

ZÁPADNÉ KARPATY

SÉRIA

paleontológia 5

Západné Karpaty
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paleontológia 5

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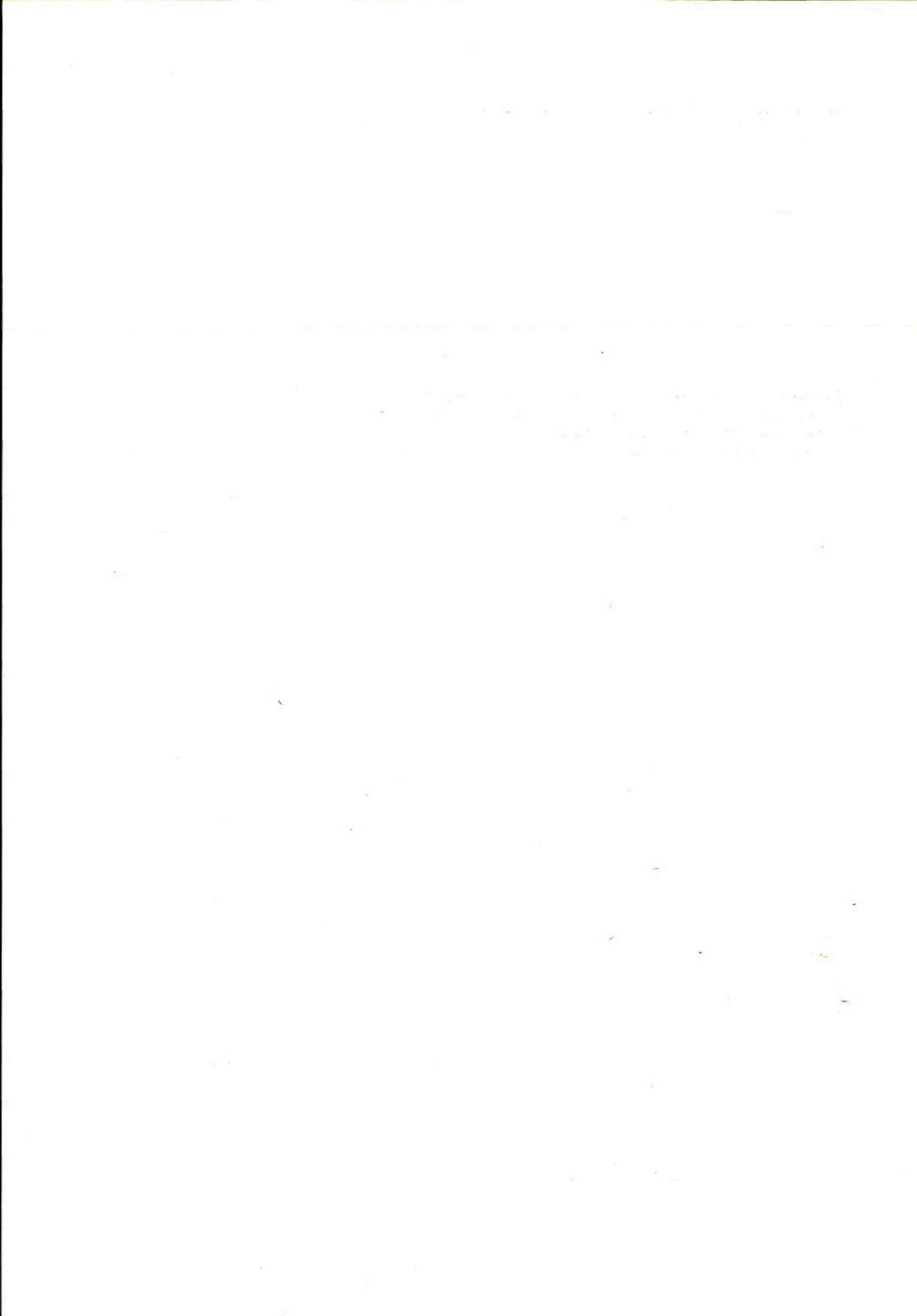
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OBSAH – CONTENTS – INHALT

SNOPKOVÁ, P.: Paleogene Sporomorphs from West Carpathians	7
PLANDEROVÁ, E.: Monosaccate pollen of genera Potonieisporites Bharadw. and Striomonosaccites Bharadw. from the Autunian (Oslavany near Brno)	75
KNOBLOCH, E.: Die jungtertiäre Flora des slowakischen Teils des Orava-Beckens	95



Paulína Snopková

Paleogene Sporomorphs from West Carpathians

2 text-fig., 44 plates (I–XLIV)

Abstract. Presented is morphological-systematical valuation of spores and pollen grains from Paleogene sediments of the West Carpathians, made for the first time in this region. Treated were 33 species of spores of Pteridophyta, 17 species of pollen grains of Gymnospermae and 65 species of Cryptospermae. Stratigraphically significant species of spores and pollen grains and entire assemblages, systematically-morphologically well characterized were a basis for microbiostratigraphical division of Paleogene of the West Carpathians.

Distinguished were 7 pollen spectra ($Ps_1 - Ps_7$ – Senonian to Oligocene (Rupelian). They correspond to one or two microfaunistic zones.

Introduction

I present the results of morphological-systematical study of spores and pollen utilized for biostratigraphical division i. e. definition of basical pollen spectra of Paleogene sedimentary rocks from the West Carpathians. I examined about 600 samples mostly from surficial exposures, and from drill holes. Sediments whose pollen spectra were defined had already been faunistically documented from the most part.

I studied sporomorphs from Paleogene sediments (Middle Eocene – Oligocene) in an epinontinental facies (around Štúrovo). The sediments contained best preserved spores and pollen so their morphologic characters (sculpture, structure, germinal apparatus) were easy to study. I studied many spores and pollen grains from sediments from the Inner-Carpathian depressions (the Hornonitrianska, Liptovská, Spišská kotlina depressions, the eastern part of the Šarišská hornatina mountains) and from the Outer Flysch zone (sediments of the Magura and Dukla units), Fig. 1. There the sporomorphs were not so well preserved because of the aqueous environment which they got in. Among all sporomorphs of quite a wide stratigraphical range (Lower Eocene – Oligocene (Rupelian), $Ps_3 - Ps_7$) 33 species of spores of Pteridophyta, 17 species of pollen grains of Gymnospermae and 65 species of Cryptospermae were systematically classified. Sporomorphs characteristic of the pollen spectrum Ps_{1-2} were already described by T. KORÁB – P. SNOPKOVÁ (1972) and will not be treated here.

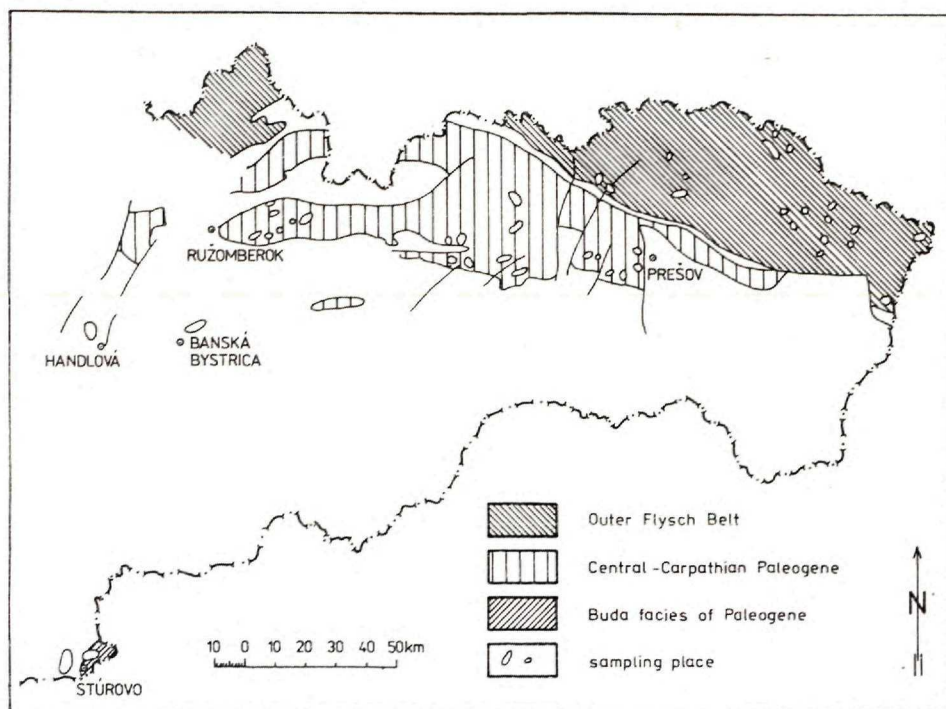


Fig. 1 A Scheme of sampling Places.

I present here the basic characteristic of pollen spectra from Paleogene sediments of the Slovak West Carpathians. I have distinguished 7 pollen spectra and the characteristic species are on the pollen diagram (Fig. 2).

Systematic classification of spores and pollen grains

Many species of spores and pollen grains are ranged in the taxa of the natural system, more to families than to genera. My classification is based on F. NOVÁK'S (1972) botanical system. Non-classified sporomorphs are at the ends of single systematic sets among „*Incertae sedis*“.

I described genera and species in accordance with the botanical nomenclature published in Czech (J. HOLUB 1968). Morphological terms for description of sporomorph are taken from R. POTONIE (1934), partly from P. THOMSON – H. PFLUG (1953) and mainly from G. KREMP (1965).

My generic and genotypic terms are based on R. POTONIE'S „Synopsis“ published several times (see References). The editor from 1960 is most suitable for Tertiary palynology because most genera and genotypes are still valid.

My systematic-morphological classification of Pteridophyta spores of Gymnos-

permae pollen grains (including a group of monocolpate pollen grains) is based on W. KRUTZSCH'S works (see References).

A group of Cryptospermae pollen grains – the so-called Brevaxones pollen grains (according to P. THOMSON – H. PFLUG (1953)) were classified according to W. KRUTZSCH (1961, 1962, 1966, 1970) and mainly M. KEDVES (1974).

My morphological-systematical classification of the so-called Longaxones pollen grains is based on the work of P. THOMSON – H. PFLUG (1953). Their classification was based on the structure of the germinal apparatus (pores, colpae). But morphology of the germinal apparatus is not equally distinct on all tricolporate and tricolpate pollen grains. It depends upon the degree of fossilization and so it is better to classify the pollen grains of this group according to the surface (sculpture) and structure of exine. This way of classification was introduced by Van der HAMMEN (1956) and fully applied on tricolporate pollen grains by M. KEDVES (1978). This author also made combinations in the genus Tricolporopollenites and simplified many names of species and subspecies introduced by P. THOMSON – H. PFLUG (1953). My classification of tricolporate pollen grains of this group from Paleogene sediments of the West Carpathians is also based on his classification to a considerable extent.

Lepidophytina

Lycopodiaceae

Retitriletes (v. d. HAMMEN 1956 ex PIERCE 1961, DOR., W. KR., MAI et SCH. 1963)

Genotype: *Retitriletes globosus* PIERCE 1961

Retitriletes sp.

Pl. IX, Fig. 3

Occurrence: Current in the Middle Eocene of the Magura unit; scarce in the Upper Eocene of the Central Carpathian Paleogene.

Remark: Similar spores were presented by W. KRUTZSCH – R. VANHOORNE (1977) as *Retitriletes belgicus* W. KR. et R. VANHOORNE from Loksbergen in Belgium (Eocene, Pl. 5, Fig. 21–23). They only differ in their size. The species described by W. KRUTZSCH – R. VANHOORNE is smaller (35–40 µm).

Zlivisporis PACLTOVÁ 1961

Genotype: *Zlivisporis blanensis* PACLTOVÁ 1961

Zlivisporis dorogensis (KDS., 1965) L. RAKOSI 1973

Pl. XXIX, Fig. 4

1965 *Retitriletes dorogensis* n. sp. – M. KEDVES Abt. 1/1–6, s. 188–190

1973 *Zlivisporis* (KDS., 1965) n. comb. – L. RAKOSI, Pl. XI, Fig. 1–3, p. 516

Occurrence: Scarce in the Upper Eocene of the Hornonitrianska kotlina (depression).

Stratigraphical range: Middle Eocene of Hungary.

Selaginellaceae, cf. Selaginellaceae

Echinatisporis W. KRUTZSCH 1959

Genotype: *Echinatisporis longechinus* W. KR. 1959

Echinatisporis longechinus W. KR. 1959

Pl. IX; Fig. 4; Pl. XXXVII, Fig. 5

1959 *Echinatisporis longechinus* n. sp. — W. KR., Pl. XXII, Fig. 229–233, p. 133

Occurrence: Scarce in the Middle and Upper Eocene of the eastern part of the Podunajská nížina (Danube lowland), Central-Carpathian Paleogene, in the Upper Eocene of the Inner-Carpathian depressions, Magura unit, Dukla unit, in the Upper Priabonian–Lower Oligocene of the Liptovská kotlina (depression), Dukla unit, and in the Rupelian of the eastern part of the Podunajská nížina (Danube lowland).

Stratigraphical range: Eocene–Oligocene.

Phyllophytina

Osmundaceae, cf. Osmundaceae

Baculatisporites THOMSON et PFLUG 1953

Genotype: *Baculatisporites primarius* (WOLFF 1934), TH. et PF. 1953

Baculatisporites nanus (WOLFF 1934) W. KRUTZSCH 1959 subsp. *robustoides* W. KR. 1967

Pl. XXI, Fig. 4

1934 *Sporites nanus* n. sp. — WOLFF, Pl. 5, Fig. 9, p. 66

1959 *Baculatisporites nanus* (WOLFF 1934) n. comb. — W. KRUTZSCH, s. 140

1967 *Baculatisporites nanus* (WOLFF 1934) W. KR. 1959 *robustoides* n. subsp. — W. KRUTZSCH, Pl. 14, Fig. 1–26, p. 64

Occurrence: Scarce in the Upper Eocene of the western part of the Liptovská kotlina (depression) — shale lithofacies.

Stratigraphical range: Scarce in the Oligocene, mainly in the Miocene-Pliocene.

Remark: The spore described differs from the subspecies presented by W. KRUTZSCH (1967) in a thinner wall of the exospore. Its diagnostic characters are the same.

Baculatisporites quintus (THOMSON et PFLUG 1953) W. KRUTZSCH 1967

Pl. XXIX, Fig. 3, Pl. XXX, Fig. 3, Pl. XXXVII, Fig. 1

- 1953 *Rugulatisporites quintus* n. sp. — THOMSON et PFLUG, Pl. 2, Fig. 44–47, p. 56
 1959b *Verrucosisorites quintus* (Th. et Pf. 1953) n. comb. — W. KRUTZSCH, Pl. XXVII, Fig. 288–289, p. 144/5
 1967 *Baculatisporites quintus* (THOMSON et PFLUG 1953) n. comb. — W. KRUTZSCH, Pl. 6, Fig. 2–10, p. 48

Occurrence: Frequent in the Upper Eocene — Lower Oligocene of the Central-Carpathian Paleogene, Magura unit and Dukla unit.

Stratigraphical range: Middle Eocene — Miocene.

Baculatisporites gemmiclavatus W. KRUTZSCH 1959

Pl. XXXVIII, Fig. 1

1959 *Baculatisporites gemmiclavatus* n. fsp. — W. KRUTZSCH; Pl. XXV, Fig. 272, p. 142/3

Occurrence: in the Middle Eocene of Germany, Hungary (Dorog-Tokod basin).

Remark: The species is most frequent in the Middle Eocene. It was most likely resedimented into Rupelian sedimentary rocks from the basement rocks.

Schizeaceae

Leiotriletes (NAUMOVA 1937) R. POT. KRP. 1954

Genotype: *Leiotriletes sphaerotriangulus* (LOOSE 1932) R. POT. et KRP. 1954

Leiotriletes adriennis (R. POT. et GELL. 1933) W. KR. 1959 subfsp. *adriennis* W. KR. 1959

Pl. I, Fig. 1, Pl. VII, Fig. 2, Pl. VIII, Fig. 4, Pl. XXXVI, Fig. 3

1933 *Punctatisporites adriennis* n. sp. — R. POTONIÉ et GELLETICH, Pl. II, Fig. 14–15, p. 521

1954a *Laevigati adriennis* (R. POT. et GELL. 1933) n. comb. — W. KRUTZSCH, Pl. 4, Fig. 1–4, p. 294–259, 310

1959 *Leiotriletes adriennis* (R. POT. et GELL. 1933) n. comb. subfsp. *adriennis* — W. KRUTZSCH, p. 57)

Occurrence: current in the Lower Eocene of the Magura and Dukla units, in the Middle Eocene of the eastern part of the Podunajská nížina (Danube lowland), Hornonitrianska kotlina (depression), in the Upper Eocene of the Inner-Carpathian depressions, in the Upper Eocene–Lower Oligocene of the Magura and Dukla units, and in the Rupelian of the eastern part of the Podunajská nížina (Danube lowland).

Stratigraphical range: Lower Eocene — Oligocene.

Remark: Spores of this species from the Lower Eocene of the Dukla and the Magura units are corroded. They range in size from 45 to 70 μm . Larger specimens were found in the Middle Eocene of the Hornonitrianska kotlina (depression).

Leiotriletes adriennis (R. POT. et GELL. 1933) W. KR. 1959 var. *pseudodivisus* W. KR. 1959

Pl. VIII, Fig. 5, Pl. XXXVI, Fig. 2

1959 *Leiotriletes adriennis* fvar. *pseudodivisus* n. fvar. – W. KRUTZSCH, Pl. 2, Fig. 8–9, p. 60

Occurrence: Scarce in the Middle Eocene of the Magura unit, in the Rupelian of the eastern part of the Podunajská nížina (the Danube lowland).

Stratigraphical range: Lower Eocene – Oligocene.

Remark: Spore from the Middle Eocene of the Magura unit (Pl. VIII, Fig. 5) is partly corroded on the surface.

Leiotriletes adriennis (R. POT. et GELL. 1933) W. KR. 1959 cf. fvar. *pseudotriplan* M. KEDVES 1961

Pl. XXXVII, Fig. 2

1961 *Leiotriletes adriennis* (R. POT. et GELL. 1933), W. KR. 1959 fvar. *pseudotriplan* – M. KEDVES n. fvar. et nom., Pl. 4, Fig. 4, p. 118

Occurrence: Scarce in the Rupelian of the eastern part of the Podunajská nížina (Danube lowland).

Stratigraphical range: Lower Eocene–Upper Oligocene.

Remark: Spores found in the Rupelian of the eastern part of the Podunajská nížina (Danube lowland) differ from species varieties presented in the synonymy in their smaller size and thinner exospore wall.

Leiotriletes microadriennis W. KRUTZSCH 1959

Pl. VIII, Fig. 1, 3

1959 *Leiotriletes microadriennis* n. fsp. – W. KRUTZSCH, Pl. 1, Fig. 3–7, p. 61–62

1973 *Leiotriletes microadriennis* W. KR. 1959, *Schizeaceae* cf. *Lygodium* – M. KEDVES, Pl. III, Fig. 1–2, p. 31

Occurrence: Frequent mainly in the Middle Eocene of the eastern part of the Podunajská nížina (Danube lowland), the Hornonitrianska kotlina (depression), the Magura unit and the Dukla unit.

Stratigraphical range: Lower–Upper eocene, scarcely Oligocene.

Leiotriletes microadriennis W. KR. 1959

fvar. *triplan* M. KEDVES 1961

Pl. XXXVI, Fig. 4

1961 *Leiotriletes microadriennis* W. KR. 1959, fvar. *triplan* n. fvar. – M. KEDVES, Pl. 4, Fig. 9–13, p. 119

Occurrence: Scarce in the Rupelian of the Podunajská nížina (Danube lowland).

Stratigraphical range: Lower–Upper Eocene.

Remark: Spores of this species in the triplan form occurred only in the Rupelian. They are also quoted (by M. KEDVES 1969, 1979), from the Lower and Upper Eocene.

Leiotriletes dorogensis (M. KEDVES 1960) KEDVES 1961

Pl. VII, Fig. 1, Pl. XXXVI, Fig. 1

1960 *Laevigatisporites dorogensis* n. fsp., M. KEDVES, Pl. 3, Fig. 1, 2, 5, 7, p. 98

1961 *Leiotriletes dorogensis* (M. KEDVES 1960) n. comb., *Schizeaceae* cf. *Lygopodium* – M. KEDVES, Pl. 4, Fig. 14–18, p. 120

Occurrence: Scarce in the Middle Eocene and Rupelian of the eastern part of the Podunajská nížina (Danube lowland).

Stratigraphical range: Lower Eocene–Oligocene. Maximum occurrence in the Middle Eocene.

Remark: The species from the Rupelian of the eastern part of the Podunajská nížina (Danube lowland) corresponds in its diagnostic characters rather to *fvar. pseudodivisus* recorded in the Lower–Upper Eocene of the Bakony mountains by M. KEDVES (1973).

Leiotriletes maxoides W. KR. 1962 subsp. *maximus* (Pf. 1953) W. KR. 1959

Pl. XXXV, Fig. 1

1962 *Leiotriletes maxoides* n. fsp. et subfsp. – W. KRUTZSCH, Pl. 2, Fig. 1–5, p. 18

1962 *Leiotriletes maxoides* W. KR., subsp. *maximus* (Pf. 1953) W. KR., 1959 – W. KRUTZSCH, Pl. 3, Fig. 1–4, p. 20

Occurrence: Frequent in the Rupelian of the eastern part of the Podunajská nížina (Danube lowland), in the Upper–Lower Oligocene of the Liptovská kotlina (depression).

Stratigraphical range: Oligocene–Miocene.

Remark: Spores from the Rupelian of the eastern part of the Podunajská nížina differ from the species presented in the synonymy by their smaller size and by less conspicuous bifurcation of the Y-scar.

Punctatisporites IBRAHIM 1933

Genotype: *Punctatisporites punctatus* (IBR. 1932) IBR. 1933

Punctatisporites gelletichi KEDVES 1961 subsp. *minor* KEDVES 1961

Pl. VIII, Fig. 2, Pl. II, Fig. 5

1961 *Punctatisporites gelletichi* n. fsp. subfsp. *minor* n. subfsp. – M. KEDVES, Pl. 2, Fig. 25–27, p. 111

Occurrence: Scarce; Middle Eocene of the eastern part of the Podunajská nížina; Lower Eocene of the Magura unit.

Stratigraphical range: Middle Eocene of Hungary (M. KEDVES 1969, 1973).

Remark: The spore from the Middle Eocene of the Magura unit (Pl. II, Fig. 5) is very corroded. Its punctate surface shape, and size correspond partly to the subspecies which it is ranged to.

Trilites COOKSON et COUPER 1953

Genotype: *Trilites tuberculiformis* COOKSON 1974

Trilites multivallatus (Pf. 1953) W. KR. 1959

Pl. XII, Fig. 5; Pl. XIII, Fig. 1; Pl. XXI, Fig. 6

1934 *Sporites solidus* n. sp. — R. POTONIE, Pl. 1, Fig. 35, p. 42

1953 *Corrugatisporites solidus* R. POT. *multivallatus* n. subsp. (Pf.) — PFLUG in THOMSON et PFLUG, Pl. 2, Fig. 37–38

1959 *Trilites multivallatus* (PFLUG 1953) n. comb. — W. KRUTZSCH, p. 149

1967 *Trilites multivallatus* (Pf. 1953) W. KR. 1959b "sensu lato" — W. KRUTZSCH, Pl. 18, Fig. 1–16, p. 72

Occurrence: Frequent in the Middle to Upper Eocene of the Hornonitrianska kotlina (depression), in the Upper Eocene to the Lower Oligocene of the Liptovská and the Spišská kotlina (depressions).

Stratigraphical range: Scarce in the Eocene, currently in the Oligocene and Miocene.

Trilites paravallatus W. KR. 1959

Pl. XXX, Fig. 2

1959 *Trilites paravallatus* n. fsp. — W. KRUTZSCH, Pl. 27, Fig. 298, p. 152

Occurrence: Scarce; in the Middle Eocene of the Magura unit, Upper Priabonian–Lower Oligocene of the Magura unit, in the Upper Priabonian–Lower Oligocene of the Liptovská kotlina (depression).

Stratigraphical range: Middle Eocene–Oligocene.

Ischyosporites Balme 1957

Genotype: *Ischyosporites crateris* Balme 1957

Ischyosporites asolidus (W. KR. 1959) W. KR. 1967

Pl. I, Fig. 2, Pl. IX, Fig. 5, Pl. XXXVII, Fig. 3

1959 *Trilites asolidus* n. fsp. — W. KRUTZSCH, Pl. 27, Fig. 290–293, p. 151

1967 *Ischyosporites asolidus* (W. KR. 1959b) n. comb. — W. KRUTZSCH, Pl. 21, Fig. 1–6, p. 78

Occurrence: Frequent in the Middle Eocene of the eastern part of the Podunajská nížina, Hornonitrianska kotlina, in the Lower–Middle Eocene of the Magura and the Dukla units, in the Upper Eocene of the Liptovská kotlina, the Šarišská hornatina (mountains), of the Dukla unit, and in the Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Eocene, very scarcely Oligocene.

Polypodiaceosporites R. POTONIE 1956

Genotype: *Polypodiaceosporites speciosus* (R. POT. 1954) R. POT. 1956

Polypodiaceosporites cf. *marxheimensis* (MÜRR. et PF. 1952) W. KRUTZSCH 1959

Pl. XII, Fig. 1, Pl. XXI, Fig. 1

1952 *Triradiatosporites marxheimensis* n. sp. – MÜRRIGER et PFLUG, Pl. II, Fig. 2–4, p. 57, 61

1953 *Cingulatisporites marxheimensis* (MÜRRIGER et PFLUG) n. comb. – P. THOMSON et H. PFLUG, Pl. I, Fig. 13–15, p. 58

1959 *Polypodiaceosporites marxheimensis* (MÜRR. et PF. 1952) n. comb. – W. KRUTZSCH, p. 180

Occurrence: Scarce in the Middle Eocene of the eastern part of the Podunajská nížina, of the Magura unit, in the Upper Eocene of the Liptovská kotlina (depression), of the Magura unit, in the Upper Eocene–Lower Oligocene of the Hornonitrianska kotlina (depression).

Stratigraphical range: Upper Eocene–Miocene.

Remark: The spores described differ from the original species by their smaller size (50–55 μm) and non-bifurcate Y-scar. The structure of sculptural elements corresponds to that of species presented in the synonymy.

Cicatricosisporites R. POT. et GELL. 1933

Genotype: *Cicatricosisporites pseudodorogensis* TH. et PF. 1953

Cicatricosisporites dorogensis R. POT. et GELL. 1933

Pl. XI, Fig. 1–3, cf. 4, Pl. XXII, Fig. 1–2, Pl. XXXVII, Fig. 4

1933 *Cicatricosisporites dorogensis* n. sp. – R. POTONIE et GELETICH, Pl. 1, Fig. 1–3, p. 522

1967 *Cicatricosisporites dorogensis* R. POT. et GELL. 1933 – W. KRUTZSCH, Pl. XXII, Fig. 1–6, p. 80

Occurrence: Frequent in the Middle Eocene of the eastern part of the Podunajská nížina, Hornonitrianska kotlina and the Magura unit, in the Upper Eocene of the Klippen Belt, of the eastern part of the Podunajská nížina, and of the Inner-Carpathian depressions.

Stratigraphical range: Paleocene–Oligocene.

Remark: The spores depicted range from 40 to 65 μm in size; their shape is round-triangular, only in Pl. XI, Fig. 2, 4 and Pl. XXI, Fig. 1 they are triplane. Sculpture of spores in Pl. XI, Fig. 1,3 is somewhat thicker than that of spores in Pl. XXI, Fig. 1,2, and so they correspond rather to the subspecies presented by

M. KEDVES (1973) as *C. dorogensis* R. POT. et GELL. 1933 subfsp. *major* Kds. 1961a (Pl. XIII, Fig. 3, 4, 5, 6).

Cicatricosisporites chattensis W. KR. 1961 subfsp. *chattensis* W. KR. 1967
Pl. XXII, Fig. 4

1961b *Cicatricosisporites chattensis* n. fsp. — W. KRUTZSCH, Pl. I, Fig. 1–2, p. 302

1967 *Cicatricosisporites chattensis* W. KR. 1961d subfsp. *chattensis* n. subfsp. — W. KRUTZSCH,
Pl. XXIII, Fig. 1–7, p. 82

Occurrence: Scarce in the Upper Eocene (in the Paleogene) of the Klippen Belt of the Liptovská kotlina.

Stratigraphical range: Upper Eocene-Oligocene.

Cicatricosisporites sp.
Pl. II, Fig. 4

Occurrence: Scarce in the Lower Eocene of the Magura unit.

Remark: The spore resembles the species *Cicatricosisporites paradorogenensis* W. KR. 1959b in the nodular sculpture of lamellae. The lamellae are aligned more tightly on *C. paradorogenensis* W. KR. 1959.

Pteridaceae

Polypodiaceoisporites R. POT. 1956

Genotype: *Polypodiaceoisporites speciosus* (R. POT. 1934) R. POT. 1956

Polypodiaceoisporites cf. *simplex* E. NAGY 1969
Pl. XI, Fig. 5–6

Occurrence: Scarce in the Middle Eocene of the eastern part of the Podunajská nížina, in the Upper Priabonian–Lower Oligocene of the Liptovská kotlina.

Stratigraphical range: The Middle–Upper Eocene of the Bakony mountains; the Miocene of the Mecsek mountains (Hungary).

Remark: The spore differs from the original species (E. NAGY 1963, Pl. XX, Fig. 1, p. 346) by its smaller size, and by sculptural elements slightly surpassing the edge of the spore body. The spore corresponds to the holotype by width of the cingulum and by the papillate sculpture.

Polypodiaceoisporites cf. *saxonicus* W. KR. 1967
Pl. XXXVIII, Fig. 4

Occurrence: Scarce in the Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: (scarcely) the Oligocene, (currently) the Miocene and Pliocene.

Remark: The spore differs from the species described by W. KRUTZSCH (1967) in less distinctly granulate sculpture. The two species have the same size, shape and width of the cingulum.

Verrucingulatisporites M. KEDVES 1961

Genotype: *Verrucingulatisporites verrucatus* M. KEDVES 1961

Verrucingulatisporites (*Treplinisporites*) cf. *magnus* M. KEDVES 1973

Pl. XII, Fig. 3

Occurrence: Scarce in the Middle Eocene of the Hornonitrianska kotlina.

Stratigraphical range: Middle Eocene (Hungary).

Remark: Our specimen differs in less bifurcated, not pointed cuts on the cingulum from the species described by M. KEDVES (1973) from the Middle Eocene of the Bakony mountains. The two species show identic size and sculpture of central body.

Verrucingulatisporites undulatus E. NAGY 1963

Pl. XXXIX, Fig. 2

1963 *Verrucingulatisporites undulatus* n. sp. E. NAGY – Pl. I, Fig. 7–8, p. 400

Occurrence: Scarce in the Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower Miocene of Hungary (loc. Eger).

Remark: The spore found among our specimens differs from the original species in its size – it is larger (40 μ m).

Gleicheniaceae*, cf. *Gleicheniaceae

Toroisporis W. KRUTZSCH 1959

Genotype: *Toroisporis torus* (Pf. 1953) W. KRUTZSCH 1959

Toroisporis (*Toroisporis*) *eocenicus* Kds. 1966c.

Pl. IX, Fig. 2, Pl. XXIX, Fig. 5

1966 *Toroisporis* (*Toroisporis*) *eocenicus* n. fsp. – M. KEDVES, Pl. IV, Fig. 1–3, p. 57

Occurrence: Scarce in the Middle Eocene of the Magura unit, in the Upper Priabonian–Lower Oligocene of the Dukla unit.

Stratigraphical range: Lower–Upper Eocene of Hungary.

Toroisporis (Toroisporis) cf. teupitzensis W. KR. 1962 subfsp. *medioris* W. KR. 1962
Pl. I, Fig. 6

Occurrence: Frequent in the Upper Eocene–Lower Oligocene of the Liptovská kotlina (depression), scarce in the Lower-Middle Eocene of the Magura unit.

Stratigraphical range: The Oligocene-Miocene of Germany; the Middle Eocene of the Bakony mountains (Hungary).

Remark: According to the diagnostic characters the spore belongs most likely to the subspecies it has been ranged to. However, it was secondarily compressed.

Concavisporite PF. 1953

Concavisporites (Obtusisporis) W. KR. 1959

Concavisporites (Obtusisporites) cf. obtusangulus R. POT. 1934/b W. KRUTZSCH 1959

Pl. VIII, Fig. 6

Remark: It is likely that the spore depicted in Pl. VIII, Fig. 6 corresponds by the wavy course of the Y-scar, by the slight indication of the “obtusi” apparatus and by its triangular shape with concave walls to the species defined by W. KRUTZSCH (1954b).

Occurrence: Scarce in the Middle Eocene of the eastern part of the Podunajská nížina (Danube lowland).

Stratigraphical range: Middle Eocene of Geiseltal (Germany).

Polypodiaceae

Laevigatosporites IBRAHIM 1933

Genotype: *Laevigatosporites vulgaris* (IBR. 1932) IBR. 1933

Laevigatosporites haardti (R. POT. et VEN. 1934)

TH. et PF. 1953 subfsp. *haardti* W. KRUTZSCH 1967

Pl. II, fig. 3, Pl. XIV, Fig. 2, Pl. XXI, Fig. 5, Pl. XIII, Fig. 2, 7; Pl. XXXIX, Fig. 4

1934 *Sporites haardti* n. sp. – POTONIE et VENITZ, Pl. I, Fig. 13, p. 13–14

1953 *Laevigatosporites haardti* R. POT. et VEN. (pro parte) – THOMSON et PFLUG, Pl. III, Fig. 27, 29, 32–33, 34–35, 36, 37, p. 59

1967 *Laevigatosporites haardti* (R. POT. et VEN. 1934) TH. et PF. 1953 subfsp. *haardti* – W. KRUTZSCH, Pl. 52, Fig. 12–21, p. 146–148

Occurrence: Frequent in the Middle Eocene–Oligocene of the West Carpathians. Scarce in the Lower Eocene of the Magura and Dukla units.

Stratigraphical range: Mass occurrence throughout the Tertiary of Central Europe.

Laevigatosporites haardti (R. POT. et VEN. 1934) subfsp. *haardtoides*

W. KRUTZSCH 1967

Pl. XXIX, Fig. 6

1967 *Laevigatosporites haardti haardtoides* n. subfsp. W. KRUTZSCH, Pl. 52, Fig. 22–25, p. 148

Occurrence: Scarce in the Upper Priabonian–Lower Oligocene of the Liptovská kotlina (depression).

Stratigraphical range: In milder climatic parts of the Middle and Late Tertiary (W. KRUTZSCH 1967).

Laevigatosporites cf. *adiscordatus* W. KRUTZSCH 1959

Pl. I, Fig. 3

Occurrence: Scarce in the Lower Eocene of the Magura unit, in the Middle–Upper Eocene of the Magura and Dukla units.

Stratigraphical range: Middle to Upper Eocene, scarce in the Oligocene of Central Europe.

Polypodiisporites R. POTONIE 1933

Genotype: *Polypodiisporites favus* R. POT. 1933

Polypodiisporites alienus (R. POT. 1934) E. NAGY 1973

Pl. XXIX, Fig. 1–2, Pl. XXI, Fig. 7, Pl. XXXIX, Fig. 3, 5

1931 *Sporonites alienus* n. sp. – R. POTONIE, s. 556, Abh. 1, p. 556 (non vidi)

1953 *Verrucatosporites alienus* (R. POT.) n. comb. – P. THOMSON et H. PFLUG, Pl. III, Fig. 47, cf., 48–50, p. 60

1973 *Polypodiisporites alienus* (R. POT. 1934) n. comb., – E. NAGY, s. 456–457.

Occurrence: Frequent in the Upper Eocene of the eastern part of the Podunajská nížina, of the Inner-Carpathian depressions, of the Magura unit, and in the Upper Priabonian–Lower Oligocene of the Inner-Carpathian depressions, of the Magura and Dukla units, and in the Rupelian of the Eastern part of the Podunajská nížina.

Stratigraphical range: (scarce) in the Middle–Upper Eocene, (frequent) in the Oligocene–Miocene.

Polypodiisporites cf. *favus* (R. POT. 1933) subsp. *favus* (W. KRUTZSCH, 1967)

E. NAGY 1973

Pl. XIII, Fig. 3, (?) 4, Pl. XXXIX, Fig. 6

Occurrence: Scarce in the Middle Eocene of the eastern part of the Podunajská nížina, of the Magura unit; frequent in the Upper Eocene–Oligocene.

Stratigraphical range: Throughout the Tertiary, mostly in warmer climatic parts.

Sporites H. POTONIE 1823 — *Incertae sedis*

Leiotriletes (NAUMOVA 1937) R. POT. — KRP. 1954

Genotype: *Leiotriletes sphaerotriangulus* (LOOSE 1932) R. POT. et KRP. 1954

Leiotriletes cf. *neddenoides* W. KR. 1962

Pl. XXXVI, Fig. 5

Occurrence: Scarce in the Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Upper Oligocene—Lower Miocene of Germany.

Remark: It is likely that the spore with its shape, size belongs to the species quoted but its Y-scar does not extend up to the edge of the spore wall.

Punctatisporites IBRAHIM 1933

Genotype: *Punctatisporites punctatus* (IBR. 1932) IBRAHIM 1933

Punctatisporites luteticus W. KRUTZSCH 1959

Pl. X, Fig. 1, 2, Pl. XIV, Fig. 1

1959 *Punctatisporites luteticus* n. fsp. — W. KRUTZSCH, Pl. IV, Fig. 25–26, p. 68

Occurrence: Frequent in the Middle Eocene of the eastern part of the Podunajská nížina (Danube lowland), of the Hornonitrianska kotlina (depression), scarce in the Upper Eocene.

Stratigraphical range: Middle Eocene of Germany (Geiseltal), Hungary (the Bakony mountain).

Remark: The spore in Pl. XIV, Fig. 1 has a compressed Y-scar forming a fold. The spore in Pl. X, Fig. 2 also has secondary folds (due to damaged surface of the spore body) and partly connected sculptural elements. So they differ from the original species.

Granulatisporites (IBR. 1933) R. POT. et KREMP 1954

Genotype: *Granulatisporites granulatus* IBRAHIM 1933

Granulatisporites paleogenicus M. KEDVES 1966

Pl. II, Fig. 1

1966 *Granulatisporites paleogenicus* n. fsp. — M. KEDVES, Pl. I, Fig. 4–6, p. 339–340

Occurrence: Scarce in the Lower Eocene of the Magura unit.

Stratigraphical range: Eocene of Hungary.

Toroisporis W. KRUTZSCH 1959

Genotype: *Toroisporis torus* (Pf. 1953) W. KRUTZSCH 1959

Toroisporis (Toroisporis) cf. irregularis (Pf. 1953) W. KRUTZSCH 1959

Pl. I, Fig. 5

1953 *Laevigatosporites neddeni* R. Pot., subsp. *irregularis* n. subsp. (Pf.) – PFLUG in THOMSON et PFLUG, Pl. II, Fig. 2–7, p. 54

1959 *Toroisporis (Toroisporis) irregularis* (Pf. 1953) n. comb. – W. KRUTZSCH, Pl. X, Fig. 73, p. 74

Occurrence: Scarce in the Lower–Middle Eocene of the Outer Flysch zone of the West Carpathians.

Stratigraphical range: Paleocene–Lower Oligocene (scarce).

Remark: The spore from our region corresponds to species presented in the synonymy by its size, shape, thickness of wall and by the course of rays of the Y-scar. It only differs in fine (punctate or? foveolate) sculpture conspicuous around the Y-scar. It also has secondary foldines.

Retitriteles (v. d. HAMMEN 1956 ex PIERCE 1961) H. DÖRING, W. KRUTZSCH, D. H. MAI et SCHULZ 1963

Retitriteles sermoensis W. KRUTZSCH 1963

Pl. XXXVIII, Fig. 6

1963 *Retitriteles sermoensis* n. fsp. – W. KRUTZSCH, Pl. XII, Fig. 1–8, p. 62

Occurrence: Scarce in the Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Oligocene of Germany.

Polypodiaceoisporites gracillimus E. NAGY 1963 subsp. *granoverrucatus* W. KR. 1967

Pl. XXI, Fig. 3

1967 *Polypodiaceoisporites gracillimus granoverrucatus* n. subsp. – W. KRUTZSCH, Pl. XXXV, Fig. 8–13, mainly Fig. 5–7, p. 106

Occurrence: Scarce mainly in the Upper Priabonian–Lower Oligocene of the Liptovská kotlina.

Stratigraphical range: Upper Oligocene of Germany (Lower Cottbus beds).

Polypodiaceoisporites verruspeciosus W. KRUTZSCH 1959

Pl. XII, Fig. 4

1959 *Polypodiaceoisporites verruspeciosus* n. fsp. – W. KRUTZSCH, Pl. XXXVIII, Fig. 402–405, p. 183

Occurrence: Scarce in Middle Eocene (mainly of the Hornonitrianska kotlina).
Stratigraphical range: Middle Eocene of Germany.

Polypodiaceoisporites cf. *obuncus* W. KRUTZSCH 1959

Pl. XII, fig. 6

Occurrence: Scarce in Middle Eocene of the Hornonitrianska kotlina.

Stratigraphical range: Mainly in Middle Eocene of Germany (Geiseltal).

Remark: The spores from the Middle Eocene of our country are smaller than the original species described by W. KRUTZSCH (1959) from Geiseltal in Germany. Their walls are also more concave.

Polypodiaceoisporites seidewitzensis W. KR. 1967

Pl. XXXVIII, Fig. 3

1967 *Polypodiaceoisporites seidewitzensis* n. fsp. — W. KRUTZSCH, Pl. XXXIX, Fig. 8–14, p. 114

Occurrence: Scarce in the Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Oligocene of South Bohemia and Lower Miocene of NN Saxony.

Verrucingulatisporites M. KEDVES 1961

Verrucingulatisporites verrucatus M. KEDVES 1961

Pl. XII, Fig. 2

1961 *Verrucingulatisporites verrucatus* n. fsp. — M. KEDVES, Pl. VIII, Fig. 10–12, p. 140

Occurrence: Scarce in the Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower–Middle Eocene of Hungary.

Gemmatosporis W. KRUTZSCH 1959

Genotype: *Gemmatosporis gematoides* W. KRUTZSCH 1959

Gemmatosporis minor L. RAKOSI 1973

Pl. II, Fig. 6

1973 *Gemmatosporis minor* n. fsp. — L. RAKOSI, Pl. XIX, Fig. 6–7, p. 522

Occurrence: Scarce in the Lower Eocene of the Magura unit (the Beloveža beds).

Stratigraphical range: Eocene of Hungary.

Gymnospermophyta (Coniferophytina NOVÁK 1961)

Pinopsida (Coniferopsida)

Podocarpaceae

Podocarpidites COOKSON 1947

Genotype: *Podocarpidites ellipticus* COOKSON 1947

Podocarpidites podocarpoides (THG. 1958) W. KRUTZSCH 1971

Pl. XXIV, Fig. 3, Pl. XL, Fig. 3

1958 *Pityosporites podocarpoides* n. sp. — THIERGART, Pl. I, Fig. 15, p. 449, 457

1971 *Podocarpidites podocarpoides* (THG. 1958) n. comb. — W. KRUTZSCH, Pl. XXXIII, Fig. 1–11, p. 130

Occurrence: Scarce in Middle Eocene of the Magura unit.

Stratigraphical range: Middle Eocene of Germany (Geiseltal).

Pinaceae

Abietoidae

Abiespollenites THIERGART 1937

Genotype: *Abiespollenites absolutus* THIERGART 1937

Abiespollenites absolutus THIERGART 1937

Pl. XLI, Fig. 1

1937 *Abiespollenites absolutus* n. sp. — THIERGART, Pl. XXIV, Fig. 6, p. 306

1971 *Abiespollenites absolutus* THG. 1937 — W. KRUTZSCH, Pl. XV, Fig. 1–9, p. 86

Occurrence: Scarce in Rupelian of the eastern part of the Podunajská nížina (Danube lowland).

Stratigraphical range: (Scarce) Oligocene (mainly) Miocene and Pliocene of Central Europe.

Botanic range: *Abies* sp.; according to W. KRUTZSCH (1971) it has most characters in common with the species *Abies bicolor*.

Piceapollis W. KRUTZSCH 1971

Genotype: *Piceapollis praemarianus* W. KR. 1971

Piceapollis tobolicus (PANOVA 1966) W. KRUTZSCH 1971

Pl. XXV, Fig. 1, Pl. XXXII, Fig. 1, Pl. XL, Fig. 1

1966 *Piceapollis tobolica* n. sp. — PANOVA, Pl. 103, Fig. 1, Pl. 105, Fig. 4, Pl. 108, Fig. 5, p. 220–221 (in *Paleopalinologija*, vol. I.)

1971 *Piceapollis tobolicus* (PANOVA 1966) n. comb. — W. KRUTZSCH, Pl. XXII, Fig. 1–5, p. 104

Occurrence: Scarce in Upper–Lower Oligocene of Inner-Carpathian depression, of the Magura and Dukla units, in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Upper Oligocene–Pliocene (W. KRUTZSCH 1971).

Botanical range: *Picea* sp.

Remark: Reticulate sculpture of morphotypes shown in Pl. XXV, Fig. 1, Pl. XXXII, Fig. 1 is corroded.

Zonalapollenites H. PFLUG 1953

Genotype: *Zonalapollenites igniculus* (R. POT. 1931c) TH. et PF. 1953

Zonalapollenites maximus (RAATZ 1937) W. KRUTZSCH 1971

Pl. XXXI, Fig. 1, 3, Pl. XLI, Fig. 2

1937 *Tsuga-pollenites igniculus* R. POT. f. *maximus* n. f. – RAATZ, Fig. 13, p. 15

1971 *Zonalapollenites maximus* (RAATZ 1937) n. comb. – W. KRUTZSCH, Pl. 36, Fig. 1–8, p. 138

Occurrence: Scarce in the Upper Priabonian–Lower Oligocene of Inner-Carpathian depressions, of the Magura unit, and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Upper Priabonian (Pg.-zone 19) – Pliocene.

Botanical range: *Tsuga* sp. (cf. *Tsuga canadensis* = *americana*).

Remark: Morphotypes of this species from flysch sediments (Pl. XXXI, Fig. 1, 3) have slightly corroded sculptural elements.

Zonalapollenites verrucatus W. KRUTZSCH 1971

Pl. XXIV, Fig. 4

1971 *Zonalapollenites verrucatus* n. sp. – W. KRUTZSCH, Pl. XXXIX, Fig. 1–10, p. 144

Occurrence: Scarce in the Upper Eocene (Paleogene of the Klippen Belt Globigerinous marls).

Stratigraphical range: Middle Oligocene (Pg.-zone 20) – Upper Miocene of Germany, scarcely Upper Pliocene.

Botanical range: *Tsuga* sp.

Remark: W. KRUTZSCH (1971) presumes the species *Z. verrucatus* can only be a subspecies of *Z. maximus*.

Pinoidae

Pityosporites SEWARD 1914

Genotype: *Pityosporites antarctitus* SEWARD 1914

Pityosporites microalatus (R. POT. 1931b) TH. et PF. 1953

Pl. XXIII, Fig. 2-3

1931b *Piceapollenites microalatus* n. sp. — R. POTONIE, p. 5, Abb. 34 (non vidi)

1953 *Pityosporites microalatus* (R. POT. 1931b) n. comb. — THOMSON et PFLUG, Pl. V, Fig. 54, 57, p. 67-68

1971 *Pityosporites microalatus* (R. POT. 1931b) TH. et PF. 1953 — W. KRUTZSCH, Pl. I, Fig. 1-12, p. 48

Occurrence: Frequent in Upper-Lower Oligocene of the Inner-Carpathian depressions and of the Outer Flysch Paleogene.

Stratigraphical range: Throughout the Tertiary.

Botanical range: *Pinus*-subgenus *Haploxylon*.

Remark: Pollen grains ranged to this species are considerably corroded.

Pityosporites alatus (R. POT. 1931b) TH. et PF. 1953

Pl. XXIII, Fig. 1, 4; Pl. XXXII, Fig. 4; Pl. XXV, Fig. 5, Pl. XXII, Fig. 3

1931b *Piceae-pollenites alatus* n. sp. — R. POTONIE, Abh. 31, P. 5 (non vidi)

1934 *Piceae-pollenites alatus* R. POT. — R. POT. et VENITZ, Pl. II, Fig. 22, p. 18, 19

1953 p. p. *Pityosporites microalatus* (R. POT.) n. comb. — f. *major* (R. POT.) n. comb. — THOMSON et PFL., Pl. V, Fig. 53, p. 68

1971 *Pityosporites alatus* (R. POT. 1931b) TH. et PF. 1953 — W. KRUTZSCH, Pl. II, Fig. 1-10, p. 51-52

Occurrence: Frequent together with *P. microalatus* (R. POT.) TH. et PF., in Upper Eocene-Lower Oligocene of Inner-Carpathian depressions and of the outer Flysch zone.

Stratigraphical range: ± Throughout the Tertiary.

Botanical range: *Pinus* sp. — subgenus *Haploxylon*.

Remark: The surface of pollen grains—with the exception of the pollen grain in Pl. XXV, Fig. 5 is considerable corroded. Shape, size, position of air sacs correspond to those of the species presented in the synonymy.

Pityosporites labdacus (R. POT. 1931b) TH. et PF. 1953 subfsp. *labdacus* W. KR. 1971

Pl. XXII, Fig. 5

1931b *Pollenites labdacus* n. sp. — R. POTONIE, Fig. 32, p. 5 (non vidi)

1934 *Pollenites labdacus* R. POT. — R. POTONIE et VENITZ, Pl. II, Fig. 25, p. 20

1953 *Pityosporites labdacus* (R. POT.) n. comb. — THOMSON et PFLUG, Pl. V, Fig. 60, cf. 61, p. 68

1971 *Pityosporites labdacus* subsp. *labdacus* — W. KRUTZSCH Pl. VII, Fig. 11-18, p. 64

Occurrence: Frequent mainly in Upper Eocene-Lower Oligocene of the eastern part of the Podunajská nížina (Danube lowland), of Inner-Carpathian depressions, of the outer Flysch zone.

Stratigraphical range: Throughout the Tertiary.

Botanical range: *Pinus* sp. Basing upon a comparison with recent pollen grain W. KRUTZSCH (1971) presents many species of the genus *Pinus*. Their pollen grains resemble to the species quoted (*P. nigra*, *P. excelsa* a. o.)

Pityosporites peuceformis (ZAKLINSKAJA 1957) W. KRUTZSCH 1971
Pl. III, Fig. 1

1957 *Pinus peuceformis* sp. nov. (pollen) – ZAKLINSKAJA, Pl. XII, Fig. 9–12, p. 149

1971 *Pityosporites peuceformis* (ZAKLINSKAJA 1971) n. comb. – W. KRUTZSCH, Pl. 9, Fig. 12–14, p. 70

Occurrence: Scarce in the Lower Eocene of the Magura unit.

Stratigraphical range: Scarce in Central Europe in some parts of the Miocene and Pliocene. In Soviet Union (ZAKLINSKAJA 1952) and in Germany (W. KRUTZSCH 1971) it was found in the Middle Eocene.

Botanical range: *Pinus* sp.; ZAKLINSKAJA (1957) compares the species with the recent species of *Pinus peuce*.

Inaperturopollenites THOMSON et PFLUG 1953 *sensu stricto*

Genotype: *Inaperturopollenites dubius* (R. POT. et VEN.) TH. et PF.

Inaperturopollenites hiatus (R. POT. 1931b) TH. et PF. 1953

Pl. XIV, Fig. 3,4 (cf.), Pl. XXIV, Fig. 6, Pl. III, Fig. 4, 6 (cf.) Pl. XXV, Fig. 2, 3, Pl. XXX, Fig. 5, Pl. XLI, Fig. 3

1931b *Pollenites hiatus* n. sp. – R. POTONIÉ, Fig. 23, p. 3 (non vidi)

1934 *Pollenites hiatus* R. POT. – R. POTONIÉ et H. VENITZ, Pl. I, Fig. 16–17, p. 16

1953 *Inaperturopollenites hiatus* (R. POT.) n. comb. – P. THOMSON – H. PFLUG, Pl. V, Fig. 14–20, p. 65

1971 *Inaperturopollenites hiatus* (R. POT. 1931b) TH. et PF. 1953 – W. KRUTZSCH, Pl. LXIV, Fig. 1–6, p. 202

Occurrence: Frequent in Middle Eocene–Oligocene (Rupelian) of the eastern part of the Podunajská nížina, in Upper Eocene–Lower Oligocene of Inner Carpathian depressions, of the Magura and Dukla units.

Stratigraphical range: Upper Eocene–Miocene (W. KRUTZSCH, 1971). Since Middle Eocene in Paleogene of the West Carpathians.

Botanical range: *Taxodiaceae*, cf. *Taxodium*.

Remark: Morphotypes from sediments of Middle Eocene–Oligocene of our country are very variable. Some specimens ranged from 30 to 45 μ m in size. Some have a distinct tongue (Pl. XIV, Fig. 3, Pl. XXV, Fig. 3, Pl. XLI, Fig. 3), others only a split. Their surface is mostly chagrenate or finely punctate. Many have corroded surface (Types in Pl. XIV, Fig. 4, Pl. III, Fig. 4, 6 belong most likely to the species quoted. They differ in the shape of the split typical of the species *I. hiatus*. They differ from species presented in the synonymy by less smooth surface.

Inaperturopollenites cf. *concedipites* (WODEH. 1933) W. KR. 1971

Pl. XIV, Fig. 5, 6, 8

Occurrence: Scarce in the Middle Eocene of the Magura unit, in Upper Eocene of the Magura unit and in Upper Priabonian–Lower Oligocene of the Dukla unit.

Stratigraphical range: Eocene–Miocene; mainly in warmer parts of the Tertiary.

Botanical range: *Taxodiaceae*.

Remark: W. KRUTZSCH (1971) depicted pollen grains of the species *I. concedipites* (WODEH.) W. KR. of circular shape, and only four types with a split like that of the “hiatus” forms. By their small, almost invisible “ligule”, tightly punctate sculpture and size the species found in our country (Pl. XIV, Fig. 5, 6) correspond most likely to *I. concedipites* (WODEH.) W. KR.

Sciadopitaceae

Sciadopityspollenites RAATZ resp. THIERGART. 1937, ex. R. POT. 1959

Genotype: *Sciadopityspollenites serratus* (R. POT. et VEN. 1937) THIERGART 1937

Sciadopityspollenites serratus (R. POT. et VEN. 1934) THIERGART 1937

Pl. XXX, Fig. 6, Pl. XXXI, Fig. 4, 6, Pl. XLII, Fig. 3

1934 *Sporites serratus* n. sp. – R. POTONIÉ et VENITZ, Pl. I, Fig. 6–7, p. 15

1937 *Sciadopityspollenites serratus* R. POT. – THIERGART, Pl. XXIII, Fig. 14a, p. 302

1971 *Sciadopityspollenites serratus* (R. POT. et VEN. 1934), THIERGART 1937 – W. KRUTZSCH, Pl. LIII, Fig. 1–15, p. 176

Occurrence: Scarce in Upper Priabonian–Lower Oligocene of Inner-Carpathian depressions, of the Magura and Dukla units.

Stratigraphical range: Upper Eocene–Pliocene.

Botanical range: *Sciadopitys* sp.

Sciadopityspollenites verticillatiformis (ZAUER 1960) W. KRUTZSCH 1971

Pl. XXX, Fig. 4, Pl. XXXI, Fig. 2

1960 *Sciadopitys verticillata* ZAUER sp. nov. – in POKROVSKAJA–STELMAK et al., Pl. V, Fig. 6a

1971 *Sciadopityspollenites verticillatiformis* (ZAUER 1960) n. comb. – W. KRUTZSCH, Pl. LIV, Fig. 7–25, p. 178

Occurrence: Scarce in Upper Priabonian–Lower Oligocene of the Spišská kotlina (depression) and the Šarišská vrchovina (mountains).

Stratigraphical range: Scarce in Middle and Upper Eocene of Central Europe.

Botanical range: *Sciadopitys* sp.

Cupressaceae* v. *Taxodiaceae

Cupressacites BOLCHOVITINA 1956

Genotype: *Cupressacites russeus* BOLCH. 1956

Cupressacites bockwitzensis W. KRUTZSCH 1971

Pl. XXXI, Fig. 5

1971 *Cupressacites bockwitzensis* n. sp. — W. KRUTZSCH, Pl. LXII, Fig. 19, 25, p. 195–196

Occurrence: Scarce in Upper Priabonian-Oligocene of the Inner-Carpathian depressions.

Stratigraphical range: Middle–Late Tertiary of Germany (W. KRUTZSCH 1971), Lower-Middle Eocene–Upper Oligocene of the Bakony mountains — Hungary (M. KEDVES 1974).

Remark: Pollen grains found in sediments studied differ from species presented in the synonymy by less deep split and considerably corroded exine surface.

Ephedropsida

Ephedraceae, Ephedra

Ephedripites BOLCHOVITINA 1953

Genotype: *Ephedripites mediolobatus* BOLCHOVITINA 1953

Ephedripites (Distachyapites) cocenipites (WODEH. 1933) W. KR. 1961

Pl. XXII, Fig. 6

1933 *Ephedra cocenipites* sp. nov. — WODEHOUSE, p. 495, Fig. 6

1961a *Ephedripites (Distachyapites) cocenipites* (W.DH. 1933) n. comb. — W. KRUTZSCH, Pl. IV, Fig. 68–70, p. 27

1971 *Ephedripites (Distachyapites) cocenipites* (W.DH. 1933) W. KR. 1961 — W. KRUTZSCH, Pl. XLII, Fig. 1–8, p. 154–156

Occurrence: Scarce in Upper Eocene of the Klippen Belt Paleogene and in Upper Priabonian–Lower Oligocene of the Liptovská kotlina (depression).

Stratigraphical range: Upper Eocene–Upper Miocene.

Remark: The species found differs from the original one by less conspicuous branches between the longitudinal ribs. They have equal shape, number of ribs and size.

Ephedripites (Distachyapites) tertiarus W. KRUTZSCH 1970

Pl. XLII, Fig. 1

1970 *Ephedripites (Distachyapites) tertiarus* n. sp. — W. KRUTZSCH, Pl. XLIV, Fig. 1–21, p. 156

Occurrence: Scarce in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Middle Oligocene–Middle Miocene (W. KRUTZSCH 1970).

Remark: By the number of longitudinal grooves and by its size the pollen grain corresponds to the original species. Only its grooves are more tight because of secondary compression.

Cycadopsida

Cycadaceae

Cycadopites WODEHOUSE 1933 ex WILSON--WEBSTER 1946 (sensu lato)

Genotype: *Cycadopites follicularis* WILS. -- WEBSTER 1946

Cycadopites cycadoides (ZAKL. 1957) M. KEDVES 1968

Pl. XIV, Fig. 9, 10

1957 *Encephalarites cycadoides* nov. sp. -- ZAKLINSKAJA, Pl. I, Fig. 4-5, p. 93

1968 *Cycadopites cycadoides* (ZAKL. 1957) n. comb. -- M. KEDVES, Pl. II, Fig. 18, 21, p. 326

Occurrence: Frequent in Middle-Upper Eocene of the eastern part of the Podunajská nížina, the Hornonitrianska kotlina (depression); scarce in Upper Eocene-Lower Oligocene of Inner Carpathian depressions and of the outer Flysch Belt.

Stratigraphical range: Lower-Upper Eocene, Upper Oligocene of Hungary (M. KEDVES 1974).

Gymnospermophyta -- Incertae sedis

Cycadopites WODEHOUSE 1933 ex WILSON et WEBSTER 1946 (sensu lato)

Cycadopites cf. *gracilis* W. KRUTZSCH 1970

Pl. XLII, Fig. 2

1970 *Cycadopites gracilis* n. sp. -- W. KRUTZSCH, Pl. XVIII, Fig. 1-3, p. 94

Occurrence: Scarce in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Scarcely Middle Eocene-Miocene (W. KRUTZSCH 1970).

Remark: By its size and narrow elliptic shape the pollen grain corresponds to the original species. It differs by slightly broadened colpa on its distal side.

Angiospermophyta (Angiospermophytatina NOVÁK 1961)

Magnoliopsida

Myricaceae

Triatriopollenites TH. et PF. 1953

Genotype: *Triatriopollenites rurensis* TH. et PF. 1953

Triatriopollenites cf. *rurensis* PF. et TH. 1953

Pl. XX, Fig. 15

Description: Triatrioporate pollen grains, 30-35 μm in size, with convex walls, small atrium and labrum. Exine: 1-1,5 μm . Chagrenate to finely punctate surface.

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina, of the Magura unit, in Upper Priabonian–Lower Oligocene of Inner Carpathian depressions.

Stratigraphical range: Lower Eocene – Miocene.

Triatriopollenites bituites (R. POT. 1931) TH. et PF. 1953

Pl. XIX, Fig. 11, Pl. XXVII, Fig. 9, 10, Pl. XLIV, Fig. 1

1931a *Pollenites bituites* n. sp. – R. POTONIÉ, Pl. II, Fig. 17, p. 332

1953 *Triatriopollenites bituitus* (R. POT.), n. comb. – Pl. VII, Fig. 116–134, typical 118–120, 122, 128, p. 79

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina, of the Magura unit, in Upper Eocene–Lower Oligocene of the Inner-Carpathian depressions, of the Magura and Dukla units.

Stratigraphical range: Lower Eocene–Miocene.

Triatriopollenites coryphaeus (R. POT. 1931) TH. et PF. 1953

Pl. XXVII, Fig. 12

1931a *Triatriopollenites coryphaeus* n. sp. – R. POTONIÉ, Pl. II, Fig. 15, p. 334

1953 *Triatriopollenites coryphaeus* (R. POT.) n. comb. – P. THOMSON – H. PFLUG, Pl. VIII; only fig. 36, 37, p. 80

1967 *Triatriopollenites coryphaeus* (R. POT.) TH. et PF. – W. KRUTZSCH, Pl. II, Fig. 1–12, p. 89

Occurrence: Frequent in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, of the Dukla unit, scarce in Middle Eocene and Upper Priabonian–Lower Oligocene of the Magura unit.

Stratigraphical range: Throughout the Tertiary.

Botanical range: cf. *Myricaceae*.

Remark: Pollen grains of the species found in sediments from the areas studied, differ from the species presented in the synonymy mainly by finely punctate exine surface and by the absence of secondary foldings. They mostly resemble to the species presented by L. RAKOSI (1973) from Hungarian Paleogene (Pl. XXXV, Fig. 14).

Triatriopollenites intermedius (GLADKOVA 1965) M. KEDVES 1974

Pl. XIX, Fig. 7–8, Pl. XX, Fig. 1

1965 *Myrica intermedia* sp. nov. – GLADKOVA, Pl. I, Fig. 5, p. 162

1974 *Triatriopollenites intermedius* (GLADKOVA 1965) n. comb., *Myricaceae* – M. KEDVES, Pl. XVII, Fig. 10–12, p. 47

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower and Upper Eocene and Upper Oligocene of Hungary (M. KEDVES 1974). A. N. GLADKOVA (1965) describes the species from Maastrichtian and Danian of the eastern part of the West Siberian lowland.

Triatriopollenites pseudogranulatus GLADKOVA (1965) M. KEDVES 1974

Pl. XIX, Fig. 9–10

1965 *Myrica pseudogranulata* sp. nov. – GLADKOVA, Pl. II, Fig. 4–6

1974 *Triatriopollenites pseudogranulatus* (GLADKOVA 1965) n. comb. – M. KEDVES, Pl. XVII, Fig. 7–9, p. 46

Occurrence: Scarce in Middle Eocene of the Magura unit.

Stratigraphical range: Lower–Middle Eocene of Hungary (M. KEDVES 1974). Lower–Middle Oligocene of the northern part of the West-Siberian lowland (A. N. GLADKOVA 1965).

Triatriopollenites lubomirovae (GLADKOVA 1965) M. KEDVES 1974

Pl. XIX, Fig. 16–17

1965 *Myrica lubomirovae* sp. nov. – A. N. GLADKOVA, Pl. III, Fig. 1, 2, p. 165

1974 *Triatriopollenites lubomirovae* (GLADKOVA 1965) n. comb. – M. KEDVES, Pl. XVII, Fig. 1–3, p. 46

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina in Hungary.

Stratigraphical range: Lower–Middle Eocene (M. KEDVES 1974), Lower–Middle Oligocene (A. N. GLADKOVA 1965).

Momipites WODEHOUSE 1933

Genotype: *Momipites coryloides* WDH. 1933

Momipites myricoides (KREMP 1949) W. KR. 1967

Pl. XXXIII, Fig. 11; Pl. XXVII, Fig. 11, Pl. XLIV, Fig. 5

1949, 1950 *Pollenites myricoides* n. sp. – G. KREMP, Pl. VI, Fig. 63, p. 64–65

1967 *Momipites myricoides* (KREMP) n. comb. – W. KRUTZSCH, Pl. IX, Fig. 25–28, p. 91

1973 *Momipites myricoides* (KREMP 1949) W. KR. 1971 – L. RAKOSI, Pl. XXXV, Fig. 33, p. 544

Occurrence: Frequent in Middle and Upper Eocene of the eastern part of the Podunajská nížina, in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions; scarce in Upper Eocene–Lower Oligocene of the Spišská kotlina (depression) and of the Dukla unit.

Stratigraphical range: (Scarce) in Middle–Upper Eocene, (frequent) in Oligocene–Miocene.

Botanical range: cf. *Myricaceae*.

Remark: Pollen grains of the species described differ from the original species

(22 µm in size) by their size and by less conspicuous foldings on the surface of the exine. The pollen grains correspond better to the species quoted by L. RAKOSI (1973) from Oligocene of the Dorog-Togod area. G. KREMP presented the holotype in *Palaeontographica*, B.90, Pl. VI, Fig. 63 from 1950 and not 1949 – as quoted by many authors.

Momipites punctatus (R. POT. 1931) E. NAGY 1969

Pl. XXVII, Fig. 4, 5–6, cf. 7–8

1931 *Pollenites coryphaeus punctatus* n. f. – R. POTONIE, Pl. II, Fig. 7, 11, p. 332

1969 *Momipites punctatus* (R. POT. 1931) n. comb. – E. NAGY, Pl. LIV, Fig. 9–10, p. 478

Occurrence: Scarce in Upper Eocene of Inner-Carpathian depressions.

Stratigraphical range: (Scarcely) Upper Eocene–Oligocene, (frequently) Miocene.

Botanical range: cf. *Myricaceae*, ?*Juglandaceae*.

Plicapollis H. PFLUG 1953b

Genotype: *Plicapollis sarta* PF. 1953b

Plicapollis cf. *pseudoexcelsus* (W. KR. 1958a) W. KR. 1961d

Pl. V, Fig. 6

Occurrence: Frequent in Middle Eocene of the eastern part of the Podunajská nížina, of the Magura unit; scarce in Lower Eocene of the Magura and Dukla units; in Upper Priabonian–Lower Oligocene of Inner-Carpathian depressions.

Stratigraphical range: Middle Turonian – base of Middle Oligocene.

Botanical range: cf. *Myricaceae*.

Remark: Pollen grains ranged to this species and found in Lower Eocene of the Magura and Dukla units are considerably corroded and their morphological characters (anulus, plical, thickness of exine wall) damaged.

Juglandaceae

Genotype: *Caryapollenites simplex* (R. POT. 1931b) R. POT. 1960

Caryapollenites R. POT. 1960 et RAATZ 1937, emend. W. KR. 1961b

Caryapollenites simplex (R. POT. 1931b) R. POT. 1960

Pl. XIX, Fig. 2, Pl. XXXIV, Fig. 1, Pl. XXVIII, Fig. 1–2, Pl. XXXIII, Fig. 17, 18, Pl. XLIII, Fig. 10–11

1931b *Pollenites simplex* n. sp. – R. POTONIE, p. 3, Fig. 3

1937 *Caryapollenites simplex* R. POT. f. *communis* n. f. – RAATZ, Pl. I, Fig. 6, p. 19

1953 *Subtriporopollenites simplex* (R. POT. et VEN.) n. comb., THOMSON–PFLUG, Pl. IX, Fig. 65–73, p. 86

1960 *Caryapollenites* (al. *Pollenites*) *simplex* (R. POT. 1931) RAATZ 1937 – R. POTONIE, Pl. VII, Fig. 162–163, p. 123–124

Occurrence: Frequent in Upper Eocene–Lower Oligocene of the eastern part of the Podunajská nížina of Inner-Carpathian depressions, of the Magura and Dukla units.

Stratigraphical range: Upper Eocene–Miocene.

Botanical range: *Carya* sp.

Remark: Morphotypes ranged to this species and found mainly in Flysch sediments, have corroded surface (Pl. XXXIV, Fig. 1, Pl. XXVIII, Fig. 2).

Polyatriopollenites PFLUG 1953

Pterocaryapollenites THIERGART 1937 ex R. POT. 1960

Genotype: *Polyatriopollenites stellatus* (R. POT. 1931d) Pf. 1953

Polyatriopollenites stellatus (R. POT. 1931) Pf. 1953,

Pl. XXXIV, Fig. 2, Pl. XLIII, Fig. 12.

1931d *Pollenites stellatus* n. sp., POTONIÉ, Fig. 20, p. 3

1937 *Pterocaryapollenites stellatus* (R. POT.), THIERGART, Pl. XXIV, Fig. 19, p. 311

1953 *Polyatriopollenites stellatus* (R. POT. et VEN.) n. comb. – H. PFLUG, Pl. XXIV, Fig. 47, p. 115

Occurrence: Scarce in Upper Eocene of the eastern part of the Podunajská nížina, in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, of the Dukla unit.

Stratigraphical range: Upper Eocene–Middle Oligocene; (scarcely) Upper Oligocene–Miocene.

Botanical range: *Pterocarya* sp.

Subtriporopollenites TH. et PF. 1953

Genotype: *Subtriporopollenites anulatus* TH. et PF.

Subtriporopollenites constans Pf. 1953 subsp. *constans* W. KR. 1961

Pl. XVIII, Fig. 11–12

1953 *Subtriporopollenites constans* n. sp. – (PF.) – THOMSON et PFLUG, Pl. IX, Fig. 78–89, p. 87

1961d *Subtriporopollenites constans* Pf. 1953a *constans* – W. KRUTZSCH, p. 309–310

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina, of the Hornonitrianska kotlina, in Lower and Middle Eocene of the Magura and Dukla units, in Upper Eocene of the Liptovská and Spišská kotlina (depressions).

Stratigraphical range: Lower–Middle Eocene, (scarcely) Upper Eocene.

Botanical range: cf. *Juglandaceae*.

Remark: Pollen grains ranged to the subspecies “constans” are comparatively small (approx. 18–20 μm). They have a rather thin exine wall (to 1 μm) with fine reticulate – or rather rugulate – sculpture.

Subtriporopollenites constans PF. 1953a subsp. *medius* W. KR. et R. VANHOORNE 1977

Pl. V, Fig. 11, Pl. XIX, Fig. 1, Pl. XVIII, Fig. 15

1977 *Subtriporopollenites constans medius* n. subsp. — W. KRUTZSCH — R. VANHOORNE, Pl. XXII, Fig. 9–15, p. 57

Occurrence: Scarce in Lower Eocene of the Magura unit, in Middle Eocene of the Horonitrianska kotlina and of the Magura unit.

Stratigraphical range: according to W. KRUTZSCH et R. VANHOORNE (1977) the subspecies only occurred in the Pg-zone 11 (Epinois-Bild-Lower Eocene).

Botanical range: cf. *Juglandaceae*.

Platycaryapollenites E. NAGY 1969

Genotype: *Platycaryapollenites miocaenicus* E. NAGY 1969

Platycaryapollis flagellus W. KRUTZSCH 1967

Pl. V, Fig. 4, Pl. XXXIII, fig. 14, Pl. XLIV, Fig. 3

1967 *Platycaryapollis flagellus* sp. n. — W. KRUTZSCH, Pl. IV, Fig. 13–14, p. 92

Occurrence: Scarce in Lower Eocene of the Magura unit, in Upper Eocene of the Liptovská kotlina, of the Šarišská hornatina (mountains) in Oligocene (Rupelian) of the eastern part of the Podunajská nížina.

Stratigraphical range: Eocene, characteristically in the Pg-zone 15 (Middle Eocene — W. KRUTZSCH 1967).

Botanical range: cf. *Platycarya*.

Platycaryapollenites fsp. C. M. KEDVES 1974

Pl. V, Fig. 5

Occurrence: Scarce in Lower Eocene of the Magura unit.

Stratigraphical range: According to M. KEDVES (1974) this “fsp.” occurs in Lower-Middle Eocene of the northern and southern parts of the Bakony mountains.

Botanical range: *Platycarya*

Engelhardtoidites R. POT. 1960, THOMS. ex. R. POT. et THIERGART 1950

Genotype: *Engelhardtoidites microcoryphaeus* (R. POT. 1931a) R. POT. 1960

Engelhardtoidites microcoryphaeus (R. POT. 1931a) R. POT. 1960

Pl. XIX, Fig. 3–4, 13, 15, Pl. XXXIII, Fig. 15, Pl. XXVII, Fig. 13–14, Pl. XLIV, Fig. 4

1931a *Pollenites microcoryphaeus* R. POTONIÉ, Pl. II, fig. 13, p. 329

1950 *Engelhardtoidites microcoryphaeus* R. POT. — R. POTONIÉ, THOMSON et THIERGART, p. 41, Pl. B, Fig. 8, Pl. C, Fig. 16 (nomen nudum)

1960 *Engelhardtoidites* (al. *Pollenites*) *microcoryphaeus* (R. POT. 1931) POT., THOMSON et THIERGART 1950 — R. POTONIÉ, Pl. VII, Fig. 148–149, p. 118

Occurrence: Scarce in Middle Eocene of the Hornonitrianska kotlina, of the Magura and Dukla units; frequent in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, of the Magura and Dukla units, and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Eocene–Miocene, (more frequently) Upper Eocene–Miocene.

Botanical range: cf. *Engelhardtia*.

Plicatopollis W. KRUTZSCH 1962

Genotype: *Plicatopollis plicatus* (R. POT. 1934b) W. KRUTZSCH 1962

Plicatopollis plicatus (R. POT. 1934) W. KR. 1962

Pl. V, Fig. 3, Pl. XX, Fig. 2–3, Pl. XXXIII, Fig. 13, Pl. XIX, Fig. 5, 6

1934 *Pollenites plicatus* n. sp. – R. POTONIE, Pl. II, Fig. 19, p. 55

1962 *Plicatopollis plicatus* (R. POT. 1934b) n. comb. – W. KRUTZSCH, p. 277

Occurrence: Scarce in Lower Eocene of the Magura and Dukla units; in Upper Eocene–Lower Oligocene of the Liptovská kotlina and in Rupelian of the eastern part of the Podunajská nížina. Frequent in Middle Eocene of the eastern part of the Podunajská nížina and of the Magura unit.

Stratigraphical range: Eocene, mainly Middle Eocene, scarcely Upper Eocene–Oligocene.

Remark: Some morphotypes of this species are corroded and their arcuate foldings are indistinct (Pl. V, Fig. 3, Pl. XX, Fig. 2–3).

Plicatopollis hungaricus M. KEDVES 1974

Pl. V, Fig. 2

Occurrence: Scarce in Lower Eocene of the Magura unit.

Stratigraphical range: Lower Eocene of Hungary (M. KEDVES 1974).

Triatriopollenites TH. et PF. 1953

Triatriopollenites minimus (GLADKOVA 1965) M. KEDVES 1974

Pl. XX, Fig. 8–9, 11–12

1965 *Comptonia minima* sp., nov., GLADKOVA, Pl. IV, Fig. 2–4, p. 172

1974 *Triatriopollenites minimus* (GLADKOVA 1965) n. comb. *Juglandaceae*, *Engelhardtia* – M. KEDVES, Pl. XVI, Fig. 22–24

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower–Middle Eocene of Hungary (M. KEDVES 1974).

Botanical range: *Engelhardtia*.

Triatripollenites fsp. A, M. KEDVES 1974

Pl. XX, Fig. 10

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower Eocene of Hungary.

Multiporopollenites (R. POT. 1931) TH. et PF. 1953

Genotype: *Multiporopollenites maculosus* (R. POT. 1931) TH. et PF. 1953

Multiporopollenites maculosus (R. POT. 1931) TH. et PF. 1953

Pl. XXXIII, Fig. 19, Pl. XXXIV, Fig. 7 (cf.)

1931 *Pollenites maculosus* n. sp. — R. POTONIÉ, Pl. II, Fig. 5, 19d, p. 27

1953 *Multiporopollenites maculosus* (R. POT.) n. comb. — THOMSON et PFLUG, Pl. X, Fig. 95, p. 94–95

Occurrence: Scarce in Upper Priabonian–Lower Oligocene of Inner-Carpathian depressions and of the Magura unit.

Stratigraphical range: In Central Europe in Middle Oligocene–Pliocene, mostly in colder climatic zones.

Botanical range: cf. *Juglans*.

Multiporopollenites cf. *pusztamaroti* L. RAKOSI 1973

Pl. VI, Fig. 1

Occurrence: Scarce in Lower Eocene of the Magura unit.

Stratigraphical range: Eocene of Hungary (L. RAKOSI 1973).

Remark: Pollen grains (35 μ m in size) found in the Lower Eocene of the Magura unit differ from the original species (L. RAKOSI 1973) by indistinct pores (because of poor preservation). The pores are more than 20 in number. Shape, distribution of pores on the equator, intragranulate sculpture of exine, and size correspond to those of the original species.

Betulaceae

Trivestibulopollenites TH. et PF. 1953

Genotypus: *Trivestibulopollenites betuloides* PFLUG 1953

Trivestibulopollenites betuloides PFLUG 1953

Pl. XXXIII, Fig. 12, 16, Pl. XLIV, Fig. 8–9

1953 *Trivestibulopollenites betuloides* n. sp. — PFLUG (in THOMSON — PFLUG), Pl. IX, Fig. 25–34, p. 85

Occurrence: Scarce in Upper Priabonian–Lower Oligocene of Inner-Carpathian depressions and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Middle and Late Tertiary of Central Europe.

Botanical range: *Betula* sp.

Corylaceae

***Carpinuspollenites* THIERGART 1938**

***Carpinuspollenites carpinoides* (Pl. 1953) E. NAGY 1969**

Pl. XXVIII, Fig. 3, Pl. XLIV, Fig. 10

1953 *Polyporopollenites carpinoides* n. sp. — PFLUG in THOMSON, Pl. X, Fig. 79–84, p. 92

1969 *Carpinuspollenites carpinoides* (Pl. 1953) n.c. — E. NAGY, Pl. LII, Fig. 8.

Occurrence: Scarce in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: (Regularly) Oligocene–Miocene.

Botanical range: *Carpinus* sp.

Remark: Pollen grains differ from species presented in the synonymy by smaller labrum.

Fagaceae

***Faguspollenites* RAATZ 1937 ex R. POT, 1960**

Genotype: *Faguspollenites verus* RAATZ ex R. POT. 1960

***Faguspollenites* cf. *subtilis* E. NAGY**

Pl. XXVI, Fig. 1

Occurrence: Scarce in Upper Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Helvetian of the Mecsek mountains (according to E. NAGY 1969).

Botanical range: *Fagus silvatica* L.

Remark: Pollen grains of this species were not found in Eocene of Central Europe. Our pollen grain differs from the original species only by its size.

***Cupuliferoideaepollenites* R. POT. 1960**

Genotype: *Cupuliferoideaepollenites liblarensis* THOMSON in POT., THOMSON et THIERGART 1950

***Cupuliferoideaepollenites liblarensis* (THOMS. in R. POT.) THOMSON et THIERGART 1950) R. POT. 1960**

Pl. VI, Fig. 5, 8, 11, Pl. XXVI, Fig. 8, Pl. XXXIII, Fig. 4

1953 *Tricolpopollenites liblarensis* (THOMS.) TH. et PF. 1953 subfsp. *liblarensis* — THOMSON et PFLUG, Pl. XI, Fig. 133–151, p. 96–97

1978 *Cupuliferoideaepollenites liblarensis* (THOMS. in POT. THOMS. et THIERG. 1950). R. POT. 1960, *Fagaceae* v. *Leguminosae* — M. KEDVES, Pl. II, Fig. 10–15, p. 18–19

Occurrence: Frequent in Middle Eocene–Oligocene of the eastern part of the Podunajská nížina, in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, in Lower Eocene of the Magura unit, in Middle to Upper Eocene of the Magura unit, in Upper Eocene–Lower Oligocene of the Dukla unit.

Stratigraphical range: (Mass occurrence) in Eocene, (plentiful) in Oligocene, (very scarce) in Miocene.

Botanical range: *Fagaceae* v. *Leguminosae*.

Cupuliferoidaepollenites quisqualis (R. POT. 1934) R. POT. 1960

Pl. XLII, Fig. 11

1934 *Pollenites quisqualis* n. sp. — R. POTONIE, Pl. III, Fig. 13–16, p. 70

1953 *Tricolpopollenites liblarensis* (THOMS.) TH. et PF. 1953 subsp. *fallax* (R. POT. 1934) n. comb. TH. et PF. Pl. XI, Fig. 133–155, p. 97

1978 *Cupuliferoidaepollenites quisqualis* (R. POT. 1934) R. POT. 1960 — M. KEDVES, Pl. II, Fig. 16–18, p. 19

Occurrence: Frequent in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower Eocene–Oligocene.

Botanical range: *Fagaceae* v. *Leguminosae*.

Remark: The pollen grain depicted differs from species presented in the synonymy by thicker exine and more conspicuous colpae.

Cupuliferoipollenites R. POT. 1960

Genotype: *Cupuliferoipollenites* (al. *Pollenites*) *pusillus* R. POT. 1934

Cupuliferoipollenites pusillus (R. POT. 1934) R. POT. 1960

Pl. XVI, Fig. 4, 9, 10, 11, Pl. XXXIII, Fig. 2

1934 *Pollenites quisqualis pusillus* n. f. — R. POTONIE, Pl. III, Fig. 21, p. 70

1953 *Tricolporopollenites cingulum* (R. POT. n. comb. subsp. *pusillus* R. POT.) n. comb. — THOMSON et PFLUG, Pl. XII, Fig. 12, 28–41, p. 100

1978 *Cupuliferoipollenites pusillus* (R. POT. 1934) R. POT. 1960, *Fagaceae*, cf. *Castaneae* — M. KEDVES, Pl. VI, Fig. 17–22, Pl. VII, Fig. 1–6, p. 37

Occurrence: Scarce in Lower Eocene of the Magura and Dukla units, frequent in Middle Eocene of the eastern part of the Podunajská nížina, of the Hornonitrianska kotlina, of the Magura and Dukla units, in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, of the Magura and Dukla units.

Stratigraphical range: Lower Eocene–Upper Oligocene.

Botanical range: *Castanea*

Cupuliferoipollenites oviformis (R. POT. 1931) R. POT. 1960

Pl. VI, Fig. 2, Pl. XXVI, Fig. 4, 5, Pl. XVI, Fig. 8, Pl. XXXIII, Fig. 3, Pl. XLIII, Fig. 1

1931a *Pollenites oviformis* n. sp. — R. POTONIE, Pl. I, Fig. 20, p. 332

1953 *Tricolporopollenites cingulum* (R. POT.) n. comb. subsp. *oviformis* (R. POT.) n. comb. — THOMSON et PFLUG, Pl. XII, Fig. 42–49, p. 100

1978 *Cupuliferoipollenites oviformis* (R. POT. 1931a) R. POT. 1960 — *Fagaceae*, *Castanea*, M. KEDVES, Pl. VII, Fig. 7–9, p. 38

Occurrence: Scarce in Lower Eocene of the Magura unit, in Middle Eocene of the Magura unit, frequent in Upper Eocene of the Liptovská kotlina, in Upper Priabonian–Lower Oligocene of the Dukla unit, and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower Eocene–Upper Oligocene.

Botanical range: *Castanea*.

Intrabaculitricolporites M. KEDVES 1978

Genotype: *Intrabaculitricolporites porasper* (Pf. 1953) M. KEDVES 1978

Intrabaculitricolporites porasper (Pf. 1953) M. KEDVES 1978

Pl. VI, Fig. 7, Pl. XLIII, Fig. 2

1953 *Tricolporopollenites porasper* n. sp. (Pf.) – THOMSON et PFLUG, Pl. XIV, Fig. 11–25, p. 105

1978 *Intrabaculitricolporites porasper* (Pf. 1953) n. comb. – M. KEDVES, Pl. X, Fig. 12–17, p. 53

Occurrence: Scarce in Lower Eocene of the Magura unit and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower–Middle Eocene of Hungary (M. KEDVES 1978).

Remark: The pollen grain found in Lower Eocene of the Magura unit (Pl. VI, Fig. 7) is partly corroded but its intrabaculate structure is distinct as well as colpae and pores.

Fususpollenites M. KEDVES 1978

Genotype: *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978

Fususpollenites fusus (R. POT. 1931) M. KEDVES 1978

Pl. VI, Fig. 3–4, Pl. XVI, Fig. 1–3, Pl. XVII, Fig. 6–7, 10, Pl. XLII, Fig. 13–14

1931 *Pollenites fusus* n. sp. – R. POTONIÉ, Pl. I, Fig. 13, p. 332

1953 *Tricolporopollenites cingulum* (R. POT.) TH. et Pf. subsp. *fusus* (R. POT.) n. comb. – THOMSON et PFLUG, Pl. XII, Fig. 15–17, p. 100

1978 *Fususpollenites fusus* (R. POT. 1931) n. comb. *Fagaceae, Castanopsis* – M. KEDVES, Pl. XIII, Fig. 1–9, p. 66

Occurrence: Frequent in Middle–Upper Eocene of the eastern part of the Podunajská nížina, the Hornonitrianska kotlina, in Lower–Middle Eocene of the Magura unit, scarce in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, of the Magura and Dukla units, scarce in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Eocene (mass occurrence), Oligocene (sporadic).

Bacutricolporites M. KEDVES 1978

Genotype: *Bacutricolporites villensis* (THOMS. 1950)

Bacutricolporites villensis (THOMS.) M. KEDVES 1978

Pl. XVI, Fig. 6, 19, Pl. XXVI, Fig. 12, Pl. XLII, Fig. 15

1950 *Pollenites cingulum villensis* n. sp. — THOMSON in POTONIÉ-THOMSON et THIERGART, Pl. B, Fig. 28, 29

1953 *Tricolporopollenites villensis* (THOMS.) n. comb. — M. KEDVES, Pl. XIV, Fig. 16–17, 21–23, p. 70

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina, of the Hornonitrianska kotlina, the Magura unit, in Lower Eocene of the Magura unit, and in Rupelian, of the eastern part of the Podunajská nížina.

Tricolporopollenites TH. et PF. 1953

Genotype: *Tricolporopollenites dolium* (R. POT.) TH. et PF. 1953

Tricolporopollenites cf. *microhenrici* (R. POT. 1931) W. KR. 1961

Pl. XVI, Fig. 13–14, cf. 15–16, Pl. XXVI, Fig. 7, Pl. XLII Fig. 7–8, Pl. XXXIII, Fig. 5.

Occurrence: Frequent in Middle Eocene–Oligocene of the eastern part of the Podunajská nížina, Inner-Carpathian depressions, the Magura and Dukla units.

Stratigraphical range: Eocene–Middle Miocene.

Botanical range: cf. *Quercus*.

Remark: To this species we have ranged morphotypes 25–30 µm in size, mostly with punctate and fine verrucate sculpture and baculate structure, conspicuous colpae and almost invisible pores. In their diagnostic characters they resemble mostly the species presented by L. RAKOSI (1973) from Eocene of the Dorog-Tokod region (Pl. XXVII, Fig. 19–20, p. 533) and by P. A. HOCHULI (1978) from Oligocene and Lower Miocene of central and western Paratethys (Pl. XII, Fig. 4, p. 82).

Quercoidites R. POT. 1960 ex. R. POT., THOMSON et THIERGART 1950

Genotype: *Quercoidites henrici* (R. POT. 1931a) et R. POT. 1960 ex POTONIÉ, THOMSON et THIERGART 1950

Quercoidites henrici (R. POT. 1931a) R. POT. 1960 ex POTONIÉ, THOMSON et THIERGART 1950

Pl. XXV, Fig. 4, cf. Pl. XXVI, Fig. 9, Pl. XLII, Fig. 9–10

1931 *Pollenites henrici* n. sp. — R. POTONIÉ, Pl. II, Fig. 19, p. 329 (non vidi)

1953 *Tricolporopollenites henrici* (R. POT.) n. comb. — THOMSON et PFLUG, Pl. XI, fig. 30–42, p. 95

1960 *Quercoidites* (al. *Pollenites*) *henrici* (R. POT. 1931) POT. THOMS. et THIERG. — R. POTONIÉ, Pl. VI, Fig. 96, p. 92–93

1976 *Quercoidites henrici* (R. POT.) R. POT. cf. *Quercus* — M. MAZANCOVÁ, Pl. V, Fig. 13–15, p. 21

Occurrence: Scarce in Upper Eocene of the eastern part of the Podunajská nížina, in Upper Priabonian–Lower Oligocene of Inner-Carpathian depressions, Magura and Dukla units, in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Throughout the Tertiary, Oligocene (mass occurrence).

Botanical range: cf. *Quercus*.

Remark: Morphotypes found in Upper Eocene—Oligocene of our country differ from species presented in the synonymy in being rather oval than spindle-shaped. On the exine of the pollen grain depicted in Pl. XXV, Fig. 4 are besides granulate formations also smaller and larger openings. It is likely that they are secondary, due to corrosion.

Tricolporopollenites asper (TH. et PF. 1953) W. KR. 1961

Pl. XLII, Fig. 12

1953 *Tricolporopollenites asper* n. sp. — H. PFLUG et P. THOMSON, Pl. XI, Fig. 43–49, p. 96

1961 *Tricolporopollenites asper* (TH. et PF. 1953) n. comb. — W. KRUTZSCH, p. 322

Occurrence: Scarce in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Throughout the Tertiary of Central Europe, more frequent in Oligocene and Miocene.

Botanical range: cf. *Quercus*.

Monimiaceae

Momipites WODEHOUSE 1933

Genotype: *Momipites coryloides* WODEHOUSE 1933

Momipites quietus (R. POT. 1931) D. J. NICHOLS 1973

Pl. XIX, fig. 12, 14, 18 (cf.) 19, Pl. V, Fig. 8

1931 *Pollenites quietus* n. sp. — R. POTONIÉ, Abh. 13, p. 556 (non vidi)

1934 *Pollenites quietus* R. POT. — R. POTONIÉ, Pl. IV, Fig. 18, 21, p. 83

1973 *Momipites quietus* (POTONIÉ 1931) comb. nov. — D. J. NICHOLS, p. 107

Occurrence: Scarce in Lower Eocene of the Magura unit, frequent in Middle Eocene of the eastern part of the Podunajská nížina, the Magura unit, in Upper Eocene—Lower Oligocene of Inner-Carpathian depressions.

Stratigraphical range: Lower Eocene—Oligocene.

Fabaceae

Verrutricolporites Van der HAMMEN et WJUMSTRA 1964

Verrutricolporites ovalis (R. POT. 1934) M. KEDVES 1978

Pl. XXVI, Fig. 2–3

1934 *Pollenites cingulum ovalis* n. f. — R. POTONIÉ, Pl. IV, Fig. 8, p. 83

1978 *Verrutricolporites ovalis* (R. POT. 1934) n. comb. — *Fabaceae* — M. KEDVES, Pl. XIV, Fig. 1–3, p. 67–68

Occurrence: Scarce in Upper Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower–Upper Eocene of Hungary (M. KEDVES 1978).

Sapotaceae, cf. Sapotaceae

Tetracolporopollenites PF. et TH. 1953

Genotype: *Tetracolporopollenites sapotoides* PF. et TH. 1953

Tetracolporopollenites sapotoides PF. et TH. 1953

Pl. XVIII, Fig. 8, Pl. XXXIII, Fig. 10

1953 *Tetracolporopollenites sapotoides* n. sp. — Pflug et Thomson, Pl. XV, Fig. 6–12, p. 110

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina, in Upper Eocene–Lower Oligocene of the Spišská kotlina.

Stratigraphical range: Eocene–Oligocene.

Tetracolporopollenites cf. oculus PF. et TH. 1953

Pl. XVIII, Fig. 3–4, 5–6

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Eocene.

Remark: The pollen grains differ from the original species (H. PFLUG et P. THOMSON 1953, Pl. XIV, Fig. 110–112) in being somewhat smaller. The structure of the exine is indistinct in pollen grains depicted in Pl. XVIII, Fig. 3–4.

Sterculiaceae

Granotricolporites M. KEDVES 1978

Genotype: *Granotricolporites semiglobosus* (KDS. 1963b) M. KEDVES 1978

Granotricolporites semiglobosus (KDS. 1963) M. KEDVES 1978

Pl. XVII, Fig. 12–13, cf. 9–11

1963 *Tricolporopollenites semiglobosus* n. fsp. — M. KEDVES, Pl. IV, Fig. 9, 10, 13, 14, p. 36

1978 *Granotricolporites semiglobosus* (KDS. 1963b) n. comb. — M. KEDVES, Pl. XIII, Fig. 19–23, p. 67

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina, the Hornonitrianska kotlina, in Lower Eocene of the Magura unit.

Stratigraphical range: Lower–Upper Eocene.

Tiliaceae, cf. Tiliaceae

Intratripolporopollenites THOMSON et PFLUG 1953

Genotype: *Intratripolporopollenites instructus* (R. POT. 1931c) PF. et TH. 1953

***Intratropipollenites insculptus* Mai 1961**

Pl. XXXIV, Fig. 5, 6, Pl. XXVIII, Fig. 4 (cf.), Pl. XLIV, Fig. 6

1961 *Intratropipollenites insculptus* n. sp. — MAI, Pl. XI, Fig. 10–27, p. 65

Occurrence: Scarce in Upper Eocene of the eastern part of the Podunajská nížina, in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, of the Magura and Dukla units, and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Oligocene–Miocene. According to W. KRUTZSCH (1970) the species occurs sporadically on the Eocene (Oligocene boundary (Pg-zone 19)).

***Intratropipollenites instructus* (R. POT. 1931c) PF. et TH. 1953**

Pl. XLIV, Fig. 7

1931c *Tiliae-pollenites instructus* n. sp. — R. POTONIE, Fig. 9, p. 56

1934 *Tiliae-pollenites instructus* R. POT. — R. POTONIE et VENITZ, Pl. IV, Fig. 109–110, p. 37

1953 *Intratropipollenites instructus* (R. POT. et VEN.) n. comb. — H. PFLUG et THOMSON, Pl. X, Fig. 14–23, p. 89

Occurrence: Scarce in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Oligocene (scarce) Miocene (frequent in warmer parts).

Botanical range: *Tilia* sp.

Euphorbiaceae

***Spinaepollis* W. KRUTZSCH 1969d**

Genotype: *Spinaepollis spinosus* (R. POT. 1931a) W. KRUTZSCH 1961d

***Spinaepollis spinosus* (R. POT. 1931a) W. KR. 1961d**

Pl. XXVI, Fig. 15

1931 *Pollenites spinosus* n. sp. — R. POTONIE, Pl. I, Fig. 29–30, p. 328

1934 *Pollenites spinosus* R. POT., R. POTONIE, Pl. V, Fig. 18, 20, p. 92

1961 *Spinaepollis spinosus* (R. POT. 1931a) n. comb. — W. KRUTZSCH, p. 323

Occurrence: Scarce in Upper Eocene of the SE part of the Šarišská hornatina mountains.

Stratigraphical range: Paleocene (scarce), Pg. zone 6, 8–9), Middle–Upper Eocene (frequent; W. KRUTZSCH 1970).

Botanical range: cf. *Euphorbiaceae*. According to P. THOMSON — H. PFLUG (1953) — *Lauraceae*.

Simarubacaceae

***Pentapollenites* W. KRUTZSCH 1958**

Genotype: *Pentapollenites pentangulus* (PF. 1953) W. KRUTZSCH 1958a

Pentapollenites pentangulus (Pf. 1953) W. KR. 1958 subsp. *pentangulus* W. KR. 1962

Pl. XX, Fig. 16

1953a *Periporopollenites pentangulus* n. sp. (Pf.) — PFLUG in THOMSON et PFLUG, Pl. XV, Fig. 62–64, p. 112

1953b *Pentapollis pentangulus* (PFLUG) n. comb. — PFLUG, Pl. XX, Fig. 23, p. 113

1958a *Pentapollenites pentangulus* (Pf. 1953) n. comb. — W. KRUTZSCH

Occurrence: Scarce in Lower Eocene of the Magura unit.

Stratigraphical range: Lower–Middle Eocene, Oligocene (sporadic).

Botanical range: *Simarubaceae*, *?Eleagnaceae*.

Remark: W. KRUTZSCH (1962e) dealt with detail diagnosis and nomenclature of the genus *Pentapollenites*.

Pentapollenites cf. *laevigatus* W. KR. 1962 subsp. *laevigatus*

Pl. IV, Fig. 10

Occurrence: Scarce in Lower Eocene of the Magura unit.

Stratigraphical range: Lower–Upper Eocene of Central Europe.

Botanical range: *Eleagnaceae* or *Simarubaceae*.

Remark: Scarce specimens belonging most likely to the species *P. laevigatus* W. KR. are considerably corroded. They are only identified according to their shape, size and a part of pore area.

Icacinaeae

Compositoipollenites R. POT. 1960

Genotype: *Compositoipollenites* (al. *Pollenites*) *rhizophorus* (R. POT. 1934b) R. POT. 1960

Compositoipollenites rhizophorus (R. POT. 1934b) R. POT. 1960 subsp. *burghasungensis* MÜRR. et PF. 1953

Pl. V, Fig. 12

1934b *Pollenites rhizophorus* n. sp. — R. POTONÉ, Pl. V, Fig. 25–26, Pl. VI, Fig. 32, p. 94

1953 *Intratropipollenites rhizophorus* (R. POT.) n. comb. subsp. *burghasungensis* n. subsp. (Pf.) — MÜRRIGER et PFLUG in THOMSON et PFLUG, Pl. IX, Fig. 126–132, p. 88–89

1974 *Compositoipollenites rhizophorus* (R. POT. 1934b) R. POT. 1960 subsp. *burghasungensis* MÜRR. et PFLUG 1953, *Icacinaeae* — M. KEDVES, Pl. XIII, Fig. 25–26, p. 36

Occurrence: Scarce in Lower Eocene of the Magura unit.

Stratigraphical range: Eocene, mostly Lower and Middle (scarcely) Upper Eocene.

Remark: The subspecies 35 μ m in size, with 1 μ m segments (echinate sculpture) corresponds in its diagnostic signs mostly to pollen grains presented by M. KEDVES (1974) from Lower–Middle Eocene of Hungary.

Aquifoliaceae

Ilexpollenites (THIERGART 1937) R. POT. 1960

Genotype: *Ilexpollenites margaritatus* (R. POT. 1931) THIERGART 1937

Ilexpollenites erdtmani M. KEDVES 1978

Pl. XVIII, Fig. 1–2

1978 *Ilexpollenites erdtmani* n. fsp. – M. KEDVES, Pl. XV, Fig. 22, 23, Pl. XVI, Fig. 1–7, p. 72–73

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower–Middle Eocene of Hungary.

Ilexpollenites margaritatus (R. POT. 1931) THG. 1937 f. *medius* PF. et TH. 1953

Pl. XLIII, Fig. 5 (cf.), Fig. 7

1953 *Tricolporopollenites margaritatus* (R. POT.) n. comb. PFLUG et THOMSON f. *medius* (PF. et TH.), Pl. XIV, Fig. 46–60, p. 107

1978 *Ilexpollenites margaritatus* (R. POT. 1931) THG. 1937 f. *medius* PF. et TH. 1953 – M. KEDVES, Pl. XV, Fig. 10–12, p. 71

Occurrence: Scarce in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Throughout the Tertiary of Central Europe.

Botanical range: *Ilex* sp.

Cyrillaceae

Cyrillaceapollenites (MÜRRIGER et PFLUG 1951) R. POT. 1960

Genotype: *Cyrillaceapollenites* (al. *Pollenites*) *megaexactus* (R. POT. 1931) R. POT. 1960

Cyrillaceapollenites megaexactus (R. POT. 1931) R. POT. 1960

Pl. VI, Fig. 12, cf. 10, Pl. XXVI, Fig. 6, Pl. XXXIII, Fig. 6–7, Pl. XLIII, Fig. 4

1931 *Pollenites megaexactus* n. sp. – R. POTONIE, Pl. I, Fig. V, 42b, p. 26

1953 *Tricolporopollenites megaexactus* (R. POT.) n. comb., THOMSON et PFLUG, Pl. XII, Fig. 50–57, p. 101

1960 *Cyrillaceapollenites megaexactus* (R. POTONIE 1931) emend. – R. POTONIE, Pl. VI, Fig. 115, p. 102

Occurrence: Frequent in Upper Eocene–Lower Oligocene of the Liptovská kotlina, scarce in Middle and Upper Eocene of the eastern part of the Podunajská nížina, the Hornonitrianska kotlina, in Lower and Middle Eocene of the Magura unit, in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Throughout the Tertiary, mass occurrence in Middle Tertiary.

cf. Celastraceae

Tetracolporopollenites (PF. et TH. 1953)

Tetracolporopollenites (Brecolpites) GÓCZAN 1964

Genotype: *Tetracolporopollenites (Brecolpites) sphaericus* (COUPER 1960) GÓCZAN 1964

Tetracolporopollenites (Brecolpites) cf. gregussi L. RAKOSI 1973

Pl. XVIII, Fig. 13–14

Occurrence: Scarce in Middle Eocene of the Hornonitrianska kotlina.

Stratigraphical range: Eocene of Hungary.

Remark: The pollen grain depicted differs from the original species (L. RAKOSI 1973) in a greater size (30 μ m) and a more oval shape.

Anacardiaceae

Rhoipites WODEHOUSE 1933

Rhoipites ERDMANN 1947

Genotype: *Rhoipites bradley* WDH. 1933

Rhoipites pseudocingulum (R. POT. 1931) R. POT. 1960,

Pl. XXV, Fig. 6 (cf.), Pl. XXXIII, Fig. 9, Pl. XXVI, Fig. 10, 11

1931a *Pollenites pseudocingulum* n. sp. – R. POTONIE, Pl. I, Fig. 3–4, p. 332 (non vidi)

1934 *Pollenites pseudocingulum* R. POT. – R. POTONIE, Pl. III, Fig. 28, 29 (depiction of holotype from 1931a, Fig. 34, 36, p. 74–75)

1953 *Tricolporopollenites pseudocingulum* (R. POT.) n. comb. – THOMSON et PFLUG, Pl. XII, Fig. 96–111, p. 99

1960 *Rhoipites* (al. *Pollenites*) *pseudocingulum* (R. POT. 1931a) n. comb. – R. POTONIE, p. 101

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina, Hornonitrianska kotlina, Magura unit, in Upper Eocene–Lower Oligocene of Inner-Carpathian depressions, Magura and Dukla units, frequent in Upper Eocene–Lower Oligocene of the Liptovská kotlina, and in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Tertiary.

Botanical range: cf. *Rhus*.

Tricolporopollenites TH. et PF. 1953

Genotype: *Tricolporopollenites dolium* R. POT.

Tricolporopollenites dolium (R. POT. 1931) TH. et PF. 1953

Pl. XVII, Fig. 3–4, 8

1931a *Pollenites dolium* n. sp. – POTONIE, Pl. II, Fig. 22, p. 329 (non vidi)

1953 *Tricolporopollenites dolium* (R. POT.) n. comb. – THOMSON et PFLUG, Pl. XII, Fig. 112–117, p. 98

Occurrence: Scarce in Middle Eocene of eastern part of the Podunajská nížina.

Stratigraphical range: Eocene–Oligocene.

Remark: Pollen grain found in Middle Eocene of the eastern part of the Podunajská nížina differ in size from species included in the synonymy. They are 25–30 μ m in size. In their shape, intrabaculate structure, structure of the germinal apparatus they correspond to the species of P. THOMSON et H. PFLUG (1953).

Monocotyledonidae

Areaceae

***Monocolpopollenites* TH. et PF. 1953**

Genotype: *Monocolpopollenites tranquillus* (R. POT. 1934) TH. et PF. 1953

***Monocolpopollenites tranquillus* (R. POT. 1934b) TH. et PF. 1953**

Pl. XV, Fig. 1–5, Pl. XXXII, Fig. 2, 3, Pl. V, Fig. 10, Pl. XXVI, Fig. 16, 17, Pl. XLII, Fig. 4–5

1934 *Pollenites tranquillus* n. sp. – R. POTONIÉ, Pl. II, Fig. 3, 8, p. 51

1953 *Monocolpopollenites tranquillus* (R. POT.) n. comb. – THOMSON et PFLUG, Pl. IV, Fig. 24–37, 39–47, p. 62

1962a *Monocolpopollenites tranquillus* (R. POT.) TH. et PF. *tranquillus* – W. KRUTZSCH, Pl. III, Fig. 8–10, p. 270

1970 *Monocolpopollenites tranquillus* (R. POT. 1934b) TH. et PF. 1953 – W. KRUTZSCH, XIX, Fig. 1–32, p. 89–100

Occurrence: Frequent in Middle Eocene of the eastern part of the Podunajská nížina, Hornonitrianska kotlina, Magura unit, in Lower–Middle Eocene of the Dukla unit, in Upper Eocene of the eastern part of the Podunajská nížina, Inner-Carpathian depression, in Upper Priabonian–Lower Oligocene of the Outer Flysch Belt, in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower Eocene–Lower Oligocene.

Remark: We range to the species *M. tranquillus* (R. POT.) TH. et PF. the pollen grains 20–40 μm in size with smooth to finely punctate exine and a larger colpa. More detail synonymy is in W. KRUTZSCH (1970a).

***Monocolpopollenites minor* M. KEDVES 1961**

Pl. XV, Fig. 8, 11

1961 *Monocolpopollenites minor* n. fsp. – *Palmae*? *Cycadaceae* – M. KEDVES, Pl. X, Fig. 15–17, p. 149

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower Eocene of Hungary, according to M. KEDVES (1961).

Botanical range: *Areaceae*, aff. *Chrysalidocarpus*.

***Arecepites* WODEHOUSE 1933**

Genotype: *Arecepites punctatus* WDH. 1933

***Arecepites granulatus* (KEDVES 1961) M. KEDVES 1974**

Pl. XXXII, Fig. 5, 6, Pl. XV, Fig. 6 (cf.), Pl. XLII, Fig. 6

1961 *Monocolpopollenites granulatus* n. fsp. *Palmae* – M. KEDVES, Pl. X, fig. 22, 23, p. 150

1973 *Arecepites granulatus* (KDS. 1961) n. comb. – L. RAKOSI, Pl. XXVI, Fig. 7–10

Occurrence: Scarce in Middle Eocene of the Magura unit, in Upper Priabonian–Lower Oligocene of the Liptovská kotlina, the Magura unit, in Rupelian of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower–Eocene of Hungary.

Arecipites cf. *microreticulatus* W. KRUTZSCH – R. VANHOORNE 1977

PL. XV, Fig. 10, 12

1977 *Arecipites microreticulatus* n. fsp. – W. KRUTZSCH et R. VANHOORNE, Pl. XII, Fig. 10–12, p. 26–27

Occurrence: Scarce in Middle Eocene of the eastern part of the Podunajská nížina.

Stratigraphical range: Lower Eocene of Germany (Pg-zone 11, Epinois-Bild, W. KRUTZSCH – R. VANHOORNE (1977).

Botanical range: cf. *Arecaceae*.

Remark: The pollen grain depicted differs from the original species in less pointed ends. They have equal size and sculpture.

Spinizonocolpites MÜLLER 1968

Genotype: *Spinizonocolpites echinatus* MÜLLER 1968

Spinizonocolpites prominatus McINTYRE 1965 (M. KEDVES 1974),

Pl. III, Fig. 5

1965 *Monosulcites prominatus* n. sp. – McINTYRE, Fig. 33, 34, p. 214

1974 *Spinizonocolpites prominatus* (McINTYRE 1965) n. comb. *Palmae*, cf. *Nipa* – M. KEDVES, Pl. VIII, Fig. 7–9, p. 20–21

Occurrence: Scarce in the Lower Eocene of the Magura unit.

Stratigraphical range: Lower–Middle Eocene.

Botanical range: cf. *Nipa*

Angiospermophyta*°*incertae sedis

***Normalopolles* PFLUG 1953**

Basopollis H. PFLUG 1953

Genotype: *Basopollis orthobasalis* PFLUG 1953

Basopollis cf. *urkutensis* M. KEDVES 1974

Pl. IV, Fig. 1–2

Occurrence: Scarce in the Lower Eocene of the Magura unit.

Stratigraphical range: Lower Eocene of Hungary (M. KEDVES 1974).

Remark: Pollen grains 30 μ m in size differ partly from the original species. Corrosion of the area of germinal apparatus resulted in oculi-shaped segments (Fig. 2). Detail examination under microscope shows the germinal apparatus identic with that of the original species.

Pompeckjoidaepollenites (PFLUG 1953b) W. KR. 1967

Genotype: *Pompeckjoidaepollenites subhercynicus* W. KRUTZSCH 1954a (W. KR. 1967)

Pompeckjoidaepollenites subhercynicus (W. KR. 1954) W. KR. 1967

Pl. IV, Fig. 3

1954a *Trudopollis subhercynicus* n. nom. — W. KRUTZSCH, Pl. I, Fig. 19–22, p. 287

1967 *Pompeckjoidaepollenites subhercynicus* (W. KR. 1954) n. comb. — W. KRUTZSCH, Pl. XIII, Fig. 19–30, p. 492

Occurrence: Scarce in Senonian–Paleocene of the Dukla unit and in Lower Eocene of the Magura unit.

Stratigraphical range: Maastrichtian–Middle Eocene in Central Europe.

Interpollis W. KRUTZSCH 1961d

Genotype: *Interpollis suppligensis* (Pf. 1953), W. KRUTZSCH 1961d

Interpollis velum W. KRUTZSCH 1961d

Pl. IV, Fig. 4–6

1961d *Interpollis velum* n. fsp. — W. KRUTZSCH, Pl. I, Fig. 24–26, p. 305–306

1974 *Interpollis velum* W. KR. 1961d — M. KEDVES, Pl. IX, Fig. 4–9, p. 24

Occurrence: Frequent in Lower Eocene of the Magura unit.

Stratigraphical range: Paleocene–Lower Eocene, (scarcely) Middle Eocene (M. KEDVES 1974).

Interpollis microsuppligensis W. KRUTZSCH 1961

Pl. IV, Fig. 8, (cf.) 9, Pl. XVIII, Fig. 10 (cf.)

1961 *Interpollis microsuppligensis* n. fsp. — W. KRUTZSCH, Pl. I, Fig. 12–23, p. 305–306

Occurrence: Scarce in Lower–Middle Eocene of the Magura unit, in Upper Senonian–Paleocene of the Dukla unit.

Stratigraphical range: Maastrichtian–Middle Eocene.

Remark: Pollen grains of this species are somewhat smaller than *I. velum* W. KR. They range to 20 μ m in size.

Triporites (NAUMOVA 1939) R. POTONIE 1960

Platycaryapollenites E. NAGY 1969

Genotype: *Platycaryapollenites miocenicus* E. NAGY 1969

Platycaryapollenites cf. anticyclis W. KR. – R. VANHOORNE 1977

Pl. V, Fig. 7, 9

1977 *Platycaryapollenites anticyclis* n. sp. – W. KRUTZSCH, – R. VANHOORNE, Pl. XX, Fig. 19–21, p. 45

Occurrence: Scarce in Lower Eocene of the Magura unit.

Stratigraphical range: Lower Eocene, Pg-zone 11 (Epinois-Bild), according to W. KRUTZSCH – R. VANHOORNE 1977.

Remark: Pollen grains found in Lower Eocene of the Dukla unit differ from the original species in thinner exine wall (Pl. V, Fig. 7) due most likely to corrosion.

Triatriopollenites hannoverensis W. KR.

Pl. IV, Fig. 12, Pl. XXVII, Fig. 15

1977 *Triatriopollenites hannoverensis* W. KR. – W. KRUTZSCH et R. VANHOORNE, Pl. XV, Fig. 31–35, p. 42

Occurrence: Scarce in Lower Eocene of the Magura unit, in Upper Eocene of the eastern part of the Podunajská nížina. There it is perhaps resedimented from the underjacent beds.

Stratigraphical range: Paleocene (Pg.-zone 2–8) of Belgium (loc. Loksbergen), according to W. KRUTZSCH – R. VANHOORNE (1977).

Remark: The species "*Triatriopollenites hannoverensis*" was described as early as 1967 by W. KRUTZSCH. The manuscript has not been published as yet.

Triatriopollenites roboratus PFLUG 1953a

Pl. V, Fig. 1

1953 *Triatriopollenites roboratus* n. sp. (Pf.) – PFLUG (in THOMSON – PFLUG), Pl. VII, Fig. 71–74, p. 78

1977 *Triatriopollenites roboratus* Pf. 1953a – W. KRUTZSCH – R. VANHOORNE, Pl. XIX, Fig. 3–7, p. 42

Occurrence: Scarce in Paleocene–Lower Eocene of the Dukla unit.

Stratigraphical range: Paleocene–Lower Eocene of Central Europe (up to Pg-zone 13a – Upper Paleocene – Lower Eocene, according to W. KRUTZSCH).

Application of Systematical-Morphological Valuation of spores and Pollen Grains in Stratigraphical Division of Paleogene of West Carpathians

General valuation and systematical classification show that composition of the Paleogene microflora (spores, pollen) is not uniform. The microflora is composed of various elements only partly comparable directly with recent species and genera. The species are identified predominantly morphologically and their botanical range is determined only as far as family is concerned. Many Early Tertiary pollen grains are from extinct plants and from small relict area so they are insufficient for thorough phylogenetical study and detailed paleoecological reconstruction.

Because of the difficulties in determination of basical pollen spectra from the Paleogene of our country I had to use the existing palynological data and to study spores and pollen with a narrower stratigraphical range, and of such significance as to be comparable with faunal guide fossils. According to W. KRUTZSCH (1967, 1970) such are species of the genera *Stephanoporopollenites*, *Thomsonipollis*, *Mediocolpopollis*, *Boehlensipollis* a. o. Since stratigraphically significant sporomorphs are infrequent or missing in smaller amounts of samples palynological research is partly based on the study of complete microfloral assemblages. Beside their stratigraphy the time of their origin, maximum occurrence, decay and extinction are to be studied. Paleoecological analysis of such assemblages is a reliable, generally accepted method facilitating fine, detailed division, particularly as regards valuation of drilling results from larger areas.

Stratigraphical valuation may be also based on decrease and increase of three principal floral elements determined by W. KRUTZSCH (1966, 1967) in the Early Tertiary of Germany and Central Europe in general. They are: Upper Cretaceous (archaic), Eocene-paleotropical, pre-arctotertiary floral elements. Their quantity is indicative of climatic changes; i.e. gradual cooling is indicated by extinction of Cretaceous (archaic) and increase of pre-arctotertiary elements. The maximum occurrence of Eocene-paleotropical elements is followed by decrease. The course of cooling was variable so it is possible to determine several periods. The climatic periods were more-or-less stable in Central Europe, so they may be applied in stratigraphical division as well. The above mentioned ways of valuation of microfloral assemblages may all be applied in stratigraphical division of the Paleogene in the areas under study. So in the Paleogene of our country seven pollen spectra have been distinguished. They correspond to two microbiostratigraphical zones (O. SAMUEL – J. SALAJ 1968). These floral elements facilitated approximate determination of characteristic species of spores and pollen grains of the single pollen spectra. Their decrease, increase, and appearance of new elements are in Fig. 2 presenting generalized basical results of palynological research of the West Carpathians. It is to be mentioned again that the pollen spectra are mostly from Flysch sediments with less preserved microflora and smaller amount of stratigraphically significant species than in other sediments. Dominant are species with a broader stratigraphical range.

Although the purpose of this work is systematical valuation of sporomorphs of Paleogene sediments, included are also Upper Cretaceous sediments (systematically treated in T. KORÁB–P. SNOPOKOVÁ 1972) commencing the bed sequence of the Dukla unit in East Slovakia (the Lupkov beds). So the pollen spectrum 1 is still from the subjacent Upper Cretaceous sediments of the Dukla unit.

Pollen spectrum 1 comprising the Senonian (marine flysch facies, the Lupkov beds of the Dukla unit) is correlable with microfaunal zone of agglutinated foraminifers *Rzehakina epigona*. The period is characterized by pollen grains of *Normapollis*. Their stratigraphical range is wider within the Senonian, and as shown by the pollen diagram (Fig. 2) – they occur sporadically in the Paleocene of the region studied.

The characteristic species are: *Plicapollis peneserta* PF., *Semioculopollis* cf. *minutus* W. KR. et PACLTOVÁ, *Semioculopollis* fsp., *Pseudooculopollis principalis*

Fig. 2. Biostratigraphical Abundance of the Paleogene Sporomorphs.

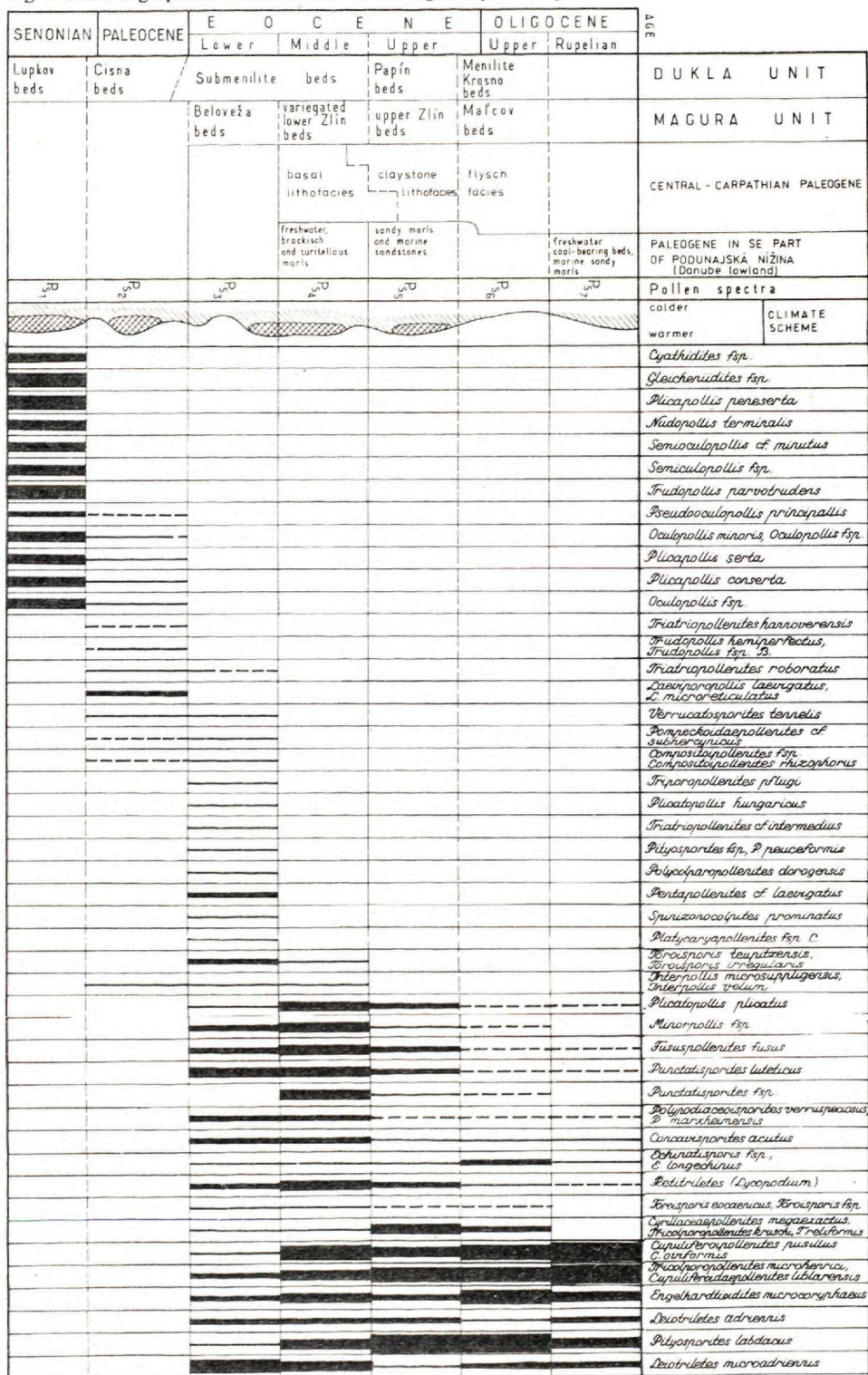
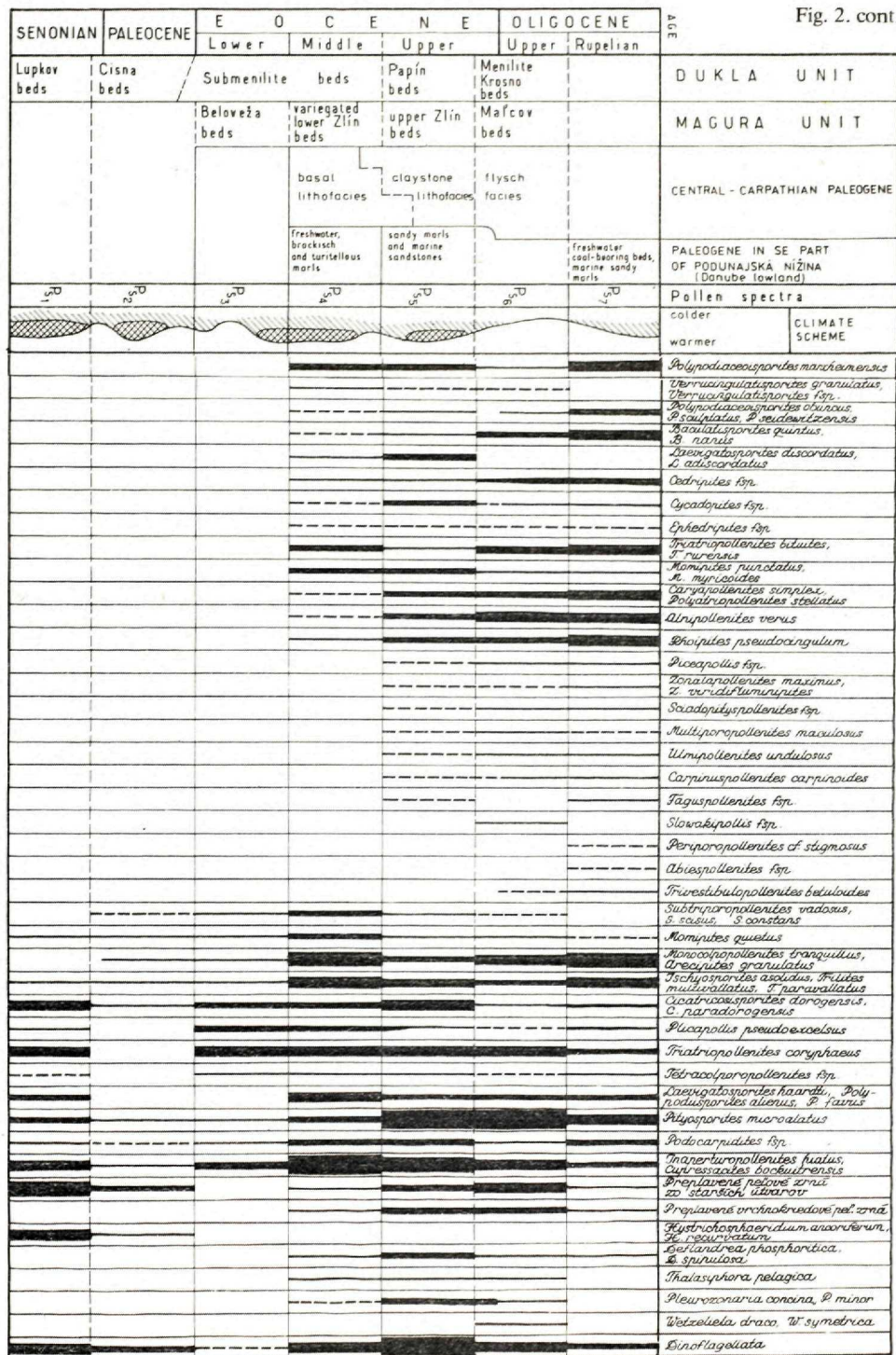


Fig. 2. cont.



OCCURRENCE: ----- very scarce

current

scarce

frequent

~~unvollständig~~ mild

 very plentiful

(WEYL. et GRIEG) W. KR., *Pseudooculopollis* fsp., *Trudopollis parvotrudens* PF., *T. pertudens* PF., *Nudopollis terminalis* (TH. et PF.) PF., and cf. *Praebasopollis*. Microflora of Eocene-paleotropical elements is represented by tricolporate and small triangular pollen grains.

The pollen spectrum is important from climate viewpoint because it comprises many pollen grains of tropical plants (Families *Rhoipteleaceae*, *Sapindaceae*, *Rubiaceae*, among pteridophyta families *Schizeaceae*, *Gleicheniaceae*, *Cyathaceae*) indicative of a very warm and comparatively humid climate in the Senonian time. It is also proved by the occurrence of pollen grains of the swamp family *Taxodiaceae*, and by plentiful microplankton.

The pollen spectrum also contains a typically high percentage of resedimented microflora from the Late Paleozoic and Triassic which is paleogeographically interesting.

Pollen spectrum 2 is representative of the Upper Senonian-Paleocene (the Cisna beds in marine flysch facies of the Dukla unit). It is partly correlable with pollen spectra of microfaunal zones of agglutinated foraminifers *Rzehakina complanata*. The pollen spectrum is poor in species and contains typically pollen grains of Normapollis in lower percentage. Some species are even missing. It is due most likely to poor preservation of microflora from that time (Fig. 2). Stratigraphically significant species: *Trudopollis hemiperfectus* PF., *Trudopollis* fsp. B., *Basopollis*, *Laeviporopollis laevigatus* W. KR., *Polyporites microreticulatus* (W. KR.), W. KR. The last two species are quoted by W. KRUTZSCH (1961, 1966, 1970) from the Paleocene of the Pg-zone 7b-8 (Middle Paleocene, Wiesener-Bild and Brandenburger-Bild from brackish beds of Nassenheider). Scarce occurrence of these species quoted L. RAKOSI (1973) from the Eocene of the Dorog-Tokod basin in Hungary. In the pollen spectrum 1 are scarce species *Oculopollis minoris* W. KR. et I. MIBUS, *Plicapollis sarta* PF. and *Plicapollis conserta* PF. and also microflora typical of the pollen spectrum 3, i. e. of the Lower Eocene (*Pompeckjoidaepollenites* cf. *subhercynicus* (W. KR.) W. KR., *Compositoipollenites* cf. *rhizophorus* (R. POT.) R. POT. According to W. KRUTZSCH (1970) the species occur in the Pg-zone 3a, b (Lower Paleocene) up to the zone 18 (Upper Eocene) in Germany. The species *Interpollis microsuppligensis* W. KR. and *I. suppligensis* (PF.) W. KR. present in the pollen spectrum, range from the Maastrichtian to the Lower Eocene according to W. KRUTZSCH (1966). In the Paleogene of the region studied they were also found in the Middle Eocene of the Magura unit. Pollen grains of Eocene-paleotropical elements are characteristic of species belonging in the recent most likely to the family Juglandaceae (*Subtriporopollenites vadosus* (PF.) W. KR., *S. constans* (PF.), palms (*Monocolpopollenites tranquillus* R. POT.) and to the family Monimiaceae (*Momipites quietus* R. POT.) W. KR. Generally the pollen grains of *Cryptospermae* predominate. Spores of *Pteridophyta* and pollen grains of *Gymnospermae* are sporadic. The percentage of pollen grains of hydrophilous family *Taxodiaceae* is lower than in the pollen spectrum 1. Both of the pollen spectrum and 2 the pollen grains of tropical plants indicative of warm-tropical climate are characteristic. In the pollen spectrum of this period the microflora regarded as typically Paleocene by W.

KRUTZSCH (1960, 1967, 1970), M. KEDVES (1974), M. KEDVES – N. HEGEDÜS – E. BOHONY (1971) is still missing. This mostly concerns the genera *Stephanoporopollenites*, *Tetrapollis* and *Menatipollenites* and pre-arctotertiary flora found by W. KRUTZSCH (1966) in the Lower (Eislebener-Bild 2) and Upper (Helle-Bild 10) Paleocene of Germany for this reason the author presumed cooling of the climate.

Pollen spectrum 3 is representative of the Lower Eocene (marine flysch facies, Beloveža beds of the Magura unit, and partly of the menilitic beds, profile Driečna, 500 m NE of the village – the Dukla unit). The spectrum corresponds to the zone of agglutinated foraminifers *Glomospira-Ammodiscus*. Microflora of Upper Cretaceous elements (Normapollens) decreases and pollen grains of Eocene-paleotropical elements get more variable in species characteristic of the Lower and mainly Middle Eocene. The pollen diagram 2 shows many microfloral species restricted to the pollen spectrum; mainly: *Tripurapollenites pflugii* M. KEDVES, *Plicatopollis hungaricus* M. KEDVES, *Triatriopollenites cf. intermedius* (GLADKOVA) M. KEDVES, *Polycolporopollenites dorogensis* L. RAKOSI, *Pentapollenites cf. laevigatus* W. KR., and *Platycaryapollenites* fsp. C. In the pollen spectrum 2 are sporadic species *Verrucatosporites tennelii* (W. KR.) W. KR., *Pompeckjoidapollenites subhercynicus* (W. KR.) and *Compositoipollenites* fsp. Generally the microflora is richer in species. The Middle Eocene is the period of maximum occurrence of the many species of the microflora, mostly of Eocene-paleotropical element like *Plicatopollis plicatus* (R. POT.) W. KR., *Plicapollis pseudoexcelsus* (W. KR.) W. KR., species of the genus *Subtripurapollenites* and of spores of tropical-subtropical Pteridophyta (*Leiotriletes microadriennis* W. KR., *Punctatisporites luteticus* W. KR. and *Cicatricosisporites dorogensis* R. POT. et GELL.). The pollen spectrum also comprises some pollen grains of the family Fagaceae represented mainly by *Fususpollenites fusus* (R. POT. 1931) M. KEDVES (1978), *T. microhenrici* (R. POT.) W. KR. and *Cupulifaeroidapollenites liblarensis* (TH.) R. POT. Pollen grains of Upper Cretaceous elements are infrequent in the pollen spectrum 3 and pollen grains of Eocene-paleotropical plants start to predominate. Their species are mostly representative of the tropical families Myricaceae, Icacinaceae, Juglandaceae, and of Pteridophyta like Schizaceae, Gleicheniaceae. Such composition of flora is indicative of warm and humid climate.

I have not found pollen grains of the genus *Thomsonipollis* regarded as typical of the Lower Eocene (Fig. Hu-zone 13b) of Germany, by W. KRUTZSCH (1966).

Pollen spectrum 4 represents the Middle Eocene (marine flysch facies – the lower Zlín beds and variegated beds of the Magura unit, submenilitic beds, the profile Vyšná Jablonka in the Dukla unit, basal lithofacies of the Inner-Carpathian Paleogene, freshwater, brackish beds and Turitella marls of the Paleogene in the eastern part of the Podunajská nížina). As for microfauna, the spectrum corresponds to the zone of agglutinated foraminifers *Cyclammina amplexans* and to the planktonic zone *Truncotaloides rohri* (this concerns the Central-Carpathian Paleogene and the Paleogene of the eastern part of the Podunajská nížina). The pollen spectrum comprises plentiful pollen grains of Eocene-paleotropical plants, and few or no pollen grains of Upper Cretaceous plant elements. Scarce occurrences

of the species of *Interpollis microsuppligensis* W. KR., *I. velum* (PF.) W. KR. were found in the lower Zlín beds and in variegated beds of the Magura unit in East Slovakia. Among Eocene-paleotropical elements are mainly *Plicatopollis plicatus* (R. POT.) W. KR., *Fususpollenites fusus* M. KEDVES, *Subtriporopollenites constans* PF. *S. vadosus* (PF.) W. KR., *Momipites quietus* (R. POT.) W. KR., *Monocolpopollenites tranquillus* R. POT., *Arecipites granulatus* (KDS.) KDS., *Plicapollis pseudoexcelsus* (W. KR.) W. KR., *Triatriopollenites coryphaeus* (R. POT.) TH. et PF. and *Minorpollis* fsp. Tropical-subtropical Pteridophyta of the period are represented by spores of the genera *Punctatisporites luteticus* W. KR. and *Leiotriletes microadriensis* W. KR. Percentage of pollen grains of the genera *Cupuliferodaepollenites* and *Cupulifacroideaepollenites* with the species *C. pusillus* (R. POT.) R. POT., *C. oviformis* (R. POT.) R. POT., *T. microhenrici* (R. POT.) W. KR., *Cupuliferopollenites liblarensis* (TH.) R. POT., and of the genus *Engelhardtoidites* is higher than in the pollen spectrum 3. These species are paleoecologically significant and stratigraphically insignificant. They are particularly plentiful in the Middle Eocene of the Paleogene in the eastern part of the Podunajská nížina, especially in the facies of marine Turitella marls, variegated marls and in the Middle Eocene of the Magura unit (lower Zlín beds and variegated beds). They are less frequent in the Middle Eocene of the Hornonitrianska kotlina depression (basal lithofacies).

The pollen diagram 2 shows that some species appear in the pollen spectrum 4 and also occur in younger pollen spectra. Such species are *Verrucingulatisporites* cf. *granulatus* W. KR., *Polypodiaceoisporites obuncus* W. KR., *P. verruspeciosus* W. KR. and *P. sculptatus* (typical of the Middle Eocene of the Hornonitrianska kotlina), *Baculatisporites quintus* (TH et PF.) W. KR., *Momipites myricoides* (KREMP) W. KR. (Middle Eocene of the eastern part of the Podunajská nížina), *Ephedripites* and *Cycadopites* (Middle Eocene of the eastern part of the Podunajská nížina and Hornonitrianska kotlina). In the pollen spectrum also appear the first pollen grains of arctotertiary plant elements represented by the genera *Alnipollenites*, *Pterocaryapollenites* and *Caryapollenites*.

Pollen spectrum 5 represents the Upper Eocene (marine flysch facies – the upper Zlín beds of the Magura unit, the Papín beds of the Dukla unit, claystone lithofacies of the Central-Carpathian Paleogene, the Budín facies of sandy marls and sands in the eastern part of the Podunajská nížina). Microfaunally the spectrum corresponds to zones of planktonic foraminifers *Globigerapsis index* and partly *Globigerina officinalis*. The spectrum comprises high percentage of pollen grains of coniferous plants, mainly the genus *Pinus* with the species *Pityosporites microalatus* (R. POT.) TH. et PF. and *P. labdacus* (R. POT.) TH. et PF., plentiful plankton represented by the species *Deflandrea phosporitica* EISENACK, *D. spinulosa* ALBERTI, *Thalasiphora pelagica* (EISENACK) EISENACK et GOCHT, *Pleurozonaria concinna* GOOKSON et MANUN, *P. minor* (K. E. HUTTER) L. RAKOSI, by the genera *Hystrichosphaera* and *Hystrichosphaeridium*, and by less numerous species of Eocene-paleotropical elements characteristic of the spectrum 4. Upper Cretaceous elements disappear and isolated pollen grains of pre-arctotertiary plant like *Piceapoliis* fsp., *Zonalapollenites* fsp., *Faguspollenites* fsp., *Carpinuspollenites*, *Sciadopityspollenites* and *Mul-*

tipropollenites cf. *maculosus* (R. POT.) TH. et PF. appear. Percentage of the species *Caryapollenites simplex* (R. POT.) R. POT. and *Polyatriopollenites stellatus* (R. POT.) PF. increases. We therefore presume a slight cooling of climate in the Upper Eocene. It was also stated by M. KEDVES (1963, 1969) and L. RAKOSI (1971, 1973) in the areas of the Dorog-Tokod basin and the Bakony mountains in Hungary. W. KRUTZSCH (1966), W. KRUTZSCH – G. LENK (1973) also stated cooling of climate in Germany in the so-called Zeiter-Bild (Pg-zone 18). We have not found pollen grains quoted by W. KRUTZSCH as characteristic of the Pg-zone 18 in Germany. They are representatives of the genera *Mediocolpopollis*, *Alangiopollis* and the species *Aglaoredia cyclops* ERDTMAN. It is because representatives of the genera were found in sediments of continental and epicontinental facies whereas in our region the sediments are mostly in marine flysch facies with microflora generally poor in species and the pollen grains are not preserved. In the pollen spectrum 5 are some local differences in composition of microflora from the respective areas under study. Whereas in the Upper Eocene of the Magura and Dukla units, in the SE part of the Šarišská hornatina mountains and Liptovská kotlina depression are plentiful representatives of the swamp family Taxodiaceae, they are less frequent in the Hornonitrianska kotlina and Spišská kotlina depressions. In contrast to this the percentage of pollen grains of hydrophilous plants of the families Cyrillaceae-Mysaceae increases in the Upper Eocene of both depressions and in the Spišská kotlina also the family Myricaceae. There is another difference in pollen grains of coniferous plants, mainly *Pinus*, being less frequent in the Upper Eocene of the Liptovská kotlina and of the eastern part of the Podunajská nížina. It is most likely due to changed configuration of relief. But coniferous forests must have been extensive in the period since pollen diagrams show predominance of pollen grains of coniferous plants in comparison with the preceeding period.

Pollen spectrum 6 corresponds to the upper part of the Upper Eocene up to the Lower Oligocene i.e. to microfaunal zones *Globigerina officinalis* – *Globigerina postcretaceae*. The pollen spectrum 6 represents marine flysch sediments of the menilite Krosno group of the Dukla unit, of the Malcov beds of the Magura unit, flysch facies of the Central-Carpathian Paleogene.

The pollen spectrum is characterized by higher percentage of pollen grains of coniferous plants and by further decrease in number of pollen grains of Eocene-paleotropical plant elements, mainly *Plicapollis pseudoexcelsus* (W. KR.) W. KR., *Plicatopollis plicatus* (R. POT.) W. KR. present in all areas studied in respect of this period. The genus *Minorpollis* occurs sporadically also in the menilite Krosno group of the Dukla unit, and in conglomerate and microconglomerate flysch of the SE part of the Šarišská hornatina mountains. The species *Subtriporopollenites constans* PF. occurs sporadically in the Upper Priabonian and Lower Oligocene of the Hornonitrianska kotlina and Spišská kotlina (depressions). Predominant are pollen grains of palms, mainly the genus *Monocolpopollenites tranquillus* (R. POT.) TH. et PF. in comparison with the pollen spectrum 5. Increased is, however, percentage of pollen grains of arctotertiary genera *Piceapollis*, *Carpinuspollenites*, *Sciadopityspollenites* and *Zonalapollenites* as well as the genera *Caryapollenites* and *Alnipollenites*. The

period is also characterized by considerable decrease of spores of tropical-subtropical Pteridophyta, mainly the genera *Aneimia*, *Lycopodium* and *Lygodium*. Like the pollen spectrum 5 this one is also indicative of gradually cooling climate. As seen in Fig. 2 percentage of pollen grains of prearctotertiary plants increases slowly. So the pollen spectrum 6 may be regarded as floral transition to the Oligocene and/or Rupelian.

There is a rough accordance between the pollen spectrum 6 and the pollen pattern of Heskemer-Bild (Pg-zone 19) presented by W. KRUTZSCH (1966) from the so-called Wittenberg beds in Germany. This pollen pattern includes also the upper part of the Upper Eocene and the Lower Oligocene. W. KRUTZSCH – in accordance with our results – stated decrease in microflora of Eocene-paleotropical elements and gradual increase in microflora of arctotertiary elements (alnoide-Formen, tsugoidae-Formen, Pinaceae a.o.).

In contrast to the pollen spectrum 5 the pollen spectrum 6 shows slight decrease in pollen grains of swamp plants of the family Taxodiaceae and of the assemblage of Nyssaceae-Cyrillaceae. Predominant are assemblages of hydrophilous coastal mixed forests growing perhaps on plain or slightly elevated areas. Such assemblages are the genus *Castanea*, representatives of the family Fagaceae, of genera *Carya*, *Engelhardtia* a.o. Certain differences might have been in quantitative increase or decrease of swampy, hydrophilous or xerophilous plant elements. So in frequency diagram of the Mafcov beds of the Magura unit, of the menilite-Krosno group of the Dukla unit, and of the SE part of the Šarišská hornatina mountains predominant are pollen grains of the swamp family Taxodiaceae whereas in the Levočské pohorie mountains, in the Spišská kotlina depression, the Liptovská kotlina depression the microflora of hydrophilous assemblages, i. e. hydrophilous coastal forests predominated (P. ŠNOPOVÁ 1977).

Pollen spectrum 7 corresponds to the Rupelian of the Buda facies of the eastern part of the Podunajská nížina. The pollen spectrum was obtained from more drill holes, from various lithological facies and mainly from foraminiferal marls. Microfaunal zone has not been defined accurately so far.

In contrast to the pollen spectrum 6 the pollen spectrum 7 is indicative of slight warming of climate because the percentage of microflora of Early Tertiary plant elements increased in comparison with the former period. Plentiful were pollen grains of palms of the species *Monocolpopollenites tranquillus* (R. POT.) PF. et TH., tropical-subtropical spores of the species *Cicatricosisporites dorogensis* R. POT. et GELL., *Leiotriletes microadriennis* W. KR., *L. dorogensis* M. KEDVES, pollen grains of the genus *Podocarpidites*, of the species *Plicapollis pseudoexcelsus* (W. KR.) W. KR. The percentage of the genus *Pinus* is also lower than in the pollen spectrum 6 but the species *Caryapollenites simplex* (R. POT.) R. POT., *Alnipollenites verus* R. POT. increase in number and pollen grains of the genera *Sciadopityspollenites*, *Ulmipollenites* and *Carpinuspollenites* also increase slightly. Besides microflora of these arctotertiary genera there are isolated occurrences of the genus *Abiespollenites*. They do not surpass percentage of Early Tertiary i. e. Eocene-paleotropical elements. So I regard microflora of this period as mixed since paleotropical and

arctotertiary elements are more-or-less dispersed in all lithological facies. We may say that the character of microflora is the same both in the variegated coal-bearing beds and marine foraminiferal marls, and that there are only facial differences. It follows that in the coal-bearing beds microflora of swamp and hydrophilous assemblages with the representatives of the family Taxodiaceae, Myricaceae are dominant whereas in marine sediments the assemblages of mixed forests (*Castanea*, *Castanopsis*, quercoid types, *Alnus*, *Carya* a.o.) are dominant.

The amount of arctotertiary types of microflora in the pollen spectrum 7 corresponds roughly to the pollen pattern of Calauer-Bild (Pg-zone 20) distinguished by W. KRUTZSCH (1966, 1967) in the Rupelian beds of Germany (locality Lausitz) and in the profile Profen (freshwater, brackish and marine sediments) W. KRUTZSCH — G. LENK (1937) quoted lower percentage of paleotropical elements than I found in the Rupelian of our region. I did not find the species regarded by W. KRUTZSCH (1967) as guide species of the Pg-zone 20. They are *Boehlensipollis hohli* W. KR., *Cupaneidites eucalyptoides* W. KR. The genus *Ephedripites* occurs in the pollen spectrum 7 and isolated occurrences are in the pollen spectrum 6. So in the German Pg-zone 20 the pollen grains of arctotertiary plant elements are more frequent than in the pollen spectrum 7 from our region, and Eocene-paleotropical elements are less frequent.

Summarized results

1. I present here the first detailed systematical-morphological valuation of sporomorphs from Paleogene sediments of the West Carpathians. I have studied sediments from the Buda Paleogene (the eastern part of the Podunajská nížina), Inner-Carpathian depressions (Hornonitrianska, Liptovská, Spišská, the Levočské pohorie Mts., SE part of the Šarišská hornatina Mts.), and from the Magura and Dukla units.

2. I present systematical valuation of 33 species of spores of Pteridophyta, 17 species of pollen grains of Gymnospermae and 65 species of Cryptospermae. Spores and pollen grains denoted as "sp" will most likely belong to new species and so they will be further examined.

3. The valuation of spores and pollen grains is based on the examination under optical microscope. Systematical and morphological valuations were based on the existing literature commonly used in Tertiary palynology. Tricolporate pollen grains were morphologically valued mostly according to M. KEDVES (1978).

4. Morphologically-systematically valued species are botanically ranged at least to Family so as to facilitate the study of paleoecological and the respective paleoclimatical conditions in the Paleogene of our region.

5. Stratigraphically significant species of spores and pollen grains and entire assemblages, systematically-morphologically well characterized served a basis for microstratigraphical division of the Paleogene in the West Carpathians. Distinguished were 7 pollen spectra (Fig. 2) of regional significance. They correspond either to one or to two microfaunal zones.

6. The existing results of the study of sporomorphs from the Paleogene of the

West Carpathians, both systematical and stratigraphical are prospective for their detailed examination by electron microscope and for a detailed division of sediments studied.

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Explanations to Tables I–XLIV

(all microphotographs are 1000× magnified)

Tables are arranged according to stratigraphical significance of spores and pollen grains in single pollen spectra.

Pollen spectrum

3 – Plate I–VI (Lower Eocene)

- 4 – Plate VII–XX (Middle Eocene)
- 5 – Plate XXI–XXVIII (Upper Eocene)
- 6 – Plate XXIX–XXXIV (Upper Priabonian–Lower Oligocene)
- 7 – Plate XXXV–XLIV (Rupelian)

Plate I

1. *Leiotriletes adriennis* (R. POT. et GELL. 1933) W. KR., 1959 subsp. *adriennis* W. KR. 1959, Beloveža beds, Magura unit
2. *Ischyosporites asolidus* (W. KR., 1959) W. KR., 1967, Beloveža beds, Magura unit
3. *Laevigatosporites* cf. *adiscordatus* W. KR., 1959, Beloveža beds, Magura unit
4. cf. *Punctatisporites*, Submenilite beds, Dukla unit
5. *Toroisporis* (*Toroisporis*) cf. *irregularis* (PF. 1953) W. KR. 1959, Beloveža beds, Magura unit
6. *Toroisporis* (*Toroisporis*) cf. *teupitzensis* W. KR. 1962, subfsp. *medioris* W. KR. 1962, Beloveža beds, Magura unit

Plate II

1. *Granulatisporites paleogenicus* M. KEDVES, 1966
2. cf. *Planctonites*
3. *Laevigatosporites haardti* (R. POT. et VEN., 1934) TH. et PF. 1953
4. *Cicatricosisporites* sp.
5. *Punctatisporites* cf. *gelletichi* M. KEDVES, 1961
6. *Gemmatosporis minor* L. RAKOSI, 1973
- 7.–9. Spores of *spongiae*

All spores are from the Beloveža beds of the Magura unit

Plate III

1. *Pityosporites peuceformis* (ZAKLINSKAJA 1957) W. KR., 1971, Beloveža beds, Magura unit
2. *Pityosporites* sp., Submenilite beds, Dukla unit
3. cf. *Cedripites*, Submenilite beds, Dukla unit
4. *Inaperturopollenites* cf. *hiatus* (R. POT. 1931b) TH. et PF., 1953, Beloveža beds, Magura unit
5. *Spinizonocolpites prominatus* (McINTYRE 1965) M. KEDVES, 1974, Beloveža beds, Magura unit
6. *Inaperturopollenites* cf. *hiatus* (R. POT.) 1931, TH. et PF., 1953, Submenilite beds, Dukla unit

Plate IV

- 1.–2. *Basopollis* cf. *urkutensis* M. KEDVES 1974, Beloveža beds, Magura unit
3. *Pompeckjoidapollenites subhercynicus* (W. KR. 1954) W. KR., 1967, Beloveža beds, Magura unit
- 4.–6. *Interpollis velum* W. KR., 1961, Beloveža beds, Magura unit
7. *Interpollis* (corroded), Submenilite beds, Dukla unit
8. *Interpollis microsuppligensis* W. KR., 1961, Beloveža beds, Magura unit
9. *Interpollis* cf. *microsuppligensis* W. KR. 1961, Beloveža beds, Magura unit
10. *Pentapollenites* cf. *laevigatus* W. KR. 1962, Beloveža beds, Magura unit
11. *Interporopollenites* sp. Submenilite beds, Dukla unit
12. *Triatriopollenites hannoverensis* W. KR., Beloveža beds, Magura unit

Plate V

1. *Triatriopollenites roboratus* PFLUG 1953a, Beloveža beds, Magura unit
2. *Plicatopollis hungaricus* M. KEDVES 1974, Beloveža beds, Magura unit
3. *Plicatopollis plicatus* (R. POT. 1934) W. KR. 1962, Submenilite beds, Dukla unit
4. *Platycaryapollenites flagellus* W. KR. 1967
5. *Platycaryapollenites* fsp. C, Beloveža beds, Magura unit
6. *Plicatopollis* cf. *pseudoexcellus* (W. KR. 1958) W. KR. 1961 Submenilite beds, Dukla unit
7. *Platycaryapollenites* cf. *anticyclus* W. KR. et R. VANHOORNE 1977, Beloveža beds, Magura unit
8. *Momipites quietus* (R. POT. 1931) D. J. NICHOLS 1973, Beloveža beds, Magura unit
9. *Platycaryapollenites anticyclus* W. KR. et R. VANHOORNE 1977, Beloveža beds, Magura unit
10. *Monocolpopollenites tranquillus* (R. POT. 1931) TH. et PF. 1953, Beloveža beds, Magura unit
11. *Subtriporopollenites constans* PF. 1953, subsp. *medius* W. KR. et R. VANHOORNE 1977, Beloveža beds, Magura unit

12. *Compositoipollenites rhizophorus* (R. POT. 1934b) R. POT. 1960, *burghasugennis* MÜRR. et PF. 1953, Beloveža beds, Magura unit

Plate VI

1. *Multiporopollenites* cf. *pusztamaróti* L. RÁKOSI 1973
 2. *Cupuliferoipollenites oviformis* (R. POT. 1931), R. POT. 1960
 - 3.-4. *Fususpollenites fusus* M. KEDVES 1978
 5. *Cupuliferoideaipollenites liblarensis* (TH. 1950) R. POT. 1960
 6. *Striatricolporites* sp.
 7. *Intrabuculicoprites porasper* (PF. 1953) M. KEDVES 1974
 8. *Cupuliferoideaipollenites liblarensis* (TH. 1950) R. POT. 1960
 9. cf. *Echimonocolpites*
 10. *Cyrtillaceapollenites* cf. *megaexactus* (R. POT. 1931) R. POT. 1960
 11. *Cupuliferoideaipollenites liblarensis* (TH. 1950) R. POT. 1960
 12. *Cyrtillaceapollenites megaexactus* (R. POT. 1931) R. POT. 1960
 13. *Tetracolporopollis* fsp.
 - 14.-15. *Laeviporopollenites laevigatus* (W. KR. 1961) W. KR. 1966
- The pollen grains are from the Beloveža beds of the Magura unit

Plate VII

1. *Leiotriletes dorogensis* (M. KEDVES 1960) M. KEDVES 1961, eastern part of the Podunajská nížina (Danube lowland), Buda facies
2. *Leiotriletes adriennis* (R. POT. et GELL. 1933) subfsp. *adriennis* W. KR. 1959, the Hornonitrianska kotlina (depression), basal lithofacies

Plate VIII

1. *Leiotriletes microadriennis* W. KR. 1959, eastern part of Podunajská nížina, Buda facies
2. *Punctatisporites gelletichi* 1961, subsp. *minor* M. KEDVES 1961
3. *Leiotriletes microadriennis* W. KR. 1959, Hornonitrianska kotlina, basal lithofacies
4. *Leiotriletes adriennis* (R. POT. et GELL. 1933) W. KR. 1959, subfsp. *adriennis* W. KR. 1959, eastern part of Podunajská nížina, Buda facies
5. *Leiotriletes adriennis* (R. POT. et GELL. 1933) W. KR. 1959, fvar. *pseudodivisus* W. KR. 1959, lower Zlín beds, Magura unit
6. *Concavisporites* (*Obtusisporites*), cf. *obtusangulus* (R. POT. 1934b) W. KR. 1959, eastern part of Podunajská nížina, Buda facies

Plate IX

1. *Leiotriletes adriennis* (R. POT. et GELL. 1933) W. KR. 1959 fvar. *pseudodivisus* W. KR. 1959, variegated beds, Kochanovce unit, Magura unit
2. *Toroisporis* (*Toroisporis*) *eocenicus* M. KEDVES 1966, lower Zlín beds, Magura unit
3. *Retitriletes* sp., lower Zlín beds, Magura unit
4. *Echinatisporis longechinus* W. KR. 1959, eastern part of Podunajská nížina, Buda facies
5. *Ischyosporites asolidus* W. KR. 1959, lower Zlín beds, Magura unit

Plate X

1. *Punctatisporites luteticus* W. KR. 1959, eastern part of Podunajská nížina
2. *Punctatisporites* cf. *luteticus* W. KR. 1959, Hornonitrianska kotlina, basal facies

Plate XI

- 1., 3. *Cicatricosisporites dorogensis* R. POT. et GELL. 1933, eastern part of Podunajská nížina, Buda facies
2. *Cicatricosisporites dorogensis* (R. POT. et GELL. 1933) subfsp. *dorogensis* fvar. *triplan* M. KEDVES 1961, Hornonitrianska kotlina, basal lithofacies
4. *Cicatricosisporites* cf. *dorogensis* R. POT. et GELL. 1933, lower Zlín beds, Magura unit
- 5.-6. *Polypodiaceoisporites* cf. *simplex* E. NAGY 1969, eastern part of Podunajská nížina, Buda facies

Plate XII

1. *Polypodiaceoisorites maxheimensis* (MÜRR. et PF. 1952) W. KR. 1959, variegated beds of the Kochanovce partial unit, Magura unit
2. *Verrucingulatisporites verrucatus* M. KEDVES 1961, eastern part of Podunajská nížina, Buda facies
3. *Verrucingulatisporites* (*Treplinisorites*) cf. *magnus* M. KEDVES 1973, Hornonitrianska kotlina, basal lithofacies.
4. *Polypodiaceoisorites verruspeciosus* W. KR. 1959, Hornonitrianska kotlina, basal lithofacies
5. *Trilites multivallatus* (PF. 1953) W. KR. 1959, Hornonitrianska kotlina, basal lithofacies
6. *Polypodiaceoisorites* cf. *obuncus* W. KR. 1959, Hornonitrianska kotlina, basal lithofacies

Plate XIII

1. *Trilites multivallatus* (PF. 1953) W. KR. 1959, Hornonitrianska kotlina, basal lithofacies
2. *Laevigatosporites haardti* (R. POT. et VEN. 1934) TH. et PF. 1953, subfsp. *haardti* W. KR. 1967, Hornonitrianska kotlina, basal lithofacies
3. *Polypodiisorites* cf. *favus* (R. POT. 1933) E. NAGY 1973, eastern part of Podunajská nížina, Buda facies
4. *Polypodiisorites* cf. *favus* (R. POT. 1933) E. NAGY 1973, variegated beds of Kochanovce partial unit, Magura unit
- 5.-6. *Spores of sponges*, eastern part of Podunajská nížina, Buda facies
7. *Laevigatosporites haardti* (R. POT. et VEN. 1934) TH. et PF. 1953, subfsp. *haardti* W. KR. 1967, eastern part of Podunajská nížina, Buda facies

Plate XIV

1. *Punctatisporites luteticus* W. KRUTZSCH 1959, Hornonitrianska kotlina, basal lithofacies
2. *Laevigatosporites haardti* (R. POT. et VEN. 1934) TH. et PF. 1953 subfsp. *haardti* W. KR. 1967, variegated beds of Kochanovce unit, Magura unit
- 3.-4. *Inaperturopollenites hiatus* (R. POT. 1931) TH. et PF. 1953, variegated beds of Kochanovce unit, eastern part of Podunajská nížina, Buda facies
- 5.-6. *Inaperturopollenites concedipites* (WODEH. 1933) W. KR. 1971, variegated beds of Kochanovce partial unit, Magura unit
7. *Phycopeltis eocaenica* EDWARDS 1922
8. *Inaperturopollenites concedipites* (WODEH. 1933) W. KR. 1971, eastern part of Podunajská nížina, Buda facies
- 9.-10. *Cycadopites cycadioides* (ZAKL. 1957) M. KEDVES 1968, eastern part of Podunajská nížina, Buda facies

Plate XV

- 1.-4. *Monocolpopollenites tranquillus* (R. POT. 1934) TH. et PF. 1953, eastern part of Podunajská nížina, Buda facies
5. *Monocolpopollenites tranquillus* (R. POT. 1934) PF. et TH. 1953, lower Zlín beds, Magura unit
6. *Arecipites* cf. *granulatus* (KDS. 1961) M. KEDVES 1974, lower Zlín beds, Magura unit
- 7.-9. *Arecipites* sp. 1, eastern part of Podunajská nížina, Buda facies
- 8., 11. *Monocolpopollenites minor* M. KEDVES 1961, eastern part of Podunajská nížina, Buda facies
- 10., 12. *Arecipites* cf. *microreticulatus* (W. KR. 1958) W. KR. et VANHOORNE 1977, eastern part of Podunajská nížina, Buda facies

Plate XVI

- 1.-3. *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978, eastern part of Podunajská nížina, Buda facies, lower Zlín beds of Magura unit
4. *Cupuliferoipollenites pusillus* (R. POT. 1934) R. POT. 1960, lower Zlín beds of Magura unit
5. *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978, eastern part of Podunajská nížina, Buda facies
6. *Bacutricolporites villensis* (THOMS.) M. KEDVES 1978, variegated beds, Magura unit
7. *Tricolporopollenites* (corrosion), lower Zlín beds

8. *Cupuliferoipollenites oviformis* (R. POT. 1931) R. POT. 1960, lower Zlín beds, Magura unit
- 9.–10. *Cupuliferoipollenites pusillus* (R. POT. 1934) R. POT. 1960, eastern part of Podunajská nížina, Buda facies
11. *Cupuliferoipollenites pusillus* (R. POT. 1934) R. POT. 1960, lower Zlín beds, Magura unit
12. cf. *Tricolporopollenites* (corrosion), variegated beds – Magura unit
- 13.–14. *Tricolporopollenites microhenrici* (R. POT. 1931) W. KR. 1961, eastern part of Podunajská nížina, Buda facies
- 15.–16. *Tricolporopollenites* cf. *microhenrici* (R. POT. 1931) W. KR. 1961, eastern part of Podunajská nížina, Buda facies
- 17.–18. *Intrabaculitricolporites* cf. *bonai*, M. KEDVES 1978, eastern part of Podunajská nížina, Buda facies
19. *Bacutricolporites villensis* (THOMS.) M. KEDVES 1978, lower Zlín beds, Magura unit
20. *Bacutricolporites* (corrosion), lower Zlín beds, Magura unit

Plate XVII

- 1.–2. *Striatricolporites* sp., eastern part of Podunajská nížina, Buda facies
- 3.–4. *Tricolporopollenites dolium* (R. POT. 1931) TH. et PF. 1953, eastern part of Podunajská nížina, Buda facies
5. *Rhoipites pseudocingulum* (R. POT. 1931) R. POT. 1960, eastern part of Podunajská nížina, Buda facies
- 6.–7. *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978, lower Zlín beds, Magura unit
8. *Tricolporopollenites dolium* (R. POT. 1931) TH. et PF. 1953, eastern part of Podunajská nížina, Buda facies
- 9.+11. *Granotricolporites* cf. *semiglobosus* (M. KEDVES 1963), Hornonitrianska kotlina, basal lithofacies
10. *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978, eastern part of Podunajská nížina, Buda facies
- 12.–13. *Granotricolporites semiglobosus* (M. KEDVES 1963), M. KEDVES 1978, eastern part of Podunajská nížina, Buda facies

Plate XVIII

- 1.–2. *Ilexpollenites erdtmani* M. KEDVES 1978, eastern part of Podunajská nížina, Buda facies
- 3.–4. *Tetracolporopollenites* cf. *occultus* PF. et TH. 1953, eastern part of Podunajská nížina, Buda facies
- 5.–6. *Tetracolporopollenites* cf. *occultus* PF. et TH. 1953, eastern part of Podunajská nížina, Buda facies
7. cf. *Tetracolporopollenites* (corrosion), lower Zlín beds, Magura unit
8. *Tetracolporopollenites sapotoides* PF. et TH. 1953, eastern part of Podunajská nížina, Buda facies
9. *Dicolpopollis* sp., eastern part of Podunajská nížina, Buda facies
10. *Interpollis* cf. *microsuppligennis* W. KR. 1961, lower Zlín beds, Magura unit
- 11.–12. *Subtriporopollenites constans* (PF. 1953) subsp. *constans* W. KRUTZSCH 1961, eastern part of Podunajská nížina, Buda facies
- 13.–14. *Tetracolporopollenites (Brecolpites)* cf. *gregussi* L. RAKOSI 1973, Hornonitrianska kotlina, basal lithofacies
15. *Subtriporopollenites constans* (PF. 1953) subsp. *medius* W. KR. et R. VANHOORNE 1977, Hornonitrianska kotlina, basal lithofacies

Plate XIX

1. *Subtriporopollenites constans* PF. 1953, subsp. *medius* W. KR. et R. VANHOORNE 1977, variegated beds of Kochanovce partial unit, Magura unit
2. *Caryapollenites simplex* (R. POT. 1931) R. POT. 1960, eastern part of Podunajská nížina, Buda facies
- 3.–4. *Engelhardtoidites microcoryphaeus* (R. POT. 1931) R. POT. 1960, eastern part of Podunajská nížina, Buda facies
5. *Plicatopollis plicatus* (R. POT. 1934) W. KR. 1962, eastern part of Podunajská nížina, Buda facies

6. *Plicatopollis plicatus* (R. POT. 1934) W. KR. 1962, variegated beds of Kochanovce partial unit, Magura unit
- 7.-8. *Triatriopollenites intermedius* (GLADKOVA 1965) M. KEDVES 1974, eastern part of Podunajská nížina, Buda facies
- 9.-10. *Triatriopollenites pseudogranulatus* (GLADKOVA 1965) M. KEDVES 1974, lower Zlín beds, Magura unit
11. *Triatriopollenites bituites* (R. POT. 1931) TH. et PF. 1953, variegated beds of Kochanovce unit, Magura unit
12. *Momipites quietus* (R. POT. 1931) D. J. NICHOLS 1973, eastern part of Podunajská nížina, Buda facies
13. *Engelhardtoidites microcoryphaeus* (R. POT. 1931) R. POT. 1960, eastern part of Podunajská nížina, Buda facies
14. *Momipites quietus* (R. POT. 1931) D. J. NICHOLS 1973, eastern part of Podunajská nížina, Buda facies
15. *Engelhardtoidites microcoryphaeus* (R. POT. 1931), R. POT. 1960 lower Zlín beds, Magura unit
- 16.-17. *Triatriopollenites lubomířovae* (GLADKOVA 1965) M. KEDVES 1974, eastern part of Podunajská nížina, Buda facies
18. *Momipites quietus* (R. POT. 1931) D. J. NICHOLS 1973, eastern part of Podunajská nížina, Buda facies
19. *Momipites cf. quietus* (R. POT. 1931) D. J. NICHOLS 1973, eastern part of Podunajská nížina, Buda facies

Plate XX

1. *Triatriopollenites intermedius* (GLADKOVA 1965) M. KEDVES 1974, eastern part of Podunajská nížina, Buda facies
- 2.-3. *Plicatopollis plicatus* (R. POT. 1934) W. KR. 1962, eastern part of Podunajská nížina, Buda facies
- 4.-5. *Momipites cf. myricioides* (KREMP 1949) W. KRUTZSCH 1967, eastern part of Podunajská nížina, Buda facies
- 6.-7. *Momipites punctatus* (R. POT. 1931) E. NAGY 1969, eastern part of Podunajská nížina, Buda facies
- 8.-9. *Triatriopollenites minimus* (GLADKOVA 1965) M. KEDVES 1974, eastern part of Podunajská nížina, Buda facies
10. *Triatriopollenites* sp. A, eastern part of Podunajská nížina, Buda facies
- 11.-12. *Triatriopollenites minimus* (GLADKOVA 1965) M. KEDVES 1974, eastern part of Podunajská nížina, Buda facies
13. *Triatriopollenites cf. minimus* (GLADKOVA 1965) M. KEDVES 1974, lower Zlín beds, Magura unit (corrosion)
14. cf. *Triatriopollenites*, Hornonitrianska kotlina, basal lithofacies
15. *Triatriopollenites cf. rurensis* PF. et TH. 1953, lower Zlín beds, Magura unit
16. *Pentapollenites pentangulus* (PF. 1953), W. KR. 1958, subsp. *pentangulus* W. KR. 1962, lower Zlín beds, Magura unit

Plate XXI

1. *Polypodiaceoisporites marxheimensis* (MÜRR. et PF. 1952) W. KR. 1959, basal lithofacies, Liptovská kotlina (depression)
2. *Polypodiaceoisporites cf. sculptatus* M. KEDVES 1966, claystone lithofacies, Liptovská kotlina
3. *Polypodiaceoisporites gracillinus* E. NAGY 1963, subsp. *granoverrucatus* W. KR. 1967, claystone lithofacies, Liptovská kotlina
4. *Baculatisporites nanus* (WOLF 1934) W. KR. 1959, subsp. *robustoides* W. KR. 1967, claystone lithofacies, Liptovská kotlina
5. *Laevigatosporites haardti* (R. POT. et VEN. 1934) TH. et PF. 1953, subsp. *haardti* W. KR. 1967, claystone lithofacies, Liptovská kotlina
6. *Trilites multivallatus* (PF. 1953) W. KR. 1959, claystone lithofacies, Liptovská kotlina
7. *Polypodiisporites alienus* (R. POT. 1934) E. NAGY 1973, claystone lithofacies, Liptovská kotlina

Plate XXII

- 1.-2. *Cicatricosisporites dorogensis* R. POT. et GELL. 1933, globigerinous marls, Klippen Belt Paleogene
3. *Pityosporites alatus* (R. POT. 1931b) TH. et PF. 1953, globigerinous marls, Klippen Belt Paleogene
4. *Cicatricosisporites chattensis* W. KR. 1961, subfsp. *chattensis* W. KRUTZSCH 1967, globigerinous marls, Klippen Belt Paleogene
5. *Pityosporites labdacus* (R. POT. 1931b) TH. et PF. 1953, subsp. *labdacus* W. KR. 1971, globigerinous marls, Klippen Belt Paleogene
6. *Ephedripites* (*Distachyapites*) *eocenipites* (WODEH. 1933) W. KR. 1961, globigerinous marls, Klippen Belt Paleogene

Plate XXIII

1. *Pityosporites alatus* (R. POT. 1931b) TH. et PF. 1953, claystone lithofacies, Liptovská kotlina
2. *Pityosporites microalatus* (R. POT. 1931b) TH. et PF. 1953, upper Zlín beds, Magura unit
3. *Pityosporites microalatus* (R. POT. 1931b) TH. et PF. 1953, claystone lithofacies, Spišská kotlina (depression)
4. *Pityosporites alatus* (R. POT. 1931b) TH. et PF. 1953, eastern part of Podunajská nížina, Buda facies

Plate XXIV

- 1.-2. *Cedripites* sp., claystone lithofacies, Spišská kotlina, upper Zlín beds, Magura unit
3. *Podocarpidites podocarpoides* (THG. 1958) W. KRUTZSCH 1971, claystone lithofacies, Liptovská kotlina
4. *Zonalapollenites verrucatus* W. KRUTZSCH 1971, globigerinous marls, Klippen Belt Paleogene
5. *Cycadopites* sp. 2, claystone lithofacies, Liptovská kotlina
6. *Inaperturopollenites hiatus* (R. POT. 1931b) TH. et PF. claystone lithofacies, Spišská kotlina

Plate XXV

1. *Piceapollis toboolicus* (PANOVA 1966) W. KRUTZSCH 1971, claystone lithofacies, SE part of the Šarišská hornatina (mountains), (corrosion)
- 2.-3. *Inaperturopollenites hiatus* (R. POT. 1931) KREMP. 1949, upper Zlín beds, Magura unit, eastern part of Podunajská nížina, Buda facies
4. *Quercoidites henrici* (R. POT. 1931) R. POT. 1960, claystone lithofacies, Liptovská kotlina
5. *Pityosporites alatus* (R. POT. 1931b) TH. et PF. 1953, eastern part of Podunajská nížina, Buda facies
6. *Rhoipites* cf. *pseudocingulum* (R. POT. 1931) R. POT. 1960, eastern part of Podunajská nížina, Buda facies

Plate XXVI

1. *Faguspollenites* cf. *subtilis* E. NAGY, eastern part of Podunajská nížina, Buda facies
- 2.-3. *Verrutricolporites ovalis* (R. POT. 1934) M. KEDVES 1978, eastern part of Podunajská nížina, Buda facies
- 4.-5. *Cupuliferoipollenites oviformis* (R. POT. 1931) R. POT. 1960, claystone lithofacies, Liptovská kotlina
6. *Cyrillaceaepollenites* cf. *megaexactus* (R. POT. 1931) R. POT. 1960, claystone lithofacies, Liptovská kotlina
7. *Tricolporopollenites microhenrici* (R. POT. 1931) TH. et PF. 1953, claystone lithofacies, Liptovská kotlina
8. *Cupuliferoideaepollenites liblarensis* (TH. 1950) R. POT. 1960, eastern part of Podunajská nížina, Buda facies
9. *Quercoidites henrici* (R. POT. 1931) R. POT. 1960, upper Zlín beds, Magura unit
- 10.-11. *Rhoipites pseudocingulum* (R. POT. 1931) R. POT. 1960, globigerinous marls, Klippen Belt Paleogene, SE part of Šarišská hornatina (mountains)
12. *Bacutricolporites villensis* (THOMS. 1950) M. KEDVES 1978 globigerinous marls, Klippen Belt Paleogene
13. *Polycolporopollenites* sp., eastern part of Podunajská nížina, Buda facies

14. *Tricolporopollenites kruschi accessorius* (R. POT. 1934) TH. et PF. 1953, eastern part of Podunajská nížina, Buda facies
15. *Spinaepollis spinosus* (R. POT. 1931a) W. KRUTZSCH 1960, claystone lithofacies, SE part of Šarišská hornatina
- 16.–17. *Monocolpopollenites tranquillus* (R. POT. 1931) PF. et TH. 1953, globigerinous marls, Klippen Belt Paleogene, claystone lithofacies, SE part of Šarišská hornatina

Plate XXVII

1. *Arecipites* sp. 2, claystone lithofacies, Liptovská kotlina
- 2.–3. *Alnipollenites verus* (R. POT. 1931b) emend. R. POT. 1960, eastern part of Podunajská nížina, Buda facies
4. *Momipites punctatus* (R. POT. 1931) E. NAGY 1969, claystone lithofacies, SE part of Šarišská hornatina
- 5.–6. *Momipites punctatus* (R. POT. 1931) E. NAGY 1969, claystone lithofacies, SE part of Šarišská hornatina
- 7.–8. *Momipites* cf. *punctatus* (R. POT. 1931) E. NAGY 1969, (corrosion) claystone lithofacies, SE part of Šarišská hornatina
- 9.–10. *Triatriopollenites bituites* (R. POT. 1931) TH. et PF. 1953, claystone lithofacies, Spišská kotlina, Liptovská kotlina
11. *Momipites myricoides* (KREMP. 1949) W. KR. 1971, eastern part of Podunajská nížina, Buda facies
12. *Triatriopollenites coryphaeus* (R. POT. 1931) PF. et TH. 1953, claystone lithofacies, SE part of Šarišská hornatina
- 13.–14. *Engelhardtoidites microcoryphaeus* (R. POT. 1931) R. POT. 1960, claystone lithofacies, Liptovská kotlina, SE part of Šarišská hornatina
15. "*Triatriopollenites*" *hannoverensis* W. KR., eastern part of Podunajská nížina, Buda facies (re-sedimented species from underlying sediments)

Plate XXVIII

- 1.–2. *Caryapollenites simplex* (R. POT. 1931) R. POT. 1960, claystone lithofacies, Liptovská kotlina, upper Zlín beds, Magura unit
3. *Carpinuspollenites carpinooides* (PF. 1953) E. NAGY 1969, claystone lithofacies, Liptovská kotlina
4. *Intratriporopollenites* cf. *insculptus* Mai 1961, Malcov beds, Magura unit
5. *Plicapollis* fsp., claystone lithofacies Liptovská kotlina (resedimented pollen grain from the Upper Cretaceous)
6. *Trudopollis* fsp., claystone lithofacies, Liptovská kotlina (resedimented pollen grain from the Upper Cretaceous)
7. *Pseudooculopollis* fsp., claystone lithofacies, Liptovská kotlina (resedimented pollen grain from the Upper Cretaceous)
8. *Oculopollis* fsp., claystone lithofacies Liptovská kotlina (resedimented pollen grain from the Upper Cretaceous)
9. cf. *Interpollis*, claystone lithofacies, Liptovská kotlina (resedimented pollen grain)
- 10.–11. *Classopollis classoides* Pf. 1953, Papin beds, Dukla unit, claystone lithofacies, SE part of the Šarišská hornatina (mountains), (resedimented pollen grains – Upper Trias – Lower Cretaceous)
12. cf. *Classopollis*, claystone lithofacies, Spišská kotlina (resedimented pollen grain)

Plate XXIX

- 1.–2. *Polypodiisporites alienus* (R. POT. 1934) E. NAGY 1973, flysch lithofacies, Liptovská kotlina
3. *Baculatisporites quintus* (WOLF 1934) W. KR. 1959, Malcov beds, Magura unit
4. *Zlivisporis dorogensis* (KDS. 1961) L. RAKOSI 1973, flysch lithofacies, Hornonitrianska kotlina (depression)
5. *Toroisporis* (*Toroisporis*) *eocenicus* M. KEDVES 1966, fsp., Krosno beds, Dukla unit
6. *Laevigatosporites haardti* R. POT. et VEN. 1934, subfsp. *hardtoides* W. KR. 1967, flysch lithofacies, Liptovská kotlina

Plate XXX

1. *Polypodiisporites histiopteroides* (W. KR. 1962) E. NAGY 1973, flysch lithofacies, Liptovská kotlina
2. *Trilites paravallatus* (W. KR. 1959) W. KR. 1967, flysch lithofacies, Liptovská kotlina
3. *Baculatisporites quintus* (TH. et PF. 1953) W. KR. 1967, flysch lithofacies, Hornonitrianska kotlina
4. *Sciadopityspollenites verticillatiformis* (ZAUER 1960) W. KR. 1971, SE part of Šarišská hornatina
5. *Inaperturopollenites hiatus* (R. POT. 1931) TH. et PF. 1953, flysch lithofacies, Hornonitrianska kotlina
6. *Sciadopityspollenites serratus* (R. POT. et VEN. 1934) THIERGART 1937, flysch lithofacies, Liptovská kotlina

Plate XXXI

1. *Zonalapollenites maximus* (RAATZ 1937) W. KR. 1971, flysch lithofacies, Liptovská kotlina
2. *Sciadopityspollenites verticillatiformis* (ZAUER 1960) W. KR. 1971, flysch lithofacies, Spišská kotlina (depression)
3. *Zonalapollenites maximus* (RAATZ 1937) W. KR. 1971, Mafcov beds, Magura unit
4. *Sciadopityspollenites serratus* (R. POT. et VEN. 1934) THIERGART 1937, flysch lithofacies, Hornonitrianska kotlina
5. *Cupressacites bockwitzensis* W. KR. 1971, flysch lithofacies, SE part of Šarišská hornatina
6. *Sciadopityspollenites serratus* (R. POT. et VEN. 1934) THIERGART 1937, flysch lithofacies, Liptovská kotlina

Plate XXXII

1. *Piceapollis tobolicus* (PANOVA 1966) W. KRUTZSCH 1971, flysch lithofacies, Spišská kotlina
- 2.-3. *Monocolpopollenites tranquillus* (R. POT. 1934) PF. et TH. 1953, Krosno beds, Dukla unit, flysch lithofacies, Liptovská kotlina
4. *Pityosporites alatus* (R. POT. 1931b) TH. et PF. 1953, flysch lithofacies, Spišská kotlina
5. *Arecipites granulatus* (KEDVES 1961) M. KEDVES 1974, flysch lithofacies, Liptovská kotlina
6. *Arecipites granulatus* (KEDVES 1961) M. KEDVES 1974, Mafcov beds, Magura unit

Plate XXXIII

1. *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978, flysch lithofacies, Liptovská kotlina
2. *Cupuliferoipollenites pusillus* (R. POT. 1934) R. POT. 1960, flysch lithofacies, Liptovská kotlina
3. *Cupuliferoipollenites oviformis* (R. POT. 1931) R. POT. 1960, Krosno beds, Dukla unit
4. *Cupuliferoidaepollenites liblarensis* (TH. 1950) R. POT. 1960, Krosno beds, Dukla unit
5. *Tricolporopollenites microhenrici* (R. POT. 1931) W. KR. 1961, flysch lithofacies, Liptovská kotlina
- 6.-7. *Cyrtaceapollenites megaexactus* (R. POT. 1931) R. POT. 1960, flysch lithofacies, Liptovská kotlina
8. *Aceripollenites* sp. flysch lithofacies, Liptovská kotlina
9. *Rhoipites pseudocingulum* (R. POT. 1960, flysch lithofacies, Liptovská kotlina)
10. *Tetracolporopollenites sapotoides* PF. et TH. 1953, flysch lithofacies, Spišská kotlina
11. *Momipites myricoides* (KREMP 1949) W. KR. 1971, flysch lithofacies, Liptovská kotlina
12. *Trivestibulopollenites betuloides* 1953, flysch lithofacies, Liptovská kotlina
13. *Plicatopollis plicatus* (R. POT. 1934) W. KR. 1962, flysch lithofacies, Liptovská kotlina
14. *Platycaryapollis flagellus* W. KR. 1967, flysch lithofacies, Liptovská kotlina
15. *Engelhardtoidites microcoryphaeus* (R. POT. 1931) R. POT. 1960, flysch lithofacies, Spišská kotlina
16. *Trivestibulopollenites betuloides* PF. 1953, flysch lithofacies, Liptovská kotlina
17. *Caryapollenites simplex* (R. POT. 1931) R. POT. 1960, flysch lithofacies, Spišská kotlina (corrosion)
18. *Caryapollenites simplex* (R. POT. 1931) R. POT. 1960, flysch lithofacies, Liptovská kotlina
19. *Multiporopollenites maculosus* (R. POT. 1931) TH. et PF. 1953, flysch lithofacies, Hornonitrianska kotlina

Plate XXXIV

1. *Caryapollenites simplex* (R. POT. 1931) R. POT. 1960, flysch lithofacies, Spišská kotlina
2. *Polyatriopollenites stellatus* (R. POT. 1931) PF. 1953, flysch lithofacies, Liptovská kotlina

- 3.-4. *Alnipollenites verus* (R. POT. 1931) emend. R. POT. 1960, flysch lithofacies, Liptovská kotlina, SE part of Šarišská hornatina
5. *Intratropopollenites* cf. *insculptus* Mai 1961, Maľcov beds, Magura unit
6. *Intratropopollenites insculptus* Mai 1961, flysch lithofacies, Liptovská kotlina
7. *Multiporopollenites* cf. *maculosus* (R. POT. 1931) TH. et PF. 1954, flysch lithofacies, Hornonitrianska kotlina
8. *Ulmipollenites undulosus* Wolf 1934, flysch lithofacies, Liptovská kotlina
9. *Slowakipollis* cf. *hipophaeoides* W. KR. 1962, flysch lithofacies, Liptovská kotlina
10. *Corsinipollenites* ex. gr. *oculusnoctis* (THIERG. 1940) NAKOMAN, 1965, upper Zlín beds, Magura unit
- 11.-12. *Pseudooculopollis* fsp. flysch lithofacies, Spišská kotlina, Hornonitrianska kotlina (re-sedimented from the Upper Cretaceous)

Plate XXXV

1. *Leiotriletes maxoides* W. KR. 1962, subsp. *maximus* (PF. 1953) W. KR. 1959, slightly sandy marls (Štúrovo 1.417,0–421,0 m)
2. *Triplanisporites* cf. *sinomaxoides* W. KR. 1962, variegated coal-bearing beds (Obid-13, 185,0–186,3 m)

Plate XXXVI

1. *Leiotriletes dorogensis* (M. KEDVES 1960) M. KEDVES 1961, foraminiferal marls (Kováčov II. 115,0–117,0 m)
2. *Leiotriletes adriennis* (R. POT. et GELL. 1933) W. KR. 1959, var. *pseudodivisus* W. KR. 1959, variegated coal-bearing beds (obid-13, 261,0–262,0 m)
3. *Leiotriletes adriennis* (R. POT. et GELL. 1933) W. KR. 1959, variegated coal-bearing beds (Obid-13, 261,0–262,0 m), slightly sandy claystones (Štúrovo-1, 540,6–545,3 m)
4. *Leiotriletes microadriennis* W. KR. 1959, fvar. *triplan* M. KEDVES 1961 variegated coal-bearing beds (Obid-13, 192,20–192,70 m)
5. *Leiotriletes* cf. *neddenoides* W. KR. 1962, foraminiferal marls (Obid-13, 52,0–53,0 m)

Plate XXXVII

1. *Baculatisporites quintus* TH. et PF. 1953) W. KR., 1959, variegated coal-bearing beds (Obid-13, 261,0–262,0 m)
2. *Leiotriletes adriennis* (R. POT. et GELL. 1933) W. KR. 1959, fvar. *pseudotriplan* M. KEDVES 1961, variegated coal-bearing beds (Obid-15, 185,80–186,20 m)
3. *Ischyosporites asolidus* (W. KR. 1959) W. KR. 1967, foraminiferal (Obid-13, 46,30–47,30 m)
4. *Cicatricosisporites dorogensis* R. POT. et GELL. 1933, variegated coal-bearing beds (Obid-13, 192,20–20–192,70 m)
5. *Echinatisporis longechinus* W. KR. 1959, foraminiferal marls (Obid-13, 52,0–53,0 m)

Plate XXXVIII

1. *Baculatisporites gemmiclavatus* W. KR. 1959, foraminiferal marls (Obid-13, 52,0–53,0 m)
2. *Foveatrilites* sp., variegated coal-bearing beds (Obid-13, 261,0–262,0 m)
3. *Polypodiaceoisporites seidewitzensis* W. KR. 1967, variegated coal-bearing beds (Obid-13, 261,0–262,0 m)
4. *Polypodiaceoisporites* cf. *saxonicus* W. KR. 1967, variegated coal-bearing beds (Obid-13, 273,0–276,0 m)
5. *Polypodiaceoisporites* sp., foraminiferal marls (Obid-13, 52,0–53,0 m)
6. *Retitrites sernoensis* W. KR. 1963, thin pelitic intercalations in grey disintegrating sandstones with carbonized plant rests (Št-1, 417,0–421,0 m)

Plate XXXIX

1. *Polypodiaceoisporites lusaticus* W. KR. 1967, variegated coal-bearing beds (Obid-13, 147,0–148,0 m)
2. *Verrucingulatisporites undulatus* E. NAGY 1963, foraminiferal marls (Obid-13, 52,0–53,0 m)

- 3.-5. *Polypodiisporites alienus* (R. POT. 1934) E. NAGY 1973, variegated beds (Obid-13, 261,0-262,0 m) sandy marls (K-II, 102,0-104,0 m)
4. *Laevigatosporites haardti* (R. POT. et VEN. 1934) TH. et PF. 1953, subfsp. *haardti* W. KR. 1967, foraminiferal marls (Obid-13, 52,0-53,0 m)
6. *Polypodiisporites favus* (R. POT. 1933) subfsp. *favus* (W. KR. 1967) E. NAGY 1973, variegated coal-bearing beds (Obid-13, 262,0-263,0 m)

Plate XL

1. *Piceapollis tobolicus* (PANOVA 1966) W. KR. 1971, sandy marls (K-II, 28,0-29,0 m)
2. *Podocarpidites* sp., foraminiferal marls (Obid-13, 52,0-53,0 m)
3. *Podocarpidites podocarpoides* (THIERG. 1958) W. KR. 1971, foraminiferal marls (Obid-13, 51,0-52,0 m)

Plate XLI

1. *Abiespollenites absolutus* THIERGART 1937, foraminiferal marls (Obid-13, 52,0-53,0 m)
2. *Zonalapollenites maximus* (RAATZ 1937) W. KR. 1971, foraminiferal marls (Obid-13, 51,0-52,0 m)
3. *Inaperturopollenites hiatus* (R. POT. 1931) KREMP 1949, pellicitic intercalations in disintegrating sandstones (Št-1, 540,6-545,3 m)
4. *Inaperturopollenites dubius* (R. POT. et VEN. 1934) TH. et PF. 1953, variegated coal-bearing beds (Obid-13, 192,20-192,70 m)

Plate XLII

1. *Ephedrites (Distachyapites) tertiarus* W. KRUTZSCH 1970, foraminiferal marls (Obid-13, 52,0-53,0 m)
2. *Cycadopites cf. gracilis* W. KRUTZSCH 1970, foraminiferal marls (Obid-13, 52,0-53,0 m)
3. *Sciadopityspollenites serratus* (R. POT. et VEN. 1934) R. POT. 1958, sandy marls (Kováčov-II, 77,0 m)
- 4.-5. *Monocolpopollenites tranquillus* (R. POT. 1934) PF. et TH. 1953, pellicitic intercalations in disintegrating sands (Štúrovo-1, 597,7-599,0 m; 417,0-421,0 m)
6. *Arecipites granulatus* (M. KEDVES 1961) M. KEDVES 1974, pellicitic intercalations in disintegrating sandstones (Štúrovo-1, 417,0-421,0 m)
- 7.-8. *Tricolporopollenites microhenrici* (R. POT. 1931) W. KR. 1961, variegated coal-bearing beds, (Obid-13, 192,20-192,70 m)
- 9.-10. *Quercoidites henrici* (R. POT. 1931a) R. POT. 1960, slightly sandy claystones (Štúrovo-1, 437,90-439,20 m), grey marlstones (Kováčovo-II, 434,0 m)
11. *Cupuliferooidapollenites quisqualis* (R. POT. 1934) R. POT. 1960, foraminiferal marls (Obid-13, 52,0-53,0 m)
12. *Tricolporopollenites asper* (TH. et PF. 1953) W. KR. 1961, slightly sandy claystones (Štúrovo-1, 437,9-439,20 m)
13. *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978, slightly sandy claystones (Štúrovo-1, 437,90-439,20 m)
14. *Fususpollenites fusus* (R. POT. 1931) M. KEDVES 1978, slightly sandy claystones (Štúrovo-1, 467,40-469,80 m)
15. *Bacutricolporites villensis* (THOMS. 1950) M. KEDVES 1978, slightly sandy claystones (Štúrovo-1, 40-469,80 m)

Plate XLIII

1. *Cupuliferoipollenites oviformis* (R. POT. 1931) R. POT. 1960, foraminiferal marls (Obid-15, 37,40-38,40 m)
2. *Intrabaculitricolporites porasper* (PF. 1953) M. KEDVES 1978, slightly sandy claystones (Štúrovo-1, 467,40-469,80 m)
3. *Rhoipites pseudocingulum* (R. POT. 1931) R. POT. 1960, slightly sandy claystones (Štúrovo-1, 437,90-439,20 m)

4. *Cyrillaceapollenites megaexactus* (R. Pot. 1931) R. Pot. 1960, gray marlstones (Kováčov-II, 434,0 m)
5. *Illexpollenites margaritatus* (R. Pot. 1931) THG. 1937, f. *medius* Pf. et Th. 1953, slightly sandy claystones (Štúrovo-1, 467,4–469,8 m)
6. *Tricolporopollenites kruschi accessorius* (R. Pot. 1934) Th. et Pf. 1953, variegated coal-bearing beds (Obid-13, 143,0–144,0 m)
7. *Illexpollenites margaritatus* (R. Pot. 1931) Th. 1937, grey slightly sandy claystones (Štúrovo-1, 467,4–469,8 m)
8. *Tetracolporopollenites* cf. *obscurus* Pf. et Th. 1953, slightly sandy claystones (Štúrovo-1, 437,90–439,20 m)
9. *?Periporopollenites stigmaeus* (R. Pot. 1931) Th. et Pf. 1953, foraminiferal marls (Obid-13, 52,0–53,0 m)
- 10.–11. *Caryapollenites simplex* (R. Pot. 1931) R. Pot. 1960, slightly sandy marls (Kováčov-II, 104,0–106,0 m), variegated sandstone beds (Obid-15, 146,0–147,0 m).
12. *Polyatriopollenites stellatus* (R. Pot. 1931) Ph. 1953, slightly sandy claystones (Štúrovo-1, 540,60–545,30 m)
13. *Tetracolporopollenites (Brecolpites) c.f. gregussi* L. RAKOSI 1973, foraminiferal marls (Obid-13, 46,30–47,30 m)

Plate XLIV

1. *Triatriopollenites bituites* (R. Pot. 1931) Th. et Pf. 1953, foraminiferal marls (Obid. 13, 52,0–53,0 m)
2. *Plicatopollis plicatus* (R. Pot. 1933) W. KR. 1962, pellictic intercalations in disintegrating sandstones (Štúrovo-1, 597,70–599,90 m)
3. *Platycaryapollis flagellus* W. KR. 1967, foraminiferal marls (Obid-13, 52,0–53,0 m), slightly sandy claystones (Štúrovo-1, 467,40–469,80 m)
4. *Engelhardtoidites microcoryphaeus* (R. Pot. 1931) R. Pot. 1960, foraminiferal marls (Obid-13, 52,0–53,0 m)
5. *Momipites myricoides* (KREMP 1949) W. KR. 1967, variegated coal-bearing beds (Obid-13, 261,0–262,0 m)
6. *Intratroporopollenites insculptus* MAI 1961, foraminiferal marls (Kováčov-II, 242,0–243,0 m)
7. *Intratroporopollenites instructus* (R. Pot. 1931) Th. et Pf. 1953, pellictic intercalations in grey disintegrating sandstones (Štúrovo-1, 540,60–545,30 m)
- 8.–9. *Trivestibulopollenites betuloides* Pf. 1953, variegated coal-bearing beds (Obid-13, 52,0–53,0 m)
10. *Carpinuspollenites carpinoides* (Pf. 1953) E. NAGY 1969, variegated coal-bearing beds (Obid-13, 192,20–192,70 m)
11. *Ulmipollenites undulosus* WOLF 1934, foraminiferal marls, (Kováčov-II, 120,0–122,0 m)
12. *Alnipollenites* sp., foraminiferal marls (Obid-13, 52,0–53,0 m)
- 13., 16. *Anipollenites verus* R. Pot. 1934, variegated coal-bearing beds (Obid-13, 192,20–192,70 m) foraminiferal marls (Obid-13, 52,0–53,0 m)
- 14.–15. *Interporopollenites* fsp., slightly sandy claystones (Štúrovo-1, 437,90–439,20 m), pellictic intercalations in disintegrating sandstones (Štúrovo-1, 540,60–545,30 m), resedimented pollen grain)
17. *Trudopollis* sp. (pollen grain resedimented from the Upper Cretaceous)

Reviewed: N. Gabrielová

Translated: E. Jassingerová

EVA PLANDEROVÁ

Monosaccate pollen of genera *Potonieisporites* Bharadw. and *Striomonosaccites* Bharadw. from the Autunian (Oslavany near Brno)

2 text-fig., 32 plantes (XLV–LXXVI)

Abstract. I present description of the Autunian genera *Potonieisporites* BHARADW. and *Striomonosaccites* BHARADW. from the locality Oslavany near Brno. I describe five new species from the genus *Potonieisporites*, namely *Potonieisporites rotundus* n. sp., *Potonieisporites doubingeri* n. sp., *Potonieisporites sivaki* n. sp., *Potonieisporites schwartsmanni* n. sp., *Potonieisporites minimus* n. sp. From the genus *Striomonosaccites* four new species are described: *Striomonosaccites nigratus* n. sp., *Striomonosaccites oslavanensis* n. p., *Striomonosaccites major* n. sp., *Striomonosaccites striatus* n. sp. Presented are also described species of these genera, characteristic of the Lower Permian of the Euro-American bioprovince.

Results of palynological investigation in the Rosice – Oslavany coal basin show that microflora in the bed succession studied is very rich in species. I have found particularly well preserved microflora in younger Lower Permian grey schists. Species of monosaccate pollen representative of genera *Potonieisporites*, *Florinites*, *Nuskoisporites* and *Striomonosaccites* are most plentiful. They are significant also for biostratigraphical research of Late Paleozoic rocks in Euro-American Permian bioprovince. So I decided to do morphological description of species from two biostratigraphically significant genera of Autunian microflora in the first stage of work. In our country the Autunian microflora has not been examined from that region neither from the Carpathians so far. The genera are richer in species than those quoted in literature, and many species of these genera have not been described as yet.

For the specimens examined, the whole profile of a blackcoal seam in a mine at Rosice was sampled as well as overlying Lower Permian schists in an exposure at Oslavany (a cut of the Oslava river).

Dr. L. MALÝ senior geologist in the Rosice–Oslavany Mines is to receive my heartiest thanks for offering me special information about the deposit, the overlying beds, and for his aid at sampling.

I also want to express my sincere thanks to Dr. SIVÁK from Palynological Laboratory in Montpellier in France for his special advice at preparation of samples for scanning electron microscopy.

A brief geological – lithological description of locality and bed sequence studied.

The bed sequence under study is a part of the Boskovická brázda (trench) in Moravia. The trench extends from Moravský Krumlov through Rosice-Kuřim, Tišnov to Boskovice and to Moravská Třebová (Fig. 1).

According to V. HAVLENA (1964) sedimentation in the Rosice – Oslavany vertical depression commenced in the Uppermost Stephanian.

Above basal conglomerates a green – grey lacustrine complex deposited to fill a shallow crystalline depression. In the Rosice – Oslavany complex of beds are alternant conglomerate – sandstone – siltstone – sandstone – siltstone cycles. In the upper part of the complex are also claystones, coal clays and coal seams. In the top cycle are representatives of the genus *Callipteris*, and it is therefore placed on the Stephanian – Autunian boundary. Deeper drill holes down to the basement encountered the Stephanian C. The Stephanian beds contain the following macroflo-

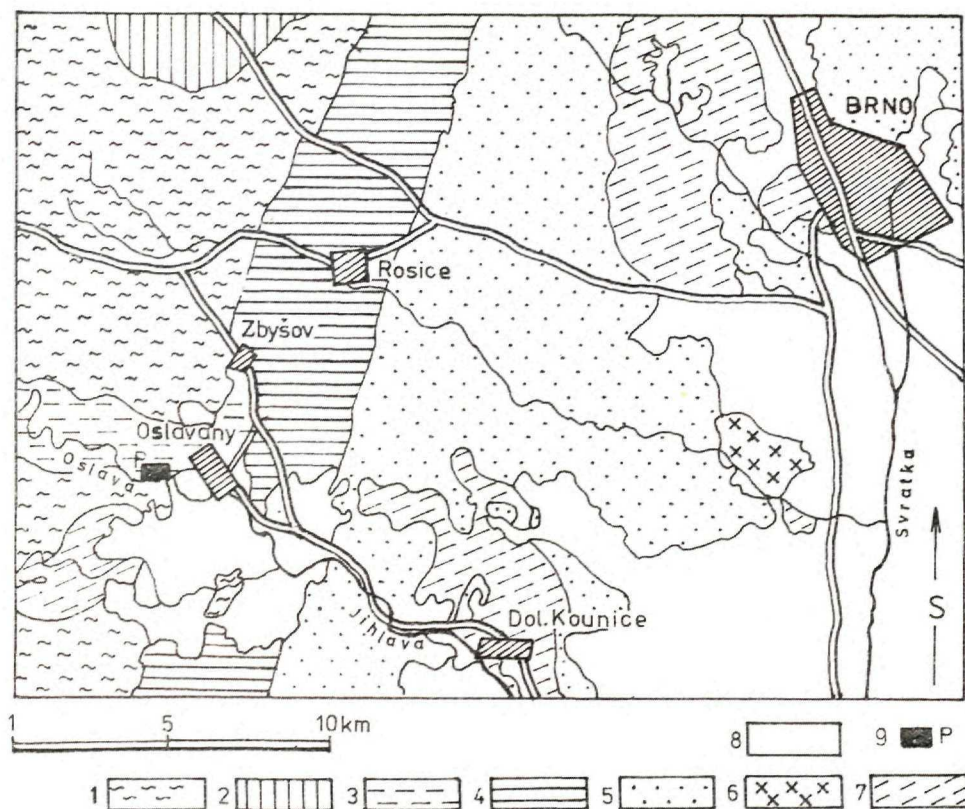


Fig. 1 Sketch-map of localities. 1 – biotite orthogneiss, Biteš orthogneiss, granulite, 2 – Phyllite, 3 – Stephanian, lower red waste, 4 – lower red waste, 5 – biotite granodiorite, partly schistose granite, 6 – hornblende, 7 – diorite, 8 – Lower Miocene, 9 – samples for palynological research.

Taken from geological map 1 : 200 000 M-33-XXIX – Brno.

ral species: *Annularia sphenophylloides*, *A. stellata*, *Sphenophyllum longifolium*, *S. oblongifolium*, *Sigillaria brardi*, *Pecopteris arborescens*, *P. candolleana*, *P. cyathea*, *P. densifolia*, *P. feminaeformis*, *P. hemitellioides*, *P. lepidorachis*, *P. polypodioides*, *P. unita*, *Dicksonites pluckeneti*, *Pseudomariopteris busqueti*, *Odontopteris minor*, *O. osmundaeformis*, *O. subcrenulata*, *Alethopteris bohémica*, *Linopteris germani*. The Stephanian beds are overlaid by Lower Permian beds and by Quaternary sedimentary rocks.

Above the Ist., uppermost coal seam are grey deposits up to 180 m in thickness. They are shallow-water lacustrine sediments with intercalations of lacustrine delta-type arcoses, sandstones and conglomerates. Bituminous marlstones are key horizons of the filling. They contain Lower Autunian flora and fauna of no biostratigraphical significance (V. HAVLENA 1964). Typical representatives of the flora are: *Annularia stellata*, *Sphenophyllum oblongifolium*, *Pecopteris arborescens*, *P. cyathea*, *P. hemitelloides*, *Mixoneura neuropteroides*, *Linopteris germani*, *Callipteris conferta*, *C. naumani*, *C. nicklesi*, *C. lyratifolia*, *C. jutieri*, *Taeniopteris multinervis*, *T.*

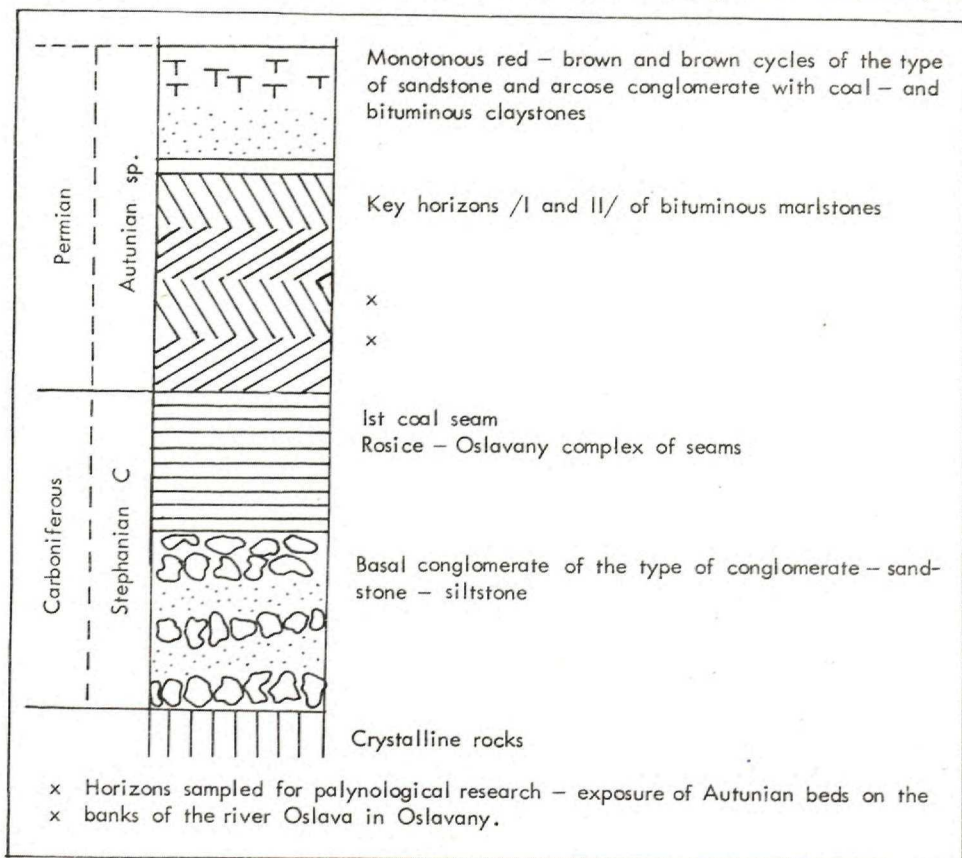


Fig. 2. Schematic lithological profile of the Rosice - Oslavany basin (according to V. HAVLENA 1964).

jejunata, and *Walchia*: *Lebachia piniformis*, *L. parvifolia*, *L. speciosa*, *Ernestiodendron filiciforme*. The Lower Permian microflora is from an exposure of overlaying brown beds containing dominantly bituminous clays in the cut of the r. Oslava at Oslavany, fig. 2). I had ten samples from the whole profile. They contained well preserved microflora typical of the Lower Autunian. Monosaccate and bisaccate pollen, and representatives of the genus *Vittatina* were dominant. There were no spores of Pteridophyta. Here I want to give paleontological description of some genera; biostratigraphical characteristic of microflora will be treated elsewhere. Now I will present morphological characteristic of two genera, significant biostratigraphically and most plentiful in microfloral assemblage from the locality studied. They are the genera *Potonieisporites* BHARADW. (1954) known from the Upper Stephanian and Lower Permian throughout the world, and *Striomonosaccites* BHARADW. 1962. It is less frequent, unknown in Europe and restricted to the Upper and Middle Permian.

***Pollenites* POTONIE 1941**

***Saccites* ERDTMAN 1947**

***Monosaccites* (CHITALEY) POT. KREMP 1954**

***Potonieisporites* BHARADW. 1954**

Genotype: *Potonieisporites novicus* BHARADW. 1954

Pollen grains of various species of the genus are provided with one air sac loosely fitted to central body. Their shape varies from circular to oval and elongated-oval. Monolete scar in central body is typical, its length being the species character. The colouring of central body, dark folds of the exine of central body and their arrangement are also typical. Structure of exine of the air sac is infrareticulate. Species of the genus appear since the Westphalian B and it is most frequent in the Autunian according to J. DOUBINGER'S (in A. BOUROS — J. DOUBINGER 1975) biostratigraphical data on the Stephanian — Permian boundary. Many representatives of the genus were at Oslavany near Brno in schists overlaying in turn the Stephanian coal seams of the Rosice — Oslavany coal basin.

Some species of the genus are identic with macrofossil species *Lebachia piniformis* FLORIN and *Walchianthus cylindraceous* FLORIN since pollen of the genus *Potonieisporites* were found in situ together with fructification organs of the above species.

I have found the following species which were partly described and are partly new:

Potonieisporites novicus (BHARADW. 1954) BHARADW. 1964

Potonieisporites bhardwaji REMY 1961

Potonieisporites solidus f. *magnus* ŠVARTSMAN 1976

Potonieisporites rotundatus n. sp.

Potonieisporites enormis ŠVARTSMAN 1976

Potonieisporites doubingeri n. sp.

Potonieisporites grandis TSCHUDY et KOS.

Potonieisporites sivaki n. sp.

Potonieisporites bilateris SINGH 1964

Potonieisporites svartsmani n. sp.

Potonieisporites minimus n. sp.

Potonieisporites sp. A

The generic description is added description of exine microstructure after examination by SEM at multiple magnification. Microstructure of exine in the central body is chagrenate, fine-granulate. Among species are differences in size and density of granules. Microstructure of air sac is indistinct; arrangement of structural elements is variable. In parts distinct infrareticulate microstructure passes into grooved structure.

Potonieisporites novicus BHARADW. 1954

Pl. XLV, Fig. 1–3, Pl. XLVI, Fig. 1, 3

Holotypus: *Potonieisporites novicus* BHARADW. 1954 N. Jahrbuch f. Geol. u. Paläont. Mh. 1, p. 512–525.

Pollen grains of the species are characterized by dark folds of exine on the periphery of the central body, by 2–3 vertical folds of exine, crossing monolet scar of a size up to 2/3 of the central body of pollen grain. Microstructure of air sac is infrareticulate, on proximal side partly passing into elongated costate structure. Central body is grooved with scarce granules (1 μ in size) both on the central body and on air sac. Botanically the species corresponds to *Lebachia piniformis* (SCHLOTHEIM) FLORIN according to M. KALIBOVÁ (1978).

The species is in the Upper Carboniferous and Lower Permian. D. C. BHARADWAJ (1956) found it in the Stephanian C; M. KALIBOVÁ (1978) in the Stephanian of the Jelenice beds and Kounov beds at Kladno; J. JERZYKIEWICZ (1977) on the Stephanian Autunian boundary. Most data about the occurrence of the species in the Autunian in Europe were quoted by J. DOUBINGER (1974, 1975). In our country the species occurred in the Stephanian D – and Autunian of the Nízke Tatry (mountains) (E. PLANDEROVÁ 1979 in lit.).

In the Soviet Union K. INOSOVA and A. CH. KRIZINA – E. G. SCHWARTSMAN (1976) found the species in the Upper Carboniferous and Lower Permian in the Don region. J. Z. FADDEJEVA (1975) found it in the Lower Permian of the southern Peri-Uralian region. M. S. BARS (1969) also found it in the Lower Permian and Upper Carboniferous in Canada. So the species is geographically widely distributed, being most plentiful in the Lower Autunian, scarce in the Upper Carboniferous. It is very frequent in the samples from Oslavany near Brno.

Potonieisporites bharadwaji REMY 1961

Pl. XLVII, Fig. 1–2, Pl. XLVIII, Fig. 1–3

Holotypus: *Potonieisporites bharadwaji* R. REMY and W. REMY
Monatsberichte Deutsch. Akad. d. Wiss. REMY 1961, p. 500, p. 4. Fig. 4–6.

Besides basal generic characters there is a dark fold of exine on periphery of the central body, opposite to the air sac. Monolete scar is as long as longitudinal axis of the central body is irregular, horizontally grooved. Grooves are separated from one another by narrow furrows. On its contact with the central body the exine is pitted. The whole exine is finely granulate.

R. REMY (1961) found the species in the Lowermost Autunian. It is frequent in Europe, mainly in the Upper Stephanian and Lower Autunian in France (J. DOUBINGER 1973). R. COCQUEL, J. DOUBINGER, S. LOBOZIAK (1976) found it in the Lower Autunian in Spain. The species is characteristic of palynomorph assemblages typical of the Autunian of Western Europe, according to C. CLAYTON, R. COCQUEL et al. (1977). It is not mentioned in publications from Eastern Europe. In our country it was in the Stephanian in the Nízke Tatry (mountains) (E. PLANDEROVÁ in lit.). In Oslavany near Brno the species is less frequent than *P. novicus*.

Potonieisporites solidus SCHWARTSMAN 1976 f. *bianca* n. f. sp.

Pl. XLIX, Fig. 1-2, Pl. L, Fig. 1-3

Holotypus: *P. solidus* E. G. SCHWARTSMAN in K. J. INOSOVA, A. Ch. KRUZINA-E. G. SCHWARTSMAN 1976, p. 98, Pl. X, Fig. 7.

The specimen has a monolete scar extending to 1/2 or 2/3 of the central body. On the distal and the proximal sides of the pollen grain are dark folds of exine opposite to air sac. Monolete scar is also joined with a dark fold of exine. As for size, the species belongs among the forms *magnus* according to E. G. SCHWARTSMAN (1976) only the central body of the species described is darker than air sac. Our form species is $135 \times 85 \mu$ in size, its central body is $100 \times 70 \mu$ and its air sac does not differ from central body in colour. The wall of exine seems as thin as that of air sac. On the proximal side the structure of body is reticulate in places. Examination by SEM showed microstructure of central body with irregular shallow folds of exine. The folds form vaguely confined fields. On air sac are some radial thickenings of exine running from the central body to the margin of air sac. According to E. G. SCHWARTSMAN (1976) *P. solidus magnus* occurred from the Middle Carboniferous to the Lower Permian. It is scarce in Oslavany near Brno.

Potonieisporites rotundus n. sp.

Pl. LI, Fig. 1-2; PL. LII, Fig. 1-3

Holotypus: Bratislava, Dionýz Štúr Institute of Geology, prep. No. 178 (Pl. LI, Fig. 1-2).

Locus typicus: Oslavany near Brno (Fig. 1)

Stratum typicum: Autunian, bituminous marlstones.

Derivatio nominis: According to round pollen grain.

Description of pollen grain: The pollen grain, its central body and air sac are

circular. Size: 90 μ . Size of central body: 68–70 μ . Monolete scar extends to 4/5 of the body of pollen grain. Central body is dark, thin air sac is lightbrown. Around central body, opposite to air sac is a dark fold of exine. There are other brown folds on the body, forming dark and light areas. Structure of air sac is infrareticulate with radial rays running loosely to the margin of air sac. Microstructure of central body is intensely grooved horizontally. In places, microstructure is foveolate, with openings about 2 μ in size. On air sac are also some smaller foveolate openings.

Our specimen differs from *P. bilateralis* SINGH (1964) in shape, size and dark central body.

Occurrence: quite frequent in the Lower Autunian in Oslavany near Brno.

Potonieisporites enormis SCHWARTSMAN 1976 f. sp. *radiatus* n. fsp.

PL. LIII, Fig. 1,2; Pl. LIV, Fig. 1–3

Holotypus: *P. Enormis* E. G. SCHWARTSMAN in K. I. INOSOVA, A. Ch. KRUZINA, E. G. SCHWARTSMAN 1976.

p. 104, Pl. XII., Fig. 3–4

Our description is in accordance with that by E. G. SCHWARTSMAN. Size of the species is 135 $\times$ 95 μ .

The species is typically large, its monolete scar extends to 5/5 of the central body of pollen grain. Dark folds of exine on both the distal and the proximal sides are on the periphery of the central body opposite to air sac and along monolete scar. It differs from other species also in structure of air sac: it is more conspicuously reticulate. Examination by SEM showed that microstructure of the central body is almost smooth, multiple magnification shows fine horizontal grooves, shallow tight pits and tiny granules not larger than 0,5 μ . Thick muri on air sac are trimming the reticules. In contrast to the species described, on our specimen there are radial thickenings of exine on air sac. They run from the periphery of the central body to the air sac margin. Because of this morphological character I have introduced new fsp. "radiatus". According to E. G. SCHWARTSMAN (1976) the species is plentiful and characteristic of the Lower Permian, more exactly P₁ –sl. in the Don black-coal basin.

On the locality Oslavany near Brno were some specimens of the species. Neither on the Carboniferous of the Nízke Tatry mountain, nor in Western Europe were any finds of the species.

Potonieisporites doubingeri n. sp.

Pl. LV, Fig. 1,2; Pl. LVI, Fig. 1–3

Holotypus: at Dionýz Štúr Institute of Geology, prepar. No. 211, Pl. LV, Fig. 1–2

Locus typicus: Oslavany near Brno (Fig. 1)

Stratum typicum: Autunian – bituminous marlstones.

Derivatio nominis: According to French palynologist J. DOUBINGER.

Species description: Shape of pollen grain: oval – elongated. Size: $145 \times 90 \mu$. Exines of central body and air sac are of the same colour. Dark-brown irregular folds are on the periphery of the central body and on the margins of monolete scar. The scar extends to $3/4$ of the central body. Structure of air sac is infrareticulate. On the proximal side reticules are larger. Dark folds of exine are less distinct on the proximal than on the distal side.

Examination of pollen grain by SEM shows microstructure of protuberating irregular muri forming areas of shallow pitted structure which could indicate a verrucate structure. Exine below monolete scar is smooth, finely granulate. Air sacs have radial projections from central body to margins of air sacs.

It differs from *P. rimosus* SHWARTSMAN 1976 in horizontal irregular folds along monolete scar and radial projections on air sacs.

Potonieisporites grandis TSCHUDY et KOS.

Pl. LVII, Fig. 1, 2

Holotypus: *P. grandis* TSCHUDY et KOSANKE 1966, p. 69, p. 2. fig. 50, 52–53. Our specimen corresponds to the species described. Its size ranges from 125 to 120μ . Central body is either oval, pointed – like that of the holotype R. H. TSCHUDY–M. KOS. Pl. 2, fig. 53) or oval and rounded on the ends of longitudinal axis (R. H. TSCHUDY–M. KOS. pl. 2, Fig. 50). This is evidently not regarded as a character decisive for distinguishing subspecies. Air sac is broad in comparison with the central body which is $85 \times 50 \mu$. Longitudinal dark folds along monolete scar all over the central body are characteristic of the species. R. H. TSCHUDY and R. M. KOSANKE (1966) found it in the Lowermost Permian in Texas. R. I. INOSOVA, A. Ch. KRUZINA and E. G. SHWARTSMAN (1976) found scarce specimens in the Upper Stephanian. The species was most frequent in the Lower Permian (P_1 , P_1 sl suite).

Occurrence: Plentiful in the Lower Permian at Oslavany near Brno. According to literary data the species was widely distributed in a short time interval.

Potonieisporites cf. grandis TSCHUDY et KOS. 1966

Pl. LVIII, Fig. 1–4

In its basical characters i.e. horizontal monolete scar and dark parallel folds of exine along the scar, the species is in accordance with description of *P. grandis*. Only the shape of air sac is different: it is almost round whereas the central body is elongated – rounded. There is also a difference in many radial protuberances running from the periphery of central body to the margin of air sac. They are most conspicuous on the proximal side of the pollen grain; dark biserial rays aligned tightly beside one another giving radial outlook to the air sac structure which is infrareticulate.

Examination of central body by SEM showed that it is shallow – grooved along the monolete scar. There are scarce foveolate openings, and tight granulate protuberances.

The species is rare in the Lower Permian at Oslavany.

Potonieisporites sivaki n. sp.

Pl. LIX, Fig. 1, 2; Pl. LX, Fig. 1–3

Holotypus: at Dionýz Štúr Institute of Geology, Bratislava, prepar. No. 153, Pl. LIX, Fig. 1, 2

Locus typicus: Oslavany near Brno (fig. 1)

Stratum typicum: Autunian, bituminous marlstones

Derivatio nominis: According to French palynologist J. SIVÁK

Description of pollen grain. Oval shape. Size: $135 \times 90 \mu$. Size of central body: $85 \times 65 \mu$. Central body darker than air sac. Significant feature: Monolete scar extending to 9/10 of central body; dark fold of exine on the periphery opposite to air sac is missing although it is present on some species of the genus, like *P. solidus*, *P. novicus*, *P. bilateralis* a.o. Entire central body is crossed by thin dark folds of exine on the proximal side of pollen grain to form a reticulate-like structure passing to the exine of air sac. Two distinct folds run crosswise to the longitudinal axis across monolete scar of pollen grain. On the distal side the structure of central body is smoother and reticulate structure less conspicuous.

Structure of central body is different from that of *Potonieisporites bharadwaji* REMY. Air sacs are crossed radially by thin folds of exine from the periphery of central body to the margin of air sac. Examination by SEM also showed signs of reticulate arrangement of folds of exine.

Potonieisporites cf. *bilateralis*, SINGH 1964

Pl. LXI, Fig. 1, 2

Holotypus: *Potonieisporites bilateralis* H. P. SING (1964) p. 254, Pl. 45, Fig. 16. Our specimen corresponds to the species description by H. P. SINGH (1964) with the exception of the following morphologic characters: according to Singh the dark subcircular folds of exine in the central body, perpendicular to monolete scar, are a typical feature. Dark folds of our specimen do not terminate at monolete scar: they run from one pole to the other of the central body and get shorter. The structure of air sac is like that of *P. bilateralis* and the structure of central body on the proximal side is also similar. Monolete scar extends to 4/5 of central body and is parallel with a narrow dark fold of exine.

Occurrence: Quite frequent in the Lower Permian at Oslavany.

H. P. SINGH (1964) found it in the Lower Permian in Iraq.

Potonieisporites schwartsmani n. sp.

Pl. LXII, Fig. 1, 2; Pl. LXIII, Fig. 1–3

Holotypus: Dionýz Štúr Institute of Geology, Bratislava, prepar. No 190, Pl. LXII, Fig. 1–2.

Locus typicus: Oslavany near Brno (Fig. 1).

Stratum typicum: Autunian; bituminous marlstones.

Derivatio nominis: According to the Russian palynologist E. G. SWARTSMAN.

Species description: Pollen grain elongated – oval, air sac slightly elongated along the longitudinal axis. Conspicuous long monolete scar on the whole central body. Pollen grain size: $140 \times 80 \mu$. Central body size: $90 \times 60 \mu$. It is darker than air sac. Dark folds, 4–5 μ wide are along monolete scar. The rest of folds of exine run radially from monolete scar to the periphery of central body. In this it differs from *P. bilateralis* SINGH 1964.

Monolete scar extends to 4/5 of central body. Air sac structure is reticulate. Many radial dark folds run from central body to the margin of air sac.

Microstructure of central body is verrucate; composed of large granules aligned tightly side by side. They are 1,5–2 μ in diameter. On the granulate protuberances are tiny secondary granules aligned in rows and forming characteristic granulate microstructure.

Microstructure of air sac is reticulate. Reticules are confined by elevated muri. Fine granulate microstructure is preserved too.

Occurrence: The species is quite frequent in the Autunian at Oslavany.

Potonieisporites minimus n. sp.

Pl. LXIV, Fig. 1–6

Holotypus: Dionýz Štúr Institute of Geology, Bratislava, prepar. No 198, Pl. LXIV, Fig. 1–6.

Locus typicus: Autunian; bituminous marlstones.

Derivatio nominis: According to small size of pollen grain.

Species description: Monosaccate pollen grain; size: $90/100 \times 60/75 \mu$. Monolete scar extends to 5/5 of central body. Air sac is narrow, light-coloured and comparatively small in respect to central body. The central body is triangular or quadrangular with distinct morphological characters different from those of other species described. On the distal side of central body is a dark subcircular fold of exine, spiral-twisted and forming another broad fold of exine. The folds are vertically crossed by dark radial folds perpendicular to monolete scar. Radial folds on the proximal side are more conspicuous than on the distal. Radial folds of exine are also on air sac. Structure of air sac is reticulate.

Microstructure of exine of central body is grooved to verrucate, with fine-granulate secondary structure.

Occurrence: Autunian; locality Oslavany; scarce.

Potonieisporites sp. A

Pl. LXV, Fig. 1–4

Structure and arrangement of folds on central body are different from those of other species. Because of few specimens it is not described as a new species. Size: $115 \times 60 \mu$. Shape: elongated-oval. Significant are many folds on exine. They

confine the central body opposite to air sac and run chaotically along monolet scar and across the scar. It differs from *P. bilateralis* SINGH 1964 in more numerous dark concentric folds of exine, in size and shape.

Concentric folds passing in a spiral to the second circle in central body remind of morphologic characters of *P. minimus* n. sp. There are differences in the shape of central body in size of pollen grain and air sac in comparison to central body and in the lack of radial rays on central body. Microstructure of central body is verrucate, of air sac — reticulate.

Occurrence: Autunian at Oslavany, plentiful.

Infraturma: *Dipolsacciti* HART 1965

Striomonosaccites BHARADW. 1962

Synonym: *Distriomonosaccites* BHARADW. 1967

Genotypus: *Striomonosaccites ovatus* BHARADW. 1962

The genus was described by D. C. BHARADWAJ 1962. G. F. HART (1965) fused the genera *Striomonosaccites* and *Distriomonosaccites* into one genus. Among generic characters most significant are: one air sac, central body darker than air sac, several parallel grooves inside central body. G. F. HART (1965) does not insist on parallel grooves. According to the original description by D. C. BHARADWAJ the genus comprises monosaccate pollen grains with striae on the proximal side of central body and without striae on the distal side. According to G. F. HART (1965) there belong all monosaccate pollen with striae (5–7) on the proximal side or on both the proximal and distal sides. Among our monosaccate striate pollen are species with only 3–4 striae on the proximal side. It is a genus with few species and narrow geographical range. In available European literature no species of the genus were mentioned. J. Z. FADDEJEVA (1976) mentioned the species *Strioblebachiites varius* ZAUER that could be referred to the genus *Striomonosaccites* from the Lower Permian of southern peri-Uralian region. L. A. LUBER (1955) mentioned the species *Noeggerothiopsisizonoletes rotatus* (LUB.) A. A. LUBER (1955) with horizontal grooves. The grooves are not parallel nor regular like on monostriate pollen. The authoress refers it to *Cordaitales*. B. B. ZAUER (1965) found striate monosaccate pollen in the Lower Permian of Solikamsk and denoted them with generic names *Striatoflorinites*, *Striatowalchiites* and *Striatoblebachiides* but without generic description. Other striate pollen are bisaccate and morphologically distinguishable from monosaccate striate pollen. *Striatoflorinites*, *Striatoblebachiites* and *Striatowalchiides* could perhaps be fused in one genus *Striomonosaccites*. Regretfully, I have not found any reference nor publication in which V. V. ZAUER describes the genera. In palynological literature from Western and Central Europe were no data about the genus. K. JIZBA (1962) mentioned a species *Striomonosaccites* sp. without generic description. It is from the Lower and Middle Permian of U.S.A.

In the Lower Permian at Oslavany the genus is represented by many species. Some of them are described as new species like:

Striomonosaccites rotatus BHARADW. 1962

Striomonosaccites nigratus n. sp.

Striomonosaccites striatus n. sp.

Striomonosaccites oslavanensis n. sp.

Striomonosaccites major n. sp.

Striomonosaccites sp. "A".

Striomonosaccites cf. *rotatus* (BHARADW. 1962) HART 1965

Pl. LXVI, Fig. 1–2

Synonymum: *Distriomonosaccites rotatus* BHARADW. 1962. Pollen grains of the species correspond to the description by D. C. BHARADWAJ (1962) and G. F. HART (1965) as regards shape, size of central body and infrareticulate structure of air sac. Reticules are round or secondary-deformed. Different are numbers of striae. On our specimen are 5 striae on the proximal side and 3 on the distal, on *S. rotatus* are 6 and 7 striae on the respective sides. It was found by D. C. BHARADWAJ (1962) and G. F. HART (1965) in the Permian of India. It is scarcely present in the Lower Permian at the locality Oslavany.

Striomonosaccites nigratus n. sp.

Pl. LXVII, Fig. 1–2; Pl. LXVIII, Fig. 1–3

Holotypus: Dionýz Štúr Institute of Geology, Bratislava; prepar. No. 44, Pl. LXVII, Fig. 1–2.

Locus typicus: Oslavany near Brno (Fig. 1).

Stratum typicum: Autunian; bituminous marlstones.

Derivatio nominis: according to dark exine of pollen grain.

Species description: Monosaccate spore of regular round shape. Size: 105–110 μ . Central body: 60–65 μ . Air sac is yellow in central to dark central body with subcircular dark folds around the body. On the proximal side of central body are thin parallel striae (7–9) along dark folds of exine. On the distal side striae are not visible. There are only dark folds of exine. Structure of air sac is infrareticulate. Reticules are either round or quadri-pentagonal. Muri are 1,5–2 μ wide. Radial thin folds of exine running out from the periphery of the central body are more plentiful on the proximal side than on the distal. Microstructure of exine of the central body was examined by SEM. 1000 $\times$ magnified distal side of pollen grain displays no distinct striae. Multiple magnification (5400 $\times$) shows pitted and grooved exine of central body of the pollen grain. Microstructure of air sac is shallow reticulate. Reticules are 3–4 μ wide. Radial folds of exine are conspicuous.

The species resembles *S. ovatus* BHARADW. 1962 in shape, size of central body, proportions of central body and air sac, and differs from it in dark central body, more striae and dark folds of exine parallel with striae.

Occurrence: frequent in Autunian at Oslavany.

Striomonosaccites striatus n. sp.

Pl. LXIX, Fig. 1–2; Pl. LXX, Fig. 1, 2

Holotypus: Dionýz Štúr Institute Bratislava, prepar. 12, Pl. LXIX, Fig. 1–2.

Locus typicus: Oslavany near Brno (fig. 1).

Stratum typicum: Autunian; bituminous marlstones.

Derivatio nominis: According to striate central body of pollen grain.

Pollen grain description: Almost circular monosaccate pollen grain. Size: $110 \times 100 \mu$. Central body: $90 \times 65 \mu$. The central body is elongated-oval. Air sac light-coloured, narrow. Central body is $2/3$ of the whole pollen grain, and darker. On the proximal and distal sides of the pollen grain are striae along dark folds of exine. On the proximal side the structure is more conspicuous and striae confined by dark folds $2-8 \mu$ wide. There are 5–6 striae on both the proximal and distal sides of the pollen grain. Structure of air sac: very finely infrareticulate. Muri around reticules are prolonged. Pollen grain body structure is grooved, on the proximal side foveolate. Microstructure of central body examined by SEM (magnif. $5400 \times$) is grooved, with dark papillate, secondarily granulate, high muri foveolate openings on muri are visible.

It differs from *S. rotatus* (BHARADW. 1962) HAART (1965) in a larger central body, in number of striae and in papillatae-foveolate structure of central body. From *S. nigratus* n. sp. it differs in shape, number and arrangement of striae.

Occurrence: Autunian at Oslavany, frequent.

Striomonosaccites oslavanensis n. sp.

Pl. LXXI, Fig. 1, 2; Pl. LXXII, Fig. 1–3

Holotypus: Dionýz Štúr Inst. of Geol., Bratislava, prepar. 99, Pl. LXXI, Fig. 1, 2.

Locus typicus: Oslavany near Brno, (Fig. 1).

Stratum typicum: Autunian; bituminous marlstones.

Derivatio nominis: According to the locality Oslavany.

Pollen grain description: Monosaccate pollen grain. Size: $105 \times 75 \mu$. Central body: $70 \times 45 \mu$. According to the original description by D. C. BHARADWAJ (1962) the round shape is characteristic. But C. F. HART (1965) having emended and complemented the genus, included in generic description both the round and oval shapes. I consider this ranging the species in the genus. Air sac is narrow in relation to central body. The air sac is yellow, the central body somewhat darker. Conspicuous longitudinal parallel striae on the central body are 6–7 on the proximal and the distal sides along dark folds of exine. Air sac structure is reticulate. Examination by SEM showed the following microstructure: Exine of central body is fine-corrugate with sporadical foveoles. Structure of air sac is reticulate, with muri $2.5-3 \mu$ wide. Reticules: $4-5 \mu$. On air sac are radial folds of exine. They run from central body to the periphery of air sac. The species differs from *S. ovatus* BHARADW. 1962 and *S. rotatus* (BHARADW.) HART 1965 in shape, size and in morphological

characters of striae. It is more resemblant to *Striatolebachiites* sp. V. V. ZAUER (1965). Regretfully I only got the depiction; no species description was available.

Occurrence: quite frequent at Oslavany.

Striomonosaccites cf. *oslavanensis*

Pl. LXXI, Fig. 3, 4

It differs from *S. oslavanensis* n. sp. in broader dark folds around striae and in smaller air sac. Reticules are finer. Margin of air sac waved.

Occurrence: scarce in the Autunian at Oslavany.

Striomonosaccites major n. sp.

Pl. LXXIII, Fig. 1, 2, Pl. LXXIV, Fig. 1–3

Holotypus: Dionýz Štúr Inst. of Geol. Bratislava, prepar. 232, Pl. LXXIII, Fig. 1, 2.

Locus typicus: Oslavany near Brno Fig. 1.

Stratum typicum: Autunian; bituminous marlstones.

Derivatio nominis: according to great size of pollen grain.

Pollen grain description: Almost round, slightly oval monosaccate pollen grain. Size: $120 \times 95 \mu$. Central body: $80 \times 60 \mu$. Central body has a subcircular thin dark folds on exine. Exines of air sac and of central body are light, yellow-brown. Dark folds are more conspicuous on the proximal than on the distal side. On central body are 5 parallel striae running longitudinally over the central body. Structure of air sac is reticulate with irregular mostly pentagonal reticles. Microstructure of central body (Pl. LXXIV, Fig. 3) is papillate to corrugate with granulate segments forming secondary structure (magn. $540 \times$). Microstructure of air sac consists of large reticules and broad muri. These are fine-granulate.

It differs from *S. rotatus* (BHARADW. 1962) HART 1965 in larger central body; from *S. ovatus* (BHARADW. 1962) in less striae and from *S. nigratus* n. sp. in shape and arrangement of striae on central body.

Occurrence: quite frequent at Oslavany.

Striomonosaccites sp. A.

Pl. LXXV, Fig. 1–2

Almost round monosaccate pollen grain. Size: $110 \times 85 \mu$. Central body: $75 \times 60 \mu$. Central body is confined by a subcircular dark folds of exine on both the proximal and distal sides of pollen grain.

On the central body are 7–8 longitudinal striae on the proximal side. They are not visible on the distal side. Dark folds of exine are scarce. Structure of air sac is reticulate with prolonged muri. Radial folds of exine run from central body to the periphery of air sac.

Occurrence: scarce in the Lower Permian at Oslavany.

Striomonosaccites cf. *nigratus*

Pl. LXXVI, Fig. 1-3

Pollen grain is round like that of *S. nigratus* n. sp. Central body is dark as well, only larger: up to 115 μ . Number and alignment of striae on central body are different. Whereas there are 7-9 striae on *S. nigratus*, this one has only 5-7 striae along dark folds of exine. Microstructure of central body is tightly grooved. On the contact of central body with air sac the structure is corrugate. Radial folds of exine on air sac resemble those on *S. nigratus*.

Occurrence: frequent in the Autunian at Oslavany.

Conclusions

I have presented morphological description of monosaccate pollen of Lower Permian species of the genus *Potonieisporites* BHARADW. 1954. Besides other species of the genus I also described 7 new species. From the genus *Potonieisporites* described were species *Potonieisporites rotundatus* n. sp., *Potonieisporites doubingeri* n. sp., *Potonieisporites sivaki* n. sp., *Potonieisporites swartsmani* n. sp., *Potonieisporites minimus* n. sp.

From the genus *Striomonosaccites* the following new species were described:

Striomonosaccites nigratus n. sp.,

Striomonosaccites striatus n. sp.,

Striomonosaccites oslavanensis n. sp.,

Striomonosaccites maior n. sp.

Lower Permian floras of Moravia and Slovakia have not been described so far. Thus the results here presented are a new contribution to information about Permian microflora and to solving biostratigraphical problems of the Late Paleozoic.

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Explanations to Plates XLV–LXXVI

Plate XLV

1–3. *Potonieisporites novicus*; A-59

Plate XLVI

1. *Potonieisporites novicus*; SEM, A-59

2. *Potonieisporites novicus*; SEM – detail of air sac

3. *Potonieisporites novicus*; SEM – detail of central body microstructure, A-59

Plate XLVII

1. *Potonieisporites bharadwaji* – dist. side, No. 114

2. *Potonieisporites bharadwaji* – prox. side, No. 114

Plate XLVIII

1. *Potonieisporites bharadwaji*; SEM, No. 114
2. *Potonieisporites bharadwaji*; SEM, No. 114
3. *Potonieisporites bharadwaji*; SEM, No. 114

Plate XLIX

1. *Potonieisporites solidus* f. *bianca* — prox. side
2. *Potonieisporites solidus* f. *bianca* — dist. side

Plate L

1. *Potonieisporites solidus* f. *bianca*; SEM
2. *Potonieisporites solidus* f. *bianca*; SEM — detail, contact of air sac with central body
3. *Potonieisporites solidus* f. *bianca*; SEM — detail, contact of air sac with central body

Plate LI

1. *Potonieisporites rotundus* n. sp.; prox. side, No. 178
2. *Potonieisporites rotundus* n. sp.; dist. side, No. 178

Plate LII

1. *Potonieisporites rotundus* n. sp.; SEM, No. 170
2. *Potonieisporites rotundus* n. sp.; SEM — detail of central body and air sac
3. *Potonieisporites rotundus* n. sp.; SEM — detail, of central body

Plate LIII

1. *Potonieisporites enormis* f. *radiatus* n. sp. — prox. side, No. 55
2. *Potonieisporites enormis* f. *radiatus* n. sp. — dist. side, No. 55

Plate LIV

1. *Potonieisporites enormis* f. *radiatus*; SEM, No. 55
2. *Potonieisporites enormis* f. *radiatus* — detail of monolete scar; SEM, No. 55
3. *Potonieisporites enormis* f. *radiatus* — detail of air sac and central body; SEM, No. 55

Plate LV

1. *Potonieisporites doubingeri* n. sp. — prox. side, No. 211
2. *Potonieisporites doubingeri* n. sp. — dist. side, No. 211

Plate LVI

1. *Potonieisporites doubingeri* n. sp.; SEM, No. 211
2. *Potonieisporites doubingeri* n. sp. — detail of central body; SEM, No. 211
3. *Potonieisporites doubingeri* n. sp. — detail of central body and air sac; SEM, No. 211

Plate LVII

1. *Potonieisporites grandis* — dist. side, No. 179
2. *Potonieisporites grandis* — prox. side, No. 179

Plate LVIII

1. *Potonieisporites* cf. *grandis* — prox. side, No. 158
2. *Potonieisporites* cf. *grandis* — dist. side, No. 158
3. *Potonieisporites* cf. *grandis* — air sac — dist. side, No. 158
4. *Potonieisporites* cf. *grandis* — detail monolete scar; SEM, No. 158

Plate LIX

1. *Potonieisporites sivaki* n. sp. — prox. side, No. 154
2. *Potonieisporites sivaki* n. sp. — dist. side, No. 154

Plate LX

1. *Potonieisporites sivaki* n. sp. — dist. side, No. 154
2. *Potonieisporites sivaki* n. sp. — dist. side; SEM, No. 154
3. *Potonieisporites sivaki* n. sp. — detail of monolete scar dist. side; SEM, No. 154

Plate LXI

1. *Potonieisporites* cf. *bilateralis* — dist. side, No. 94
2. *Potonieisporites* cf. *bilateralis* — prox. side, No. 113

Plate LXII

1. *Potonieisporites shwartsmani* n. sp. — prox. side, No. 52
2. *Potonieisporites shwartsmani* n. sp. — dist. side, No. 52

Plate LXIII

1. *Potonieisporites shwartsmani* n. sp.: SEM, No. 52
2. *Potonieisporites shwartsmani* n. sp. — detail; SEM, No. 52
3. *Potonieisporites shwartsmani* n. sp. — detail; SEM, No. 52

Plate LXIV

1. *Potonieisporites minimus* n. sp. — dist. side, No. 198
2. *Potonieisporites minimus* n. sp. — prox. side (holotype)
3. *Potonieisporites minimus* n. sp. — prox. side, No. 181
4. *Potonieisporites minimus* n. sp. — air sac dist. side, No. 181
5. *Potonieisporites minimus* n. sp.; SEM, No. 181
6. *Potonieisporites minimus* n. sp. — detail; SEM, No. 181

Plate LXV

1. *Potonieisporites* sp. A. — prox. side, No. 262
2. *Potonieisporites* sp. — dist. side, No. 262
3. *Potonieisporites* sp. — dist. side; SEM, No. 262
4. *Potonieisporites* sp. — detail dist. side, No. 262
5. *Potonieisporites* sp. A. — prox. side, No. 297

Plate LXVI

1. *Striomonosaccites* cf. *rotatus* — dist. side, No. 233
2. *Striomonosaccites* cf. *rotatus* — prox. side, No. 233

Plate LXVII

1. *Striomonosaccites nigratus* n. sp. — prox. side, No. 44
2. *Striomonosaccites nigratus* n. sp. — dist. side, No. 44

Plate LXVIII

1. *Striomonosaccites nigratus* n. sp.; SEM, No. 44
2. *Striomonosaccites nigratus* n. sp. — detail of structure of air sac; SEM, No. 44
3. *Striomonosaccites nigratus* n. sp. — detail of structure of central body; SEM, No. 44

Plate LXIX

1. *Striomonosaccites striatus* n. sp. — prox. side, No. 12
2. *Striomonosaccites striatus* n. sp. — dist side, No. 12

Plate LXX

1. *Striomonosaccites striatus*; SEM, No. 12
2. *Striomonosaccites striatus* — detail; SEM, No. 12

Plate LXXI

1. *Striomonosaccites oslavanensis* n. sp. – prox. side, No. 97
2. *Striomonosaccites oslavanensis* n. sp. – dist. side, No. 97
3. *Striomonosaccites* cf. *oslavanensis*, No. 188
4. *Striomonosaccites* cf. *oslavanensis*, No. 188

Plate LXXII

1. *Striomonosaccites oslavanensis*; SEM, No. 99
2. *Striomonosaccites oslavanensis* – detail of striae; SEM, No. 99
3. *Striomonosaccites oslavanensis* – detail of central body; SEM, No. 99

Plate LXXIII

1. *Striomonosaccites major* n. sp. – prox. side, No. 232
2. *Striomonosaccites major* n. sp. – dist. side, No. 232

Plate LXXIV

1. *Striomonosaccites major*; SEM, No. 232
2. *Striomonosaccites major* – detail of air sac; SEM, No. 232
3. *Striomonosaccites major* – detail of central body; SEM, No. 232

Plate LXXV

1. *Striomonosaccites* sp. „A“ – prox. side, No. 136
2. *Striomonosaccites* sp. „A“ – prox. side; SEM, No. 136

Plate LXXVI

1. *Striomonosaccites* cf. *nigratus* – prox. side, No. 136
2. *Striomonosaccites* cf. *nigratus* – prox. side; SEM, No. 136
3. *Striomonosaccites* cf. *nigratus* – detail of central body; prox. side, SEM, No. 136

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ERVÍN KNOBLOCH

Die jungtertiäre Flora des slowakischen Teils des Orava-Beckens

1 Karte in Text, 10 Tafeln (LXXVII–LXXXVI)

Abstrakt. Die Flora des slowakischen Teils des Orava-Beckens läßt sich durch zwei verschiedene Pflanzengesellschaften charakterisieren. Die Assoziation des mesophilen Waldes mit Vertretern der Gattungen *Ginkgo*, *Platanus*, *Ulmus*, *Castanea* und *Fagus* und eine feuchtigkeitsliebende bis wasserbewohnende Assoziation mit Vertretern der Gattungen *Glyptostrobus*, *Myrica*, *Typha*, *Decodon*, *Mneme*, *Cladium*, *Caldesia* und *Sparganium*. Die Flora beweist ein Alter der fossiliferen Schichten in der Spannweite Sarmat bis Pannon, wobei das pannonische Alter wahrscheinlicher ist.

Einleitung

Im Jahre 1967 begann Verfasser (vgl. E. KNOBLOCH 1968) mit paläofloristischen Studien im slowakischen Teil des Orava-Beckens bei dem Dorfe Nové Ústie (damals als Ústie n. priehr. benannt). Diese Aufsammlungen konnte Verfasser noch durch die Ausbeutung einer neuen, weiter nördlich von Nové Ústie gelegenen Fundstelle (Lok. D in dieser Arbeit) sowie durch das Schlämmen zahlreicher Bohrkernkerne ergänzen. Diesen Aufsammlungen ist im wesentlichen dieser Beitrag gewidmet.

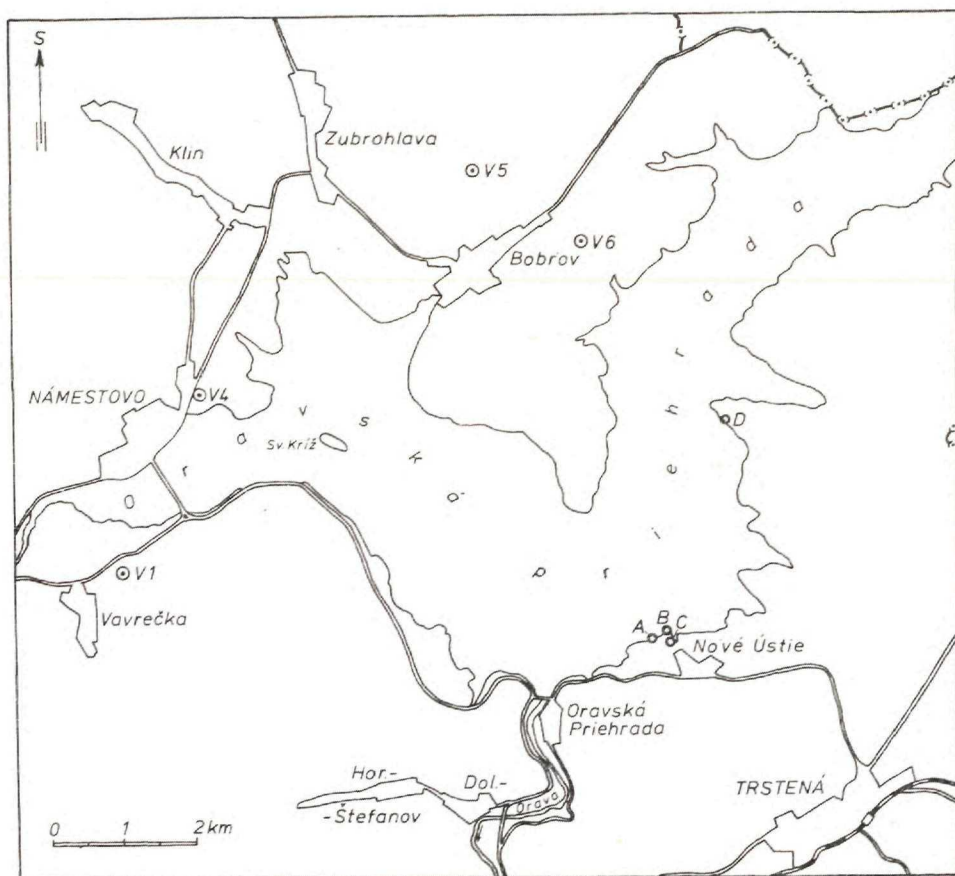
In den letzten Jahren erschienen einige wichtigere paläobotanische Arbeiten, in denen manche im Orava-Becken gefundenen Arten ausführlicher behandelt wurden, so daß es in vielen Fällen nicht notwendig erschien, bekannte Tatsachen zu wiederholen. Manche der inkohlten Samen und Früchte liegen bisher nur in wenigen Exemplaren vor, andere sind aus dem europäischen Jungtertiär wenig bekannt, was wiederum mit dem Umstand zusammenhängt, daß diese Sedimente zu wenig geschlämmt wurden.

Verfasser ist zu ganz besonders großen Dank Herrn Dr. D. H. MAI (Berlin) verbunden. Ohne dessen stete Hilfsbereitschaft und Konsultationen wäre die Bestimmung zahlreicher inkohlten Samen und Früchte nicht möglich gewesen.

Geologie und Fundumstände

Obwohl in verschiedenen Zeitabständen im Orava-Becken Bohrungen abgetäuft wurden, existiert über deren biostratigraphische und lithologisch-geologische Au-

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Die geologische Karte der einzelnen Fundstellen.

swertung keine ausführliche Schrift. Es wird wiederholt unterstrichen (vgl. z. B. Z. ROTH et al. 1963), daß es sich um eine pelitisch-sandige Beckenfüllung handelt, in der wenig mächtige Kohlenflözchen eingeschaltet sind. Diese Wechsellagerung wurde auch in der Bohrung V 6 – Bobrov bei Námestovo angetroffen, aus der besonders häufige Pflanzenreste gewonnen wurden.

Was die Fossilführung der einzelnen Tagesaufschlüsse im Prallhang des Orava-Staubekken anbelangt, so läßt sich eine direkte Abhängigkeit von der Lithofazies nachweisen. Im wesentlichen lassen sich zwei verschiedene Pflanzenassoziationen und zwei verschiedene Sedimenttypen nachweisen:

- gelbliche mehlsandige Tone bis tonige feinkörnige mürbe Sandsteine mit einer mesophilen Pflanzengesellschaft (*Fagus*, *Platanus*, *Ulmus*) d. h. die Fundstellen A, D.
- graue, fette Tone mit einer an sumpfiges Milieu gebundenen Pflanzengesellschaft, die einerseits durch Blätter belegt wird (*Betula*, *Byttneriophyllum*,

Fraxinus), andererseits durch Früchte und Samen (*Glyptostrobus*, *Mneme*, *Decodon*, *Myrica*, *Caldesia*, *Cladium*, *Typha*, *Sparganium*). Hierher gehören die Fundstellen B 1, B 2 und C.

Die Lage der einzelnen Fundstellen ist auf der Karte eingezeichnet. Aus kartographischen Gründen ist es nicht möglich die Fundstellen B 1 und B 2 auseinanderzuhalten. Als B (auf der Karte) und B 2 (im Text) wird die Fundstelle der grauen Tone mit Blätterresten bezeichnet, die geographisch zwischen der Fundstelle A und C (dem Flözausbiß) liegt. Als B 1 wird die Fundstelle von Samen und Früchten im Liegenden der Blatterschicht (Fundstelle A) bezeichnet. Es handelt sich bei der Fundstelle B 1 um graue Tone, die lithologisch und stratigraphisch den Tonen der Fundstelle B (B 2) entsprechen.

Systematischer Teil

Charophyta

Characeae gen. et sp. indet.

Bemerkungen: Es liegen nur einige wenige isolierte verkalkte Spiralzellen vor.

Vorkommen: Náместovo – V 4, 11,0–13,0 m (4 Fragm.), Nové Ústie, Lok. B 2 (6 Fragm.).

Lycopodiopsida

Selaginellaceae

Selaginella pliocenica P. I. DOROFEEV

Tafel LXXVIII, Fig. 22

1957 *Selaginella pliocenica* DOROF. – DOROFEEV, S. 489, Textabb. 1/1.

1963a *Selaginella pliocenica* DOROF. – DOROFEEV, S. 80, Taf. I, Fig. 1–4.

Bemerkungen: Megasporen der Gattung *Selaginella* wurden aus dem europäischen Tertiär bisher nur selten verzeichnet. Sie sind allerdings von zahlreichen Stellen in der Sowjetunion bekannt (vgl. z. B. DOROFEEV 1963a).

Vorkommen: Vavrečko – V 1, 12,8 m (1 Ex.), 13,0–14,0 m (3 Ex.), Bobrov – V 6, 18,0–20,0 m (1 Ex.), 21,0–22,0 m (5 Ex.).

Ginkgoopsida

Ginkgoaceae

Ginkgo adiantoides (UNGER) HEER

Tafel LXXXIII, Fig. 1

Bemerkungen: Diese sehr eindeutige Art wird bisher aus dem europäischen Neogen vor allem aus seinem jüngsten Teil angegeben – z. B. aus dem Pannon des

Wiener Beckens (BERGER 1955, E. KNOBLOCH 1969), aus dem Pliozän von Frankfurt a. M. (K. MÄDDLER 1939), aus den Transkarpaten (I. A. ILJINSKAJA 1968) sowie anderen Fundstellen. Die ältesten Funde stammen aus dem Miozän der Niederlausitz und dem wahrscheinlich Ober-Baden bis Sarmat des Plzeň-Beckens (F. NĚMEJC 1958).

Vorkommen: Nové Ústie, Lok. D (2 Ex.).

Pinopsida

Pinaceae

Tsuga sp.

Tafel LXXVIII, Fig. 29

Bemerkungen: Isolierte Nadelreste, die nach freundlicher Mitteilung von Herrn Dr. D. H. MAI (Berlin) zur Gattung *Tsuga* zu stellen sind.

Vorkommen: Bobrov-V 6, 26,8–27,0 m (8 Fragm.), 46,0–49,0 m (1 Fragm.).

Abies sp.

Tafel LXXVII, Fig. 1

Bemerkungen: Von dieser Gattung liegen nur Bruchstücke der Nadeln vor, die nach Mai (Berlin, mündl. Mitteilung) zur Gattung *Abies* zu stellen sind. W. SZAFER (1961) bildet von ihnen eine größere Menge von *Staré Gliwice* ab.

Vorkommen: Bobrov – V 6, 26,8–27,0 m (1 Fragm.), 46,0–49,0 m (1 Fragm.).

Picea sp.

Tafel LXXXIV, Fig. 9

Bemerkungen: Isolierte Nadelfragmente, die nach Mai (Berlin, mündl. Mitteilung) zur Gattung *Picea* gestellt werden können.

Vorkommen: Bobrov – V 6, 46,0–49,0 m (2 Fragm.).

Pinus sp.

Bemerkungen: Von dieser Gattung lag nur ein unvollständiges und zusammengedrücktes Kätzchen vor, das leider zerfallen ist.

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Fragm.).

Cupressaceae

Glyptostrobus europaeus (BRONGNIART) UNGER

Tafel LXXVIII, Fig. 19–21, 24

Vorkommen: Nové Ústie, Lok. B 2 (16 Fragm.), Lok. C (50 Fragm.), Bobrov – V 6, 20,0–21,0 (1 Fragm.), 21,0–22,0 m (2 Fragm.), 26,8–27,0 m (2 Fragm.), 46,0–49,0 M (2 Fragm.).

Magnoliopsida

? Saururaceae

***Carpolithes bilobatus* NIKITIN ex DOROFEEV**

Tafel LXXVIII, Fig. 27

1963a *Carpolithes bilobatus* NIKIT. – DOROFEEV, S. 277, Textabb. 37/2–3.

1965 *Carpolithes bilobatus* NIKIT. – NIKITIN, S. 92–93, Taf. XVIII, Fig. 12–13, Taf. XIX, Fig. 1–2.

Bemerkungen: Von dieser Art liegt nur 1 Tegmen vor. Nach Mai (Berlin, mündl. Mitteilung) gehört *Carpolithes bilobatus* NIKIT. ex DOROF. zur Gattung *Saururus*.

Vorkommen: Námestovo – V 4, 22,8–23,5 m (1 Ex.).

Ceratophyllaceae

***Ceratophyllum dubium* (LUDWIG) KIRCHHEIMER**

Tafel LXXVII, Fig. 25

Bemerkungen: Diese Art wird als *Ceratophyllum submersum* L. erst ab Pliozän bezeichnet. F. KIRCHHEIMER (1957, S. 130) nahm von dem Gebrauch des Namens der rezenten Art Abstand. Während *Ceratophyllum submersum* L., vielmehr *C. dubium* (LUDW.) KIRCHH. im mitteleuropäischen Tertiär erst ab Obermiozän erwähnt wird (KIRCHHEIMER 1957), kommt die Art in Westsibirien schon ab Oberoligozän vor (P. I. DOROFEEV 1963a).

Vorkommen: Nové Ústie, Lok. B 2 (1 Ex.).

? Schisandraceae

***Carpolithes reniculus* (LUDWIG) MENZEL**

Tafel LXXVII, fig. 24

1857 *Cytisus reniculus* LUDW. – LUDWIG, S. 101–102, Taf. 20, Fig. 21.

1913 *Carpolithes reniculus* (LUDW.) MENZ. – MENZEL, S. 19–20, Taf. 1, Fig. 37.

Bemerkungen: Von dieser Art liegt nur ein seitlich zusammengedrückter Same vor, deren Bestimmung ich Herrn Dr. D. H. MAI (Berlin) verdanke. Nach seiner mündlichen Mitteilung muß die Art zur Gattung *Schisandra* gestellt werden.

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Ex.).

Ranunculaceae

Batrachium sp.

Tafel LXXVII, Fig. 4–10

Bemerkungen: Breit-ovale bis rundliche Samen, deren Oberfläche von wurmförmigen, schwachen Verdickungen ornamentiert ist, wobei diese Verdickungen auch eine schwache polygonale Struktur bilden können. Eine Stellung bei der Gattung *Ranunculus* kann nicht ausgeschlossen werden.

Vorkommen: Nové Ústie, Lok. B 1 (55 Ex.).

Capparidaceae

“*Cleome*” *rugosa* (E. M. REID) DOROFEEV

Tafel LXXVII, Fig. 26

Bemerkungen: DOROFEEV (1963a) vergleicht die fossile Art vor allem mit den rezenten Arten *Cleome viscosa* L. und *C. simplicifolia* Hook et THOMS, die heute im Himalaya und China vegetieren. “*Cleome*” *rugosa* (E. M. REID) DOROF. wurde bisher aus dem europäischen Neogen nur ganz vereinzelt erwähnt (z. B. E. M. REID 1920), obwohl sie in der Sowjetunion vom Oligozän bis in das Pliozän verbreitet ist (vgl. verschiedene Arbeiten von P. I. DOROFEEV).

Vorkommen: Nové Ústie, Lok. B 1 (1 Ex.).

Myricaceae

Myrica ceriferiformis KOWNAS

Tafel LXXVII, Fig. 33–37

1955 *Myrica ceriferiformis* KOWNAS. – KOWNAS, S. 459–461, Textabb. I.

Bemerkungen: Von anderen fossilen *Myrica*-Arten unterscheidet sich diese Art durch die typischen großen Warzen auf der Oberfläche. Die Größe schwankt bei unseren Exemplaren zwischen 2,0–2,5 mm.

Vorkommen: Nové Ústie, Lok. B 2 (35 Ex.), Lok. C (15 Ex.).

Junglandaceae

Pterocarya sp.

Tafel LXXVIII, Fig. 13; Tafel LXXIX, Fig. 5, 6, 8

Vorkommen: Bobrov – V 6, 18,0–20,0 m (1 Ex.), 20,0–21,0 m (1 EX.), 46,0–49,0 m (2 Ex.).

Carya sp.

Tafel LXXXI, Fig. 7

Bemerkungen: Die keilförmige Basis eines Teilblattes ist einfach gezähnt. Die Zähne sind lang, nach vorn vorgezogen und ein wenig abgerundet. Die Sekundärnerven sind sehr zahlreich und relativ parallelverlaufend. Alle diese Merkmale – vor allem die Form der Basis – weisen eindeutig auf die Zugehörigkeit zur Gattung *Carya* hin.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Cercidiphyllaceae

Cercidiphyllum crenatum (UNGER) BROWN

Tafel LXXXIV, Fig. 5

Vorkommen: Nové Ústie, Lok. D (2 Ex.).

Betulaceae

Carpinus grandis UNGER emend. HEER

Tafel LXXIX, Fig. 3

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Carpinus cf. *betulus* L.

Tafel LXXVII, Fig. 22

Bemerkungen: Während im älteren Schrifttum (siehe zusammenfassend bei KIRCHHEIMER 1957) der größte Teil der jungtertiären *Carpinus*-Früchte mit der rezenten Art *Carpinus betulus* L. in Verbindung gebracht wurde, wurden in neuerer Zeit auch zahlreiche Arten definiert, die nicht direkt mit rezenten Arten in Verbindung gebracht werden (vgl. z. B. *Carpinus miocenica* NEGRU, *C. europaea* NEGRU–NEGRU 1972). J. JENTYS-SZAFEROWA (1961) konnte anhand ausführlicher anatomischer Untersuchungen an europäischen fossilen *Carpinus*-Früchten bestimmte Unterschiede in den Früchten aus verschiedenen alten Schichten feststellen. Sie spricht jedoch im wesentlichen auch nur von einem "betulus-Typ".

Vorkommen: Bobrov – V 6, 20,0–21,0 m, (1 Ex.), 26,8–27,0 m (1 Ex., 4 Fragm.).

Betula prisca ETTINGSHAUSEN

Tafel LXXX, Fig. 8

Bemerkungen: Obwohl das Blatt aus Nové Ústie relativ schlecht erhalten ist,

weist es alle wesentliche Merkmale der *Betula prisca* ETT. auf (Form, Basis, Anzahl der Sekundärnerven).

Vorkommen: Nové Ústie, Lok. A (1 Ex.).

Betula cf. longisquamosa MÄDLER

Tafel LXXVII, Fig. 20–21

1939 *Betula longisquamosa* MÄDLER–MÄDLER, S. 73–75, Taf. 6, Fig. 21.

Bemerkungen: (K. MÄDLER (1939) beschrieb vor allem anhand von zahlreichen Fruchtschuppen die neue Art *Betula longisquamosa*. Zu ihnen stellt er auch Früchte, die vielleicht mit den unseren artgleich oder artverwandt sind. Unsere Früchte sind vollkommen flachgedrückt und etwas kleiner (Länge 1,6 mm, Breite 1,1 mm).

Vorkommen: Bobrov – V 6, 26,8–27,0 m (1 Ex.), 46,0–49,0 m (1 Ex.).

Corylus sp.

Bemerkungen: Die bisherigen Funde der Gattung *Corylus*, die aus dem europäischen Neogen und älteren Quartär anhand von Früchten beschrieben wurden, werden meistens direkt mit der rezenten *Corylus avellana* L. in Verbindung gebracht (E. M. REID–G. REID 1913, K. MÄDLER 1939, D. H. MAI in D. H. MAI–J. MAJEWSKI–K. P. UNGER 1963, W. SZAFAER 1947, R. KRÄUSEL 1937, zusammenfassend vgl. ? KIRCHHEIMER 1957). Eine Ausnahme bilden einige Funde aus Krościenko (W. SZAFAER 1947), die auch mit *C. maxima* MILLER und *C. rostrata* AITON in Verbindung gebracht werden. Anhand unseres einzigen Fundes scheint es zu spekulativ zu sein, sich zu dieser Frage eindeutig äußern zu wollen.

Obwohl Blattreste auch aus verschiedenen miozänen Schichten des europäischen Tertiärs erwähnt werden, scheinen die Fruchtreste vor allem auf pliozäne und jüngere Schichten beschränkt zu sein.

Vorkommen: Bobrov – V 6, 20,0–21,0 m.

cf. *Alnus* sp.

Tafel LXXXIII, Fig. 5

Bemerkungen: Die gegabelten, relativ zahlreichen Sekundärnerven in Verbindung mit dem gezahntem Blattrand und der fragmentarisch erhaltenen Blattform weisen auf die mögliche Zugehörigkeit zur Gattung *Alnus* hin.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

***Betulaceae* gen. et sp. indet.**

Tafel LXXX, Fig. 2–4; Tafel LXXXIV, Fig. 1,8; Tafel LXXXV, Fig. 3; Tafel LXXXVI, Fig. 5

In der Schicht grauer Tone von Nové Ústie (Lok. B auf der Karte) kommen im

wesentlichen nur Betulaceen-Reste vor, zu denen sich noch häufig die als *Cyperacites* sp. beschriebenen Blätter gesellen. In untergeordneter Menge treten auch *Byttneriophyllum*, *Acer* und *Fraxinus* auf.

Die Blätter der Betulaceen-Schicht lassen sich nicht gut als Einzelexemplare isolieren und die Variabilität der einzelnen Arten, soweit überhaupt mehrere vorhanden sind, läßt sich schlecht feststellen. Einige dieser Reste untersuchte Herr Dr. KVAČEK (Prag) kutikular-analytisch. Das auf Taf. LXXX, Fig. 3 abgebildete Blatt bezeichnete er anhand dieser Studien als *Betula macrophylla* GOEPP., das auf Taf. LXXX, Fig. 4 abgebildete Blatt als *Betula* cf. *macrophylla* GOEPP. Verfasser vertritt diese Ansicht nur zum Teil, da er sich nicht vorstellen kann, daß zu den relativ breiten Blättern auch die breit-lanzettlichen Blätter gehören sollen. Ebenfalls die Zugehörigkeit zur Gattung *Betula* scheint nicht allen in Fällen als gesichert. Bei manchen Blättern scheint eine Zugehörigkeit zur Gattung *Alnus* oder *Carpinus* nicht ausgeschlossen zu sein. Da es in diesem Falle zu viele offene Fragen gibt, nimmt er einstweilen von einer artlichen Bestimmung Abstand.

Vorkommen: Nové Ústie, Lok. B (20 Ex.).

Fagaceae

Quercus latifolia (SORDELLI) KNOBLOCH

Tafel LXXIX, Fig. 4

1878 *Castanea ungeri* HEER.—ZWANZIGER, S. 38, Taf. IX, Fig. 3, Taf. X, XI.

1896 *Castanea latifolia* SORD.—SORDELLI, S. 224–225, Taf. 39, 40.

1959 *Quercus pontica miocenica* KUBÁT.—ANDREÁNSZKY, S. 107, Taf. XXIX,

1969 *Quercus latifolia* (SORD.) KNOBL.—KNOBLOCH, S. 88–90, Textabb. 212–213, Taf. XXII, Fig. 4, Taf. XXIII, fig. 2, 4, Taf. XL, Fig. 2.

Bemerkungen: Die fossilen Reste unterscheiden sich von der rezenten Art *Quercus pontica* K. KOCH (vgl. V. SITÁR 1968, Taf. XLVI) durch den unterschiedlichen Verlauf der tertiären Nervatur. Es ist daher mehr zutreffend für die fossilen Reste den Namen einer ausgestorbenen Art zu gebrauchen.

Quercus latifolia (SORD.) KNOBL. ist bisher vor allem aus dem Sarmat und Pliozän bekannt. Diese Art läßt sich mitunter von *Castanea atavica* UNG. schwer abgrenzen, unterscheidet sich im wesentlichen vor allem durch die ausgesprochen großen Blätter.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Fagus cf. *grandifolia* EHRH. foss.

Tafel LXXIX, Fig. 12; Tafel LXXXI, Fig. 3, Tafel LXXXIII, Fig. 4, Tafel LXXXIV, Fig. 3, Tafel LXXXV, Fig. 6

(?)1847 *Fagus castaneaefolia* UNG.—UNGER, S. 104–105, Taf. XXVIII, Fig. 1.

(?)1959 *Fagus aperta* ANDREÁNSZKY.—ANDREÁNSZKY, S. 97, Abb. 79, Taf. XXV, Fig. 5.

1959 *Fagus* cfr. *grandifolia* EHRH.—ANDREÁNSZKY, S. 96–97, Abb. 81–82, Taf. XXVI, Fig. 1, 2.

Beschreibung: Blätter länglich-oval, Basis keilförmig (niemals typisch herzförmig), schwach herzförmig oder abgerundet. Rand mit kleinen Zähnen besetzt in die die Sekundärnerven münden, der Rand ist auch oftmals gewellt, wie dies bei Buchenblättern üblich ist. Die Sekundärnerven verlaufen gerade, im unteren Blatteil zweigen sie unter weniger spitzen Winkeln ab als im mittleren Teil, wo sich der Winkelgrad zwischen 40–60° bewegt. Die Enden der Sekundärnerven konvergieren der Spitze zu. Ihre Anzahl schwankt zwischen 11 und 14, gewöhnlich sind es 14.

Bemerkungen: Die Taxonomie der fossilen *Fagus*-Reste aus Nové Ústie zu klären ist keine einfache Aufgabe. Außer anderem handelt es sich einerseits um die Beziehungen zu bestimmten rezenten Arten, andererseits zu fossilen Blättern, die mit den Namen rezenter Arten belegt wurden. Die wichtigsten Funde seien in diesem Zusammenhang kurz notiert.

Mit den Funden aus Nové Ústie stimmen artlich die Blätter aus Willershausen (Oberpliozän) überein, die TRALAU (1962, Taf. IV) als *Fagus grandifolia* EHRH. bezeichnet. Das gleiche gilt von *Fagus* cfr. *grandifolia* EHRH. und *Fagus aperta* ANDR. bei G. ANDREÁNSZKY (1959). Die Übereinstimmung ist in erster Linie in der hohen Zahl der Sekundärnerven, in ihrem geraden Verlauf, der Blattform und der Form der Basis gegeben. Demgegenüber lassen sich unsere Funde nicht mit den Blättern vergleichen, die K. MÄDLER (1939, S. 83–84, Taf. 7, Fig. 21–22, Textabb. 27–28) aus dem Unterpliozän von Frankfurt a. Main erwähnt. Sie unterscheiden sich von unseren Blättern durch die geringere Zahl der Sekundärnerven (7–10), die größeren Zähne und im Durchschnitt auch in einer unterschiedlichen Blattform. Unklar sind auch die Beziehungen zu *Fagus attenuata* GOEPP. im Sinne der ursprünglichen Abbildung (GOEPPERT 1855, Taf. V, Fig. 9) aus Sośnice (ovale Form, 11, maximal 12 Sekundärnervenpaare). Eine kleine Anzahl von Sekundärnerven (rund 10) weisen auch andere Blätter aus dem schlesischen Tertiär auf (vgl. REICHENBACH in KRÄUSEL 1919, Taf. 11, Fig. 4, 5, Taf. 12, Fig. 22). Andere Blätter (ibid., Textabb. 12–13) können auch 12 Sekundärnerven haben.

Einige Blätter, die P. MENZEL (1906, S. 48–62, Taf. III, Fig. 4, 5, 10–12, Taf. VIII, Fig. 15) als *Fagus ferruginea* AIT., *miocenica* abbildet, scheinen nähere Beziehungen zu unseren Funden aufzuweisen. Wie Menzel erwähnt, standen ihm eine große Menge Blätter zur Verfügung. Als typisch erwähnt er folgende Werte: Länge: 4–9 cm, Breite: 2,5–4,5 cm, Sekundärnervenzahl: 8–13, Winkel der Sekundärnerven: 30–60°. Wenn wir von dieser Charakteristik ausgehen, stellen wir fest, das wir die im Durchschnitt länger als 10 cm großen Blätter mit 14 Sekundärnervenpaaren aus Nové Ústie nicht hierher stellen können.

Die Blätter aus dem Ober-Baden von Smolkov in Nordmähren (E. KNOBLOCH 1969) haben eine geringere Anzahl von Sekundärnerven, sind nicht vollkommen gerade und zwischen den Zähnen, in die die Sekundärnerven münden lassen sich noch weitere kleinere Zähne feststellen. Es handelt sich daher in diesem Falle um einen wirklich typischen *Fagus attenuata* GOEPP. Gleichfalls die Blätter aus dem Pannon des Wiener Beckens, die Verfasser (E. KNOBLOCH 1969) als *Fagus haidingeri* Kov. sensu novo erwähnte, unterscheiden sich im Durchschnitt durch kleinere

Dimensionen und eine kleinere Anzahl der Sekundärnerven. Demgegenüber müssen die Blätter, die E. ZASTAWNIAK (1972) von der Fundstelle Domański Wierch als *Fagus haidingeri* KOV. sensu KNOBL. erwähnt, zu der hier behandelten Art gestellt werden.

Die Bezeichnung unserer Blätter (*Fagus* cfr. *grandifolia* EHRH. foss.) ist nur eine provisorische Bezeichnung.

Vorkommen: Nové Ústie, Lok. A. (58 Ex.), Lok. D (14 Ex.).

Castanea atavia UNGER

Tafel LXXXIII, Fig. 9; Tafel LXXXIV, Fig. 9

Bemerkungen: Die Blätter aus dem Orava-Becken, obwohl wenig zahlreich, sind morphologisch gesehen, recht variabel. Gegenüber von anderen Fundstellen sind die Blätter aus Nové Ústie im Durchschnitt etwas breiter.

Vorkommen: Nové Ústie, Lok. D (8 Ex.).

Hamamelidaceae

Liquidambar europaea AL. BRAUN

Tafel LXXXI, Fig. 2

Bemerkungen: Von dieser Gattung wurde auch ein nicht ausgereifter Samen gefunden.

Vorkommen: Nové Ústie, Lok. B 2 (1 Ex.).

Platanaceae

Platanus leucophylla (Unger) KNOBLOCH

Tafel LXXXIII, Fig. 8

1850 *Populus leucophylla* UNG.—UNGER, S. 417.

1971 *Platanus leucophylla* (UNG.) KNOBL.—KNOBLOCH, S. 264.

Bemerkungen: Diese Art ist eindeutig bestimmbar, wenn "normal" entwickelte dreilappige Blätter vorliegen, die schon an anderer Stelle ausführlich behandelt wurden (E. KNOBLOCH 1969, E. ZASTAWNIAK 1972). Diese Blätter liegen auch aus Nové Ústie vor. An dieser Stelle soll nur ein wenig eindeutiges einfaches, jedoch relativ typisch gezähntes Blatt zur Abbildung kommen.

Vorkommen: Nové Ústie, Lok. A. (16 Ex.), Lok. D (8 Ex.).

Moraceae

Morus sp.

Tafel LXXVII, Fig. 27

Bemerkungen: Die nächsten Beziehungen scheinen bei unserem unvollständig

erhaltenen Exemplar zu *Morus moldavica* DOROFEEV et NEGRU vorhanden zu sein (vgl. NEGRU 1972).

Vorkommen: Bobrov – V 6, 46,0–49,0 m (1 Ex.).

Ulmaceae

Ulmus pyramidalis GOEPPERT

Tafel LXXX, Fig. 5, 9; Taf. LXXXIV, Fig. 4, 7; Taf. LXXXV, Fig. 2, 4; Taf. LXXXVI, Fig. 1–4, 6–8

Bemerkungen: Die Ulmenblätter aus Nové Ústie sind recht polymorph. Neben relativ großen und breiten Blättern, die nicht als typische Blätter von *Ulmus pyramidalis* GOEPP. bezeichnet werden können, kommen kleinere, sehr breite, wahrscheinlich einfach gezähnte Blätter vor, die Verfasser (E. KNOBLOCH 1969) von den typisch pyramidalen als *Ulmus minuta* GOEPP. als eine selbständige Art behandelte, vor. Weiter wurden auch lanzeitliche Formen mit gabelig geteilten Sekundärnerven festgestellt (vgl. Taf. LXXXV, Fig. 2), die wiederum anders bezeichnet werden könnten. Die Ansichten der einzelnen Autoren unterscheiden sich bei der Beurteilung der morphologisch-systematischen Merkmale bei der Gattung *Ulmus* recht beträchtlich. Während die einen (z. B. I. A. ILJINSKAJA 1968) einige Arten unterscheiden, sprechen andere (z. B. Č. BŮŽEK 1971) nur von einer Art oder die Reste werden nicht artlich bestimmt (z. B. *Ulmus* div. sp. bei E. ZASTAWNIAK 1972).

Vorkommen: Nové Ústie, Lok. D (22 Ex.).

Rosaceae

Rubus sp.

Tafel LXXVIII, Fig. 40

Bemerkungen: Die wenig zahlreichen *Rubus*-Reste weisen auf eine nicht unbeträchtliche Variabilität hin, die erst bei zahlreicheren Populationen erfaßbar ist.

Vorkommen: Nové Ústie, Lok. C (2 Ex.), Bobrov – V 6, 20,0–21,0 m (1 Ex.), 26,8–27,0 m (1 Ex.).

Actinidiaceae

Actinidia cf. *faveolata* C. et E. M. REID

Tafel LXXVII, Fig. 2

1915 *Actinidia faveolata* C. et E. M. REID. – C. REID. – E. M. REID, S. 117–118, Taf. 13, Fig. 1–4.

Bemerkungen: Nach F. KIRCHHEIMER (1957) ist diese Art in Europa nur aus dem Pliozän bekannt. D. H. MAI (1967) konnte diese Angabe weitgehend korrigieren und sie schon aus dem Oberoligozän nachweisen. Zu unterstreichen ist ferner, daß sie nach den Untersuchungen von Mai vor allem an die warm-gemäßigten Zeitabschnitte gebunden ist und vor allem in den jüngeren Florenzonen häufiger vorkommt als in den älteren. Da bisher aus dem mitteleuropäischen Tertiär nur zwei

Actinidia-Arten beschrieben wurden, ist die Zugehörigkeit unseres Bruchstückes zu *Actinidia faveolata* wegen der typischen Oberflächenstruktur wahrscheinlich.

Vorkommen: Bobrov – V 6, 18,0–20,0 m (1 Ex.), 20,0–21,0 m (1 Ex.).

Hypericaceae

Hypericum sp.

Tafel LXXVII, Fig. 38

Beschreibung: Samen walzenförmig, mit rund 30 in Längsreihen angeordneten sechseckigen Grübchen ornamentiert. Größe: 1,0 × 0,4 mm.

Bemerkungen: Von anderen in der Literatur veröffentlichten Resten (C. REID–E. M. REID 1907, P. DOROFEEV 1968a) unterscheidet sich diese Art in der höheren Anzahl der in Längsreihen angeordneten Grübchen.

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Ex.).

Ericaceae

Andromeda sp.

Tafel LXXVII, Fig. 3

Beschreibung: Samen oval, ungerade, braun, zusammengedrückt. Oberfläche mit sehr feinen, gekrümmten Grübchen besetzt. Größe: 2,3 × 1,7 mm.

Bemerkungen: Der abgebildete Samen aus dem Orava-Becken ist beträchtlich größer als die bisher unveröffentlichten Funde aus dem Tertiär der DDR. Er ist auch größer als die veröffentlichten Arten aus dem Tertiär der Sowjetunion (P. I. DOROFEEV 1963a). Soweit ein Vergleich nur anhand von Abbildungen aus dem Tertiär Sibiriens berechtigt ist, läßt sich unser Fund nur mit *Andromeda brunnea* DOROF. vergleichen.

Vorkommen: Námestovo – V 4, 22,0–22,8 m (1 Ex.), Nové Ústie, Lok. B 2 (1 Ex.).

Salicaceae

Salix cf. *lavateri* AL. BRAUN sensu HANTKE

Bemerkungen: Außer den weiter erwähnten und als cf. *Salix* sp. beschriebenen Blatt kommt in der Flora aus Nové Ústie noch ein zweites Blatt vor, das ganz sicher zur Gattung *Salix* gehört. Es ist mit größter Wahrscheinlichkeit ganzrandig, 9 × 1,2 cm groß, hat lange Sekundärnerven, die sich mit sehr häufigen kleinen Schlingen miteinander verbinden. Leider ist es nicht so gut erhalten, so daß es eine gute photographische Wiedergabe gestatten würde.

R. HANTKE (1954) stellt zu ganzrandigen *Salix*-Arten auch gezähnte Arten.

Verfasser vertritt diese Ansicht nicht. Wenn er seinen Fund zu dieser Art stellt, geschieht dies deswegen, weil es den Anschein hat, daß er an manchen Stellen auch fein gezähnt sein könnte.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

? *Salicaceae*

cf. *Salix* sp.

Tafel LXXXII, Fig. 5

Bemerkungen: Ein ganzrandiges lanzettliches Blatt mit einem ausgesprochen starken Mittelnerv und sehr steilen Verlauf der Sekundärnerven. Alle diese Merkmale weisen auf die Zugehörigkeit zur Gattung *Salix* hin, ohne daß vielleicht auch eine andere systematische Einstufung vollkommen ausgeschlossen werden könnte.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

? *Populus* sp.

Tafel LXXX, Fig. 1

Bemerkungen: Ein morphologisch schlecht erhaltener Rest. Nach den kutikularanalytischen Untersuchungen von Herrn Dr. KVAČEK (Prag) dürfte der Rest zur Gattung? *Populus* zu stellen sein. Nach Ansicht des Verfassers sprechen die Sägezähne gegen diese Zuordnung.

Vorkommen: Nové Ústie, Lok. B 2 (1 Ex.).

Violaceae

Viola sp.

Tafel LXXIX, Fig. 10

Bemerkungen: Ein flachgedrückter Samen, der nach freundlicher Mitteilung von Herrn Dr. Mai (Berlin) zur Gattung *Viola* zu stellen ist. Ähnlich wie auch andere Gattungen, die anhand von fossilen Samen und Früchten aus dem Orava-Becken bekannt sind, ist die Gattung *Viola* bisher aus Europa vor allem aus dem Pliozän bekannt (zusammenfassend vgl. F. KIRCHHEIMER 1957).

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Ex.).

Asteraceae gen. et sp. indet.

Tafel LXXVIII, Fig. 32, 33

Bemerkungen: Die vorliegenden Reste können nur die Anwesenheit der Compositen in der bearbeiteten Flora beweisen.

Verbreitung: Bobrov – V 6, 20,0–21,0 m (2 Ex.).

Euphorbiaceae

Phyllanthus sp.

Tafel LXXVIII, Fig. 17

Bemerkungen: Von den bisher beschriebenen Arten der Gattung *Phyllanthus* (vgl. besonders P. DOROFEEV 1963a) könnte unser stark verdrückter Samen nur mit *Phyllanthus compassica* DOROF. in Verbindung gebracht werden.

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Ex.).

Sterculiaceae

Byttneriophyllum tiliaefolium (AL. BRAUN) KNOBLOCH et KVAČEK

Tafel LXXXII, Fig. 1

Bemerkungen: Dieser Art widmeten E. KNOBLOCH und KVAČEK (1965) aufgrund der Funde aus dem Pannon des Wiener Beckens eine ausführliche Studie.

Verbreitung: Nové Ústie, Lok. B 2 (2 Ex.), Lok. D (2 Ex.).

? Meliaceae

“*Cedrela*” *sarmatica* É. KOVÁCS

Tafel LXXXV, Fig. 1

Bemerkungen: Lanzettliche Blätter mit relativ parallel verlaufenden ganzrandigen Rändern sind unter verschiedenen Namen bekannt. Für eines unserer Blätter ist eine bestimmte Ungleichseitigkeit bemerkenswert, die sich im unterschiedlichen Winkel der Sekundärnerven bemerkbar macht. Gleiche Blätter werden in letzter Zeit sowohl zur Gattung *Juglans* (vgl. z. B. *Juglans acuminata* AL. BRAUN et UNGER, vgl. Č. BŮŽEK 1971, Textabb. 3a) oder auch *Cedrela* (vgl. z. B. *Cedrela sarmatica* É. KOV., G. ANDREÁNSZKY 1959, Taf. XLV, Fig. 1)

Vorkommen: Nové Ústie, Lok. D (2 Ex.).

Oleaceae

Fraxinus sp.

Tafel LXXX, Fig. 7

Bemerkungen: Ein ovales Blatt, dessen Bezeichnung nur undeutlich erkennbar

ist. Die Sekundärnerven sind bogenläufig. Die Stellung bei der Gattung *Fraxinus* konnte anhand von kutikularanalytischen Studien von Herrn Dr. KVAČEK (Prag) festgestellt werden.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Lythraceae

Mneme menzelii (E. M. REID) EYDE

Tafel LXXVIII, Fig. 1–4

Vorkommen: Nové Ústie, Lok. B 1 (15 Ex.), Lok. B 2 (8 Ex.), Lok. C (1 Ex.),
Námestovo – V 4, 22,0–23,5 m (3 Ex.), 26,5–27,0 m (6 Ex.).

Decodon globosus (E. M. REID) NIKITIN

Tafel LXXVIII, Fig. 5–11, 14–16

Vorkommen: Nové Ústie, Lok. B 1 (130 Ex.), Lok. B 2 (65 Ex.), Lok. C (1 Ex.).

Trapaceae

Trapa moravica OPRAVIL et KNOBLOCH

Tafel LXXIX, Fig. 7, 9

Vorkommen: Nové Ústie, Lok. B 2 (18 Reste von Hörnern, 11 Nüßchen).

Halorrhagaceae

Proserpinaca reticulata C. et E. M. REID

Tafel LXXVIII, Fig. 25, 26, 34

Bemerkungen: Diese sehr charakteristischen Fossilien wurden bisher vor allem aus dem holländischen und polnischen Pliozän eingehend beschrieben.

Vorkommen: Nové Ústie, Lok. B 2 (1 Ex.), Námestovo – V 4, 22,0–22,8 m (2 Ex.), 22,8–23,5 m (1 Ex.).

Vitaceae

Vitis cf. *teutonica* AL. BRAUN

Tafel LXXVIII, Fig. 41

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Ex.).

Anacardiaceae

aff. "*Rhus*" sp.

Tafel LXXXI, Fig. 4

Beschreibung: Ein länglich-ovales Blatt bei dem die unter wenig spitzen Winkeln verlaufenden Sekundärnerven sich spalten oder auch ohne Spaltung in sehr typische, relativ große, beiderseitig ausgebauchte Zähne des Blattrandes verlaufen.

Bemerkungen: Was die fossilen Blätter anbelangt, so bildet ähnliche, wenn nicht gleiche Blätter A. N. KRIŠTOFOVIČ—T. N. BAJKOVSKAJA (1965, Taf. XXIII, Fig. 10, 11, 11a) als *Rhus noeggerathii* WEB. aus dem Sarmat von Krynka ab (diese dürften mit den anderen unter gleichen Namen abgebildeten Blättern nicht art- und gattungsgleich sein). *Rhus*- (oder *Anacardiaceen*-Blätter) weisen zwar eine ähnliche Form der Zähne des Blattrandes auf, der Verlauf der Sekundärnerven ist jedoch durchwegs unterschiedlich gestaltet (vgl. H. WEYLAND 1941, Taf. XXII, Fig. R 8, Taf. XXIII, R 3, R 4, A. N. KRIŠTOFOVIČ—T. N. BAJKOVSKAJA 1965, Taf. XXIII, Fig. 12).

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Aceraceae

Acer tricuspidatum BRONN

Tafel LXXXVI, Fig. 9

Bemerkungen: Diese Art kommt in Nové Ústie nur ganz selten vor.

Vorkommen: Nové Ústie, Lok. B 1 (3 Ex.), Lok. D (1 Ex.).

Acer cf. hungaricum ANDREÁNSZKY

Tafel LXXXII, Fig. 4; Tafel LXXXIII, Fig. 7

1955–6 *Acer hungaricum* ANDREÁNSZKY.—ANDREÁNSZKY, S. 200, Taf. XXV, Fig. 1, 2.

(?) 1959 *Acer hungaricum* ANDREÁNSZKY.—ANDREÁNSZKY, S. 163, Taf. L, Fig. 8.

1968 *Acer hungaricum* ANDREÁNSZKY.—ILJINSKAJA, S. 67, Taf. V, Fig. 1, Taf. XX, Fig. 2.

Bemerkungen: Gegenüber von *Acer tricuspidatum* BRONN ist für diese Art der vollkommen unterschiedliche Verlauf der Basalnerven bemerkenswert. Gleichfalls die Größe und das Verhältnis der Seitenlappen zum Mittellappen sind anders ausgebildet.

Vorkommen: Nové Ústie, Lok. A (1 Ex.), Lok. D (2 Ex.).

? Aceraceae

? *Acer* sp. 1

Tafel LXXXI, Fig. 1

Beschreibung: Ein zweilappiges Blatt mit relativ schmalen Lappen bei denen

von den bogenläufigen und sich mit Schlingen verbindenden Sekundärnerven Nerven abzweigen, die in ganz kleine Zähnedes Blattrandes münden.

Bemerkungen: Es dürfte sich um ein reduziertes dreilappiges Blatt handeln, dessen Zugehörigkeit zu den Aceraceen wegen den sehr kleinen Zähnen nicht gegeben sein dürfte.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

? *Acer* sp. 2

Tafel LXXXI, Fig. 6

Beschreibung: Ein Blatt mit wahrscheinlich drei Hauptlappen, wobei die Lappen ganzrandig zu sein scheinen. Die Sekundärnerven verbinden sich miteinander durch Schlingen, an die sich weitere kleine Bögen anschmiegen.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

? *Cornaceae* – ? *Onagraceae*

Hartziella rosenkjaeri (HARTZ) SZAHER

Tafel LXXVII, Fig. 14–19

1909 *Carpolithes rosenkjaeri* HARTZ. – HARTZ, S. 113, Taf. IV, Fig. 1–15.

1963 *Hartziella rosenkjaeri* (HARTZ) SZAHER. – SZAHER, S. 27

1963a *Carpolithes rosenkjaeri* HARTZ. – DOROFEEV, S. 276, Textabb. 36.

Bemerkungen: Dieser Art widmete eine ausführliche Studie SZAHER (1963). Die bisher beschriebenen Funde dieser Art weisen weniger deutliche kantige Verstärkungen der Oberfläche auf, wobei auf diesen Leitbündel verlaufen.

Vorkommen: Nové Ústie, Lok. B 1 (80 Ex.), Lok. B 2 (1 Ex.), Bobrov – V 6, 20,0–21,0 m (5 Ex.).

Araliaceae

Aralia sp. vel *Acanthopanax* sp.

Tafel LXXIX, Fig. 13–14

Bemerkungen: Endokarprien von *Araliaceen* wurden bisher nur selten im europäischen karpologischen Schrifttum erwähnt (z. B. W. SZAHER 1947). Zahlreiche Arten beschrieb aus dem sibirischen Tertiär P. I. DOROFEEV (1963a). Seine Abbildungen sind jedoch nicht so eindeutig und unser Material nicht so gut erhalten, daß artliche Beziehungen geklärt werden könnten.

Vorkommen: Bobrov – V 6, 20,0–21,0 m (2 Ex.).

Lamiaceae

Ajuga cf. *antiqua* C. et E. M. REID

Tafel LXXVII, Fig. 11

1915 *Ajuga antiqua* C. et E. M. REID. – C. REID – E. M. REID, S. 122, Taf. 16, Fig. 13, 14

Bemerkungen: Von den bisherigen fossilen Funden dieser Art unterscheidet sich das Nüßchen aus Bobrov durch das unterschiedliche Länge/Breite – Verhältnis (unser Nüßchen ist 2,1 mm lang und 1,1 mm breit). Die typische, in Längsrichtung angeordnete Netzstruktur ist die gleiche.

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Ex.).

Magnoliopsida gen. et sp. indet.

Unter *Dicotylophyllum* sp. 1–4 werden vier verschiedene Blatt-Typen zusammengefaßt, die zwar in Sinne der bisherigen Literatur zumindestens teilweise bestimmbar sind – deren richtige Einstufung im Sinne des natürlichen Systems aber kaum gewährleistet ist.

Dicotylophyllum sp. 1

Tafel LXXXIV, Fig. 6

Beschreibung: Ein ganzrandiges, ovales, beiderseitig allmählich zugespitztes Blatt. Die Sekundärnerven entspringen unter spitzen Winkeln, sind bogenläufig und gabeln sich.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Dicotylophyllum sp. 2

Tafel LXXXIII, Fig. 3

Beschreibung: Ein breit-ovales Blatt mit bogenläufigen Sekundärnerven, die sich mit Schlingen miteinander verbinden. Zwischen den Sekundärnerven verlaufen zum Mittelnerv fast senkrecht orientierte Tertiärnerven.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Dicotylophyllum sp. 3

Tafel LXXXII, Fig. 3

Beschreibung: Ein längliches Blatt mit relativ auffallend parallel verlaufenden Rändern, die mit verhältnismäßig großen Sägezähnen besetzt sind. In diese enden fast gerade (oder ganz schwach gekrümmte) Sekundärnerven, deren Enden sich gabeln, wobei jeder Gabelast in einen Zahn mündet.

Bemerkungen: Gleiche oder zumindestens sehr ähnliche Blätter bildete BERGER (1952, Abb. 61–62) als *Carya serraefolia* ab. Nach Ansicht des Verfassers ist die Zugehörigkeit des Blattes aus Nové Ústie zu den Juglandaceen nicht gegeben.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Dicotylophyllum sp. 4

Tafel LXXXII, Fig. 6

Beschreibung: Ein unterer Blatteil mit einer abgestutzten Basis. Die basalen sowie höherliegenden Sekundärnerven entspringen unter spitzen Winkeln, verbinden sich – soweit sichtbar – bogenläufig. Wesentlich erscheint das bogenläufige Maschennetz in der unteren rechten Blatthälfte, wobei in den schlingenförmigen Bögen sich ein loses Maschennetz erkennen läßt.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Monocotyledonae

Smilacaceae

Smilax weberi WESSEL in WESSEL et WEBER

Tafel LXXXII, Fig. 2; Tafel LXXXV, Fig. 5

Bemerkungen: Über diese Art berichten ausführlich BŮŽEK (1971) und KNOBLOCH–KVAČEK (1976).

Vorkommen: Nové Ústie, Lok. D (2 Ex.).

Cyperaceae

Scirpus sp.

Tafel LXXVIII, Fig. 12, 13, 23

Vorkommen: Bobrov – V 6, 20,0–21,0 m (1 Ex.), Námestovo – V 4, 22,8–23,5 m (4 Ex.).

Cladium oligovasculare MAI in KNOBLOCH

Tafel LXXVII, Fig. 28–32

1978 *Cladium oligovasculare* MAI.–KNOBLOCH, S. 158–159, Taf. I, Fig. 1–3, 8, 9.

Beschreibung: Früchte eiförmig mit abgestutzter Basis und allmählich zulaufenden fleischigen Griffel. Steinkerne eiförmig, mit wenige stark aufgeblähten Mittelteil, mit 3–5 tief eingeschnittenen meridionalen Leitbündelfurchen, Halsteil sehr kurz, stark verengt. Länge: 1,1–1,6 mm, Breite: 0,9–1,1 mm.

Bemerkungen: Diese Art ist bisher nur aus dem Untermiozän von Šafov und aus dem Tertiär der DDR bekannt (E. KNOBLOCH 1978).

Vorkommen: Nové Ústie, Lok. B 1 (2 Ex.), Lok. C (4 Ex.), Bobrov – V 6, 20,0–21,0 m (1 Ex.).

Cyperacites sp.

Tafel LXXXIII, Fig. 2

Bemerkungen: Die bisherigen Abbildungen der *Cyperacites*-Arten sind nicht so eindeutig, daß es möglich wäre unsere Reste zu einer bestimmten Art der Gattung *Cyperites*, vielmehr *Cyperacites* zu stellen.

Vorkommen: Nové Ústie, Lok. B 2 (4 Ex.).

Sparganiaceae

Sparganium neglectum BEEBY foss.

Tafel LXXVII, Fig. 23; Tafel LXXX, Fig. 6; Tafel LXXXI, Fig. 5

Bemerkungen: Dieser Art wurde eine ausführliche Studie gewidmet in der auch die Funde aus dem Orava-Becken eingehend behandelt wurden (vgl. KNOBLOCH–MAI 1975).

Vorkommen: Nové Ústie, Lok. B 1 (150 Ex.), Lok. B 2 (5 Ex.), Lok. C (3 Ex.).

Sparganium nanum DOROFEEV in KOLAKOVSKIJ

Tafel LXXVIII, Fig. 18

1915 *Sparganium* cf. *simplex* FRIES. – REID–REID, S. 57, Taf. I, Fig. 18.

1958 *Sparganium nanum* DOROF. – KOLAKOVSKIJ, S. 325–326, Taf. VII, Fig. 2–5.

Bemerkungen: Unser einziges Exemplar (1,4 × 0,8 mm groß) ist mit *Sparganium* cf. *simplex* FRIES aus Reuver (C. REID–E. M. REID 1915) gleichgestaltet. Von anderen zu dieser Art gestellten Endokarprien (vgl. W. SZAFER 1954, Taf. XX, Fig. 1–5, 1961, Taf. XXV, Fig. 9–14) unterscheidet sich unser Fossil durch die geringere Breite und die Zuspitzung. Zu *Sparganium neglectum* BEEBY foss. mit der die Art vieles gemeinsam hat, kann dieser Rest nicht gestellt werden, da er beträchtlich kleiner ist (vgl. D. H. MAI–E. KNOBLOCH 1975). Unser Fund stimmt vollkommen mit *Sparganium nanum* DOROF. in KOLAK. aus der Bohrung Kunovice überein (KNOBLOCH 1976b).

Vorkommen: Námestovo – V 4, 22,8–23,5 m (1 Ex.).

Typhaceae

Typha sp.

Tafel LXXVIII, Fig. 35–39

Bemerkungen: Inkohlte Reste der Reproduktionsorgane der Gattung *Typha* wurden bisher aus dem europäischen Tertiär nur selten erwähnt (z. B. W. SZAFER 1961). Sie wurden aber wegen der kleinen Dimensionen jedoch eher übersehen. Wie das zahlreiche, unveröffentlichte Material von D. H. MAI (Berlin) beweist, war die Gattung mit zahlreichen Arten in der DDR verbreitet.

Vorkommen: Nové Ústie, Lok. B 1 (700 Ex.), B 2 (40 Ex.), Bobrov – V 6 4,0–5,0 m (10 Ex.), Vavrečko – V 1, 12,8 m (7 Ex.).

Alismataceae

Caldesia cylindrica (E. M. REID) DOROFEEV

Tafel LXXVII, Fig. 12, 13

1920 *Myriophyllum cylindricum* REID. – REID, S. 71–72, Taf. IV, Fig. 2, 4.

1960 *Caldesia tertiaria* DOROF. – DOROFEEV, S. 1424–1426, Taf. II, Fig. 10.

1963a *Caldesia cylindrica* (E. M. REID) DOROF. – DOROFEEV, S. 110–111, Textabb. 17/10, Taf. X, Fig. 1–7.

Bemerkungen: In bezug auf die bisher aus dem Tertiär beschriebenen Funde weisen unsere Exemplare keine bemerkenswerten Unterschiede auf. Diese Art wurde bisher aus dem tschechoslowakischen Tertiär nur aus dem Pannon der Umgebung von Těmice nachgewiesen (E. KNOBLOCH in P. ČTYROKÝ – E. KNOBLOCH 1976).

Vorkommen: Nové Ústie, Lok. C (4 Ex.).

Potamogetonaceae

Potamogeton aff. *kunovicensis* KNOBLOCH

Tafel LXXVIII, Fig. 30; Tafel LXXIX, Fig. 12

1977 *Potamogeton kunovicensis* KNOBL. – KNOBLOCH, S. 35–36, Taf. I, Fig. 20–26.

Bemerkungen: Dies Funde aus Nové Ústie unterscheiden sich von den Typen dieser Art in der Größe sowie der deutlicheren Dickwandigkeit.

Vorkommen: Nové Ústie, Lok. B 2 (8 Ex.).

Potamogeton dubnanensis KNOBLOCH

Tafel LXXIX, Fig. 1, 2, 11

1977 *Potamogeton dubnanensis* KNOBL. – KNOBLOCH, S. 33–35, Taf. I, Fig. 1–19

Bemerkungen: Die Funde aus dem Orava-Becken weisen die gleiche Variabili-

tät sowie die gleichen seitlichen Verdrückungen auf wie die Funde aus Dubňany (vgl. E. KNOBLOCH 1977).

Vorkommen: Bobrov – V 6, 25,0–26,0 m (13 Ex.), Nové Ústie, Lok. B 2, (3 Ex.), Lok. C (2 Ex.).

Zingiberaceae

***Spirematospermum wetzleri* (HEER) CHANDLER**

Tafel LXXVIII, Fig. 28

Bemerkungen: Die bisherigen Funde faßten B. E. KOCH und W. L. FRIEDRICH (1971) zusammen. Sie wiesen bei den fossilen Resten auf Beziehungen zum rezenten *Cenolophon oxymitrum* (SCHUM.) HOLTUM (*Zingiberaceae*) aus Thailand hin.

Vorkommen: Nové Ústie, Lok. B 2 (7 Ex.), Námestovo – V 4, 22,8–22,5 m (1 Ex.).

***Monocotyledonae* gen. et sp. indet.**

Tafel LXXXII, Fig. 7

Beschreibung: Ein bandförmiges, beiderseitig allmählich zugespitztes Blatt. In der Mitte wird es durch einen relativ dicken (1,5 mm) Leitbündelstrang durchzogen. Beiderseitig von ihm verlaufen in nicht genau gleichen Abständen (rund 4 mm) stärkere Nerven zwischen denen wiederum feinere Nerven sichtbar sind.

Vorkommen: Nové Ústie, Lok. D (1 Ex.).

Stratigraphische Bemerkungen

Eine Übersicht über die stratigraphischen Ansichten anderer Forscher hinsichtlich des Alters der Beckenfüllung des Orava-Beckens wurde schon früher gegeben (vgl. E. KNOBLOCH 1968). Bei eigenen früheren Ausführungen kam Verfasser zur Feststellung, daß diese Beckenfüllung in das Sarmat zu stellen sei, wobei das Ober-Torton (= Ober-Baden in der heutigen Auffassung, vielmehr Kosovien nach der neuesten Nomenklatur) und pannonische Alter nicht ausgeschlossen werden kann.

Diese Feststellung kann noch durch einige neuere Erkenntnisse ergänzt werden.

Zahlreiche in dieser Arbeit beschriebenen Reste sind – soweit es die stratigraphische Reichweite anbelangt – bisher nicht genügend bekannt, da im europäischen Tertiär bisher nicht genügend Sedimente geschlämmt wurden, so daß die stratigraphische Reichweite von einigen Arten nur vorgetäuscht sein kann. Die folgenden Bemerkungen müssen daher unter diesem Blickwinkel betrachtet werden.

Übersicht der nachgewiesenen Arten

	Nové Ústie, Lok. A	Nové Ústie, Lok. B 1	Nové Ústie, Lok. B 2	Nové Ústie, Lok. C	Nové Ústie, Lok. D	Námestovo - V 1	Námestovo - V 4	Bobrov - 6
Characeae gen. et sp. indet.			6					
Selaginella pliocenica DOROFEEV						4	4	6
Ginkgo adiantoides (UNGER) HEER					2			
Tsuga sp.								7
Abies sp.								2
Picea sp.								2
Pinus sp.								1
Glyptostrobus europaeus (BRONGNIART) UNGER			16	50				7
Carpolithes bilobatus NIKITIN ex DOROFEEV							1	
Ceratophyllum dubium (LUDWIG) KIRCHHEIMER			1					
Carpolithes reniculus (LUDWIG) MENZEL								1
Batrachium sp.		55						
"Cleome" rugosa (E. M. REID) DOROFEEV		1						
Myrica ceriferiformis KOWNAS			35	15				
Pterocarya sp.								4
Carya sp.					1			
Cercidiphyllum crenatum (UNGER) BROWN					2			
Carpinus grandis UNGER emend HEER					1			
Carpinus cf. betulus L.								5
Corylus sp.								1
Betula prisca ETTINGSHAUSEN					1			
Betula cf. longisquamosa MÄDLER								2
Betulaceae gen. et sp. indet.			20					
cf. Alnus sp.					1			
Quercus latifolia (SORDELLI) KNOBLOCH					1			
Castanea atavia UNGER					8			
Fagus cf. grandifolia EHRH. FOSS.	58				14			
Liquidambar europaea AL. BRAUN			1					
Platanus leucophylla (UNGER) KNOBLOCH	16				8			
Morus sp.								1
Ulmus pyramidalis GOEPPERT					22			
Rubus sp.				2				2
Actinidia cf. faveolata C. et E. M. REID								2
Hypericum sp.								1
Andromeda sp.			1				1	
Salix cf. lavateri AL. BRAUN sensu HANTKE					1			
cf. Salix sp.					1			
? Populus sp.			1					1
Viola sp.								1
Asteraceae gen. et sp. indet.								2
Phyllanthus sp.								1

Fortsetzung der Tab.

	Nové Ústie, Lok. A	Nové Ústie, Lok. B 1	Nové Ústie, Lok. B 2	Nové Ústie, Lok. C	Nové Ústie, Lok. D	Námestovo – V 1	Námestovo – V 4	Bobrov – V 6
<i>Byttneriophyllum tiliaefolium</i> (AL. BRAUN)								
Knobloch et Kváček			2		2			
"Cedrela" sarmatica Ě. Kovács					2			
<i>Fraxinus</i> sp.								
<i>Mneme menzelii</i> (E. M. Reid) Eyde		15	8	1			9	
<i>Decodon globosus</i> (E. M. Reid) Nikitin		130	65	1				
<i>Trapa</i> cf. <i>moravica</i> Opravil et Knobloch			29					
<i>Proserpinaca reticulata</i> C. et E. M. Reid			1				3	
<i>Vitis</i> cf. <i>teutonica</i> AL. Braun								1
aff. "Rhus" sp.								1
<i>Acer tricuspidatum</i> Bronn.		3			1			
<i>Acer</i> cf. <i>hungaricum</i> Andreánszky	1				2			
? <i>Acer</i> sp. 1					1			
? <i>Acer</i> sp. 2					1			
<i>Hartziella rosenkjaeri</i> (Hartz) Szafer		80	1					5
<i>Aralia</i> sp. vel <i>Acanthopanax</i> sp.								5
<i>Ajuga</i> cf. <i>antiqua</i> C. et E. M. Reid								1
<i>Dicotylophyllum</i> sp. 1								1
<i>Dicotylophyllum</i> sp. 2								1
<i>Dicotylophyllum</i> sp. 3								1
<i>Dicotylophyllum</i> sp. 3								1
<i>Smilax weberi</i> Wessel in Wessel et Weber					2			
<i>Scirpus</i> sp.								
<i>Cladium oligovasculare</i> Mai in Knobloch		2		4			4	1
<i>Cyperacites</i> sp.			4					1
<i>Sparganium neglectum</i> Beeby foss.		150		3				
<i>Sparganium nanum</i> Dorofeev in Kolakovskij							1	
<i>Typha</i> sp.		700				7		10
<i>Caldesia cylindrica</i> (E. M. Reid) Dorofeev				4				
<i>Potamogeton</i> aff. <i>kunovicensis</i> Knobloch			8					
<i>Potamogeton dubnanensis</i> Knobloch			3	2				13
<i>Spirematospermum wetzleri</i> (Heer) Chandler			7				1	
<i>Monocotyledonae</i> gen. et sp. indet.					1			

Sparganium neglectum BEEBY foss. Bisher wird die Art vor allem aus dem Pannon, Pliozän und Quartär angeführt. Die ältesten Funde sind aus dem höheren Miozän aus den Florenzonen X–XIII im Sinne von D. H. MAI (1967) bekannt.

Abies sp. Die Gattung ist erst aus den jüngeren miozänen Ablagerungen bekannt. Das älteste Vorkommen der Nadelreste wird aus Staré Gliwice (Sarmat – W. SZAFFER 1963) erwähnt.

Ajuga cf. *antiqua* REID. Die Art wird nur aus dem Pliozän erwähnt.

Batrachium sp. wurde bisher nur selten erwähnt.

Betula latisquamosa MÄDLER ist aus dem Pliozän von Frankfurt bekannt.

Caldesia cylindrica (REID) DOROF. wurde bisher nur aus dem Pliozän sowie Pannon von Polen und Mähren (W. SZAFFER 1947, P. ČTYROKÝ–E. KNOBLOCH 1976) sowie aus dem Sarmat bis Mäot von Weißrußland (P. I. DOROFEEV 1960) und aus dem Pleistozän von Weißrußland (P. I. DOROFEEV 1963b) beschrieben, wenn wir allerdings von den älteren Funden aus dem Tertiär Sibiriens absehen (P. I. DOROFEEV 1963a).

Ceratophyllum dubium (LUDW.) KIRCHH. erwähnt KIRCHHEIMER (1957) erst ab Pliozän.

Hypericum sp. wurde bisher nur ganz vereinzelt aus dem Pliozän erwähnt (C. REID–E. M. REID 1907), obwohl das Vorkommen auch in stratigraphisch älteren Ablagerungen nicht ausgeschlossen werden kann.

Myrica ceriferiformis KOWNAS ist eine Art, die vom Obermiozän bis in das Pliozän verbreitet ist.

Morus sp. Die Gattung scheint bisher nur aus dem jüngeren Sarmat aus Moldavien beschrieben worden sein (A. G. NEGRU 1972).

Außer den erwähnten Samen und Früchten kommen in den Floren von Námestovo, Bobrov und Nové Ústie zahlreiche Gattungen vor, die ebenfalls an die jüngsten Zeitabschnitte des Neogens gebunden sein scheinen (*Typha* sp., *Viola* sp., *Tsuga* sp., *Sparganium nanum* DOROF. ex KOLAK., *Selaginella pliocenica* DOROF., *Potamogeton* aff. *kunovicensis* KNOBL., *P. dubnanensis* KNOBL., *Picea* sp., *Phyllanthus* sp., *Corylus* sp. und *Trapa* cf. *moravica* OPR. et KNOBL.).

Da den Untersuchungen von fossilen Blätterresten bisher mehr Interesse entgegengebracht wurde als den karpologischen Forschungen sind erstere auch besser bekannt. Dennoch weisen einige von ihnen im wesentlichen nur eine stratigraphische Verbreitung von Obermiozän (Sarmat, höchstens Ober-Baden) bis in das Pliozän auf. In diese Gruppe gehören *Ginkgo adantoides* (UNG.) HEER, *Bytneriophyllum tiliaefolium* (AL. BRAUN) KNOBL. et KVAČ., *Fagus* cf. *grandifolia* EHRH. foss., *Platanus leucophylla* (UNG.) KNOBL., *Quercus latifolia* (SORD.) KNOBL., "*Cedrela*" *sarmatica* E. KOV. und *Acer* cf. *hungaricum* ANDREÁNSZKY.

Aus allen angeführten Angaben geht eindeutig der jungmiozäne Charakter der gesamten Pflanzengesellschaft hervor. Die Funde gestatten eine Einstufung in die

Zeitspanne Sarmat bis Pannon. Während die bisherigen Blätterfunde keine andere Einstufung gestatten, weisen die Samen und Früchte eher auf ein pannonisches Alter hin. Es ist schwierig zu entscheiden, welcher Konzeption der Vorzug gegeben werden soll. Verfasser neigt zur Ansicht, daß die fossilführenden Schichten zur Zeit eher in das Pannon als in das Sarmat gestellt werden sollten. Dazu verleiten ihn die zahlreichen Formen, die bisher nur aus dem Pliozän bekannt sind, das Vorkommen von einigen Koniferen mit ebenfalls sehr jungtertiären Gepräge sowie die Anwesenheit eines nicht unwesentlichen Bestandes von Pflanzen von krautigem Wuchs.

Bemerkungen zur Ökologie

Wie schon früher bemerkt wurde (E. KNOBLOCH 1968) existieren im Prinzip im slowakischen Teil des Orava-Beckens zwei ökologisch unterschiedlich gestaltete Pflanzengesellschaften: die Assoziation des mesophilen Laubwaldes und die Assoziation des Sumpfwaldes (incl. der wasserbewohnenden Pflanzengesellschaften). Beide sind auch an eine bestimmte Lithofazies gebunden. Die Assoziation des mesophilen Laubwaldes stammt aus gelblichen mehlsandigen Tönen und wird von Vertretern der Gattungen *Fagus*, *Platanus*, *Ulmus*, *Acer*, *Ginkgo* und *Castanea* gebildet. Die feuchtigkeitsliebende Gesellschaft stammt aus grauen Tönen und soweit es die Blätter anbelangt setzt sie sich aus Vertretern der Familie Betulaceae, Monokotylen, den Gattungen *Byttneriophyllum*, *Fraxinus* und *Acer* zusammen. Die Früchte und Samen aus den gleichen Tönen gehören vor allem Vertretern der Gattungen *Myrica*, *Tyrpha*, *Decodon*, *Mneme*, *Cladium*, *Caldesia*, *Trapa*, *Glyptostrobos*, *Potamogeton*, *Sparganium*, *Spirematospermum*, *Cladiocaria* und *Rubus* an.

Die Beziehungen zu anderen mitteleuropäischen jungtertiären Floren

Die engsten Beziehungen weist die Blätterflora aus Nové Ústie verständlicherweise zur Flora des Domański Wierch am Dunajec in Polen auf (E. ZASTAWNIAK 1972), obwohl dort zahlreiche Reste mit anderen Namen belegt sind. Von den gemeinsam vorkommenden Arten sind vor allem die nicht eindeutig bestimmbar Blätter aus der Gruppe der Betulaceae, weiter *Fagus* cfr. *grandifolia* EHRH. foss., *Castanea atavia* UNG., *Quercus latifolia* (SORD.) KNOBL., *Liquidambar europaea* AL. BRAUN, *Platanus leucophylla* (UNG.) KNOBL. und die als *Cyperacites* sp. beschriebenen Blätter zu nennen. In Nové Ústie fehlen bisher von den wesentlicheren Arten des Domański Wierch *Cornus* cf. *mas* L., *Quercus pseudocastanea* GOEPP., *Parrotia pristina* (ETT.) STUR und *Acer vindobonensis* (ETT.) BERGER.

Viele gemeinsame Arten weist die Blätterflora von Nové Ústie auch zu mit den Blätterfloren aus dem Pannon des Wiener Beckens auf (BERGER 1955, E. KNOBLOCH 1969), aber auch zu anderen jungtertiären Floren, z. B. aus dem Turiec-Becken der mittleren Slowakei (V. SITÁR 1968).

Die Samen- und Früchte-Flora weist natürlich besonders enge Beziehungen zur bisher nur in einer vorläufigen Mitteilung erwähnten Flora von Chyž im polnischen

Teil des Orava-Beckens auf M. LANČUCKA-ŠRODONIOWA 1963), allerdings auch zu anderen jungterziären Floren. Da jedoch diese Floren meistens artenreicher sind können diese Beziehungen auch nur vorgetäuscht sein (etwa bei den Fundstellen Mizerna – W. SZAFAER 1954, KROŚCIENKO – W. SZAFAER 1947).

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Tafelerläuterungen LXXVII–LXXXVI

Tafel LXXVII

1. *Abies* sp., Bobrov, V – 6, 46,0–49,0 m, 7,5 x.
2. *Actinidia* cf. *faveolata* C. et E. M. REID, Bobrov, V 6, 20,0–21,0 m, 20 x.
3. *Andromeda* sp., Námostovo, V – 4, 22,0–22,8 m, 10x.
- 4.–10. *Batrachium* sp., Nové Ústie, Lok. B 1, 20x.
11. *Ajuga* cf. *antiqua* REID, Bobrov, V – 6, 20,0–21,0 m, 20x.
- 12.–13. *Caldesia cylindrica* (E. M. REID) DOROFEEV, Nové Ústie, Lok. C, 15x.
- 14.–19. *Hartziella rosenkjaeri* (HARTZ) SZAFER, Nové Ústie, Lok. C, 6,5x.
20. *Betula* cf. *longisquamosa* MÄDLER, Bobrov, V – 6, 26,8–27,0 m, 15x.
21. *Betula* cf. *longisquamosa* MÄDLER, Bobrov, V-6, 46,0–49,0 m, 10x.
22. *Carpinus* cf. *betulus* L., Bobrov, V-6, 20,0–21,0 m, 6,5x.
23. *Sparganium neglectum* BEEBY foss., Nové Ústie, Lok. B 1, 10x.
24. *Carpolithes reniculus* (LUDWIG) KIRCHHEIMER, Bobrov, V-6, 20,0–21,0 m, 10x.
25. *Ceratophyllum dubium* (LUDWIG) KIRCHHEIMER, Nové Ústie, Lok. B 2, 6,5x.
26. "*Cleome*" *rugosa* (E. M. REID) DOROFEEV, Nové Ústie, Lok. B 1, 10x.
27. *Morus* sp., Bobrov, V-6, 46,0–49,0 m, 20x.
- 28.–32. *Cladium oligovascularis* MAI in KNOBLOCH, Nové Ústie, Lok. C, 20x.
- 33.–37. *Myrica ceriferiformis* KOWNAS, Nové Ústie, Lok. B 2, 10x.
38. *Hypericum* sp., Bobrov V-6, 20,0–21,0 m, 20x.

Tafel LXXVIII

- 1.–2. *Mneme menzelii* (E. M. REID) EYDE, Námostovo, V-4, 26,5–27,0 m, 6,5x.
- 3.–4. *Mneme menzelii* (E. M. REID) EYDE, Nové Ústie, Lok. B 2, 6,5x.
- 5.–11. *Decodon globosus* (E. M. REID) NIKITIN, Nové Ústie, Lok. B 1, 20x.
- 12.–13. *Scirpus* sp., Námostovo, V-4, 22,8–23,5 m, 10x.
- 14.–16. *Decodon globosus* (E. M. REID) NIKITIN, Nové Ústie, Lok. B 1, 10x.
17. *Phyllanthus* sp., Bobrov, V-6, 20,0–21,0 m, 25x.
18. *Sparganium nanum* DOROFEEV in KOLAKOVSKIJ, Námostovo, V-4, 22,8–23,5 m, 20x.
19. *Glyptostrobus europaeus* (BRONGNIART) UNGER, Nové Ústie, Lok. C, 6,5x.
20. *Glyptostrobus europaeus* (BRONGNIART) UNGER, Bobrov V-6, 21,0–22,0 m, 6,5x.
21. *Glyptostrobus europaeus* (BRONGNIART) UNGER, Nové Ústie, Lok. B 2, 6,5x.
22. *Selaginella pliocenica* DOROFEEV, Námostovo, V-1, 13,0–14,0 m, 30x.
23. *Scirpus* sp., Námostovo, V-4, 22,8–23,5 m, 10x.
24. *Glyptostrobus europaeus* (BRONGNIART) UNGER, Nové Ústie, Lok. C, 6,5x.
- 25.–26. *Proserpinaca reticulata* C. et E. M. REID, Námostovo, V-4, 22,0–22,8 m, 10x.
27. *Carpolithes bilobatus* NIKITIN, Námostovo, V-4, 22,8–23,5 m, 30x.
28. *Spiromatospermum wetzleri* (HEER) CHANDLER, Nové Ústie, Lok. B 2, 6,5x.
29. *Tsuga* sp., Bobrov, V-6, 46,0–49,0 m, 10x.
30. *Potamogeton* cf. *kunovicensis* KNOBLOCH, Nové Ústie, Lok. B 2, 10x.
31. *Pterocarya* sp., Bobrov, V-6, 18,0–20,0 m, 10x.
- 32.–33. *Asteraceae* gen. et sp. indet., Bobrov, V-6, 20,0–21,0 m, 6,5x.
34. *Proserpinaca reticulata* C. et E. M. REID, Námostovo, V-4, 22,8–23,5 m, 6,5x.
- 35.–39. *Typha* sp., Nové Ústie, Lok. B 2, 20x.

40. *Rubus* sp., Nové Ústie, Lok. C, 20×.
41. *Vitis* cf. *teutonica* AL. BRAUN, Bobrov, V-6, 20,0–21,0 m, 6,5×.

Tafel LXXIX

- 1.–2. *Potamogeton dubnanensis* KNOBLOCH, Nové Ústie, Lok. B 2, 15×.
3. *Carpinus grandis* UNGER emend. HEER, Nové Ústie, Lok. D, 2×.
4. *Quercus latifolia* (SORDELLI) KNOBLOCH, Nové Ústie, Lok. D, 1:1.
- 5.–6. *Pterocarya* sp., Bobrov, V-6, 46,0–49,0 M, 10×.
7. *Trapa moravica* OPRAVIL et KNOBLOCH, Nové Ústie, Lok. B 2, 15×.
8. *Pterocarya* sp., Bobrov, V-6, 20,0–21,0 m, 10×.
10. *Viola* sp., Bobrov, V-6, 20,0–21,0 m, 20×.
11. *Potamogeton dubnanensis* KNOBLOCH, Nové Ústie, Lok. C, 20×.
12. *Potamogeton* aff. *kunovicensis* KNOBLOCH, Nové Ústie, Lok. B 2, 20×.
- 13, 14. *Aralia* sp. vel *Acanthopanax* sp., Bobrov, V-6, 20,0–21,0 m, 13–10×, 14–15×.

Tafel LXXX

- 1.? *Populus* sp., Nové Ústie, Lok. B 2, 1:1.
- 2.–4. *Betulaceae* gen. et sp. indet., Nové Ústie, Lok. B 2, 1:1.
5. *Ulmus pyramidalis* GOEPPERT, Nové Ústie, Lok. D, 1:1.
6. *Sparganium neglectum* BEEBY foss., Nové Ústie, Lok. B 1, 10×.
7. *Fraxinus* sp., Nové Ústie, Lok. B 2, 1:1.
8. *Betula prisca* ETTINGSHAUSEN, Nové Ústie, Lok. D, 1:1.
9. *Ulmus pyramidalis* Goepfert, Nové Ústie, Lok. D, 1:1.

Tafel LXXXI

1. ?*Acer* sp. 1, Nové Ústie, Lok. D, 0,75×.
2. *Liquidambar europaea* AL. BRAUN, Nové Ústie, Lok. B 2, 16×.
3. *Fagus* cf. *grandifolia* EHRH. foss., Nové Ústie, Lok. D, 0,75×.
4. aff. "*Rhus*" sp., Nové Ústie, Lok. D, 1,1×.
5. *Sparganium neglectum* BEEBY foss., Nové Ústie, Lok. B 1, 0,75×.
6. ?*Acer* sp. 2, Nové Ústie, Lok. D, 0,75×.
7. *Carya* sp., Nové Ústie, Lok. D, 1,1×.

Tafel LXXXII

1. *Byttneriophyllum tiliaefolium* (AL. BRAUN) KNOBLOCH et KVAČEK, Nové Ústie, Lok. D, 0,75×.
2. *Smilax weberi* WESSEL in WESSEL et WEBER, Nové Ústie, Lok. D, 1,1×.
3. *Dicotylophyllum* sp. 3, Nové Ústie, Lok. D, 1,5×.
4. *Acer* cf. *hungaricum* ANDREÁNSZKY, Nové Ústie, Lok. D, 0,75×.
5. cf. *Salix* sp., Nové Ústie, Lok. D, 1,1×.
6. *Dicotylophyllum* sp. 4, Nové Ústie, Lok. D, 0,75×.
7. *Monocotyledonae* gen. et sp. indet., Nové Ústie, Lok. D, 1,5×.

Tafel LXXXIII

1. *Ginkgo adiantoides* (UNGER) HEER, Nové Ústie, Lok. D, 1,1×.
2. *Cyperacites* sp., Nové Ústie, Lok. B 2, 2,2×.
3. *Dicotylophyllum* sp. 2, Nové Ústie, Lok. D, 0,75×.
4. *Fagus* cf. *grandifolia* EHRH. foss. Nové Ústie, Lok. A, 0,75×.
5. cf. *Alnus* sp., Nové Ústie, Lok. D, 1,1×.
6. *Potamogeton dubnanensis* KNOBLOCH, Nové Ústie, Lok. B 2, 1,1×.
7. *Acer* cf. *hungaricum* ANDREÁNSZKY, Nové Ústie, Lok. A, 0,75×.
8. *Platanus leucophylla* (UNGER) KNOBLOCH, Nové Ústie, Lok. D, 1,1×.
9. *Castanea atavia* UNGER, Nové Ústie, Lok. D, 0,75×.

Tafel LXXXIV

1. *Betulaceae* gen. et sp. indet., Nové Ústie, Lok. B 2, 0,75×.
2. *Castanea atavia* UNGER, Nové Ústie, Lok. D, 0,75×.
3. *Fagus* cf. *grandifolia* EHRH. foss., Nové Ústie, Lok. D, 0,75×.
4. *Ulmus pyramidalis* GOEPPERT, Nové Ústie, Lok. D, 0,75×.
5. *Cercidiphyllum crenatum* (UNGER) BROWN, Nové Ústie, Lok. D, 1,1×.
6. *Dicotylophyllum* sp. 1, Nové Ústie, Lok. D, 0,75×.
7. *Ulmus pyramidalis* GOEPPERT, Nové Ústie, Lok. D, 0,75×.
8. *Betulaceae* gen. et sp. indet., Nové Ústie, Lok. B 2, 0,75×.
9. *Picea* sp., Bobrov, V-6, 46,0–49,0 m, 15×.

Tafel LXXXV

1. "*Cedrela*" *sarmatica* É. KOVACS, Nové Ústie, Lok. D, 0,75×.
2. *Ulmus pyramidalis* GOEPPERT, Nové Ústie, Lok. D, 1,5×.
3. *Betulaceae* gen. et sp. indet., Nové Ústie, Lok. B 2, 0,75×.
4. *Ulmus pyramidalis* GOEPPERT, Nové Ústie, Lok. D, 1,1×.
5. *Smilax weberi* WESSEL in WESSEL et WEBER, Nové Ústie, Lok. D, 1,1×.
6. *Fagus* cf. *grandifolia* EHRH. foss., Nové Ústie, Lok. D, 1,1×.

Tafel LXXXVI

- 1.–4. *Ulmus pyramidalis* GOEPPERT, Nové Ústie, 1–3 – Lok. D, 4 – Lok. B 2. 1–2 – 1,1×, 3 – 1,5×, 4 – 0,75×.
5. *Betulaceae* gen. et sp. indet., Nové Ústie, Lok. B 2, 0,75×.
- 6.–8. *Ulmus pyramidalis* GOEPPERT, Nové Ústie, Lok. D, 6 – 1,5×, 7–8 – 0,75×.
9. *Acer tricuspidatum* BRONN, Nové Ústie, Lok. B 2, 0,75×.

ZÁPADNÉ KARPATY

SÉRIA

paleontológia 5

Vydal Geologický ústav Dionýza Štúra vo vydavateľskom oprávnení Vedy, vydavateľstva Slovenskej akadémie vied v Bratislave roku 1980.

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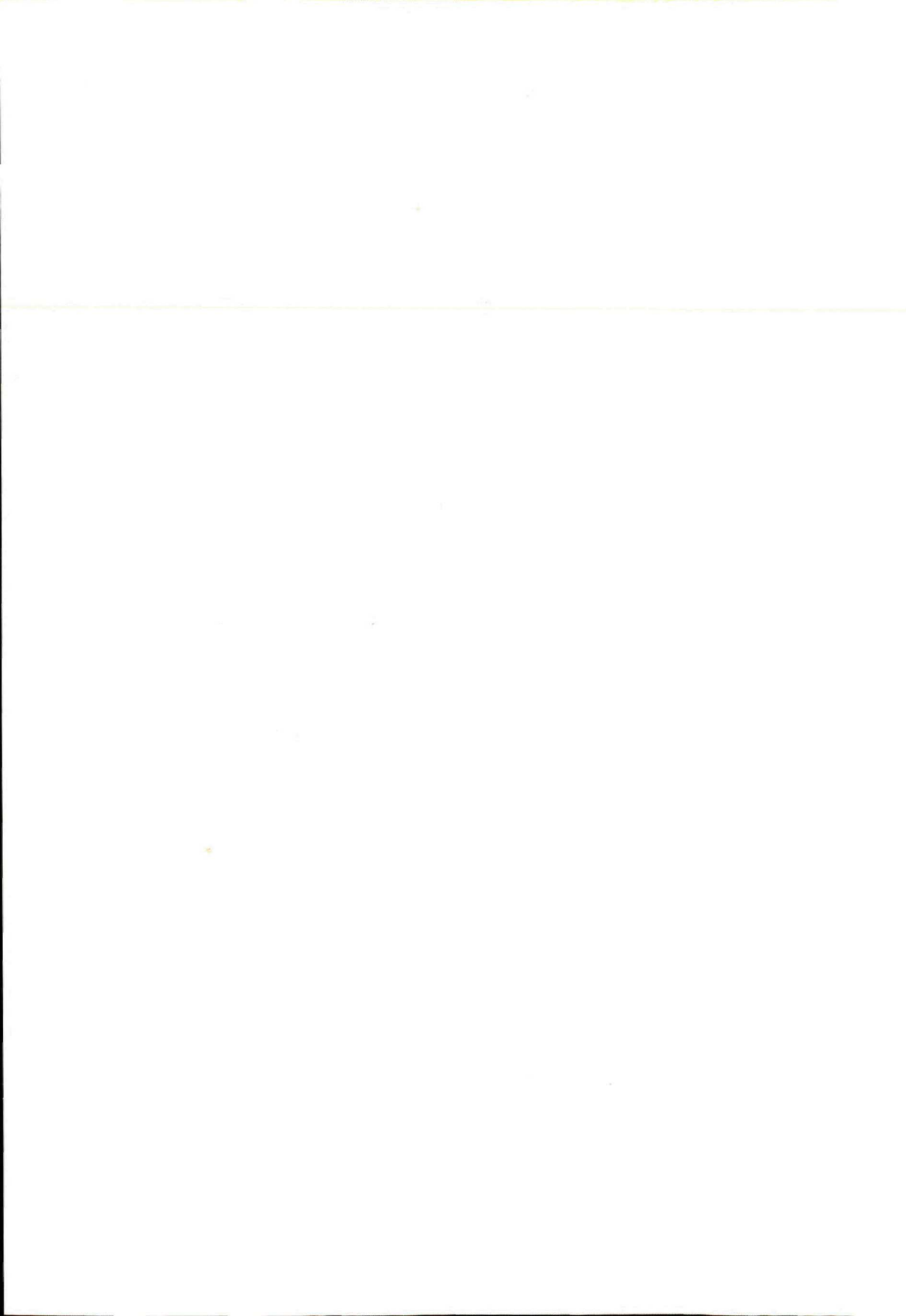
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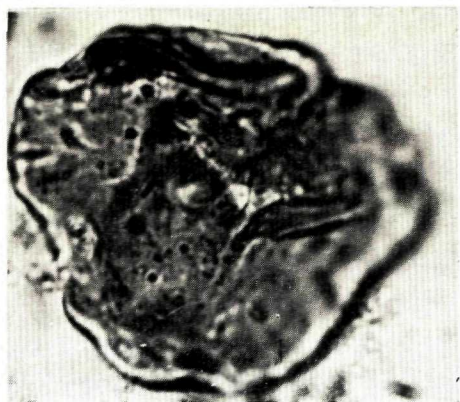
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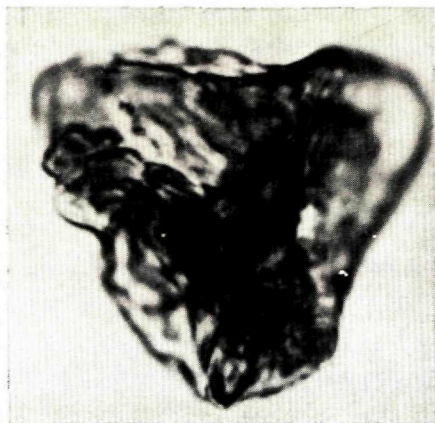
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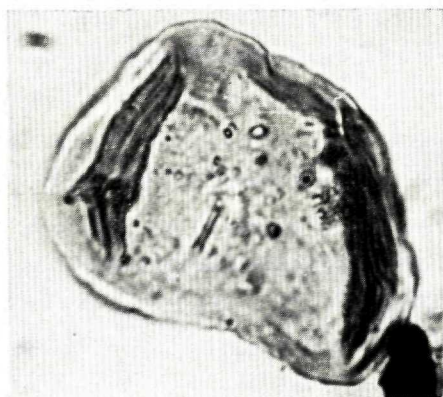




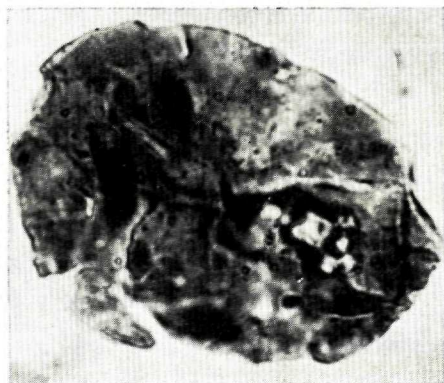
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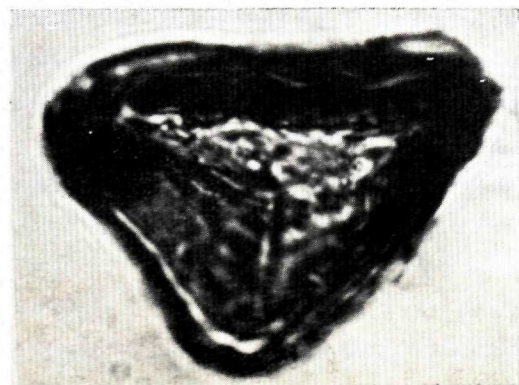
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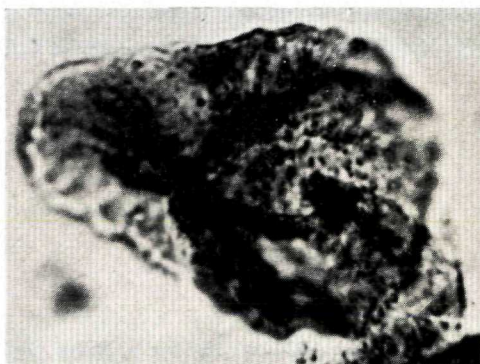
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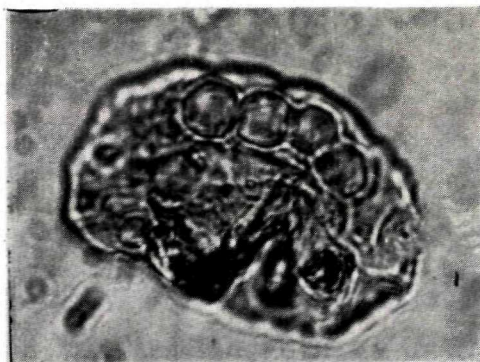
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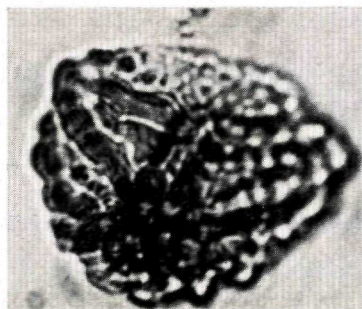
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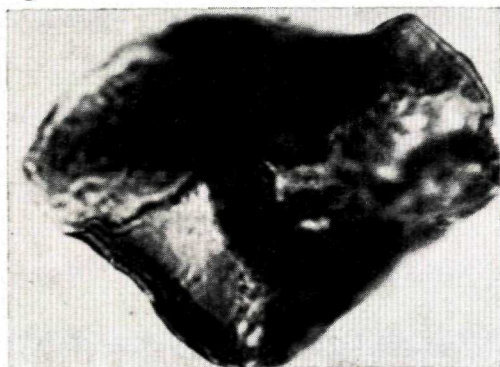
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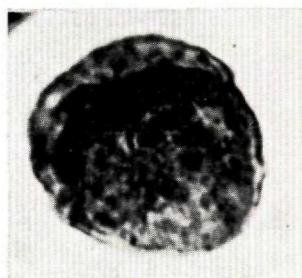
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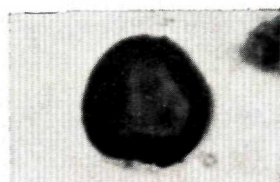
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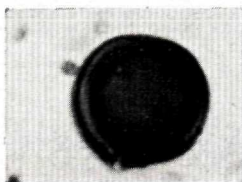
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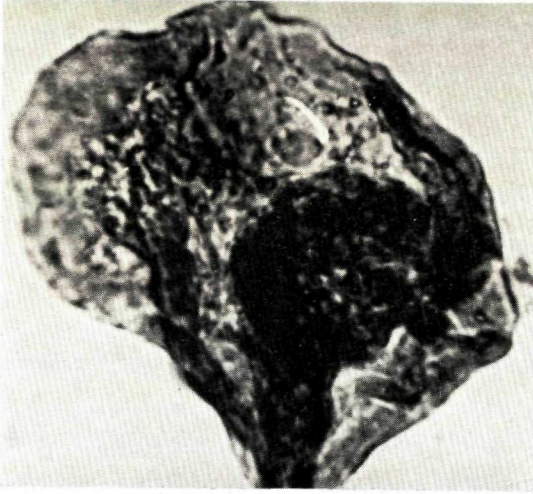
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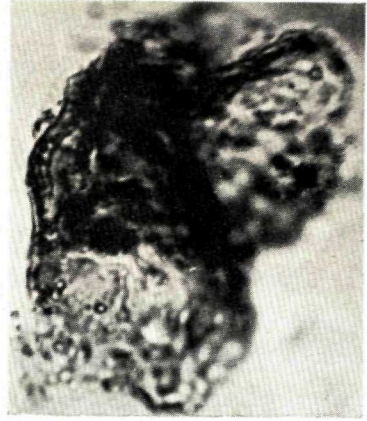
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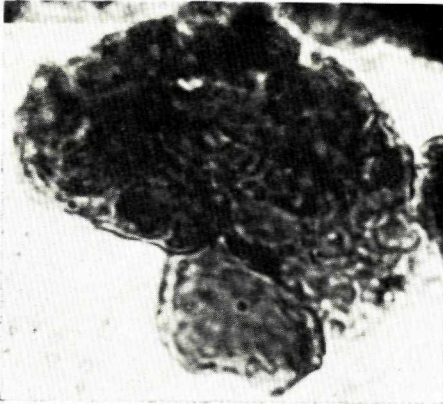
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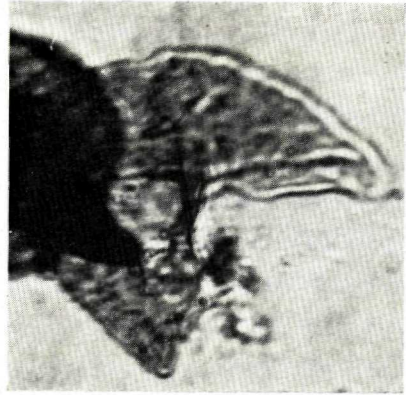
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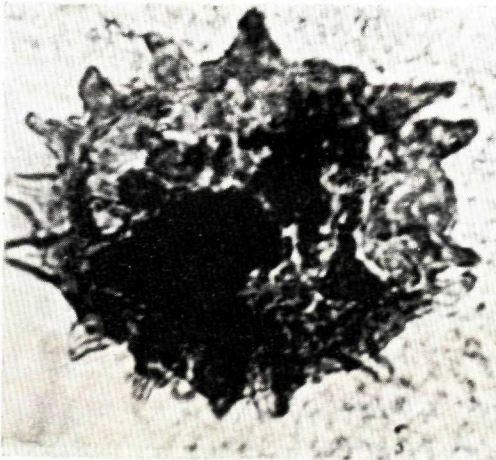
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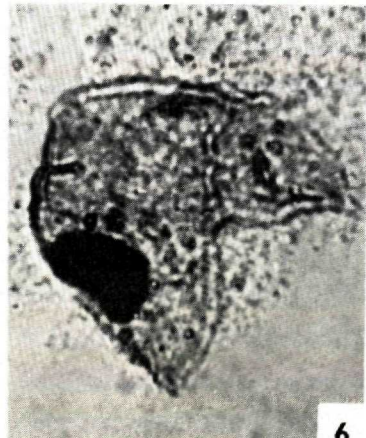
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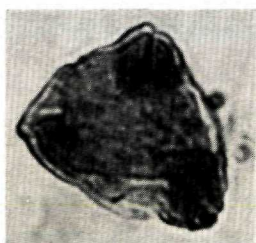
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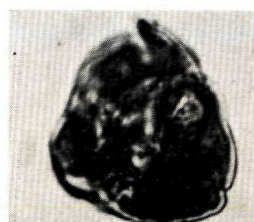
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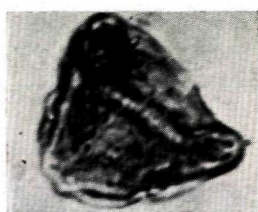
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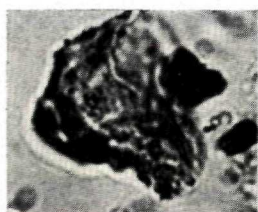
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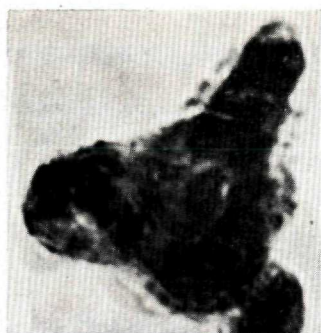
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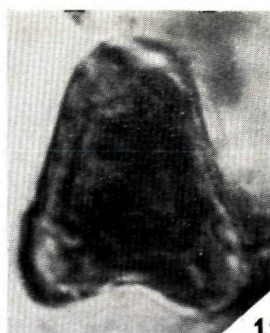
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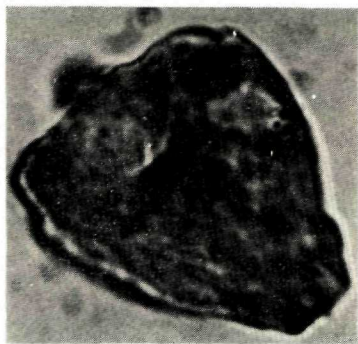
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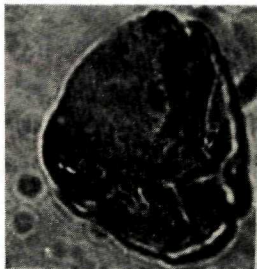
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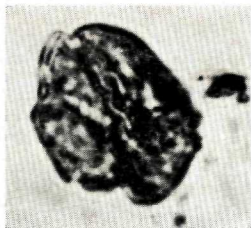
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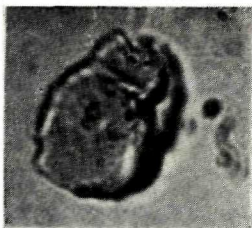
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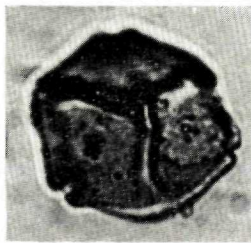
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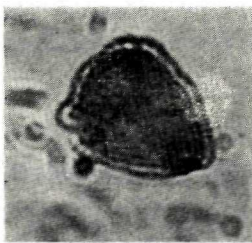
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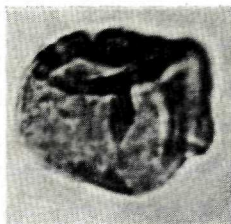
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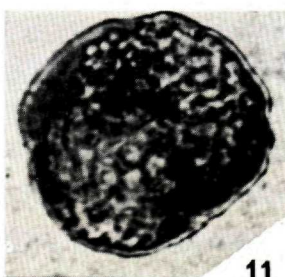
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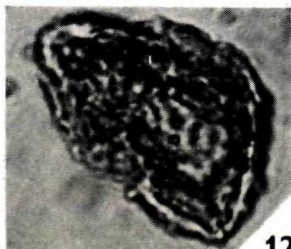
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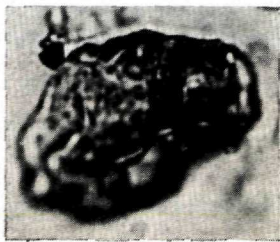
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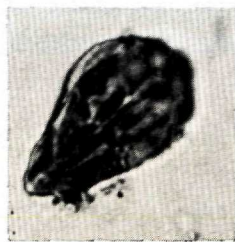
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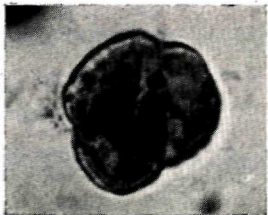
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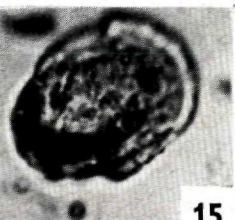
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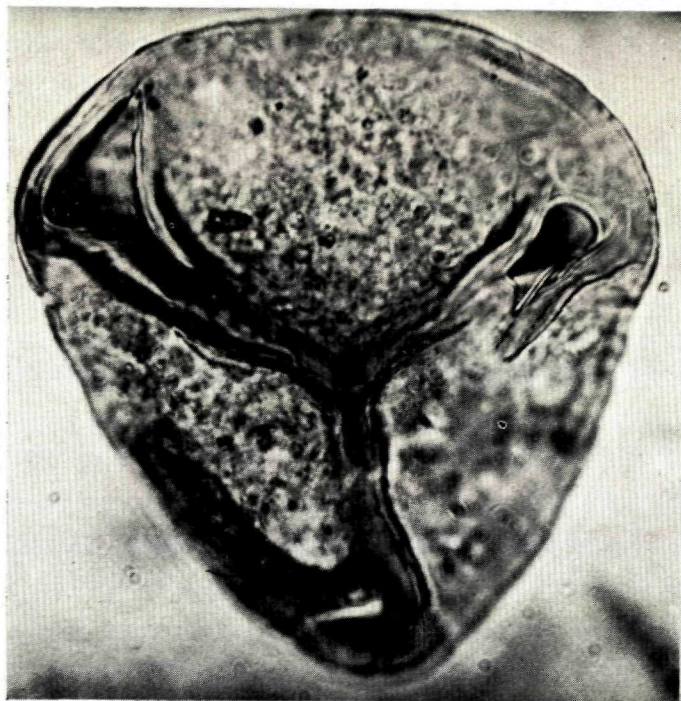
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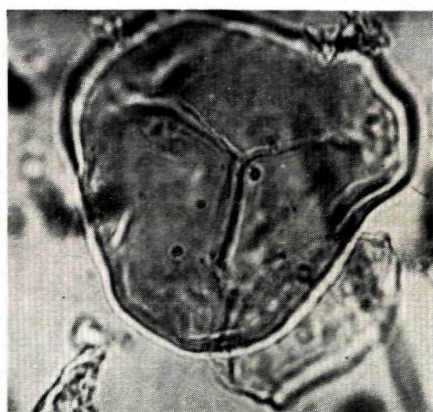
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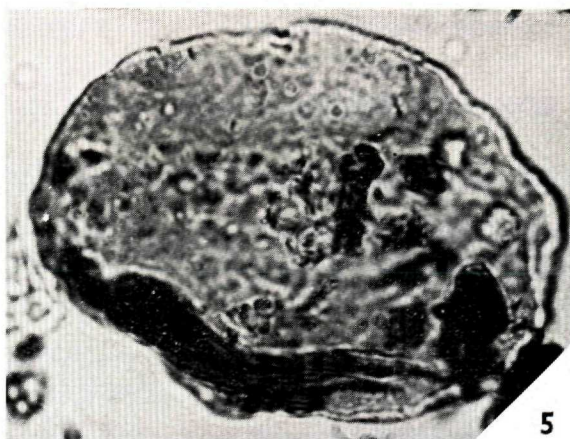
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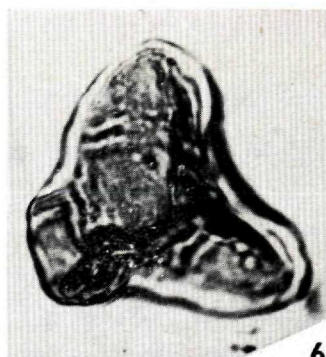
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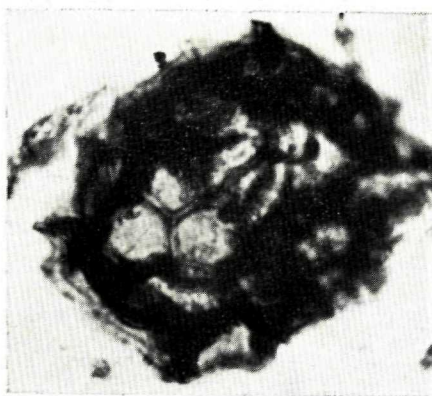
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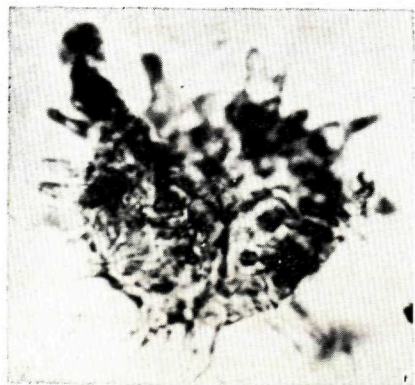
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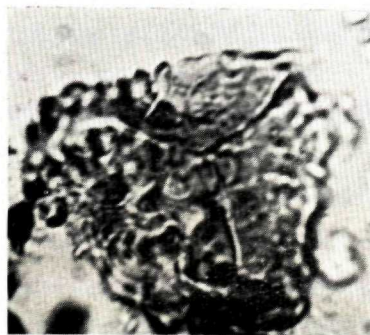
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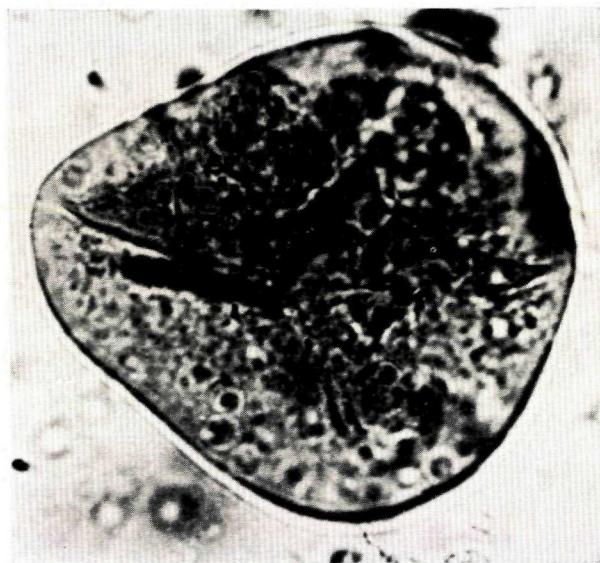
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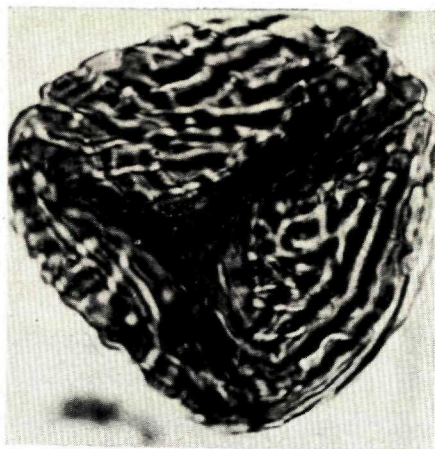
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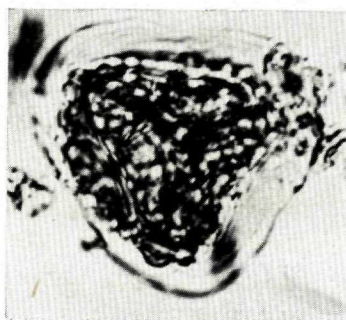
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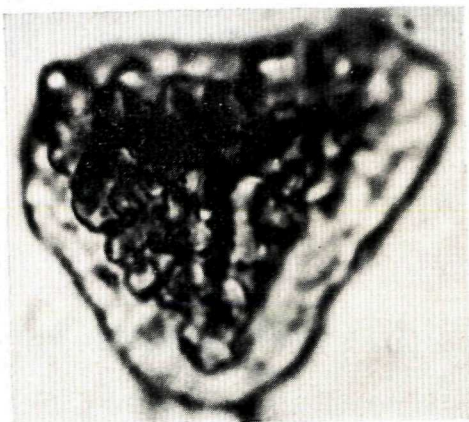
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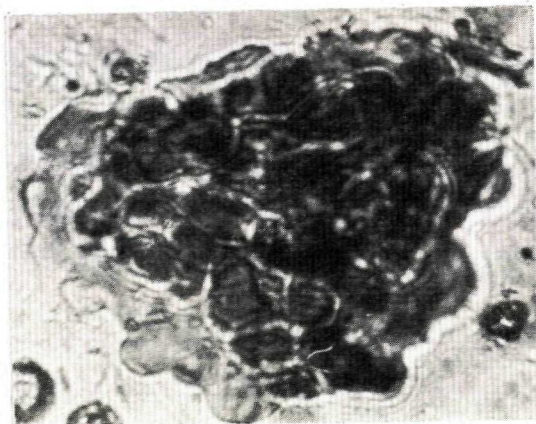
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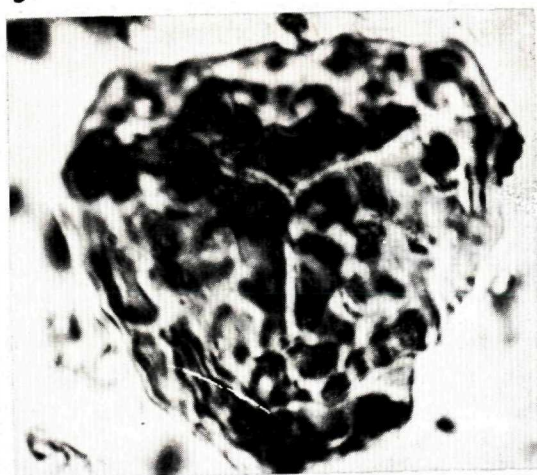
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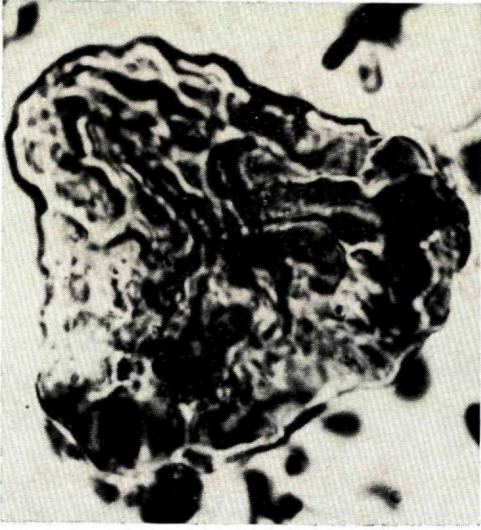
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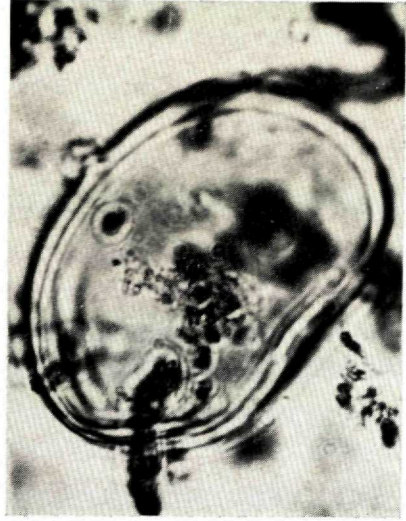
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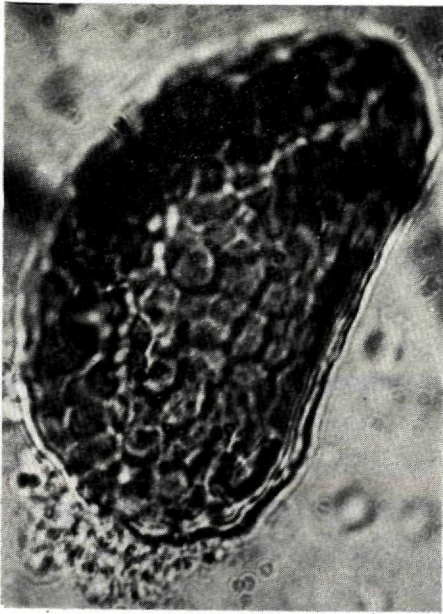
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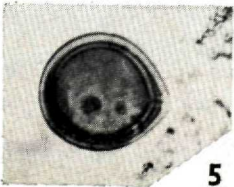
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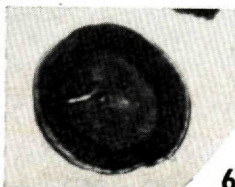
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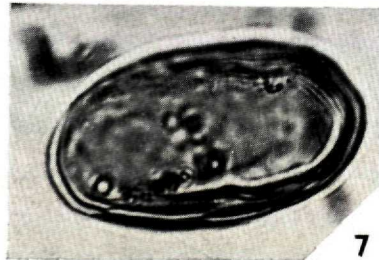
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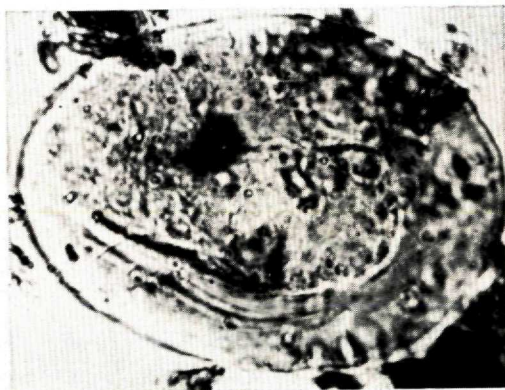
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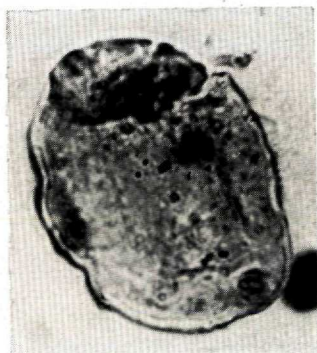
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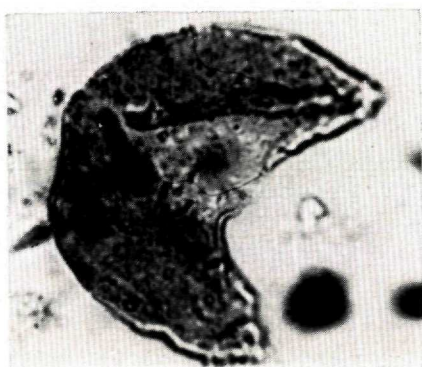
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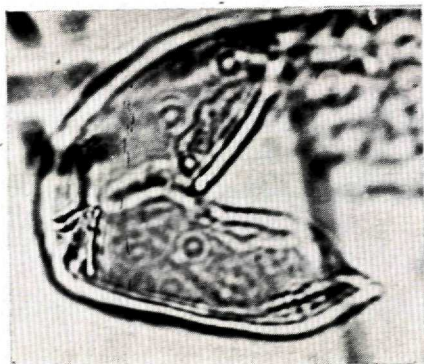
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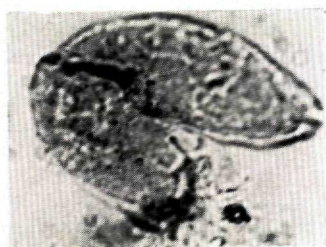
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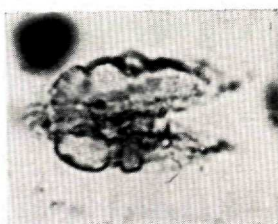
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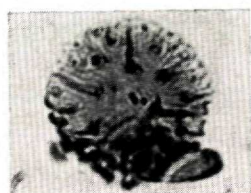
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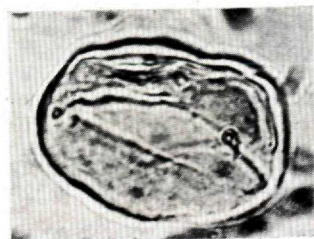
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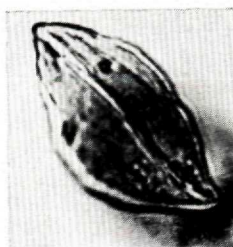
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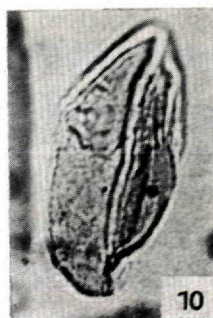
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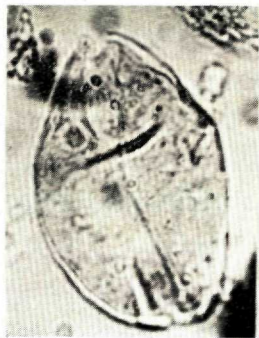
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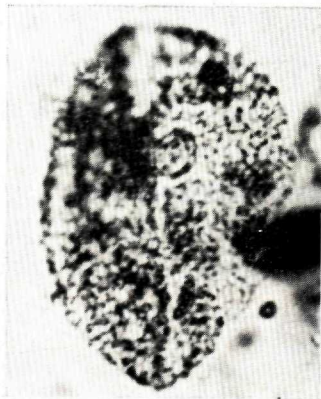
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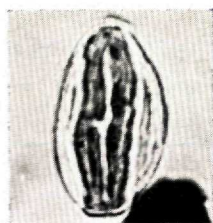
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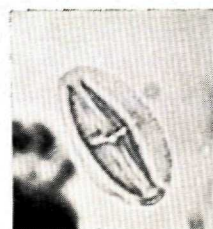
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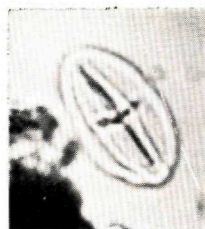
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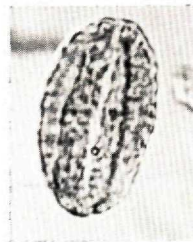
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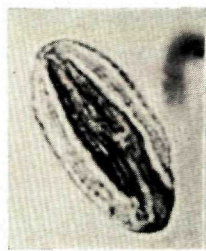
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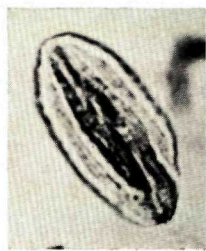
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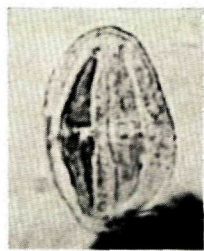
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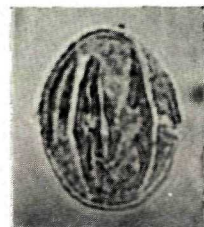
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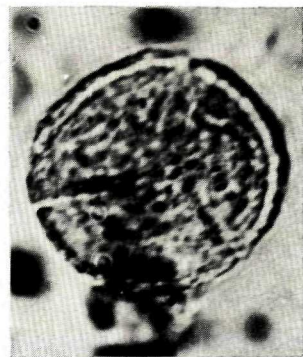
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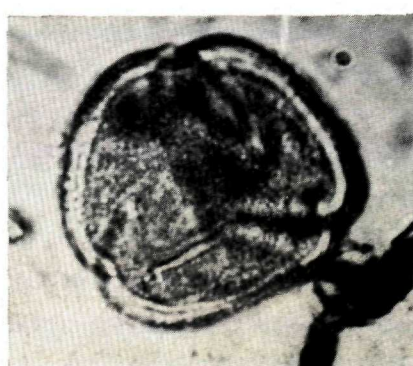
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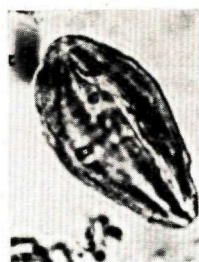
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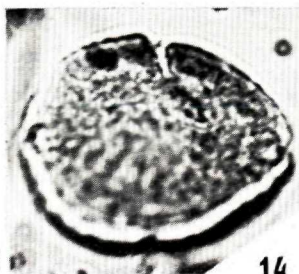
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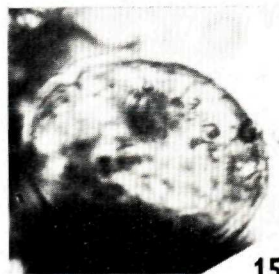
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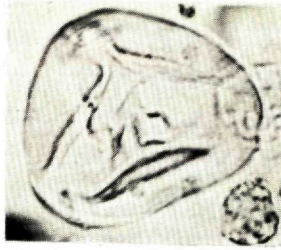
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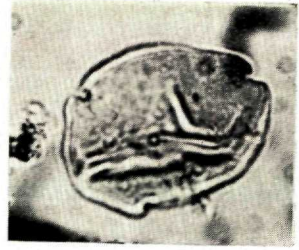
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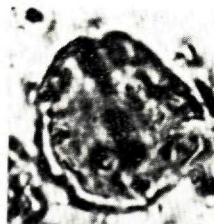
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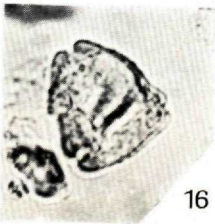
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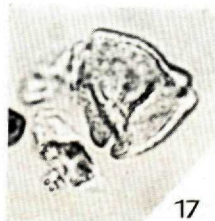
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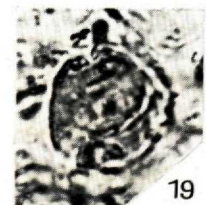
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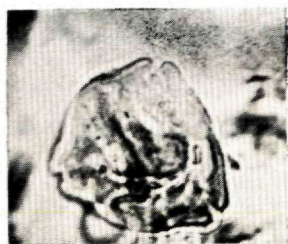
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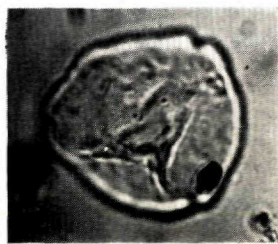
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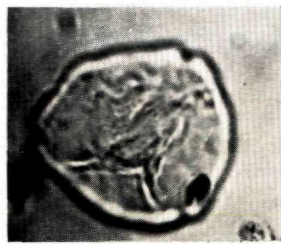
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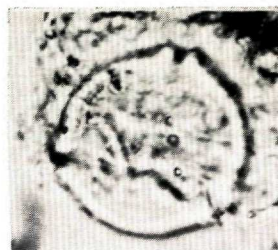
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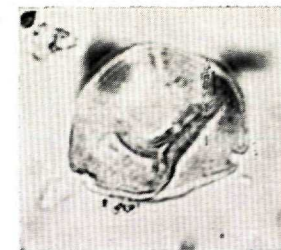
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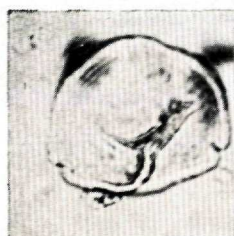
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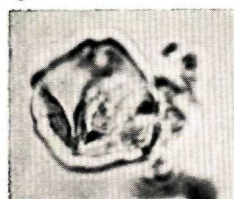
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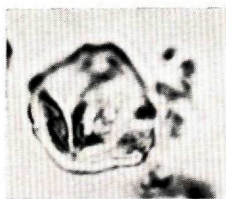
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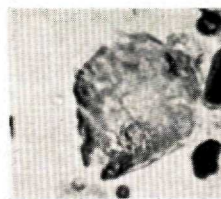
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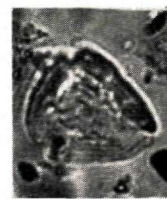
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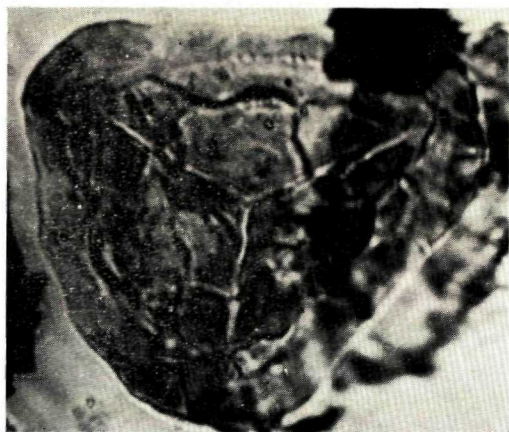
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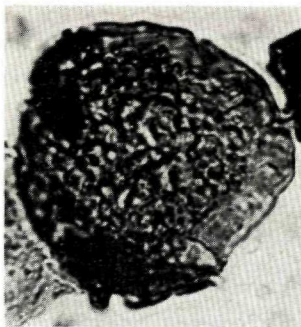
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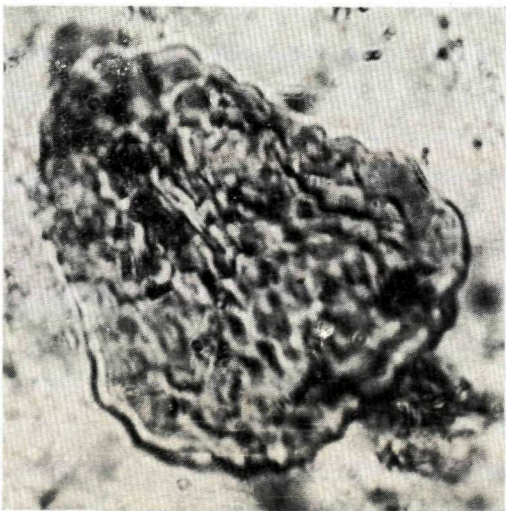
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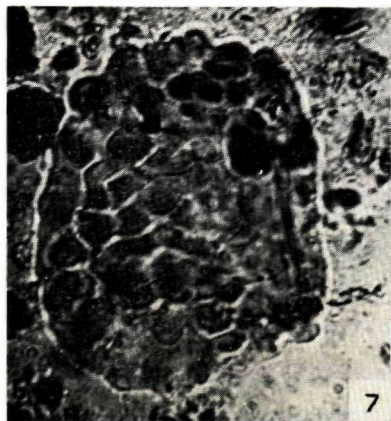
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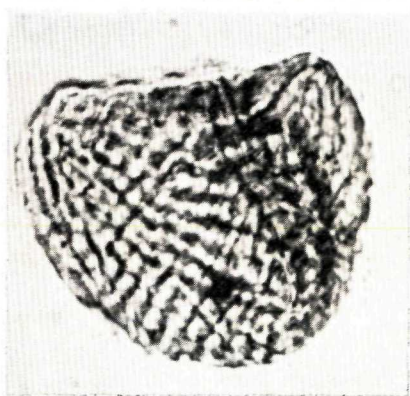
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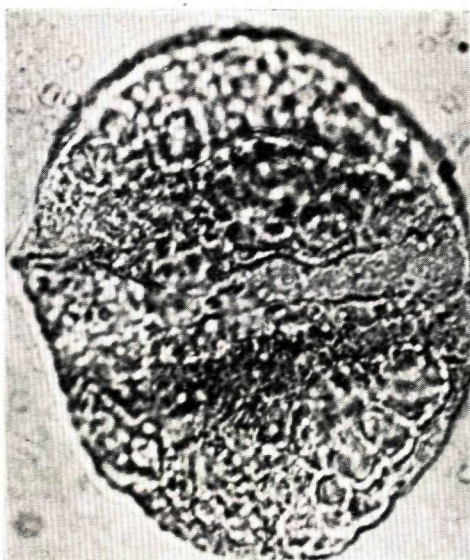
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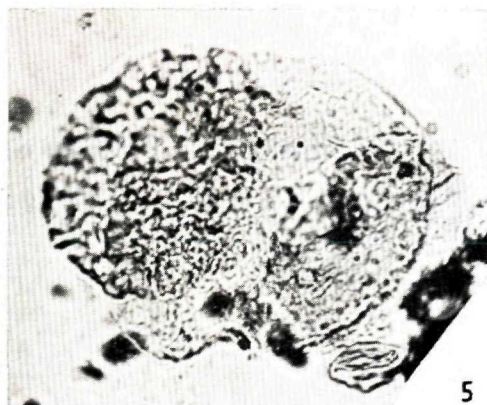
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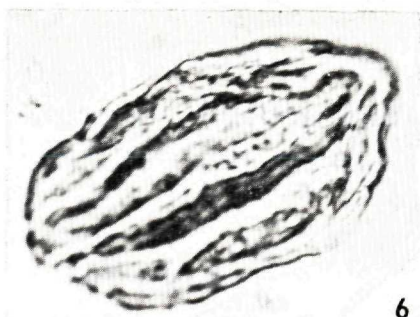
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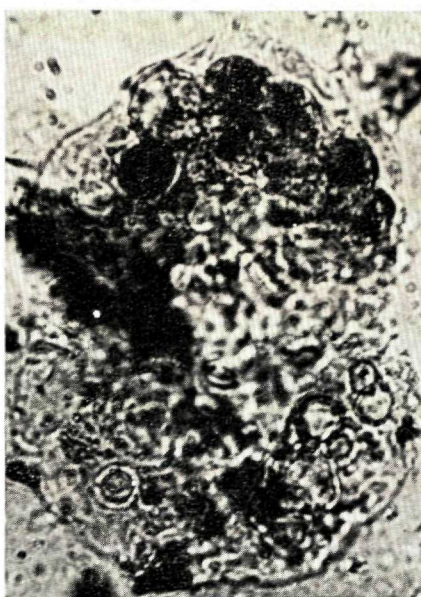
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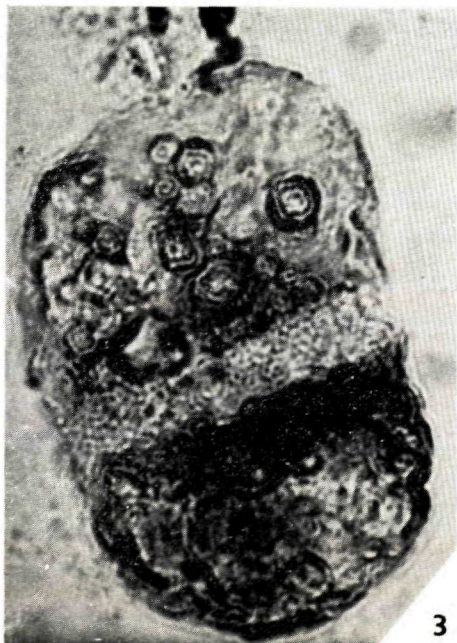
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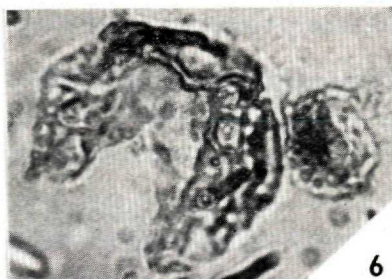
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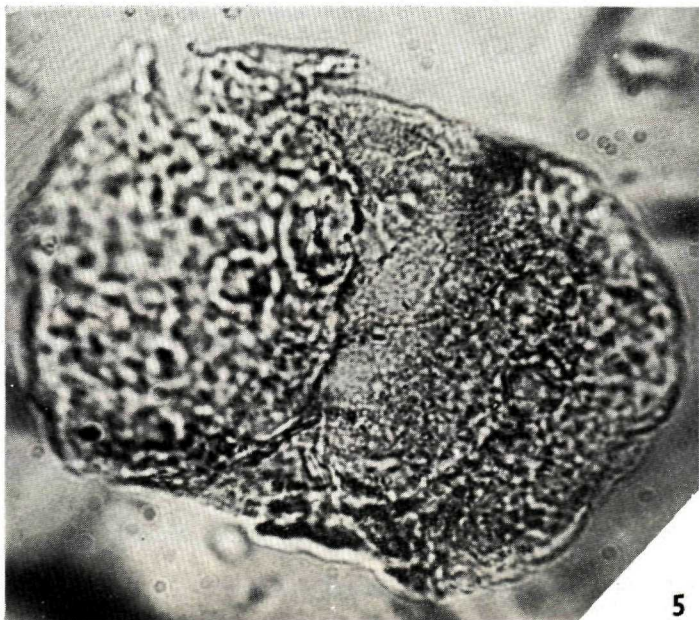


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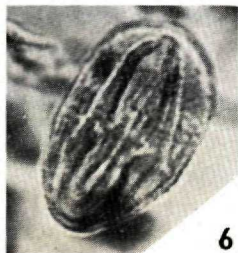
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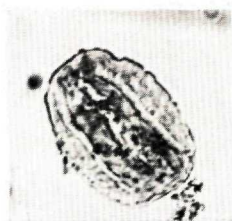
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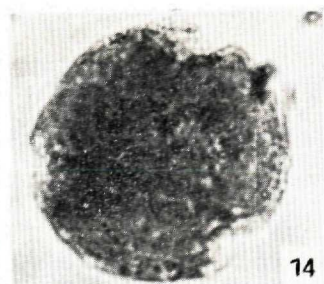
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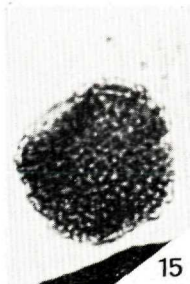
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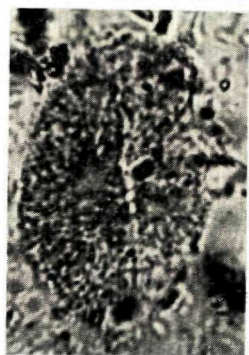
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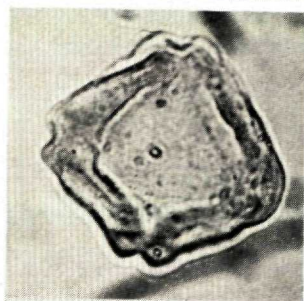
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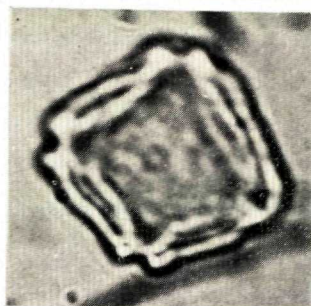
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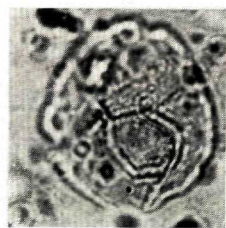
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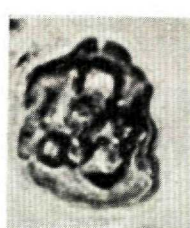
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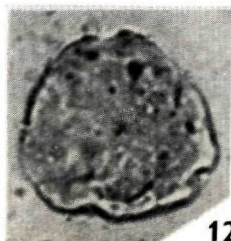
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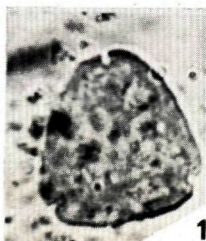
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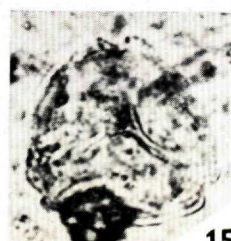
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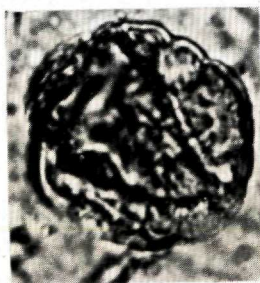
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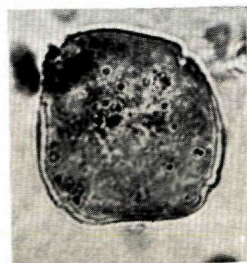
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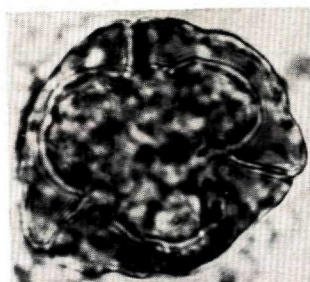
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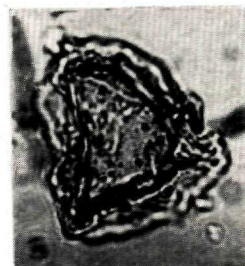
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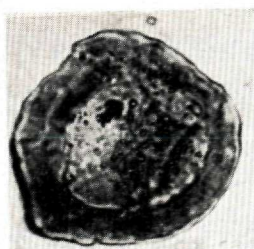
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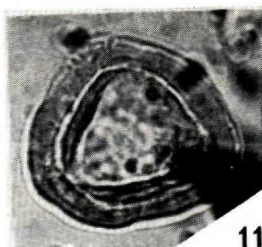
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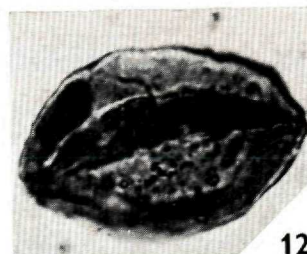
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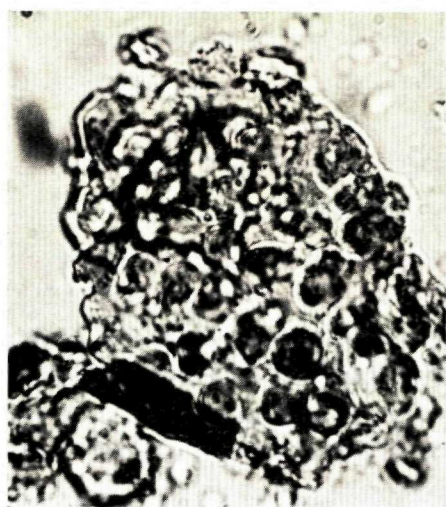
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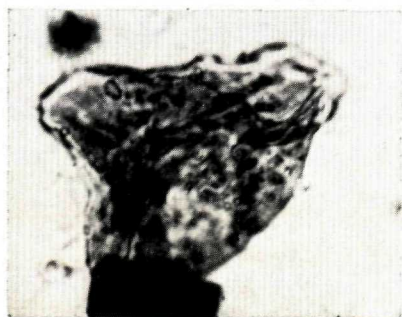
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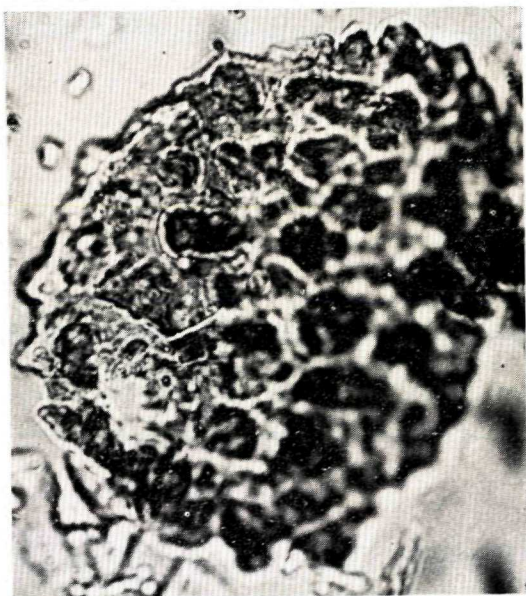
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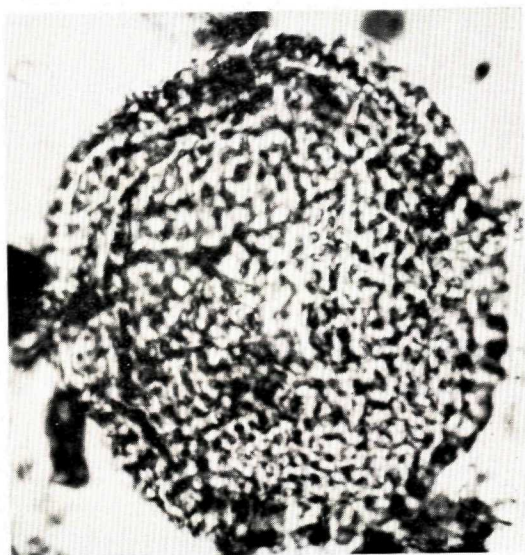
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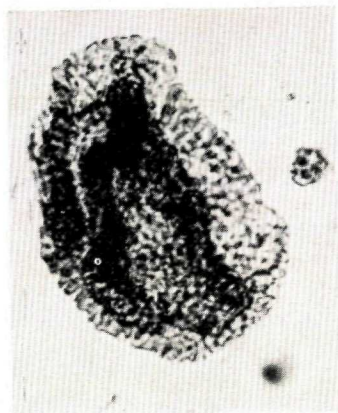
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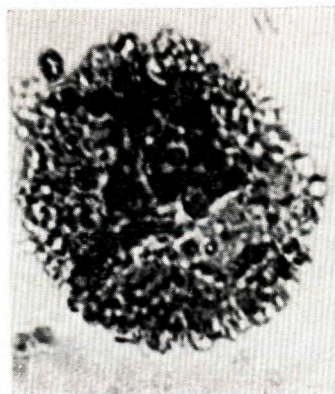
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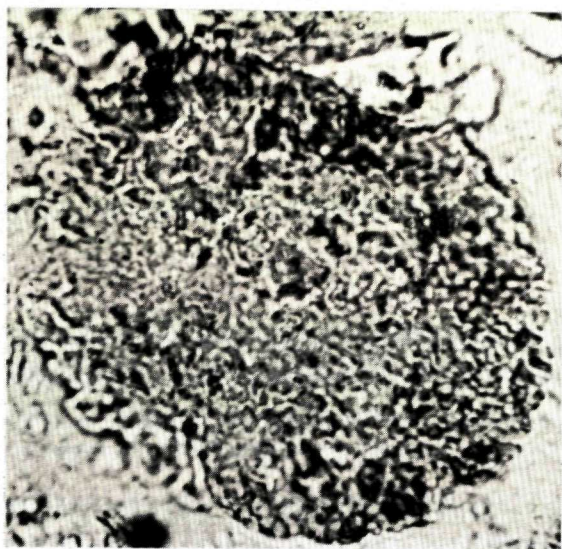
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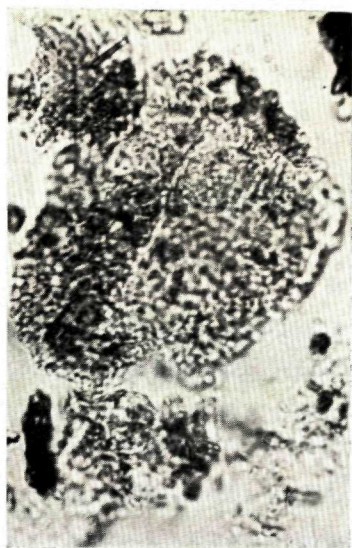
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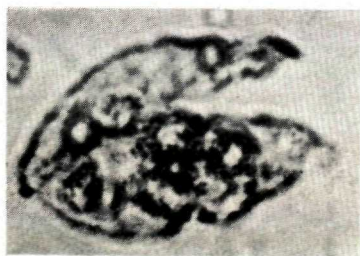
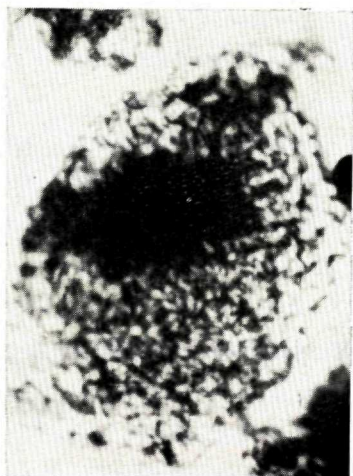


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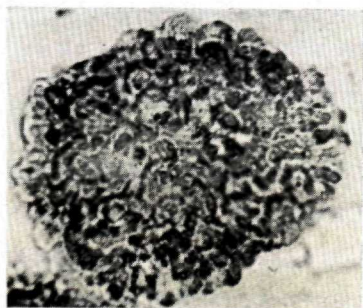
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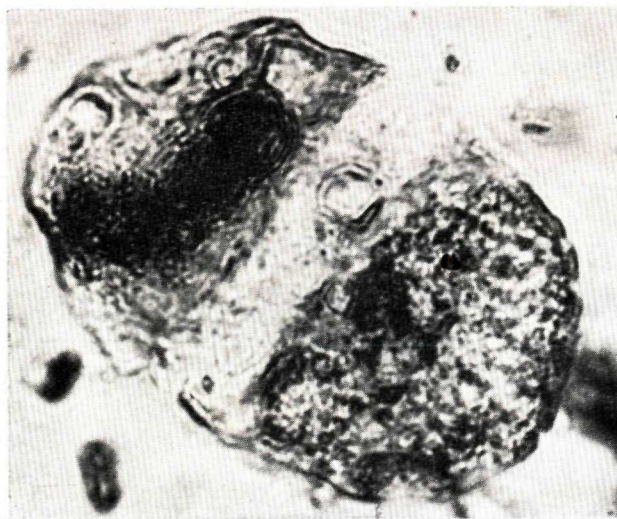
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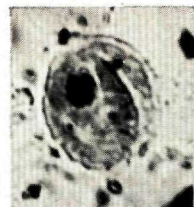
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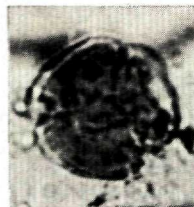
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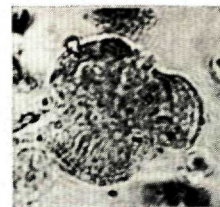
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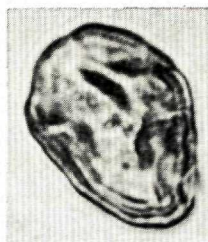
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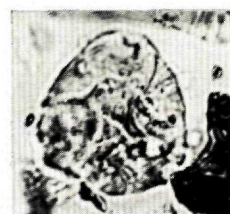
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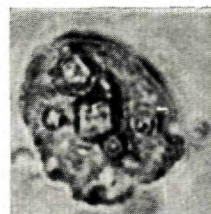
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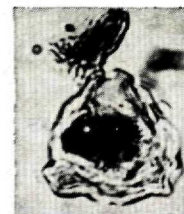
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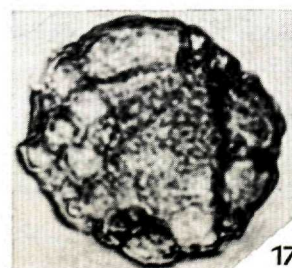
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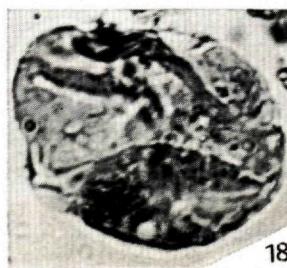
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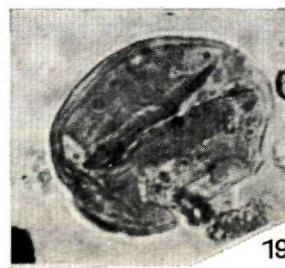
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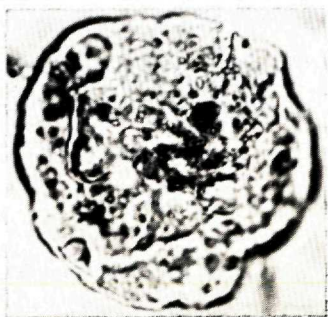
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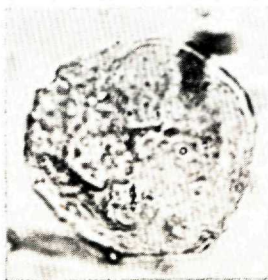
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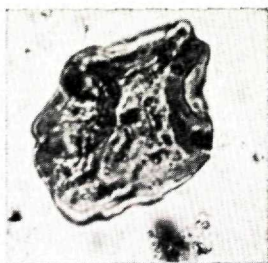
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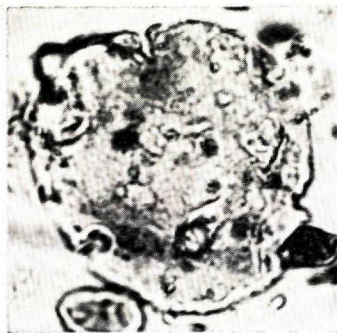
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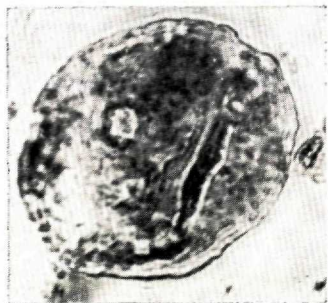
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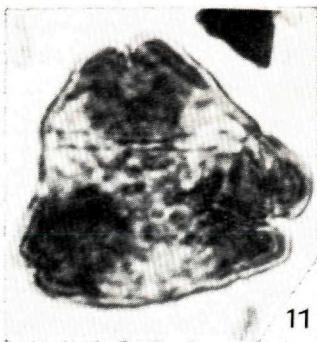
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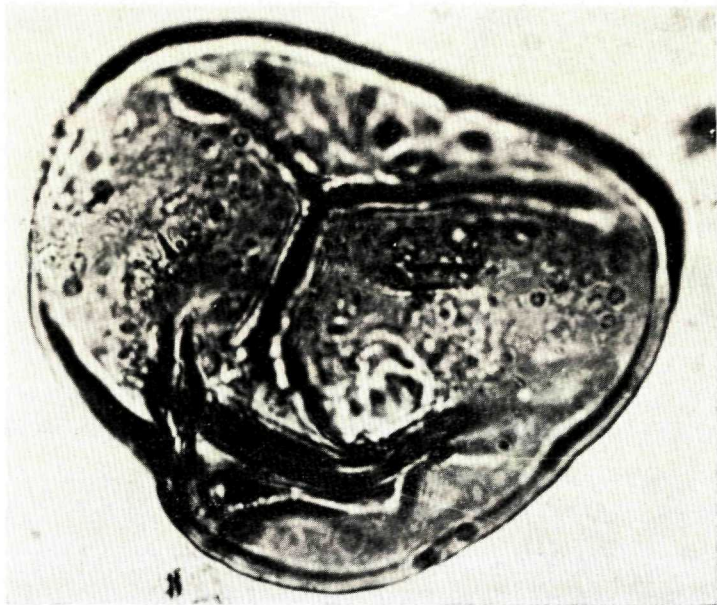
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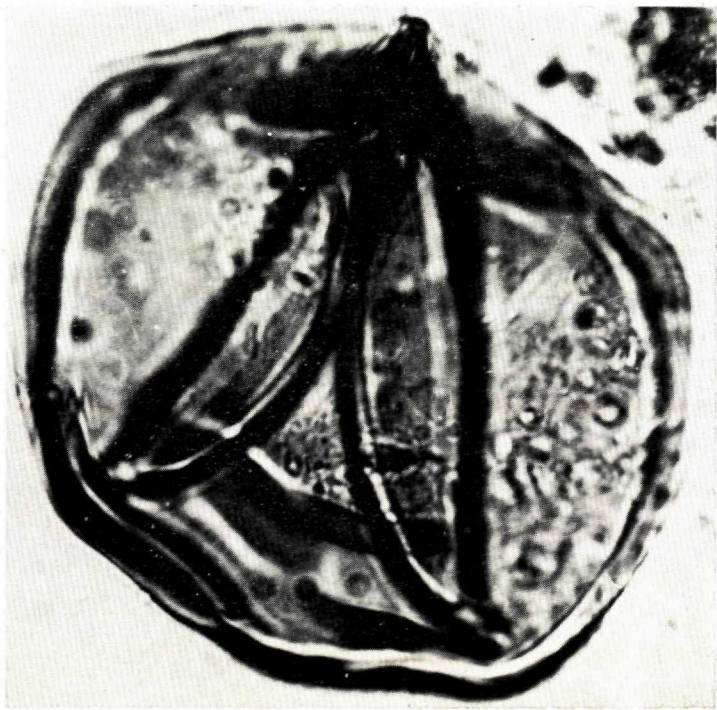
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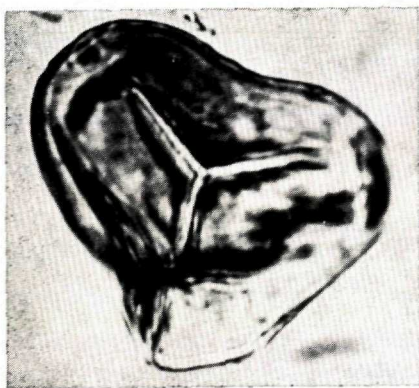
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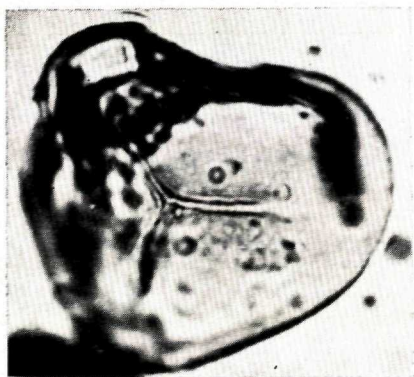
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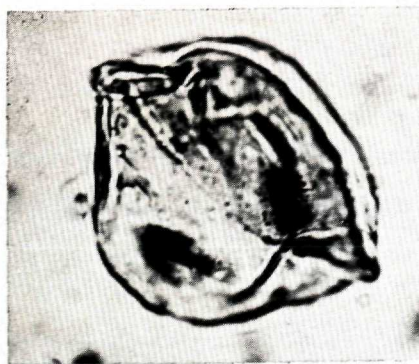
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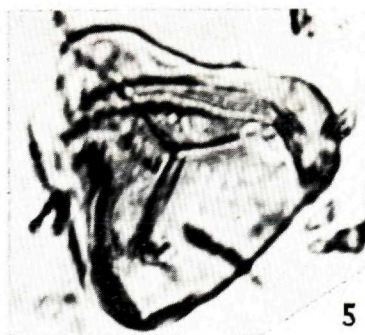
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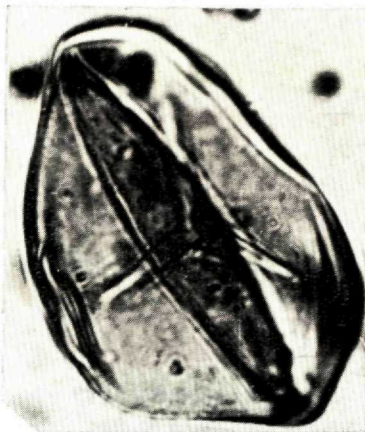
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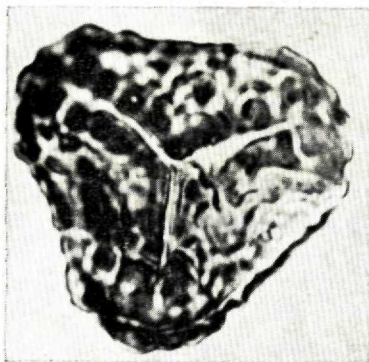
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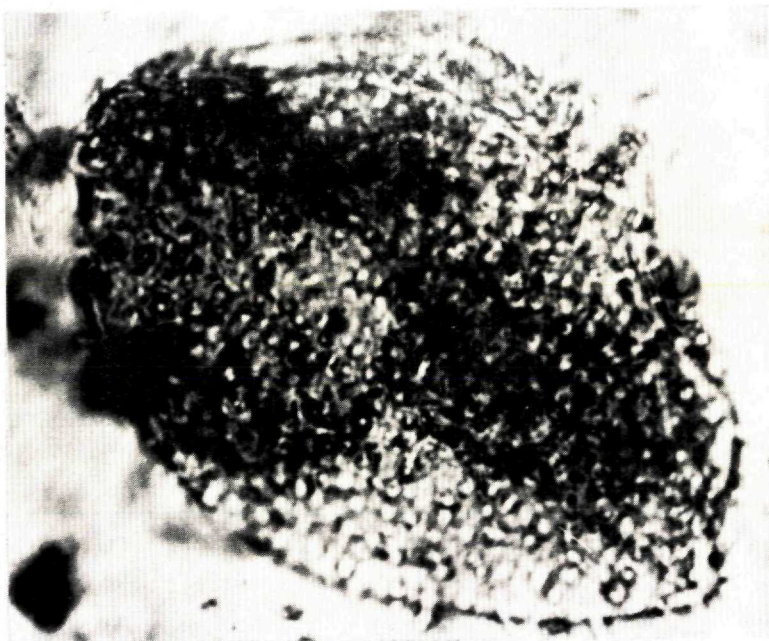
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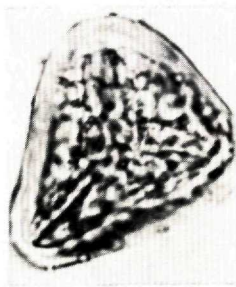
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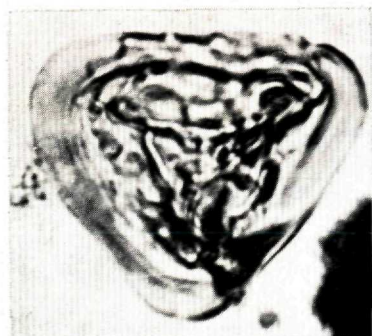
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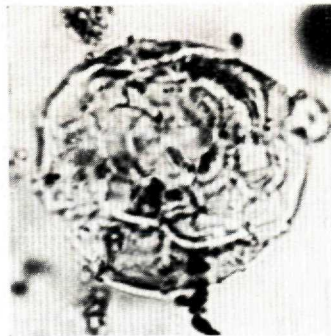
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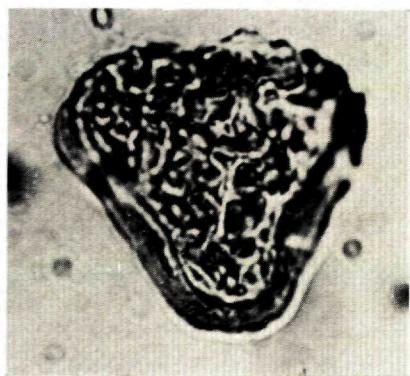
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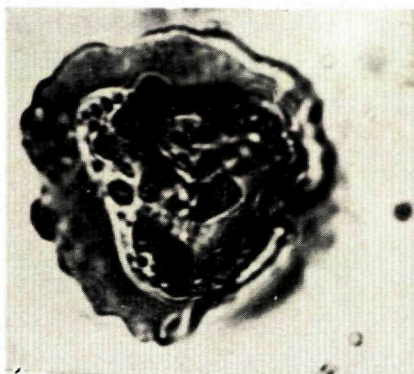
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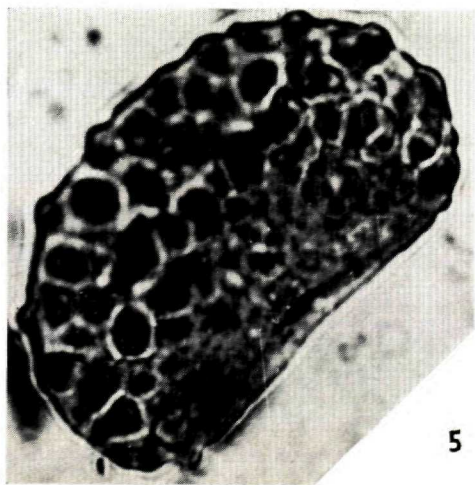
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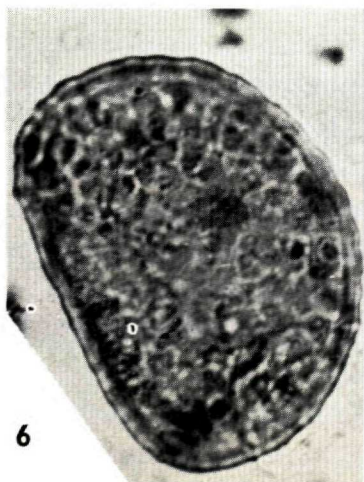
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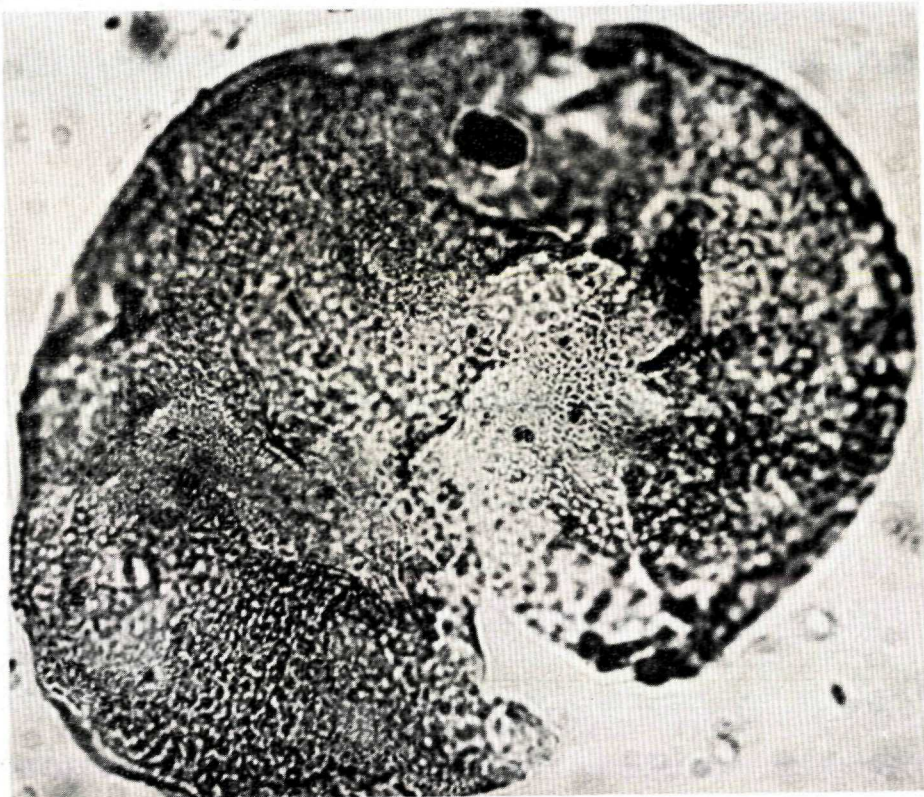
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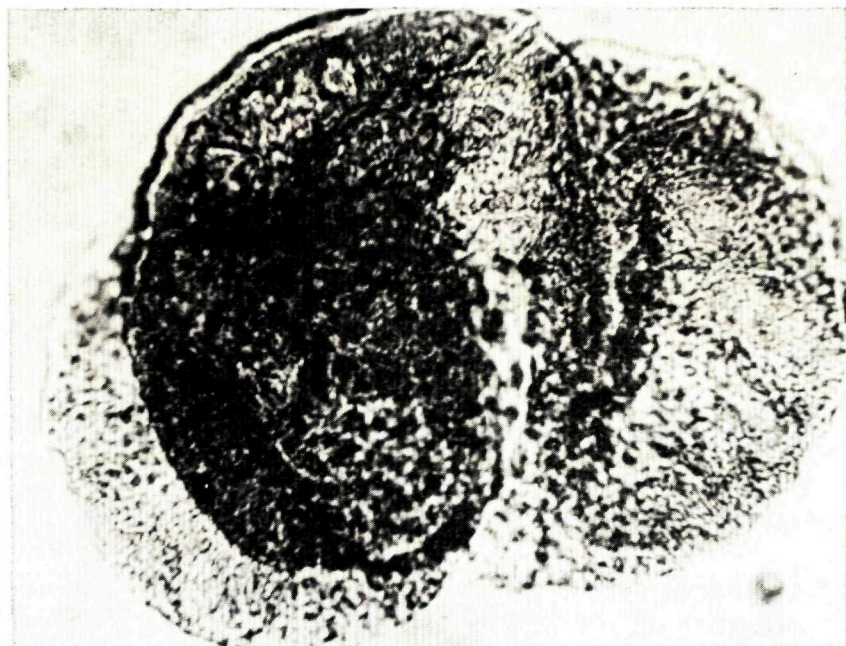
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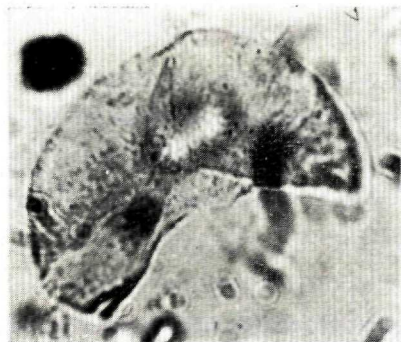
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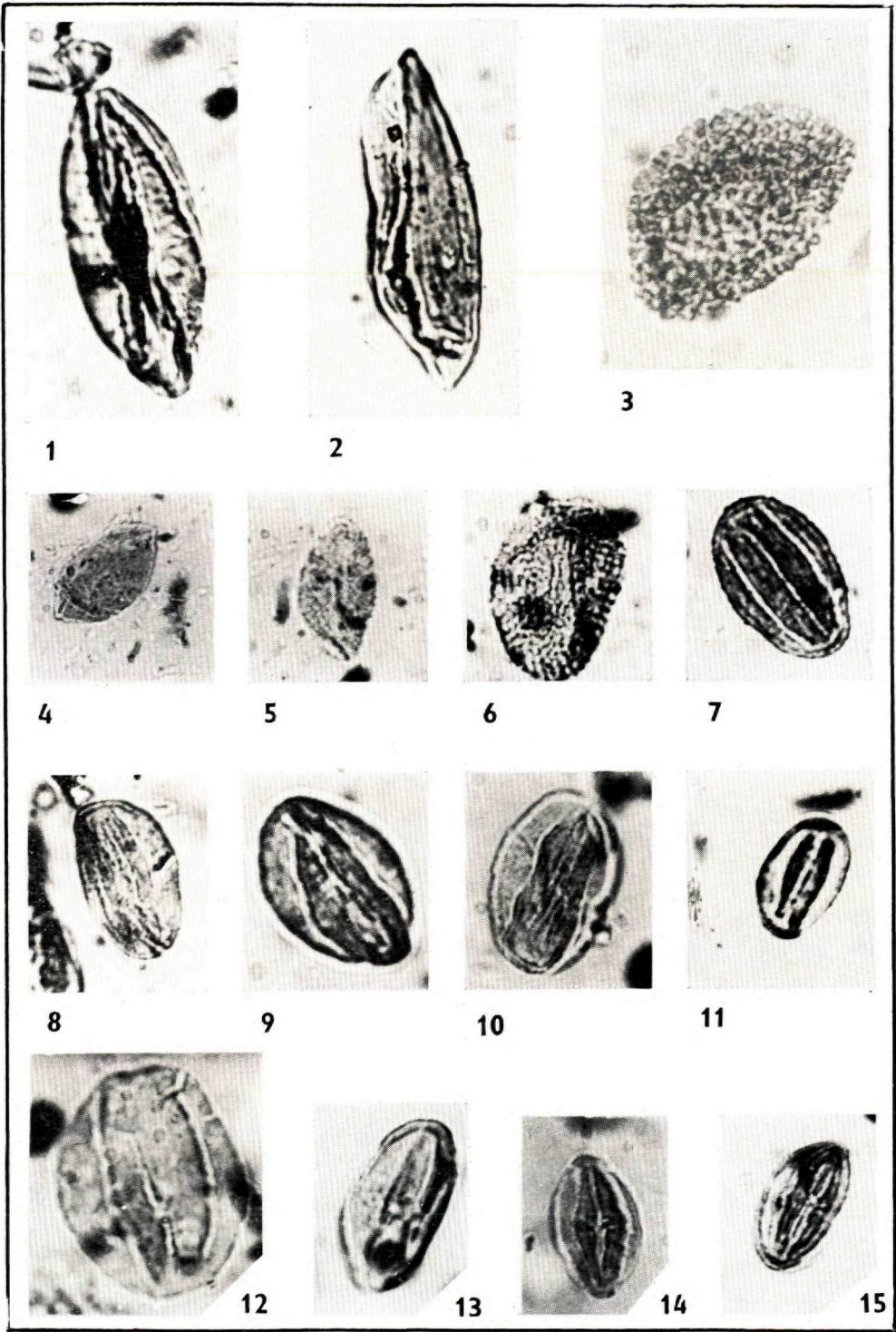
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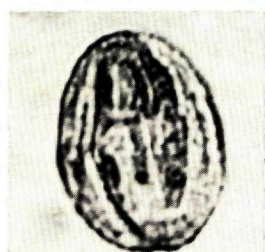


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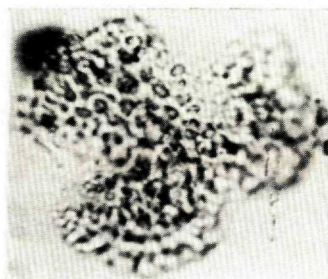
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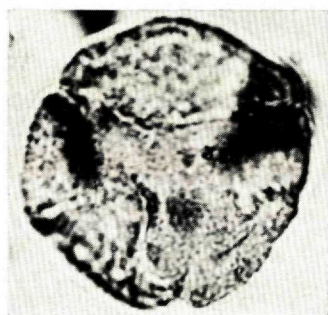
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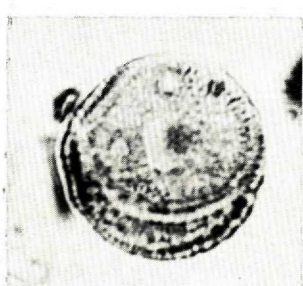
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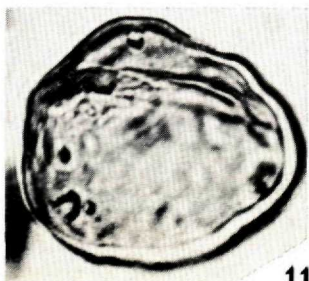
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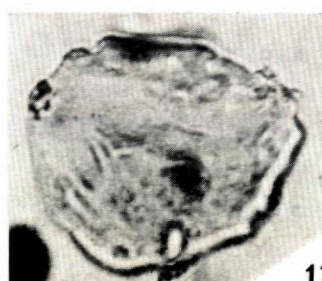
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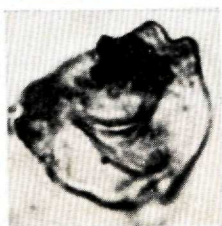
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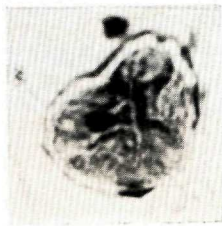
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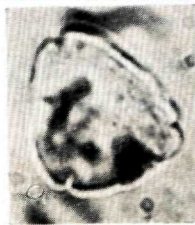
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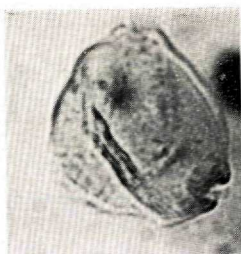
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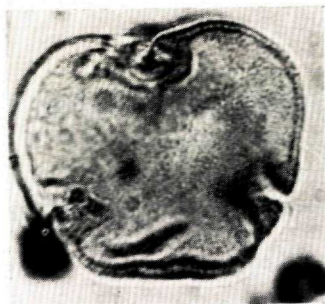
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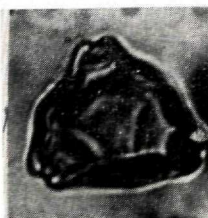
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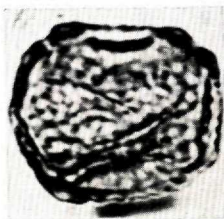
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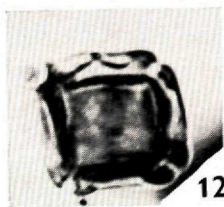
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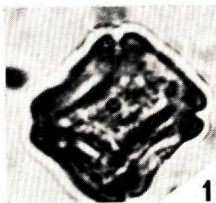
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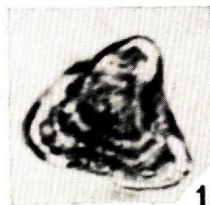
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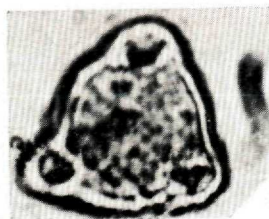
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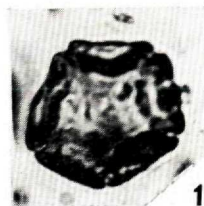
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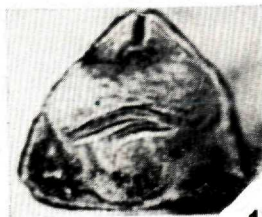
14



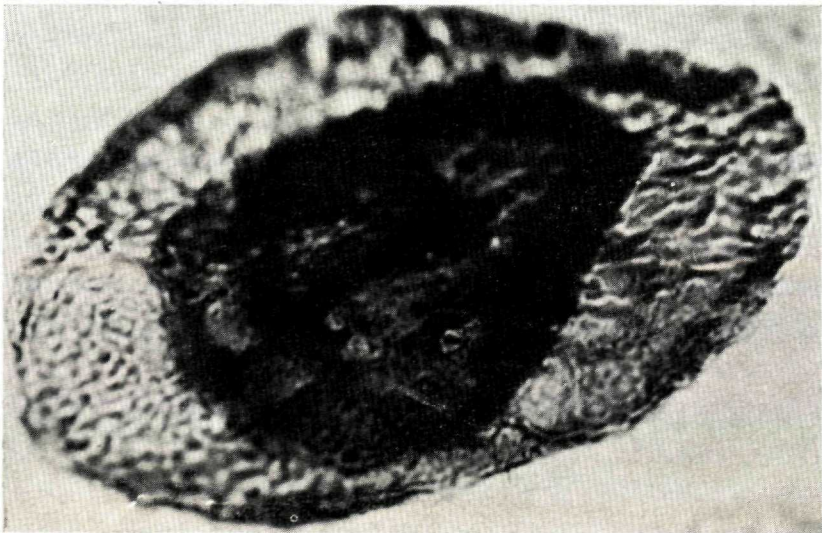
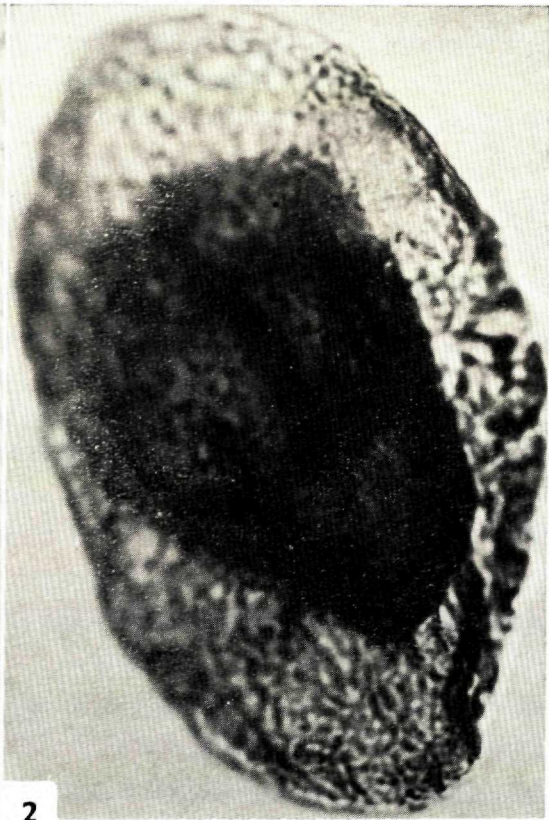
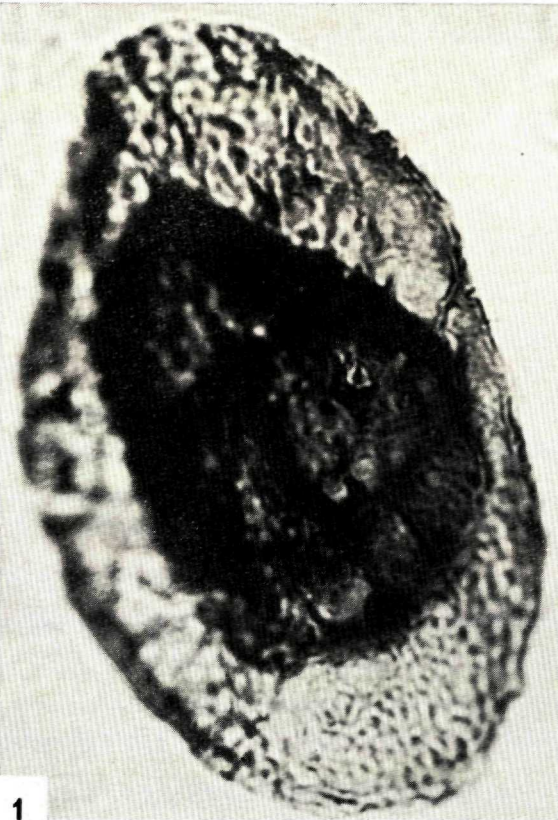
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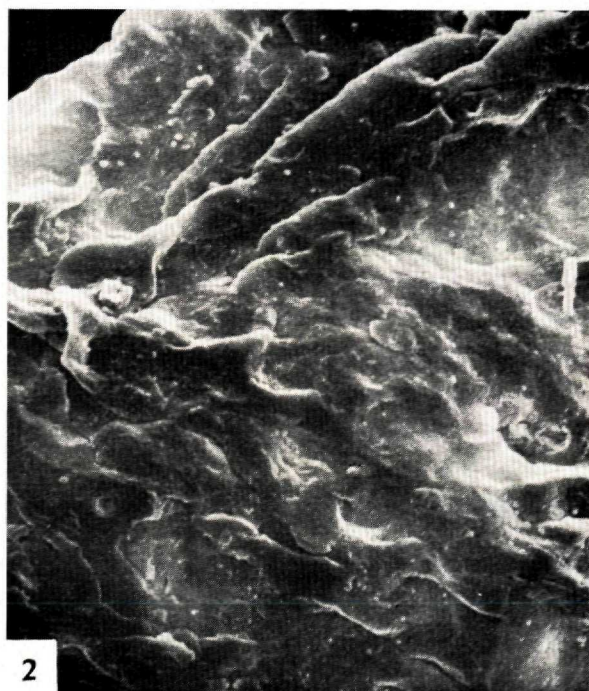
16

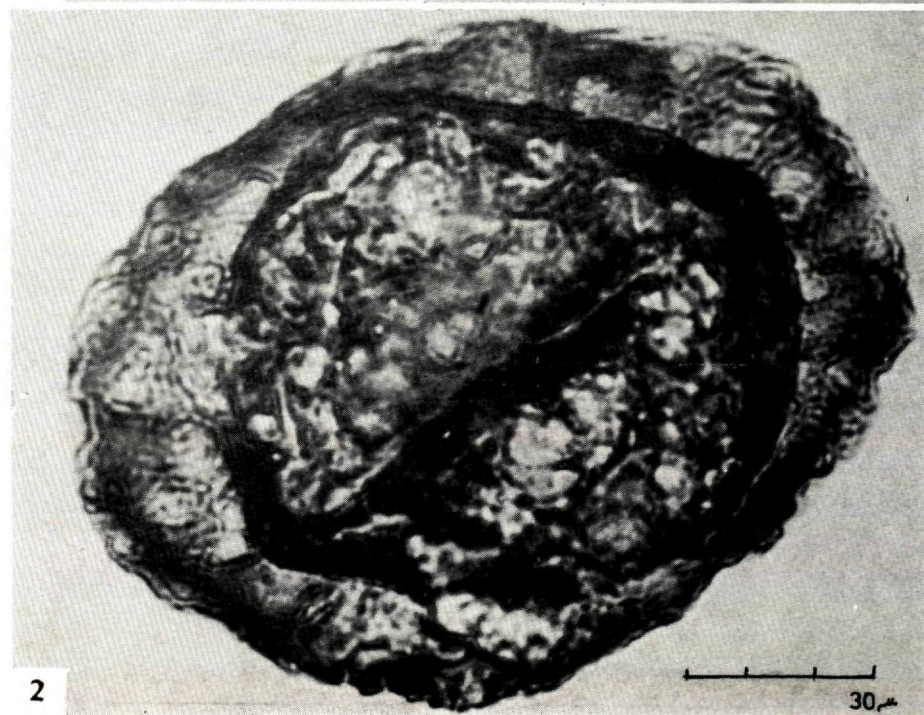
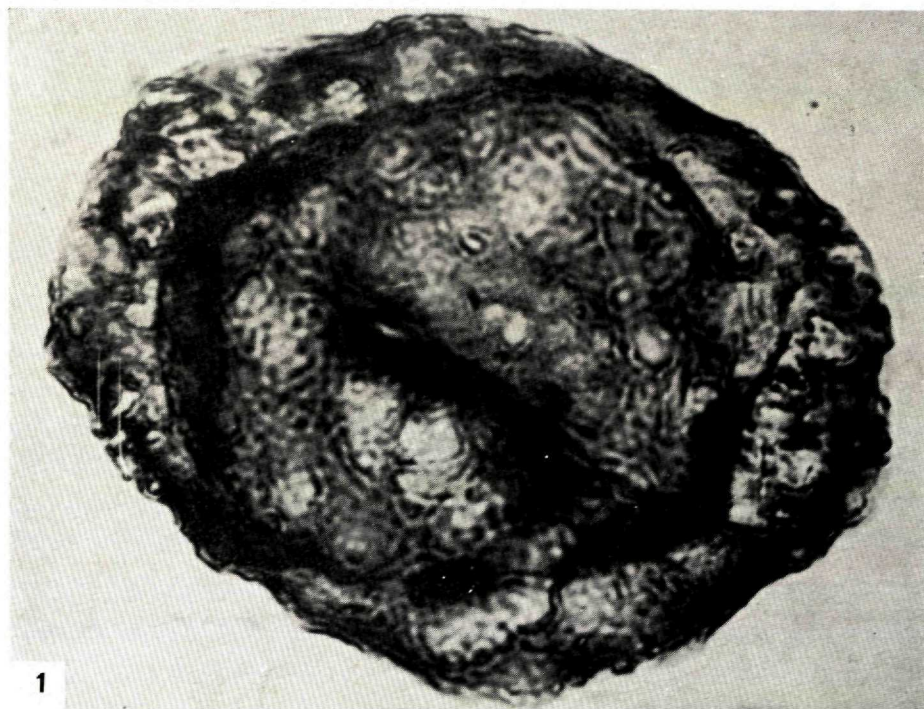


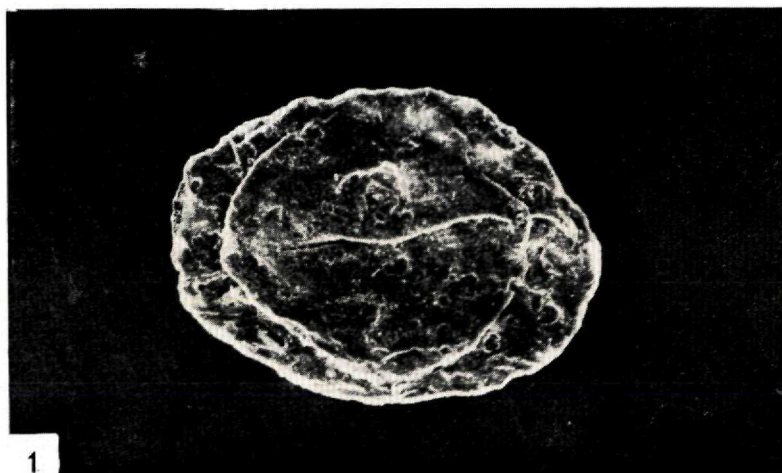
17



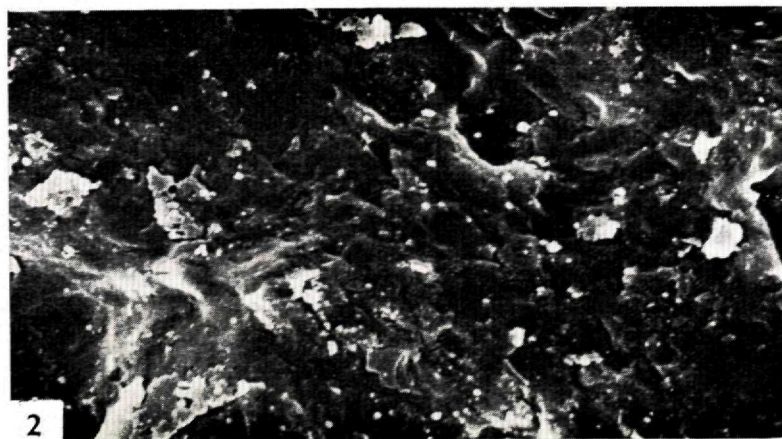
30 μ



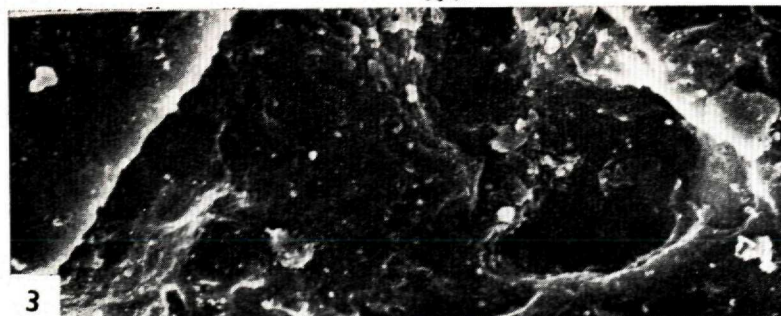


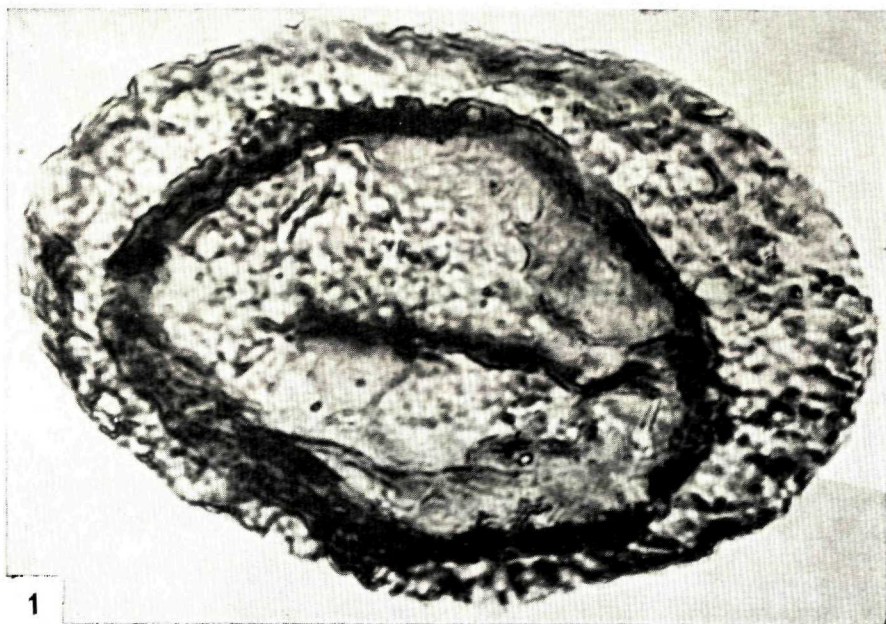


50 μ

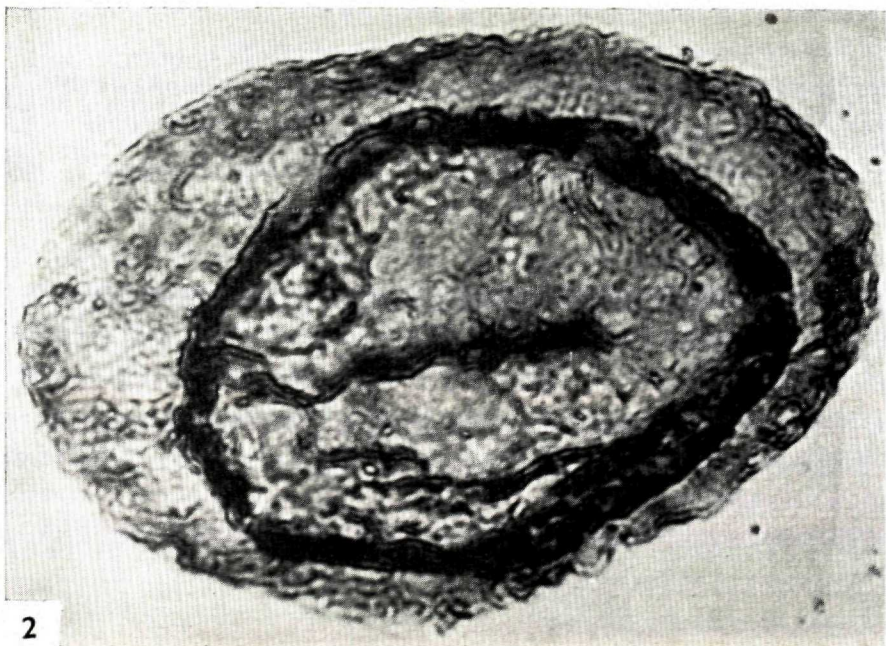


10 μ





40 μ

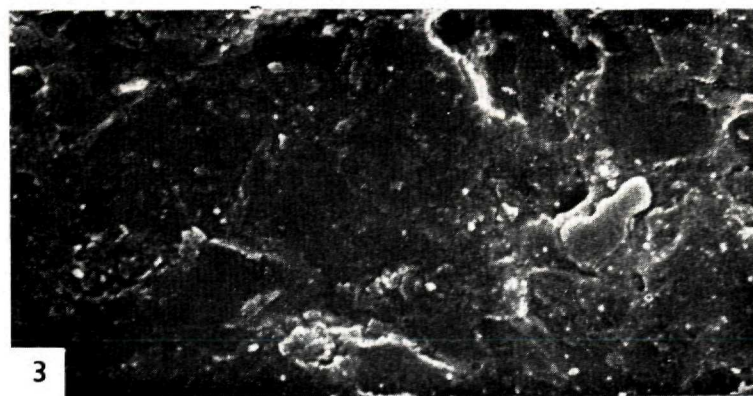


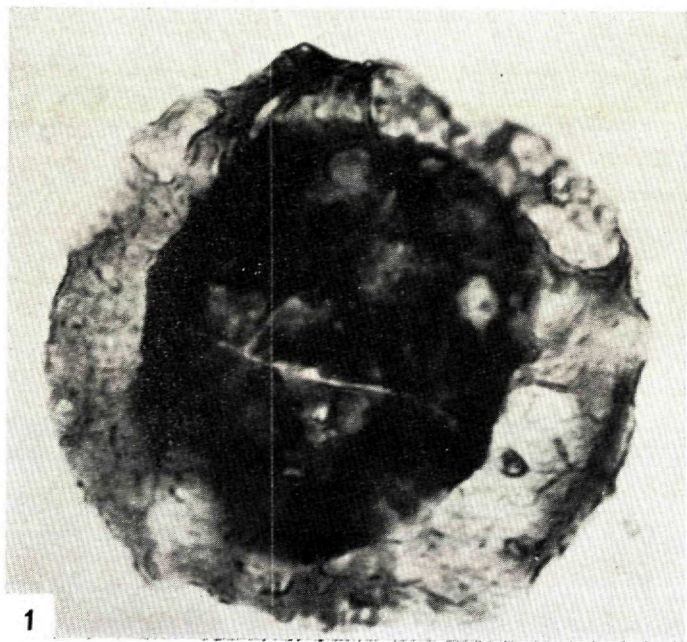


50 μ

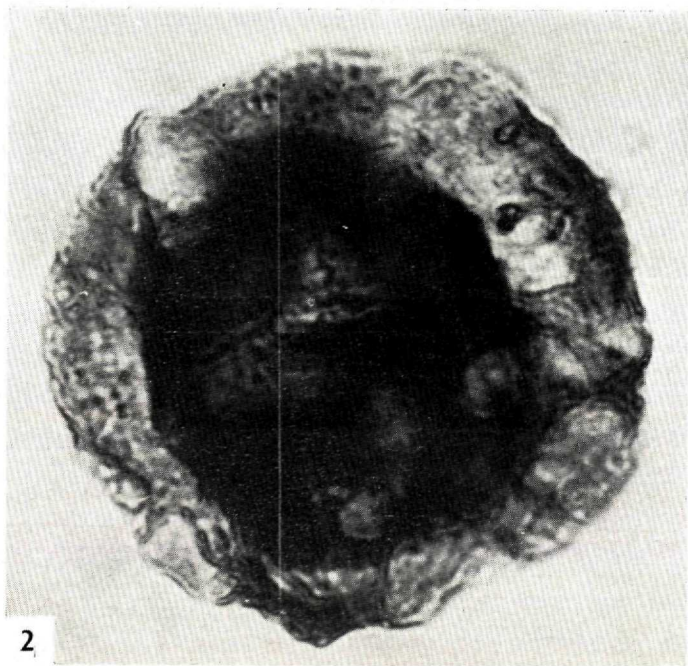


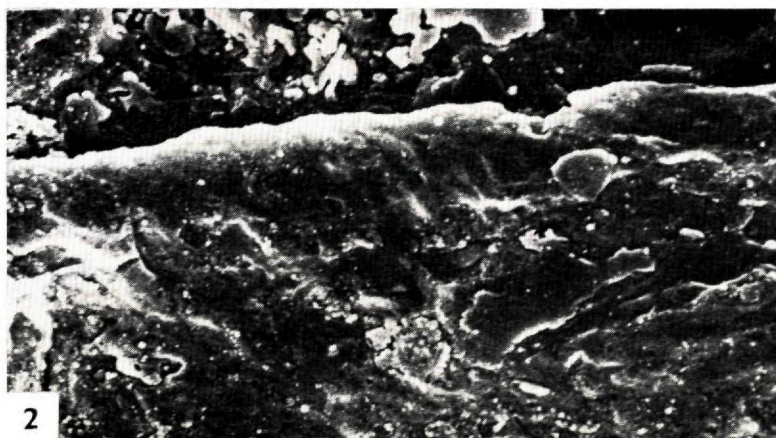
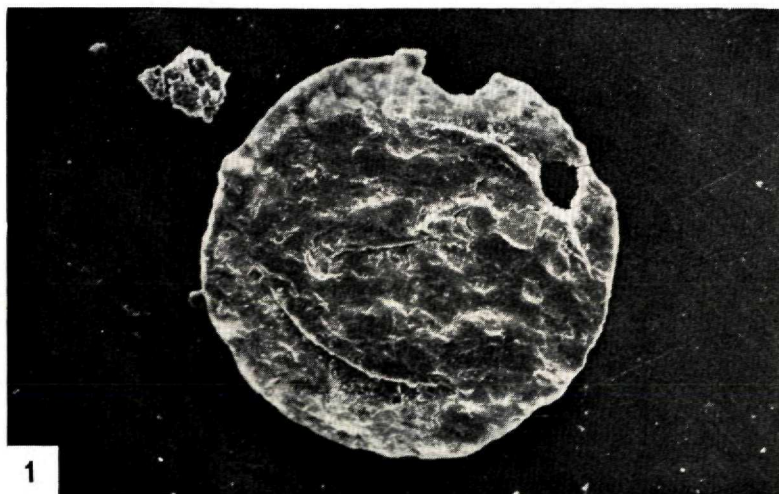
10 μ

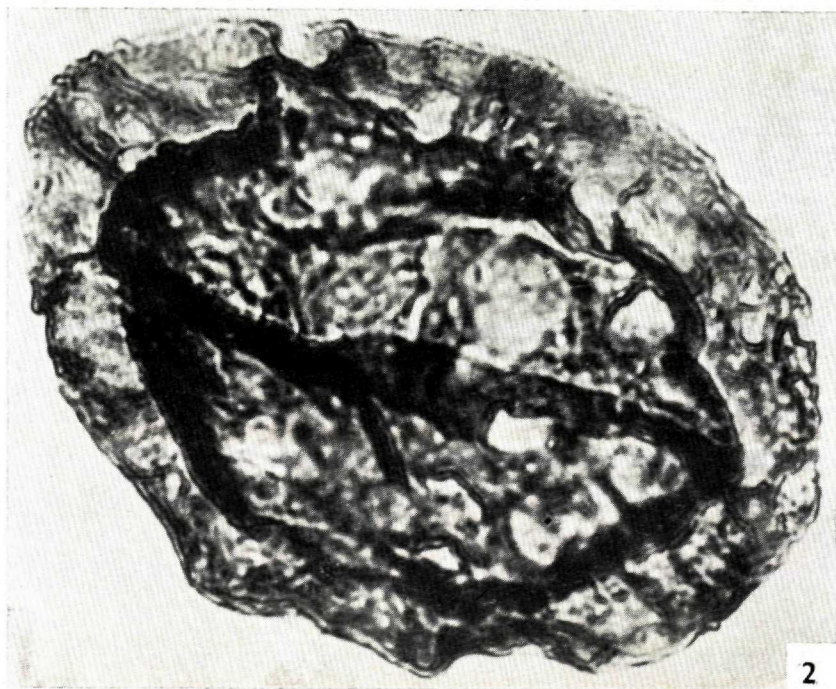
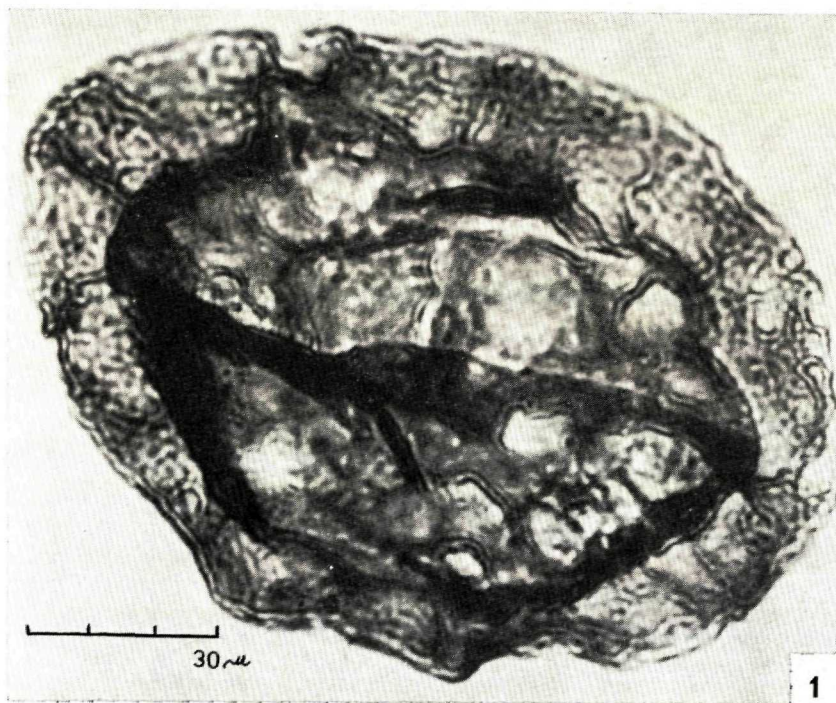


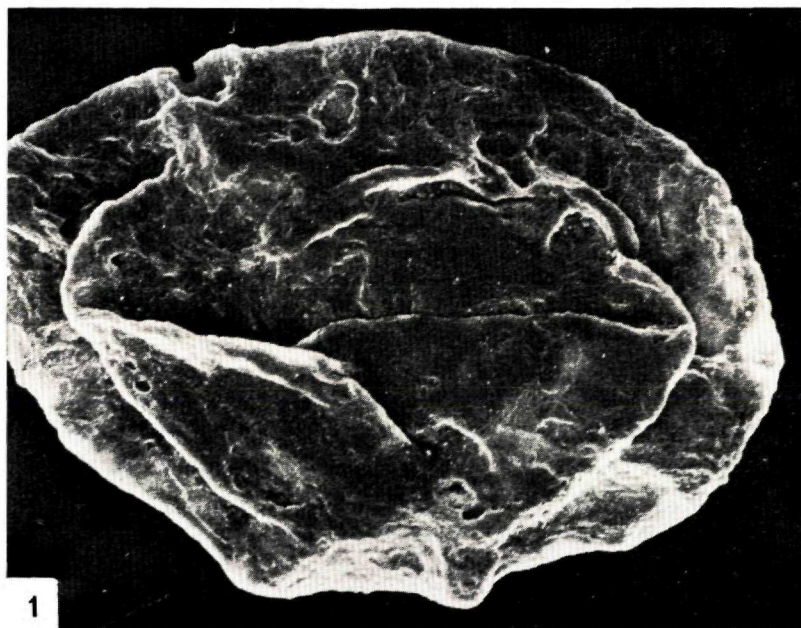


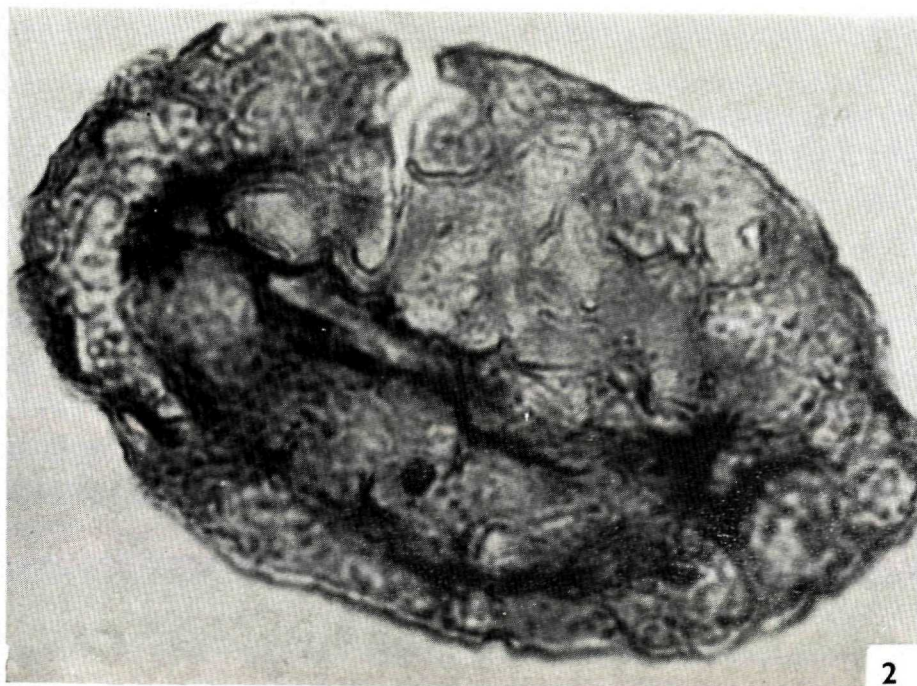
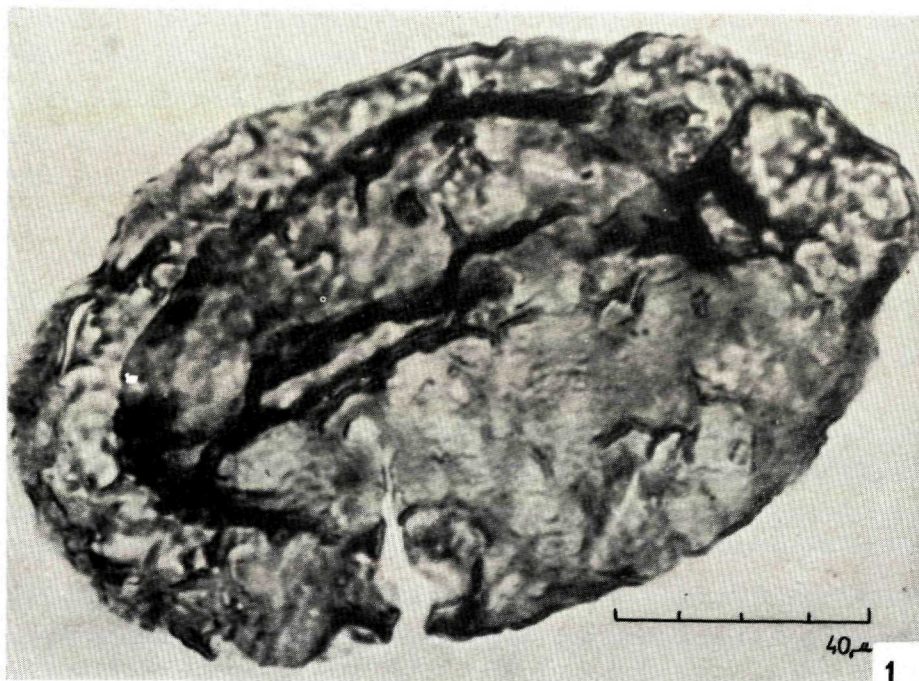
40 μ

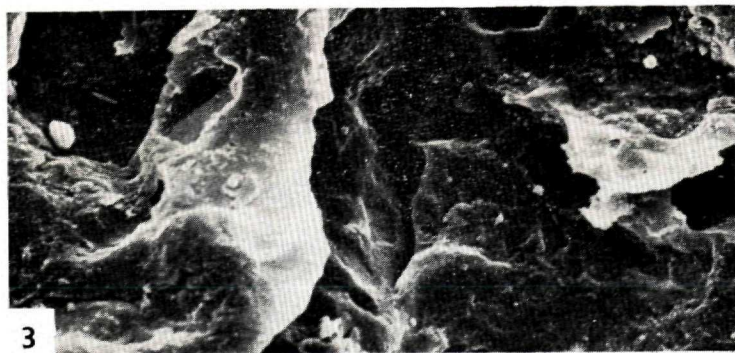
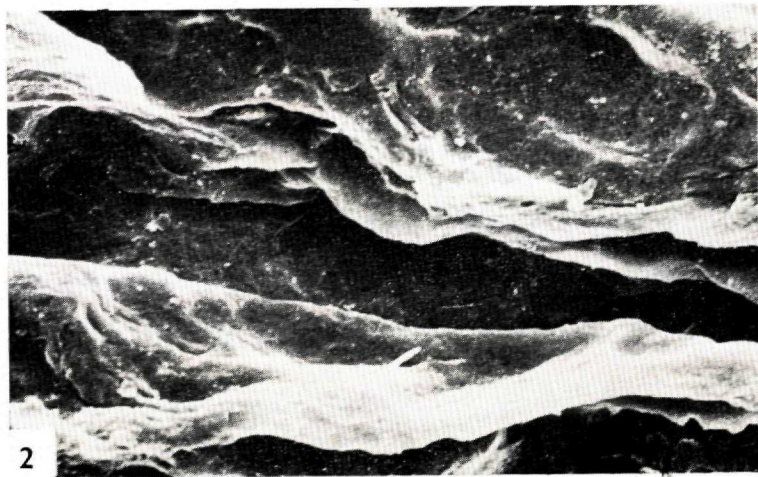
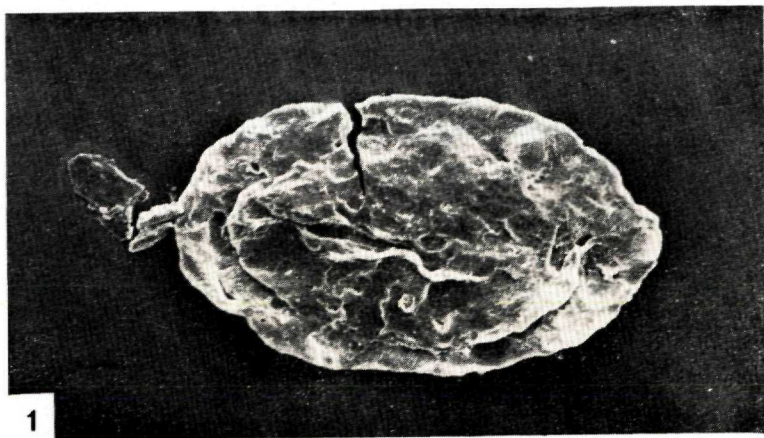


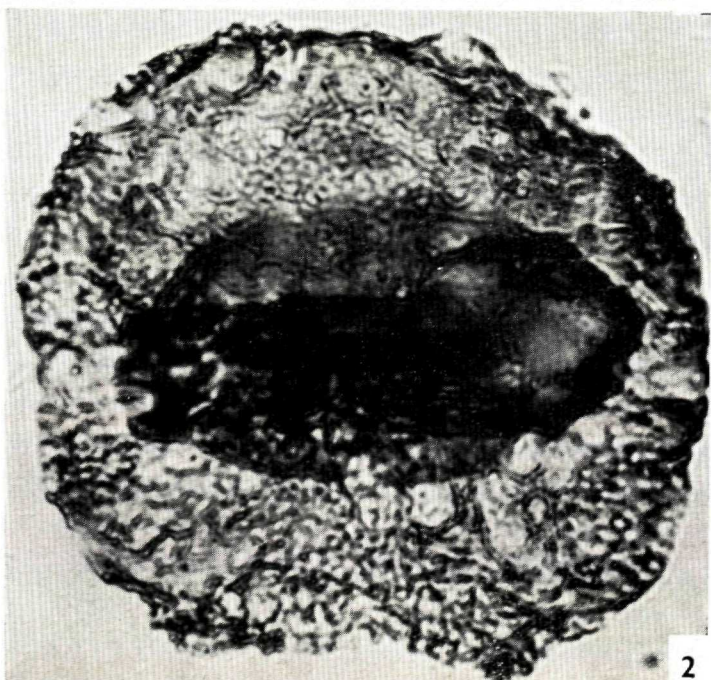
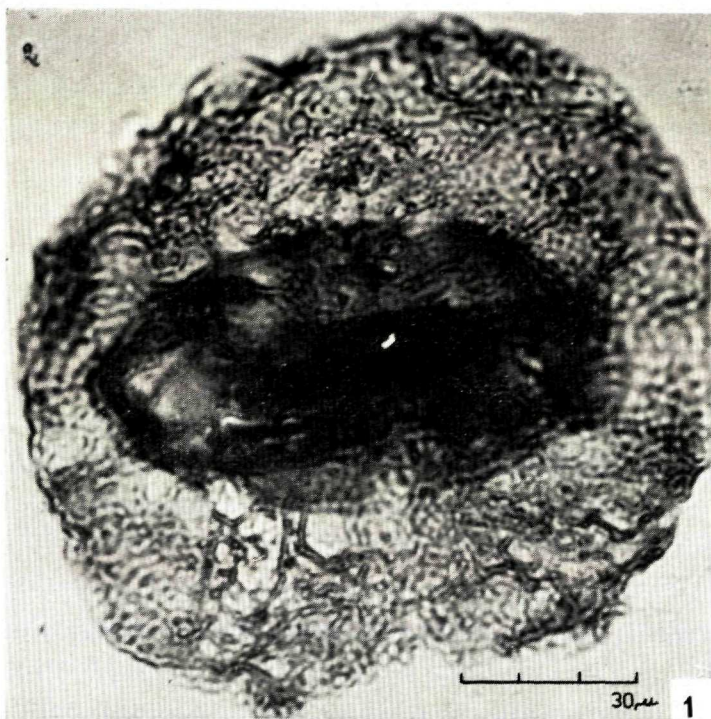


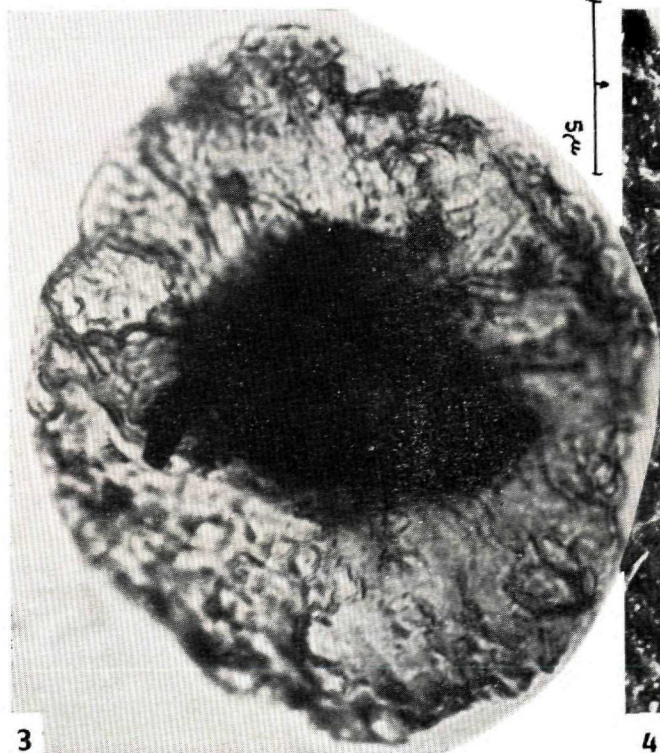
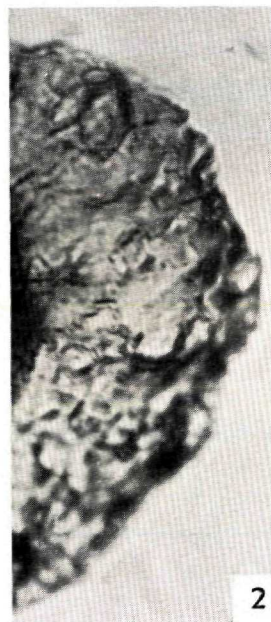
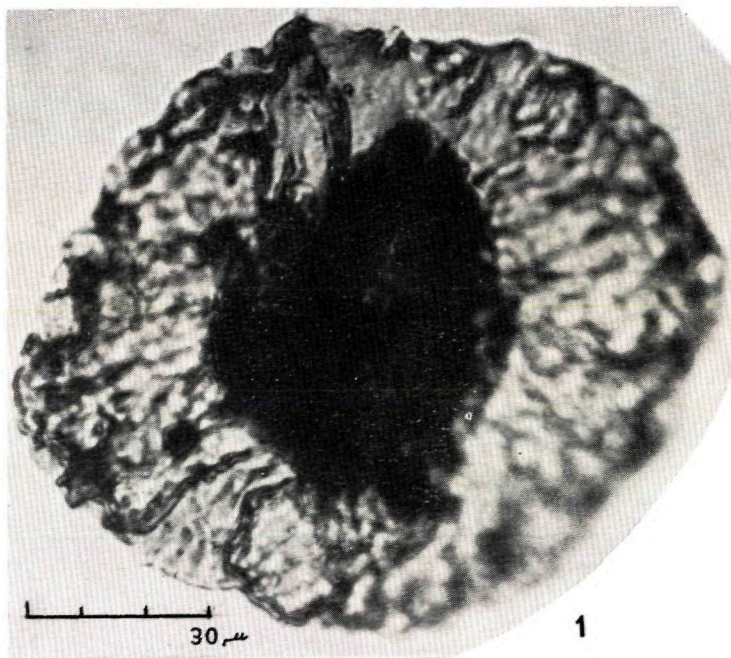


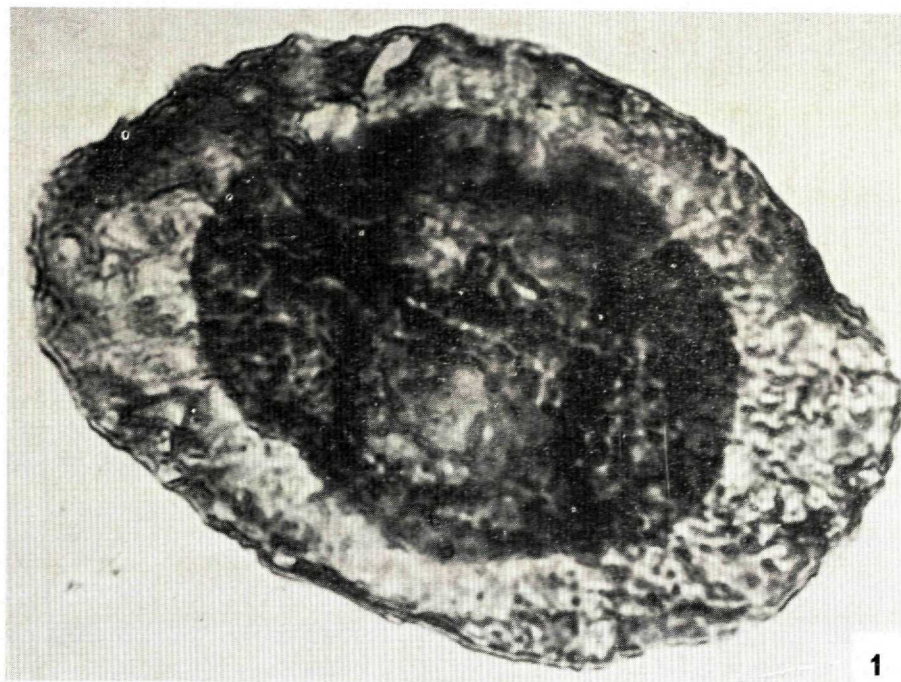




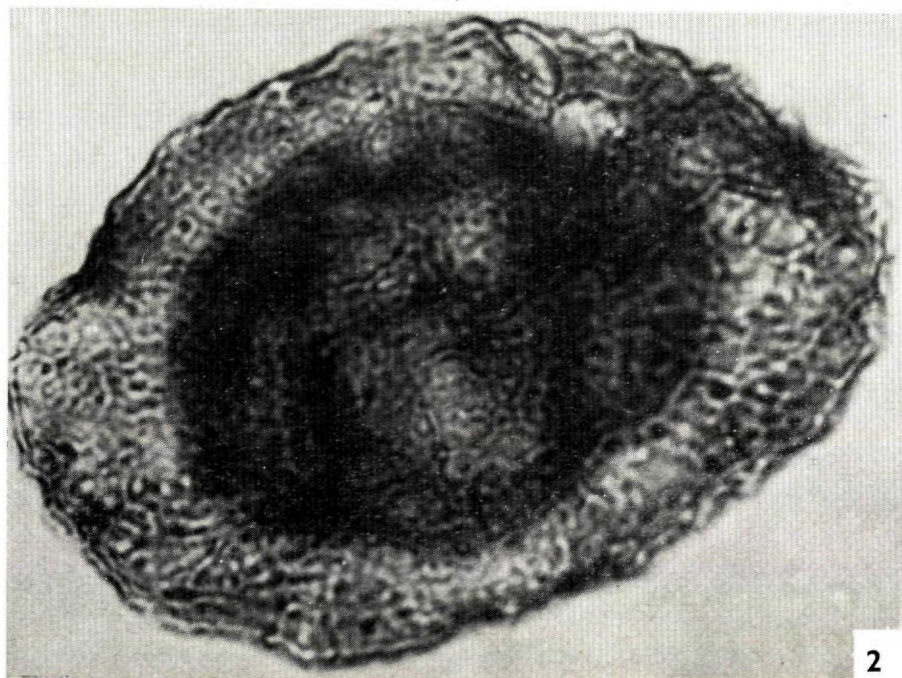


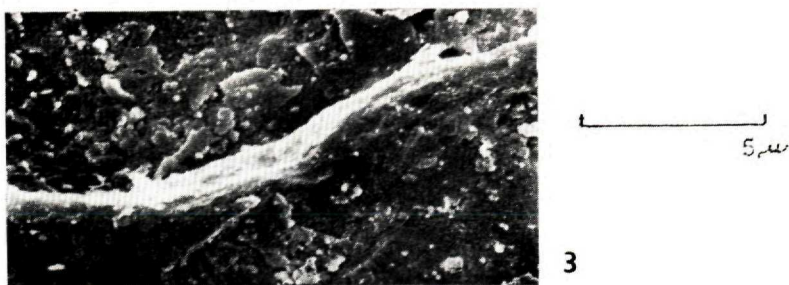
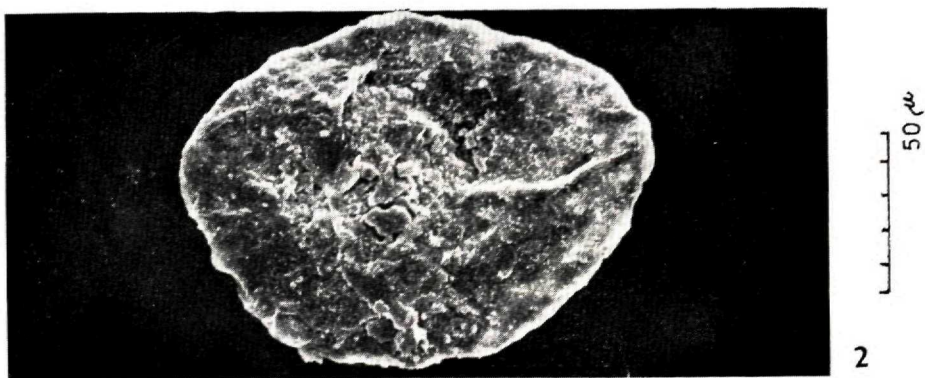
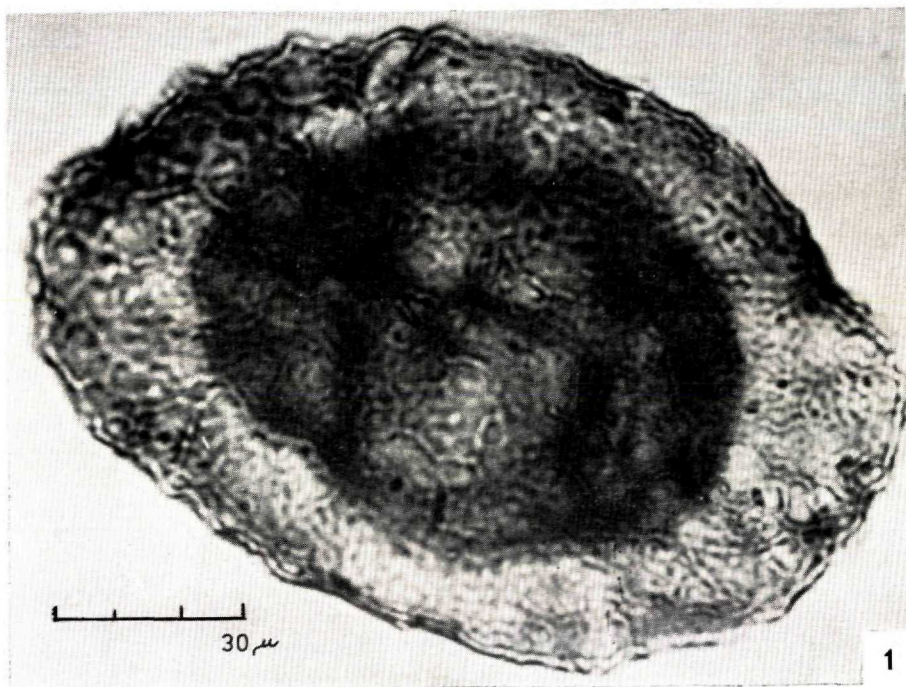


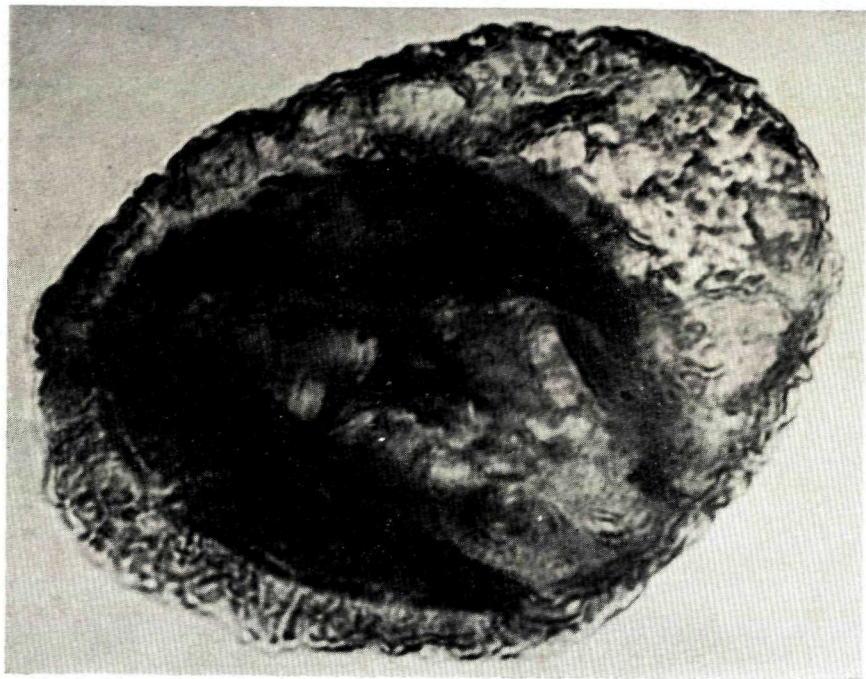




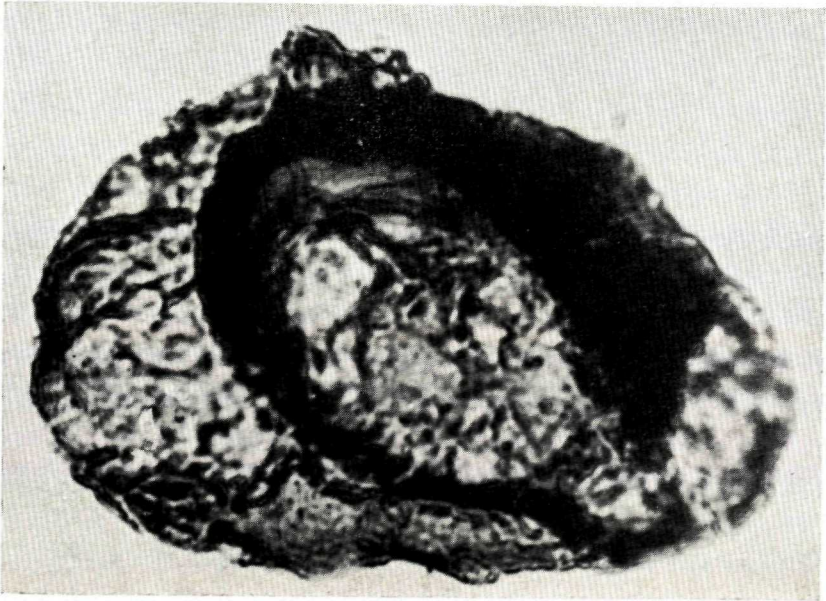
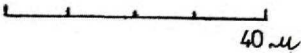
50 μ m



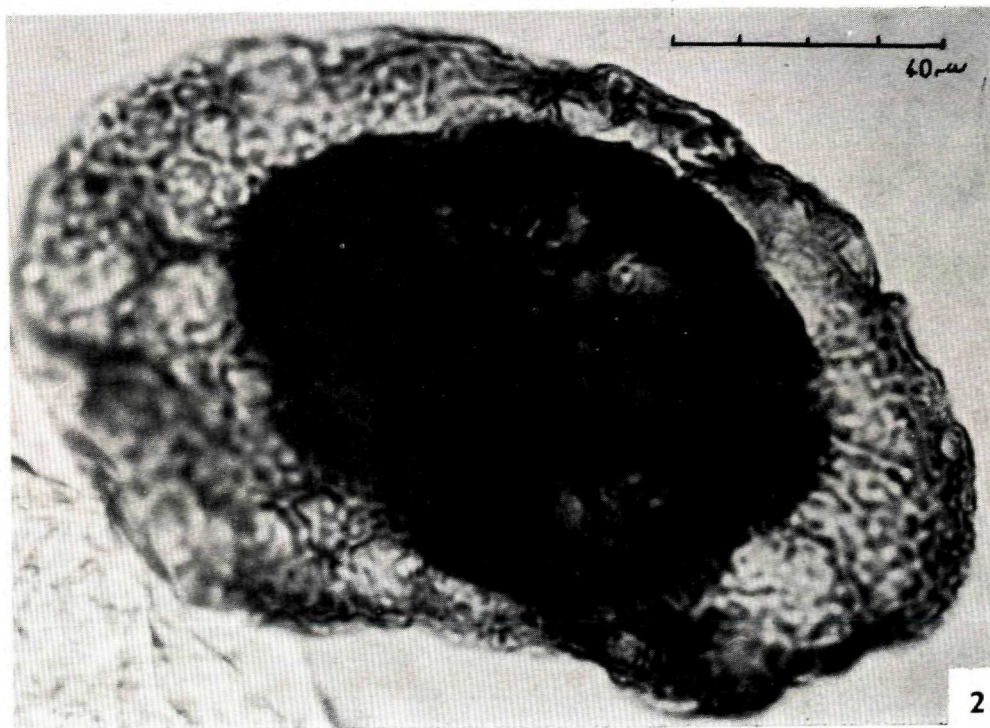
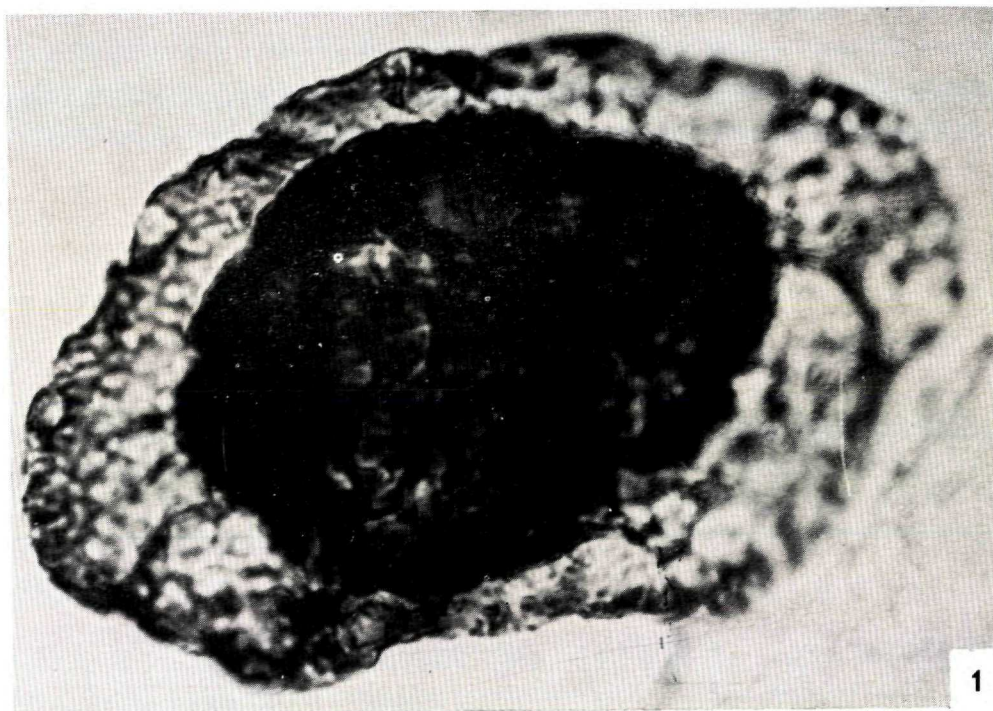


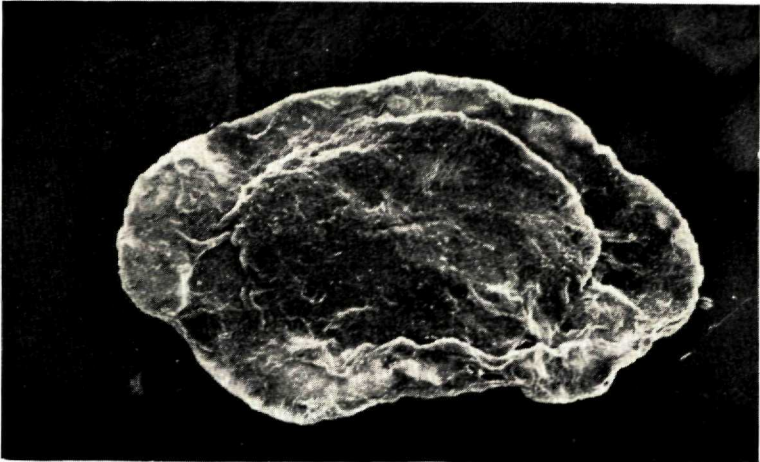


1



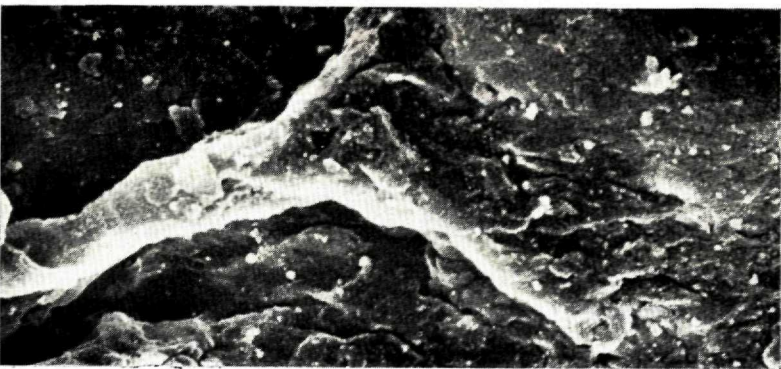
2





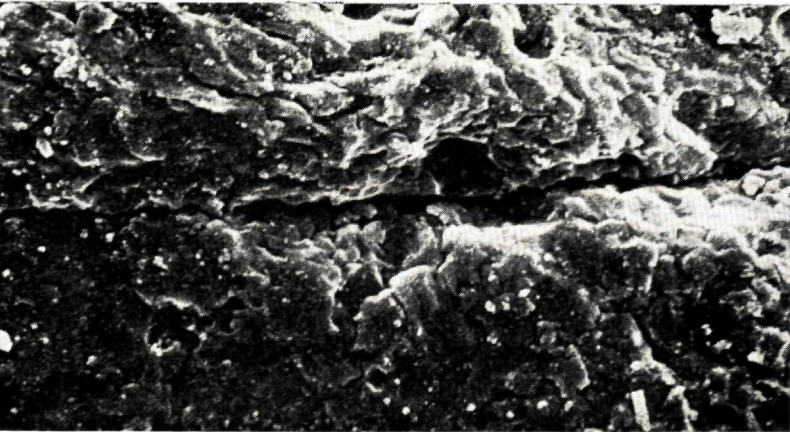
50 μ

1

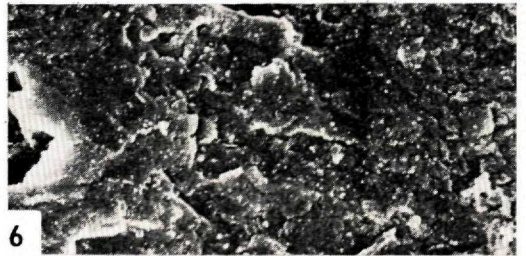
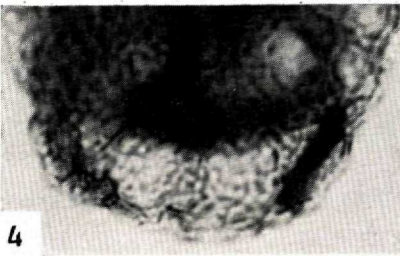
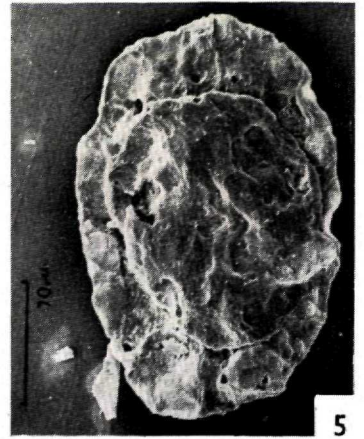
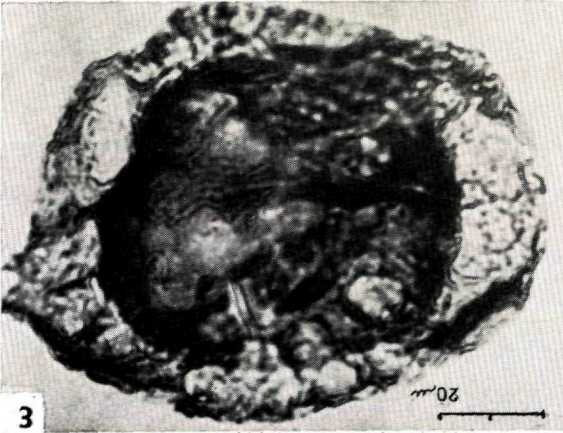
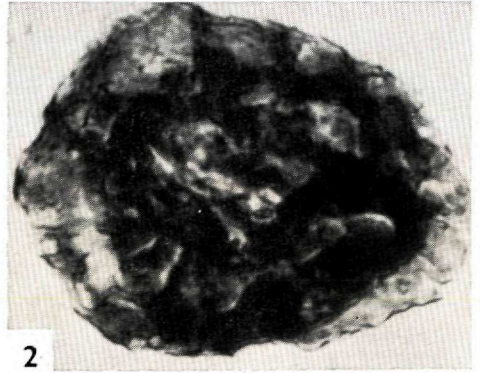
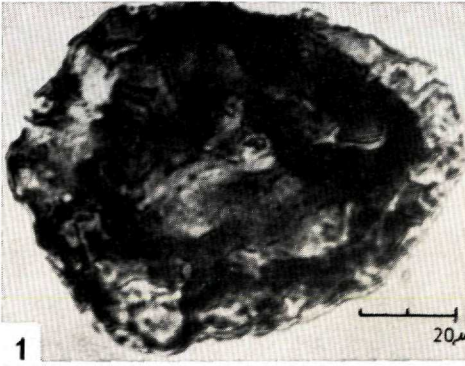


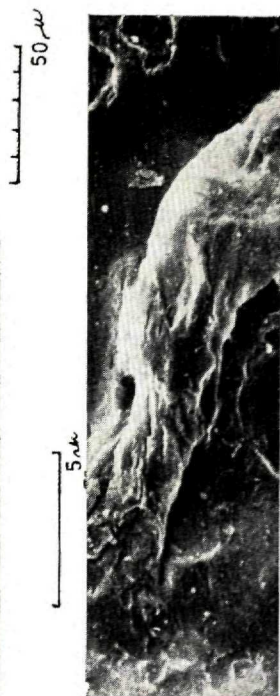
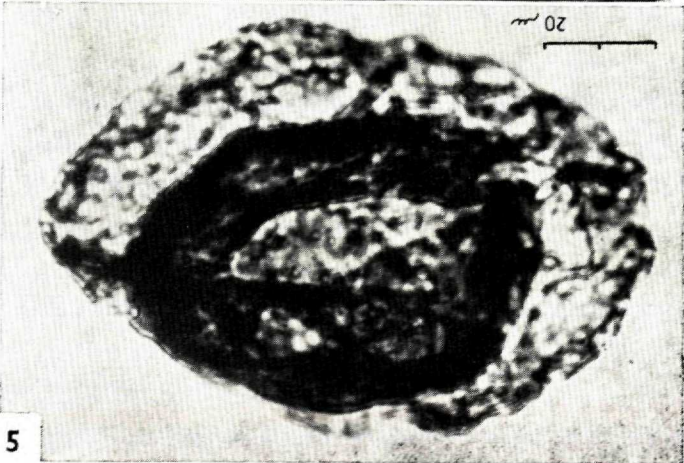
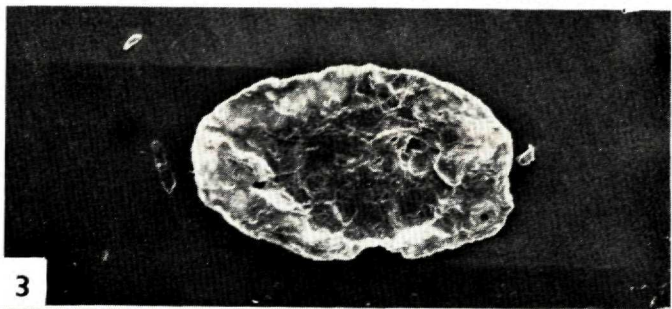
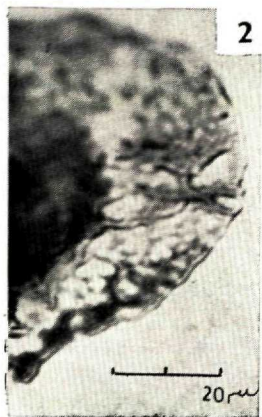
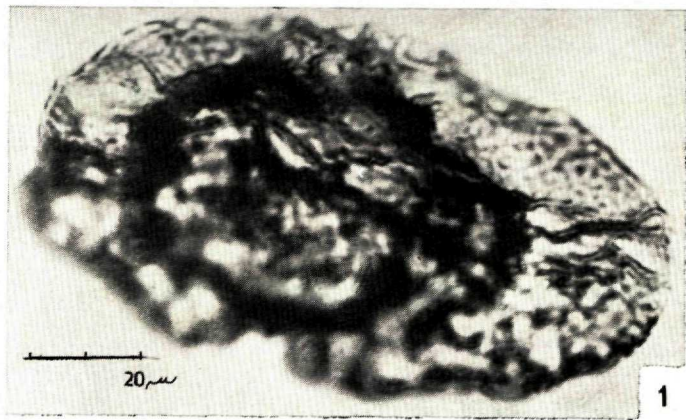
2

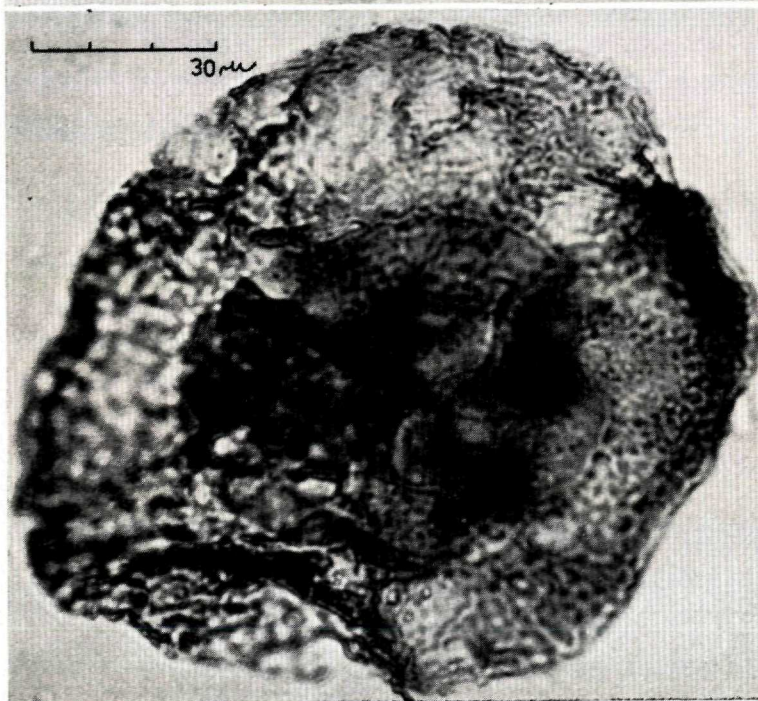
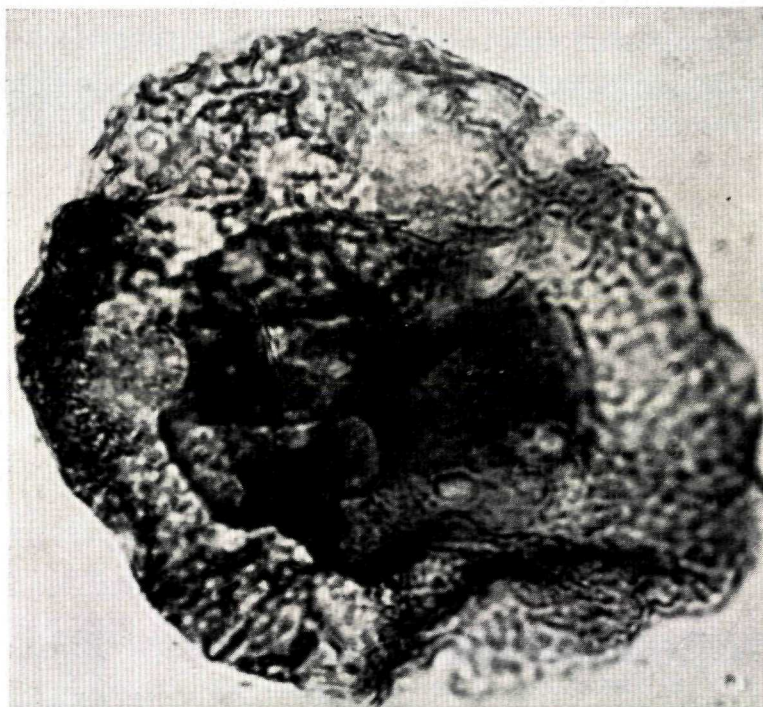
5 μ

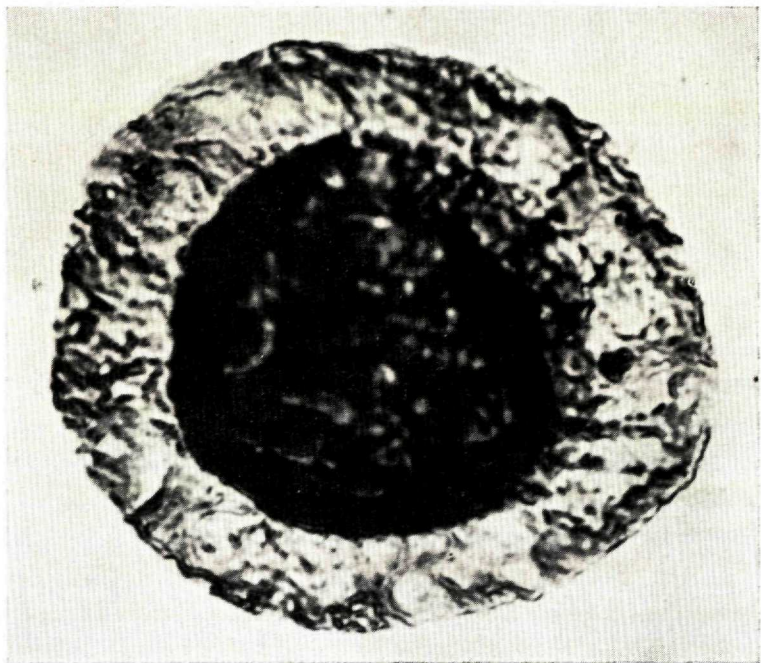


3



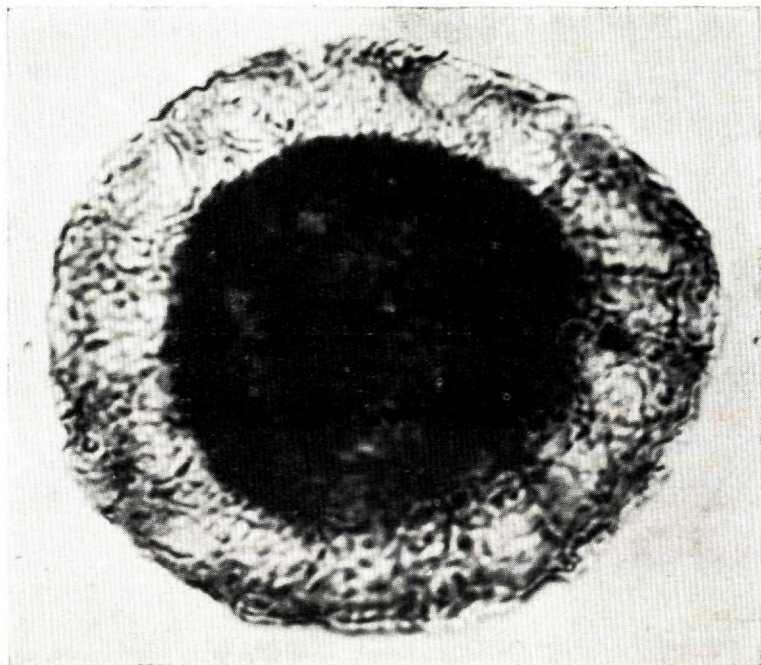




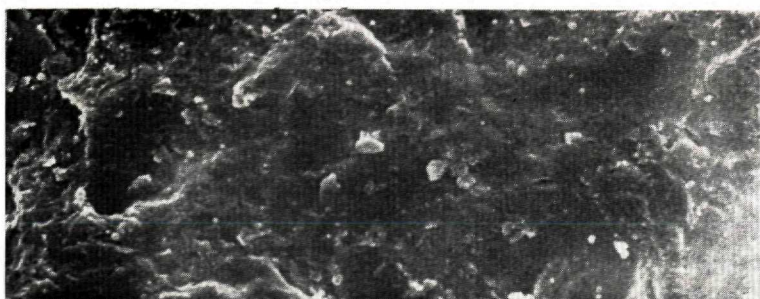
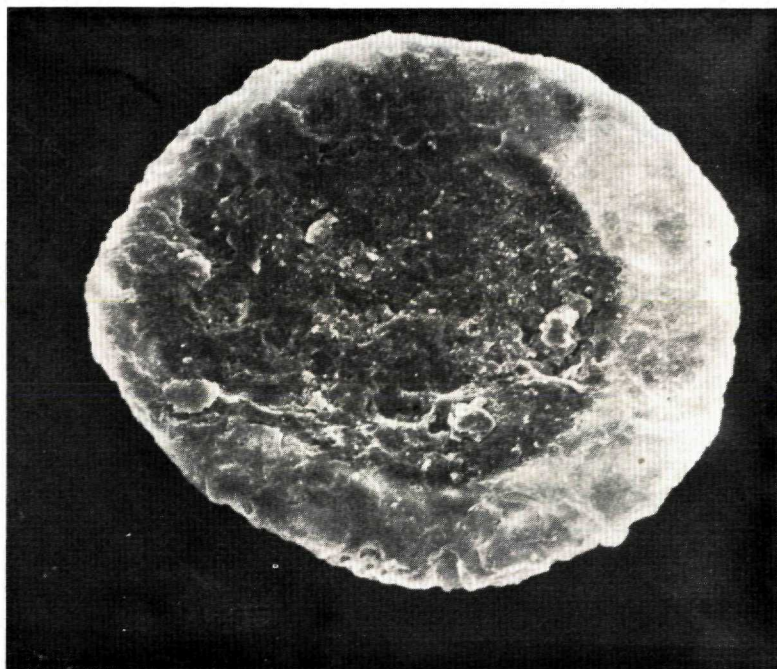


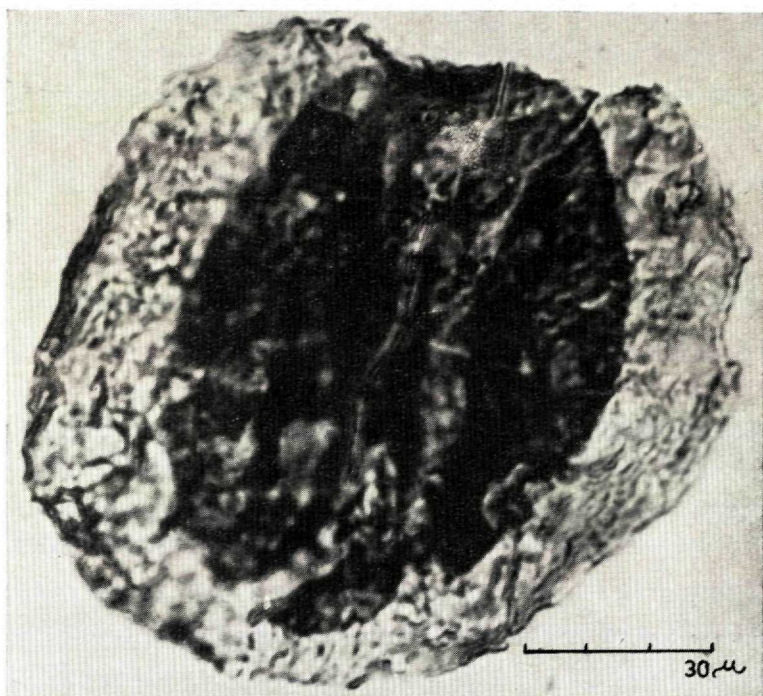
1

40 μ

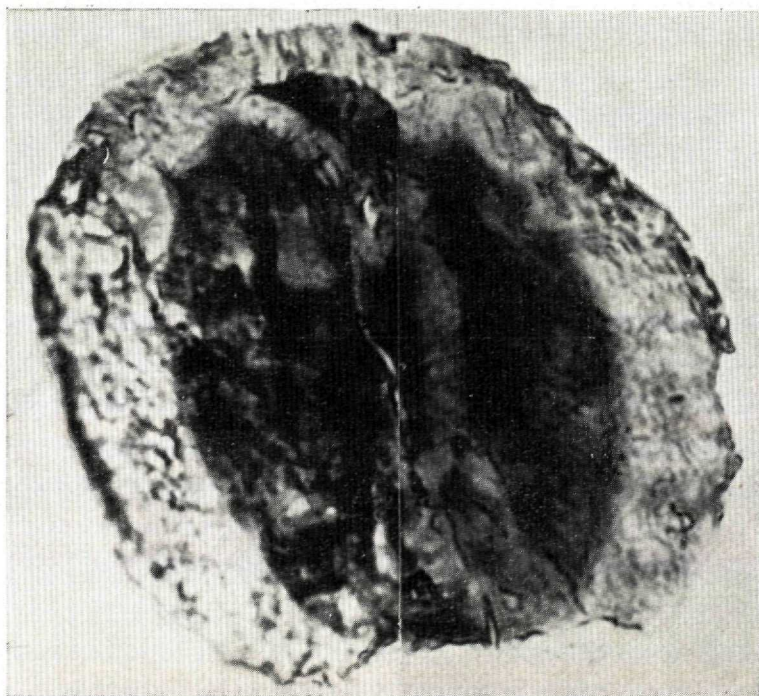


2





1



2



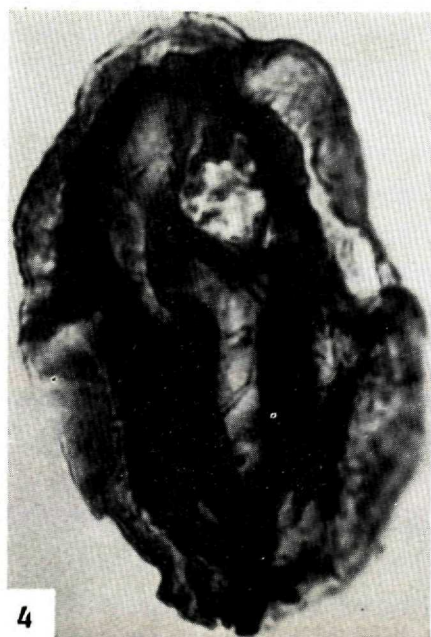
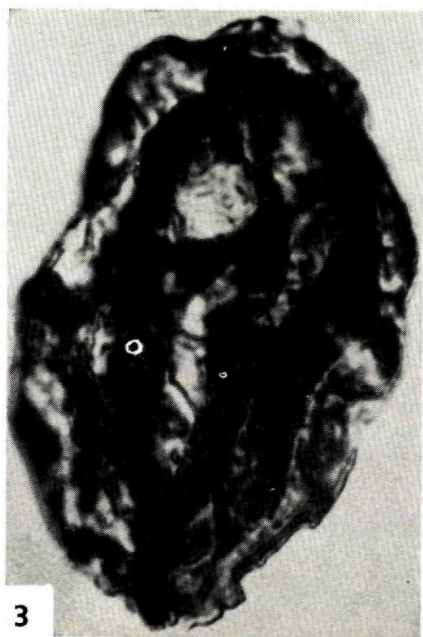
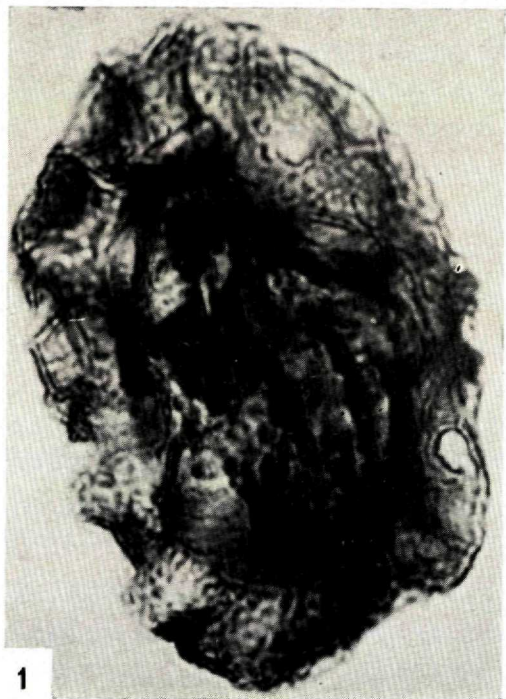
1

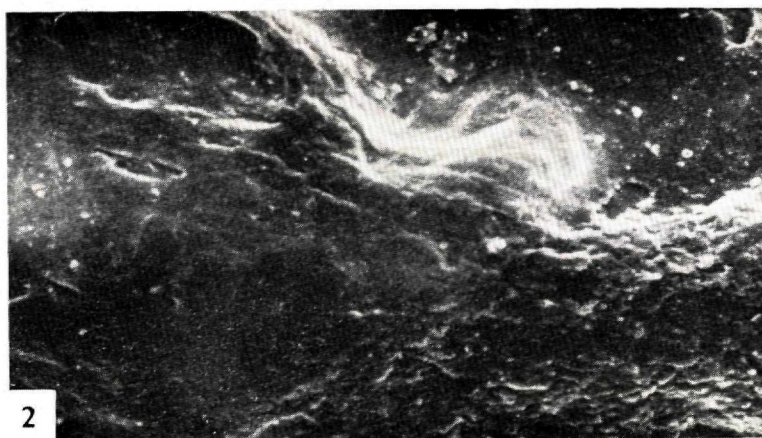
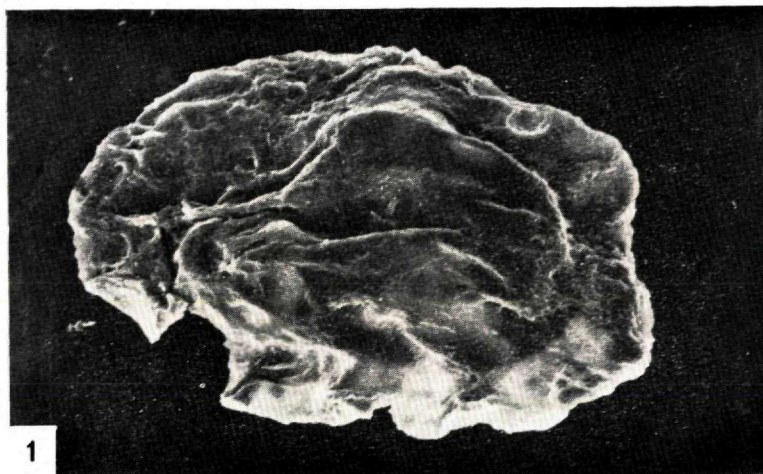
40 μ

10 μ



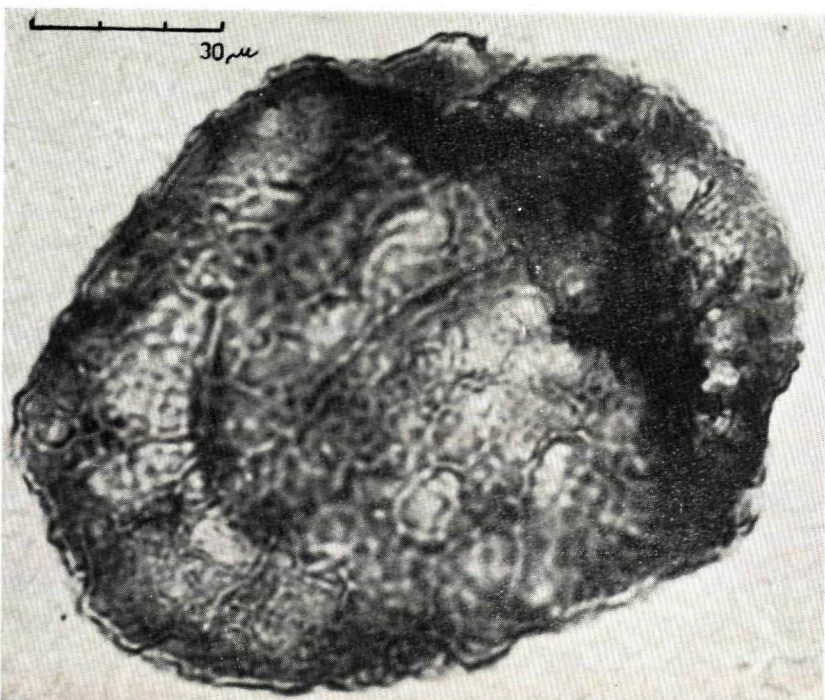
2



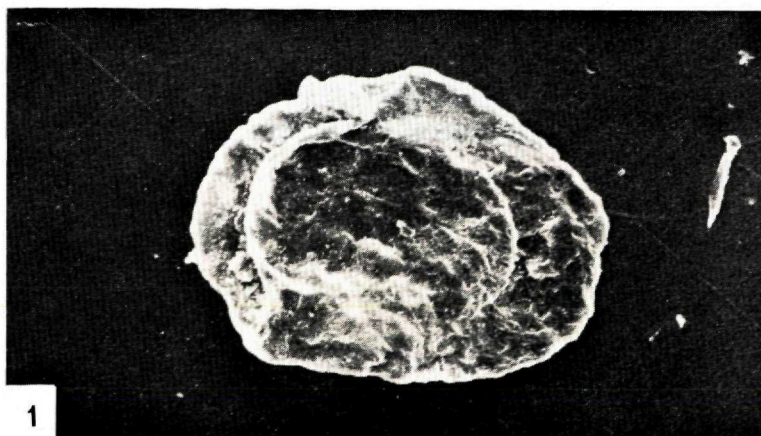


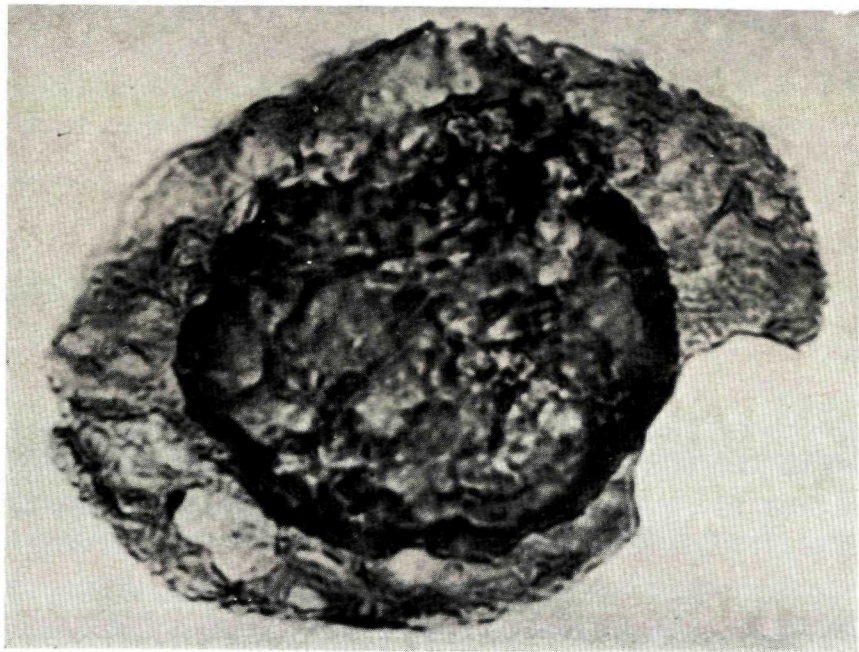


1



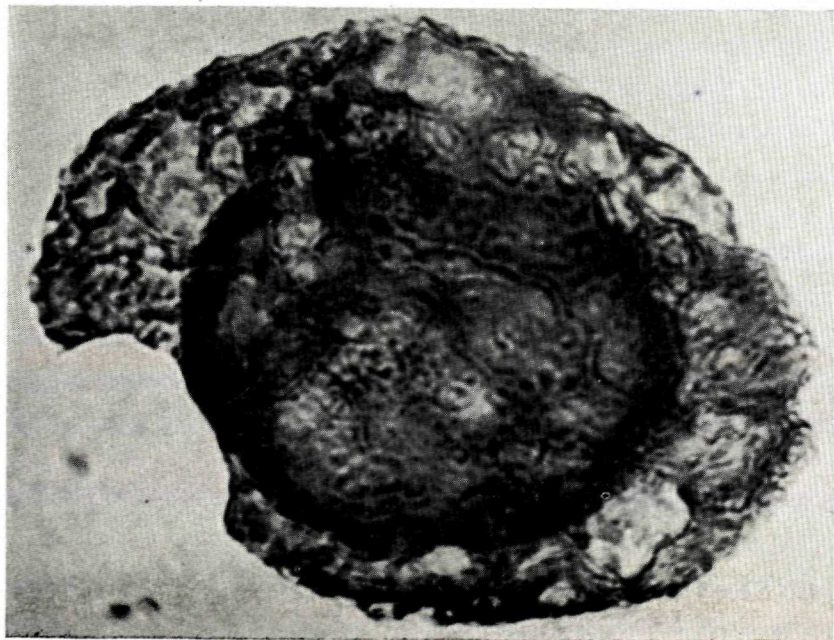
2



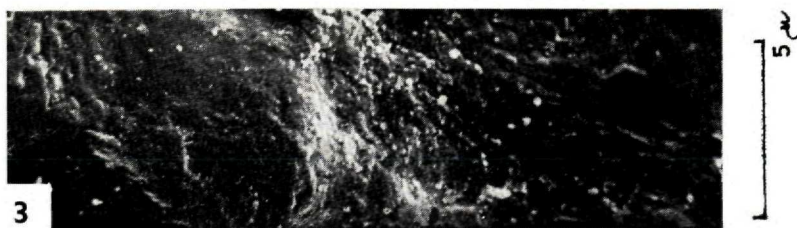
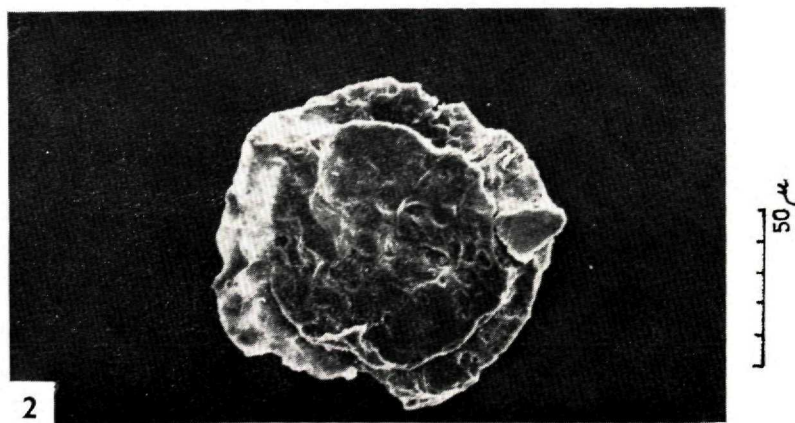
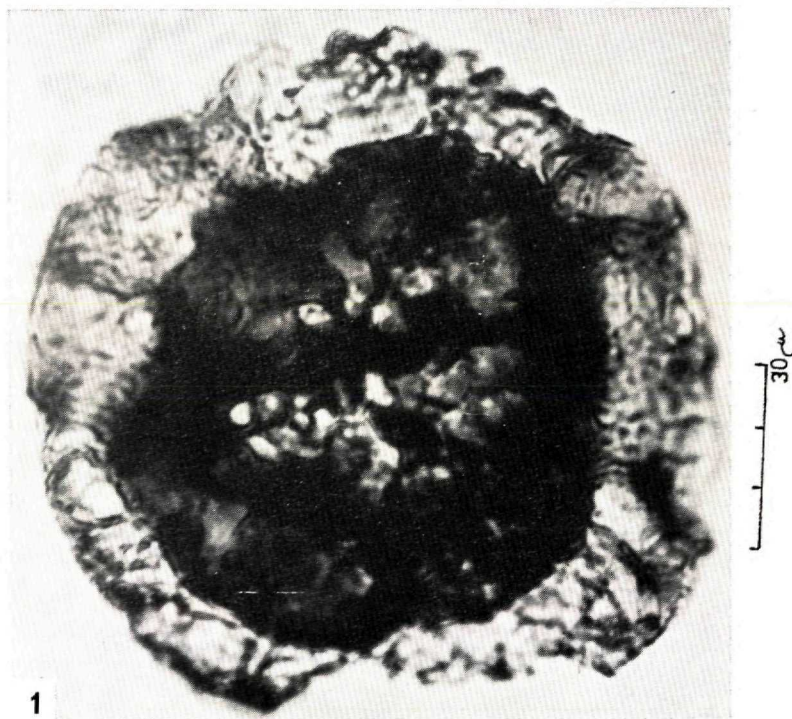


1

50 μ

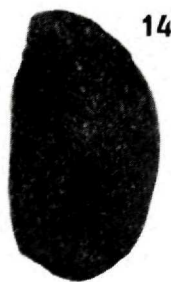
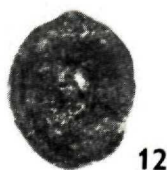
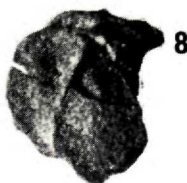
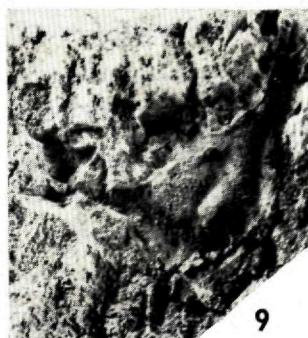
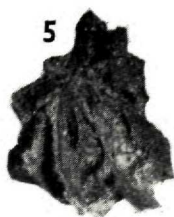
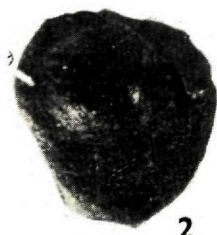


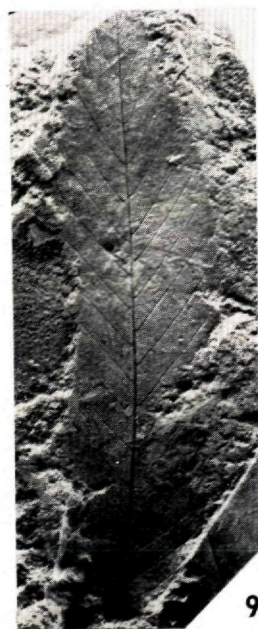
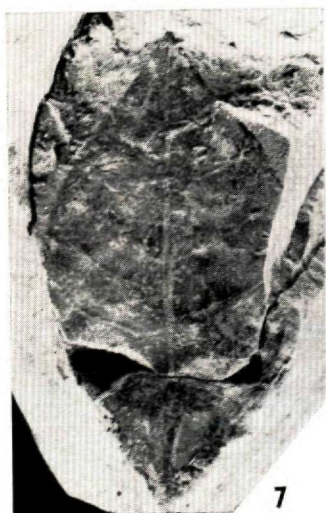
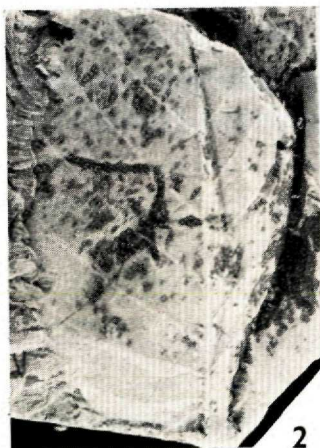
2

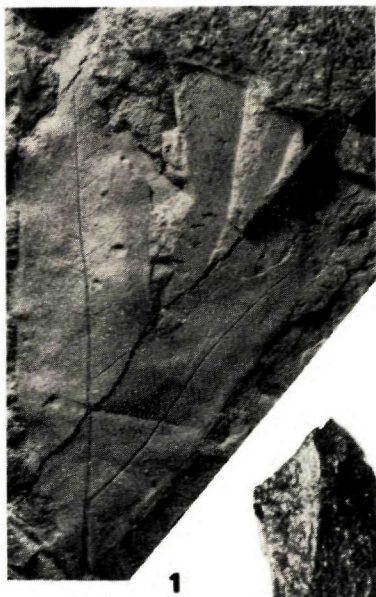












1



2



3



4



5



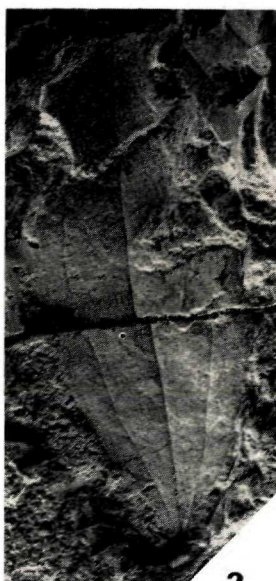
6



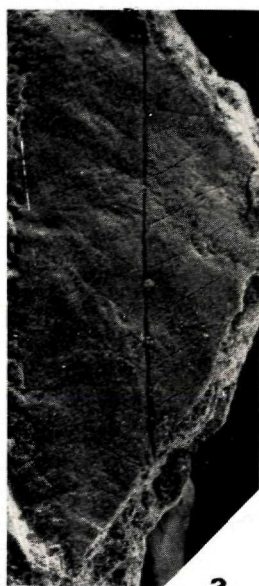
7



1



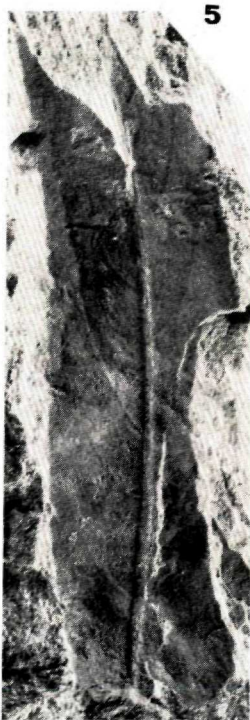
2



3



4



5

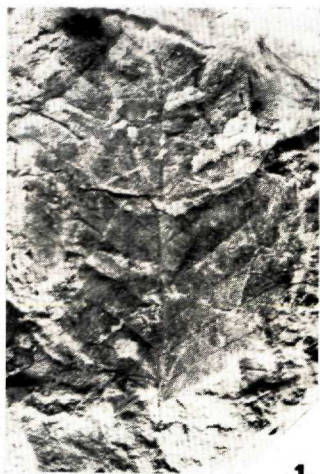


6



7





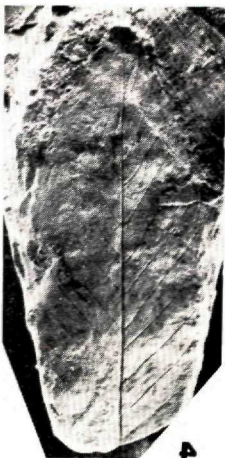
1



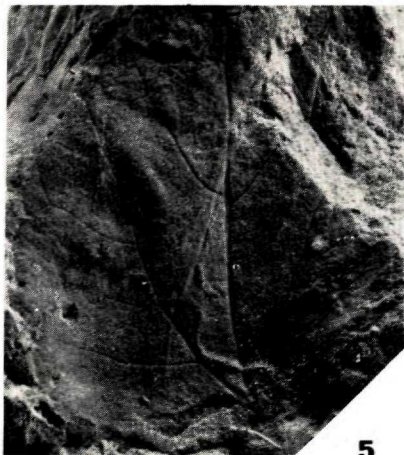
2



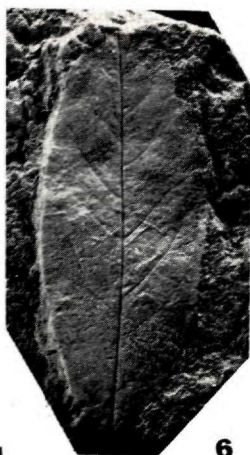
3



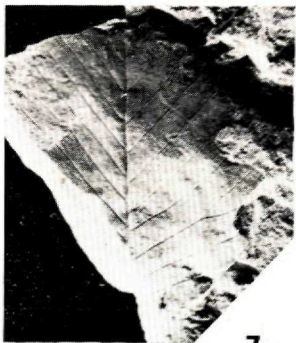
4



5



6



7



8

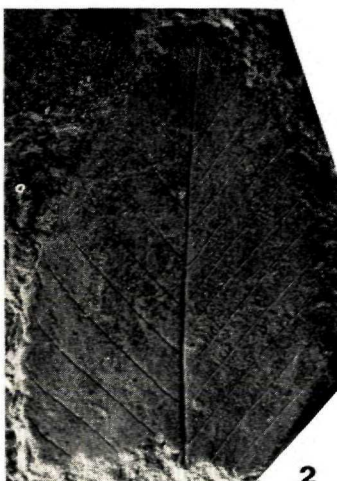


9





1



2



3



4



5



6



7



8



9

- Lehotayová, R.: New data on calcareous nannoflora in pelites of the brick-kiln at Devínska Nová Ves — Novšie poznatky o vápnitej nanoflóre pelitov tehne Devínska Nová Ves (13 pp., 1 text-fig., 10 plates).
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Paleontology 4

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