952
Genus *Sphenolithus* Deflandre, 1952

Sphenolithus abies Deflandre, 1954

Pl. LXXXIII, Fig. 3

1954 *Sphenolithus abies* Defl. — G. Deflandre in G. Deflandre et Ch. Fert: Observation sur... etc., p. 50, Pl. 10, fig. 1—4

1975 *Sphenolithus abies* Deflandre — S. A. Jafar: Calcareous Nannoplankton from the miocene... etc., p. 62, Pl. 7, fig. 17—18

Remark: *S. abies* is a very frequent species in the Badenian sediments of Central Paratethys. Most authors (G. Deflandre 1954; E. Martini 1969, M. Clocchiatti 1971, S. A. Jafar 1975) recorded it from Upper Miocene Pliocene sediments.

Familia *Syracosphaeraceae* Lemmermann, 1908
Genus *Syracosphaera* Lohmann, 1902

Syracosphaera dalmatica Kamptner, 1927

Pl. LXXXVIII, Fig. 2, 4

1927 *Syracosphaera dalmatica* nov. spec. — E. Kamptner: Beitrag zur Kenntnis... etc., p. 178, text. fig. 2 (fide A. Farinacci 1972)

1970 *Syracosphaera dalmatica* Kamptner — H. Stradner: Catalogue of calcareous nannoplankton from... etc., p. 1196, Pl. 29. fig. 1—6

Remark: A form frequent in pelites of the brick-kiln. Representatives of the species are in Upper Badenian sediments of Rumania (N. Gheta 1975).

Stratigraphical range: Recently it was recorded from the Adriatic sea. H. Stradner (1973) recorded it also from Lower Pliocene sediments from the Atlantic and Mediterranean seas, from the nannoplankton zone Reticulofenestra pseudoumbilica (NN 15).

Reviewed by H. Bystrická.
Translated by E. Jassingerová.

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Ružena Lehotayová

Novšie poznatky o vápnitej nanoflóre pelitov tehelne Devínska Nová Ves

1 obr., 10 tab. (LXXXI—XC), resumé anglického textu

Predložená práca prináša výsledky štúdia vápnitej nanoflóry doplneného materiálu z juhozápadnej steny íloviska uvedenej lokality.

Metódou scan-elektrónovej mikroskopie sme v jemnopelitických sedimentoch zistili bohaté nanoasociácie, ktoré pozostávali z druhov, ktoré doteraz v študovaných sedimentoch badenu nášho územia neboli známe, a to:
Cyclococcolithus macintyrei Bukry — Bramlette, *Discosphaera jerkovici* Müller, *Discosphaera* sp., *Helicosphaera* cf. *walbersdorfensis* Müller, *Helicosphaera* sp., *Nannocorbis challengeri* Müller, *Rhabdosphaera procera* Martini, *Rhabdosphaera poculi* (Bóna — Kernerné) Müller, *Scyphosphaera apsteini* Lohmann, *Syracosphaera* cf. *histrica* Kamptner, *Syracosphaera* cf. *pulchra* Schiller, *Syracosphaera dalmatica* Kamptner, *Umbilicosphaera jafori* Müller. Ide o taxóny uvádzané zo sedimentov mladších obzorov stredného miocénu tak z oblasti centrálnej Paratetýdy, ako aj mimo nej.

Výskyt týchto druhov umožnil koreláciu vápnitého nanoplanktónu pelitov badenu lokality tehelňa Devínska Nová Ves s nanoplanktonickou zónou *Discoaster exilis* NN 6 v zmysle štandardnej nanoplanktonickej škály (E. Martini 1970, 1971).

Explanations of plates LXXXI — XC

Plate LXXXI

Fig. 1 General view of association of calcareous nannoflora from sediments studied. Predominant are: *Reticulofenestra pseudoumbilica* (Gartner) Gartner, *Holodiscolithus macroporus* (Deflandre) Roth; locality: brick-kiln at Devínska Nová Ves; SEM, 4000 ×

Fig. 2 *Discolithina multipora* (Kamptner) Martini, locality: brick-kiln at Devínska Nová Ves, SEM, distal. view, 4000 ×

Fig. 3 *Holodiscolithus macroporus* (Deflandre) Roth, locality: brick-kiln at Devínska Nová Ves, SEM, lateral. view, 8000 ×.

Plate LXXXII

Fig. 1 *Reticulofenestra pseudoumbilica* (Gartner) Gartner, locality: brick-kiln at Devínska Nová Ves, SEM, Coccosphaera, 8000 ×.

Fig. 2 *Reticulofenestra pseudoumbilica* (Gartner) Gartner, locality: brick-kiln at Devínska Nová Ves, proxim. view, 5000 ×

Fig. 3 *Rhabdosphaera clavigera* Murray — Blackman, locality: brick-kiln at Devínska Nová Ves, lateral. view, 9000 ×.

Plate LXXXIII

Fig. 1 *Rhabdosphaera clavigera* Murray-Blackman and *Syracosphaera* sp., locality: brick-kiln at Devínska Nová Ves, SEM, 5000 ×.

Fig. 2 *Coccolithus pelagicus* (Wallich) Schiller, locality: brick-kiln at Devínska Nová Ves, SEM, distal. view, 5000 ×.
Fig. 3 *Sphenolithus abies* Deflandre, locality: brick-kiln at Devínska Nová Ves, SEM, distal. view, 5000 ×.
Fig. 4 *Micrascidites vulgaris* Deflandre et Deflandre Rigaud, locality: brick-kiln at Devínska Nová Ves, SEM, 1500 ×.
Fig. 5 *Coccolithus pelagicus* (Wallich) Schiller, locality: brick-kiln at Devínska Nová Ves, *Coccosphaera* SEM, 6000 ×.

Plate LXXXIV

Fig. 1 *Scapholithus fossilis* Deflandre, locality: brick-kiln at Devínska Nová Ves, SEM, lateral. view, 5000 ×.
Fig. 2 *Reticulofenestra pseudoumbilica* (Gartner) Gartner, locality: brick-kiln at Devínska Nová Ves, SEM, *Coccosphaera*, 4500 ×.
Fig. 3 *Syracosphaera* sp., locality: brick-kiln at Devínska Nová Ves, SEM, 10 000 ×.
Fig. 4 *Syracosphaera* cf. *pulchra* Schiller, locality: brick-kiln at Devínska Nová Ves, SEM, 5000 ×.
Fig. 5 *Coccolithus pelagicus* (Wallich) Schiller, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view, and *Syracosphaera* sp., 9000 ×.

Plate LXXXV

Fig. 1 *Rhabdosphaera poculi* (Bóna — Kernerné) Müller, locality: brick-kiln at Devínska Nová Ves, SEM, lateral. view, 10 000 ×.
Fig. 2 *Rhabdosphaera poculi* (Bóna — Kernerné) Müller, locality: brick-kiln at Devínska Nová Ves, SEM, lateral. view, 10 000 ×.
Fig. 3 *Discosphaera jerkovici* Müller, locality: brick-kiln at Devínska Nová Ves, SEM, lateral. view, 10 000 ×.

Plate LXXXVI

Fig. 1 *Helicosphaera wallichi* (Lohman) Boundreaux et Hay, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view, 4000 ×.
Fig. 2 *Helicosphaera* sp., *locality:* brick-kiln at Devínska Nová Ves, SEM, proxim. view, 5000 ×.
Fig. 3 *Helicosphaera carteri* (Wallich) Kamptner, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view, 5000 ×.
Fig. 4 *Helicosphaera carteri* (Wallich) Kamptner, locality: brick-kiln at Devínska Nová Ves, distal. view, 4000 ×.
Fig. 5 *Helicosphaera carteri* (Wallich) Kamtner, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. and distal. view, 4000 ×.
Fig. 6 *Helicosphaera* cf. *walbersdorfensi* Müller, locality: brick-kiln at Devínska Nová Ves, SEM, distal, view, 5000 ×.

Plate LXXXVII

Fig. 1 *Lithostromation perdurum* Deflandre, locality: brick-kiln at Devínska Nová Ves, SEM, 7000 ×.
Fig. 2 *Helicosphaera wallichi* (Lohmann) Boudreaux et Hay, locality: brick-kiln at Devínska Nová Ves, SEM, proxim, view, 10 000 ×.

Plate LXXXVIII

Fig. 1 *Syracosphaera* cf. *histrica* Kamptner, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view, 10 000 ×.
Fig. 2 *Syracosphaera dalmatica* Kamptner, locality: brick-kiln at Devínska Nová Ves, SEM, later. view, 5000 ×.
Fig. 3 *Syracosphaera* sp. 1, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view. 10 000 ×.
Fig. 4 *Syracosphaera dalmatica* Kamptner, locality: brick-kiln at Devínska Nová Ves, lateral. view, SEM, 5000 ×.
Fig. 5 *Syracosphaera* sp. 1, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view, 5000 ×.
Fig. 6 *Syracosphaera* sp. 1, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view, 5000 ×.
Fig. 6 *Syracosphaera* sp. 1, locality: brick-kiln at Devínska Nová Ves, SEM, proxim. view, 10 000 ×.

Plate LXXXIX

Fig. 1 *Cyclococcolithus rotulus* (Kamptner) Kamptner, locality: brick-kiln at Devínska Nová ves. SEM, distal. view, 100 00 ×.
Fig. 2 *Scyphosphaera apsteini* Lohmann, locality: brick-kiln at Devínska Nová Ves, SEM, 3000 ×.
Fig. 3 *Nannocorbis challengeri* Müller, locality: brick-kiln at Devínska Nová Ves. SEM, 5000 ×.

Plate XC

Fig. 1 *Acanthoica* sp., locality: brick-kiln at Devínska Nová Ves, SEM, lateral. view, 5000 ×.
Fig. 2 *Cyclococcolithus macintyrei* Bukry — Bramlette, locality: brick-kiln at Devínska Nová Ves, proxim. view, SEM, 4000 ×.
Fig. 3 *Discosphaera* sp., locality brick-kiln at Devínska Nová Ves, SEM, lateral. view, 7500 ×.
Fig. 4 *Rhabdosphaera procera* Martini, locality: brick-kiln at Devínska Nová Ves, SEM, lateral. view, 4000 ×.
Fig. 5 *Pontosphaera* sp., locality: brick-kiln at Devínska Nová Ves, distal. view, SEM, 3500 ×.

All scan electronmicrographs were made on the Jeol — JSM U 3 microscope at Dionýz Štúr's Institute of Geology in Bratislava.

Západné Karpaty, sér. paleontológia, 2—3 P. 189—202, Geol. úst. D. Štúra, Bratislava, 1977

Ján Mello

Plexoramea cerebriformis n. gen. n. sp. and some other microproblematics and microfossils from Triassic limestones of the West Carpathians

1 text-fig., 6 pl. (XCI—XCVI), Slovak summary

Abstract. The article presents description of *Plexoramea cerebriformis* n. gen. n. sp. and gives information on occurrence of *Ladinella porata* Ott, *Tubiphytes obscurus* Maslov, *„Problematikum"* Bystrický, *Pycnoporidium? eomesozoicum* Flügel, *Thaumatoporella parvovesiculifera* (Rain), *Bacinella ordinata* Pantić, *Baccanella floriformis* Pantić and some others, until now undescribed microfossils from Triassic bioherm, transitional, and partly lagoonal limestones of some West Carpathian areas (especially from the Slovak Karst region).

Introduction

Triassic bioherm (and transitional towards a basin) limestones of the alpine area are very rich with organic remains of the reef biotope. In adition to recognisable sponges, corals, hydrozoans, bryozoans, stromatoporoids and algae abundant are remnants of problematic appurtenance which had been designated as problematics. Many of them have been described and depicted, others are unknown as yet. In lagoonal areas some problematic algae can be found.

This article presents a description of a new genus and species of problematic appurtenance. Attention is also paid to some other microproblematics (both described before and undescribed till now).

Many of problematic microfossils have been recently filed among algae, especially codiaceans; these are dealt with separately.

Stratigraphical, facial and geographical distribution of species in the West Carpathians is briefly considered, chiefly in the Slovak Karst and partly in other areas (Fig. 1).

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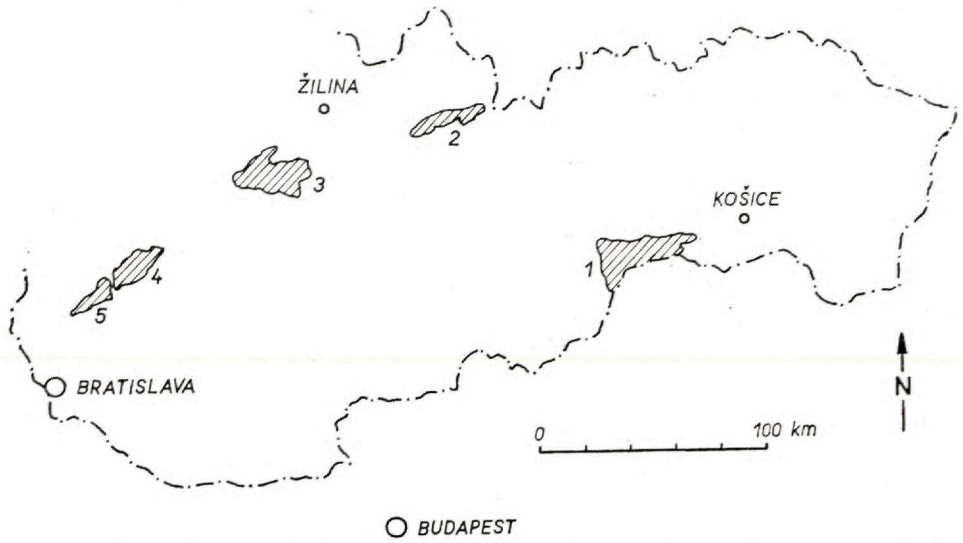


Fig. 1 Studied areas with occurrences of the Triassic microproblematics and microfossils. 1 — East part of the Slovak Karst, 2 — the Choč Mts., 3 — North part of the Strážovská hornatina Mts., 4 — the Jablonické pohorie Mts., 5 — Biele pohorie of the Malé Karpaty Mts.

Paleontological description

Incertae sedis
Plexoramea n. gen.

Derivatio nominis: From Latin „plexus" — a tangle and „rameus — a — um" — branching.

Type species: *Plexoramea cerebriformis* n. sp.

Diagnosis: A tangle of intertwined, discontinuous, uneven and irregularly ramifying twig and leaf-like partitions, in thin sections showing bush-like appearance with chaotic intertwined dead twigs. „Twigs" are made of dark aphanitic mass with very irregular thickness. Interspace material is sparitic. The twig tangle is either loose and free or dense and close, thus making a very irregular network.

Dimensions: An average size of individuals (bioclasts) 2—3 mm, unfrequently 6—7 mm, thickness of twigs 0,002—0,08 mm.

Remarks: Genus *Plexoramea* n. g. displays some similar features and is probably related to genus *Bacinella* Radoičić 1959, which have been defined as follows: „Nodular and incrusted algae whose interior is constructed by irregular cells of different size and form, which are filled with crystalline

calcite, whereas the intercellular mass is cryptocrystalline. The subdermal structure is differentiated" (R. Radoičić 1959).

Occurrences: The West Carpathians — The Wetterstein Bioherm and Bedded Limestones, the „Raming" Limestones and turbidite inclusions in the Reifling Limestones (the Gemeric and Hronic tectonic units sensu D. Andrusov — J. Bystrický — O. Fusán 1973, resp. J. Bystrický in J. Bystrický et al. 1973; Ladinian — Cordevolian).

Plexoramea cerebriformis n. g. n. sp.

Plate XCI, Fig. 1—6; Pl. XCII, Fig. 1—9

Derivatio nominis: From Latin „cerebriformis"; to indicate a brain reminding appearance and shape of the species.

Holotypus: Depicted in pl. XCI, Fig. 1, thin section Nr. 51—78, collections of Dionýz Štúr's Geological Institute, Bratislava.

Syntypes: pl. XCI, Fig. 3—4, thin sections Nos. 51—91, 51—57 (sampling points PP — 475, PP — IV/4 respectively).

Locus typicus: The central part of the Plešivecká planina karst plateau, 500 m north of the Ostré vŕšky hill (sampling point PP — VI/3).

Stratum typicum: The Wetterstein Bioherm Limestones (Ladinian — Cordevolian).

Diagnosis: See above under genus description.

Description: A tangle of irregularly intertwined, discontinuous, uneven and irregularly ramifying leaf-like partitions and twigs, in the thin sections displaying appearance of chaotic intertwined dead twigs. In many cases these sections possess a brain resemblance.

The tangle of twigs is very dense and close at places (Pl. XCI, Fig. 1, 4, 6) making thus a continuous very irregular network. In other cases their heaping up is very free, even without twigs touching one another (Pl. XCI, Fig. 2, Pl. XCII, Fig. 4, 8).

The twigs and leaves are made of dark aphanitic mass and interspace material is sparitic. Twig thickness is very irregular; different projections, protuberances, swellings and ramifications are present. The average twig thickness ranges from 0,002 to 0,08 mm. The length of the twigs is very different and cannot be taken as a diagnostic feature.

The described specimens are only bioclasts, hence it is difficult to ascertain the real size and shape of individuals. The maximum size from until now collected material reach exemplars from Pl. XCII, Fig. 7(7 mm) and Pl. XCI, Fig. 4(6,3 mm). The original shape of individuals was probably brain-like or bush-like with a discontinuous outer outline.

Relations: The taxonomic appurtenance of *Plexoramea cerebriformis* n. gen. n. sp. is not yet clear. Most probably it belongs among *Codiaceans*. It

shows some similarities with *Bacinellas* (R. Radoičić 1959, S. Pantić 1972), having also some common occurrences with them.

Occurrences in the West Carpathians and their stratigraphical range:

a) The Wetterstein Bioherm Limestones (Ladinian — Cordevolian) of the Silica nappe, the Slovak Karst (Pl. XCI. Fig. 1, 3—5, Pl. XCII, Fig. 1—3, 8; J. Mello 1975a, Fig. 3—6 in the text), the Veterník nappe of the Malé Karpaty Mts (Pl. XCI, Fig. 6, Pl. XCII, Fig. 9), the Jablonica nappe of the Jablonické pohorie Mts (Pl. XCII, Fig. 7) and the Strážov nappe of the Strážovská hornatina Mts (J. Hanáček — J. Mello in press, Pl. IV, Fig. 6).

b) The Wetterstein Bedded Limestones of the Silica nappe (Lower Ladinian; characteristics of the limestones see in J. Mello 1975c), the Slovak Karst (Pl. XCI, Fig. 2).

c) The „Raming" Limestones (Ladinian — Cordevolian) of the Strážov and Choč nappes in the Strážovská hornatina and Choč Mts. respectively (Pl. XCII, Fig. 4, 6).

d) Turbidite material in the Reifling Limestones (Ladinian), underlying the „Raming" Limestones, the Choč nappe, Choč Mts. (Pl. XCII, Fig. 5).

Genus *Ladinella* Ott, 1968

Ladinella porata Ott, 1968

Pl. XCVI, Fig. 3—6

The description, synonymy and interpretation are given in details in papers by O. Kraus — E. Ott (1968), E. Flügel (1972) and E. Jablonský (1973).

Occurences and stratigraphical range: *Ladinella porata* Ott has been known only from Ladinian: from the Wetterstein Reef Limestones — Karwendelgebirge, Gesäusee, Dobratch (E. Ott in O. Kraus — E. Ott 1968) and from another comparable Ladinian facies: Cipitkalkblöcke near St. Cassian (ibid)., Ladinian of Monte Negro (S. Pantić 1967), Bosnien (S. Pantić 1971) and that of Karaburun Isle (E. Flügel 1972).

Up to this time the following occurrences have been known from the West Carpathians:

a) The „Raming" Limestones of the Choč nappe in the Lower Tatra Mts (Liptovská Osada), in the Choč Mts. (Martinček) and in the Strážovská hornatina Mts (Homôlka) — E. Jablonský (1973, p. 415).

b) The Wetterstein Bioherm Limestones of the Silica nappe, the Slovak Karst (a number of localities at the Silická planina Karst plateau, the Plešivecká planina plateau, the Horný vrch plateau and the Dolný vrch plateau — J. Mello 1975a, Pl. VI, Fig. 2, 4, Fig. 3—6 in the text; 1976, Pl. XXVIII,

Fig. 7, Fig. 3 in the text.) In addition, some individuals from the Slovak Karst Wetterstein Bioherm Limestones are shown here in Pl. XCVI, Fig. 4.

Further new occurrences from the West Carpathians come from the „Raming" Limestones of the Strážov and the Choč nappes of the Strážovská hornatina and the Choč Mts respectively (Pl. XCVI. Fig. 3, 5).

After the changes in the Ladinian — Carnian division and terminology, the stratigraphical range of the West Carpathians *Ladinella porata* occurrences is as broad as Ladinian — Cordevolian. This is evidently the case of the above cited extra — Carpathian localities, too.

Genus *Tubiphytes* Maslov, 1956

Tubiphytes obscurus Maslov, 1956

Pl. XCIII, Fig. 1—3

The synonymy, description and data on distribution and occurrences were presented in detail by V. P. Maslov (1956), O. Kraus — E. Ott (1968, p. 269—273), M. Mišík (1972, p. 33—37), E. Flügel (1972, p. 970—971) and others.

Hence, only a short report will be given here on *T. obscurus* new occurrences in the Slovak Karst and some other West Carpathian areas.

a) The Slovak Karst — *T. obscurus* was found at numerous localities mainly in the Wetterstein Bioherm Limestones of the Silica nappe at the Plešivecká (Pl. XCIII, Fig. 1), Silická and Jasovská planina karst plateaus, as well as at the Horný vrch karst plateaus (J. Mello 1975a, Pl. XCVI, Fig. 1, 3—6 in the text; M. Kochanová — J. Mello — M. Siblík 1975, Pl. XI, Fig. 8, Pl. XII, Fig. 4).

Besides, *T. obscurus* finds in this unit were reported from the dark-grey micritic and crinoidal limestones (? Pelsonian — Illyrian in age) and from the Ladinian Raming Limestones (J. Mello 1975c, Pl. IV, Fig. 3).

b) The Choč Mts — *T. obscurus* was found in bioclastic inclusions in the Reifling Limestones of the Choč nappe (western slope of the Choč Mount, Pl. XCIII, Fig. 2, 3).

c) The Jablonické pohorie Mts, the Wetterstein Bioherm Limestone of the Jablonica nappe (e. g. the Vysoká skala hill SE from Hradište pod Vrátnom and quarry NE from the Dobrá Voda castle ruins).

d) The Malé Karpaty Mts — *T. obscurus* was found mainly in the Wetterstein Bioherm Limestones of the Veterník and the Havranica nappes at numerous localities (e. g. the saddle north of the Javorinka hill, 2 km SE of Plavecký Mikuláš; elevation point 461, 700 m E of the Kršlenica hill; valley 600 m W of the Hurtovec hill; Malá skala and Veterlín a. o.).

„*Problematikum*" Bystrický, 1964

Pl. XCIII, Fig. 4—6

This problematics, known so far only from the Slovak Karst, depicted originally J. Bystrický (1964, Tab. XXXII, Fig. 1). Later on it had been found at numerous localities of Silická, Jasovská and Dolný vrch karst plateaus (J. Mello 1975a, Fig. 5—6 in text, Pl. VI, Fig. 6; M. Kochanová — J. Mello — M. Siblík 1975, p. 60).

Description: By its cylindrical shape, construction of a test (existence of the central hollow and of internoding), and by its size as well (⌀ as much as 5 mm, length of the test fragments 10—16 mm, ⌀ of the central hollow d = 1—1,5 mm), this problematics reminds dasycladaceans, chiefly species *Diplopora annulata*. „*Problematikum*" Bystrický, 1964, however is typical for the absence of pores and the small diameter of the central hollow in comparison with the outer diameter is striking.

Low nodes possess the shape of a wide funnel with elevated edges. The outer edges of the „funnels" are usually smooth and only sometimes notched. The funnel-like nodes fit into one another; the grooves between the nodes are usually larger than their height.

Occurrence: „*Problematikum*" Bystrický occurs in the Slovak Karst in a similar position and localities as *Bacinella ordinata* Pantić, their common occurrences are current. „*Problematikum*" Bystrický is plentifully represented mainly in the Bedded Wetterstein Limestones north of the village Silica overlying the Illyrian Schreyeralm Limestones. Nests with the mass occurrences can be found there at places (e. g. south from the Žabec hill, Pl. XCIII, Fig. 4. 5; south-west from the Rakaťa gamekeeper's cottage, Pl. XCIII, Fig. 6). „*Problematikum*" Bystrický occurs as well higher up in the massive Wetterstein Bioherm Limestones, however, its findings in the upward direction stop sooner than those of *B. ordinata*.

Pycnoporidium ? eomesozoicum Flügel, 1972

Pl. XCIV, Fig. 1, 2

1969 *Pycnoporidium (?) eomesozoicum* Flügel, 1962 nom. nud. — H. Zankl: Der Hohe Göll... etc. S. 39, Abb. 39

1972 *Pycnoporidium ? eomesozoicum* n. sp. — E. Flügel: Mikroproblematika in Dünnschliffen... etc, S. 968—970, Taf. 2, Fig. 2, Taf. 3.

Diagnosis: Colonies of very irregularly formed, highly indulated, and tangled cell threads grow at different biogens and form bended cell tubes with rare thin partitions. The new cell-tube walls are built by simple ramifying of thin cell threads. The cell threads are micritic with thin bended tube-cross-sections at places. The boundary between the organisms and substratum is commonly sharp. — Dimensions of the holotype: maximal

colony height 2000 μ, maximal colony width 7 000 μ. Cell-tube diameters inside of the colony between 25 and 50 μ, with $\pm$ 10 μ fluctuation if considered inside of one cell tube. Cell thread thicknesses are about 10 μ, that of partitions 6—10 μ (E. Flügel 1972, p. 968).

Occurrences: 1. The Dachstein Reef Limestone (probably Norian) of Gosaukamm, 2. the Dachstein Reef Limestone of the Begunjscica Mts (probably Rhaetian), 3. the Hallstatt Reef Limestone of Hohe Wand, 4. the Rhaeto-Liassic Limestone of Chios Isle (cf. E. Flügel, lit. cit.).

In the West Carpathians this fossil has been found in the Slovak Karst Dachstein Reef Limestones (Norian) of the Drienkova hora hill near Drnava (the south foothill, cca 100 m W of the Bleskový prameň spring, Pl. XCIV, Fig. 1, 2). These limestones are known under a local name as the Furmanec Limestones as well (J. Bystrický 1972, J. Mello 1974, 1975a). In addition to *P. ? eomesozoicum* a very rich assemblage of reefbuilders (corals, sponges, foraminifers, encrusting organisms, problematic etc.) occurs in them.

Thaumatoporella parvovesiculifera (Rain, 1922)

Pl. XCIV, Fig. 3, 5

The synonymy, description, occurrences and discussions on the systematic appurtenance have been presented in details mainly by R. Radoičic (1960), J. H. Johnson (1969) and E. Flügel (1972).

Distribution: Anisian — Cretaceous (eventually Lower Paleocene).

Triassic occurrences: The Anisian and Ladinian reef limestones of the Dinarids (S. Pantić — S. Mojsilović 1967, p. 214), the Wetterstein Limestones of Karnwendel (E. Flügel 1972, p. 967), the Dachstein Reef Limestones: Sauwand near Gusswerk, Gosaukamm (E. Flügel ibid.), Hoher Göll (H. Zankl 1969, p. 39, Fig. 40), the Rhaetian — Liassic Reef Limestones: Steinplatte near Weidring, Rötelwand near Hallein, east foothill of Rofan-Sonnwendgebirges (E. Flügel ibid.).

In the West Carpathians *Th. parvovesiculifera* was found in the Wetterstein Limestones (Ladinian-Cordevolian) of the Silica nappe, the Slovak Karst. It occurs here both in the bioherm (Pl. XCIV, Fig. 3; J. Mello 1975a, Fig. 3, 6) as well as in the lagoonal varieties of the Wetterstein Limestones (Pl. XCIV, Fig. 5; J. Mello 1976, Pl. XXVIII, Fig. 8). The latter case is much more common (e. g. number of localities at the Dolný vrch karst plateau).

Some further microfossils of problematic appurtenance

Pl. XCIV, Fig. 4, 6—8

In thin sections with above depicted and described problematics can be met cross-sections which are difficult to determinate. Many of them had not yet been named and described, probably.

Some problematic individuals from this group are depicted in Pl. IV. According to view of Dr. E. Jablonský (written communication, May 1975) in Figs. 4, 6, 8 are depicted representatives of calcareous sponges (Fig. 4 —? *Uvanella irregularis* Ott; Fig. 6 — section resembles according to him in the West Carpathians relatively rarely occurring *Vesicocaulis alpinus* Ott, but most probably, it is a new species; cross-section in Fig. 8 belongs perhaps to genus *Amblysiphonella* sp.).

Cross-section in Fig. 7 differs considerably from the others and its filing up into any organic group is questionable.

Family *Codiaceae*
Genus *Bacinella* Radoičić, 1959

Bacinella ordinata Pantić, 1972

Pl. XCV, Fig. 1—4

1972 *Bacinella ordinata* sp. n. — S. Pantić: Bacinella ordinata sp, n. from the Middle Triassic... etc. p. 151—154, Pl. I—IV.
1975 *Bacinella ordinata* Pantić — M. Kochanová — J. Mello — M. Siblík: Fossilien aus dem Wettersteinkalke... etc., Pl. XI, Fig. 4.

Description: *B. ordinata* shows in thin sections the form of a „relatively regular, twisty, intervowen in various directions and nearly parallel cellules. It is built of cellules irregular in shape (circular, triangular, rectangular, square, etc.) which are filled with crystalline calcite. The external wall is thin (0.008—0.016 mm), occasionally somewhat thicker (to 0.032 mm). Internal walls between the cellules are nearly as thin (less than 0.016 mm) and generally normal to the external wall" (S. Pantić 1972, p. 154).

Stratigraphical level: Ladinian.

Occurrences: Dinarids — Mratinje (Montenegro), Srebrnica surroundings (Bosnia), Tara and Zlatibor Mts. (Serbia), Prijepolje, and the Triassic belt between Novi Pazar and Sjenica (S. Pantić, lit. cit.).

The West Carpathians — a) the Slovak Karst, the Silica nappe, numerous localities in the northern part of the Silická planina karst plateau, at the Horný vrch and the Jasovská planina karst plateaus (J. Mello 1975a, Fig. 4—6 in text) and at the Dolný vrch karst plateau (M. Kochanová — J. Mello — M. Siblík 1975, Pl. XI, Fig. 4, J. Mello 1976). *B. ordinata* Pantić occurs here in the Wetterstein Bioherm Limestones (Pl. XCV, Fig. 1, 3, 4), in the Lower Ladinian Wetterstein Bedded Limestones of the transitional nature (Pl. XCV, Fig. 2) and in the untypical Schreyeralm Limestones in areas of their lateral transition into the light massive limestones.

The stratigraphical range of the Slovak Karst occurrences can be appreciated only preliminarily for the time being. The lowermost occurrence was

found at the Silická planina plateau north of Silica in the profile east of the Zakázané hill in the grey limestone bed from basal part of the Schreyeralm Limestones (*avisianus* Zone), 10 m over *Physoporella pauciforata* occurrence. The uppermost occurrences reach only several meters (or ten meters respectively) into the lower part of the Wetterstein Limestones. This lower part, when considering total thickness of the Wetterstein Limestones (cca 600—1 200 m) is most probably Fassanian in age.

b) The Strážovská hornatina Mts, the Strážov nappe, several small fragments from the Wetterstein Bioherm and „Raming" Limestones. Much more frequent, however, is *B. irregularis* Radoičić there (J. Hanáček — J. Mello, in press.).

Family *Codiaceae (?)*
Genus *Baccanella* Pantić, 1971

Baccanella floriformis Pantić, 1971

Pl. XCVI, Fig. 1, 2, 6, 7

1971 *Baccanella floriformis* n. sp. — S. Pantić: Baccanella floriformis n. gen. n. sp. from the Middle Triassic etc., p. 270, Fig. 1
1972 *Baccanella floriformis* Pantić 1971 — E. Flügel: Mikroproblematika in Dünnschliffen etc., S. 965, Taf, I, Fig. 6
1972 *Baccanella floriformis* Pantić — S. Pantić — J. P. Rampnoux: Triassic Microfacies etc., S. 322, Pl. II, Fig. 2
1975 *Baccanella floriformis* Pantić — M. Kochanová — J. Mello — M. Siblík: Fossilien aus dem Wettersteinkalke etc., Taf. XI. Fig. 10
1975 *Baccanella floriformis* Pantić — J. Mello: Triassische Biohermemkalke, etc. Taf. VI, Fig. 10.

Description: This alga possesses a spherical shape, but there also occur elliptical and elongated elliptical forms. Baccanellas usually appear in groups, in which they are densely packed beside each other. Sometimes we find them as separated units. In the centre of the alga there is a small aperture, which can but rarely be clearly visualized. From it there radiate branches, the form of which corresponds to the shape of leaves in a flower. Their number amounts from 3 to over 10. Each branch is divided into smaller, tinier parts. The rims of the distal parts are finely indented (S. Pantić 1971, p. 270).

Dimensions: ∅ of alga ranges from 64 μ to about 530 μ, the diameter of the small opening amounts from 8 μ to about 500 μ.

Interpretation: S. Pantić (1971) compared this alga with fresh-water alga *Microcodium* Glück 1914, but pointed out at Baccanellas colligation on a sea environment and filed it with reservations among codiaceans.

Similar „flower-like" formations described and depicted M. Mišík (1966, pl. 77; 1968, p. 135). He hinted at a possibility of their organic (e. g. alga

Microcodium elegans Glück 1914) as well as inorganic origin and set up criteria to distinguish between them.

Distribution: The Ladinian limestones of the Dinarids (together with calcareous sponges, hydrozoans, bryozoans, algae and foraminifers; S. Pantić 1971). E. Flügel (1972, p. 965) mentioned sporadical occurrences of similar sections from the Upper Triassic reef limestones of the Northern Calcareous Alps.

In the Slovak Karst Silica nappe (West Carpathians) *Baccanella floriformis* Pantić occurs at numerous localities in the Wetterstein Bioherm Limestones (Ladinian — Cordevolian in age): at the Silická planina karst plateau (M. Kochanová — J. Mello — M. Siblík 1974, Pl. XI, Fig. 10), at the Plešivecká, Silická, Zádielska, and the Horný vrch karst plateaus (J. Mello 1975a, Pl. VI, Fig. 3—6 in the text, Plate VI, Fig. 10). *B. floriformis* (Pl. XCVI, Fig. 1) occurs there in association with other microproblematics (*Tubiphytes obscurus* Maslov, *Ladinella porata* Ott, *Bacinella ordinata* Pantić etc.), with calcareous sponges and with other organisms typical for bioherm facies.

In other areas of the West Carpathians *B. floriformis* occurs in the Wetterstein Bioherm Limestones of the Jablonické pohorie Mts (the Jablonica nappe, Pl. XCVI, Fig. 2, 7), Malé Karpaty Mts (Pl. XCVI, Fig. 6) and the Strážovská hornatina Mts (the Strážov nappe, J. Hanáček — J. Mello in press Pl. IV, Fig. 4).

Facial and stratigraphical conclusions

Despite the fact that the question of taxonomic appurtenance with many of described problematics is not until recently cleared up, still these organisms have facial and stratigraphical significance.

From the facial point of view is important the fact that microproblematics *Plexoramea cerebriformis* n. gen. n. sp., *Ladinella porata* Ott, *Tubiphytes obscurus* Maslov, *Pycnoporidium ? eomesozoicum* Flügel, and *Baccanella floriformis* Pantić hint at and indicate unambiguously a reef biotope. *Baccinella ordinata* Pantić and „*Problematikum*" Bystrický hint either at a reefal or transitional towards a basin environment. *Thaumatoporella parvovesiculifera* (Rain), was found both in reefal and lagoonal biotops, its occurrence in the latter is, however, much more abundant.

Stratigraphical value of the above given microfossils is diverse. Mainly forms with a narrow stratigraphical span are valuable. Here belong according to until now knowledge *Bacinella ordinata* Pantić and „*Problematikum*" Bystrický (Ladinian). Stratigraphically valuable are besides further forms with somewhat broader stratigraphical span *Ladinella porata* Ott, *Plexoramea cerebriformis* n. gen. n. sp. (Ladinian — Cordevolian) and *Pycnoporidium ? eomesozoicum* Flügel (Norian — ? Liassic).

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Ján Mello

Plexoramea cerebriformis n. gen. n. sp. a niektoré ďalšie mikroproblematiká a mikrofosílie z triasových vápencov Západných Karpát

1 obr., 6 tab. (XCI—XCVI), resumé anglického textu

Triasové biohermné vápence, ako i vápence prechodnej fácie medzi rífmi a panvovými oblasťami alpínskej oblasti sú veľmi bohaté na organické zvyšky rífového biotopu. Okrem húb, koralov, hydrozoí, bryozoí, stromatopórov a rias hojne sú zastúpené zvyšky problematickej príslušnosti. Im je venovaný tento príspevok.

Ťažiskom paleontologickej časti je opis nového rodu a druhu *Plexoramea cerebriformis* n. gen. n. sp. zo skupiny *Incretae sedis*. *Plexoramea cerebriformis* má vzhľad spleti nepravidelných vetvičiek a lístkov (vo výbruse často pripomínajú vyobrazeniny mozgu). Ich veľkosť sa pohybuje v priemere 2—3 mm, ojedinele 6—7 mm.

Príspevok ďalej prináša informácie o výskytoch *Ladinella porata* Ott, *Tubiphytes obscurus* Maslov, „*Problematikum*" Bystrický, *Pycnoporidium ? eomesozoicum* Flügel, *Thaumatoporella parvovesiculifera* (Rain), *Bacinella ordinella ordinata* Pantić, *Baccanella floriformis* Pantić a niektorých ďalších problematík, najmä s ohľadom na ich stratigrafické, faciálne a geografické rozšírenie v Západných Karpatoch.

Explanation of plates XCI—XCVI

Abbreviations:

Litostratigraphical units: WRL — the Wetterstein Reef Limestones (Ladinian — Cordevolian), WBL — the Wetterstein Bedded Limestones (Lower Ladinian), WLL — the Wetterstein Lagoonal Limestones (Ladinian — Cordevolian), RE — the Reifling Limestones (Upper Anisian — Cordevolian), RA — the Raming Limestones (? Ladinian — Cordevolian), DRL — the Dachstein Reef Limestones (Norian)

Geographical areas and tectonic units: — The Slovak Karst (all localities belonging to the Silica nappe): PP — the Plešivecká planina karst plateau, SP — the Silická planina k. p., HV — the Horný vrch k. p., DV — the Dolný vrch k. p., JS — the Jasovská planina k. p.; the Choč Mountains: CH — the Choč nappe; The Jablonické pohorie MTs: JP — the Jablonica nappe; The Malé Karpaty Mts: MK/Vk — the Veterník nappe, MK/Ha — the Havranica nappe); The Strážovská hornatina Mts: SŽ — the Strážov nappe.

Plate XCI

Plexoramea cerebriformis n. gen. n. sp.

Fig. 1 Holotype, the WRL of PP (central part, sampling point PP-VI/3, thin section Nr. 51—78), × 38.

Fig. 2 „Loose" exemplar from the WBL of SP (southern foothill of Žabec, north of the village Silica, Si-364, 52—789), × 22.

Fig. 3 Syntype from the WRL of PP (the Železné vráta reef body, PP-485, 51—91) together with (not shown) *Cryptocoelia zitteli* (Steinm.), × 35

Fig. 4 Syntype, detto as Fig. 3 (1 km eastward, PP-IV/4, 51—57), × 20.

Fig. 5 From the WRL of PP (south part, PL-561, 51—223), × 30.

Fig. 6 From the WRL of MK/Vk (1 km west of the Veterník hill, MK-15, 300/74), × 20.

Plate XCII

Plexoramea cerebriformis n. gen. n. sp.

Fig. 1 From the WRL of PP (PL-95/A, 51—200), × 22.

Fig. 2 From the WRL of SP (RO-161, 52—863), × 22.

Fig. 3 From the WRL of DV (SI-266/D_1, 51—743), × 15

Fig. 4 From the RA of SŽ (the Rohatín hill near Mojtín, SŽ-34/E), × 40.

Fig. 5 From the RE of CH (western slope of the Choč mount, CH — II/7, 2586/67), × 25.

Fig. 6 From the RA of CH (the Mních hill, CH-6, 2620/67a), × 12.

Fig. 7 From the WRL of JP (a quarry 400 m NW of the Dobrá Voda castle ruins, JP-71/B), × 14.

Fig. 8 From the WRL of PP (south part, PL-561, 51—561), × 26.

Fig. 9 From the WRL of MK/Vk (1 km SW of the Veterník hill, MK-17), × 20.

Plate XCIII

Fig. 1 *Tubiphytes obscurus* Maslov, 1956 from the WRL of PP (south part, PL-601, 51—231), × 14.

Fig. 2 *Tubiphytes obscurus* Maslov, 1956, from the RE of CH (western slope of Choč, CH-II/7, 2586/67), × 22.

Fig. 3 Detto as Fig. 2.

Fig. 4 „*Problematikum*" Bystrický, 1964 from the WBL of SP (south foothill of Žabec, SI-364, 52—786), × 12.

Fig. 5 Bioclastic limestone (WBL) with „*Problematikum*" Bystrický, 1964 from SP (locality as Fig. 4, thin section Nr. 52—789), × 6.
Fig. 6 Bioclastic limestone (WRL) with „*Problematikum*" Bystrický, 1964 from SP (1 km SW from Rakaťa, RO-167, 52—868), × 6.

Plate XCIV

Fig. 1 *Pycnoporidium (?) eomesozoicum* Flügel, 1972 from the DRL of HV (Drienkova hora near Drnava, south foothill, JA-101/C, 52—825), × 40.
Fig. 2 Detto as Fig. 1, × 36.
Fig. 3 *Thaumatoporella parvovesiculifera* (Rain, 1922) from the WRL of PP (central part, PP-VI/10, 51—83), × 36.
Fig. 4 Problematic section resembling a calcareous sponge (*? Uvanella irregularis* Ott, determination Dr. E. Jablonský) from the WRL of HV (Holubia skala near Hrhov, JA-421/B, 51—848), × 20.
Fig. 5 *Thaumatoporella parvovesiculifera* (Rain, 1922) from the WLL of DV (2,5 km S of Hrušov PV-4, 52—681), × 25.
Fig. 6 Problematic section resembling either a calcareous sponge (*? Vesicocaulis alpinus* Ott or some new species, according to Dr. E. Jablonský) or a hydrozoa; the WRL of HV (the Kukudičova skala hill north of Jablonov, JA-259, 51—579), × 6.
Fig. 7 Problematic section of unknown appurtenance from the WRL of PP (the Železné vráta reef body, PP-69, 52—388), × 15.
Fig. 8 Problematic section resembling a calcareous sponge (*? Amblysiphonella* sp., determination Dr. E. Jablonský) from the WRL of HV (the Holubia skala reef near Hrhov, JA-417/A, 51—845), × 14.

Plate XCV

Bacinella ordinata Pantić, 1972
Fig. 1 From the WRL of HV (Tegar area 2 km S of Lúčka, JA-234, 52—936), × 15.
Fig. 2 From the WBL of SP (south foothill of Žabec, SI-70, 52—856), × 30.
Fig. 3 From the WRL of JS (2 km west of Debrad, TU-58/C_1, 52—182), × 15.
Fig. 4 From the WRL of SP (central part, 1 200 m SW of the Rakaťa gamekeeper's cottage, RO-168, 52—869), × 15.

Plate XCVI

Fig. 1 *Baccanella floriformis* Pantić, 1971 from the WRL of HV (1,5 km N of Jablonov, JA-296, 52—958), × 24.
Fig. 2 *Baccanella floriformis* Pantić, 1971 from the WRL of JP (Vysoká skala 2 km SE of Hradište pod Vrátnom, JP-12, 1367/74), × 45.
Fig. 3 *Ladinella porata* Ott, 1968 from the RA of SŽ (the Rohatín hill near Mojtín, SŽ-34/c), × 35.
Fig. 4 *Ladinella porata* Ott, 1968 from the WRL of SP (2 km SW of Krásnohorská Dlhá Lúka, RO-29, 51—516), × 26.
Fig. 5 *Ladinella porata* Ott, 1968 from the RA of CH (the Mních hill, CH-IX/21, 63—66), × 35.
Fig. 6 *Baccanella floriformis* Pantić, 1971 from the WRL of MK/Vk (Malá skala, 1 km SW of the Veterník hill, MK-27/B — 313/74), × 40.
Fig. 7 *Baccanella floriformis* Pantić, 1971 from the WRL of JP (quarry 400 m NW of the Dobrá Voda castle ruins, JP-71/B), × 20.

Photos by the author.

Západné Karpaty, sér. paleontológia, 2—3, P. 203—220, Geol. úst. D. Štúra Bratislava, 1977

Miloš Siblík

Rod Gemerithyris gen. n. (Brachiopoda) ze slovenského triasu

17 obr. v texte, 3 tab. (CVII—CIX), anglické resumé

Abstract. This paper contains description of the new genus Gemerithyris gen. n. and new subspecies Gemerithyris hungarica globosa ssp. n. from the Carnian of the SE Slovakia.

Při systematickém zpracovávání ramenonožcové fauny triasu Slovenského krasu se v poslední době zabývám karnickou faunou, nacházející se v blízkosti starého lomu na mramor asi 1 km na ZJZ od osady Silická Brezová. Početná a druhově rozmanitá ramenonožcová fauna byla z této lokality popsána již K. Baloghem (1940), který odtud uvedl řadu druhů známých od ladinu až do svrchního triasu. Biostratigrafií lokality a širšího okolí se zabýval později J. Bystrický (1964 a j.) se spolupracovníky. Z té doby pocházejí i jejich početné sběry zkamenělin. Karnické stáří souvrství s bohatou ramenonožcovou faunou bylo prokázáno nálezy nehojné amonitové fauny, kterou studovala V. Kollárová — Andrusovová (1961,1962).

Při studiu terebratelidních ramenonožců výše uvedené lokality jsem zjistil nový rod a nový poddruh, které popisuji v předložené práci.

Dr. J. Bystrickému (Geologický ústav SAV, Bratislava) děkuji za zapůjčení ramenonožců ze Silické Brezové. Kromě tohoto početného materiálu jsem pro zpracování použil vlastních nálezů z téže lokality.

Čeleď *Zeilleriidae* Allan, 1940
Gemerithyris gen. n.

Typický druh: *Waldheimia (Aulacothyris) supina* var. *hungarica* Balogh, 1940. Svrchní trias, Slovensko.

Derivatio nominis: Gemer — historický název kraje, odkud nálezy pocházejí.

Diagnóza: viz anglický text.

Druhy: *Gemerithyris hungarica hungarica* (Balogh, 1940)
Gemerithyris hungarica globosa ssp. n.
Gemerithyris (?) *zugmayeri* Bittner, 1891.

Rozšíření: Střední (?), svrchní trias; ČSSR, Rakousko, Rumunsko.

RNDr. M. Siblík, CSc., Geologický ústav ČSAV, 28. pluku 19, 101 00 Praha.

Gemerithyris hungarica hungarica (Balogh, 1940)

tab. CVII, obr. 1—7; tab. CVIII, obr. 1; text-obr. 1—8.

1940 *Waldheimia (Aulacothyris) supina* Bittn. var. *hungarica* var. n. — K. Balogh: p. 174, 197, tab. 1, fig. 9—10.
1940 *Waldheimia (Aulacothyris) Zugmayeri* Bittn. — ibid.: p. 175, 197, tab. 1, fig. 11—12.

Lektotyp: Za lektotyp vybírám jedince vyobrazeného K. Baloghem (1940) na tab. 1, obr. 9 a uloženého ve sbírkách Geologického ústavu v Budapešti pod č. T. 1654. Pochází od Silické Brezové a má rozměry 13,2 × 9,0 × × 7,7 mm.

Materiál: 170 jedinců (více či méně dobře zachovaných jader se zbytky původních schránek); jejich rozměrová variabilita je patrná z tabulek a textových obrázků (vyloučeni jsou mladí jedinci).

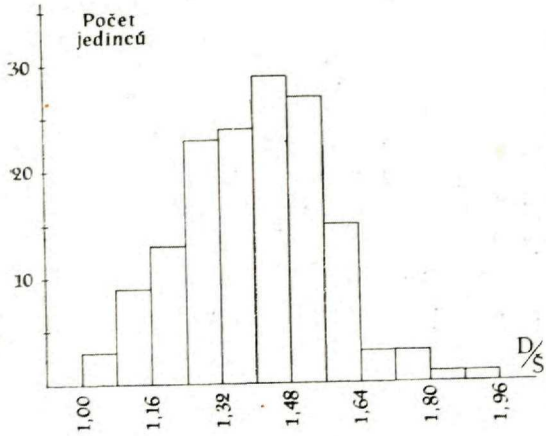
délka schránky	počet jedinců
8,0— 8,9	2
9,0— 9,9	2
10,0—10,9	7
11,0—11,9	11
12,0—12,9	30
13,0—13,9	31
14,0—14,9	15
15,0—15,9	14
16,0—16,9	12
17,0—17,9	4
18,0—18,9	5
19,0—19,9	2
celkem	135

šířka schránky	počet jedinců
6,0— 6,9	5
7,0— 7,9	7
8,0— 8,9	26
9,0— 9,9	41
10,0—10,9	26
11,0—11,9	21
12,0—12,9	7
13,0—13,9	3
14,0—14,9	2
celkem	138

výška schránky	počet jedinců
4,0— 4,9	8
5,0— 5,9	5
6,0— 6,9	14
7,0— 7,9	31
8,0— 8,9	31
9,0— 9,9	33
10,0—10,9	8
11,0—11,9	10
12,0—12,9	3
celkem	143

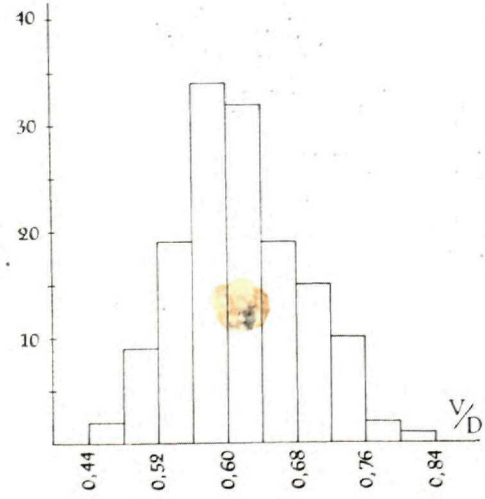
Vyobrazení jedinci mají rozměry:

délka	šířka	výška	
? 4,0	3,8	2,0	tab. CVII, obr. 1
5,1	3,6	2,5	tab. CVII, obr. 2
6,2	5,0	3,4	tab. CVII, obr. 3
7,5	5,6	4,4	tab. CVII, obr. 4
13,4	8,6	8,2	tab. CVII, obr. 5
12,0	8,7	5,8	tab. CVII, obr. 6
16,2	10,6	9,0	tab. CVII, obr. 7
16,8	10,2	10,4	tab. CVIII, obr. 1

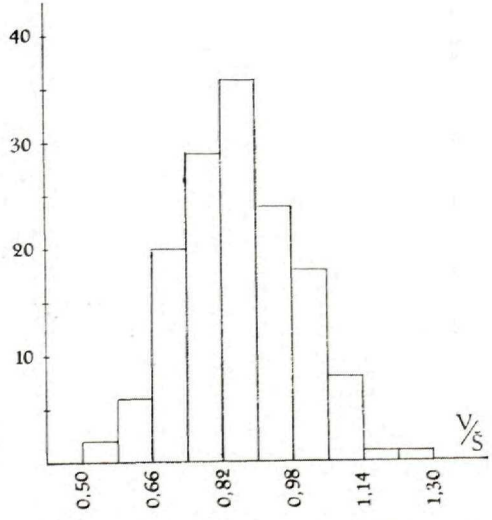


Obr. 1 *Gemerithyris hungarica hungarica* (Balogh). Silická Brezová. D-length, Š-width; vertically-number of specimens

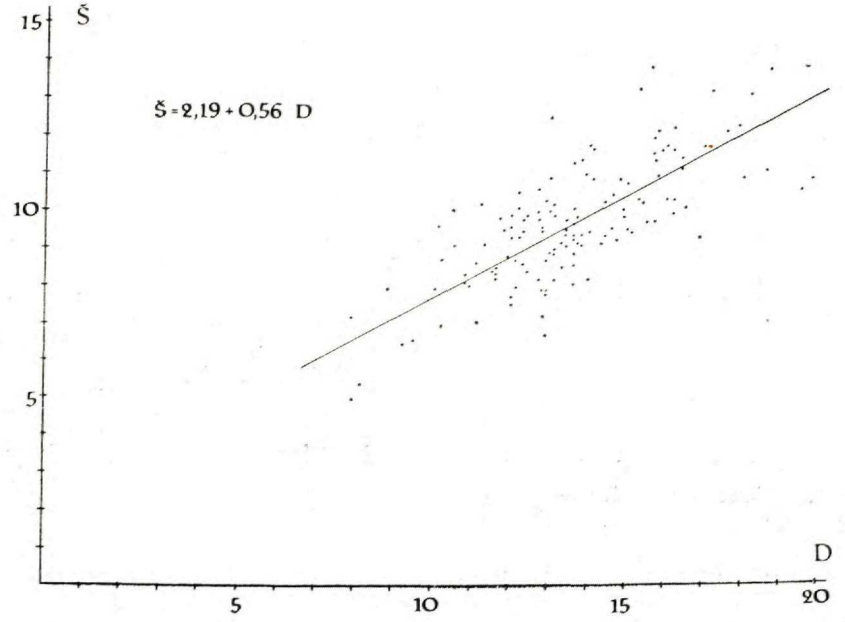
Popis: Schránky nejčastěji subpentagonálního obrysu s téměř rovnoběžnými boky jsou do délky protaženy a vyznačují se velmi rozdílnou výškou misek (patrno při bočním pohledu); břišní miska je až čtyřnásobně vyšší než hřbetní. Slabě konkávní hřbetní miska má nízký a zaoblený střední val, nápadný v přední polovině misky, kde vyniká nad její celkovou úroveň. Po stranách je omezen mělkými brázdami, stýkajícími se v zadní, vrcholové části misky. Brázda břišní misky odpovídá délkou délce hřbetního valu a je omezena po stranách více nebo méně vyniklými kýly, které odpovídají brázdám hřbetní misky. Boky schránky jsou při dorzálním pohledu subparalelní nebo se poněkud rozbíhají směrem k přednímu okraji schránky. Příčný průřez schránkou je zaobleně trojboký. Přední vazba misek je intraplikátní. Silný zahnutý vrchol břišní misky má zaoblené vrcholové hrany zřetelné v zadní čtvrtině misky. Stvolový otvor je kruhovitý, mesothyridní. Proměnlivá je především výraznost trojbokého valu a brázd hřbetní misky a zprohýbání čelní vazby misek.



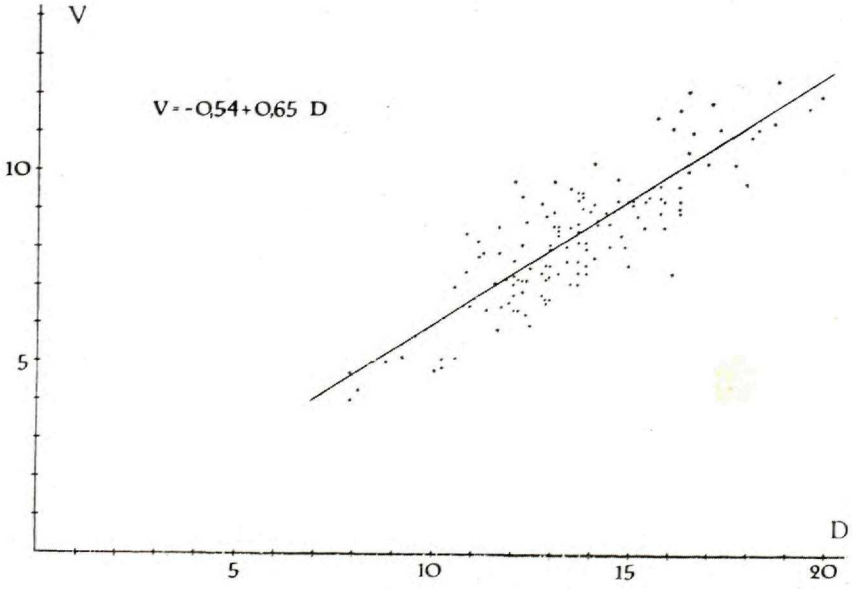
Obr. 2 *Gemerithyris hungarica hungarica* (Balogh). V-thickness, D-length



Obr. 3 *Gemerithyris hungarica hungarica* (Balogh). V-thickness, Š-width

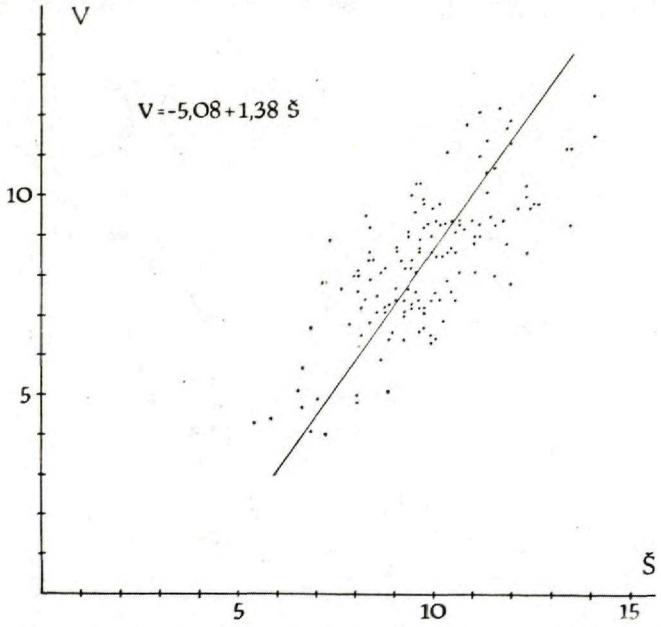


Obr. 4 *Gemerithyris hungarica hungarica* (Balogh). Silická Brezová. D-length, Š-width



Obr. 5 *Gemerithyris hungarica hungarica* (Balogh). D-length, V-thickness

Mladí jedinci (do délky schránky kolem 8 mm) se neodlišují svými znaky a proměnlivostí nijak podstatně od jedinců dospělých. Zdá se jen, že mají častěji poměrně větší šířku schránky (nižší hodnotu poměru D/Š). Pro překrystalování vnitřků schránek se u nich nepodařilo zjistit žádné údaje o vnitřní stavbě.

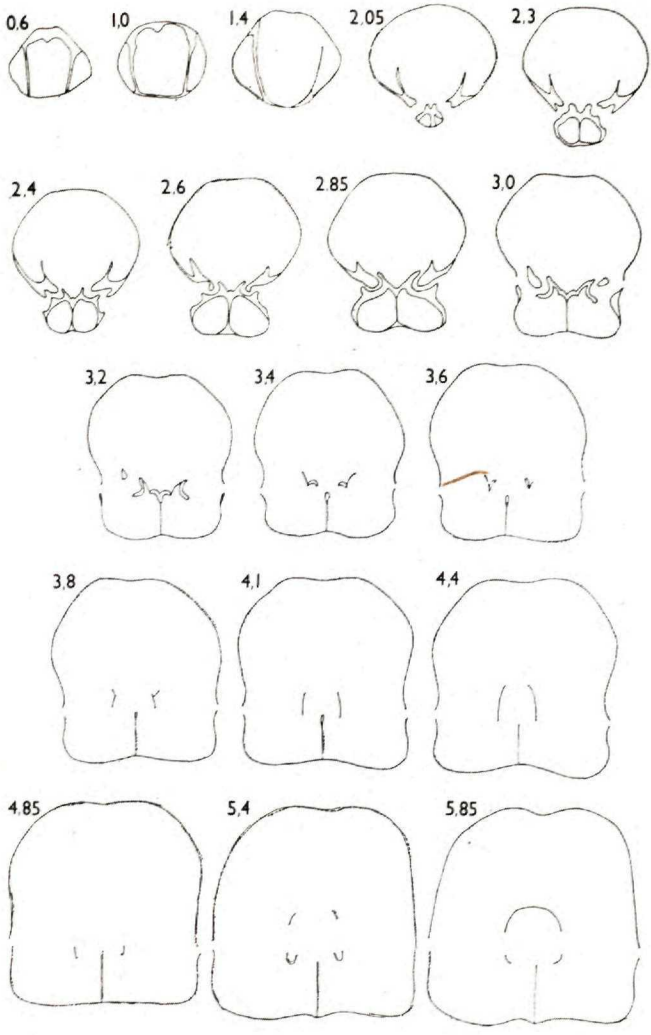


Obr. 6 *Gemerithyris hungarica hungarica* (Balogh). Š-width, V-thickness

Vnitřní stavba: Zubové lišty jsou velmi krátké a probíhají rovnoběžně nebo jsou poněkud dorzálně sbíhavé. Jednoduché šikmé zuby zapadají do zubových jamek volně, bez náznaku vroubkování (krenulace). Dentikula jsou krátká, ale vždy zřetelně vyvinuta. Stvolový prstenec bývá vyvinut a je spojen s vnitřními stěnami zubových lišt.

Kardinální výběžek nebyl zjištěn. Vnější zámkové destičky probíhají šikmo nebo mohou být ventrálně vyklenuté a jsou vždy dobře odděleny jak od septaliových destiček, tak od vnitřních stěn zubových jamek. Ty jsou poměrně široké a různou měrou hluboké, jejich vnější stěny jsou mohutněji vyvinuty než stěny vnitřní. Septalium je široké a hluboké; na příčném řezu má podobu písmena V nebo širokého U. V prvním případě svírají septaliové destičky úhel blízký 90° (text. obr. 7a, řezy 2,4 — 2,6 — 2,85), v druhém zaujímají téměř vodorovnou polohu a ohraničení „septalia" je tvořeno téměř svislými nebo poněkud šikmými přilehlými částmi vnějších zámkových destiček (text. obr. 8, řezy 3,2 — 3,4 — 3,7). Vysoké hřbetní septum je dobře vyvinuto a dosahuje až k přednímu okraji schránky, někdy proniká i do prostoru septalia (text. obr. 7a, řezy 2,4 — 2,6). Základy ramenního přístroje se nacháze-

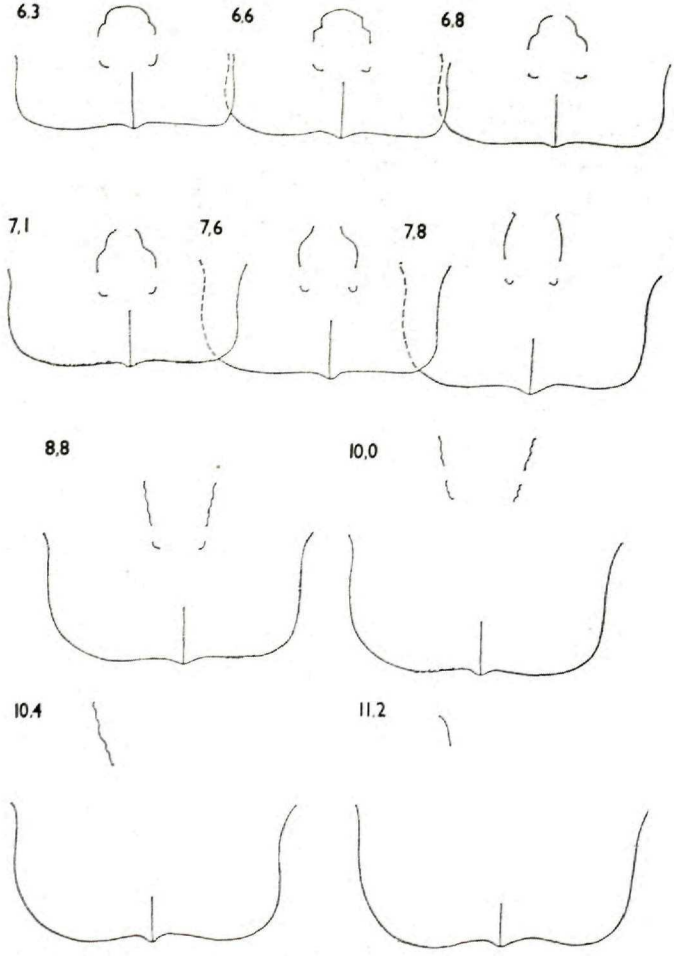
jí na ventrální straně zámkových lišt. Dlouhá smyčka dosahuje téměř k přednímu okraji schránky. Je tvořena úzkými sestupnými lamelami prohnutého až podkovovitého příčného průřezu a velmi širokými lamelami vzestupnými. Ty jsou směrem dále od předního okraje schránky podélně zprohýbány a nakonec na své ventrální straně spojeny užším příčným páskem. Krurální výběžky jsou nápadně vyvinuty. Hřbetní strany sestupných lamel nesou krátké



Obr. 7a *Gemerithyris hungarica hungarica* (Balogh). Silická Brezová. Seriální příčné řezy jádrem. Délka jedince 15,5 mm. Hřbetní septum vymizí ve vzdálenosti 13,1 mm od vrcholu schránky. Zvětšeno × 3,5 (Pokračuje text. obr. 7b). — A series of transverse sections through the shell. Original length of specimen 15,5 mm. The dorsal septum disappeared at 13,1 mm from the posterior end. All × 3,5 approx. (Continued)

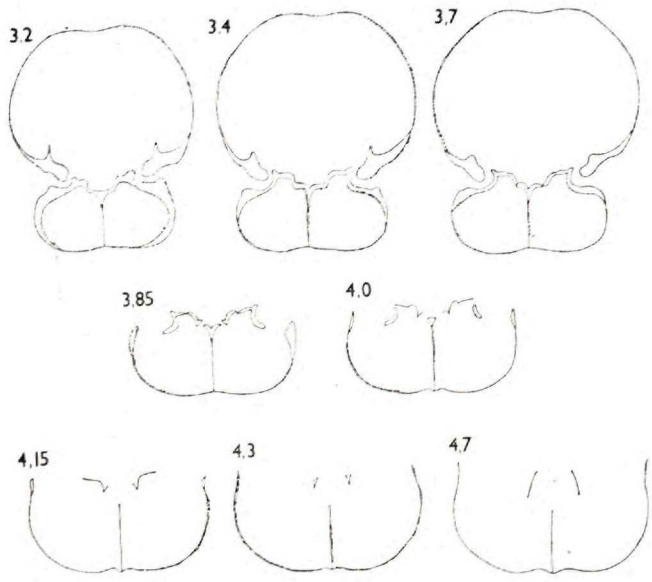
jehlicovité výběžky. Smyčka zasahuje směrem dopředu stále více do oblasti břišní misky.

Poznámky: Baloghův materiál k práci z roku 1940 je uložen v Geologickém ústavu v Budapešti. Jedinci označení K. Baloghem (1940) jako *W.(A.) supina hungarica* var. n. se podstatně odlišují od druhu *A. supina* Bittner, 1903 a vyžadují druhového osamostatnění. Mnou vybraný lektotyp poddruhu *G. hungarica hungarica* i paralektotyp č. inv. T 2000 (Balogh 1940, tab. I, obr. 10, rozměry 13,3 × 8,0 × 7,2 mm) představují jedince užšího obrysu se subparalelními boky. Jedinci označovaní K. Baloghem (1940) jako *W.(A.) zugmayeri* spadají zcela jasně do variační šíře jím nově popisované „variety".



Obr. 7b *Gemerithyris hungarica hungarica* (Balogh). Pokračování seriálních řezů z obr. 7a. — Continuation of the text-fig. 7a.

Gemerithyris hungarica hungarica je velmi podobná druhu *Aulacothyris zugmayeri* Bittner, 1891. Pod tímto jménem byly nálezy z lokality Silická Brezová mylně uváděny, jednak částečně K. Baloghem (1940) a jednak J. Bystrickým (1964). Jejich vzájemné odlišení je však dobře možné, jak jsem zjistil studiem všech tří originálních Bittnerových jedinců druhu *A. zugmayeri*, které jsem měl laskavostí dr. H. Lobitzera zapůjčeny ze sbírek Geologického ústavu (Geol. Bundesanstalt) ve Vídni. Pocházejí z lokality Preinerwand, Raxalpe, která je dosud v literatuře považována za nórickou. Podle ústního sdělení dr. L. Krystyna (Paleontologický ústav vídeňské university) z roku 1973 však poukazují nejnovější dosud nepublikované výsledky dr. Leina, mapujícího v dané oblasti, spíše na karnické stáří lokality. Rozměry nejlépe vyvinutého jedince (vyobrazen v práci A. Bittnera 1892, na tab. III, obr. 29), kterého z nich vybírám jako lektotyp, jsou 11,6 × 7,7 × × 6,4 mm. Jedinec vyobrazený tamtéž na tab. III, obr. 28 měří 8,4 × 5,9 × × 4,5 mm; pravděpodobně nedospělý jedinec vyobrazený na tab. III, obr. 27 má rozměry 7,0 × 5,8 × 3,9 mm. Druh *Aulacothyris zugmayeri* se odlišuje od našeho materiálu — pokud je možno soudit podle obou větších (pravděpodobně dospělých) Bittnerových jedinců — podstatně menší velikostí, zřetelně pětibokým obrysem schránky s největší šířkou v její zadní polovině, zřetelným (subangulárním) rozlišením laterální a posterolaterální části boků schránky, kratším hřbetním septem (dosahujícím přibližně do poloviční délky



Obr. 8 *Gemerithyris hungarica hungarica* (Balogh). Silická Brezová. Seriální příčné řezy jiným jedincem. Délka jedince 16,2 mm. Zvětšeno × 4. — A series of eight transverse sections through another specimen. Original length of specimen 16,2 mm. All × 4

misky) a během individuálního vývoje jedince především výrazným konkávním charakterem zadní poloviny hřbetní misky. Ten se zachovává i u dospělých jedinců a je dobře vyvinut u všech tří Bittnerových jedinců. S tím souvisí i kratší vyvin hřbetního valu, který začíná až poměrně daleko od vrcholu misky. Naši jedinci (včetně nedospělých) mají vrcholovou část hřbetní misky plochou, poměrně vyrovnanou, a hřbetní val zřetelný již blízko vrcholu misky. O rozdílné délce hřbetního septa materiálu ze Silické Brezové ve srovnání s materiálem Bittnerovým se zmínil již K. Balogh (1940).

Jedinci popsaní a vyobrazení E. Jekeliusem (1936, tab. 5, obr. 24—27) jako *Waldheimia zugmayeri* Bittner pravděpodobně patří Bittnerovu druhu. Menší rozměry a zvláště výrazně konkávní zadní polovina hřbetní misky tomu nasvědčuje. Lokalita v Brašově, odkud Jekeliusovy sběry pocházejí, je v literatuře považována za ladinskou, i když tam byly učiněny nálezy ukazující částečně na zastoupení starších i mladších členů. Fauna tam však byla získávána přesíváním rozvětralé části profilu, takže zachycení širšího stratigrafického rozpětí je dosti pravděpodobné.

Stratigrafické rozpětí a výskyt: Světlé krinoidové vápence tuvalu, zóna *Tropites subbulatus*. Jde o „2. horizont s brachiopodami" v profilu J. Bystrického (1964, str. 66), kde byl nalezen i *Paratropites phoebus* (Dittmar). Většina nálezů *Gemerithyris hungarica hungarica* (Balogh) pochází ze závrtu ležícího SZ od kóty 492,2 (křižovatka cest JZ od obce Silická Brezová). Menší počet jedinců byl získán na hřbítku JZ a ZJZ od téže kóty. Část souvrství, v níž jsem ramenonožcovou faunu sbíral, odpovídá stratigraficky zóně *Tropites dilleri* a spodní části zóny *Tropites welleri* (H. Kozur — R. Mock 1974). J. Bystrický (1964, str. 67) udává ještě výskyt v oblasti Šimáku (kóta 419,3) a to jižně od písmene „z" v názvu obce Silická Brezová.

Gemerithyris hungarica globosa ssp. n.

tab. CVIII, obr. 2—4; tab. CIX, obr. 1—4; text-obr. 9—17

Holotyp: Jedinec vyobrazený na tab. CIX, obr. 1 pochází ze sbírky dr. J. Bystrického a je uložený ve sbírkách Slovenského národního muzea v Bratislavě pod č. Z 7344.

Vyobrazené paratypy: Jedinci vyobrazení na tab. CIX, obr. 3—4 jsou uloženi rovněž ve sbírkách Slovenského národního muzea v Bratislavě, ostatní vyobrazení jedinci v Geologickém ústavu ČSAV v Praze.

Derivatio nominis: „*globosus*" — lat. kulovitý.

Stratum typicum et locus typicus: Tuval; Silická Brezová.

Materiál: 108 jader jedinců (z toho 4 hřbetní a 32 břišních misek) se zbytky schránky. Rozměry všech měřitelných jedinců jsou patrny z přiložených tabulek.

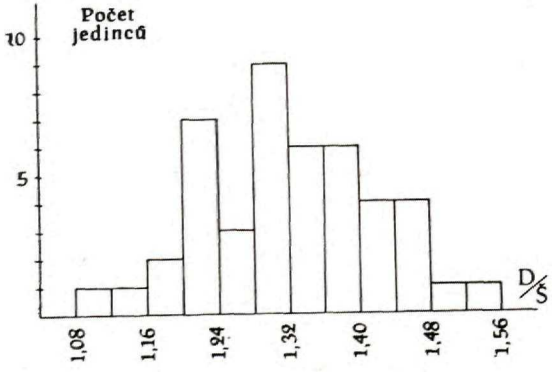
délka schránky	počet jedinců
12,0—12,4	1
12,5—12,9	4
13,0—13,4	7
13,5—13,9	4
14,0—14,4	12
14,5—14,9	2
15,0—15,4	5
15,5—15,9	1
16,0—16,4	5
16,5—16,9	3
17,0—17,4	5
celkem	49

šířka schránky	počet jedinců
9,0— 9,4	2
9,5— 9,9	5
10,0—10,4	11
10,5—10,9	6
11,0—11,4	5
11,5—11,9	10
12,0—12,4	9
12,5—12,9	1
13,0—13,4	2
13,5—13,9	1
14,0—14,4	2
celkem	54

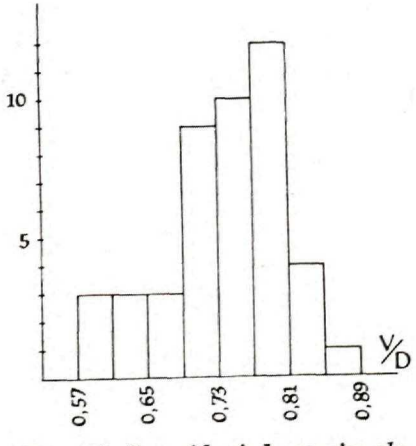
výška schránky	počet jedinců
7,0— 7,4	1
7,5— 7,9	2
8,0— 8,4	—
8,5— 8,9	3
9,0— 9,4	3
9,5— 9,9	1
10,0—10,4	18
10,5—10,9	4
11,0—11,4	9
11,5—11,9	3
12,0—12,4	6
12,5—12,9	2
13,0— 13,4	1
celkem	53

Rozměry vyobrazených jedinců:

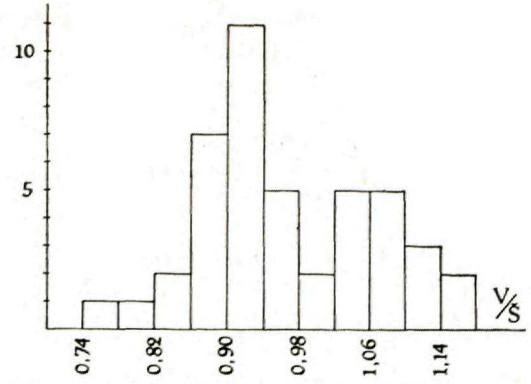
délka	šířka	výška	
13,6	9,9	10,9	tab. CVIII, obr. 2
13,2	10,2	8,9	tab. CVIII, obr. 3
? 9,6	8,2	5,5	tab. CVIII, obr. 4
14,3	10,7	11,8	tab. CIX, obr. 1
? 13,0	10,2	10,4	tab. CIX, obr. 2
14,9	10,6	10,5	tab. CIX, obr. 3
? 13,3	11,5	10,4	tab. CIX, obr. 4



Obr. 9 *Gemerithyris hungarica globosa* ssp. n. Silická Brezová. D-length, Š-width

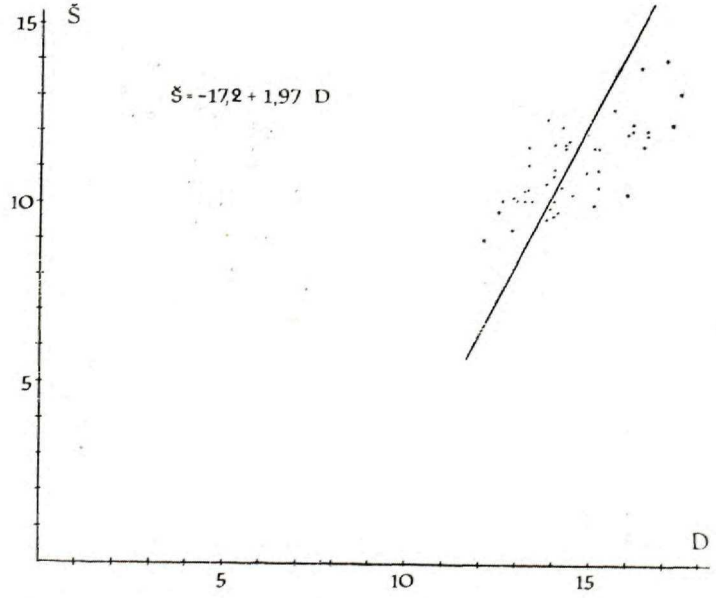


Obr. 10 *Gemerithyris hungarica globosa* ssp. n. V-thickness, D-length

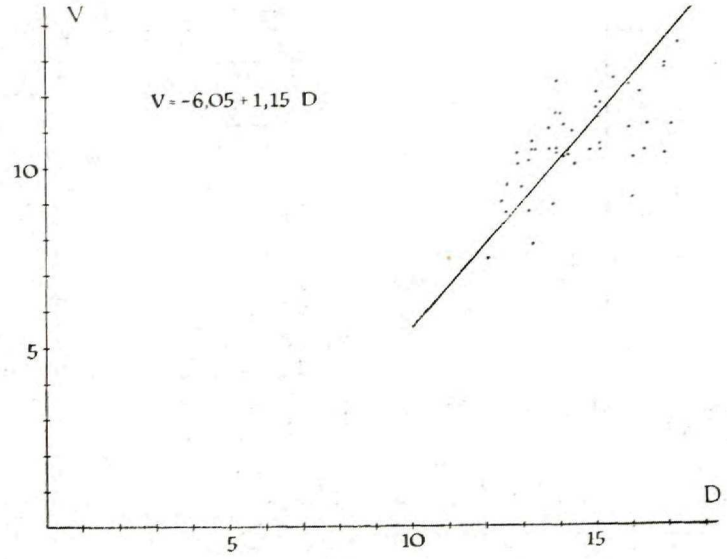


Obr. 11 *Gemerithyris hungarica globosa* ssp. n. V-thickness, Š-width

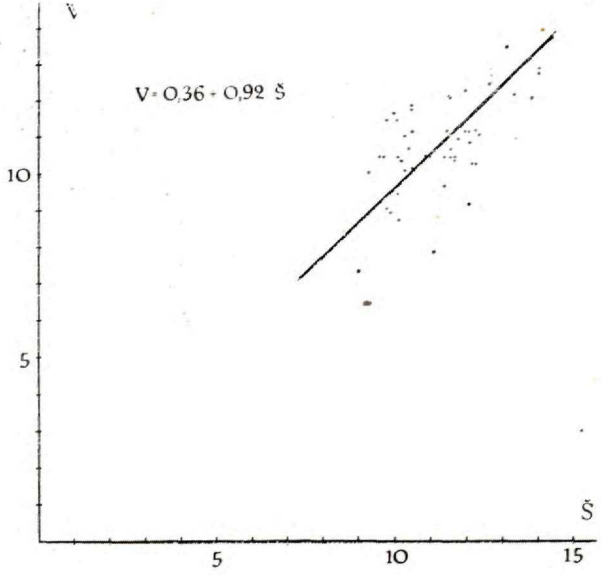
Popis: Schránky mají zaobleně trojboký nebo téměř oválný do délky protažený obrys s poměrně značnou výškou, někdy jsou až téměř kulovité. Jsou nerovnoměrně bikonvexní; miska břišní je vyklenutější a přibližně 3 × vyšší než miska hřbetní. Okraje misek se vzájemně stýkají pod značným úhlem, 90° a větším, na boční vazbě až pod úhlem 140—170°. Hřbetní miska je ve střední části své přední poloviny někdy sploštělá nebo až slabě konkávní; ve své přední polovině má pouze náznak valu, který je velmi nízký, zaoblený a zřetelný jen při předním okraji misky. Po jeho stranách jsou někdy naznačeny brázdovité prohlubeniny, zřetelné rovněž jen při předním okraji schránky. Břišní miska může mít velmi nezřetelnou a krátkou brázdu; ta je však ve většině případů nahrazená pouhým osovým sploštěním přední poloviny misky. Přední vazba misek je intraplikátní. Silný vrchol břišní misky je zahnutý a má krátké zaoblené vrcholové hrany. Stvolový otvor je mesothyridní. Přírůstkové linie



Obr. 12 *Gemerithyris hungarica globosa* ssp. n. Silická Brezová. D-length, Š-width



Obr. 13 *Gemerithyris hungarica globosa* ssp. n. D-length, Š-width



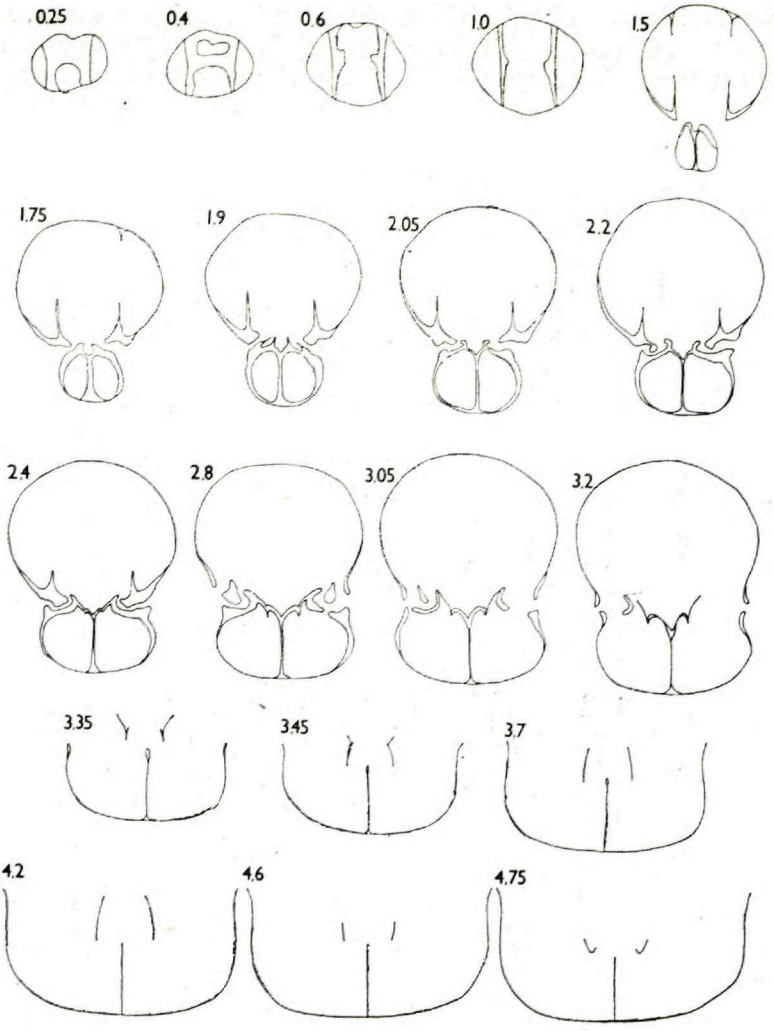
Obr. 14 *Gemerithyris hungarica globosa* ssp. n. Š-width, V-thickness

jsou na miskách dobře zřetelné a výrazné především v přední třetině schránky.

Variabilita vnějších znaků není nijak veliká a týká se především celkového obrysu schránky, většího nebo menšího zdůraznění plikace a různého vzájemného poměru mezi šířkou a výškou schránky.

Mladé jedince se nepodařilo zjistit.

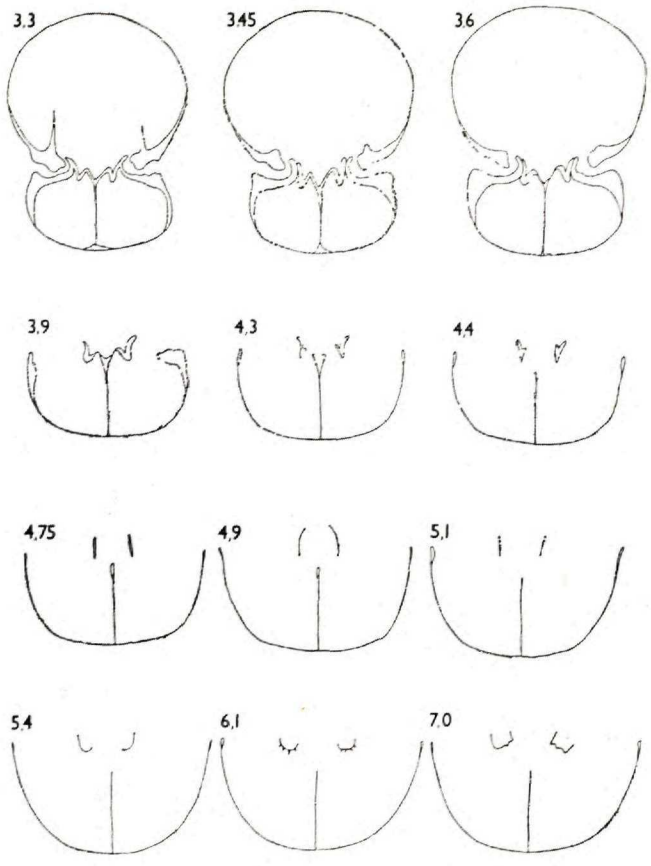
Vnitřní stavba: V hlavních rysech platí totéž co u typického poddruhu.



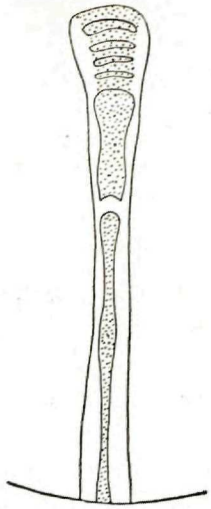
Obr. 15 *Gemerithyris hungarica globosa* ssp. n. Silická Brezová. Seriální příčné řezy jádrem. Délka jedince 13,9 mm. Zvětšeno × 4 — A series of transverse sections through the shell. Original length of specimen 13,9 mm. All × 4 approx.

U poddruhu *Gemerithyris hungarica globosa* ssp. n. bylo možno zjistit výraznější vzájemné ohraničení septaliových a zámkových destiček, někdy nápadně ventrální vyklenutí septaliových destiček (text. obr. 15, řezy 2,8 — 3,05 — 3,2) a lépe vyvinuté jehlice na sestupných lamelách.

Poznámky: Jedinci popisovaného poddruhu se odlišují od poddruhu typického větší výškou schránky a poměrně vyšší a vyklenutější hřbetní miskou oválného obrysu (dobře patrno při dorzálním pohledu, kdy přední část schránky poddruhu *G. hungarica hungarica* je subangulární s více méně přímým předním okrajem), odlišným příčným průřezem schránkou, slabým vývojem valu hřbetní misky a rozdílným úhlem sbíhání misek k jejich vazbě. Nápadné je to na pohledu s boku, kdy tento úhel při předním okraji schránky typického poddruhu je ostrý, kdežto u poddruhu nově popisovaného se téměř vždy



Obr. 16 *Gemerithyris hungarica globosa* ssp. n. Silická Brezová. Seriální příčné řezy jiným jedincem. Délka jedince 14,1 mm. Zvětšeno × 4 — A series of transverse sections through another specimen. Original length of specimen 14,1 mm. All × 4 approx.



Obr. 17 *Gemerithyris hungarica globosa* ssp. n. Silická Brezová. Příčný průřez hřbetním septem. Zvětšeno × 30. — Transverse section of the dorsal septum × 30 approx.

rovná 90° nebo je větší. Boky břišní misky jsou klenutější než u poddruhu *G. hungarica hungarica*, kde jsou někdy až sploštěny.

Stratigrafické rozpětí a výskyt: Popisovaný poddruh byl nalezen v závrtu SZ od kóty 492,2 v nadloží horizontu s *Gemerithyris hungarica hungarica* (Balogh) v šedých a masově červených celistvých vápencích tuvalu. Ty odpovídají „3. horizontu" J. Bystrického (1964, str. 67), z něhož pochází *Discotropites quinquepunctatus* (Mojs.), „*Spiriferina*" *halobiarum* Bittn. atd., resp. nejvyšší části zóny *Tropites welleri* a zóně *Klamathites macrolobatus* (podle H. Kozura a R. Mocka 1974).

Do tlače odporučila M. Kochanová.

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Miloš Siblík

New brachiopod genus Gemerithyris gen. n. from the Slovak Triassic

17 text-fig., 3 pl. (CVII—CIX), Summary of the Czech text

The rich brachiopod fauna from the locality Silická Brezová near Plešivec was previously studied by K. Balogh (1940). It was shown to include species already known not only from the Upper Triassic but also from the Ladinian. The revision of the geology and biostratigraphy of this locality and its environs was made later on by J. Bystrický (1964 etc.) with collaborators. The age of the brachiopod — bearing layers was stated to be Carnian (based on the study of rare ammonites by V. Andrusovová).

My revision of the brachiopods has shown the necessity of establishing a new genus — *Gemerithyris* including *G. hungarica hungarica* (Balogh, 1940) and *G. hungarica globosa* ssp. n. both based on material from the locality Silická Brezová. These subspecies are not known from elsewhere in the Slovak Triassic apart from the Silická Brezová area.

Familia *Zeilleriidae* Allan, 1940
Gemerithyris gen. n.

Type — species: *Waldheimia (Aulacothyris) supina* var. *hungarica* Balogh, 1940. Upper Triassic, Slovakia.

Derivatio nominis: „Gemer" — historical name of the administration region where it is found.

Diagnosis: Medium — sized, unequally biconvex, smooth zeilleriids. subpentagonal to elongate in outline. Pedicle valve sometimes carinate, fairly high with median sulcus, brachial valve flatter, sulcate, with median fold. Anterior commissure intraplicate. Beak erect with rounded beak — ridges. Pedicle opening mesothyridid in position.

Dental plates short and in most specimens subparallel. Pedicle collar developed. Cardinal process not observed. Hinge-plates distinctly separated into inner and outer parts by massive crural bases. Septalium deep, V-/or broadly U-shaped. Dorsal median septum very long, nearly reaching the anterior margin and not attached to loop. Loop long, given off ventrally, with narrow descending and broad ascending branches. Descending branches rarely with short spines.

Species: *Gemerithyris hungarica hungarica* (Balogh, 1940)
Gemerithyris hungarica globosa ssp. n.
Gemerithyris (?) zugmayeri (Bittner, 1891)

Distribution: Middle (?), Upper Triassic; Czechoslovakia, Austria, Roumania.

Gemerithyris hungarica hungarica (Balogh)

The lectotype here specified: the characteristic specimen figured by K. Balogh (1940) in plate 1, fig. 9 and coming from Silická Brezová. It is deposited in the Geological Institute in Budapest (no. T 1654) where I was kindly shown Balogh's collection. Dimensions of lectotype: Length 13,2 mm; width 9,0 mm; thickness 7,7 mm.

Internal characters: In the pedicle valve the dental plates are mostly parallel or slightly converging dorsally, very short. Pedicle collar developed. The hinge-teeth are hook-like, without crenulations. Laterally there are well-developed denticula in most specimens.

In the brachial valve there was no cardinal process observed. The external hinge-pla-

tes are oblique and sometimes convex ventrally. They are well-delimited both from the septalial plates and from the inner socket-ridges. The broad sockets have the outer socket-ridges better developed than the inner ones. The septalium is large, V-shaped or broadly U-shaped, medianly horizontal. The dorsal median septum is well-developed and very long, reaching nearly the anterior margin. The crural bases are given off ventrally. The loop is long, consisting of narrow descending and broad ascending branches. A narrow, ventrally-convex transverse band is present. The crural processes are remarkably developed. The descending branches rarely have short spines. The ascending branches show a curious longitudinal undulation. The loop reaches anteriorly into the interior of the pedicle valve.

Remarks: The species *Aulacothyris zugmayeri* Bittner, 1891 is externally very similar to the subspecies under consideration. Dr. H. Lobitzer kindly sent me 3 figured specimens from the original Bittner collection deposited in „Geologische Bundesanstalt" in Vienna for study. I select the specimen figured by A. Bittner (1892) in plate III., fig. 29 and coming from Raxalpe as lectotype. Its dimensions are 11,6 × 7,7 × 6,4 mm. *Aulacothyris zugmayeri* differs from *G. hungarica hungarica* (Balogh) externally by its smaller size and remarkably subpentagonal shape, in having the posterior part of the brachial valve clearly concave and in having a much shorter dorsal median septum.

Distribution: Light crinoidal limestones; „*dilleri*" — and lower parts of „*welleri*" zone (after H. Kozur — R. Mock 1974).

Gemerithyris hungarica globosa ssp. n.

Type-specimen: The holotype (collected by J. Bystrický) is figured on plate CIX, fig. 1 and deposited in the collection of Slovak National Museum in Bratislava (no. Z 7344). Its dimensions are: Length 14,3 mm; width 10,7 mm; thickness 11,8 mm.

Paratypes: The specimens figured on plate CIX, figs. 3—4 are deposited in the collection of Slovak National Museum in Bratislava. Other figured specimens are in the possession of the Geological Institute of Czechoslovak Academy of Sciences in Prague.

Derivatio nominis: Latin „globosus" i. e. globose, globular.

Stratum typicum et locus typicus: Upper Carnian-Tuvalic; Silická Brezová in the Slovak Karst, SE Slovakia.

Material: 72 specimens with conjoined valves, 4 brachial and 32 pedicle valves, preserved as internal moulds with remains of shell.

The new subspecies differs from *Gemerithyris hungarica hungarica* (Balogh) in its globular form, its higher dorsal valve of oval outline, its weaker development of the dorsal fold and ventral sulcus and by its more remarkable convexity of the shell flanks.

Internally the new subspecies may differ by more clear separation of the septalial plates and external hinge — plates and by the better development of spines on the descending branches.

Distribution: *Gemerithyris hungarica globosa* ssp. n. accompanied by *Discotropites quinquepunctatus* (Mojs.), *Spiriferina halobiarum* Bittn. etc. occurs in light-grey to flesh-coloured thick-bedded massive limestones (upper part of „*welleri*" zone and „*macrolobatus*" zone; after H. Kozur — R. Mock 1974).

Vysvětlivky k tabulím CVII—CIX

Explanations to plates CVII—CIX

Všichni vyobrazení jedinci pocházejí z lokality Silická Brezová a jsou uloženi v Geologickém ústavu ČSAV v Praze, pokud není jinak uvedeno. SNM — nálezy J. Bystrického uložené ve sbírkách Slovenského národního muzea v Bratislavě. Foto M. Páralová.

All specimens derive from Silická Brezová. They are deposited in the Geological Institute of the Czechoslovak Academy of Sciences in Prague if not otherwise stated. SNM — collections of Slovak National Museum in Bratislava. Photographs by M. Páralová.

Tab. CVII

Obr. 1—4 *Gemerithyris hungarica hungarica* (Balogh). Mladí jedinci, × 3. — Obr. 5 *Gemerithyris hungarica hungarica* (Bal.). SNM, inv. č. Z 7347, × 2,5. — Obr. 6 *Gemerithyris hungarica hungarica* (Bal.), × 2,5.

Tab. CVIII

Obr. 1 *Gemerithyris hungarica hungarica* (Bal.) SNM, inv. č. Z 7348 × 2,5. Obr. 2—3 *Gemerithyris hungarica globosa* ssp. n., × 2,5. — Obr. 4 *Gemerithyris hungarica globosa* ssp. n. Netypický (nedospělý?) jedinec.

Tab. CIX

Obr. 1 *Gemerithyris hungarica globosa* ssp. n. Holotyp. SNM, inv. č. Z 7344, × 2,5. — Obr. 2 *Gemerithyris hungarica globosa* ssp. n., × 2,5. — Obr. 3—4 *Gemerithyris hungarica globosa* ssp. n. SNM, inv. č. Z 7345 a Z 7346, × 2,5.

Translated by the author.

Západné Karpaty, sér. paleontológia, 2—3, P. 221—226, Geol. úst. D. Štúra Bratislava, 1977

Mária Kochanová

Prvý nález Otapiria (Monotidae, Bivalvia) v Západných Karpatoch

1 obr. v texte, 1 tab. na kriede (CX), anglické resumé

Abstrakt. Nach der ersten Feststellung der Gattung *Otapiria (Otapiria marshalli alpina Zapfe*, 1973) in den österreichischen Kalkalpen, gehören unsere Exemplare zu den ersten Vorkommnissen dieser Gattung in den Westkarpaten. Es ist ein weiterer Beweis dessen, dass diese Gattung nicht nur auf arktische und indo-pazifische Gebiete beschränkt ist. Sie stammen aus den grauen Fleckenmergelkalken östlich von der Ortschaft Bohúňovo in dem Slovakischen Karst, die als Zlambachschichten betrachtet wurden. Leider erlaubt der schlechte Erhaltungszustand dieser Fauna keine Artenbestimmung und weil es in den genannten Schichten keine begleitende Mikro oder Makrofauna gibt, bleibt deren stratigraphische Stellung problematisch, Obersevat — Rhät (im Sinne von G. Gümbel und E. Suess).

Rod *Otapiria* definoval J. Marwick (1935, str. 302 a 1953, str. 95), nasledovne: schránka strednej veľkosti, šikmo oválna, misky nerovnaké, pravá menej vyklenutá ako ľavá, zadné uško je dobre vyvinuté. Skulptúru tvoria husté zvlnené, lúčovité rebrá, na pravej miske (v origináli nesprávne — ľavej) sú slabšie, alebo je hladká. Pravá miska má malé predné uško oddelené hlbokou ryhou. Za typický druh rodu stanovil „*Pseudomonotis*" *marshalli* Trechmann, 1923 zo spodnej jury Nového Zélandu.

Príslušníci tohoto rodu boli až donedávna známi iba z boreálnej a cirkumpacifickej oblasti. Prvé údaje o výskyte tohoto rodu v Alpách sú pomerne mladého dáta — H. Zapfe 1973. Na tieto výskyty nadväzujú teraz nálezy zo Západných Karpát. Ide o lokalitu východne od obce Bohúňovo, v Slovenskom krase (text obr. 1). V nadloží červených hallstattských vápencov tu vystupujú sivé slienité a škvrnité vápence s polohami slienitých bridlíc, ale aj slabokrinoidových vápencov. J. Bystrický (1964, str. 79) považuje toto súvrstvie za ekvivalent zlambašských vrstiev zo Severných Álp. Zo slienitých škvrnitých vápencov pochádza faunistický materiál, malých bivalvií, ktorých zachovanie však nedovoľuje ich druhové určenie. Že ide o príslušníkov roku *Otapiria* mohla som si overiť pri korelácii s jedincami z alpského materiálu Prof. Dr. Zapfe-ho vo Viedni, za čo mu aj touto cestou vyslovujem svoje poďakovanie.

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Obr. 1 Situačný náčrt študovaného územia.

Čeľaď *Monotidae*
Rod *Otapiria* Marwick, 1935

Otapiria sp.

tab. CX, obr. 1—7

Materiál: Osem neúplných, alebo poškodených ľavých misiek, väčšina z nich je bez vrchnej vrstvy schránky; jeden úlomok a štyri jadrá pravej misky, patriace mladým vývojovým štádiám.

Rozmery: Ľavé misky — V = 16 mm, 11 mm, 8 mm, Dl = 14 mm, 9,5 mm, 8 mm.

Opis: Ľavé misky. Majú značne variabilný tvar, šikmo oválny, až takmer okrúhly. Hlavičkovitý vrchol je umiestnený bližšie k prednému okraju, prečnieva cez zámkový okraj a je nahnutý dopredu. Väčšina misiek je vyklenutá hlavne vo vrcholovej oblasti asi do prvej štvrtiny celkovej výšky. K prednému okraju sa potom zvažujú strmšie, k zadnému a spodnému pozvoľna. Iba dve misky v našom materiáli sú ploché, najskôr v dôsledku stlačenia. Zreteľné trojuholníkové zadné uško výrazne oddelené od tela misky možno pozorovať len na dvoch jedincoch. Skulptúra povrchu pozostáva z lúčovitých rebier a koncentrických prírastkových čiar a záhybov. Lúčovité rebrá sú jemné, zaoblené a husto pokrývajú celý povrch misiek s výnimkou zadného uška. Vyskytujú sa medzi nimi rebrá zdvojené i vsunuté a niekoľko výraznejších primárnych. U jedného jedinca sa miesto nich nachádzajú brázdy, ktoré spomína aj L. D. Kiparisova (1966, str. 113). Na drobných útržkoch zachovanej vrch-

nej vrstvy schránky pozorovať na lúčovitých rebrách drobné zrniečka, vytvorené prírastkovými čiarami. Nepravidelné koncetrické rebrá a brázdy spôsobujú nepravidelné zvlnenie povrchu.

Pravé misky, ako bolo už spomenuté, patria mladým jedincom a sú horšie zachované ako ľavé. Sú drobné, viac, alebo menej vyklenuté a pokiaľ to nie sú jadrá, možno na nich pozorovať slabú lúčovitú a zreteľnejšiu koncentrickú skulptúru. Predné uško nie je zachované.

Porovnanie: Opísané jedince možno porovnať s druhmi: *Otapiria dissimilis* (Cox, 1878), *Otapiria limaeformis* Zacharov, 1962 a *Otapiria tailleuri* Imlay, 1967.

Na rozdiel od druhu *Otapiria dissimilis* majú opisované jedince zreteľnejšie oddelené zadné uško, pravideľnejšiu lúčovitú a nie takú výraznú koncentrickú skulptúru. Pokiaľ ide o ďalšie dva druhy, tvarom ľavej misky a jej zadného uška sa podobajú druhu *Otapiria tailleuri*. Jej lúčovité rebrá sú však početnejšie a rovnako sa vyskytujú na ľavej, ako na pravej miske. Skulptúrou povrchu stoja bližšie druhu *Otapiria limaeformis*, s ktorou, zdá sa, majú najviac príbuzných znakov. Keďže o hlavné kritérium, ktorým sú pravé misky, sa v našom materiáli nemôžeme oprieť, nemožno tieto druhy identifikovať. S problémom druhového určenia uvedených jedincov úzko súvisí aj ich vek, a teda aj stratigrafické zaradenie súvrstvia, z ktorého pochádzajú. Okrem opísaných bivalvií sa tu totiž nenašla žiadna sprievodná mikrofauna, alebo makrofauna. Iba z najvyššej časti hallstattských vápencov, ktoré tvoria normálne podložie študovaného súvrstvia, sú známe holotúrie. Zastúpené sú druhmi (*Theelia kristanae* Mostler, *Theelia stellifera bistellata* Kozur — Mock, *Theelia conglobata* Mostler a *Solopedatus parvus* Mostler), charakteristickými pre spodnú časť spodného sevatu (H. Kozur — R. Mock 1974, str. 136). Na základe superpozície môže ísť u opisovaného súvrstvia o vrchnú časť vrchného sevatu, alebo už o rét (v ponímaní G. Gümbela a E. Suessa). Nakoľko otapírie pochádzajúce z tohoto súvrstvia nebolo možné určiť druhove, nemáme spoľahlivé kritérium pre riešenie tohoto problému.

Dosiaľ známe druhy patriace rodu *Otapiria* s ich stratigrafickým rozšírením:

Otapiria ussuriensis (Voronetz, 1937)	karn-vrchný nor — rét Prímorie a Severovýchod SSSR
Otapiria dissimilis (Cox, 1878)	rét — Nový Zéland
Otapiria marshalli (Trechmann, 1923)	spodný lias Nový Zéland, Nová Kaledónia
Otapiria limaeformis (Zacharov, 1962)	spodný lias — Severovýchod SSSR
Otapiria tailleuri Imlay, 1967	toark — bajok Severná Aljaška
Otapiria masoni (Marwick, 1953)	titon — Nový Zéland
? *Otapiria* cf. *ussuriensis* (Voronetz)	rét — Pobrežná oblasť Chile

Otapiria marshalli alpina Zapfe, 1973	sevat (rét) — Severné vápencové Alpy
Otapiria sp.	? sevat ? rét — Západné Karpaty

Do tlače odporučila A. Ondrejičková.
Do redakcie odovzdané v októbri 1973.

Mária Kochanová

First record of the genus Otapiria in the West Carpathians

Summary of the Slovak text

The representatives of the genus *Otapiria* have been recorded previously from the Northern Kalkalps in Austria (*Otapiria marshalli alpina* Zapfe, 1973). The recent record of the same genus in the West Carpathians belongs to the first ones in this area and is another proof that this genus is not bound to the Arctic and Indo-Pacific regions only. The described faunule comes from grey marly limestones near the village Bohúňovo in the Slovak Karst, which are considered as Zlambach Beds. The generic assignment to *Otapiria* was correct as also confirmed by Prof. H. Zapfe in Vienna and I express my deepest thank to him also in this way.

The described individuals to a certain degree resemble specimens of *Otapiria dissimilis* (Cox, 1878), *Otapiria tailleuri* Imlay, 1967 and *Otapiria limaeformis* (Zacharov, 1962). From *Otapiria dissimilis* they differ by more distinctly separated posterior ear, by radial ribs more regular in strength and spacing and by fewer and less conspicuous concentric ribs. In the shape of the left valve and its posterior ear they resemble very much *Otapiria tailleuri*, but their radial ribs are less numerous. They are most closely related to *Otapiria limaeformis* in the shape as well as in the sculpture of the left valve surface. The main reason that their identification is not possible is the bad preservation of the immature right valves.

As to the problem of the age of the described *Otapiria* sp. it can not be solved yet as there were not found any other organisms at that locality. They occur only in the underlying Hallstatt limestones and from their upper part there were described several specimens of *Holothuroids*, which are characteristic for the lower part of the Upper Sevatian (H. Kozur — R. Mock 1975, p. 136).

On the basis of the superposition of the layers the Zlambach Beds near Bohúňovo can be considered therefore Upper Sevatian or Rhaetian (in the meaning of G. Gümbel and E. Suess).

Translated by the author.

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Vysvetlivky k tabuľke CX:

Fig. 1. Otapiria sp., linke Valve, × 2
Fig. 2. Otapiria sp., linke Valve, × 2
Fig. 3. Otapiria sp., linke Valve, × 3
Fig. 4. Otapiria sp., linke Valve, × 2
Fig. 5. Otapiria sp., linke Valve, × 2
Fig. 6. Otapiria sp., linke Valve, × 3
Fig. 7. Otapiria sp., linke Valve, × 3

Západné Karpaty, sér. paleontológia, 2—3, P. 227—232, Geol. úst. D. Štúra Bratislava, 1977

Zoltán Schmidt .

Emys orbicularis (L.) from travertines of the Vápnik in Mýtne Ludany in the Ipeľská Pahorkatina upland

1 text-fig., 2 pl. (XCVII—XCVIII), Slovak summary

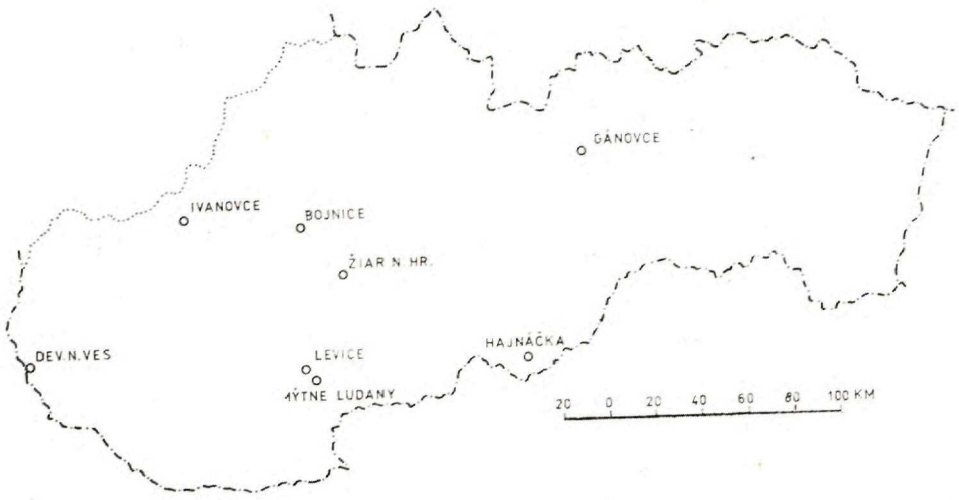
Abstrakt. In Süsswasserkalken (Travertinen) der Lokalität Vápnik („Šikloš") in Mýtne Ludany bei Levice (Ipeľ-Hügelland, SW Slowakei) ist ei Fund einer Schildkröte der Art *Emys orbicularis* (L.) festgestellt worden. Mittels der Analyse der Biogeocoenose wurde das oberpliozäne Alter der Travertine von Vápnik abgeleitet.

Introduction

In the time of the Tertiary development of the biosphere in Slovakia we notice turtles in older, marine sediments of the Upper Miocene (Badenian) in Devínska Nová Ves, also in genetically younger (Pliocene, Pleistocene) terrestrial deposits. From marine environment, from the sand-pit Sandberg on the SW slope of the mount Devínska Kobyla (514 m above sea level) come the relicts of a giant turtle of the genus Psephophorus v. Meyer, 1847 (J. Koutek — V. Zoubek 1936). In the Pliocene turtles were found in Slovakia in Ivanovce near Trenčín (M. Mlynarski 1963), near Levice J. Petrbok 1938 in J. Kovanda 1971) near Žiar nad Hronom (M. Ciesarik 1970) and in Hajnáčka near Fiľakovo (M. Mlynarski 1963). The find in Pleistocene sediments in Gánovce near Poprad was published by O. Štěpánek (1934). J. Skutil (1938) mentioned its occurrence also in Bánovce near Prievidza. Concerned is a variously preserved osteological material of the genus *Emys* Duméril 1806.

In the year 1958 impressions of turtle carapace were found in Mýtne Ludany near Levice, in the Ipeľská pahorkatina upland. It was found in the quarry of the tranvertine hill Vápnik, elev. p. 274,4 above sea level („Šikloš"), about 35 below the elev, point, below the monument of World War II. The secretary of the Local National Committee, Štefan Vojtáš, handed it over to the local-Tekov Museum (Inv. Nr. 2971).

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Obr. 1 Výskyty fosílnych korytnačiek na Slovensku. (Z. Schmidt 1975) Kreslil B. Orth.
Fig. 1 Occurrences of fossil turtles in Slovakia (Z. Schmidt 1975)
Author of photographs: Z. Schmidt

Description and diagnosis of paleontological material

Genus *Emys* Duméril, 1806

Emys orbicularis (Linnaeus, 1758)

Material: Travertine cast (compact, solid, bedded and finely porous freshwater limestones) of inner, soft parts of the turtle body between the carapace and plastron. It is of a light-ochreous-brown colour with wite precipitated clusters of aragonite in cavities in the areas of the neural canal and the margins of marginalia (including the nuchale, pygale), costalia and neuralia of the innercarapace surface; also of the margins of shields of the inner plastron surface.

Description of material: The length of the preserved carapace, measured in its middle, is 147 mm; maximum width 102 mm$_{(n\ 4)}$. Greatest height 59 mm$_{(n\ 4)}$. Width of nuchale, measured in points at the costalia-marginalia contact, is 30,6 mm. The width of the neural canal varies within the limits 2,5—3,3 mm. The neuralia have the following length and width: n_1 is 12,8 mm long, 15 mm wide; n_2 is 16,7 mm long, 15,4 mm wide; length of n_3 attains 18,2 mm, width 16,5 mm; n_4 is 18,2 mm long (?), 15,0 mm wide; length n_5 is 19,1 mm (?), width 14,2 mm. In n_6 length is immeasurable, width probably

attains 14,2 mm. Other neuralia are indistinct and immeasurable, equally as suprapygale and pygale, also marginalia (perhaps n_4 is 17,1 mm long, 24,5 mm wide). From indistinguishable costalia we mention the dimensions of c_1, which is 45,8 mm long, 23,2 mm wide; then c_2 is 44,6 mm long, 12,9 mm wide, c_3, in turn, is 49,3 mm long, 17,2 mm wide; c_4 attains the length of 48,1 mm, width 15,4 mm. Other costalia are invisible.

The plastron is concave (female individual), 124,8 mm long, within the range of points in the middle of the upper part of the guttural and anal shields attains 115 mm. The maximum width of the preserved inner part of plastron is 95 mm. Beside the little distinct guttural shields are the shields of the other body part invisible or very little visible.

The index values of the observed turtle according to Terentiev and Černova, 1949 (J. Lác 1968 in O. Oliva — S. Hrabě — J. Lác 1968) are:

L. car./Lt. car. 1,44 and

L. car./Alt. car. 2,49.

Diagnosis: From the biometric data and values of the mentioned indices, which according to the quoted authors vary in *Emys orbicularis* (L.) in the first case from 1,16 to 1,35 and in the second case from 1,87 to 2,48, we see that in the case of the find in Mýtne Ludany there is a swamp tortoise, Emys orbicularis (Linnnaeus, 1758).

Geological — paleontological conclusion

Till now paleontological evidence material on the age of freshwater limestones (travertines) in Mýtne Ludany has been missing in literature. On the basis of the reports of Petrbok about the finds of tortoise (J. Petrbok 1938 in J. Kovanda 1971) we cannot find the concrete locality in the Levice group of the freshwater limestones of the Ipeľská pahorkatina upland, to which also the travertine hill Vápnik, elev. p. 274,4 m („Šikloš") in Mýtne Ludany belongs. Therefore the above mentioned find of carapace impressions of *Emys orbicularis* (L.) not only fulfils the essence of the circumstance of the find but contributes to establishing the age of freshwater limestones in Mýtne Ludany and finally also of the Levice travertine group. The latter have generally been mentioned as Neogene in literature (J. Kovanda 1971).

The freshwater limestones of the Levice group formed from tempered and thermal mineral water springs, ascending on tectonic lines with young activity of movements in the time of the Pliocene to Quaternary (I. Vaškovsky 1975). The levelled platform surface of the travertine hill Vápnik corresponds in height to the level of the called „riverain level" — defined by Mazúr (1963) — (R. Halouzka 1976), which is considered as Upper Pliocene in age (M. Lukniš 1972 in Lukniš et al. 1972). Halouzka therefore correctly deduces that the age of the „Šikloš" travertines cannot be younger than the Upper Pliocene. The earlier age of these travertines is also attested by their-already mentioned-petrographic character.

The tortoise *Emys orbicularis* (L.) is spread in warm and moderately warm regions. Analogically we conclude that also in the geological past it lived in warmer zones of the earth. In the Upper Pliocene a warm and moderately humid climate was predominating by us (V. Ložek 1964). The tectonic movements conditioned formation of local freshwater lakes or from time to time flooded areas with small thickness of lacustrine and fluvial sediments (formation of riverain level). This altogether created the conditions of a suitable biotope of the swamp tortoise. Its biotope namely form standing or moderately running, usually turbid waters with a muddy bottom, without denser overgrowth, always only in lower positions, most often in inundation areas of large rivers (J. Lác 1968 in O. Oliva — S. Hrabě — J. Lác 1968).

The climate of the Pleistocene from the very beginning of this epoch also by us characterized by alternation of periods of warm and humid climate with moderately colder oscillations (V. Ložek 1964). The swamp tortoise, *Emys orbicularis* (L.), is very sensitive to the mentioned climatic oscillations (compare also H. Ullrich in M. Ciesarik 1970). For that reason we cannot suppose with certainty its occurrence in the Eopleistocene of Slovakia. That is also confirmed by the up to present finds of *Emys orbicularis* (L.) in Pliocene sediments in Slovakia or adjacent countries (see M. Ciesarik 1970). Also in this case the find of *Emys orbicularis* (L.) supports the deduced Upper Pliocene age of travertines at the deposit Vápnik in Mýtne Ludany and of the Levice group of travertines in general.

Reviewed by O. Samuel.
Translated by J. Pevný.

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Z. Schmidt

Emys orbicularis (L) z travertínov vápnika v Mýtnych Ludanoch v Ipeľskej pahorkatine

1 obr., 2 tab. (XCVII—XCVIII), resumé anglického textu

V travertínoch Vápnika, k. 274,4 m n. m., v Mýtnych Ludanoch (Ipeľská pahorkatina, jz. Slovensko) sa našiel vyliatok vnútorných, mäkkých častí tela korytnačky močiarnej, *Emys orbicularis* (L.), medzi karapaxom a plastrónom. Petrograficky ide o celistvý, pevný, okrovožltkastohnedý, zvrstvený a pórovitý sladkovodný vápenec, miestami s bielymi vyzrážanými zhlukmi aragonitu.

Ložisko v Mýtnych Ludanoch patrí k levickej skupine sladkovodných vápencov, ktoré vznikli z temperovaných a termálnych minerálnych prameňov, vystupujúcich po tektonických líniách s mladou aktivitou pohybov (J. Kovanda 1971), v období pliocén až kvartér (I. Vaškovský 1975). Zarovnaný plošinový povrch travertínového kopca Vápnik („Šikloš") zodpovedá výškove úrovni tzv. „poriečnej rovne" (R. Halouzka 1975), ktorá sa považuje za vrchnopliocénnu (E. Mazúr 1963; M. Lukniš 1972). V období vrchného pliocénu prevládala u nás teplá a mierna vlhká klíma (V. Ložek 1964). Tektonické pohyby podmienili vytváranie lokálnych sladkovodných jazier, prípadne občas zaplavovaných oblastí s malou mocnosťou jazerných a fluviálnych sedimentov (formovanie poriečnej rovne). To spolu utváralo podmienky vhodného biotopu korytnačky močiarnej.

Klíma pleistocénu je od samého začiatku tejto epochy aj u nás charakterizovaná striedaním období teplej a vlhkej klímy s mierne chladnejšími výkyvmi. *Emys orbicularis* (L.) je veľmi chúlostivá na uvedené výkyvy podnebia (porov. aj H. Ullrich in M. Ciesarik 1970). Z toho dôvodu nemôžeme s určitosťou predpokladať jej výskyt v pleistocéne na Slovensku. Potvrdzujú to aj doterajšie nálezy korytnačky močiarnej v pliocénnych sedimentoch na Slovensku, alebo v susedných krajinách (pozri M. Ciesarik 1970). Aj v tomto prípade, nález *Emys orbicularis* (L.) podporuje vyššie odvodený vrchnopliocénny vek travertínov ložiska Vápnik v Mýtnych Ludanoch a levickej skupiny travertínov vôbec.

Vysvetlivky k tabuľkám XCVII–XCVIII

Tab. XCVII Obr. 1, 2 Odtlačky panciera (karapaxu i plastróna) *Emys orbicularis* (L.) z Vápnika („Šikloš") v Mýtnych Ludanoch pri Leviciach (vrchný pliocén).
Tab. XCVIII Kameňolom travertínového kopca Vápnika v Mýtnych Ludanoch pri Leviciach (vrchný pliocén).

Foto: Z. Schmidt

Explanation of plates XCVII–XCVIII

Plate XCVII
Fig. 1, 2 Impressions of armour (carapace and plastron) of *Emys orbicularis* (L.) from Vápnik (Šikloš) in Mýtne Ludany near Levice (Upper Pliocene).

Plate XCVI II Quarry in the travertine hill Vápnik in Mýtne Ludany near Levice (Up per Pliocene).

Západné Karpaty, sér. paleontológia, 3—2 P. 233—240, Geol. úst. D. Štúra Bratislava, 1977

Zoltán Schmidt

Geographical extension of archidiscodonts in Slovakia

1 text-fig., 4 pl. (XCIX—CII), Slovak summary

Devoted to the sixtieth birthday of Univ. Prof. Dr. Michal Lukniš, DrCc.

Abstrakt. Gesamtinformation über die Existenz von Archidiskodonten auf dem Gebiete der slowakischen Karpaten und Ebenen, im ganzen Umfange des ältesten Pleistozäns, Eopleistozäns.

Die Biostratigraphie der Schichten, der Elephanten-Fauna der warmen biologischen Fazies nach, ändert die geologisch-stratigraphischen Interpretationen der Funde in der Záhorie —, besonders aber in der Donau-Ebene.

Introduction

In Slovakia we also are finding at the beginning skeleton relicts of elephants together with mastodontoid proboscideans in sediments from the Pliocene-Pleistocene boundary. Continuing from regional paleozoogeographical surveys on the existence of proboscideans in the Tertiary and Quaternary of Slovakia (Z. Schmidt 1972; 1975) we present in this work an outline of the occurrence and geographical extension of the starting genus of elephantoids, archidiscodonts and on the basis of their biostratigraphy we adjust up to present geological-stratigraphical interpretation. From the characterization of the biotope of archidiscodonts we may create an idea of the country character by us in the earliest Pleistocene.

Occurrences of archidiscodonts in Slovakia

The Villafranchien is a period when the mastodonts left the territory of the Slovakian Carpathians and lowlands. In that time they had already their successors. They were probescideans of the elephantoid group (*Elephantoidea* Osborn 1921), i. e. proper elephants from the family *Elephantidae* Gray

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1821. In Slovakia they were represented by the so called southern elephant, archidiscodonts (*Archidiskodon* Pohlig 1885) of older, primitive species, *Archidiskodon meridionalis* f. arch., then the younger in evolution, modern species — *Archidiskodon meridionalis* (Nesti 1825).

This is also proved by the latest dated discovery of proboscideans from Strekov in the Hronská pahorkatina upland in the Danube lowland. Together with the osteological material of zygolofodont and bunodont mastodonts, *Zygolophodon borsoni* (Hays) and *Anancus arvernensis* (Groizet et Jobert),

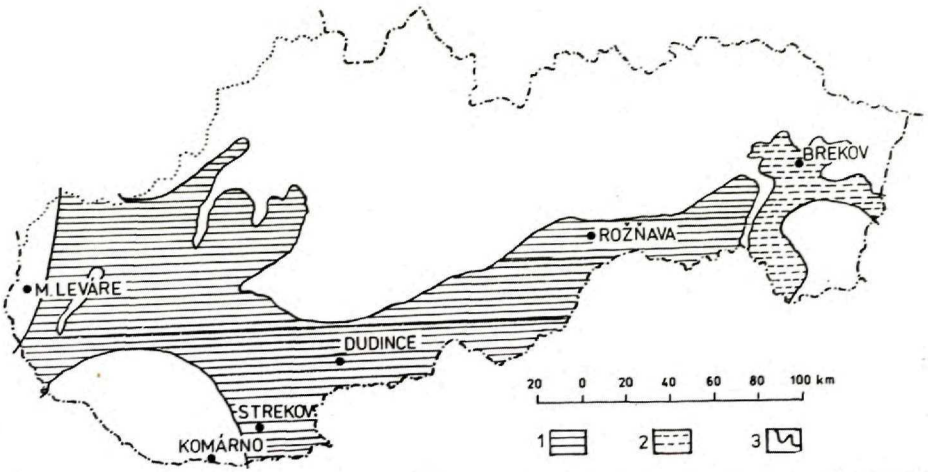


Fig. 1 Occurrence of archidiskodonts in Slovakia Full circle, occurrence of archidiskodonts. 1 — region of maximum geographical extension of mastodontoid proboscideans; 2 — region of supposed extension of mastodontoids; 3 — boundary of the area of mastodontoids. Z. Schmidt 1975.

from the mentioned period here in the gravelous-sandy, rusty-red-coloured horizon also an archidiscodont was found, even its older, still archaic evolutionary form, mentioned by Z. Schmidt and R. Halouzka (1970) as *Archidiskodon (Protelephas) planifrons* (Falconer et Caulley 1846). The stratigraphic position of the bed with the find in Strekov is the basal Pleistocene of Upper to Middle Villafranchien (R. Halouzka 1975 — see also V. Šibrava 1974), eqivalent to the Tegelén to Brüggen in the sense of the continental paleobioclimatological classification of the northern stratigraphic scheme of van *Eysinga* (1975).

One of important Quaternary—paleontological localities from the standpoint of archidiskodonts finds in our country is the gravel terrace near Malé Leváre in the Záhorie lowland. The first to describe and determine the osteological material from this locality was R. Musil (1960). He mentioned the metrical data of modern type of archidiskodonts. Z. Schmidt 1969 published also the enclosed generalized outline of position of sediments (situation) at the excavation

pit of gravelous sands near Malé Leváre, based on the findings of A. Sabol (1959, 1965), and puts the archidiskodont find into connection with other fossil vertebrate species. The up to that time isolated discovery of archidiskodont from Slovakia, according to Musil, comes already from the development period of *A. meridionalis* into *M. trogontherii* and *P. antiquus*. Thus it points to the Eopleistocene whereas other established vertebrate species, as to their evolution, are from the Middle Pleistocene. This is also confirmed by the finds of pollen grains at this locality (E. Krippel 1965).

An incompletely preserved archidiskodont molar is also described in the research report by Z. Schmidt (1971). It was found at the slope of the northern part of the travertine platform Gestence in Dudince* (in the amphitheatre of the spa area, opposite the travertine heap „Roman spa"), in the Štiavnica valley, at the contact of the Krupinská vrchovina highlands and Ipeľská pahorkatina upland. According to the information by Halouzka, the bed of find is characterized by greyishwhite disintegrating freshwater limestones (travertines), in places even friable, in the lower part more compact. Thickness 1—1,5 m. In the overlier was blackish-brown lumpy loam (soil horizon, partly slid down the slope). In the underlier a gradual transition into compact greyishwhite freshwater limestone was distinct (exposed at the depth to 0,5 m).

Due to the relative value of metric documentation (incomplete molar) it was determined as *Archidiskodon* sp. It is, however, almost sure that it belongs to the modern type of archidiskodont, to *A. meridionalis* (Nesti).

In accordance with the preliminary assumption of Halouzka on stratigraphicranging of this find, sediments from the transitional phase of the terminating warm and setting in cold period of the Cromer Interglacial (possibly the end of the Cromer Interglacial) are concerned. It may be supposed not only according to the find of not very frequent malacofauna at other place of the Gestence platform, determined and interpreted by V. Ložek (personal communication) but also on the basis of geological-morphological analysis of the relief and sediments of the adjacent Ipeľská pahorkatina upland, from the point of view of its development in the Quaternary.

Beside the mentioned odontological material, the circumstances of find of which are known, their stratigraphic position, we record the osteological remnants of archidiskodonts of narrower or wider provenance, without indicating the sediment of the bed contaning the find. From the aspect of geographical extension or eventual forming of archidiskondont areas in Slovakia, we cannot neglect even such, nevertheless at last an evidence material of their presence. They testify to great spatial differentiation of their area on our territory. The molars of elephants from the development period of *A. meridionalis* into *M. trogontherii* and *P. antiquus* we observed from the envi-

* Fragment of maxillar molar of A. meridionalis (Nesti) 85 mm long, 86 mm wide, 108 mm high. Three lamellae are preserved. Thickness of tooth enamel 2,2 mm. The roots are broken.

rons of Komárno* in the Danube lowland, from the environments of Rožňava** (southern Slovakia) and Humenné*** in eastern Slovakia. They are deposited in country museums in Komárno, Rožňava and the latter — in Michalovce.

Geological-paleontological conclusion

Much discussion is there about the older form of archidiskodont, not in world literature but also by us. Many authors consider the existence of Archidiskodon planifrons (Falconer et Cautley) in Europe (V. Gromova 1965; A. H. Müller 1970) as uncertain. The Strekov find, in intentions of this doubt and on recommendation of O. Fejfar — the older form of archidiskodont, *A. meridionalis* f. arch.; urges not only to solve the geological problem of stratigraphic position of sediments of the bed containing the find but also makes the question of the conventional Quaternary base in Slovakia generally necessary (V. Šibrava 1974).

E. Thenius 1956, 1962, H. Küpper 1955, 1968, and others mentioned the finds from the Laarberg terrace of the Danube in Vienna containing older forms of archidiskodonta and a mastodont fauna of the genera *Zygolophodon* Vacek 1877 and *Anancus* Aymard 1855. In the following Wienerberg terrace an archidiskodont of younger type is found. As the Pregünz age (Donau) of the Wienerberg terrace of the Danube is proved in general (J. Fink 1973, 1974), then the analogy must be valid that also other Donau terrace accumulations and sediments (e. g. in the Danube lowland the Svodin gravels — J. Harčár 1967, 1971) cannot contain any mastodont fauna, nor the older type of archidiskodont as it was in Strekov (Z. Schmidt — R. Halouzka 1970) Therefore, in contrast to Harčár, the Strekov gravels must be considered as older than those from Svodin, i. e. Predanubian.

The fact of a short fauna redeposition into the fossiliferous horizon, stated by J. Harčár (in J. Harčár — Z. Schmidt 1965), has also been confirmed by the latest observations of Halouzka. This author does not suppose the

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* Probably the third lower right premanent molar of elephant from the Eopleistocene near Komárno in the Danube lowland is concerned. The length of molar 225 mm (?), width 83 $mm_{(III.)}$, height 85 $mm_{(VI.)}$. The number of lamellae 10 (?), on one decimeter 5. Thickness of tooth enamel 2,4 mm. The roots are broken.

** Probably the third lower left permanent molar of elephant, perhaps from Gombasek, probably from Eopleistocene sediments of limestone joint. It is long 160 mm (?), 83,4 mm $wide_{(IV.)}$, 57 mm high. The number of lamellae is probably 7, on one decimeter 4,5. Thickness of tooth enamel 3,8 mm.

The molar comes from the collections of the Rožňava gymnasium.

*** Third upper left permanent molar of A. meridionalis (Nesti) from the Eopleistocene near Humenné (?) (Brekov), 200 mm long, 145 mm high. Length of chewing surface 139,9 mm; with 62 mm (maximum width of the VIII th lamella is 43 mm). The number of lamellae is 9, on one decimeter only 6,5. The tooth enamel is highly wrinkled and the roots are broken.

possibility of fauna redeposition even from the preceding geological period to the find bed already also because it might have undergone destruction.

The conventional base of the Quaternary (V. Šibrava 1974) is distinct only in marine development (base of the the Calabrien). In the continental fauna this corresponds only to the base of the higher part of the middle Villafranchien, Villafranchien according to the definition and division of Azzaroli (1970,) in eastern Europe, the south of the European part of the USSR, the time of this conventional boundary (the above mentioned conventional Quaternary base) should be ranged in time — according to communication of R. Halouzka (see also in Šibrava 1974) — still prior to the end of the Chaprovién (time of the Chaprovién complex of mammals), or in freshwater biostratigraphy to positions of the uppermost Porat (in Moldavia) and finally in the stratigraphic scale of the Caspian region the conventional Quaternary base should be ranged somewhat below the Akčagyl (Apšeron boundary in continental development) in the sense of Moskvitin (in N. A. Lebedeva 1972).

In connection with the stratigraphic position of both Archidiskodont forms in the Quaternary of Slovakia we have also in mind the opinion of V. Gromova (1965), excluding the coexistence of a herd of several species of one genus. This prognosis does not take into account such a possibility ef coexistence on one territory. Therefore for the older form of archidiskodont we suppose its presence in the whole range of terrestrial biostratigraphy — the Villafranchién, including cold oscillations. *Archidiskodon meridionalis* (Nesti) can be proved with certainty by us within the range Eburon — Cromer.

The area of archidiskodonts in Slovakia was most probably coincident with the area of mastodonts.

The living environment of archidiskodonts by us was formed by associations of moist fen, marshy deciduous forests, with a rich undergrowth (meadow forests with the presence of southern subtropical flora elements) or fen meadows (Z. Schmidt — R. Halouzka 1970).

From the fact that especially the progressive, modern type of archidiskodont is in the line of steppe elephants we conclude that they reached also areas of more xerothermic character, steppe-forests and steppes of the Inner-Carpathian depressions in Slovakia in proximity of river streams (Z. Schmidt — A. Randík 1972).

Reviewed by O. Samuel.
Translated by J. Pevný.

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Geografické rozšírenie archidiskodontov na Slovensku

2 obr., 4 tab. (XCIX—CII), resumé anglického textu

V nadväznosti na regionálne paleozogeografické prehľady o existencii chobotnatcov v terciéri a kvartéri Slovenska (Z. Schmidt 1972, 1975) predkladáme v tejto práci náčrt výskytu a geografického rozšírenia východiskového rodu slonovitých, archidiskodontov.

Aj na Slovensku nachádzame spočiatku kostrové zvyšky elefantov spolu s mastodontoidnými chobotnatcami v sedimentoch z rozhrania pliocén — pleistocén. Dôkazom toho je aj posledný datovaný objav chobotnatcov zo Strekova na Hronskej pahorkatine v Podunajskej nížine (Z. Schmidt — R. Halouzka 1970).

O staršej forme archidiskodonta sa veľa diskutuje. Mnohí pokladajú za neistú existenciu *Archidiskodon planifrons* (Falc. et Cautley) v Európe (V. Gromovová 1965; A. H. Müller 1970). Strekovský nález, v intenciách tejto pochybnosti a podľa O. Fejfara, ktorý ho odporúča považovať za staršiu formu archidiskodonta, A. *meridionalis* f. arch., nalieha nielen riešiť geologický problém stratigrafickej pozície sedimentov nálezovej vrstvy, ale vynucuje aj otázku, kde leží konvenčná báza kvartéru na Slovensku vôbec (V. Šibrava 1974). Stratigrafická pozícia nálezovej vrstvy v Strekove je bazálny pleistocén vrchného až stredného villafranchienu (R. Halouzka 1975 — pozri tiež V. Šibrava 1974), čo zodpovedá tegelénu až brüggenu v zmysle kontinentálnej paleobioklimatologickej klasifikácie severskej stratigrafickej schémy van Eysingu (1975).

Metrické údaje moderného typu archidiskodonta na Slovensku prvý uvádza R. Musil (1960) zo štrkovej terasy pri Malých Leváročh v Záhorskej nížine. Podľa neho archidiskodont pochádza už z obdobia vývoja *A. meridionalis* v *M. trogontherii* a *P. antiquus*. Poukazuje teda na eopleistocén, kým iné zistené druhy vertebrát patria vývojove do stredného pleistocénu (Z. Schmidt 1969).

V odkryve sladkovodných vápencov v Dudinciach, na styku Krupinskej vrchoviny a Ipeľskej pahorkatiny, sa našiel neúplný molár *A. meridionalis* (Nesti). Podľa Halouzkovho predbežného predpokladu stratigrafického zaradenia tohto nálezu ide o sedimenty z prechodnej fázy končiaceho teplého a nastupujúceho dosť chladného obdobia kromérskeho interglaciálu (azda záver kromérskeho interglaciálu).

Okrem uvedeného odontologického materiálu, o ktorom sú známe okolnosti nálezu a ich stratigrafická pozícia, evidujeme osteologické zvyšky archidiskodontov s užšou či širšou provenienciou bez udania sedimentu nálezovej vrstvy. Z aspektu zemepisného rozšírenia, prípadne konštituovania areálu archidiskodontov na Slovensku nemôžeme zanedbať ani takýto, napokon predsa len dôkazový materiál o ich prítomnosti. Svedčia o veľkej priestorovej diferenciácii ich areálu na našom území. Stoličky slonov z obdobia vývoja *A. meridionalis* v *M. trogontherii* a *P. antiquus* zaznamenávame z okolia Komárna v Podunajskej nížine, Rožňavy (j. Slovensko) a Humenné na východnom Slovensku. Sú deponované vo vlastivedných múzeách v Komárne, Rožňave a posledný v Michalovciach.

V súvislosti so stratigrafickou pozíciou obidvoch foriem archidiskodontov v kvartéri Slovenska máme na mysli aj názor V. Gromovovej (1965), ktorá vylučuje koexistenciu stáda viacerých druhov jedného rodu. Táto prognóza neráta s takou možnosťou koexistencie na jednom teritóriu. Preto predpokladáme, že staršia forma sa vyskytovala v celom rozsahu terrestrickej biostratigrafie villafranchienu, vrátane chladných oscilácií. *Archidiskodon meridionalis* (Nesti) môže byť u nás dokázateľne doložený v rozsahu eburon-kromér.

Areál archidiskodontov sa na Slovensku s najväčšou pravdepodobnosťou prekrýval s areálom mastodontov.

Vysvetlivky k tabuľkám XCIX—CII a k text. obr. 1:

Tab. XCIX Prvý spodný, pravý, trvalý molár *A. meridionalis* f. arch. z piesčitých štrkov bazálneho pleistocénu v Strekove. Foto F. Vrbovský.
Tab. C ? M 3 sup. dex. archidiskodonta zo štrkovne v Malých Levároch. Eopleistocén. Foto z Archívu Moravského múzea v Brne.
Tab. CI. Úlomok maxilárneho molára *A. meridionalis* (Nesti) zo sladkovodných vápencov kromérskeho interglaciálu v Dudinciach. Foto F. Vrbovský.
Tab. CII
Obr. 1 Pravdepodobne tretí spodný, ľavý, trvalý molár elefanta z okolia Rožňavy (? Gombasek, akiste z eopleistocénnych sedimentov vápencovej pukliny). Foto J. Varga, Múzeum, Rožňava.
Obr. 2 Pravdepodobne tretí spodný, pravý, trvalý molár slona z eopleistocénu v okolí Komárna. Foto F. Vrbovský.
Obr. 1 Výskyt archidiskodontov na Slovensku (Z. Schmidt 1975). Plný krúžok = výskyt archidiskodontov. 1 — oblasť maximálneho zemepisného rozšírenia mastodontoidných chobotnatcov; 2 — oblasť predpokladaného rozšírenia mastodontoidov; 3 — hranica areálu mastodontoidov.

Explanation of plates XCIX—CII

Plate XCIX First lower right parmanent molar of *A. meridionalis* f. arch. from sandy gravels of the basal Pleistocene in Strekov. Photo F. Vrbovský.
Plate C ? M 3 sup. dex of archidiskodont from the gravel pit in Malé Leváre. Eopleistocene. Photo from the Archives of the Moravian Museum Brno.

Plate CI Fragment of maxillar molar of *A. meridionalis* (Nesti) from freshwater limestones of the Cromer Interglacial in Dudince. Photo F. Vrbovský.

Plate CII
Fig. 1 Probably the third lower left permanent molar of elephant from the environs of Rožňava (? Gombasek, perhaps from Eopleistocene sediments of limestone joint). Photo J. Varga, Museum of Rožňava.
Fig. 2 Probably the third lower right permanent molar of elephant from the Eopleistocene near Komárno. Photo F. Vrbovský.

Západné Karpaty, sér. paleontológia, 2—3, P. 241—248, Geol úst. D. Štúra Bratislava, 1977

Ján Pristaš — Zoltán Schmidt

Find of Mammuthus primigenius (Blumenbach) 1799 from the environs of Chrámec (Rimavská kotlina basin, Southern Slovakia)

2 text-fig., 2 pl. (CIII—CIV), Slovak summary

Abstrakt. Die geologische Position des Fundes von *Mammuthus primigenius* (Blumenbach) 1799 in der Schottergrube des südlichen Teiles des Rimava-Beckens (Chrámec). Das paläontologische Material wurde in Sandschottern der unteren Stufe der Hauptterrasse gefunden. Es lagerte zusammen mit den Schottern in der Zeit des jüngsten Risses ab.

Introduction

The finds of skeleton remnants of fossil vertebrates in Quaternary sediments of the Rimavská kotlina basin are not rare. From time to time they are found with exploitation of terrace gravels and sands. It is a pity that in some, very desirable cases their stratigraphic position is not cleared up. Therefore, where only a little possible, in Quaternary-geological investigrations we strive for solving geology, morphology and stratigraphy in connection with accessible paleontological material.

The director of the Country Museum in Rimavská Sobota, Vladimír Kmeť, called our attention to the mandibula and other osteological material of mammoth in the museum collection fund. The fossil remnants were found in the year 1957 in sediments (sandy gravels) of the Pleistocene Rimava terrace, NNW of the community Chrámec southern part of the Rimavská kotlina basin), about 350 m in its land-register. It was in the depth of 2,50 m from the field surface. To the Museum it was devoted by Alexander Bacsó.

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Description and diagnosis of paleontological material

Subfamilia *Elephantinae* Bonaparte 1858
Genus *Mammuthus* Burnett 1830

Mammuthus primigenius (Blumenbach) 1979

Material: Mandibula, two tusks and a fragment of the long bone of extremity. The paleontological material is incomplete, very damaged.

Description of material: The mandibula is of light-ochreous-rusty-brown colour. The lower jaw is in the left part (close behind symphyse) broken; it is damaged on the inner side and in the basal part. The ramus mandibulae has partly preserved only (130 mm). The left molar is damaged, has not preserved completely. It is 120 mm (?) long, 69,6 mm wide, 31,2 mm high. The length of the accessible root in the posterior part the tooth attains 112 mm. 9 lamellae have been preserved. The maximum width of the lamella is 6,6 mm. length 66 mm. Thickness of tooth-enamel 1,4 mm. The last two lamellae are deformed.

The right part of mandibula is 360 mm long. The ramus mandibulae has not preserved completely, is 80 mm long, 190 mm high. The height of the right mandibula is 180 mm (in front), 138 mm (at the molar end); the width is 105 mm (in front) and 145 mm (in the middle); in the back immeasurable. The measures of openings are 24 × 15 mm (of the largest), 11,8 × 7,5 mm) of the smallest).

The length of mandibula in the symphyse is 89 mm. The width of symphyse 29 mm.

The back tooth of th right mandibula is 167 mm long. The right molar is partly damaged in front. On the backside is a markedly develeped talon, 27 mm long. The molar has 14 lamellae (surely it had 15 lamellae). The width of lamella is 46 $mm_{(III)}$. The mandibular opening is 15 × 24 mm. The accessible root is broken.

From the indices DLQ displays the value 11,1 and DLI 8,9.

The larger tusk (right) belonged to an adult individual.
It is incomplete, broken into 4 pieces. The maximum length of tusk, measured at the periphery on the outer side, is 148 cm (?), at the periphery from the interior 124 cm (?). Thicknesses of the tusk are as follows: 44 cm at the basis, 38 cm in the middle, and 16 cm at the point.

The smaller tusk belonged to a juvenile individual. It consists of two fragments. The first fragment is about 60 cm long, with a periphery of 26 cm. The second fragment is 40 cm long, its periphery about 21 cm. Probably a left tusk is concerned.

The long bone of the extremity is nearly 118 mm thick, 87,4 mm wide, 460 mm long.

Diagnosis: It is to be seen from the morphological features, metrical data and calculation of indices that the mentioned osteological material belongs to the species *Mammuthus primigenius* (Blumenbach) 1799.

Geological-lithofacial description of the find from the neighbourhood of Chrámec

The gravel pit in which osteological remnants of the mammoth were found, was founded on the erosional edge of the lower main terrace bench of the Rimava river. The relict of this terrace immediately joins the unterraced steep northern slopes of the Fiľakovská vrchovina highlands, which in this part is separated from the Rimavská kotlina basin by a distinct fault, still active in the latest Pleistocene.

In the geological structure of the Quaternary substratum of Chrámec above all grey, in the overlier in places yellowish, aleuritic, muscovite marls take part, in which the Rimava valley with its system of 6 to 7 Pleistocene terrace benches was modelled.

On the basis of the geological investigation of the Rimavská kotlina basin Quaternary (J. Pristaš 1970, 1971) we conclude that the remnant of terrace near Chrámec is equivalent in age to the main Rimava terrace with a relative height of the surface 14—16 m. The terrace is bordered by a flood plain from the bend of the Slaná river near Jesenské to the Czechoslovak-Hungarian state frontier. The terrace surface near Chrámec is 12—16 m high above the flood plain surface; the erosion level is 4—6 m. Thickness of the terrace complex varies 5—10 m.

The terrace base is formed by variegated strata of sandy gravel, rhythmically alternating with layers and beds of medium — to coarse — grained stratified sands, with sporadical, larger pebbles (see the geological profile, Fig. 2). The fluvial pebble material is well worked, composed of quartz, quartzite, sandstone, granitoids and crystalline schists with quite a distinct share of andesite pebbles and tuff. Subordinately diabases and basic eruptives are represented.

Toward the overlier the basal fluvial complex passes to sandy gravels. In these beds, at the depth 2,50 m from the surface, skeleton remnants of mammoth were found. The fluvial gravelous-sandy complex is capped by a series of noncalcareous loess loams, divided by two fossil soil horizons, which typologically belong to the Eem Interglacial pedocomplex. The lower main terrace bench is separated from the youngest Holocene alluvia of flood plains by two phases of incision of the Rimava river bed and deposition of gravels of the low terrace (Early Würm) and valley filling (Younger Würm). The summary effect of erosion in both phases is about 15 m. A distinct erosion and

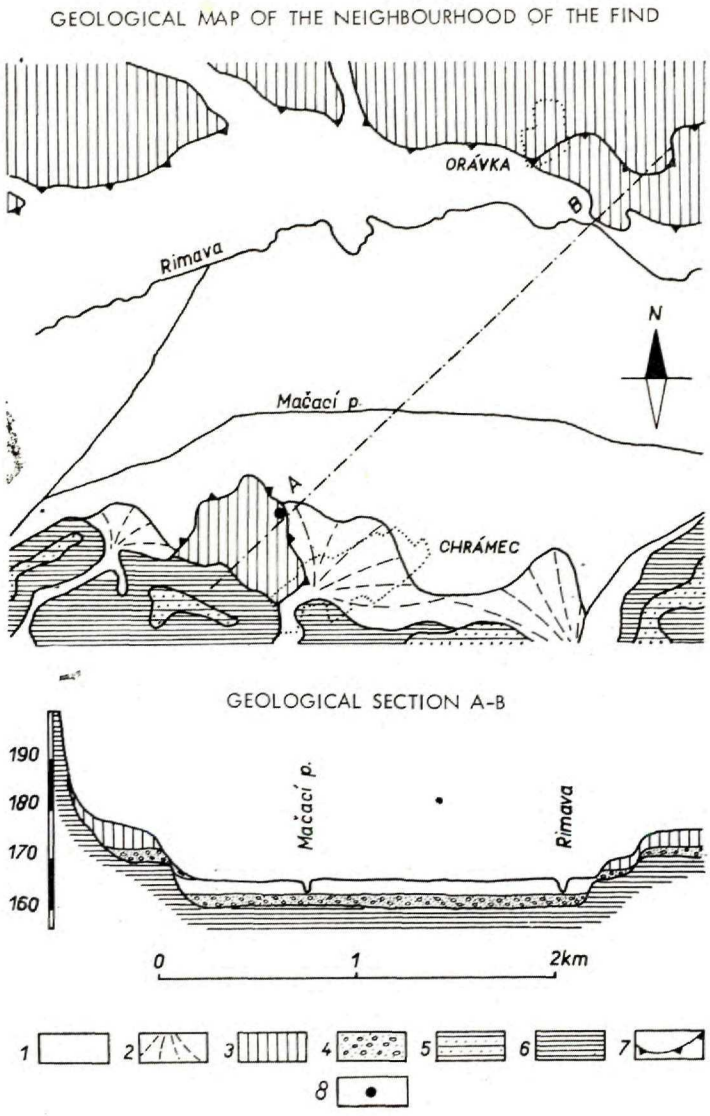


Fig. 1 Explanations to the geological map of the neighbourhood of the find and to the geological section A, B. 1 — Sands, clays and flood loams of the Rimava river flood plain (Holocene), 2 — Loams of alluvial cones (Holocene), 3 — Aleuritic to slightly sandy, loess loams (Würm), 4 — Sandy gravels, sands of the valley filling and Pleistocene terraces (Würm and Late Riss), 5 — Loams (eluvial-deluvial) of loess character (Würm-Holocene), 6 — Aleuritic to slightly sandy marl (Egerian), 7 — Edges of Pleistocene terraces, 8 — Site of find.

gravel accumulation stage is the terrace with osteological material separated from the older Riss terrace or terrace cones with a relative height of 25 m, mainly from the 40—50 m terrace in the loess series, in which already rubefied fossil soil horizons are found.

Closing, on the basis of reconstruction of Quaternary sediments development, mainly of alternation of erosion and accumulation phases, of super-position and typology of fossil soils on the individual terrace benches, we conclude that the fossiliferous gravels and sands of the main terrace lower bench deposited in the time of the latest Riss. Together with them the damaged mammoth remmants were deposited.

From the geographical aspect of extension of the mammoth species Mammuthus primigenius (Blumenbach) the paper is a contribution to establishing its presence as early as the Riss Glacial in Slovakia.

Reviewed by O. Samuel.
Translated by J. Pevný.

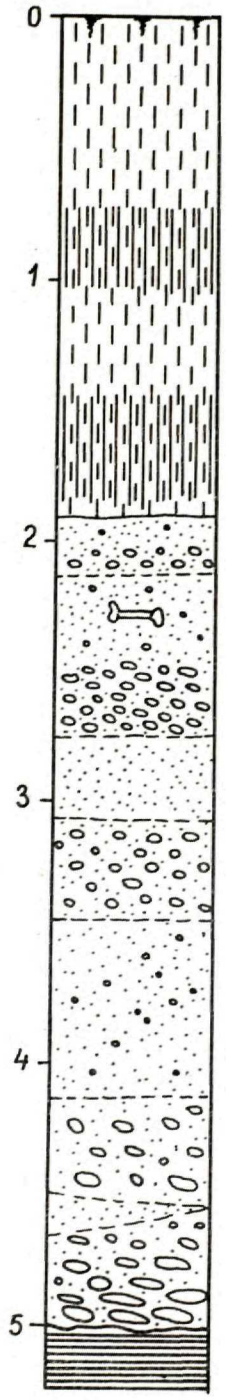


Fig. 2 Geological profile of the Rimava terrace outcrop in the gravel pit of Chrámec.

0,00—0,70 m Loam of grey colour or yellowish, aleuritic to slightly sandy, with sporadical pea-gravels; texture lumpy, in the overlier humic with gradual transition to the underlying horizon; noncalcareous (soil).

0,70—1,10 m Loam of distinct brown colour; aleuritic, lumpy texture, noncalcareous, humic (fossil soil horizon).

1,10—1,40 m Loam (loess) of lighter yellowish-grey colour, aleuritic, more clayey, in the underlier sandy, texture prismatic, noncalcareous.

1,40—1,80 m Loam of dark-brown to blackish colour, aleuritic, noncalcareous (fossil soil horizon).

1,80—5,00 m Sandy gravels, grey to brownish with distinct rhythmical alternation of beds and lenticles of medium-to coarse-grained polymict sand; fluvial pebble material well worked. Composition: quartz, quartzite, sandstone, granitoids, crystalline schists, andesite, tuff and basalt (Riss). At the depth of 2,50 m from the surface the find of Mammuthus primigenius (Blumenbach).

5,00— m Grey marl (siltstone), muscovitic (Egerian).

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Nález Mammuthus Primigenius (Blumenbach) 1799 z okolia Chrámca (Rimavská kotlina, j. Slovensko)

2 obr., 2 tab. (CIII—CIV), resumé anglického textu

Osteologické zvyšky *Mammuthus primigenius* (Blumenbach), ktoré okolo roku 1957 našli v južnej časti Rimavskej kotliny (Chrámec) v štrkovni, na hrane spodného stupňa hlavnej terasy Rimavy (rel. výška 12—16 m), sedimentovali pred etapou rozsiahleho formovania pôdneho komplexu riss-würmského interglaciálu. Túto etapu na základe analýzy vývoja kvartérnych sedimentov, a najmä fáz erózie akumulácie od holocénu po starý pleistocén a na základe typológie fosílnych pôdnych komplexov na terasách zaraďujeme do obdobia najmladšieho rissu.

Z aspektu geografického rošírenia mamutov tohto druhu je práca príspevkom k ich výskytu už v risskom glaciáli na Slovensku.

Obr. 1 Vysvetlivky ku geologickej mape okolia nálezu a ku geologickému rezu A, B. 1 — piesky, íly a povodňové hliny poriečnej nivy Rimavy (holocén), 2 — hliny náplavových kužeľov (holocén), 3 — hliny prachovité až slabopiesčité, sprašové (würm), 4 — piesčité štrky, piesky údolnej výplne a pleistocénnych terás (würm a mladý riss), 5 — hliny (eluviálno-deluviálne) sprašového charakteru (würm-holocén), 6 — slieň prachovitý až slabo piesčitý (eger), 7 — hrany pleistocénnych terás, 8 — miesto nálezu.

Obr. 2 Gelogický profil odkryvu terasy Rimavy v štrkovni v Chrámci.

0,00—0,70 m hlina sivej farby, slabo žltkastá, prachovitá až slabo piesčitá, s ojedinelými drobnými štrčíkmi; štruktúra hrudkovitá, v nadloží humózna s postupným prechodom do podložného horizontu; nevápnitá (pôda).

0,70—1,10 m hlina výraznej hnedej farby, prachovitá štruktúra, hrudkovitá, nevápnitá, humózna (fosílny pôdny horizont).

1,10—1,40 m hlina (sprašová) svetlejšej žltosivej farby, prachovitá viac ílovitá, v podloží piesčitá štruktúra hranolkovitá, nevápnitá.

1,40—1,80 m hlina tmavej hnedej až černastej farby, prachovitá, nevápnitá (fosílny pôdny horizont).

1,80—5,00 m štrky piesčité, sivé až hnedasté s výrazným rytmickým striedaním vrstiev a šošoviek strednozrnného až hrubozrnného polymiktného piesku; valúnový fluviálny materiál je dobre opracovaný. Zloženie: kremeň, kremenec, pieskovec, granitoidy, kryštalické bridlice, andezit, tuf a čadič (riss). V hĺbke 2,50 m od povrchu terénu nález *Mammuthus primigenius* (Blumenbach).

5,0— m slieň sivý (prachovec), muskovitický (eger).

Vysvetlivky k tabuľkám CIII—CIV

Tab. CIII Panoráma Chrámca a jeho okolia v Rimavskej kotline. Foto J. Pristaš, 1975.
Tab. CIV Kostrové zvyšky Mammuthus primigenius (Blumenbach) z Chrámca, v Rimavskej kotline.

Explanations of plates CIII—CIV

Plate CIII Panorama of Chrámec and its surroundings in the Rimavská kotlina basin. Photo by J. Pristaš, 1975.
Plate CIV Skeleton remnants of *Mammuthus primigenius* (Blumenbach) from Chrámec in the Rimavská kotlina basin. Photo by J. Pristaš 1970.

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Paleodictyonidae from Czechoslovakia

2 pl. (CV—CVI), Russian and Czech summary

Abstract. In the presented paper the authors describe and figure some peculiar trace — fossils (Problematica) of the form of honey — comb-like network, known as Paleodictyon Meneghini, 1850. Their nature, origin and occurrence are discussed, as well a scheme of their classification is proposed. Five species of two subgenera of Paleodictyon are now recognised in Czechoslovakian Mesozoic and Caenozoic. On one specimen a bent worm-trace is present, which begins visibly from one of the cells. It may be a proof of the worm origin of Paleodictyon.

During his visit to Czechoslovakia in 1960 O. S. Vialov acquainted himself with the collection of Problematica at the Geological Institute of Charles University and the Geological Department of the Public Museum in Prague. He displayed great interest in the specimens of *Paleodictyonidae* because on the one hand, such Problematica from Czechoslowakia have not been described as yet (although separate figures have appeared in literature), and, on the other hand, because some of them are very rare on condition of the location.

In recent years both authors were engaged in a special study of *Paleodictyonidae* and their systematization. They have accumulated a large volume of material: specimens, plastercast and photographs from deposits of different age and different regions of the USSR and the countries of Europe. Since they almost had no opportunity to deal with the specimens from Czechoslovakia they welcomed the possibility to desribe several of these specimens and outline some of their general views on these interesting and still mysterious Problematica on the pages of the main Czechoslovak geological magazine.

The photographs of *Paleodictyonidae* illustrating this paper were received through the kindness of Professor B. Bouček, Professor V. Pokorný and Doctor V. Zázvorka. We use the opportunity to thank them for this and the warm hospitality and their exceptional attention during our meetings in Prague.

We also express our gratitude to Academician D. Andrusov who supplied us with additional data on two of the *Paleodictyonidae* from his old collection described in this paper. We also recall with great pleasure our conversations with Doctor B. Leško and his colleagues T. Ďurkovič, R. Marschalko, J. Nem-

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čok, O. Samuel and the review of interesting specimens at the D. Štúr Geological Institute in Bratislava (some of which were illustrated in below mentioned articles).

Problematica of the *Paleodictyon* type are widespread in Flysh formation and layers which are close to them in formation. We know of but single *Paleodictyon* in the not geosynclinal-platform formations. They include, for example, two plates from the Cretaceous or Tertiary deposits of the eastern slope of the Urals, which were depicted by A. P. Karpinski 1945 (pl. XVII, fig. 3—5), as well as the plate from Valanginian of the Gerecse mountains in Hungary (Fülöp 1958). That is why one of the networks from the quadern sandstones of Northern Bohemia (described below) presents a difinite interest. All the more so that it belongs to the little known and as yet rarely found specimen of *Paleodictyon (Glenodictyum) preadictum* Vialov et Golev.

The convex nets of *Paleodictyon* are always on the undersurface of the layer, and this bioglyph — bearing layer is always sandstone or aleurolite, and very rarely aleuritic argillite. We have never seen or met in literature any mention of *Paleodictyon* having been found on the surface of limestone. All the more interesting it was for us to see at Charles University a *Paleodictyon* specimen on a radiolarian limestone plate from the Malm of Kurovice. Assuming that the strip where the fine radiolarian limestone was formed was situated in somewhat deeper weter and farther away from the shore, we can expand the limits of the bathymetric distribution of *Paleodictyon*.

Now let us say a few words about *Paleodictyon* and their nature in general.

More than 100 years ago Meneghini (1851) described a little net with hexagonal cells divided by convex partitions under the name of *Paleodictyon*.

The most different assumptions have been made as regards the origin of *Paleodictyon*. Some writers ascribed them the inorganic origin (undulation of water, separation of gas bubbles, mud cracks) other considered them as organic remains (sponges, algae, corals, impressions of reptils carapaces, etc.) and finally there were also authors wich connected them with the vital activities of the organisms (a swarm of tadpoles, the imprints of fish or gastropodes spawns, the traces of crawling of sea worms). The question concernig the origin of *Paleodictyon* has been still unsolved. More or less regular hexagonal cells, separated by partitions, can be formed in a different way, either organically or inorganically, as the result of undulation water, mud cracks, motion of tails of a swarm of tadpoles etc.

The review of present conceptions can be found in a number of papers (Sacoo 1899, 1939; Karpinski 1932, 1945; Firsov 1949; Golev 1953; Nowak 1959; Vialov, Golev 1966).

We still do not know, what is *Paleodictyon* in reality. However of present time one can definitely establish, that the number of assumptions concerning their origin must be rejected.

The main feature of *Paleodictyonidae* is their location always only at the

undersurface of the layer. Thus, the networks of *Paleodictyon* are the negative model-the bas-relief of any primary from on the bottom, i. e. at the upper surface of the subjacent layer. This primary form resembled to the same network, but with convex middle parts divided by small channels, which on the cast correspond to the convex partitions (ridges). So, all the hypotheses, which regard the ridges of *Paleodictyon* as primary basreliefs on the bottom, i. e. at the uppersurface of a layer, must be excepted.

The primary hexagonal nets on the uppersurface with convex partitions formed organically were united by us into the group of *Priodictyonidae*. In respect of their origin they have nothing in common with the real *Paleodictyonidae* (Vialov, Golev 1960). In this group *Priodictyonidae* will be included the cells, formed by a swarm of tadpoles (for ex. Vialov, Golev 1966, pl. XI, fig. 3) and other animals, and also the cells, which are, how sometimes supposed, if they exist, the imprints of the spawns of fish („*Palaeopiscovum*" Bányai 1939) or of gastropods (Fuchs 1895; Abel 1935).

The primary networks convex partitions of which can be formed inorganically too-as a result of undulation of water (forms of type *Batrachoides* Hitchock 1858) or as the traces of separation of gas bubbles etc.

As regards the true *Paleodictyonidae*, the acceptable hypotheses are less numerous. One can only consider the conceptions on their algal character and the traces of crawling of organisms on the bottom, in particular sea worms. Namely this latter conception is the wide-spread hypothesis (Seilacher 1954; Lessertisseur 1955). It was developed by W. Nowak 1959 in his special work.

Paleodictyons are of no stratigraphic importance due to the fact that they are found in old and young sediments (Paleozoic — Caenozoic). However, being connected merely with the undersurface of a layer, they make it possible easily to establish a normal or reverse attitude.

In the literature there are described about 30 species of *Paleodictyon*, however they all require detailed re-examination. We have made an attempt to begin this revision and develop a general systematization scheme of *Paleodictyonidae*. In the present case, of course, only an artificial classification is possible.

This classification is stated in the number of our works (Vialov and Golev 1960, 1963, 1964, 1966), but here we'll quite briefly repeat the principles, upon wich it is based.

To separate the artifical genera which belong to the group of *Paleodictyonidae*, the form of the cells is considered. In the majority of cases it is hexagonal. However, there are several specimens having the rounded-loop shaped cells. Such specimens have been separated into special genus *Squamodictyon* Vialov et Golev. Among the forms which have the hexagonal cells there have been established only several specimens characterized by a special structure of partitions — interrupted or hill-shaped. These forms are termed *Pleurodictyon* Fuchs 1895 (Vialov et Golev 1960).

However we would like to point out that almost all the forms described in the literature and presented in our collection of hieroglyphs possess the hexagonal cells separated by continuous, uninterrupted partitions. They all belong to the genus *Paleodictyon*. According to the relative width of the partitions, the *Paleodictyon* may be devided into two subgenera — with narrow partitions (*Paleodictyon* s. str.) and with broad partitions (*Glenodictyum* Marck).

Thus, the net-like hieroglyphs of organic origin formed at the undersurface of a layer can consequently be divided as follows (Vialov — Bolev 1960):

Paleodictyonidae

Net-like formations at the undersurface of layer (secondary) with convex partitions, continuous or interrupted. The contours of cells vary: hexagonal (*Paleodictyon*) or imbricated (*Squamodictyon*).

Genus *Paleodictyon* Meneghini, 1851

Nets composed of hexagonal cells are formed by continuous partitions with no ornaments. Type species: *Paleodictyon strozzii* (Meneghini).

Subgenus *Paleodictyon* s. str.

Partitions of the cells relatively narrow.

Subgenus *Glenodictyum* Marck, 1876

Partitions of the cells relatively wide; the cels usually very regular. Type species: *Glenodictyum hexagonum* Marck.

Genus *Pleurodictyum* Fuchs, 1895

Nets of hexagonal cells formed by interrupted bill-shaped partitions. From the opinion of Häntzschel (1965), T. Fuchs made a mistake when he used the term *Pleurodictyon* instead of *Paleodictyon*, however this name is mentioned several times in the work of T. Fuchs, including the explanation of plates (Fuchs 1895, pp. 394, 396, pl. VI. fig. 1). Even if this term was appeared by a mistake, it was applied to the form with the special properties which compelled us to separate it into the special genus. Type *Pleurodictyon fuchsi* Vialov et Golev.

Genus *Squamodictyon* Vialov et Golev, 1960

Characteristic quadrilateral or trilateral nets with a long, half-circular, convex side, and two or three shorter concave sides. The general appearance of the net resembles the fish scales. Type *Squamodictyon squamosum* Vialov et Golev.

Besides, the genus *Squamodictyon* was divided into two subgenera (Vialov et Golev 1965).

Subgenus *Squamodictyon* s. str.

Partitions comparatively narrow.

Subgenus *Largodictyon* Vialov et Golev

Partitions comparatively wide. Type species of the subgenus: *Squamodictyon (Largodictyon) saccoi* Vialov et Golev (pro *Paleodictyon tectiforme* Sacco (pars), 1886, pl. XI. fig. 5).

The clasification according to the species is based upon the determination of the dimensions of the cells of each species. The similar method was used by F. Sacco (1939), H. Gonez de Llarena (1946) and W. Nowak (1959). The consideration of the distribution and the names of the species suggested by them will be avoided. We shall only give our scheme of the subdivision. It has come as a result of the revision of the material both the descriptions available from the literature and our collection from various parts of the Soviet Union — Carpathians, Crimea, the Caucasus, and Chukotka, and also from some countries of Europe.

We have adopted the following dimensions of cells for the particular species of *Paleodictyon (Paleodictyon)*.

1. 1— 2 mm — *P. minimum* Sacco, 1888.
2. 2,5—5,5 mm — *P. strozzi* (Meneghini, 1851) Peruzzi, 1880 (= *P. miocenium* H. Fuchs, 1961, non Sacco)
   4—5,5 mm — *P. strozzii* var. *tellinii* Sacco, 1888 (forma major),
3. 6—10 mm — *P. carpaticum* (Matyasowszky, 1878)
   8—10 mm — *P. carpaticum* var. *majus* Meneghini, 1880 (= *P. caucasicum* Papp, 1910) (forma major)
4. 11—13 mm — *P. tauricum* Vialov et Golev, 1964
5. 14—18 mm — *P. götzingeri* Vialov et Golev, 1965
6. 19—24 mm — was not found (now — *P. Andrusovi* sp. n.)
7. 25—29 mm — not found yet
8. 30—38 mm — not found yet
9. 40—48 mm — not found yet
10. over 50 mm — *P. gomezi* Azpeitia, 1933

Almost the same or similar intervals of species have also been adopted for *Paleodictyon* (*Glonedictyum*) with broad partitions.

1. 1— 2 mm — *Gl. latum* Vialov et Golev
2. 3— 5 mm — *Gl. miocenicum* (Sacco), 1886
3. 6— 9 mm — *Gl. regulare* Sacco, 1886 (= *P. seranense* Wanner, 1949)
4. 10—13 mm — *Gl. maximum* (Eichwald), 1865 (= *P. giganteum* Peruzzi, 1880 — *P. majus* Peruzzi, 1880, pars tav. I, fig. 6)
5. 14—18 mm — *Gl. hexagonum* Marck, 1876 (= *P. tectiforme* Sacco, 1886, pars, tav. XI, fig. 7, 8)
6. 19—24 mm — *Gl. praedictum* Vialov et Golev, 1964
7. 25—29 mm — *Gl. ponticum* (Toula), 1890
8. 30—38 mm — *Gl. italicum* Vialov et Golev, 1965 (= *P. maximum* Sacco, 1886)
9. 40—48 mm — not found yet
10. Over 50 mm — *Pl. azpeitiai* Vialov, 1968

The existence of the cells of different size in the same net and to avoid the division into many species compelled us to determine rather large limits of dimensions of the cells for the species adopted in the classification. However, one often meets cases when the cells in a network are rather homogeneous and their size sometimes approximates to the minimum size of the species given, sometimes to the maximum size, and sometimes they are of medium size. In order to be more precise in the determination of these or those networks we introduced the supplementary denominations in the rand of the form (forma) identical for each species.

The nets with cells aproximating in size to the minimum size given for the species are designated as forma *minor*, and to the maximum size as forma *major*, the nets with the medium size are designated as forma *media*, and, finally, those with the cells of different size are designated as forma *mixta*.

In the cases, when forms, corresponding to forma minor or forma major have been named, the names can be used as subspecial. For instance the special interval of *P. strozzi* is adopted in the limits of 2,5—5,5 mm. The dimensions of cells of *P. tellinii* are 4—5 mm and correspond to *P. strozzii* forma *major*. Instead of the designation *P. strozzi* forma *major* one can use the name *P. strozzii* var. *tellinii*. One meets with cases when any cells in a network of definite species have larger limits of dimensions, then adopted for this species. The existence of such cells does not influence the determination. However, if they are very multiple and in the limits of single large net one can speak about two different species, we may use the double name of species — for instance, *P. strozzii — carpaticum*.

Dealing with the described collection, we point out that it contains representatives of the subgenus *Paleodictyon* s. str. and subgenus *Glenodictyum* Marck.

The following Czechoslovak species will be described here:

1. *Paleodictyon* (*Paleodictyon andrusovi* sp. n. Vialov et Golev. *Malm*, radiolarious limestone. Moravia, Kurovice.

2. *Paleodictyon* (*Glenodictyum*) *regulare* Sacco, forma major. Albian, Slovakia, ravine to the North of Pupov vrch at Zazrivá.

3. *Paleodictyon* (*Glenodictyum*) *praedictum* Vialov et Golev, forma minor. Upper Cretaceous. Northern Bohemia, Dobkovice, osada Prosetín near Děčín.

Moreover, some informations are given about Paleodictyons from Czechoslovakia, which are known from literature — *Paleodictyon strozzii* Meneghini and *P. carpaticum* (Matyasowszki).

We have also given the figure of the net, which is in the Public Museum in Prague. however it comes from Italy, but not from Czechoslovakia. This net, which is designated as *Paleodictyon* (*Paleodictyon*) *strozzi* Meneghini is of great general interest. One can see, that from one of the hexagonal cells the long curving trace is separated. Probably this trace belongs to the worm. One of the authors, (O. S. Vialov) considers that this example proves convincing by the hypothesis, which connects the *Paleodictyon* with the vital activity of the see worms. The other author (B. T. Golev) continues to consider *Paleodictyonidae* as the remains of algae.

One distinctive network was figured by B. Leško (1952, pl. XIII, fig. 2), but without any mention in the text.

This specimen was found at the surface of the layer of glauconitic limestone-sandstone shale in the „submenilitic Eocene" of Dukla-Uzhok zone of the Flysch Carpathians in the space to the North of village Zvaly. On the photograph one can see that the diameter of the cells even along the long axis which connects two opposite corners does not exceed 5 mm. The size of the cells is usually about 4 mm. Thus the network can be designated as *Paleodictyon* (*Paleodictyon*) *strozzii* (Meneghini).

D. Andrusov mentions the following findings of *Paleodictyon:* from the Lias of inner Klipp-belt near the v. Zázrivá (D. Andrusov 1959, p. 117); from the Tithonian Klipps (Cliffs) (the radiolarian limestones) along the margin of Magura zone — in Kurovice near Tlumačov (1953, p. 166; 1959, p. 173) (this specimen is described below); from Albian mantle deposits of the cliffs of Manín zone near Zázrivá (1953, p. 89; 1959, p. 280) (this specimen is described below) and from Upper Cretaceous Flysch of Magura zone (1959, p. 315).

T. Ďurkovič (T. Ďurkovič 1960, p. 72, pl. II. fig. 1—4) published four plates with the nets of *Paleodictyon* from the Paleogene Flysch of Magura zone and of Dukla zone. He gave the opinions of different authors on the origin of *Paleodictyon*. T. Ďurkovič specially noted, that these networks were at the undersurface of layers together with the mechanoglyphs.

He regards the specimens on the fig. 1 and 3, pl. II rather similar to the *P. majus* Menegh., although in the text of the plate he called them and all the other simply *Paleodictyon*.

For the specimens described by T. Ďurkovič (1960, pl. II) we can adopt the following names:

fig. 1. *Paleodictyon carpaticum* (Matyas.) forma mixta.
fig. 2. *Paleodictyon strozzii* (Menegh.) forma major.
fig. 3. *Paleodiction carpaticum* (Matyas.).
fig. 4. *Paleodictyon strozzi* (Menegh.) forma minor.

In order to base these definitions we include in the systematical part of our article the hort description of all mentioned specimens according to their photographs.

Genus *Paleodictyon* Meneghini, 1851
Subgenus *Paleodictyon* s. str.

Paleodictyon (Paleodictyon) strozzii (Meneghini) Peruzzi, 1880

Pl. CV, fig. 1

1851 *Paleodictyon strozii Meneghini.* Osservacione stratigrafiche; p. 484.
1880 *Paleodictyon strozzii Peruzzi.* Osservacione sui generi Paleodictyon, p. 7, pl. I, fig. 8.
1888 *Paleodictyon Tellinii* Sacco. Note di Paleoichnologia, p. 158, tav. I, fig. 2, 3.
1939 *Palaeopiscovum Tellini* Bányai. Fossilien — Abdrücke von Fischrogen, S. 82, fig. b.
1952 *Paleodictyum* Leško. Geológia vonkajšieho flyša, tab. XIII, obr. 2.
1959 *Palaeodictyum* Nowak. Palaeodictyum w Karpatach, tab. II, fig. b; tab. IV, fig. a, d; tab. VI, fig. c.
1960 *Palaedictyon* Ďurkovič. Príspevok k petrografii krosnenského a magurského flyša, str. 72, tab. II, fig. 2, 4 (non. fig. 1,3).
1961 *Palaeodictyon* cf. *tellini (Palaedictyon miocenicum)*, sp. n. ? Fuchs, Fossile Lebensspuren, S, 73, Fig. 1.
1964 *Paleodictyon (Paleodictyon) strozzii* Vialov et Golev. Paleodictyon — Maradványok az Albániai, p. 187, 198, tabl. I, fig. 5.
1965 *Paleodictyon (Paleodictyon) strozzii* Vialov et Golev. O drobnom podrazdelenii, s. 95, tab. 1, fig. 1.

The short description of *P. strozzii* were made from the photographs in the works of B. Leško and T. Ďurkovič.

1. The specimen which is figured by B. Leško 1952, pl. XII, fig. 2) represents the small not very regular network of 30 cells, which are not clearly distinguished. In the majority of cases the size of the cells is about 3,5—4 mm, reaching 5 mm along the longer axis (sometimes up to 6 mm). The width of the cells is 3—3,5 mm (the width of two cells is nearly 2 mm). The medium size is about 3,5—4 mm. This is the typical *P. strozzii* (Menegh.).

2. In the work of T. Ďurkovič there are two plates with the networks, which have the small cells. One of them (1960, pl. II. fig. 4) is composed of irregular heterogeneous cells. The medium diameter of them is 3—3,5 mm. Sometimes the diameter of the cells reaches 4 mm many cells are of 2,5 mm

and sometimes 2 mm. Hence, the size of the cells occupies the position near the lower limit of the specific interval, covers (keeps) the intraspecific interval and some of them even drop in the limits of the species *P. minimum* Sacco. This specimen we have designated as *P. strozzii* forma minor.

3. The cella of the other network (1960, pl. II, fig. 2) seem rather more regular, however among them there are equilateral cells and elongated cells. The diameter of the first cells is usually 4—5 mm, the size of the others is about 5 mm along the longer axis (sometimes up to 6 mm) and about 3 5 — —4 mm along the short axis. Hence, the medium size is about 4,5—5 mm. Therefore for this network is accepted the name *P. strozzii* forma major.

The synonymy of this species was specially discussed in our work (Vialov et Golev 1965).

We place here the photo (Pl. CV, fig. 1) of small fragmentary network from the National Museum in Prague, which does not originate from Czechoslovakia, but from Italy. This network is composed of the irregular heterogeneous cells, which are sometimes unclosed. It is very interesting. At the link upper corner of the network one can see the small surved prominence down from the upper cells. At the lower part almost across all the phorograph stretches a thin narrow somewhat bended trace apparently of a worm. This trace has its beginning from one of the cells. O. S. Vialov connects this trace with the animal, which has formed the network of *Paleodictyon*. The given specimen can prove that *Paleodictyons* are the result of the vital activity of sea organisms (probably the sea worms).

Age and locality: Eastern Slovakia. Between the rivers Laborec and Cirocha to the North of Zvaly, Submenilitic Eocene (Leško 1952, pl. XIII, fig. 2). Eastern Slovakia. Submelitic Eocene (Krosno zone), (Ďurkovič 1960, pl. II, fig. 4). Eastern Slovakia. Below layers of the lower Paleogene. (Magura zone) (Ďurkovič 1960, pl. II. fig. 2).

Paleodictyon (Paleodictyon) carpaticum (Matyasowszky) 1878

1878 *Glenodictyum carpaticum* Matyasowszky. Ein fossiler Spongit, S. 262, Taf. XII.
1880 *Paleodictyon majus Peruzzii*. Osservazioni sui generi Paleodictyon, p. 7, pl. I, fig. 1 (non pl.I, fig. 6).
1910 *Glenodictyum caucasicum* Papp. Die Versteinerungen des Kaukasus. S. 300, fig. 141.
1939 *Palaeopiscovum carpaticum* Bányai. Fossilien-Abdrücke von Fischrogen. S. 82, Fig. C.
1948 *Hieroglyf* Puščarovskij, — Nekotoryje morfologičeskije osobennosti fliša, s. 81, fig. 9.
1956 *Paleodictyon majus* Fuschs. Paleodictyon. S. 300, Fig. 1.
1959 *Palaeodictyum* Nowak. Palaeodictyum w Karpatach, tabl. III, fig. 1; tabl. IV, fig. c; tabl. V, fig. b, c, d; tabl. VI, fig. a.
1960 *Paleodictyon* Ďurkovič. Príspevok k petrografii krosnensk. a magursk. flyša, str. 72, tabl. II, fig. 1, 3, (non fig. 2—4).
1964 *Paleodictyon (Paleodictyon) carpaticum* Vialov, Golev. Paleodictyon-Maradványok az Albaniai, p. 188, tabl. 1, fig. 4.

1964 *Paleodictyon (Paleodictyon) carpaticum* Vialov, Golev. Paleodictyon Kryma, s. 27, tab. 1, fig. 1.
1965 *Paleodictyon (Paleodictyon) carpaticum* Vialov, Golev. O drobnom podrazdelenii, s. 97, tab. 1, fig. 2.
1966 *Paleodictyon (Paleodictyon) carpaticum* Vialov, Golev. O paleodiktionach iz fliša Bolgarii, s. 175, fig. 1.

In the paper of T. Ďurkovič there are two photographs of networks. According to the size of the cells these networks are designated as *P. carpaticum* Matyas.

1. The first network (Ďurkovič 1960, pl. II, fig. 1) represents highly heterogeneous elongated cells with thin partitions.

Generally the size of the cells along the longer axis 7—9 mm, along the shorter axis 5—6 mm. The medium size 6—7 mm.

2. The other network (Ďurkovič 1960, pl. II. fig. 3) is composed of the irregular elongated cells. The size of the cells along the longer axis is 8—10 mm, along the shorter axis approximately 5 mm (sometimes 4 or 6 mm). The medium size is approximately 7 mm.

T. Ďurkovič considers that the two forms are similar to *P. majus* Menegh. About this species we must tell following: in 1880 Paruzzi gave first the pictures of two specimens of network under the name *Paleodictyon majus* Meneghini. The first specimen (Perruzzii 1880, pl. I, fig. 1) according to the size of the cells occupies the position within the limits of the species *P. carpaticum* Matyas., described two years earlier. In the majority of cases the size of the cells is 9—10 mm, that is near the upper limit of the species *P. carpaticum* Matyas. This specimen can be designated as *P. carpaticum* Matys. forma major or *P. carpaticum* Matys. var. *majus* Paruzzi. The other specimen of *P. majus* represented by Peruzzi (Peruzzi 1880, pl. I, fig. 6), has very large width of the partitions. According to this indication the specimen must be included into the subgenus *Glenodictyum*. The size of the cells has compelled us to include this specimen into the synonymy of *Gl. maximum* (Eichw.), 1865.

We have considered the synonymy of *P. carpaticum* in another paper (Vialov et Golev 1965).

Age and locality: 1. Eastern Slovakia. Kochanovce Eocene Facies (Magura Zone) (Ďurkovič 1960, pl. II. fig. 1). 2. Eastern Slovakia. Kochanovce Eocene Facies (Magura Zone) (Ďurkovič 1960, pl. II, fig. 3).

Paleodictyon (Paleodictyon) andrusovi sp. n.

Pl. CV, Fig. 2

On the surface of the plate of radiolarian limestone there are about 10 cells. They are rather oblong, variable in size, with the partitions sometimes pinched out, not interrupted or tubercular. The width of the cells between the

parallel sides is 16—18 mm, the medium width is 17 mm. The minimum size of the cells along the longer axis-between the opposite angles is 18 mm, the maximum size (of only one cell) — nearly 26 mm. More often these dimensions are 21—23 mm. The medium diameter of cells in 19—20 mm. Hence it occupies the position within the limits of the species (19—24 mm), proposed by us in 1964. The forms for this interval was reserved in general scheme have not been described yet. For these forms we suggest the name *Paleodictyon andrusovi* sp. n. The width of the patritions reachs 2—2,5 mm, the height of them is 0,5—1 mm. The width is rather large, but considerably smaller than the width of partitions of the nets of *Glenodictyum* with the same specific interval (*Gl. hexagonum* Marck). Therefore this species we include into the subgenus Paleodictyon s. str.

Locality: Moravia. The collection of D. Andrusov. Kurovice. Age: Tithonian radiolarian limestones in the belt of cliffs (Klipps) along the outer margin of Magura zone.

The place of storage: The Geol Institute of Charles University in Prague.

Subgenus *Glenodictyum* Marck, 1876

Paleodictyon (Glenodictyum) regulare Sacco, 1886

Pl. CVI, Fig. 1

1886 *Paleodictyon regulare* Sacco. Intorno ad aclune impronto, p. 930, tav. XI, fig. 3.
1888 *Paleodictyon regulare* Sacco, Note de Paleoichnologia Italiana, p. 159, pl. I, fig. 4.
1899 *Paleodictyon regulare* Sacco. Note sur l'origine des Paleodictyon, p. 1—12, pl. I, fig. 1.
1939 *Paleodictyon regulare* Sacco. Paleadictyon, pl. II, fig. 11.
1949 *Paleodictyon seranense* Wanner. Lebensspuren aus der Obertrias, S. 186, Fig.1.
1953 *Paleodictyon* Andrusov. Étude géologique de la zone des Klippes, p. 89.
1955 *Paleodictyon chyttoni* Pugin. Sur la présence d' un Paleodictyon, p. 210, pl. I, fig. 1.
1959 *Paleodictyon* Andrusov. Geológia Československých Karpát, II, str. 280.
1964 *Paleodictyon (Glenodictyum) regulare* Vialov, Golev. Paleodictyon (Kryma, s. 30, tab. II, fig. 2.
1964 *Paleodictyon (Glenodictyum) regulare* Vialov, Golev. Paleodictyon-Maradványok az Albániai, p. 189, tab. II, Fig. 1.
1965 *Paleodictyon (Genodictyum) regulare* Vialov, Golev. O drobnom predrazdelenii, s. 102, tab. II, fig. 4.

On the surface of sandstone one can see a network with 4—5 series of rather regular, equilateral, hexagonal cells with wide patritions. However, some cells near the margin, and inside of the network are unclosed.

Some cells have the irregular form. The width and the length of the cells are variable ranging from 7 to 8 mm (sometimes 6 mm). The width of well pronounced patritions is 2,5—3 mm; their height ranges from 1 to 2,5 mm.

The width of partitions makes the network to belong to the subgenus *Glenodictyum*. According to the size of the cells this network is designated as typical *P. regulare* Sacco.

In the synonymy we placed P. seranense Wanner. According to the sizes, which are given by Wanner and made also by us from the photograph, this network occupies the position within the limits of the species interval of P. regulare Sacco.

Wanner described and depicted another little network under the name of *P. regulare* (Wanner, S. 188, Fig. 2). But in the majority of cases the diameter of cells is 5 mm. This network is at the upper limit and we attribute them to the species *P. miocenicum* Sacco. The motives of including it in the the synonymy of *P. achttoni* Pugin from the Dogger deposits of Switzerland can be found in our other work (Vialov, Golev 1966).

Locality. Slovakia, near the v. Zazrivá to the North of the Pupov vrch. Collection of D. Andrusov.

Age: Albian deposits of the coat of cliffs (Klipps) of Manín zone.

Place of storage: Geological Institute of Charles University in Prague, N°D—216.

Paleodictyon (Glenodictyum) praedictum Vialov et Golev

Pl. CV, Fig. 2

1964 *Paleodictyon (Glenodictyum) praedictum* Vialov, Golev, Paleodictyon Kryma, s. 35, tab. 1Y, fig. 3.

1965 *Paleodictyon (Glenodictyum) praedictum* Vialov, Golev. O drobnom podrazdelenii, s. 105.

The whole plate of sandstone (12 × 12 cm) is covered with regular well pronnounced network; only on the right upper part of the plate it gradually becomes smooth and nearly disappears. The cells regular, equilateral of approximatly indentical size only with small fluctuation of dimension. In the majority of cases the distance between the parallel walls is about 19 mm, raging from 18 to 20 mm. The size of the cells along the longer axis, i. e. the axis which connects two opposite corners, ranges from 21 to 23 mm. Hence the medium size of the cells is about 20 mm. The width of the partitions is 3,5 mm. (from 3 to 4 mm).

As we made out the classification of Paleodictyonidae and tried to establish the specific intervals for the size of cells, we included in the general scheme the interval of 19—24 mm with the indication, that such specimens have not been found yet (Vialov and Golev 1964). However, later the network which get into this interval (10—24 mm) was found in Crimea (Tauric series) and described under the name of *Paleodictyon (Glenodictyum)* preadictum Vialov et Golev 1964).

The specimen of Czechoslovakia with the medium diameter about 20 mm

undoubtly must be put into this species. It has the dimensions, which are nearer to the lower specific limit and can be designated as *Paleodictyon praedictum* Vialov et Golev forma minor.

This specimen is especially interesting because it does not descend from geosynclinal but from the platform formation, where *Paleodictyonidae* are very rare.

Locality: Northern Bohemia, Dobkovice, osada Prosetín near Děčín. On the label there is the date 1898, but without the name of the collector.

Age. According to the explanation of Dr. Zazvorka these deposits were considered as Oligocene, but then were related to the Upper Creataceous. This is the quadern sandstone of Turonian. However, on the photograph, which was sent to us, there is indicated the Senonian age of the specimen.

The place of storage. National Museum in Prague, N° 0—1243. On the label there is designated the first place of the storage — Die K. K. Deutsche Universität, Prag. Jahr 1898 — and the old inventary number G. I. N 11975.

Reviewed by V. Pokorný and O. Samuel.

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О. С. Вялов и Б. Т. Голев

Paleodictyonidae из Чехословакии

Резюме английского текста

Проблематические остатки, известные под названием *Paleodictyon*, встречаются в отложениях разного возраста, чаще всего во флишевых толщах. В литературе имеются самые разнообразные представления об условиях их возникновения. Они рассматриваются как органичес-

кие и как неорганические образования. В настоящее время обсуждаемся могут лишь предположения об их водорослевом характеер и как о следах ползания данных организмов (морских червей). Авторы специально занимались изучением палеодиктионов и разработкой их систематики. Предложенная ими схема классификации приведена и в данной работе.

Из Чехословакии палеодиктионы не раз упоминались и изображались, но описаний их в литературе почти не появлялось.

В настоящей работе приводится описание трех экземпляров палеодиктионов из разных мест Чехословакии, находящихся в Карловом Университете и в Народном Музее в Праге. Новый вид *P. andrusovi* sp. n. из Мальма Куровиц интересен как единственный вообще известный авторам экземпляр сеточки, находящейся на известняке, а не на песчанике или алевролите. Второй экземпляр *P. regulare* Sacco происходит из гольта района Зазрива. Третий экземпляр принадлежит редкому и недавно лишь описанному виду *P. praedictum* Vialov et Golev. Он был найден в верхнемеловых отложениях не флищевого, а платформенного типа. Кроме того изображена сеточка *P. strozzii* Meneghini из Италии, представляющая специальный интерес. На ней видно, как от одной из ячеек отходит длинный слегка изгибавщийся след повидимому, червя. По мнению одного из авторов (О. С. Вялова) этот образец вполне убедительно доказывает происхождение палеодиктионов как следов жизнедеятельности организмов.

В статье помещено также сделанное по опубликованным ранее фотографиям некоторых форм из Карпатского флиша, остававшихся не определенными. Эти формы отнесены к видам *P. carpaticum* (Matyas.) и *P. strozzii* (Menegh.).

O. S. Vialov — B. T. Golev

Paleodictyonidae z Československa

Resumé anglického textu

Nápadné, voštinám podobné zbytky, známé v literatuře pod názvem *Paleodictyon* Meneghini, vyskytují se v uloženinách různého stáří, nejčastěji ve flyši třetihorního i křídového stáří. V literatuře je množství různých názorů na způsob jejich vzniku. Vyskytly se názory o neorganickém vzniku, avšak dnes se většinou považují za zbytky řas nebo (nejčastější názor) za stopy činnosti mořských organismů, asi červů. Autoři, kteří se již delší dobu zabývají studiem paleodiktyonidů, navrhli také jejich systematické rozdělení, které je také použito v této práci. Z křídy a paleogénu Československa byly již zbytky rodu *Paleodictyon* uvedeny a některé i vyobrazeny, ale bez bližšího určení (Leško 1952, Ďurkovič 1960). V této práci jsou blíže popsány a zařazeny k druhu *Paleodictyon (Paleodictyon) strozzii* (Meneghini 1880) Peruzzi 1880 nebo *P. (P.) carpaticum (Matyaszowski*, 1878). V této práci je vyobrazen jeden exemplář *P. strozzii* z Italie (sbírky Národního muzea v Praze)), který je zajímavý tím, že z jedné příčky polygónu vybíha stejně široká rovná stopa, patřící zřejme nějakému červu. Tím je podán skoro důkaz, že stopy *Paleodictyon* jsou stopami po činnosti mořských červů (O. S. Vialov).

Dále jsou z československa uvedeny, podrobně popsány i vyobrazeny další tři druhy, z nichž *Paleodictyon (Paleodictyon) andrusovi* sp. n. z malmu od Kurovic (Morava) je druhem novým. *P. (Glenodictyon) regulare* Sacco, 1886 pochází z paleogénu východního Slovenska a *P. (G.) praedictum* Vialov, Golev, 1964 z kvádrových pískovců platformní svrchní křídy. Za zmínku ještě stojí, že *P. andrusovi* není zachován na rubu siltovce nebo pískovce, nýbrž slínitého vápence (Kurovice).

The explanation of plates CV—CVI

Plate CV

Fig. 1 *Paleodictyon (Paleodictyon) strozzii* (Menegh.). Italy, Pelago; Cretaceous deposits. The collection of prince Salvator. The place od stroge: National Museum in Prague, No C 3024.
In the lower part there extends the trace of a sea worm, which is curved and takes its beginning from the cells of *Paleodictyon*. The origin of the networks of *Paleodictyon* is proved by that as the traces of life activity of the organisms (worms). The increase is of 2 times.
Fig. 2 *Paleodictyon (Paleodictyon) andrusovi* sp. n. Moravia, Kurovice, Tithonian radiolarian limestone. The collection of D. Andrusov. The place of storge: The geol. Institute of Charles University in Prague. The decrease is up to 0,85.

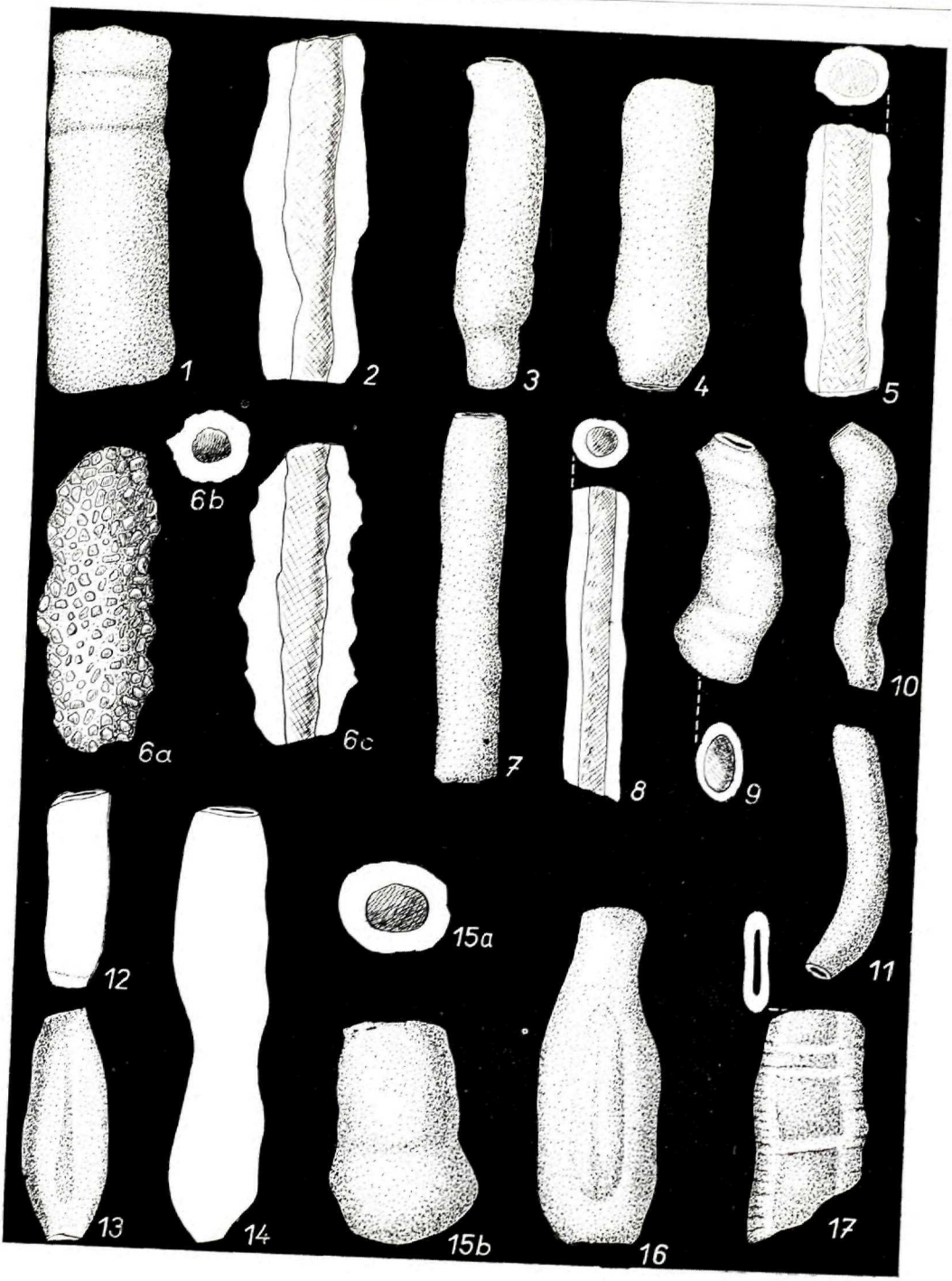
Plate CVI

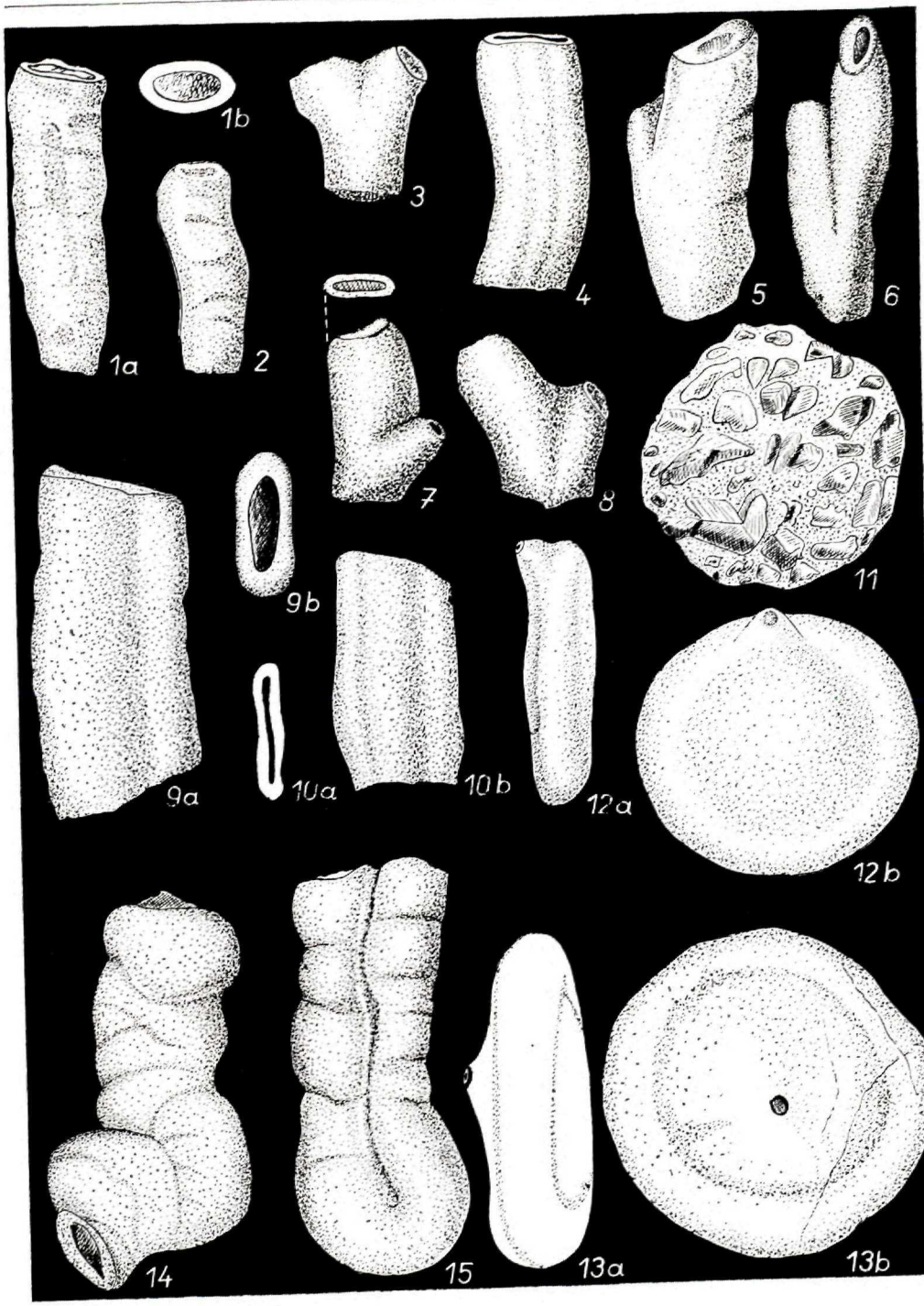
Fig. 1 *Paleodictyon (Glenodictyum) regulare* Sacco. Slovakia. Zázrivá, Alb. Coll of D. Andrusov. Alb. Cole of D. Andrusov. The place of storage. The Geol. Institute of Charles University in Prague. The decrease is up to 0,89.
Fig. 2 *Paleodictyon (Glenodictyum) praedictum* Vialov et Golev. The Northern Bohemia, Dobkovice, near Děčín, Upper Cretaceous.
The place of storage: National Museum in Prague, No 01243. The natural size.

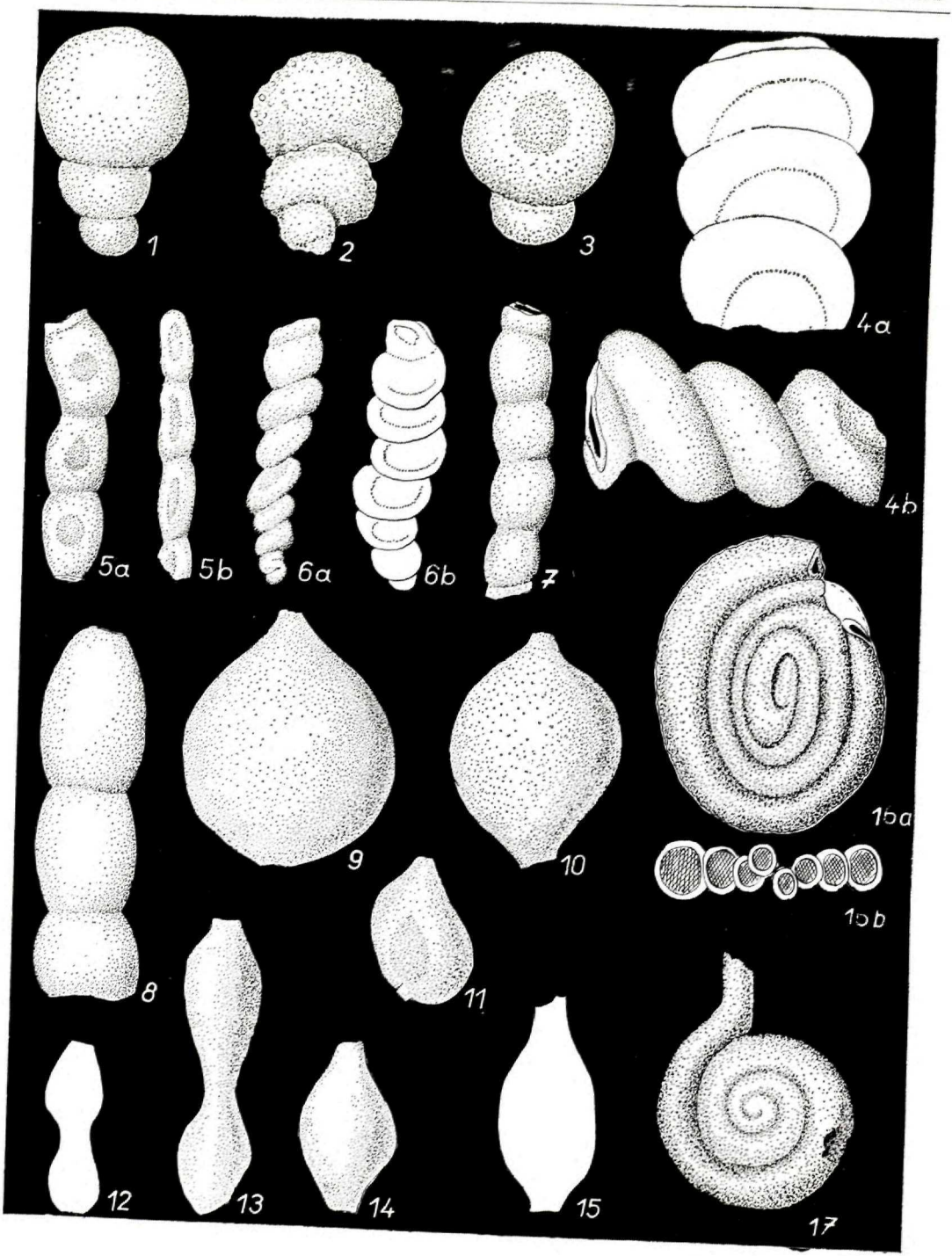
Phot. B. Bouček

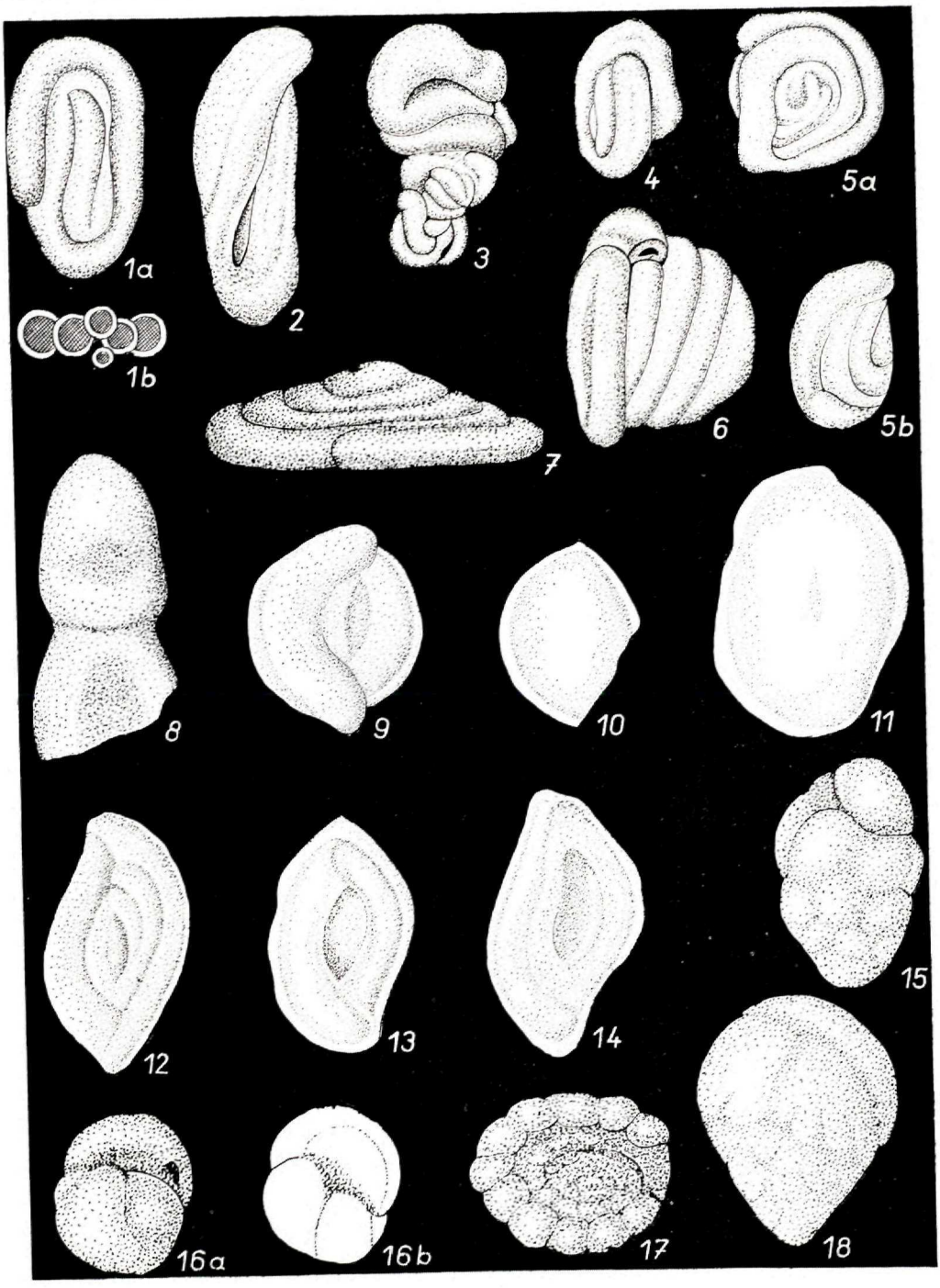
FOTOGRAFICKÁ PRÍLOHA
PHOTOGRAPHS

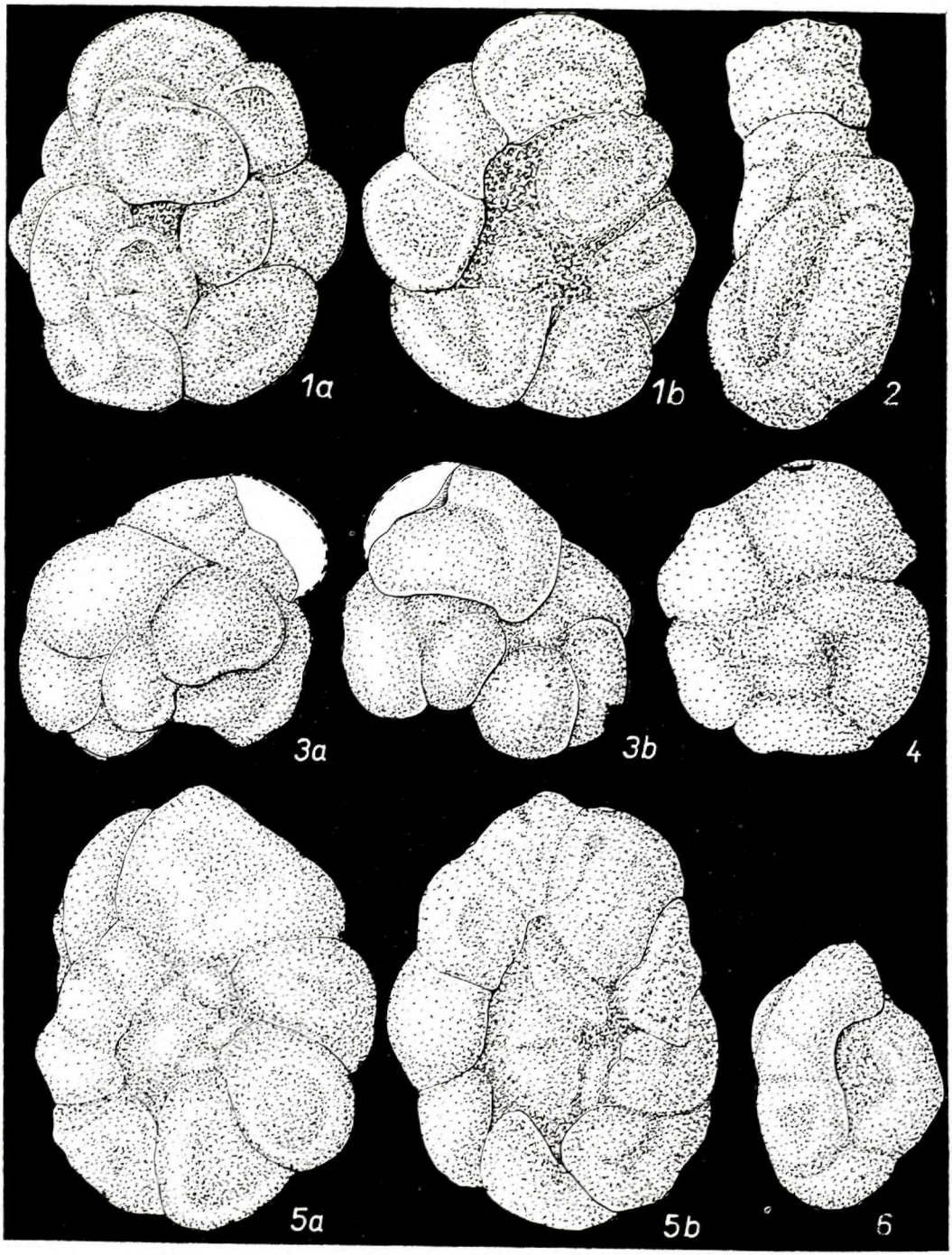
PLATES I—CXI

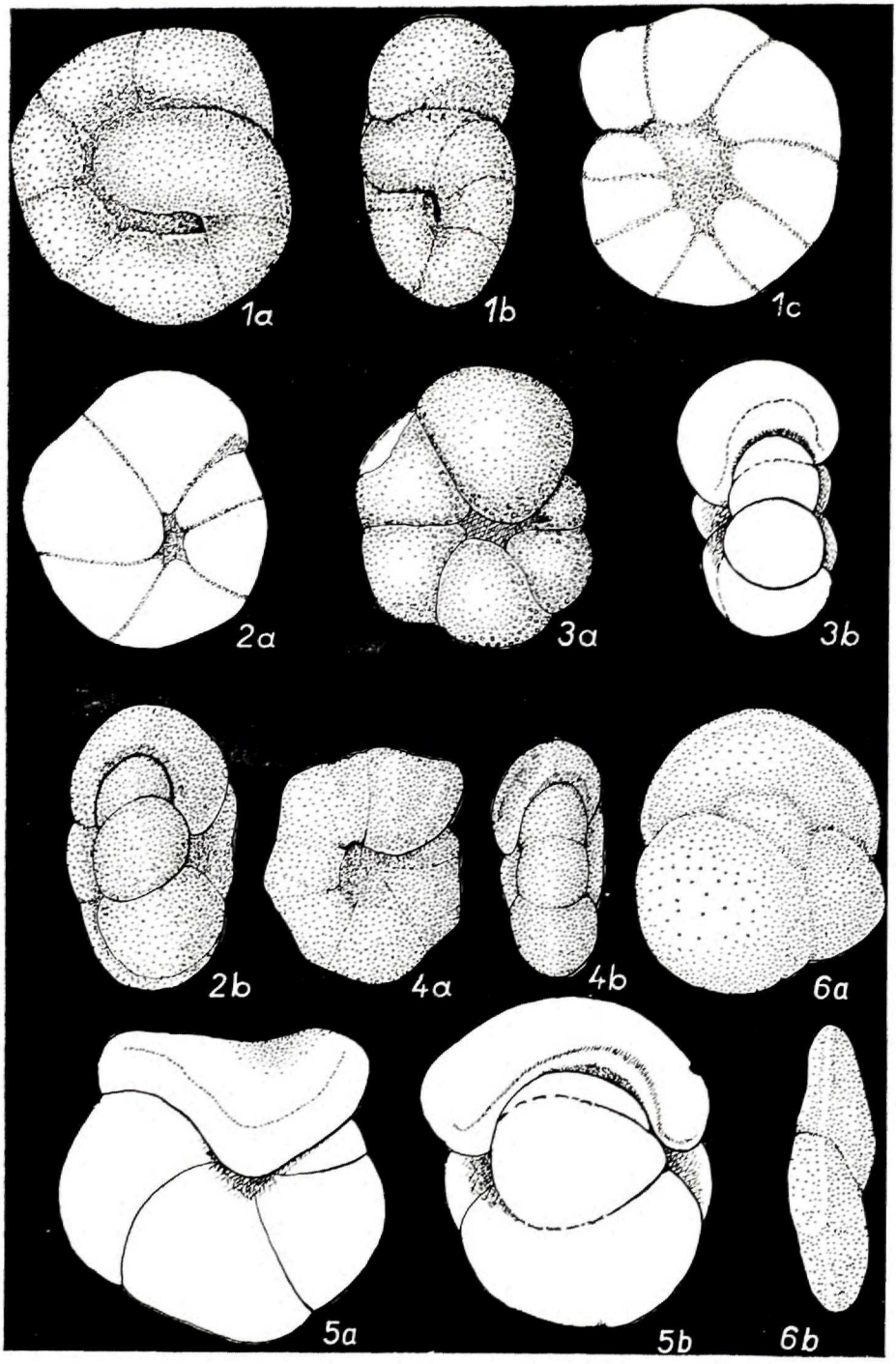

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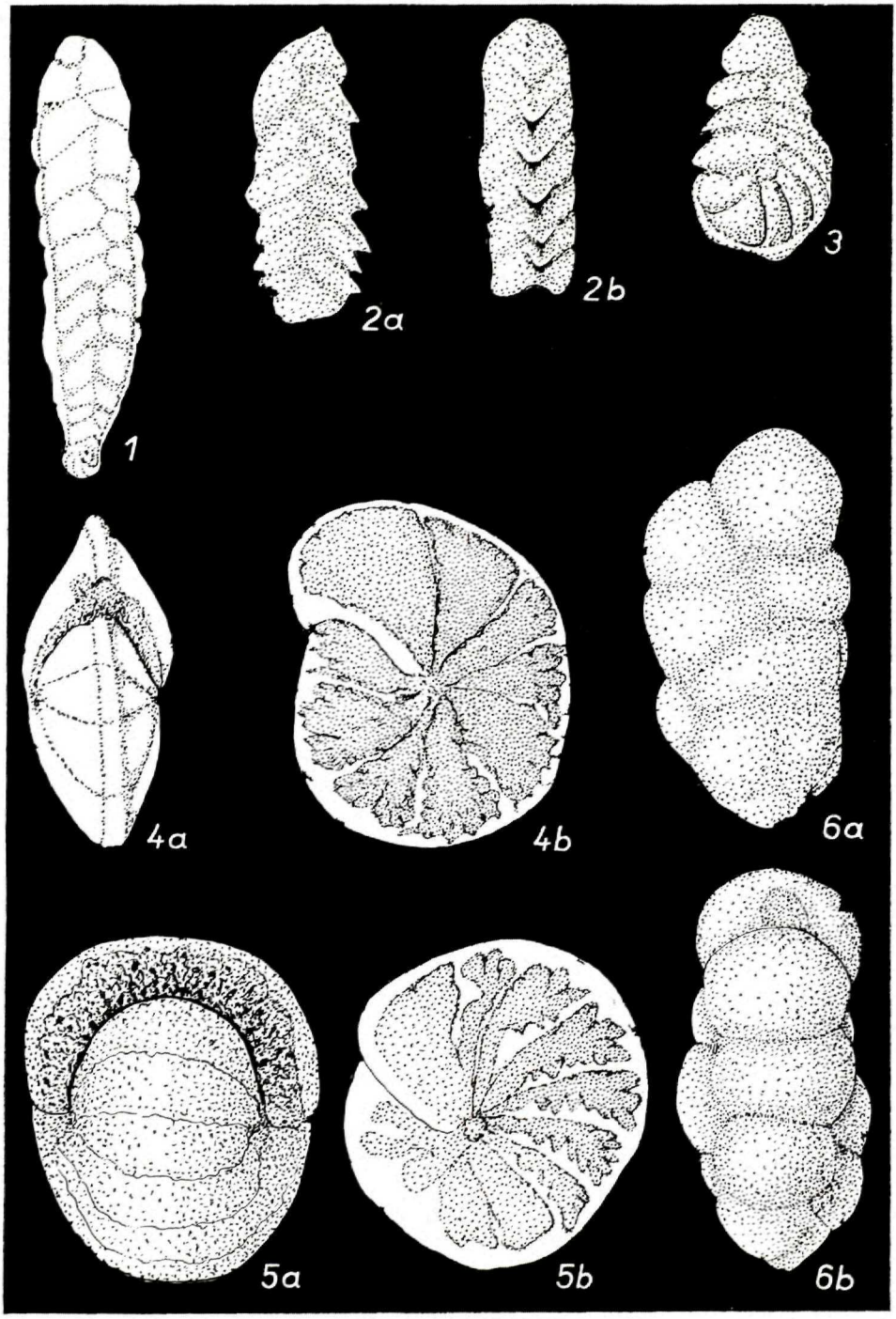

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13b
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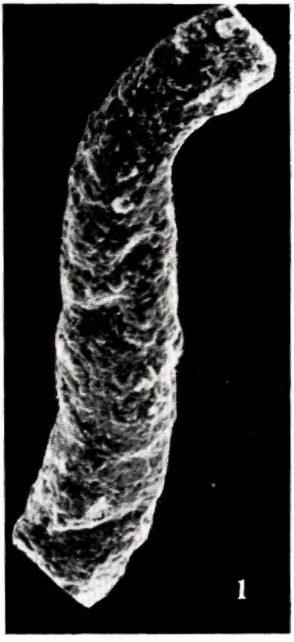

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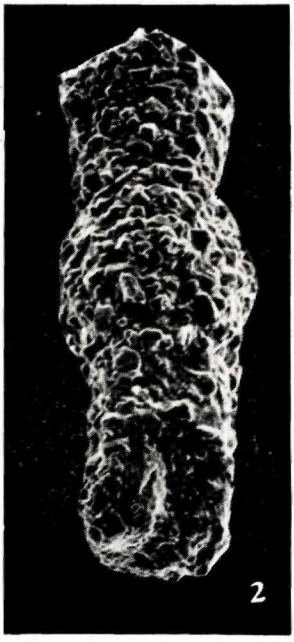

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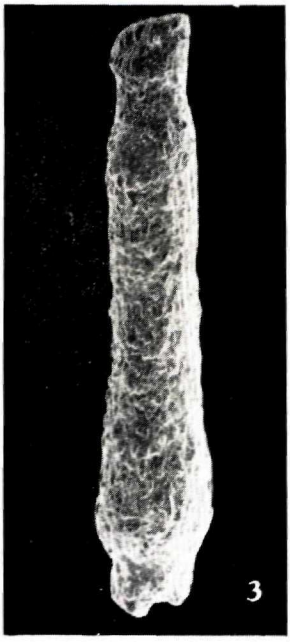

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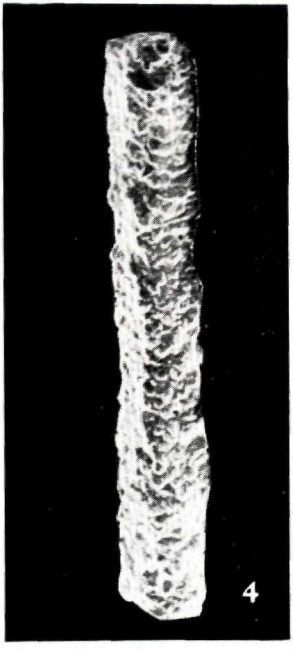

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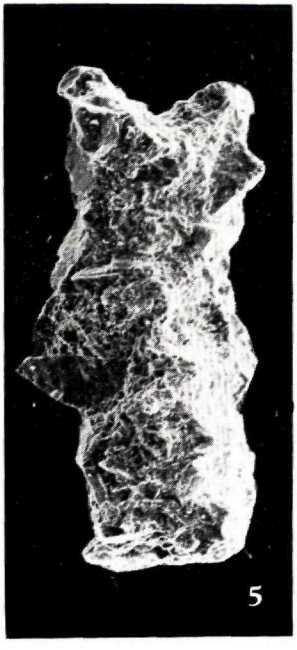

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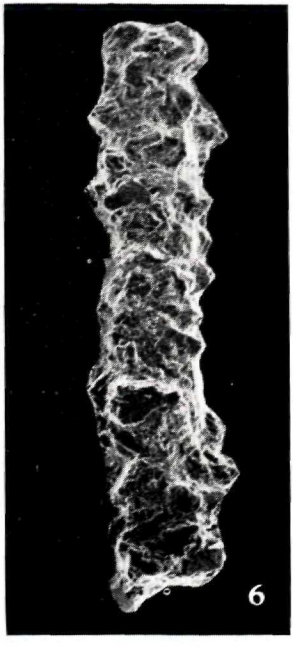

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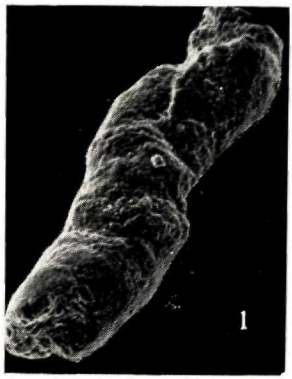

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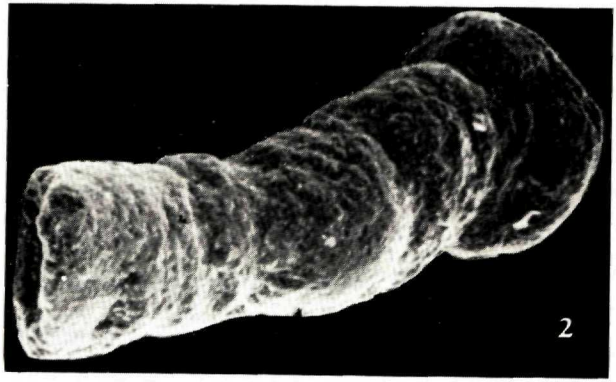

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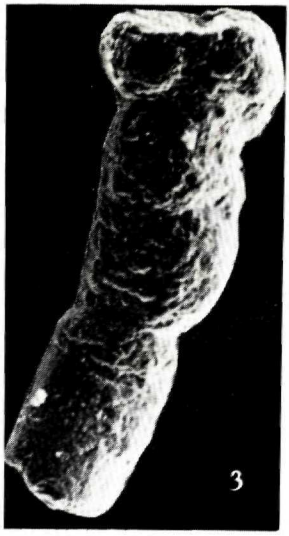

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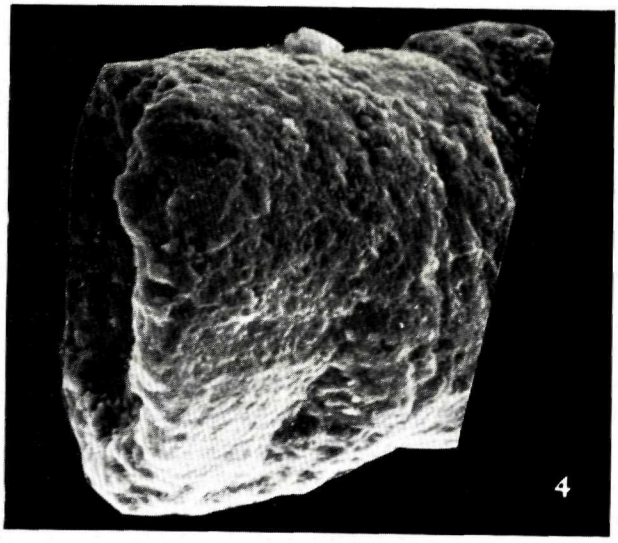

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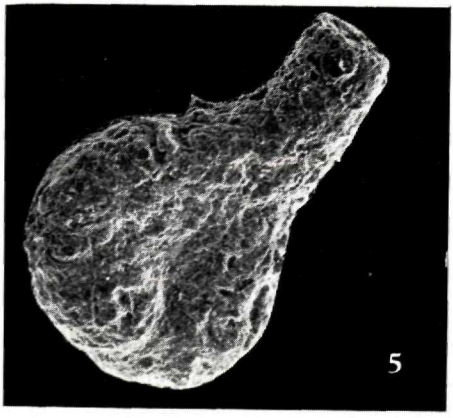

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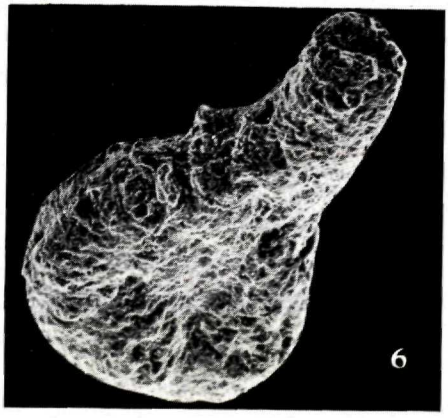

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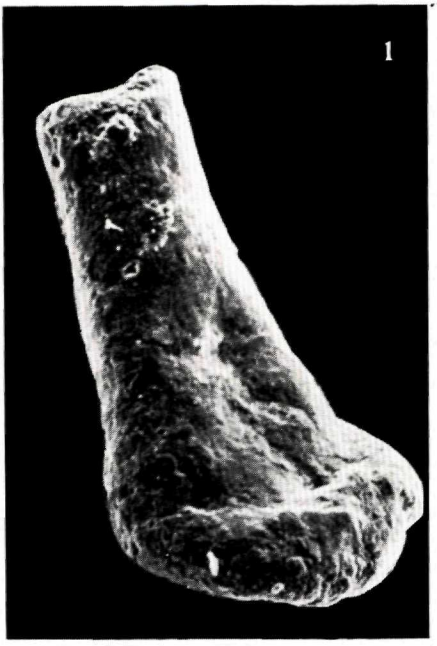

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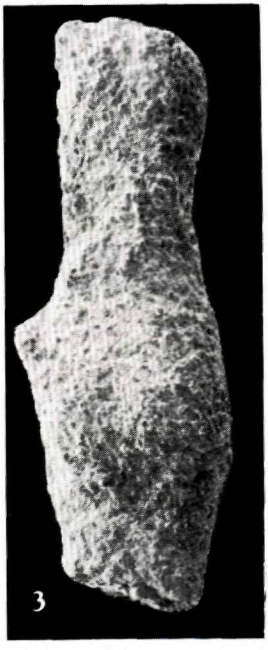

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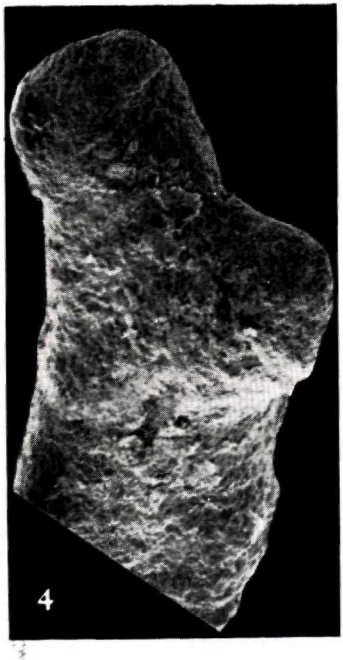

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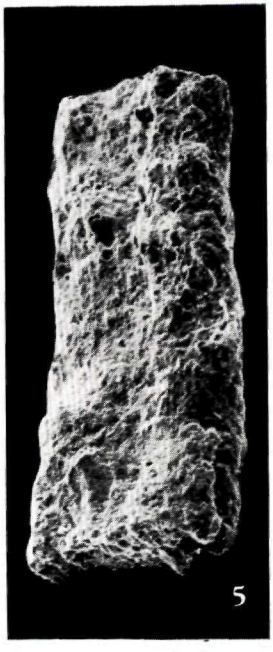

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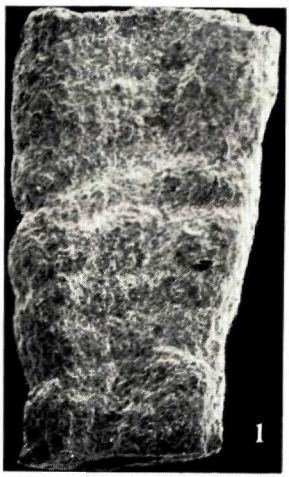

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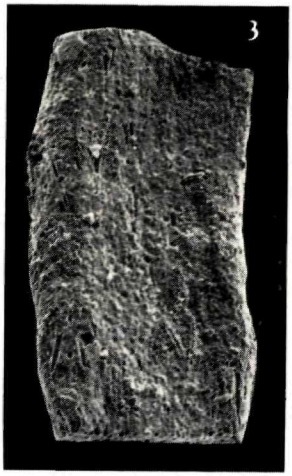

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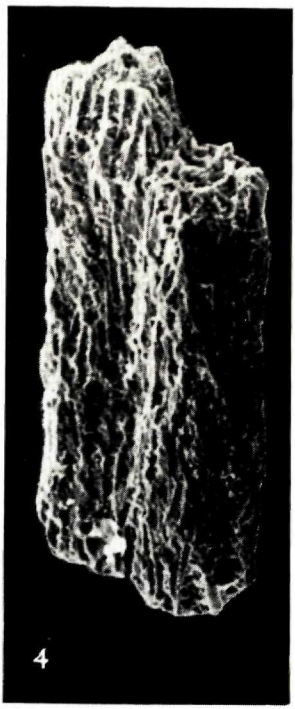

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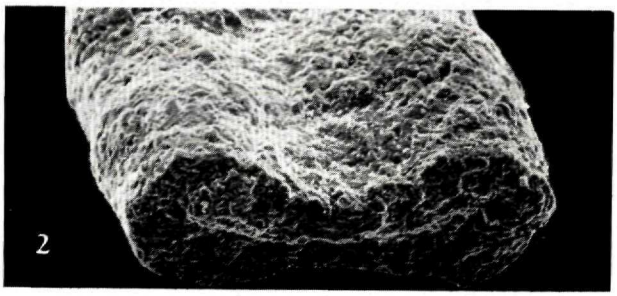

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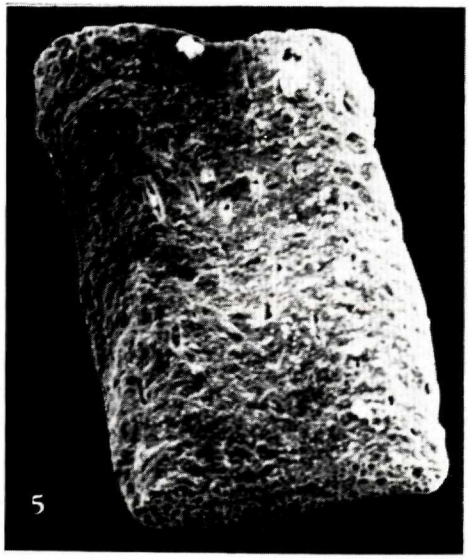

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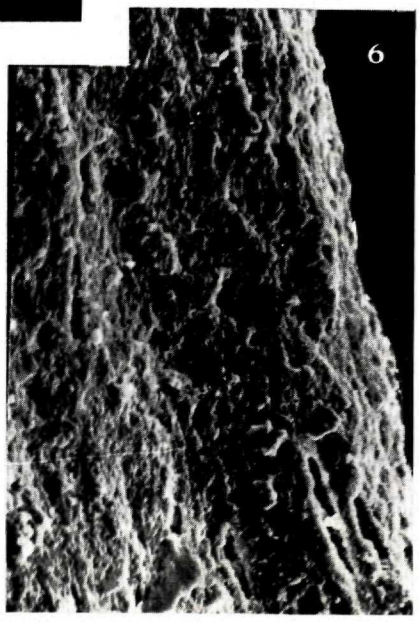

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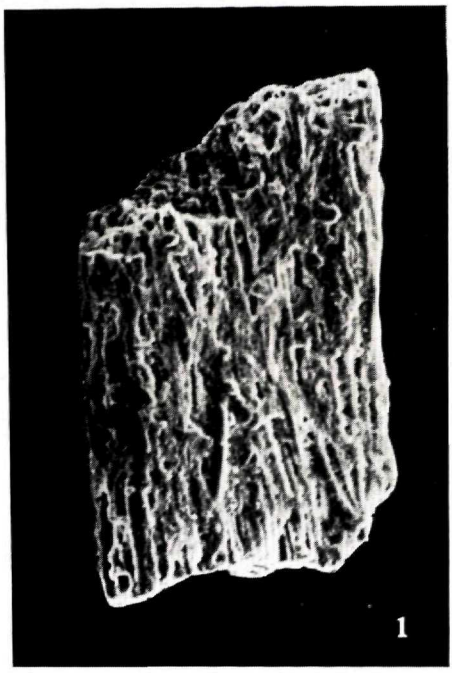

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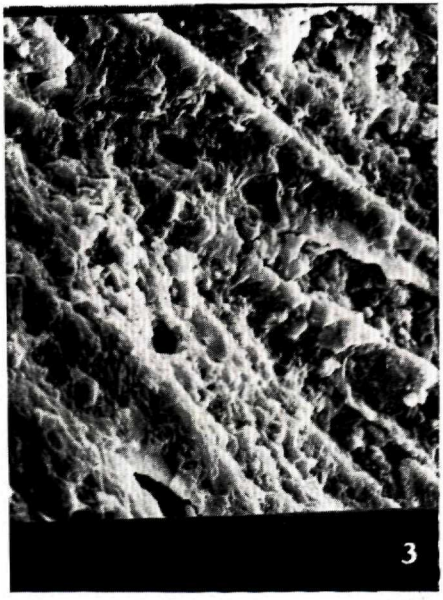

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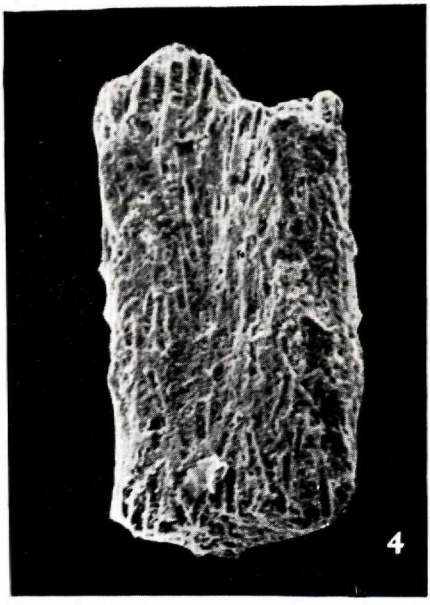

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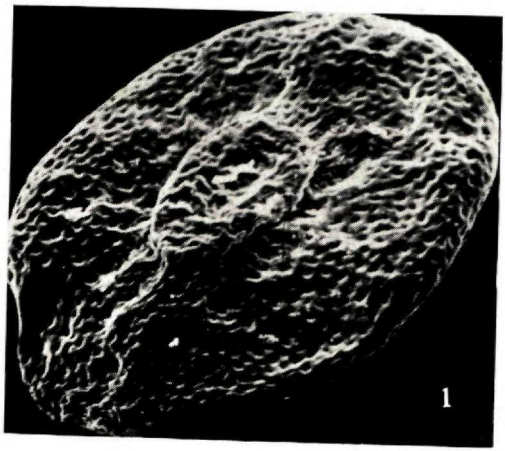

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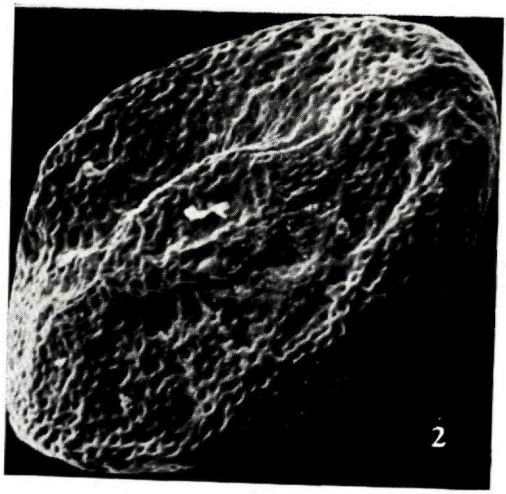

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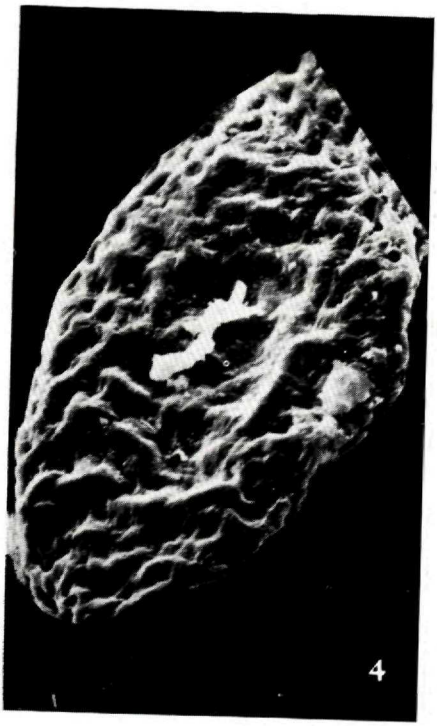

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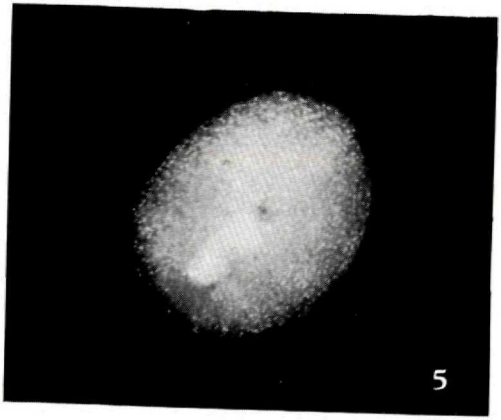

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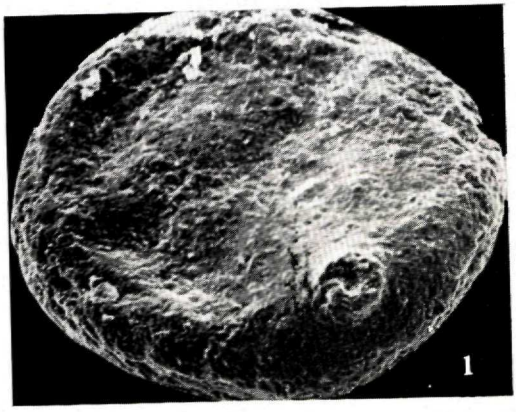

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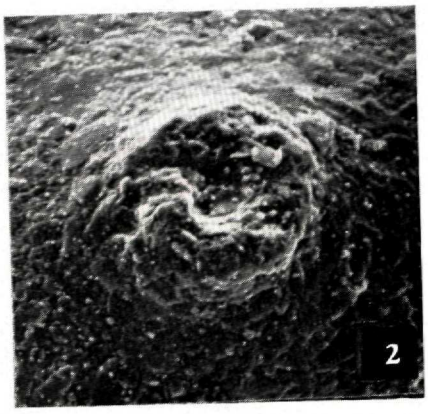

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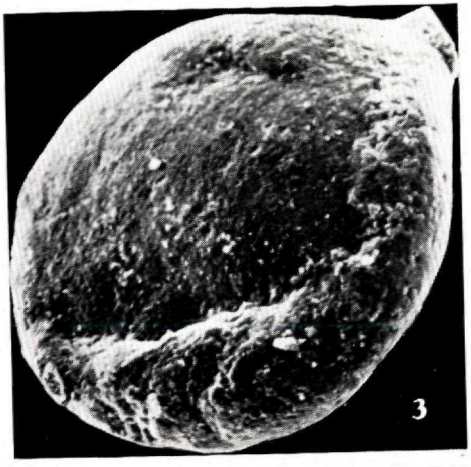

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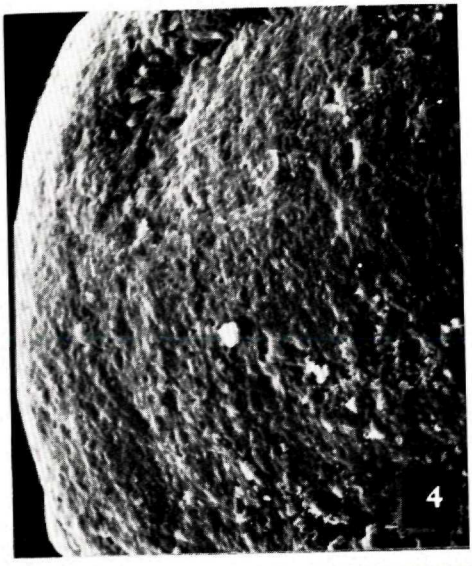

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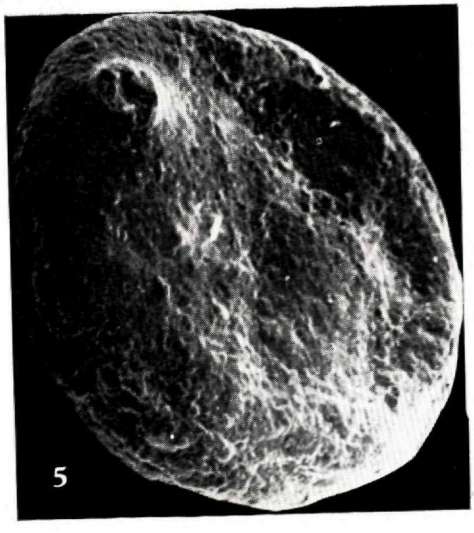

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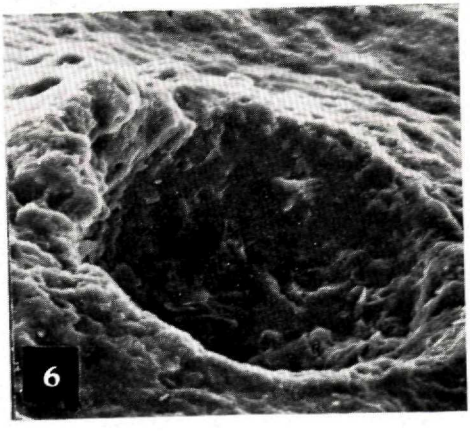

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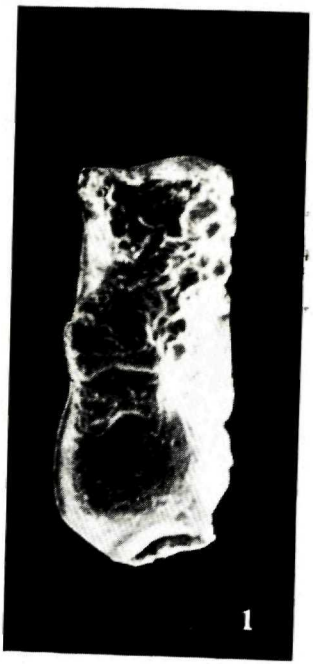

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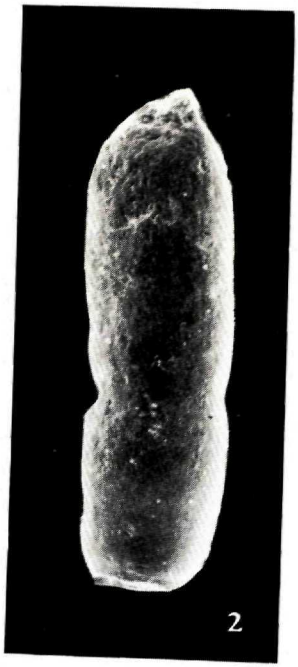

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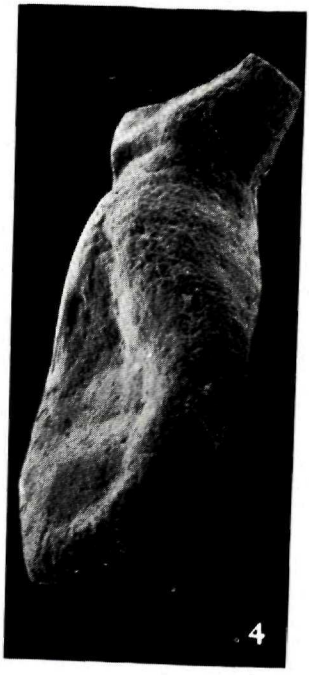

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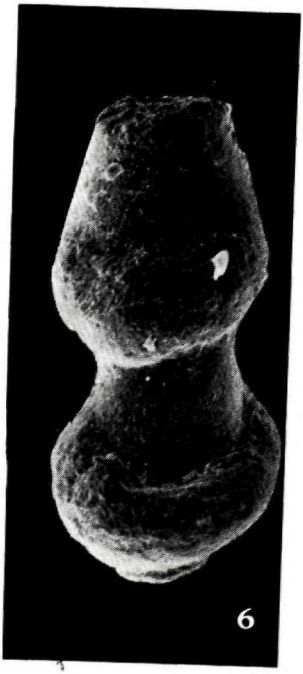

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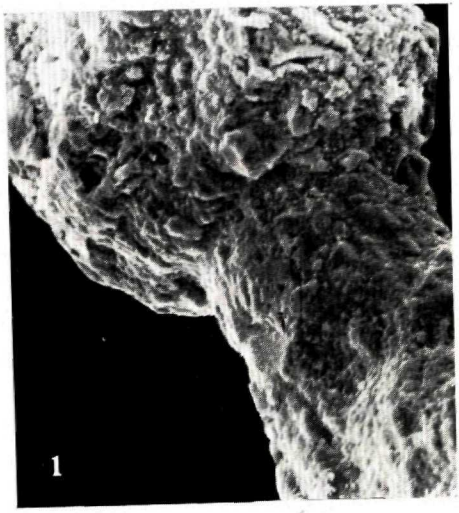

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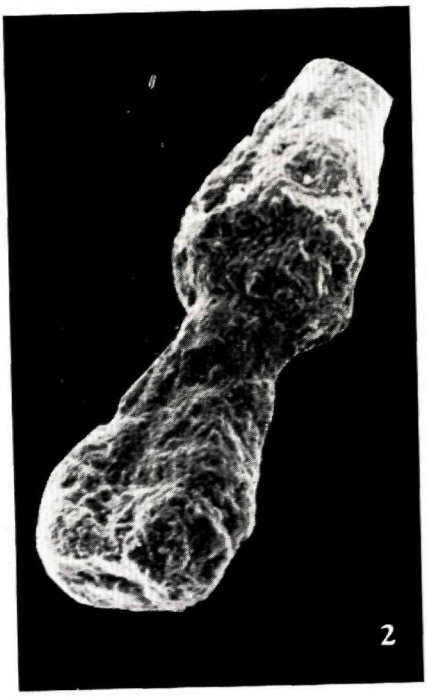

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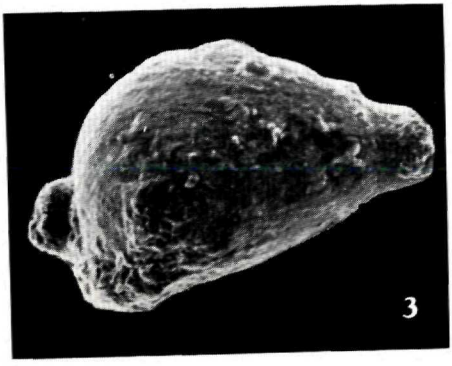

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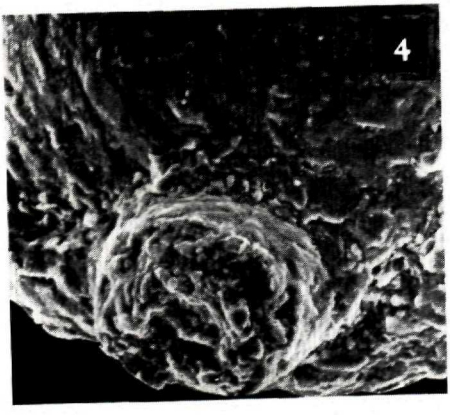

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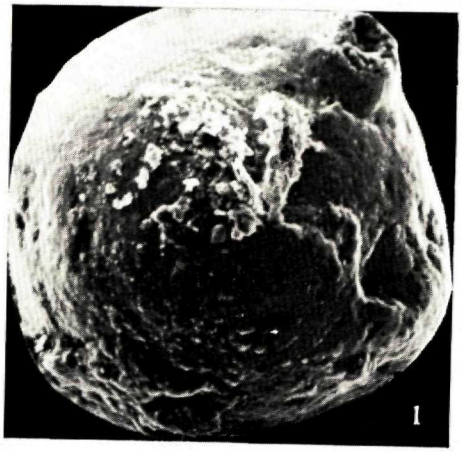

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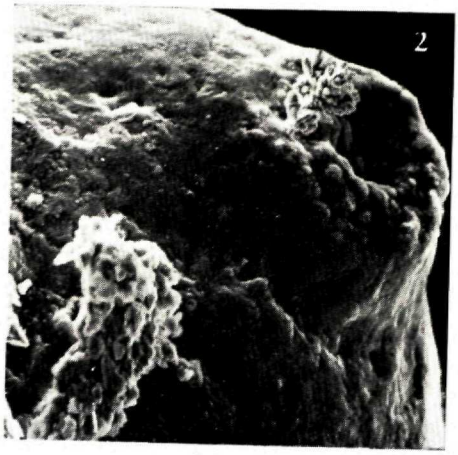

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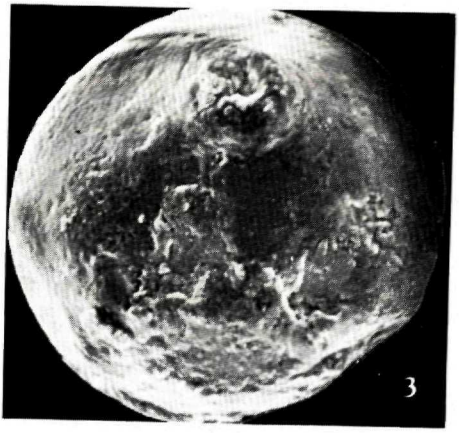

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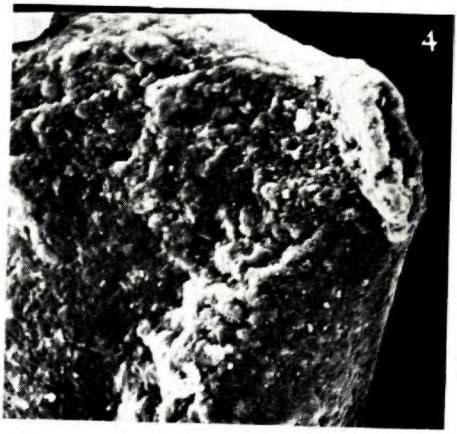

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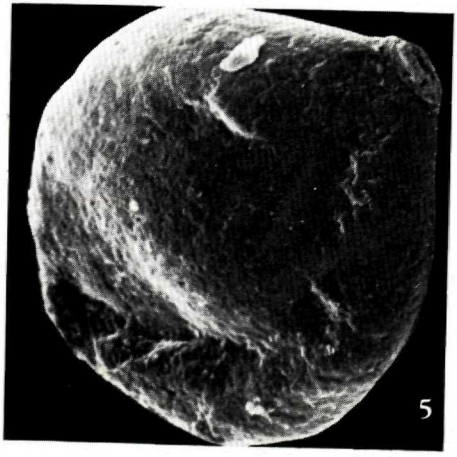

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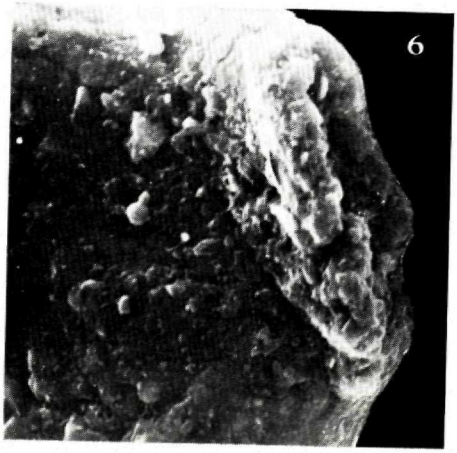

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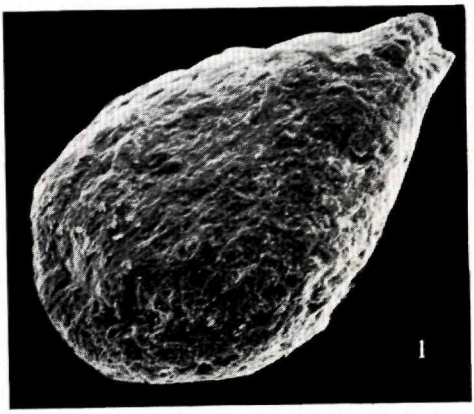

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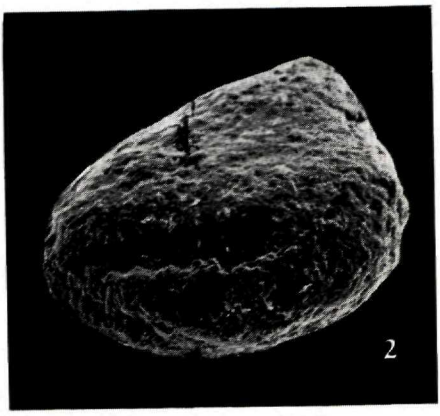

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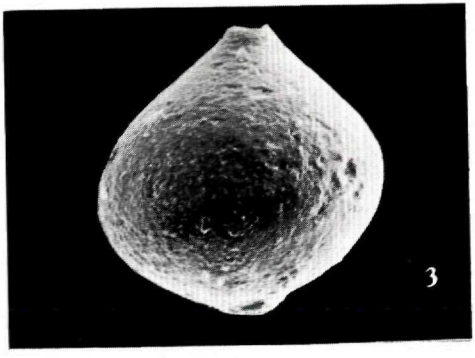

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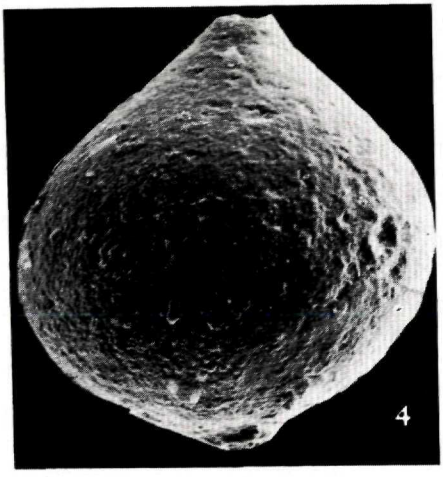

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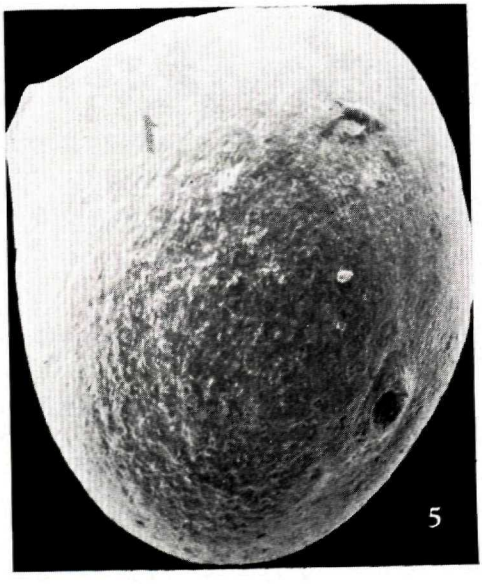

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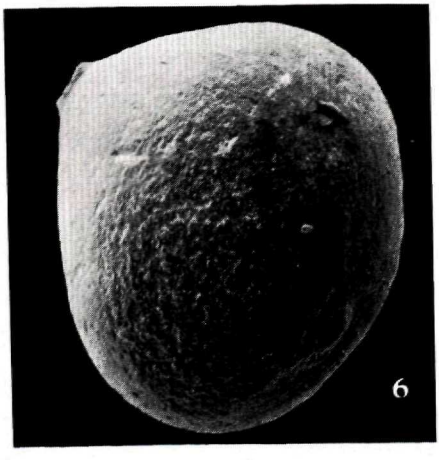

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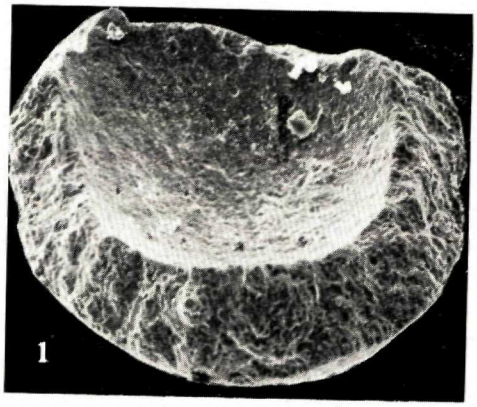

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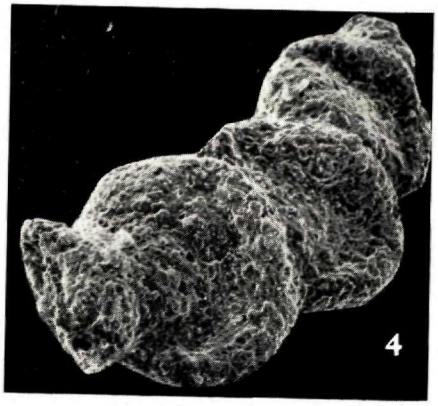

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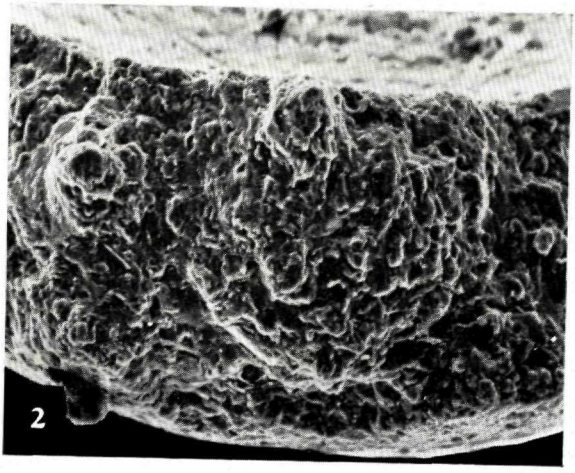

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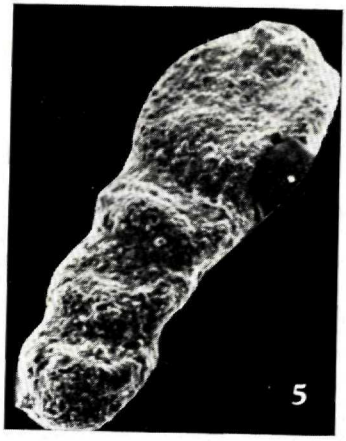

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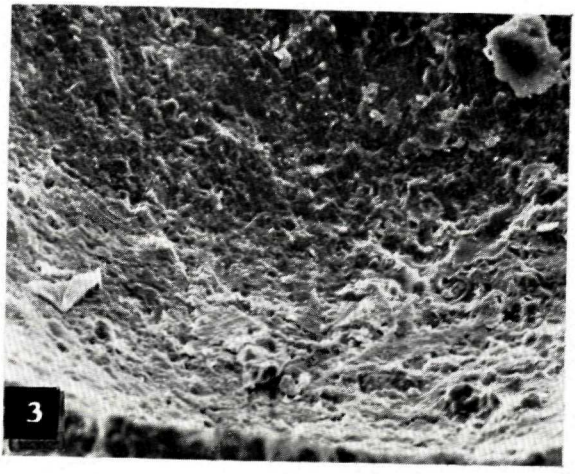

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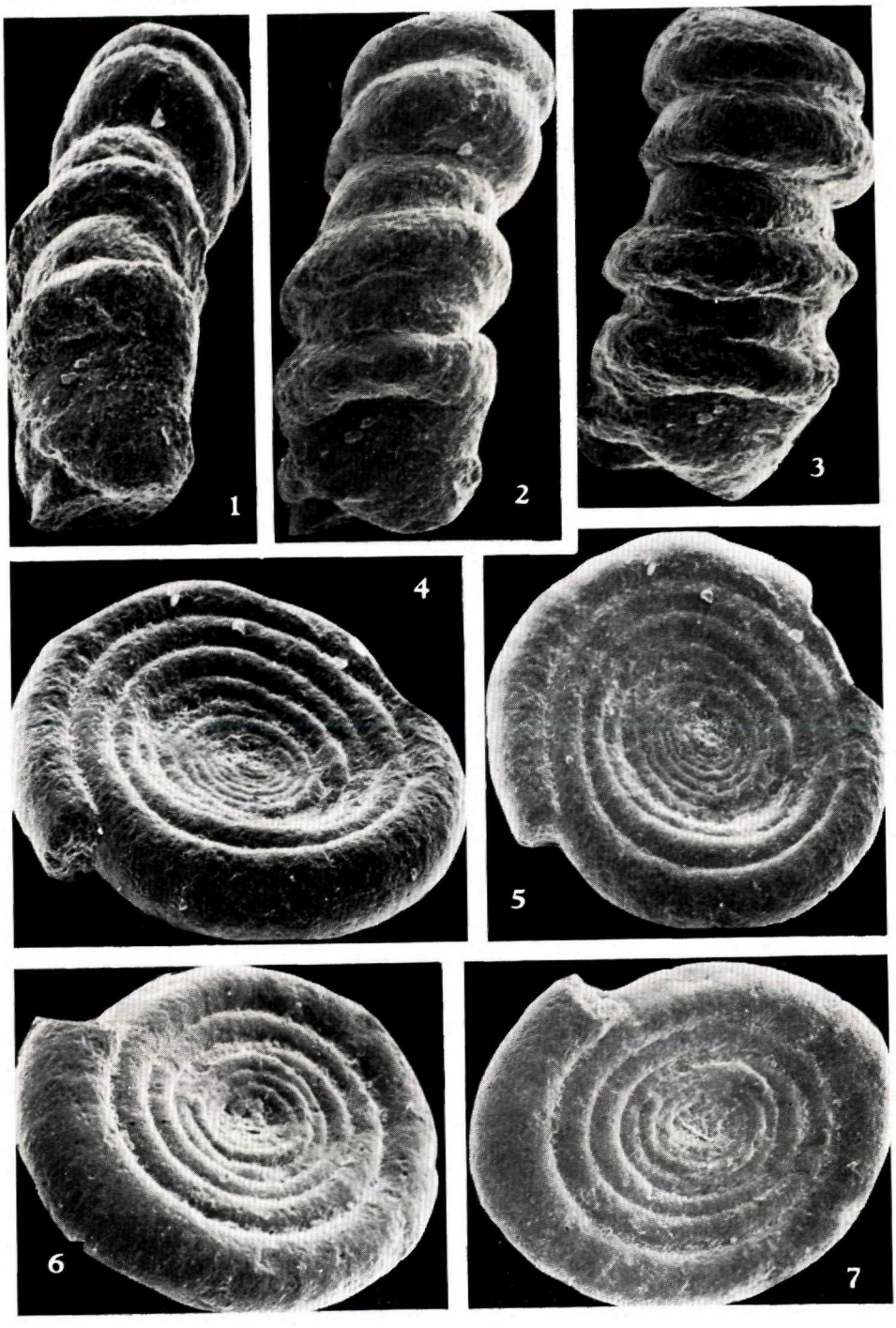

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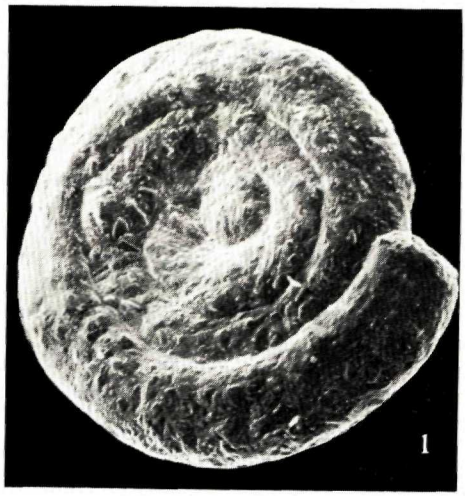

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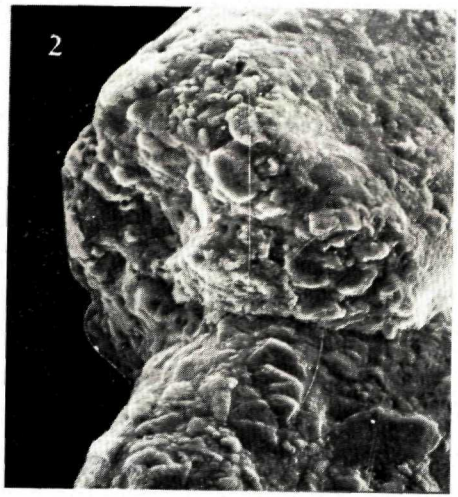

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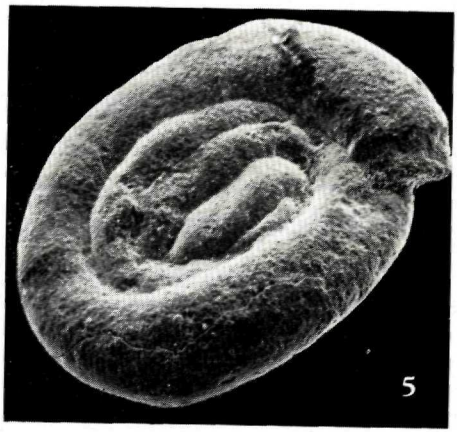

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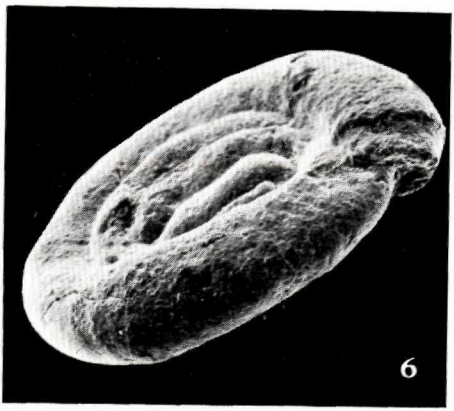

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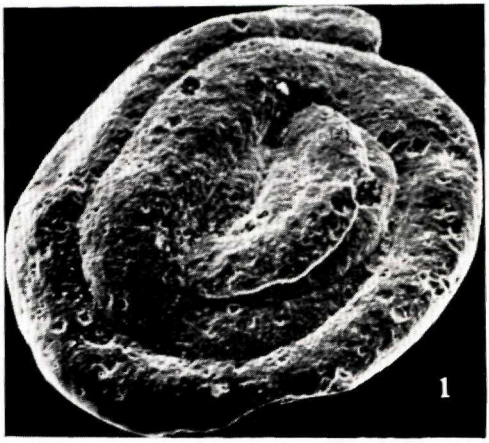

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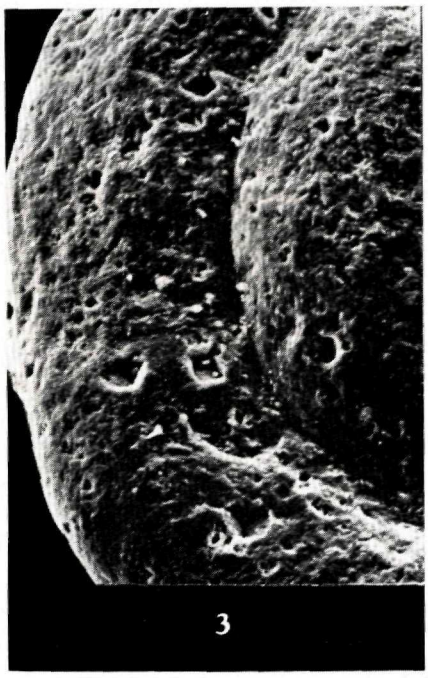

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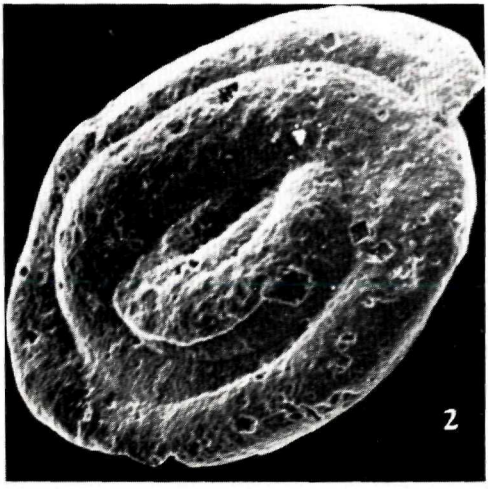

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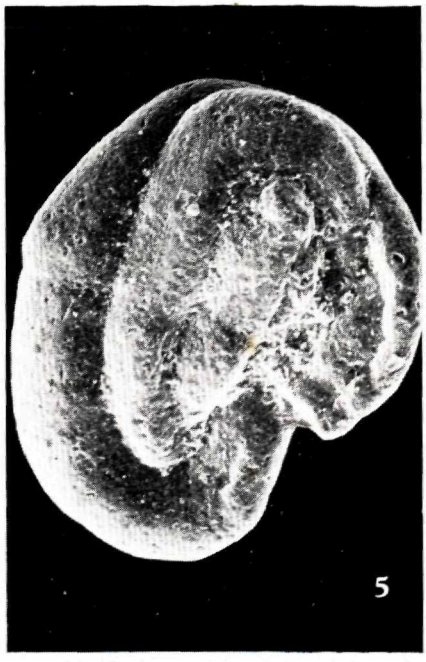

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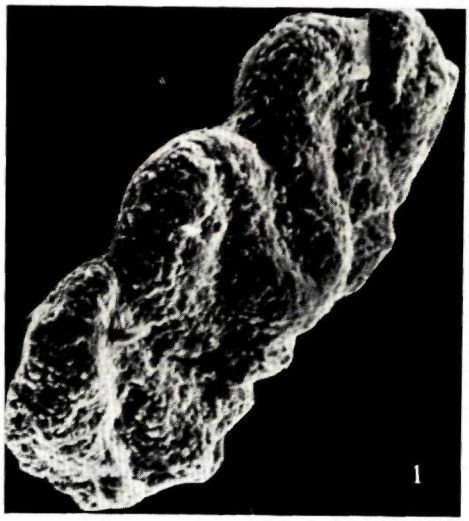

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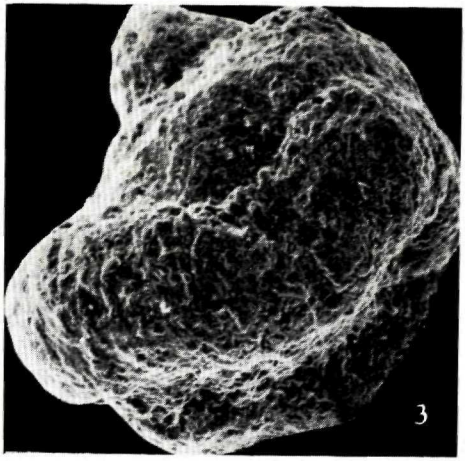

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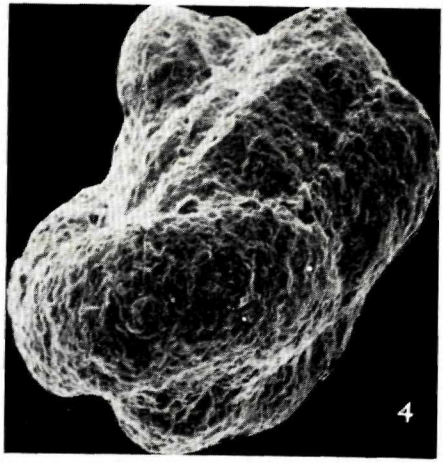

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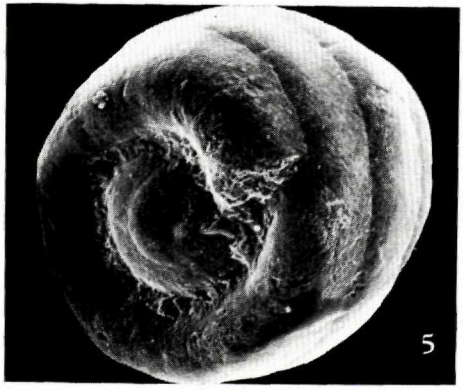

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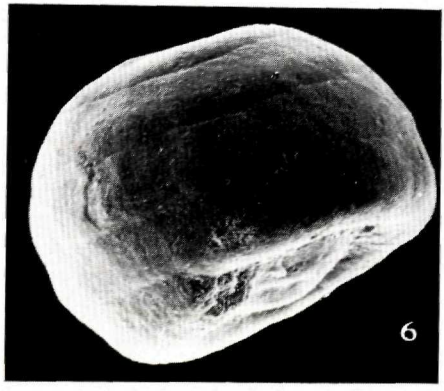

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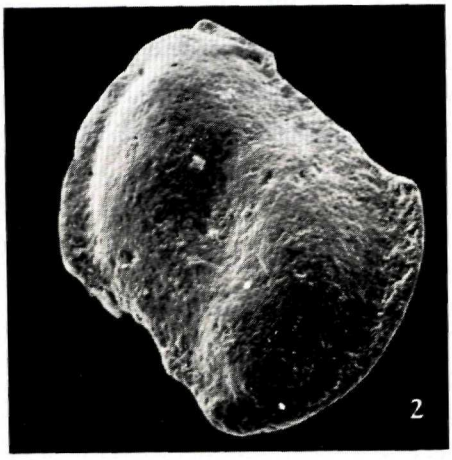

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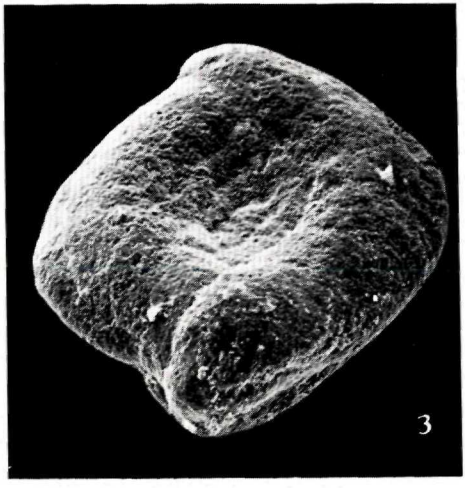

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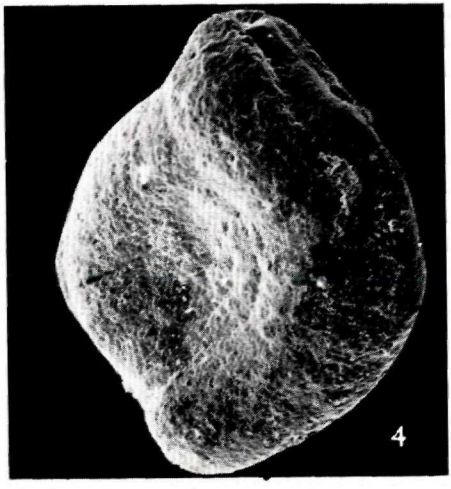

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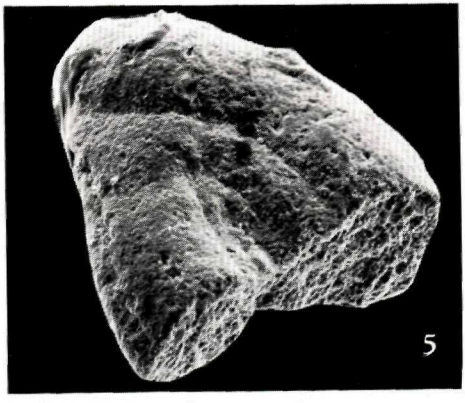

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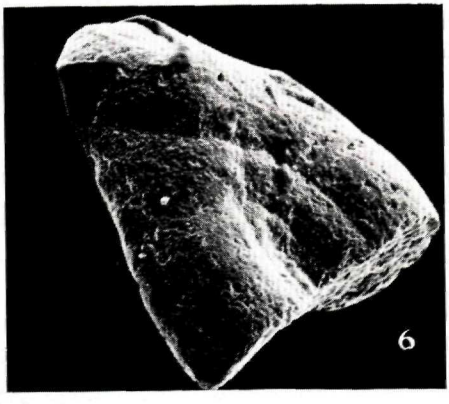

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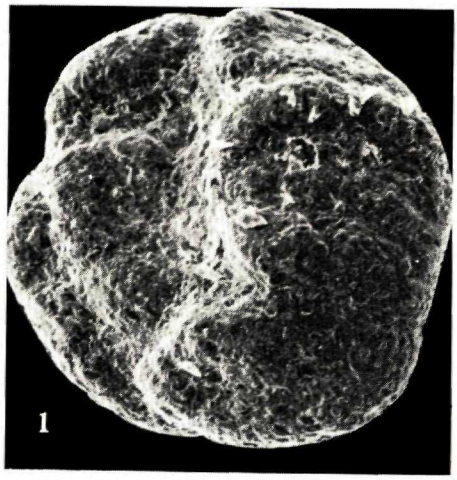

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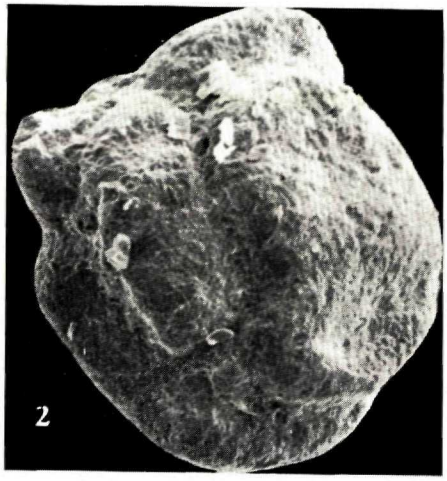

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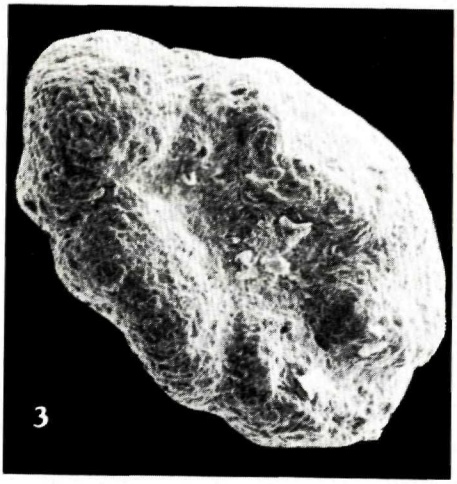

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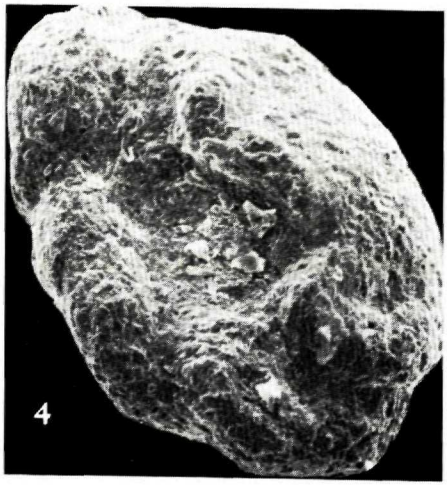

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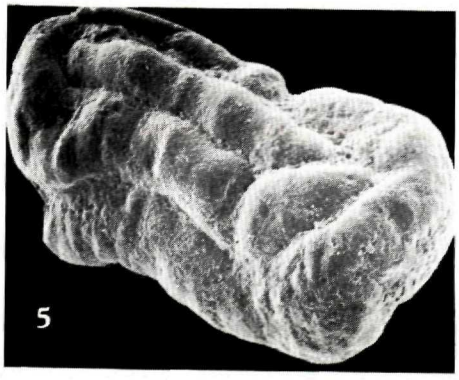

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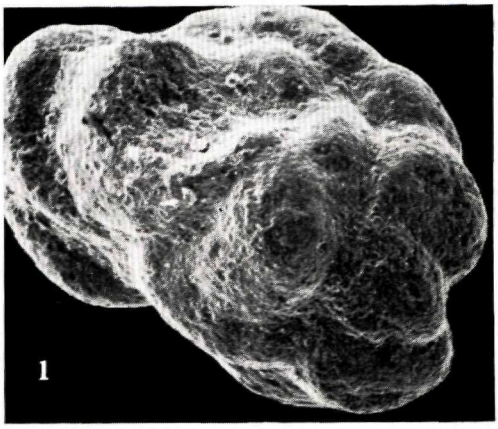

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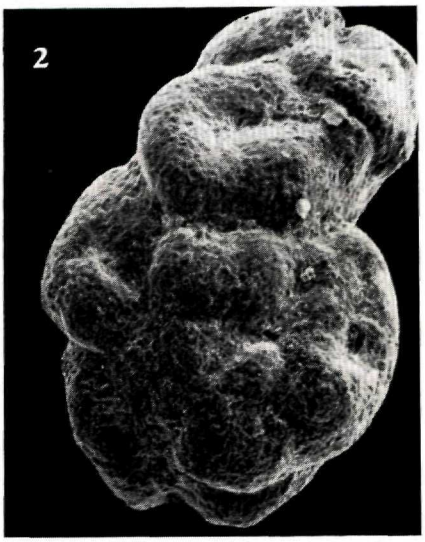

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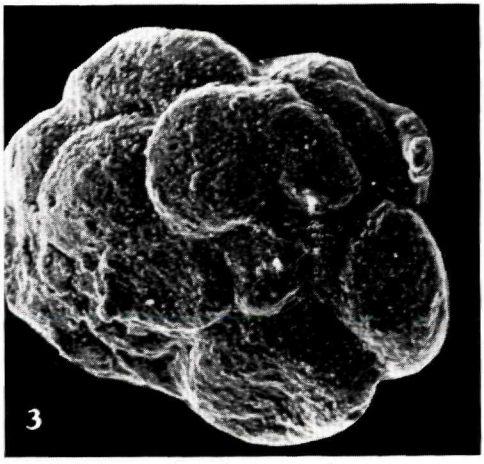

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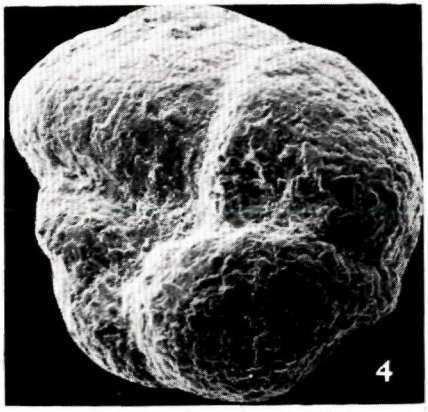

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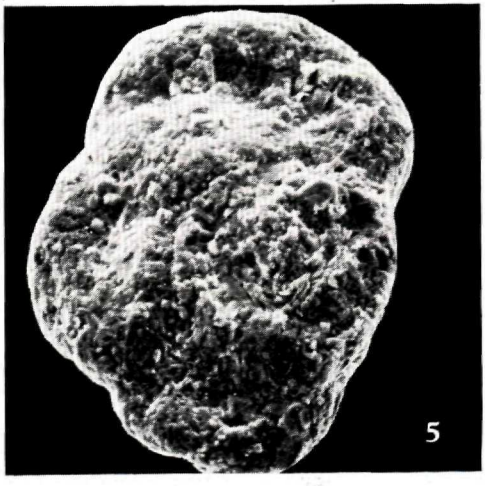

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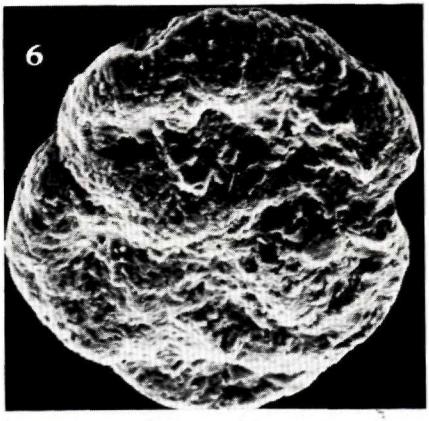

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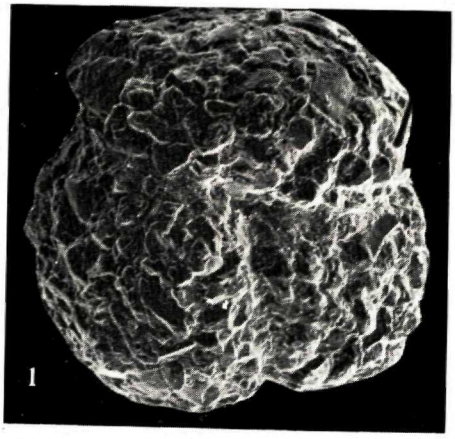

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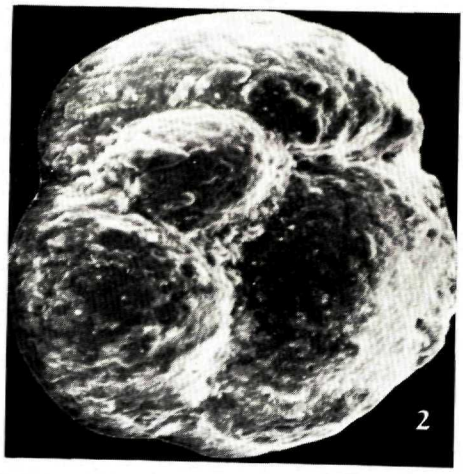

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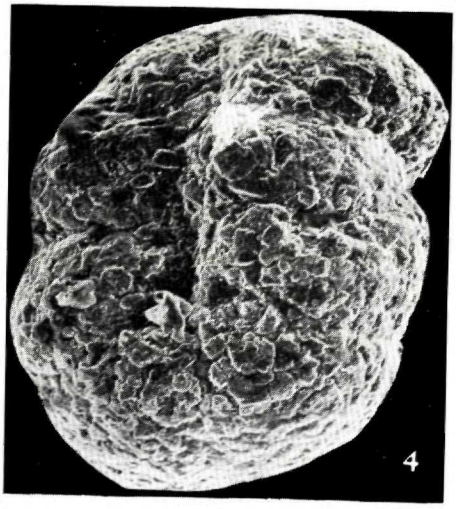

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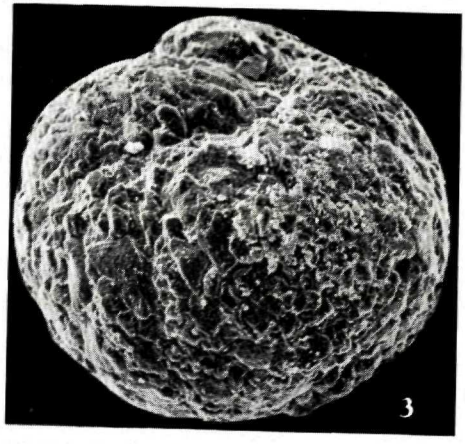

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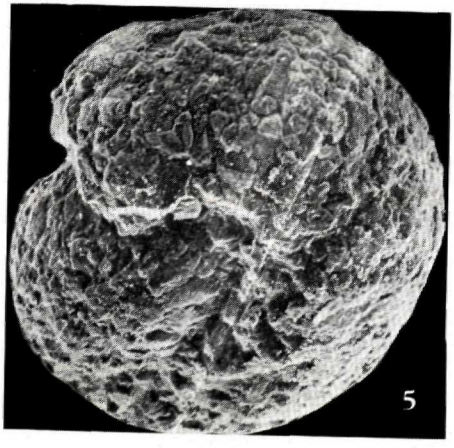

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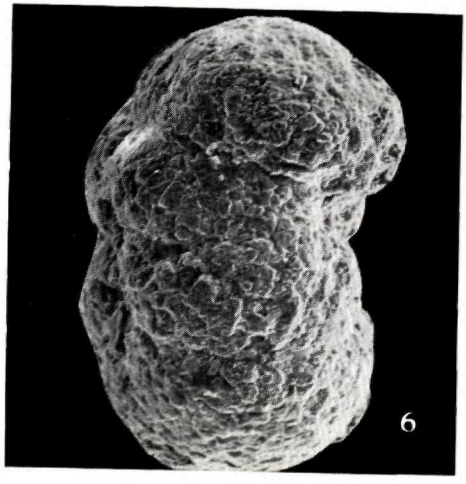

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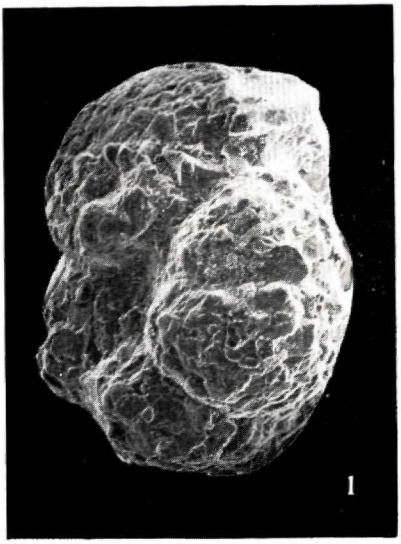

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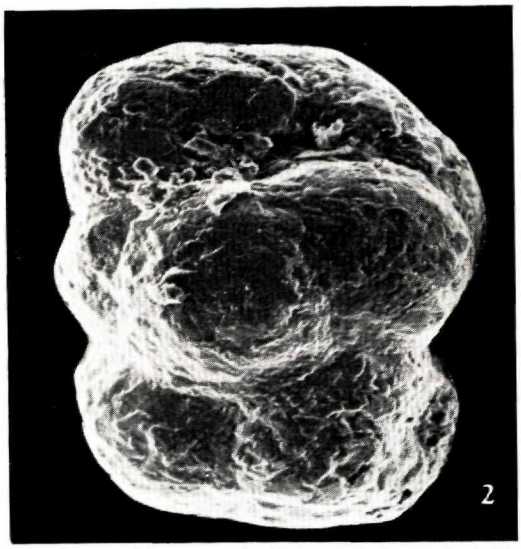

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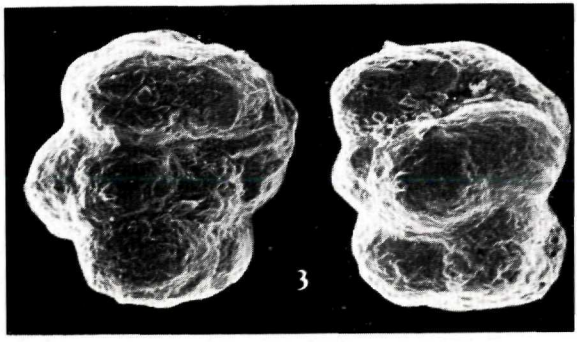

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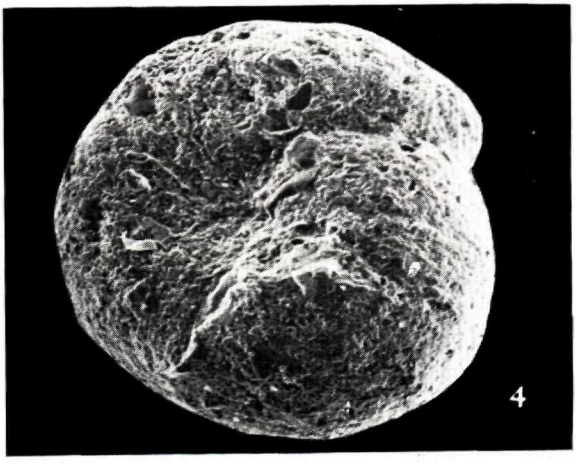

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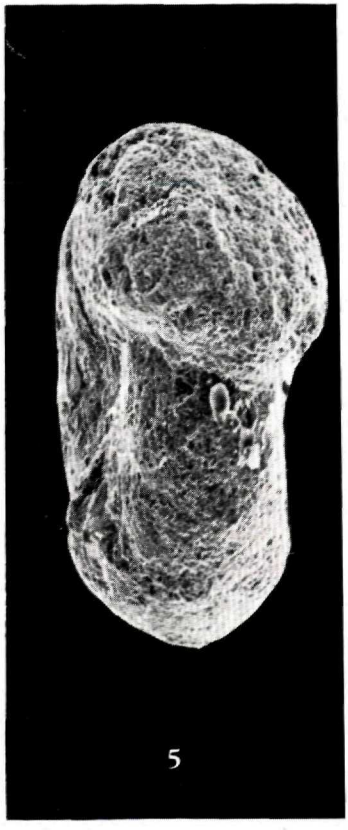

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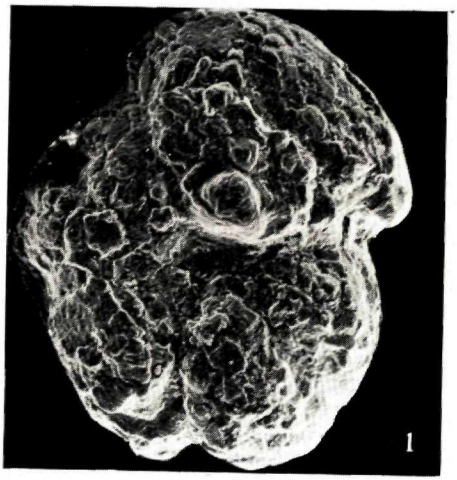

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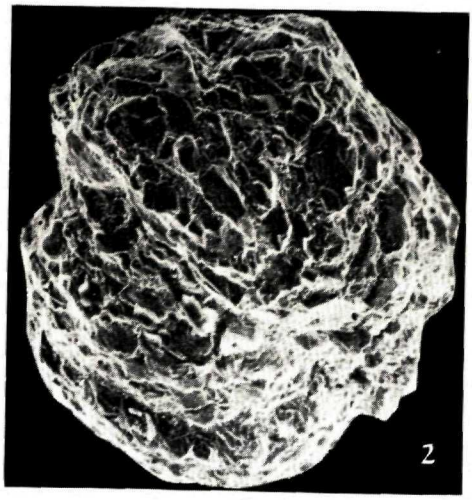

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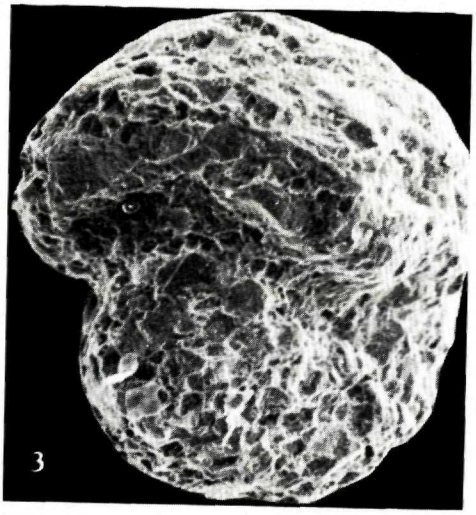

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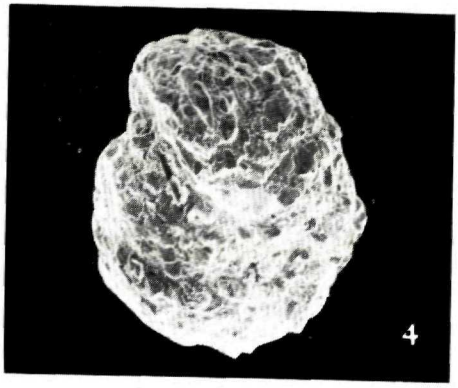

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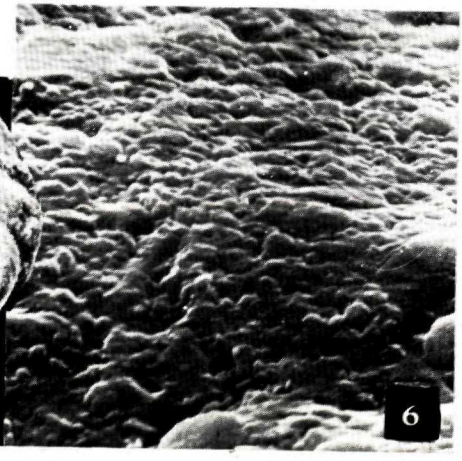

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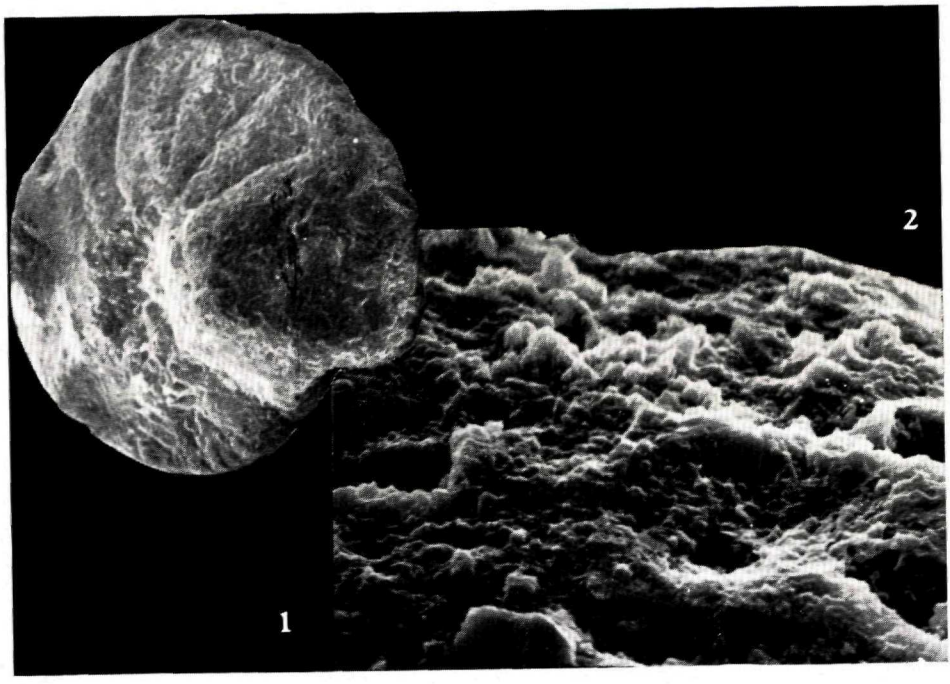

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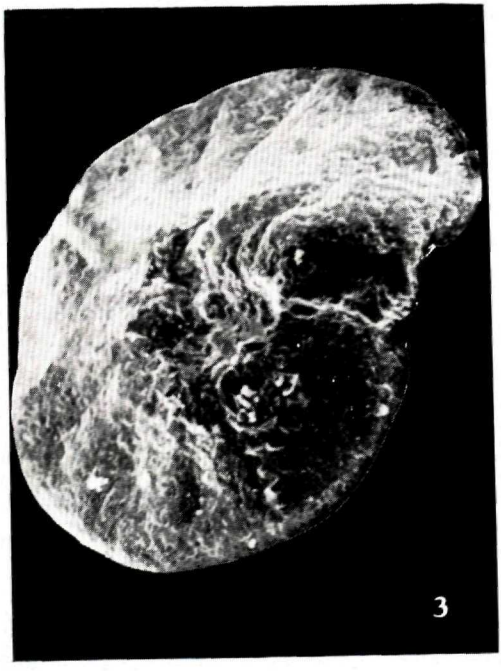

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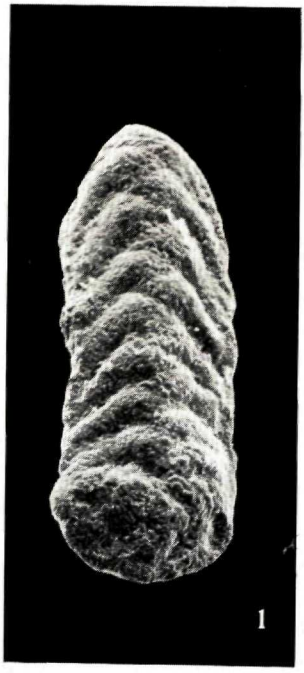

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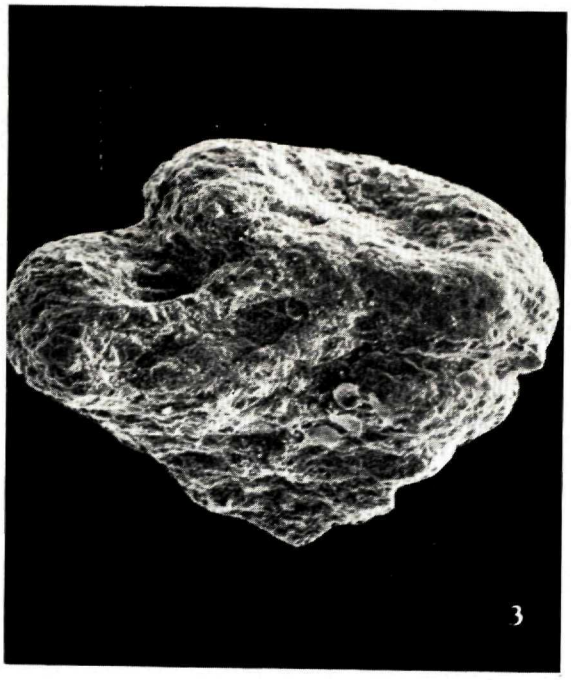

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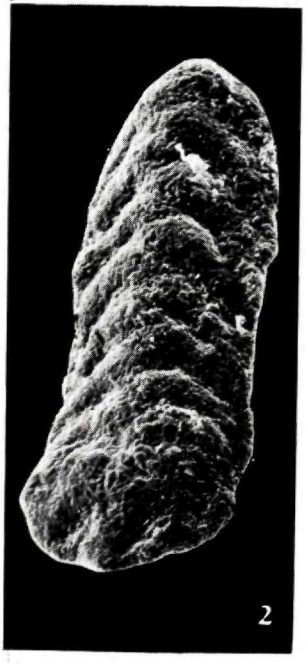

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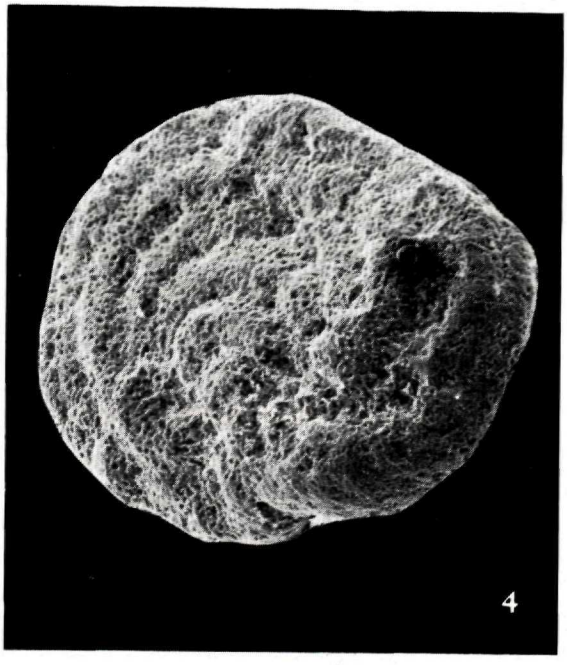

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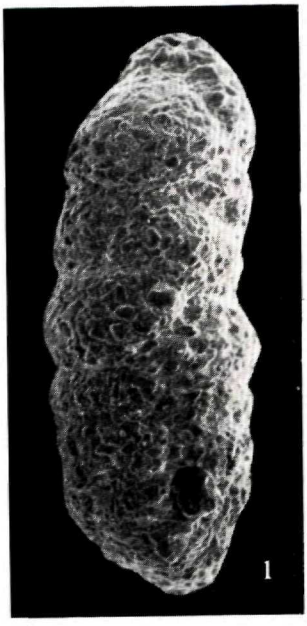

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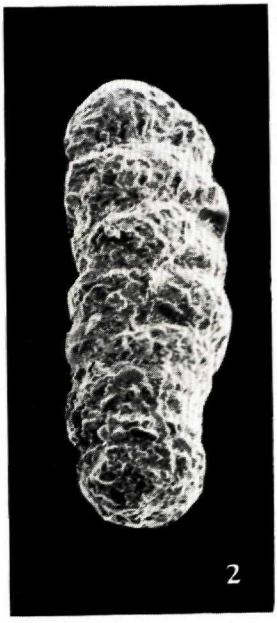

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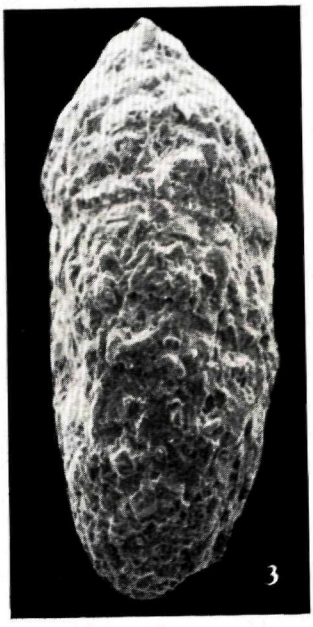

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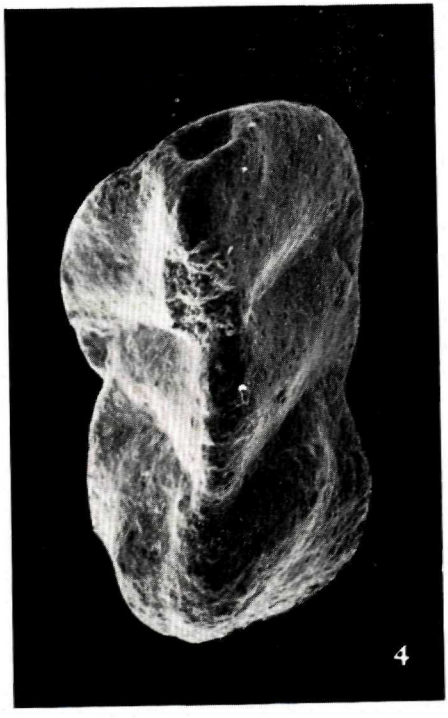

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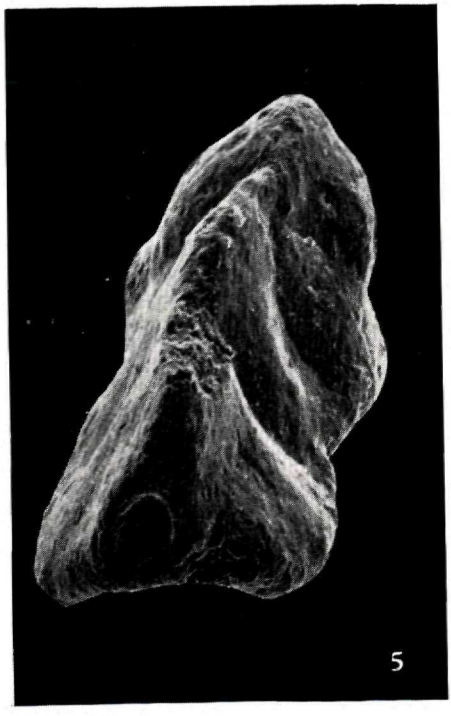

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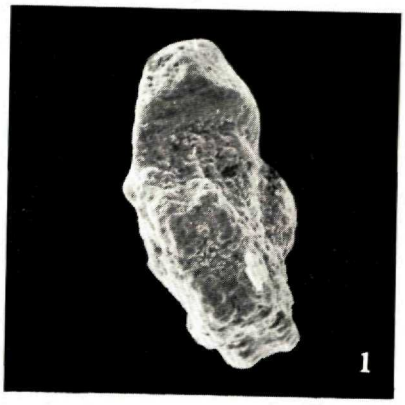

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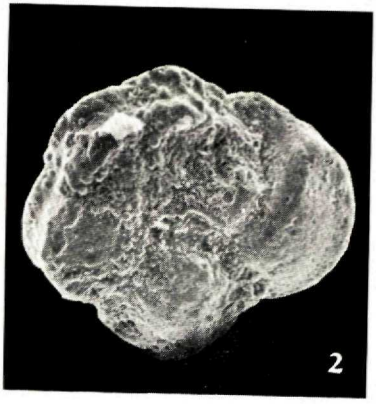

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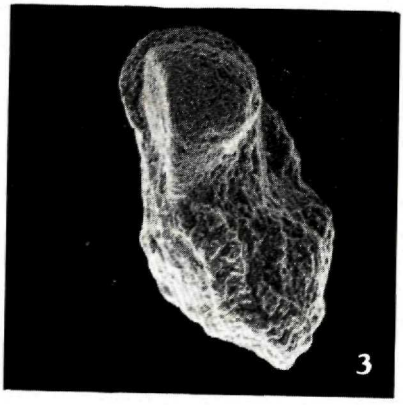

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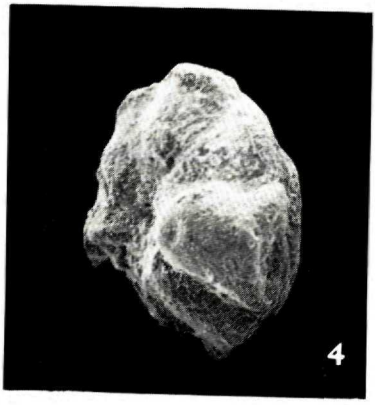

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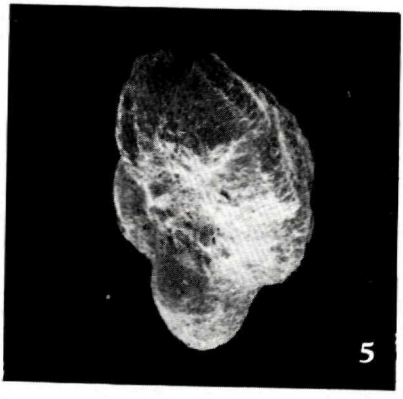

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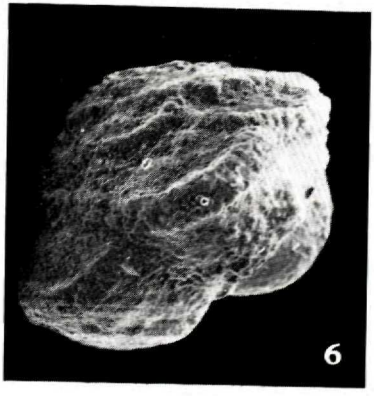

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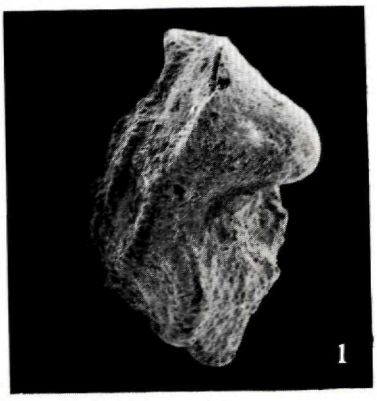

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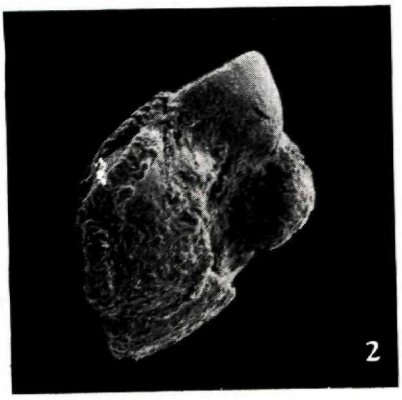

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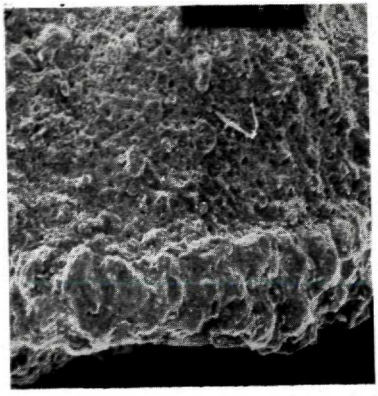

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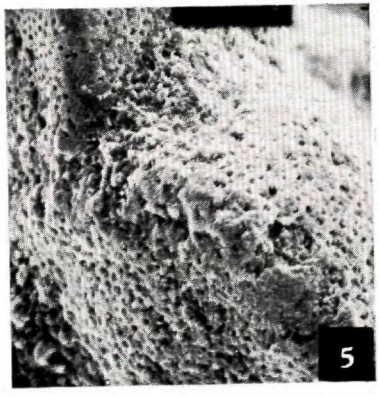

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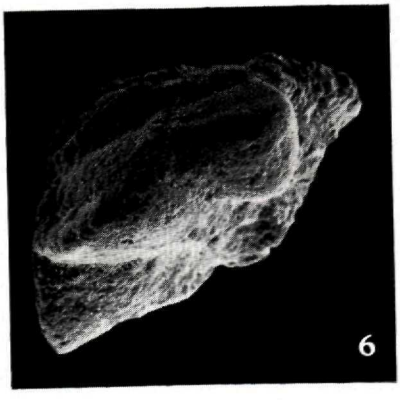

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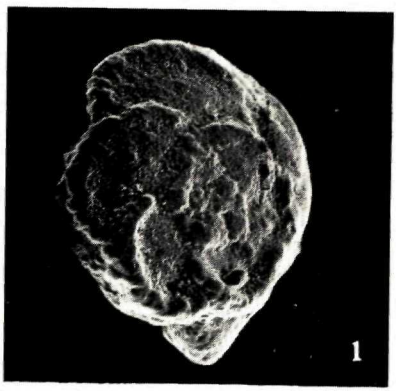

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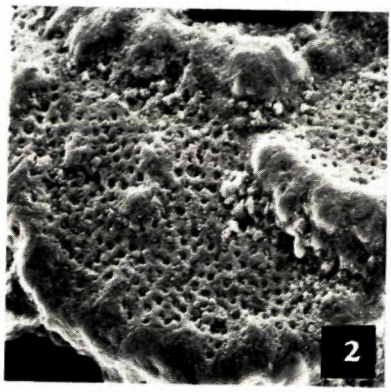


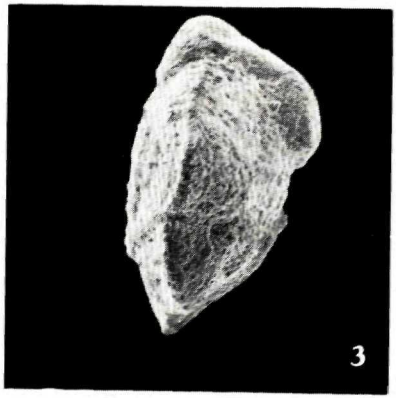

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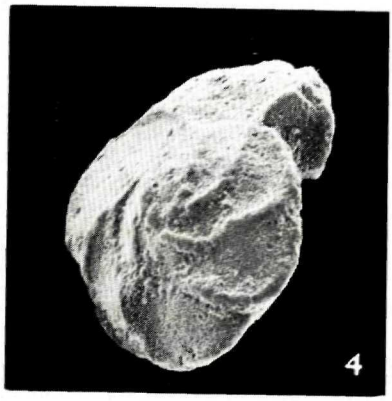

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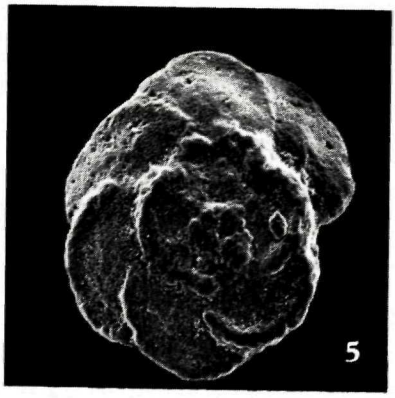

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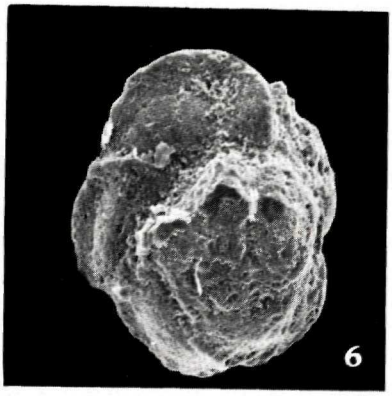

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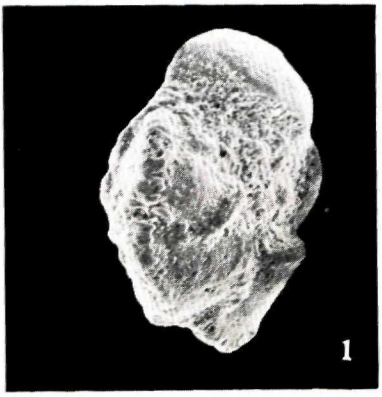

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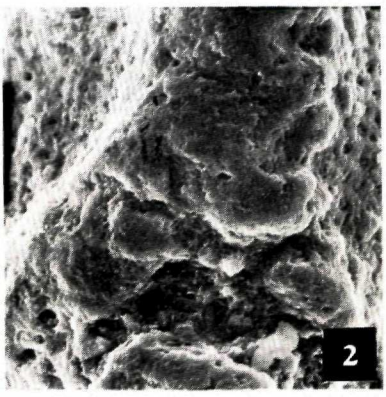

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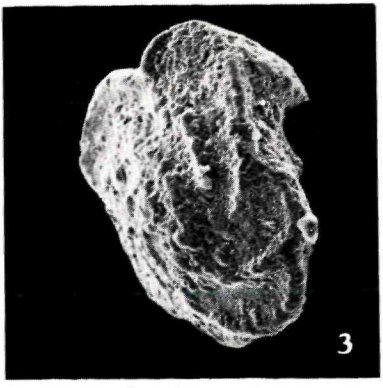

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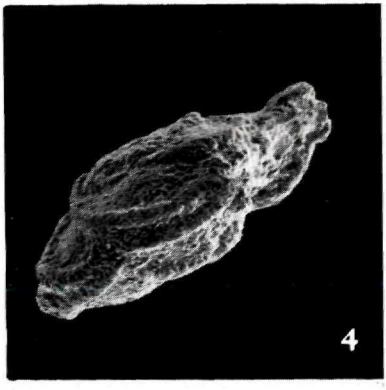

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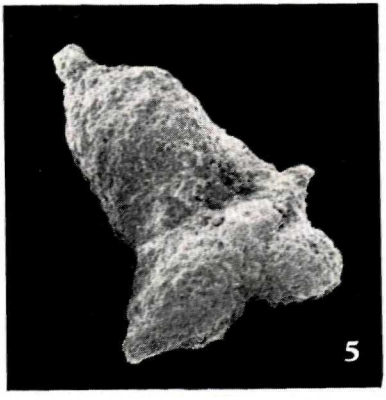

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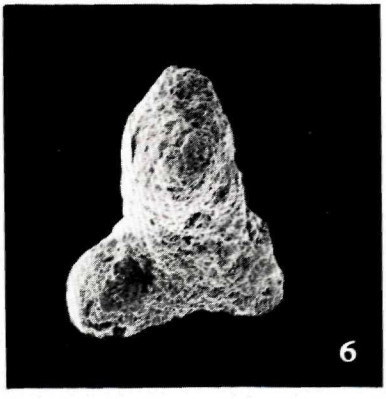

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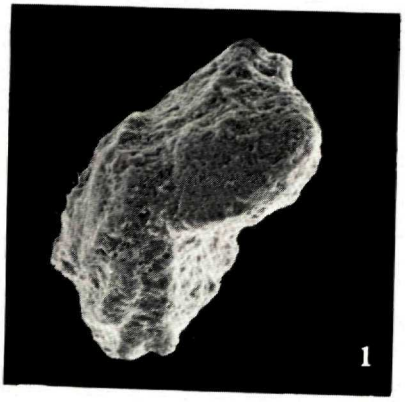

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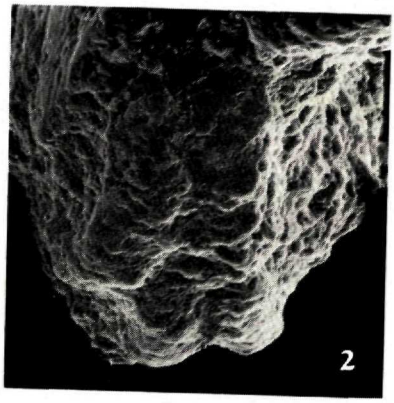

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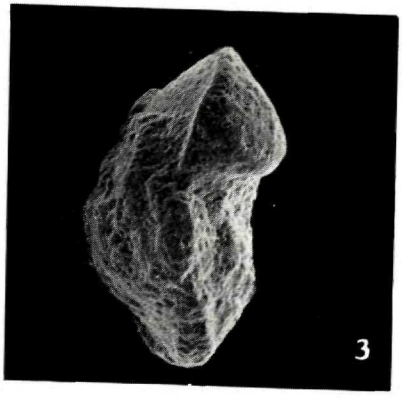

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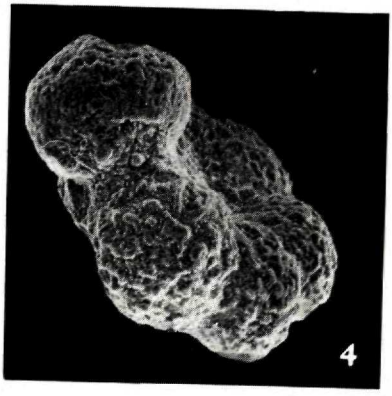

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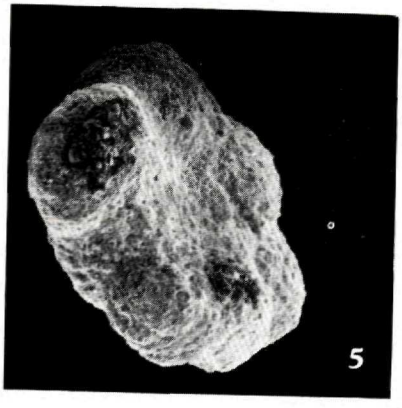

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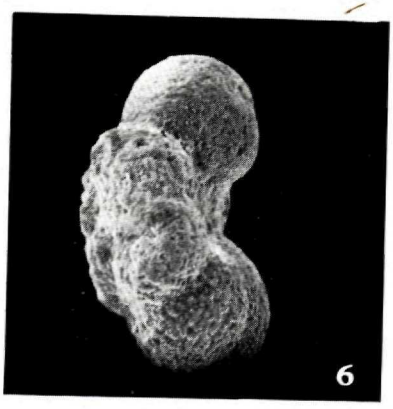

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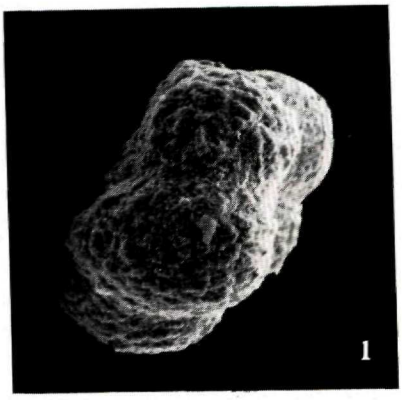

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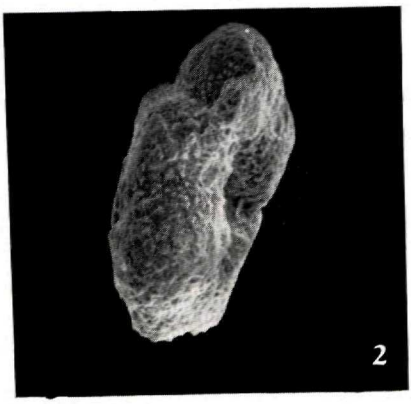

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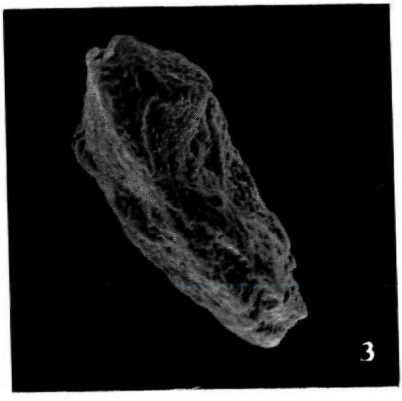

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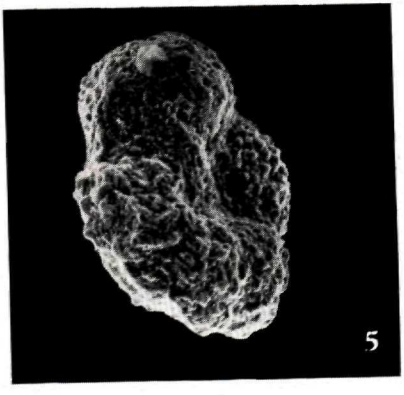

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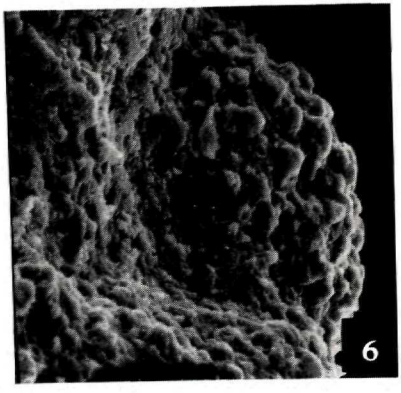

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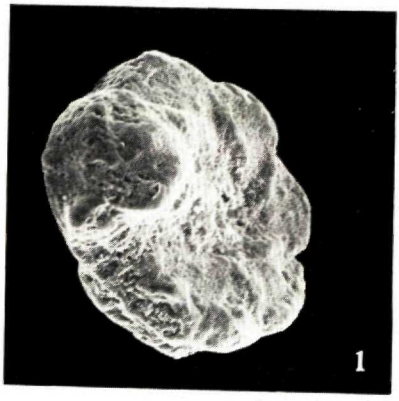

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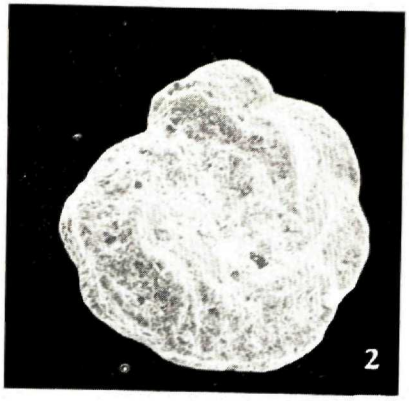

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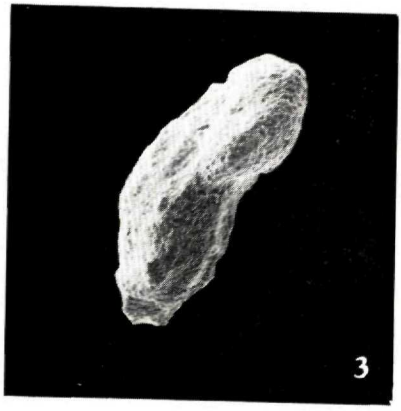

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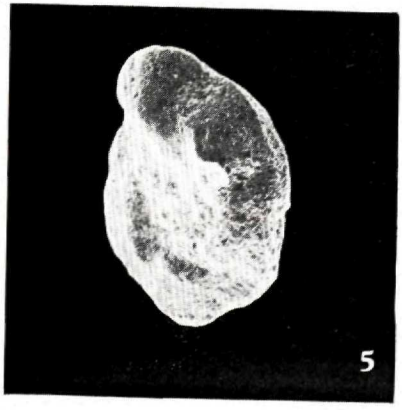

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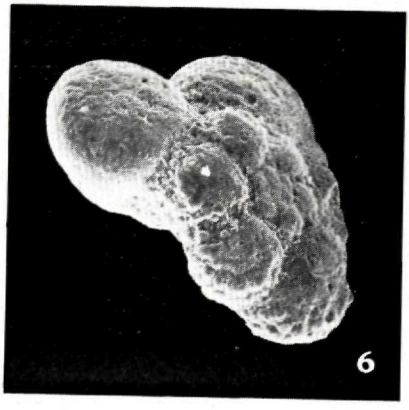

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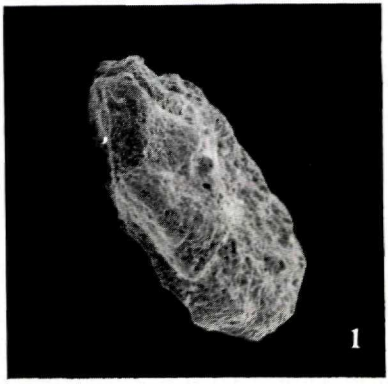

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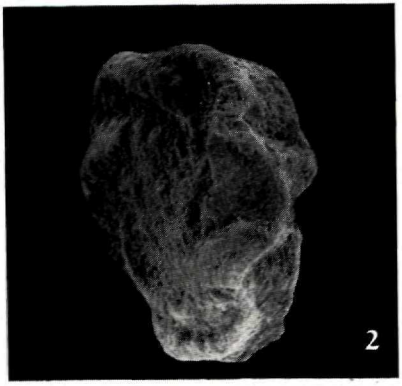

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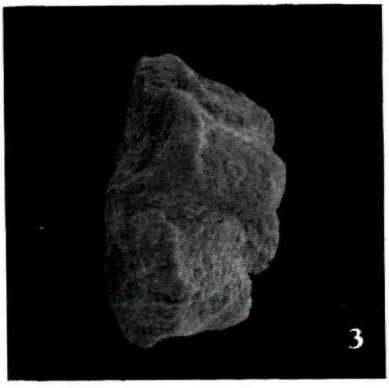

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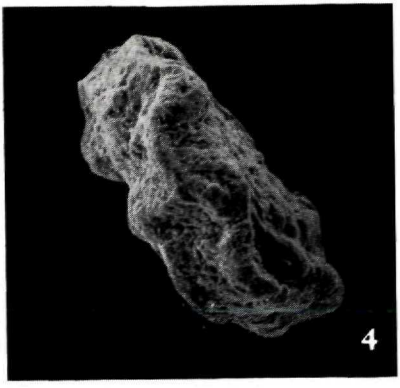

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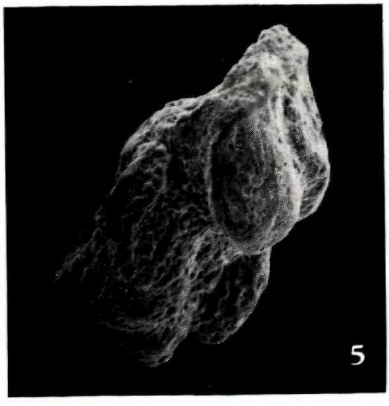

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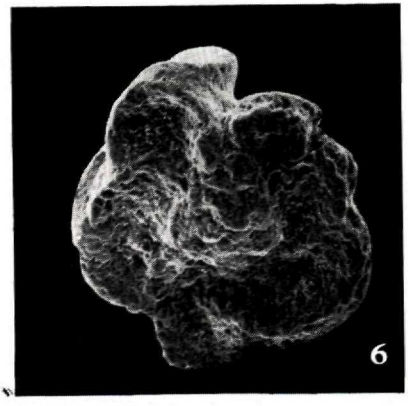

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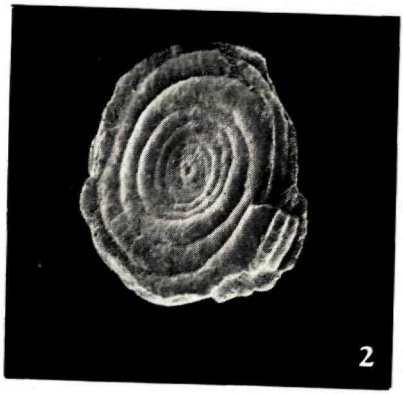

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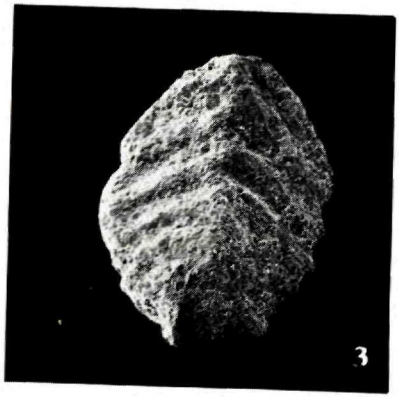

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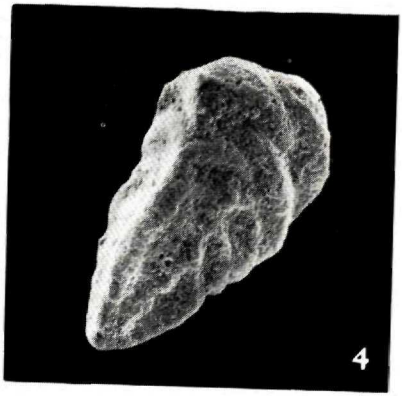

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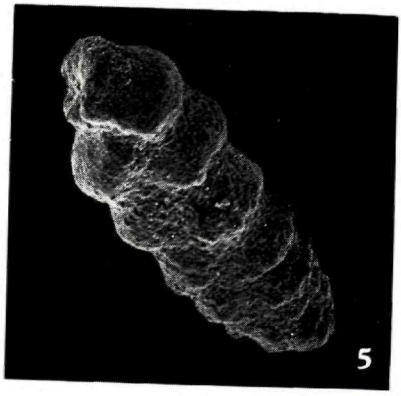

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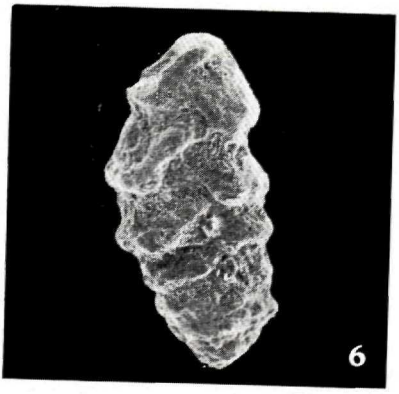

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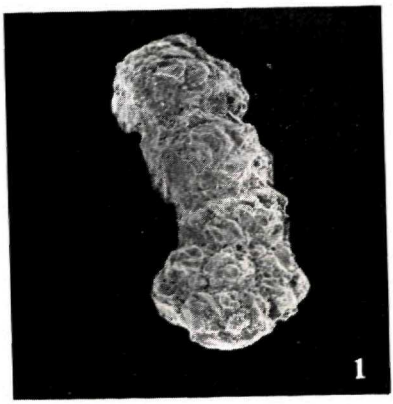

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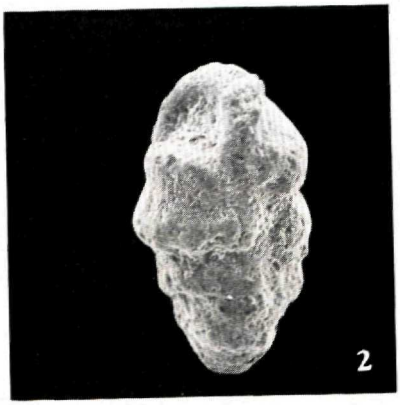

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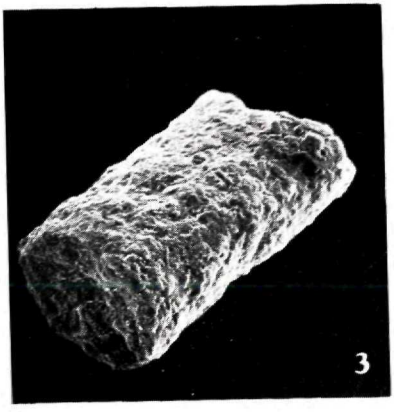

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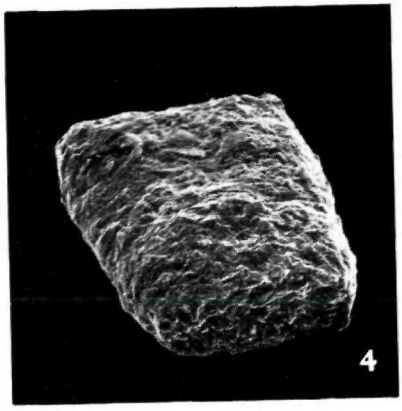

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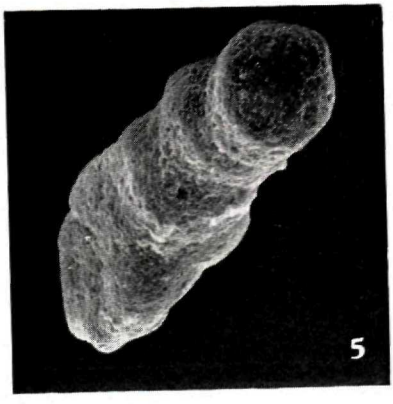

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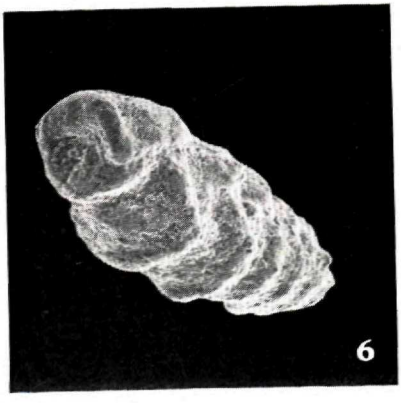

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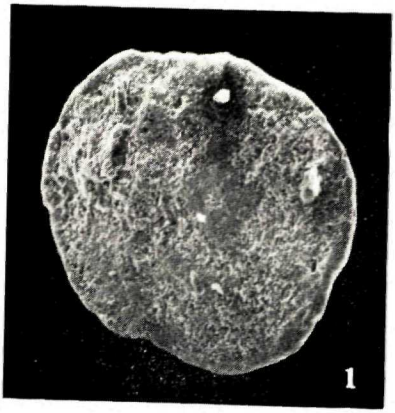

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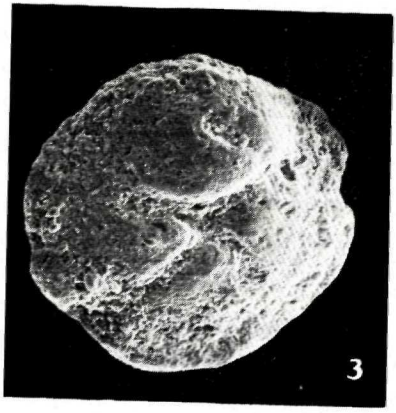

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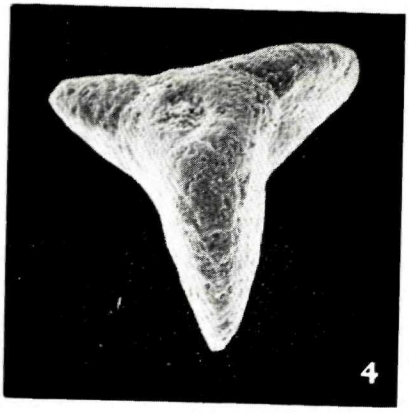

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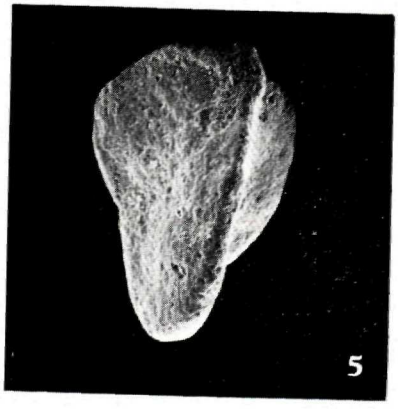

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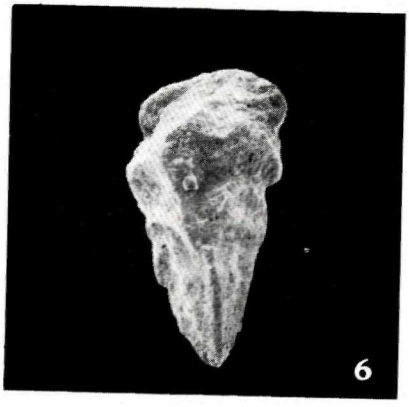

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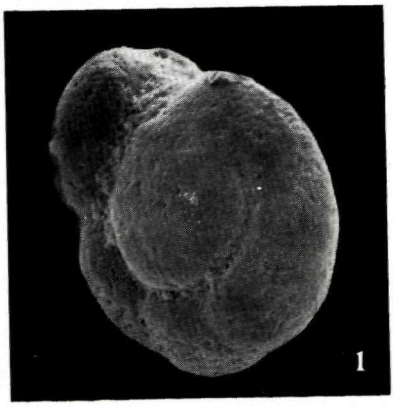

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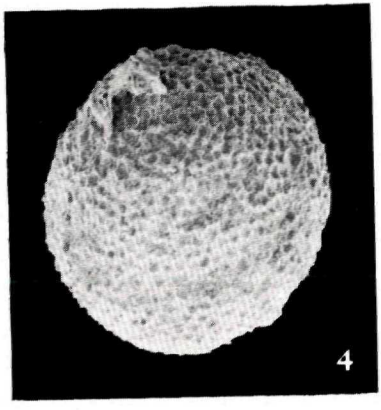

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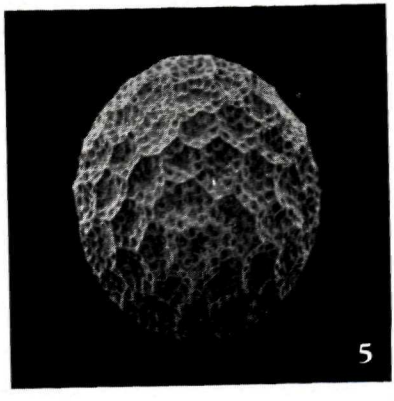

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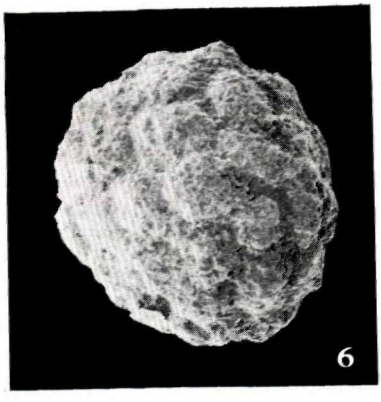

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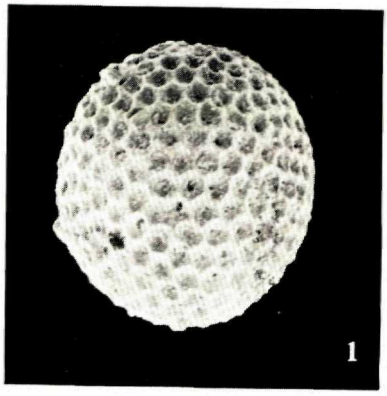

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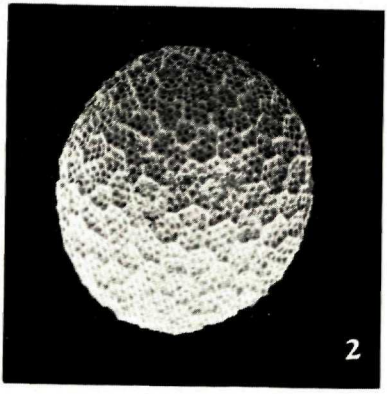

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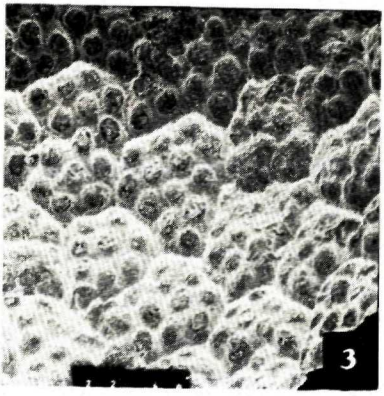

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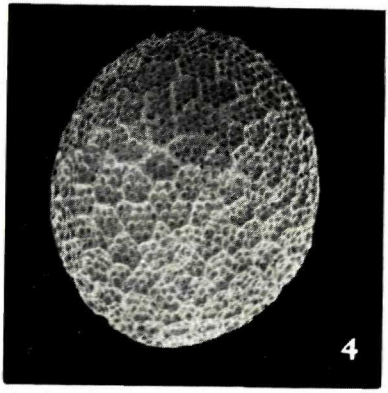

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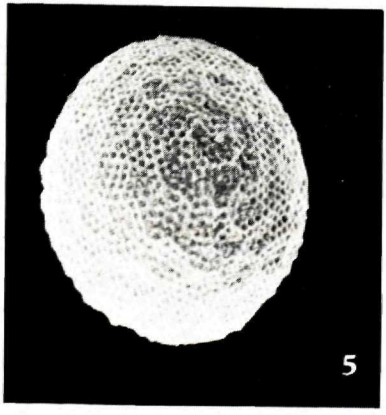

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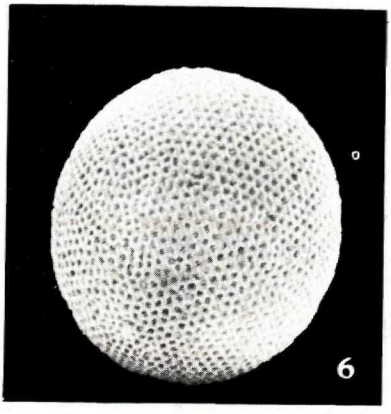

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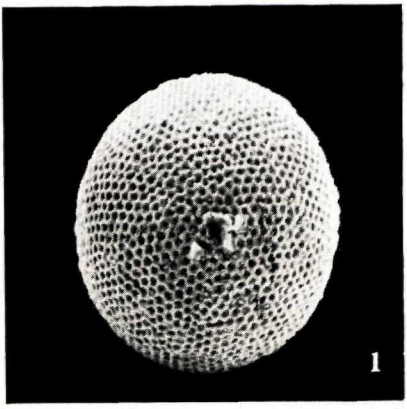

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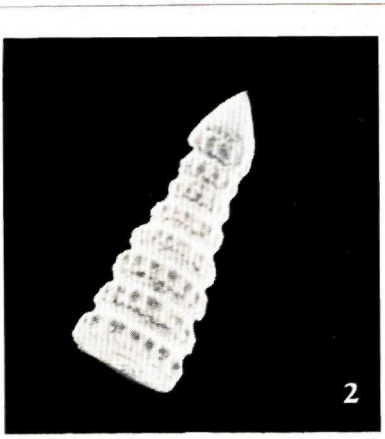

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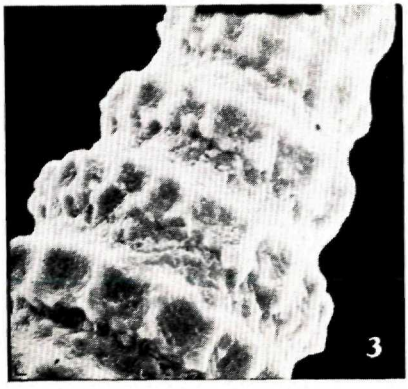

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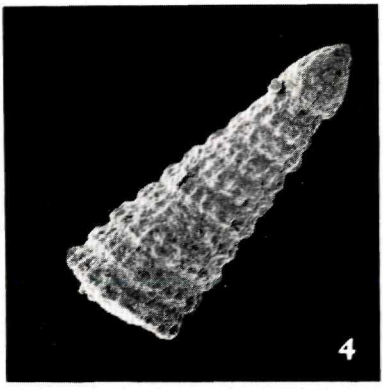

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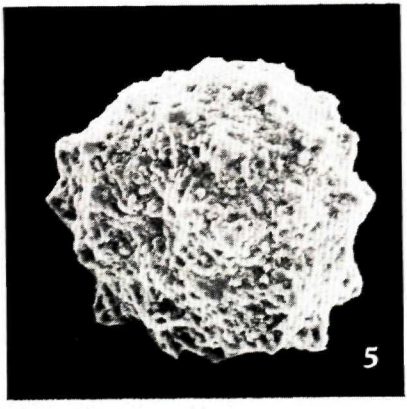

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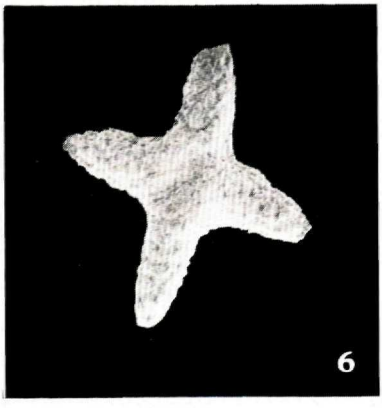

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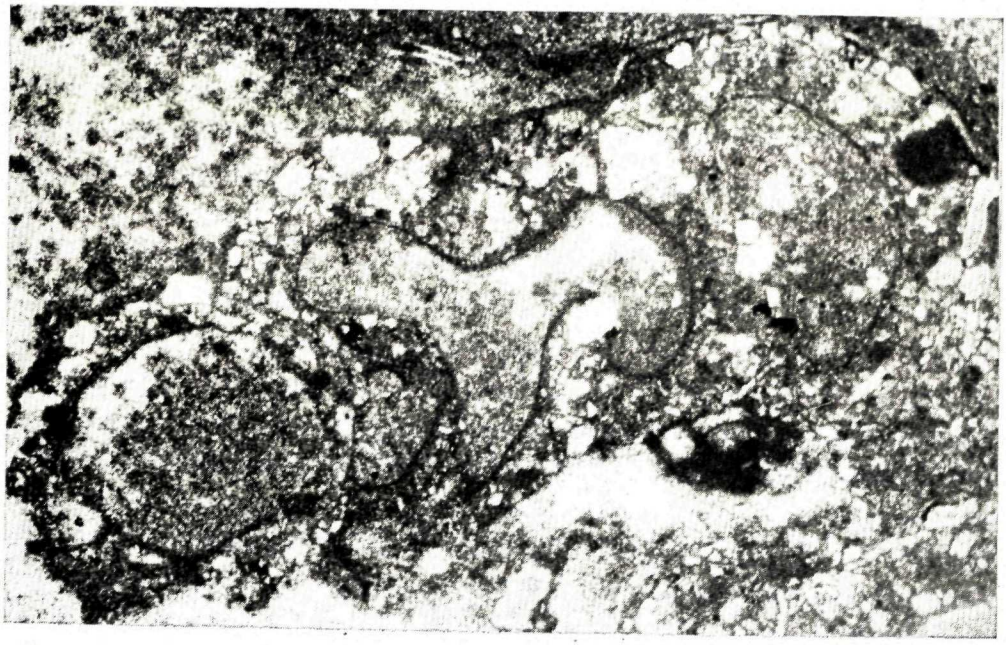

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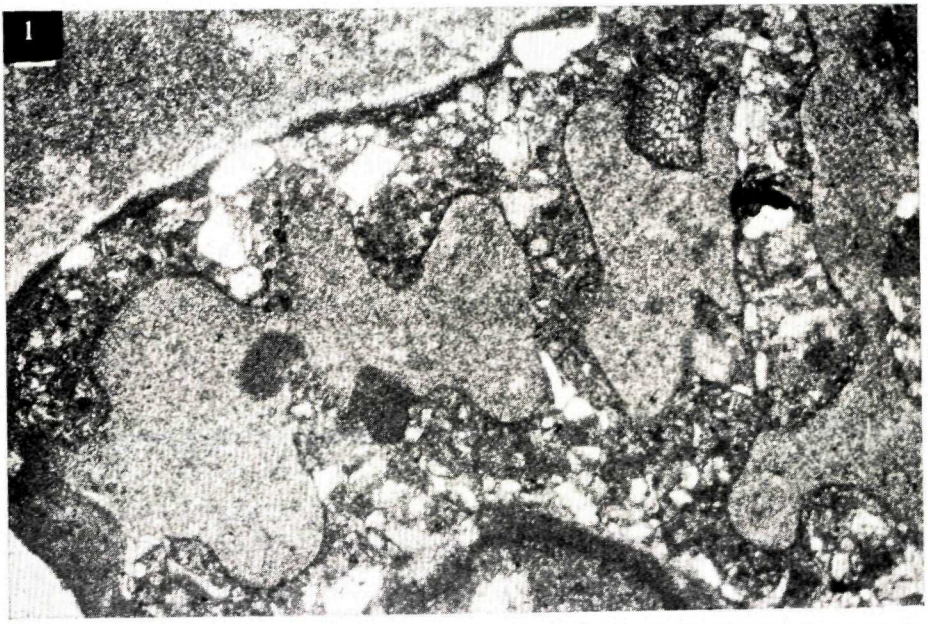

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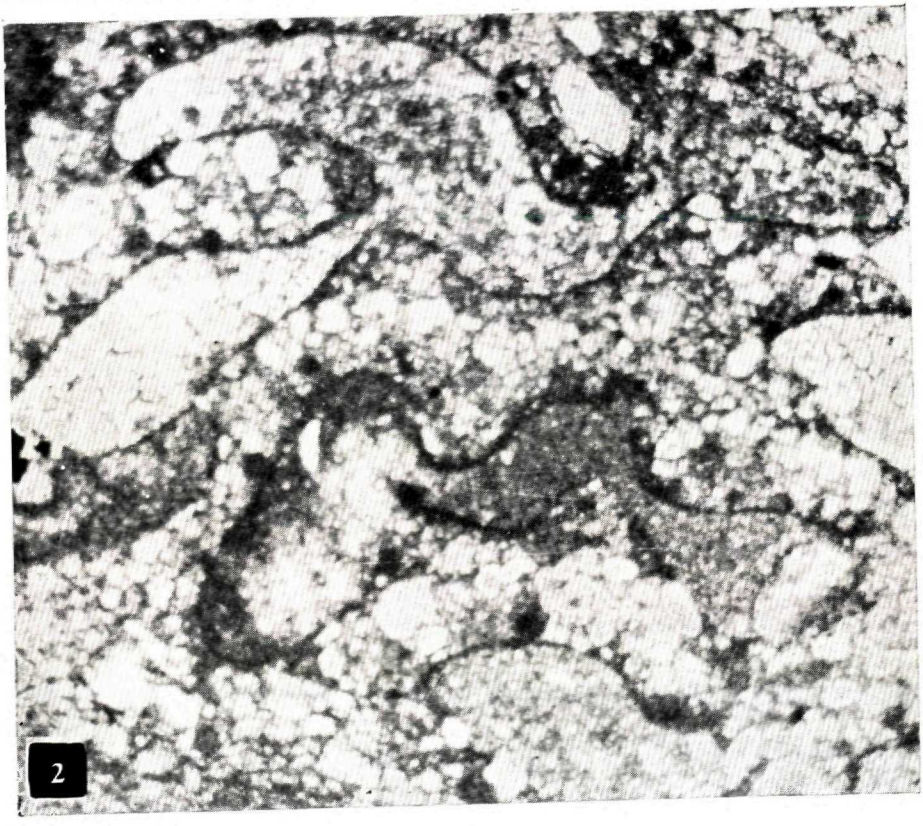


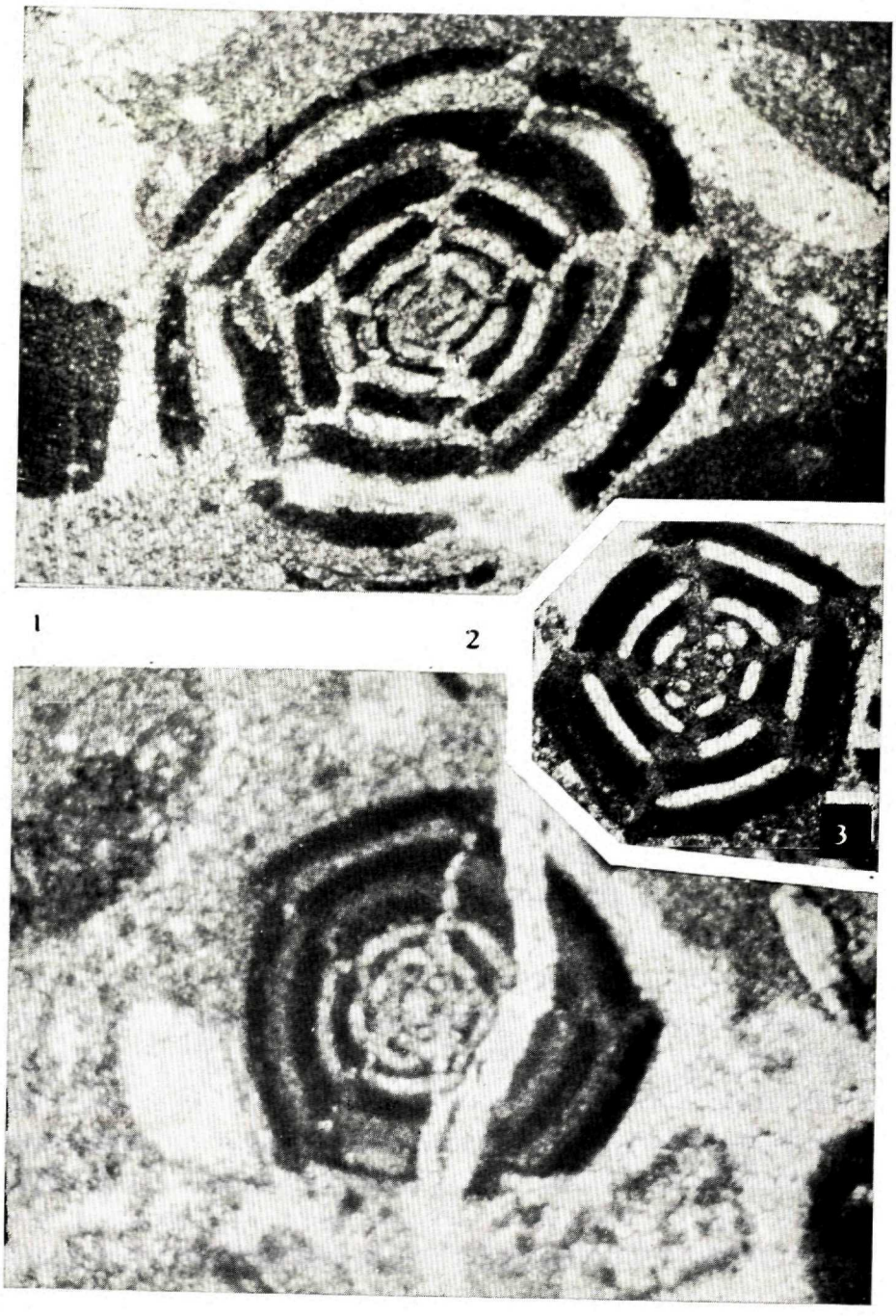
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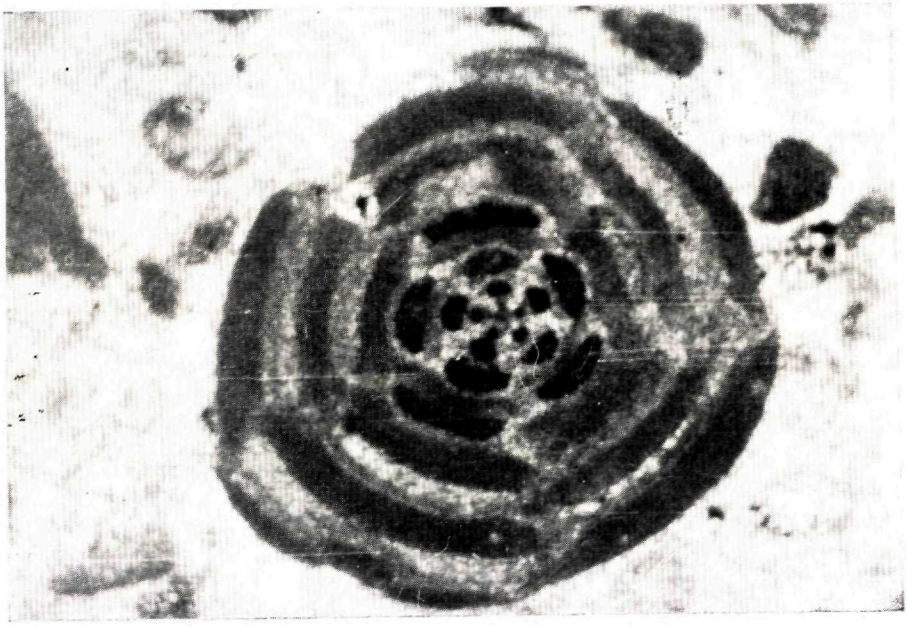


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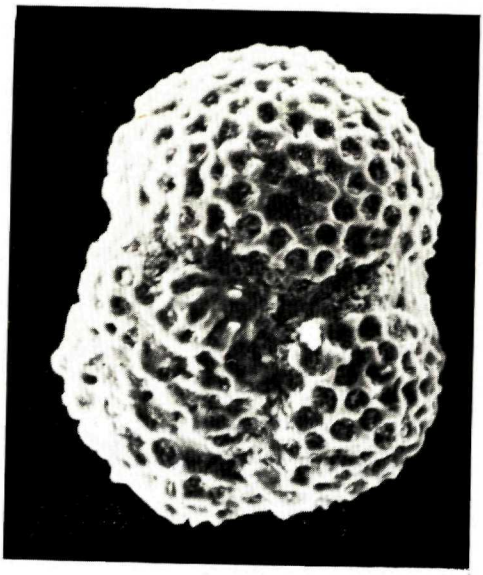


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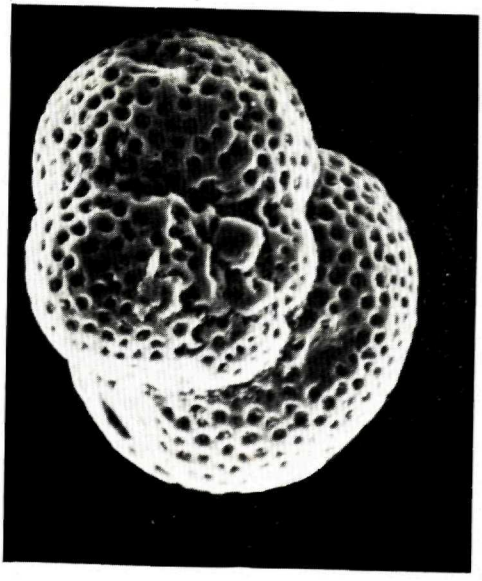




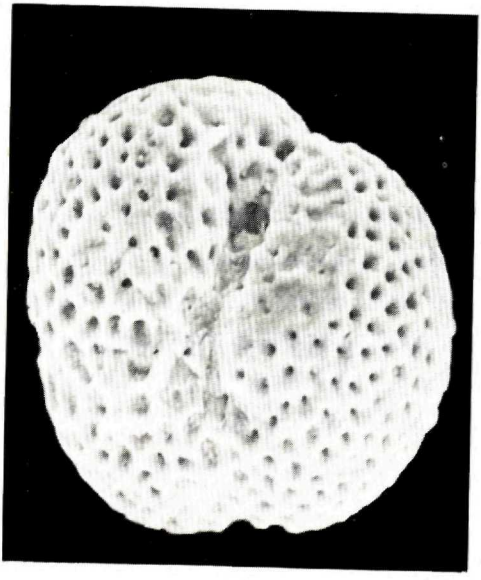
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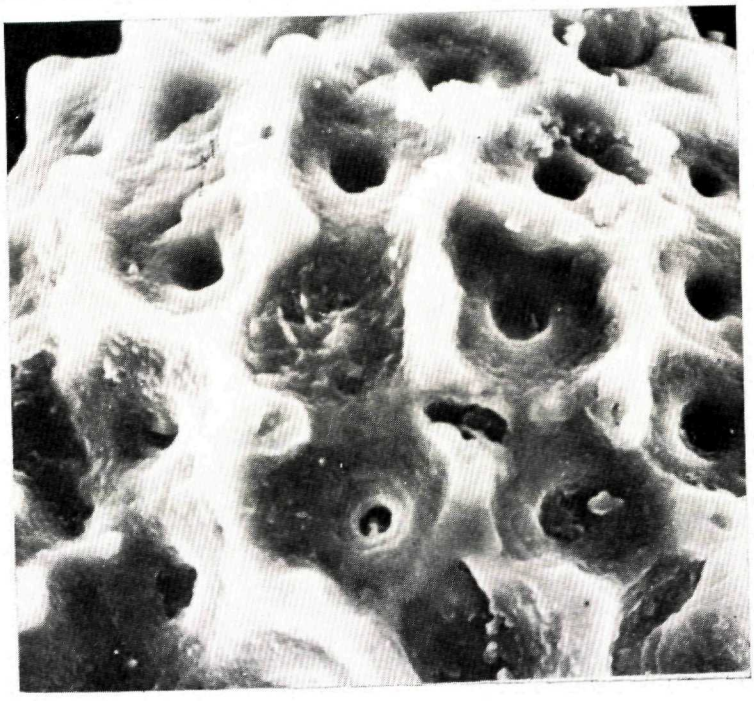


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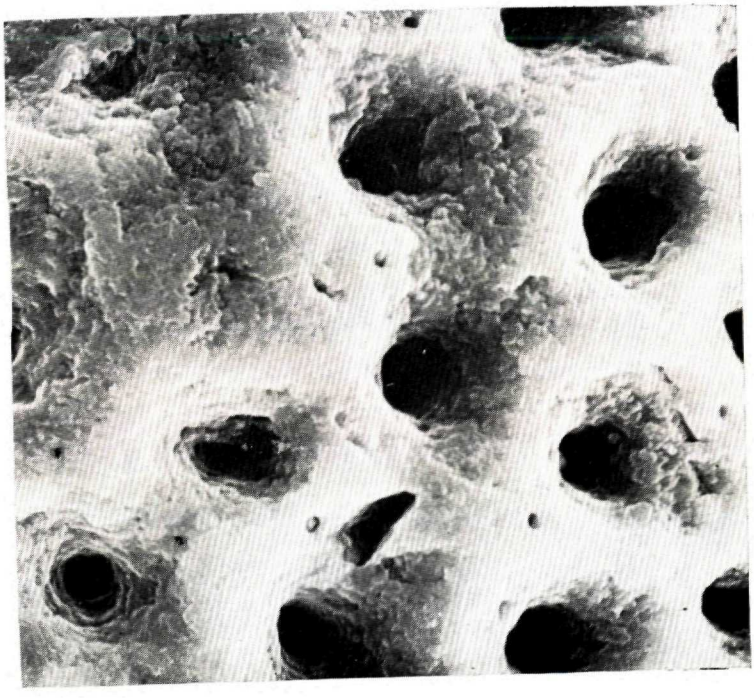


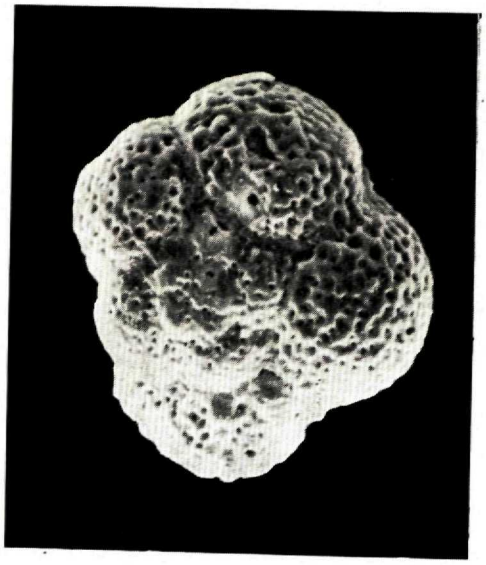
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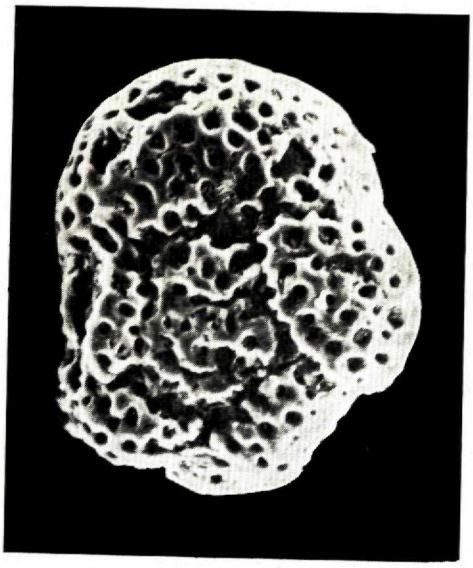


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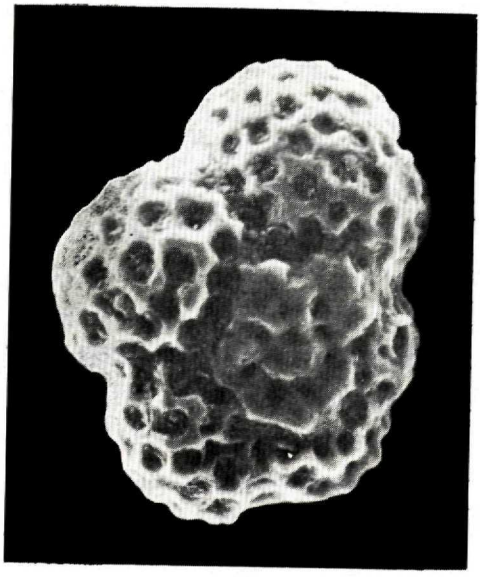




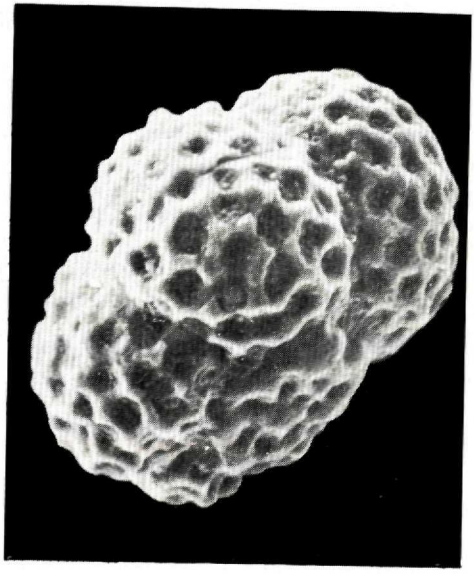
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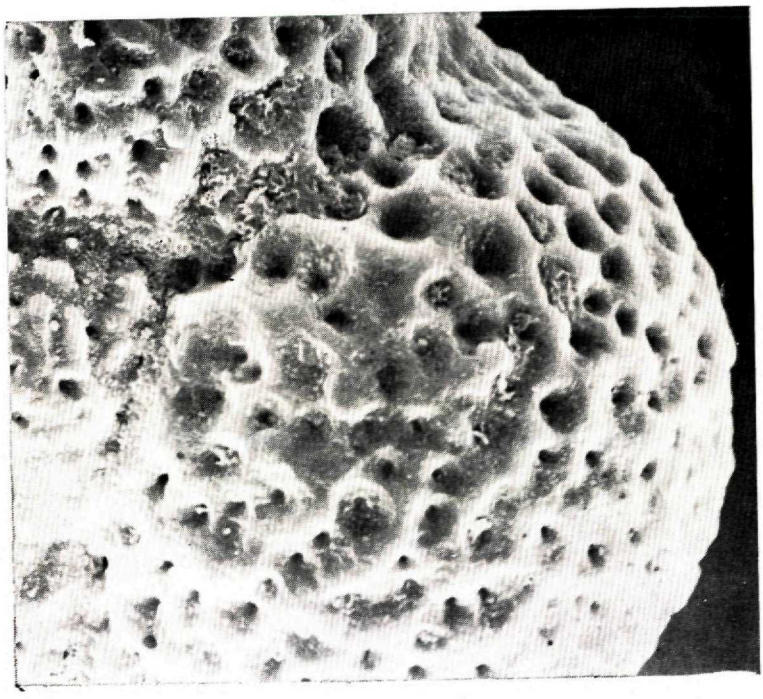


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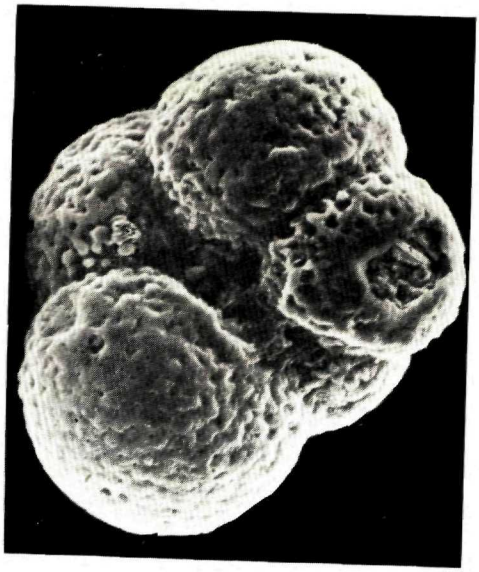


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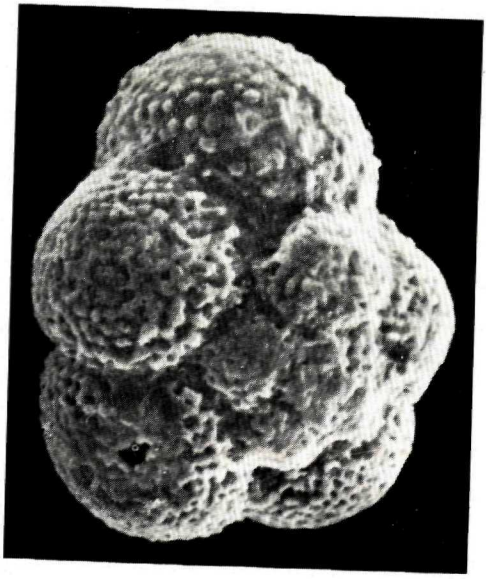




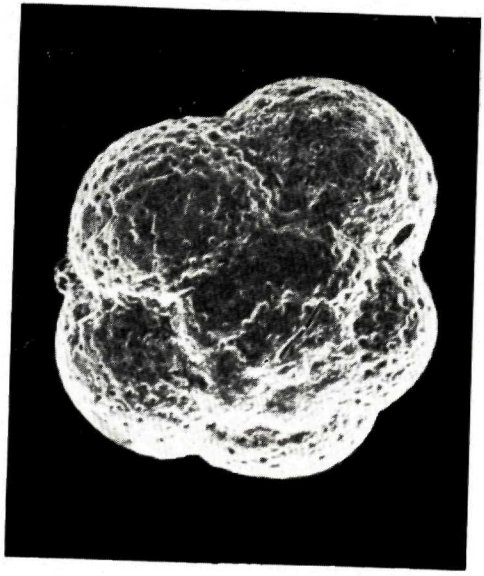
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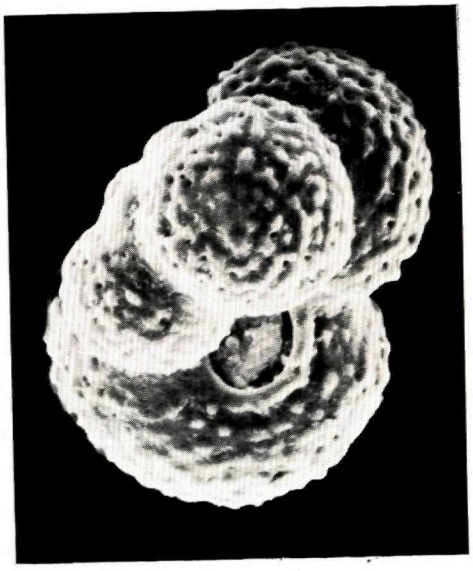
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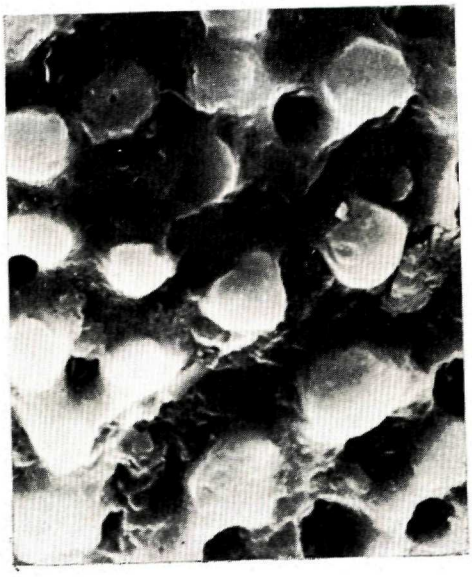
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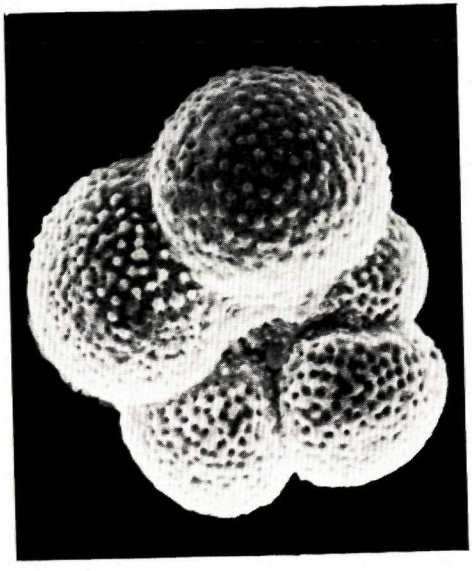
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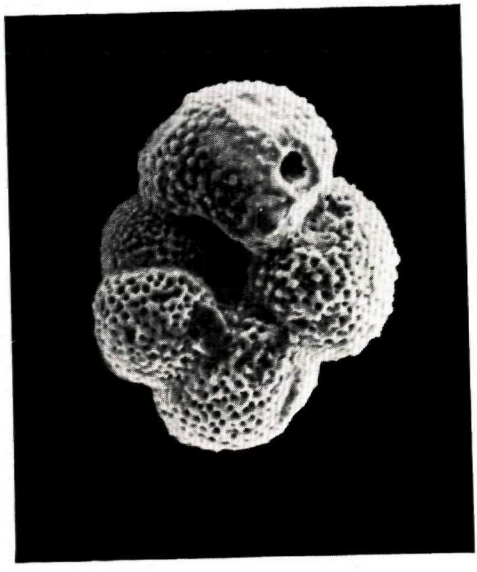
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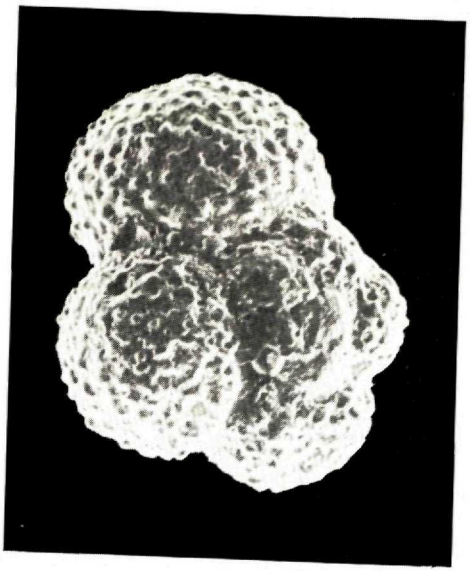
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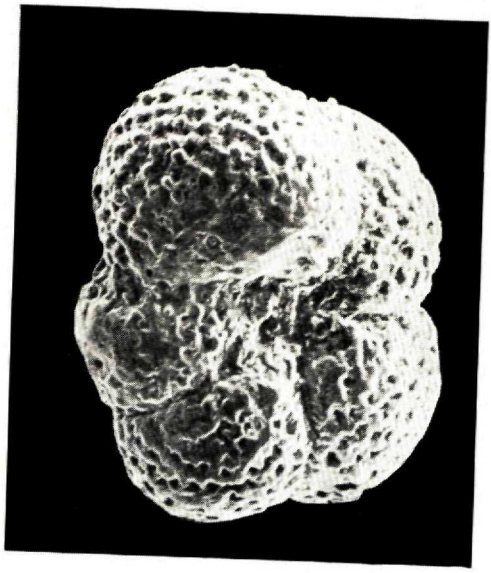
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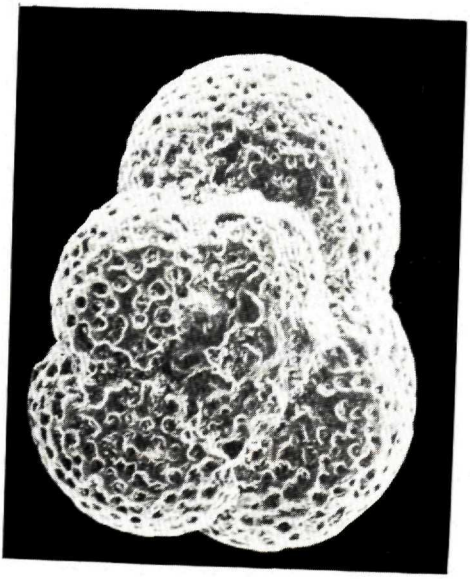
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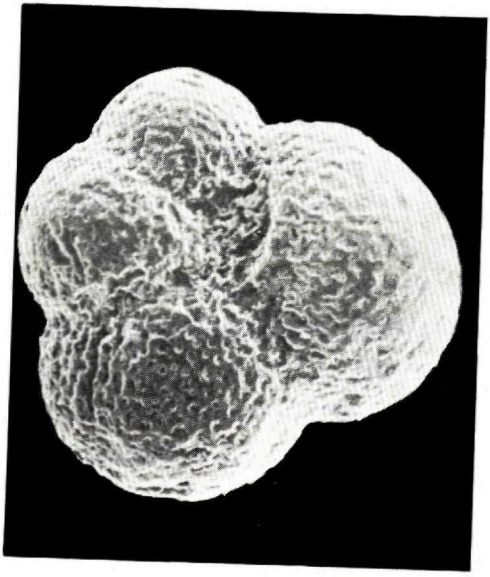
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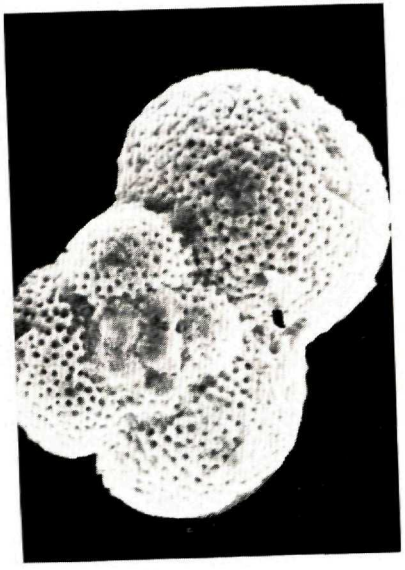
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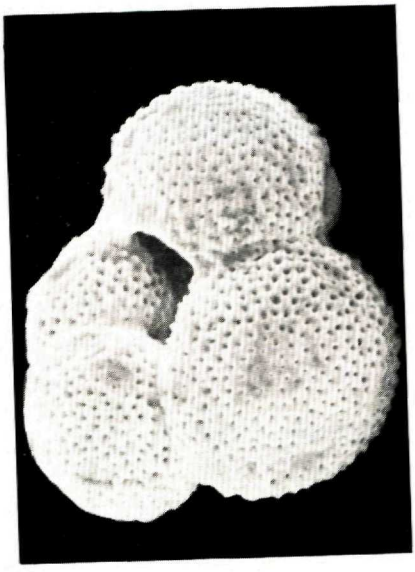
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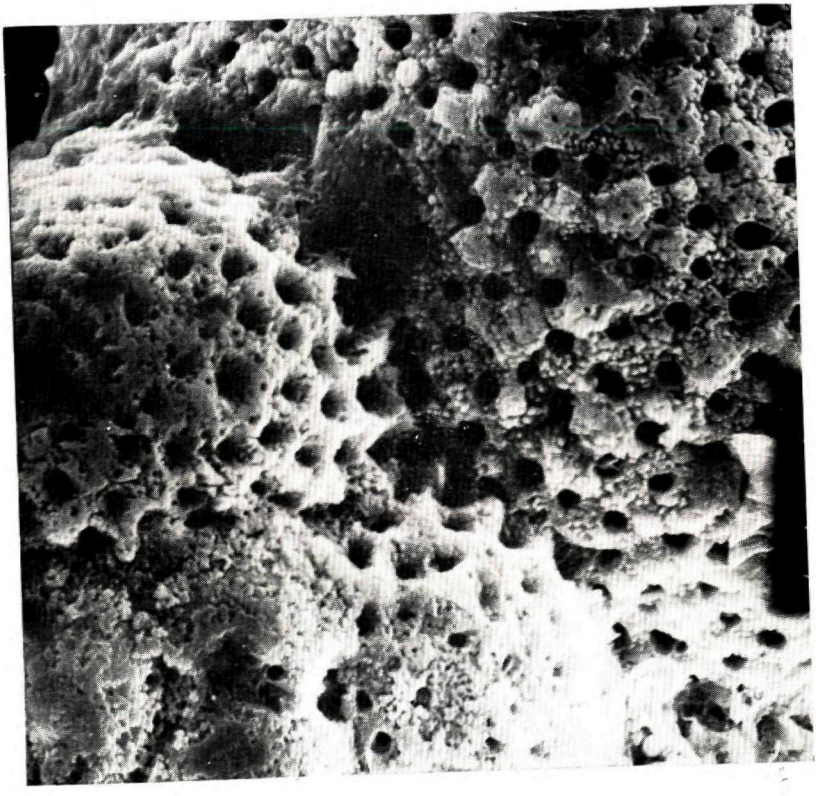


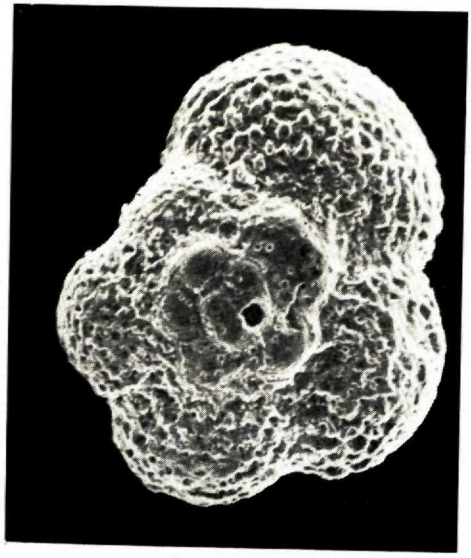
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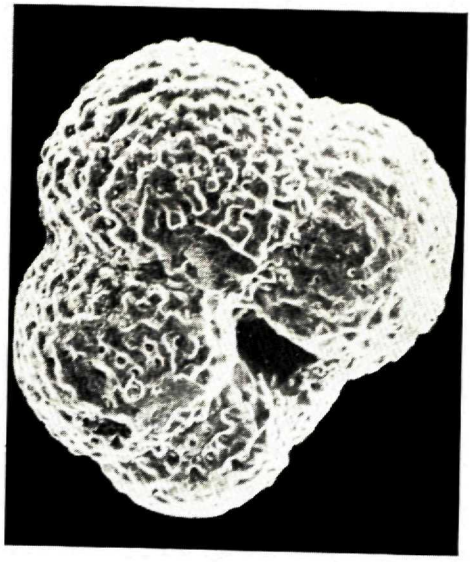
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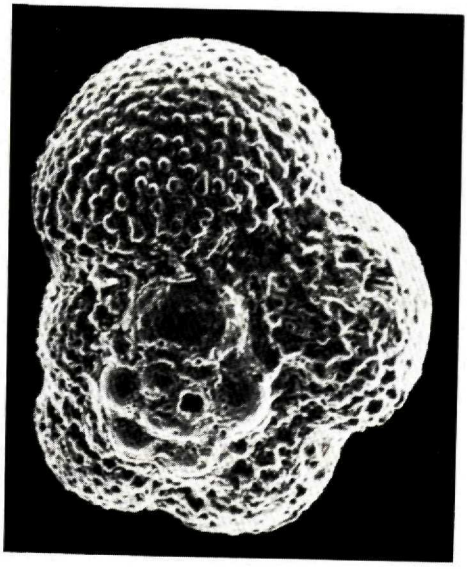




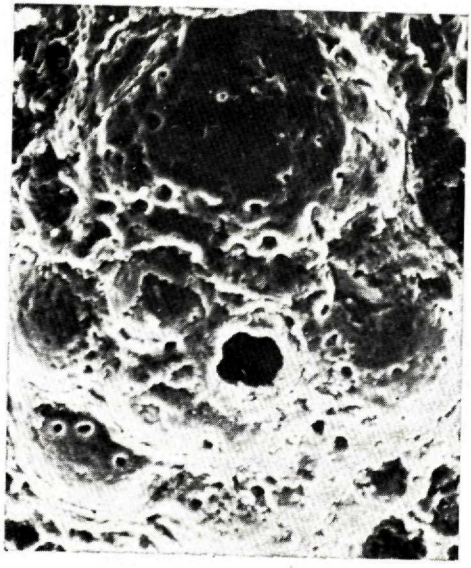
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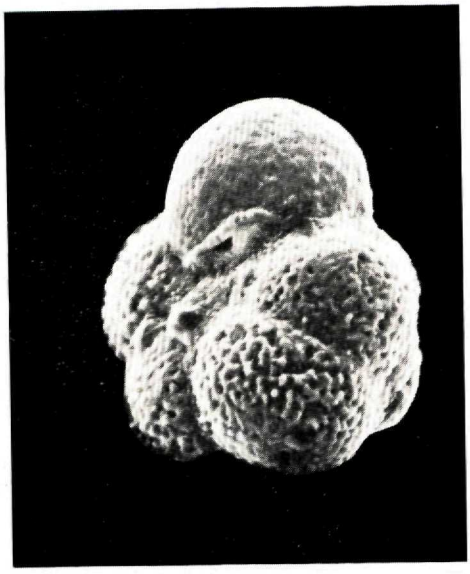
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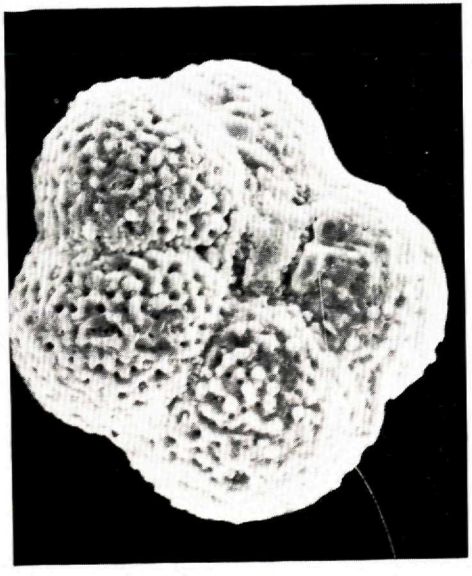
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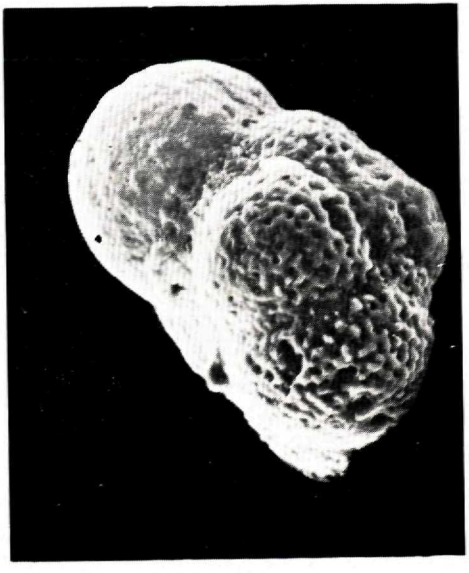
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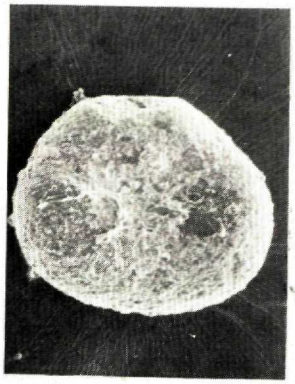
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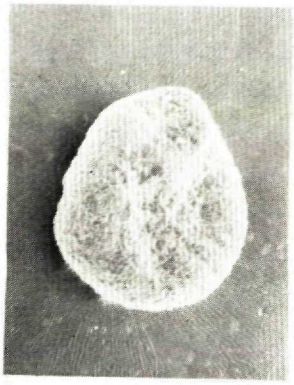
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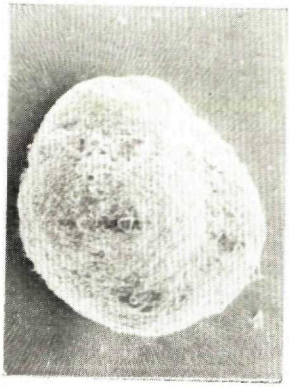
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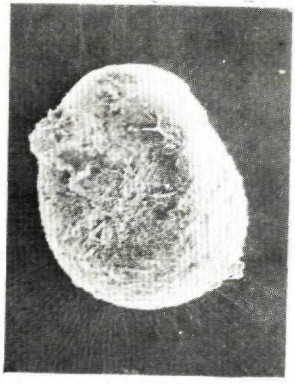
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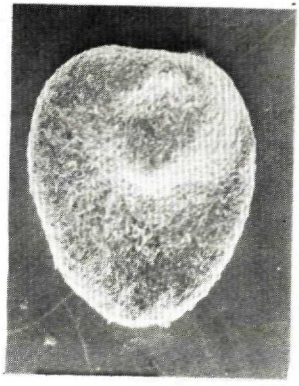
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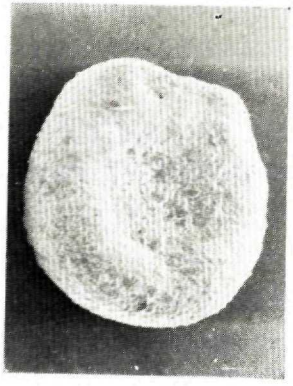
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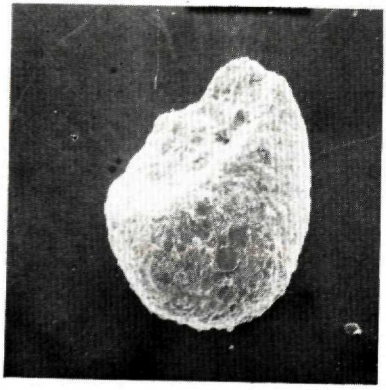
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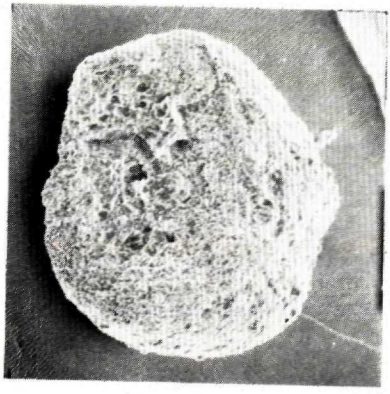
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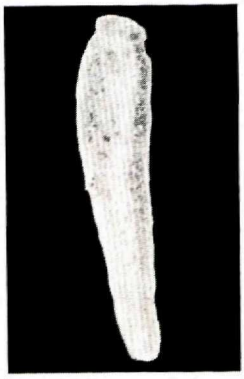
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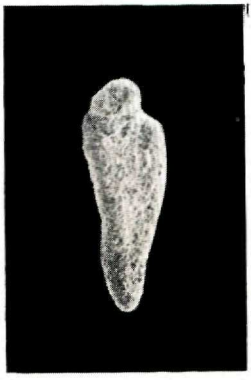
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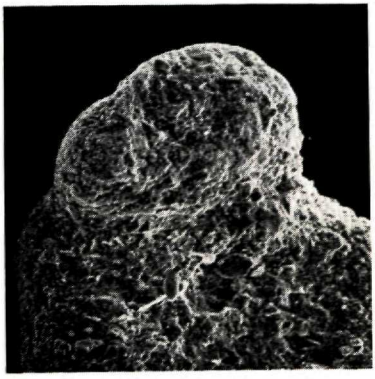
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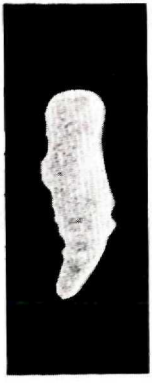
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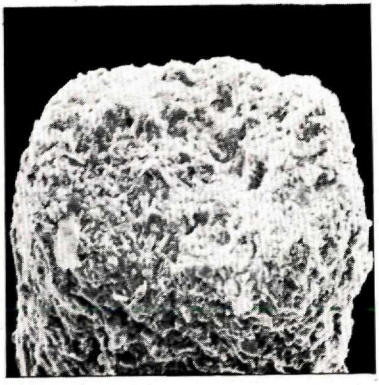
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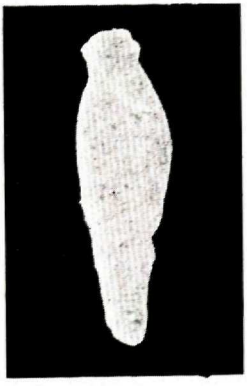
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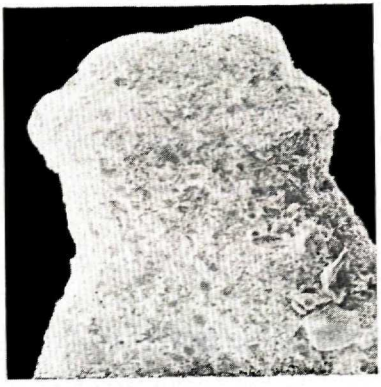
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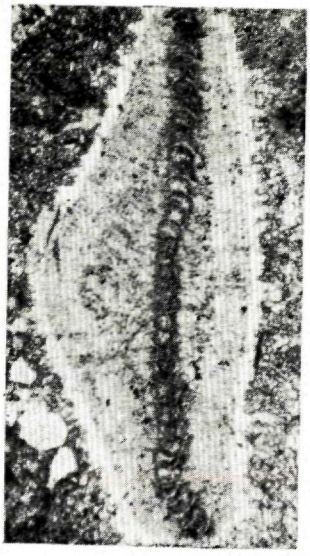
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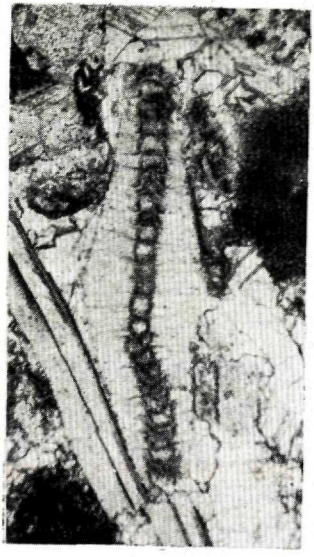
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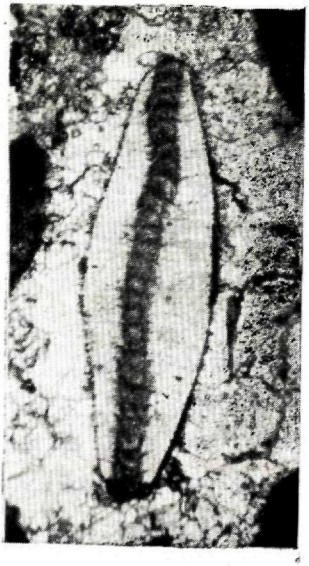
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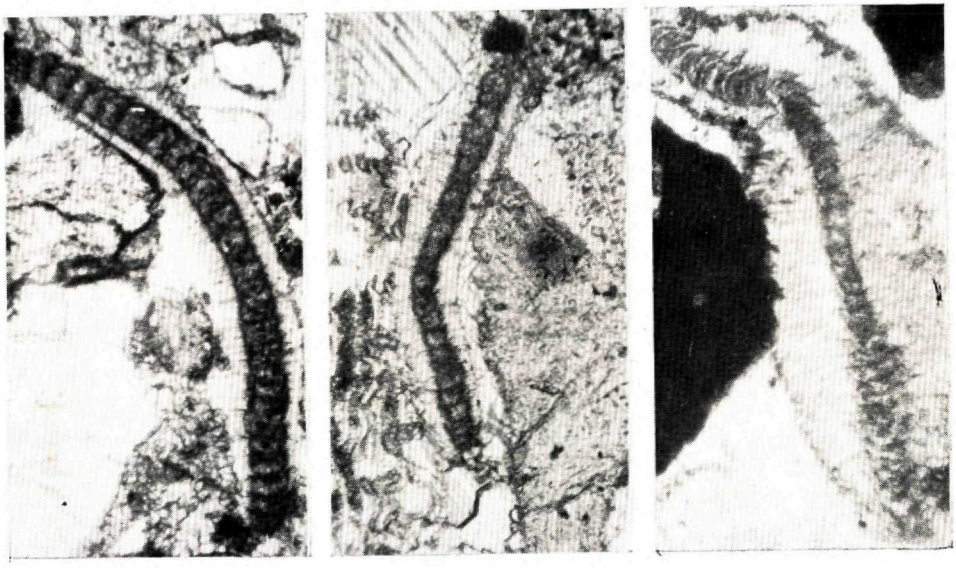
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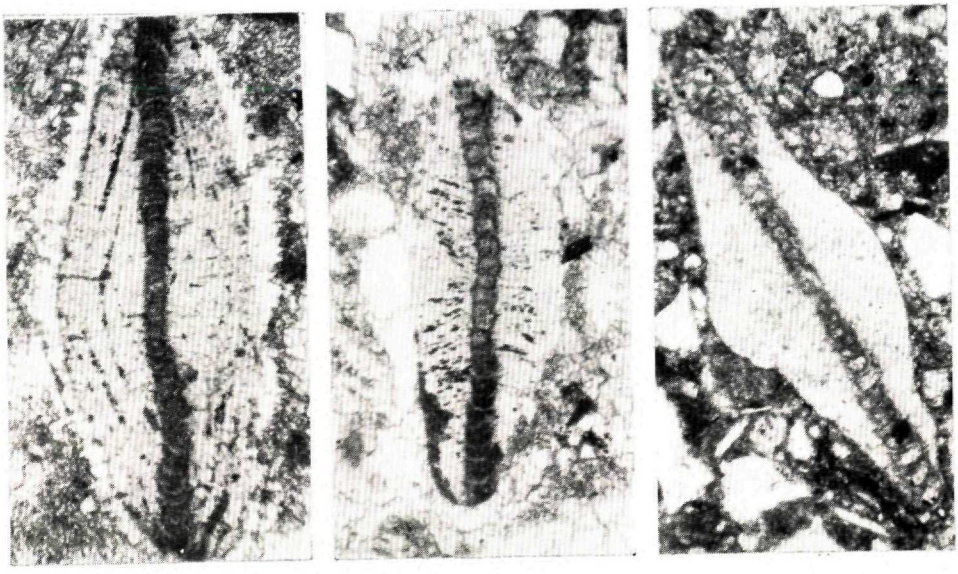
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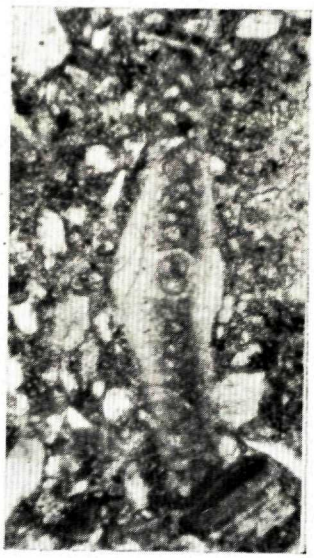
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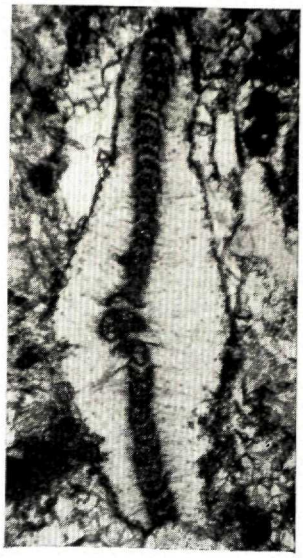
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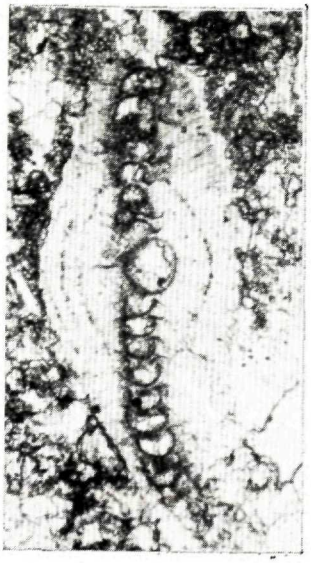
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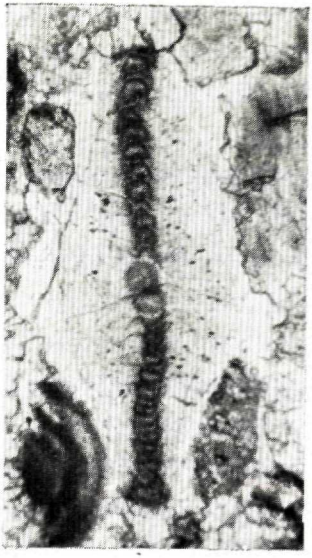
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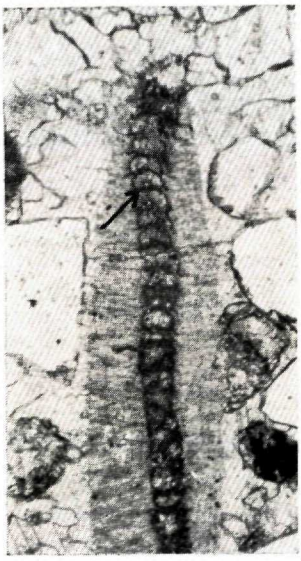
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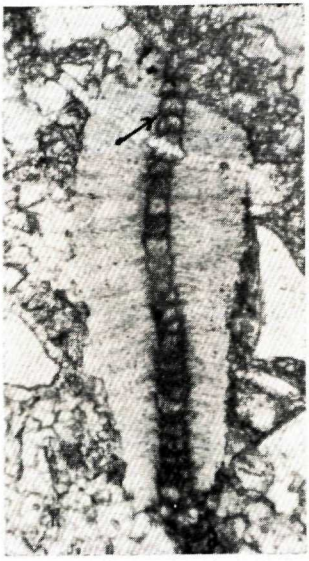
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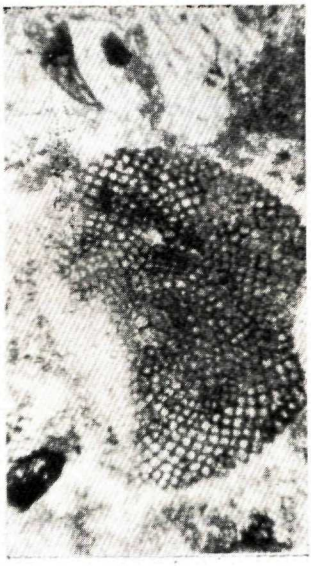
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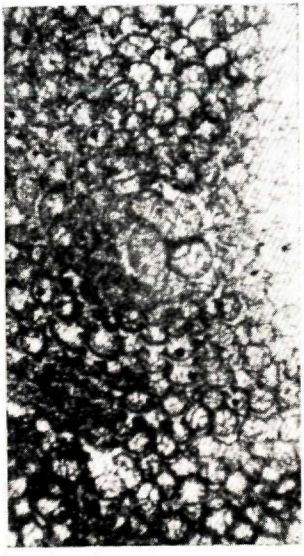
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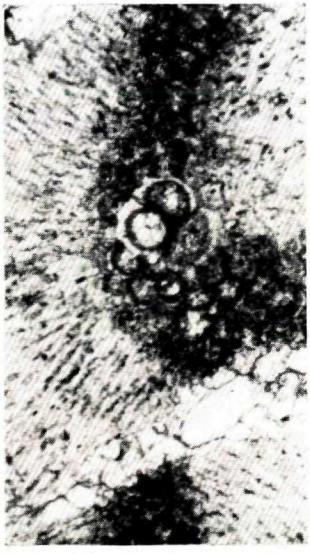
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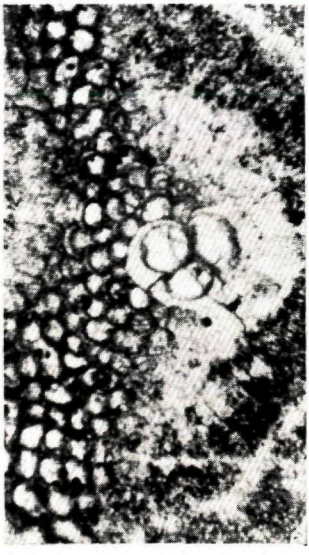
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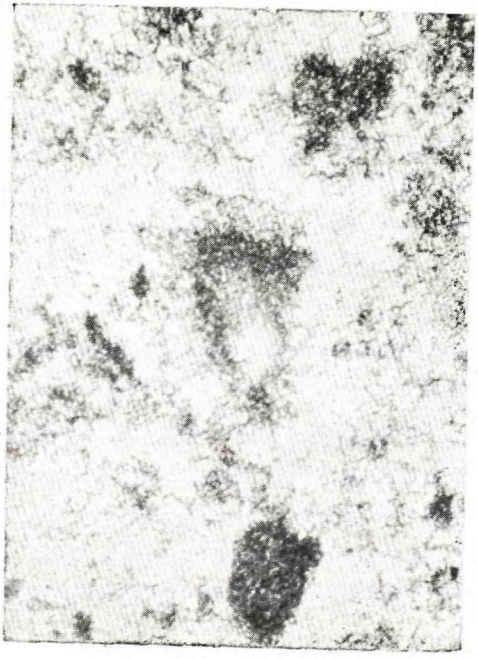
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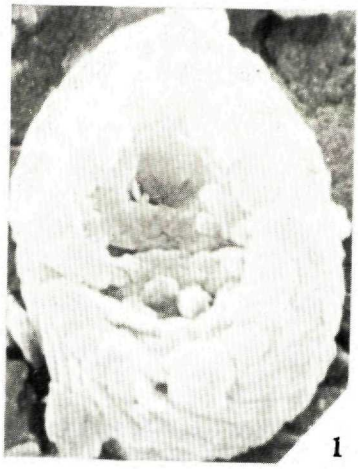
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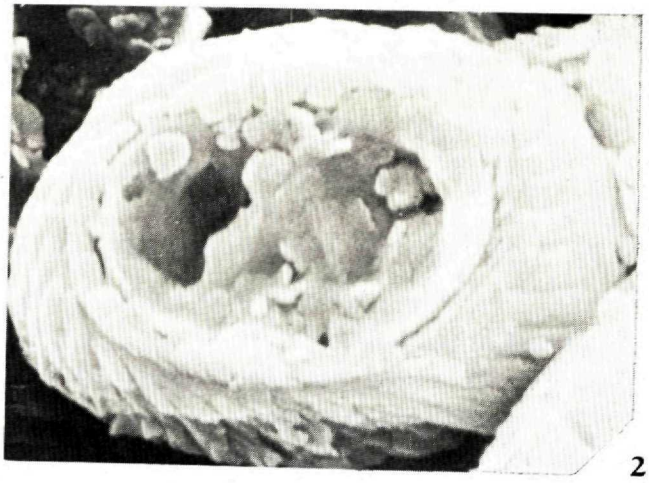
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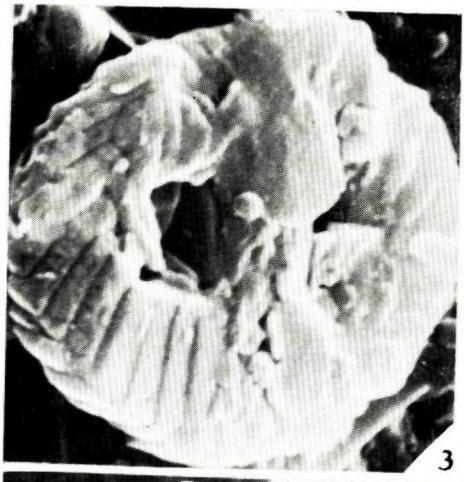
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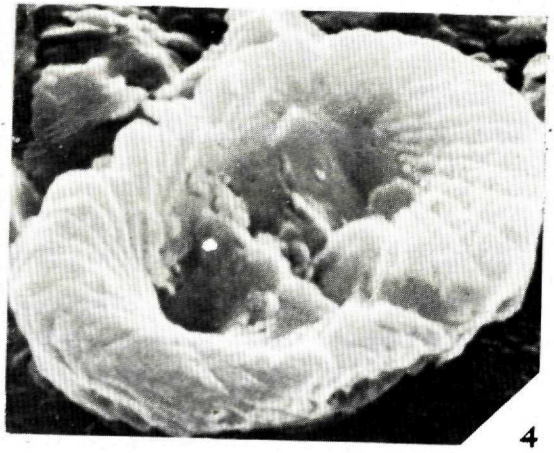
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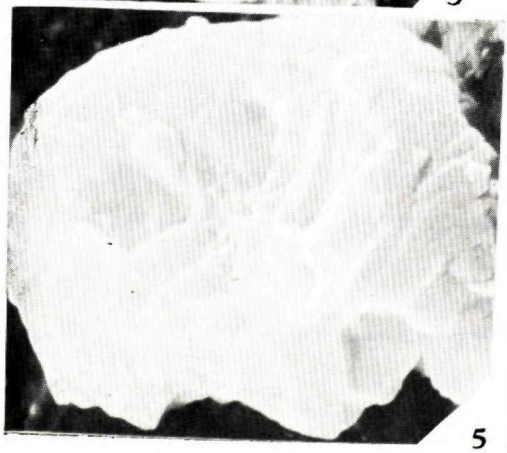
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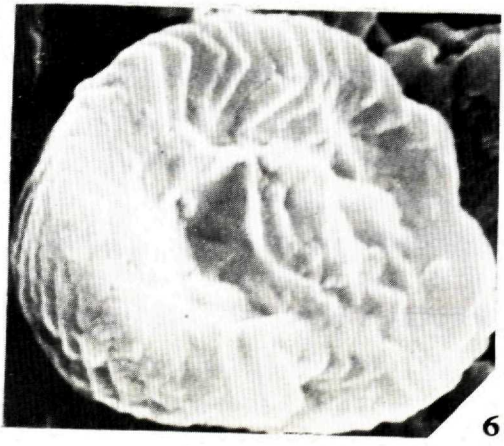
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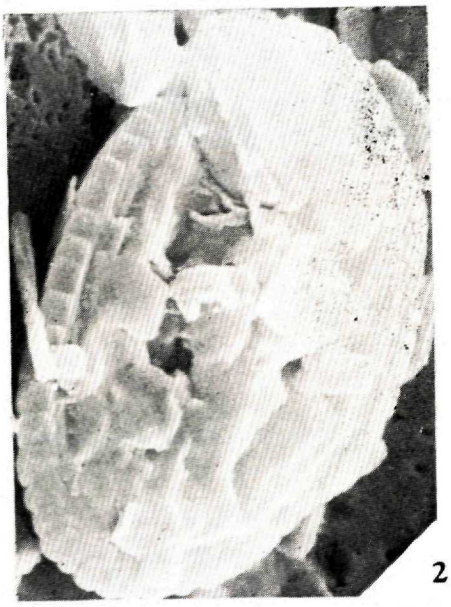


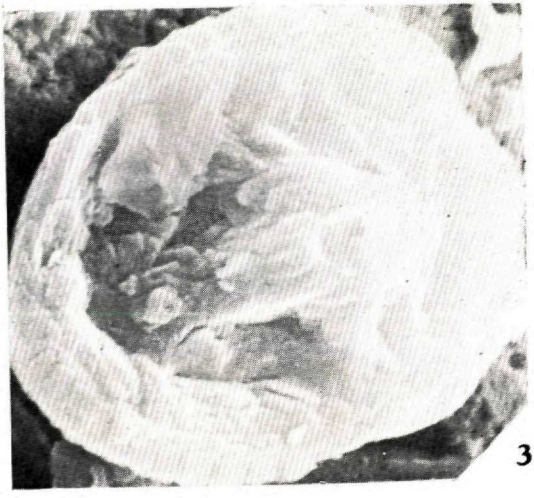
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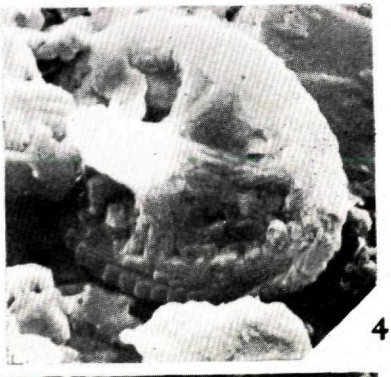


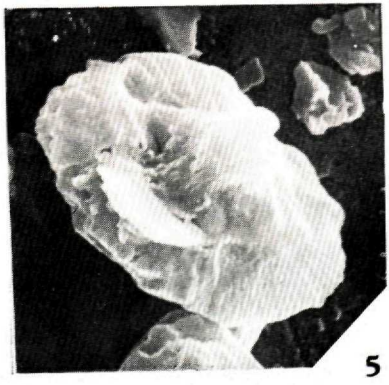
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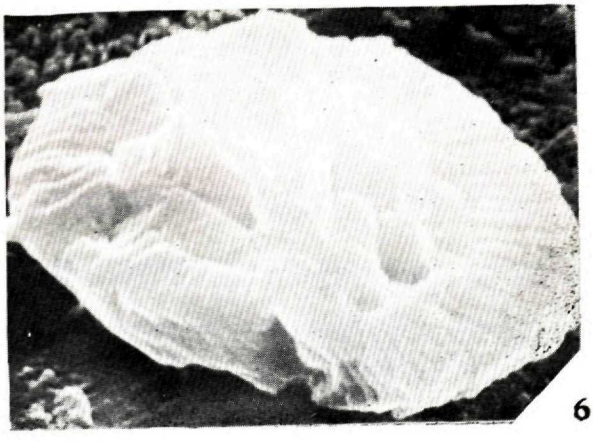

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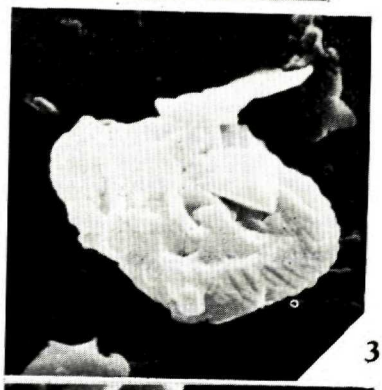

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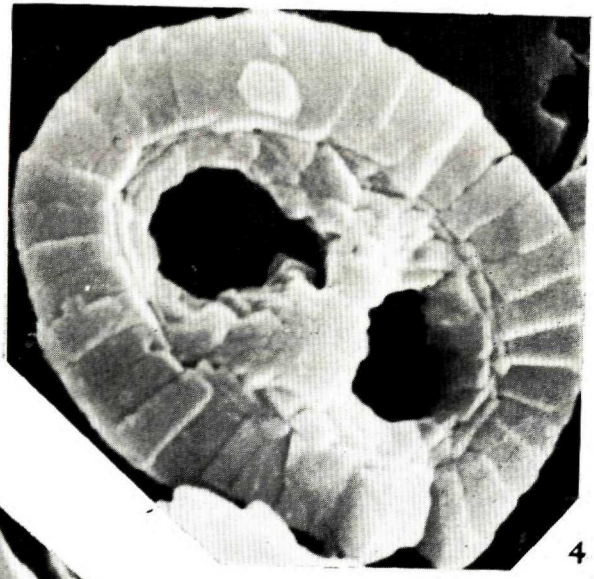
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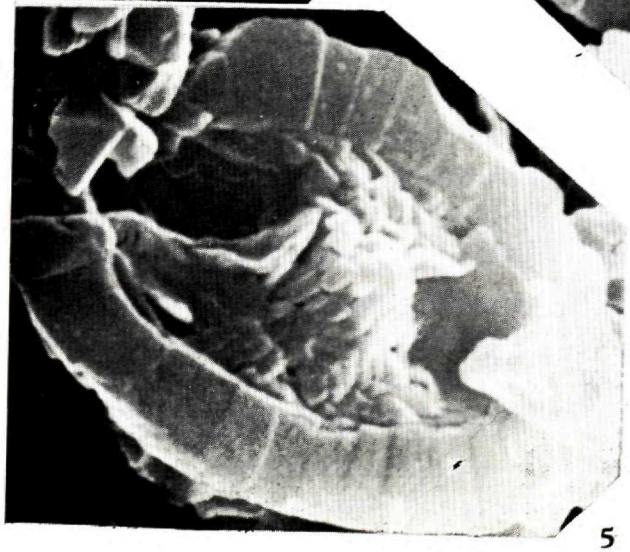
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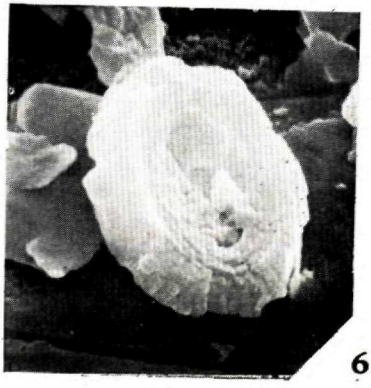
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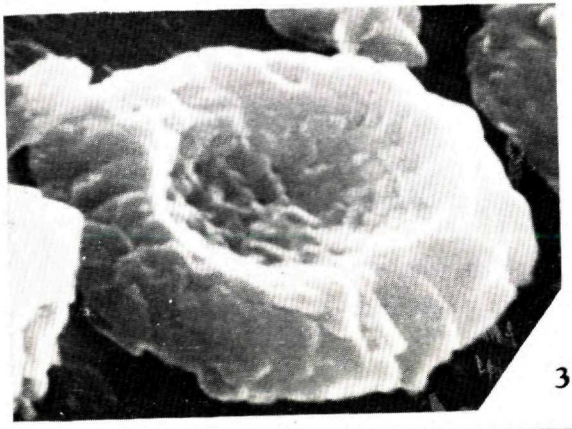
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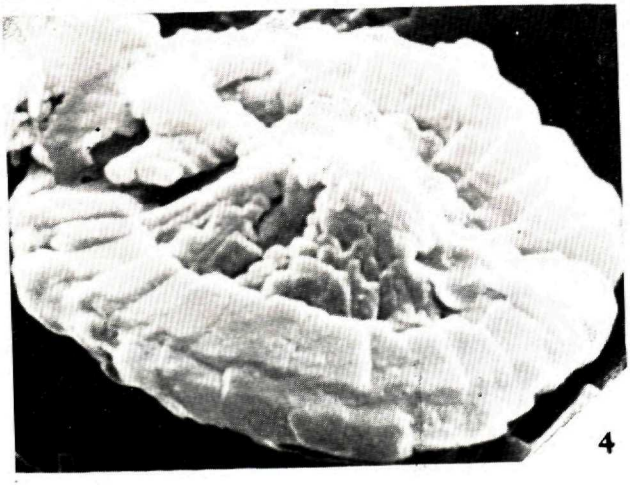
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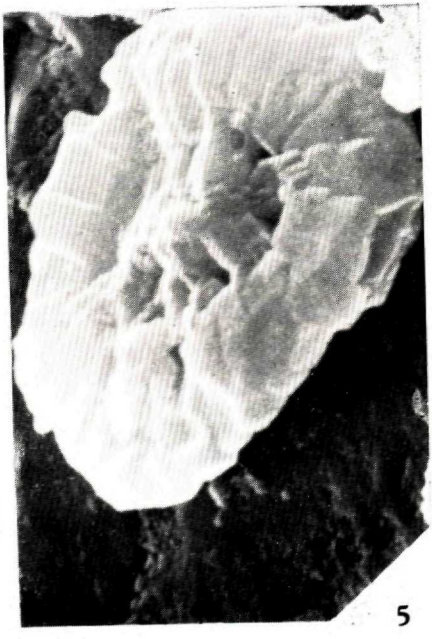
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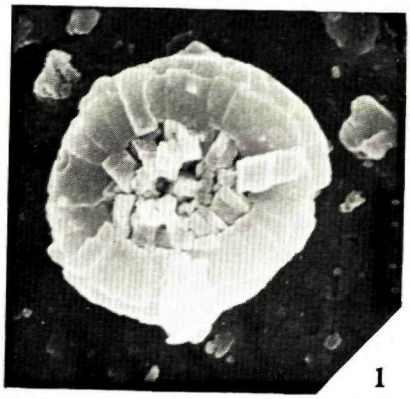
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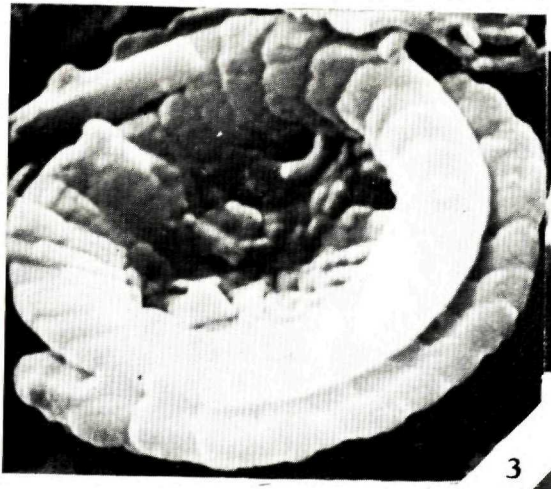
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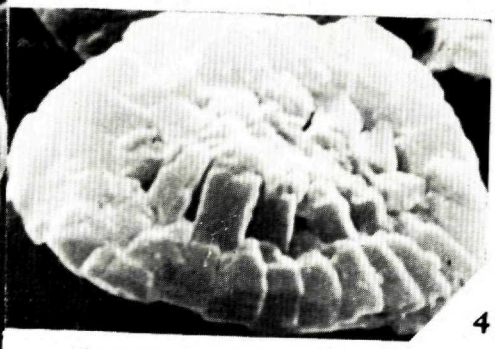
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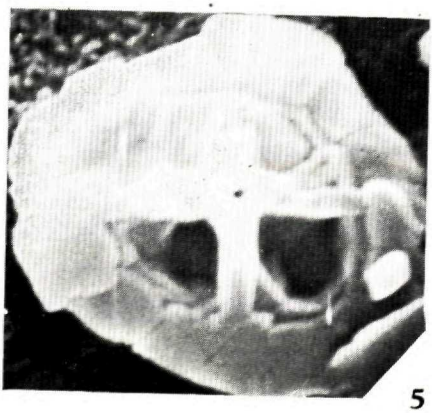
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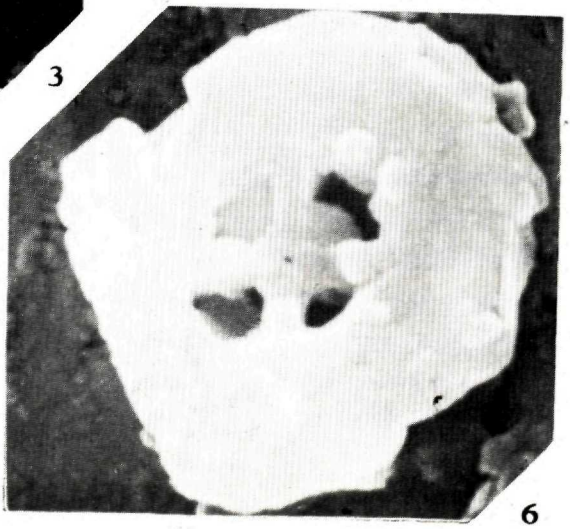
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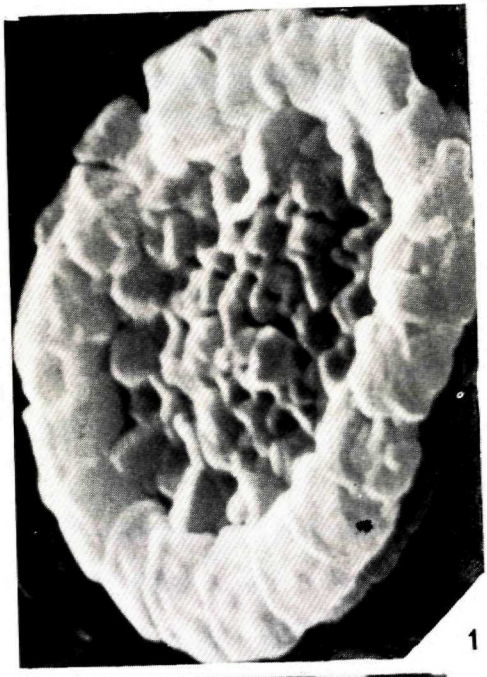
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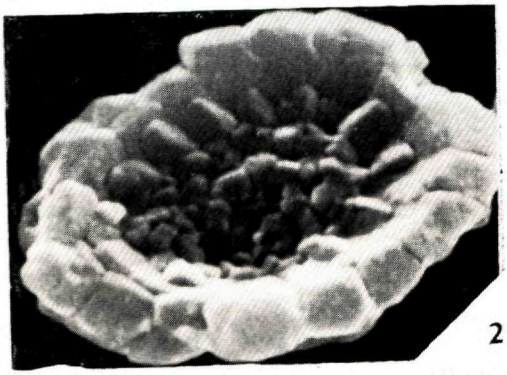
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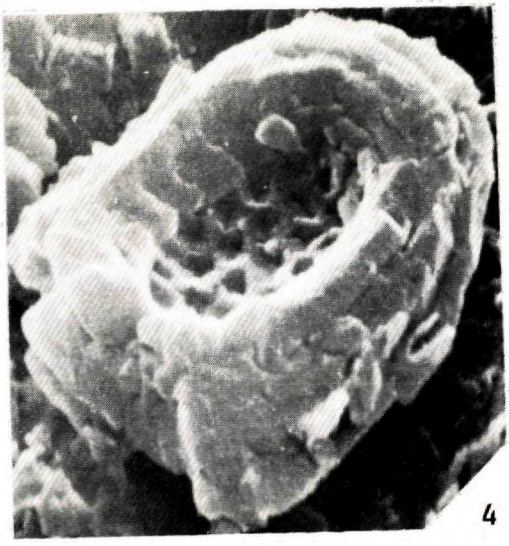
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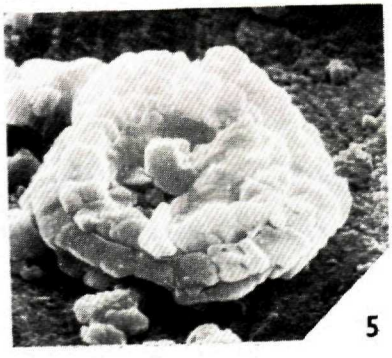
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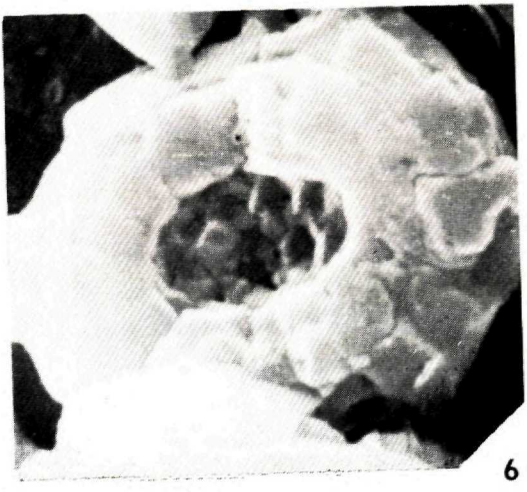
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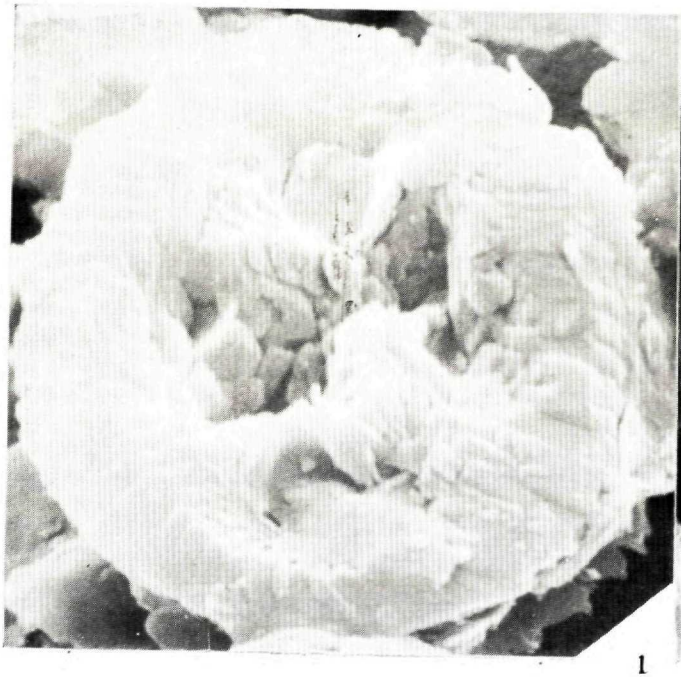
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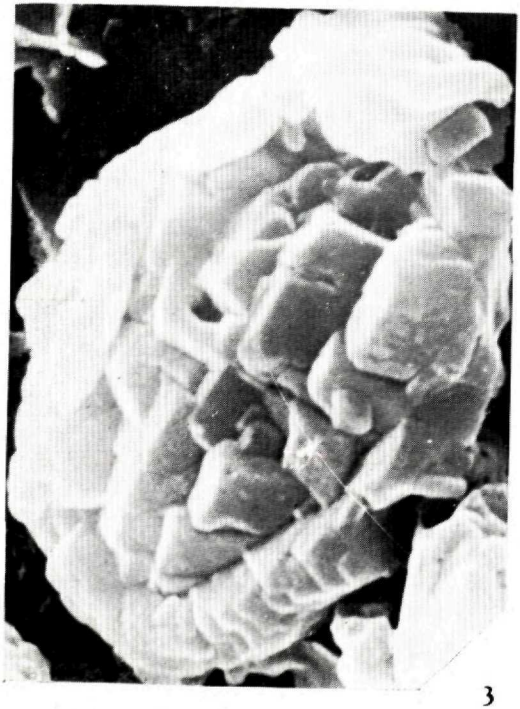
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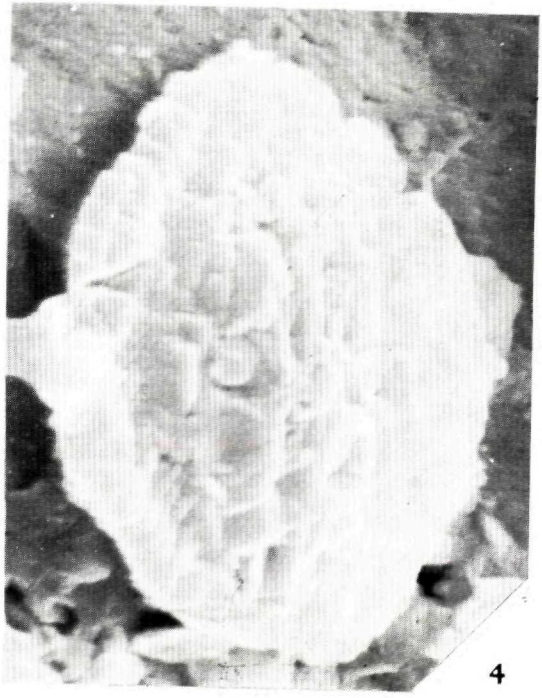
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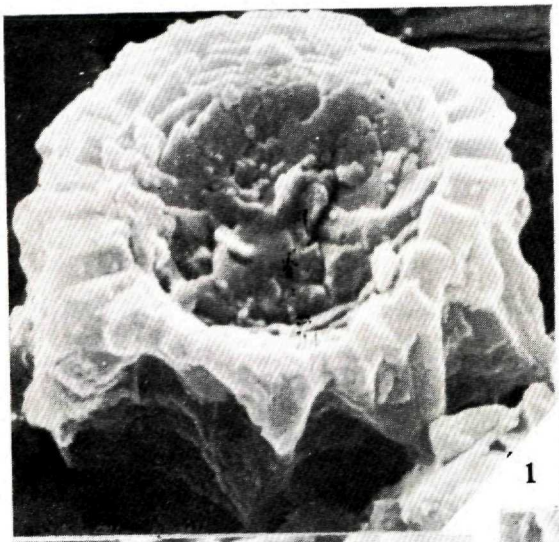
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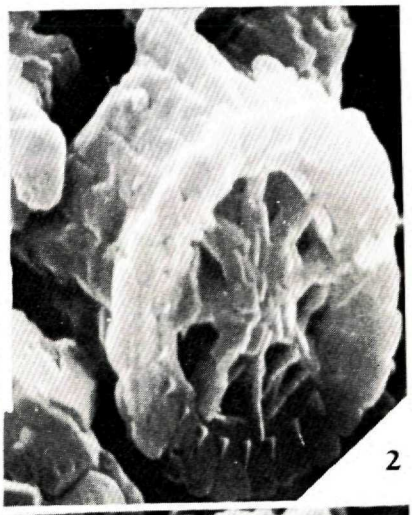


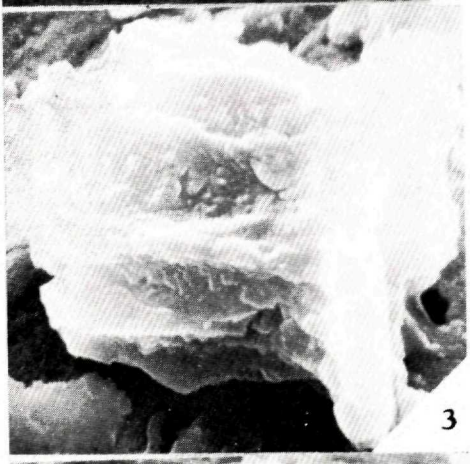
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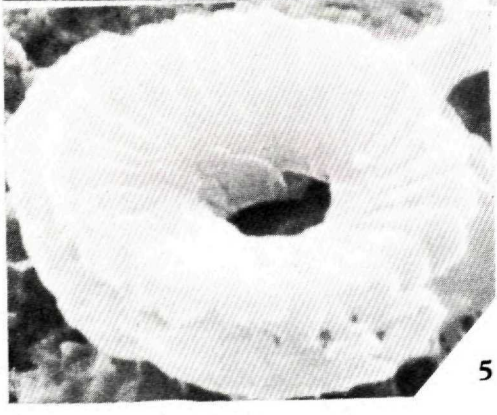
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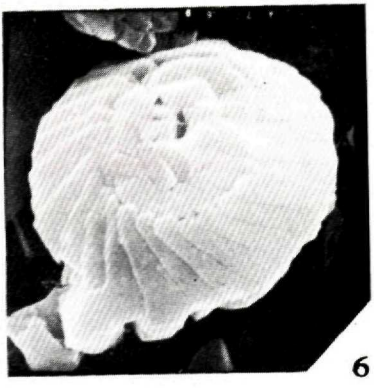

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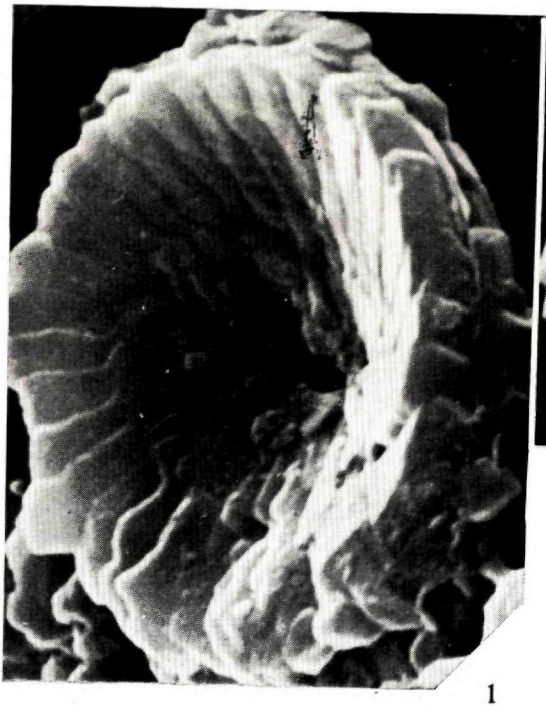

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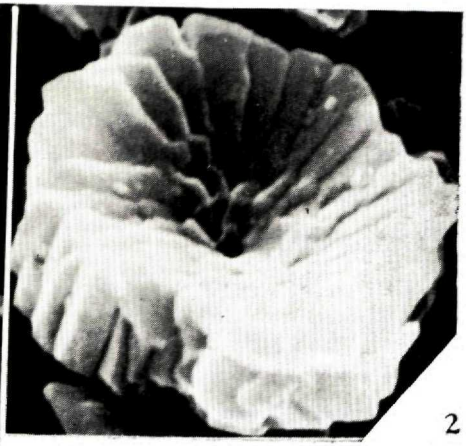

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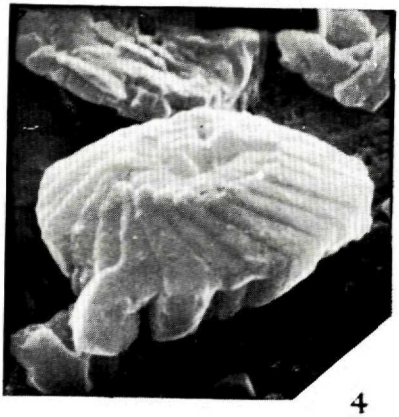
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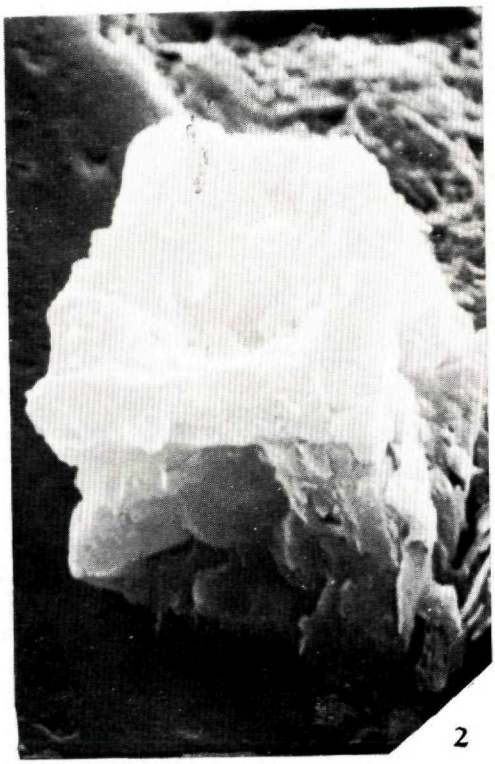


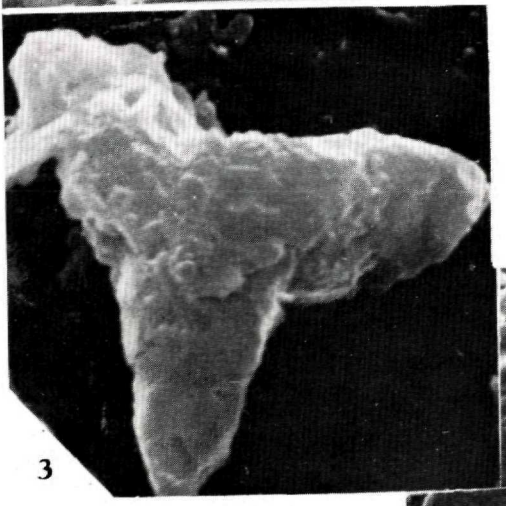
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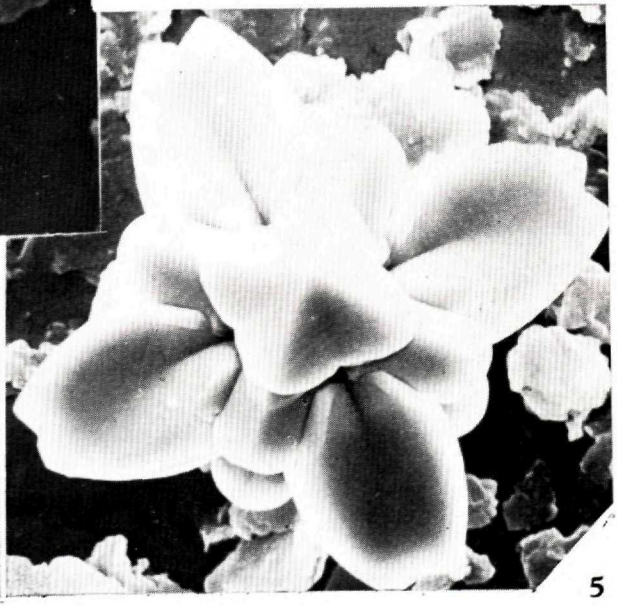


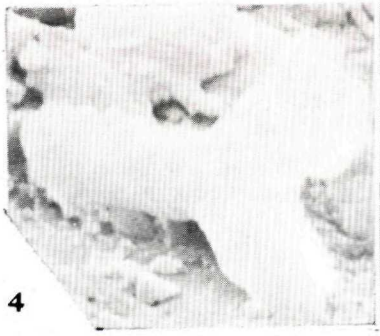
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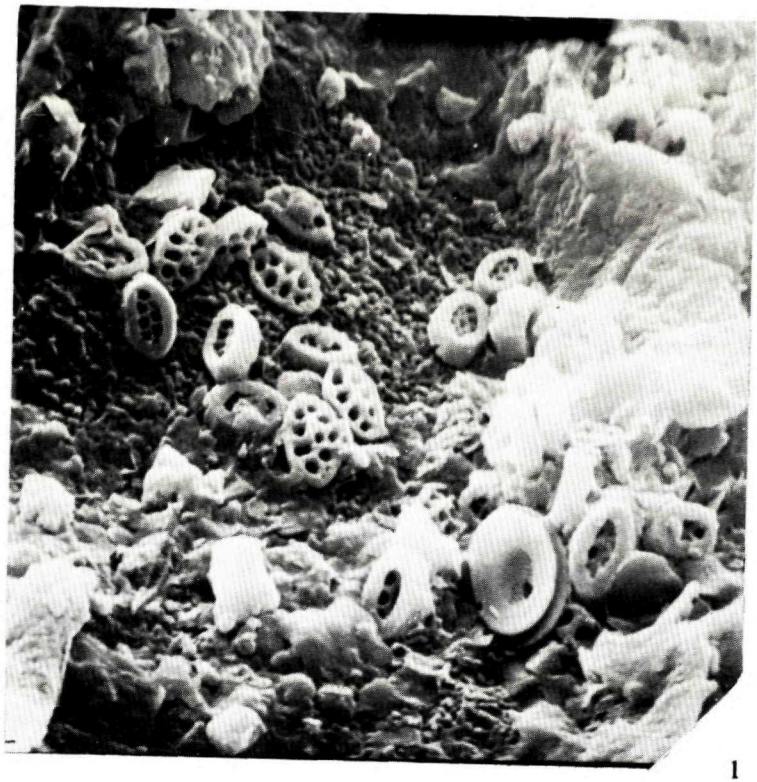

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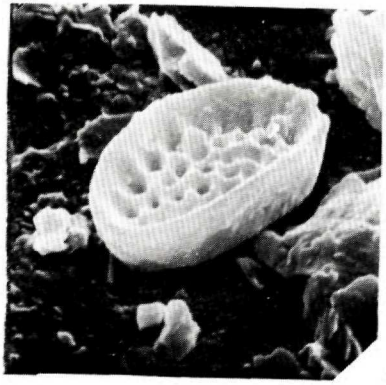

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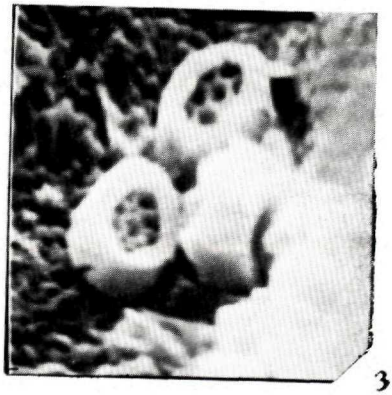

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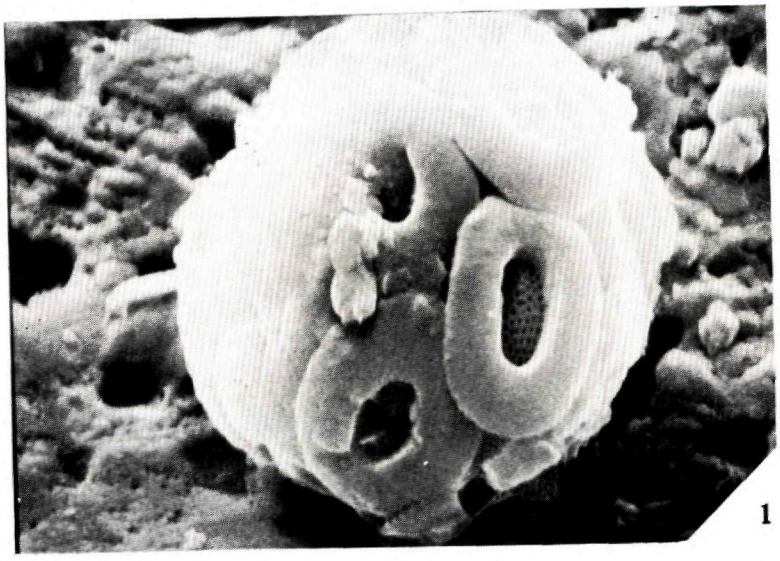
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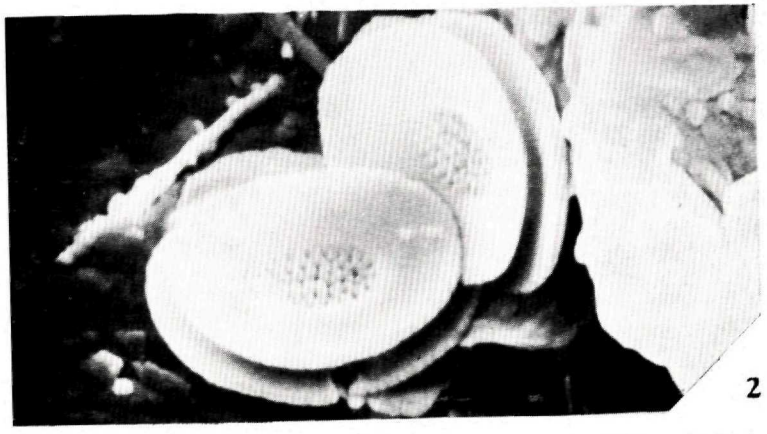
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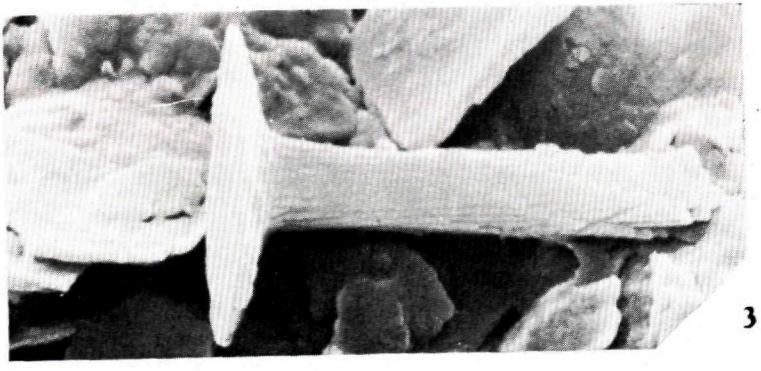
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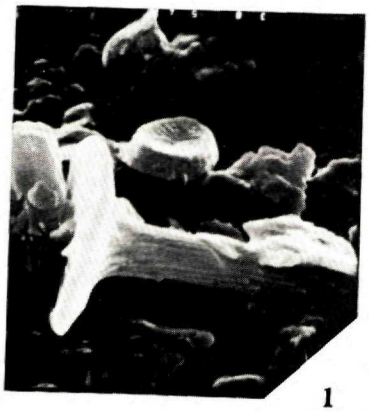
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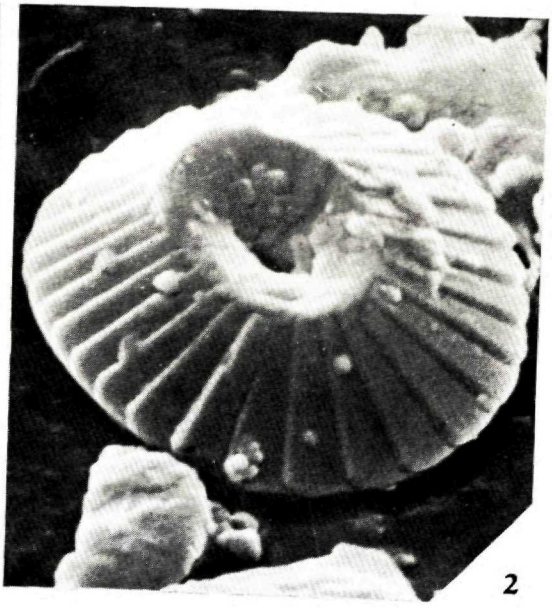
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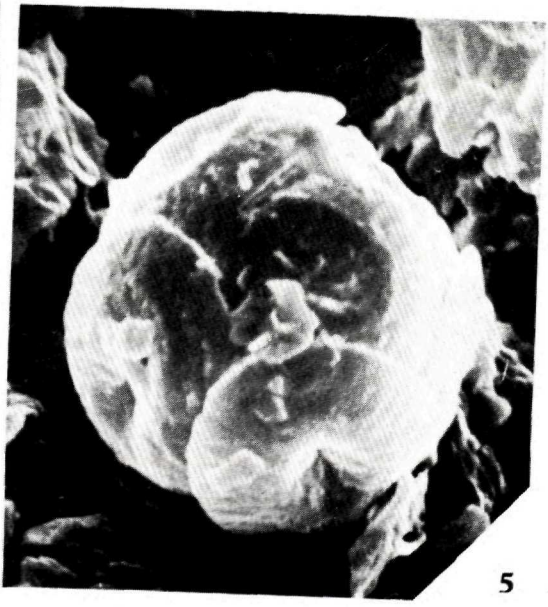
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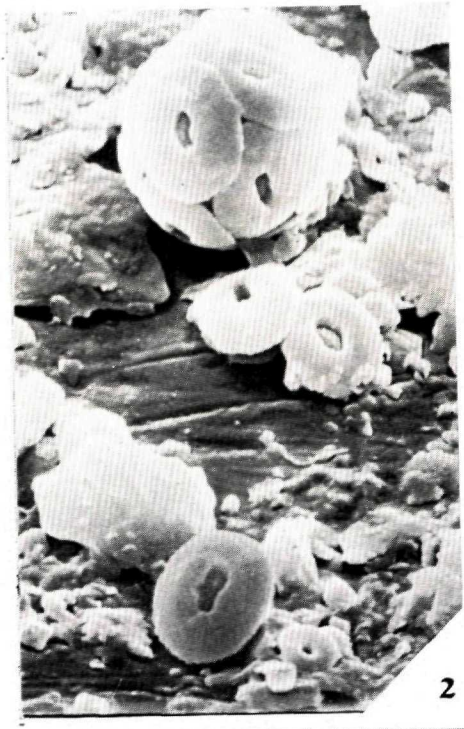
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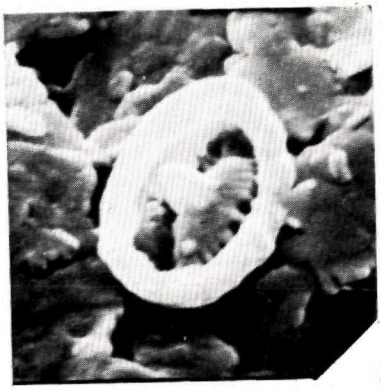
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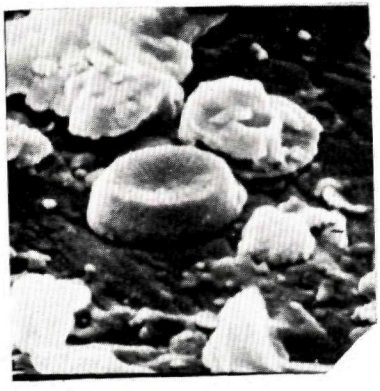
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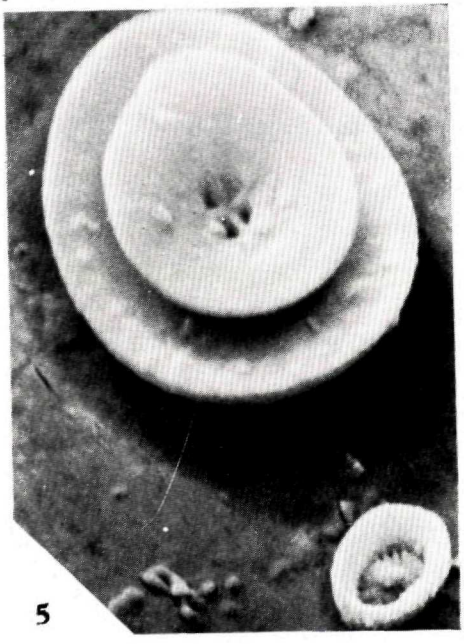
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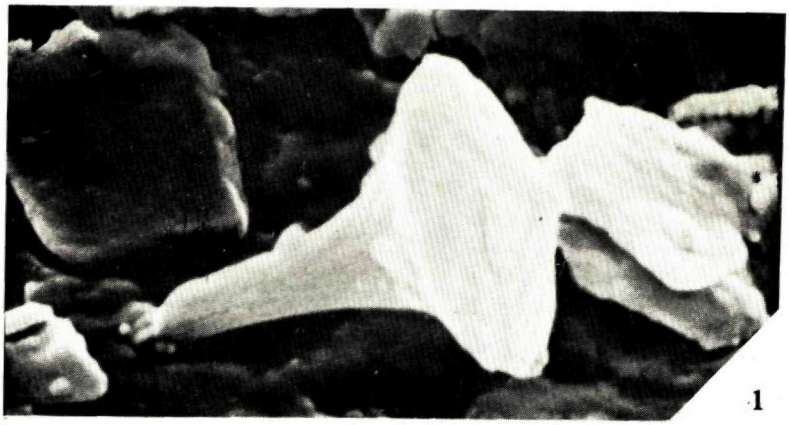
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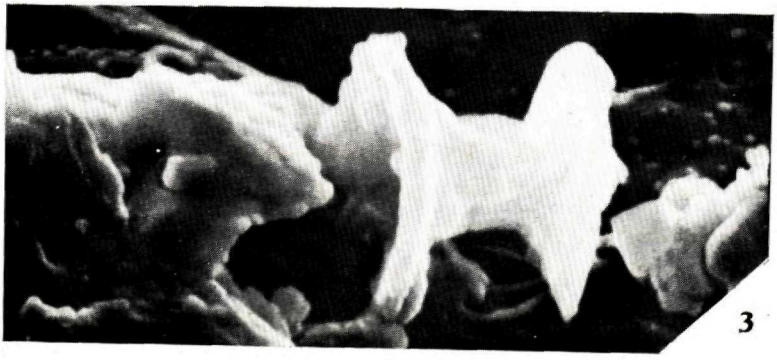
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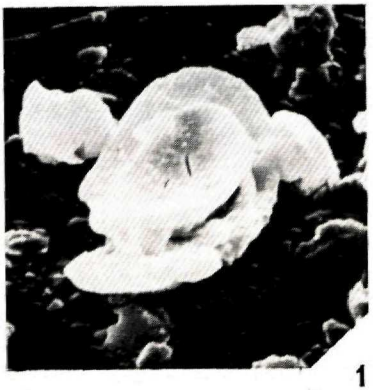
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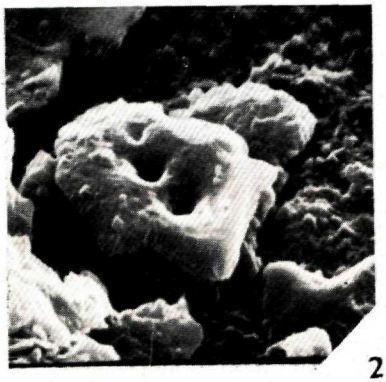
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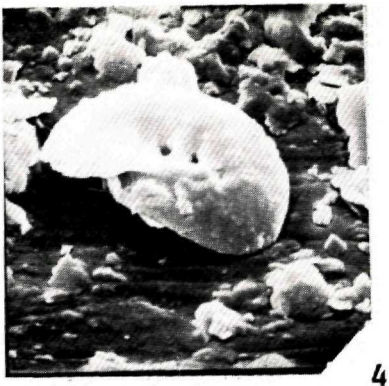
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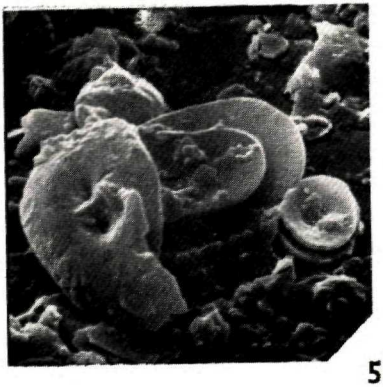
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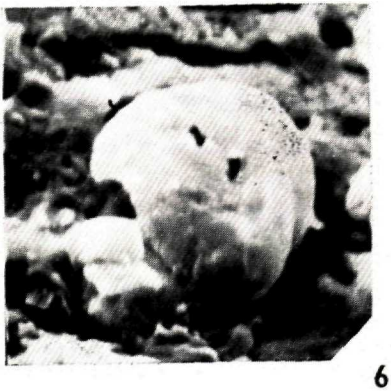
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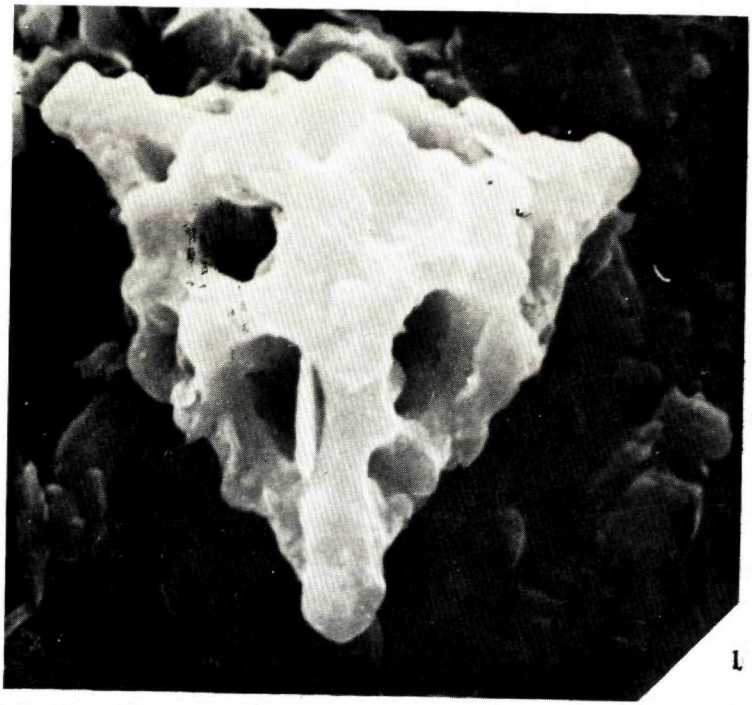
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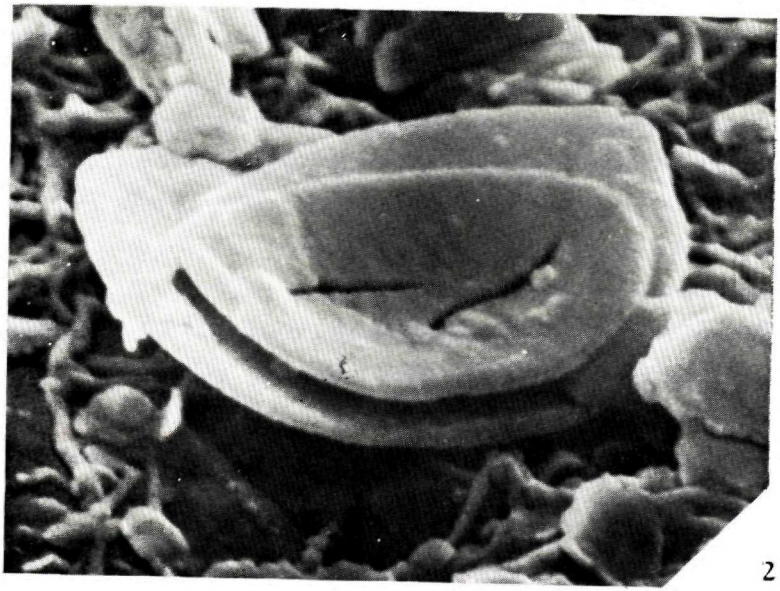
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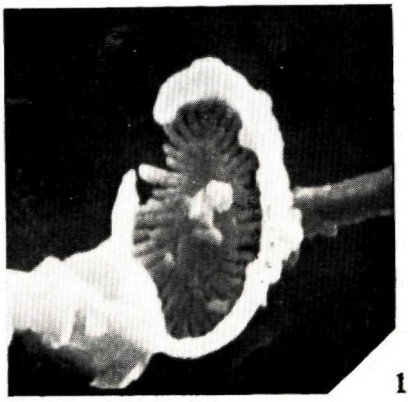
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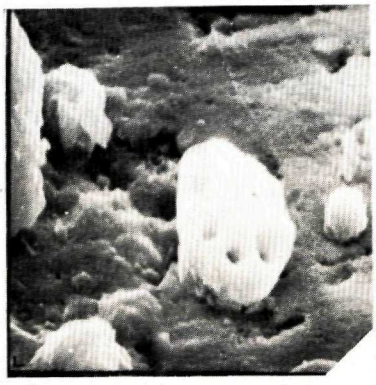


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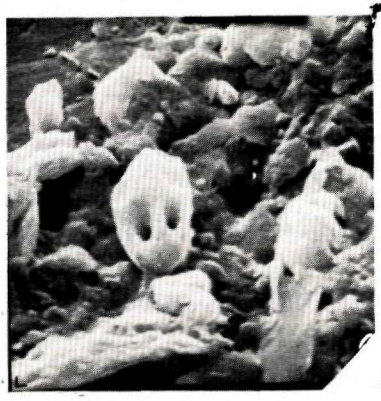


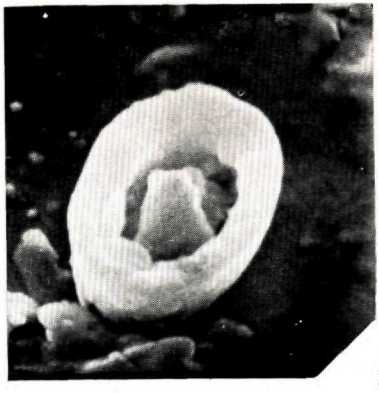
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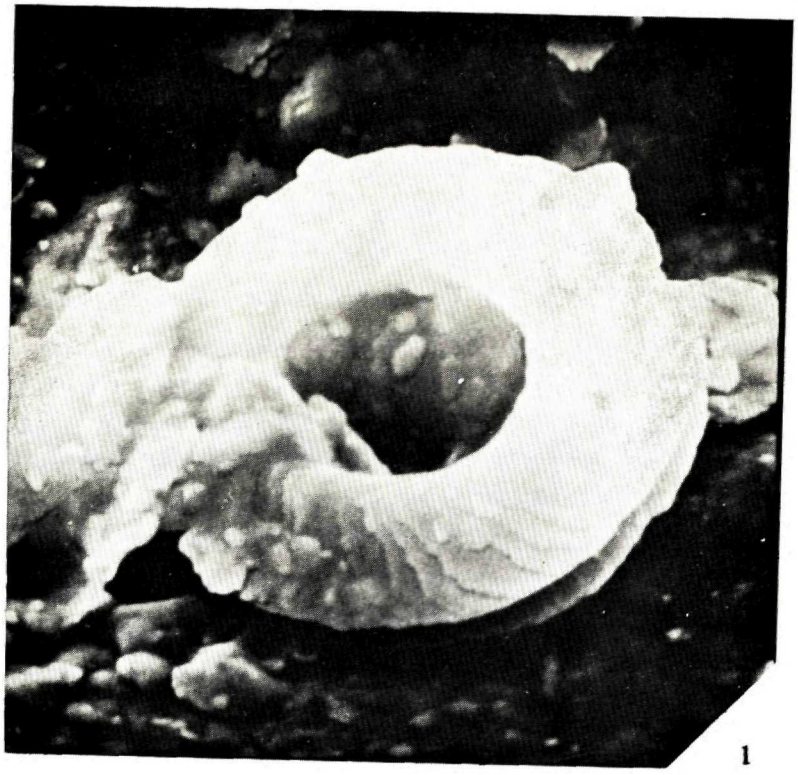

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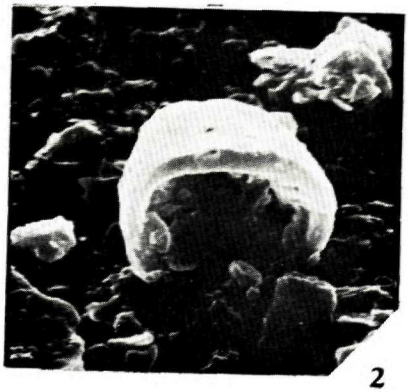

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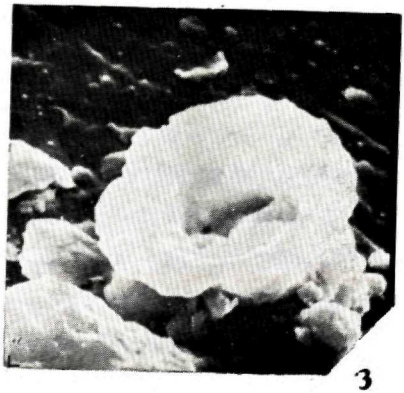

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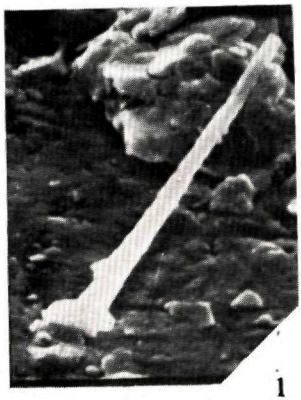
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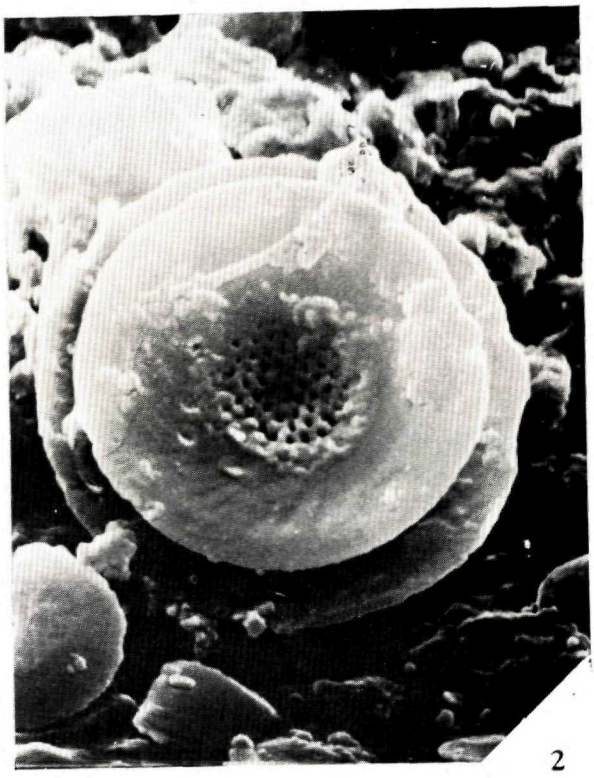
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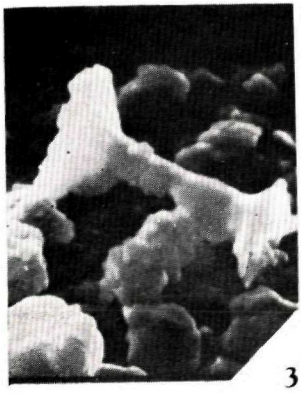
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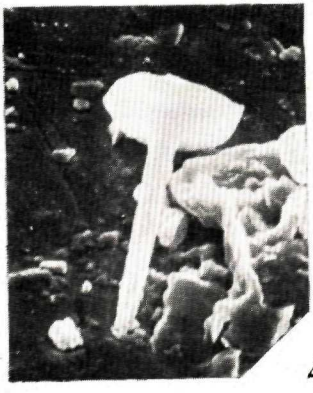
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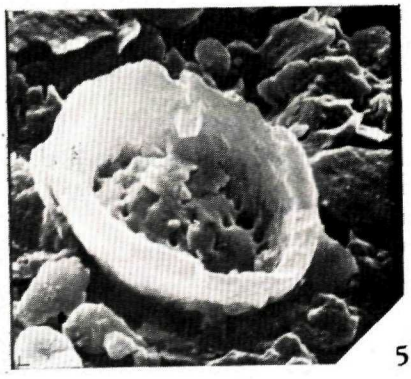
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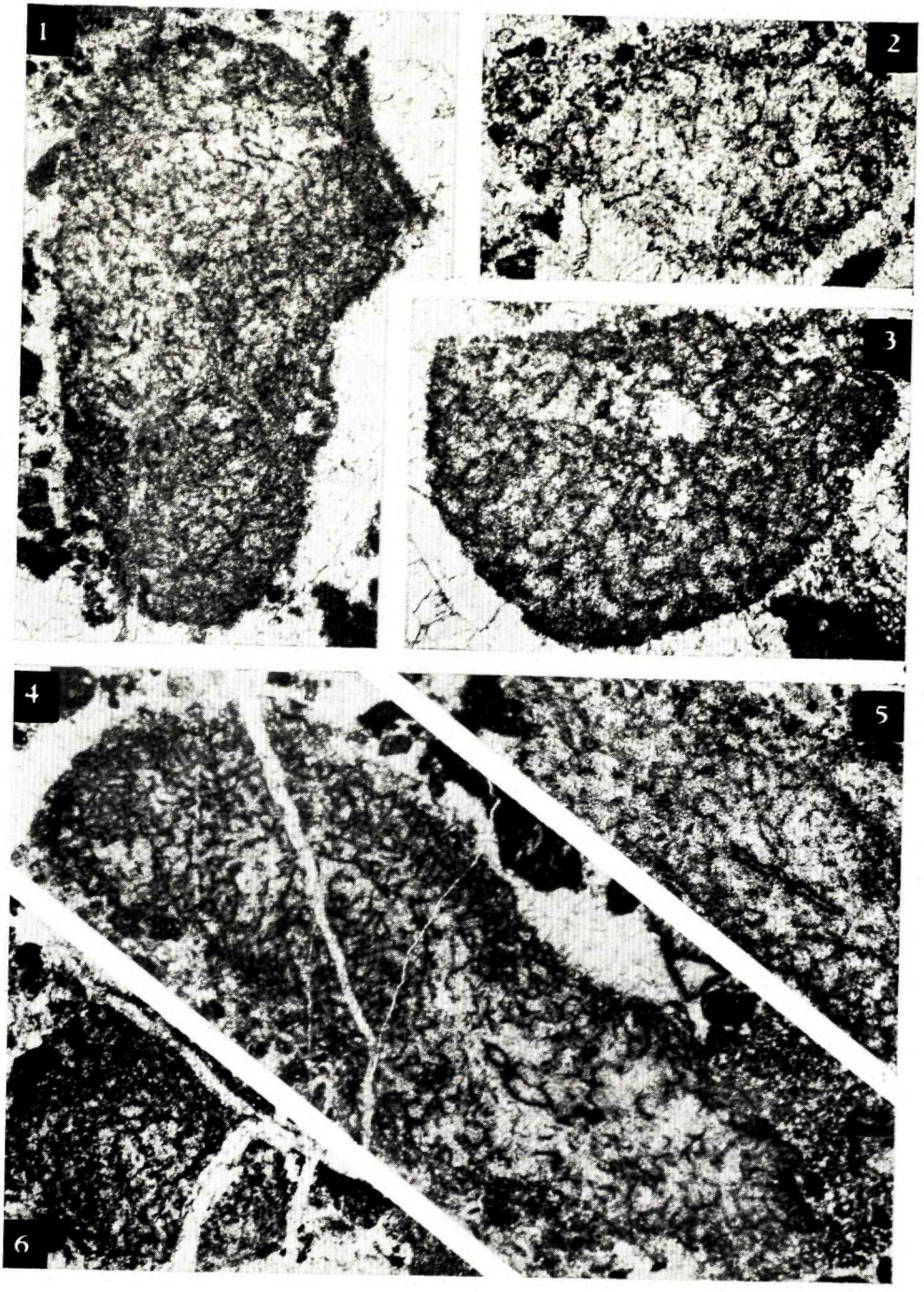
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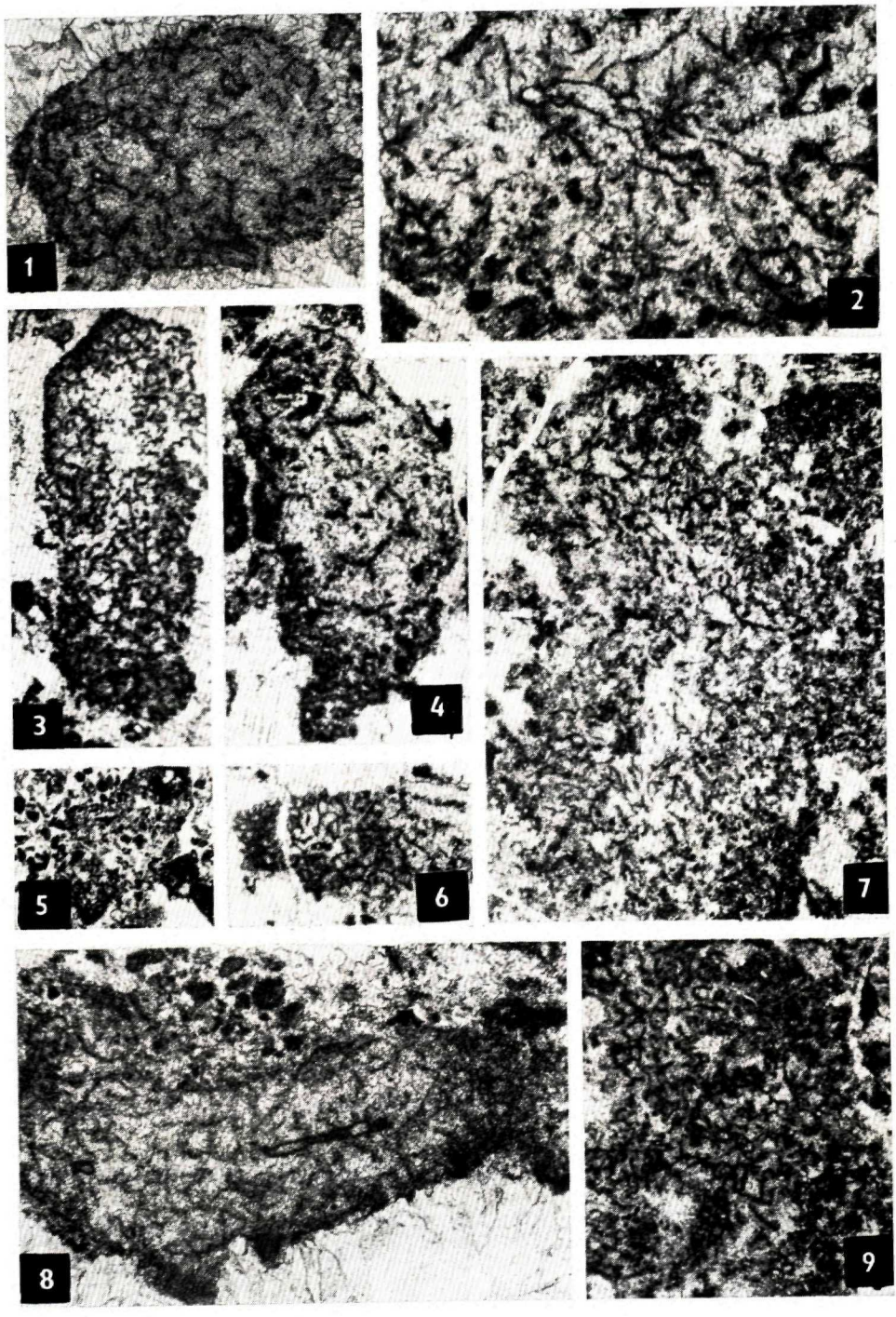


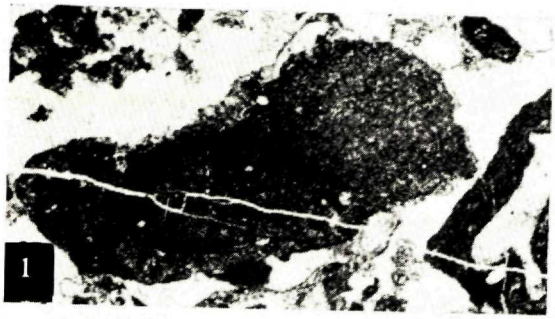
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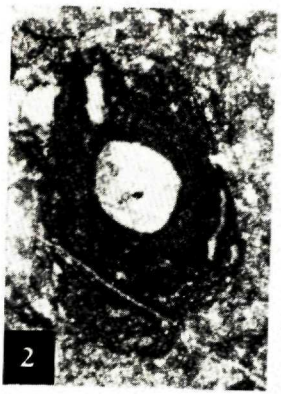


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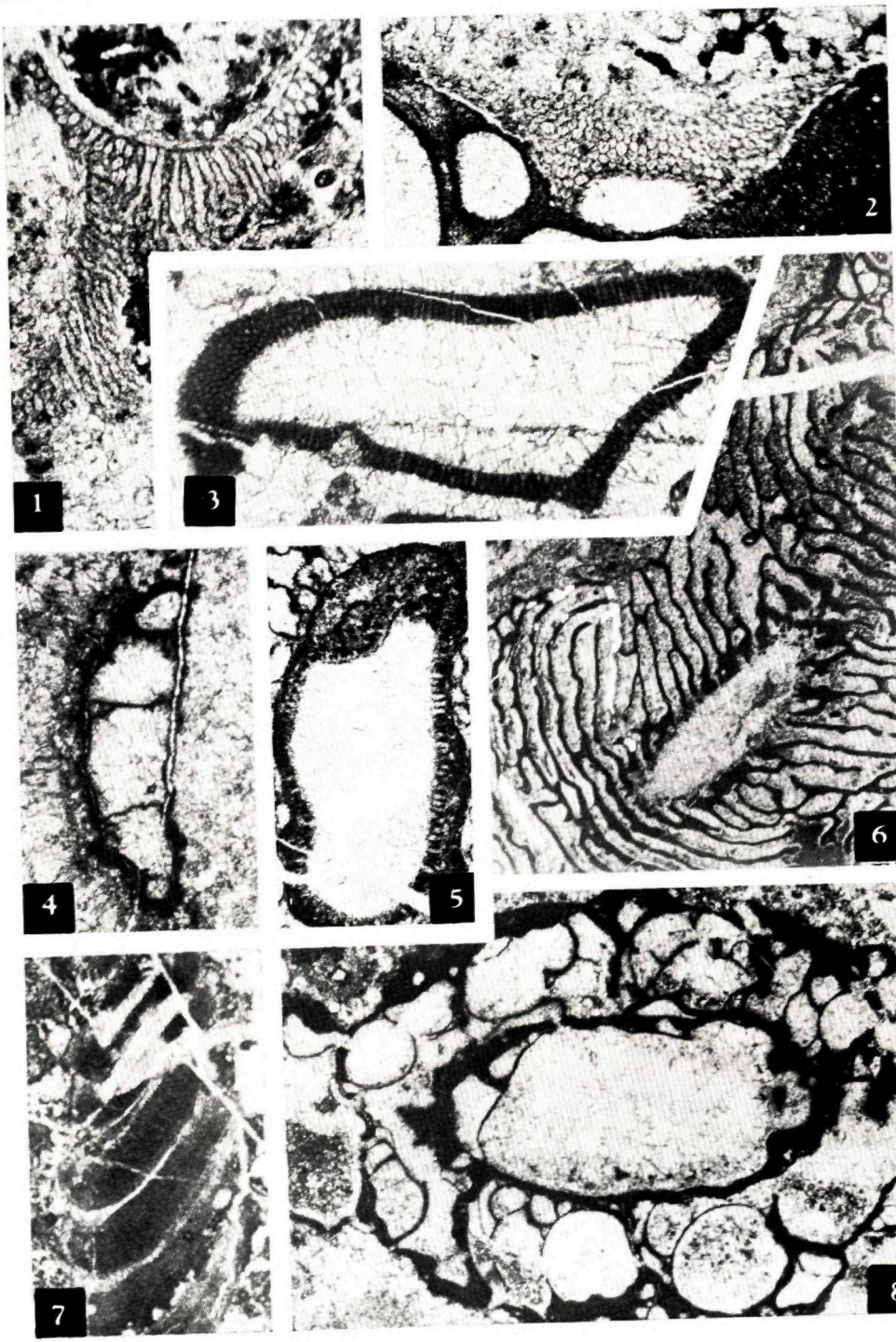

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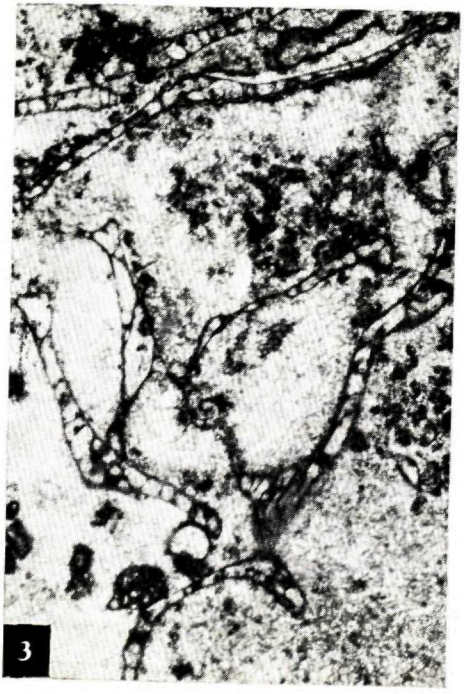

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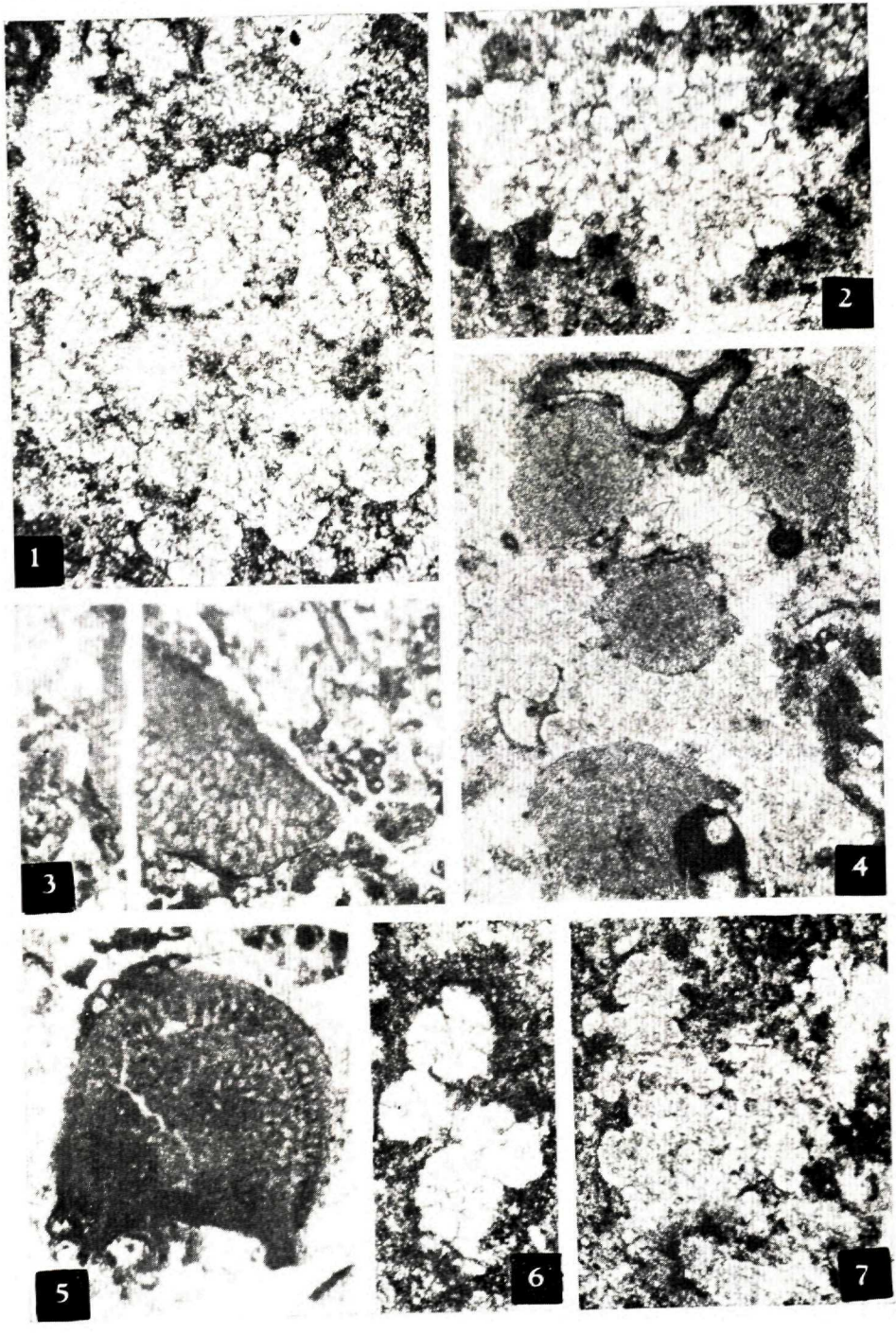

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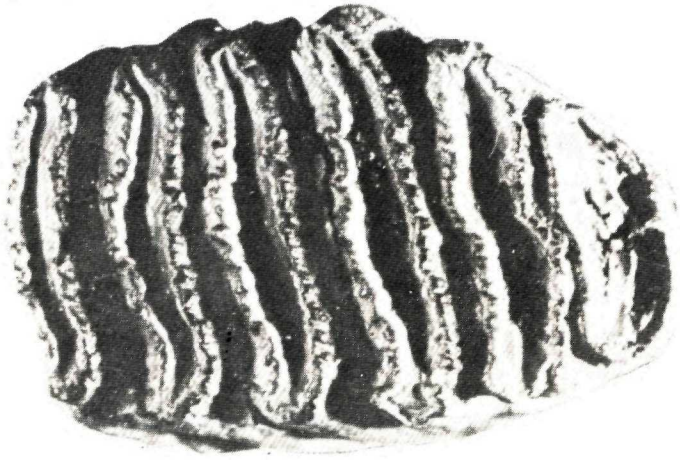
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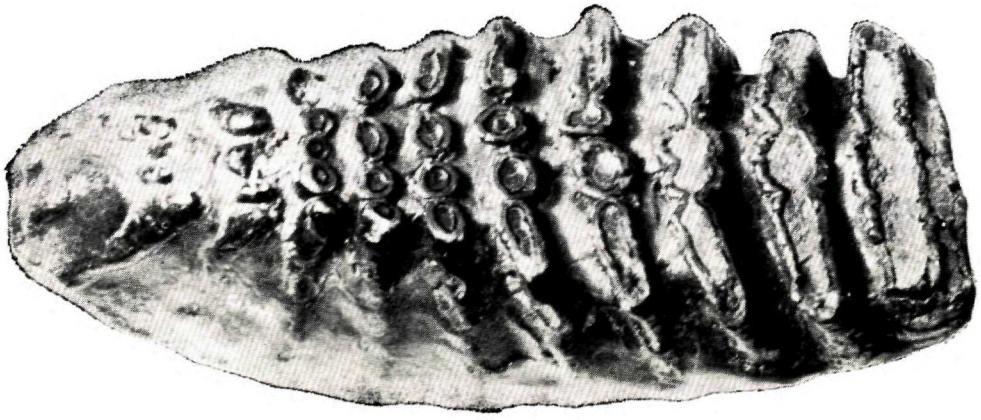




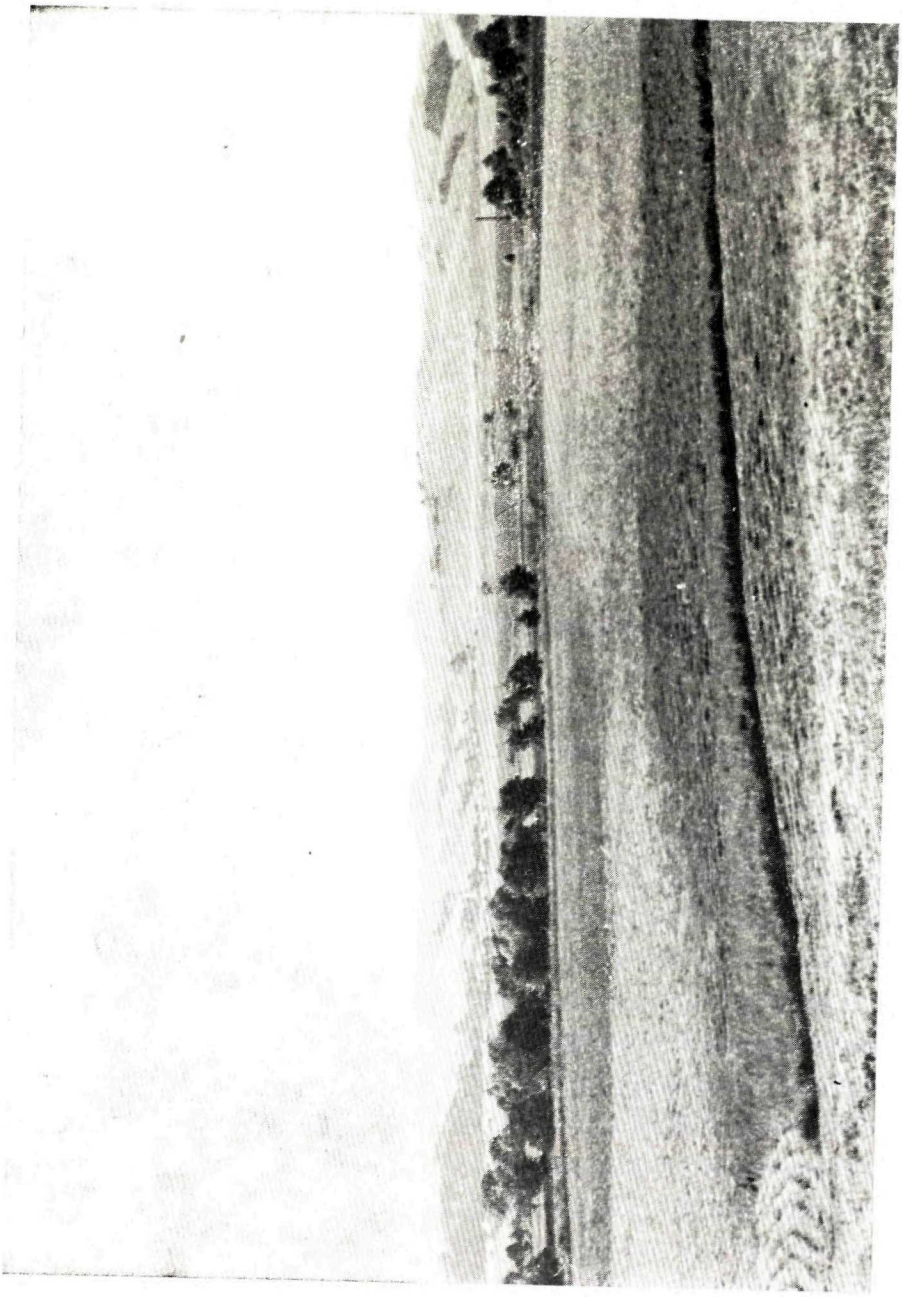




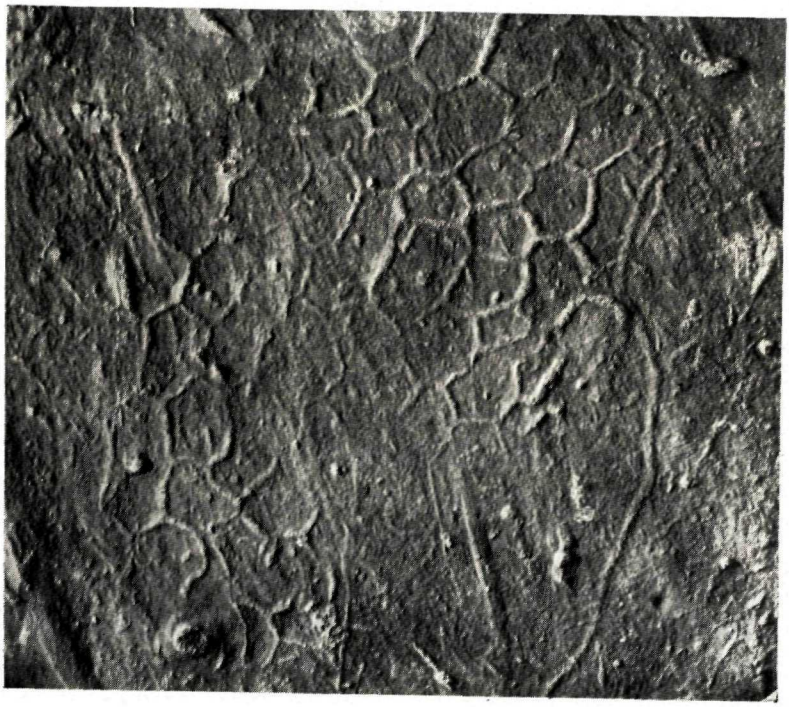
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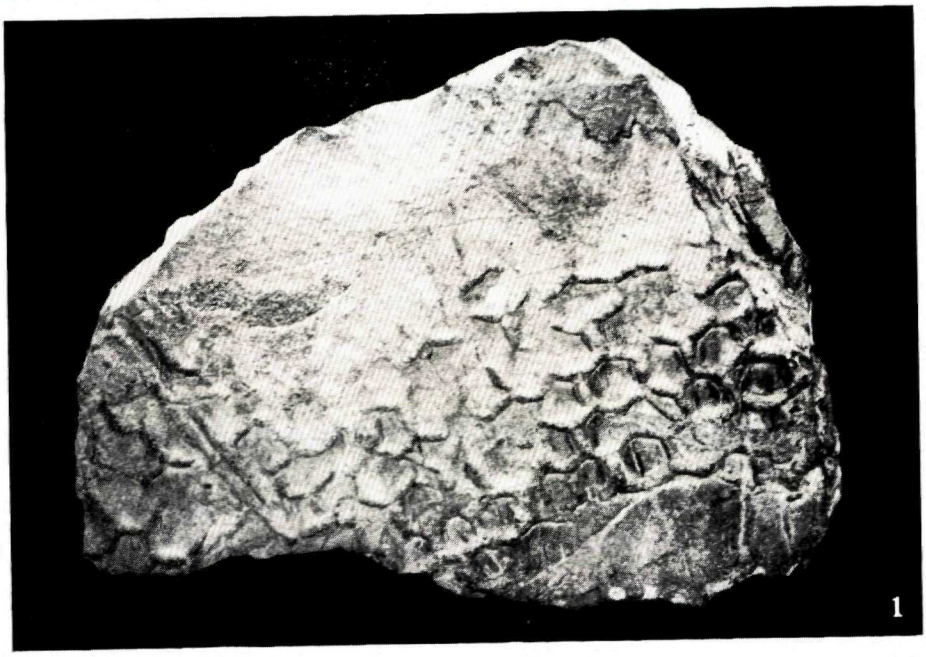


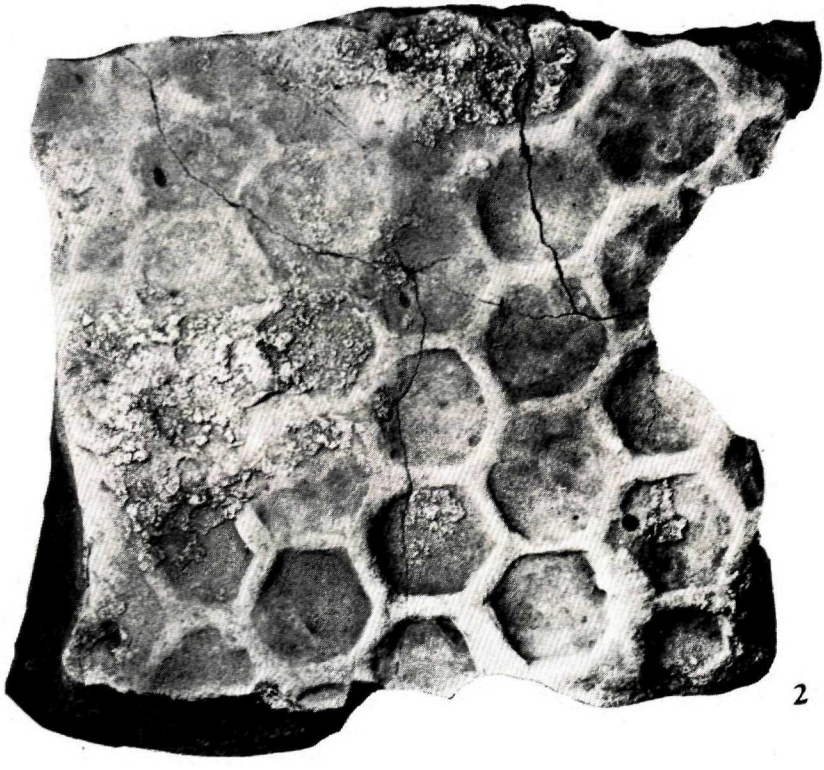


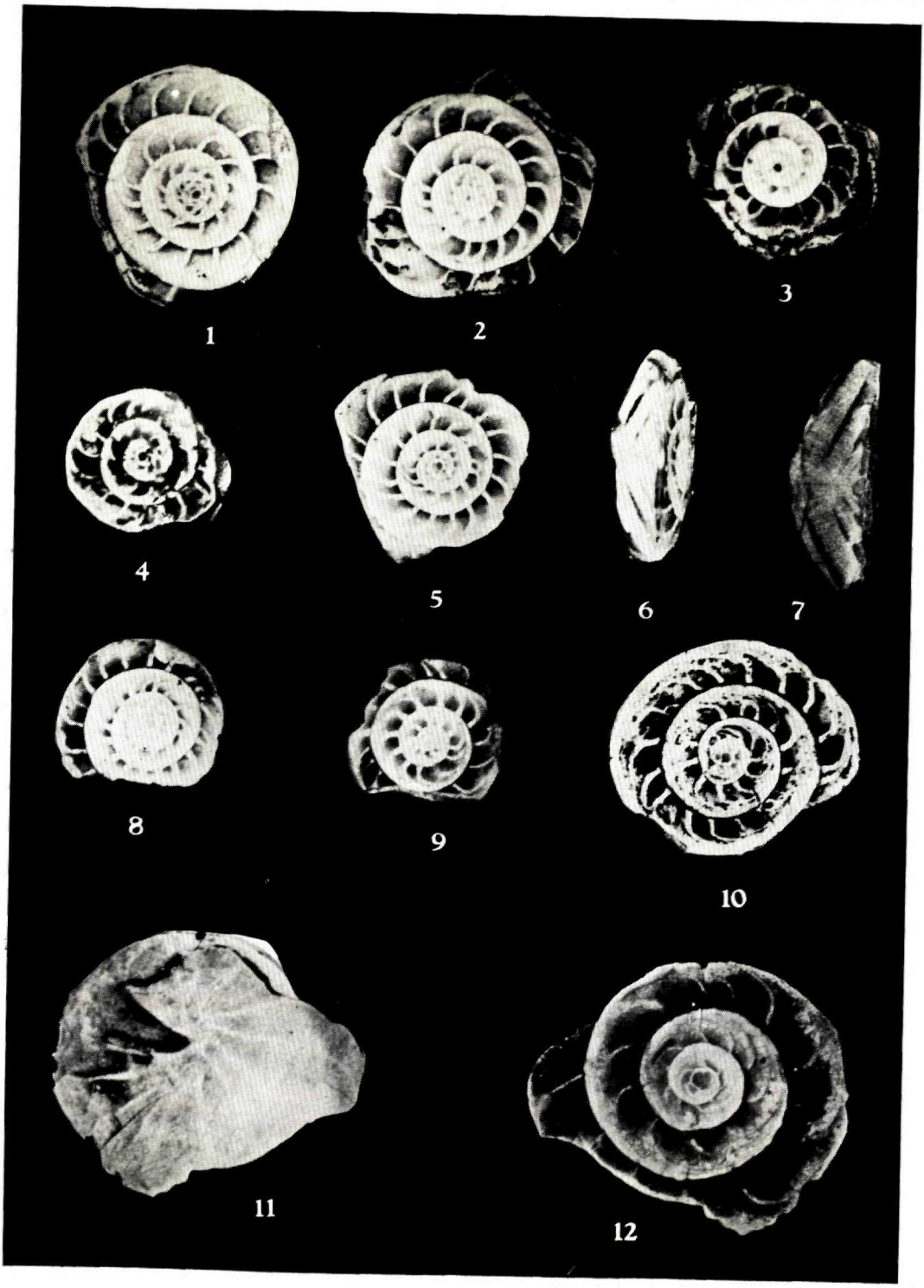
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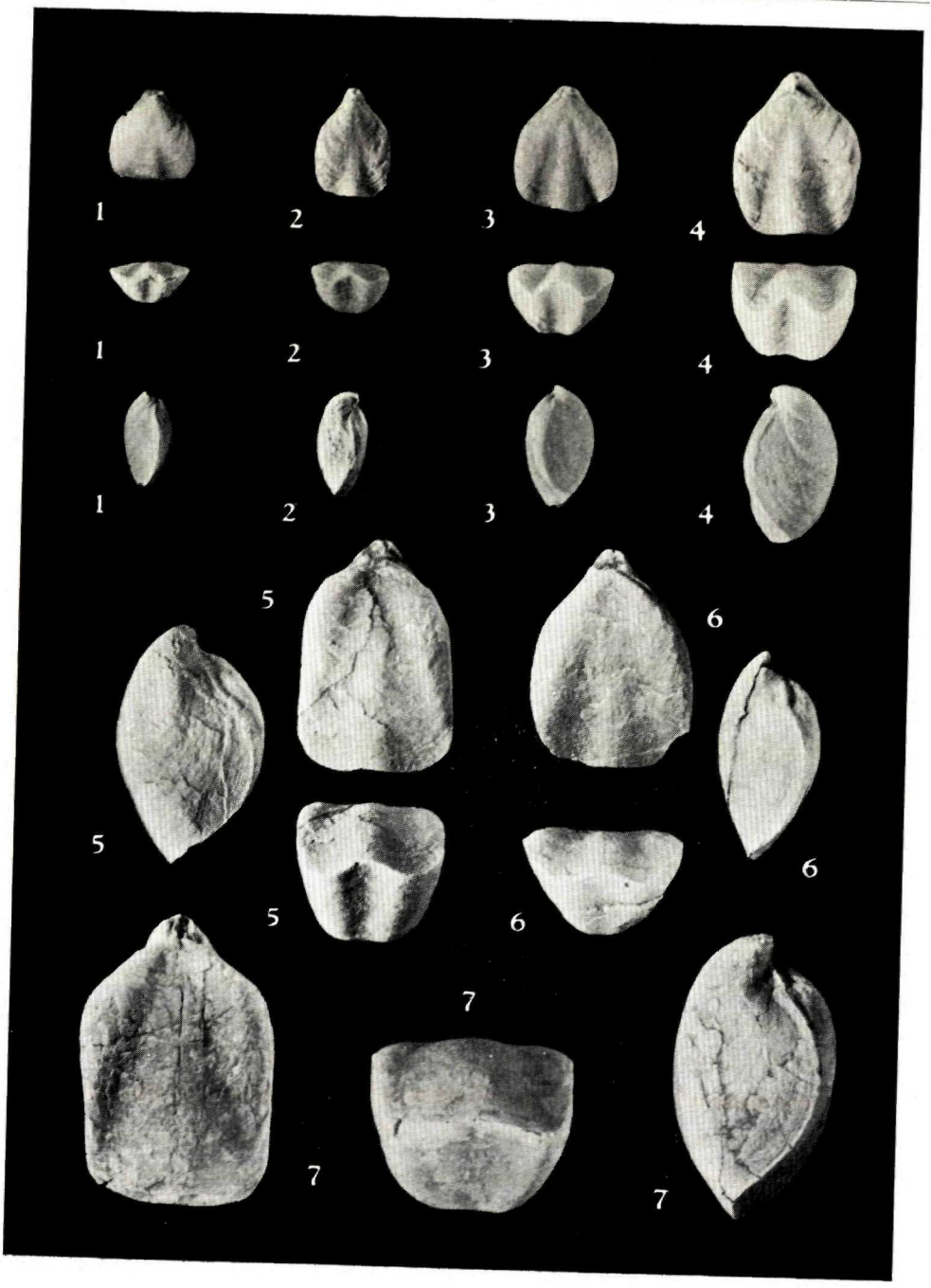


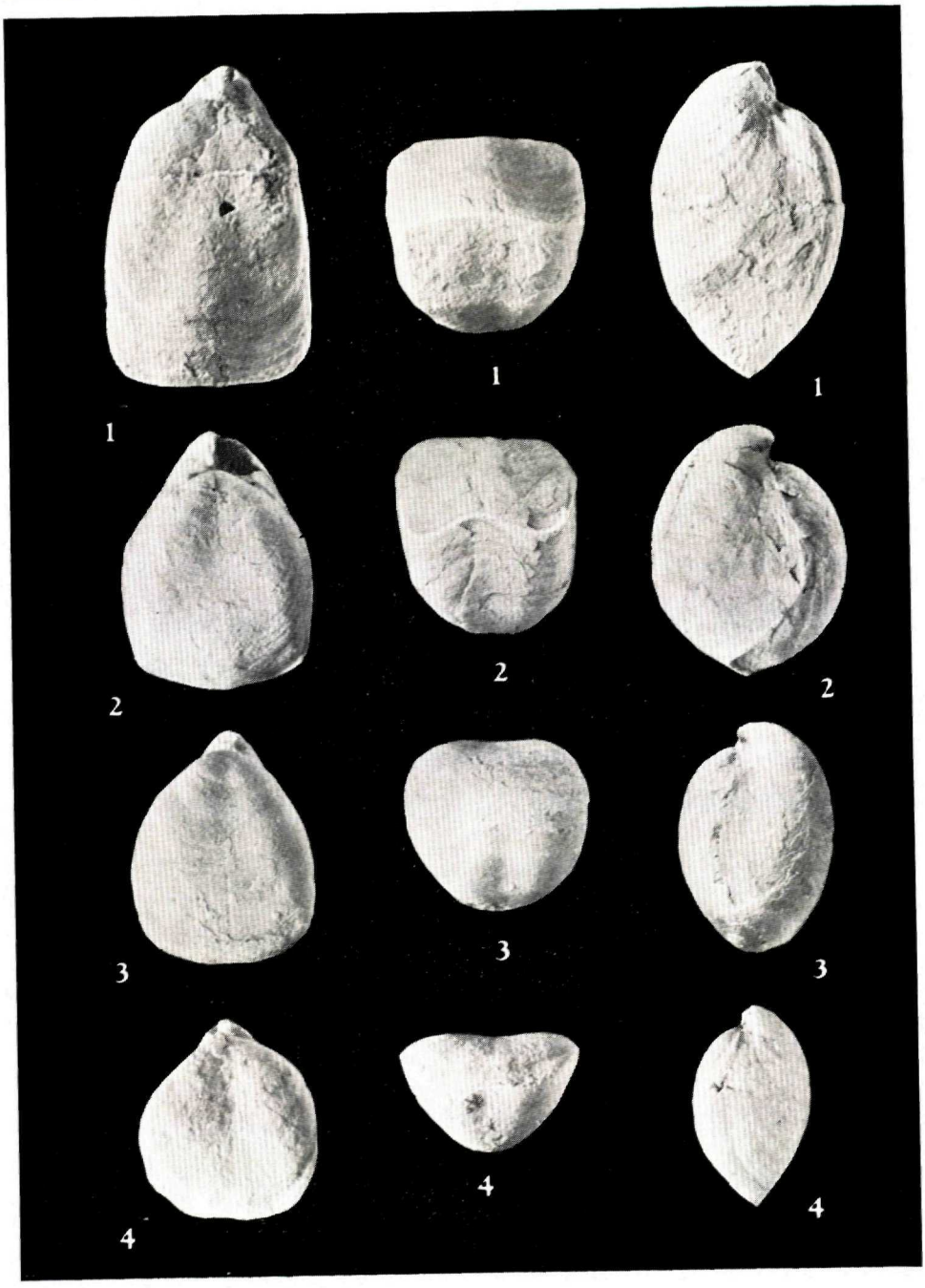
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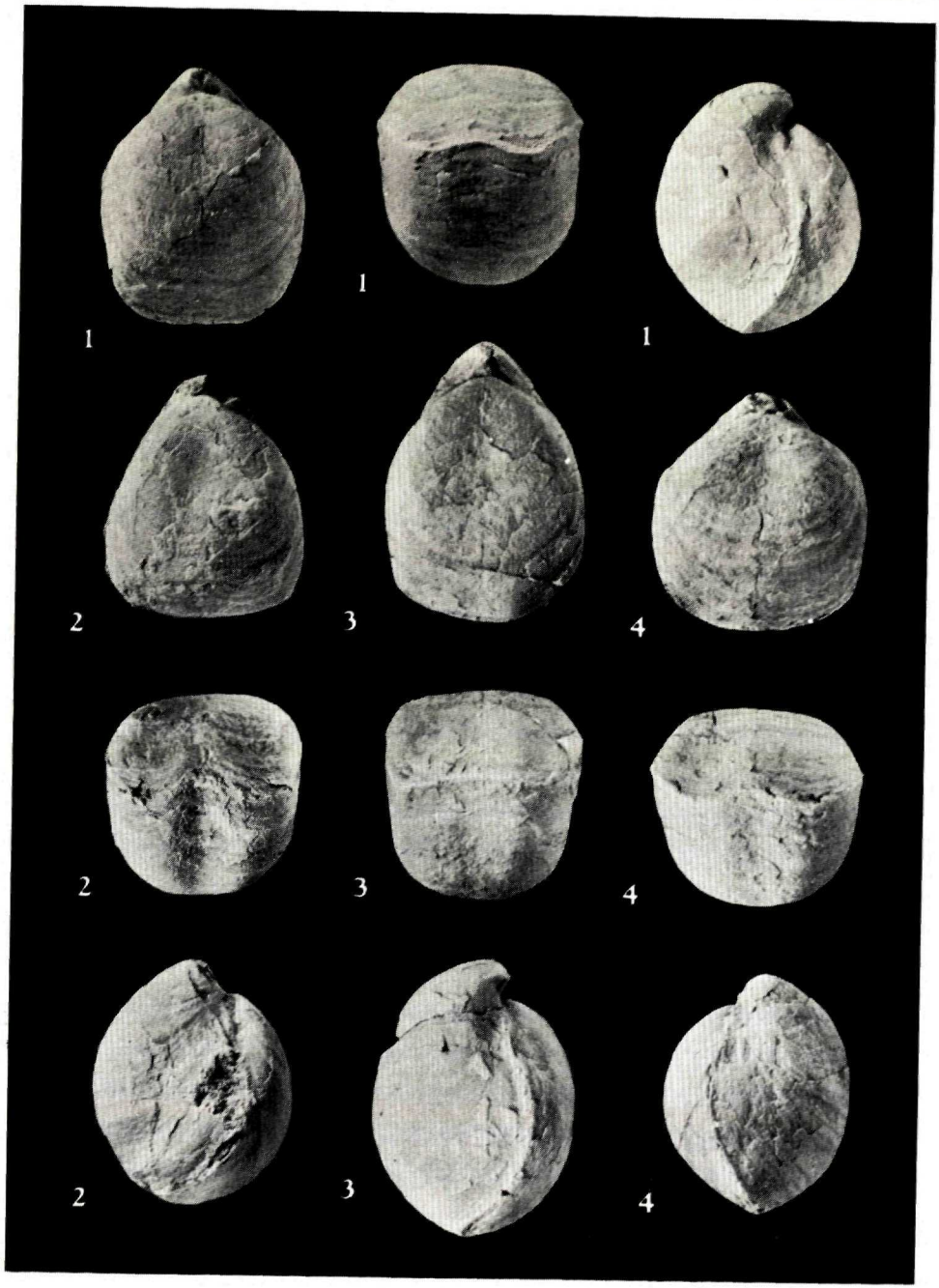

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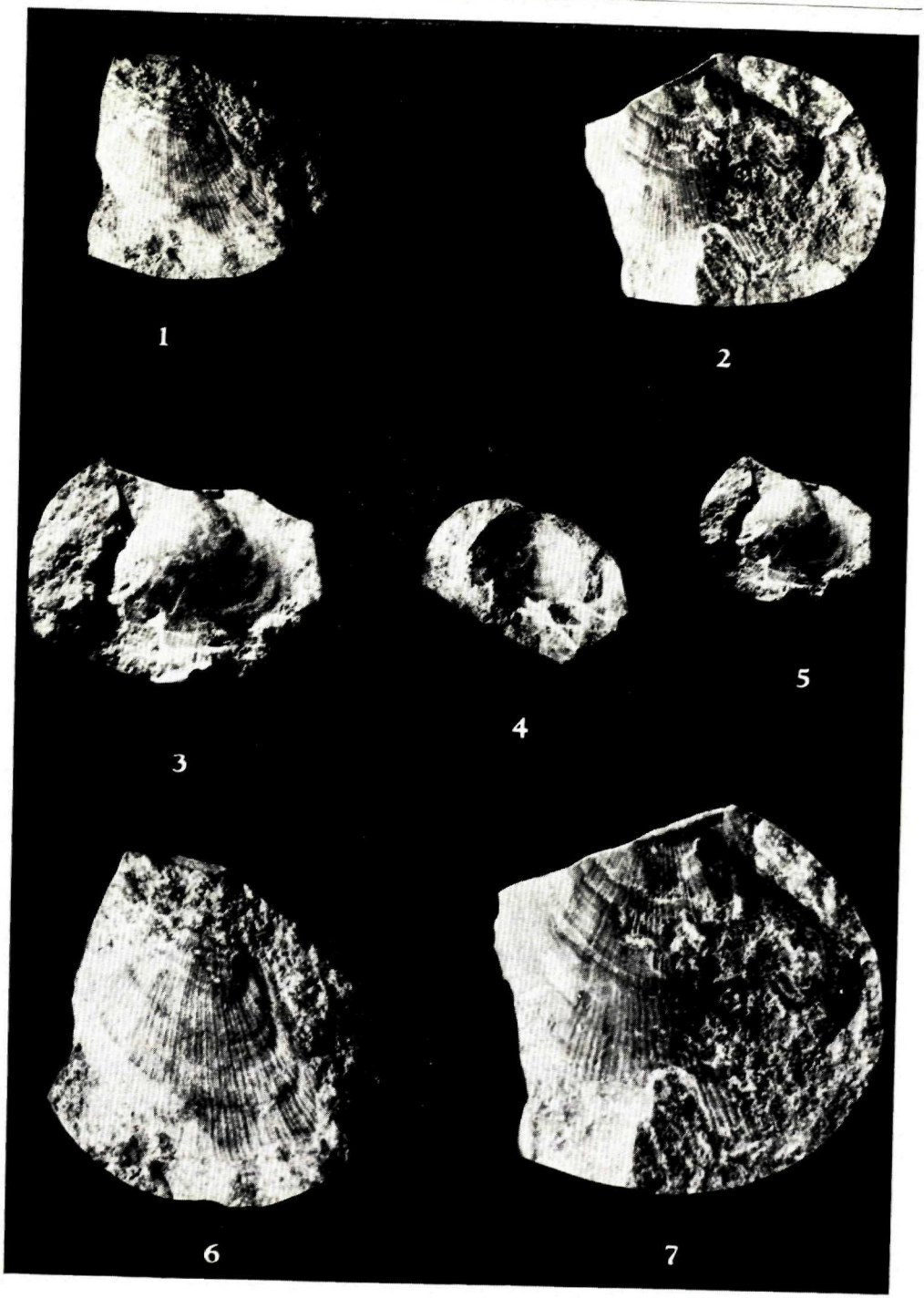

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ZÁPADNÉ KARPATY
séria paleontológia 2—3

Vydal Geologický ústav Dionýza Štúra vo Vede, vydavateľstve Slovenskej akadémie vied v Bratislave roku 1977. Rukopis schválený redakčnou radou GÚDŠ 21. 10. 1975.

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