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ZAPADNÉ KARPATY

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SÉRIA

paleontológia 13

GEOLOGICKÝ ÚSTAV DIONÝZA ŠTÚRA, BRATISLAVA 1989

ZÁPADNÉ KARPATY

SÉRIA

Paleontológia 13

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ZÁPADNÉ KARPATY

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Nepredajný exemplár

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GEOLOGICKÝ ÚSTAV DIONÝZA ŠTÚRA, BRATISLAVA 1989

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Eva Planderová

Upper Triassic sporomorphs from the substratum of the Vienna basin

3 text-figs., 24 pls. (I—XXIV), Slovak summary

Abstract. In the work systematic and morphological investigation of the Upper Triassic sporomorphs from the substratum of the Vienna basin is concerned, which I consider as important in age. 80 species of sporomorphs of Carnian to Norian-Rhaetian age are described. In the description of the species, besides the morphological marks, I was also focused on the range of species in the Triassic of Europe regarding to the occurrence in our country. This way the species from the Lunz beds and overlying dark shales (? Opponitz beds) and from shales belonging to the Hauptdolomit were investigated palynologically.

The palynological investigation of the Lunz beds and overlying dark shales, in the substratum of the Vienna basin, has brought a whole series of knowledge on their age and partly also paleoecology and paleoenvironment.

The spores and pollen, which I describe, are obtained from investigation of a large amount of samples, mostly of dark shales, ranged to the Lunz beds from the lithological standpoint and dark shales, which partly may belong to the Opponitz beds and partly to the Hauptdolomit (J. KYSELA 1983).

The majority of palynological results I obtained from investigation of samples from deep boreholes in the substratum of the Vienna basin and I correlated these with the palynological results from the Lunz beds at other localities in the region of the West Carpathians (Fig. 1).

In palynological investigation of the Lunz beds and dark shales in their overlier I have established that a part of sediments is:

- a) negative in sporomorphs, but positive in organic kerogen
- b) a part of sediments is positive in sporomorphs, also organic kerogen, there are lithologically equally characterized sediments.

Sediments positive in sporomorphs we may divide into:

1. Very rich in well preserved sporomorphs, yellow to light-brown coloured.
2. Poor in well preserved sporomorphs.
3. Poor in poorly preserved sporomorphs.

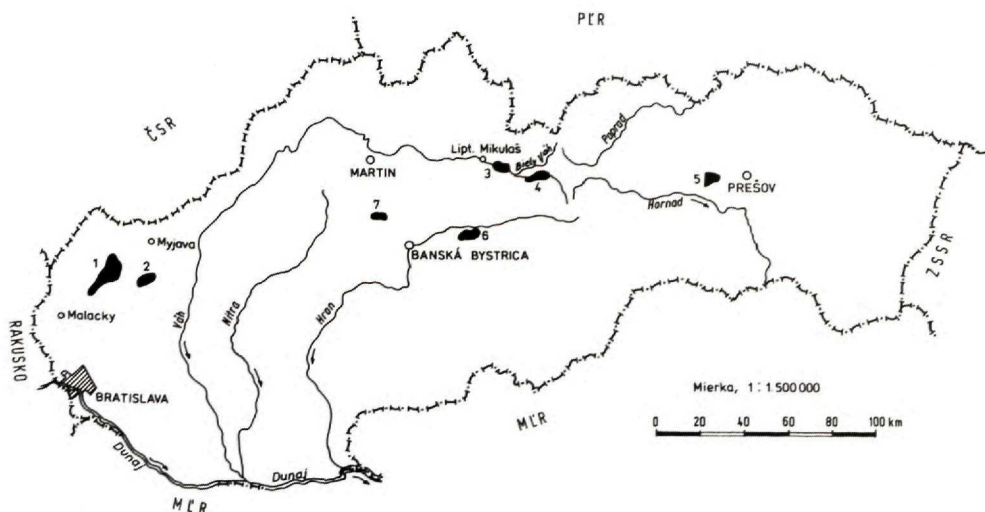


Fig. 1 Map of the areas from which palynological research of Lunz beds and shales above them was carried out.

As the faunistic association from the lower part of the Lunz beds is typical of the deeper part of the neritic to bathyal zone of the sea, we must consider a sedimentary environment of this character. On the basis of the presence of marine plankton belonging to the group Acritarchs, we consider marine sedimentary environment also in the Lunz beds and dark shales overlying them.

In the scheme of the lithostratigraphical units in the West Carpathians, compiled according to J. BYSTRICKÝ (1983, Fig. 2.), representation of the Lunz beds in the region of the West Carpathians according to region with underlying and overlying sediments is shown. From some localities of the Lunz beds also palynological investigation was carried out. A typical microflora of the Lunz beds of Julian age was found in the area of Liptovský Hrádok (E. PLANDEROVÁ 1972), in Dubová and Hradište pod Vrátnom (P. SNOPKOVÁ in M. KOCHANOVÁ, A. KULLMANOVÁ, P. SNOPKOVÁ 1978) as well as from the substratum of the Vienna basin, from many boreholes (E. PLANDEROVÁ), LNV-7, LNV-2, Láb-90, Malacky-20. M. KOCHANOVÁ (in M. KOCHANOVÁ, A. KULLMANOVÁ, P. SNOPKOVÁ 1978) found a macrofauna of the species *Halobia rugosa* Gümbel in the Lunz beds, in the lower part of borehole LNV-7, together with this species she found the species *Carnites floridus* Wulfen, the age of which is mentioned as Cordevolian-Julian (*Trachyceras aon* and *Trachyceras aonoides* zones) in the Alps. In the West Carpathians, however, it was found in the Julian only.

For considering the age of the shaly formation (of the Lunz beds) I correlated the sporomorph association from the Lunz beds from the region of the Carpathians with the palynological results from the Upper Triassic from whole Europe. Some authors mention sporomorph associations dated by ammonite fauna (H. VISSCHER and L. KRYSZTYN 1978). These may be considered as

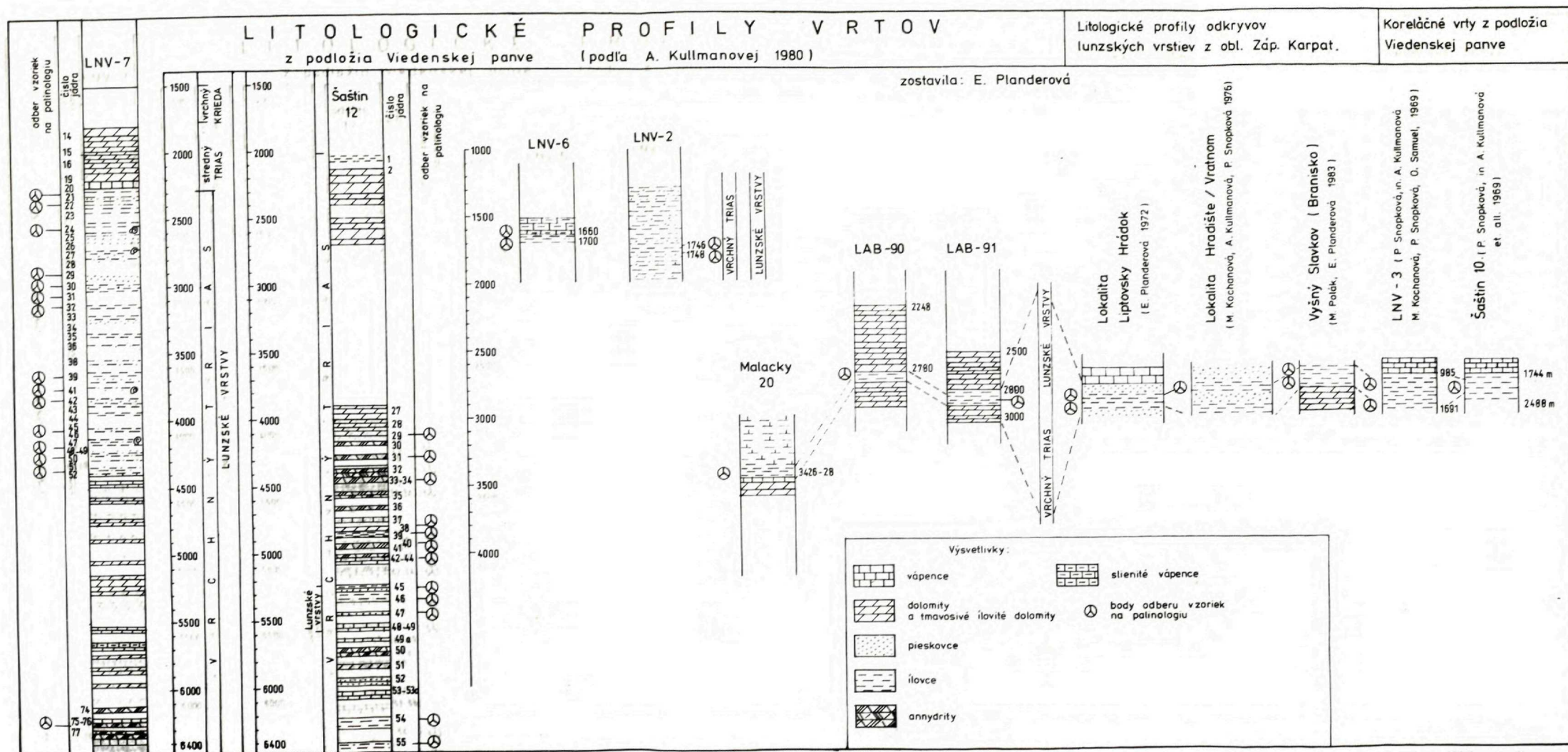


Fig. 3 Lithological profiles of boreholes from the substratum of the Vienna basin (According to A. KULLMANOVÁ 1983). The sites of sampling of palynological research are indicated.

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supporting from the viewpoint of correlation of age of these formations, in which fauna has not been found. We consider as important works from the viewpoint of assignment of the age of Upper Triassic associations those correlated with faunistic zones. I used for correlation of the age of the Lunz beds mainly the works by W. KLAUS (1960), H. VISSCHER and L. KRYSZTYN (1978), T. ORLOWSKA-ZWOLINSKA (1983), E. SCHULZ (1967), B. SCHEURING (1970), M. FISCHER (1972) and others.

The palynological results are from boreholes in the area of Lakšárska Nová Ves (LNV-7, LNV-2, LNV-6), from the area of Láb and Malacky (Láb-20, Láb-90, 91, Malacky-20), Šaštín: Šaštín-12 (The lithological profiles from boreholes in the substratum of the Vienna basin with the position of sampling are in Fig. 3).

a) The Middle Triassic (Ladinian) — Lower Carnian I established only from dark shales underlying the Lunz beds (LNV-7 6267 m) and from borehole Šaštín-12 (6927 m).

The dark shales from the mentioned borehole contained different associations of sporomorphs from samples of the overlier. The microfloristic assemblages mostly consisted of species of the genus *Triadispora*, as *Triadispora crassa* KLAUS, *Triadispora palettae* KLAUS, *Triadispora aurea* SCHEURING, species of the genus *Limitisporites*, which are abundant in the Middle Triassic and pass to the Carnian seldom only. In samples from borehole Šaštín-12 (6427—6277 m) the species *Constatisulcites ovatus* SCHEURING, *Taeniaesporites* sp., *Thomsonisporites* sp., *Cristianisporites* sp., *Cyclotriletes margaritatus* MÄDLER, *Striatites goswitzensis* MÄDLER, *Tigrisporites halleiensis* KLAUS, *Triadispora* sp. were found. The mentioned assemblages most probably indicate the end of the Ladinian to Lower Carnian.

Preservation of sporomorphs was somewhat poorer than in the overlying sediments, what may be ascribed to a greater pressure of rocks on sporomorphs. As to the age, we may range the sediments from this level to the Ladinian or Carnian base.

b) The Carnian age (Julian substage) I established in sediments of the Lunz beds. The Lunz beds contained the following sporomorph association: *Ovalipollis ovalis* (KRUTZSCH) KLAUS, *Ovalipollis notabilis* SCHEURING, *Ovalipollis lepidus* SCHEURING, *Triadispora stabilis* SCHEURING, *Triadispora modesta* SCHEURING, *Aratrisporites virgatus* PAUTSCH, *Aratrisporites scabratus* KLAUS, *Reticulatisporites* cf. *bunteri* MÄDLER, *Paraconcavisporites lunzensis* KLAUS, *Corrugatisporites klausi* KAVARY, *Conosmundasporites othmari* KLAUS, *Porcellispora longdonensis* (CLARKE) SCHEURING, *Zebrasporites fimbriatus* KLAUS, *Saturnisporites palettae* KLAUS, *Saturnisporites fimbriatus* KLAUS.

c) The dark shales overlying the Lunz beds (? Opponitz beds) are of Tuvallian — Lacian age (LNV-7, Šaštín-12, LNV-6).

The Tuvallian — Lacian age is indicated by the occurrence of such species, which begin to occur in the Upper Carnian to Norian. The composition of the microflora is as follows: *Annulispora microanulata* DE JERSEY, *Paraconcavisporites lunzensis* KLAUS, *Deltoidospora crassiexina* NILSS., *Polycingulatisporites*

circulus SIM., *Carnisporites anteriscus* NORBEY, *Camarozonosporites rudis* (LESCHIK) KLAUS, *Apiculatisporites parvispinosus* (LESCHIK) SCHULZ, *Porcellispora longdonensis* (CLARKE) SCHEURING, *Aratrisporites* cf. *rotundus* MÄDLER, *Todisporites major* COUPER, *Granuloperculatisporites rudis* VEN. GOCZÁN, *Chasmatosporites apertus* (ROG.) NILSS., *Camerosporites secatus* LESCHIK, *Praecirculina granifer* KLAUS, *Eucommiidites troedsoni* ERDTMAN, *Ovalipollis ovalis* KR.

d) The youngest sporomorph associations I found in borehole Šaštín-12 (4120—4124 m) in shales between dolomites. This dolomite complex perhaps belongs to the Hauptdolomit according to J. KYSELA (1983). The microfloristic associations are already exclusively Norian-Rhaetian in age, of the following composition: *Paracirculina* sp., *Granuloperculatisporites rudis* VEN. GOCZ., *Tuberculatisporites* sp., *Thomsonisporites* sp., *Taenisporites rhaeticus* SCHULZ., *Conbaculatisporites longdonensis* CLARKE, *Platysaccus* div. sp., *Ginkgocycadopites*, — many species of the genus *Classopollis*, *Eucommiidites troedsoni* ERDT., *Araucariacidites* sp., *Chasmatosporites apertus* (ROG.) NILSS., *Cyathidites australis* COUPER, *Ovalipollis ovalis* KRUTZSCH and other bisaccate pollen without nearer species determination.

On the basis of comparison with the Upper Triassic, according to J. MORBEY (1975), we may state that the majority of the established species is of stratigraphic range from the Norian, but mainly in the Lower Rhaetian. Therefore I suppose on the basis of correlations with German development, that an age mentioned as the upper part of the Gipskeuper to Rhaetian Keuper is concerned (B. SCHEURING 1970 and J. MORBEY 1975).

In the work 80 species of spores and pollen are systematically ranged and described, stressing their range of age. The systematic assignment and morphological descriptions of species are connected with detailed biostratigraphical investigation of dark shaly sediments from the substratum of the Vienna basin, which are part of the team work by J. KYSELA et al. (in lit.).



Fig. 2 Lithostratigraphical units of the Upper Triassic of the West Carpathians according to J. BYSTRICKÝ (1983).

Ammonoid zones

A — *Choristoceras marshi*, B — *Rhabdoceras suessi*, C — *Halorites macer*, D — *Himavavites hogardi*, E — *Cyrtopleuritis bicrenatus*, F — *Juvavites magnus*, G — *Malayites paulckeii*, H — *Guembelites jandianus*, I — *Anatropites bereich*, J — *Tropites subbulatus*, K — *Tropites dilleri*, L — *Austrotrachyceras austriacum*, M — *Trachyceras anoides*, N — *Frankites ? regoledanus*, O — *Protrachyceras archelaus*, P — *Protrachyceras gredleri*, a) Lunz nappe, b) Ötscher nappe.

**Systematical Description of Spores, Pollen and Acritarchs
from the Lunz Beds and Dark Shales in their Overlier**

Cyathidites COUPER

Cyathidites minor COUPER

Pl. I, Figs. 1, 7

Remark: Trilete Spores of 35—40 μ of size. They correspond to the description of the species according to R. A. COUPER (1958).

Distribution: This genus is generally mentioned from the Triassic and Jurassic. R. A. COUPER (1958) states competence to the botanical genus *Thymopteris*.

Occurrence: In the Carpathian region this genus is abundant in the Lunz shales and in dark shales from borehole LNV-7 (4400—2301 m).

Cyathidites cf. *sobuli* REINH.

Pl. II, Fig. 1

Remark: Shape triangular, size 48 μ . The exine is smooth. The structure of inner area is punctate. From the genus described by P. REINHART (1961) it differs in the smaller central area around Y mark.

Distribution: P. REINHART (1961) mentions this species from the Rhaetian.

Occurrence: In our material the species was found in dark shales in position above Lunz beds of Carnian — Norian age and from the shales of the dolomite complex (Šaštín-12, 4400—4120 m).

Paraconavisporites KLAUS

Paraconavisporites lunzensis KLAUS

Pl. I, Figs. 2—6

Remark: the species corresponds to the description according to W. KLAUS (1960). The Y mark is mostly accompanied by indistinct tori. A sign typical of the genus is asymmetrical connection of Y mark rays. The shape is triangular with straight walls in equatorial position.

Distribution: W. KLAUS (1960) mentions the distribution of this species in the Lunz shales from the Triassic of Alpine development from the Julian substage of the Carnian.

Occurrence: This species is common in the Lunz shales from the Vienna basin, i.e. associations which are rich in spores of *Pteridophyta* (LNV-2 1748 m, LNV-7 3700—4400 m, locality Liptovský Hrádok).

Bot. significance: unknown.

Toroisporis W. KR.

Toroisporis sp.

Pl. I, Fig. 16

Remark: Trilete spore. Size about 45 μ . Around the thick Y mark a dark torus is developed. From species of the genus *Gleicheniidites* it differs in straight walls of tori and not concave shape.

Occurrence: Seldom in the Lunz beds of deep borehole LNV-7 (3700—4400 m), LNV-2 (1746—1748 m).

Retusotriletes NAUM.

Retusotriletes mesozoicus KLAUS

Pl. I, Figs. 10—11

Remark: Trilete spore of roundish shape. Size 35—40 μ . Corresponds to the description of the species according to W. KLAUS (1960).

Distribution: The main distribution of this species is, according to W. KLAUS (1960), in the Lunz beds of the Carnian stage, mainly in sphaerosiderite layers. An isolated occurrence of this species is in the Zlambach beds, also mentioned by W. KLAUS (1960).

Occurrence: Always we found this species in the Lunz beds in the Carpathian region. It was most abundant in dark shales above the Lunz beds in the deep drilling LNV-7 (2301—2400 m) and LNV-6 (1660—1700 m).

Concavisporites KRUTZSCH

Concavisporites cf. *toralis* (LESCHIK) NILSSON

Pl. I, Figs. 8—9, 12—13

Remark: Trilete spores with distinctly concave shape and thick tori. Size 26—28 μ . It differs from the species described by T. NILSSON (1958) in size. Our species is smaller by several μ .

Occurrence: Quite abundant in sediments of the dolomitic complex (Šaštín-12, 4120 m).

Concavisporites toralis (LESCHIK) NILSS.

Pl. V, Figs. 1—2

Remark: Trilete spore. Size 40 μ . Exine smooth, thin. Y mark reaches 5/6 of the spore. Around the Y mark is a thick dark torus.

Distribution: Mainly from the Rhaetian stage and Jurassic (W. SCHUURMANN 1977).

Occurrence: Very rarely I found it in the shales above the Lunz beds (LNV-7, 2301 m, LNV-6, 1660 m), abundant in the shales of the dolomite complex (Šaštín-12, 4120—4124 m).

***Concavisporites* (GLEICHENIA) *umbonatus* (BOLCH.) ARJANG**

Pl. XI, Fig. 3

Remark: Trilete spore of triangular shape. Size 40—45 μ . Significant are the toruses, around the Y mark, elongated to a beek-like growth. It corresponds to the species according to B. ARJANG (1975).

Distribution: From the Middle Rhaetian to the Liassic.

Occurrence: In our material I found this species sporadically in the shales of the dolomite complex (Šaštín-12, 4120—4124 m).

***Concavisporites* sp. 1**

Pl. III, Figs. 1, 5, 6

Remark: According to the shape I range the spores (Pl. III, Figs. 5—6) to the genus *Concavisporites*. The exina is smooth. The structure is fine reticulate to foveolate. Y mark reaches do 1/3 spore body. Against ranging to the genus *Cyathidites* they are the lenght of Y mark testifies.

Occurrence: This species I found in dark shales above the Lunz beds of Tuvalian-Lacian age in the samples from deep drillings LNV-7 (2301—2800 m), LNV-6 (1660—1700 m), Šaštín-12 (4400—4900 m).

***Concavisporites* sp. 2**

Pl. III, Figs. 2—3

Remark: The shape of the spore is concave. The sculpture is fine reticulate. The rays of Y mark reach 1/5 of spore. On Fig. 2 we see (by SEM) that the exine surface is finely chagrenate.

Occurrence: In dark shales overlying the Lunz beds in the substratum of the Vienna basin. Deep drilling LNV-6 (1660—1700 m).

***Distanulisporites* KLAUS**

***Distanulisporites punctus* KLAUS**

Pl. II, Figs. 2—3

Remark: Our species corresponds to the species *D. punctus* according to W. KLAUS (1960).

Distribution: W. KLAUS (1960) mention this species from the *Cardita* and *Halobia* beds of the Carnian of Alpine development of the Triassic. M. PAUTSCH (1971) mentions this species from the Upper Triassic of Poland.

Occurrence: In the West Carpathians I found the species in the Lunz beds in the substratum of the Vienna basin (Malacky-20, 3426 m, LNV-7, 3400—4000 m). Isolated spores I found from the shales overlying the Lunz beds of Tuvalian-Lacian age (LNV-7, 2301 m).

Convolutispora HOFFMEISTER, STAPLIN, MALOY

Convolutispora microrugulata SCHULZ

Pl. II, Figs. 4, 8

Remark: Trilete spore. Size 35—40 μ . The fine — reticulate structure is typical and Y mark reaches 4/5 of spore body. Y mark is thick sometimes open.

Distribution: In the whole Triassic mainly in the Carnian stage. O. P.JAROŠENKO (1978) mentions the occurrence of this species from the Lower part of the Carnian stage in Russia.

Occurrence: In the Lunz beds from the deep drilling LNV-7 (2900—4400 m) LNV-2 (1746—1748 m).

Bianulisporites PAUTSCH

Bianulisporites badius PAUTSCH

Pl. II, Fig. 7

Remark: Our species corresponds to the description according to M. Pautsch (1971).

Distribution: In the Upper Triassic of Poland.

Occurrence: In the West Carpathians I found this species in the Lunz beds of Julian age (LNV-7, 4400 m).

Stereisporites PFLUG THOMSON

Stereisporites radiatus SCHULZ

Pl. II, Fig. 9

Remark: The species corresponds to the description according to E. SCHULZ (1970).

Distribution: The species is known from the Carnian to Rhaetian stages in whole Europe.

Occurrence: In our samples it was found in the Julian stage in the Lunz beds (LNV-7, 3400—4400 m).

Tripartites SCHEMEL

Tripartites mesozoicus ROGALSKA

Pl. II, Fig. 10

Distribution: In the Upper Triassic, mainly in the Rhaetian.

Occurrence: Isolated in dark shales of the Dolomite complex from deep drilling Šaštín-12 (4120—4124 m).

Zebrasporites KLAUS

Zebrasporites fimbriatus KLAUS

Pl. II, Fig. 11

Remark: Our species corresponds to the described species *Z. fimbriatus* according to W. KLAUS (1960).

Distribution: The Halobia beds of Alpine development of the Carnian.

Occurrence: In Carpathians this species was found sporadically in the Lunz beds in Liptovský Hrádok (E. PLANDEROVÁ 1972), and in the Lunz beds from the substratum of the Vienna basin (LNV-7, 2900—4400 m, LNV-2, 1746—1748 m).

Calamospora SCH. W. B.

Calamospora nathorstii (HALLE) KLAUS

Pl. III, Fig. 4

Remark: It corresponds to the description according to W. KLAUS (1960).

Distribution: In the whole Triassic to Liassic. W. KLAUS (1960) mentions distribution from the Cardita, Halobia and the Lunz beds of the Carnian stage.

Occurrence: In the West Carpathians I found this species sporadically in dark shales overlying the Lunz beds (LNV-7, 2301 m, LNV-6, 1660 m) from the substratum of the Vienna basin.

Botanical significance: To the family *Equisetaceae*.

Calamospora sp.

Pl. VI, Figs. 11—12

Remark: Trilete spore of irregular round shape. Y mark is darker than the remaining exine. Y mark consists of small roundish segments. The exine is smooth to chagrenate. It has many secondary folds. Y mark reaches 2/3 of spore body. In the morphological signs it belongs to the genus *Calamospora*.

Occurrence: Isolated in dark shales of the Dolomite complex in deep drilling Šaštín-12 (4120—4124 m) of Norian — Rhaetian age.

Deltoidospora MINER emend. POTONIE

Deltoidospora crassiexina NILSSON

Pl. IV, Figs. 1—4

Remark: Trilete spore with smooth exine. By SEM I found sparsely ordered tuberculate excrescences at the surface.

Distribution: In the Upper Triassic and Liassic of Europe. Most data we have from the Rhaetian in Germany (W. SCHUURMANN 1979).

Occurrence: Quite abundant in dark shales above the Lunz beds in the substratum of the Vienna basin (LNV-7, 2501—2201 m, LNV-6, 1660 m, Šaštín-12, 4826—4829 m).

Deltoidospora sp.

Pl. VII, Fig. 1

Remark: Trilete spore. Size 56 μ . Exine smooth. Around the Y mark there is a dark fold of the exine. A similar species is described by W. SCHUURMANN (1977) from the Rhaetian of France. It has some morphological signs of the genus *Cyathidites*, therefore I ranged it to this genus (E. PLANDEROVÁ 1980). The convex walls of spores point to its competence to the genus *Deltoidospora*.

Occurrence: In dark shales from the deep drilling (LNV-7 2348 m, LNV-6, 1660 m).

Conbaculatisporites KLAUS

Conbaculatisporites mesozoicus KLAUS

Pl. IV, Figs. 5, 6

Remark: It corresponds to the description according to W. KLAUS (1960). With the study of the exine by SEM I observe densely spaced baculate excrescences. They are concentrated to the outer margins of trilete spore.

Distribution: In the Halobia beds of Alpine development of the Upper Triassic. They are, however, also found in the Cardita beds (W. KLAUS 1960).

Occurrence: Common in the Lunz beds in the West Carpathians (LNV-7, 3734—4347 m, Šaštín-12, 5446 m).

***Conbaculatisporites* sp.**

Pl. II, Figs. 5—6

Remark: From the species *Conbaculatisporites mesozoicus* KLAUS it differs in the size (our specimen has 35 μ only), by the length of baculae (short baculae) and in Y mark which reaches 4/5 of spore.

Occurrence: In the shales of the Dolomite complex in the substratum of the Vienna basin (Šaštín-12, 4120—4124 m).

Apiculatisporites (Ibrahim) R. POT. KREMP.

***Apiculatisporites parvispinosus* (LESCHIK) SCHULZ**

Pl. V, Figs. 3, 6—8

Remark: Trilete spore of nearly round to irregular shape. It corresponds to the description of the species according to G. LESCHIK (1956). The size of spores established in our samples varies between 23—29 μ . This species is typical by not visible distinct Y mark E. SCHULZ (1967) also made the same observation.

Distribution: From the Middle Keuper to Liassic.

Occurrence: In the Carpathians this species is very abundant in the Lunz beds and overlying dark shales (LNV-7, 3063—3802 m, LNV-6, 1666—1700 m, Šaštín-12, 4120—4124 m).

Botanical significance: According to G. LESCHIK (1956) this morphological species belongs to the family *Marattiaceae*.

***Punctatisporites* (IBR.) POT. KREMP.**

***Punctatisporites* cf. *digestus* LESCHIK**

Pl. V, Fig. 4

Remark: Trilete spore of almost roundish shape. It corresponds to the description of the species according to G. LESCHIK (1956) except the size. Our species is 20 μ in diameter only.

Distribution: G. LESCHIK (1956) mentions distribution of the species in the Keuper of German development.

Occurrence: In the Lunz beds of the Carpathian region it is found rarely only. It is more abundant in dark shales above the Lunz beds (LNV-7, 2301—2304 m).

Botanical significance: According to G. LESCHIK (1956) the spores of this species belong to the family *Marattiaceae*.

***Punctatisporites toralis* LESCHIK**

Pl. IX, Figs. 5—6

Remark: Trilete spore of triangular shape, with slightly convex outline. Size 55 μ . It corresponds to the description of the species according to G. LESCHIK (1956).

Distribution: According to G. LESCHIK (1956) the species is common in Middle Keuper of Germany.

Occurrence: In all samples of the Lunz beds, in the substratum of the Vienna basin and in Liptovský Hrádok (E. PLANDEROVÁ 1972).

Granulatisporites LESCHIK

Granulatisporites granifer LESCHIK

Pl. V, Figs. 10—11

Remark: Monolete spore. Size 30 μ . It corresponds to the description of the species according to G. LESCHIK (1956) except the size. The species described by G. LESCHIK is 36 μ , in diameter.

Distribution: In our samples this species was rare in the Lunz beds (LNV-7, 3736 m).

Duplicisporites (LESCHIK) R. POT. emend. KLAUS

Duplicisporites granulatus LESCHIK

Pl. V, Figs. 12—15, Pl. XI, Figs. 4—5

Remark: Trilete spore with typical ribbon-like folds of exine. The sculpture is granulate. It corresponds to the description of G. LESCHIK (1956) and W. KLAUS (1960).

Distribution: The species is spread in German development of the Triassic, in the Middle Keuper. In Alpine development it is spread in the Carnian, in the Halobia beds (W. KLAUS 1960). T. ORLOWSKA-ZWOLINSKA (1983) mentions the occurrence from the Cordevolian and Julian stages.

Occurrence: In the Carpathians we observe abundant distribution in the Lunz beds. In dark shales above the Lunz beds we found it rarely (Láb-90, 2780 m, LNV-7, 3405—4221 m).

Duplicisporites cf. *punctus* LESCHIK

Pl. V, Figs. 16—17

Remark: Trilete spore of slightly convex shape. The sculpture is fine punctate. Ribbon-like folds are light-coloured, also punctate. The species corresponds to the description according to G. LESCHIK (1956) except the shape. The spores in our samples are less roundish than in *D. punctatus* LESCHIK.

Distribution: G. LESCHIK (1956) mentions distribution of this species in Middle Keuper of Germany.

Occurrence: In our country it occurs mainly in the Lunz beds (LNV-7, 2995—4175 m).

Camarozonosporites (R. POT.) emend. KLAUS

Camarozonosporites rudis (LESCHIK) n. comb. emend. KLAUS

Pl. VI, Figs. 1—3

Remark: Trilete spores of roundish shape. Size 40 μ . It corresponds to the description of G. LESCHIK (1956) and W. KLAUS (1960).

Distribution: Very abundant in the Carnian of Europe. In older Triassic strata it has not been found so far. T. ORLOWSKA-ZWOLINSKA (1983) mentions the occurrence of this species from the Julian, but also from the Rhaetian.

Occurrence: In the Lunz beds of the Carpathians this species was found in all samples. We recorded a rare occurrence in dark shales above the Lunz beds (LNV-7, 3405—4029 m, LNV-6, 1660 m, LNV-2, 1746 m).

Camarozonosporites sp.

Pl. VI, Figs. 4—5

Remark: Trilete spore, belonging with all morphological marks to the genus *Camarozonotriletes*. From the described species it however differs in structure. The central body of the spore has not rough tuberculate growths, differing so from the *C. rudis* (LESCHIK) KLAUS. From the species *Camarozonosporites laevigatus* SCHULZ it differs in size, and distinct torus around Y mark.

Occurrence: Rare in dark shales above the Lunz beds in the substratum of the Vienna basin (LNV-7, 2301 m, LNV-6 1660 m).

Camarozonosporites aulosenensis SCHULZ

Pl. VI, Figs. 6—7

Remark: Trilete spore of the roundish shape. Size 35—40 μ . It corresponds to the description of the species according to E. SCHULZ (1967).

Distribution: E. SCHULZ (1967) mentions the occurrence of this species from the Triassic of Europe.

Occurrence: In the Carpathians I found this species in dark shales in the Dolomite complex (Šaštín-12, 4120—4124 m).

Polycingulatisporites SIMONCSICS et KEDVES

Polycingulatisporites cf. *liassicus* SCHULZ

Pl. VI, Fig. 8

Remark: The trilete polycingulate spore corresponds in many morphological marks to the species *P. liassicus* SCHULZ. It differs however in size. Our species has 55 μ . The described species varies between 35—42 μ .

Distribution: E. SCHULZ (1967) mentions the main occurrence in the Jurassic. It begins to occur however in the Upper part of the Middle Keuper of German development (Norian).

Occurrence: In the Carpathians I found this species in dark shales of the Dolomite complex (Šaštín-12, 4120—4124 m).

***Polycingulatisporites cf. bicolateralis* (ROGALSKA) MORBEY**

Pl. VIII, Fig. 4

Remark: Large trilete spore with distinct cingulum. It corresponds to the description of the species according to J. S. MORBEY (1975) in the arrangement of cingulum and Y mark. It differs in size. Our species has 60 μ . The size of *P. bicolateralis* (ROGALSKA) MORBEY is 31—49 μ in diameter. In the central part, there are sporadic tuberculate growths which are not mentioned at the exine of the species *P. bicolateralis*.

Distribution: In Europe the species is mainly spread in the Rhaetian and Liassic.

Occurrence: In the Carpathians the species was found in dark shales of the Dolomite complex (Šaštín-12, 4120—4124 m).

***Polycingulatisporites cf. circulus* SIMONCSICS et KEDVES**

Pl. X, Figs. 4—7

Remark: Trilete spore with typical polycingulate structure of the body. The thickening of exine is of concentric structure. In the size, shape and structure it corresponds to the description of the species according to P. SIMONCSICS and M. KEDVES (1961) and E. SCHULZ (1967). The difference is in darker colour of corrugate growths on the cinguli.

Distribution: According to above mentioned authors it is a Rhaetian, Liassic species in the German development of the Triassic.

Occurrence: In the Carpathians I found the species in dark shales of the Dolomite complex (Šaštín-12, 4120—4124 m).

***Lycopodiacidites* (COUPER) R. POT.**

***Lycopodiacidites cf. kuepperi* KLAUS**

Pl. VI, Figs. 9—10

Remark: Trilete spore of nearly round shape. Size 50 μ . The exine is thick, as also the Y mark, which reaches 2/3 of the spore. The difference between

the species described by W. KLAUS (1960) and our specimens is in the sculpture of the exine. While the exine of the species *L. keupperi* KLAUS is strongly rugulate, our specimens have the rugulate sculpture more polar and not so distinct. In other morphological marks it, however, corresponds to the species *L. keupperi*.

Distribution: In the Carnian stage of Alpine development of the Triassic according to W. KLAUS (1960). In the lower part of the Triassic it has not been found.

Occurrence: In the Carpathians the species is found in dark shales above the Lunz beds in the substratum of the Vienna basin (LNV-7, 2348 m, Šaštín-12, 4265 m).

Saturnisporites KLAUS

Saturnisporites fischeri KLAUS

Pl. VII, Fig. 2

Remark: The large monolete spore (size 80—90 μ) corresponds to the description of the species according to W. KLAUS (1960).

Distribution: W. KLAUS (1960) mentions its rare occurrence in the Halobia beds. In older and younger sediments has not been found in Alpine development of the Triassic. In Germany is mentioned from the Middle Keuper.

Occurrence: In the Lunz beds in the substratum of the Vienna basin (LNV-7, 3140 m) also at the locality of Liptovský Hrádok (E. PLANDEROVÁ 1972).

Corrugatisporites (TH. PF.) ex MEYLAND et GREIF

Corrugatisporites klausi KAVARY

Pl. VII, Figs. 3—4

Remark: Trilete spore of round shape with typical cingulum and thick folds of exine. On the exine there are corrugate growths. It corresponds to the description of the species according to E. KAVARY (1972).

Distribution: Rare in the Upper Triassic (Carnian) of the region of the Alps (E. KAVARY 1972).

Occurrence: In the Carpathians it was present in all samples of the Lunz beds in the substratum of the Vienna basin (LNV-7, 3405—4219 m, LNV-2, 1746 m).

Corrugatisporites sp.

Pl. VII, Fig. 5

Remark: Trilete cingulate spore with many dark folds of the exine. It

has thick corrugate growths, which are passing from the dark ribbon-like fold at the exine below the cingulum. In this mark it differs from the species *C. klausii* KAVARY. Size 60 μ .

Occurrence: Common in the Lunz beds in the substratum of the Vienna Basin (LNV-7, 1746 m, LNV-7 2995—4343 m, Malacky-20, 3426 m).

Conosmundasporites W. KLAUS

Conosmundasporites othmari KLAUS

Pl. VII, Fig. 6, Pl. VIII, Fig. 6

Remark: Trilete spore of ovale shape. Size 50—60 μ . Besides the Y mark there are numerous dark folds at the exine. It corresponds to the description of the species according to W. KLAUS (1960).

Distribution: According to W. KLAUS (1960) this species is very abundant in the Halobia beds of Alpine development of the Triassic and rare in the Zlambach beds of Rhaetian age. T. ORLOWSKA-ZWOLINSKA (1983) mentions its occurrence from the Cordevolian to Tuvalian.

Occurrence: In the Carpathian region I found abundant specimens in the Lunz beds (LNV-7, 3140 m, LNV-2 1846 m, Malacky-20, 3426 m) and rarely in dark shales above the Lunz beds (LNV-7, 2301 m, LNV-6, 1660 m).

Stereisporites THOMSON et PFLUG

Stereisporites glabrescens MALJ.

Pl. VIII, Figs. 1, 2

Remark: Trilete spore of round shape with thin exine. Y mark is short, thick, it reaches 1/2 of spore. The exine studied under SEM is fine granulate. The Y mark is distinct. Size 28 μ . It corresponds to the description of E. SCHULZ (1970).

Distribution: According to E. SCHULZ (1970) the species is found in sediments from the Lower Keuper to Jurassic.

Occurrence: In our samples I found this species throughout the Lunz beds (LNV-7, 2995 m, LNV-2).

Stereisporites sp.

Pl. VIII, Fig. 3

Remark: Small trilete spore. Size 20 μ . Exine smooth. The trilete mark is distinct, reaches 2/3 of spore. On the exine there are dark small folds. The exine is distinctly two-layered.

Occurrence: Rare in the Lunz beds of the Carpathian region (LNV-7, 2995-3140 m).

Retitriletes v. d. HAMMEN ex PIERCE

Retitriletes jenensis REINH.

Pl. IX, Figs. 1—2

Remark: Trilete spore of round-oval shape with typical irregular reticulate sculpture. It corresponds to the description of species according to P. REINHARDT and W. SCHMITZ (1965).

Distribution: According to P. REINHARDT and W. SCHMITZ (1965) it is present in the Middle Keuper.

Occurrence: In the West Carpathians I found it rarely in the Lunz beds (Malacky-20, 3426—3428 m).

Retitriletes sp.

Pl. VIII, Fig. 5

Remark: Trilete spore. Size 55 μ . The reticulate sculpture is little distinct, but visible in the whole surface of spore. The walls of the reticulate sculpture are of the same color as the exine, so it differs from the species *R. jenensis* REINH. The folds of the exine are also distinct. They are in subequatorial position.

Occurrence: In dark shales above the Lunz beds (LNV-6, 1660 m).

Porcellispora SCHEURING

Porcellispora longdonensis (CLARKE) n. comb. emend. SCHEURING

Pl. IX, Figs. 3, 4, Pl. X, Figs. 1—3

Remark: Large trilete spores with indistinct Y mark. Size 60—65 μ . In the morphological marks they corresponds to the description according to B. SCHEURING (1970).

Distribution: The species is present in strata from the Cordevolian to Norian (Schilfsandstein) B. SCHEURING (1970).

Occurrence: In the Carpathians I found the species sporadically in the Lunz beds (Šaštín-12, 5446—5258 m).

Spore type „A“

Pl. VIII, Fig. 7

Trilete spore. Size 65 μ . The shape is irregularly rounded — triangular. Exine is thin, two-layered. At the exine surface there are irregularly scattered tuberculate growths 2—5 μ large. The Y mark is very thick (10—15 μ). It is dark-coloured. At the margin of the spore the Y mark is thickened and rounded. The Y mark

forms the dominant morphological characteristic. So far I do not know to range the spore of the morphological species to a described genus. The rare occurrence of the spore does not permit me to create a new genus. I mention it preliminarily as spore of type „A“.

Occurrence: In dark shales above the Lunz beds in the substratum of the Vienna basin (LNV-7, 2301 m).

Carnisporites MÄDLER

Carnisporites anteriscus MORBEY

Pl. XI, Figs. 1—2

Remark: Trilete spore with indistinct mark. The spinate growths at the exine surface are distinct. They are either doubled or with angular ending. It corresponds to the description of the species according to J. S. MORBEY (1975).

Distribution: J. S. MORBEY (1975) mentions the occurrence from the Rhaetian to Liassic in Austria.

Occurrence: In the Carpathians I found this species only in shales of the Dolomite complex in the substratum of the Vienna basin (borehole Šaštín-12, 4120—4124 m).

Carnisporites telephorus (PAUTSCH) MÄDLER

Pl. XII, Fig. 6

Remark: Trilete spore with spinate growths. It corresponds to the description of the species according to W. KLAUS (1960). This author described the species as *Apiculatisporites telephorus*. K. MÄDLER (1964) ranged the species to the genus *Carnisporites*.

Distribution: According to W. KLAUS (1960) the species occurs in the Carnian of Alpine development of the Upper Triassic. K. MÄDLER (1964) mentions distribution of the species from the Middle Keuper to Rhaetian.

Occurrence: In the Lunz beds and dark shales above the Lunz beds from the substratum of the Vienna basin (Šaštín-12, 4848—5379 m).

Aratrisporites cf. *rotundus* MÄDLER

Pl. XI, Figs. 7—8

Remark: Round — monolete spore. The central part is separated from the marginal part by the zone. In the shape, size and other morphological marks it corresponds to the description of the species according to K. MÄDLER (1964) and M. PAUTSCH (1971). The difference is only in the length of lesure, which does not reach beyond the central part of spore.

Distribution: According to K. MÄDLER (1964) it occurs in the Lower

Keuper of Germany; according to M. PAUTSCH (1971) in the Lower and Upper Keuper of Poland.

Occurrence: In the Carpathians I found this species sporadically in dark shales above the Lunz beds (Tuvalian — Norian in age) in the substratum of the Vienna basin (LNV-7, 2301—2504 m).

Todisporites COUPER

Todisporites cf. *major* COUPER

Pl. XI, Fig. 6

Remark: Trilete spore with smooth exine. Size 60 μ . From the species *Todisporites major* COUPER it differs in dark folds around the Y mark. The dark folds are thickest in the middle of the spore. To the margin the folds become more thinner. In other morphological marks it corresponds to the description according to R. A. COUPER (1958).

Distribution: The genus *Todisporites* is found from the Middle Triassic. The species *T. major* is mentioned only from the uppermost Triassic, mainly, however, in the Liassic.

Occurrence: In the Carpathians it was found in dark shales from deep drilling (LNV-6 1660 m) in the substratum of the Vienna basin.

Todisporites cinctus (MALJ.) ORLOWSKA-ZWOLINSKA

Pl. XII, Figs. 3—4

Remark: Trilete spore size 50—55 μ . It has a relatively short Y mark without tori. At the exine in subequatorial position we observe numerous folds of darker colour. It corresponds to the description of the species according to T. ORLOWSKA-ZWOLINSKA (1971).

Distribution: According to T. ORLOWSKA-ZWOLINSKA (1971) it is found from the end of the Middle Triassic to the Liassic.

Occurrence: In the Carpathians I found this species in dark shales above the Lunz beds in the substratum of the Vienna basin (LNV-6, 1660 m, LNV-7, 2301-2504 m).

Tuberculatisporites IMGR.

Tuberculatisporites sp.

Pl. XI, Figs. 9—10

Remark: Monolete spore of oval shape. Size up to 30 μ . I ranged it to the genus *Marattiopsis*, species *M. scabratus* (E. PLANDEROVÁ 1980) because of

the typical shape and rough scabrate-sculpture. After revaluation of all spores from the Triassic of the Carpathian region I range this spore to the genus *Tuberculatisporites* because of the tuberculate structure of the exine.

Occurrence: Very abundant in dark shales of the Lunz beds in the substratum of the Vienna basin (LNV-7, 2301-2504 m, LNV-6, 1660—1664 m, Šaštín-12, 3265—4848 m).

Kreuselisorites LESCHIK

Kreuselisorites lituus LESCHIK

Pl. XII, Figs. 1—2

Remark: Zonate spore of 55 μ size. The central part of spore is 40 μ in diameter and bounded by ribbon-like thickened exine. In the central part, there are numerous dark papillar growths. It corresponds to the description of G. LESCHIK (1956).

Distribution: Middle Keuper of Germany (G. LESCHIK 1956).

Occurrence: In the Carpathians I found this species in dark shales of the Dolomite complex from the substratum of the Vienna basin (Šaštín-12, 4120—4124 m).

Granuloperculatisporites VEN. GOCZÁN

Granuloperculatisporites rudis VEN. GOCZÁN

Pl. XIII, Figs. 1—3, 5

Remark: The arrangement of pollen grains is very often into tetrads. They are of round shape. It corresponds to the description according to B. VENKATACHALA and F. GOCZÁN (1964).

Distribution: Generally this species is mentioned from the Norian. T. ORLOWSKA-ZWOLINSKA (1983) mentions this species as most abundant in the Norian and Rhaetian, rarely also from the Liassic.

Occurrence: In the Carpathians I found the species in the shales above the Lunz beds (LNV-7, 2301—2504 m). It is very abundant in dark shales of the Dolomite complex in the substratum of the Vienna basin (Šaštín-12, 4120—4124 m).

Thomsonisorites LESCHIK

Thomsonisorites punctus LESCHIK

Pl. XIII, Fig. 4

Remark: Zonate-trilete spore. Size 50—60 μ . The central part of the spore is dark. The marginal part is light — coloured. It corresponds to the description of the species according to G. LESCHIK (1956).

Distribution: According to G. LESCHIK (1956) it is common in the Middle Keuper of Germany.

Occurrence: Rare in the Lunz beds in the whole Carpathian region (LNV-7, 2995—4175 m).

Botanical significance: According to G. LESCHIK (1956) the morphological species belongs to the class *Pteridophyta*. It has probable relationship to the species *Diacalpea aspidioides* BL.

Chasmatosporites Nilsson emend. POCK et JANS.

Chasmatosporites apertus (ROG.) NILSSON

Pl. XV, Fig. 1

Remark: Monosulcate pollens of round shape. Size 50—55 μ . It corresponds to the description of the species according to M. ROGALSKA (1956) and T. NILSSON (1958).

Distribution: In general, this species is mentioned from the Rhaetian and Liassic only. According to J. BONA (1969), T. ORLOWSKA-ZWOLINSKA (1983) and I. LUND (1977) this species is present from the Lower Rhaetian.

Occurrence: In the Carpathians I found this species in dark shales above the Lunz beds (LNV-7, 2301 m), it is, however, more abundant in shales of the Dolomite complex of Norian — Rhaetian age.

Chasmatosporites elegans NILSSON

Pl. XIV, Fig. 1

Remark: Monosulcate pollen grains with smooth, fine punctate exine. It corresponds to the description according to T. NILSSON (1958).

Distribution: In the Rhaetian and Liassic of Europe (T. NILSSON 1958, I. LUND 1977).

Occurrence: In the Carpathians I found the species in dark shales above the Lunz beds (LNV-7, 2301—2504 m, Šaštín-12, 4120—4124 m).

Camerosporites LESCHIK

Camerosporites secatus LESCHIK

Pl. XIV, Fig. 2

Remark: The spore is of oval shape and with camerate structure of exine. It corresponds to the description according to G. LESCHIK (1956).

Distribution: According to G. LESCHIK (1956) a rich occurrence of the species is in the Middle Keuper.

According to H. VISCHER and L. KRISTYN (1978) it is an index species for the age of the end of the Tuvanian-beginning of the Laccian, correlated with the ammonite fauna of the species *Anatropites* BEREICH till *Mojsisovicsites kerri*.

Occurrence: In the Carpathians I found this species in dark shales above the Lunz beds, which we consider as Tuvanian—Laccian in age (LNV-6, 1660 m).

Botanical significance: According to G. LESCHIK (1956) this morphological species belongs to *Pteridospermophyta*, to the species *Aetheotesta elliptica* and *Pachytesta gigantea*.

Zonalasporites (IBR.) emend. LESCHIK

Zonalasporites cinctus LESCHIK

Pl. XV, Fig. 2

Remark: Spore of roundish shape with dark granulate central body and foveolate border. Size 50 μ . It corresponds to the description of the species according to G. LESCHIK (1956).

Distribution: The above mentioned author quoted this species in the Middle Keuper.

Occurrence: In black shales of Dolomite complexe (Šaštín-12, 4120—4124 m). Rare.

Praecirculina KLAUS

Praecirculina granifer KLAUS

Pl. XIV, Fig. 5, Pl. XV, Figs. 4—5

Remark: Spore (? pollen grain) of roundish shape. Size 35—40 μ . Structure fine granulate. At the spore formation the zone between the foldings of the exine is indicated. It corresponds to the description according to W. KLAUS (1960).

Distribution: W. KLAUS (1960) mentions this species from the Carnian of Alpine development of the Triassic.

Occurrence: In the Carpathians I found this species in the Lunz beds in the substratum of the Vienna basin, also in the dark shales above the Lunz beds (LNV-7 2301—2504 m, LNV-6 1660 m, Malacky-20 3426 m, LNV-2 1746 m).

Circulina MALJ.

Circulina meyeriana KLAUS

Pl. XIV, Figs. 3, 6, 7—8, Pl. XV, Fig. 3

Remark: Pollens of round shape. Size 38—40 μ . It corresponds to the description according to W. KLAUS (1960).

Distribution: From whole Europe is information about the presence of this species from the end of the Norian to younger strata.

Occurrence: Rare in dark shales above the Lunz beds in the substratum of the Vienna basin (LNV-6 1660 m, LNV-7 2301 m). It is abundant in shales of the Dolomite complex from borehole Šaštín-12 (4120—4124 m).

Botanical significance: According to T. M. HARRIS (1957) there is relationship to the genus *Cheirolepis*.

Classopollis (PFLUG) POCK, JANS.

Classopollis simplex (DANZE-CORSIN, LAVEIN) REIS. et WILLIAMS

Pl. XIV, Fig. 4

Remark: Roundish pollen grains with structure typical of the genus *Classopollis*. The equatorial folds of the exine are running around the periphery of pollen grain. Size 22 μ . It corresponds to the description of T. ORLOWSKA-ZWOLINSKA (1983).

Distribution: In the Rhaetian and Liassic according to T. ORLOWSKA-ZWOLINSKA (1983).

Occurrence: Common in shales of the Dolomite complex in the substratum of the Vienna basin (Šaštín-12 4120—4124 m).

Classopollis sp.

Pl. XIV, Figs. 9—10

Remark: The pollen grains are of round shape with subequatorial folding of the exine. The distinct inter-loculum is situated between the inner exine and folding of exine. In the middle of the pollen grains is a small Y mark. On the exine there are darker papillar growths, in which our species differs from the described species of the genus *Classopollis* or *Circulina*.

Occurrence: In shales above the Lunz beds from borehole LNV-6 (1660 m) in the substratum of the Vienna basin.

Eucommiidites ERDTMAN

Eucommiidites troedsoni ERDTMAN

Pl. XIV, Figs. 11—12

Remark: Pollen grains of oval shape. Size up to 40 μ . Exine smooth, sculpture fine chagrenate. It has distinct colpus.

Distribution: E. SCHULZ (1967) mentioned this species from the Middle Rhaetian and Liassic. T. ORLOWSKA-ZWOLINSKA (1983) in the Liassic.

Occurrence: In the Carpathians this species was found for the first time in shales above the Lunz beds (LNV-7 2301—2504 m) of Tuvanian — Lacian age. I found it also in dark shales of the dolomite complex in the substratum of the Vienna basin (Šaštín-12 4120—4124 m).

Lagenella MALJ.

Lagenella martini (LESCHIK) n. comb. emend. KLAUS

Pl. XV, Fig. 8, Pl. XXIV, Figs. 8—9

Remark: Pollen grains of oval shape corresponding to the description of W. KLAUS (1960).

Distribution: According to most authors the main extension of this species is in the Carnian stage. Rarely it was found in younger Triassic stages.

Occurrence: In the Carpathians I found this species rarely in the Lunz beds (LNV-7 2995 m).

Ovalipollis KRUTZSCH

Ovalipollis ovalis KRUTZSCH

Pl. XVI, Figs. 1—5, Pl. XVII, Fig. 2

Remark: Pollen grains of oval shape. Their size varies 55—95 μ . The air sacks are reduced. It corresponds to the description according to W. KRUTZSCH (1955).

Distribution: According to data from literature the species occurred from the Lower Keuper to Liassic. It is most abundante in the Gipskeuper according to B. W. SCHEURING (1970) corresponding to the Carnian in Alpine — Carpathian development of the Triassic.

Occurrence: In the Lunz beds of the Carpathian region is distribution of the species is non equal. In the substratum of the Vienna basin the species is very abundant. In the shales above the Lunz beds it is found rarely. In the shales of the Dolomite complex it has not been found. In the Lunz beds from the locality Liptovský Hrádok it is found sporadically.

Triadispora KLAUS

Triadispora plicata KLAUS

Pl. XVII, Figs. 1, 5

Remark: Pollen grains with air sacks. Size 65 μ . In the central body is an

insignificant Y mark. It corresponds to the description of the species according to W. KLAUS (1964).

Distribution: W. KLAUS (1960) mentions distribution of the species from the Lower and Middle Triassic. T. ORLOWSKA-ZWOLINSKA (1979) mentions it from the Carnian and Rhaetian. So it is evident that the species has a wide stratigraphical range.

Occurrence: In Carpathian region I found the species mainly in the Lunz beds from the substratum of the Vienna basin and from the locality Liptovský Hrádok (LNV-2 1746 m, Láb-91 2770 m).

***Triadispora stabilis* SCHEURING**

Pl. XVII, Fig. 6, Pl. XVIII, Fig. 7, Pl. XIX, Fig. 6

Remark: Bisaccate pollen grains. Size 60 μ . The air sacks are arch-shaped attached to the central body. In the central body is a distinct Y mark. It corresponds to the description of the species according to B. W. SCHEURING (1970).

Distribution: According to the above mentioned authors the species occurs in the Carnian and Norian.

Occurrence: In the Carpathian region it is common in the Lunz beds (LNV-7 4200—2990 m, Malacky-20 3426 m, LNV-7 1746 m).

***Triadispora modesta* SCHEURING**

Pl. XVII, Fig. 3

Remark: Bisaccate pollen grains. Size 60 μ . The central body is dark with sulcus. The sacks are larger exceeding the outline of the central body. It corresponds to the description of the species according to B. W. SCHEURING (1970). The sulcus of our species is not clearly visible.

Distribution: The species is most abundant in the Carnian stage, but is also found in the Rhaetian stage (B. W. SCHEURING 1970).

Occurrence: In the carpathian region it is abundant in those parts of the Lunz beds, in which are a plenty of other coniferae pollens (LNV-7 3140—3605 m).

***Triadispora böschii* SCHEURING**

Pl. XIX, Fig. 4

Remark: Bisaccate pollen grains. Size 70 μ . The sculpture of the body and air sacks is nearly equal. The Y mark is visible. It corresponds to the description according to B. W. SCHEURING (1970).

Distribution: According to B. W. SCHEURING (1970) it is most abundant in the Gipskeuper (Carnian), but also found rarely in the Rhaetian.

Occurrence: In the Carpathian region I found the species in the Lunz beds and dark shales of the Dolomite complex in the substratum of the Vienna basin (LNV-7 4029—4219 m).

Protohaploxypinus SAMOILOVICH

Protohaploxypinus sp.

Pl. XVIII, Fig. 1, Pl. XIX, Figs. 1—3

Remark: Bisaccate pollen grains of size 60—85 μ . Central body round. The air sacks are haploxoidally connected with the central body. The central body has many folds and several transversal furrows.

Distribution: According to B. W. SCHEURING (1978) it is mainly found in the Gipskeuper.

Occurrence: In the Carpathian region sporadically in the Lunz beds (LNV-7 3605—4175 m).

Lunatisporites LESCHIK

Lunatisporites sp.

Pl. XVIII, Fig. 2

Remark: Bisaccate round pollen grains with sulcus, which is typical of the genus *Lunatisporites*. The central body is granulate. The air sacks have a reticulate sculpture.

Occurrence: Rare in the Lunz beds in the Carpathian region (borehole Šaštín-12 5446 m).

Succinctisporites (LESCHIK) emend. MÄDLER

Succinctisporites grandior (LESCHIK)

Pl. XIX, Fig. 5

Remark: Large bisaccate pollen grains. Size 95 μ . The pollen grains have a distinct furrow. In the central body when observing under SEM we can see this furrow touching the margins of the central body exine. It corresponds to the description according to K. MÄDLER (1964).

Distribution: The Middle Keuper of Germany, according to K. MÄDLER (1964).

Occurrence: Abundant in the Lunz beds in the some samples with other conifers (LNV-2 1726 m, Malacky-20 3426 m, Šaštín-12 5440 m).

Vitreisporites LESCHIK

Vitreisporites signatus LESCHIK

Pl. XVIII, Fig. 6

Remark: Small bisaccate pollen grains. Size 23 μ . It corresponds to the description according to G. LESCHIK (1956).

Distribution: The genus *Vitreisporites* is found from the Permian and reaches to the Triassic with the species *Vitreisporites palidus* NILSS. *V. signatus* LESCHIK is known from the Middle Keuper.

Occurrence: In Lunz beds of the substratum of Vienna basin (LNV-7 3605 m).

Monosulcites COOKSON ex COUPER

Monosulcites minimus COOKSON

Pl. XX, Figs. 1, 2, 14—16

Remark: Monocolpate pollen grains. Size up to 30 μ . It corresponds to the description of the species according to R. A. COUPER (1958).

Distribution: According to T. ORLOWSKA-ZWOLINSKA (1983) the species is present in the Tuvalian, more abundant in the Norian, Rhaetian and Liassic.

Occurrence: In the Carpathians I found this species abundant in dark shales above the Lunz beds in the substratum of the Vienna basin (LNV-7 2301—2504 m, LNV-6 1660 m).

Monosulcites punctatus ORLOWSKA-ZWOLINSKA

Pl. XX, Fig. 8

Remark: Monosulcate pollen grains. Size 40 μ . It corresponds to the description of the species according to T. ORLOWSKA-ZWOLINSKA (1966).

Distribution: In the Rhaetian and Liassic according to T. ORLOWSKA-ZWOLINSKA (1983) and I. LUND (1977).

Occurrence: In the Carpathians I found the species rarely in the shales of the Dolomite complex (Norian, Rhaetian) in the substratum of the Vienna basin (Šaštín-12 4120—4124 m).

Ginkgocycadophytus SAMOILOVICH

Ginkgocycadophytus sp.

Pl. XX, Figs. 3, 4, 5—6, 9, 11, 12

Remark: We range to this genus a very variable group of pollen grains. It has one colpus, the shape is oval or pointed-ellipsoidal. Size 30—50 μ . The structure is smooth or chagrenate.

Distribution: It has a large stratigraphic range. It is mentioned mainly from the Upper Triassic (Carnian — Rhaetian — Jurassic).

Occurrence: In the shales above the Lunz beds from the substratum of the Vienna basin (LNV-7 2301—2504 m, Šaštín-12 4120—4124 m).

Cycadopites (WODEH) ex WILS. WEB.

Cycadopites sp. major

Pl. XXI, Figs. 1, 3, 4—6

Remark: Large monocolpate pollen grains of pointed — ellipsoidal shape. Size 70—95 μ . They correspond to the description of the genus *Ginkgocycadophytus*, but from the morphological point of view (in size) differ from the small forms, which are varying between 35—50 μ .

Occurrence: Abundant in dark shales above the Lunz beds from the Vienna basin (LNV-7 2301 m, LNV-6 1660 m).

Cycadopites bleibergensis KAVARY

Pl. XXI, Fig. 2

Remark: Monosulcate pollen grains corresponding to the description of the species according to E. KAVARY (1972).

Distribution: In the Upper Triassic, mainly in the Carnian (E. KAVARY 1972).

Occurrence: In the Carpathians I found the species rarely in the Lunz beds (LNV-7 2995—4219 m, Malacky-20 3426 m).

Araucariacites COOKSON et COUPER

Araucariacites sp.

Pl. XXII, Fig. 5

Remark: Large round pollen grains, reaching 70 μ . On the body they have thick folds of the exine. The sculpture is granulate. According to morphological marks it belongs to the genus *Araucariacites* or *Brachyphyllum*.

Distribution: Generally this species is found from the uppermost Triassic but mainly from the Jurassic to Cretaceous.

Occurrence: In the Carpathians it was found in dark shales above the Lunz beds and in shales of the Dolomite complex from the substratum of the Vienna basin (LNV-7 2301 m, Šaštín-12 4120—4124 m).

Leiosphaeridia EISENACK emend. DOWNIE et SARJ.

Leiosphaeridia sp.

Pl. XXII, Figs. 1—3

Remark: Large planktonic forms reaching 60—70 μ in diameter. The aperture is weakly visible. Similar species are mentioned by T. ORLOWSKA-ZWOLINSKA (1971) from the Jurassic of Poland.

Occurrence: Abundant in the dark shales overlying the Lunz beds from the substratum of the Vienna basin (LNV-7 2301—2504 m, LNV-6 1660 m).

Micrhystridium (DEFL.) SARJEANT

Micrhystridium licroidium MORBEY

Pl. XXIII, Figs. 3—6, Pl. XXIV, Figs. 1—2, 6, 7, 11, 12

Remark: J. S. MORBEY (1975) described seven forms of this species according to the shape of their growths. Our species can be ranged to the form 2. Variability of the forms of this species is large and in our material we found several different forms, which are not mentioned by J. S. MORBEY (1975).

Occurrence: In Carpathian I found this species mainly in the shales above the Lunz beds from the substratum of the Vienna basin (LNV-7 2301—2504 m, LNV-6 1660 m).

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Eva Planderová

Systematicko-morfologické spracovanie sporomorf z lunzských vrstiev a tmavých bridlíc vrchného triasu z podložia viedenskej panvy

Resumé

V rámci komplexného geologického výskumu podložia viedenskej panvy sa venovala pozornosť biostratigrafickému výskumu tmavých bridlíc z mnohých hlbokých vrtov. Časť sedimentov z niektorých vrtov spracovala P. SNOPKOVÁ, výsledky jej práce budú uvedené v spoločnej práci kolektívu autorov (J. KYSELA et al., in lit.). V predloženej práci sú zhrnuté výsledky palynologického výskumu z vrtov LNV-7, LNV-2 LNV-6, Láb-90, Malacky-20, Šaštín-12. Biostratigrafické výsledky z týchto vrtov budú tiež uvedené v práci J. KYSELA et al. (in lit.) V práci je venovaná pozornosť systematickému zaradeniu a morfologickým opisom tých druhov, ktoré som považovala za dôležité pri vekovom hodnotení sedimentov. Z hľadiska litologického ide o spracovanie tmavých bridličnatých sedimentov v podloží viedenskej panvy považovaných za lunzské vrstvy. Po vyhodnotení sporopelových asociácií sa ukázalo, že časť tmavých bridlíc je karnského veku (julský podstupeň), ktoré tvoria časť lunzských vrstiev, korelovateľnú s lunzskými vrstvami alpského vývinu (W. KLAUS 1960). Časť tmavých bridlíc obsahovala sporomorfy, ktoré sú uvádzané z tuvalu až noríku (? oponické vrstvy). Najmladšie asociácie sporomorf som zistila v tmavých bridliciach, ktoré vekove patria do noríku-rétu (bridlice v komplexe hlavného dolomitu).

Opísaných je 80 taxónov so skráteným opisom, alebo s odvolaním na autora opisu druhu a uvedením vekového rozšírenia a výskytu spóry alebo peľových zŕn v Európe s koreláciou výskytu u nás.

Explanation to the Plates I—XXIV

All the photographs are magnified 1000× except those made by SEM; their magnification is mentioned with the explanations.

Plate I

- | | |
|-------|--|
| 1, 7 | <i>Cyathidites minor</i> COUPER, LNV-7 2301 m |
| 2—6 | <i>Paraconavisporites lunzensis</i> KLAUS, LNV-2 1748 m |
| 10—11 | <i>Retusotrilletes mesozoicus</i> KLAUS, LNV-6 1660—1700 m |

- 8—9, 12—13 *Concavisporites* cf. *toralis* (LESCHIK) NILSS. Šaštín-12 4120 m
 14—15 *Clatropteris* sp., Šaštín-12 4400 m
 16 *Toroisporis* sp., LNV-7 2301 m

Plate II

- 1 *Cyathidites* cf. *sobuli* REINH., Šaštín-12 4400—4120 m
 2—3 *Distanulisporites punctus* KLAUS Malacky-20 3426 m
 4, 8 *Convolutispora microrugulata* SCHULZ, LNV-2 1746 m
 5—6 *Conbaculatisporites* sp., Šaštín-12 4120—4124 m
 7 *Bianulisporites badius* PAUTSCH, LNV-7 4400 m
 9 *Stereisporites radiatus* SCHULZ, LNV-7 2900 m
 10 *Tripartites mesozoicus* ROGALSKA, Šaštín-12 4120 m
 11 *Zebrasporites fimbriatus* KLAUS, LNV-2 1746 m
 12 *Gleicheniidites umbonatus* (BALDI) KRUTZSCH

Plate III

- 1, 5, 6 *Concavisporites* sp. 1, Šaštín-12 4400—4900 m
 2—3 *Concavisporites* sp. 2, LNV-6 1660—1700 m
 4 *Calamospora nathorstii* (HALLA) KLAUS, LNV-6 1660 m

Plate IV

- 1—4 *Deltoidospora crassixina* NILSSON, LNV-7 2501 m
 5—6 *Conbaculatisporites mesozoicus* KLAUS, LNV-7 3734 m

Plate V

- 1—2 *Concavisporites toralis* (LESCHIK) NILSS. Šaštín-12 4120—4124 m
 3, 6—8 *Apiculatisporites parvispinosus* (LESCHIK) SCHULZ, LNV-7 3068 m, Šaštín-12 4120 m
 4 *Punctatisporites* cf. *digestus* LESCHIK, LNV-7 2301 m
 5 *Punctatisporites* sp. 1, LNV-7 4314 m
 9 *Punctatisporites* sp. 2, LNV-7 2301 m
 10—11 *Granulatisporites granifer* LESCHIK, LNV-7 3736 m
 12—15 *Duplicisporites granulatus* LESCHIK, Láb-90 2780 m
 16—17 *Duplicisporites* cf. *punctatus* LESCHIK, LNV-7 2995 m

Plate VI

- 1—3 *Camarozonosporites rudis* (LESCHIK) KLAUS, LNV-2 1746 m
 4—5 *Camarozonosporites* sp., LNV-6 1660 m
 6—7 *Camarozonosporites aulosenensis* SCHULZ, Šaštín-12 4120—4124 m
 8 *Polycingulatisporites* cf. *liassicus* SCHULZ, Šaštín-12 4120—4124 m
 9—10 *Lycopodiacidites kuepperi* KLAUS, Šaštín-12 4265 m
 11—12 *Calamospora* sp., Šaštín-12 4120—4124 m

Plate VII

- 1 *Deltoidospora* sp., LNV-6 1660 m
 2 *Saturnisporites fischeri* KLAUS, LNV-7 3140 m
 3—4 *Corrugatisporites klausi* KAVARY, LNV-2 1746 m
 5 *Corrugatisporites* sp., LNV-2 1746 m
 6 *Conosmundasporites othmati* KLAUS, LNV-7 3140 m

Plate VIII

- 1 *Stereisporites glabrescens* (MALJ.) SCHULZ, LNV-7 2995 m
 2 *Stereisporites glabrescens* (MALJ.) SCHULZ, LNV-7 2995 m, SEM magn. 3500 ×
 3 *Stereisporites* sp., LNV-7 2995 m
 4 *Polycingulatisporites* cf. *bicolateralis* (ROG.) MORBEY, Šaštín-12 4120—4124 m

- 5 *Retitriteles* sp., LNV-6 1660 m
 6 *Conosmundosporites othmari* KLAUS, Malacky-20 3426 m
 7 Spore typ A

Plate IX

- 1—2 *Retitriteles jenensis* REINH., Malacky-20 3426—3428 m
 3—4 *Porcellispora longdonensis* (CLARKE) SCHEURING, Šaštín-12 5446—5258 m
 5—6 *Punctatisporites toralis* LESCHIK, LNV-2 1746 m

Plate X

- 1—3 *Porcellispora longdonensis* (CLARKE) SCHEURING, Šaštín-12 5446 m
 4—7 *Polycingulatisporites* cf. *circulus* SIMONCS. KEDVES, Šaštín-12 4120—4124 m

Plate XI

- 1—2 *Carnisporites anteriscus* MORBEY, Šaštín-12 4120—4124 m
 3 *Concavisporites umbonatus* (BOLCH.) ARJANG, Šaštín-12 4120—4124 m
 4—5 *Duplicisporites granulatus* LESCHIK, LNV-7 3405 m
 6 *Todisporites* cf. *major* COUPER, LNV—6 1660 m
 7—8 *Aratrisporites* cf. *rotundus* MÄDLER, LNV-7 2301—2504 m
 9—10 *Tuberculatisporites* sp., LNV-6 1660—1664 m

Plate XII

- 1—2 *Kreuselisorites lituus* LESCHIK, Šaštín-12 4120—4124 m
 3—4 *Todisporites cinctus* (MALJ.) ORLOWSKA-ZWOLINSKA, LNV-6 1660 m
 5 *Equisetites* sp., LNV-6 1660 m
 6 *Carnisporites telephorus* (BAUTSCH) MÄDLER, Šaštín-12 4848 m
 7 *Eucommiidites* sp., LNV-6 1660 m

Plate XIII

- 1—3, 5 *Granuloperculatisporites rudis* VEN. GOCZÁN, LNV-7 2301 m
 4 *Thomsonisporites punctus* LESCHIK, LNV-7 2995 m

Plate XIV

- 1 *Chasmatosporites elegans* NILSS., LNV-7 2301—2304 m
 2 *Camerosporites secatus* LESCHIK, LNV-6 1660 m
 3, 6, 7—8 *Circulina meyeriana* KLAUS, LNV-6 1660 m, Šaštín-12 4120 m
 4 *Classopollis simplex* (DANZE-CORSIN-LAVEIN) REIS. et WILL., Šaštín-12 3120 m
 5 *Praecirculina granifer* KLAUS, LNV-7 2301—2304 m
 9—10 *Classopollis* sp., LNV-6 1660 m
 11—12 *Eucommiidites troedsoni* ERDTMAN, LNV-7 2301—2504 m

Plate XV

- 1 *Chasmatosporites apertus* (ROG.) NILSSON, LNV-7 2301 m
 2 *Zonalasporites cinctus* LESCHIK, Šaštín-12 4120—4124 m
 3 *Circulina meyeriana* KLAUS, Šaštín-12 4120—4124 m
 4—5 *Praecirculina granifer* KLAUS, LNV-6 1660 m
 6—7 *Weylandites* sp., LNV-6 1660 m
 8 *Lagenella martini* (LESCHIK) KLAUS, LNV-7 2995 m

Plate XVI

- 1—4 *Ovalipollis ovalis* W. KR., LNV-7 2995 m
 5 *Ovalipollis ovalis* W. KR., LNV-7 2995 m photo SEM magn. 1100 ×

Plate XVII

- 1,5 *Triadispora plicata* KLAUS, Láb-90 2770 m

- 2 *Ovalipollis ovalis* W. KR., LNV-7 4214 m
- 3 *Triadispora modesta* SCHEURING, LNV-7 3140 m
- 4 *Triadispora*, sp.
- 6 *Triadispora stabilis* SCHEURING, LNV-7 2990 m

Plate XVIII

- 1 *Protohaploxylinus* sp., LNV-7 2995 m
- 2 *Lunatisporites* sp., Šaštín-12 5446 m
- 3 *Pityosporites* sp.
- 4 *Pityosporites* sp.
- 5 *Vitreisporites* sp., LNV-7 3605 m
- 6 *Vitreisporites signatus* LESCHIK, LNV-7 3605 m
- 7 *Triadispora stabilis* SCHEURING, Malacky-20 3426 m

Plate XIX

- 1—3 *Protohaploxylinus* sp., Láb-90 2780—2790 m
- 3 *Ovalipollis* sp.
- 4 *Triadispora bölschii* SCHEURING, LNV-7 4029 m
- 2 *Succinctisporites grandior* (LESCHIK) MÄDLER SEM magnif. 900 ×, LNV-2 1726 m
- 5 *Succinctisporites grandior* (LESCHIK) MÄDLER, LNV-2 1726 m
- 6 *Triadispora stabilis* SCHEURING, Malacky-20 3426 m

Plate XX

- 1—2 *Monosulcites minimus* COOKSON, LNV-7 2301 m
- 3 *Ginkgocycadophytus* sp., LNV-7 2301 m
- 4 *Ginkgocycadophytus* sp., LNV-7 2504 m
- 5—6 *Ginkgocycadophytus* sp., LNV-6 1660 m
- 7—10 ? *Benettitinae*, LNV-7 2301 m
- 8 *Monosulcites punctatus* ORLOWSKA-ZWOLINSKA, Šaštín-12 4120—4124 m
- 9, 11, 12 *Ginkgocycadophytus* sp., LNV-6 1660 m
- 13 *Monosulcites* sp., Šaštín-12 4120—4124 m
- 14—16 *Monosulcites minimus* COOKSON LNV-6 1660 m

Plate XXI

- 1 *Cycadopites* cf. *major*, LNV-7 2301 m
- 2 *Cycadopites bleibergensis* KAVARY, Malacky-20 3426 m
- 3 *Cycadopites* cf. *major*, SEM magnif. 1100 ×, LNV-7 2301 m
- 4—6 *Cycadopites* cf. *major*, LNV-7 2301 m

Plate XXII

- 1—3 *Leiosphaeridia* sp., LNV-7 2301—2504 m
- 4, 6 *Patinasporites* sp., Šaštín-12 4848 m
- 5 *Araucariacites australis* COUPER, LNV-7 2301 m

Plate XXIII

- 1—2 *Plankton* indet. LNV-7 2301-2504 m
- 3—5 *Micrhystridium licroidium* MORBEY, LNV-7 2301 m, LNV-6 1660 m
- 6 *Micrhystridium* cf. *licroidium* MORBEY, LNV-7 2301 m, Photo SEM, magnif. 2800 ×

Plate XXIV

- 1—2 *Micrhystridium licroidium* MORBEY, LNV-6 1660 m
- 3—4 *Veryhachium valensii* DOWN., LNV-7 2301 m
- 5 *Micrhystridium* sp., LNV-6 1660 m

- 6—7 *Micrhystridium licroidium* MORBEY, LNV-7 2301—2304 m
8—9 *Lagenella martini* (LESCHIK) KLAUS, LNV-7 2995 m
10 *Plankton* indet., Šaštin-12 4848 m
11 *Micrhystridium licroidium* MORBEY, SEM, magnif. 3000 ×
12 *Micrhystridium* det. magnif. 9000 ×, LNV-7 2301—2304 m

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New late Neogene floras of southern Slovakia (Pinciná and Hajňačka)

8 Pls. (XXV—XXXII), Slovak summary

Abstract. Characteristics of two newly recovered local floras of Upper Miocene and Pliocene age are given. Both are associated with volcanogenic rocks dated by radiometric (K-Ar) technics. In Pinciná (Podrečany Basalt Formation, 4.90—7.15 MA) broad-leaved deciduous forest with *Fagus*, *Quercus* sect. *Cerris*, *Zelkova*, *Parrotia* and accessory *Betulaceae*, *Carya*, cf. *Byttneriophyllum* etc. was developed while at Hajňačka (Cerova Basalt Formation, 1.32—2.75 MA) mixed deciduous and conifer forest was dominated mainly by *Quercus*, *Acer*, *Ulmus*, *Tilia*, *Buxus* and *Torreya*. The latter locality is known by mammalian fauna of Lower Villafranchian age (mammal zone MN 16a).

Introduction

Our preliminary paper on fossil floras of Pinciná and Hajňačka gives first taxonomical evaluation of the material obtained by joined field research in 1984 and a revision of samples collected by Fejfar 1955—1982 at the latter locality (FEJFAR-HEINRICH 1985). These localities belong to different geological formations of southern Slovakia in the environs of the Lučenec Basin.

The exposure at Pinciná is formed by white grey diatomaceous tuffite in the wall of an abandoned pit. The geological section represents a part of the Poltar Formation, which extends over the western and north-western part of the Lučenec Basin (for details see VASS-KRAUS 1985). Radiometric dating was carried out by two laboratories and independently measured data indicate an age of 4.90 to 7.14 MA for basalts of this formation (BALOGH et al. 1981, KANTOR-WIEGEROVÁ 1981). In chronostratigraphical terms the age corresponds approximately to the Upper Miocene, Pontian (RÖGEL-STEININGER 1983) of Central Paratethys. The Poltar Formation is deposited unconformably on Paleozoic and Paleogene rocks. According to ČECHOVIČ (1963) it contains gravels, sands and clays with local lignite seams which often interfinger and wedge out. In the above mentioned section NE of Pinciná, the Poltar Formation

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is formed by tuffitic to tuffitic-diatomaceous deposits, which according to VASS-KRAUS (1985) include ash matter of the Podrečany Basalt Formation. These layers near the top of the section have yielded plant impressions described below.

The locality at Hajnačka is situated in the Cerova Highland. The exposure lies in the road-cut 1.5 km SE of the village (see FEJFAR—HEINRICH 1985, fig. 2). The plant-bearing layers consist of whitish green brown tuffite. In the environs over the eastern slope of the near-by basalt volcano several sites of fossil mammal fauna are known and were called by FEJFAR (1964) as Hajnačka I. Tuffs and tuffites, according to VASS et al. (1981) filled up the upper part of a large maar and belong to the Cerova Basalt Formation. Beside the main place in the road-cut where plant remains are found as imprints, in nodules of limonitic sandstones external molds of cones, and in tuffs permineralized bodies (wood, fungus) have been recovered. The Cerova Basalt Formation includes mostly nefelinic basanites and volcanoclastics (VASS-KRAUS 1985), their radiometric age was determined by the same laboratories as quoted above (BALOGH et al. 1981), (KANTOR-WIEGEROVÁ 1981) between 1.35 and 2.75 MA. The biostratigraphic position of the mammal fauna was estimated by FEJFAR (1964) as the Lower Villafranchian, by MEIN (1975) as the Upper Pliocene, by FEJFAR-HEINRICH (1985) as the mammal zone MN 16a, which also corresponds to mammal faunas of the Middle Romanian (ANDREESCU 1983).

All samples studied are deposited in the collections of the Museum of Natural History, Bratislava (BRA) and in the National Museum, palaeontological department, Praha (PRNM).

We are grateful to RNDr. Dionýz Vass, DrSc., RNDr. Ivan Kraus, CSc. and RNDr. Oldřich Fejfar, CSc. for calling our attention to the new sites of fossil flora at Pinciná and Hajnačka and for information concerning stratigraphical position of fossiliferous deposits.

Flora of Pinciná

Pinaceae gen. et sp.

Pl. XXV, Fig. 10

A fragment of a needle-like leaf, 18×1.5 mm in size, sharply pointed, bilaterally (secondarily) flattened, without any trace of stomatal rows, truncate at the base. It recalls a needle of spruce.

Populus sp.

Pl. XXVI, Fig. 9

Rounded leaves with sinuate margin recalling the living *Populus tremula* L.

***Betula* sp. div.**

Pl. XXV, Figs. 1a, 7

Incomplete leaves, oval in outline, with sharply double serrate margin.

***Carpinus grandis* UNG.**

Pl. XXV, Fig. 8

Fragments of sharply dentate leaves with closely spaced parallel secondaries, which recall hornbeam foliage.

***Fagus attenuata* GOEPP.**

Pl. XXV, Figs. 2—5

Several leaves, mostly oblong, $7-9 \times 3.8-4$ cm in size, with widely bluntly toothed margin, up to 12 secondaries slightly bent outwards. They can be best matched with the late Miocene populations from the Poznań and Gozdnica Formations in Poland (e.g. HUMMEL 1983). *Fagus haidingeri* KOVATS sensu KNOBLOCH (1969) differs by ovate leaves rounded at the base and lower number of secondaries. But our material is not rich enough to allow a statistical evaluation.

***Quercus pseudocastanea* GOEPP.**

Pl. XXVI, Figs. 3—6

Leaves recalling by their sinuate lobate margin and longly ovate outline *Q. pseudocastanea* except for blunt lobes. Such leaf forms have often been described in the late Miocene strata (Moravská Nová Ves — KNOBLOCH 1969, Močiar — SITÁR 1973, Zschipkau — MENZEL 1906) and obviously fall within the variability of this species.

***Quercus* sp.**

Pl. XXVI, Figs. 1, 2

Fragmentary leaves, conspicuous by large dimensions and somewhat irregular type of marginal lobes. In one specimen the lobes are shallow sinuate, in another one the upper lobe is doubled. Similar forms were described as *Quercus cerris-fossilis* KOLAKOVSKIJ (e.g. in TAKTAJAN et al. 1982), but they differ in much deeper lobate leaves.

***Ulmus* sp.**

Pl. XXV, Fig. 6

Leaves shortly petiolate, obovate, asymmetric at the base, recalling small forms of *Ulmus carpinoides* GOEPP. or *U. ruszovensis* HUMMEL (cf. HUMMEL 1983) but the details of the margin are badly preserved and do not allow more precise identification.

***Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA**

Pl. XXVII, Figs. 1—4, 6, 7

Twigs with small leaves and fruits beside larger coarsely dentate leaf imprints with typical venation are classified here as belonging to one species, although several authors have tendency to separate larger leaves into an independent taxon *Zelkova praelonga* (UNG.) BERGER. Such anisophylly of fertile and sterile twigs is well known e. g. in *Z. carpinifolia* (PALL.) K. KOCH.

***Morus cf. lanceolata* ANDREÁNSZKY**

Pl. XXVI, Fig. 8

Incomplete dentate leaf imprint, slightly asymmetric at the base with secondaries running at angles of 23°—30° towards leaf margin. Similar forms have been described from the Hungarian Sarmatian (ANDREÁNSZKY 1959).

***Arbutus elegans* KOLAKOVSKIJ**

Pl. XXVII, Fig. 9

A longly oval leaf, finely serrate with semicraspedodrome venation. The base is missing, secondaries bent and looping close to the margin. Morphologically it corresponds to the species described by KOLAKOVSKIJ (1964) from the Pliocene of Kodor, U.S.S.R.

***Parrotia pristina* (ETTINGSH.) STUR**

Pl. XXVII, Fig. 5

Leaves ovate with sinuate margin and characteristic basal secondaries extending below the base of the leaf lamina. They do not differ in any respect from the other record of this species in Europe.

***Carya cf. minor* SAP. et MAR.**

Pl. XXV, Figs. 1b, 9

The elongate form of the leaflets and their semicraspedodrome venation suggest an affinity to *Carya* NUTT. It is so far uncertain whether the late Miocene hickories are not conspecific with the Oligocene ones.

***Acer* cf. *integerrimum* (VIV.) MASSAL.**

Pl. XXVII, Figs. 10, 11

Two basal parts of leaves which appear to be entire margined with five to seven lobes.

cf. *Byttneriophyllum tiliifolium* (AL. BR.) KNOBLOCH et KVAČEK

Pl. XXVII, Fig. 8

A fragmentary leaf with prominent tertiary venation and entire (?) margin can be compared with this common species.

***Phragmites oeningensis* AL. BR.**

Pl. XXVI, Fig. 7

Fragments of monocotyledonous stems 5—6 mm wide, with nodes.

Flora of Hajnačka

***Polyporaceae* gen. et sp.**

The only specimen of calcified bracket fungus found at the Kormos' locality (FEJFAR-HEINRICH 1985) will be treated in a separate study.

***Pteris palaeoaurita* E. KOVÁCS**

Pl. XXIX, Fig. 1, 2

Terminal parts of fronds or pinnae with alternate, densely spaced, broadly triangular pinnules and a terminal (incomplete) larger pinnule showing dense non-anastomosing and dichotomous venation. Margin obviously entire, slightly revolute, number of veins in one pinnule attaining usually 6—8 on either side of the midvein.

Similar remains, but for the enlarged terminal pinnule, has been described by SITÁR (1973) from Močiar. They both differ from the type material of *P. palaeoaurita* by more dense venation. Because of fragmentary nature of sterile material the systematic assignement remains tentative.

cf. *Ginkgo adiantoides* (UNG.) HEER

The only specimen found during earlier excavation by Fejfar and identified by E. KNOBLOCH (pers. comm.) has not been available to the present study.

***Torreya fejfarii* sp. n.**

Pl. XXVIII, Figs. 1—5

Diagnose: Leaves flat, lineate lanceolate, straight to slightly falcate, 25—38 × 3—5 mm in size, shortly petiolate, rounded at the base, gradually attenuate with a 1.5 mm long sharply pointed apex. Adaxial side with indistinct longitudinal grooves, abaxial side with 0.4—0.5 mm wide stomatal bands showing minute impresions of papillae and faint walls of prosenchymatous cells (0.8 µm wide) in non-stomatal areas.

Holotype: Inv. No. G 5650 (PRNM), pl. XXVIII, figs. 2, 4

Paratypes: Inv. Nos. G 5649 (PRNM), pl. XXVIII, 1, G 5634 (PRNM), G 5636 (PRNM), G 5642 (PRNM), G 5648 (PRNM), G 5651 (PRNM), G 5652 (PRNM), H 4 (BRA), pl. XXVIII, f. 3, H 8 (BRA), pl. XXVIII, f. 5,

Locus typicus: Hajnačka, southern Slovakia, Czechoslovakia.

Stratum typicum: tuffites of the Cerova Formation, late Pliocene (mammal zone MN 16 a).

These so far the youngest and very abundant remains of *Torreya* ARN. in Europe have so far been compared with the extant Japanese *Torreya nucifera* (L.) SIEB. et ZUCC. (FEJFAR-HEINRICH 1985) but after a more detailed comparison they are suggested as a new species because of an unusual large size of leaves. In other respect *T. fejfarii* matches well with the early Pliocene *T. nucifera* (L.) SIEB. et ZUCC. *fossilis* ENGELHARDT et KINKELIN from Frankfurt a. M. (ENGELHARDT-KINKELIN 1908), Willershausen (STRAUS 1952), Kodor (KOLAKOVSKIJ 1964), in which the leaves hardly exceed the length of 28 mm. *T. aff. nucifera* from Drevenik (NĚMEJC 1968, pl. 41, figs. 4, 5) is also comparable only with the smallest leaves of *T. fejfarii*. *T. nucifera* var. *brevifolia* SAP. et MAR. of Meximieux (SAPORTA-MARION 1876) has still shorter leaves — up to 18 mm. The Oligocene species *T. bilinica* SAP. et MAR. (= *Podocarpus eocenica* auct.) decidedly differs by the lack of mucro (KVAČEK 1984). Among extant species similar size variation as in *T. fejfarii* can be found in *T. taxifolia* ARN. from SE U.S.A.

***Picea* sp. 1**

Pl. XXVIII, Figs. 7—9

In the layer of ferruginous sandstone nodules of Kormos' locality (according to FEJFAR-HEINRICH 1985) two external molds and a compression of spruce cones were found in 1956. They are cylindrical, about 7 cm long and 2 cm across. Tightly adhering cone scales flat, without a visible trace of the bract, slightly striated, quite thin, broadly triangular, blunt at the apex, about 1 × 1.8 cm in size. Cone axis covered by distinct rhomboidal bolsters.

A very similar cone has been found in travertine of Drevenik near Spišské Podhradie (NĚMEJC in DOMIN 1938, textfig. 155) attached to a twig. These remains belong doubtlessly to sect. *Picea* with firm woody cones. Cones of similar size are found e.g. in *Picea glehnii* (F. SCHMIDT) MAST., *P. obovata*

LEDEB. or *P. schrenkiana* FISCH. et MEY. The common european *P. abies* (L.) KARST. has bigger cones.

***Picea* sp. 2**

Pl. XXVIII, Fig. 6

An impression of spinulose needle-like leaf of incomplete length of 12 mm and the width of 1 mm. Its quadrangular cross section is the feature of the sect. *Picea*.

***Salix* sp.**

Pl. XXIX, Figs. 3—5

Bud scales, broadly conical, ruptured at a side, more or less pointed, in some cases recurved, narrowed at the base, there usually with the visible insertion rim, 4—8 mm long and up to 5 mm across with fine and shallow longitudinal grooves.

Similar bud scales in form of compressions have been found in the Pontian of Poštorná, southern Moravia, both match well with bud scales of willows but their specific determination even with the aid of anatomy is impossible (RABIEN 1953).

cf. ***Alnus* sp.**

Pl. XXIX, Fig. 6

A fragment of broadly oval leaf with badly preserved marginal details showing venation aspects of an alder foliage, particularly *Alnus glutinosa* (L.) GAERTN. More precise determination is due to fragmentary nature impossible.

***Betula* sp.**

Pl. XXIX, Fig. 7

A leaf ovate, slightly cordate, finely and sharply serrate, venation craspedodrome (?), secondaries faintly visible, slightly bent, basal veins giving off marginal veinlets towards the margin.

The general form of the leaf is reminiscent to some birches, e. g. *Betula occidentalis* HOOK. or *B. verrucosa* EHRH.

***Carpinus grandis* UNG.**

Pl. XXIX, Fig. 8

Leaves elliptic, 2.4—3.3 cm wide and approximately up to 6 cm long, rounded at the base, double dentate, with fine, badly preserved teeth, venation

craspedodrome, secondaries straight, near the base slightly S — shaped, subopposite to alternate, regularly closely spaced, at angles of 35°—55° (at the base up to 90°), near the margin giving off marginal veinlets into teeth, tertiaries at nearly right angles, forked and joining half way between secondaries.

This purely formal species says nothing about the relationship to the taxa based on fruits, which have not yet been recovered at Hajnačka. One imprint of this species, before having been properly uncovered, was erroneously identified as cf. *Fagus* sp. (in FEJFAR-HEINRICH 1985).

cf. *Pterocarya* sp.

Pl. XXIX, Figs. 9, 10

Fragments of winged fruits with radially disposed venation of the wing, diverging and forking towards the margin, wing 8 mm wide and narrowed to the attachment.

Remains of similar size have been published e.g. by GREGOR (1982) as *Pterocarya* sp. from the late Miocene of the F.R.G.

***Quercus* ex gr. *roburoides* GAUDIN**

Pl. XXXI, Figs. 9, 10, 12, 13

Incomplete imprints of shallow sinuate lobate leaves with quite dense secondaries, widely cuneate and slightly asymmetric at the base, petiolate. Marginal lobes of some leaves are narrow and bluntly pointed. They recall some members of the sect. *Robur*, e.g. *Quercus canariensis* WILLD. but they differ from the usual form of *Q. roburoides* from the Pliocene (Reuverian) of Europe by smaller dimensions, some fragments with pointed lobes may represent juvenil foliage but also another species.

***Ulmus braunii* HEER**

Pl. XXIX, Figs. 11—13, 15, 16

Leaves elongate to ovate, 1—2.5 cm × 2—5 cm in size, double dentate, often strongly asymmetric and semicordate at the base, blunt at apex, venation craspedodrome, secondaries densely spaced, very often forked, straight, at the base at right to wide angles, normally at angles of 30—45°, higher order venation indistinct.

Without the knowledge of fruits the affinities to extant species must remain open. Small leaves of *Zelkova* with simple teeth can be easily mistaken for this elm when marginal details are obscure.

***Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA**

Pl. XXXI, Figs. 1, 2

Incomplete leaves attaining up to 5 cm in length, with coarse blunt teeth and craspedodrome venation, secondaries diverging at wider acute angles, at the slightly cordate base (seen in one specimen) at the right angle, pairs of secondaries approx. 10 in number.

As stated above, larger leaf forms are sometimes assigned to an independent species *Z. praelonga* (UNG.) BERGER, allegedly with the relationship to *Z. serrata* (THUNB.) MAK. However, leaves of sterile ultimate twigs in *Z. carpinifolia* (PALL.) DIPP. as well in less tolerant *Z. hyrcana* A. GROSSH. et A. JARM. reach a length of 10—12 cm and possess 9—12 secondaries on either side of the midvein. Thus the Tertiary record in Europe shows a mixture of features met with in Caucasian and East Asiatic extant species but there are no grounds to maintain two sympatric separate species.

***Vitis cf. teutonica* AL. BR.**

Pl. XXIX, Fig. 14

A seed impression from the dorsal side, 4 mm long, with the maximum width of 3.8 mm in the upper third of the length, obovate in outline, with an oval chalaza.

It best matches with the extinct *V. teutonica*, the approximate determination is due to bad preservation. *V. teutonica* is related to *V. riparia* MICHX. while *V. amurensis* RUPR. with similar seeds differs in foliage. *V. teutonica* occurs mostly in Miocene but survives till Pliocene, e. g. at Krościenko (SZAFFER 1947).

***Acer integerrimum* (VIV.) MASSAL.**

Pl. XXXI, Fig. 3

Incomplete imprint of palmately 5—7 lobed leaves, of reconstructed sizes 6 to 8 cm across, entire-margined, with a distinct higher-order venation and tiny meshes of areolation.

According to the classification of TANAI (1978) they belong to the group with simple free ending veinlets, which are sometimes absent or very rarely forked within the areole. This type of areoles is represented in sect. *Platanioidea* PAX, *Goniocarpa* POJARK., *Integrifolia* PAX and *Syriaca* OGATA. By the form of leaf blades and the number of leaf lobes and their elongate tips they mostly recall sect. *Platanioidea*.

***Acer* sp. 1**

Pl. XXXI, Fig. 4

Fragmentary maple leaves with finely dentate margin, not identifiable precisely, though their superficial similarity to more advanced (Pliocene) forms of *Acer tricuspidatum* BRONN cannot be denied.

Acer sp. 2

A fragment of a maple leaf without leaf margin, possibly belonging to the previous entity.

Acer sp. 3

Pl. XXXI, Fig. 5

An incomplete samara 1.7 cm long with the straight dorsal side of the wing, which is narrowed near the tip and runs on the ventral side nearly to the incompletely preserved flat seed part, where it forms a prominent lobe. The wings were obviously wide spreading at an angle of nearly 180°. Despite its small size it recalls most fruits of the sect. *Platanioidea*, which is also represented by leaf remains.

Acer sp. 4

Pl. XXXI, Figs. 6—8

Incomplete samaras about 2.5 cm long with the straight dorsal side of the wing, broad and rounded at the tip, on the ventral side decurrent to the seed part (in pl. XXXI, fig. 8 seemingly narrowed, but the margin is probably broken off). The seed part bears longitudinal ribs, of which the medial one is more prominent. In the proximal view the seed part is biconvex. The contact area appears very narrow.

The relationship to the species of Tertiary and extant maples is uncertain.

Tilia cf. *platyphyllos* SCOP.

Pl. XXX, Figs. 1—8

Leaves orbiculate to ovate, truncate or cordate at the base, rarely strong asymmetric, apiculate, 2—5 × 3—5.5 cm in size, marginal teeth broad with convex sides and a very short mucro. Secondaries looping near the margin, tertiaries distinct and parallel. Pubescence not preserved.

STRAUS (1967) figured a similar leaf form as *Tilia* sp., which shows clear axillary tufts of hairs, in other linden leaves of Willershausen (STRAUS 1969) not seen. MAI (1983) brings as *T. platyphyllos* SCOP. a leaf impression of Pleistocene age, still more reminiscent to our specimens. Of the linden species with ribbed fruits *T. platyphyllos* seems really the best match while the Caucasian species differ by longly mucronate marginal teeth. In general leaf form *T. tomentosa* MOENCH is also similar but differs by fruits (see below).

The leaves are accompanied by fragments of bracts (incomplete length 5 cm, the broadest specimen 2.5 cm wide), probably cordate at the base, as indicated by less steep veins, but without any trace of the peduncle. The coalescence cannot be revealed with certainty even according to the stout midvein, which can be found both in pedunculate and non-pedunculate species.

The peduncles are regularly missing in the late Miocene linden bracts of the Vienna Basin described as *T. vindobonensis* STUR or *T. longebracteata* ANDRAE (e. g. KNOBLOCH 1969). The bracta of Pliocene age from Willershausen (STRAUS 1969) are both non-pedunculate (i. e. without a decurrent part of bract) and pedunculate (the bract is sessile to the peduncle), hence two species are present there. A twig belonging to the non-pedunculate species bears leaves with asymmetric truncate to widely cuneate base (see also STRAUS 1967) like *T. caucasica* RUPR., also a non-pedunculate species. The leaves from Willershausen differ morphologically from those described above.

Besides, detached impressions of nuts have been found at Hajnačka, according to latex replicas 7×7 mm in size, secondarily compressed laterally, obovate, with 5 slightly raised ribs, rough surface, with a 5-sided attachment scar 2×1 mm in size at the base and a small hole after style on the apex.

Ribbed fruits with a strong pericarp are developed in sect. *Anestrea* V. ENGL. By its obovate form, size and distinct ribs the remains at hand are best comparable with *T. platyphyllos* SCOP. In also similar *T. dasystyla* STEV. the fruits are mucronate, in *T. europaea* L. bigger and oblong, the East-Asiatic members of subsect. *Costatae* Ig. VASSIL. have fruits oblong or subglobular except *T. semicostata* NAKSI with obovate fruits, but the ribs are developed only in the basal part. Most of other linden have fruits without ribs, e. g. all the American species or also *T. tomentosa* mentioned above.

***Buxus pliocenica* SAPORTA et MARION**

Pl. XXXI, Figs. 15, 16

Leaves oblong (to spatulate), $10-12 \times 4$ mm in size, sometimes emarginate, nearly sessile and narrowly cuneate at the base, venation not always visible, with numerous densely spaced secondaries and intersecondaries joined in a fimbrial vein on the margin.

In the form and size of leaves this population does not differ from others occurring in the late Miocene and Pliocene of Europe (KVAČEK et al. 1982).

***Dicotyledonae* gen. et sp.**

Pl. XXXI, Figs. 11, 14

Among leaf imprints, mostly fragmentary, which are hardly identifiable, there occur several forms, partly entire-margined. In view of a rather complicated reticulate venation, at least some of them may represent the leaves of herbs.

Conclusions

Comparing the assemblages from Pinciná and from Hajnačka trends in development of mesophytic forest vegetation between the late Miocene and

Pliocene can be traced. Generally the character of fossiliferous deposits (i. e. tuffaceous clays) are rather similar in both sites, so that the possibility of differences caused by habitat conditions might be neglected. Also landscapes — volcanic regions — must have been alike. The period of field collections was in both cases rather short (at Pinciná very short, only a few hours), thus the obtained assemblages include obviously most common elements and only supplementary accessories are to be expected in the future.

The collection of Pinciná includes the leaf imprints of 1 conifer, 14 dicotyledones and stems of 1 monocotyledone. The reconstructed vegetation suggests a hardwood stand with *Fagus-Quercus-Carya* in the canopy layer and a thick second storey of smaller trees ((*Zelkova*, *Parrotia*, *Acer*, *Carpinus*, *Ulmus*). Conifers were very few and rare. The assemblage corresponds to deciduous broad-leaved mesophytic forest. Similar, but much richer assemblages are known in the Sarmatian floras of central Slovakia (SITÁR 1973) and elsewhere. Among oaks, however, more advanced forms replaced *Quercus kubinyi*, commonly distributed in Miocene floras till Pannonian s. s. The scarcity of evergreen elements may refer to more continental climate with severe winter season and lower precipitation within warm-temperate conditions. This well corresponds to the radiometric data, which indicate Pontian to the lowest Dacian. Among the floras of similar composition that of the Polish locality Domański Wierch (ZASTAWNIAK 1972) can be suggested.

The assemblages at Hajnačka taken together are composed of 1 fungus, 1 fern, 3 gymnosperms und 12 dicotyledones. We can expect an open forest, probably more simple than the previous one. In the canopy predominated *Quercus*, *Tilia*, *Ulmus*, *Acer*. Shrub layer was rich and included also evergreen forms (*Buxus*), lianas (*Vitis*) and abundantly represented *Torreya*. In this mixed deciduous and conifer forest *Fagus* was obviously lacking. The existence of herb layer is indicated by a fern and various imprints with curious venation patterns that may refer to herbs. The locality has yielded a rich terrestrial fauna of the mammal zone MN 16a which coincides (teste ANDREESCU 1983) with the Middle Romanian. The radiometric data (1.35 and 2.75 MA) indicate in average a slightly younger age than one would expect according to the faunal evidence. However, the basalts dated by radiometric technics are not identical with fossiliferous layers. Normal polarity of the whole section without any reversal event (Fejfar according Opdyke, pers. comm.) coincides with the Gauss epoch (3.40—2.48 MA). The flora of Hajnačka possesses still warm temperate aspects (*Torreya*), which exclude a comparison with the so-called Praetiglian, a cold wave, which should have taken place approximately 2.3 MA. At present it is difficult to offer a similar assemblage among European Pliocene floras but we merely stress the fact that in pollen spectras of late Reuverian (e. g. v. BRELIE 1983) *Fagus* pollen forms only short-termed indistinct maxima and in the upper part of the Pliocene section of Mizerna it is also only poorly represented (OSZAST in SZAFER 1954).

Table List of taxa at Pinciná and Hajnačka

Taxon	Pinciná	Hajnačka		
		Road cut	Kormoš locality	Test pits
<i>Polyporaceae</i> gen. et sp.			1	
<i>Pteris palaeoaurita</i>		3		1
cf. <i>Ginkgo adiantoides</i>				
<i>Torreya fejfarii</i>		20		
<i>Picea</i> sp. 1			3	
<i>Picea</i> sp. 2		1		
<i>Pinaceae</i> gen. et sp.	2			
<i>Salix</i> sp.		5		
<i>Populus</i> sp.	2			
cf. <i>Alnus</i>		1		
<i>Betula</i> sp. div.	3	1		
<i>Carpinus grandis</i>	4	1		
cf. <i>Pterocarya</i> sp.		2		
<i>Carya</i> cf. <i>minor</i>	4			
<i>Fagus attenuata</i>	9			
<i>Quercus pseudocastanea</i>	4			
<i>Quercus</i> sp.	5			
<i>Quercus</i> ex gr. <i>roburoides</i>	5	6		
<i>Ulmus braunii</i>		3		
<i>Ulmus</i> sp.	2			
<i>Zelkova zelkovifolia</i>	7	2		
<i>Morus</i> cf. <i>lanceolata</i>	1			
<i>Arbutus elegans</i>	1			
<i>Parrotia pristina</i>	1			
<i>Vitis teutonica</i>		1		
<i>Acer integerrimum</i>		1		
<i>Acer</i> cf. <i>integerrimum</i>	4			
<i>Acer</i> sp. 1		2		
<i>Acer</i> sp. 2		1		
<i>Acer</i> sp. 3		1		
<i>Acer</i> sp. 4		3		
cf. <i>Byttneriophyllum tiliifolium</i>	1			
<i>Tilia</i> cf. <i>platyphyllos</i>		7		
<i>Buxus pliocenica</i>		7		
<i>Dicotyledonae</i> gen. et sp.	1	3		
<i>Phragmites oeningensis</i>	1			

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Nové flóry južného Slovenska (Pinciná a Hajnačka)

Resumé

V predloženej práci podávame opis fosilnej flóry z lokalít, ktoré sa nachádzajú v geologicky rozdielnych formáciách na južnom Slovensku, bližšie v Lučenskej kotline.

Pinciná patrí do tzv. poltárskej formácie, presnejšie do podrečianskej bazaltovej formácie, ktorá je rozšírená v z. a sz. časti Lučenskej kotliny. Hajnačka patrí do tzv. cerovej bazaltovej formácie, rozšírenej v Cerovej vrchovine. Geologickou stavbou študovanej oblasti sa podrobnejšie zaoberajú D. VASS — I. KRAUS (1985). Rádiometrický výskum juhoslovenských bazaltov bol robený v dvoch laboratóriách a nezávisle na sebe boli namerané veky podrečianskych bazaltov na 4,90 až 7,15 mil. rokov (K. BALOGH et al. 1981, J. KANTOR — V. WIEGEROVÁ 1981). Ti istí autori uvádzajú aj rádiometrický vek bazaltov z Cerovej vrchoviny a ten sa pohybuje od 1,35 do 2,75 mil. rokov. V chronometrickej škále paratetýdneho neogénu F. RÖGL — F. STEININGER 1983) v prvom prípade zodpovedá uvedený rádiometrický vek pontu, v druhom prípade vrchnému pliocénu (ruman).

Poltárska formácia leží diskordantne na paleozoiku a paleogéne. Podľa V. ČECHOVIČA (1963) sú v nej zastúpené štrky, piesky, íly, ojediniele aj sloje lignitu, ktoré sa striedajú vo veľmi pestrom slede a rýchle vyklínajú. V lome sv. od obce Pinciná sa nachádza poltárske súvrstvie, tvorené z tufového materiálu (podľa D. VASSA — J. KRAUSA 1985 ide o popolovitú hmotu vulkanoklastik podrečianskej bazaltovej formácie). Práve v týchto tufových vrstvách sa nachádzajú odtlačky flóry.

Lokalita Hajnačka sa nachádza jv. od obce Hajnačka, asi 1,5 km v záreze cesty v oblasti, z ktorej pochádza fauna cicavcov, ktorú opísal O. FEJFAR (1964) a označil ako lokalita Hajnačka I. Lokalita je súčasťou Cerovej vrchoviny. Ide o sedimenty tufov a tufitov, ktoré podľa D. VASSA a kol. (1981) predstavujú vrchnú časť výplne pomerne veľkého maaru a sú súčasťou cerovej bazaltovej formácie. V týchto sedimentoch sa nachádza pomerne bohaté spoločenstvo flóry vo forme odtlačkov listov a tiež bohatá fauna cicavcov. Podľa D. VASSA a I. KRAUSA (1985) je cerová bazaltová formácia tvorená prevažne nefelinickými bazanitmi a vulkanoklastikami. Vek študovanej oblasti je určený jednak rádiometricky (viď vyššie) a jednak na základe fauny cicavcov, ktorú FEJFAR (1964) považuje za spodný vilafrank, MEIN (1975) za vrchný pliocén. O. FEJFAR — V. HEINRICH (1985) za zónu MN 16a. Tomu nezodpovedá rádiometrické datovanie, ktoré ukazuje na mladší vek.

Na lokalite Pinciná sa odtlačky listov nachádzajú v sivých tufitoch. Boli určené nasledujúce druhy: *Pinaceae* gen. et sp., *Betula* sp. div., *Carpinus grandis* UNG., *Fagus attenuata* GOEPP., *Quercus pseudocastanea* GOEPP., *Quercus* sp., *Ulmus* sp., *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, *Morus* cf. *lanceolata* ANDREÁNSZKY, *Arbutus elegans* KOLAKOVSKIJ, *Parrotia pristina* (ETTINGSH.) STUR, *Carya* cf. *minor* SAP. et MAR., *Acer* cf. *integerrimum* (VIV.) MASSAL., cf. *Byttneriophyllum tiliifolium* (AL. BR.) KNOBLOCH et KVAČEK, *Phragmites oeningensis* AL. BR.

Zo starších zberov FEJFARA i nami nájdených odtlačkov rastlín sme na lokalite Hajnačka určili: *Polyporaceae* gen. et sp., *Pteris palaeaurita* E. KOVÁCS, cf. *Ginkgo adiantoides* (UNG.) HEER, *Torreya fejfarii* sp. n., *Picea* sp. 1, 2, *Salix* sp., cf. *Alnus* sp., *Betula* sp. div., *Carpinus grandis* UNG., cf. *Pterocarya* sp., *Quercus* ex gr. *roburoides* GAUDIN, *Ulmus braunii* HEER, *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, *Vitis* cf. *teutonica* AL. BR., *Acer integerrimum* (VIV.) MASSAL., *Acer* sp. 1—4, *Tilia* cf. *platyphyllos* SCOP., *Buxus pliocenica* SAP., *Dicotyledonae* gen. et sp.

Z uvedeného vidieť, že ide o dve rozdielne flóry, aj keď sa na prvý pohľad zdá, že sú si veľmi podobné. Na lokalite Hajnačka sú časté *Torreya*, *Ulmus*, *Carpinus*, *Quercus roburoides*, *Tilia*, *Buxus pliocenica*. Na lokalite Pinciná sú zastúpené hlavne *Carpinus*, *Fagus*, *Quercus* a *Carya*. Zaujímavý je výskyt druhov *Parrotia fagifolia*, cf. *Byttneriophyllum tiliifolium* a *Quercus pseudocastanea*. Tieto formy môžeme považovať za relikty sarmatu a tým aj celé spoločenstvo za staršie ako spoločenstvo lokality Hajnačka. Potvrdzujú to aj výsledky rádiometrických údajov.

Zhodne môžeme konštatovať, že flóra z Pincinej je pontského veku, zatiaľ čo flóra Hajnačky je vrchnopliocénna.

Explanations of plates XXV—XXXII

Pl. XXV

- 1 a) *Betula* sp., b) *Carya* cf. *minor* SAP. et MAR. (P 7 BRA), Pinciná, 1:1.
- 2 *Fagus attenuata* GOEPP. (P 19 BRA), Pinciná, 1:1
- 3 *Fagus attenuata* GOEPP. (P 20 BRA), Pinciná, 1:1
- 4 *Fagus attenuata* GOEPP. (P 20 BRA), Pinciná, 1:1
- 5 *Fagus attenuata* GOEPP. (P 21 BRA), Pinciná, 1:1
- 6 *Ulmus* sp. (P 22 BRA), Pinciná, 1:1
- 7 *Betula* sp. (P 5 BRA), Pinciná, 1:1
- 8 *Carpinus grandis* UNG. (P 9 BRA), Pinciná, 1:1
- 9 *Carya* cf. *minor* SAP. et MAR. (P 10 BRA), Pinciná, 1:1
- 10 *Pinaceae* gen. et sp. (P 1 BRA), Pinciná, $\times 3$

Photo: L. Osvald

Pl. XXVI

- 1 *Quercus* sp. (P 17a BRA), Pinciná, 1:1
- 2 *Quercus* sp. (P 24 BRA), Pinciná, 1:1
- 3 *Quercus pseudocastanea* GOEPP. (P 26 BRA), Pinciná, 1:1
- 4 *Quercus pseudocastanea* GOEPP. (P 25₂ BRA), Pinciná, 1:1
- 5 *Quercus pseudocastanea* GOEPP. (P 30 BRA), Pinciná, 1:1
- 6 *Quercus pseudocastanea* GOEPP. (P 25₂ BRA), Pinciná, 1:1
- 7 *Phragmites oeningensis* AL. BR. (P 28 BRA), Pinciná, 1:1
- 8 *Morus* cf. *lanceolata* ANDREÁNSZKY (P 27 BRA), Pinciná, 1:1
- 9 *Populus* sp. (P 2 BRA), Pinciná, 1:1

Photo: L. Osvald

Pl. XXVII

- 1 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, (P 12 BRA), Pinciná, 1:1
- 2 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, (P 13 BRA), Pinciná, 1:1
- 3 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, (P 14 BRA), Pinciná, 1:1
- 4 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, (P 15 BRA), Pinciná, 1:1
- 5 *Parrotia pristina* (ETTINGSH.) STUR (P 29 BRA), Pinciná, 1:1
- 6 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, (P 18 BRA), Pinciná, 1:1
- 7 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA, (P 17 BRA), Pinciná, 1:1
- 8 cf. *Byttneriophyllum tiliifolium* (A. BR.) KNOBLOCH et KVAČEK, (P 7 BRA), Pinciná, 1:1
- 9 *Arbutus elegans* KOLAKOVSKIJ (P 25₃ BRA), Pinciná, 1:1
- 10 *Acer* cf. *integerrimum* (VIV.) MASSAL. (P 31 BRA), Pinciná, 1:1
- 11 *Acer* cf. *integerrimum* (VIV.) MASSAL. (P 32 BRA), Pinciná, 1:1

Photo: L. Osvald

Pl. XXVIII

- 1 *Torreya feiffarii* sp. n. (G 5649, PRNM), Hajnačka, $\times 1,5$
- 2 *Torreya feiffarii* sp. n. (G 5650, PRNM, holotype), Hajnačka, $\times 1,5$
- 3 *Torreya feiffarii* sp. n. (H 4 BRA), Hajnačka, $\times 2$
- 4 *Torreya feiffarii* sp. n., magnified part of fig. 1, $\times 10$
- 5 *Torreya feiffarii* sp. n. (H 8 BRA), Hajnačka, 1:1
- 6 *Picea* sp. 2 (G 5642, PRNM), Hajnačka, $\times 3$
- 7 *Picea* sp. 1 (G 5643, PRNM), Hajnačka, 1:1
- 8 *Picea* sp. 1 (G 5647, PRNM), Hajnačka, 1:1
- 9 *Picea* sp. 1 (G 5645, PRNM), Hajnačka, 1:1

Photo: Figs. 1, 2, 4, 6—9 J. Brožek, Figs. 3, 5 L. Osvald

Pl. XXIX

- 1 *Pteris palaeoaurita* E. KOVÁCS (H 2 BRA), Hajnačka, × 2
 - 2 *Pteris palaeoaurita* E. KOVÁCS (H 1 BRA), Hajnačka, × 4
 - 3 *Salix* sp. (G 5655, PRNM), Hajnačka, × 3
 - 4 *Salix* sp., the same specimen from below, × 3
 - 5 *Salix* sp. (G. 5638, PRNM), Hajnačka, × 3
 - 6 cf. *Alnus* sp. (H 9 BRA), Hajnačka, 1:1
 - 7 *Betula* sp. (H 10 BRA), Hajnačka, 1:1
 - 8 *Carpinus grandis* UNG. (H 11 BRA), Hajnačka, 1:1
 - 9 cf. *Pterocarya* sp. (G 5633, PRNM), Hajnačka, × 2:1
 - 10 cf. *Pterocarya* sp. (G 5641, PRNM), Hajnačka, × 3
 - 11 *Ulmus braunii* HEER (H 14 BRA), Hajnačka, 1:1
 - 12 *Ulmus braunii* HEER (H 12 BRA), Hajnačka, 1:1
 - 13 *Ulmus braunii* HEER (H 16 BRA), Hajnačka, × 2
 - 14 *Vitis* cf. *teutonica* A. BR. (G 5636, PRNM), latex cast, Hajnačka, × 5
 - 15 *Ulmus braunii* HEER (H 15 BRA), Hajnačka, 1:1
 - 16 *Ulmus braunii* HEER (H 13 BRA), Hajnačka, 1:1
- Photo: Figs. 1, 2, 6—8, 11—13, 15, 16 L. Osvald, figs. 3—5, 9, 10, 14 J. Brožek

Pl. XXX

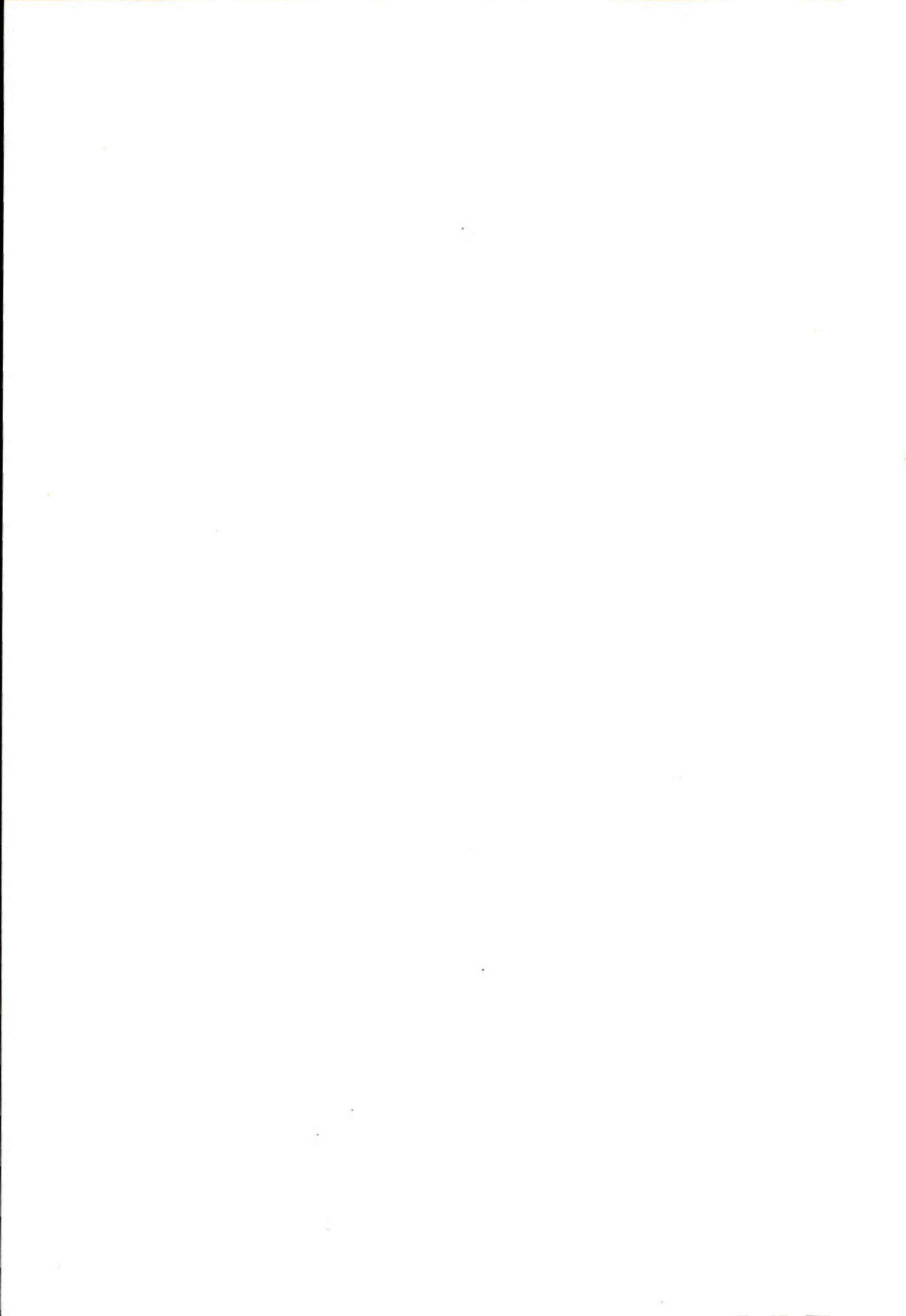
- 1 *Tilia* cf. *platyphyllos* SCOP. (H 17 BRA), Hajnačka, 1:1
 - 2 *Tilia* cf. *platyphyllos* SCOP. (H 18 BRA), Hajnačka, 1:1
 - 3 *Tilia* cf. *platyphyllos* SCOP., magnified part of fig. 8, × 2
 - 4 *Tilia* cf. *platyphyllos* SCOP. (H 19 BRA), Hajnačka, 1:1
 - 5 *Tilia* cf. *platyphyllos* SCOP. (G 5650, PRNM), latex cast, Hajnačka, × 4
 - 6 *Tilia* cf. *platyphyllos* SCOP., the same specimen from above, × 4
 - 7 *Tilia* cf. *platyphyllos* SCOP. (G 5635, PRNM), Hajnačka, × 2
 - 8 *Tilia* cf. *platyphyllos* SCOP. (G 5648, PRNM), Hajnačka, 1:1
- Photo: Figs. 1, 2, 4, L. Osvald, figs. 3, 5—8 J. Brožek

Pl. XXXI

- 1 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA (H 20 BRA), Hajnačka, 1:1
 - 2 *Zelkova zelkovifolia* (UNG.) BŮŽEK et KOTLABA (H 21 BRA), Hajnačka, 1:1
 - 3 *Acer integerrimum* (VIV.) MASSAL. (H 22 BRA), Hajnačka, 1:1
 - 4 *Acer* sp. 1 (H 23 BRA), Hajnačka, 1:1
 - 5 *Acer* sp. 3 (G 5640, PRNM) Hajnačka, × 2
 - 6 *Acer* sp. 4 (G 5639, PRNM), latex cast, Hajnačka, × 3
 - 7 *Acer* sp. 4 (G 5648, PRNM), Hajnačka, × 1,5
 - 8 *Acer* sp. 4 (G 5634, PRNM), Hajnačka, × 1,5
 - 9 *Quercus* ex gr. *roburoides* GAUDIN (H 24 BRA), Hajnačka, 1:1
 - 10 *Quercus* ex gr. *roburoides* GAUDIN (H 25 BRA), Hajnačka, 1:1
 - 11 *Dicotyledonae* gen. et sp. (H 27 BRA), Hajnačka, 1:1
 - 12 *Quercus* ex gr. *roburoides* GAUDIN (H 26 BRA), Hajnačka, 1:1
 - 13 *Quercus* ex gr. *roburoides* GAUDIN (H 27 BRA), Hajnačka, 1:1
 - 14 *Dicotyledonae* gen. et sp. (H 29 BRA), Hajnačka, 1:1
 - 15 *Buxus pliocenica* SAP. et MAR. (H 30 BRA), Hajnačka, × 2
 - 16 *Buxus pliocenica* SAP. MAR. (H 31 BRA), Hajnačka, × 2
- Photo: Figs. 1—4, 9—16 L. Osvald, figs. 5—8 J. Brožek

Pl. XXXII

- 1 Locality Pinciná — abandoned pit.
 - 2 Locality Hajnačka — road-cut with plant bearing tuffites.
- Photo: V. Sitár



Ružena Lehotayová

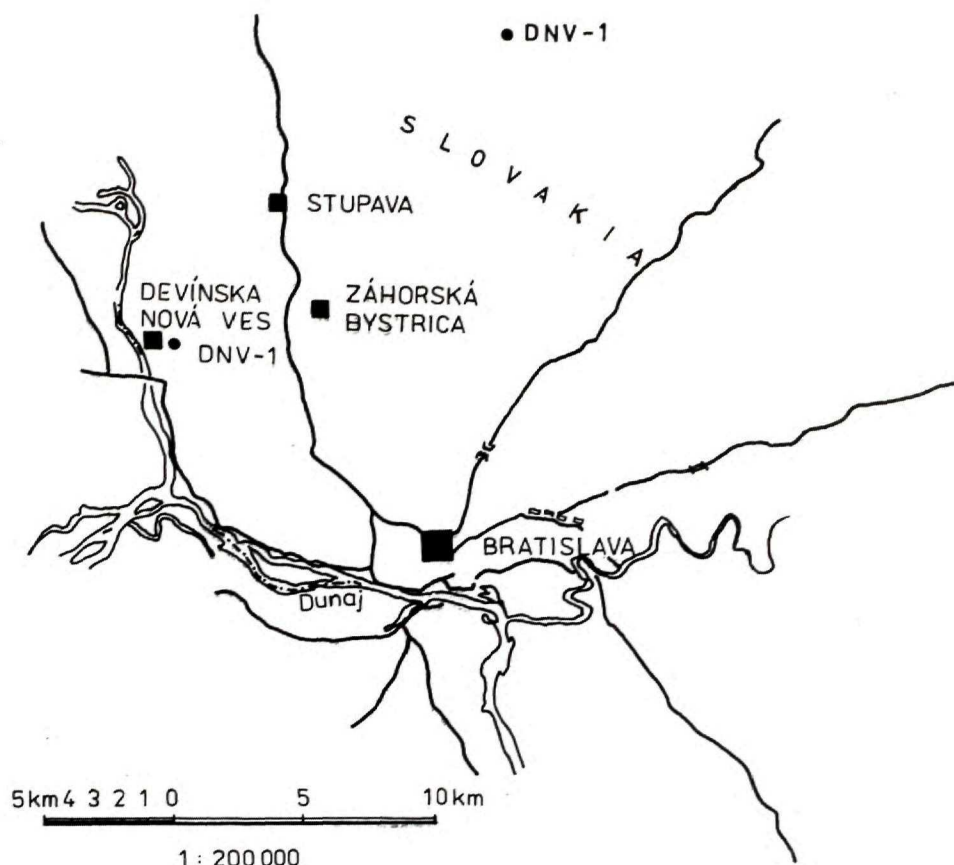
The Calcareous Nannoplankton of Badenian Deposits from the Borehole Devínska Nová Ves-1

1 text-fig., 10 pls. (XXXIII—XLII), Slovak summary

Abstract. The paper contains results of the borehole DVN-1 deposits calcareous nannoplankton study by the scanning electron microscopy. The calcareous nannoplankton of the borehole studied can be correlated with nannoflora of the Middle Miocene NN-5 *Sphenolithus heteromorphus* and NN-6 *discoaster exilis* to NN-7 *Discoaster kugleri* nannoplanktonic biozones (in sense of E. MARTINI'S (1971) zonation). It concerns deposits of the regional stage Badenian. The borehole lower horizons belong probably to the Lower Badenian (substage Moravian). The borehole DNV-1 deposits prevailing part corresponds to the Upper Badenian (Kosovian).

Deposits of the borehole DNV-1 (situated westward from the village Devínska Nová Ves) correspond on the basis of their calcareous nannoflora analyses to three distinct faunal horizons.

The first lower horizon, the poor one (conglomerates with a pelitic cement from the 643—496.4 m depth interval belong here) is more or less without nannofossils or with very rarely occurring elements of the calcareous nannoplankton. It concerns mostly species occurring during the whole Neogene (such as *Braarudosphaera bigelowi* (GRAN et BRAARUD) DEFLANDRE, *Coccolithus pelagicus* (WALLICH) SCHILLER, *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, *Helicosphaera carteri* (WALLICH) KAMPTNER, *Micrantholithus vesper* DEFLANDRE, etc. Specimens of *Discoaster variabilis* MARTINI et BRAMLETTE, *Sphenolithus heteromorphus* DEFLANDRE, *Coronosphaera* sp. are present rarely of other species, the stratigraphic diapazone of which is bound to the upper part of the NN-4 *Helicosphaera ampliaperta* nannoplanktonic biozone (an age equivalent of the regional stage Carpathian), up to the NN-5 *Sphenolithus heteromorphus* biozone (an age equivalent of the Lower Badenian). Since the above species are only rarely represented in the material studied, it is not possible to determine their stratigraphic range in this phase of study. In spite of this, I am of the opinion that these poor horizon deposits studied correspond more to the NN-5 *Sphenolithus heteromorphus* biozone, i. e. to the Lower Badenian (Moravian).



Map of locality

The second borehole DNV-1 horizon (grey sands from the 99.90—61.20 m depth) is even poorer than the former one. Only species occurring during the whole Badenian (*Coccolithus pelagicus* (WALLICH) SCHILLER, *Pontosphaera multipora* (KAMPTNER) ROTH, *Rhabdosphaera clavigera* MURRAY et BLACKMAN, *Helicosphaera carteri* (WALLICH) KAMPTNER, fragments of *Micrascidites vulgaris* DEFLANDRE are rarely present in incomplete nannoassemblages. To rank these horizon nannoassemblages to any nannoplanktonic biozone is very difficult. It can only be supposed, that the deposits studied belong to the marine Badenian with a normal salinity of shallow near shore facies.

The third borehole DNV-1 horizon (grey, sandy clays of the 59.90—7.30 m depth) is rich in qualitative as well as quantitative representation of calcareous nannoflora species. Along with the species occurring during the whole Badenian *Braarudosphaera bigelowi* (GRAN et BRAARUD) DEFLANDRE, *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, *Cyclococcolithus leptoporus* (MURRAY et BLACKMAN) KAMPTNER, *Discoaster variabilis* MARTINI et BRAMLETTE, *Dis-*

coaster exilis MARTINI et BRAMLETTE, *Helicosphaera carteri* (WALLICH) KAMPTNER, *Rhabdosphaera clavigera* MURRAY et BLACKMAN, etc., the nannoassemblages are enriched by the ones occurring most frequently in the Upper Badenian not only in our Carpathian conditions, but also in the whole Central Paratethys (*Cyclococcolithus macintyreii* BRAMLETTE et BUKRY, *Cycloperfolithus carlae* LEHOTAYOVÁ et PRIEWALDER, *Helicosphaera wallichi* (LOHMANN) BODREAUX et HAY, *Helicosphaera walbersdorfensis* MÜLLER, *Helicosphaera sellii* BUKRY et BRAMLETTE, *Helicosphaera obliqua* BRAMLETTE et WILCOXON, *Sphenolithus abies* DEFLANDRE. It concerns the nannoflora corresponding to the NN-6 *Discoaster exilis* nannoplanktonic biozone (with presence of the nominal species) up to the NN-7 *Discoaster kugleri* biozone according to the standard zonation (E. MARTINI 1971). So far, it cannot be, from the point of view of the calcareous nannoplankton study, unambiguously stated whether any horizon of the borehole Devínska Nová Ves-1 studied does not correspond to the Wielickian (the foraminiferal zone with *Spiroplectammina carinata*). Both Badenian substages — the Wielickian and the Kosovian — contain (besides little differences mainly in some species quantitative representation) the same nannoassemblages corresponding to the ranges of the NN-6 *Discoaster exilis* up to the NN-7 *Discoaster kugleri* nannoplanktonic biozones. Several authors report a greater number of *Discoaster specimens* in Wielickian deposits. In the borehole DNV-1, the samples from the 59.70—59.80 m and 56.30—56.40 m depths are richer in *Discoaster* and *Helicosphaera* specimens. I suppose, it concerns Upper Badenian deposits of the substage Kosovian, the greater number of the above taxa being not a stratigraphic significance indicator, but only a reflection of changed climatic ecologic-facies conditions.

The last faunal horizon (from the 59.80 m depth to the overlies of 7.30 m) is the most suitable for correlations of the borehole Devínska Nová Ves-1 Upper Badenian calcareous nannoplankton. Rich assemblages consist of the species: *Braarudosphaera bigelowi* (GRAN et BRAARUD) DEFLANDRE, *Coccolithus miopelagicus* BUKRY, *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, *Cyclococcolithus leptoporus* (MURRAY et BLACKMAN) KAMPTNER, *Coronosphaera mediterranea* (LOHMANN) GARDER, *Discoaster exilis* MARTINI et BRAMLETTE, *Discoaster variabilis* MARTINI et BRAMLETTE, *Helicosphaera carteri* (WALLICH) KAMPTNER, *Helicosphaera wallichii* (LOHMANN) BODREAUX et HAY, *Helicosphaera sellii* (BUKRY et BRAMLETTE), *Pontosphaera multipora* (KAMPTNER) ROTH, *Reticulofenestra pseudumbilica* (GARTNER) GARTNER, *Rhabdosphaera clavigera* MURRAY et BLACKMAN, *Sphenolithus abies* DEFLANDRE.

All the species above of the borehole DNV-1 Badenian deposits occur also in other Upper Badenian nannoassemblages so far studied by us not only from our territory (localities Stupava, Rohožník, Devínska Nová Ves — the brick pit), but also from Northern Moravia (localities Hnevošice, Koběříce, Sudice), as well as from more distant regions of the Central Paratethys. Corresponding nannoflora is contained in deposits of the region Meczek (the borehole Tekeres-1 upper horizons) in Hungary, in Romania (localities Urey Devy, Hunedoara), in Poland (localities Sulkov, Wenglin, Mochov), in Austria the locality Walbersdorf.

Some significant Upper Badenian species, such as *Triquetrorhabdulus rugosus* BRAMLETTE et WILCOXON, *Rhabdosphaera poculi* (BÓNA et KENERNÉ) MÜLLER, *Discosphaera jerkowici* MÜLLER, found in nannoassemblages of other Upper Badenian localities (such as Devínska Nová Ves — the brick pit, Semerovce, or also the Austrian locality Walbersdorf, or the Hungarian one Tekeres-1) are not present in the borehole Devínska Nová Ves-1. Likewise, they were not found in the Upper Badenian samples of Northern Moravia (the localities Hnevošice, Koběřice, Sudice), either. Absence of these taxa, however, does not prevent us to rank stratigraphically the borehole DNV-1 Upper Badenian nannoassemblages studied to the NN 6 *Discoaster exilis* — NN 7 *Discoaster kugleri* biozones. Most probably it concerns taxa occurring very rarely, of a local importance.

Only little can be said to the ecology of the borehole DNV-1 lower horizon calcareous nannoplankton (of the depth interval 643—496.4 m). Incomplete assemblages, rare occurrence of species specimens (represented frequently only by one) of very small sizes are a reflection of unfavourable calcareous nannoplankton development conditions. Occurrence of specimens of the genera *Helicosphaera*, *Sphenolithus*, *Discoaster*, *Braarudosphaera*, *Micrantholithus* indicate a warm water marine environment of near shore facies. Since occurrence of the above taxa is very rare, conditions of the above beds deposition cannot be exactly reconstructed. The same applies to the borehole DNV-1 second horizon (sands of the depth 99.9—61.2 m). Sporadic occurrence of representatives of the genera *Helicosphaera*, *Pontosphaera*, *Rhabdosphaera*, *Reticulofenestra* (as well as presence of algae *Micrascidites* fragments) indicate a warm water environment with the normal salinity and little depth. Pyrite concretions suggest an insufficiently aired water basin. Evaluating the paleoclimatic questions, attention is also paid to conditions of preservation, disintegration and the size of shells. Nannoassemblages of small and simple shells (D. BUKRY 1971) are typical from a colder water. In general, the majority of nannoflora prefers warm water. The most abundant nannoassemblages (composed of intact, well preserved, large shells) are contained in the deposits of the borehole DNV-1 third horizon (the depth 59.80—7.30 m). It concerns the species characterizing a warm marine environment of the normal salinity and greater depth (not exceeding 200 m) with a direct communication with the open sea. *Cyclococcolithus leptoporus*, *Cyclococcolithus rotula*, *Cyclococcolithus macintyreii*, *Cycloperfolithus carlae*, *Helicosphaera carteri*, *Helicosphaera wallichii*, *Pontosphaera multipora*, *Rhabdosphaera clavigera*, *Rhabdosphaera sicca*, *Sphenolithus abies*, etc. belong to the most frequent species.

In the borehole DNV-1 samples in the direction toward the overlier, the alternation of deep water assemblages with shallow water ones (the nannoassemblages being enriched in such species as *Braarudosphaera bigelowii*, *Micrantholithus vesper*) can be observed, indicating a continual oscillation of the water level. Nannoflora of the borehole DNV-1 deposits of the depth 9.10—9.20 m as well as of the depth 7.30—7.40 m indicate distinct increasing of depth and a good communication with the open sea. Cooling during the Upper Badenian terminal phases can be suggested on the basis of some cold water

species occurrence (*Holodiscolithus macroporus* DEFLANDRE, *Coronosphaera mediterranea* (LOHMANN) GARDER.

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R. Lehotayová

Vápnitý nanoplanktón bádenských sedimentov z vrtu Devínska Nová Ves-1

Resumé

Práca prináša výsledky štúdia vápnitého nanoplanktónu (metodou riadkovej elektrónovej mikroskopie) sedimentov vrtu DNV-1, situovanom na západnom okraji obce Devínska Nová Ves.

Analýzy vápnitej nanoflóry ukazujú, že sedimenty skúmaného vrtu patria trom výrazným obzorom.

Prvý spodný, chudobný (zlepence s pelitickým tmelom z hĺbkového intervalu 643, 496,4 m) s veľmi vzácnymi prvками vápnitého nanoplanktónu.

Druhý obzor (sivé piesky z hĺbky 99,90—61,20 m) taktiež chudobný s neúplnými nanospoločenstvami, iba s ojedinelými sa vyskytujúcimi nanofosilnými druhmi a fragmentmi rias rodu *Micrascidites*.

Tretí obzor (sivé piesčité íly z hĺbky 59,80—7,30 m) bohatý tak po stránke kvalitatívneho, ako i kvantitatívneho zastúpenia jednotlivých druhov.

Sedimenty spodného obzoru skúmaného vrtu na základe výskytu druhu *Sphenolithus heteromorphus* DEFLANDRE (ktorého stratigrafický diapazón je karpát až spodný baden), nie je možné jednoznačne stratigraficky začleniť. Predpokladám, že ide skôr o ochudobnené nanospoločenstvá biozóny NN-5 *Sphenolithus heteromorphus*, čiže spodný baden (podstupeň moravan) ako o biozónu NN-4 *Helicosphaera ampli — aperta* (regionálny stupeň karpát).

Zistené nanospoločenstvá druhého a tretieho obzoru vrtu DNV-1 zodpovedajú biozónam NN 6 *Discoaster exilis* až NN-7 *Discoaster kugleri*. Ide o vrchný baden (podstupeň kosov).

Podstupeň weličkan, nakoľko zodpovedá tým istým biozónam, nie je možné na základe vápnitej nanoflóry vyčleniť. Zistená vrchnobádenská nanoflóra vrtu DNV-1 sa dá dobre korelovať s vrchnobádenskými nanospoločenstvami ďalších doteraz nami skúmaných lokalít nielen z nášho

územia (lokality Stupava, Rohožník, Devínska Nová Ves — tehelná), ale i z územia severnej Moravy (lokality Hnevošice, Kobědice, Sudice) a zo vzdialenejších oblastí centrálnej paratetedy. Z územia Maďarska (BONA, J. et al. 1964) uvádzajú zhodnú nanoflóru z oblasti Meczeka (vrchné obzory vrtu Tekeres-1). Z Rumunska zhodné nanoasociácie sú z porovnávacieho materiálu lokalít Urey Deva, Hunedoara. Z Poľska ide o nanoasociácie lokalít Sulkov, Wenglin, Mochov. Z Rakúska zhodnú nanoflóru uvádza C. MÜLLER z lokality Walbersdorf (1974).

Z hľadiska ekologického vápnitá nanoflóra mala svoj optimálny rozvoj vo vrchnom bádene — kosove. Teplovodnéorské príbrežné prostredie sa vyznačovalo osciláciou a dobrým spojením s otvoreným morom. Hĺbka nepresahovala 150—200 m.

Na základe prítomnosti uvedených druhov vápnitej nanoflóry usudzujeme, že v terminálnych fázach vrchného bádenu nastalo značné ochladenie oproti spodného bádenu.

Výsledky vyhodnotenia vápnitej nanoflóry vrtu DNV-1 môžu slúžiť ako ďalší prínos na spresnenie poznatkov v študovanej oblasti, a to z hľadiska biostratigrafického, paleontologického i ekologického.

Explanations of Plates XXXIII—XLII

Plate XXXIII

- 1 *Braarudosphaera bigelowi* (GRAN et BRAARUD) DEFLANDRE, borehole DNV-1, dept 11,40—11,50 m, prox. view.
- 2 *Braarudosphaera bigelowi* (GRAN et BRAARUD) DEFLANDRE, borehole DNV-1, dept 24,10—24,20 m.
- 3 *Coccolithus pelagicus* (WALLICH) SCHILLER *coccosphaera*, borehole DNV-1, dept 32,40—32,50 m, prox. view.
- 4 *Coccolithus pelagicus* (WALLICH) SCHILLER *coccosphaera*, borehole DNV-1, dept 32,40—32,50 m, prox. view.
- 5 *Coccolithus pelagicus* (WALLICH) SCHILLER (*coccosphaera*), borehole DNV-1, dept 42,10—42,30 m, dist. view.
- 6 *Coccolithus pelagicus* (WALLICH) SCHILLER (*coccosphaera*), borehole DNV-1, dept 56—30—56,40 m.

Plate XXXIV

- 1 *Coccolithus pelagicus* (WALLICH) SCHILLER, borehole DNV-1, dept 9,10—9,20 m prox. view.
- 2 *Coccolithus pelagicus* (WALLICH) SCHILLER, borehole DNV-1, dept 21,70—21,80 m dist. view.
- 3 *Coccolithus miopelagicus* (WALLICH), SCHILLER, borehole DNV-1, dept 56,30—56,40 m, dist. view.
- 4 *Coccolithus miopelagicus* (WALLICH) SCHILLER, Devínska Nová Ves-1, borehole DNV-1, dept 56,30—56,40 m, dist. view.
- 5 *Coronocyclus nitescens* (KAMPTNER), borehole DNV-1, dept 45,40—45,50 m.
- 6 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, Devínska Nová Ves, borehole, dept 45,40—45,50 m, prox. view.

Plate XXXV

- 1 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, Devínska Nová Ves, borehole dept 45,40—45,50 m, prox. view.
- 2 *Cyclicargolithus floridanus* (ROTH et HAY) BUKRY, borehole DNV-1, dept 48,40—48,50 m, dist. view.
- 3 *Coronosphaera mediterranea* (LOHMANN) GAARDER, borehole DNV-1, dept 24,10—24,20 m, prox. view. — dist. view.
- 4 *Cyclococcolithus leptoporus* (MURRAY et BLACKMANN) KAMPTNER, borehole DNV-1, dept 45,40—45,50 m, prox. view.
- 5 *Cyclococcolithus leptoporus* (MURRAY et BLACKMANN) KAMPTNER, borehole DNV-1, dept 45,40—45,50 m, dist. view.
- 6 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, borehole DNV-1, dept 24,10—24,20 m, prox. view.

Plate XXXVI

- 1 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, borehole DNV-1, dept 45,40—45,50 m, prox. view.
- 2 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, borehole DNV-1, dept 59,70—59,80 m, dist. view.
- 3 *Cyclococcolithus rotula* (KAMPTNER) KAMPTNER, borehole DNV-1, dept 11,40—11,50 m, prox. view.
- 4 *Cyclococcolithus macintyreii* BUKRY — BRAMLETTE, borehole DNV-1, dept 32,40—32,50 m, prox. view.
- 5 *Cyclococcolithus macintyreii* BUKRY — BRAMLETTE, borehole DNV-1, dept 32,40—32,50 m, dist. view.
- 6 *Cycloperfolithus carlae* LEHOTAYOVÁ et PRIEWALDER, borehole DNV-1, dept 32,40—32,50 m, dist. view.

Plate XXXVII

- 1 *Cycloperfolithus carlae* LEHOTAYOVÁ et PRIEWALDER, borehole DNV-1, dept 59,70—59,80 m, prox. view.
- 2 *Cycloperfolithus carlae* LEHOTAYOVÁ et PRIEWALDER, borehole DNV-1, dept 24,10—24,20 m, dist. view.
- 3 *Cycloperfolithus carlae* LEHOTAYOVÁ et PRIEWALDER, borehole DNV-1, dept 24, 10—24,20 m, prox. view.
- 4 *Discoaster exilis* MARTINI et BRAMLETTE, borehole DNV-1, dept 11,40—11,50 m, prox. view.
- 5 *Discoaster variabilis* MARTINI et BRAMLETTE, borehole DNV-1, dept 18,50—18,60 m, prox. view.
- 6 *Discoaster* sp. borehole DNV-1, dept 32,40—32,50 m.

Plate XXXVIII

- 1 *Helicosphaera carteri* (WALLICH) KAMPTNER, borehole DNV-1, dept 59,70—59,80 m, prox. view.
- 2 *Helicosphaera carteri* (WALLICH) KAMPTNER, borehole DNV-1, dept 45,40—45,50 m, dist. view.
- 3 *Helicosphaera carteri* (WALLICH) KAMPTNER, (*coccosphaera*) borehole DNV-1, dept 11,40—11,50 m, dist. view.
- 4 *Helicosphaera granulata* BUKRY et PERCIVAL, borehole DNV-1, dept 35,40—35,50 m, dist. view.
- 5 *Helicosphaera selli* BUKRY et BRAMLETTE, borehole DNV-1, dept 24,10—24,20 m, dist. view.
- 6 *Helicosphaera granulata* BUKRY et PERCIVAL, borehole DNV-1, dept 45,40—45,50 m, dist. view.

Plate XXXIX

- 1 *Helicosphaera wallichii* (LOHMANN) BOUDREAUX et HAY, borehole DNV-1, dept 32,40—32,50 m, prox. view.
- 2 *Helicosphaera wallichii* (LOHMANN) BOUDREAUX et HAY, (*coccosphaera*) borehole DNV-1, dept 59,70—59,80 m, prox. view.
- 3 *Helicosphaera walbersdorfensis* MÜLLER, borehole DNV-1, dept 42,20—42,30 m, prox. view.
- 4 *Helicosphaera walbersdorfensis* MÜLLER, borehole DNV-1, dept 24,10—24,20 m, dist. view.
- 5 *Helicosphaera* sp. borehole DNV-1, dept 35,40—35,50 m, prox. view.
- 6 *Helicosphaera* sp. borehole DNV-1, dept 38,40—38,50 m, prox. view.

Plate XL

- 1 *Holodiscolithus macroporus* (DEFLANDRE) ROTH, borehole DNV-1, dept 45,40—45,50 m, prox. view.
- 2 *Lithostromation perdurum* (DEFLANDRE) borehole DNV-1, dept 32,40—32,50 m, prox. view.
- 3 *Micrantholithus vesper* DEFLANDRE, borehole DNV-1, dept 18,50—18,60 m, prox. view.
- 4 *Micrascidites vulgaris* DEFLANDRE, borehole DNV-1, dept 69,40—69,50 m.
- 5 *Pontosphaera multipora* (KAMPTNER) ROTH, borehole DNV-1, dept 11,40—11,50 m, prox. view.
- 6 *Pontosphaera multipora* (KAMPTNER) ROTH, borehole DNV-1, dept 11,40—11,50 m, dist. view.

Plate XLI

- 1 *Rhabdosphaera claviger* MURRAY et BLACKMANN, borehole DNV-1, dept 45,40—45,50 m, lateral view.
- 2 *Rhabdosphaera sicca* (STRADNER) MARTINI, borehole DNV-1, dept 45,40—45,50 m, lateral view.
- 3 *Reticulofenestra pseudumbilica* (GARTNER) GARTNER, borehole DNV-1, dept 48,40—48,50 m, prox. view.
- 4 *Reticulofenestra pseudumbilica* (GARTNER) GARTNER, borehole DNV-1, dept 18,50—18,60 m, (*coccosphaera*), prox. view.
- 5 *Reticulofenestra pseudumbilica* (GARTNER) GARTNER, borehole DNV-1, dept 21,70—21,80 m, dist. view.
- 6 *Reticulofenestra pseudumbilica* (GARTNER) GARTNER, (*coccosphaera*) borehole DNV-1, dept 32,40—32,50 m, dist. view.

Plate XLII

- 1 *Sphenolithus abies* DEFLANDRE, Devínska Nová Ves-1, borehole, dept 24,10—24,20 m.
- 2 General view of association borehole DNV-1, dept 24,10—24,20 m.
- 3 General view of association borehole DNV-1, dept 45,40—45,50 m.
- 4 General view of association borehole DNV-1, dept 45,40—45,50 m.
- 5 General view of association borehole DNV-1, dept 38,50 m.
- 6 General view of association borehole DNV-1, dept 48,40—48,50 m.

Miroslav Plička

Rotundusichnium zumayensis ichnogen. n. a new trace fossil from the Outer Carpathian Flysch of West Slovakia (Czechoslovakia)

8 text-figs., 4 Pls. (XLIII—XLVI), Czech summary

Abstract. *Rotundusichnium* ichnogen. n. is a new fossil species, in the past erroneously assigned to the trace fossil species *Helminthoida* SCHAFFHÄUTL, 1851 or *Spirorhaphe* FUCHS, 1895. The new fossil trace differs conspicuously from these two traces in its morphology, position in the member and its origin. In our territory this fossil trace was discovered in members of the upper Paleogene portion of the Biele Karpaty unit (Eocene) in the Vlársky priesmyk pass. In one case, a new species *Rotundusichnium magnum* ichnosp. n. was defined for an exceptionally large form.

Introduction

In 1965, during my study of rock jointing in the Carpathian flysch in our territory, I discovered in the quarry Štepán (Vlársky priesmyk pass) circular forms with a striking circular division in the upper bedding surface of fine-grained, calcareous sandstone, separable in small tables. The circular forms overlapped one another in places. A younger trace destructed the structure of a trace that originated before. I deposited the samples for further processing. In 1984—1985, during geological research in the region of the Vlársky priesmyk pass, employees of the Ústřední ústav geologický (Central Geological Institute) branch office Brno (Dr. E. MENČÍK CSc., Dr. Z. STRÁŇÍK CSc. and Dr. O. KREJČÍ) discovered fossil traces entirely identical with my discovery at Štepán. Their discoveries come from the Slovak part of the Vlársky priesmyk pass, again from the upper Paleogene portion of the Biele Karpaty unit.

In literature there occur first mentions of these circular forms, discovered in flysch sediments of Cretaceous age (Maestrichtian) in Spain, locality San Sebastian, region Zumaya (J. G. LLARENA, 1946, Fig. 11, Pl. 3 and Fig. 12, Pl. 3). This author assigned the circular trace to the genus *Helminthoida* SCHAFFHÄUTL, 1851 and gave it a new species name according to the place of its discovery *Helminthoida zumayensis* n. sp. (J. G. LLARENA, 1946, p. 37—42, Pl. 1, Fig. 12 and Pl. 3, Fig. 11). In 1970 M. KSIĄŻKIEWICZ (1970) assigned this circular form, that had been described by J. G. LLARENA (1946) and found in the Carpathian

flysch, too, to genus *Spirorhaphe* FUCHS, 1895. He gave it a new species name *Spirorhaphe minuta* ichnosp. nov. (M. KSIĄŻKIEWICZ, 1970, p. 305, Pl. 3, Fig. e). The sample from the Polish territory is of Paleogene age. In his compilation work on fossil traces in the Carpathian flysch in Poland, M. KSIĄŻKIEWICZ (1977) describes this circular trace as *Spirorhaphe minuta* KSIĄŻKIEWICZ, 1970 (p. 147, Pl. 18, Fig. 3).

In his extensive elaborate work on fossil traces, W. HÄNTSCHEL mentions under the genus name *Spirorhaphe* FUCHS, 1895 only a conspicuous spiral form as a positive hyporelief (p. W105, Fig. 1a, 1b). In his extensive work W. HÄNTSCHEL (1975) does not mention the circular forms found in Spain and Poland. While comparing our discoveries with those from the Spanish and Polish flysch that are quite identical, it proved that this fossil trace is quite different from the genus *Spirorhaphe* FUCHS, 1895, as far as its shape, position in the member and its origin are concerned.

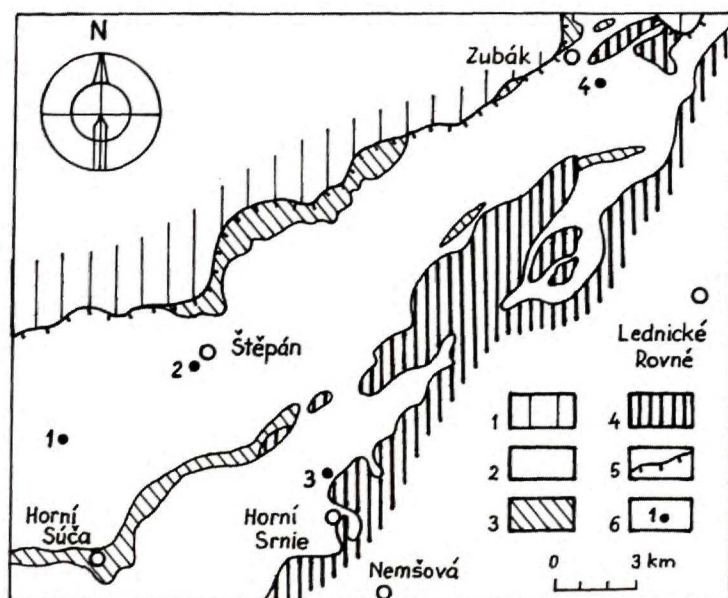


Fig. 1 Geological sketch of sites where the fossil trace *Rotundusichnium ichnogen. n.* occurs. General maps of the sheets M-33-XXX Gottwaldov (T. BUDAY, 1963) and M-33-XXV Žilina (M. MAHEL, 1962) were used as a geological basis.

1 — Bystrica unit, 2—4 — Biele Karpaty unit: 2 — upper Paleogene portion, 3 — lower Paleogene portion, 4 — inner Klippen belt, 5 — overthrust line of the Biele Karpaty unit, 6 — locality of the fossil trace *Rotundusichnium ichnogen. n.* occurrence

Systematical description

Ichnogenus *Rotundusichnium* n. ichnogen. (LLARENA, 1946)

Type specimen: *Rotundusichnium zumayensis* (LLARENA, 1946)

Denomination: According to the circular shape of its trace, from Latin *rotundus* — oval, circular.

Diagnosis: Circular trace with an internal circular division. The diameter of the trace range from 2.7 to 26 cm. The trace occurs in the upper bedding plane of sandstone, or strongly sandy claystone. The traces may partly overlap one another.

Remark: The circular traces discovered in Spain by J. G. LLARENA (1946) are erroneously regarded as the genus *Helminthoida* SCHAFFHÄUTL, 1851. In this case, their designation as *Helminthoida* is invalid, the name *Helminthoida* is a synonym of the new ichnogenus *Rotundusichnium* n. ichnogen. The species designation of Spanish findings is valid. The same applies to the findings in the Polish territory, where the circular traces are assigned to the genus *Spirorhappe* FUCHS, 1895 (M. KSIĄŻKIEWICZ, 1970, 1977).

This similarity of the circular traces to the ones of the genus *Spirorhappe* FUCHS, 1895 may appear at first superficial sight. Examining and comparing these two, entirely different traces, that differ not only in their shape, but also in their position in the member and origin, we come, as shown in Fig. 2 in the text, to the following conclusions:

Fossil trace of the genus *Spirorhappe* FUCHS, 1895 is in the form of a spiral in the lower bedding plane of sandstone as a positive hyporelief. A marine organism, probably a sea worm moved on the surface of a clayey sea floor in a spiral in the direction towards its centre and then it returned between its former trace towards its outer portion. K. GRIPP (1927) stresses that the recent worm *Pavonis fulgens* makes similar spirals at present. Another feature of the genus *Spirorhappe* is that the trace of the spiral has a cylindrical shape and is isolated in the bedding plane (two spirals do not overlap). On the contrary, the fossil trace of the genus *Rotundusichnium* ichnogen. n., as shown in the comparing table and Fig. 3, 4, 6, 7 in the text, is of a circular shape and occurs in the upper bedding plane of sandstone or (sandy) claystone, as it was by the discovery of a large fossil in the locality Horná Súča (Fig. 3D in the text). The circular traces of the genus *Rotundusichnium* ichnogen. n. can overlap one another. A younger trace destructs an older one (see Fig. in the text 2D₁, 3A, 4 and photography Pl. XLIII). The trace is created by an organism rotating on the surface of a sandy or clayey floor. Smaller forms seem to occur on the surface of a sandy floor. Circular structure of the trace *Rotundusichnium* ichnogen. n. is very shallow and fine and forms circular planes, rising from the centre of the circle towards its periphery like slate on a house roof. The central part of the circular trace is a little higher (see Fig. 2C-C₁).

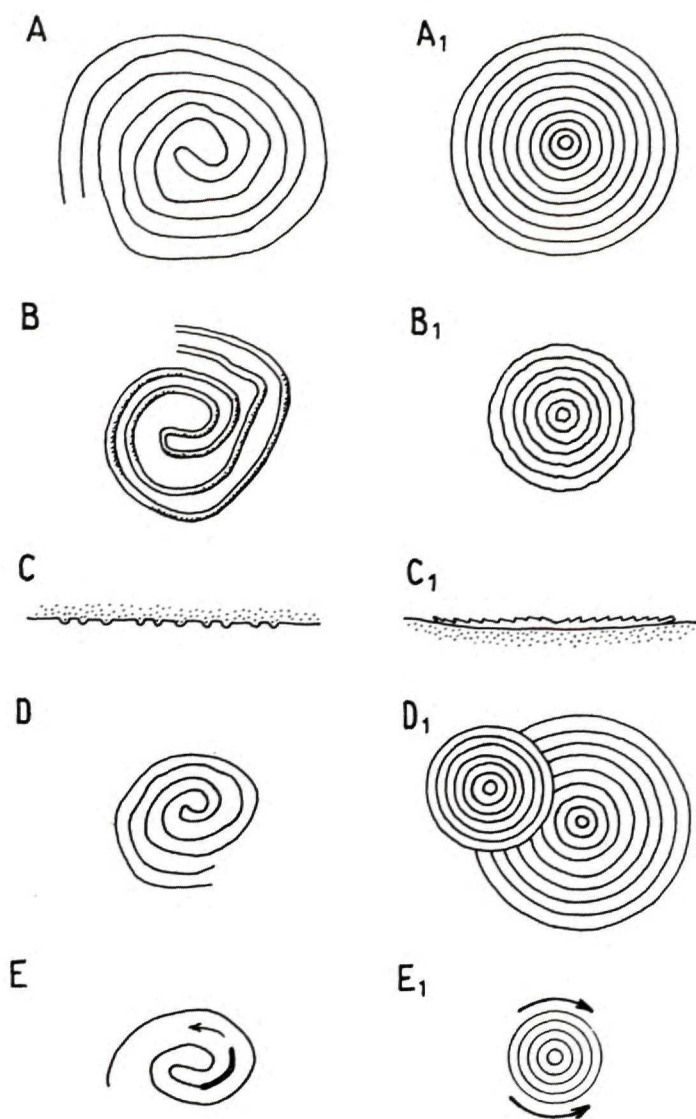


Fig. 2 Schematic explanation of differences between *Spirorhaphé* FUCHS, 1895 and *Rotundusichnium* ichnogen. n.

A — spiral, A₁ — circle, B — cylindrical positive hyporelief, B₁ — circular negative epirelief, C — section through the upper bedding plane of sandstone (sketch), C₁ — section through the upper bedding plane of sandy claystone, projections extend towards the outer circle (sketch), D — isolated spirals, do not overlap one another, D₁ — circular traces destruct one another, the younger trace destructs the older one, E — motion of an organism in a spiral on a clayey surface of the sea floor, (probably a sea worm), E₁ — rotary motion of an unknown organism on a sandy surface of the sea floor.

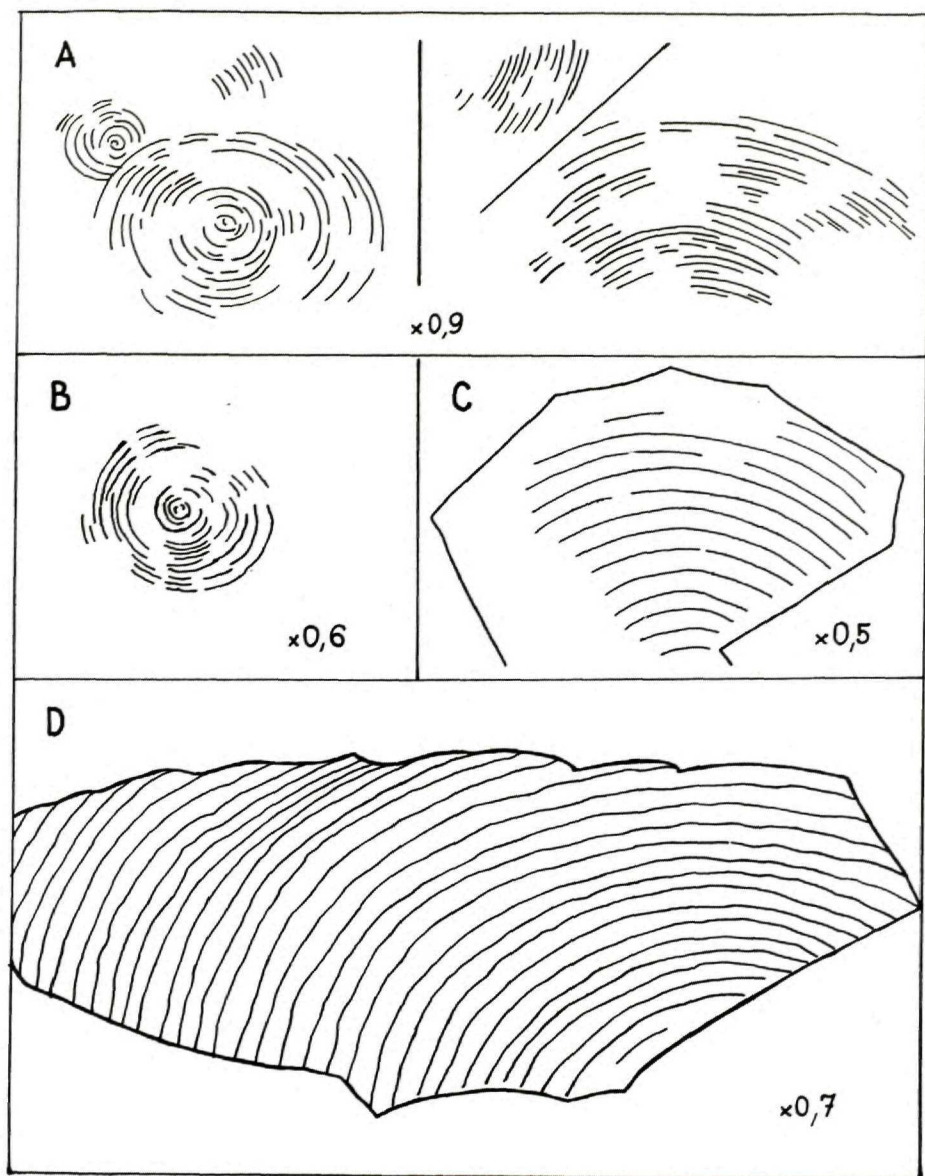


Fig. 3 A — C — *Rotundusichnium zumayensis* (LLARENA, 1946) upper Paleogene portion of the Biele Karpaty unit (Eocene), Vlársky priesmyk pass. A — holotype, quarry at Štepán, B — Horné Srnie, quarry 250 m E of the gamekeeper's lodge Sietné, branch valley, C — village Zubák, 1 km ESE of the village, right erosional bank of the brook Zubák, D — *Rotundusichnium magnum* ichnosp. n. upper Paleogene portion of the Biele Karpaty unit, Vlársky priesmyk pass, Horná Súča, 5 km WNW of the village centre, 1 km W of the gamekeeper's lodge Biele Potoky.

Rotundusichnium zumayensis

Pl. XLIII, XLIV, XLVI, Fig. 3A, B, C, 4, 6, 7 in text

Holotype: Sample No. 11/82-B 586-F is deposited in the collection of the Moravian Museum in Brno, Pl. I, IV, Fig. 3A, 8 in the text.

Type locality: Quarry at Štěpán, Vlársky priesmyk pass.

Type level: Upper Paleogene portion of the Biele Karpaty unit, Eocene, Magura nappe group.

Denomination: Genus denomination used J. G. LLARENA according to the site of its occurrence — Zumaya in the Spanish territory.

Material: 3 samples.

Diagnosis: The circular trace with an internal circular division occurs in the upper bedding plane as a negative epirelief. The diameter of the trace ranges from 2.7 to 10 cm. The circular traces may overlap one another.

Description: In the holotype sample from the quarry Štěpán, there occur in the upper bedding plane of tabular, finegrained, laminated sandstone 4 circular traces of 2.7—5.6—6.6 and 3.4 diametres. In one case, two traces overlap one another. A younger trace of a 2.7 cm diameter destructs the structure of an older trace of a 5.4 cm diameter (Pl. XLIII, Fig. 3A). In a sample from the locality Horné Srnie (quarry) the circular trace has a diameter of 4 cm. It occurs in the upper bedding plane of sandstone with tabular division, too. A

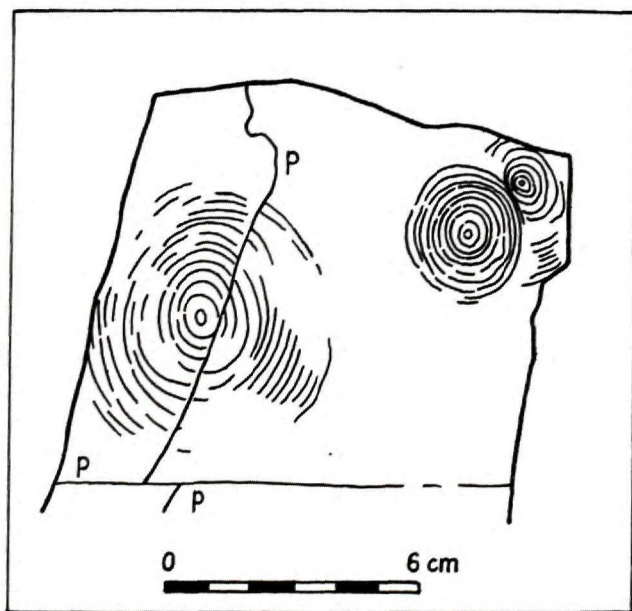
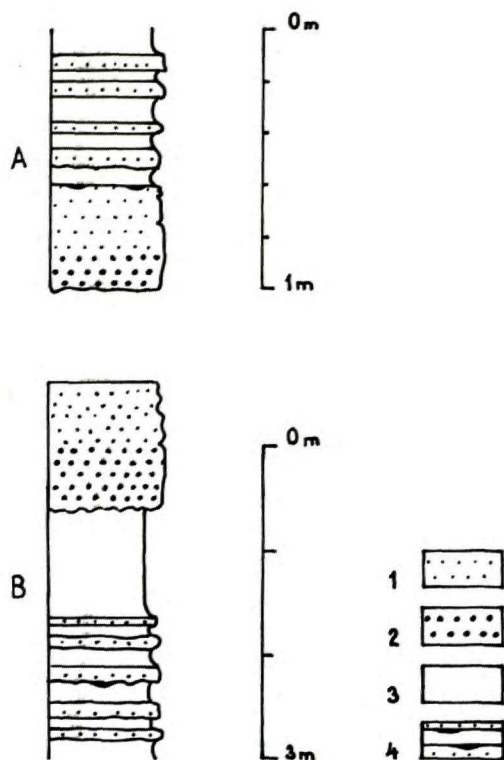


Fig. 4 Detail of the holotype sample from the quarry Štěpán, original state before a part of the sample was broken along a fissure (p).

Fig. 5 Lithological profiles of the upper Paleogene portion of the Biele Karpaty unit (Eocene) of the Magura nappe group with occurrences of the new fossil trace *Rotundusichnium* ichnogen. n. A — upper Paleogene portion of the Biele Karpaty unit in a typical Vlára development with alternating intercalations of calcareous sandstones and claystones. Horné Srnie, N of the lime-kiln, quarry 250 m E of the gamekeeper's lodge Sietné, in a branch valley. Occurrences of the fossil trace *Rotundusichnium zumayensis* ichnogen. n. can be seen in the upper bedding plane of sandstone bench 40 cm thick. B — upper Paleogene portion of the Biele Karpaty unit of the Magura nappe group with alternating calcareous claystones and blue-gray aleurite sandstones. The fossil trace *Rotundusichnium magnum* ichnosp. n. in the upper bedding plane of brown-gray, strongly sandy claystone 18 cm thick. Horná Súča, 5 km WNW of the village centre, 1100 m W of the gamekeeper's lodge Biele Potoky.



circular trace from the locality Zubák (1 km ESE of the village) has a larger diameter (10 cm), Fig. 3C.

Remark: The average value of the diameter of the new genus *Rotundusichnium* ichnogen. n. of Czechoslovak, Polish and Spanish fossil traces is about 5–8 cm. Smaller individuals also occur (e.g. an individual from the sample from the locality Štěpán has a diameter of only 2.7 cm, Pl. XLIII), this can be explained, however, as a trace of a smaller (younger) individual.

Sediment: Gray to gray-green, fine-grained, tabular, calcareous, finely micaceous sandstone (localities Štěpán, Horné Srnie).

Association: *Planolites* sp., *Helminthoida crassa*, *H. miocenica*, *H. labyrinthica*, *Cosmorhapha sinuosa*, *Spirophycus* sp., *Spirorhapha involuta*.

Origin: The circular trace originated by an activity of a marine organism, that moved in a rotary way in one place, on the sea floor surface. As the structure is a shallow, superficial one and not a den, the circular trace is probably only an impression of an organism that could have stayed on the sea floor surface only temporarily and could move from one place to another.

Stratigraphic range: Upper Paleogene portion of the Biele Karpaty unit of the Magura nappe group (Eocene), localities Štěpán, Horné Srnie and

Zubák. Outer Carpathian flysch (Poland): Ropianska beds (Senonian), Szczawnica beds (Paleocene), Beloveža beds (Lower Eocene), (M. KSIĄZKIEWICZ, 1977, p. 147) and flysch sediments of Cretaceous age (Maestrichtian) in Spain in the region of Zumaya, San Sebastian (J. G. LLARENA, 1946).

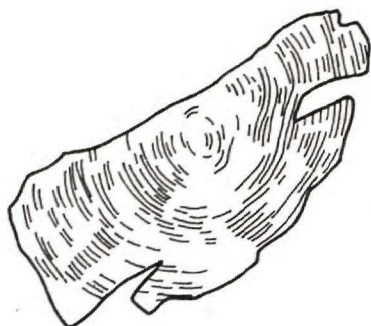


Fig. 6 *Rotundusichnium zumayensis* ichnosp. n., San Sebastián — Deva, Zumaya (J. G. LLARENA, 1946, Fig. 11, Pl. 3, *Helminthoida zumayensis* n. sp.). $\times 0.4$.

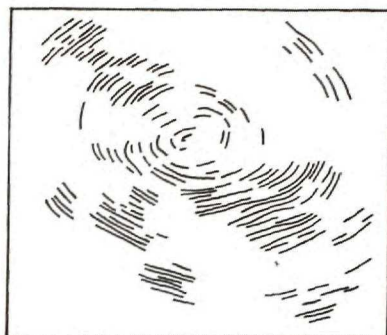


Fig. 7 *Rotundusichnium zumayensis* ichnogen. n., San Sebastián — Deva, Zumaya (J. G. LLARENA, 1946, Fig. 12, Pl. 1, *Helminthoida zumayensis* n. sp.). $\times 0.3$.

***Rotundusichnium magnum* ichnosp. n.**

Pl. XLV, Fig. 3D in text

Holotype: Sample No 23921 is deposited in the collection of the Moravian Museum in Brno, Pl. III.

Type locality: Horná Súča, 5 km NNW of the village centre, 1 km W of the gamekeeper's lodge Biele Potoky.

Type level: Upper Paleogene portion of the Biele Karpaty unit of the Magura nappe group (Eocene).

Denomination: Because of its large dimensions, from the Latin word *magnus* — large.

Material: 1 sample (holotype).

Diagnosis: Circular trace with an internal circular division of a diameter of up to 26 cm, circular traces can overlap one another.

Description: A part of the circular trace is in the surface of sandy claystone. Individual circles, forming inclined areas whose deepest part is in their centre, differ slightly in altitude, as can be seen in Fig. 8 in the text. External margins of individual circles (their areas) look as if they were broken and therefore the circles exhibit a wavy course (see Fig. 3 in the text). Distances between traces of individual circles amount 1.5 to 5 mm.

Remark: *Rotundusichnium magnum* ichnogen. n. sp. n. is much larger (more than twice) in comparison with individuals that form circular traces in the surface of as sandy sea floor. The growth of the individuals, forming these large

traces, may have been influenced by the environment in which they lived. In this case it is a clayey surface of the sea floor, probably richer in marine fauna, that could serve as food to the organisms forming the trace *Rotundusichnium* and there exist also other conditions that could have caused the intensive growth of these organisms.

Sediment: Brown-gray, strongly sandy, calcareous, finely micaceous claystone of 18 cm thickness.

Association: *Planolites* sp.

Origin: The same as for the species *Rotundusichnium zumayensis* ichnosp. n.

Stratigraphic range: Upper Paleogene portion of the Biele Karpaty unit of the Magura nappe group (Eocene).



Fig. 8 *Rotundusichnium magnum* ichnosp. n., cross-section of the fossil trace (scheme, vertical dimension exaggerated)

Conclusion

The study of the fossil trace *Rotundusichnium* ichnogen. n. brought a very valuable knowledge. It proved clearly, that it is necessary to pay great attention to fossil traces while distinguishing them and to notice all the facts that can help us to discover their presence and to assign them systematically.

E. g. small forms of fossil traces in the immediate vicinity of larger ones may not be noticed because the forms of larger dimensions attract the observer's attention already in the field. This applies mainly to the fossil traces: *Godulaichnium tenue* (M. PLIČKA in press), *Agrichnium incompositum* (M. PLIČKA, 1984), *Popradichnium minutum* (M. PLIČKA in press) etc.

As far as larger forms, that can be easily noticed already during field observations, are concerned, we cannot rely on random similarity of fossil traces among one another, as it was in the case of the new fossil trace *Rotundusichnium* ichnogen. n., when the discovered fossil traces were two times erroneously denominated. In one case the found circular trace was wrongly assigned to the genus *Helminthoida* SCHAFFHÄUTL, 1851 (J. G. LLARENA, 1946), in other case this mistake was discovered, but another erroneous denomination took place — genus *Spirorhaphe* FUCHS, 1895. The differences between the genera *Spirorhaphe* FUCHS, 1895 and *Rotundusichnium* ichnogen. n. are evident in Fig. 2. in the text. Wrong denomination of a fossil trace may lead to erroneous conclusions on ecology and paleoecology of the studied object.

The finding of a large form of the fossil trace — *Rotundusichnium magnum* ichnosp. n. in the upper bedding plane of claystone may mean that the change of the sea floor surface character caused strikingly different conditions for the development of organisms, in this case resulting in their larger growth.

A new discovery of the U.S. oceanographic research (Woods Hole Oceanographic Institution) may serve as an example of exceptionally suitable conditions for the development of organisms on the sea floor. Dr. F. GRASSLE, a member of the expedition of board of the submarine "Alvin", discovered in the depth of about 3000 m a rich life with huge sea worms (*Riftia pachyptila* JONES, 1980, M. L. JONES, 1980) in place where hot gases emanated from the ocean floor near the rift (surplus of oxygen and increased water temperature, exceptionally suitable conditions for the development of organisms).

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Miroslav Plička

Rotundusichnium zumayensis ichnogen. n. — nová fosilní stopa z vněkarpatského flyše na západním Slovensku (Československo)

Resumé

Při výzkumných geologických pracech, které prováděli v roce 1984—1985 pracovníci Ústředního ústavu geologického, pobočka Brno v oblasti Vlárského průmysku na z. Slovensku a v. Moravě (Dr. E. MENČÍK CSc., Dr. Z. STRÁNÍK CSc. a Dr. O. KREJČÍ) byly zjištěny na svrchní vrstevní ploše pískovců a jílovců kruhovitě stopy. Stopy se nacházejí ve vrstvách svrchního paleogenního oddílu jednotky bělokarpatské (eocén), magurské skupiny příkrovů. Jsou zcela shodné s kruhovitými stopami, které jsem zjistil v r. 1965 v lomu ve Štěpánu na Moravě, rovněž svrchní paleogenní oddíl v oblasti Vlárského průmysku (obr. 1).

Tyto kruhovitě stopy, vyskytující se ve flyšových sedimentech, byly dříve mylně řazené k rodu *Helminthoida* SCHAFFHÜTL, 1851 (J. G. LLARENA, 1946 *Helminthoida zumayensis* n. sp.) (Fig. 6, 7 in text) a později k rodu *Spirorhappe* FUCHS, 1895 (M. KSIĄŻKIEWICZ, 1977, *Spirorhappe minuta* ichnosp. nov.). Při srovnání našich vzorků (paleogén, Fig. 3A—D) a nálezů z flyše ve Španělsku (křída) a Polsku (křída, paleogén), s nimiž jsou naše nálezy zcela shodné se ukázalo, že se jedná o zcela odlišnou fosilní stopu, která se od rodu *Spirorhappe* FUCHS, 1895 a rodu *Helminthoida* SCHAFFHÜTL, 1851 výrazně liší nejen svým tvarem, ale i pozicí ve vrstvě a svým vznikem (viz Fig. 2 in text).

Podobnost kruhovitých fosilních stop rodu *Spirorhappe* FUCHS 1895 je zdánlivá jen při zběžném pohledu. Při podrobnějším srovnávání těchto dvou, zcela odlišných stop zjišťujeme, že stopa rodu *Spirorhappe* FUCHS 1895 tvoří spirálu na spodní vrstevní ploše pískovce jako pozitivní hyporelief. Stopu vytvořil pravděpodobně mořský červ, blízký recentní *Pavonis fulgens*, vytvářející v současné době podobné spirály (K. GRIPP, 1927). Stopa má válečkovitý tvar, červ se tedy pohyboval na jilovitěm povrchu mořského dna. Naproti tomu kruhovitě stopy *Rotundusichnium* ichnogen. n. jsou vždy na povrchu vrstvy (pískovec, jílovec), jsou kruhovitěho tvaru. Mořský organizmus se pohyboval otáčivým pohybem na povrchu písčitého nebo jílovitého mořského dna, takže vytvářel kruhovitě plochy, zvedající se mírně od středu kružnice směrem k jejímu obvodu (Fig. 8 in text).

Pro velkou kruhovitou stopu na svrchní vrstevní ploše písčitého jílovce na lokalitě Horní Súča (leg. Dr. Z. STRÁŇÍK CSc.) jsem zvolil nový druhový název *Rotundusichnium magnum* ichnosp. n. (Pl. XLV, Fig. 3D in text). Kruhovitá stopa s vnitřním kruhovitým členěním má průměr 26 cm, zatímco *Rotundusichnium zumayensis* ichnogen. n. má průměr v rozmezí 2,7 až 10 cm. Zjištění velké formy *Rotundusichnium magnum* ichnosp. n. na svrchní vrstevní ploše jílovce je upozorněním, že se může jednat v souvislosti se změnou povahy povrchu mořského dna o výrazné rozdílné podmínky, mající vliv na rozvoj organizmů, v tomto případě na zvětšení jejich růstu.

Explanations to Plates XLIII—XLVI (Photographed by V. Skala, ÚÚG, Praha)

Plate XLIII

Rotundusichnium zumayensis ichnogen. n. in the upper bedding plane of fine-grained sandstone. Upper Paleogene portion of the Biele Karpaty unit (Eocene), quarry at Štěpán. Holotype, sample No 11/82-B 586-F, Moravian Museum, Brno.

Plate XLIV

- 1 *Rotundusichnium zumayensis* ichnogen. n. in the upper bedding plane of fine-grained sandstone. Upper Paleogene portion of the Biele Karpaty unit (Eocene), brook bank, 1 km ESE of the village Zubák. Moravian Museum, Brno.
- 2 *Rotundusichnium zumayensis* ichnogen. n. in the upper bedding plane of fine-grained sandstone. Upper Paleogene portion of the Biele Karpaty unit (Eocene), Horné Srnie, N of the lime-kiln, branch valley. Moravian Museum, Brno.

Plate XLV

Rotundusichnium magnum ichnogen. n. ichnosp. n. in the upper bedding plane of strongly sandy calcareous claystone. Upper Paleogene portion of the Biele Karpaty unit (Eocene), Horná Súča, 5 km NNW of the village. Holotype, sample No 23921, Moravian Museum, Brno.

Plate XLVI

Rotundusichnium zumayensis ichnogen. n., holotype, sample No 11/82 — B 586 — F (detail). Moravian Museum in Brno.

Helena Eliášová

Les Madréporaires du Crétacé supérieur de la Montagne de Beskydy (Tchécoslovaquie)

1 texte-fig., 16 Pls (XLVII—LXII), Sommaire

Abstract. The coral fauna from the Příbor area has already been known on the basis of F. TRAUTH'S (1911) paper. The corals form part of the clastic rocks redeposited in the Frýdek and Trinec Members (Senonian to Paleogene) of the Subsilesian unit of the Carpathian Flysch. Thus, the probably Upper Cenomanian to Lower Santonian age of the coral fauna, does not agree with the age of the host rock which is younger. In the present paper 18 coral species are described, of which one belongs to a new genus and 3 species are new. The coral assemblage is of a transitional character between the Cretaceous coral assemblages of the epi — Variscan platform and those of the Tethys (the Carpathians and the Alps). The coral fauna from the Příbor area represents a pioneer assemblage existing during a short stage of favourable conditions, probably on the western side of the Baška cordillera. During the Laramian or younger movements, the already silicified coral colonies were redeposited in rather deep parts of the Subsilesian basin.

Introduction

La faune corallienne provenant des environs du village de Klokočov (dans la littérature plus ancienne nommé «Klogsdorf», qui aujourd'hui forme une partie de la ville de Příbor) était connue déjà depuis la fin du siècle dernier. On a d'abord supposé que la faune était dérivée des blocs erratiques (M. REMEŠ 1898, 1904, 1906; J. FELIX 1903a) mais cette opinion fut réfutée après la découverte de la même faune dans la carrière Panský lom sur la pente de la vallée du ruisseau Klenos, environ 350 m à l'ouest de la côte 327 (J. SLAVÍČEK 1907). La faune a été récoltée dans des grès, conglomérats et argilites, que J. SLAVÍČEK (l.c.) rapporte — d'après les caractères macroscopiques — aux marnes de Frýdek, c'est-à-dire aux Couches de Frýdek. L'histoire détaillée de ces recherches a été présentée dans l'étude de F. TRAUTH (1911). Tous ces problèmes géologico-paléontologiques de la faune de Klokočov ont été récapitulés par D. ANDRUSOV 1965.

Aujourd'hui, la carrière Panský lom près de Klokočov est abandonnée et on ne connaît pas d'autres affleurements. A présent, la faune de polypiers apparaît dans les champs et les vergers aux environs nord-est de Klokočov dans l'éluvion



Position des gisements étudiés

1 — environs nord-est de Klokočov; 2 — fouilles au sud-ouest de Fryčovice

désintégrée des grès, conglomérats et argilites. Je n'ai trouvé qu'un fragment d'une colonie corallienne in situ (*Actinacis remesi* FELIX) au niveau des boues à galets dans les marnes grises des Couches de Frýdek de l'unité Sous-silésienne du flysch externe des Carpates occidentales (fouilles au sud-ouest de Fryčovice près du réservoir à eau, texte-fig. 1). E. HANZLÍKOVÁ, dans une communication orale a précisé, d'après les foraminifères, que le sédiment est d'âge maastrichtien, comme les Couches de Frýdek à développement typique. Du point de vue sédimentologique, les descriptions des roches de la localité-type sont indiquées dans les études de J. SLAVÍČEK (1907) et F. TRAUTH (1911) et correspondent aussi aux roches désignées aujourd'hui comme boues à galets (pebbly mudstone) ou fluxoturbidites.

H. BECK (1910) a rangé ces grès et conglomérats fossilifères dans le soit-disant grès de Klokočov, qui représente les intercalations de roches clastiques grossières dans les marnes de Frýdek, c'est-à-dire les Couches de Frýdek d'aujourd'hui. E. MENČÍK et V. PESL (1955) ont désigné ces roches clastiques comme les grès et conglomérats du type de Klokočov. Z. ROTH et al. (1962) a réuni ces grès et conglomérats aux roches paléogènes analogues et les a nommés grès et conglomérats du type de Strážov. Ils sont considérés comme partie de la Formation de Třinec (Crétacé supérieur- Eocène supérieur). Dans cette formation, les conglomérats sont concentrés surtout dans les parties d'âge Crétacé supérieur à Eocène inférieur. Dans les couches de grès du type de Strážov (Paléocène-Eocène inférieur) E. HANZLÍKOVÁ et al. (1955) attire l'attention, entre autres, sur les Lithothamnia et les fragments de Bivalves à coquille épaisse, et dans les argilites de la région de Choryně près de Valašské Meziříčí (c'est-à-dire aussi dans les boues à galets) elle signale également des polypiers silicifiés.

Les polypiers fossiles de toutes les roches mentionnées ci-dessus se trouvent redéposés dans un sédiment (déjà Z. ROTH et al. 1962) dont l'âge ne doit pas être nécessairement le même que l'âge des fossiles.

Conservation de la faune corallienne

Les polypiers sont fortement silicifiés. Leur apparence correspond à celle de silex noduleux bleu-gris, clair à sombre, en quartz granuleux et calcédoine. L'intensité de la silicification varie même dans une seule colonie corallienne. Dans quelques exemplaires, la silicification est moins prononcée et ils restent partiellement calcitiques. La limonitisation et la pyritisation, causant la couleur gris-jaune à brun sombre des colonies coralliennes, ont été observées également. Dans quelques colonies, fortement silicifiées, les éléments du squelette ne sont plus perceptibles que par les traces des centres de calcification. Les contours des septes et des autres éléments morphologiques ne se traduisent que par des ombres ou sont effacés totalement. Il est probable que la silicification des polypiers détachés et leur fragmentation avaient lieu avant leur dépôt définitif dans les conglomérats.

Matériel

Le matériel décrit ici a été récolté par l'auteur de cette étude durant les années 1957—1984, aux environs nord-est de Klokočov, à peu près au nord de la localité de F. Trauth (cf. F. TRAUTH 1911, texte-figure 1).

Des 31 espèces de Scléractiniaires signalées par F. TRAUTH (l. c.) je n'en ai trouvé que 14. J'ai récolté dans cette localité 4 autres espèces signalées pour la première fois.

L'inventaire de toute la faune madréporique connue jusqu'à présent a été réuni sur le tableau 1. Pour le matériel ancien, il est indiqué, autant que possible, un reclassement systématique éventuel à d'autres genres.

Le matériel étudié par Trauth est conservé au Naturhistorisches Museum à Vienne. Il n'y avait pas la possibilité de le réviser.

Partie systématique

Actinastraeidae ALLOITEAU, 1952

Actinastraea D'ORBIGNY, 1849

Espèce- type: *Astrea geminata* GOLDFUSS, 1826

Actinastraea hexaphylloides (FELIX, 1906)

Pl. XLVII, Fig. 1, 2

Tableau I

No.	Designation des coraux (F. TRAUTH 1911)	Designation nouvelle des espèces	Présence des espèces (autre Klokočov près de Příbor)
1	<i>Dendrogyra</i> cf. <i>pyrenaica</i> MICH.	<i>Meandrina pyrenaica</i> (MICH., 1847)	Sénonien de la France (Montagne-des- Cornes)
2	<i>Diplocoenia klogsdorffensis</i> n. sp.	<i>O Diplocoenia</i>	
3	<i>Cryptocoenia kittli</i> n. sp.	? <i>Pseudocoeniopsis kittli</i> (TRAUTH, 1911)	
4	<i>Cryptocoenia uhligi</i> n. sp.	<i>Pseudocoeniopsis uhligi</i> (TRAUTH, 1911)	
5	<i>Phyllocoenia lepidoides</i> n. sp.	cf. <i>Phyllocoeniopsis lepidoides</i> (TRAUTH, 1911)	
6	<i>Orbicella?</i> <i>moravica</i> n. sp.	<i>Plesiastraeopsis moravica</i> (TRAUTH, 1911)	Urgonien-Aptien d'Espagne; Cénomanien de Bavière et de Grèce
7	<i>Orbicella</i> cf. <i>cribraria</i> MICH. sp.	? <i>Phyllocoeniopsis cribraria</i> (MICH., 1840)	Turonien, France (Uchaux, Vaucluse)
8	<i>Orbicella sulcatolamellosa</i> MICH.	? <i>Plesiastraeopsis</i> sp.	
9	<i>Isastraea subhörnesi</i> n. sp.	<i>Osastraea</i>	
10	<i>Isastraea</i> aff. <i>Guettardi</i> M. EDW.-H.	?	
11	<i>Isastraea</i> sp.	? <i>Rothastrea lubinensis</i> sp. n.	
12	<i>Isastraea</i> n. sp. indet.	<i>Rothastrea laurina</i> sp. n.	
13	<i>Isastraea bieskidensis</i> n. sp.	<i>Rothastrea bieskidensis</i> (TRAUTH, 1911)	
14	<i>Favia carpathica</i> n. sp.	? <i>Palaeofavia carpathica</i> (TRAUTH, 1911)	
15	<i>Thecosmilia dilatata</i> DE FROM.	? <i>Latiphyllia dilatata</i> (FROM., 1877)	Turonien jusqu'à Sénonien, France
16	<i>Diploria Slavičeki</i> n. sp.	<i>Orbignygyra slavičeki</i> (TRAUTH, 1911)	
17	<i>Thamnastraea</i> sp.	? <i>Dimorphomeandra</i> sp.	
18	<i>Thamnastraea decipiens</i> MICH.	<i>Archaeofungia decipiens</i> (MICH., 1847)	Cénomanien de la France et Cénomanien-Turonien de la Bohême; Santonien de Gosau et les environs de Wiener Neustadt
19	<i>Thamnastraea decipiens</i> var. <i>confusa</i> REUSS	<i>Dimorphomeandra confusa</i> (REUSS, 1854)	Cénomanien du Crétacé de la Bohême, Santonien de Gosau et les environs de Wiener Neustadt
20	<i>Thamnastraea exigua</i> REUSS	<i>Dimorphomeandra exigua</i> (REUSS, 1854)	Santonien de Gosau; Coniacien inférieur et Santonien supérieur de Corbière, France; Sénonien moyen de la zone de klippes
21	<i>Latimeandraraea Felixi</i> n. sp.	?	
22	<i>Astrocoenia hexaphylloides</i> FELIX	<i>Actinastraea hexaphylloides</i> (FELIX, 1906)	Deljatina (Crétacé supérieur des Carpates Orientales)
23	<i>Astrocoenia</i> cf. <i>hexaphylla</i> QU. sp.	? <i>Actinastraea</i> sp.	
24	<i>Actinacis Remeši</i> FEL.	<i>Actinacis remest</i> FELIX, 1903	Turonien- Sénonien inférieur des Alpes Orientales (Autriche)
25	<i>Actinacis cymatoclysta</i> FELIX	<i>Actinacis cymatoclysta</i> FELIX, 1906	Deljatina (Crétacé supérieur des Carpates Orientales)
26	<i>Actinacis retifera</i> n. sp.	<i>Rothastrea retifera</i> (TRAUTH, 1911)	
27	<i>Actinacis?</i> <i>octophylla</i> FEL. sp.	? <i>Astraeopora</i> sp.	Galicie orientale
28	<i>Porites</i> aff. <i>textilis</i>	? <i>Goniopora</i> sp. ou <i>Litharaea</i> sp.	
29	<i>Heliopora Lindströmi</i> REMEŠ	<i>Polytremacis lindströmi</i> (REMEŠ, 1898)	galets près de Hájov et Štramberk (près de Příbor), galets des environs d'Opolí (Pologne), Turonien- Sénonien des Alpes Orientales (Autriche)
30	<i>Heliopora tenera</i> n. sp.	<i>Polytremacis tenera</i> (TRAUTH, 1911)	Santonien de Gosau; Santonien supérieur de la Provence Aptien inférieur des Alpes Orientales (Roumanie)
31	<i>Ahrdorffia chaetetoides</i> gen. nov.	<i>Mesomorpha chaetetoides</i> (TRAUTH, 1911)	?Cénomanien du Crétacé de la Bohême
32		<i>Cyathophora</i> sp.	
33		<i>Monticulastraea roseola</i> sp. n.	
34		<i>Dimorphomeandra</i> sp.	
35		<i>Fungiastraea</i> sp.	?Turonien (Uchaux en France)

- 1903a *Astrocoenia* aff. *hexaphylla* QU. sp.; J. FELIX: Verkieselte Korallen etc., p. 571. •
 1904 *Astrocoenia* aff. *hexaphylla* QU.; M. REMES: Zkameněliny bludných balvanů etc., p. 10.
 1906 *Astrocoenia hexaphylloides* n. sp.; J. FELIX: Über eine Korallenfauna etc., p. 50, Pl. III/1, 1a.
 1911 *Astrocoenia hexaphylloides* J. FELIX sp.; J. ALLOITEAU — J. TISSIER: Les Madréporaires etc., p. 257, Pl. III/4.
 non 1958 *Actinastraea ?hexaphylloides* J. FELIX sp.; J. ALLOITEAU — J. TISSIER: Les Madréporaires etc., p. 257, Pl. III/4.

Matériel: 1 fragment du polypier, 1 plaque mince transversale, Klokočov près de Příbor.

Conservation: Silicification.

Dimensions*: $D = 1,3 - 1,8$ (1,9 – 2,8 durant la multiplication); $c - c = 1,2 - 1,9$; $N_s = 6S_1 + 6S_2$.

Description: Colonie céroïde. Calices serrés à contour polygonal. $6S_1$ se soudent à la columelle, $6S_2$ n'atteignent qu'à $1/4 - 1/3$ du rayon du polypierite. Columelle multitrabéculaire à développement variable. Bourgeonnement intracalical axial double.

Microstructure: Centres de calcification relativement gros, unisériaux ou bien en couleur sombre (menus cristaux?, un reste d'un tissu organique?), ou claires, c'est-à-dire dissouts et remplis secondairement de sparite.

Remarque: De l'espèce décrite de J. ALLOITEAU et J. TISSIER (1958) du Montien des Petites Pyrénées *A. hexaphylloides* diffère par le développement constant des septes du second cycle (cette différence a été signalée déjà par J. ALLOITEAU et J. TISSIER, l.c.) de même que par le mode différent de bourgeonnement (chez l'espèce pyrénéenne le bourgeonnement est extracalical).

Répartition: Crétacé supérieur de la région de Deljatina en Ukraine, USSR, Tchécoslovaquie.

Cyathophoridae VAUGHAN et WELLS, 1943

Cyathophora MICHELIN, 1843

Espèce-type: *Cyathophora richardi* MICHELIN, 1843

Cyathophora sp.

Pl. XLVIII, Fig. 1, 2

? 1964 *Cyathophora steinmanni* FRITZSCHE; E. MORYCOWA: *Hexacoralla* des couches de Grodziszczce etc., p. 24, Pl. III/2a–b; Pl. V/2, 3.

? 1971 *Cyathophora* sp.; E. MORYCOWA: *Hexacorallia* et *Octocorallia* du Crétacé inférieur etc., p. 42, Pl. VIII/2.

* Abréviations employées dans les descriptions: C = côtes; $c - c$ = distance centre à centre des polypierites; col = columelle; D = diamètre de calice; dis = dissépiments; d_1 = diamètre de lumen du polypierite; end = endothèque; ds = densité; l = lumen; lg = largeur; N = nombre; per = perithèque; S = septes; $S_{/mm}$ = densité des septes; syn = synapticules; tab = planchers.

Dimensions en millimètres. UUG = le Service géologique à Prague.

Matériel: 1 fragment de la colonie, 1 plaque mince.

Conservation: CaCO_3 , matériel fortement sparitisé.

Dimensions: $D = 2,5 - 4,5$; $c - c = 2,5 - 5,0$; $N_s = 6S_1 + 6S_2 + nS_3$ (rudimentaires); $N_c = 24$; $ds \text{ tab} = 2 - 3/2 \text{ mm}$.

Remarque: D. TURNŠEK (1976, p. 12) signale que l'espèce du genre *Cyathophora* décrit de E. MORYCOWA (l.c.) n'appartient pas à l'espèce *C. steinmanni* à cause de ses dimensions trop élevées. La taille de l'espèce de Klokočov est conforme à celle du matériel polonais et roumain. Mais pour une comparaison plus détaillée le matériel, jusqu'alors à disposition, n'est pas suffisant.

Répartition: Tchécoslovaquie.

Stylinidae D'ORBIGNY, 1851

Pseudocoeniinae RONIEWICZ, 1976

Pseudocoeniopsis Roniewicz, 1976

Espèce-type: *Pseudocoeniopsis maior* RONIEWICZ, 1976

Pseudocoeniopsis uhligi (TRAUTH, 1911)

Pl. XLVIII, Fig. 3

1911 *Cryptocoenia Uhligi* n. sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 50, Pl. I/3a—c.

Matériel: 1 fragment de la colonie, 1 plaque mince.

Conservation: Echantillon silicifié, partiellement limonitisé. Les cavités primaires sont remplies de SiO_2 , les cavités secondaires de pyrite et de limonite.

Dimensions: $D = (1,3) 2,8 - 4,5$, pour la plupart environ 3; $c - c = 2,3 - 4,1$; $lg \text{ per} = 0,4 - 0,6$; $N_s = (16) 18 - 20 (9 - 10 S_1 + 9 - 10 S_2, \text{exceptionnellement } 8 S_1 + 8 S_2)$.

Description: Polypier plocôide à une périthèque étroite. Contours des polypières polygonaux arrondis. Lames radiaires développées en 2 cycles en systèmes égaux. S_1 n'atteignent pas complètement le centre, les largeurs de S_2 égalent à peu près $1/3$ jusqu'à $1/2$ de longueur de S_1 . Les bords internes des septes sont munis de petits lobes paliformes. Ceux des septes voisins peuvent se toucher. Faible columelle pariétale instable. Dans la région de la muraille septoparathéciale les septes s'élargissent. La partie costale des lames radiaires est relativement courte. Le nombre des côtes correspond au nombre des septes. Les côtes sont nonconfluentes, rarement subconfluentes.

Remarques: F. TRAUTH (l.c.) a rangé cette espèce dans le genre *Cryptocoenia* D'ORBIGNY, 1849. La révision de ce genre dans les travaux de J. ALLOITEAU (1958), L. BEAUVAIS (1964) et E. RONIEWICZ (1966, 1976) a montré que le genre *Cryptocoenia* n'a pas été défini suffisamment. On l'emploie souvent

par erreur en désignant les représentants des genres *Pseudocoenia* D'ORBIGNY et *Cyathophora*. Un fragment du polypier de Klokočov est apparenté aux espèces du genre *Pseudocoenia* dont il se distingue par la présence des lobes paliformes et par la columelle pariétale.

Répartition: Tchécoslovaquie.

Faviidae GREGORY, 1902

Monticulastraea DUNCAN, 1880

Espèce- type: *Monticulastraea insignis* DUNCAN, 1880

Remarque: Ce genre est peu connu. On n'a pas encore décrit que quelques espèces peu nombreuses du Miocène de l'Inde, Iran et le Bassin Méditerranéen (France). Duncan a défini le genre *Monticulastraea* comme le genre *Hydnophora* à columelle lamellaire. Sur l'échantillon de Klokočov il y a l'ornementation des faces latérales des septes, qui est caractéristique du genre *Hydnophora* FISCHER de WALDHEIM, 1870: les grains qui aux bords internes des septes s'allongent de manière lamellaire perpendiculairement au parcours des lames radiaires (comp. J. CHEVALIER 1961, p. 162 et J. ALLOITEAU 1952, texte-fig. 65 figurant la face latérale du sept de l'espèce typique *Hydnophora demidovii* FISCHER de WALDH.). Quant aux autres caractères, l'échantillon de Klokočov est conforme aux représentants du genre *Monticulastraea* (polypier hydno-phoroïde, columelle lamellaire, muraille septoparathécale). Il est clair que le genre *Monticulastraea* s'est différencié déjà pendant le Crétacé supérieur.

Monticulastraea roseola sp. n.

Pl. XLIX, Fig. 1, 2; pl. L, Fig. 1

Holotypus: échantillon no. HF 1.343 figuré sur Pl. XLIX, Fig. 1, 2 et pl. L, Fig. 1, déposé dans les Collections d'ÚÚG.

Locus typicus: Klokočov près de Příbor.

Stratum typicum: Intercalation de conglomérats dans les Couches de Frýdek.

Derivatio nominis: D'après les rosiers, sous lesquelles un des polypiers a été trouvé.

Matériel: 4 échantillons, dont 2 plaques minces (transversale et longitudinale).

Conservation: Calcite partiellement limonitisé; centres de calcification rouge-bruns sombres.

Diagnose: basée sur les dimensions et la forme générale des polypiers, c'est-à-dire collines coniques isolées prédominant.

Dimensions: c—c (columelle à columelle des vallées voisines) = 2,2—3,5 (4,0); longueur des collines allongées linéairement = 3,5—5,5; N_s autour des collines coniques: 16—22; ds S = 3—4/1 mm; ds e = 5—6 dis/2 mm.

Description: Polypiers hydnothoraciques, collines pour la plupart courtes, coniques, isolées ou modérément allongées, moins fréquemment légèrement sinueuses. Septes alternants un peu en largeur et épaisseur. Grains sur les faces latérales des septes s'aggrandissent à partir de la périphérie jusqu'au bord axial des septes où ils deviennent lamellaires perpendiculairement au parcours des éléments radiaires. Granules voisins peuvent être libres ou peuvent toucher l'un l'autre ou se souder à la columelle. Columelle lamellaire, mince, légèrement ondulée et discontinue à intervalles irréguliers. La muraille septoparathéciale. Des parties périphériques des lames radiaires sur les collines alternent en longueur. Les lames sont nonconfluentes, rarement subconfluentes. L'endothèque est subhorizontale moyennement développée.

Affinités: L'espèce nouvelle se distingue des espèces *Monticulastraea insignis* DUNCAN, *M. inaequalis* DUNCAN 1880 et *M. solidior* DUNCAN, 1880 par la forme générale des polypiers (collines coniques isolées prédominante) et par la densité des éléments radiaires. Du *M. provincialis* CHEVALIER, 1961 à laquelle elle est conforme quant à la densité des septes, l'espèce nouvelle se distingue par les collines plus minces (chez *M. provincialis* la largeur des collines atteint 4,5 mm) et par la forme générale un peu différente des polypiers.

Répartition: Tchécoslovaquie.

Smilotrochidae ALLOITEAU, 1952

Phyllocoeniinae ALLOITEAU, 1952

Plesiastraeopsis ALLOITEAU, 1957

Espèce-type: *Astrea vesparia* MICHELIN, 1841

Plesiastraeopsis moravica (TRAUTH, 1911)

Pl. LI, Fig. 1, 2

- 1897 *Astrea corollaris* REUSS; U. SÖHLE: Geologische Aufnahme des Labergebirges etc., p. 43, Pl. V/6,6a; pl. VI/1.
- 1905 *Phyllocoenia corollaris* REUSS; G. Angelis d'Ossat: Coralli del Cretacico etc., p. 206, Pl. 14/19.
- 1911 *Orbicella? moravica* n. sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 52, Pl. II/1a—b.
- 1936 *Phyllocoenia corollaris* REUSS; M. HACKENMESSER: Eine Kretazische Korallenfauna etc., p. 19.
- non 1954 *Provinciastraea moravica* TRAUTH sp.; J. CHEVALIER: Contribution à la révision etc., p. 120, Pl. I/1.
- ? 1960 *Montastraea corollaris* (REUSS); E. SCHEIBNER: Some new Occurrences of Corals etc., p. 282.

Matériel: 1 fragment de la colonie, 2 plaques minces.

Conservation: Silicification.

Dimensions: D = 7—10; c—c = 14; lg per = 5,0; N_s = 24 plus longs + septes rudimentaires, au total à peu près 46.

Description: Colonie massive, plocœide à calices subcirculaires à grande

taille se reproduisant par bourgeonnement extracalical. Périthèque constituée de côtes larges subégales et de dissépiments exothécaux épais cellulux bien développés. Côtes nonconfluentes ou subconfluentes. Septes disposés en systèmes inégaux. Bord interne des septes plus longs muni de forts lobes paliformes. Quelques lobes trabéculaires pénètrent dans la cavité axiale en y constituant une columelle papilleuse, lâche et volumineuse. Muraille septoparathécale. Endothèque bien développée, subhorizontale, supplémentée par quelques dissépiments obliques dans la région périphérique des polypières.

Remarques et affinités: F. TRAUTH (l.c.) a rapporté avec réserve son espèce nouvelle au genre *Orbicella*. J. CHEVALIER 1954 a regardé l'espèce de TRAUTH *O. ? moravica* comme identique avec la colonie corallienne de Mazaugues (France, Sénonien). Pour cette espèce il a proposé un genre nouveau, *Provinciastraea*, et il a indiqué *Orbicella ? moravica* TRAUTH, 1911 comme l'espèce-type. A cause de certaines différences entre le matériel français et moravien, J. CHEVALIER (l.c.) a proposé pour les coraux de Mazaugues une nouvelle variété: *Provinciastraea moravica mazaugui*. Il s'agit d'une erreur évidente. Les deux formes (l'échantillon de Klokočov et celui de Mazaugues) diffèrent par quelques traits au niveau de genre (la présence et l'absence de la columelle, le caractère de l'endothèque et l'exothèque et par la microstructure) et ne peuvent pas être assimilées. La diagnose du genre *Provinciastraea* CHEVALIER, 1954 est établie sur la base de l'étude du matériel français. *P. mazaugui* CHEVALIER, 1954 devient automatiquement l'espèce-type du genre de Chevalier.

L'espèce de TRAUTH *O. ? moravica* peut être rangée dans le genre *Plesiastraeopsis* ALLOITEAU. C'est que le caractère de l'endothèque et l'exothèque, la présence des lobes paliformes et d'une columelle spongio-papilleuse volumineuse correspondent à ce placement.

A la synonymie de l'espèce décrite appartiennent probablement des espèces du Cénomanién ou plus anciennes désignées par les auteurs comme *Phyllocoenia corollaris* (REUSS) — voir la synonymie. Déjà en 1957 ALLOITEAU et de nouveau M. BEAUVAIS 1982, à l'occasion de la révision du type de REUSS d'*Astraea corollaris* (M. BEAUVAIS a rapporté l'espèce de Reuss au genre *Neocaeniopsis* ALLOITEAU, 1957) ont signalé la nécessité de la séparation de ces coraux du Crétacé moyen de l'espèce Sénonien *Ph. corollaris* (R.). *Plesiastraeopsis moravica* diffère d'*A. corollaris* REUSS = *Neocaeniopsis* par son abondante endothèque subhorizontale, lobes paliformes aux bords internes des septes et l'absence des synapticules. Au premier coup d'oeil ces deux espèces diffèrent par la taille des calices (chez *P. moravica* D = 7—12 mm à la différence des 3—7 mm chez *Neocaeniopsis corollaris*).

Les mêmes dimensions comme chez *Plesiastraeopsis moravica* (D = 10 × 7 mm; c—c = 15 mm) ont été indiquées par J. ALLOITEAU 1941 pour l'espèce *Phyllocoeniopsis varians* du Turonien d'Uchaux, France. Les deux genres sont apparentés mutuellement, leurs aspects ressemblent l'un à l'autre mais la muraille des représentants du genre *Phyllocoeniopsis* est parathécale, la columelle réduite et les septes ne sont pas munis de lobes paliformes.

Chez la sus-dite espèce citée de la Slovaquie, du Sénonien de la zone de

klippes, comme *Montastraea corollaris* (REUSS) une description et une illustration manquent. Il serait nécessaire de réviser le matériel originel.

Répartition: l'Urgonien-Aptien de l'Espagne, le Cénomaniens de Bavière, Grèce; Cénomaniens- Santonien inférieur (Klokočov près de Příbor) et ? Sénonien de la zone de klippes en Tchécoslovaquie.

Plesiastraeopsis sp.

Matériel: Fragment d'une colonie, 1 plaque mince.

Conservation: Silicification.

Dimensions: $D = 4,0-4,5$; $c-c = 6-8$; $N_s = 24 (6S_1 + 6S_2 + 12S_3)$.

Description: Polypier plocœide. Calices circulaires espacés.

Lames radiaires aux lobes paliformes sont disposées en systèmes égaux. Grandes côtes subégales, nonconfluentes. A certaine distance de la muraille les côtes s'amincissent et leur parcours devient légèrement ondulé. Endothèque subhorizontale, exothèque celluleuse. Columelle spongio- papilleuse.

Remarques: Les dimensions de la sus-dite espèce sont conformes aux données pour l'espèce *Orbicella sulcatolamellosa* MICH. sp. de F. TRAUTH (1911). Mais J. CHEVALIER (1954, p. 117) en révisant les espèces du genre *Heliastrea* a constaté que l'«*Orbicella sulcato-lamellosa* MICH.» signalée dans l'étude de F. TRAUTH (l.c.) n'est pas identique à l'espèce *Heliastrea sulcatolamellosa* MICH., 1841. Cette espèce de Michelin a été transférée au genre *Phyllocoeniopsis* ALLOITEAU tandis que l'espèce de Klokočov appartient évidemment au genre *Plesiastraeopsis* ALLOITEAU et représente probablement une espèce nouvelle. Malheureusement le matériel de Klokočov n'est pas suffisant pour la créer.

Répartition: Tchécoslovaquie.

Phyllocoeniopsis ALLOITEAU, 1957

Espèce- type: *Astrea cribraria* MICHELIN, 1841

cf. *Phyllocoeniopsis lepidoides* (TRAUTH, 1911)

Pl. LII, Fig. 1

1911 *Phyllocoenia lepidoides* n. sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 51, Pl. I/4a-b.

Matériel: 1 fragment de la colonie, 1 plaque mince.

Conservation: Silicification.

Dimensions: $D = 3,5-4,0$; $c-c = 4,0-5,0$; $N_s = 24 + nS$ rudimentaires.

Description: Colonie plocœide à calices circulaires. Les lames radiaires sont développées en systèmes égaux. $6S_1$ et $6S_2$ atteignent plus ou moins le

centre des polypières, 12 S₃ sont distinctement plus courts. Il y a quelques septes rudimentaires du cycle suivant. Columelle faible pariétale jusqu'à sublamellaire. Parties costales des éléments radiaires sont relativement minces nonconfluentes avec les côtes des calices voisins. A une certaine distance de la muraille les côtes se dissocient en trabécules isolées. Muraille parathécale.

Remarque: Le genre *Phyllocoenia* EDW. et HAIME auquel F. TRAUTH a rapporté son espèce nouvelle, apparaît seulement dès le Paléogène (cf. J. ALLOITEAU 1957, p. 128). Au Crétacé on trouve le genre *Phyllocoeniopsis* qui diffère du genre *Phyllocoenia* surtout par l'endothèque et l'exothèque subhorizontales (toutes les deux sont vésiculeuses chez le genre *Phyllocoenia*), mais tous les autres caractères sont égaux: muraille parathécale, columelle réduite pariétale jusqu'à sublamellaire, côtes nonconfluentes.

Répartition: Tchécoslovaquie.

Thamnasteriidae VAUGHAN et WELLS, 1943

Mesomorpha PRATZ, 1883

Espèce-type: *Porites mammilata* REUSS, 1854

Remarque: Le genre *Mesomorpha* a été étudié et sa relation au genre *Ahrdorffia* TRAUTH précisée par E. KUZMICHEVA 1970, E. MORYCOWA 1964, 1971 et M. BEAUVAIS 1982. Tous ces auteurs regardent le genre *Ahrdorffia* comme un synonyme employé plus tard.

Mesomorpha chaetetoides (TRAUTH, 1911)

Pl. LII, Fig. 2

1911 *Ahrdorffia chaetetoides* n. sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 95, Pl. IV/4a—d, texte-figures 7 et 8.

1982 *Ahrdorffia chaetetoides* TRAUTH; M. BEAUVAIS: Pars II, p. 60.

Matériel: 1 petit fragment du polypier, 1 plaque mince.

Conservation: Silicification.

Dimensions: D = 0,6—0,9; c—c = ca 1,5; N_s = 6—7 S₁ + n S₂.

Description: Calices mal circonscrits. Columelle styloforme assez grosse, les septes du premier cycle se soudent à elle.

Affinités: *M. chaetetoides* diffère par ses dimensions extrêmement petites des espèces du Crétacé supérieur *M. mammilata* et *M. stellulata* (REUSS) de même que des espèces signalées du Crétacé inférieur et des espèces sporadiques du Jurassique.

Répartition: Tchécoslovaquie.

Andemantastraeidae ALLOITEAU, 1952

Dimorphomeandra ALLOITEAU, 1958

Espèce- type: *Dimorphomeandra besairiei* ALLOITEAU, 1958

***Dimorphomeandra* sp.**

Pl. LIV, Fig. 1, 2

Matériel: 1 petit fragment de la colonie, 2 plaques minces.

Conservation: squelette silicifié, coloré en partie de limonite.

Dimensions: c—c entre les calices dans les séries voisines: 2,5—3,5; $N_s = \text{ca } 27$; ds S = 7—8/2 mm.

Description: Caractère général atteste la famille *Andemantastraeidae*: lames biseptales compactes, dissépiments et synapticules se présentent à la fois, les faces latérales ornées de grains (il semble qu'il n'y ait pas l'ornementation pennulaire). D'après les autres caractères il peut s'agir du genre *Dimorphomeandra* malgré que l'on ne puisse pas discerner sur le fragment du polypier le bourgeonnement circumoral: les calices se présentent en séries, les centres des calices sont plus ou moins distincts, étant indiqués par la columelle constituée de quelque peu d'éléments; l'union des calices dans la série est trabéculaire ou par septes de vallée.

Remarque: La petite quantité de matériel ne permet pas une détermination précise et détaillée.

Répartition: Tchécoslovaquie.

***Latomeandridae* ALLOITEAU, 1952**

***Fungiastraea* ALLOITEAU, 1951**

Espèce- type: *Astrea laganum* MICHELIN, 1841

***Fungiastraea* sp.**

Pl. LIII, Fig. 2

? 1941 *Dimorphastraea* sp.; J. ALLOITEAU: Révision de la collection etc., p. 38, Pl. XII/3

Matériel: 1 fragment de la colonie, 1 plaque mince.

Conservation: Silicification.

Dimensions: c—c = 4,0—5,0; $N_s = \text{environ } 36$; ds S = 5/2 mm.

Description: Petit polypier massif, cério- méandroïde. Lames radiaires à ornementation pennulaire, irrégulièrement perforées. Volumineuse columelle spongieuse. Endothèque de nombreux dissépiments vésiculeux.

Remarque: L'échantillon semble être identique au polypier décrit et illustré comme *Dimorphastraea* sp. dans le travail de J. ALLOITEAU (l.c.). Sur le matériel français l'arrangement circumoral des calices typique du genre *Dimorphastraea* n'est pas visible.

Répartition: Turonien de France?, Tchécoslovaquie.

***Acroporidae* VERILL, 1902**

***Rothastrea* gen. nov.**

Espèce- type: *Isastraea bieskidensis* TRAUTH, 1911

Derivatio nominis: En l'honneur de Doc. Dr. ZDENĚK ROTH, DrSc.

Diagnose: Polypier cérioïde, subcérioïde jusqu'à subplocoïde. Lames radiaires sont représentées par costoseptes subcompacts à lobes paliformes. Les bords internes des septes plus longs ont la tendance à se souder. Les éléments radiaires peuvent être développés en systèmes inégaux. Muraille synapticulothécale, perforée. Endothèque tabuloïde. Bourgeonnement extracalical? Périthèque, fortement réduite, est constituée des parties costales des lames radiaires et des synapticules.

Affinités: Le genre nouveau diffère du genre plocoïde *Astraeopora* de BLAINVILLE, 1830 par la périthèque réduite. Des genres *Etallonia* RONIEWICZ, 1966 et *Paretallonia* SICHARULIDZE, 1972 qui ont la même forme générale du polypiers- subplocoïde jusqu'à cérioïde- le genre nouveau se distingue par un développement irrégulier des septes, par la présence des lobes paliformes au bord internes des septes, par la tendance des septes plus longs à se souder par les bords internes et par l'absence des planchers synapticulaires.

Constitution du genre: *Rothastrea bieskidensis* (TRAUTH, 1911), *R. retifera* (TRAUTH, 1911), *R. laurina* sp. n. et *R. lubinensis* sp. n.

Répartition stratigraphique: Comme chez les espèces décrites.

***Rothastrea bieskidensis* (TRAUTH, 1911)**

Pl. LIII, Fig. 1; pl. LV, Fig. 1, 2

1911 *Isastraea bieskidensis* n. sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 60. Pl. II/5a—c.

Matériel: 5 échantillons, 8 plaques minces.

Conservation: Silicification.

Dimensions: D = 3,5—5,0; c—c = 4,5—5,5; N_s = 16—20 (8—9 septes plus longs + 8—9 septes plus courts + quelques septes rudimentaires).

Description: Polypier massif, subcérioïde à calices subpolygonaux. Lames radiaires développées en systèmes inégaux. S₁ et S₂ de la même épaisseur à forts lobes paliformes. Les bords internes des septes plus longs ont la tendance à se souder de manière irrégulière: ou les bords des septes voisins se soudent ou ceux de quelques septes opposés. Muraille synapticulothécale, subcompacte. Parties costales des lames radiaires nonconfluentes ou subconfluentes. Petites lacunes dans la périthèque rudimentaire. Endothèque tabuloïde, concave au centre du polypierite, convexe dans la région périphérique, où elle est suppléementée par quelques dissépinements vésiculeux.

Affinités: Cette espèce diffère des autres espèces du genre par sa constitution robuste, grandes dimensions et un relativement petit nombre de septes.

Répartition: Tchécoslovaquie.

***Rothastrea retifera* (TRAUTH, 1911)**

Pl. LIV, Fig. 3; pl. LVI, Fig. 1, 2

- 1911 *Actinacis retifera* n. sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 79, Pl. III/6.
 1913 *Actinacis retifera* TRAUTH; P. OPPENHEIM: Über *Porites polystyla* etc., p. 172.
 1937 *Actinacis retifera* TRAUTH; O. KÜHN et D. ANDRUSOV: Korallen aus der Klippenhülle etc., p. 8.
 1982 *Actinacis retifera* TRAUTH; M. BEAUVAIS: Révision systématique des Madréporaires etc., Pars II, p. 267.

Matériel: 4 fragments des polypiers, 7 plaques minces.

Conservation: Une colonie comme calcite néomorphe, les autres sont silicifiées, partiellement limonitisées et pyritisées.

Dimensions: $D = 3,0-4,0$; $c-c = 4,0-5,0$; $lg\ per = 0,0-1,0$; $N_s = 24 (6S_1 + 6S_2 + 12S_3)$.

Description: Petits polypiers hémisphériques subplocoides jusqu'à subcéréioides. Calices subcirculaires. Septes subcompacts disposés en systèmes réguliers. S_1 atteignent à peu près le centre, S_2 sont distinctement plus courts. S_3 sont relativement longs atteignant à 1/2 environ du rayon du polypierite. Les lobes paliformes sont développés en relation à l'épaisseur de leurs septes. Le centre du calice est occupé par l'anastomose irrégulière des bords internes des septes et par des dissépiments ou planchers traversant au hasard le lumen. Muraille synaptculaire bien poreuse. Périthèque, développée irrégulièrement, est composée de parties costales des lames radiaires et des synapticules. Endothèque tabuloïde, subhorizontale à dissépiments supplémentaires dans la région périphérique des polypierites. Bourgeonnement extracalical.

Remarques et affinités: D. ANDRUSOV et O. KÜHN (1937) considéraient la possibilité de rapporter l'espèce *Actinacis retifera* introduite par F. TRAUTH à leur taxon *Annulopora* (d'après les auteurs le sous — genre d'*Astraeopora* BLAINVILLE d'âge de l'Eocène jusqu'à Oligocène). D'après la description et l'illustration par les sus — dits auteurs, le sous — genre *Annulopora* est caractérisé par la forme générale évidemment plocoid de la colonie à périthèque large et par un distinct stable anneau de dissépiments dans la cavité axiale des polypierites. Mais la périthèque de *R. retifera* est fortement réduite et l'espace axial est rempli de lobes paliformes et de dissépiments ou de planchers qui n'arrivent qu'au hasard jusqu'à vers le centre du lumen.

Du genre *Actinacis*, auquel cette espèce a été rapportée également, *R. retifera* diffère par le développement faible de la périthèque. C'est que déjà P. OPPENHEIM en 1913 signala que chez *Actinacis retifera* il s'agissait d'un autre genre. M. BEAUVAIS 1982 a mentionné la nécessité d'une révision du placement systématique de ce genre.

Répartition: Tchécoslovaquie.

***Rothastrea laurina* sp. n.**

Pl. LVII, Fig. 1, 2; pl. LXII, Fig. 3

- 1911 *Isastraea* n. sp. indet.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 59, Pl. II 4a—b.

Holotypus: no HF 1.346 figuré sur Pl. LVII, Fig. 1, 2, déposé dans les Collections d'ÚÚG.

Locus typicus: Klokočov près de Příbor

Stratum typicum: intercalation de conglomérats dans les Couches de Frýdek.

Derivatio nominis: d'après la variété botanique du caféier.

Matériel: 5 fragments des polypiers, 9 plaques minces.

Conservation: Silicification, pyritisation.

Diagnose: Massifs polypiers céroïdes jusqu'à subcéroïdes, calices polygonaux arrondis à septes du 3^{ème} cycles, courts.

Dimensions: $D = (1,5) \ 3,0-4,0 \ (4,5)$; $N_s = 24-28 \ (6-7 \ S_1 + 6-7 \ S_2 + 8-12 \ S_3)$; $c-c = 3,5-4,8$.

Description: Polypiers massifs céroïdes jusqu'à subcéroïdes, calices irrégulièrement polygonaux, dans les parties subcéroïdes les calices sont arrondis. Septes développés en systèmes inégaux. Légèrement ondulés S_1 et S_2 n'arrivent pas jusqu'au centre du polypierite. S_3 sont relativement courts atteignant 1/4 du rayon calicinal au maximum. Le lumen est rempli par des lobes paliformes qui peuvent variablement se souder (2-3 des septes voisins ou/et ceux des septes opposés) et par quelques planchers. La muraille mince à parcours un peu en zigzag, irrégulièrement poreuse. Endothèque tabuloïde, subhorizontale.

Remarques et affinités: Le parcours en zigzag de la muraille ensemble avec les petites lacunes dans la périthèque rudimentaire offrent l'impression d'une muraille «oieillée» (maschigporös) comme elle a été décrite par F. TRAUTH (l. c.).

Dimensions de l'espèce décrite sont presque les mêmes que celles de *R. retifera*. Mais la forme générale du polypier *R. laurina* est céroïde, subcéroïde au maximum (tandis que *R. retifera* est subplocoïde jusqu'à subcéroïde), et ses S_3 sont beaucoup plus courts. L'espèce *R. lubinensis* est aussi apparentée à *R. laurina*, *Rothastrea laurina* diffère d'elle par ses dimensions un peu plus grandes, septes plus développés et une muraille à parcours en zigzag. De l'espèce *R. bieskidensis* l'espèce décrite se diffère par ses dimensions, par les éléments du squelette plus minces et par le nombre des septes plus élevé.

Répartition: Tchécoslovaquie.

***Rothastrea lubinensis* sp. n.**

Pl. LVIII, Fig. 1, 2

? 1903a *Isastraea* sp. (Species I); J. FELIX: Verkieselte Korallen als Geschiebe etc., p. 570.

? 1904 *Isastraea* sp. (Species I); M. REMEŠ: Zkameněliny bludných balvanů etc., p. 9.

? 1911 *Isastraea* sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 58.

Holotypus: no. HF 1.347 figuré sur Pl. LVIII, Fig. 1, 2. Déposé dans les Collections d'ÚÚG.

Locus typicus: Klokočov près de Příbor.

Stratum typicum: intercalation de conglomérats dans les Couches de Frýdek.

Derivatio nominis: D'après la rivière Lubina qui coule à travers la ville de Příbor.

Matériel: 3 fragments de polypiers, 4 plaques minces.

Conservation: Silicification.

Diagnose: Basée sur les petites dimensions de l'espèce.

Dimensions: $D = 2,5-3,0$, chez les calices allongés jusqu'à 3,8; $c-c = 2,5-3,5$; $N_s = 12-23 (6S_1 + 6S_2 + xS_3)$; $ds\ tab = 2-3/2\ mm$.

Description: Colonie massive cérioïde jusqu'à subcérioïde. Calices très irrégulièrement polygonaux jusqu'à polygonaux arrondis. La déformation des calices et les grandes différences entre les dimensions des polypières sont la conséquence du bourgeonnement intense. Chez les polypières jeunes la symétrie basale radiaire est perceptible, qui plus tard s'efface par l'influence des déformations des calices. Les lames radiaires sont assez épaisses dans la région de la muraille, devenant rapidement plus minces vers le bord interne des septes. Les septes plus longs (S_1 et S_2) n'atteignent pas le centre des polypières, les S_3 développés incomplètement, sont courts et rudimentaires. L'espace axial est rempli de manière variable par la soudure irrégulière des bords internes de quelques septes plus longs et par rares éléments endothécaux traversant au hasard le lumen. Muraille synapticulothécale, poreuse. Endothèque tabuloïde, subhorizontale.

Remarques et affinités: Par ses petites dimensions *R. lubinensis* diffère de toutes les espèces décrites ci-dessus.

L'espèce *Isastraea* sp. n'a été rangée dans la synonymie de l'espèce décrite ici qu'avec réserve. Dans aucune étude (J. FELIX, M. REMEŠ et F. TRAUTH, l. c.) cette espèce n'est documentée par une figure. La supposition du classement systématique de ce taxon au genre *Rothastrea* n'est pas supportée que par la remarque de F. TRAUTH concernant la parenté des espèces *Isastraea* sp. et *Isastraea* n. sp. indet. (F. TRAUTH, l. c., p. 59).

Répartition: Tchécoslovaquie.

Actinacididae VAUGHAN et WELLS, 1943

Actinacis D'ORBIGNY, 1849

Espèce-type: *Actinacis martiniana* D'ORBIGNY, 1849

Actinacis remesi FELIX, 1903

Pl. L, Fig. 2, 3; pl. LVI, Fig. 3; pl. LIX, Fig. 1, 2; pl. LX, Fig. 1

1903a *Actinacis Remeši* nov. sp.; J. FELIX: Verkieselte Korallen als Geschiebe etc., p. 567., text. fig. 1, 2.

1904 *Actinacis Remeši* FELIX; M. REMEŠ: Zkameněliny bludných balvanů etc., p. 6, text. fig. 1, 2.

1911 *Actinacis Remeši* FEL.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 75, Pl. IV/1; text. fig. 4.

1913 *Actinacis Remeši* FELIX; P. OPPENHEIM: Über *Porites* etc., p. 172.

1914 *Actinacis Remeši* FELIX; J. FELIX: Fossilium Catalogus etc. p. 240.

non 1921 *Actinacis Remeši* FELIX; R. ZUFFARDI-COMERCI: Fauna del Neo-Cretacico etc., p. 11, Pl. II 1, 2.

- 1925 *Actinacis Remeši* FELIX; H. VETTERS: Über kretazeische Korallen etc., p. 9, Pl. I/5—6.
 non 1930 *Actinacis remesi* FELIX; O. KÜHN: Das Danien der äusseren Klippenzone etc., p. 25, Pl. II/29.
 non 1937 *Actinacis remesi* FELIX; O. KÜHN et D. ANDRUSOV: Korallen aus der Klippenhülle etc., p. 5, 12.
 non 1966 *Actinacis remesi* FELIX; E. MORYCOWA et J. LEFELD: Les Madréporaires des calcaires urgoniens etc., p. 538, Pl. 33/1—2.
 non 1976 *Actinacis remesi* FELIX; D. TURNŠEK et S. BUSER: Cnidarian Fauna from the Senonian Breccia etc., p. 27, Pl. 20/5, 6.
 1982 *Actinacis remesi* FELIX; M. BEAUVAIS: Pars III, p. 265, Tab. 12.

Matériel: Plus de 100 échantillons, colonies et fragments de tailles différentes, 30 plaques minces.

Conservation: calcite silicifié à degrés différents, en partie limonitisé. Zones d'intensités variées de silicification sont remarquables par leur couleur différente. Leur parcours correspond aux stries d'accroissement dans le polypier.

Dimensions: Diamètre des colonies = plusieurs dizaines de cm (20—50 cm). D = 1,1—2,0 (2,1); c—c = 2,5—3,2 (3,5); N_s = 16—28; ds tab synapticulaires = 8/2 mm.

Description: Polypiers subhémisphériques à surface calicifère généralement fort convexe, irrégulièrement gibbeuse, pouvant passer à la lame épaisse.

Calices circulaires jusqu'à elliptique, espacés. Columelle peut être réduite à un tigelle, mais pour la plupart, ensemble avec les lobes paliformes elle constitue une formation variablement volumineuse. Chez quelques calices cette formation occupe jusqu'à 1/3 de leur diamètre. Le bord interne des septes reste libre ou s'anastomose avec les autres septes voisins. Les septes des deux premiers cycles sont de longueur égale, ils arrivent au centre des polypières. S₃ sont courts et développées en nombre différent d'après l'âge des polypières. La muraille est synapticulothéciale. Périthèque large et lâche constituée des parties costales qui à une certaine distance de la muraille se dissocient en trabécules isolées. Les éléments horizontaux de la périthèque sont des synapticules pour la plupart se réunissant aux planchers synapticulaires. Planchers endothécaux subhorizontaux, très minces. Bourgeonnement extracalical.

Remarque: Les espèces désignées comme *Actinacis remesi* d'Italie, Pologne, Yougoslavie et Slovaquie ont les dimensions plus grandes que l'espèce décrite ci-dessus. L'espèce signalée par O. KÜHN (l.c.) dans les couches de couverture de la zone de klippes près de Vienne est située outre l'écart de la variabilité de l'espèce (D = 0,8—1,0 mm; c—c = 1,0—1,5 mm). Dans ces deux cas il s'agit probablement de nouvelles espèces.

Répartition: Turonien jusqu'à Sénonien des Alpes Orientales (Autriche) et Tchécoslovaquie.

***Actinacis cymatoclysta* FELIX, 1906**

Pl. LXI, Fig. 1, 2

1906 *Actinacis cymatoclysta* n. sp.; J. FELIX: Über eine Korallenfauna etc., p. 43, Pl. III/4, 4a.

- 1911 *Actinacis cymatoclysta* FELIX; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 79.
 1913 *Actinacis cymatoclysta* FELIX; P. OPPENHEIM: Über Porites polystyla etc., p. 172, 175.
 1982 *Actinacis cymatoclysta* FELIX; M. BEAUVAIS: Révision systématique des Madréporaires etc.,
 Pars III, p. 267, Tab. 12.

Matériel: 3 échantillons, 6 plaques minces.

Conservation: Silicification, limonitisation partielle.

Dimensions: D = 1,1—1,3; c—c = 1,5—1,8; N_s = 16—22; ds tab synapticulaires = 6—7/2 mm.

Description: Massif polypier plocœide à calices espacés. 6—12 septes plus longs atteignent presque le centre où les lobes paliformes ont la tendance à s'assimiler. Une faible columelle pariétale. Les parties costales des lames radiaires s'isolent pour la plupart en trabécules individuelles qui ensemble avec les planchers synapticulaires constituent le coenenchyme. Endothèque tabuloïde, subhorizontale, dans la région périphérique des polypières supplémentée par quelques dissépiments. Bourgeoisement extracalical.

Affinités: *A. cymatoclysta* diffère de l'espèce *A. remesi* par ses dimensions plus petites.

Répartition: Crétacé supérieur des Carpates Orientales (Deljatina en Ukraine, USSR), Tchécoslovaquie.

Helioporidae MOSELEY, 1876

Polytremacis D'ORBIGNY, 1849

Espèce — type: *Heliopora blainvillei* MICHELIN, 1841

Polytremacis tenera (TRAUTH, 1911)

Pl. LX, Fig. 2

- 1911 *Heliopora tenera* n. sp.; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 89, Pl. IV/3; Text. fig. 6.
 1971 *Polytremacis tenera* (TRAUTH); E. MORYCOWA: *Hexacorallia* et *Octocorallia* du Crétacé inférieur etc., p. 136, Pl. XL/1; text. fig. 41.
 1982 *Polytremacis tenera* (TRAUTH); M. BEAUVAIS: Révision systématique des Madréporaires etc., Pars III, p. 36, Pl. LIII/7; pl. LVIII/5.

Matériel: 1 fragment du polypier, 1 plaque mince.

Conservation: Silicification.

Dimensions: D des tubes calicinaux = 0,6—0,8; c—c = 1,5—3,1; N_s = 16—18.

Remarque: L'espèce a été décrite en détail de E. MORYCOWA 1971.

Répartition: Santonien de Gosau (Autriche), Santonien supérieur de Provence (France), Aptien inférieur des Carpates Orientales (Roumanie), Tchécoslovaquie.

Polytremacis lindströmi REMEŠ, 1898

Pl. LXII, Fig. 1, 2

- 1862—63 *Chaetetes radians* RÖMER; F. RÖMER: Über die Diluvialgeschiebe etc., p. 617, 755.
 1898 *Polytremacis Lindströmi* REMEŠ; M. REMEŠ: O zkamenělinách bludných balvanů etc., p. 5, Pl. I/1a—c.
 1903a *Polytremacis Lindströmi* REMEŠ; J. FELIX: Verkieselte Korallen als Geschiebe etc., p. 574, text. fig. 3, 4.
 1904 *Polytremacis Lindströmi* REMEŠ; M. REMEŠ: Zkameněliny bludných balvanů z okolí Příbora, p. 12.
 1911 *Heliopora Lindströmi* REMEŠ; F. TRAUTH: Die oberkretazische Korallenfauna etc., p. 86, Pl. IV/2, text. fig. 5.
 1925 *Heliopora Lindströmi* REMEŠ; H. VETTERS: Über kretazeische Korallen etc., p. 10, Pl. I/7, 8.

Matériel: 1 fragment de la colonie, 1 plaque mince.

Conservation: Silicification.

Dimensions: D des tubes calicinaux = 0,9—1,1; c—c = 2,2—3,0; N_s = 14—15; D des tubes de coenenchyme = 0,19—0,38; ds des tab = 2—3/1 mm.

Description: Fragment d'un polypier massif à tubes calicinaux circulaires. Pseudoseptes subégaux, courts, atteignant un 1/4—1/3 du rayon calicinal. Les tubes de coenenchyme à muraille très mince sont polygonaux arrondis pouvant être même circulaires. Les planchers dans les tubes calicinaux de même que dans les tubes de coenenchyme sont subhorizontaux, épars.

Remarque: Outre les dimensions, l'espèce est caractérisée également par les tubes de coenenchyme polygonaux arrondis à parois très mince.

Caractéristique de la faune

La faune madréporique décrite ci-dessus se caractérise par quelques traits spécifiques. Parmi les coraux l'espèce *Actinacis remesi* domine, elle représente 90 % de la population. Parmi les autres espèces, les représentants du genre *Rothastrea* gen. nov. sont assez fréquents, tandis que dans le matériel plus ancien *Mesomorpha chaetetoides* et *Polytremacis lindströmi* sont représentés par un nombre plus grand d'exemplaires. Au sujet des autres espèces, il s'agit de découvertes sporadiques de colonies ou de fragments.

L'espèce *Actinacis remesi* possède des polypiers massifs de forme subhémisphérique irrégulière, à surface calicifère gibbeuse, de diamètre de quelques cm jusqu'à 50 cm. Par la morphologie, la robustesse et la taille assez grande des polypiers l'espèce était adaptée à un milieu d'eau bien agitée.

Les Rudistes n'ont pas été trouvés dans l'association, malgré qu'habituellement ils accompagnent les Scléractiniaires dans d'autres localités du Crétacé supérieur. Les Rudistes et les Coraux ont tendance à s'exclure mutuellement. Les Coraux étant des adversaires plus faibles n'ont occupé que quelques niches mais par endroits ils pouvaient prédominer (COATES 1977). Peut être que l'espèce *Actinacis remesi* représentait pour les Rudistes un concurrent assez fort et bien efficace dans l'occupation de l'espace commun.

Les Polypiers solitaires manquent complètement, bien qu'ils soient assez abondants pendant le Crétacé supérieur dans d'autres localités, par exemple Bohême, France, Gosau, Grèce etc.

Jugeant d'après des exemples récents, une côte corallienne est peuplée au hasard et on ne peut pas y expliquer la prépondérance de quelques espèces de Madréporaires. Elle pourrait être en relation même avec l'agressivité de l'espèce dominante (TH. F. GOREAU, N. I. GOREAU et TH. J. GOREAU 1979).

La labilité du fond peut conduire également à la prédominance d'une ou deux espèces dans l'association des coraux (R. BRINKMANN 1924, E. RONIEWICZ, 1984), celles qui sont le mieux adaptées pour survivre dans les conditions données.

La faune corallienne est assez endémique- plus d'un tiers des coraux ne sont connus qu'à Klokočov (Tab. 1).

Ces traits spécifiques de la faune de Klokočov semblent être considérablement persistants. Déjà F. TRAUTH (l.c.) est arrivé à des conclusions analogues sur un autre matériel de la même localité.

La faune madréporique de Klokočov peut être regardée comme une association de précurseurs, à laquelle manquaient le temps et les conditions favorables pour une diversification plus variée.

L'âge de la faune madréporique

Les coraux appartiennent au benthos sessile qui est particulièrement lié à un milieu spécial. C'est pourquoi ils sont de bons indicateurs de faciès, mais ils ne sont pas appropriés pour la détermination de l'âge. De plus, la répartition stratigraphique des coraux est ordinairement étendue. Par exemple, *Polytrema-cis tenera* (TRAUTH, 1911) a été trouvé outre à Klokočov, dans l'Aptien inférieur des Alpes Orientales (Roumanie), dans le Santonien de Gosau et dans le Santonien supérieur de la Provence (France). La détermination de l'âge de l'association décrite ici est rendue difficile par le redépôt des polypiers dans les grès de Klokočov. On ne connaît pas avec certitude jusqu'à présent l'endroit où ces coraux vivaient.

L'élément le plus ancien dans l'association des coraux de Klokočov est l'espèce *Plesiastraeopsis moravica* (TRAUTH) connue dans Urgonien- Aptien d'Espagne, le Cénomaniens de Bavière et de Grèce. L'âge Cénomaniens jusqu'à Turonien de l'association peut être précisé par la présence du genre *Cyathophora* qui s'éteint pendant le Turonien.

L'âge le plus récent possible de la faune madréporique de Klokočov dépend de l'âge du sédiment qui la contient. D'après la position géologique, c'est très probablement le Sénonien supérieur. L'âge maastrichtien du sédiment n'a été confirmé que par l'étude micropaléontologique de la localité près de Fryčovice (E. HANZLÍKOVÁ, communication orale).

L'âge le plus probable de la faune madréporique de la région de Klokočov peut être déterminé avec la plus grande probabilité- d'après l'analogie des associations de la faune corallienne des régions voisines- comme Cénomaniens supérieur à Santonien inférieur (voir Tableau 1).

Provenance de la faune

La situation paléogéographique des environs de Klokočov n'est pas très claire. Les polypiers ont été redéposés dans les Couches de Frýdek ou de Třinec dans l'unité Sous-silésienne dans la région de la structure compliquée des nappes. A présent, les affleurements ne sont pas découverts et c'est pourquoi il n'est pas possible d'indiquer la direction du transport des roches clastiques dans lesquelles on trouve la sus-dite faune.

On ne peut pas alors décider si la faune madréporique provient des bords du Massif de Bohême ou du côté nord de la cordillère hypothétique de Baška (cf. A. MATĚJKA 1960, M. ELIÁŠ et H. ELIÁŠOVÁ 1984), qui constituait le bord oriental (sud -oriental) du bassin Sous-silésien. D'après la composition de l'association, d'après son caractère et la position géologique, le redépôt des polypiers à partir de la cordillère de Baška est le plus probable.

La faune madréporique crétacée de Klokočov n'est pas unique dans les Carpates et dans les Alpes Orientales. Une faune plus ou moins du même âge, aussi redéposée, se trouve à Deljatina dans les Carpates Orientales en Ukraine. La description de cette localité et de la roche d'après Zuber, sont présentées dans le travail de F. TRAUTH 1911; la faune a été décrite par J. FELIX 1906. La faune madréporique de la couverture de la zone de klippes et des Monts de Brezová a été décrite par O. KÜHN et D. ANDRUSOV 1930, 1937. Les localités nouvelles de la zone de klippes, avec la détermination préliminaire de la faune corallienne du Cénomanien et du Sénonien, ont été signalées par E. SCHEIBNER 1960. D. ANDRUSOV, 1945, a mentionné une faune madréporique non encore décrite, provenant des conglomérats des Couches de Záskaří dans la région d'Orava. H. VETTERS, 1925, a décrit dans les Alpes Orientales, une petite association de deux espèces jusqu'alors connues seulement aux environs de Klokočov, c'est-à-dire *Actinacis remesi* et *Polytremacis lindströmi*. H. VETTERS (l. c.) écrit que la faune est redéposée et il la signale dans deux localités: Ollersbach près de Neulengbach et St. Peter in der Au (Paleocène jusqu'à Eocène de la nappe partielle de Greifenstein du flysch de Wiener Wald). Les récoltes de la faune madréporique du type de Klokočov dans les Alpes Orientales indiquent que ces formes étaient présentes dans la région septentrionale de la Téthys.

Dans toutes les sus-dites localités, la faune se présente dans des roches clastiques grossières, c'est-à-dire conglomérats, brèches et boues à galets constituant des intercalations dans des argilites. Ils s'agit probablement de glissements provoqués par les mouvements lamiens ou plus jeunes (voir D. ANDRUSOV 1959, M. KSIĄŻKIEWICZ 1958).

La présence d'une faune d'eau peu profonde, redéposée dans les sédiments de bassin, conduit à la supposition de l'existence d'élévations- cordillères dans la zone de sédimentation des Carpates. Dans les parties d'eau peu profonde des cordillères pouvait s'installer une faune madréporique. Le peuplement à Scléractiniaires y était vraisemblablement discontinu dans l'espace et dans le temps. La faune madréporique était peu diversifiée. Dans l'association, quelques espèces résistantes se retrouvent à plusieurs niveaux.

Du point de vue de la répartition des Scléractiniaires du Crétacé en Europe, l'association de Klokočov montre un caractère de transition entre les faunes de la plate-forme de l'Europe et les faunes de la Téthys.

Conclusion

La faune madréporique de Klokočov, aux environs nord-est de Příbor en Moravie, provient des conglomérats, grès et boues à galets qui représentent des intercalations dans les Couches de Frýdek ou celles de Třinec (Crétacé supérieur de l'unité Sous-silésienne, la zone du flysch des Carpates externes). L'association de la faune madréporique a été étudiée pour la première fois par F. TRAUTH en 1911.

Dans cette étude, l'auteur décrit 18 taxons (dont 1 genre et 3 espèces sont nouveaux) provenant de matériel récolté par elle-même sur le Terrain.

Dans le tableau sont incluses également les formes déterminées par F. TRAUTH (l.c.) en tenant compte de leur reclassement systématique éventuel. De la comparaison des Madréporaires de Klokočov avec les assemblages du Crétacé des autres localités, on en déduit leur caractère de transition entre les associations de Scléractiniaires de la plate-forme de l'Europe et celles de la Téthys.

L'âge des Madréporaires de Klokočov (polypiers redéposés) correspond probablement à la période du Cénomaniens jusqu'au Santonien.

La faune des Scléractiniaires de Klokočov montre quelques traits spécifiques: environ 90 % de la population madréporique sont représentés par une seule espèce, *Actinacis remesi*. Dans cet assemblage, les polypiers solitaires ne sont pas présents. La faune est endémique dans la proportion d'un tiers. Les Rudistes ne sont présents en même temps que les coraux.

La faune madréporique représente probablement une association de précurseurs d'une étape relativement courte où les conditions de vie n'étaient pas très favorables pour les coraux ce qui n'a pas permis une diversification plus variée.

Les polypiers trouvés aux environs nord-est de Příbor étaient vraisemblablement déjà silicifiés avant leur transport et, durant les mouvements laramiens ou éventuellement plus jeunes, ils ont été redéposés comme des grains clastiques grossiers dans les parties les plus basses du bassin.

Traduction: J. Košáková

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Koráli ze vrchní křídý Beskyd

Résumé

Korálová fauna z okolí Příbora na Moravě je již částečně známá z práce F. Trautha 1911. Korálové trsy jsou součástí klastik redeponovaných do frýdeckých a třineckých vrstev (senon — paleogén) podslezské jednotky vnějších flyšových Karpat. Proto stáří korálové fauny, tj. pravděpodobně svrchní cenoman až spodní santon, nesouhlasí se stářím horniny, která je mladší. V předkládané práci je popsáno 18 druhů korálů (1 rod a 3 druhy jsou nové). Společenstvo korálů má přechodný charakter mezi křídovými korálovými asociacemi epivariské platformy a Tethydy (Karpát a Alp). Korálová fauna z okolí Příbora představuje pionýrské společenstvo existující v krátké etapě příhodných podmínek pravděpodobně na západní straně bažské kordilery. Za laramických, případně mladších pohybů byly již silicifikované korálové kolonie redeponovány do hlubších částí pánve.

Explication des planches XLVII—LXII

Planche XLVII

- 1, 2 *Actinastraea hexaphylloides* (FELIX, 1906). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Plaque mince.
- 1 Section transversale. 9 ×.
- 2 Détail de Pl. XLVII/1. 21 ×.

Planche LXVIII

- 1, 2 *Cyathophora* sp. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.
- 1, Fragment de la colonie. Ca 4 ×.
- 2, Plaque mince, section transversale. 8, 25 ×.
- 3 *Pseudocoeniopsis uhligi* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Plaque mince, section transversale. 7,5 ×.

Planche LXIX

- 1, 2 *Monticulastraea roseola* sp. n. Holotype. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.
- 1 Plaque mince, section transversale. 6, 75 ×.
- 2 Plaque mince, section longitudinale. 6, 75 ×.

Planche L

- 1 *Monticulastraea roseola* sp. n. Holotype. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Plaque mince. Section transversale. 6, 75 ×.
- 2 et 3 *Actinacis remesi* FELIX, 1903. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.
- 2 plaque mince, section transversale, 21 ×.
- 3 plaque mince, section longitudinale, 21 ×.

Planche LI

- 1, 2 *Plesiastraeopsis moravica* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.
- 1 plaque mince, section transversale, 6, 75 ×.
- 2 plaque mince, section longitudinale, 6, 75 ×.

Planche LII

- 1 cf. *Phyllocoeniopsis lepidoides* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Section transversale. Plaque mince. 6, 75 ×.
- 2 *Mesomorpha chaetoides* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Section transversale. Plaque mince. 46, 5 ×.

Planche LIII

- 1 *Rothastrea bieskidensis* (TRAUTH, 1911). Surface calicifère. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Ca 2 ×.
- 2 *Fungiastraea* sp. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Plaque mince. Section transversale. 9 ×.

Planche LIV

- 1, 2 *Dimorphomeandra* sp. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.
- 1 plaque mince, section transversale 21 ×.
- 2 plaque mince, section longitudinale, 21 ×.
- 3 *Rothastrea retifera* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Plaque mince. Section transversale. 6, 75 ×.

Planche LV

- 1, 2 *Rothastrea bieskidensis* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.
- 1 plaque mince, section transversale, 9 ×.
- 2 plaque mince, section longitudinale, 9 ×.

Planche LVI

- 1, 2 *Rothastrea retifera* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.
- 1 plaque mince, section transversale 6, 75 ×.
- 2 plaque mince, section oblique, 6, 75 ×.
- 3 *Actinacis remesi* FELIX, 1903. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur. Un polypier. Ca 0, 6 ×.

Planche LVII

- 1, 2 *Rothastrea laurina* sp.n. Holotype. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur:
- 1 plaque mince, section transversale, 6, 75 ×.
- 2 plaque mince, section longitudinale (oblique), 6, 75 ×.

Planche LVIII

- 1, 2 *Rothastrea lubinensis* sp.n. Holotype. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanien supérieur jusqu'à Santonien inférieur.

- 1 plaque mince, section transversale, 8,25 × .
- 2 plaque mince, section longitudinale, 8, 25 × .

Planche LIX

- 1, 2 *Actinacis remesi* FELIX, 1903. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanién supérieur jusqu'à Santonien inférieur.
- 1 plaque mince, section transversale, 21 × .
- 2 plaque mince, section longitudinale, 21 × .

Planche LX

- 1 *Actinacis remesi* FELIX, 1903. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanién supérieur jusqu'à Santonien inférieur. Plaque mince. Section transversale. 21 × .
- 2 *Polytremacis tenera* (TRAUTH, 1911). Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanién supérieur jusqu'à Santonien inférieur. Plaque mince. Section transversale. 17, 25 × .

Planche LXI

- 1, 2 *Actinacis cymatoclysta* FELIX, 1906. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanién supérieur jusqu'à Santonien inférieur.
- 1 plaque mince, section transversale, 21 × .
- 2 plaque mince, section longitudinale, 21 × .

Planche LXII

- 1, 2 *Polytremacis lindströmi* REMEŠ, 1898. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanién supérieur jusqu'à Santonien inférieur.
- 1 plaque mince, section transversale, 17, 25 × .
- 2 plaque mince, section longitudinale, 17, 25 × .
- 3 *Rothastrea laurina* sp. n. Klokočov près de Příbor. Couches de Frýdek. Faune redéposée. Age probable de l'espèce: Cénomanién supérieur jusqu'à Santonien inférieur. Plaque mince. Section transversale. 6, 75 × .

Toutes les photographies: K. Navrátilová, ÚÚG, Praha.

Miroslav Plička — Zuzana Siráňová

Hostynichnium duplex ichnogen. n. sp. n. — a new trace fossil from the Carpathian Flysch of Czechoslovakia

1 text-fig. 1 pl. (LXIII), Czech summary

Abstract. The authors present a new fossil trace found on the subface of sandstone stratum of the Soláň Formation of the Magura Flysch (Paleocene), in a quarry SE of Chvalčov in Hostýnske vrchy hills. It is provided with new generic and species denomination *Hostynichnium duplex* ichnogen. n. sp. n.

Introduction

Studying the rock cleavage on surface exposures in the western part of the Magura Flysch in 1986 in a quarry SE of Chvalčov we found a double intermittent trace on the subface of a sandstone clast from the Soláň-Formation. The locality is rich in fossil traces. They have been studied there since 1960 (M. PLIČKA 1968, 1970). The finding place is 5 km SE of Bystřice pod Hostýnem, in the Hostýnske vrchy hills.

The newly found fossil trace partly resembles the fossil trace *Tuberculichnus meandrinus* of KŚIAŹKIEWICZ 1977 (M. KŚIAŹKIEWICZ 1977). This trace is simple and occurred in our territory in 1961 (M. PLIČKA 1970) and later on in Poland (M. KŚIAŹKIEWICZ 1977). It differs mainly in its double course.

Systematical description

Ichnogenus *Hostynichnium* ichnogen. n.

Type specimen: *Hostynichnium duplex* ichnosp. n.

Denomination: according to the finding place — Hostýnske vrchy hills.

Diagnosis: Intermittent double trace (positive hyporelief). Projections of the trace are parallel to one another in distances of 2—2,5 cm.

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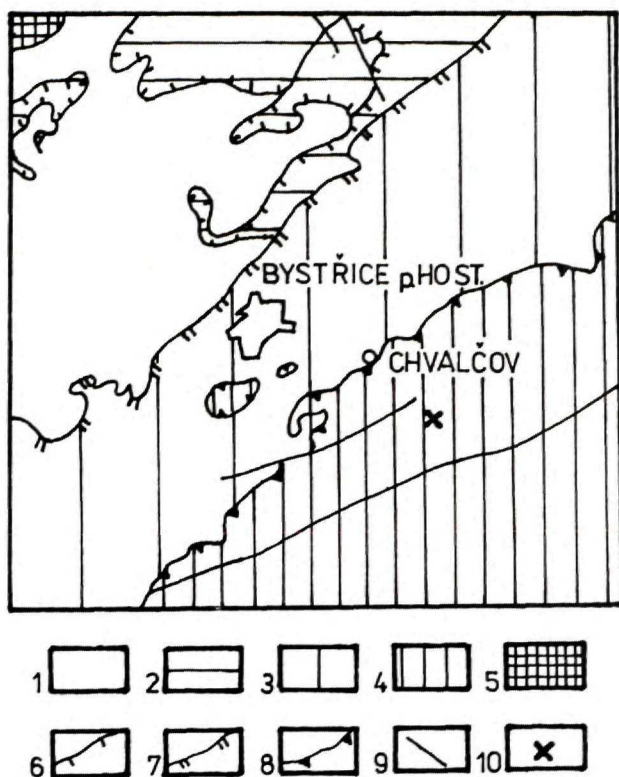


Fig. 1 Geologic situation of occurrence site of new fossil trace according to geological map 1:200 000 of sheet Olomouc (Z. ROTH et al. 1963). 1 — Neogene; 2 — Subsilesian-Ždánice unit; 3 — Silesian unit; 4 — Magura Flysch; 5 — Lower Carboniferous; 6 — overthrust line of Ždánice-Subsilesian unit; 7 — overthrust line of Silesian unit; 8 — overthrust line of Magura nappe; 9 — fault; 10 — finding place of new fossil trace.

Stratigraphical range: The Soláň Formation of the Magura Flysch (Paleocene), Outer—Carpathian Flysch.

***Hostynichnium duplex* ichnosp. n.**

Plate LXIII

Holotype: Sample No. Ge 24136, deposited in the collection of the Moravian Museum in Brno.

Type locality: A quarry near the road, 2 km SE of Chvalčov.

Type level: Paleogene sandstone facies of the Soláň formation of the Magura Flysch (Paleocene), the Outer Carpathians.

Denomination: from Latin "duplex".

Material: Three clasts of greenish-grey, fine-grained sandstone. The dimensions of the holotype (sample Nr. Ge 24136) are 22 × 15 × 7 cm.

Diagnosis: An intermittent double trace, its parallel projections are in 2—2,5 cm distance from one another (perpendicular to the trace course).

Description: Two belts of parallel projections (positive hyporelief), 2—6 mm wide are on a sandstone subsurface. The projections range up to 2,5 mm in height (= depth of sting into sea floor surface). The stings along the trace course are in 2—8 mm distance from one another. The stings on both sides of the trace are identic — they may be correlated by a perpendicular line in relation to the centre of the double trace.

Remark: In the mode of stings into the sea floor surface resembles to some extent the fossil trace found in the Zlín Formation (Eocene) near Kysucké Nové Mesto in Slovakia and later on in Poland where it got a new generic and species name *Tuberculichnus meandrinus* KŚIAŹKIEWICZ, 1977 (M. KŚIAŹKIEWICZ, 1977). The fossil trace *Hostynichnium duplex* shows a double parallel to subparallel course of stings into the clayey sea floor surface. In its double course the traces resembles the fossil trace *Saerichnites beskidensis* PLIČKA 1974 from the Gudula Formation in Beskydy Mts. (Cretaceous), (M. PLIČKA 1974) and *Saerichnites abruptus* BILLINGS 1966 from an Ordovician formation in Canada (W. HÄNTZSCHEL 1962).

Sediment: Greenish-grey, fine-grained, calcareous sandstone, laminated, micaceous, bluish-grey when fresh.

Association: *Planolites* sp., *Merostomichnites* sp., *Granularia* sp., *Helminthopsis tenuis*, *Chondrites forma intricatus*, *Helminthoida crassa*, *Cosmorhappe sinuosa*, *Tuberculichnus meandrinus*, *Helicorhappe meandriformis* ichnogen. n. sp. n. (M. PLIČKA — A. KOKOLUSOVÁ, in print).

Origin: The fossil trace *Hostynichnium duplex* ichnogen. n. sp. n. resulted from the touches of as sea organism projections, most likely of a fish moving near the sea floor. Similar is the origin of the double trace *Saerichnites beskidensis* PLIČKA, 1974 in the Gudula Formation of the Carpathian flysch in Czechoslovakia (M. PLIČKA, 1974).

Conclusions

The new trace completes the spectrum of fossil traces found in the Soláň Formation in the western part of the Carpathian flysch in Czechoslovakia. The locality studied SE of Chvalčov is very rich in fossil traces. Recently there was found another fossil trace *Helicorhappe meandriformis* sp. n. (M. PLIČKA — A. KOKOLUSOVÁ, in print). Also A. NĚMCOVÁ (1973) found various species of fossil traces at the locality mentioned.

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Miroslav Plička — Zuzana Siráňová

Hostynichnium duplex ichnogen. n. sp. n. — nová fosilní stopa z karpatského flyše v Československu

Resumé

Při studiu puklinatosti hornin na povrchových odkryvech v západní oblasti magurského flyše v r. 1986 jsme zjistili v lomu jv. od Chvalčova na spodní vrstevní ploše úlomku pískovce soláňského souvrství dvojitou stopu, která má přerušovaný průběh. Místo nálezu leží v čelní zóně magurského flyše v Hostýnských vrších. Pro fosilní stopu jsme zvolili nový rodový a druhový název *Hostynichnium duplex* ichnogen. n. sp. n.

Stopa vznikla činností mořských organismů, pravděpodobně ryb, pohybujících se těsně při mořském dně. Nová fosilní stopa se způsobem vpichů do povrchu mořského dna podobá do jisté míry fosilní stopě rodu *Tuberculichnus meandrinus* KŚIAŻKIEWICZ, 1977 (M. KŚIAŻKIEWICZ, 1977), je však oproti ní zdvojená. Zdvojením průběhu stopy se do jisté míry podobá fosilní stopě *Saerichnites beskidensis* PLIČKA, 1974 (M. PLIČKA, 1974) a stopě *Saerichnites abruptus* BILLINGS, 1966 z ordoviku v Kanadě (W. HÄNTZSCHEL, 1962).

Explanations of Plates LXIII
(Photographed by V. Kosmák)

Plate LXIII

- 1 *Hostynichnium duplex* ichnogen. n. sp. n., sandstone bed subface (paleocene). Quarry SE of Chvalčov; holotype.
- 2 *Hostynichnium duplex* ichnogen. n. sp. n., sandstone bed subface (Paleocene). Quarry SE of Chvalčov; holotype.

Miroslav Plička — Anna Kokolusová

Helicorhaphe meandriiformis sp. n. a new fossil trace from Carpathian Flysch of Czechoslovakia

2 text-fig. 1 pl. (LXIV); Czech summary

Abstract. The authors present a new fossil trace found on a sandstone bed surface from the Soláň Formation (Paleocene) in the front zone of the Magura nappe in a quarry in the Hostýnske vrchy hills. The fossil trace is denoted as *Helicorhaphe meandriiformis* sp. n.

Introduction

During an occasional visit to a quarry in the Soláň Formation sandstones in the front zone of the Magura nappe SE of Chvalčov A. KOKOLUSOVÁ found a fossil trace on sandstone clasts. The trace is identic with my find of a fossil trace in 1962. I found the trace in a quarry where I was studying fissure tectonics on surface exposures in the Carpathian Flysch (M. PLIČKA 1970, 1974). We have compared the two traces and present now the results.

Systematical description

Ichnogenus *Helicorhaphe* KSIĄŻKIEWICZ, 1961

Description: Helicoid strings along the horizontal axis (M. KSIĄŻKIEWICZ, 1977, p. 115)

Occurrence: Carpathian Flysch — Poland (Paleocene, Eocene); Czechoslovakia (Paleocene).

***Helicorhaphe meandriiformis* sp. n.**

Plate LXIV, Fig. 2

Holotype: Sample Nr. Ge 24137, deposited in collections of Moravian Museum in Brno.

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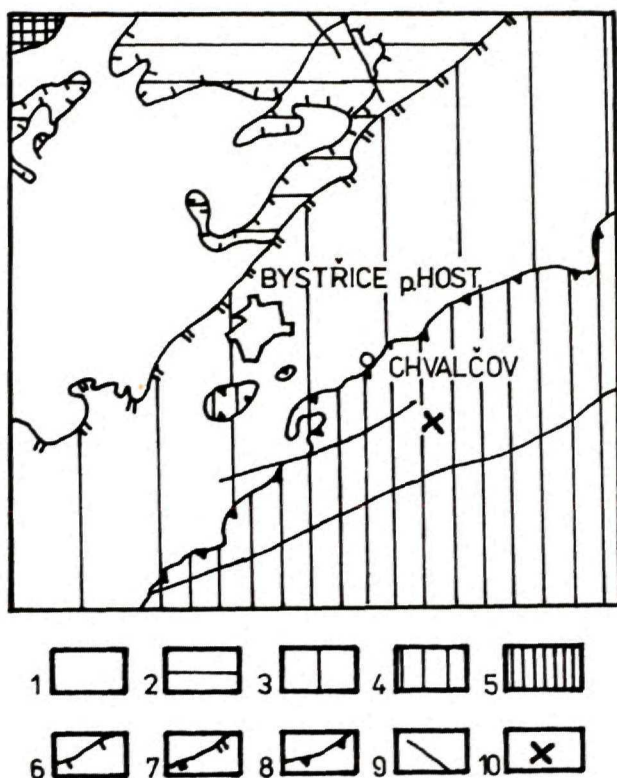


Fig. 1 Geologic situation of occurrence place of new fossil trace according to Geological map 1:200 000 sheet Olomouc (Roth et al. 1963)

1 — Neogene, 2 — Subsilesian — Ždánice unit, 3 — Silesian unit, 4 — Magura Flysch, 5 — Lower Carboniferous, 6 — overthrust line of Ždánice-Subsilesian unit, 7 — overthrust line of Silesian unit, 8 — overthrust line of Magura nappe, 9 — significant fault, 10 — place of find of new fossil trace

Type locality: Quarry near road, 2 km SE of Chvalčov.

Type level: Sandstone facies of Solán Formation of the Magura Flysch (Paleocene), Inner-Carpathian Flysch.

Denomination: According to the meander-like course of the trace.

Material: Four clasts of fine-grained sandstones. Holotype specimen dimensions are 23 × 13 × 5 cm.

Diagnosis: Meandering trace, of cylindrical form, approximately perpendicular to the trace course (positive hyporelief). In the place of the meandering bend the ends of the cylinders on the inner side of the trace bend approximate each. The trace is meandering. On 1 cm of its length are four cylinders. In its course the trace sometimes approximates the preceding, formerly formed meander (see Tab. LXIV, Fig. 2). The cylinders are parallel to each other. In the place where the trace bends more sharply, the ends of cylinders approximate

each other to touch. Single cylinders are about 0.5 mm wide range up to 8 mm in length, most of them are 5 mm long. Single trace meanders are 4—6 mm long.

Remark: The new found fossil trace consisting of minute cylinders, approximately perpendicular to its course (positive hyporelief) resembles in its cylinders shape and arrangement the fossil trace *Helicorhapbe tortilis* KŚIAŻKIEWICZ, 1970 [M. KŚIAŻKIEWICZ 1977, p. 116, Pl. 11/10; W. HÄNTZSCHEL 1975, p. W 70, Fig. 43 (4)]. By the cylinders the new fossil trace also resembles the fossil trace of the genus *Haentzschelina otto* (GEINITZ) (W. HÄNTZSCHEL 1975, p. W. 65, Fig. 42 (3a, 3b)). The trace of the genus *Haentzschelina otto* (GEINITZ) shows a circular course in contrast to the meandering new fossil trace *Helicorhapbe meandriformis* sp. n. and straight minor trace *Helicorhapbe tortilis* KŚIAŻKIEWICZ, 1970. the circle diameter is about 5 cm the centre is slightly uplifted, the single cylinders extend to the centre of the circle (W. HÄNTZSCHEL, 1975).

Sediment: Greenish-grey, fine-grained, fine-micaceous, laminated sandstone.

Association: *Planolites* sp., *Merostomichnites* sp., *Granularia* sp. *Helminthopsis tenuis*, *Chondrites forma intricatus*, *Helminthoida crassa*, *Cosmorhaphe sinuosa*, *Tuberculichnus meandrinus*, *Hostynichnium duplex* ichnogen. n.sp. n. (M. PLÍČKA — Z. SİRÁŇOVÁ, in print).

Origin: The trace resulted from a sea organism meandering movement over the clayey sea floor surface. W. HÄNTZSCHEL (1975) points out to similar traces of organisms, mentioned by A. H. MÜLLER (1971). A. H. MÜLLER (1977, p. 60, Pl. 1, Fig. 4). Presented photographs of a recent trace of the Belorhaphe type, with a loop-lined course on the near-coast sandy surface, and of a trace

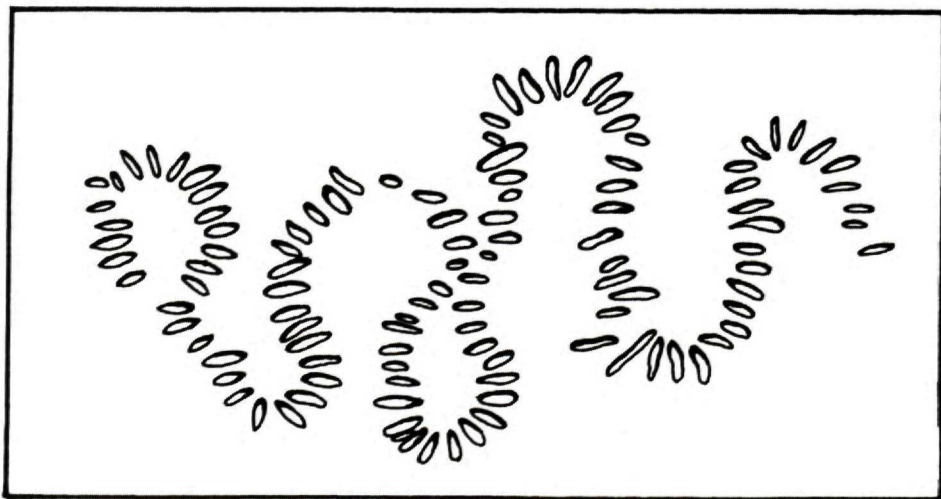


Fig. 2 *Helicorhaphe meandriformis* sp. n., lower surface of Soláň Formation sandstone (Paleocene). Quarry SE of Chvalčov, holotype sample No. 24137. $\times 1$

resembling in its shape and size our fossil trace *Helicorhaphe meadriformis* sp. n. In its almost straight course the recent trace presented by A. H. MÜLLER (1977) is identic rather with the minute fossil trace *Helicorhaphe tortilis* KŚIAŻKIEWICZ, 1970. A. H. MÜLLER (1977) assumes that recent traces on the sandy sea coast resulted from insect activity (*Insecta, Coleoptera*).

Conclusions

A detailed study of fossil traces facilitates finding of quite new traces and results in new information about their distribution in stratigraphic complexes studied, and also comparison with other traces of similar outlook from other areas. The results of such comparisons may indicate the character of depositional environment and depth conditions of the depositional basin in that area. The new finds complete and broaden the spectrum of fossil traces.

The locality with the new fossil trace is very rich as regards the variety of genera and species. It is documented by the results of the latest investigations (A. NĚMCOVÁ, 1973, M. PLIČKA — Z. SİRÁŇOVÁ, in print).

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***Helicorhapse meandriformis* sp. n. — nová fosilní stopa
z karpatského flyše v Československu**

Resumé

Na spodní vrstevní ploše úlomku jemnozrnného, zelenavěšedého pískovce (positivní hyporelief) zjistili jsme v lomu 2 km jv. od Chvalčova novou fosilní stopu. Nález pochází z pískovců solánského souvrství (paleocén) v Hostýnských vrších v čelní zóně magurského flyše. Průběh stopy je meandrovitý.

Stopa sestává z válečkovitých tvarů, ležících přibližně kolmo k jejímu průběhu. Na jeden centimetr délky stopy jsou 4 válečky. Válečky jsou k sobě navzájem přibližně paralelní. Jednotlivé válečky jsou asi 0,5 mm široké a dosahují délky až 8 mm. Pro novou fosilní stopu jsme zvolili nový druhový název *Helicorhapse meandriformis* sp. n.

Nově zjištěná fosilní stopa se poněkud podobá tvarem válečků a jejich uspořádáním fosilní stopě *Helicorhapse tortilis*, 1970, KSIĄŻKIEWICZ (M. KSIĄŻKIEWICZ 1977, p. 116, Pl. 11, fig. 10), která je však na rozdíl od nově zjištěné fosilní stopy velmi drobná a má přímý průběh. Rovněž je možné shledávat určitou analogii se stopou *Haentzschelina otto* (GEINITZ), (W. HÄNTZSCHEL, 1975), která však má válečky uspořádané do kruhu a střed kružnice je poněkud vyvýšený.

Explanation of Plate LXIV
(Photographed by V. Kosmák)

Pl. LXIV

Fig. 1 *Helicorhapse meandriformis* sp. n., lower surface of sandstone (Paleocene). Quarry SE of Chvalčov, holotyp

Fig. 2 *Helicorhapse meandriformis* sp. n., lower surface of sandstone (Paleocene). Quarry SE of Chvalčov, holotyp, detail.

Vysvětlivky k obrázkům v textu

Obr. 1 Geologická situace místa výskytu nové fosilní stopy dle geologické mapy 1:200 000 listu Olomouc (Z. ROTH et al., 1963). 1 — neogén; 2 — podslezsko-ždánická jednotka; 3 — slezská jednotka; 4 — magurský flyš; 5 — spodní karbon; 6 — přesunová linie ždánicko-podslezské jednotky; 7 — přesunová linie slezské jednotky; 8 — přesunová linie magurského příkrovu; 9 — význačnější zlom; 10 — místo nálezu nové fosilní stopy.

Obr. 2 *Helicorhapse meandriformis* sp. n., spodní vrstevní plocha pískovce solánského souvrství (paleocén). Lom jv. od Chvalčova. Holotyp, vz. č. 24137. × 1

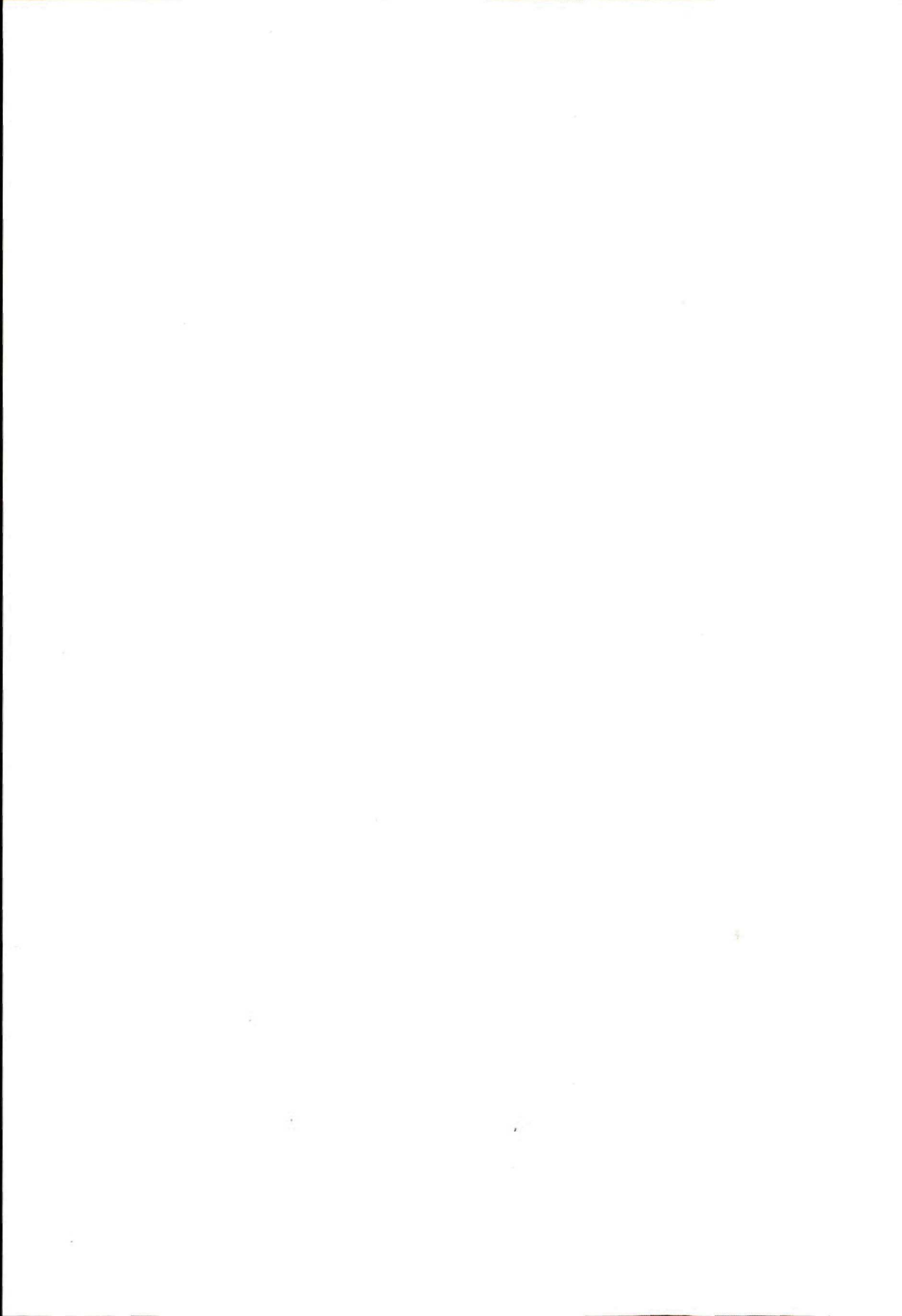
Vysvětlivky k tabulce LXIV

Tab. LXIV

1 *Helicorhapse meandriformis* sp. n., spodní vrstevní plocha pískovce (paleocén). Lom jv. od Chvalčova, holotyp.

2 *Helicorhapse meandriformis* sp. n., spodní vrstevní plocha pískovce (paleocén). Lom jv. od Chvalčova, holotyp, detail.

(Foto V. Kosmák)



Adriana Zlinská

Recent foraminifers from central equatorial part of Pacific Ocean (systematical part)

The systematical part, concerning recent foraminifers from equatorial part of the Pacific Ocean links up with the first part published by the authoress (A. ZLINSKÁ 1987) in ZK — Paleontológia 12, containing general data.

The systematical part is based on A. R. LOEBLICH and H. TAPPAN'S (1964) system with some modifications in accordance with V. POKORNÝ'S (1954) systematic work.

The systematic part concerns benthic and planktic calcareous foraminifers. No agglutinated forms were found. From the view of taxonomy the forms in question may be ranged to 14 families, 19 genera and 26 species.

Systematical part

Foraminiferida EICHWALD, 1830

Textulariidae EHRENBURG, 1838

Textularia DEFRANCE in DE BLAINVILLE 1824

Textularia sp.

(Pl. LXV, Fig. 1)

Remark: The fragment belongs to the genus *Textularia*. Precise species determination is impossible. The fragment was recovered from the depth 4.900 m.

Dimensions: L 2.3 mm; W 1.3 mm

Ataxophragmiidae SCHWAGER, 1877

Eggerella CUSHMAN, 1933

Eggerella brady nitens WIESNER, 1931

(Pl. LXV, Fig. 2)

1931 *Verneuilina brady nitens* WIESNER, p. 99 (non vidi) (fide B. F. ELLIS et A. R. MESSINA, 1950)

Remark: Three specimens of the species are preserved. The specimen depicted was recovered from the depth 4,900 m.

Dimensions: L 0.54—0.56 mm; W 0.45—0.57 mm

Miliolidae EHRENBERG, 1839

Pyrgo DEFRANCE, 1824

Pyrgo murrhina (SCHWAGER, 1866)

(Pl. LXV, Fig. 3)

1866 *Biloculina murrhina* SCHWAGER, p. 303, pl. 4, figs. 15a—c (non vidi), (fide R. G. DOUGLAS, 1973)

1973 *Pyrgo murrhina* (SCHWAGER) — R. G. DOUGLAS, p. 632, pl. 6, fig. 9

Remark: Ten specimens of this species are preserved. They are identical with specimens depicted by R. HERB (1971, p. 269, pl. 3, fig. 6; p. 293, pl. 13, figs. 2a—b), R. G. DOUGLAS (1973, p. 632, pl. 6, fig. 9) and P. R. THOMSON (1980, p. 802, pl. 7, fig. 15). The specimen depicted was recovered from depth 4,900 m

Dimensions: L 1.46 mm; W 1.36 mm

Nodosariidae EHRENBERG, 1838

Lenticulina LAMARCK, 1804

Lenticulina aff. *cultrata* (MONTFORT, 1808)

(Pl. LXV, Fig. 4)

1808 *Robulus cultratus* MONTFORT, p. 214 (non vidi), (fide A. D. ALBANI 1970)

1970 *Lenticulina cultrata* (MONTFORT) — A. D. ALBANI, p. 75, pl. 10, fig. 10 (cum syn.)

Remark: The only specimen from the depth 4,983 m is preserved.

Dimensions: L 0.88 mm; W 0.22 mm

Polymorphinidae ORBIGNY, 1839

Pyrulina ORBIGNY in de la SAGRA, 1839

Pyrulina sp. (cf. *P. angusta* (EGGER)

(Pl. LXV, Fig. 5)

Remark: The only specimen from the depth 4983 m was preserved.
Dimensions: Length 0.88 mm, width 0.22 mm

Glandulinidae REUSS, 1860

Oolina ORBIGNY, 1839

Oolina desmophora (RYMER et JONES, 1872)

(Pl. LXV, Fig. 6)

1960 *Oolina desmophora* (RYMER et JONES) — R. W. BARKER, p. 120, pl. 58, figs. 42, 43

Remark: Two specimens of the species are preserved. The specimen depicted was recovered from depth 5.127 m

Dimensions: L 0.75 mm; W 0.43 mm

Oolina sp. (cf. *O. laevicostata* CUSHMAN et GRAY, 1946)

(Pl. LXV, Fig. 7)

Remark: The only specimen of the species was found at depth 4.736 m

Dimensions: L 2.0 mm; W 1.3 mm

Fissurina REUSS, 1850

Fissurina cf. *lacunata* (BURROWS et HOLLAND, 1895)

Pl. LXV, Fig. 8)

1895 *Lagena lacunata* BURROWS et HOLLAND, in T. R. JONES, p. 205, pl. 7, figs. 12a, b (non vidi)
(fide A. D. ALBANI, 1968)

1968 *Fissurina lacunata* (BURROWS et HOLLAND) — A. D. ALBANI, p. 105, pt. 8, fig. 16 (cum syn.)

Remarks: The species is scarce in the material studied. The description and depiction agrees with A. D. ALBANI's description (1968). The species was found in the depth 5127 m.

Dimensions: Length 0.39 mm. width 0.31

Fissurina marginata (MONTAGU, 1803)

(Pl. LXV, Fig. 9)

1803 *Vermiculum marginatum* MONTAGU, p. 524 (non vidi), (fide G. VILKS, 1969)

1969 *Fissurina marginata* (MONTAGU) — G. VILKS, p. 48, pl. 2, figs. 24a—b (cum syn.)

Remark: The only specimen preserved was found at depth 4.766 m

Dimensions: L 1.07 mm; W 0.73 mm

***Fissurina* sp. (cf. *F. scarenaensis* (HANTKEN, 1883)**

(Pl. LXV, Fig. 10)

Remark: The only specimen in the material studied comes from depth 4.766 m

Dimensions: L 0.5 mm; W 0.35 mm

***Fissurina subformosa* PARR, 1950**

(Pl. LXV, Fig. 11)

1950 *Fissurina subformosa* PARR, p. 313, pt. 6 (non vidi), (fide B. F. ELLIS et A. R. MESSINA, 1950)

Remark: The specimen occurs scarcely. It differs from the specimen described by W. J. PARR (1950) in its size. The specimens were found at depth 4.766 m

Dimensions: L 2.04 mm; W 0.6 mm

***Discorbidae* EHRENBERG, 1838**

***Rosalina* ORBIGNY, 1826**

***Rosalina* aff. *bertheloti* ORBIGNY, 1839**

(Pl. LXVI, Fig. 12)

1839 *Rosalina bertheloti* ORBIGNY, p. 135, pl. 1, figs. 28, 30 (non vidi), (fide A. D. ALBANI 1968)

1968 *Rosalina bertheloti* ORBIGNY—A. D. ALBANI, p. 109, pl. 8, figs. 19, 20, 25, 26 (cum syn.)

Remark: A. R. LOEBLICH et H. TAPPAN denote *Discopulvinulina* HOFKER, 1951 (type species *R. bertheloti*) as the synonym of *Discorbinella* CUSHMAN et MARTIN, 1953, but the form described has no secondary aperture on its convex side. It is absent with *Discorbinella* s. s. *R. bertheloti* occurs at depths 4.736 m and 4.983 m

Dimensions: L 0.6—0.7 mm; W 0.4—0.5 mm

***Hantkeninidae* CUSHMAN, 1927**

***Hastigerina* THOMSON in MURRAY, 1876**

***Hastigerina aequilateralis* (BRADY, 1879)**

(Pl. LXVI, Fig. 13)

1879 *Globigerina aequilateralis* BRADY, p. 71 (non vidi), (fide P. J. BERMUDEZ et H. M. BOLLI, 1969)

1969 *Hastigerina aequilateralis* (BRADY) — P. J. BERMUDEZ et H. M. BOLLI, p. 180, pl. 17, figs. 4, 5 (cum syn.)

Remark: The species is scarce in the material studied. It was found at depth 4.766 m and 5.127 m

Dimensions: L 0.5—1.2 mm; W 0.4—1.02 mm

Globorotaliidae CUSHMAN, 1927

Globorotalia CUSHMAN, 1927

Globorotalia menardii (ORBIGNY, 1826)

(Pl. LXVI, Fig. 14)

1826 *Rotalia* (*Rotalia*) *menardii* ORBIGNY, p. 273 (non vidi), (fide R. CIFELLI, 1974)

1969 *Globorotalia menardii* (ORBIGNY) — J. HOFKER, p. 128, fig. 340, 407—420 (cum syn.)

1974 *Globorotalia menardii* (ORBIGNY) — R. CIFELLI, p. 181, pl. 3, fig. 1a—c

Remark: J. HOFKER (1956) analyses the species from Santa Cruz, from depth 800 m. The species is quite frequent. In contrast to *Globorotalia tumida* it is more rounded and more compressed. *G. menardii* and *G. tumida* are monolamellar, with the secondary thickening above outer walls with specimens living near or on the sea floor. It is also quite frequent in the material obtained. It occurs at depths 4.766 m, 4.900 m, 4.983 m and 5.127 m.

Dimensions L 1.8—2.4 mm; W 1.4—1.8 mm

Globorotalia tumida (BRADY, 1877)

(Pl. LXVI, Fig. 15)

1877 *Pulvinulina menardii* (ORBIGNY) *tumida* BRADY — H. B. BRADY, p. 535 (non vidi) (fide W. E. FRERICHS, 1971)

1962 *Globorotalia tumida* (BRADY) — F. L. PARKER, p. 239, pl. 6, fig. 8, 10 (cum syn.)

1971 *Globorotalia tumida* (BRADY) — W. E. FRERICHS, p. 13, Pt. 2, fig. 8

Remark: Because of complicated conditions the age of fragments from the type locality is unknown. H. B. BRADY (1884, p. 692) says that the precise geological age was not determined. According to B. F. ELLIS and A. R. MESSINA (1940 et al.) the type level is "recent?", syntypes in the British Museum (BMNH), Late Tertiary — with respect to BANNER et BLOW (1960, p. 26). According to the citation the authors range the lectotype (depicted in the plates) to the Upper Miocene or Pliocene. They do not say on what is the age determination based. The species is quite frequent in our material. It was recovered from the depths 4.736 m, 4.766 m, 4.900 m and 5.127 m.

Dimensions: L 1.5—2.0 mm; W 1.06—1.3 mm

Globigerinidae CARPENTER, PARKER et JONES, 1862

Globigerina ORBIGNY, 1826

Globigerina aff. *dutertrei* ORBIGNY, 1839

(Pl. LXVI, Fig. 16)

1839a *Globigerina dutertrei* ORBIGNY, pt. 4, fig. 19—21 (non vidi), (fide R. CIFELLI, 1974)

1974 *Globigerina dutertrei* ORBIGNY—R. CIFELLI, p. 176, pt. 1, figs. 3a—b

Remark: The specimen partly resembles *Neogloboquadrina dutertrei* (REISS et al. 1971). It is regarded as identic with *Globigerina egeri* (PARKER 1958). It is smaller, its umbilicus is narrower and its umbilical dents are poorly developed.

The specimen was found in depth 4.736 m, 4.766 m and 5.127 m.

Globigerinoides CUSHMAN, 1927

Globigerinoides conglobatus (BRADY, 1879)

(Pl. LXVI, Fig. 17)

1879 *Globigerina conglobata* BRADY, p. 286 (non vidi), (fide W. E. FRERICHS, 1971)

1971 *Globigerinoides conglobatus* (BRADY) — W. E. FRERICHS, p. 8, pt. 2, fig. 4

Remark: *Globigerinoides conglobatus* (BRADY) is a thick-walled species, characteristic of a deeper area. It was recovered from depth 4.766 m.

Dimensions: L 0.82 mm; W 0.9 mm

Globoquadrina FINLAY, 1947

Globoquadrina venezuelana (HEDBERG, 1937)

(Pl. LXVI, Fig. 18)

1937 *Globigerina venezuelana* HEDBERG, p. 681, pt. 92, figs. 7a—b (non vidi), (fide C. W. POAG and W. H. AKERS, 1967)

1967 *Globoquadrina venezuelana* (HEDBERG) — C. W. POAG and W. H. AKERS, p. 172, pt. 17, figs. 12—14 (cum syn.)

Remark: The specimens are identic with those determined by C. W. POAG and W. H. AKERS, p. 172, pt. 17, fig. 12—14 and by D. KADAR (1975, p. 11, pt. 4, 5, figs. 27—30) *G. venezuelana* was recovered from the depth 4.766 m.

Dimensions: L 0.6—1.02 mm; W 0.7—0.95 mm

Pulleniatina CUSHMAN, 1927

Pulleniatina obliquiloculata (PARKER et JONES, 1862)

(Pl. LXVI, Fig. 19)

1862 *Pullenia obliquiloculata* PARKER et JONES, in W. B. CARPENTER et al., p. 183 (non vidi), (fide F. L. PARKER, 1962)

- 1865 *Pullenia sphaeroides* (ORBIGNY) var. *obliquiloculata* PARKER et JONES, p. 365, 368, pl. 19, figs. 4a—b (non vidi), (fide F. L. PARKER, 1962)
 1962 *Pulleniatina obliquiloculata* (PARKER et JONES) — F. L. PARKER, p. 234, pl. 4, figs. 13—16, 19, 22 (cum syn.)

Remark: The specimen is very frequent in the material studied. The specimens are identic with those depicted and described by F. L. PARKER (1962, p. 234, pl. 4, figs. 13—16, 19, 22), J. HOFKER (1969, p. 108, figs. 287—302), E. BOLTOVSKÝ (1974, p. 708, pl. 13, Fig. 12), P. R. THOMSON (1980, p. 796, pl. 4, figs. 10, 11) and G. KELLER (1980b, p. 828, pl. 2, figs. 14—16).

The specimens were recovered from depth 4.736 m, 4.766 m, 4.900 m, 4.983 m and 5.127 m.

Dimensions: L 0.48—1.23 mm; W 0.46—1.23 mm

Sphaeroidinella CUSHMAN, 1927

Sphaeroidinella dehiscens (PARKER et JONES, 1865)

(Pl. LXVI, Fig. 20)

- 1865 *Sphaeroidina bulloides* ORBIGNY var. *dehiscens* PARKER et JONES, p. 369, pl. 19, fig. 5 (non vidi), (fide J. HOFKER, 1969)
 1969 *Sphaeroidinella dehiscens* (PARKER et JONES) — J. HOFKER, p. 106, figs. 277—286 (cum syn.)

Remark: J. HOFKER (1956) revealed its relation to the genus *Pulleniatina* according to similarities in their smooth surface, hyaline wall material and overlapping structures on the ventral side of the last chambers. A. W. H. BÉ (1965) regards *Sphaeroidinella* as an evolutionary stage of the species *Globigerina sacculifera* (BRADY). Pores on young chambers of *G. sacculifera* (BRADY) are denser than on the chambers of *Sphaeroidinella*. The embryonic spiral of *G. sacculifera* differs from *Sphaeroidinella* in its horizontal profile, although according to A. W. H. BÉ (1965) there are no differences between young species. *Sphaeroidinella dehiscens* is scarce in the material studied. It was found in depth 4.766 m and 5.127 m.

Dimensions: L 0.7—1.3 mm; W 0.6—1.4 mm

Cassidulinidae ORBIGNY, 1839

Favocassidulina LOEBLICH et TAPPAN, 1957

Favocassidulina favus (BRADY, 1877)

(Pl. LXVII, Fig. 21)

- 1877 *Pulvinulina favus* BRADY, p. 535 (non vidi), (fide R. G. DOUGLAS, 1973)
 1973 *Favocassidulina favus* (BRADY) — R. G. DOUGLAS, p. 632, pl. 6, figs. 4, 5

Remark: The species are frequent in the material studied. The specimens

are identic with depictions by R. G. DOUGLAS (1973, p. 632, pl. 6, figs. 4, 5). They were found in depths 4.766 m, 4.900 m, 5.127 m.

Nonionidae SCHULTZ, 1854

Pullenia PARKER et JONES in CARPENTER, PARKER et JONES, 1862

Pullenia bulloides (ORBIGNY, 1846)

(Pl. LXVII, Fig. 22)

1846 *Nonionina bulloides* ORBIGNY, p. 107, pl. 5, figs. 9, 10 (non vidi), (fide R. G. DOUGLAS, 1973)
1973 *Pullenia bulloides* (ORBIGNY) — R. G. DOUGLAS, p. 638, pl. 9, figs. 4, 5

Remark: The specimens resemble those depicted by R. G. DOUGLAS (1973, p. 638, pl. 9, figs. 4, 5) P. R. THOMPSON (1980, p. 802, pl. 7, fig. 9) and by D. SCHNITKER (1979, p. 403, pl. 7, figs. 9, 10). *P. bulloides* was found in depths 4.766 m and 4.983 m.

Dimensions: L 0.3—0.5 mm; W 0.29—0.47 mm

Pullenia quinqueloba (REUSS, 1851)

(Pl. LXVII, Fig. 23)

1851 *Nonionina quinqueloba* REUSS, p. 71, pl. 5, fig. 31 (non vidi), (fide D. SCHNITKER, 1979)
1979 *Pullenia quinqueloba* (REUSS) — D. SCHNITKER, p. 402, pl. 7, figs. 15, 16

Remark: The only specimen preserved was recovered from depth 4.766 m.

Dimensions: L 1.1 mm; W 0.8 mm

Pullenia cf. subcarinata (ORBIGNY, 1839)

(Pl. LXVII, Fig. 24)

1839b *Nonionina subcarinata* ORBIGNY, p. 28, pl. 5, figs. 23, 24 (non vidi), (fide R. G. DOUGLAS, 1973)
1973 *Pullenia subcarinata* (ORBIGNY) — R. G. DOUGLAS, p. 638, pl. 9, figs. 6, 7

Remark: The specimens found resemble those depicted by R. HERBA (1971, p. 268, pl. 1, fig. 12, p. 298, pl. 16, figs. 8a—b). They were found in depth 4.983 m.

Dimensions: L 0.57 mm; W 0.49 mm

Alabaminidae HOFKER, 1951

Gyrodina ORBIGNY, 1826

Gyroidina neosoldanii BROTZEN, 1936

(Pl. LXVII, Fig. 25)

1936 *Gyroidina neosoldanii* BROTZEN, p. 158 (non vidi), (fide B. F. ELLIS et A. R. MESSINA, 1950)

Remark: The specimens found differ from *G. soldanii* in slightly bent and depressed sutures, number of whorls (in B. F. ELLIS et A. R. MESSINA, 1950). The specimens were found in depths 4.900 m and 4.983 m.

Dimensions: L 0.56—0.65 mm W 0.5—0.51 mm

Anomalinidae CUSHMAN, 1927

Melonis DE MONTFORT, 1808

Melonis pompilioides (FICHTEL et MOLL, 1798)

(Pl. LXVII, Fig. 26)

1798 *Nautilus pompilioides* FICHTEL et MOLL, p. 31, pl. 2, figs. a—c (non vidi), (fide R. G. DOUGLAS, 1973)

1973 *Melonis pompilioides* (FICHTEL et MOLL) — R. G. DOUGLAS, p. 638, pl. 9, fig. 8, 9.

Remark: The species is scarce in the material studied. It is characterized by strongly perforated walls. The specimen is identic to those depicted by R. G. DOUGLAS (1973, p. 638, pl. 9, fig. 9, 10), G. KELLER (1980a, p. 858, pl. 3, fig. 11, 12), P. R. THOMPSON (1980, p. 82, pl. 7, fig. 4). Our specimen depicted was recovered from depth 4.766 m.

Dimensions: L 0.8—0.9 mm; W 0.6—0.7 mm

Table 1 Frequency of species present in samples

Species	Percentage
<i>Textularia</i> sp.	0,5
<i>Eggerella brady nites</i>	1
<i>Pyrgo murrhina</i>	2
<i>Lenticulina</i> aff. <i>cultrata</i>	1
<i>Pyrolina</i> sp. (cf. <i>P. angusta</i>)	0,5
<i>Oolina desmophora</i>	0,5
<i>Oolina</i> sp. (cf. <i>O. laevicostata</i>)	0,5
<i>Fissurina</i> cf. <i>lacunata</i>	1
<i>Fissurina marginata</i>	0,5
<i>Fissurina</i> sp. (cf. <i>F. scarenaensis</i>)	0,5
<i>Fissurina subformosa</i>	0,5
<i>Rosalina bertheloti</i>	6,5
<i>Hastigerina aequilateralis</i>	2
<i>Globorotalia menardii</i>	19
<i>Globorotalia tumida</i>	19
<i>Globigerina</i> aff. <i>duertrei</i>	10
<i>Globigerinoides conglobatus</i>	2,5
<i>Globoquadrina venezuelana</i>	1,5
<i>Pulleniatina obliquiloculata</i>	18
<i>Sphaeroidinella dehiscens</i>	2
<i>Favocassidulina favius</i>	3,5
<i>Pullenia bulloides</i>	2
<i>Pullenia quinqueloba</i>	0,5
<i>Pullenia</i> cf. <i>subcarinata</i>	1
<i>Gyroidina neosoldanii</i>	2
<i>Melonis pompilioides</i>	2

Conclusion

The systematical treatment of 26 foraminiferal species resulted in Table 1 showing that planktic foraminifers dominate over benthic but their species are less frequent.

The specimens studied were found in depths 4.736 m, 4.900 m, 4.983 m and 5.127 m. They show no signs of dissolution, so they must have deposited above the compensation level.

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Adriana Zlinská

Recentné foraminifery z centrálnej rovníkovej časti Tichého oceánu

Resumé

Systematická časť recentných foraminifer z centrálnej rovníkovej oblasti Tichého oceánu nadväzuje na prvú časť, uverejnenú v Západných Karpatoch, sér. Paleontológia 12, v ktorej sú všeobecné údaje.

Systematická časť je spracovaná na základe systému A. R. LOEBLICH a H. TAPPANOVEJ (1964) so zohľadnením systematickej práce V. POKORNÉHO (1954).

Spracované sú planktonické a bentonické vápnité foraminifery z hĺbok 4736 m, 4766 m, 4900 m, 4983 m a 5127 m. Percentuálny podiel planktonických foraminifer je v prevahe nad bentonickými, avšak v počte druhov prevláda bentos nad planktónom. Získané formy možno taxonomicky priradiť k 14 čeľadiam, 19 rodom a 26 druhom.

Explanation of plates LXV—LXVII

Plate LXV

- 1 *Textularia* sp., zv. 40 ×
- 2 *Eggerella brady nitens* WIESNER, zv. 70 ×
- 3 *Pyrgo murrhina* (SCHWAGER), zv. 30 ×
- 4 *Lenticulina* aff. *cultrata* (MONTFORT), zv. 50 ×
- 5 *Pyrulina* sp. (cf. *P. angusta* (EGGER)), zv. 50 ×
- 6 *Oolina desmophora* (RYMER et JONES), zv. 60 ×
- 7 *Oolina* sp. (cf. *O. laevicostata* (CUSHMAN et GRAY)), zv. 25 ×
- 8 *Fissurina* cf. *lacunata* (BURROWS et HOLLAND), zv. 90 ×
- 9 *Fissurina marginata* (MONTAGU), zv. 40 ×
- 10 *Fissurina* sp. (cf. *F. scarenaensis* (HANTKEN)), zv. 90 ×
- 11 *Fissurina subformosa* PARR, zv. 25 ×

Plate LXVI

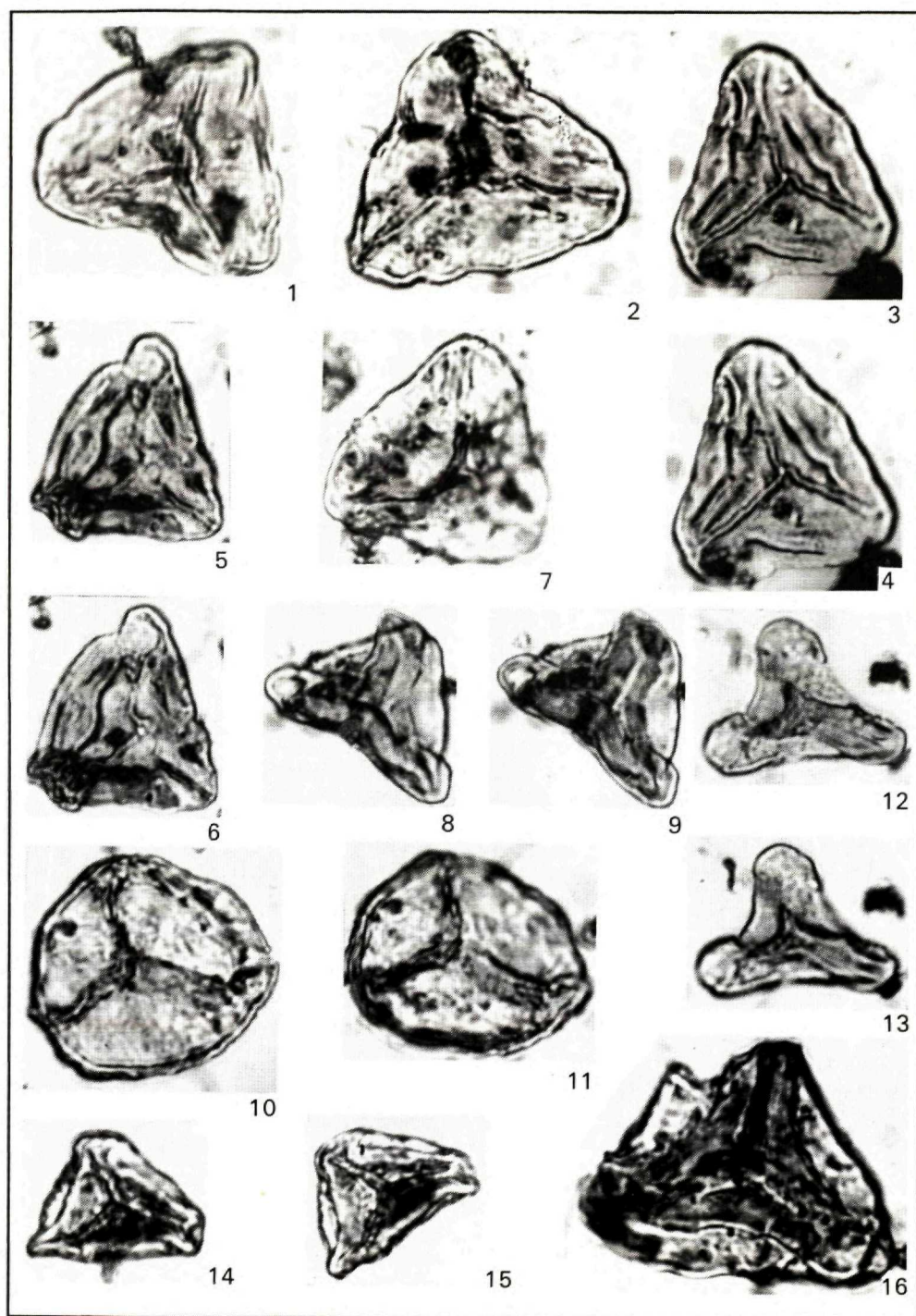
- 12 *Rosalina bertheloti* ORBIGNY, zv. 60 ×
- 13 *Hastigerina aequilateralis* (BRADY), zv. 35 ×
- 14 *Globorotalia menardii* (ORBIGNY), zv. 20 ×
- 15 *Globorotalia tumida* (BRADY), zv. 25 ×
- 16 *Globigerina* aff. *dutertrei* ORBIGNY, zv. 100 ×
- 17 *Globigerinoides conglobatus* (BRADY), zv. 50 ×
- 18 *Globoquadrina venezuelana* (HEDBERG), zv. 40 ×
- 19 *Pulleniatina obliquiloculata* (PARKER et JONES), zv. 40 ×
- 20 *Sphaeroidinella dehiscens* (PARKER et JONES), zv. 60 ×

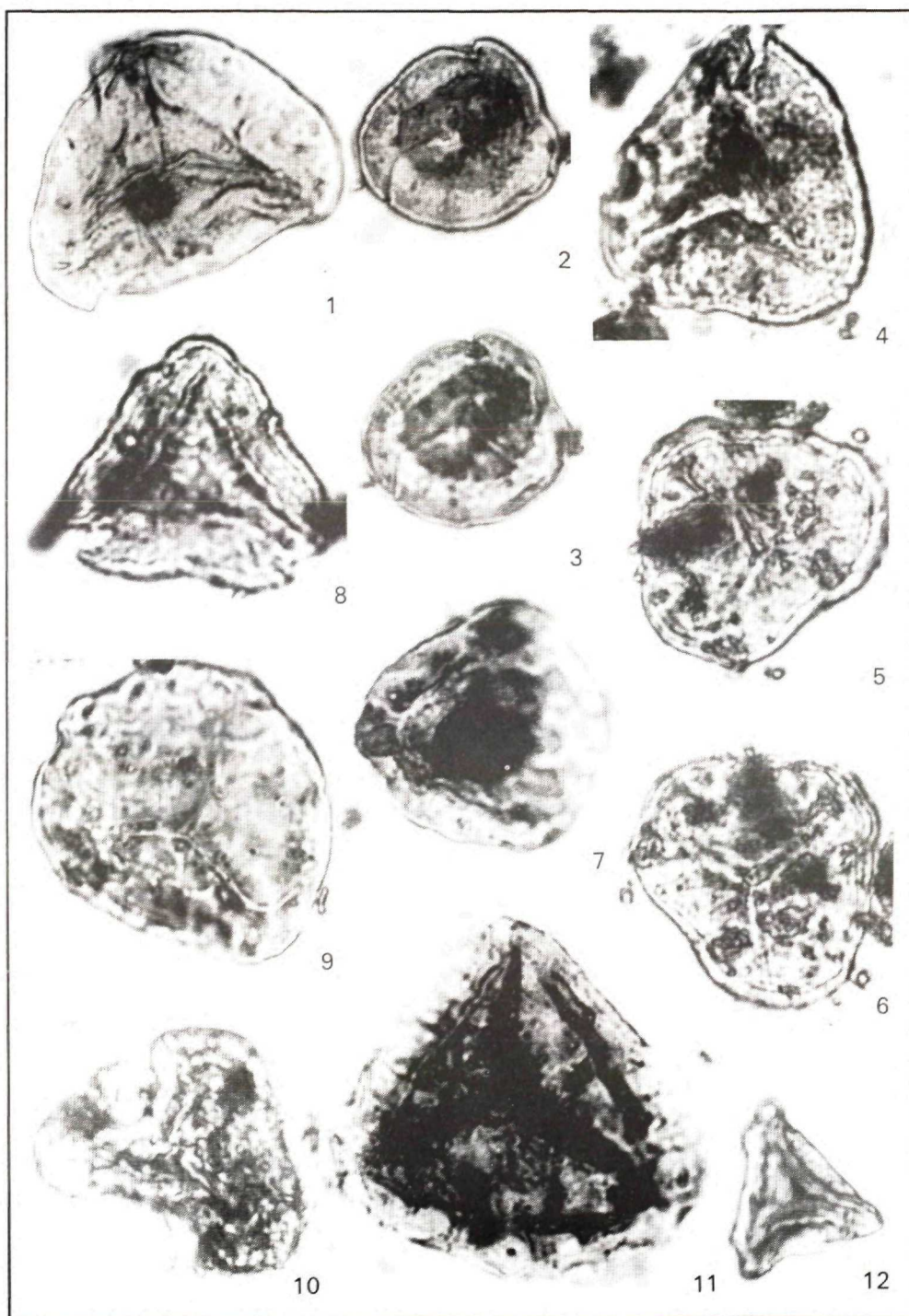
Plate LXVII

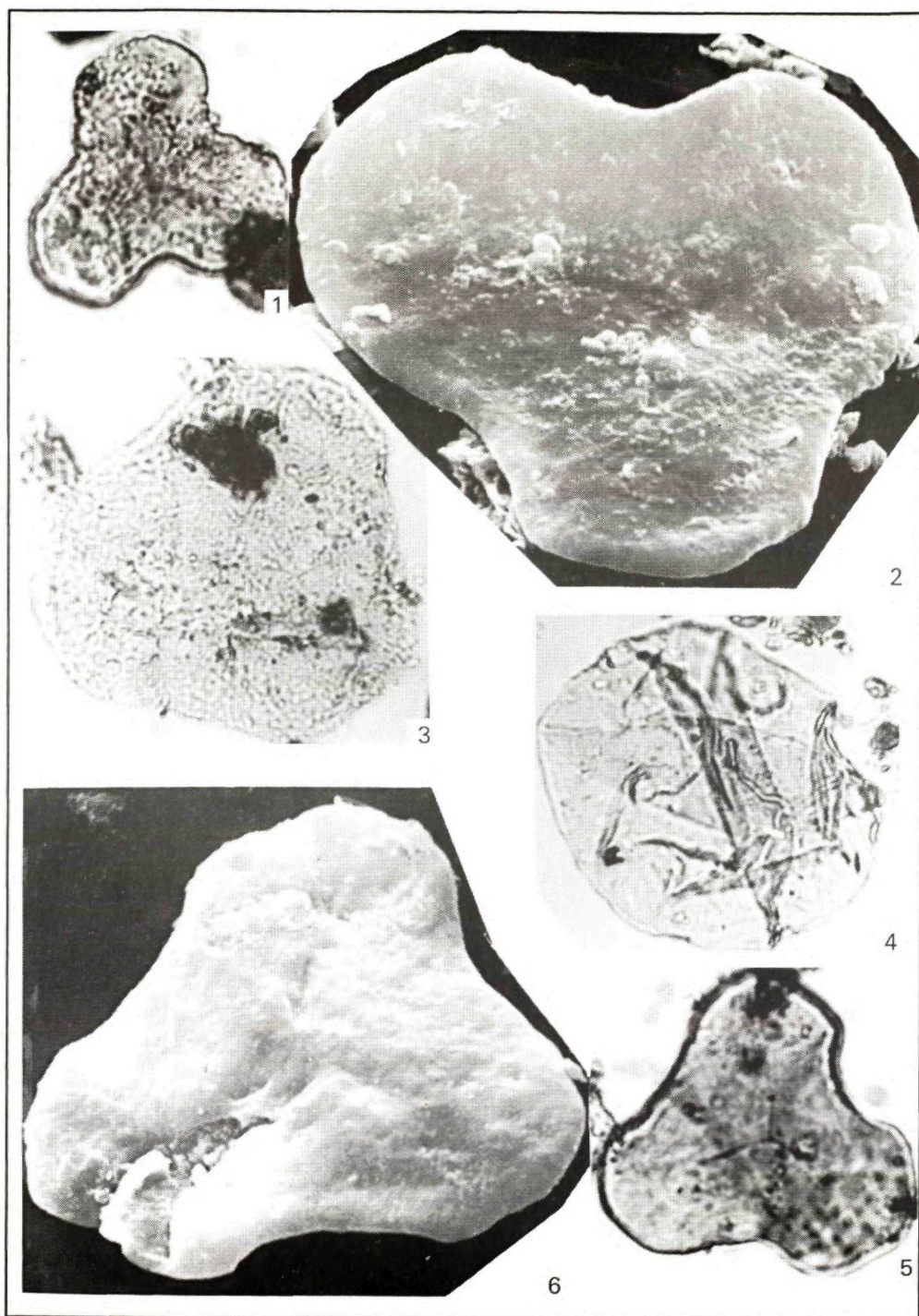
- 21 *Favocassidulina favus* (BRADY), zv. 30 ×
- 22 *Pullenia bulloides* (ORBIGNY), zv. 70 ×
- 23 *Pullenia quinqueloba* (REUSS), zv. 60 ×
- 24 *Pullenia* cf. *subcarinata* (ORBIGNY), zv. 80 ×
- 25 *Gyroidina neosoldanii* BROTZEN, zv. 80 ×
- 26 *Melonis pompilioides* (FICHTEL et MOLL), zv. 50 ×

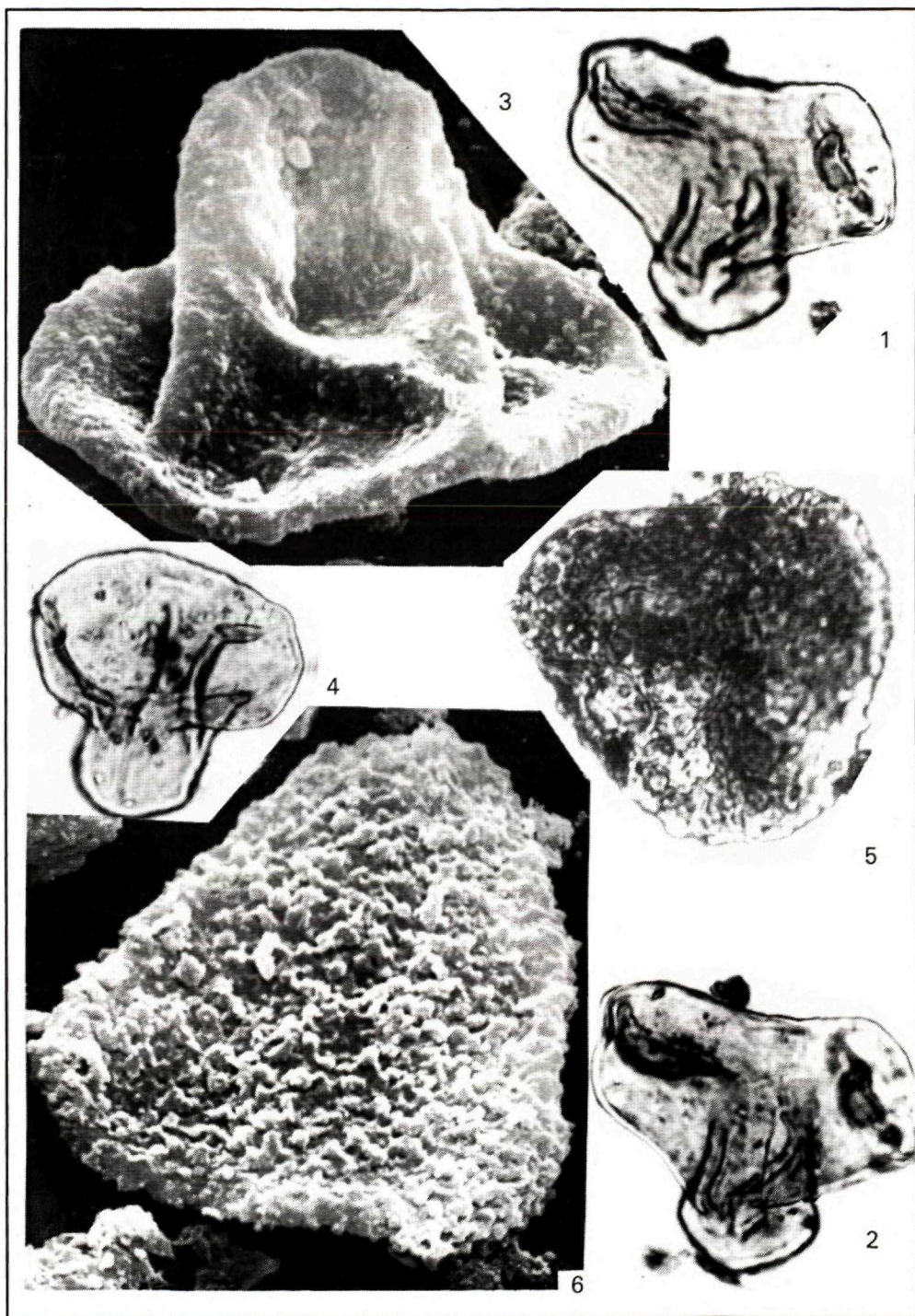
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FOTOGRAFICKÁ PRÍLOHA
I—LXVII

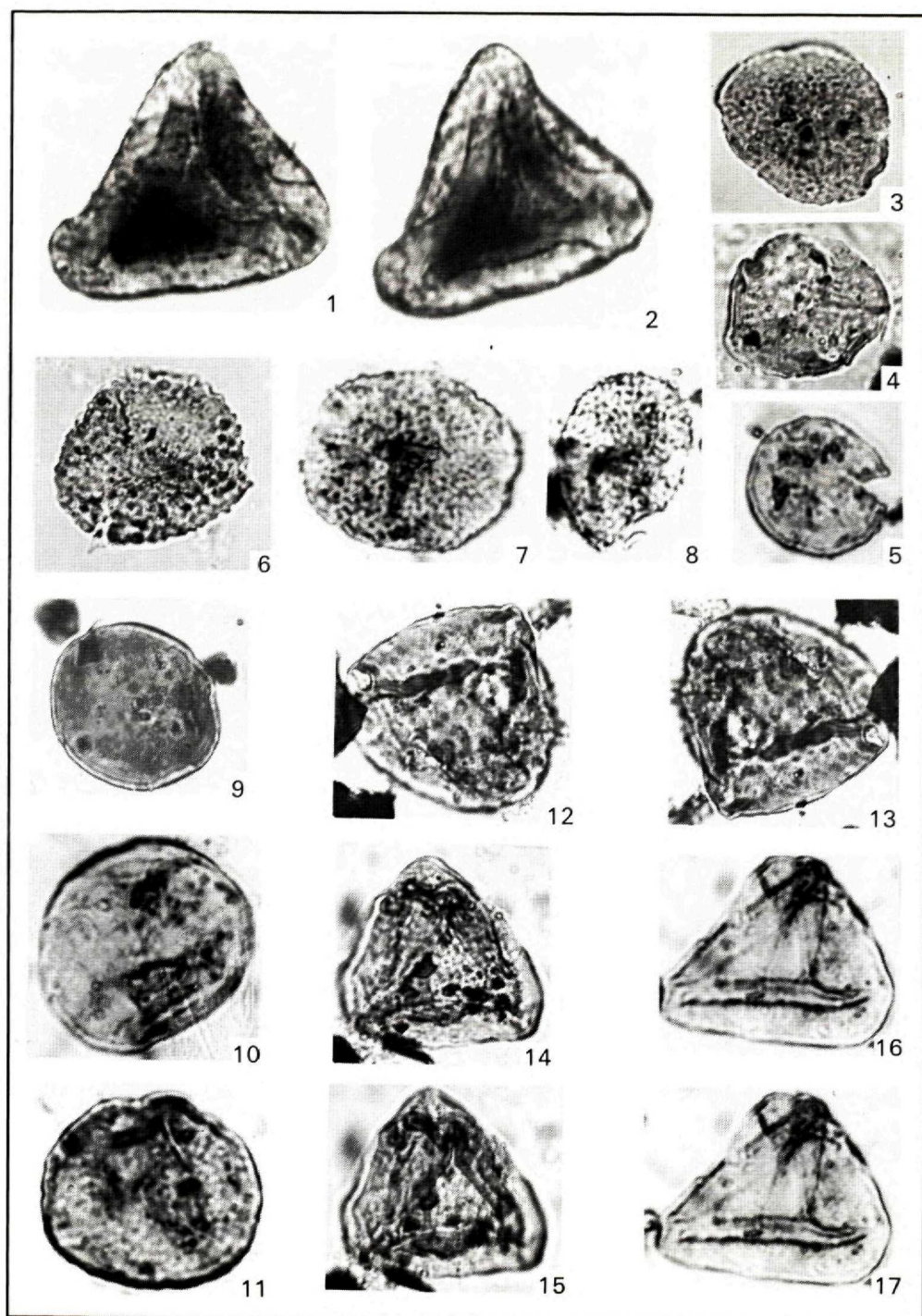
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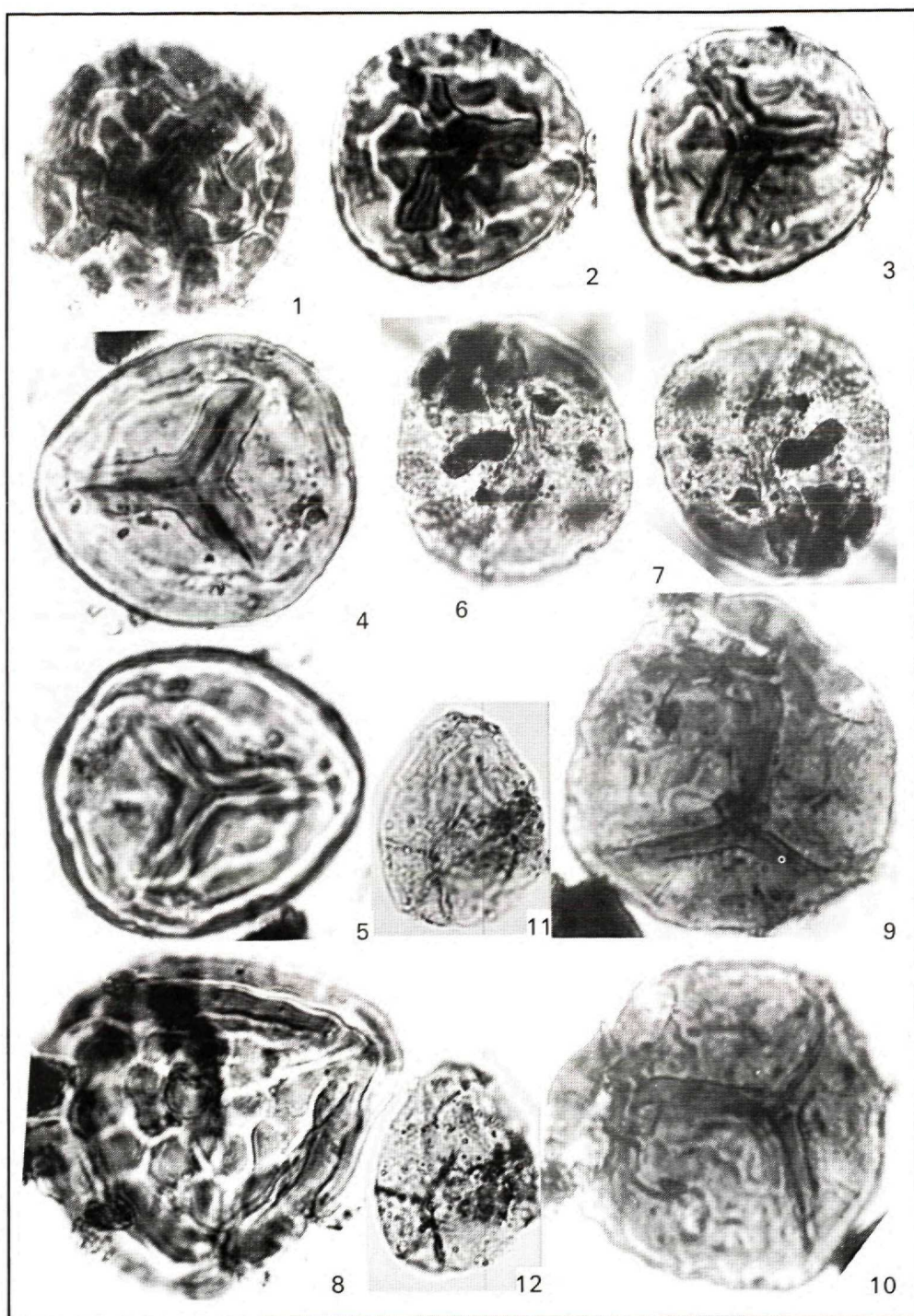


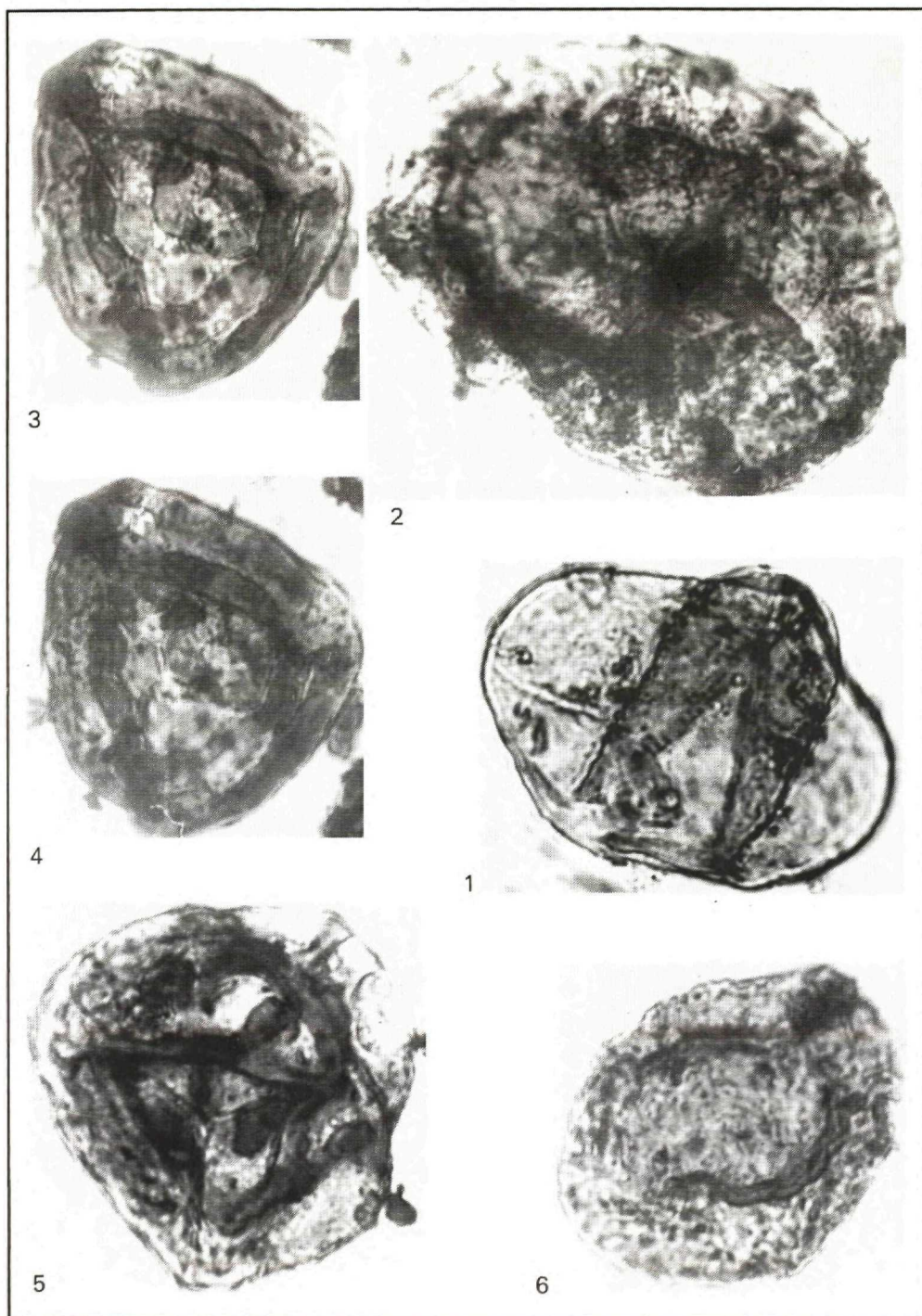


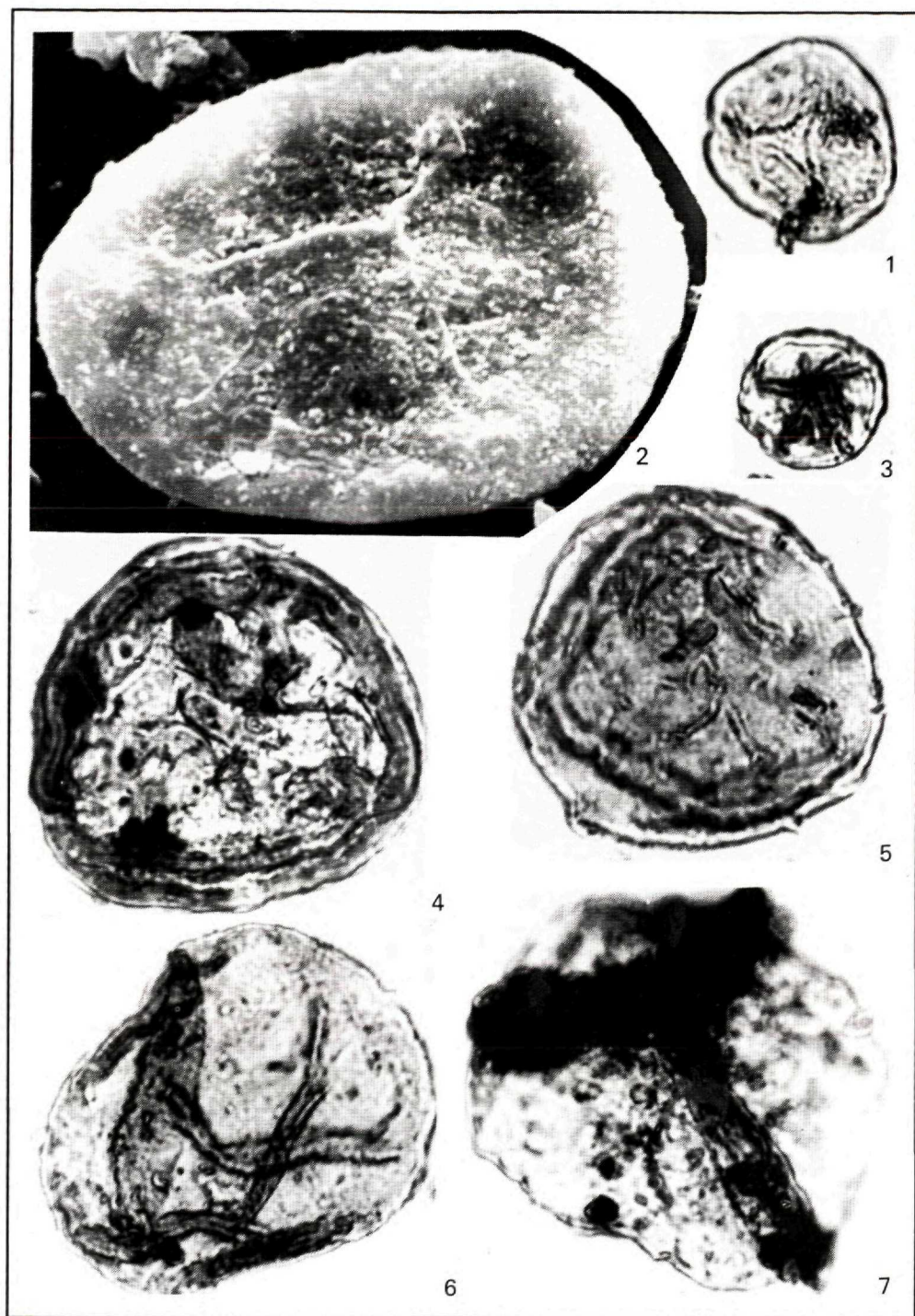


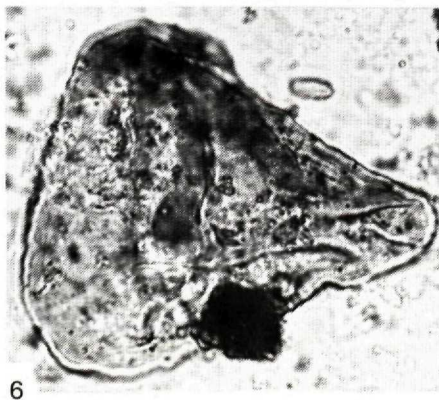
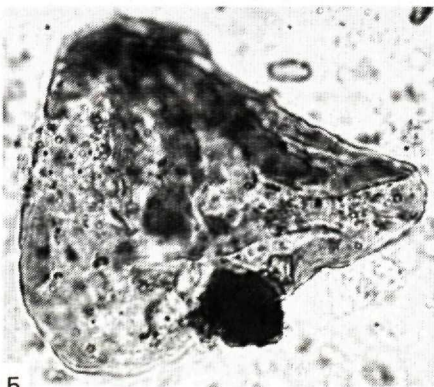
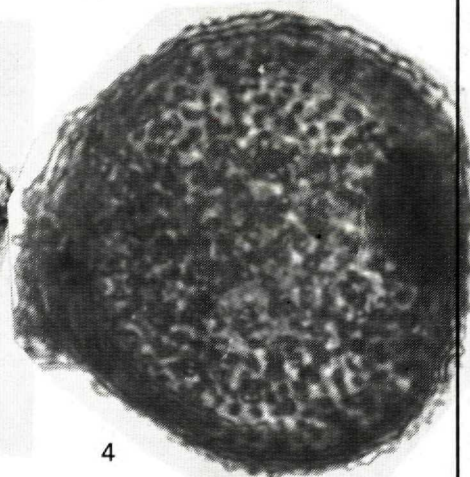
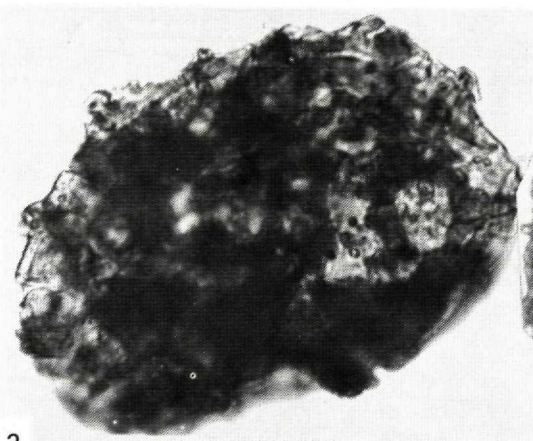
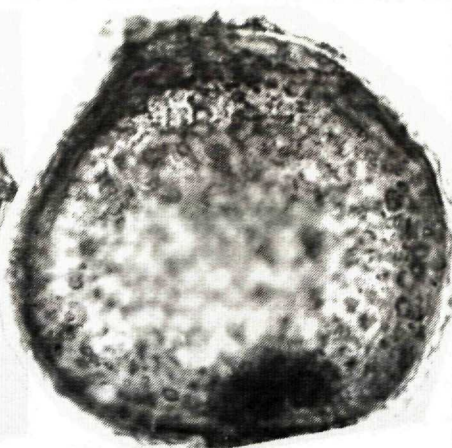


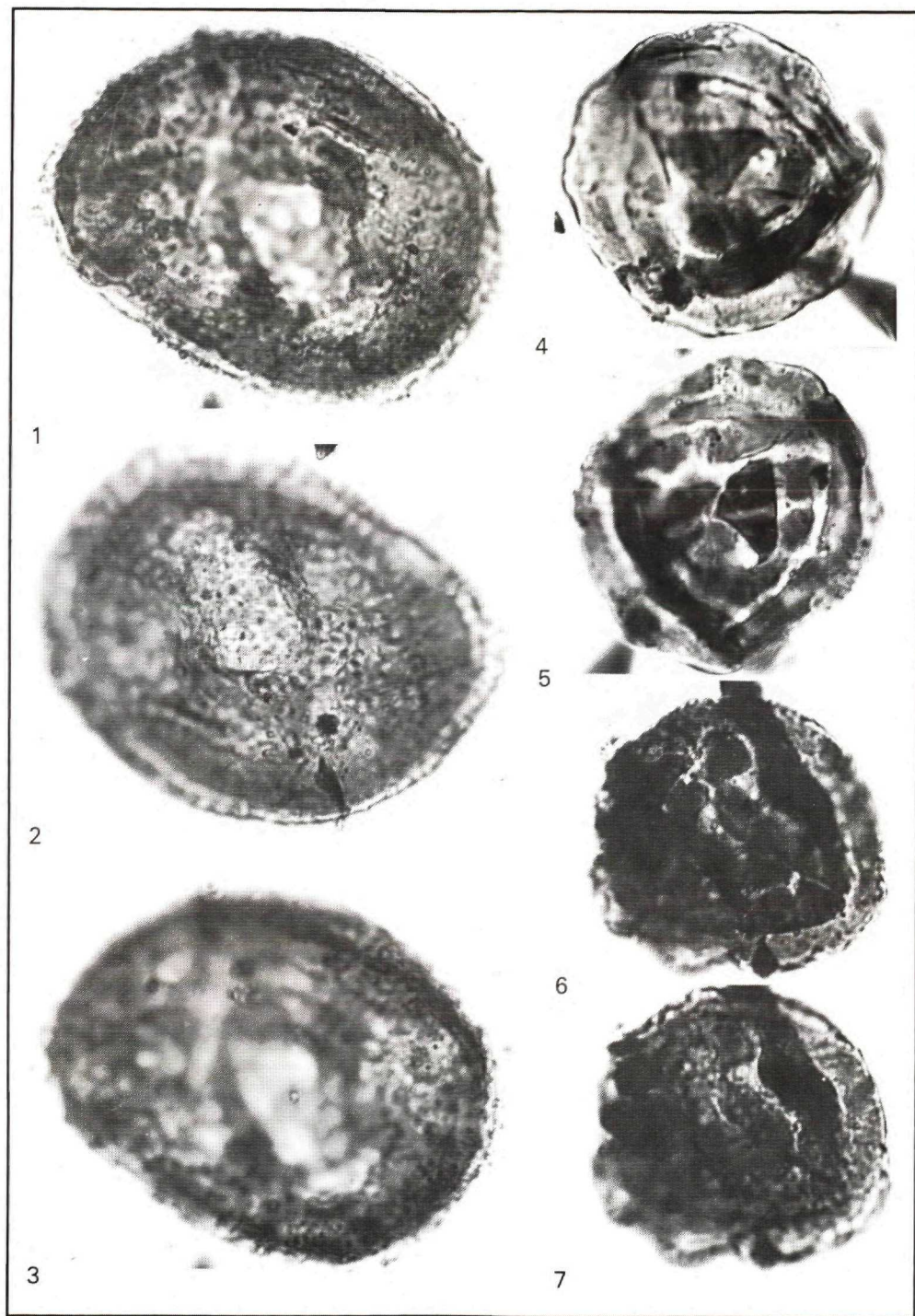


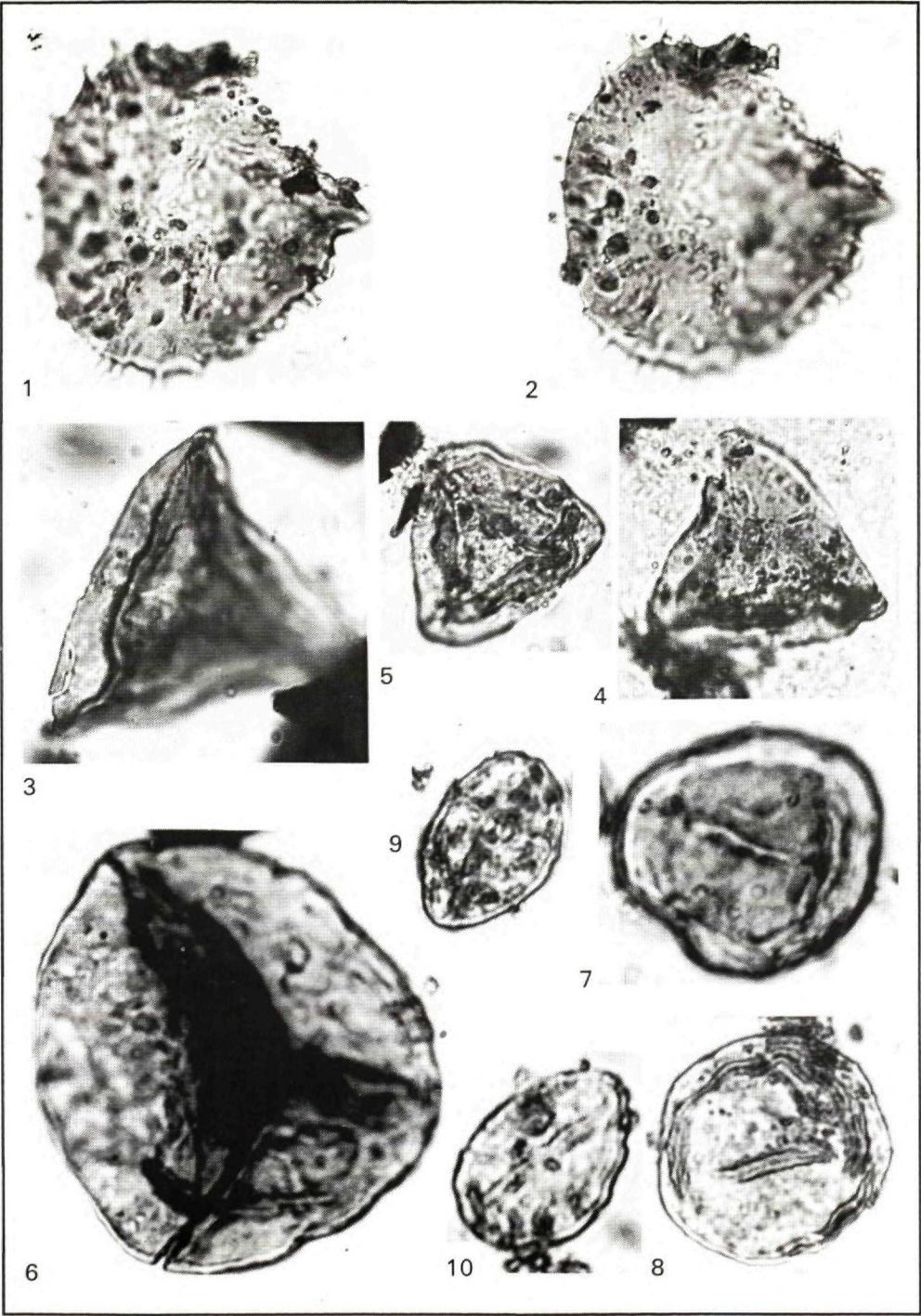


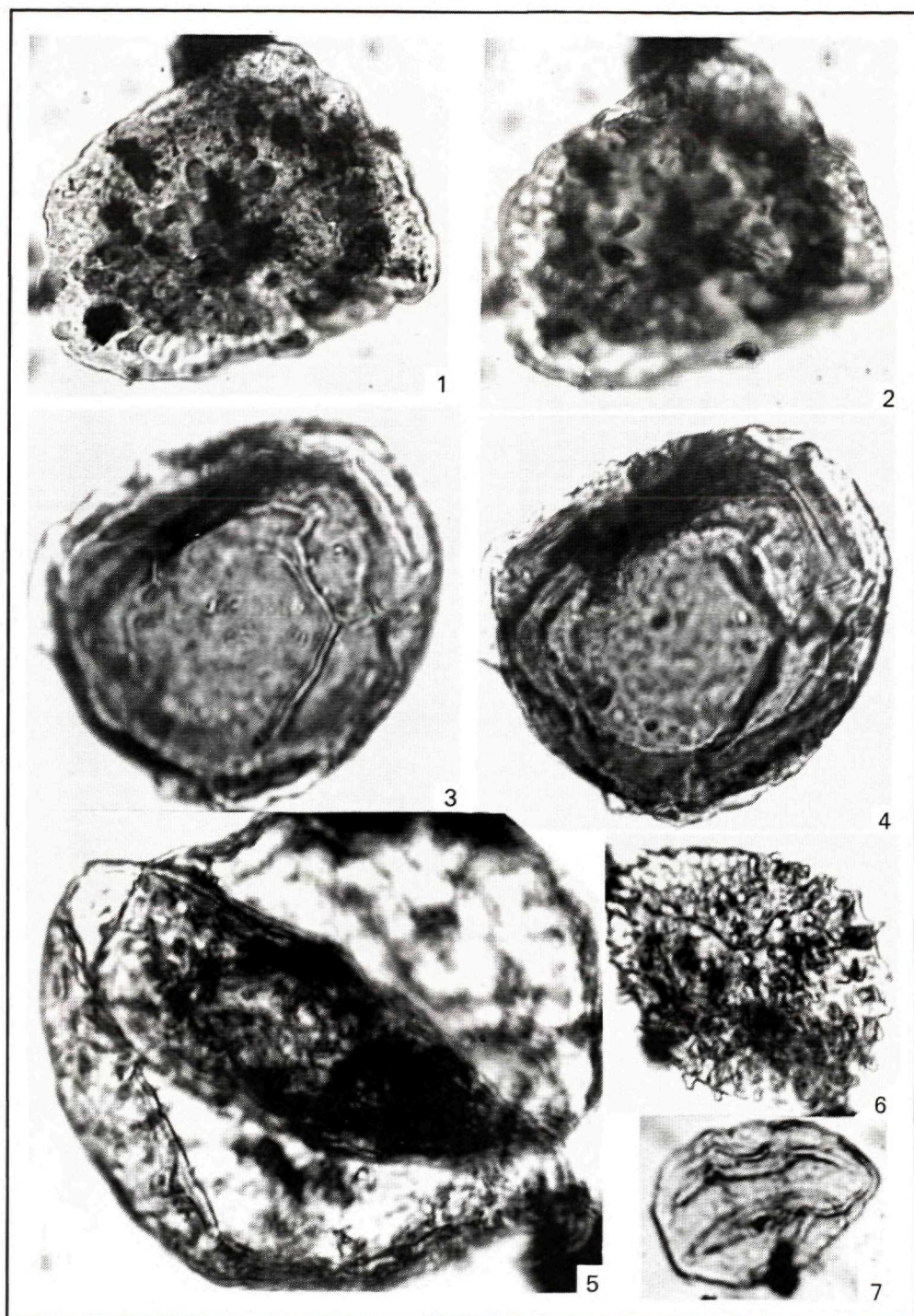


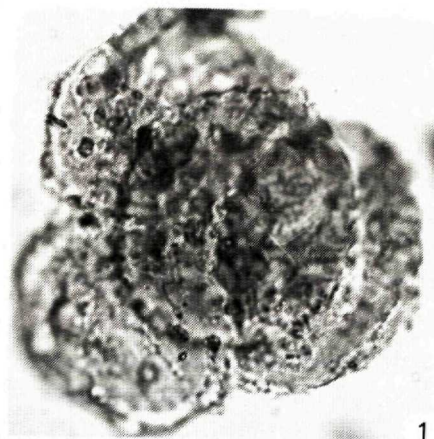




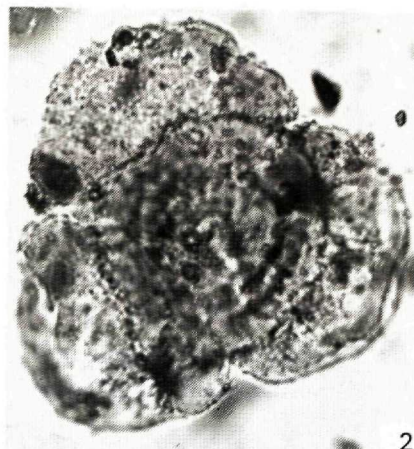




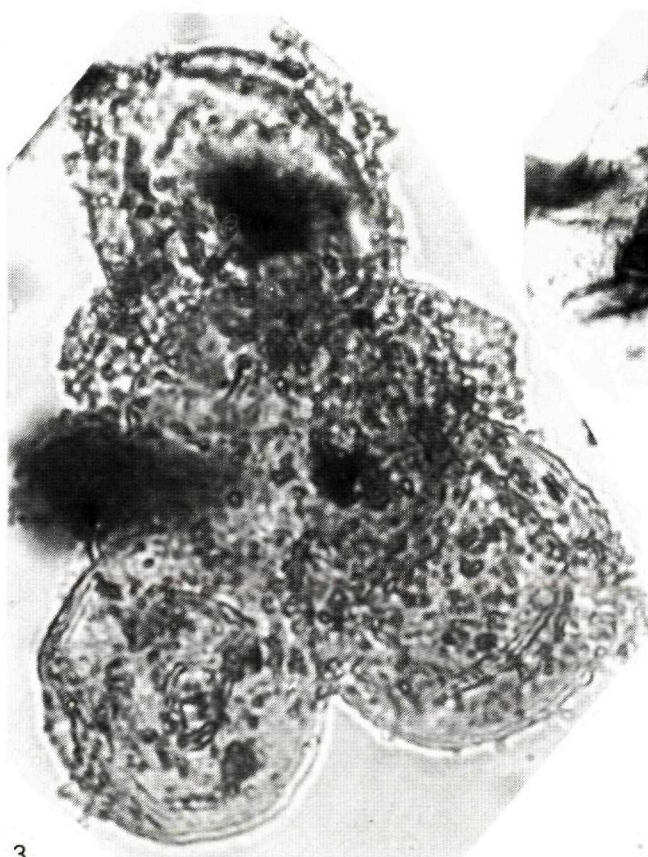




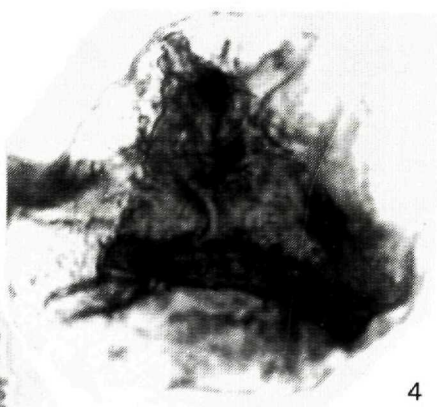
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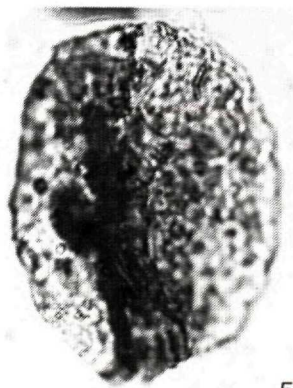
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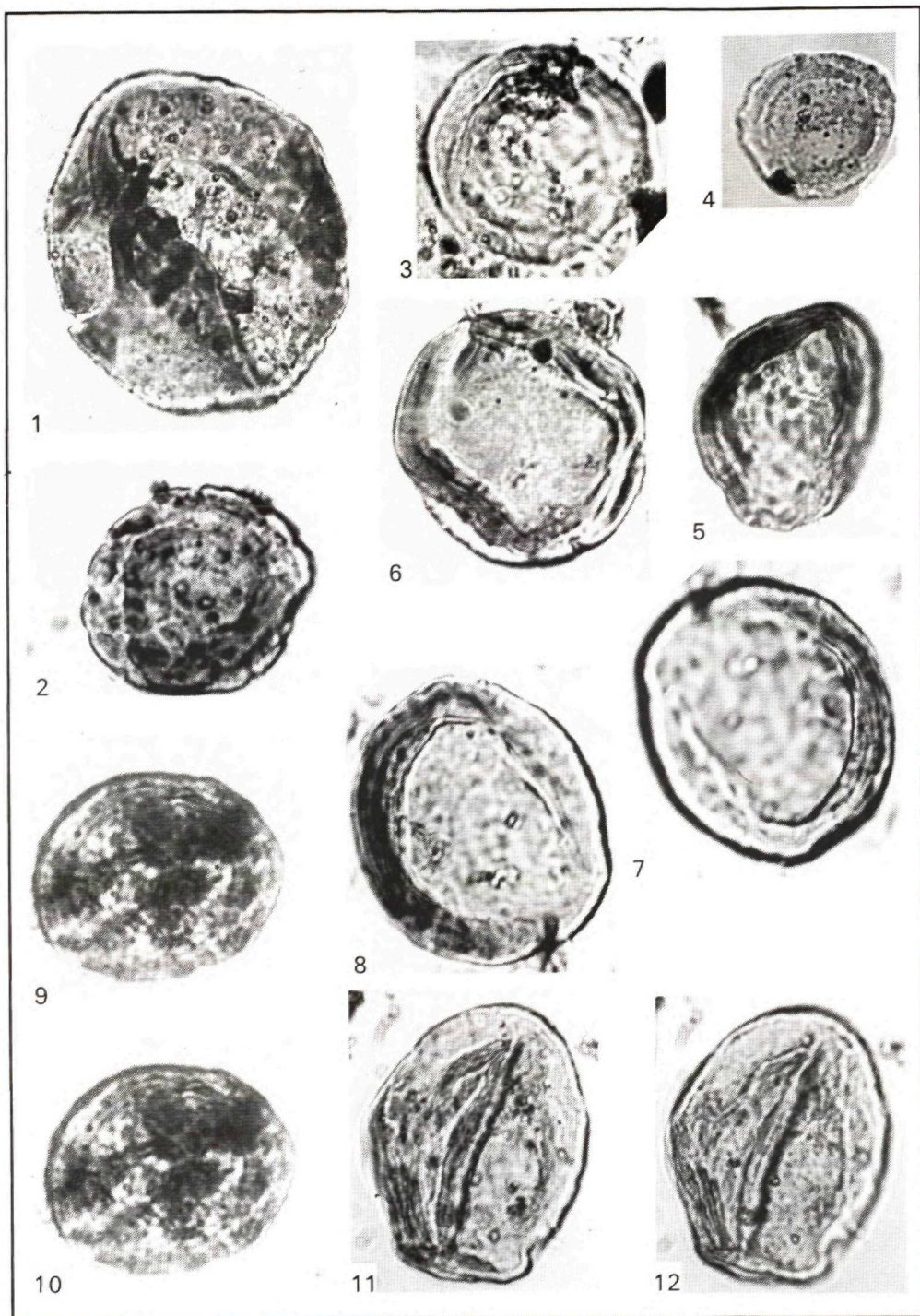
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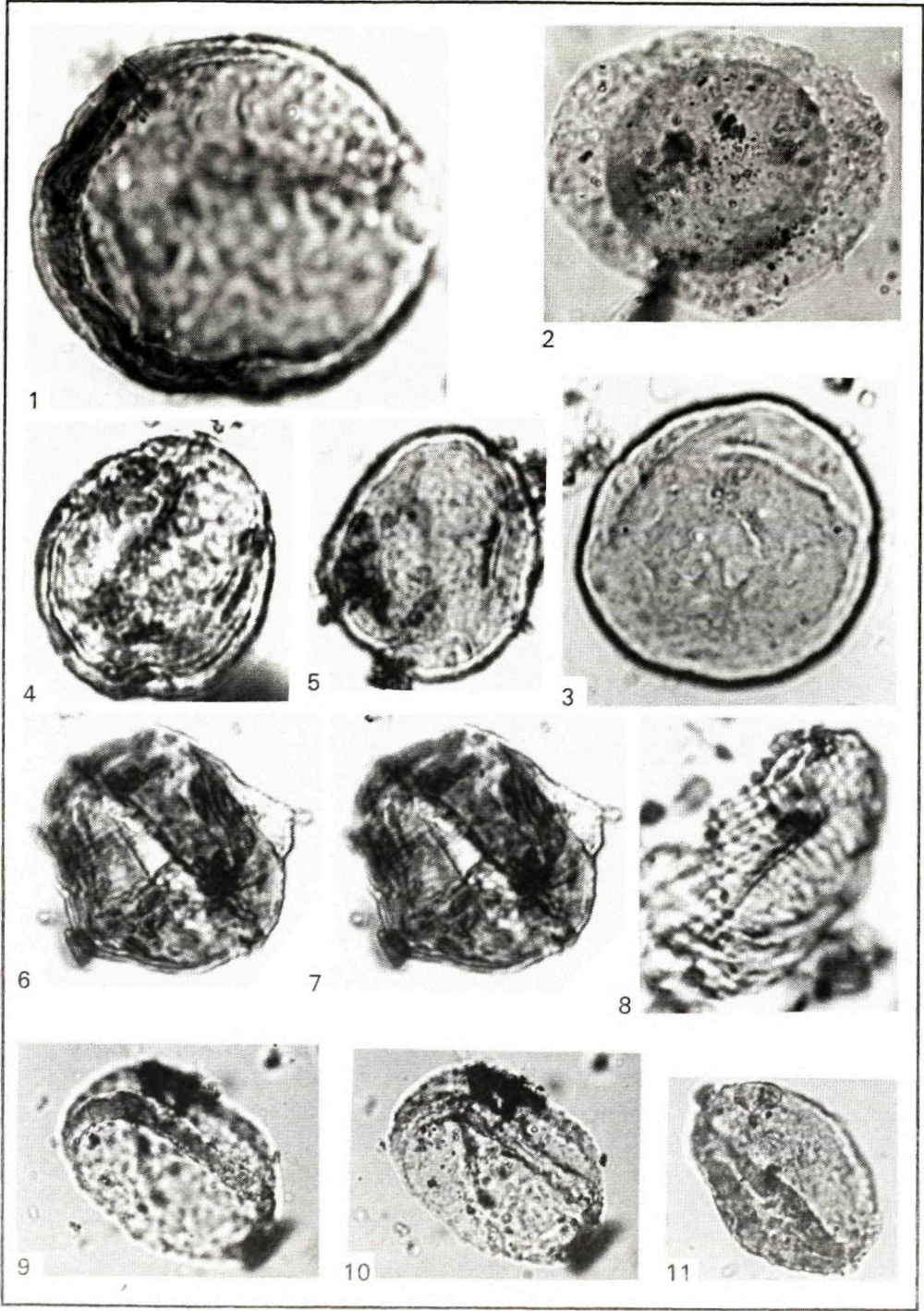


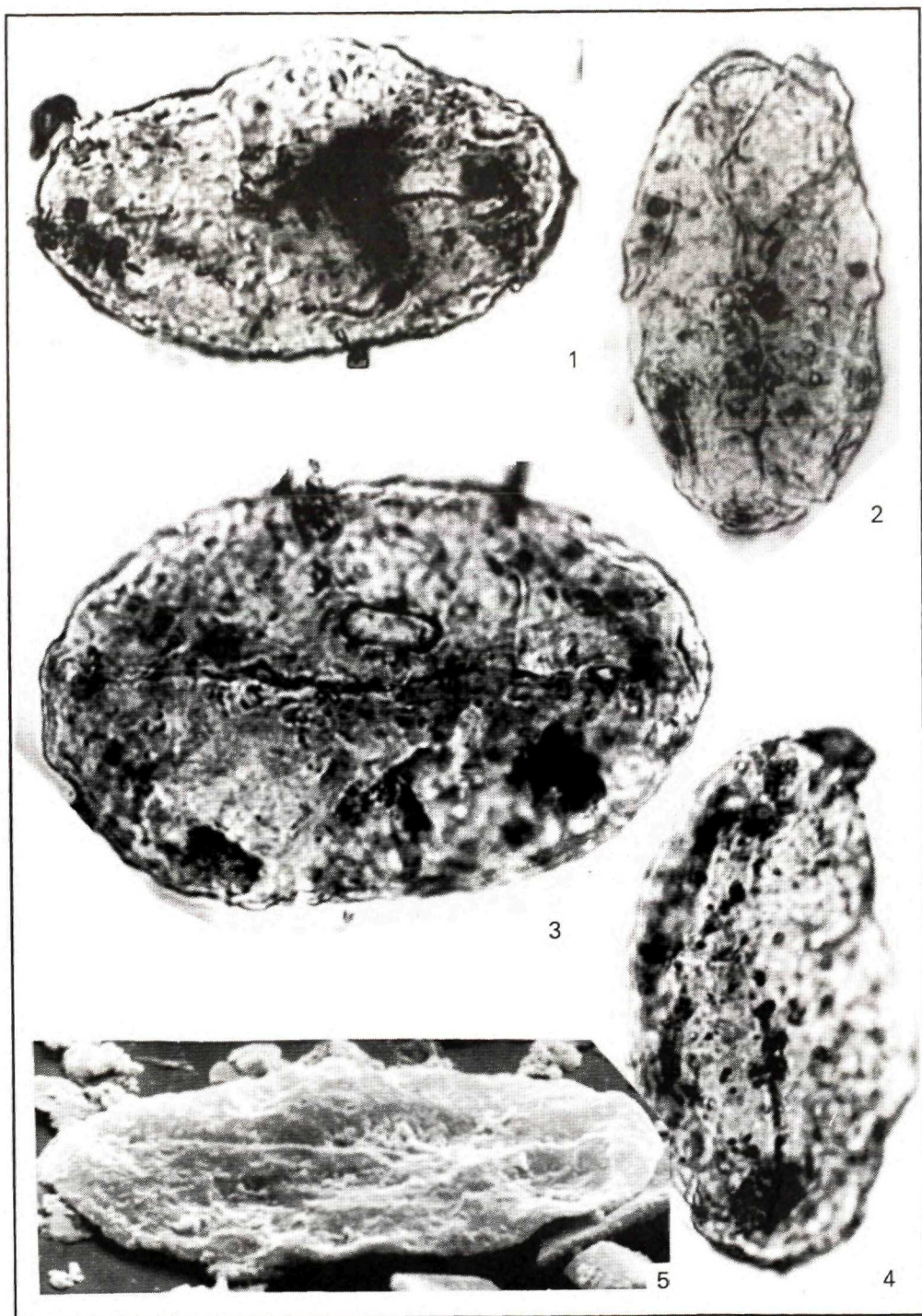
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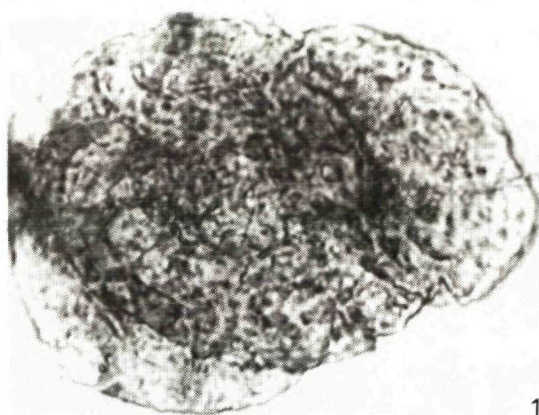


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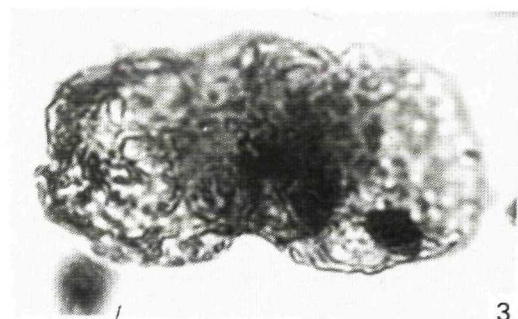




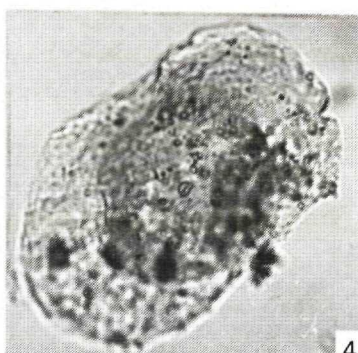
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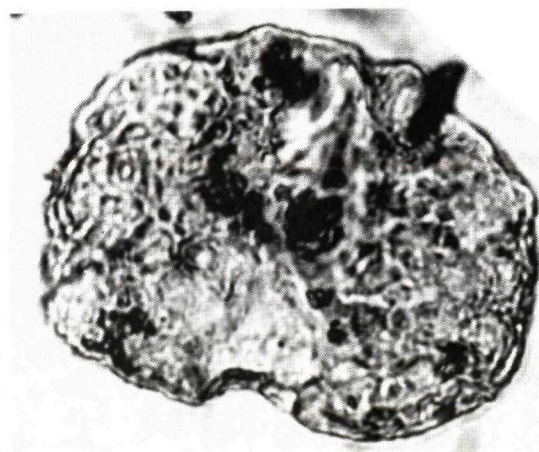
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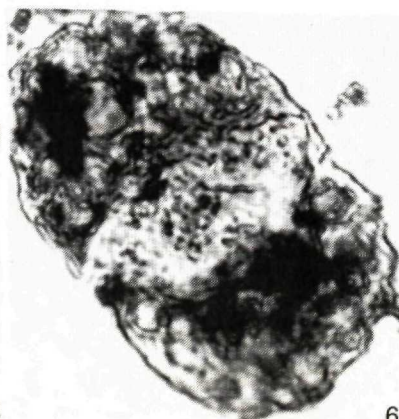
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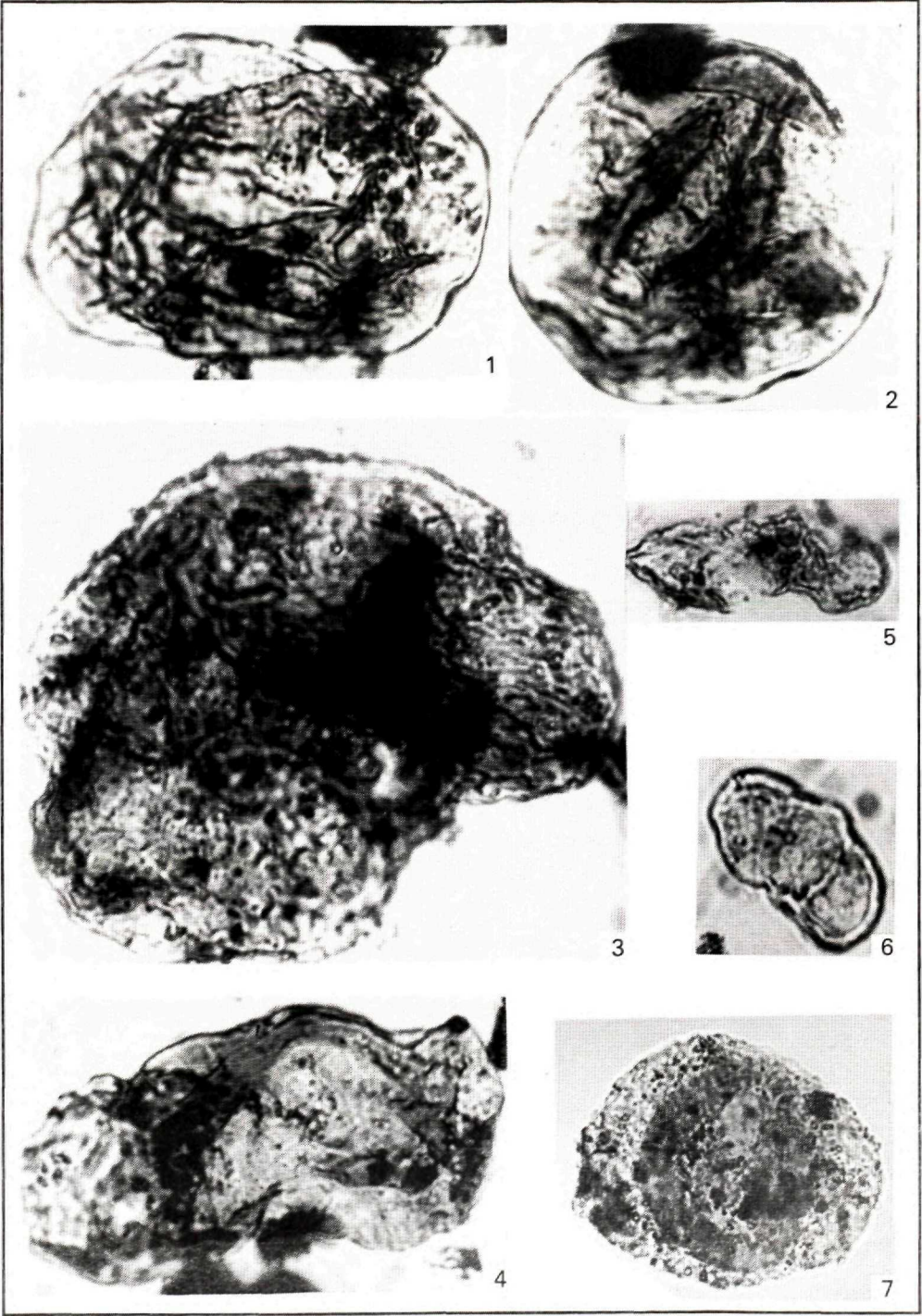
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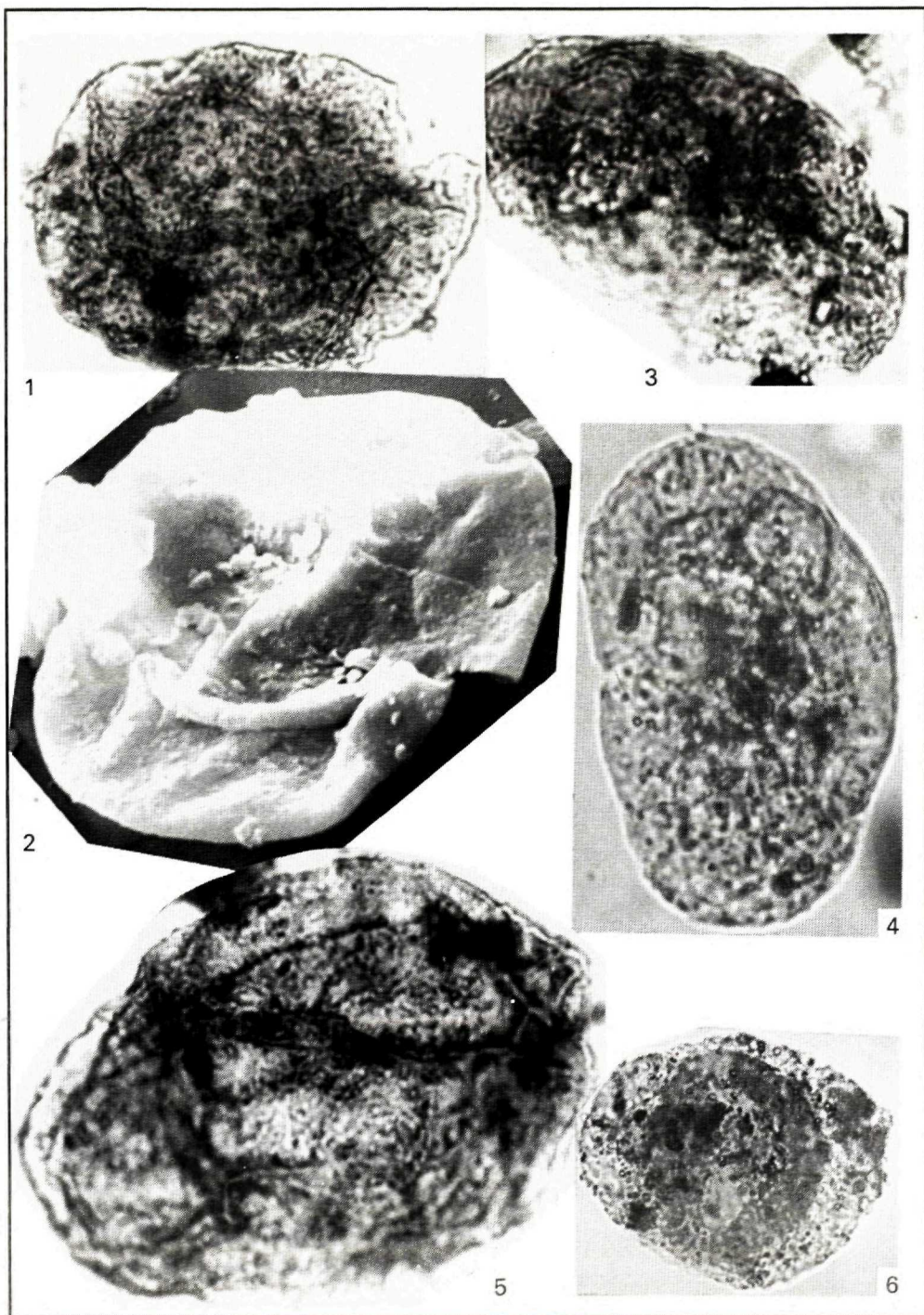


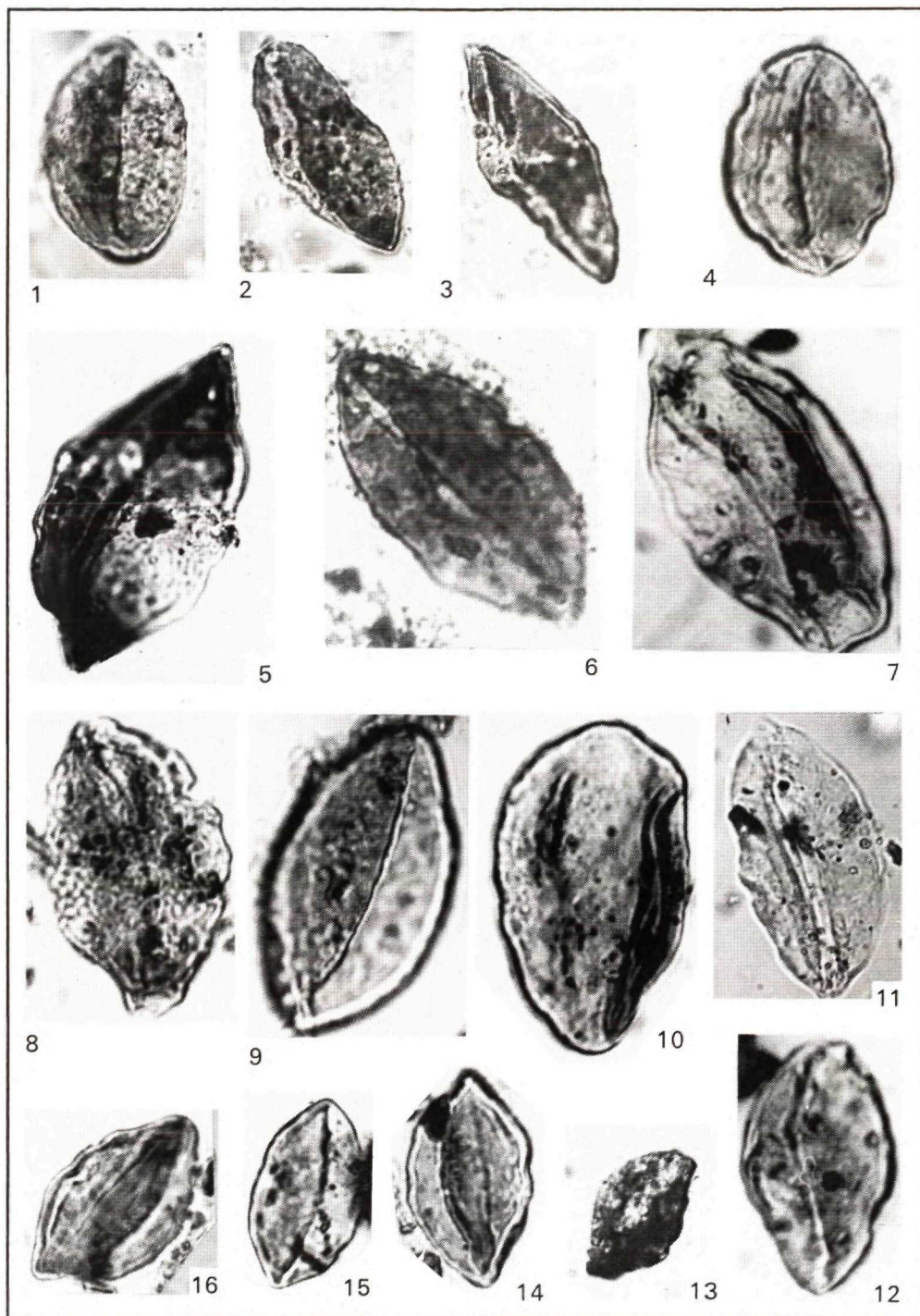
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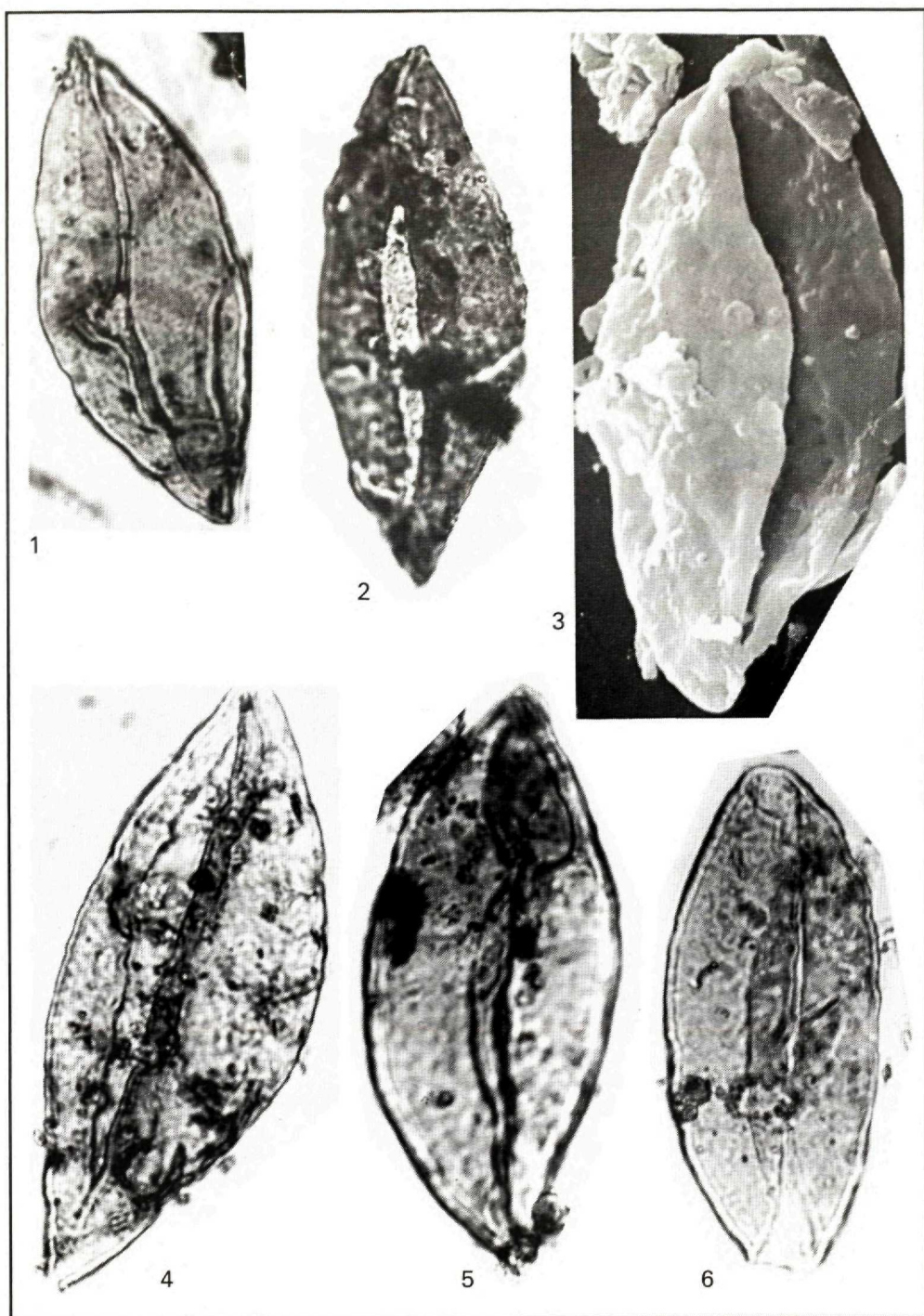


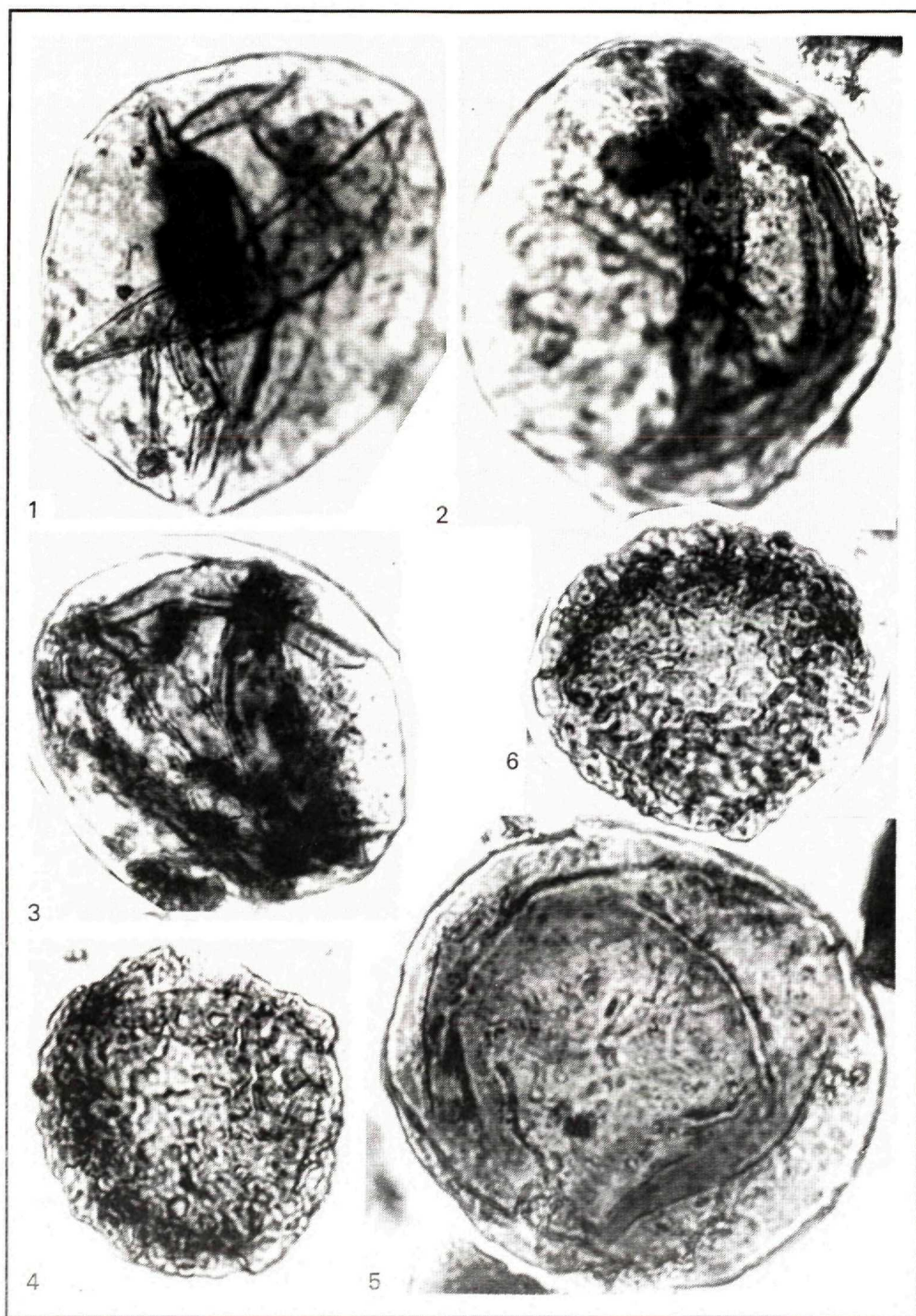
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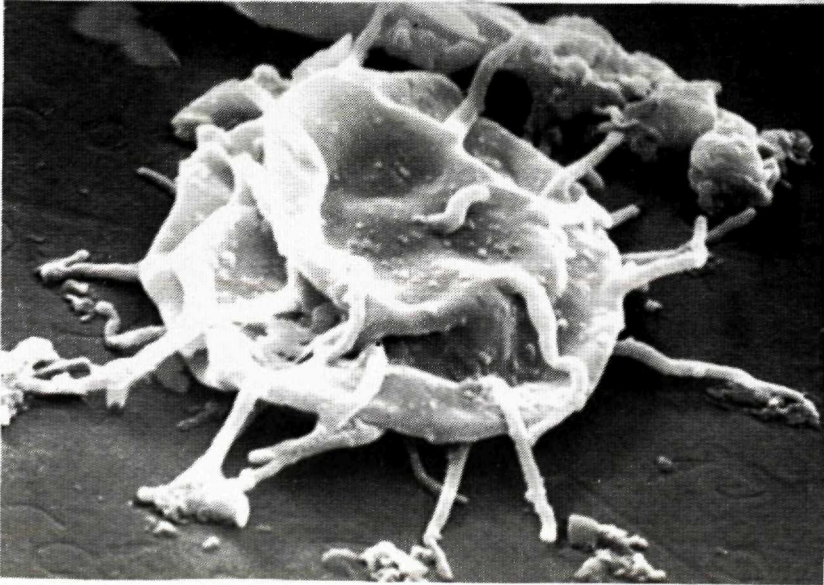
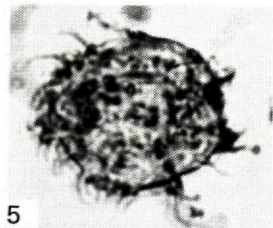
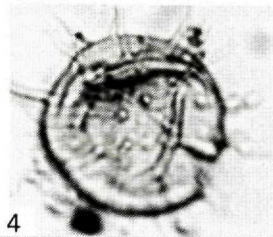
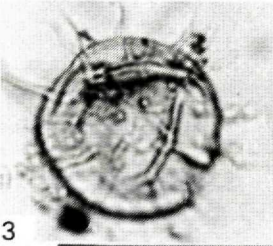
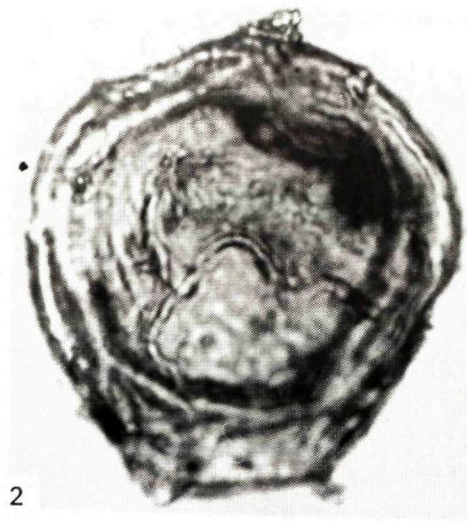


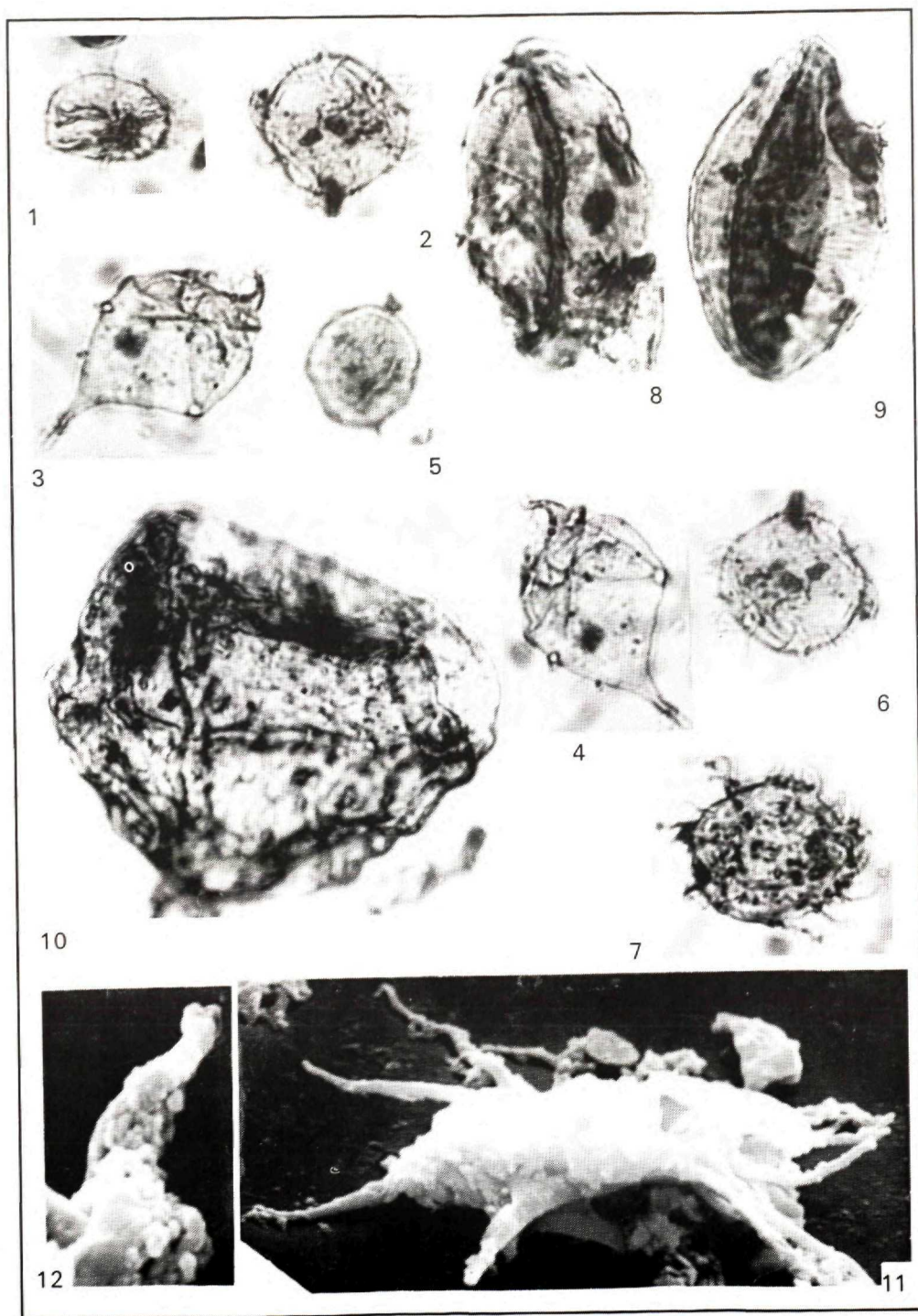


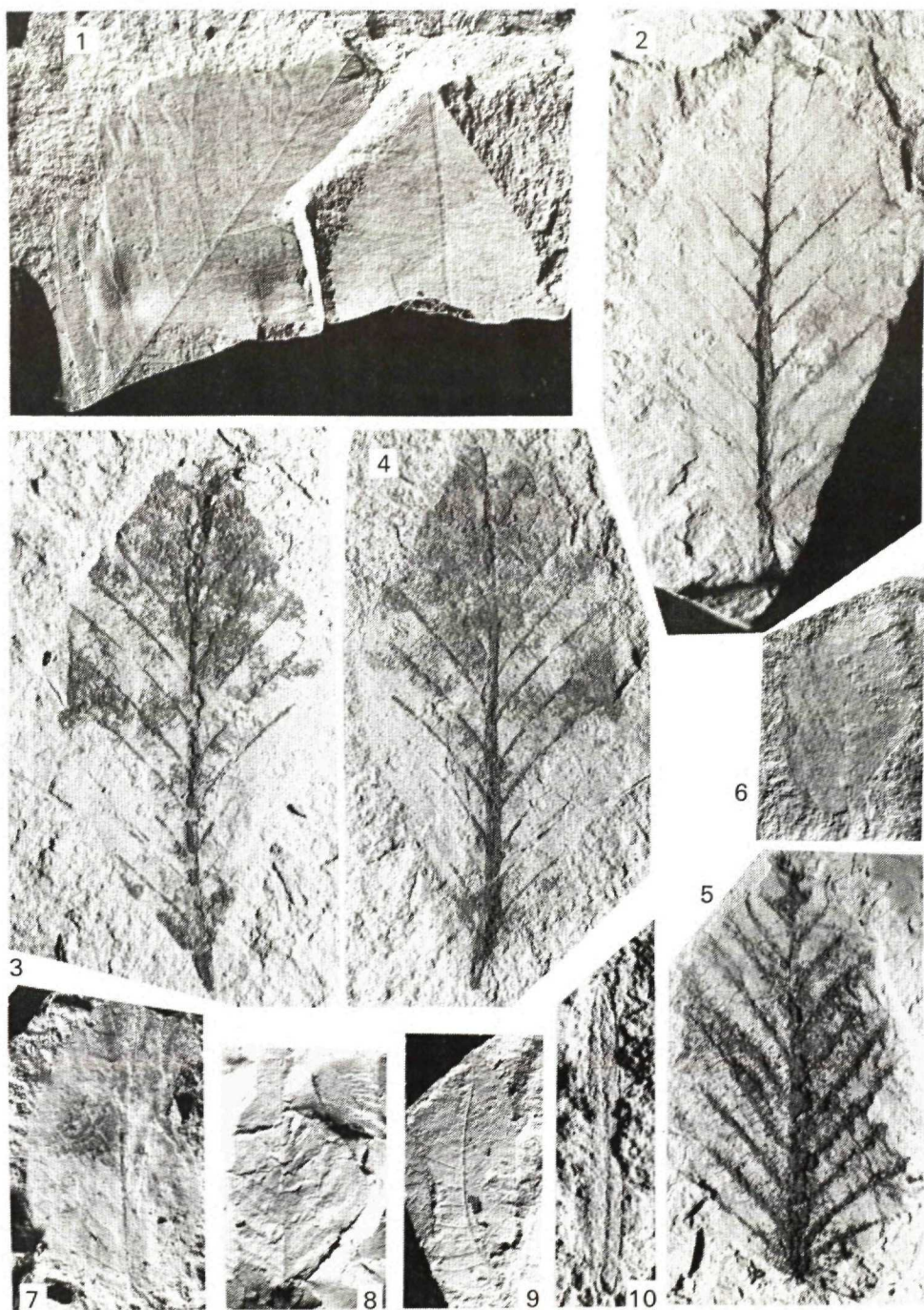


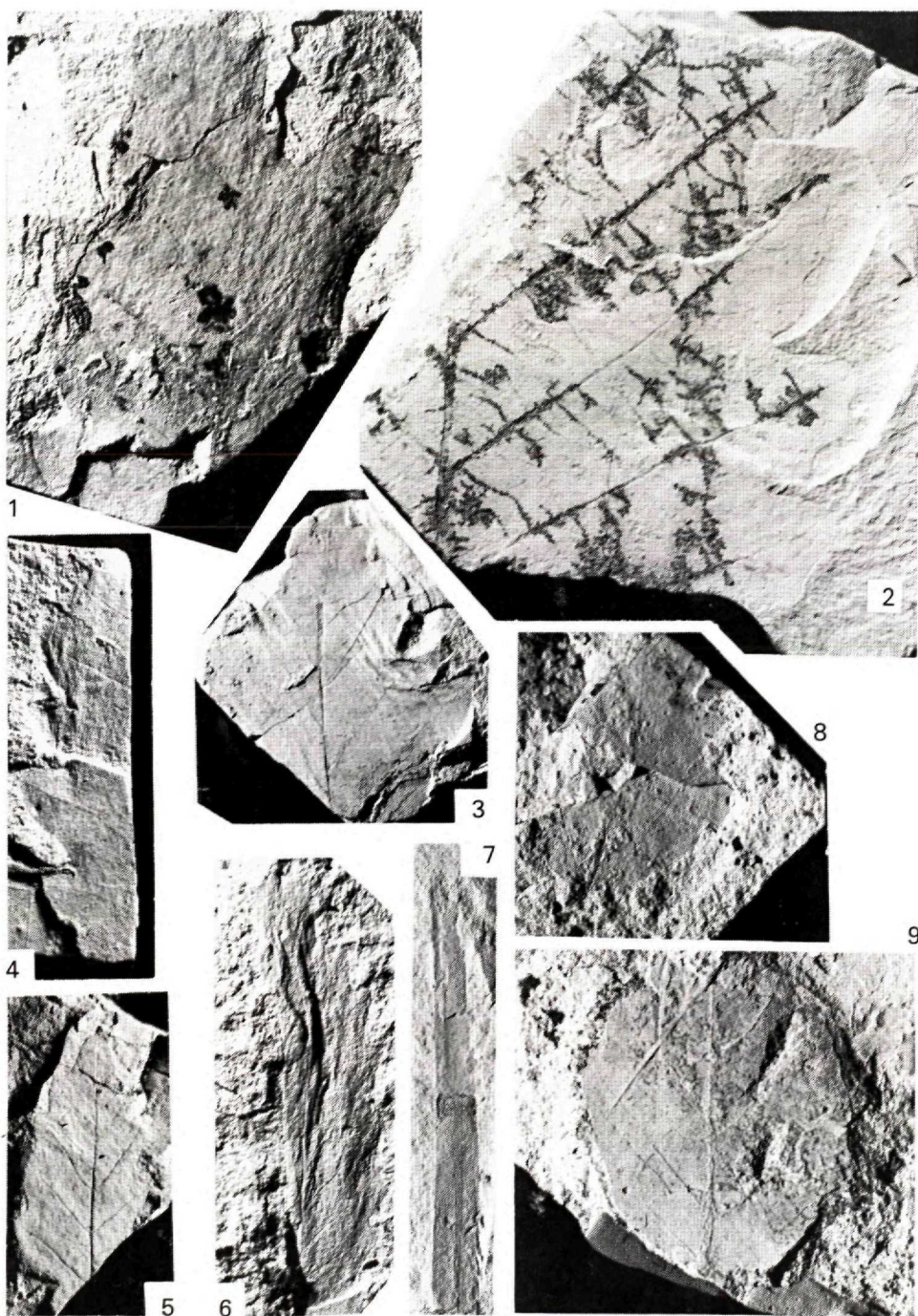


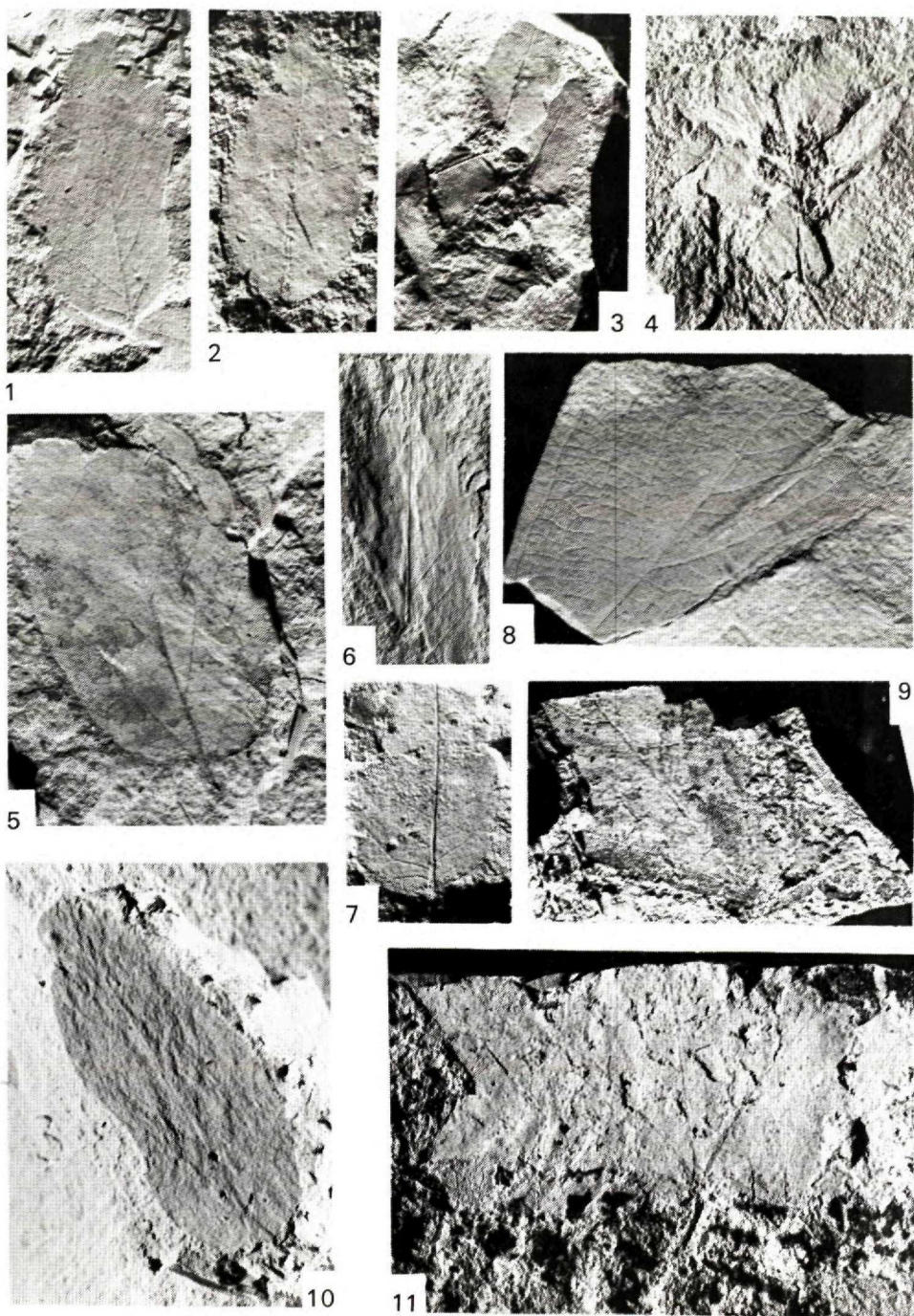


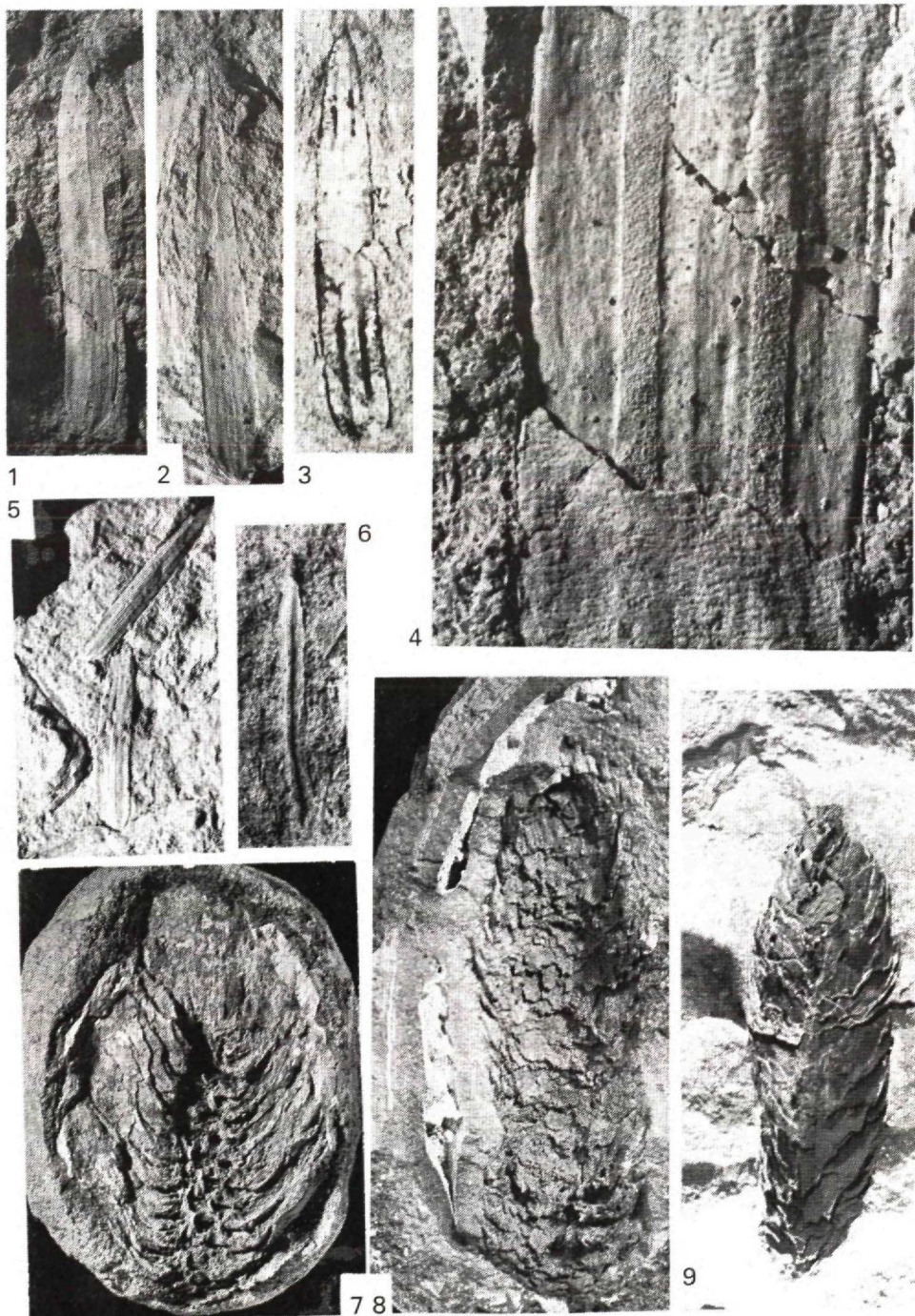


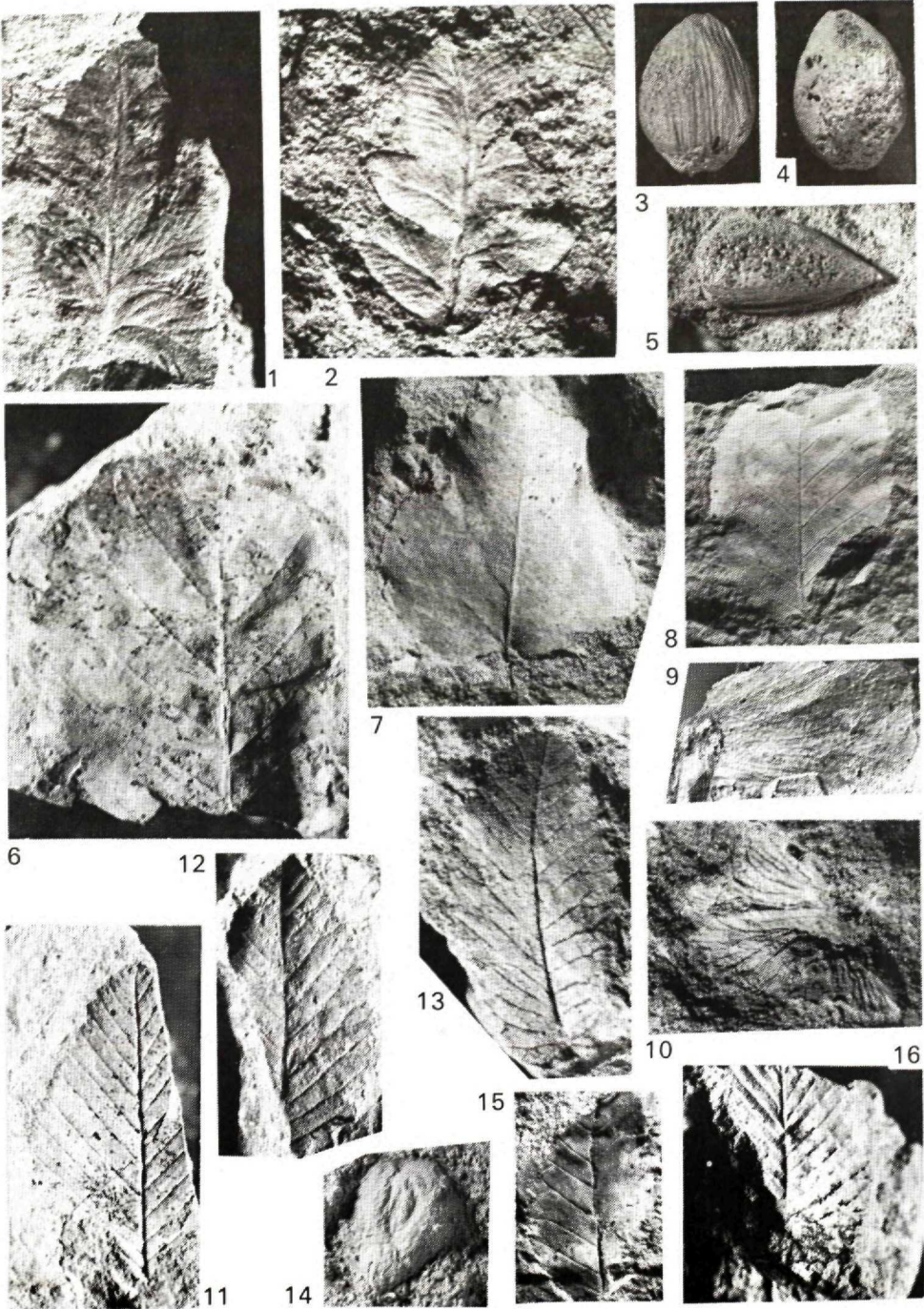


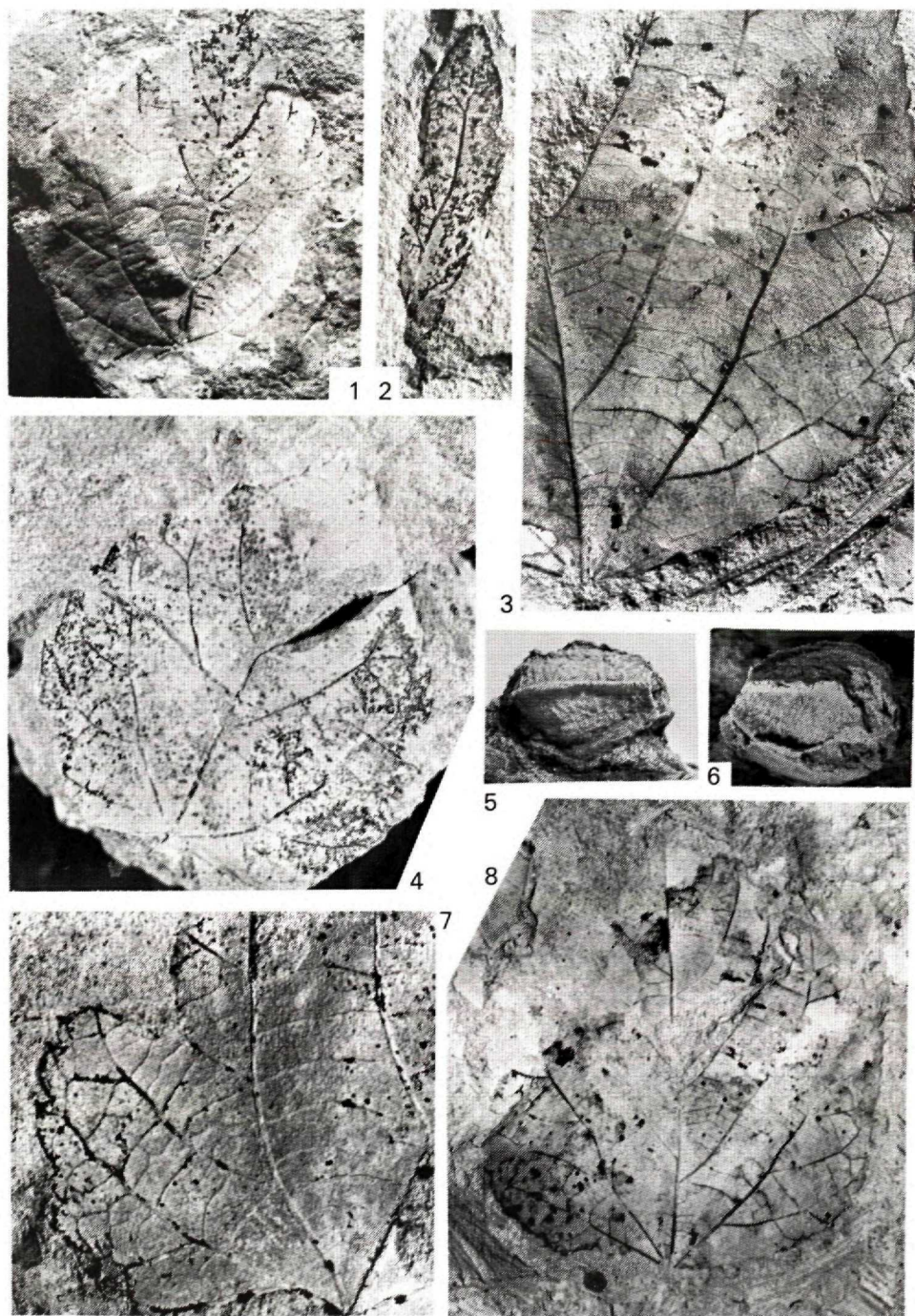


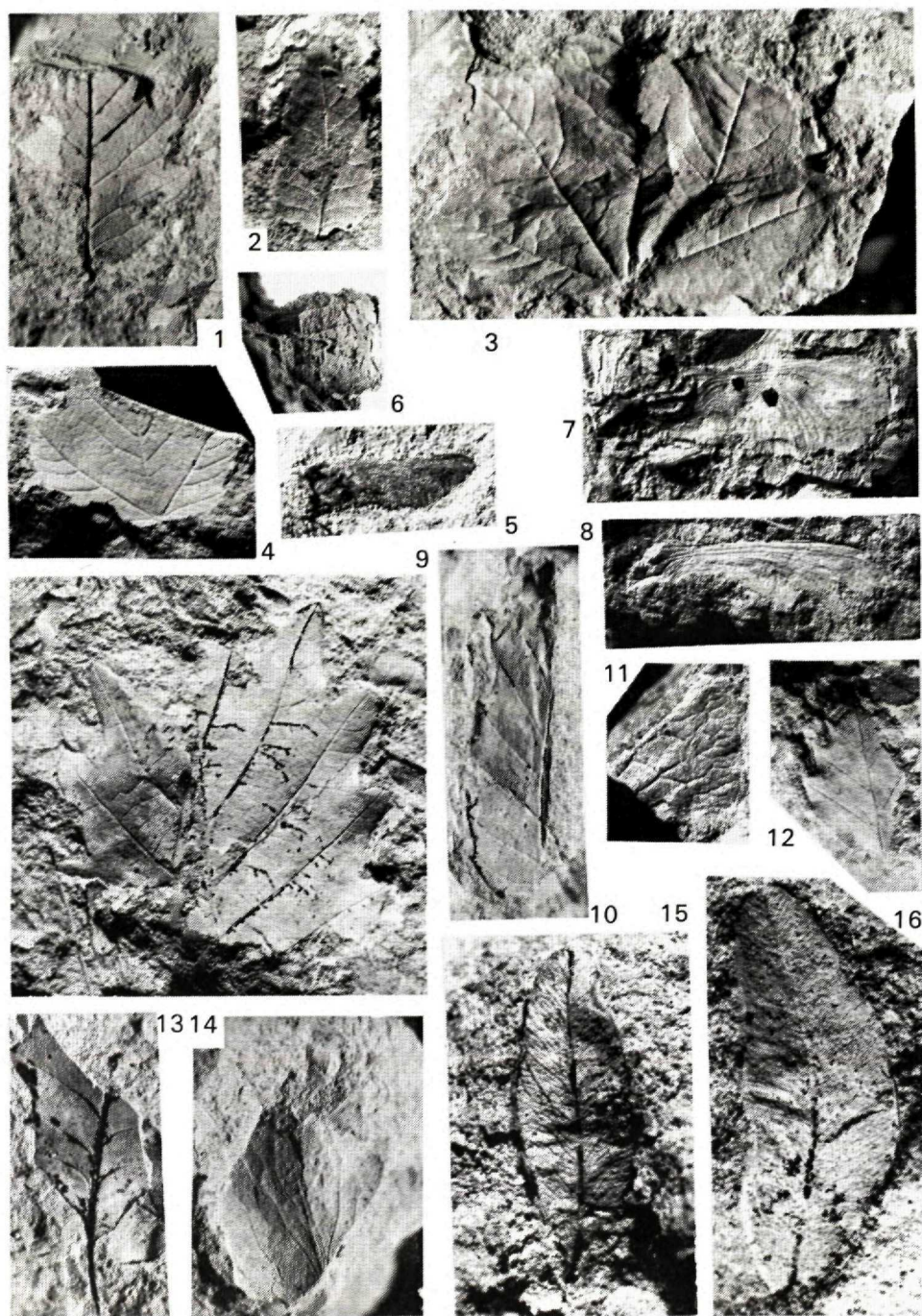










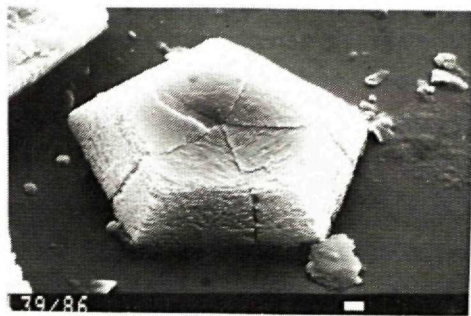




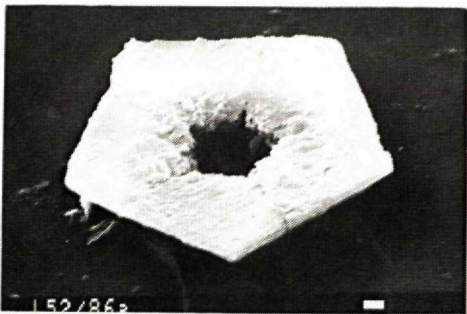
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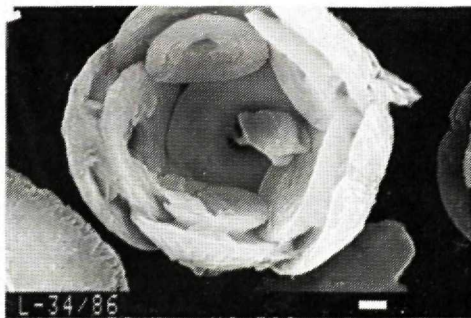
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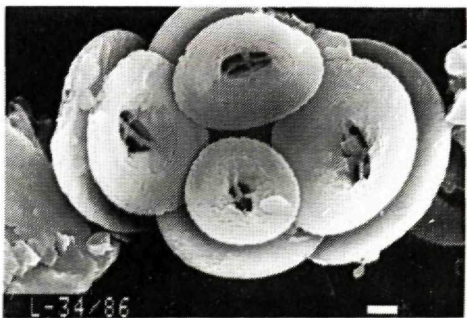
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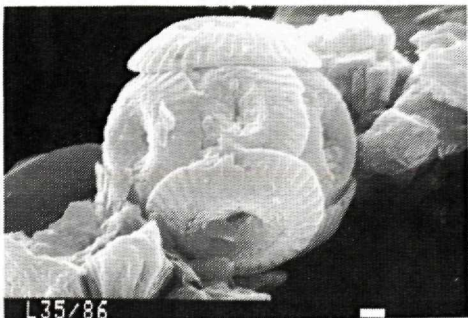
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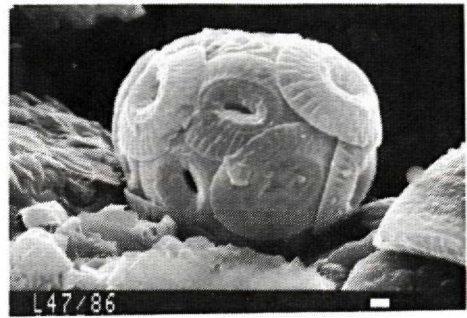
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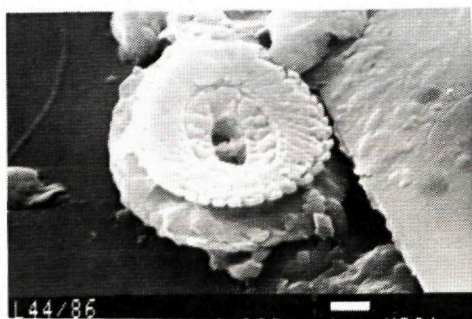
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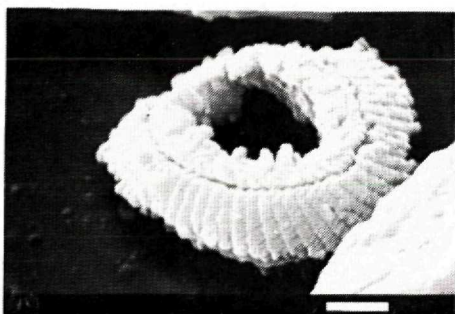
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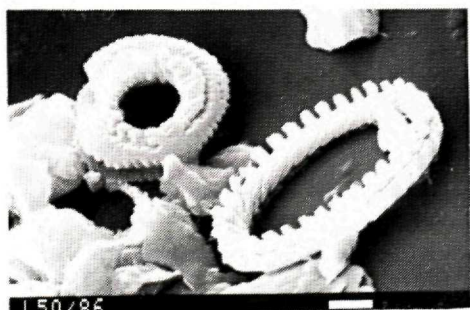
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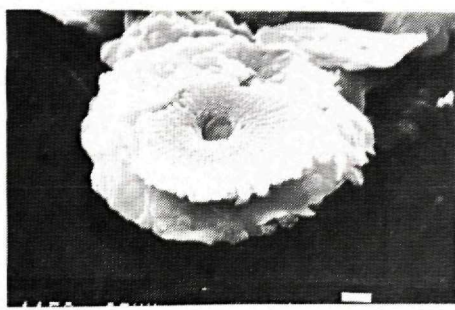
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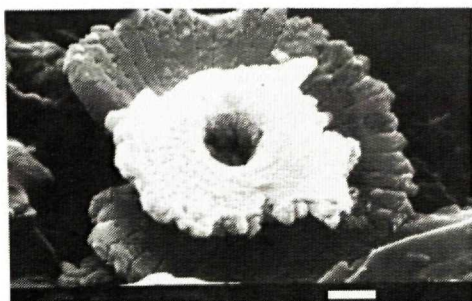
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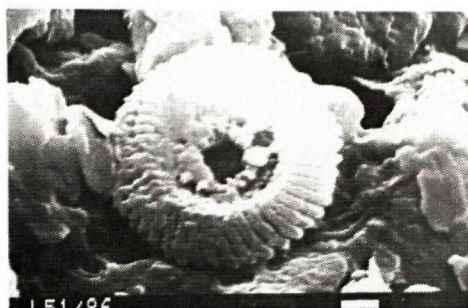
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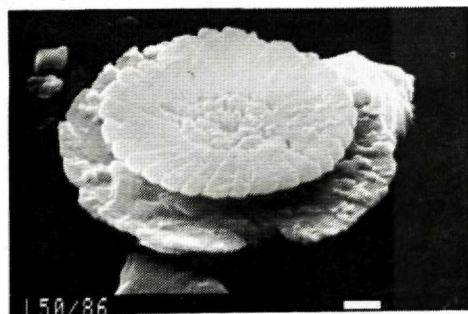
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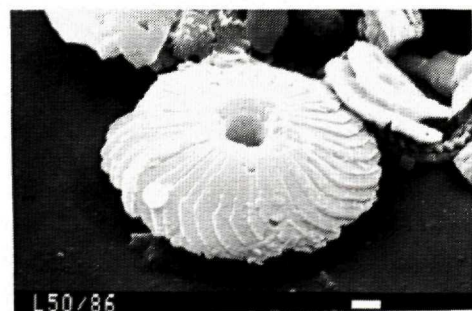
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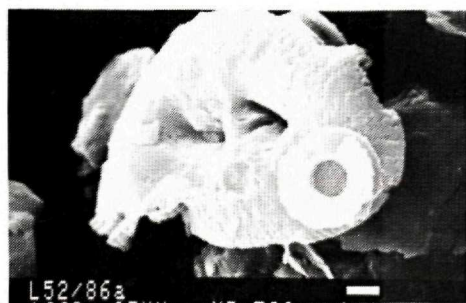
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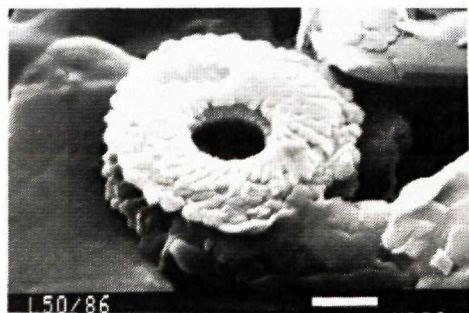
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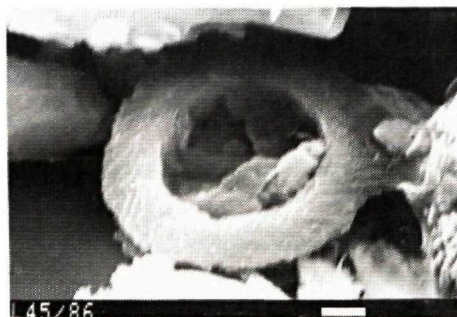
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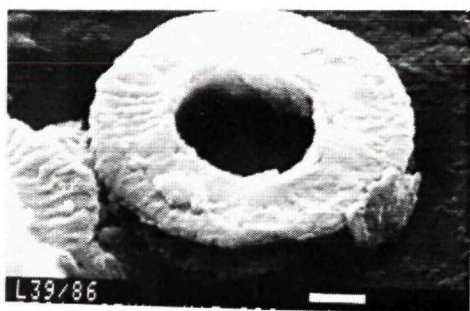
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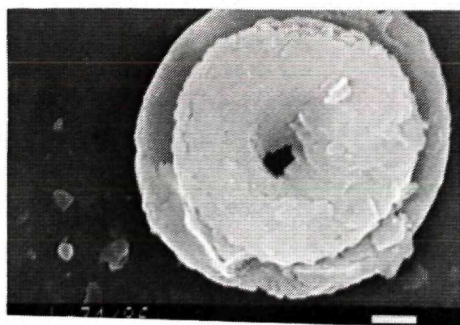
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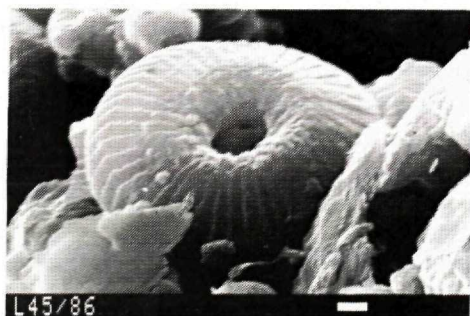
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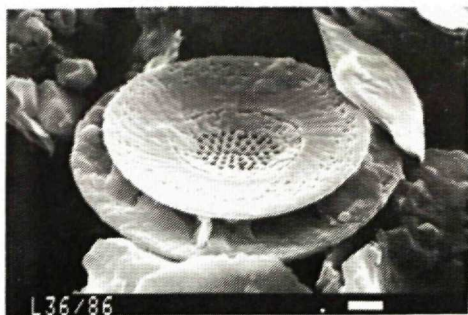
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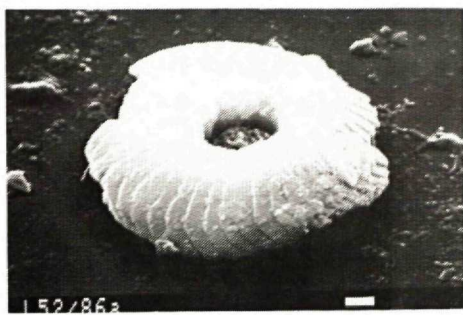
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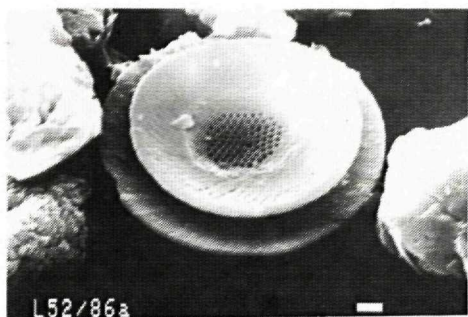
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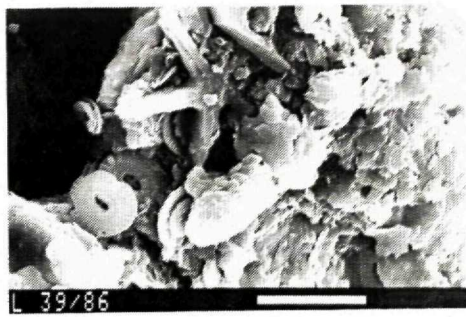
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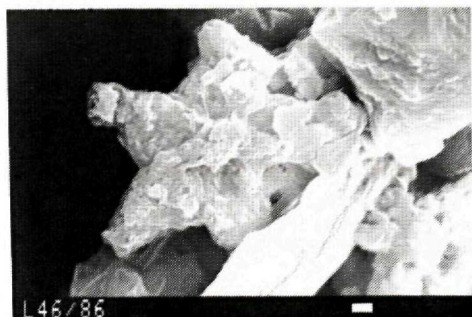
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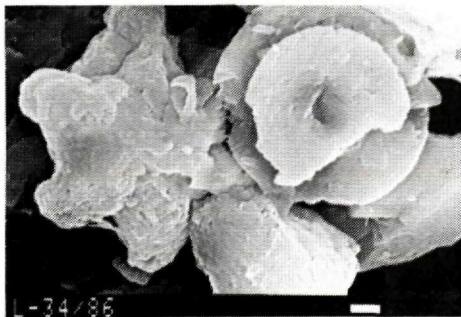
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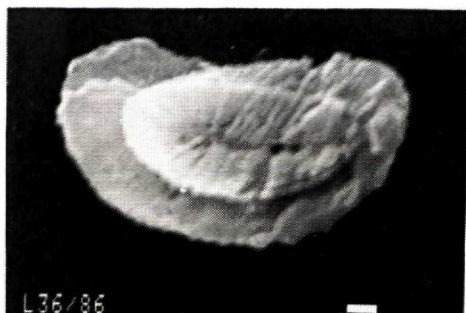
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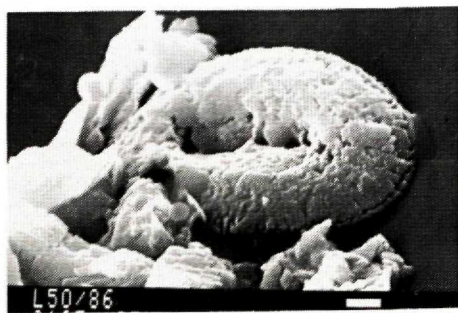
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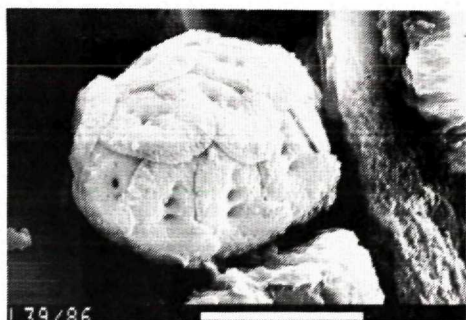
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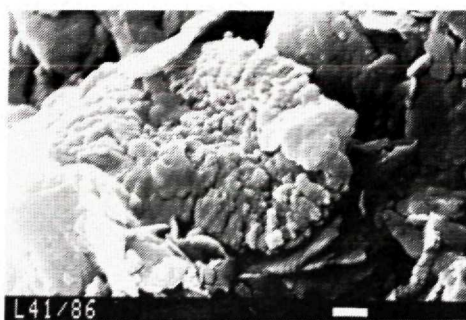
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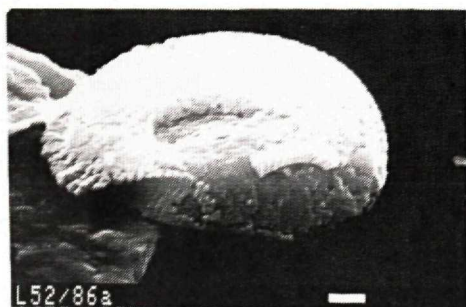
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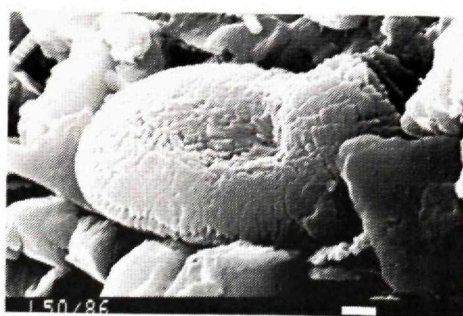
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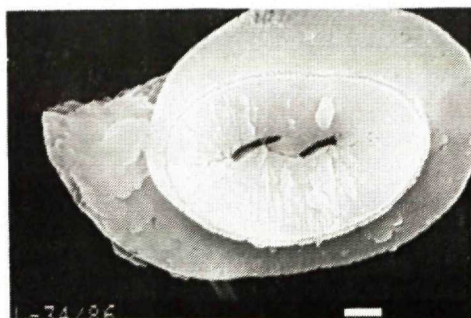
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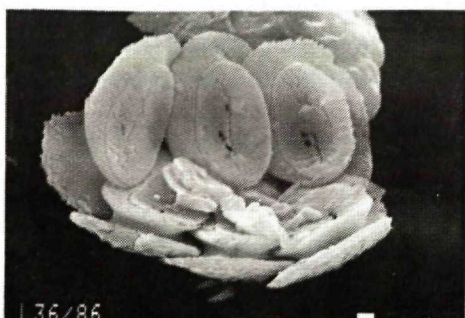
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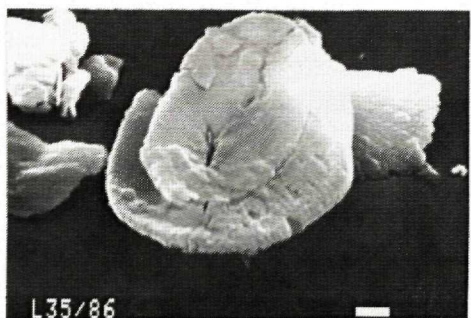
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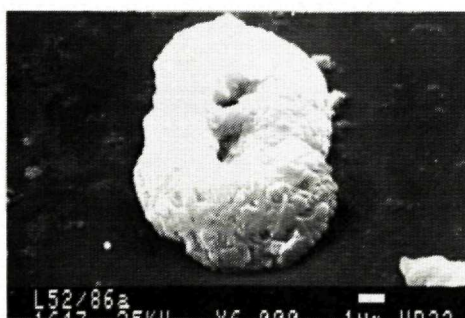
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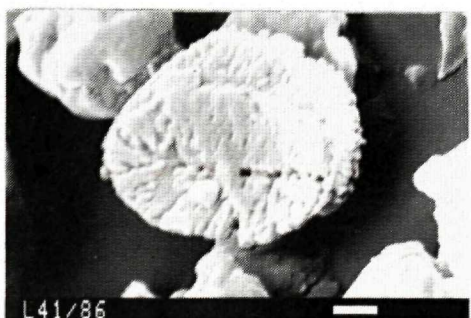
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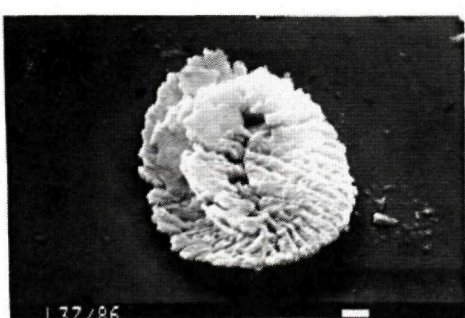
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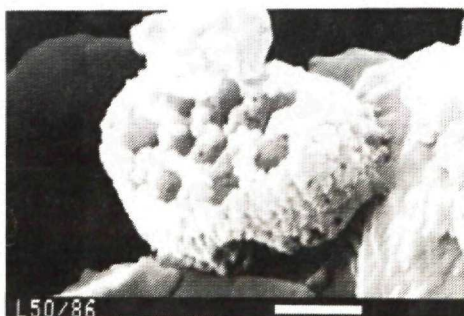
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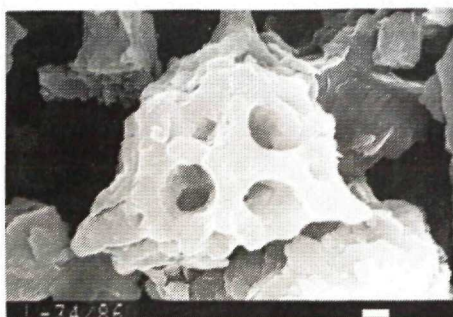
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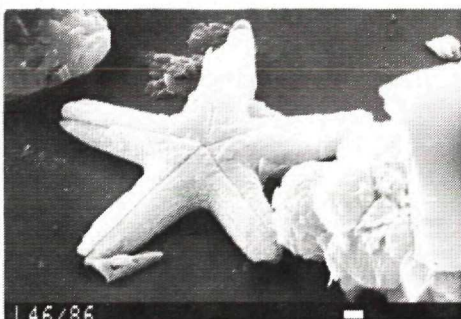
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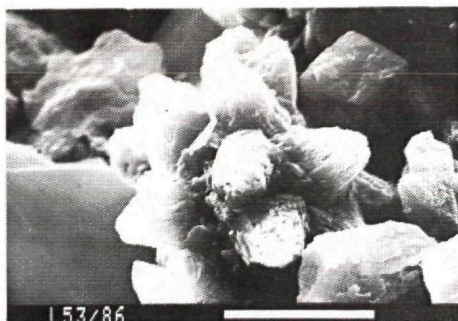
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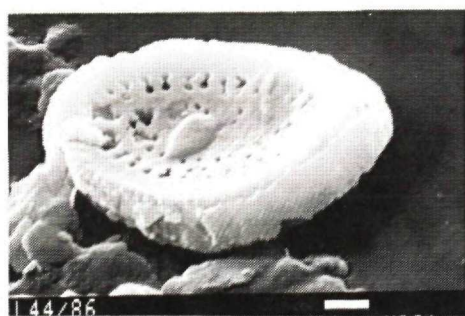
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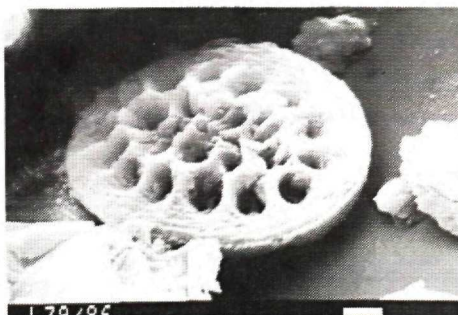
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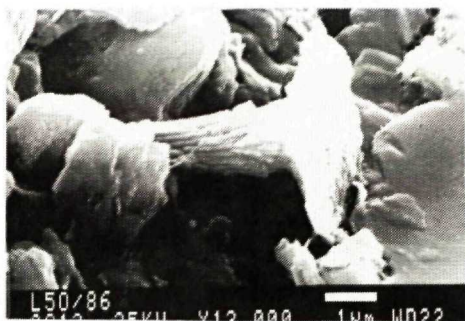
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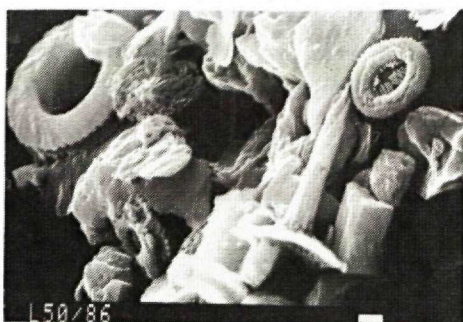
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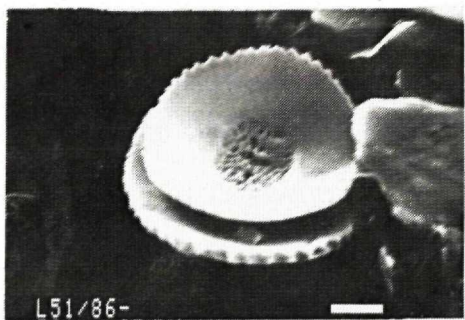
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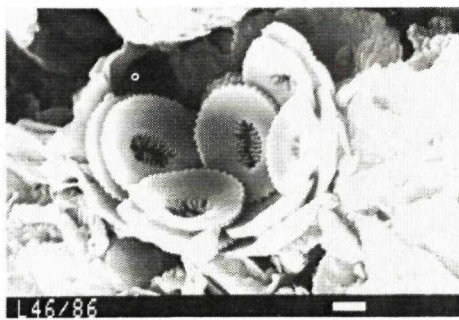
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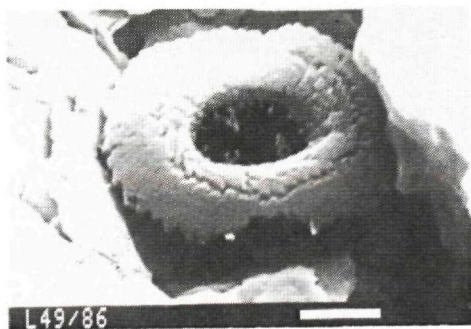
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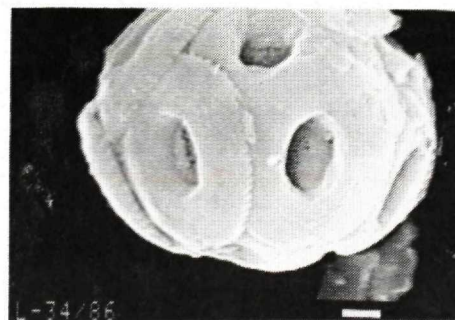
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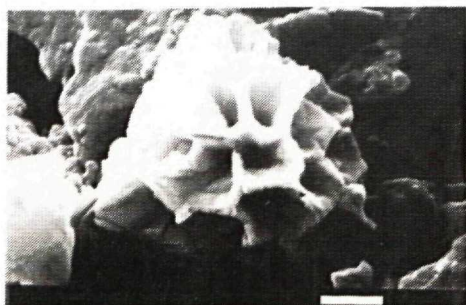
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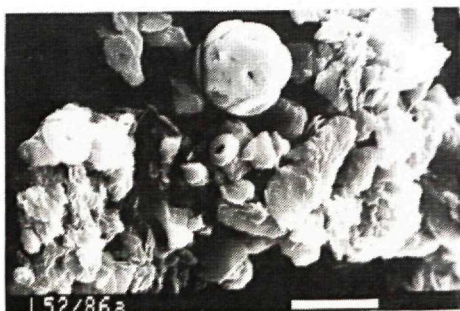
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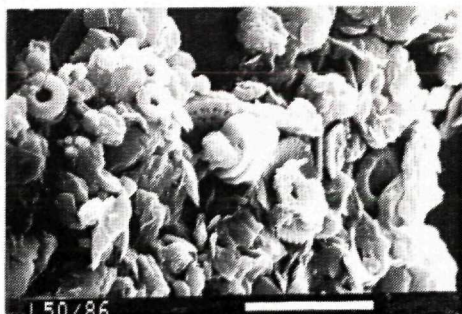
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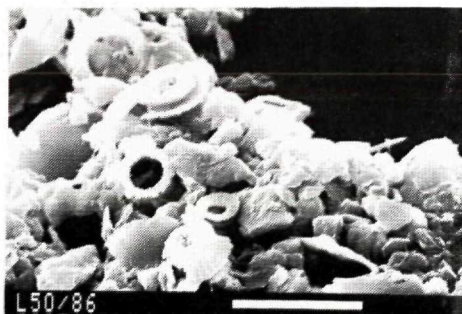
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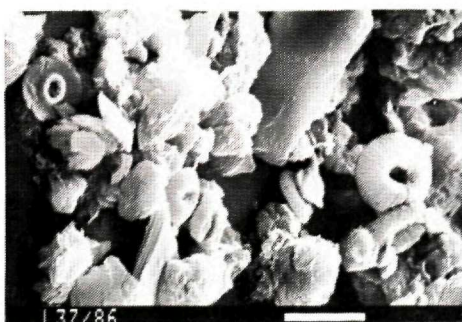
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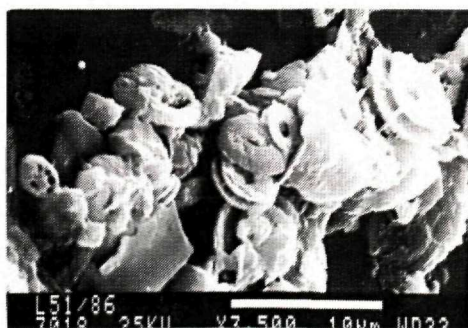
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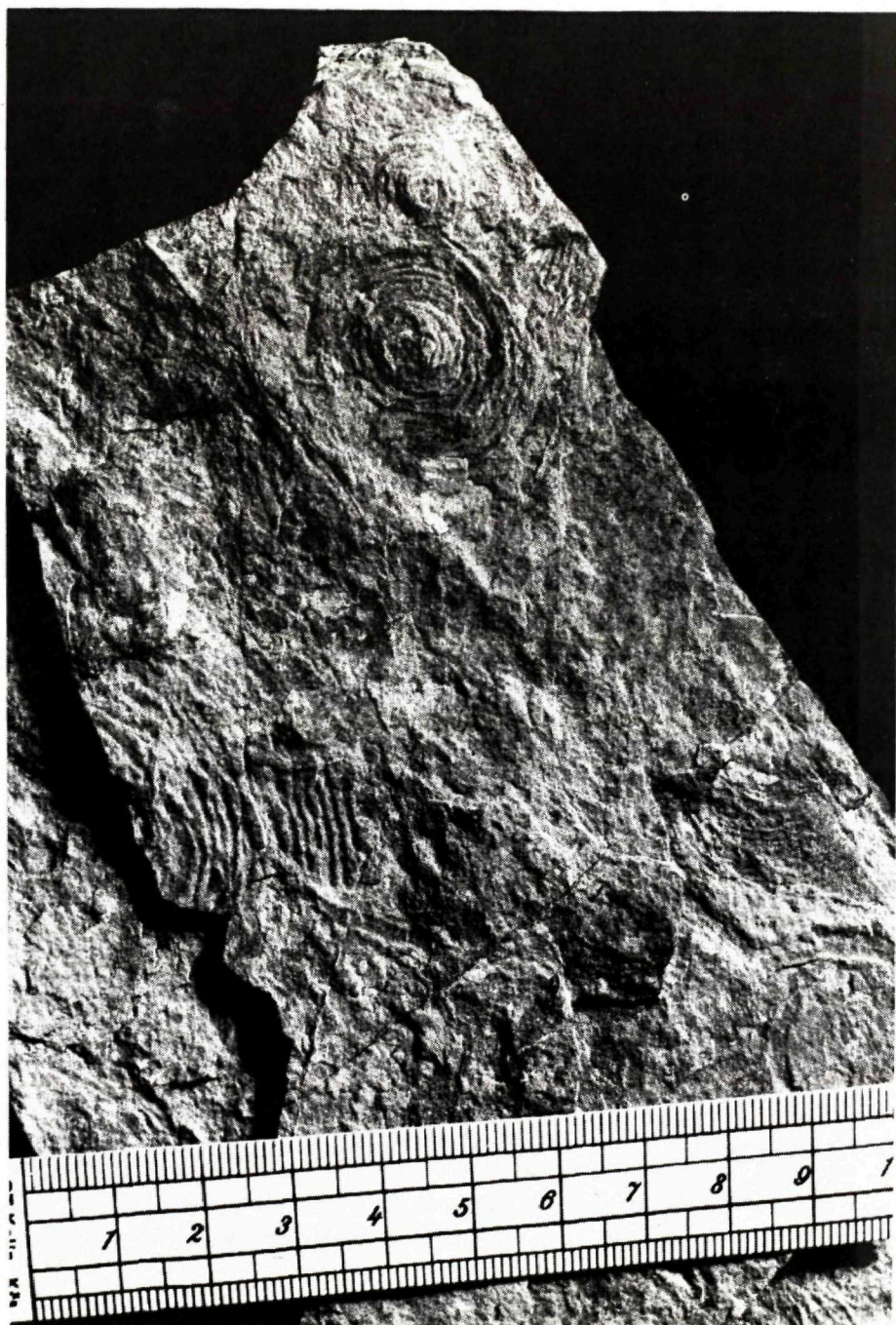
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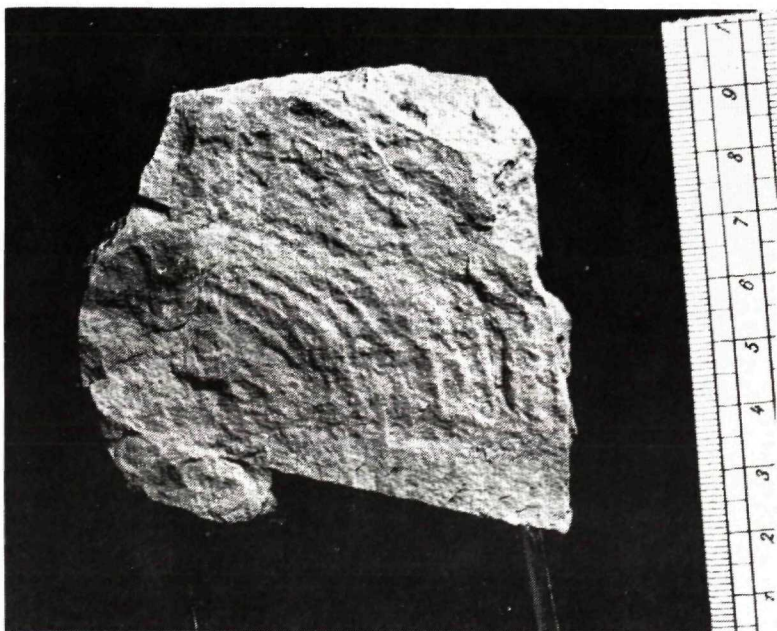


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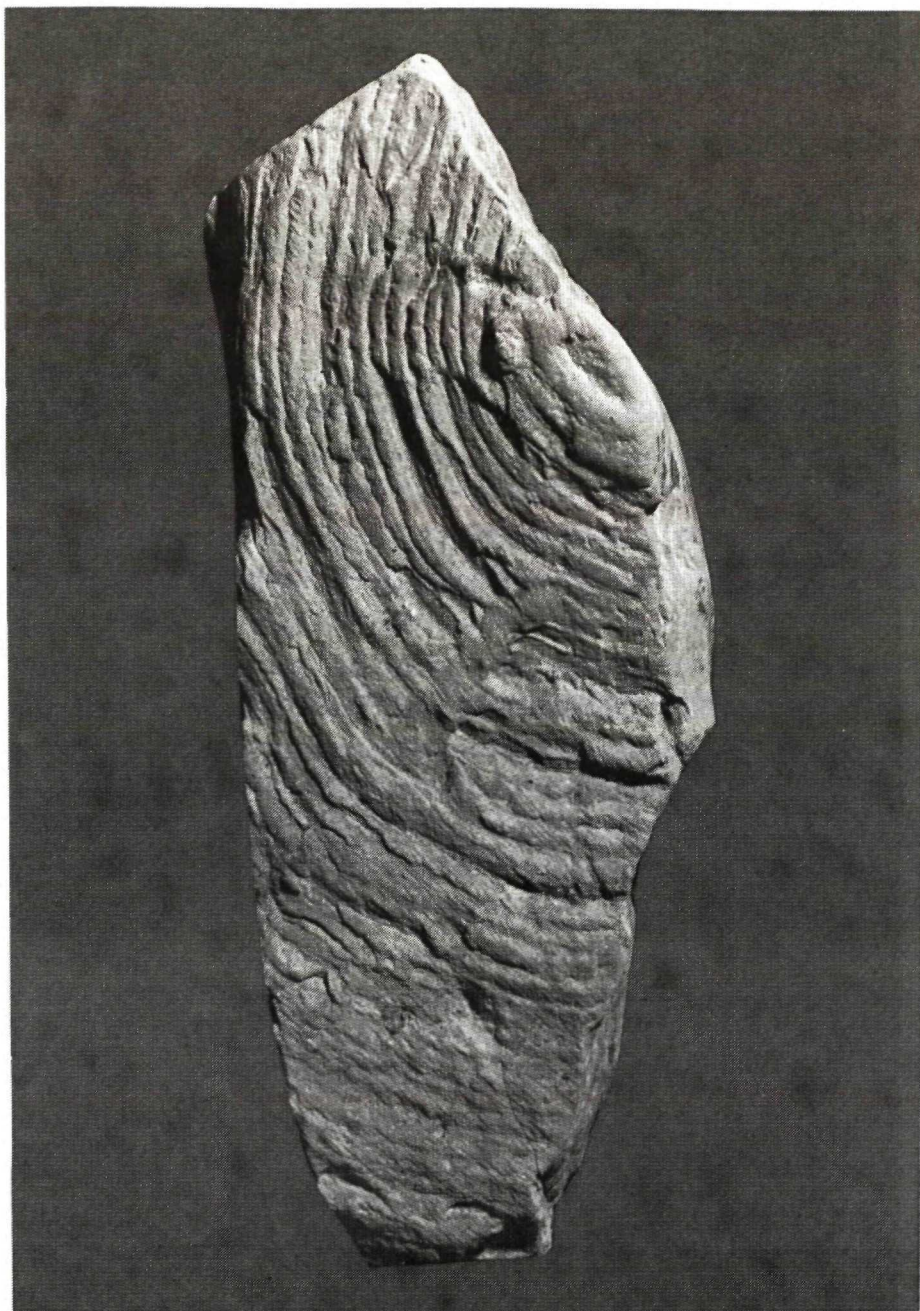


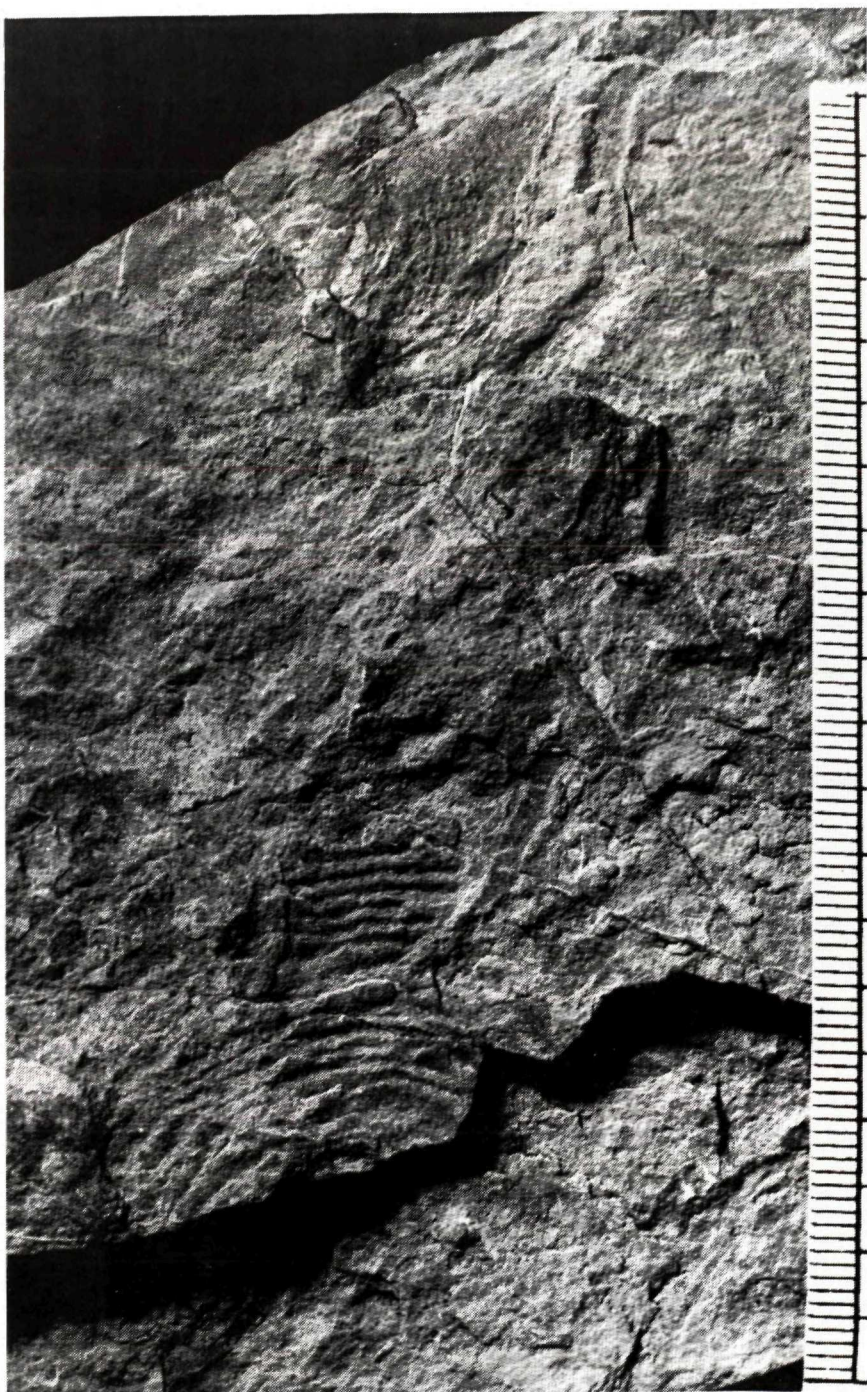


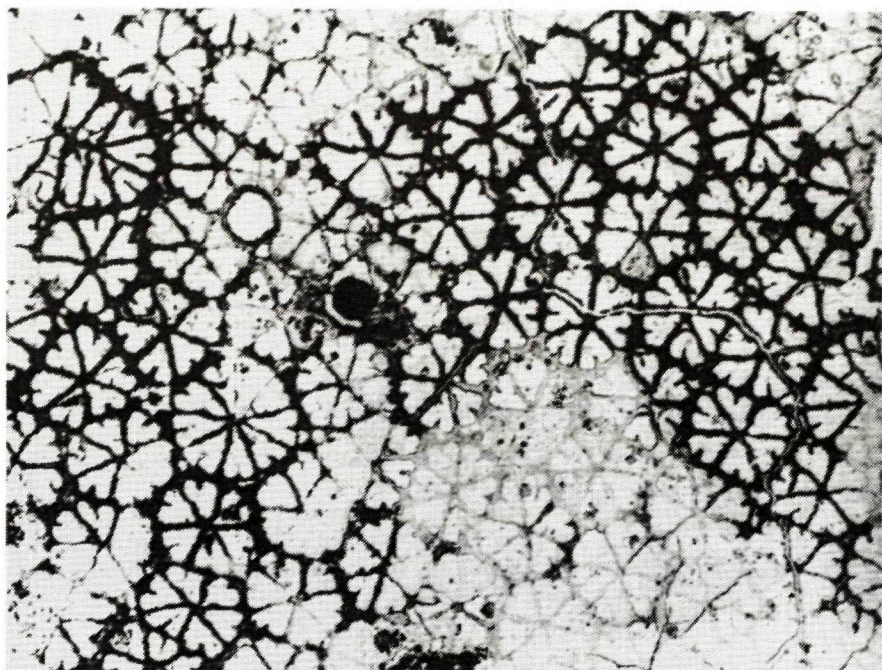
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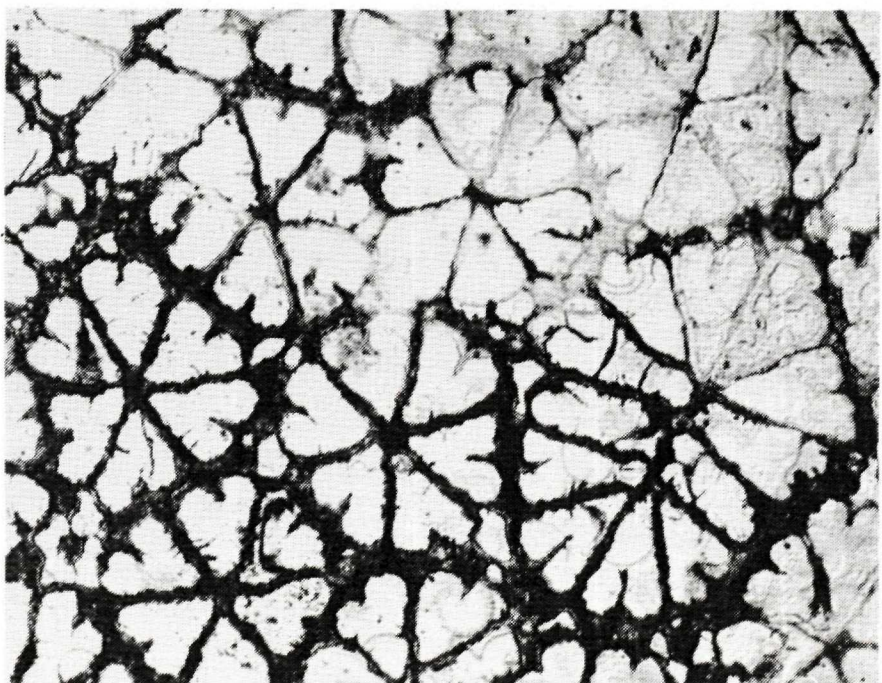
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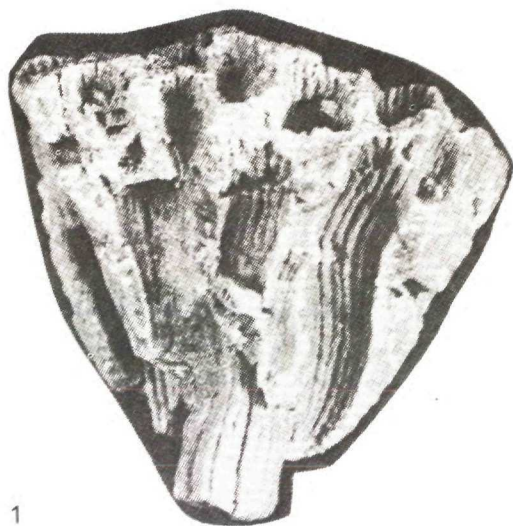




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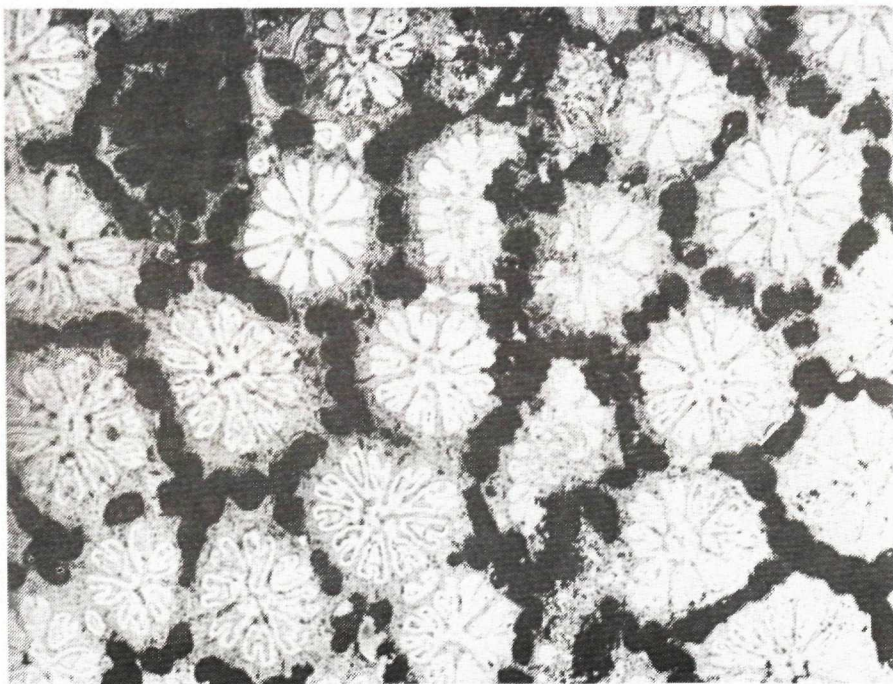
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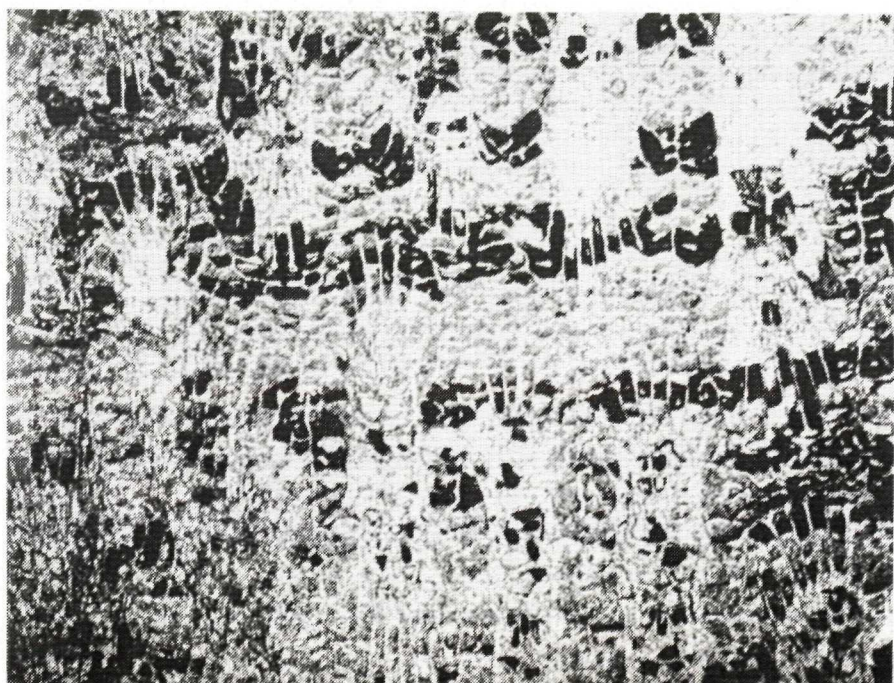
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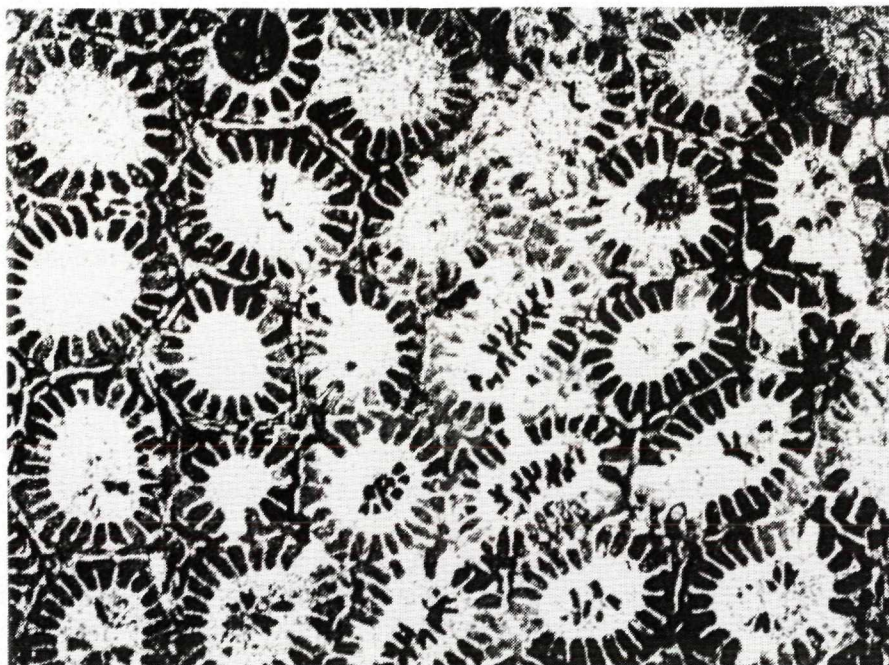
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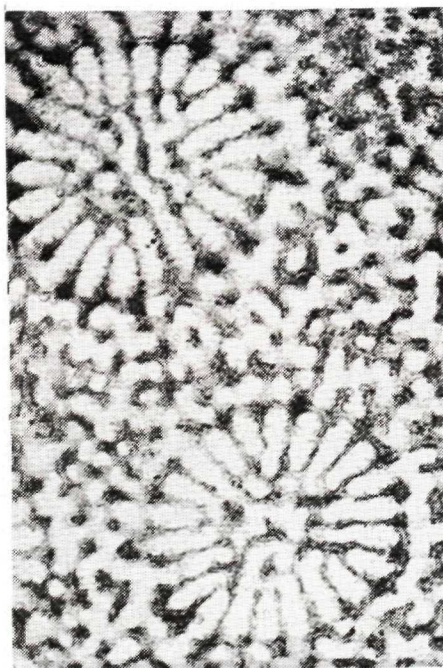
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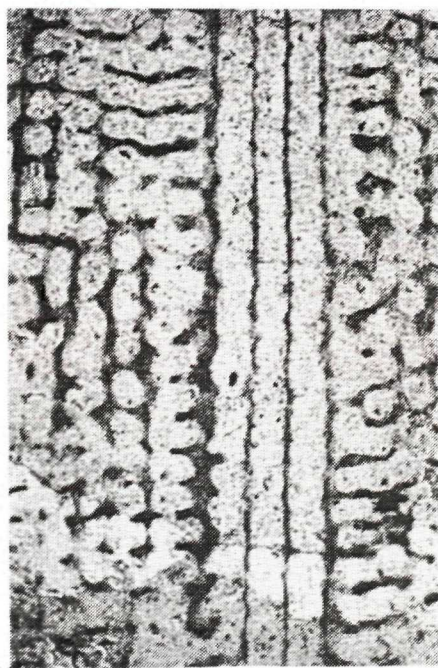
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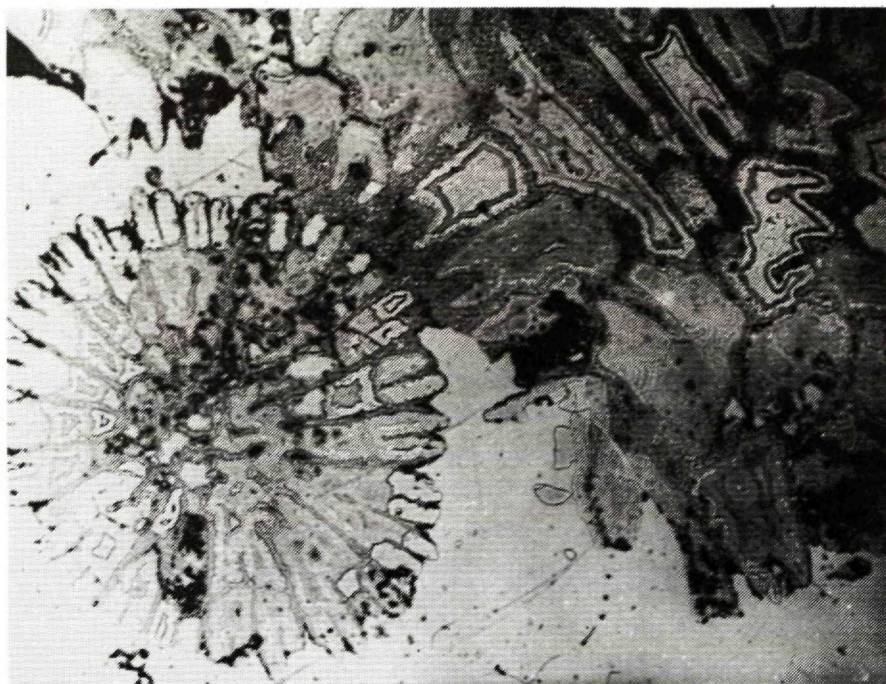
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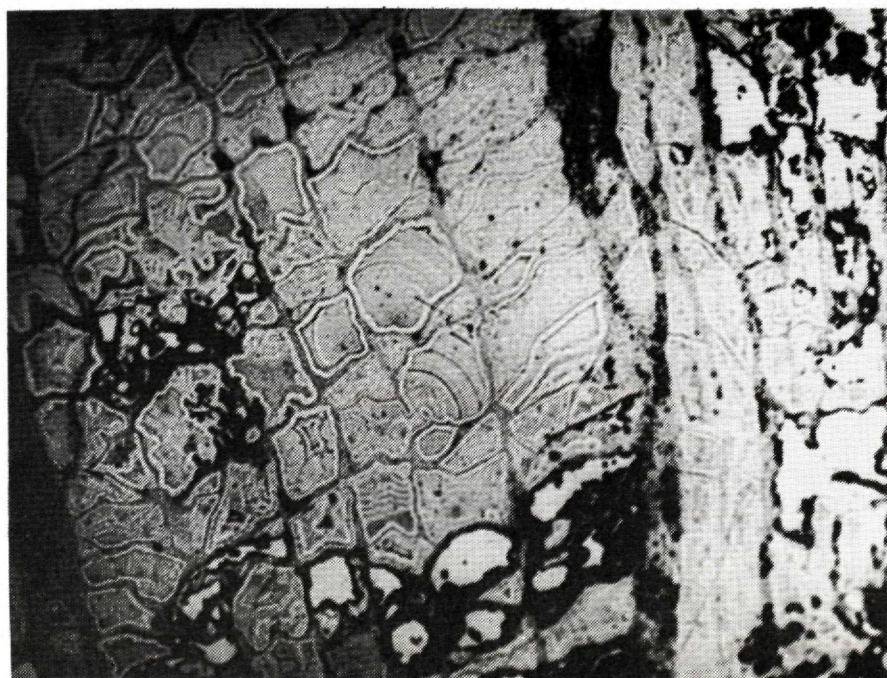
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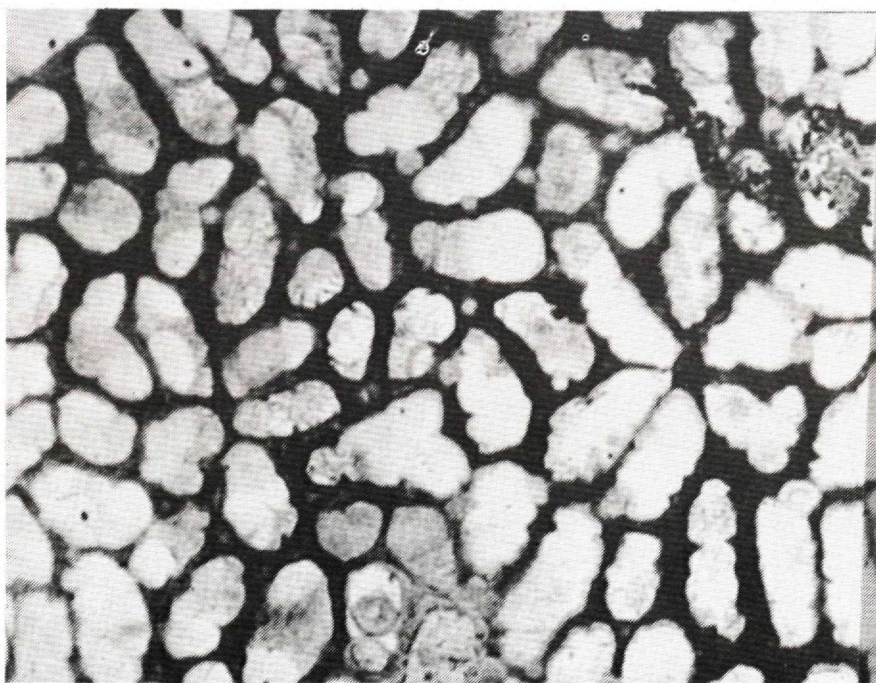
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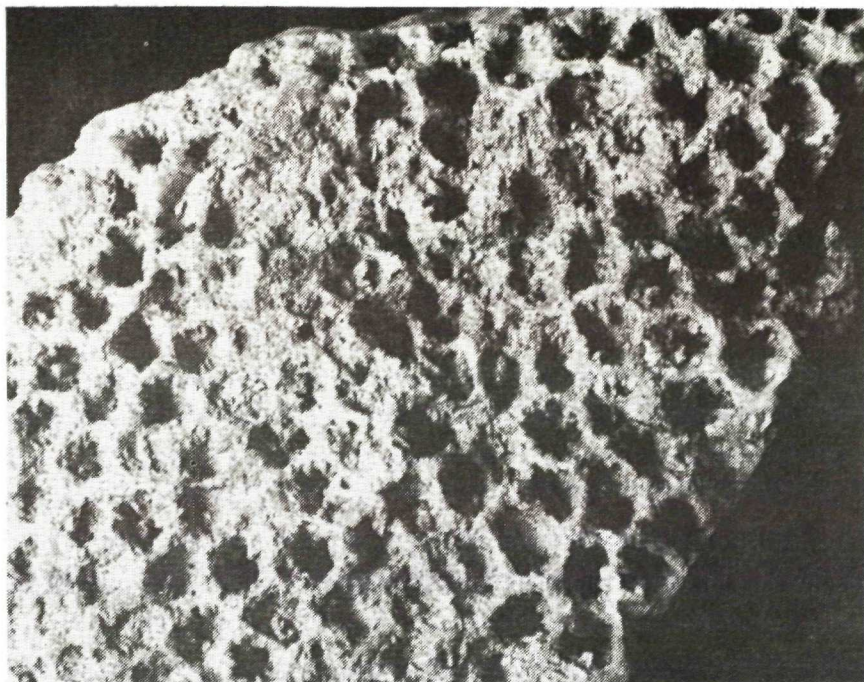
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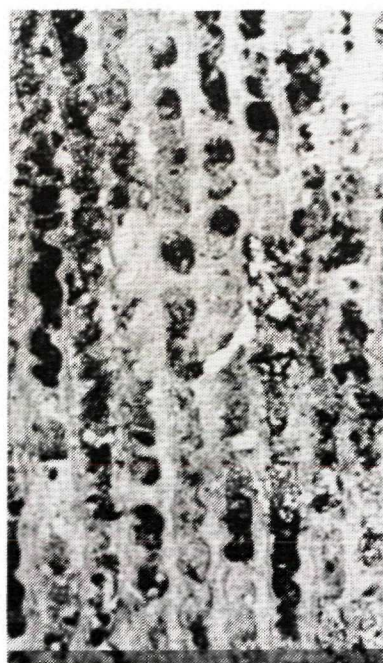
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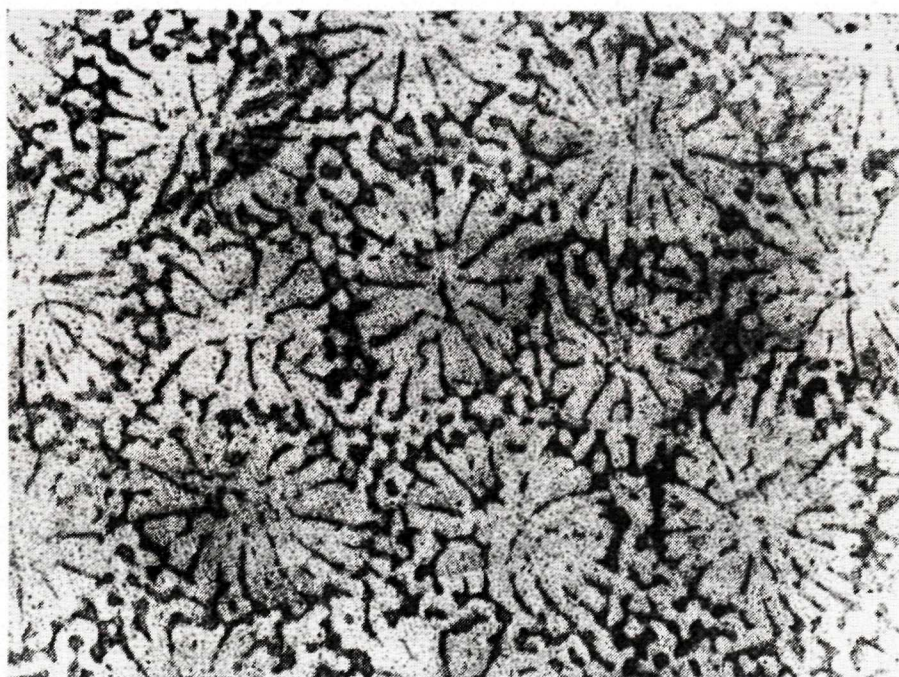
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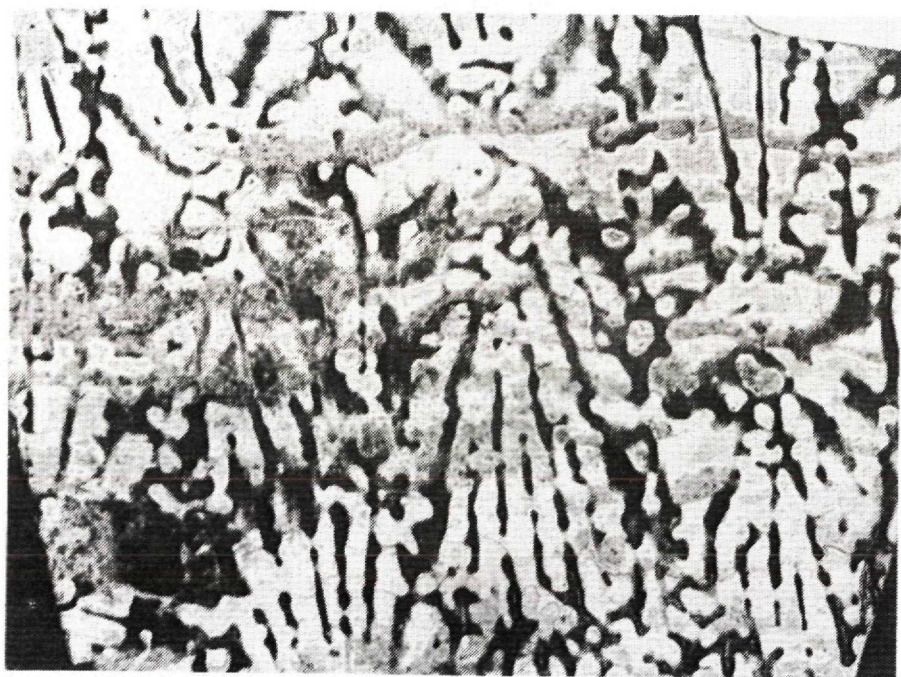
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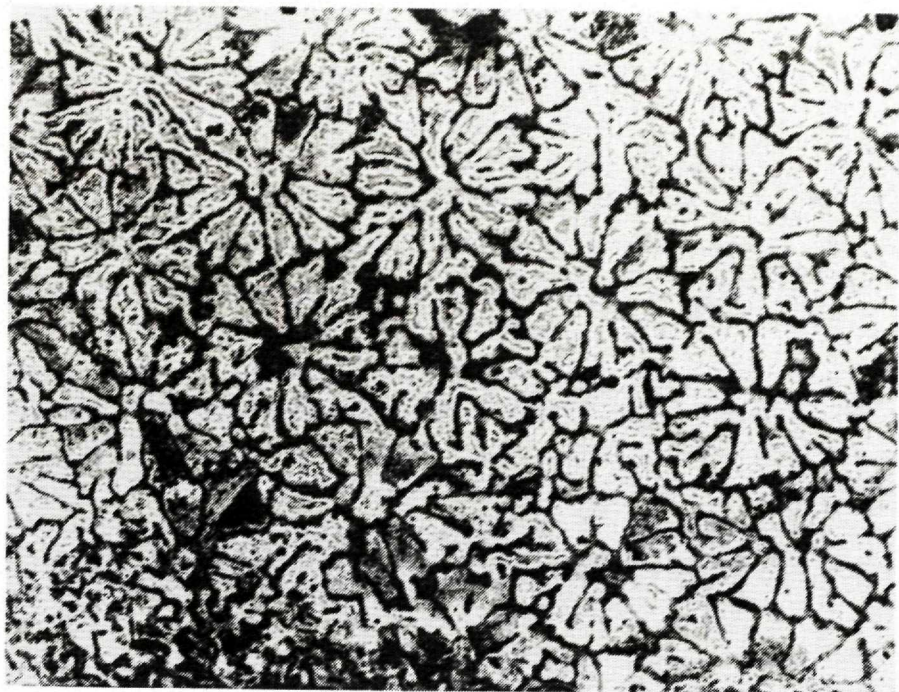
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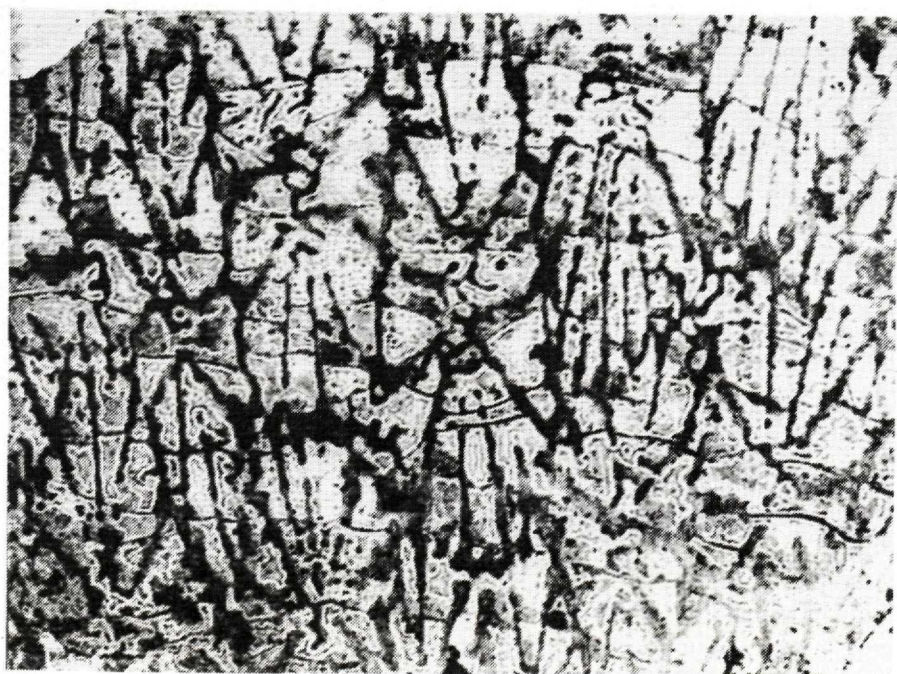
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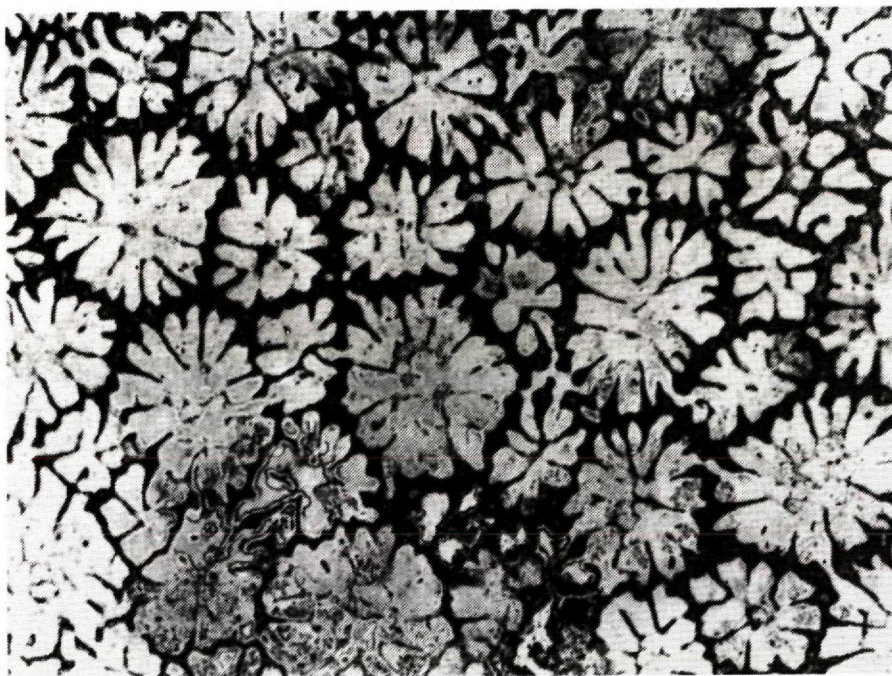
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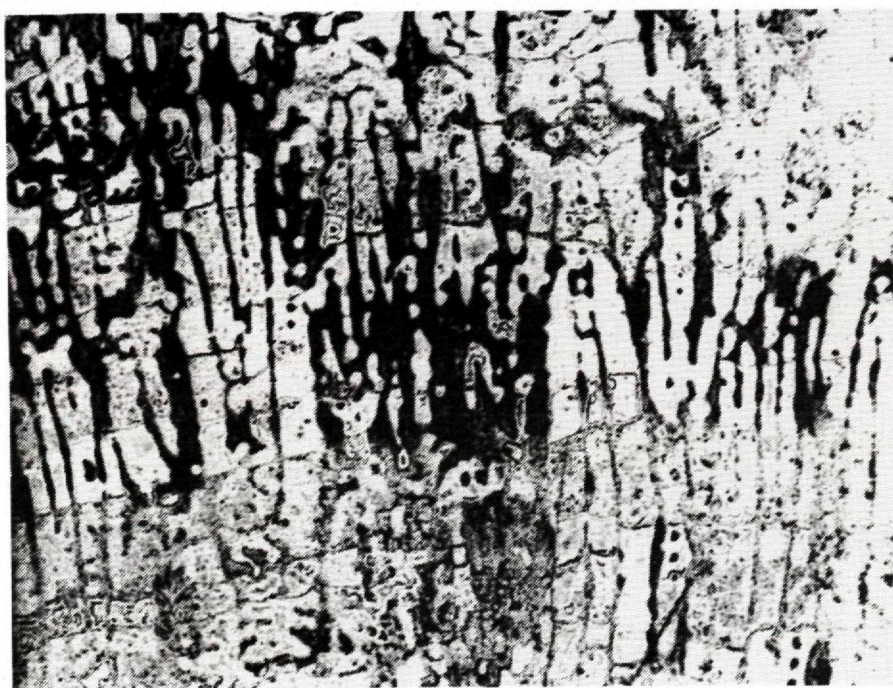
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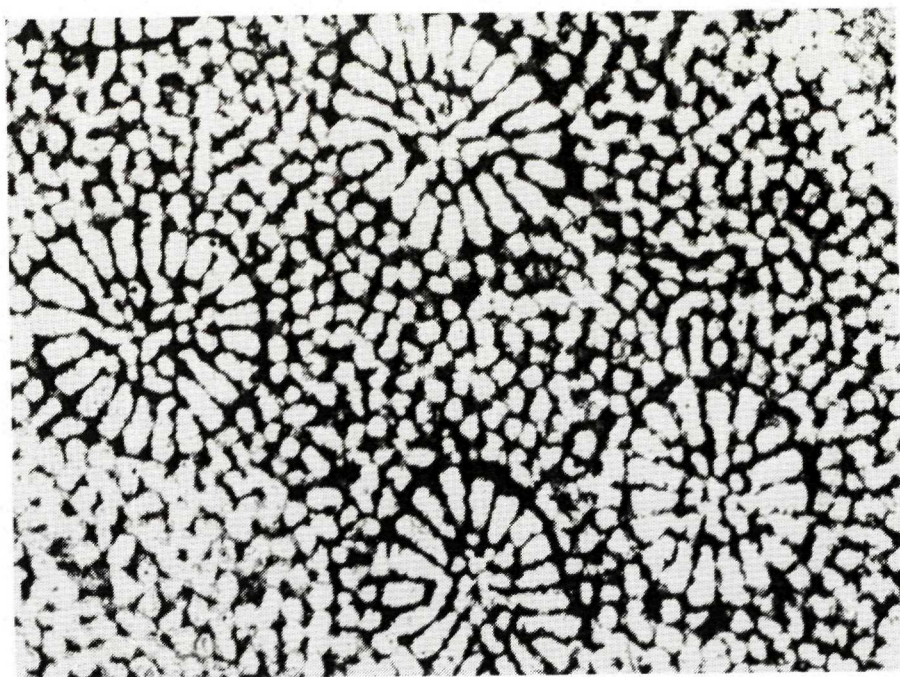
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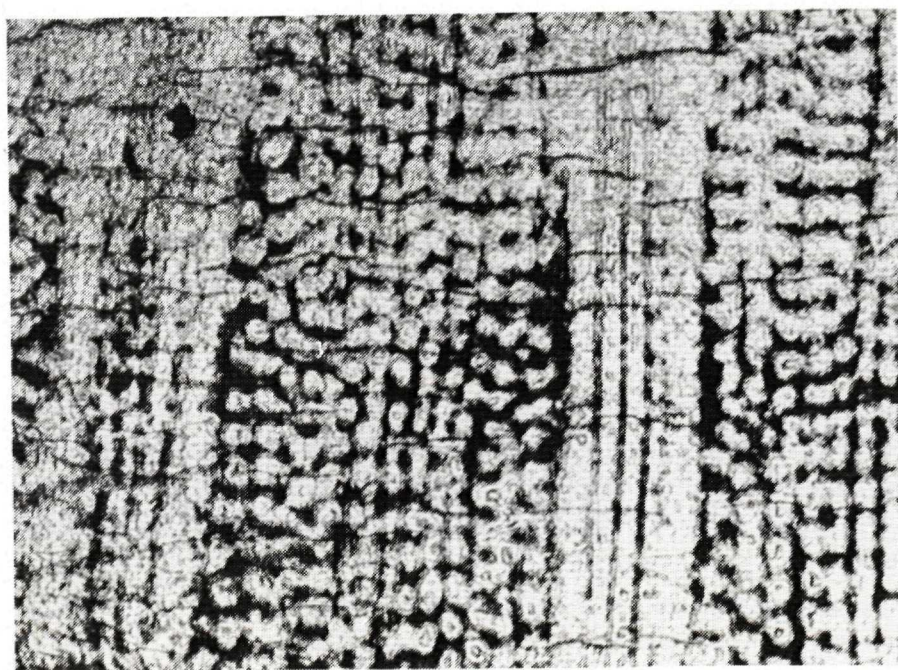
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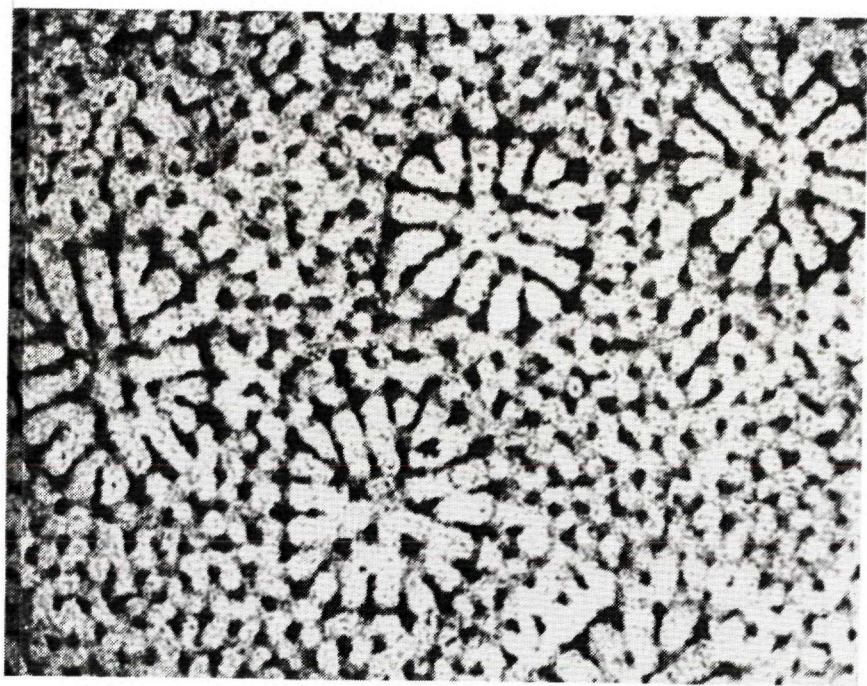
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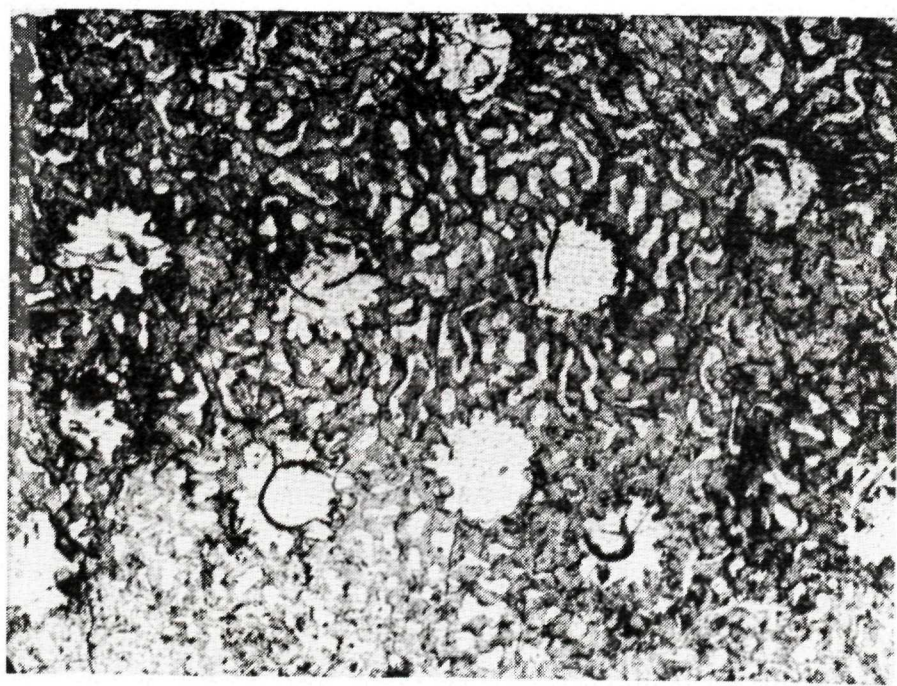
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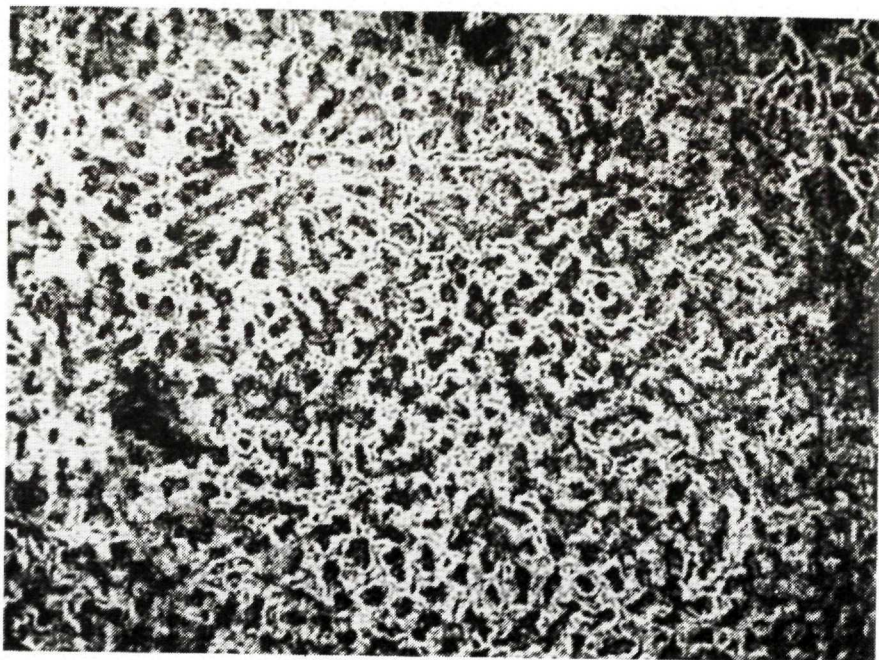
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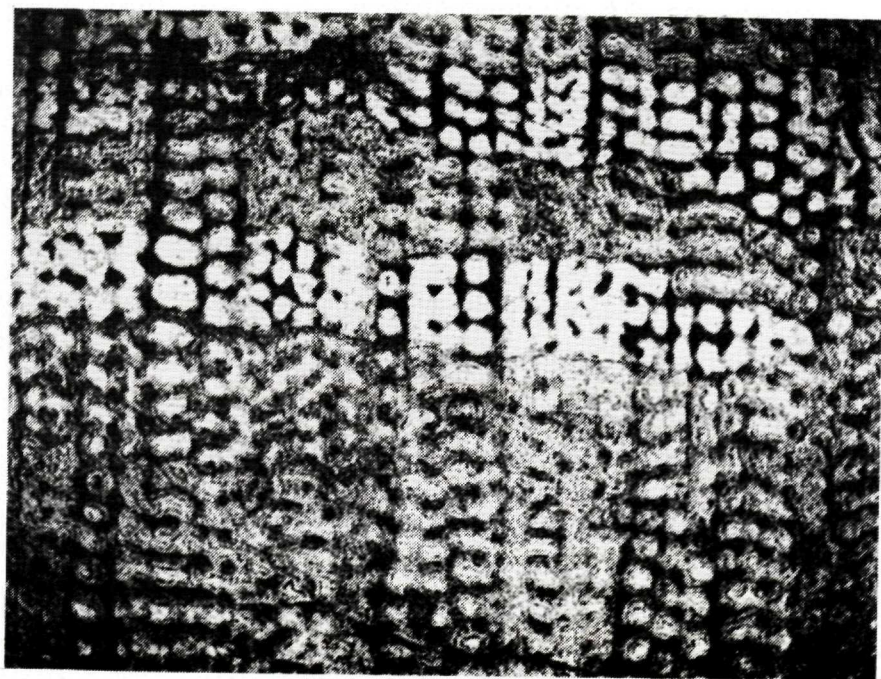
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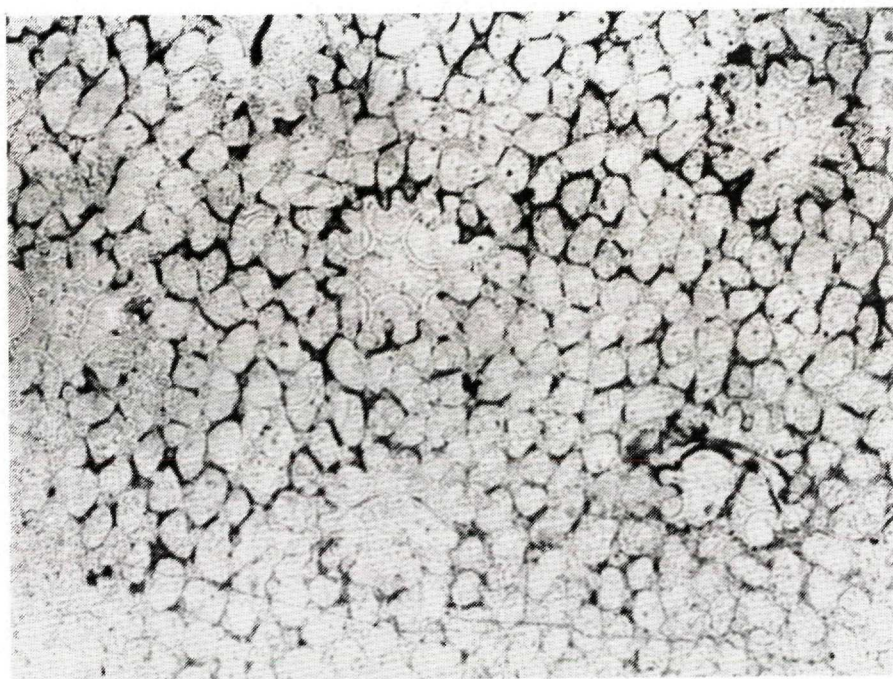
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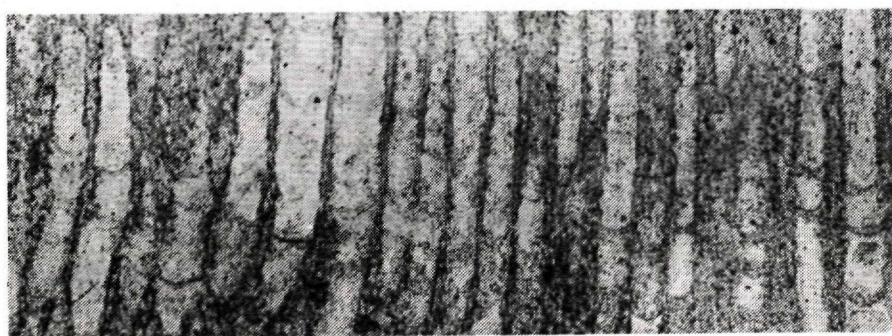
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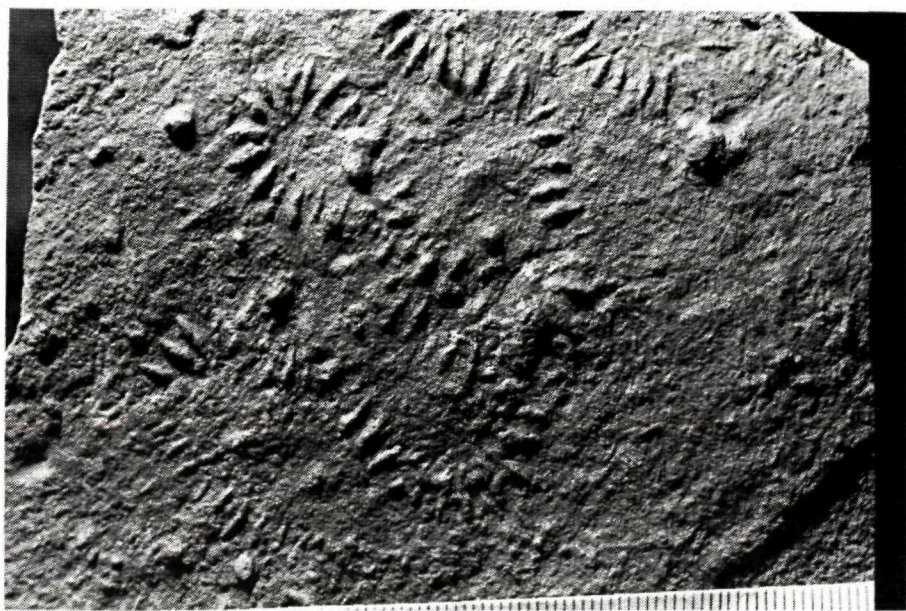
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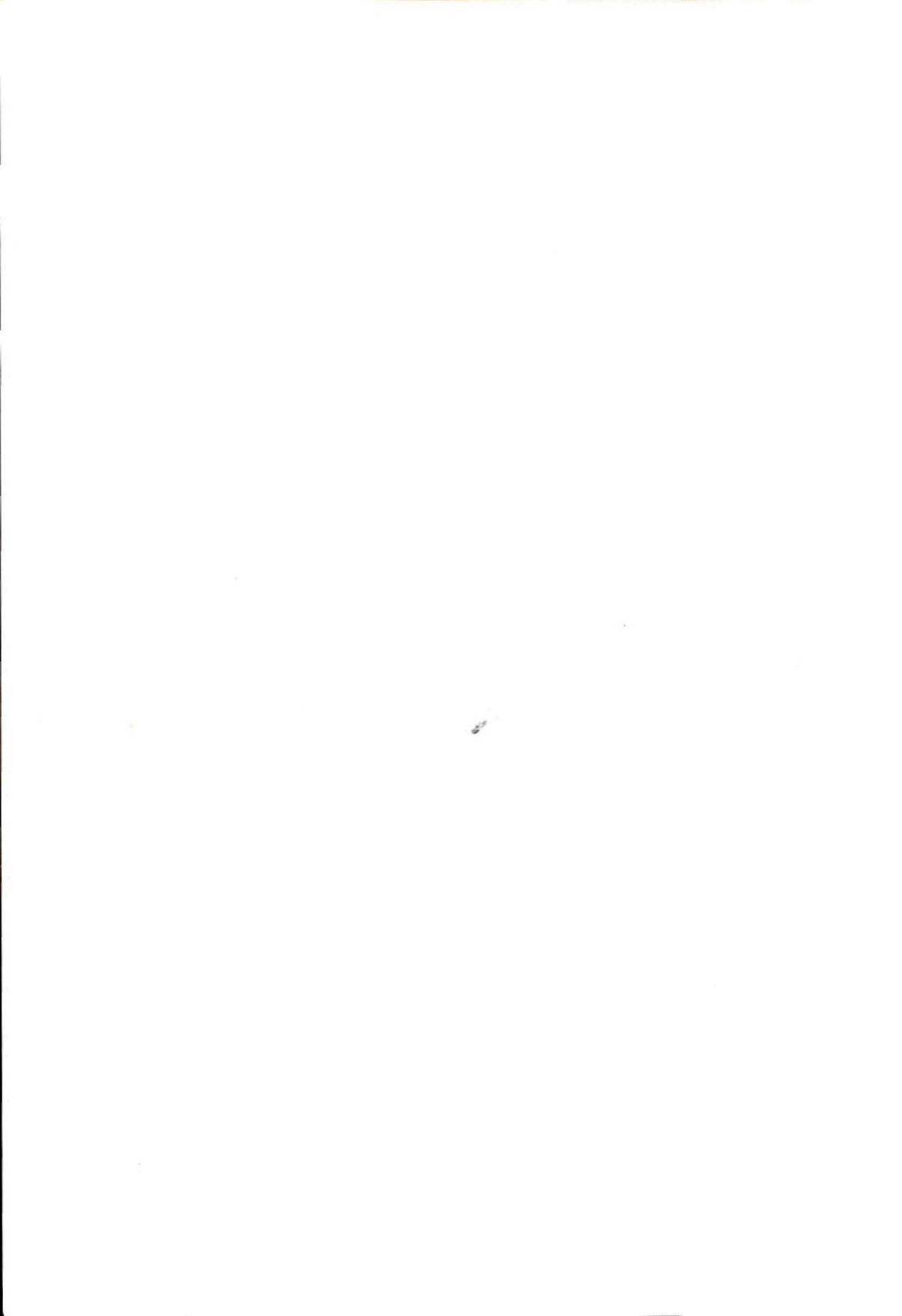
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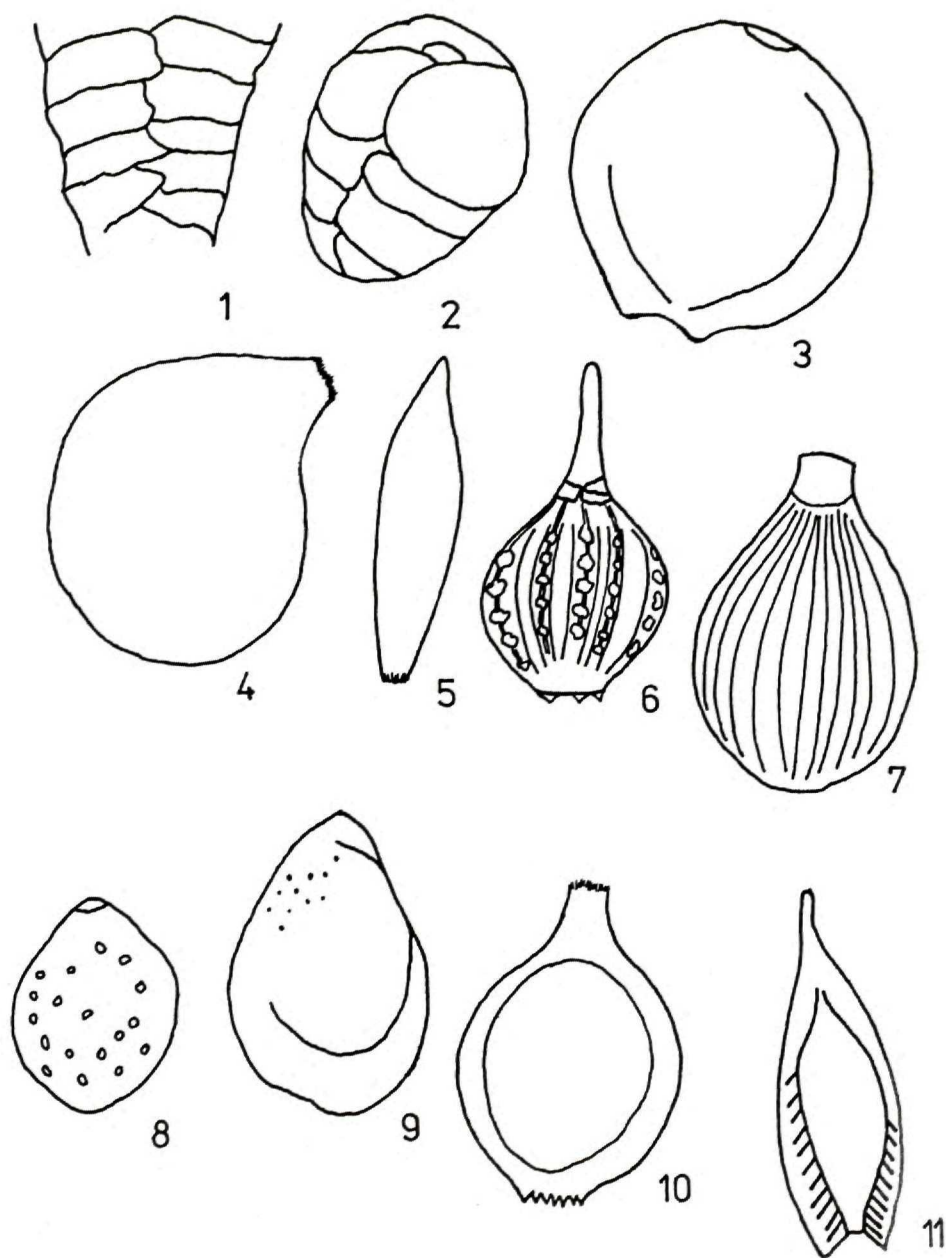


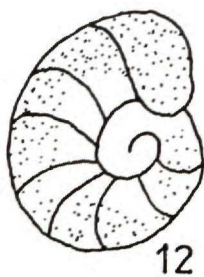
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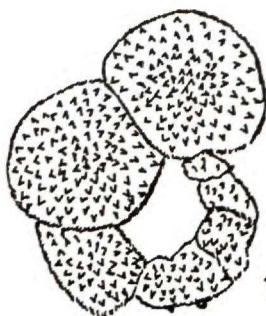
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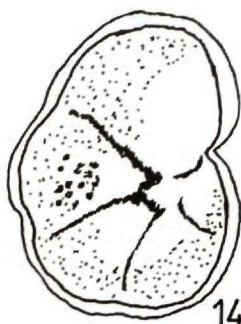




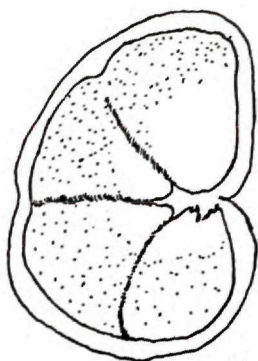
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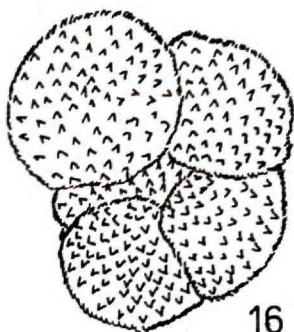
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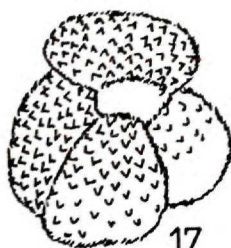
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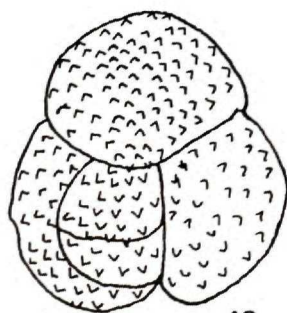
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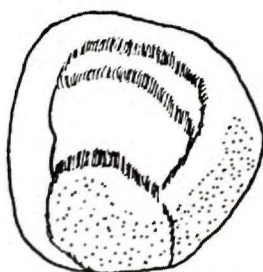
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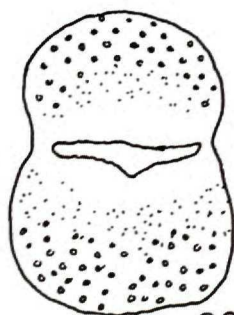
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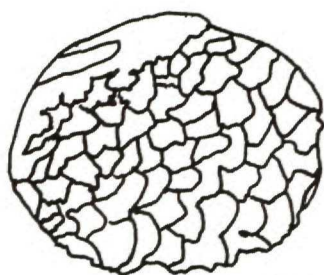
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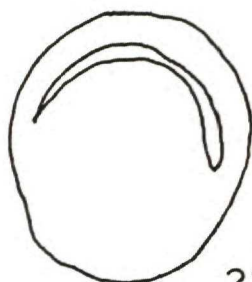
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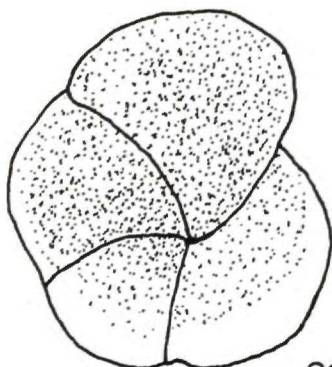
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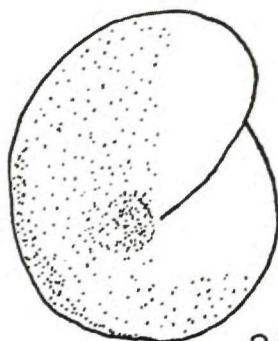
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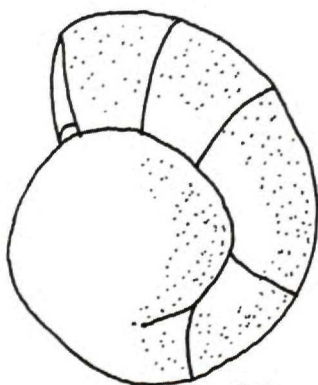
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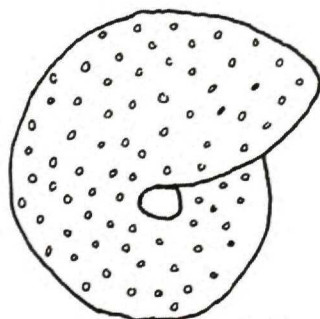
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