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Lower Jurassic spores and pollen grains from Odrowąż, Mesozoic margin of the Holy Cross Mountains, Poland

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ABSTRACT. Sixty-three taxa of fossil pollen grains and spores from Odrowąż (Central Poland) are recognized, described and illustrated, their geographical and stratigraphical distributions, and affinities are discussed. A new combination for *Pityosporites minimus* (Couper 1958) comb. nov. is proposed. Description of *Classopollis* pollen grains isolated from *Hirmeriella muensteri* (Schenk) Jung male cones are given. The pollen grains from these cones are identical as dispersed *Classopollis torosus* (Reissinger) Couper from Odrowąż. Some problems of pollen and spores dispersal are discussed. The described microflora is compared with the macroflora from the investigated locality.

The composition of the assemblages and the presence of the index species *Aratrisporites minimus* Schulz suggests that the sediments from Odrowąż represent the Hettangian. It confirms the earlier opinion of the stratigraphical position of these sediments based on geological and macrofloristical investigations.

KEY WORDS: spores, pollen grains, Lower Jurassic, Odrowąż, Poland

CONTENTS

INTRODUCTION

Odrowąż locality (known also as Sołtyków) is situated about 25 km north of Kielce, in the area of the occurrence of the Liassic deposits (Figs 1–2). It is a clay-pit, since 1997 a geological reserve. Palaeobotanical investigations of the Odrowąż outcrop started in 1975 when W. Karaszewski showed it to M. Reymanówna. E. Wcisło-Luraniec and J. Ziaja collected and investigated fossil flora from this place since 1985. Odrowąż is very interesting outcrop because of Jurassic plant macrofossils, spores and pollen grains, megaspores, dinosaur footprints and insect remains occurrence.

GEOLOGY, LITHOSTRATIGRAPHY, AND SEDIMENTARY ENVIRONMENT

Lower Jurassic sediments surround the Palaeozoic core of the Holy Cross Mountains from the north, west and southwest. The detailed history of the geological investigations of the Lower Jurassic at the margin of the Holy Cross Mountains is presented in Karaszewski (1962) and Karaszewski and Kopik (1970). Determination of the stratigraphy of these sediments is difficult because of insufficient number of index species. Hence, at the

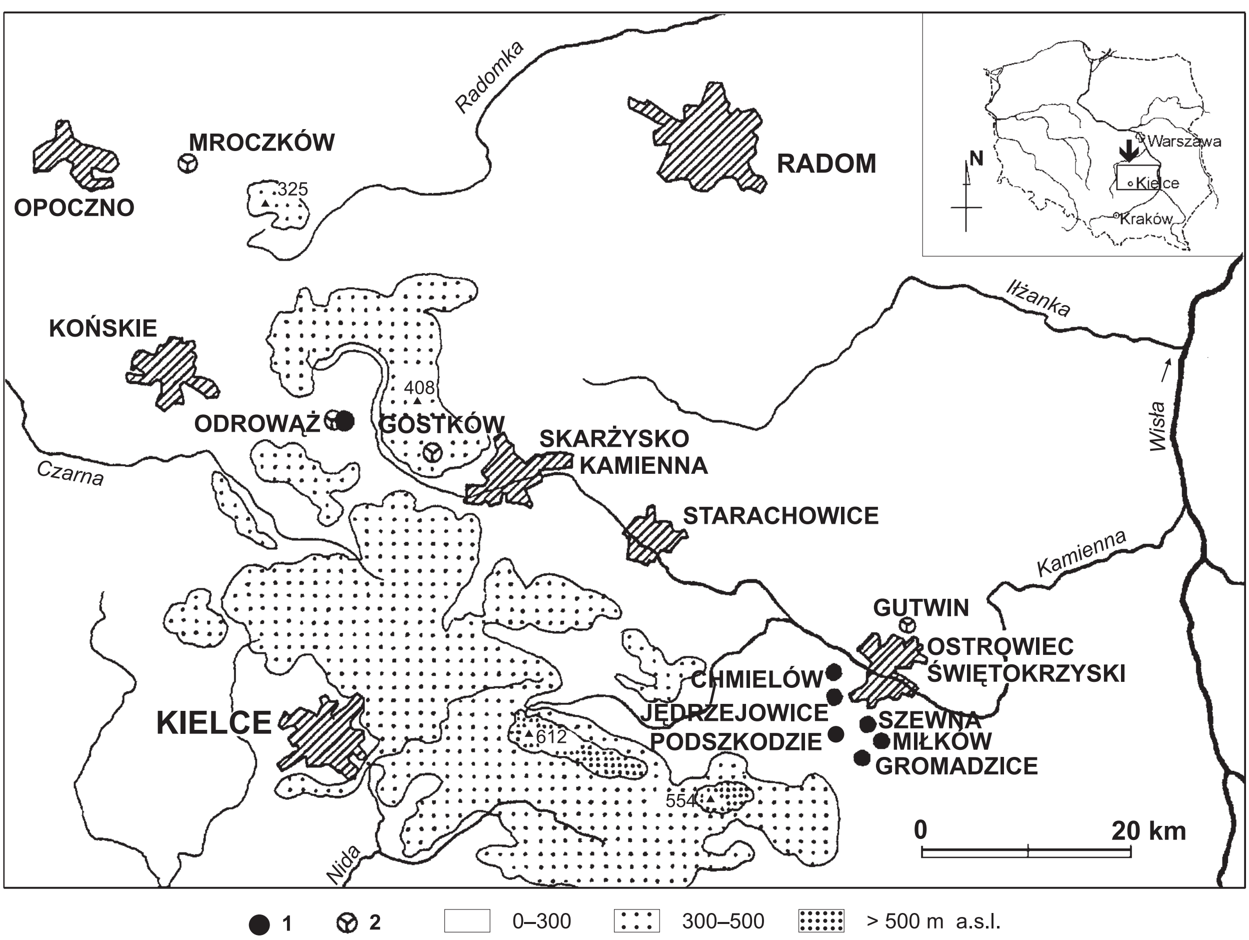

Fig. 1. Map of localities with Liassic micro- and macrofloras in the Mesozoic margin of the Holy Cross Mountains. **1** – locality with macroflora, **2** – locality with microflora (drawing by J. W. Wieser)

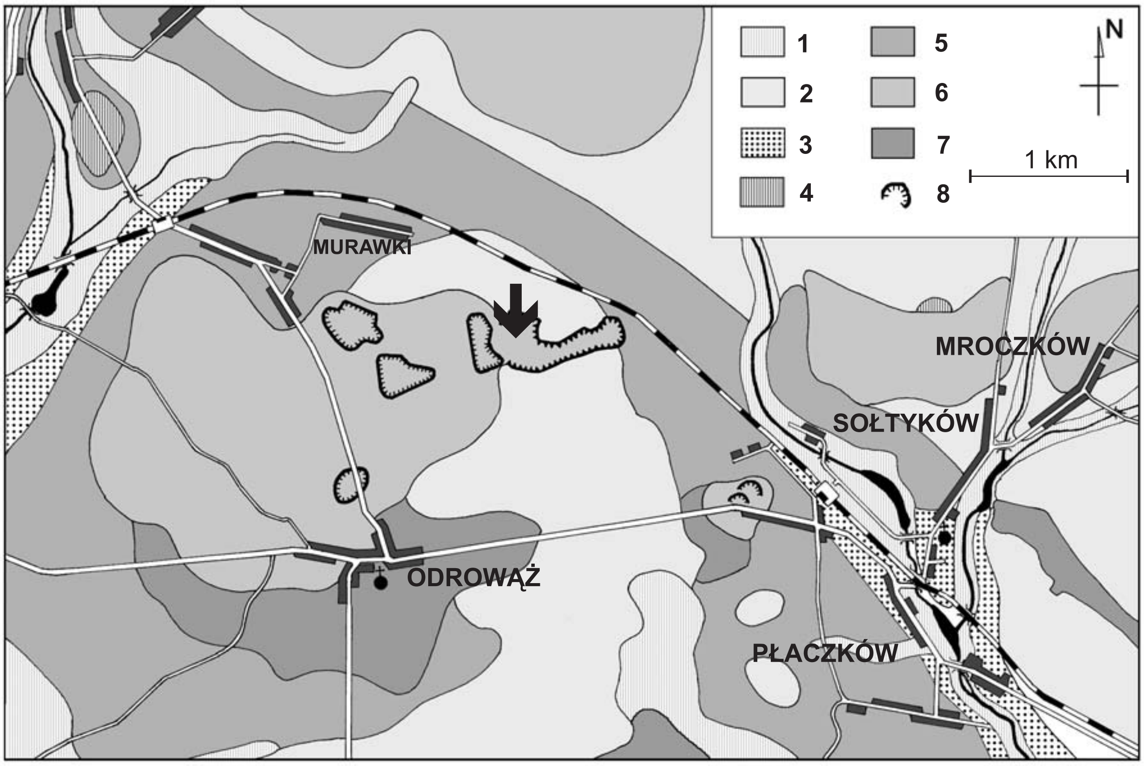

Fig. 2. Location of Odrowąż (Sołtyków). **1** – Holocene fluvial deposits, **2** – Quaternary sands, **3** – Pleistocene sands of the accumulation terraces, **4** – Pleistocene sands and gravels of a front moraine and eskers, **5** – Pleistocene postglacial sands with boulders, **6** – Jurassic sandstones, siltstones and mudstones, **7** – Triassic siltstones and silts, **8** – old mine excavations. Odrowąż outcrop indicated by arrow, after Krajewski (1955), modified (drawing by J. W. Wieser)

beginning the stratigraphy of the Liassic was based on lithostratigraphic correlation and on macroflora.

The determined lithostratigraphical units or series (Fig. 3) are assigned roughly to the stages determined for the marine Liassic. These stages are illustrated e.g. on the Geological Time Table presented by the International Commission on Stratigraphy (2004) The only exception to that rule is the division of the oldest part of the Liassic into three series: Zagaje, Skłoby, and Ore-bearing, which correspond to the Lias α_1 and α_2, i.e. Hettangian (Karaszewski 1960, 1962, Karaszewski & Kopik 1970).

The Zagaje series contains sandstones, claystones, siltstones, siderite sferolites, siderites, and intercalations of coal. The thickness of this series reaches even up to 150 m in the northern part of the Mesozoic margin of the Holy Cross Mountains. Fauna is often in a bad state of preservation. The remains of molluscs and snails were found especially in the upper part of this series. Ostracods were also recorded. Fossil macroflora, microflora, and macrospores occurred here as well.

The Skłoby series, called also Gromadzice series, consists of sandstone-claystone sediments, gravels, and conglomerates. Thickness of this series is from 30 m to 100 m. The marine fauna, including molluscs and foraminifers, as well as micro- and macrospores were described from this series.

The Ore-bearing series, called also Zarzecze series, contains clay siderites and clay shales mainly. Thickness of this series varies from 40 to 110 m. It contains large proportion of marine fauna, i.e. fishes, molluscs, and foraminifers. Megaspores are known from this series, too.

The Ostrowiec and Koszorów series, consisting of sandstones with intercalations of claystones and siltstones, correspond to Sinemurian. Their thickness varies from 40 m up to 200 m.

The Gielniów and Drzewica series correspond to Pliensbachian. The former one consists of claystones, sandstones and siltstones with siderites and contains numerous marine foraminifers and molluscs. The so-called Chmielów clays containing a lot of plant fossils. The thickness of this series varies from 15 m up to 70 m. The Drzewica series, called also Bronów series, contains sandstones mainly and is 45–80 m thick.

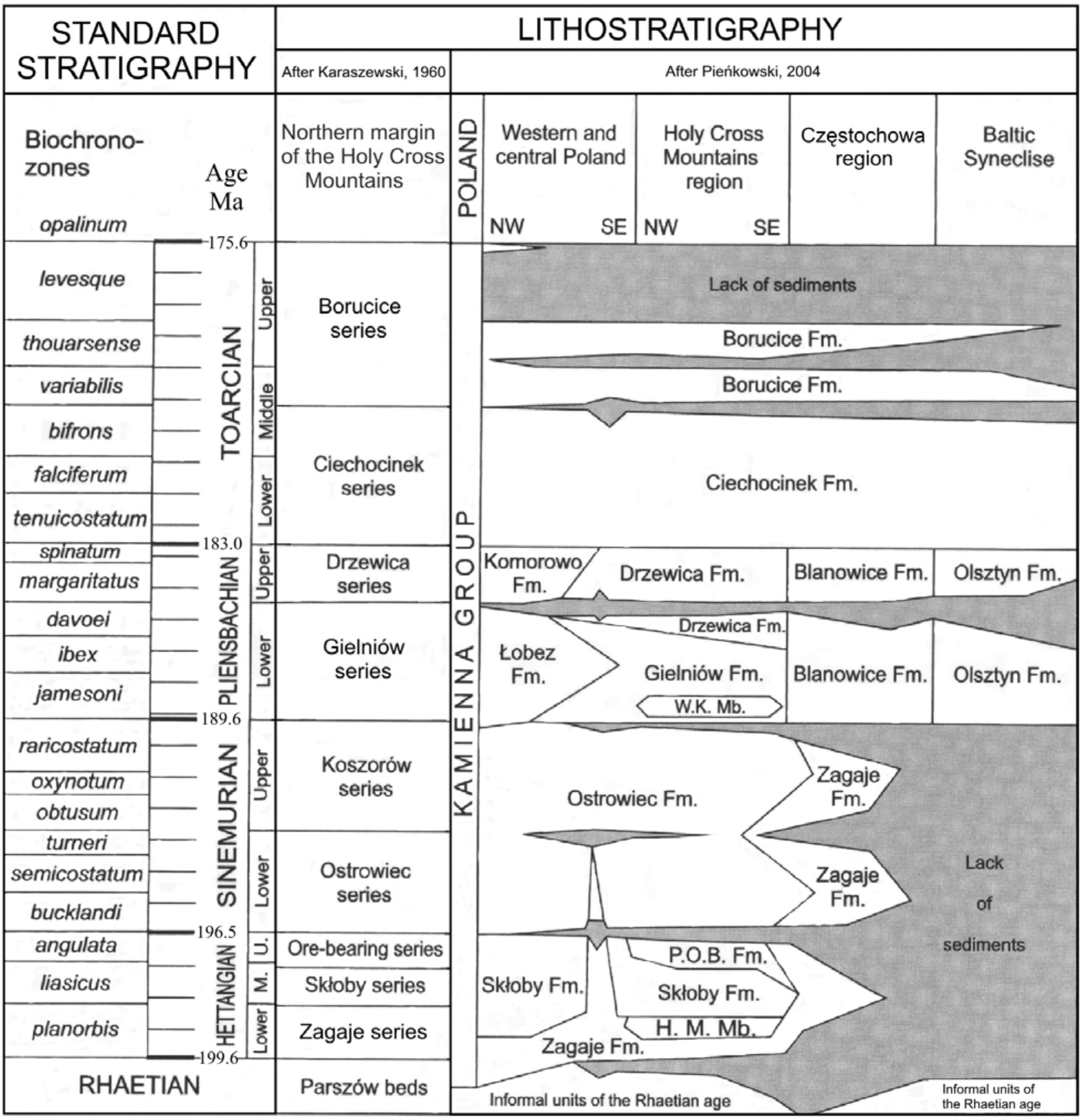

Fig. 3. Lithostratigraphical subdivisions of the Lower Jurassic deposits in Poland after Pieńkowski (2004), modified (drawing by K. Cywa)

The Toarcian sediments are divided into the Ciechocinek series, 20–80 m thick, and the Borucice series, up to 145 m thick. Silt-clay sediments predominate in the former one, with foraminifers and undeterminable remains of molluscs and fish teeth. The latter one consists of sandstones mainly.

Pieńkowski (Pieńkowski 1983, Pieńkowski & Gierliński 1987) carried out a further research of the northern part of the Holy Cross Mountains Liassic. He classified all the series as formations, lowered the lower boundary of the Skłoby series and renounced the Koszorów series, including it to the Ostrowiec Formation. He called the Ore-bearing series the Przysucha Ore-bearing Formation. After Pieńkowski (op. cit.) in the northern part of the Mesozoic margin of the Holy Cross Mountains the lowest Liassic Zagaje Formation is entirely of terrestrial origin. The fully developed facies of the formation (in ascending order) consists of: 1/ sediments of anastomosing rivers; 2/ sediments of meandering rivers, and 3/ lacustrine-boggy sediments. The other formations are mainly of marine origin. They were accumulated in a sea basin with a low salinity and its littoral areas, barriers, lagoons and deltas. Pieńkowski (op.cit.) evidenced two important sea transgressions in the Liassic sediments in the Holy Cross Mountains area: 1/ in the Hettangian, at the beginning of the Skłoby Formation, more or less at the boundary between the Lias α_1 and the Lias α_2, conditions of a brackish reservoir and its costal facies prevailed; 2/ in the Lower Sinemurian, above the lowest terrestrial complex of the Ostrowiec Formation, at the Lias α_3, the conditions of a shallow brackish reservoir and its coastal facies prevailed.

The sea regressions are clearly evidenced in the Ore-bearing Formation, and the return to the terrestrial conditions occurred in the beginning of the sedimentation of the Ostrowiec Formation.

The geology and sedimentology of the Odrowąż locality were investigated and described by Pieńkowski (Pieńkowski & Gierliński 1987, Pieńkowski 1998). This author assigned the whole Odrowąż section to the Zagaje Formation (Lower Hettangian), which consisted mainly of mudstones, siltstones, and sandstones. Pieńkowski (1998) reconstructed the Lower Jurassic palaeoenvironment of this locality. According to him the lower part of the Odrowąż section represents a flood plain of braided rivers, whereas the upper part a flood plain of meandering rivers, in which the lowlying terrains were covered with *Neocalamites* plants and the higher elevations with coniferous forest.

Pieńkowski (2004) proposed new names and definitions for all terrigenous, continental, marginal marine and marine Lower Jurassic sediments up to 1400 m in thickness deposited in a large epeiric basin extending across Poland. He defined these sediments as the Kamienna Group, which is subdivided into 12 lithostratigraphic formations. He defined also two new members (Fig. 3).

PREVIOUS PALAEONTOLOGICAL AND GEOLOGICAL INVESTIGATIONS OF LOWER JURASSIC IN THE MESOZOIC MARGIN OF THE HOLY CROSS MOUNTAINS

The first paper on the macroflora from the Jurassic sediments at the margin of the Holy Cross Mountains was published by Raciborski (1891). He described and illustrated 26 species of the Equisetales, Filicales, Cycadales and Coniferales from the localities Chmielów, Gromadzice and Miłków (Fig. 1). In the second paper Raciborski (1892) described 19 species of fossil plants from this region among them the new genus *Ixostrobus* Rac. He considered the age of this fossil macroflora as Rhaetic, following the used, at that time, stratigraphic scheme of Nathorst (1910).

The fossil flora from this region was investigated also by Makarewiczówna (1928) who described and illustrated 43 species from the localities Podszkodzie, Szewna, Jędrzejowice and Chmielów (Fig. 1). She agreed with M. Raciborski that this flora belongs to *Thaumatopteris schenkii* zone in Nathorst's scheme but following new opinions of the Rhaeto-Liassic stratigraphy placed its age in the Lower Liassic. According to Karaszewski (1965) the age of the flora from the locality Gromadzice is regarded as Lower Liassic and that from Chmielów as Middle Liassic.

In the Odrowąż outcrop (Fig. 4) fossil plants occur in a bed of grey shale occasionally with iron precipitations and are preserved as compressions or charcoal (Ziaja & Wcisło-Luraniec 1999). The flora contains numerous specimens, but not many species. The list of plants found so far in Odrowąż sediments (Reymanówna 1987, 1992, Wcisło-Luraniec 1987, 1992a, Wcisło-Luraniec and Barbacka – pers. comm.) contains: Sphenophyta, Equisetales: *Neocalamites* sp. 1 (stem), *Neocalamites* sp. 2 (stem), *Equisetites* sp.; Pteridophyta, Osmundales, Osmundaceae: *Todites princeps* (Presl) Gothan (leaves and rhizomes); Filicales, Matoniaceae: *Phlebopteris angustiloba* (Presl) Hirmer & Hoerhammer (leaves); Dipteridaceae: *Thaumatopteris schenkii* Nathorst (leaves); Filicales of unknown affinity (leaves): *Woodwardites microlobus* Schenk; Pteridospermophyta, Caytoniales: *Caytonia* sp. (seed), ?Corystospermales: *Pachypteris lanceolata* Brongniart (leaves); Cycadophyta, Bennettitales (= Cycadeoidales): *Otozamites brevifolius* Brain (leaves), *Pterophyllum* sp. (leaves); Ginkgophyta,Ginkgoales: *Schmeissneria microstachys* (Presl) Kirchner & van Konijnenburg-van Cittert 1994 (described by Wcisło-Luraniec 1992b as *Stachyopitys preslii* Schenk); Coniferophyta, Coniferales, ?Ullmaniaceae: *Swedenborgia* sp. (scales and cones), *Podozamites* sp. 1 (leaves); Cheirolepidiaceae: *Hirmeriella muensteri* (Schenk) Jung (stem

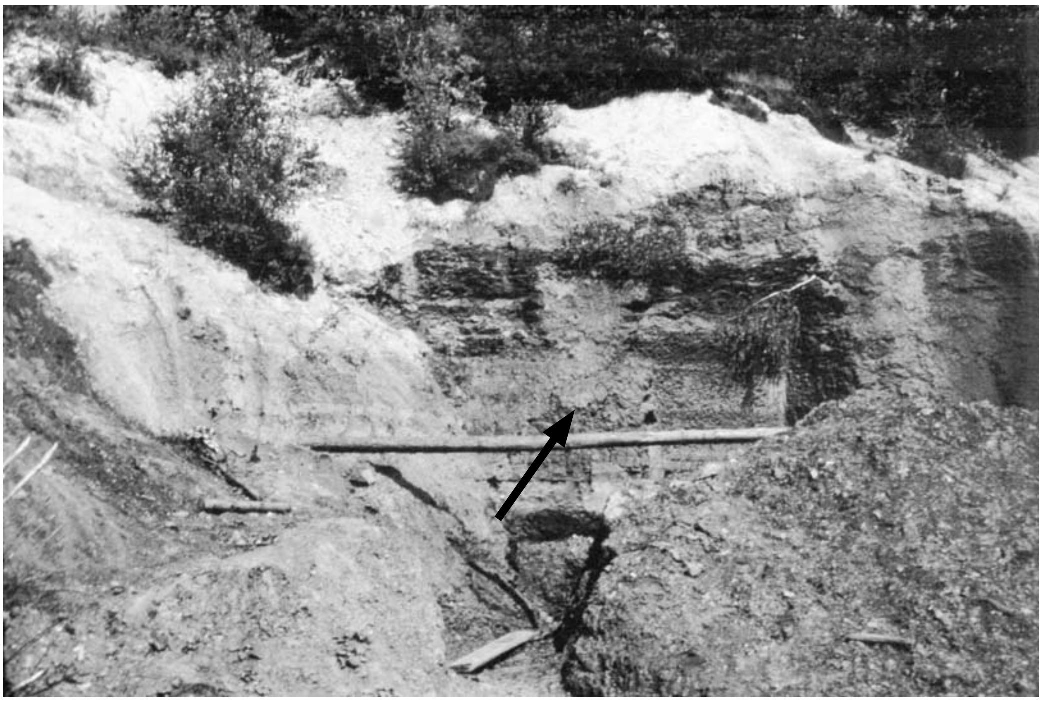

Fig. 4. General view of the investigated locality Odrowąż (Sołtyków). The arrow indicates the layer with the best palynological material. Phot. J. Ziaja, 1987

with leaves, female and male cones, ovuliferous scales).

Rogalska (1956) investigated Jurassic deposits in the Mroczków-Rozwady area, near Opoczno (Fig. 1). She determined 80 taxa of not very well preserved spores and pollen grains from Ostrowiec (5 samples), Zarzecze (39 samples), Gromadzice (2 samples) and Zagaje (1 sample) geological series. According to Rogalska (1976) the geological age of the sediments of the investigated area is probably Lias α. Describing the stratigraphy of the Middle and Lower Jurassic sediments in Poland she determined spores, pollen grains and microplankton also from borehole, Gutwin situated northeast from the Holy Cross Mountains (Fig. 1). The Gutwin profile consisted of Lower Jurassic geological beds: Drzewice (part of Middle Lias – Pliensbachian), Ciechocinek and Borucice (Upper Lias – Toarcian) and also Middle Jurassic (from Aalenian to Callovian) sediments (Rogalska 1976).

Bore cores from Skarżysko-Kamienna 15 km south-east from Odrowąż and Gostków near Odrowąż (Fig. 1), were palynologically investigated by Orłowska (Marcinkiewicz et al. 1960). She suggested that in Lower Lias (Lias α) microspore complex of the Holy Cross Mountains area, spores of Pteridophyta (63% in Skarżysko-Kamienna, 59% in Gostków) especially Filicales dominated over pollen grains of Gymnospermae (27% in Skarżysko-Kamienna, 36.3% in Gostków). However, a list of species from these localities was not given.

Preliminary results of palynological investigations from the outcrop Odrowąż were published by the present author (Ichas-Ziaja 1987, Reymanówna et al. 1987, Ziaja 1989, 1991, 1992). Marcinkiewicz (1957) investigated megaspores from sediments of Odrowąż, Skarżysko-Kamienna and other localities from the Holy Cross Mountains area and found several hundred specimens of *Nathorstisporites hopliticus* Jung (*Lycostrobus scotti* Nath.). It is considered as index species for the Lower Lias – Lias α (Marcinkiewicz 1957, Marcinkiewicz et al. 1960).

Węgierek and Zherikhin (1997) collected insect remains from the outcrop Odrowąż, preserved in grey to yellowish-grey sandy mudstone with plant remains (mainly *Hirmeriella* shoots). Among 54 insect specimens 50 belong to aquatic and terrestrial beetles, one of them *Notocupes* probably lived in a coniferous forest dominated by *Hirmeriella muensteri*

In Lower Jurassic sediments of the Holy Cross Mts. region dinosaur footprints (Karaszewski 1969, Pieńkowski & Gierliński 1987, Gierliński & Pieńkowski 1999), as well as nests and post-eggs structures (Pieńkowski 1998) have been found.

MATERIAL AND METHODS

The investigated material was collected from the outcrop of the Jurassic plant-bearing rocks in Odrowąż, Zagaje Formation, by Władysław Karaszewski and Maria Reymanówna in 1975, and by Maria Reymanówna, Elżbieta Wcisło-Luraniec, and Jadwiga Ziaja in 1985–1987. The plant macrofossils from Odrowąż were preserved partly as compressions/impressions and partly as a fusain – fossil charcoal (Reymanówna 1992, Wcisło-Luraniec 1992a, Ziaja 1992, Ziaja & Wcisło-Luraniec 1998, 1999).

In general the state of preservation of the sporomorphs is bad. Because of that a few ways of maceration were used. The samples for palynological analysis were taken and prepared by the present author with the use of the methods described by Guy (1971), slightly modified. The best palynological samples were obtained from the grey layer of mudstone, below dark-yellow layer of siltstone with siderite, about 14 m from the top of the outcrop (Fig. 4).

For maceration of the material HCl, HF, Schulze's reagent (equal quantities of HNO_3 and distilled water to which a very small amount of $KClO_3$ has been added), and KOH were used.

procedure was repeated until water above the sediment became clean;

6 – after decanting 10% solution of KOH was added to the sample, which was shaken and centrifuged for 1–3 minutes at a speed of 1000–3000 revolutions per minute; afterwards, the reagent was decanted;

7 – distilled water was added and the sample was washed a few times;

8 – the sediment was removed to smaller tubes, in which it was washed with distilled water one or a few times;

9 – the clean sample was imbedded in glycerine solution by centrifuging at a speed of 3000 revolutions per minute during 15 minutes; afterwards the glycerine solution was decanted and the residue was stored in that form.

The following samples were processed in the way described above: O5, O6/1, O6/2, O9/1, O10, O11/1, O11/2, O12, and O13. The samples O7, O8, and O9/2 were processed in a modified way: first equal quantities of 65% HNO_3 and H_2O were added to the material for 24 hours, and next $KClO_3$ for ca. 5 hours.

The best samples (O8 and O5) were obtained after maceration of dark gray mudstone shales. Table 1 shows the numbers of slides from the best samples of Jurassic sediments from Odrowąż.

Table 1. Kinds of Liassic sediments, numbers of samples and slides from the Odrowąż outcrop

the kind of sediment	gray siltstones with fossil plants	siltstones with siderite and fossil plants		dark gray mudstones with fossil plants			sandstones with fossil plants		mudstones with *Neocalamites* sp.
number of samples	O6	O10	OS2	O5	O8	O15	O9	O17	O13
number of slides	O6/1/6; O6/2/1	O10/1	OS2/4; OS2/8; OS2/13; OS2/15	5/1/95; 5/2/95; 5/3/95; 5/5/95; 5/6/95; 5/10/95; 5/11/95; 5/12/95; 5/13/95; 5/14/95; 5/15/95;	8/1; 8/2; 8/3; 8/4; 8/5; 8/6; 8/7; 8/13; 8/15; 8/18; 8/33; 8/34; 8/43; 8/45/95; 8/46/95; 8/47/95; 8/48/95; 8/49/95; 8/50/95; 8/52/95; 8/53/95; 8/54/95; 8/55/95; 8/57/95; 8/58/95; 8/59/95; 8/60/95; 8/62/95	15/5	9/1/1; 9/1/2; 9/2/5; 9/2/6; 9/2/8	17/1	13/5

The procedure was as follows:

1 – 30 grams of pulverized material was placed in a 200–250 ml plastic beaker with a cover;

2 – concentrated HCl was poured over the sample; during the final stage of the reaction 150–200 ml distilled water was added and the beaker was allowed to stand for 2 hours;

3 – the liquid from the beaker was decanted and 150–200 ml of 40% HF was added, the sample was left for 24–48 hours and occasionally stirred with a glass or plastic stick;

4 – the acid was decanted and 150–200 ml of Schulze's reagent was added to the beaker; after careful stirring the sample was allowed to stand for 24–48 hours; during that time it was once stirred;

5 – after decanting the sample was transferred to 4 big centrifuge tubes, to which distilled water was added and the sample was centrifuged for 1–3 minutes at a speed of 1000–3000 revolutions per minute; this

In the systematic part the artifical classification system is used proposed by Potonié and Kremp (1954, 1955, 1956 a,b, 1970), Potonié (1956, 1958, 1960, 1966, 1970), and Dettmann (1963). Taxonomic references to genera and higher rank taxa are not included here, they follow papers of Dettmann (1963), Schulz (1967), and Tralau (1968). Details of measurements of pollen grains and are given according to Schulz (1967, p. 555, text-fig. 1).

The slide number and the co-ordinates of the microscope cross-table in bracets [ ] indicating the position of the sporomorphs on the slide are given for Carl Zeiss type Lu microscope (no 383827). The slides and the microscope are housed in the Palaeobotanical Museum of the Władysław Szafer Institute of Botany, Polish Academy of Sciences in Kraków, Poland (KRAM-P).

Geographical distribution is given after the authors cited in the list of synonyms for each taxon and supplemented with data given by Weiss (1989).

Total number of specimens and number of specimens recorded per taxon and per sample are given in Table 2.

LM microphotographs were taken with a Carl Zeiss Jena type Lu and Laborlux Leitz microscopes, the SEM microphotographs with a Jeol SMS_1 scanning microscope in the Laboratory of Electron Microscopy of the M. Nencki Institute of the Polish Academy of Sciences in Warsaw. In the explanation of plates, after the taxon name and KRAM-P the letter "O" (Odrowąż locality) is given, followed by sample number, slide number, and in some cases also year (95).

Table 2. Number of specimens recorded per species and per sample

Taxon	O6	O10	OS_2	O5/95	O8	O9	O17	total
Cyathidites minor Couper 1953		1		6	3			10
cf. *Cyathidites australis* Couper 1953				1				1
cf. *Cyathidites* sp.		1		1				2
Concavisporites toralis (Leschik 1955) Nilsson 1958		2	1	1	4			8
cf. *Deltoidospora* sp.					1			1
Plicifera delicata (Bolch. 1953) Bolch. 1967				1	1			2
Calamospora tener (Leschik 1955) Mädler 1964		2		1	6	3		12
Rogalskaisporites cicatricosus (Rogalska 1954) Danzé-Corsin & Laveine 1963					1			1
Todisporites minor Couper 1958					2			2
cf. *Todisporites* sp.					1			1
Cibotiumspora juriensis (Balme1957) Filatoff 1975		1			1			2
Auritulinasporites triclavis Nilsson 1958				1				1
Auritulinasporites sp.				1	1			2
Conbaculatisporites mesozoicus Klaus 1960			1		1			2
Apiculatisporis ovalis (Nilsson 1958) Norris 1965					1			1
Foraminisporis jurassicus Schulz 1967					1			1
Uvaesporites argenteaeformis (Bolch. 1953) Schulz 1967	1				3			4
cf. *Uvaesporites* sp.					1			1
Leptolepidites sp.					1			1
Osmundacidites sp.		1		1				2
Acanthotriletes varius Nilsson 1958				1				1
Lycopodiacidites rugulatus (Couper 1958) Schulz 1967					1			1
Lycopodiumsporites cerniidites (Ross 1949) Delcourt & Sprumont 1955?					1			1
Lycopodiumsporites semimuris Danzé – Corsin & Laveine 1963					1			1
Lycopodiumsporites sp.				1				1
Contignisporites problematicus (Couper 1958) Döring 1965					1			1
Matonisporites sp. 1				1	2			3
Matonisporites sp. 2	1				2			3
cf. *Lycospora salebrosacea* (Malj.1949) Schulz 1967					2			2
Neochomotriletes triangularis (Bolch. 1956) Reinhardt 1961				1				1
Cingutriletes sp.					1			1
Foveotriletes sp.				1				1
cf. *Latosporites* sp.					1			1
Marattisporites sp. 1				1	1			2
Marattisporites sp. 2					1			1
Aratrisporites minimus Schulz 1967			5	17	65	1		88
Alisporites cf. *diaphanus* (Pautsch 1958) Lund 1977				1				1
cf. *Alisporites microsaccus* (Couper1958) Pocock 1962						1		1
Alisporites robustus Nilsson 1958				3	2			5
Alisporites cf. *robustus* Nilsson 1958					1			1
Alisporites thomasii (Couper 1958) Nilsson 1958				1	2			3
Vitreisporites pallidus (Reissinger 1950) Nilsson 1958		1			1			2
Pityosporites minimus (Couper 1958) comb. nov.			1	4	8			13
cf. *Pityosporites minimus* (Couper 1958) comb. nov.				1	1	1		3
Platysaccus nitidus Pautsch 1971					1			1
? *Pinuspollenites labdacus* var. *arcuatus* Danzé – Corsin & Laveine 1963					1			1
cf. *Inaperturopollenites* sp.				3	1	1		5
cf. *Araucariacites australis* Cookson 1947 ex Couper 1953			1	1	1			3

Table 2. Continued

Taxon	O6	O10	OS$_2$	O5/95	O8	O9	O17	total
cf. *Araucariacites* sp.						1		1
Spheripollenites psilatus Couper 1958				1	1			2
Spheripollenites subgranulatus Couper 1958					2			2
Spheripollenites sp.				8				8
Perinopollenites elatoides Couper 1958				3	6			9
Chasmatosporites major (Nilsson 1958) Pocock & Jansonius 1969						1		1
Chasmatosporites apertus (Rogalska 1954) Nilsson 1958				1	2		1	4
Chasmatosporites cf. *elegans* Nilsson 1958		2		3	2			7
Chasmatosporites hians Nilsson 1958						1		1
Chasmatosporites cf. *rimatus* Nilsson 1958				1				1
Monosulcites minimus Cookson 1947 ex Couper 1953					2			2
Monosulcites subgranulosus Couper 1958					1		1	2
Ephedripites tortuosus Mädler 1964					1			1
Classopollis torosus (Reissinger 1950) Couper 1958	23	4	8	63	88	10	1	187
cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, total specimens	1* 3	1* 4		8* 1** 31	4* 15			14* 1** 53
Incertae sedis Total specimens				 5	1* 12			 17
Indeterminateae	1	1		9	7			18
Total	29	20	17	176	266	20	3	531

* – complete and incomplete tetrads
** – groups

DESCRIPTION OF SPOROMORPHS

Anteturma Sporites H. Potonié

Turma Triletes Reinsch ex Schopf emend. Dettmann 1963

Suprasubturma Acavatitriletes Dettmann 1963

Subturma Azonotriletes Luber emend. Dettmann 1963

Infraturma Laevigati Bennie & Kidston emend. R. Potonié 1956

Genus ***Cyathidites*** Couper 1953

T y p e. *Cyathidites australis* Couper 1953, p. 27, pl. 2, fig. 11

cf. ***Cyathidites australis*** Couper 1953

Pl. 1, fig. 5

1953 *Cyathidites australis* sp. nov., Couper, p. 27, pl. 2, figs 11–12.
1958 *Cyathidites australis* Couper; Couper, pp. 138, 139, pl. 20, fig. 8.
1963 *Cyathidites australis* Couper; Dettmann, p. 22, pl. 1, figs 1–3.
1965 *Cyathidites australis* Couper; Playford & Dettmann, p. 131.
1967 *Cyathidites australis* Couper; Norris, p. 86, pl. 10, fig. 1.
1968 *Cyathidites australis* Couper; Tralau, p. 31, pl. 9, fig. 1.
1971 *Cyathidites australis* Couper; Guy, pp. 15, 16, pl. 1, fig. 1.
1972 *Cyathidites australis* Couper; Tralau & Artursson, p. 58, Fig. 2B.
1973 *Deltoidospora australis* (Couper) Pocock; Orbell, p. 6, pl. 3, fig. 2.
1974 *Cyathidites australis* Couper; McKellar, p. 4, pl. 1, fig. 9.
1975 *Cyathidites australis* Couper; Arjang, p. 106, pl. 1, fig. 14.
1975 *Cyathidites australis* Couper; Filatoff, p. 60, pl. 10, figs 5–6.
1975 *Deltoidospora australis* (Couper) Pocock; Vigran & Thusu, p. 9, pl. 1, fig. 3.
1977 *Cyathidites australis* Couper; Ashraf, p. 26, pl. 1, figs 18–20.
1977 *Cyathidites australis* Couper; Bjærke & Manum, p. 26.
1977 *Deltoidospora mesozoicus* (Thiergart) comb. nov., Schuurman, p. 182, pl. 1, fig. 5.
1978 *Cyathidites australis* Couper; Guy-Ohlson, p. 17, pl. 3, fig. 26.
1981 *Cyathidites australis* Couper; Achilles, p. 16, pl. 2, fig. 1.
1981 *Cyathidites australis* Couper; Shang, p. 430.
1982 *Cyathidites australis* Couper; Guy-Ohlson, p. 8.
1983 *Cyathidites australis* Couper; Orłowska-Zwolińska, p. 9, pl. 1, figs 1–2.

1984 *Cyathidites australis* Couper; Achilles et al., p. 35, pl. 1, fig. 16.
1985 *Cyathidites australis* Couper; Guy-Ohlson & Malmquist, p. 19, Fig. 2.
1985 *Deltoidospora australis* (Couper) Pocock; Hoelstad, p. 119, pl. 1, fig. 6.
1986 *Cyathidites australis* Couper; Guy-Ohlson, p. 10, pl. 1, fig. 1, pl. 11, figs 1–3.
1987 *Cyathidites australis* Couper; Schrank, p. 257, pl. 2, fig. 9.
1989 *Cyathidites australis* Couper; Weiss, pp. 18–19.
1990 *Cyathidites australis* Couper; Rauscher & Schmitt, pp. 111, 132, 134, 136, 138, 140, pl. 1, figs 2–3.
1991 *Deltoidospora australis* (Couper) Pocock; Dybkjær, p. 18.

Description. Spores trilete. Amb triangular with almost straight sides. Exine smooth, about 2 µm thick. The spore is cracked along the tetrad mark.

Dimensions. Equatorial diameter about 70 µm.

Material. 1 spore.

Slide. KRAM-P O5/2/95 [97.1/7.5].

Affinity. As the case with *Cyahidites minor* (Couper 1958), according to van Konijnenburg-van Cittert (1989) dispersed *C. australis* "would include spores of *Coniopteris margaretae* and *Dicksonia kendalliae*".

Stratigraphical distribution. Upper Triassic – Upper Cretaceous.

Geographical distribution. Afghanistan, Australia, China, Denmark, France, Germany, Great Britain, Iran, New Zealand, Norway, Poland, Sweden. Reported also from Canada, Egypt, India, Israel, Italy, Libya, New Guinea, Russia (Siberia), Zair (Weiss 1989).

Remarks. Differences within *C. australis* and *C. minor* are in sizes, not in morphology of spores. This problem is discussed by Couper (1958) and Weiss (1989) in detail.

Cyathidites minor Couper 1953

Pl. 1, figs 1–4

1953 *Cyathidites minor* sp. nov., Couper, p. 28, pl. 2, fig. 13.
1954 *Coniopteris* sp., Rogalska, p. 10, fig. 10.
1958 *Cyathidites minor* Couper; Couper, p. 139, pl. 20, figs 9–10.
1962 *Cyathidites minor* Couper; Pocock, p. 43, pl. 4, figs 57–58.
1963 *Cyathidites minor* Couper; Dettmann, pp. 22, 23, pl. 1, figs 4–5.
1965 *Cyathidites minor* Couper; Norris, p. 239, figs 1a, 5–6.
1967 *Cyathidites minor* Couper; Norris, p. 86, pl. 10, fig. 2.
1968 *Cyathidites minor* Couper; Tralau, pp. 31, 32, pl. 10, fig. 8.
1970a *Deltoidospora minor* (Couper) comb. nov., Pocock, p. 28, pl. 5, fig. 3.
1971 *Cyathidites minor* Couper; Guy, p. 16, pl. 1, fig. 2.
1974 *Cyathidites minor* Couper; McKellar, pp. 4, 5, pl. 1, fig. 11.
1975 *Cyathidites minor* Couper; Arjang, p. 106, pl. 1, figs 11–13.
1975 *Cyathidites minor* Couper; Filatoff, p. 60, pl. 10, fig. 7.
1975 *Deltoidospora minor* (Couper) Pocock; Vigran & Thusu, p. 9, pl. 1, figs 1–2.
1976 *Cyathidites minor* Couper; Rogalska, pl. 4, fig. 71.
1977 *Cyathidites minor* Couper; Ashraf, p. 26, pl. 2, figs 4–6.
1977 *Deltoidospora minor* (Couper) Pocock; Lund, p. 50, pl. 1, fig. 6.
1977 *Cyathidites minor* Couper; Bjærke & Manum, p. 26, pl. 1, fig. 2.
1977 *Deltoidospora minor* (Couper) Pocock; van Erve, pp. 49, 50, pl. 1, figs 1–2.
1978 *Cyathidites minor* Couper; Guy-Ohlson, p. 17, pl. 3, fig. 28.
1981 *Cyathidites minor* Couper; Achilles, p. 16, pl. 2, fig. 5.
1981 *Cyathidites minor* Couper; Guy-Ohlson, p. 235, Fig. 6H.
1981 *Cyathidites minor* Couper; Shang, p. 430, pl. 1, figs 5–7.
1982 *Cyathidites minor* Couper; Guy-Ohlson, p. 8.
1983 *Cyathidites minor* Couper; Orłowska-Zwolińska, p. 9, pl. 1, figs 3–4.
1984 *Cyathidites minor* Couper; Achilles et al., p. 35, pl. 1, fig. 18.
1985 *Cyathidites minor* Couper; Guy-Ohlson & Malmquist, p. 20, Fig. 2.
1985 *Deltoidospora minor* (Couper) Pocock; Hoelstad, p. 119, pl. 1, figs 3–4.
1985 *Deltoidospora minor* (Couper) Pocock; Lund & Pedersen, p. 376, pl. 1, fig. 1.
1986 *Cyathidites minor* Couper; Guy-Ohlson, p. 10, pl. 1, fig. 2.
1986 *Cyathidites minor* Couper; Ichas, pp. 10–11, pl. 1, figs 1–3.
1987 *Cyathidites minor* Couper; Schrank, p. 257.
1989 *Cyathidites minor* Couper; Weiss, pp. 21–22.
1990 *Cyathidites minor* Couper; Rauscher & Schmitt, pp. 111, 132, 134, 136, 138, pl. 1, fig. 1.
1991 *Deltoidospora minor* (Couper) Pocock; Dybkjær, p. 18, pl. 1, fig. 2.

Description. Spores trilete, amb triangular with rounded apices and concave sides. In equatorial view plano-convex and dark longitudinal fold usually visible. Laesurae clearly present, without margo, extended almost to the equator. Exine smooth.

Dimensions. Equatorial diameter 27.2–54.4 µm (9 specimens measured), polar diameter 23.8–51 µm (5 specimens measured).

Material. 10 spores.

Slides. KRAM-P O5/1/95 [99/15.5], O5/3/95 [107/6], O5/6/95 [94.2/14.5, 97.5/3], O5/12/95 [94/16, 102/19.5], O8/2 [96.5/10], O8/48/95 [105/6], O8/50/95 [108/2], O10/1 [105.5/12].

Affinity. Couper (1958) wrote that: "Many of dispersed spores recorded here as *Cyathidites minor* almost certainly belong to well known Mesozoic species *Coniopteris hymenophylloides* and to other fossil cyatheaceous or dicksoniaceous ferns such as *Eboracia lobifolia* and *Dicksonia mariopteris*". According to van Konijnenburg-van Cittert (1989) dispersed *C. minor* spores are very similar to dicksoniaceous spores in situ of *Coniopteris simplex*, *C. concinna*, *C. bella*, *C. hymenophylloides*, *C. murrayana*, *Kylikipteris arguta*, *Eboracia lobifolia*, and *Dicksonia mariopteris*. Balme (1995) placed affinity of dispersed *Cyathidites* (= *Deltoidospora* in part) in Filicopsida.

Stratigraphical distribution. Upper Triassic – Upper Cretaceous.

Geographical distribution. Afghanistan, Antarctica, Australia, Canada, China, Denmark, Egypt, France, Germany, Great Britain, Greenland, Iran, Italy, New Zealand, Norway, Poland, Sweden. Reported also from Belgium, India, Israel, Libya, Luxembourg, New Guinea, Russia (Siberia), Sahara, Switzerland (Weiss 1989).

Remarks. Some authors e.g. Pocock (1970a), Lund (1977), van Erve (1977), Dybkjær (1991), consider *Cyathidites* Couper 1953 to be a junior synonym of *Deltoidospora* Miner 1935 but others used those names separately. Pocock (1970a) wrote that generic names *Leiotriletes* Naumova, *Cyathidites* Couper, and *Deltoidospora* Miner are synonyms and *Deltoidospora* has priority. According to Pocock (1970a) *Concavisporites* Pflug is a junior synonym of *Gleicheniidites* (Ross) Delcourt & Sprumont. However Lund (1977) placed *Leiotriletes* Naumova, *Cyathidites* Couper, *Concavisporites* Pflug, and *Dictyophyllidites* Couper in *Deltoidospora* Miner. Jansonius and Hills (1976, No. 546, 692, 748, 786, 1472) treated *Concavisporites* Pflug in Thomson & Pflug 1953, *Cyathidites* Couper 1953, *Deltoidospora* Miner 1935, *Dictyophyllidites* Couper 1958, *Gleicheniidites* Ross 1949 and *Leiotriletes* Naumova ex Ishchenko as separate genera. Triangular, trilete dispersed spores with smooth exine do not have clear systematics because of various opinions of synonymy of these spores. In my opinion it is more useful to retain *Cyathidites*, *Concavisporites*, *Deltoidospora*, *Dictyophyllidites*, *Gleicheniidites*, *Leiotriletes* as separate genera because of easier correlations especially in case of papers in which authors gives the list of species without explanations about synonymy.

Cyathidites sp.

Pl. 1, fig. 6

Description. Spores triangular in equatorial outline with rounded apices and convex sides. Visible triangular dehiscence. Exine smooth.

Dimensions. Equatorial diameter 32 µm (1 specimen measured).

Material. 2 spores.

Slides. KRAM-P O5/6/95 [96.1/3.8], O10/1 [104/12].

Affinity. Fern spores, probably of Cyatheaceae or Dicksoniaceae.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. These spores differs from *Cyathidites minor* Couper 1953 spores because of the convex sides and shape of dehiscence.

Genus ***Concavisporites*** Pflug in Thomson & Pflug 1953, emended Delcourt & Sprumont 1955

Type. *Concavisporites rugulatus* Pflug in Thomson & Pflug 1953, pl. 1, fig. 22

Concavisporites toralis (Leschik 1955) Nilsson 1958

Pl. 1, figs 7–11

1954 *Clathropteris obovata* var. *magna* Turutanova-Ketova; Rogalska, pp. 11–12, pl. 3, fig. 3.
1955 *Levigatisporites toralis* sp. nov., Leschik, p. 12, pl. 1, fig. 9.
1956 *Clathropteris obovata* var. *magna* Turutanova-Ketova; Rogalska, p. 15, pl. 5, fig. 1.
1958 *Concavisporites toralis* (Leschik) comb. nov., Nilsson, p. 34, pl. 1, figs 12–13.
1964 *Toroisporis (Toroisporis) toralis* (Leschik) comb. nov., Kedves & Simoncsics, p. 19, pl. 4, figs 9–10.
1965 *Concavisporites toralis* (Leschik) Nilsson; Wall, p. 165.
1977 *Concavisporites toralis* (Leschik) Nilsson; Bjærke & Manum, p. 28.
1977 *Deltoidospora toralis* Leschik, species comb. nov., Lund, pp. 49–50, pl. 1, figs 2–3.
1977 *Concavisporites toralis* (Leschik) Nilsson; Schuurman, pp. 183–184, pl. 2, fig. 5.
1980 *Deltoidospora toralis* (Leschik) Lund; Pedersen & Lund, p. 17, pl. 1, figs 1–5.
1981 *Concavisporites toralis* (Leschik) Nilsson; Achilles, p. 15, pl. 1, figs 18–21.
1981 *Deltoidospora toralis* (Leschik) Lund; Guy-Ohlson, p. 235, Fig. 4E.
1981 *Deltoidospora toralis* (Leschik) Playford & Dettmann; Shang, p. 430, pl. 1, figs 10–11.
1983 *Toroisporis* cf. *T. toralis* (Leschik) Kedves & Simoncsics; Orłowska-Zwolińska, p. 10, pl. 1, fig. 14.
1984 *Concavisporites toralis* (Leschik) Nilsson; Achilles et al., p. 34, pl. 1, fig. 13.
1985 *Deltoidospora toralis* (Leschik) Lund; Hoelstad, p. 119, pl. 1, figs 1–2.
1989 *Concavisporites toralis* (Leschik) Nilsson; Weiss, pp. 16–17, pl. 1, figs 13–14.
1991 *Deltoidospora toralis* (Leschik) Lund; Dybkjær, p. 18, pl. 1, fig. 1.

D e s c r i p t i o n. Spores trilete, amb triangular with rounded apices and concave, sometimes convex or almost straight sides. Exinal folds surrounding tetrad mark and extended over the ends of the leasurae. Exine smooth.

D i m e n s i o n s. Equatorial diameter 23–35 µm (6 specimens measured).

M a t e r i a l. 8 spores.

S l i d e s. KRAM-P O5/2/95 [96.5/12.5], O8/3 [103/8], O8/46/95 [104/7, 104.5/12] O8/58/95 [96.5/6], O10/1 [106/14, 111/7], OS_2/4 [108.5/6].

A f f i n i t y. According to Leschik (1955) these spores are similar to spores of recent ferns *Cyathea brunonis* Wall. and *Alsophila procera* Kaulf. Balme (1995) wrote about affinity of similar dispersed spores (*Dictyophyllidites*) from the Jurassic ferns *Clathropteris obovata* Oishi var. *magna* Turutanova-Ketova and *Dictyophyllum rugosum* Lindley & Hutton.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Upper Triassic – Lower Jurassic.

G e o g r a p h i c a l d i s t r i b u t i o n. China, Denmark, France, Germany, Great Britain, Greenland, Hungary, Iran, Luxemburg, Norway, Poland, Sweden, Switzerland. Reported also from Austria, Italy, Spain (Weiss 1989).

R e m a r k s. *Concavisporites toralis* (Leschik 1955) Nilsson 1958 resembles *Dictyophyllidites mortoni* (de Jersey 1959) Playford & Dettmann 1965. Differences between these species of dispersed spores are not clear. According to Playford and Dettmann (1965) *Concavisporites toralis* (Leschik 1955) Nilsson 1958 ”has a thinner exine and apparently lacks elevated leasurate lips”. This problem is also discussed by Bjærke and Manum (1977), Achilles (1981) and Weiss (1989). See also remarks to *Cyathidites minor* Couper 1953.

Genus ***Deltoidospora*** Miner 1935 emend. R. Potonié 1956

T y p e. *Deltoidospora hallii* Miner 1935, p. 618, pl. 24, fig. 7

cf. ***Deltoidospora*** sp.

Pl. 1, fig. 12

D e s c r i p t i o n. Spore trilete, equatorial outline triangular with convex sides. Laesurae distinct, extending almost to the equator. Exinal folds reaching from apex to about 1/2 spore radius. Exine smooth.

D i m e n s i o n s. Equatorial diameter about 34 µm.

M a t e r i a l. 1 soromorph.

S l i d e. KRAM-P O8/2 [94/17].

A f f i n i t y. Probably spore of Filicales (?Dipteridaceae).

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Jurassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

R e m a r k s. This specimen resembles a fern spore of *Thaumatopteris schenkii* Nathorst of Dipteridaceae (Harris 1931) in dimensions, smooth exine and shape of exinal folds visible on photograph. Detailed comparision is impossible because of the lack of a description of *Thaumatopteris schenkii* spore in Harris' book. Couper (1958) wrote that the microphotograph of *Thaumatopteris schenkii* spore (Harris 1931, pl. 18, fig. 1) "is inadequate for detailed description but the spore appears trilete, rounded triangular and with smooth exine about 2 µm thick. The size is around 40 µm". Playford and Dettmann (1965) consider *Thaumatopteris schenkii* spores (Harris 1931) to be similar to dispersed spores *Dictyophyllidites mortoni* (de Jersey 1959) Playford & Dettmann 1965. According to Balme (1995) in situ *Thaumatopteris schenkii* spores are similar to dispersed *Cyathidites*/*Deltoidospora* spores and he suggested similarity of dispersed *Dictyophyllidites mortoni* (de Jersey 1959) Playford & Dettmann to in situ *Phlebopteris angustiloba* spores.

Genus ***Plicifera*** Bolch. 1966

T y p e. *Plicifera delicata* (Bolch.) Bolch. 1966 (*Leiotriletes delicatus* = *Gleichenia delicata* Bolch. 1953, p. 22, pl. 2, figs 1–4)

Plicifera delicata (Bolch. 1953) Bolch. 1966

Pl. 1, figs 13, 14

1953 *Gleichenia delicata* sp. nov., Bolkhovitina, p. 22, pl. 2, figs 1–4.
1962 *Gleicheniidites senonicus* Ross; Pocock, p. 42, pl. 3, figs 55–56.
1966 *Plicifera delicata* (Bolch.) Bolch., Bolkhovitina p. 68.
1967 *Plicifera delicata* (Bolch.) Bolch.; Bolkhovitina, pp. 62–63, pl. 1, fig. A.
1968 *Plicifera delicata* (Bolch.) Bolch.; Bolkhovitina, pp. 35–36, pl. 5, figs 14–21, pl. 6, figs 1–19.
1970a *Gleicheniidites delicatus* (Bolch.) comb. nov., Pocock, p. 32, pl. 5, fig. 13.

D e s c r i p t i o n. Spores in equatorial outline triangular with convex, slightly concave or almost straight sides. Triradiate tetrad mark not always distinct. Laesurae reaching almost to the equator. On the distal side three arcuate folds paralleling leasures and extending to ends of the scar. Occasionally folds connected together on the apex of the spore. Exine thin and smooth.

D i m e n s i o n s. Equatorial diameter 37.4–47.6 µm.

M a t e r i a l. 2 spores.

S l i d e s. KRAM-P O5/5/95 [106.5/5.5], O8/2 [94.5/7].

A f f i n i t y. Ferns of the family Gleicheniaceae, subfamily Gleichenioideae (Bolkhovitina 1953, 1967, 1968).

S t r a t i g r a p h i c a l d i s t r i b u t i o n. From Upper Jurassic to Oligocene (Bolkhovitina 1968), Lower Jurassic (Odrowąż – present paper).

G e o g r a p h i c a l d i s t r i b u t i o n. Poland, Russia.

R e m a r k s. Some specimens attributed to other species may be identical with *Plicifera delicata*; e.g. specimens described as *Gleicheniidites senonicus* Ross (Pocock 1962, pp. 42–43, pl. 3, figs 55–56) have not, according to Bolkhovitina (1968), equatorial thickenings characteristic of *Gleicheniidites senonicus* Ross and ought to have been attributed to *Plicifera delicata*. Specimens from Odrowąż attributed to *P. delicata* have distinct folds of the exine on the distal side and have no equatorial thickenings.

Genus ***Calamospora*** Schopf, Wilson & Bentall 1944

T y p e. *Calamospora hartungiana* Schopf, Wilson & Bentall 1944, p. 51, fig. 1

Calamospora tener (Leschik 1955) Mädler 1964

Pl. 1, figs 15, 16; Pl. 2, figs 1, 2

1955 *Laevigatisporites tener* sp. nov., Leschik, p. 13, pl. 1, fig. 20.
1955 *Punctatasporites flavus* sp. nov., Leschik, p. 31, pl. 4, fig. 2.
1956 *Calamites* sp., Rogalska, pp. 18, 19, pl. 7, fig. 5.
1958 *Calamospora mesozoica* sp. nov., Couper, p. 132, pl. 15, figs 3–4.
1960 *Calamospora nathorstii* (Halle) comb. nov., Klaus, pp. 116–118, pl. 28, fig. 1.
1964a *Calamospora tener* (Leschik) comb. nov., Mädler, pp. 92–93, pl. 8, fig. 2.
1965 *Calamospora mesozoica* Couper; Wall, p. 165.
1968 *Calamospora mesozoica* Couper; Tralau, p. 25.
1970a *Calamospora mesozoica* Couper; Pocock, p. 30, pl. 5, figs 17–19.
1971 *Calamospora tener* (Leschik) de Jersey; Pautsch, p. 9, pl. 1, fig. 1.

1973 *Calamospora mesozoica* Couper; Orbell, p. 7, pl. 3, fig. 11.
1975 *Calamospora mesozoica* Couper; Arjang, p. 108, pl. 3, fig. 2.
1975 *Calamospora mesozoica* Couper; Filatoff, p. 56, pl. 8, figs 11–12.
1976 *Calamospora* (Schopf, Wilson & Bentall) Potonié & Kremp; Rogalska, p. 40, pl. 2, fig. 34.
1977 *Calamospora mesozoica* Couper; Ashraf, p. 29, pl. 3, fig. 10.
1977 *Calamospora nathorstii* (Halle) Klaus; Bjærke & Manum, p. 26, pl. 1, fig. 1.
1977 *Calamospora tener* (Leschik) Mädler; Lund, p. 53, pl. 1, fig. 14.
1978 *Calamospora mesozoica* Couper; Guy-Ohlson, p. 21, pl. 1, fig. 7.
1980 *Calamospora tener* (Leschik) Mädler; Pedersen & Lund, p. 17, pl. 3, fig. 3.
1981 *Calamospora tener* (Leschik) Mädler; Guy-Ohlson, p. 235, Fig. 4B.
1981 *Calamospora tener* (Leschik) Mädler; Achilles., p. 20, pl. 3, figs 12–14.
1981 *Calamospora mesozoica* Couper; Shang, p. 430, pl. 1, fig. 1.
1982 *Calamospora mesozoica* Couper; Guy-Ohlson, p. 9.
1983 *Calamospora tener* (Leschik) de Jersey; Orłowska-Zwolińska, p. 10, pl. 2, fig. 5.
1984 *Calamospora tener* (Leschik) Mädler; Achilles et al., p. 38, pl. 2, fig. 11.
1985 *Calamospora mesozoica* Couper; Guy-Ohlson & Malmquist, p. 19, Fig. 2, pl. 2, fig. A.
1985 *Calamospora tener* (Leschik) Mädler; Hoelstad, p. 119, pl. 1, fig. 7.
1986 *Calamospora mesozoica* Couper; Guy-Ohlson, p. 11, pl. 1, fig. 3.
1989 *Calamospora tener* (Leschik) Mädler; Weiss, pp. 32–33.
1990 *Calamospora mesozoica* Couper; Rauscher & Schmitt, pp. 111, 134, 138, pl. 1, figs 12, 18.
1991 *Calamospora tener* (Leschik) Mädler; Dybkjær, p. 19, pl. 1, fig. 10.

Description. Spores trilete. Shape oval to rounded. Triradiate tetrad mark not always distinct. Exine very thin, smooth with various folds.

Dimensions. Length about 26.4–49.6 µm, width 20.4–40.0 µm (7 specimens measured).

Material. 12 spores.

Slides. KRAM-P O5/11/95 [99.8/6], O8/2 [93.5/12, 101/12.5, 104/7], O9/1/1 [102.5/18], O9/2/8 [106.5/13, 106/16.5], O10/1 [106.5/4, 107.5/10], O8/50/95 [107/8], O8/54/95 [103/5], O8/58/95 [98.5/9].

Affinity. Leschik (1955) considered that *Laevigatisporites tener* was calamite in affinity. Couper (1958) wrote that Mesozoic spores attributed by him to the Palaeozoic genus *Calamospora* are comparable to spores of *Equisetites (Equisetostachys) suecicus* Nathorst and *Equisetites (Equisetostachys) nathorsti* Halle. Couper (1958) suggests also that Mesozoic *Calamospora* may have originated from Mesozoic equisetalean plants fossils e.g. *Neocalamites nathorsti* Erdtman, which had morphological features comparable with Palaeozoic calamites, but spores from these *Neocalamites* plants are not known. Mädler (1964a) placed Mesozoic dispersed *Calamospora* spores affinity not in Calamitales or Noeggerathiales but in Equisetales. Filatoff (1975) attributed *Calamospora* to sphenopsid spores. Balme (1995) wrote about the affinity of *Calamospora* dispersed spores that they may have originated from Rhyniopsida (Trimerophytales), Zosterophyllopsida, Barinophytopsida (Barinophytales), Lycopsida (?Sellaginellales), Equisetopsida (Bowmanitales, Calamostachyales, Equisetales), and Progymnospermopsida (Noeggerathiales). According to Kelber and van Konijnenburg-van Cittert (1998) in situ spores from the Triassic *Equisetites arenaceus* (Jaeger) Schenk fall in with dispersed spores *Calamospora keuperiana* Mädler (1964a).

Stratigraphical distribution. Triassic to Lower Cretaceous.

Geographical distribution. Australia, Austria, Afghanistan, Canada, China, Denmark, France, Germany, Great Britain, Greenland, Iran, Poland, Spitsbergen (Hopen), Sweden, Switzerland. Reported also from Luxembourg, Madagascar, Sahara (Weiss 1989).

Remarks. Some authors e.g. Mädler (1964a), Lund (1977), Dybkjær (1991) have regarded *Calamospora tener* (Leschik) Mädler as the senior synonym of *Calamospora mesozoica* Couper. According to Filatoff (1975) *C. mesozoica* differs from *C. tener* and *C. nathorstii* by possessing scabrate, granulate or microreticulate sculpture on the contact areas. *C. tener* and *C. nathorstii* do not show differentiation of the exine. Guy-Ohlson (1986) agrees with him. On the other hand Filatoff (1975) noted that this character is probably, a secondary feature of little taxonomic and stratigraphic significance. I think that this kind of differences between specimens are not always visible, especially on bad preserved specimens. In some situations it is impossible to distinguish not only *C. meso-*

zoica from *C. tener* but also *Inaperturopollenites* from *Calamospora* because of the lack of a distinct tetrad mark.

Genus ***Rogalskaisporites*** Danzé-Corsin & Laveine 1963

Type. *Rogalskaisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine 1963, p. 80

Sporites cicatricosus Rogalska 1954, p. 26, pl. 12, fig. 11

Rogalskaisporites cicatricosus (Rogalska 1954) Danzé-Corsin & Laveine 1963

Pl. 2, fig. 5

1954 *Sporites cicatricosus* sp. nov., Rogalska, pp. 26, 44, pl. 12, fig. 11.
1955 *Stereisporites perforatus* sp. nov., Leschik, p. 10, pl. 1, figs 3–4.
1956 *Sporites cicatricosus* Rogalska; Rogalska, pp. 41, 84, pl. 29, fig. 7.
1963 *Rogalskaisporites cicatricosus* (Rogalska) comb. nov., Danzé-Corsin & Laveine, pp. 80–81, pl. 6, figs 19–21.
1965 *Stereisporites perforatus* Leschik; Playford & Dettmann, pp. 134, 135, pl. 12, figs 4–5.
1967 *Stereisporites (Rogalskaisporites) cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Schulz, p. 557, pl. 1, figs 8–9.
1968 *Stereisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Tralau, pp. 63–64, pl. 10, figs 9–10.
1971 *Stereisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Guy, p. 17, pl. 1, fig. 4.
1974 *Rogalskaisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; McKellar, pp. 15– 16, pl. 5, fig. 13.
1975 *Annulispora cicatricosa* (Rogalska) comb. nov., Morbey, pp. 16–17, pl. 3, fig. 16, pl. 13, fig. 9.
1975 *Rogalskaisporites cicatricosus* Rogalska ex Danzé-Corsin & Laveine; Filatoff, pp. 37–39, pl. 1, figs 4–6.
1975 *Rogalskaisporites cicatricosus* Rogalska ex Danzé-Corsin & Laveine; Vigran & Thusu, p. 11, pl. 7, figs 3–4.
1976 *Rogalskaisporites cicatricosus* Danzé-Corsin & Laveine; Rogalska, p. 42, pl. 20, fig. 289.
1977 *Stereisporites perforatus* Leschik; Bjærke & Manum, p. 27, pl. 1, fig. 3.
1977 *Stereisporites cicatricosus* (Rogalska) E. Schulz; Lund, p. 54, pl. 2, fig. 4.
1977 *Rogalskaisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Schuurman, p. 188, pl. 5, fig. 1.
1979 *Rogalskaisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Schuurman, p. 57, pl. 2, fig. 3.
1980 *Stereisporites cicatricosus* (Rogalska) E. Schulz; Pedersen & Lund, p. 17, pl. 3, fig. 5.
1981 *Annulispora cicatricosa* (Rogalska) Morbey; Achilles, p. 32, pl. 7, fig. 2.
1981 *Stereisporites cicatricosus* (Rogalska) Schulz; Guy-Ohlson, p. 235, Fig. 5H–I.
1983 *Rogalskaisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Orłowska-Zwolińska, p. 17, pl. 15, figs 8–10.
1984 *Annulispora cicatricosa* (Rogalska) Morbey; Achilles et al., p. 52, pl. 5, fig. 14.
1985 *Stereisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Guy-Ohlson & Malmquist, p. 20, Fig. 2.
1985 *Stereisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Hoelstad, p. 121, pl. 1, fig. 12.
1985 *Stereisporites cicatricosus* (Rogalska) E. Schulz; Lund & Pedersen, p. 376, pl. 1, fig. 5.
1986 *Stereisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Guy-Ohlson, p. 11, pl. 1, figs 4–5.
1989 *Stereisporites perforatus* Leschik; Weiss, p. 31, pl. 2, fig. 17.
1989 *Rogalskaisporites cicatricosa* (Rogalska) Danzé-Corsin & Laveine; Weiss, p. 85, pl. 6, fig. 6.
1990 *Rogalskaisporites cicatricosus* Danzé-Corsin & Laveine; Rauscher & Schmitt, p. 113, 134, 138, pl. 1, figs 12, 18.
1991 *Stereisporites cicatricosus* (Rogalska) Schulz; Dybkjær, p. 19.

Description. Spores convexly triangular in equatorial outline. Triradiate tetrad mark distinct, extending 1/2 of the spore radius. Laesurae with margo about 2.5 µm wide. In the convex central part of the distal side, exine thicker than in other parts of the spore. This central thickening forms a ring with a dentate margin or a ring consisting of verrucae. Verrucae 3.2–4.8 µm high and 2.4–3.2 µm wide. Exine smooth, forming an equatorial rim about 2.5 µm wide.

Dimensions. Equatorial diameter 27.2 µm.

Material. 1 spore.

Slide. KRAM-P O8/49 [105.5/8].

Affinity. According to Schulz (1967) *Stereisporites (Rogalskaisporites) cicatricosus* (Rogalska) Danzé-Corsin & Laveine is similar to spores of *Sphagnum*. According to Tralau (1968) no recent affinity is known. Filatoff (1975, p. 36) placed *Rogalskaisporites* spores in Sphagnaceae-type spores. Balme (1995) does not give an affinity either.

Stratigraphical distribution. Upper Triassic – Middle Jurassic.

Geographical distribution. Australia, Denmark, France, Germany, Greenland, Luxemburg, Norway, Poland, Spitsbergen (Hopen), Switzerland, Sweden. Reported also from Canada, Great Britain (Weiss 1989).

Remarks. Filatoff (1975) discussed this species in detail. This author described and illustrated the variation in distal sculpture in *Rogalskaisporites cicatricosus*. He wrote that "In some specimens of *R. cicatricosus* the radial striae are distinct. In others the striae degenerate into elliptical foveolae, adjacent pairs of which may coalesce into u-shaped depressions, convex towards the pole. In the extreme a dentate margin to the polar crassitude provides the only indication of the original or ideal striate sculpture. The variation in sculpture is probably dependent on state of the preservation and the original development or maturity of the spore". Dentate margin of the polar crassitude or ring consisting of thick verrucae is visible in the specimen from Odrowąż.

Genus ***Todisporites*** Couper 1958

Type. *Todisporites major* Couper 1958, p. 134, pl. 16, fig. 6

Todisporites minor Couper 1958

Pl. 2, fig. 3

1958 *Todisporites minor* sp. nov., Couper, p. 135, pl. 16, figs 9–10.
1962 *Todisporites minor* Couper; Pocock, p. 36, pl. 1, fig. 16.
1964 *Todisporites minor* Couper; Venkatachala & Góczán, p. 210, pl. 1, fig. 8.
1964b *Todisporites minor* Couper; Levet-Carette, pp. 92, 113, 115.
1965 *Todisporites minor* Couper; Wall, p. 165.
1967 *Todisporites minor* Couper; Norris, p. 87, pl. 10, fig. 9.
1968 *Todisporites minor* Couper; Tralau, p. 65, pl. 9, fig. 4.
1971 *Todisporites minor* Couper; Guy, p. 19, pl. 1, fig. 7.
1971 *Todisporites minor* Couper; Pautsch, p. 11, pl. 1, fig. 4.
1972 *Todisporites minor* Couper; Tralau & Artursson, p. 61, Fig. 2, A.
1975 *Todisporites minor* Couper; Filatoff, p. 57, pl. 9, fig. 1.
1975 *Todisporites minor* Couper; Vigran & Thusu, p. 11, pl. 2, figs 9–10.
1976 *Todisporites minor* Couper; Rogalska, p. 42, pl. 10, figs 153–156.
1977 *Todisporites minor* Couper; Ashraf, p. 30, pl. 3, figs 5–6.
1977 *Todisporites minor* Couper; Schuurman, p. 182, pl. 1, figs 1–2.
1977 *Todisporites minor* Couper; van Erve, p. 52, pl. 2, fig. 6.
1978 *Todisporites minor* Couper; Guy-Ohlson, p. 27
1981 *Todisporites minor* Couper; Achilles, p. 21, pl. 3, fig. 20, pl. 4, fig. 1.
1983 *Todisporites minor* Couper; Orłowska-Zwolińska, p. 10, pl. 2, figs 10–11.
1984 *Todisporites minor* Couper; Achilles et al., p. 39, pl. 2, fig. 16.
1985 *Todisporites minor* Couper; Guy-Ohlson & Malmquist, p. 21, Fig. 2.
1986 *Todisporites minor* Couper; Guy-Ohlson, p. 12.
1987 *Todisporites minor* Couper; Schrank, p. 257, pl. 2, fig. 12.
1989 *Todisporites minor* Couper; Weiss, pp. 35–36.
1990 *Todisporites minor* Couper; Rauscher & Schmitt, pp. 111, 134.

Description. Spores circular in equatorial outline. Triradiate tetrad scar extending about 2/3 of the spore radius. Exine smooth and thin.

Dimensions. Equatorial diameter about 34 μm.

Material. 2 spores.

Slides. KRAM-P O8/3 [107/19.5], O8/50/95 [108/11].

Affinity. Dispersed spores of *Todisporites minor* Couper 1958 are similar to in situ spores from the Mesozoic fern *Todites princeps* (Presl) Gothan of the family Osmundaceae (Couper 1958, Tralau 1968, van Konijnenburg-van Cittert 1978). Balme (1995) placed affinity dispersed *Todisporites* in Filicopsida (Osmundaceae).

Stratigraphical distribution. Upper Triassic to Middle Jurassic, Lower Cretaceous.

Geographical distribution. Afghanistan, Australia, Canada, Egypt, France, Germany, Great Britain, Hungary, Iran, Italy, Luxembourg, Norway, Poland, Sweden. Reported also from Austria, China, India, Israel, Libya, New Guinea (Weiss 1989).

Remarks. *Todisporites minor* has been recorded in Europe mainly from the Middle Jurassic sediments (Tralau 1968, van Konijnenburg-van Cittert 1978, Guy-Ohlson 1986). However, the presence of this species is reported also from the Upper Triassic sediments e.g. by Orłowska-Zwolińska (1983), Pautsch (1971), Lower Jurassic sediments e.g. Ashraf (1977), Achilles (1981), and Lower Cretaceous sediments e.g. by Pocock (1962). The fern *Todites princeps* is known from Liassic and Middle Jurassic (Harris 1961, Tralau 1968, van Konijnenburg-van Cittert 1978). Leaves and rhizomes of *Todites princeps* have been found in the Liassic sediments from Odrowąż (Wcisło-Luraniec 1992a). It is possible that the dispersed spores of *Todisporites minor* are the spores of this fern.

cf. ***Todisporites*** sp.

Pl. 2, fig. 4

Description. Spore circular in equatorial outline. Triradiate tetrad mark is surrounded by exine folds. Leasure extending 2/3 of the spore radius. There are short, transversal exinal folds on the ends of leasures. Exine smooth and thin.

Dimensions. Equatorial diameter about 35 µm.

Material. 1 spore.

Slide. KRAM-P O8/54 [105.5/3].

Affinity. Unknown, probably immature fern spore from Osmundaceae.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. This spore is similar to *Todisporites* spores in shape and size but has characteristic exinal folds on the ends of leasures and is therefore probably immature.

Genus ***Cibotiumspora*** Chang 1965

Type. *Cibotiumspora paradoxa* (Malyavkina) ex Chang 1965, p. 165

Tripartina paradoxa Malyavkina 1949, p. 50, pl. 7, fig. 21 (nomen nudum, not validly published in 1949)

Cibotiumspora jurienensis (Balme1957) Filatoff 1975

Pl. 2, fig. 9

1957 *Concavisporites jurienensis* sp. nov., Balme, pp. 20–21, pl. 2, figs 30, 31.
1958 *Auritulinasporites intrastriatus* sp. nov., Nilsson, pp. 36–37, pl. 1, fig. 17.
1964 *Concavisporites (Obtusisporites) divisitorus* n fsp., Kedves & Simoncsics, p. 28, pl. 7, figs 10–11.
1971 cf. *Concavisporites jurienensis* Balme; Guy, p. 25, pl. 1, fig. 18.
1975 *Concavisporites (Auritulinasporites) intrastriatus* Nilsson comb. nov., Arjang, pp. 110–111, pl. 2, fig. 14.
1975 *Cibotiumspora jurienensis* (Balme) comb. nov., Filatoff, p. 61, pl. 10, figs 8–13.
1977 *Auritulinasporites intrastriatus* Nilsson; Ashraf, pp. 22–23, pl. 1, fig. 1.
1977 *Concavisporites (Auritulinasporites) intrastriatus* (Nilsson) Arjang; Ashraf, pp. 24–25, pl. 1, fig. 6.
1977 *Concavisporites jurienensis* Balme; Schuurman, p. 184, pl. 2, fig. 30.
1981 *Concavisporites intrastriatus* (Nilsson) Arjang; Achilles, p. 13, pl. 1, figs 7–9.
1981 *Concavisporites jurienensis* Balme; Achilles, p. 13, pl. 1, fig. 10.
1983 *Concavisporites jurienensis* Balme; Orłowska-Zwolińska, p. 9, pl. 1, figs 7–8.
1984 *Concavisporites intrastriatus* (Nilsson) Arjang; Achilles et al., p. 33, pl. 1, fig. 8.
1985 *Cibotiumspora jurienensis*(Balme) Filatoff; Hoelstad, p. 121, pl. 2, figs 9–10.
1986 *Cibotiumspora jurienensis*(Balme) Filatoff; Guy-Ohlson, p. 12, pl. 1, figs 10, 12–14, pl. 11, fig. 5.
1989 *Concavisporites (Auritulinasporites) intrastriatus* (Nilsson) Arjang; Weiss, pp. 13–14, pl. 1, fig. 4.
1989 *Concavisporites jurienensis* Balme; Weiss, p. 14, pl. 1, fig. 5.
1991 *Cibotiumspora jurienensis* (Balme) Filatoff; Dybkjær, p. 18, pl. 1, fig. 4.

Description. Spores triangular in equatorial outline with concave or convex sides. Triradiate tetrad mark extending to the equator. The characteristic thickening of the central part of the distal side is visible. This thickening is 5–6 µm wide, parallel to the laesura arms extending about 2/3 of the spore radius and ending in folds 2–3 µm wide, across all apices. Exine smooth to scabrate.

Dimensions. Equatorial diameter about 24–32 µm.

Material. 2 spores.

Slides. KRAM-P O8/48 [95.1/10], O10/1 [106.5/6].

Affinity. Balme (1957) wrote that “Spores of this type have been related to the Gleicheniaceae, and rather similar forms have been obtained from the sori of *Clathropteris*”. According to Chang (1965) spores of the genus *Cibotiumspora* are similar to spores of living dicksoniaceous ferns *Cibotium splendens* (Gaud.) Krajina illustrated in Selling’s paper (1946). The photographs of mature *Cibotium splendens* spores (Selling 1946, pl. 4, figs 80–82) differ from dispersed *Cibotiumspora* but immature spores (Selling 1946, pl. 4, figs 84, 87) are similar to these dispersed spores.

Stratigraphical distribution. Lower Jurassic to Lower Cretaceous.

Geographical distribution. Afghanistan?, Australia, Denmark, France, Germany?, Hungary, Iran?, Luxemburg, Poland, Sweden.

Remarks. Ashraf (1977) illustrated in detail differences between *Auritulinasporites, Cibotiumspora* and *Cosmosporites* spores and suggested that *Auritulinasporites intrastriatus* Nilsson differs from *Concavisporites (Auritulinasporites) intrastriatus* (Nilsson) Arjang sensu Arjang 1975. Spores from Odrowąż differ from *Concavisporites (Auritulinasporites) intrastriatus* (Nilsson) Arjang sensu Arjang 1975 and from *Auritulinasporites intrastriatus* Nilsson sensu Ashraf 1977 but they are very similar to spores of *Cibotiumspora jurienensis* (Balme) Filatoff (Filatoff 1975, pl. 10, figs 8 and 10).

Genus ***Auritulinasporites*** Nilsson 1958

Type. *Auritulinasporites scanicus* Nilsson 1958, p. 35, pl. 1, fig. 16

Auritulinasporites triclavis Nilsson 1958

Pl. 2, fig. 8

1958 *Auritulinasporites triclavis* sp. nov., Nilsson, p. 36, pl. 1, figs 14–15.
1981 *Auritulinasporites triclavis* Nilsson; Guy-Ohlson, p. 235, Fig. 6F.
1986 *Auritulinasporites triclavis* Nilsson; Guy-Ohlson, p. 13.

Description. Spores triangular with concave or convex sides and rounded apices in equatorial outline. Triradiate tetrad mark extending almost to the equator. Exine thickening surrounding and parallel to leasura arms, extending on apices to distal sides of spore. The widest thickening on apices of the spore is about 10 µm wide. Exine smooth.

Dimensions. Equatorial diameter about 34 µm.

Material. 1 spore.

Slide. KRAM-P O5/2/95 [95.5/6].

Affinity. Nilsson (1958) wrote that *Auritulinasporites triclavis* spores are similar to spores illustrated by Reissinger 1950 (pl. 12, fig. 10). Reissinger (1950) sugested pteridophytic, probably fern affinity.

Stratigraphical distribution. Lower Jurassic.

Geographical distribution. Poland, Sweden.

Remarks. These spores from Odrowąż are similar to *Auritulinasporites* sensu Ashraf 1977.

Auritulinasporites sp.

Pl. 2, fig. 6

Description. Spores almost triangular in equatorial outline. Triradiate tetrad mark indistinct. Exine thickening parallel to leasures and extending on the apices to distal side. Exine smooth.

Dimensions. Equatorial diameter approximately 30 µm (precise messurement is not possible because of oblique spores position).

Material. 2 spores.

Slides. KRAM-P O5/11/95 [91/5], O8/46/95 [106/8.5].

Affinity. Unknown.

Stratigraphical distribution. Lower Jurassic.

Geographical distribution. Poland.

Remarks. These spores resembles *Auritulinasporites triclavis* spores but are in oblique position and possibly immature.

Infraturma Apiculati Bennie & Kidston emend. R. Potonié 1956

Genus ***Conbaculatisporites*** Klaus 1960

Type. *Conbaculatisporites mesozoicus* Klaus 1960, p. 126, pl. 29, fig. 15

Conbaculatisporites mesozoicus Klaus 1960

Pl. 2, fig. 10

1960 *Conbaculatisporites mesozoicus* sp. nov., Klaus, pp. 125–126, pl. 29, fig. 15.

1964a *Conbaculatisporites mesozoicus* Klaus; Mädler, p. 101, pl. 9, fig. 2.
1968 *Conbaculatisporites mesozoicus* Klaus; Tralau, pp. 98–99, Fig. 9E.
1971 *Conbaculatisporites mesozoicus* Klaus; Pautsch, p. 16, pl. 3, fig. 6.
1975 *Conbaculatisporites mesozoicus* Klaus; Arjang, p. 118, pl. 4, figs 6–7.
1975 *Conbaculatisporites* sp. cf. *C. mesozoicus* Klaus; Filatoff, pp. 50–51, pl. 4, figs 12–13.
1977 *Conbaculatisporites mesozoicus* Klaus; Ashraf, p. 40, pl. 6, fig. 16.
1977 *Conbaculatisporites mesozoicus* Klaus; Lund, pp. 55–56, pl. 2, fig. 10a–b.
1980 *Conbaculatisporites mesozoicus* Klaus; Pedersen & Lund, pl. 5, figs 1–2.
1981 *Conbaculatisporijtes mesozoicus* Klaus; Achilles, pp. 28–29, pl. 6, fig. 1.
1981 *Conbaculatisporites mesozoicus* Klaus; Guy-Ohlson, p. 235, fig. 8H.
1983 *Conbaculatisporites mesozoicus* Klaus; Orłowska-Zwolińska, p. 13, pl. 8, figs 5–6.
1984 *Conbaculatisporites mesozoicus* Klaus; Achilles et. al., p. 48, pl. 5, fig. 4.
1985 *Conbaculatisporites mesozoicus* Klaus; Guy-Ohlson & Malmquist, p. 19, Fig. 2.
1985 cf. *Conbaculatisporites mesozoicus* Klaus; Hoelstad, p. 123, pl. 2, fig. 12.
1985 *Conbaculatisporites mesozoicus* Klaus; Lund & Pedersen, p. 376.
1986 *Conbaculatisporites mesozoicus* Klaus; Guy-Ohlson, p. 16, pl. 2, fig. 3.
1986 *Conbaculatisporites mesozoicus* Klaus; Ichas, pp. 12–13, pl. 1, figs 5–6.
1989 *Conbaculatisporites mesozoicus* Klaus; Weiss, pp. 55–56.
1991 *Conbaculatisporites mesozoicus* Klaus; Dybkjær, p. 20, pl. 2, fig. 9.

Description. Spores triangular with rounded apices and convex or concave sides in equatorial outline. Triradiate tetrad mark extending to the equator. Exine covered with spines about 1 μm high and bacula about 1–2 μm high.

Dimensions. Equatorial diameter about 32–37 μm.

Material. 2 spores.

Slides. KRAM-P OS2/4 [111.5/15.5], O8/45/95 [97/3].

Affinity. According to Pedersen and Lund (1980) the *Conbaculatisporites mesozoicus* type is known in situ from fern *Clathropteris meniscoides*, Dipteridaceae (Harris 1931, pl. 18, fig. 3). However, Potonié (1956) suggests that dispersed spores from the genus *Anemiidites* Ross are similar to spores of *Clathropteris meniscoides*, Dipteridaceae (Harris 1931). According to Playford and Dettmann (1965) dispersed spores *Converrucosisporites cameroni* (de Jersey) Playford & Dettmann, show a striking similarity to the spores illustrated by Harris (1931). Also Balme (1995) wrote that *Converrucosisporites* spores are similar to spores of fern *Clathropteris meniscoides*, Dipteridaceae. Balme (1995) does not give an affinity for dispersed spores of *Conbaculatisporites mesozoicus* Klaus.

Stratigraphical distribution. Rhaetic to Middle Jurassic.

Geographical distribution. Afghanistan, Australia, Austria, Denmark, Germany, Greenland, Iran, Poland, Sweden. Reported also from France, India, Switzerland (Weiss 1989).

Genus ***Apiculatisporis*** Potonié & Kremp 1954

Type. *Apiculatisporis aculeatus* (Ibrahim) Potonié & Kremp 1954, p. 94

Holotype re-illustrated in Potonié & Kremp 1955, p. 78, pl. 14, fig. 235

Apiculatisporis ovalis (Nilsson 1958) Norris 1965

Pl. 2, fig. 7

1958 *Acanthotriletes ovalis* sp. nov., Nilsson, pp. 40–41, pl. 2, figs 8–9.
1958 *Acanthotriletes trigonus* sp. nov., Nilsson, p. 41, pl. 2, fig. 7.
1965 *Apiculatisporis ovalis* (Nilsson) comb. nov., Norris, p. 245, figs 2b, 18, 22–23.
1965 *Acanthotriletes ovalis* Nilsson; Wall, p. 165.
1975 *Acanthotriletes ovalis* Nilsson; Morbey, p. 15, pl. 3, figs 10–12.
1980 *Apiculatisporis ovalis* (Nilsson) Norris; Pedersen & Lund, p. 18, pl. 5, fig. 5.
1981 *Acanthotriletes ovalis* Nilsson; Achilles, p. 25, pl. 2, figs 2–3.
1985 *Acanthotriletes ovalis* Nilsson; Guy-Ohlson & Malmquist, p. 19, Fig. 2.
1989 *Acanthotriletes ovalis* Nilsson; Weiss, p. 48.
1991 *Apiculatisporis ovalis* (Nilsson) Norris; Dybkjær, p. 20, pl. 3, figs 1–2, 4–5, pl. 21, figs 5–6, 8.

Description. Spore oval, with folds, broken on one side. Trilete mark indistinct. Exine covered with spines about 1 μm high and papillae about 1 μm high.

Dimensions. Equatorial diameter about 48 μm.

Material. 1 spore.

Slide. KRAM-P O8/50/95 [105.5/8.5].

Affinity. Unknown for this species. According to Balme (1995) dispersed spores of the genus *Apiculatisporis* are similar to spores of Permian and Carboniferous Filicopsida.

Stratigraphical distribution. Upper Triassic to Lower Jurassic.

Geographical distribution. Antarctica, Austria, Denmark, Germany, Great Britain, Greenland, Poland, Sweden.

Genus ***Foraminisporis*** Krutzsch 1959

Type. *Foraminisporis foraminis* Krutzsch 1959, p. 130, pl. 19, figs 203, 206

Foraminisporis jurassicus Schulz 1967

Pl. 2, fig. 13

1967 *Foraminisporis jurassicus* sp. nov., Schulz, p. 564, pl. 4, figs 1–3, pl. 23, fig. 3.
1977 *Foraminisporis jurassicus* Schulz; Lund, p. 54, pl. 2, fig. 6.
1981 *Foraminisporis jurassicus* Schulz; Achilles, p. 25, pl. 5, fig. 8.
1985 *Foraminisporis jurassicus* Schulz; Hoelstad, p. 123.
1985 *Foraminisporis jurassicus* Schulz; Lund & Pedersen, p. 378.
1986 *Foraminisporis jurassicus* Schulz; Guy-Ohlson, pp. 23–24, pl. 3, fig. 7.
1989 *Foraminisporis jurassicus* Schulz; Weiss, p. 49.
1990 *Foraminisporis jurassicus* Schulz; Rauscher & Schmitt, p. 111.
1991 *Foraminisporis jurassicus* Schulz; Dybkjær, p. 20, pl. 3, fig. 12.

Description. Spore circular in equatorial outline. Triradiate tetrad mark distinct, extending to 2/3 of the spore radius. Exine covered by some verrucae 1.8–3.2 μm in diameter. Also some conical elements 1.0–2.4 μm high and 0.8–1.6 μm wide are visible around the equator of the spore.

Dimensions. Equatorial diameter about 41 μm.

Material. 1 spore.

Slide. KRAM-P O8/58/95 [99.1/2.5].

Affinity. Anthocerotaceae (Schulz 1967).

Stratigraphical distribution. Triassic to Middle Jurassic.

Geographical distribution. Denmark, Germany, Poland, Sweden. Reported also from Greenland and Russia (Weiss 1989).

Remarks. Resembles also: 1958 *Sporites telephorus* new species, Pautsch, p. 323, pl. 1, fig. 12; 1960 *Anapiculatisporites telephorus* Pautsch comb. nov., Klaus, pp. 124–125, pl. 29, fig. 17; 1962 *Anapiculatisporites telephorus* Klaus comb. nov., Jansonius, p. 45; 1964a *Carnisporites telephorus* Pautsch comb. nov., Mädler, pp. 95–96, pl. 8, fig. 9; 1991 *Anapiculatisporites telephorus* (Pautsch) Klaus; Dybkjær, p. 20, pl. 3, figs 8–9.

Genus ***Uvaesporites*** Döring 1965

Type. *Uvaesporites glomeratus* Döring 1965, p. 39, pl. 9, figs 1–4

Uvaesporites argenteaeformis (Bolchovitina 1953) Schulz 1967

Pl. 2, fig. 14

1953 *Stenozonotriletes argenteaeformis* sp. nov., Bolkhovitina, p. 51, pl. 7, fig. 9.
1954 *Ophioglossaceae* (cf. *Botrychium lunaria* L.); Rogalska, p. 9, pl. 1, fig. 9.
1956 cf. *Botrychium lunaria* L.; Rogalska, pp. 11–12, pl. 2, figs 1–3.
1961 *Trilites reissingeri* sp. nov., Reinhardt, p. 707, pl. 2, figs 1–2.
1967 *Uvaesporites argenteaeformis* (Bolch.) comb. nov., Schulz, p. 560, pl. 2, figs 10–11, pl. 23, fig. 2.
1968 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Tralau, pp. 68–69, pl. 3, fig. 4; pl. 4, figs 1–2.
1971 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Guy, pp. 25–26, pl. 2, fig. 1.
1972 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Tralau & Artursson, p. 59, Fig. 2M.
1973 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Orbell, pl. 4, figs 7–8.
1974 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Herngreen & De Boer, pl. 5, fig. 5a–b.
1975 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Arjang, p. 124, pl. 5, figs 14–15.
1975 *Leptolepidites argenteaeformis* (Bolch.) comb. nov., Morbey, p. 14, pl. 3, figs 7–9.
1975 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Vigran & Thusu, p. 11, pl. 5, figs 9–10.
1977 *Uvaesporites reissingeri* (Reinhardt) comb nov., Lund, p. 60, pl. 3, fig. 14a–b.
1977 *Leptolepidites argenteaeformis* (Bolch.) Morbey; Ashraf, p. 31, pl. 4, figs 1–3.
1977 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Bjærke & Manum, p. 31, pl. 2, figs 6, 8.

1978 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Guy-Ohlson, pl. 6, figs 61–62.

1980 *Uvaesporites reissingeri* (Reinhardt) Lund; Pedersen & Lund, p. 18, pl. 6, figs 1–3.

1981 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Guy-Ohlson, Fig. 6, I–J.

1984 *Leptolepidites reissingeri* (Bolch.) Morbey; Achilles et al., pp. 42–43, pl. 3, figs 2–5.

1985 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Hoelstad, p. 123, pl. 2, fig. 5.

1989 *Leptolepidites reissingeri* (Bolch.) Morbey; Weiss, pp. 43–44, Pl. 3, fig 8.

1990 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Rauscher & Schmitt, pp. 113, 140, pl. 1, figs 25–26.

1991 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Dybkjær, p. 21, pl. 4, figs 1–4.

Description. Spores rounded triangular to almost circular in equatorial outline. Triradiate tetrad mark indistinct extending to about 3/4 of the spore radius. Exine on the distal face covered by irregular verrucae which are 2–6 µm high and 2–8 µm in diameter. Verrucae tending to fuse together and to form an irregular reticulum.

Dimensions. Equatorial diameter 40–60 µm (3 specimens measured).

Material. 4 spores.

Slides. KRAM-P O6/1/6 [110/9.5], O8/33 [106/6, 108.5/8], O8/2 [101/13].

Affinity. Bolkhovitina (1953) compared the dispersed spore *Stenozonotriletes argenteaeformis* with spores of recent fern *Gymnogramma argentea* (Adiantaceae). Rogalska (1954, 1956) illustrated similar spores under the name *Ophioglossaceae* (cf. *Botrychium lunaria* L.). According to Schulz (1967) dispersed spores *Uvaesporites argenteaeformis* (Bolch.) Schulz are similar to spores of Ophioglossaceae ?*Botrychium*. Döring (1965) and Balme (1995) suggested that some dispersed spores of genus *Uvaesporites* are similar to microspores of the Lycopsida (Selaginellales). Looy (2000) investigated Permo-Triassic spores from the genus *Uvaesporites* and also attributed it to the Selaginellales.

Stratigraphical distribution. Upper Triassic to Lower Cretaceous.

Geographical distribution. Austria?, Afghanistan?, Denmark, France, Germany, Great Britain, Greenland, Iran?, the Netherlands, Norway, Poland, Russia, Spitsbergen (Hopen), Sweden. Reported also from America, Luxembourg, Russia (Weiss 1989).

Remarks. Similar dispersed spores are known as *Uvaesporites argenteaeformis* or *Leptolepidites argenteaeformis* or *L. reissingeri*. *Trilites reissingeri* Reinhardt 1961 is the younger synonym of *Stenozonotriletes argenteaeformis* Bolkhovitina 1953. *Uvaesporites* differs from *Leptolepidites* in having in general larger verrucae near the equator. Differences between verrucae near the equator and verrucae on the distal side of spore are bigger than in *Leptolepidites*. *Leptolepidites* spores are darker and have a thicker exine. Most of authors use the name *Uvaesporites argenteaeformis*.

cf. ***Uvaesporites*** sp.

Pl. 2, fig. 12

cf. *Uvaesporites* sp. is similar to:

1974 *Circularesporites cerebroides* Danzé & Laveine; Herngreen & De Boer, p. 360, pl. 3, fig. 5.

1975 *Leptolepidites argenteaeformis* (Bolch.) comb. nov., Morbey, p. 14, pl. 3, fig. 9.

1977 Tetrads of *Uveaesporites* sp., Lund, p. 60, pl. 3, fig. 15.

1980 *Uvaesporites reissingeri* (Reinhardt) Lund; Pedersen & Lund, p. 18, pl. 6, fig. 1.

Description. Incomplete tetrad consisting of 3 spores. Exine of spores sculptured, covered by more or less coalescent, irregular verrucae, formingan irregular reticulum on the distal side, near the equator of spore and on the proximal side near the equator. Verrucae about 2–5 µm high and about 4–6 µm in diameter. Tetrad marks invisible.

Dimensions. Length about 71 µm, width about 52 µm.

Material. 1 incomplete tetrad.

Slide. KRAM-P O8/48/95 [101.5/3].

Affinity. Unknown, probably Lycopsida. Looy (2000) described wall ultrastructure of the Permo-Triassic *Uvaesporites* tetrads in detail and considered its sellaginellalean affinity.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. Morbey (1975) included similar tetrads to *Leptolepidites argenteaeformis* (Bolch.)

Morbey, Pedersen and Lund (1980) to *Uvaesporites reissingeri*.

Genus ***Leptolepidites*** Couper 1953 emend. Schulz 1967

T y p e. *Leptolepidites verrucatus* Couper 1953, p. 28, pl. 2, fig. 14

Leptolepidites sp.

Pl. 2, fig. 15

D e s c r i p t i o n. Spore rounded triangular. Triradiate tetrad mark indistinct. Exine covered by verrucae 1–3 µm high and 3–4 µm in diameter. Spore thick and dark brown in colour. Thickness of exine indistinct.

D i m e n s i o n s. Equatorial diameter 37.4 µm.

M a t e r i a l. 1 spore.

S l i d e s. KRAM-P O8/5 [110.5/4.5].

A f f i n i t y. Unknown, probably spores of Lycopodiales (Filatoff 1975, pp. 43, 48).

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Liassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

R e m a r k s. *Leptolepidites* sp. differs from *Leptolepidites verrucatus* Couper 1953 by the larger size of spore and the smaller size of verrucae.

Genus ***Osmundacidites*** Couper 1953

T y p e. *Osmundacidites wellmanii* Couper 1953, p. 20, pl. 1, fig. 5

Osmundacidites sp.

Pl. 2, fig. 16

D e s c r i p t i o n. Spores circular in equatorial outline. Triradiate tetrad mark indistinct. Exine thin less than 1 µm, sculpture granulate.

D i m e n s i o n s. Equatorial diameter about 32–34 µm.

M a t e r i a l. 2 spores.

S l i d e s. KRAM-P O5/13/95 [97/7], O10/1 [98/6].

A f f i n i t y. Probably spores of Marattiales. According to Couper (1953, 1958) dispersed spores of the genus *Osmundacidites* are similar to osmundaceous fern spores. Balme (1995) suggested that *Osmundacidites* dispersed spores are comparable with Filicopsida (Marattiales, Osmundaceae).

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Liassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

R e m a r k s. *Osmundacidites* sp. differs from *Osmundacidites wellmanii* Couper by its smaller sizes and is therefore probably marattiaceous spore.

Genus ***Acanthotriletes*** Naumova emend. Potonié & Kremp 1954

T y p e. *Acanthotriletes primigenus* Naumova 1949, p. 54, pl. 2, fig. 14

Acanthotriletes varius (Nilsson 1958) Schuurman 1977

Pl. 2, fig. 11

1958 *Acanthotriletes varius* sp. nov., Nilsson, p. 42, pl. 2, fig. 10.
1964b *Anemiidites spinosus* sp. nov., Mädler; p. 180, pl. 2, fig. 11.
1965 *Acanthotriletes varius* Nilsson; Wall, p. 165.
1972 *Anemiidites spinosus* Mädler; Fisher, pl. 8, fig. 22.
1973 *Anemiidites echinatus* Ross; Orbell, pl. 3, fig. 4.
1975 *Acanthotriletes varius* Nilsson; Morbey, p. 15, pl. 3, figs 13–15.
1976 *Acanthotriletes levidensis* Balme; Rogalska, pl. 11, fig. 168.
1977 *Conbaculatisporites spinosus* (Mädler) comb. nov., Lund, p. 56, pl. 2, fig. 11.
1977 *Acanthotriletes varius* (Nilsson) emend., Schuurman, p. 186, pl. 4, figs 1–3.
1979 *Acanthotriletes varius* (Nilsson) Schuurman; Schuurman, p. 57, pl. 2, fig. 6.
1981 *Acanthotriletes varius* (Nilsson) Schuurman; Achilles, p. 25, pl. 5, figs 4–7.
1981 *Acanthotriletes varius* Nilsson; Guy-Ohlson, p. 235.
1983 *Acanthotriletes varius* Nilsson; Orłowska-Zwolińska, p. 12, pl. 6, figs 2–4.
1989 *Acanthotriletes varius* (Nilsson) Schuurman; Weiss, pp. 48–49, pl. 3, fig. 12.
1991 *Conbaculatisporites spinosus* (Mädler) Lund; Dybkjær, p. 21, pl. 2, fig. 10.

D e s c r i p t i o n. Spore triangular in equatorial (slightly oblique) outline. Sides concave, apices rounded to pointed. Triradiate tetrad mark extending about 3/4 of the spore radius, leasure bounded by dark folds. Exine covered by spinae about 1.0–3.2 µm high and about 0.8–1.6 µm in diameter.

D i m e n s i o n s. Equatorial diameter about 30–31 µm.

M a t e r i a l. 1 spore.

S l i d e. KRAM-P O5/11/95 [91/5].

A f f i n i t y. Unknown.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Upper Triassic to Cretaceous.

G e o g r a p h i c a l d i s t r i b u t i o n. Austria, Denmark?, France, Germany, Great Britain, Luxembourg, Poland, Sweden. Reported also from Switzerland (Weiss 1989).

Infraturma Murornati Potonié & Kremp 1954

Genus ***Lycopodiacidites*** Couper 1953

T y p e. *Lycopodiacidites bullerensis* Couper 1953, p. 26, pl. 1, fig. 9

Lycopodiacidites rugulatus (Couper 1958) Schulz 1967

Pl. 3, fig. 1

1958 *Perotrilites rugulatus* sp. nov., Couper, p. 147, pl. 25, figs 7–8.
1961 *Trilites reissingeri* sp. nov., Reinhardt, p. 707, pl. 2, figs 1–2.
1967 *Lycopodiacidites rugulatus* (Couper) comb. nov., Schulz, pp. 573–574, pl. 7, figs 15–16.
1968 *Lycopodiacidites rugulatus* (Couper) Schulz; Tralau, p. 45, pl. 5, fig. 4.
1971 cf. *Lycopodiacidites rugulatus* (Couper) Schulz; Guy, pl. 2, fig. 4.
1972 *Lycopodiacidites rugulatus* (Couper) Schulz; Tralau & Artursson, p. 59, Fig. 2, L.
1975 *Lycopodiacidites rugulatus* (Couper) Schulz; Arjang, p. 120, pl. 9, figs 9, 14.
1975 *Lycopodiacidites rugulatus* (Couper) Schulz; Morbey, pl. 5, fig. 1.
1975 *Lycopodiacidites rugulatus* (Couper) Schulz; Vigran & Thusu, p. 10, pl. 8, figs 2–3, 6.
1977 *Lycopodiacidites rugulatus* (Couper) Schulz; Ashraf, pl. 9, figs 11–12, pl. 10, figs 1–5.
1977 *Lycopodiacidites rugulatus* (Couper) Schulz; Bjærke & Manum, p. 33, pl. 3, figs 6, 9.
1977 *Lycopodiacidites rugulatus* (Couper) Schulz; Lund, pl. 5, fig. 8.
1978 *Lycopodiacidites rugulatus* (Couper) Schulz; Guy-Ohlson, p. 21, pl. 5, fig. 42.
1980 *Lycopodiacidites rugulatus* (Couper) Schulz; Pedersen & Lund, p. 18, pl. 7, fig. 3.
1981 *Lycopodiacidites rugulatus* (Couper) Schulz; Achilles, p. 35, pl. 8, figs 5–6.
1983 *Lycopodiacidites rugulatus* (Couper) Schulz; Orłowska-Zwolińska, pl. 11, fig. 4, pl. 12, fig. 9.
1984 *Lycopodiacidites rugulatus* (Couper) Schulz; Achilles et al., pp. 54–55, pl. 6, fig. 2.
1985 *Lycopodiacidites rugulatus* (Couper) Schulz; Lund & Pedersen, p. 78, pl. 3, fig. 3.
1985 *Lycopodiacidites rugulatus* (Couper) Schulz; Guy-Ohlson & Malmquist, p. 20, pl. 2, Figs B–C.
1985 *Lycopodiacidites rugulatus* (Couper) Schulz; Hoelstad, p. 124, pl. 2, fig. 14.
1986 *Lycopodiacidites rugulatus* (Couper) Schulz; Guy-Ohlson, p. 19, pl. 2, fig. 8.
1989 *Lycopodiacidites rugulatus* (Couper) Schulz; Weiss, pp. 74–75.
1990 *Lycopodiacidites rugulatus* (Couper) Schulz; Rauscher & Schmitt, pp. 111, 134, 136, pl. 2, fig. 12.

D e s c r i p t i o n. Spore circular in equatorial outline. Triradiate tetrad mark indistinct. Exine sculptured with various rugulae, about 2 to 3 µm wide. Exine about 4 µm thick.

D i m e n s i o n s. Equatorial diameter about 70 µm.

M a t e r i a l. 1 spore.

S l i d e. KRAM-P O8/3 [99.5/19].

A f f i n i t y. According to Schulz (1967) *Lycopodiacidites rugulatus* spores are similar to spores from *Lycopodium*. Filatoff (1975) placed spores of the genus *Lycopodiacidites* Couper 1953 in lycopodialean spores. Balme (1995) suggests that dispersed spores of the genus *Lycopodiacidites* are similar to some spores of the Filicopsida (Ophioglossales).

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Upper Triassic – Middle Jurassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Afghanistan, Austria, Denmark, France, Germany, Great Britain, Greenland, Iran, the Netherlands, Norway, Poland, Spitsbergen (Hopen), Sweden. Reported also from Italy (Weiss 1989).

R e m a r k s. The exine of the specimen from Odrowąż is thicker than that described by Couper (1958) and Schulz (1967).

Genus ***Lycopodiumsporites*** Thiergart 1938 emend. Delcourt & Sprumont 1955

Type. *Lycopodiumsporites agathoecus* (Potonié) Delcourt & Sprumont 1955, designation by Delcourt & Sprumont 1955, p. 31

Sporites agathoecus Potonié 1934, p. 43, pl. 1, fig. 25

Lycopodiumsporites cerniidites (Ross 1949) Delcourt & Sprumont 1955

Pl. 3, fig. 10

1949 *Lycopodium cerniidites* sp. nov., Ross, pp. 30–31, pl. 1, figs 1–2.
1955 *Lycopodiumsporites cerniidites* (Ross) comb. nov., Delcourt & Sprumont, p. 32.
1958 *Lycopodiumsporites cerniidites* (Ross) Delcourt & Sprumont; Couper, p. 132, pl. 15, figs 6–9.
1959 *Camarozonosporites cerniidites* (Ross) comb. nov., Krutzsch, p. 187.
1963 *Lycopodiacidisporites cerniidites* (Ross, Delcourt & Sprumont) comb. nov., Danzé-Corsin & Laveine, p. 77, pl. 6, figs 10, 11a–b.
1975 *Lycopodiacidites cerniidites* (Ross) Brenner; Filatoff, p. 47, pl. 4, figs 9, 10.
1976 *Lycopodiumsporites cerniidites* (Ross) Delcourt & Sprumont; Rogalska, pl. 2, figs 26–28.

Resembles also:

1967 *Camarozonosporites insignis* sp. nov., Norris, pp. 96–97, pl. 13, figs 12–16.
1970 *Camarozonosporites* sp. cf. *C. insignis* Norris; Kemp, pp. 105, 106, pl. 19, figs 12–13.

D e s c r i p t i o n. Spore almost circular in equatorial outline. Triradiate mark with sinuous leasura arms extending almost to the equator. Exine about 3 µm thick, sculptured strongly on the distal side with irregular rugulae 3–4 µm wide, sometimes visible as irregular reticulum with lumina 1–2 µm in diameter.

D i m e n s i o n s. Equtorial diameter 44.2 µm.

M a t e r i a l. 1 spore.

S l i d e. KRAM-P O8/59/95 [107.5/17].

A f f i n i t y. Ross (1949) wrote that dispersed spores of *Lycopodium cerniidites* are similar to recent spores of the tropical *Lycopodium cernuum*. Danzé-Corsin and Laveine (1963) suggested affinity with Lycopodiales or Sellaginellales.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Jurassic – Cretaceous, Eocene.

G e o g r a p h i c a l d i s t r i b u t i o n. Australia?, France, Germany, Great Britain, Poland, Sweden.

R e m a r k s. Ross (1949) described similar dispersed spores as *Lycopodium cerniidites*. Danzé-Corsin & Laveine 1963 placed these specimens in the new genus *Lycopodiacidisporites* but *Lycopodiacidisporites* Danzé-Corsin & Laveine 1963 is an obligate junior synonym of *Lycopodiacidites* Couper 1953 according to Jansonius & Hills (1976, no. 1539). Danzé-Corsin and Laveine (1963) suggested also that spore illustrated by Reissinger 1950 (pl. 12, fig. 41) and *Verrucosisporites marginalis* sp. nov. described by Leschik 1955 (p. 15, pl. 1, fig. 14) are identical with *Lycopodiumsporites cerniidites*.

According to Norris (1967) *Camarozonosporites insignis* sp. nov. is identical with *Lycopodiacidites cerniidites* auct. non Ross in Brenner and similar to *Lycopodium cerniidites* Ross 1949 (= *Camarozonosporites cerniidites* (Ross) Krutzsch) but *C. cerniidites* (Ross) Krutzsch "has labiate laesurae, a laevigate proximal face and smaller sculptural elements on the distal surface".

Lycopodiumsporites semimuris Danzé-Corsin & Laveine 1963

Pl. 3, fig. 2

1963 *Lycopodiumsporites semimuris* sp. nov., Danzé-Corsin & Laveine, p. 79, pl. 6, figs 15–17.
1964b *Lycopodiumisporites semimuris* Danzé-Corsin & Laveine; Levet-Carette, p. 102, pl. 5, fig. 33.
1968 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Tralau, p. 52, pl. 2, fig. 4.
1971 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Guy, p. 29, pl. 2, figs 11–12.
1974 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Herngreen & De Boer, p. 357, pl. 4, fig. 8.
1974 *Retitriletes semimuris* (Danzé-Corsin & Laveine) comb. nov., Mc Kellar, p. 14, pl. 5, fig. 6.
1975 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Morbey, text-fig. 25.
1976 *Retitriletes globosus* Pierce (ex Schulz); Rogalska, pl. 20, figs 284–288.
1977 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Lund, p. 59, pl. 3, fig. 11a–b.
1977 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Bjærke & Manum, p. 31, pl. 3, figs 1–3.
1977 *Retitriletes semimuris* (Danzé-Corsin & Laveine) Mc Kellar; van Erve, pp. 56–57, pl. 4, figs 6–8.
1979 *Retitriletes semimuris* (Danzé-Corsin & Laveine) Mc Kellar; Schuurman, p. 57, pl. 3, fig. 5–7.
1980 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Pedersen & Lund, p. 18, pl. 7, fig. 1.
1981 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Guy-Ohlson, p. 235.
1983 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Orłowska-Zwolińska, p. 14–15, pl. 12, figs 4–5.
1984 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Achilles et al., p. 51, pl. 5, fig. 11.

1985 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Hoelstad, p. 126, pl. 3, fig. 4.
1985 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Lund & Pedersen, p. 378, pl. 3, fig. 2.
1986 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Guy-Ohlson, p. 20.
1989 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Weiss, pp. 66–67.
1990 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Rauscher & Schmitt, pp. 111, 132, 134, pl. 2, fig. 12.
1991 *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine; Dybkjær, p. 22, pl. 5, figs 9–10.

Description. Spore rounded triangular in equatorial outline. Tetrad mark invisible. Exine on the distal side with incomplete irregular reticulum. Muri 1.0–1.5 µm wide and about 1 µm high. Lumina 2–5 µm in diameter.

Dimensions. Equatorial diameter about 34 µm.

Material. 1 spore.

Slide. KRAM-P O8/45/95 [107.1/3.8].

Affinity. Lycopodiaceous according to Danzé-Corsin and Laveine (1963) and Levet-Carette (1964b).

Stratigraphical distribution. Rhaetian to Upper Jurassic.

Geographical distribution. Austria, Denmark, Germany, Great Britain, France, Greenland, Iran, the Netherlands, Poland, Spitsbergen (Hopen), Sweden. Reported also from America, Canada, Italy, New Guinea (Weiss 1989).

Lycopodiumsporites sp.

Pl. 3, fig. 3

Description. Spore circular. Tetrad mark not clearly visible. Exine reticulate. Lumina always penta- or hexagonal 3–5 µm in diameter, muri thin, less than 1 µm wide and the same high. Exine thin, less than 1 µm.

Dimensions. Diameter about 30 µm.

Material. 1 spore.

Slide. KRAM-P O5/6/95 [98.5/3.5].

Affinity. Unknown, probably Lycopodiales.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. The surface of the exine is very similar to surfaces of dispersed spores from the genus *Lycopodiumsporites*.

Genus ***Contignisporites*** Dettmann 1963

Type. *Contignisporites glebulentus* Dettmann 1963, p. 74, pl. 15, figs 1, 2

Contignisporites problematicus (Couper 1958) Döring 1965

Pl. 3, fig. 4

1958 *Cingulatisporites problematicus* sp. nov., Couper, p. 146, pl. 24, figs 11–13.
1958 *Corrugatisporites scanicus* sp. nov., Nilsson, pp. 43–44, pl. 2, figs 15–17.
1964b *Cingulatisporites problematicus* Couper; Levet-Carette, pp. 113, 115.
1965 *Cingulatisporites problematicus* Couper; Chang, p. 168, pl. 1, fig. 12a–c.
1965 *Contignisporites problematicus* (Couper) comb. nov., Döring, p. 51, pl. 18, figs 6–8.
1965 *Duplexisporites problematicus* (Couper) comb. nov., Playford & Dettmann, p. 140.
1967 *Contignisporites problematicus* (Couper) Döring; Schulz, pp. 569–570, pl. 6, figs 1–2.
1968 *Contignisporites problematicus* (Couper) Döring; Tralau, pp. 27–28, pl. 5, figs 1–3.
1970a *Corrugatisporites amplectiformis* (Kara-Murza) comb. nov., Pocock, pp. 59–60, pl. 11, figs 1–4, 7–10.
1971 *Contignisporites problematicus* (Couper) Döring; Guy, p. 31, pl. 2, figs 17, 18.
1974 *Contignisporites problematicus* (Couper) Döring; Herngreen & De Boer, p. 354, pl. 4, figs 1–3.
1974 *Duplexisporites problematicus* (Couper) Playford & Dettmann; McKellar, p. 32, pl. 9, figs 1–3.
1975 *Duplexisporites* cf. *problematicus* (Couper) Playford & Dettmann; Arjang, p. 126, pl. 5, fig. 18.
1975 *Duplexisporites problematicus* (Couper) Playford & Dettmann; Filatoff, p. 64, pl. 13, figs 1–8.
1977 *Duplexisporites problematicus* (Couper) Playford & Dettmann; Ashraf, p. 47, pl. 8, figs 16–22.
1977 *Duplexisporites problematicus* (Couper) Playford & Dettmann; Bjærke & Manum, p. 35, pl. 5, fig. 2.
1977 *Contignisporites problematicus* (Couper) Döring; Lund, p. 61, pl. 4, fig. 2a–b.
1978 *Contignisporites problematicus* (Couper) Döring; Guy-Ohlson, p. 25, pl. 3, figs 22–23.
1980 *Contignisporites problematicus* (Couper) Döring; Pedersen & Lund, p. 18, pl. 7, fig. 2.
1981 *Duplexisporites problematicus* (Couper) Playford & Dettmann; Achilles, p. 33, pl. 7, figs 10–11.
1986 *Contignisporites problematicus* (Couper) Döring; Guy-Ohlson, p. 21, pl. 2, figs 15–16, pl. 13, fig. 4.

1989 *Duplexisporites problematicus* (Couper) Playford & Dettmann; Weiss, pp. 71–72, pl. 5, figs 8–9.

1990 *Contignisporites problematicus* (Couper) Döring; Rauscher & Schmitt, pp. 113, 134, 136, pl. 2, figs 16–17.

Description. Spore in oblique position, partly broken, almost triangular with one convex and two straight sides. Two commisures of tetrad mark are slightly visible. Exine covered with ridges 4–6 μm wide. Visible fragment of cingulum 4–5 μm wide.

Dimensions. Diameter of spore in oblique position about 46 μm.

Material. 1 spore.

Slide. KRAM-P O8/2 [97.5/7].

Affinity. Schizaeaceous or dicksoniaceous origin was suggested by Nilsson (1958). Filatoff (1975) placed *Duplexisporites problematicus* in Schizaeaceae-type spores.

Stratigraphical distribution. Triassic to Lower Cretaceous.

Geographical distribution. Afghanistan, Austria, Australia, Canada, China, Denmark, France, Germany, Greenland, Great Britain, Iran, the Netherlands, Norway, Poland, Sweden. Reported also from Israel, Luxembourg (Weiss 1989).

Remarks. Filatoff (1975) discuss in detail the sculpture of this species. According to him the correct name is *Duplexisporites problematicus* (Couper 1958) Playford & Dettmann 1965, because in *Duplexisporites* the outer murus parallels the spore amb.

Subturma Zonotriletes Waltz

Infraturma Auriculati Schopf emend. Dettman 1963

Genus ***Matonisporites*** Couper 1958

Type. *Matonisporites phlebopteroides* Couper 1958, p. 140, pl. 20, fig. 15

Matonisporites **sp. 1**

Pl. 3, figs 5, 6

1958 *Matonisporites equiexinus* sp. nov., Couper, p. 140, pl. 20, figs 13–14.

1963 *Dictyophyllidites equiexinus* (Couper) comb. nov., Dettmann, p. 27.

1965 *Leiotriletes equiexinus* (Couper) comb. nov., Döring, p. 20, pl. 5, figs 4–6.

1970a *Harrisispora equiexina* (Couper) comb. nov., Pocock, pp. 38–39, pl. 6, figs 10, 16–17, 21.

1975 *Dictyophyllidites equiexinus* (Couper) Dettmann; Filatoff, p. 61, pl. 11, figs 8–11.

1977 *Harrisispora equiexina* (Couper) Pocock; Ashraf, p. 27, pl. 2, fig. 10.

1979 *Phlebopterisporites equiexinus* (Couper 1958) comb. nov., Juhász, p. 43, pl. 2, figs 4, 6, 9.

Description. Spores triangular with usually one concave and two convex sides and rounded apices. Triradiate tetrad mark extending almost to the equator. Commisure sinuous with exine folds 1–3 μm wide, extending to the equator of spore. Exine smooth 1–2.5 μm thick.

Dimensions. Equatorial diameter about 41–48 μm (2 specimens measured).

Material. 3 spores.

Slides. KRAM-P O5/2 [97.5/7.5], O8/1 [93/4], O8/2 [102.5/12.5].

Affinity. According to Couper (1958) dispersed spores of *Matonisporites equiexinus* are similar to spores of Mesozoic ferns of the family Matoniaceae, especially spores of *Phlebopteris angustiloba* (Presl.) Hirmer & Hoerhammer, *Selenocarpus munsterianus* (Presl.) Schenk, and *Matonidium goepperti* (Ettinghausen) Schenk. Van Konijnenburg-van Cittert (1993) described similar non-valvate spores from extant and fossil Matoniaceae.

Stratigraphical distribution. Lower Jurassic to Lower Cretaceous.

Geographical distribution. Afghanistan, Australia, Canada, Great Britain, Hungary, Poland.

Remarks. Juhász (1979) created new genus *Phlebopterisporites* for smooth, trilete, spores with thickenings or folds near tetrad mark and uniformly thick exine. Juhász (1979) included spores of *Matonisporites equiexinus* Couper into *Phlebopterisporites* but this genus is a younger synonym of *Matonisporites* Couper 1958.

Matonisporites **sp. 2**

Pl. 3, fig. 7

Description. Spores triangular with rounded apices and straight or slightly concave sides in equatorial outline. Triradiate tetrad mark extending to the equator. Laesurae straight with exinal folds, surrounding ends of laesurae near the equator. Width of folds 2.5–3.5 μm. Exine smooth about 2 μm thick.

Dimensions. Equatorial diameter about 30–42 μm.

Material. 3 spores.

Slides. KRAM-P O6/1/6 [111.9/11.1], O8/1 [105/8], O8/46/95 [107/6.5].

Affinity. Unknown but probably fern spores of the Matoniaceae similar to in situ spores described by van Konijnenburg-van Cittert (1993) and van Konijnenburg-van Cittert & Kurmann (1994), or fern spores of Dipteridaceae.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. *Matonisporites* sp. 2 has folds surrounding the laesurae near the equator and the folds are in general wider in comparison with *Matonisporites equiexinus* Couper 1958.

Infraturma Cingulati Potonié & Klaus emend Dettmann 1963

Genus ***Lycospora*** Schopf, Wilson & Bentall 1944

Type. *Lycospora micropapillata* (Wilson & Coe) Schopf, Wilson & Bentall 1944

Cirratriradites micropapillatus Wilson & Coe 1940, p. 184, fig. 6

cf. ***Lycospora salebrosacea*** (Maljavkina1949) Schulz 1967

Pl. 3, fig. 8

1949 *Volucellina salebrosacea* sp. nov., Malyavkina, p. 65, pl. 13, fig. 14.
1958 *Cingulatisporites scabratus* sp. nov., Couper, p. 147, pl. 25, figs 3–4.
1958 *Aequitriradiates salebrosaceus* (Maljavkina) comb. nov., Nilsson, p. 47, figs 8–9.
1967 *Lycospora salebrosacea* (Maljavkina) comb. nov., Schulz, pp. 584–585, pl. 13, figs 8–10.
1974 *Lycospora salebrosacea* (Maljavkina) Schulz; Herngreen & De Boer, p. 358.
1981 *Lycospora salebrosacea* (Maljavkina) Schulz; Achilles, p. 40, pl. 10, fig. 1.
1989 *Lycospora salebrosacea* (Maljavkina) Schulz; Weiss, p. 87.
1991 *Lycospora salebrosacea* (Maljavkina) Schulz; Dybkjær, p. 24, pl. 8, figs 5–7.

Description. Spores convex triangular in equatorial outline consisting of central part, 19.2–24 μm in diameter with about 1 μm thick exine, ring-shaped thin area, 1.6–2.4 μm wide, around the central part, and cingulum about 1.6–5.0 μm wide. Sculpture of cingulum granular. Triradiate tetrad mark extending almost to equator. Exine strongly granular near the poles of the spore.

Dimensions. Equatorial diameter about 30–38 μm (1 specimen measured).

Material. 2 spores.

Slides. KRAM-P O8/1 [95/5], O8/18 [105/17.5].

Affinity. Unknown but probably Lycopsida. *Lepidostrobus* in Palaeozoic and in Mesozoic? (Schulz 1967). According to Balme (1995) different species of dispersed *Lycospora* were belonging to the Carboniferous genera *Lepidodendron* and *Lepidostrobus*.

Stratigraphical distribution. Upper Triassic – Middle Jurassic.

Geographical distribution. Germany, Great Britain, Denmark, Poland, Sweden. Reported also from France (Weiss 1989).

Remarks. *Lycospora salebrosacea* are probably Carboniferous reworked spores (Dybkjær 1991).

Genus ***Neochomotriletes*** Reinhardt 1961

Type. *Neochomotriletes triangularis* (Bolch.) Reinhardt 1961, p. 707

Chomotriletes triangularis Bolchovitina 1956, p. 61, pl. 7, fig. 98a–b

Neochomotriletes triangularis (Bolchovitina 1956) Reinhardt 1961

Pl. 3, fig. 9

1956 *Chomotriletes triangularis* sp. nov., Bolkhovitina, p. 61, pl. 7, fig. 98a–c.
1961 *Neochomotriletes triangularis* (Bolch.) comb. nov., Reinhardt, p. 708, pl. 1, figs 1, 5.

1965 *Polycingulatisporites triangularis* (Bolch.) comb. nov., Playford & Dettmann, p. 144.
1967 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Schulz, p. 587, pl. 14, fig. 3, pl. 23, fig. 4.
1968 *Polycingulatisporites triangularis* (Bolch.) Playford & Dettmann; Tralau, p. 60, pl. 11, fig. 2f.
1971 *Polycingulatisporites triangularis* (Bolch.) Playford & Dettmann; Guy, p. 54, pl. 4, fig. 9.
1975 *Polycingulatisporites triangularis*; Vigran & Thusu, p. 11, pl. 10, figs 5, 8.
1977 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Ashraf, p. 44, pl. 7, figs 19–20.
1977 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Lund, p. 61, pl. 4, figs 10–11.
1980 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Pedersen & Lund, p. 44, pl. 8, fig. 2a–b.
1983 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Orłowska-Zwolińska, p. 20, pl. 18, fig. 1a–b.
1986 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Guy-Ohlson, p. 24, pl. 4, fig. 2, pl. 13, fig. 5.
1989 *Polycingulatisporites triangularis* (Bolch.) Playford & Dettmann; Weiss, pp. 69–70, Pl. 5, fig. 5.

Description. Spore convex triangular in equatorial outline. Exine around the equator smooth. Two 3–4 μm wide ring-shaped thickenings of the exine parallel to the equator and a thick, almost circular area at the pole are visible on the distal side. Triradiate tetrad mark with lips extending to the equatorial exine thickening. Several verrucae are visible near the centre of the spore.

Dimensions. Equatorial diameter 44.2 μm.

Material. 1 spore.

Slide. KRAM-P O5/12/95 [96/19].

Affinity. Unknown. Tralau (1968) suggests that spores of recent species *Lophosoria* (Lophosoriaceae), illustrated by Erdtman (1957, fig. 133), are similar to dispersed *Polycingulatisporites (Neochomotriletes) triangularis* spores.

Stratigraphical distribution. Upper Triassic to Middle Jurassic.

Geographical distribution. Afghanistan, Australia, Denmark, Greenland, Germany, Norway, Poland, Russia, Sweden. Reported also from France, Great Britain, Luxembourg (Weiss 1989).

Remarks. Playford and Dettmann (1965), Tralau (1968), Weiss (1989) consider *Neochomotriletes* a junior synonym of *Polycingulatisporites*. According to Jansonius and Hills (1976, no. 1756) the type species of *Polycingulatisporites* differs from *Neochomotriletes*. *Polycingulatisporites* has simple trilete slits without lips.

Genus ***Cingutriletes*** Pierce 1961 emend. Dettmann 1963

Type. *Cingutriletes congruens* Pierce 1961, p. 25, pl. 1, fig. 1

Cingutriletes sp.

Pl. 3, fig. 11

Description. Spore circular in equatorial outline. Triradiate tetrad mark distinct, extending to about 3/4 of the spore radius. Cingulum about 3–5 μm wide. Exine smooth.

Dimensions. Equatorial diameter about 37.4 μm.

Material. 1 spore.

Slide. KRAM-P O8/46 [107.1/2.5].

Affinity. Unknown.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. This specimen resembles: 1970 *Stereisporites (Cingutriletes) infrapunctatus* sp. nov., Schulz, pp. 688–689, pl. 130, figs 22–23, pl. 131, fig. 1; 1975 *Cingutriletes infrapunctatus* Schulz; Morbey, pl. 9, fig. 4; 1989 *Cingutriletes infrapunctatus* (Schulz) Morbey; Weiss, p. 80, pl. 6, fig. 3; 1991 *Cingutriletes infrapunctatus* (Schulz) Morbey; Dybkjær, p. 24, pl. 9, fig. 3. However, it differs from *Cingutriletes infrapunctatus* by having smooth instead of punctate exine.

Genus ***Foveotriletes*** Potonié 1956

Type. *Foveotriletes scorbiculatus* (Ross ex Weyland & Krieger) Potonié 1956, p. 43 (designation of lectotype).

Trilites scorbiculatus Ross 1949, p. 32, pl. 1, fig. 5 (informal name).

Microreticulatisporites scorbiculatus Ross 1949 ex Weyland & Krieger 1953, p. 11, pl. 4, fig. 23.

Foveotriletes sp.

Pl. 3, fig. 13

Description. Spore partly broken, almost triangular with convex sides and rounded apices in equatorial outline. Outline irregular because of foveolate sculpture. Triradiate tetrad mark extending almost to the equator. Laesurae with lips, about 1 μm wide. Exine 2.5–4 μm thick, foveolate, foveolae 1.5–2.0 μm wide across and about 1–2 μm apart.

Dimensions. Equatorial diameter about 32 μm.

Material. 1 spore.

Slide. KRAM-P O5/10/95 [109/11.1].

Affinity. Unknown. Dettmann (1963) wrote that spores of *Lycopodium manii* (Hillebr.) Skottsb. and *L. laterale* are comparable to *Sestrosporites* (al. *Foveotriletes*) spores.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. This specimen resembles: 1958 *Foveotriletes irregulatus* sp. nov., Couper, p. 143, pl. 22, figs 9–10; 1963 *Sestrosporites* (al. *Foveotriletes*) *irregulatus* (Couper) comb. nov., Dettmann, p. 66, pl. 27, figs 1–3; 1974 *Foveotriletes irregulatus* Couper; Herngreen & De Boer, pl. 4, figs 5–6; 1975 *Foveotriletes* sp. cf. *F. irregulatus* Couper; Filatoff, p. 46, pl. 4, fig. 1a–b.

Detailed comparison is difficult because of bad preservation of the specimen from Odrowąż. The specimen is smaller than in Couper's (1958) diagnosis for *F. irregularis* but the surface features that could be observed resemble those from this species.

Turma Monoletes Ibrahim

Suprasubturma Acavatomonoletes Dettmann 1963

Subturma Azonomonoletes Luber Infraturma Psilamonoleti van der Hammen

Genus *Latosporites* Potonié & Kremp 1954

Type. *Latosporites latus* (Kosanke) Potonié & Kremp 1954, p. 165

Levigatosporites latus Kosanke 1950, p. 29, pl. 5, fig. 11

cf. *Latosporites* sp.

Pl. 3, fig. 12

Description. Spore almost circular in equatorial outline with one elongated aperture. Exine smooth, with pits about 1 μm in diameter visible on the surface of the exine. Exine about 1 μm thick, dark brown in colour, with folds along aperture.

Dimensions. Width 48μm, length 49.6 μm.

Material. 1 spore.

Slide. KRAM-P O8/2 [106.5/7.5].

Affinity. Unknown.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. The specimen from Odrowąż resembles: 1958 *Monolites* sp. (ssp.?); Couper, p. 149, pl. 25, fig. 18, but differs from it mainly by the aperture which is wider (3.5 μm) than in the specimen described and illustrated by Couper (1958), by its folded exine and pits on the surface of the exine. These pits are as a result of exine degradation, but folded exine is characterisic for spores of the genus *Latosporites* Potonié & Kremp 1954 (Jansonius & Hills 1976, No. 1462) while the exine of *Monolites* Coookson ex Potonié 1956 (Jansonius & Hills 1976, No. 1701) is described as rigid.

Genus *Marattisporites* Couper 1958

Type. *Marattisporites scabratus* Couper 1958, p. 133, pl. 15, fig. 20

Marattisporites sp. 1

Pl. 3, fig. 15

Description. Spores monolete, oval in equatorial diameter. Laesura narrow, extending the length of the spore. Exine granular.

Dimensions. Length 37.6 μm, width 25.6 μm (1 specimen measured).

Material. 2 spores.

Slides. KRAM-P O5/1/95 [96/5], O8/47/95 [91/13.5].

A f f i n i t y. Unknown, probably ferns from Marattiaceae. Couper (1958, p. 134, pl. 15, figs 20–23) compared *Marattisporites scabratus* (which is the type species for the genus *Marattisporites*) to spores of living and fossil ferns from the genus *Marattia*. Also van Konijnenburg-van Cittert (1975) described in situ spores from Jurassic fern *Marattia anglica* which are similar to *Marattisporites scabratus* Couper 1958 dispersed spores.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Liassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

R e m a r k s. *Marattisporites scabratus* Couper 1958 is smaller and has more delicate sculpture in comparison to *Marattisporites* sp. spores from Odrowąż.

Marattisporites sp. 2

Pl. 3, fig. 14

D e s c r i p t i o n. Spore monolete, oval in equatorial outline. Monolete mark visible as ridge, about 2 µm wide extending the whole length of spore, closed. Exine two-layered. Outer layer granulate, partly broken and folded, inner smooth, not clearly visible.

D i m e n s i o n s. Length about 35 µm, width about 27 µm.

M a t e r i a l. 1 spore.

S l i d e. KRAM-P O8/60 [95.5/17].

A f f i n i t y. Unknown, probably fern spore of Marattiaceae.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Liassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

Subturma Zonomonoletes Luber

Genus ***Aratrisporites*** Leschik 1955

T y p e. *Aratrisporites parvispinosus* Leschik 1955, p. 38, pl. 5, fig. 4

Aratrisporites minimus Schulz 1967

Pl. 4, figs 1–12

1966 *Lycostrobus scotti* Nath.; Orłowska-Zwolińska, pl. 11, figs 53–54.
1967 *Aratrisporites minimus* sp. nov., Schulz, p. 592, pl. 16, figs 7–9.
1976 *Aratrisporites minimus* Schulz; Rogalska, pp. 25, 58, pl. 11, figs 172–174.
1977 *Aratrisporites minimus* Schulz; Lund, p. 66, pl. 6, figs 4–5, pl. 12, fig. 4a–b.
1980 *Aratrisporites* cf. *minimus* Schulz; Pedersen & Lund, p. 44, pl. 12, fig. 5.
1981 *Aratrisporites* cf. *minimus* Schulz; Achilles, pp. 41, 59, pl. 11, figs 2–5b.
1981 *Aratrisporites minimus* Schulz; Guy-Ohlson, p. 235, Fig. 4M.
1990 *Aratrisporites minimus* Schulz; Rauscher & Schmitt, pp. 113, 132, pl. 1, fig. 27.
1991 *Aratrisporites minimus* Schulz; Dybkjær, p. 26, pl. 11, fig. 1.

D e s c r i p t i o n. Spores oval with pointed ends in equatorial outline. In lateral, slightly oblique, position boatshaped. Monolete mark extending whole length of the spore, closed, visible as thin ridge or slightly open, always sinuous. Exine two-layered with smooth endexine and puncate to granulate ectexine. The two layers of the exine not always clearly visible.

D i m e n s i o n s. Length 23.2–47.6 µm (46 specimens measured), width 17.6–30.4µm (7 specimens measured).

M a t e r i a l. 87 spores.

S l i d e s. Spores with a fine structure of the exine: KRAM-P O5/2/95 [95.5/3.5, 97/3], O5/3/95 [101/2.5], O5/6/95 [93/1, 93.5/2.5, 97/1.5, 98/1, 99.5/5, 105.5/5.9], O5/10/95, [99/14.1, 100/11.5, 100/17], O5/11/95 [97/6.5], O5/13/95 [102/13], O8/1 [93.5/3.5, 93.9/2.5, 93/12, 97.5/14, 102/7], O8/2 [98/18, 105.5/13, 109/20], O8/3 [104.5/5], O8/5 [106/8 (6 specimens)], O8/18 [95.5/7, 98/10 (3 specimens), 98.1/10, 98.5/3, 98/6, 106/5.5, 96/19, 101/14, 105/14], O8/45/95 [97/4.8], O8/46/95 [97.5/17.5, 98/15, 100/12, 107/8.5], O8/47/95 [90.5/11.2, 91.5/13, 92/14], O8/48/95 [95/9], O8/49/95 [105/4.5, 107/7, 107.5/7], O8/50/95 [108/11.5], O8/54/95 [99.5/2.5, 100/3, 105.1/4], O8/58/95 [95/3.5, 97/7.5, 101/14, 101/16, 109/19], O9/2/6 [108/5.5], OS_2/4 [106/11, 108/5.5], OS_2/15 [93/18.5, 97.5/11.5].

Spores with slightly coarser structure of the exine: KRAM-P O5/11/95 [104.5/14.9, 106.5/1.8, 106.5/5], O8/1 [95.5/19, 103/11], O8/2 [99/8, 104/12.5], O8/18 [95/14, 95.5/5.5, 95.5/12.5, 98.1/8, 99.5/16, 103.5/6.5, 107/5, 108/45, 110/12], O8/60/95 [108.5/16, 108.5/17.5], O8/60/95 [101.5/4, 108.5/16], OS_2/4 [106.5/9].

A f f i n i t y. According to Schulz (1967) the dispersed spores of *Aratrisporites minimus* Schulz 1967 are very similar to microspores from *Lycostrobus scotti* (Lycopodiales, Isoëtinae) described and illustrated by Nathorst (1908) from Liassic of Sweden. Also Jung (1958) described similar microspores associated with megaspores *Nathorstisporites hopliticus* from the Liassic of Germany. Schulz (1967) mentioned that Jurassic *A. minimus* spores are similar also to spores of recent *Isoëtes lacustris* L. These dispersed spores resembles also microspores found into reproductive organs known under the name *Annalepis zeilleri* Flische emend. Grauvogel-Stamm & Duringer (Lycophyta) from the Triassic of France (Grauvogel-Stamm & Duringer 1983). Balme (1995) wrote that dispersed spores of *Aratrisporites* were belonging to Lycopsida (Pleuromeiaceae) and especially *Annalepis*.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Denmark, France, Germany, Greenland, Poland, Sweden.

Remarks. Nilsson (1958) compared dispersed *Chasmatosporites* spores with microspores of *Lycostrobus scotti* (Nathorst 1908) but according to Playford and Dettmann (1965) "it seems probable that Nilsson's types are distally tenuate rather than monolete and hance are unrelated to the *L. scotti* microspores".

The two exine layers are not always clearly visible in the specimens from Odrowąż and the degree of sculpture of the outer layer is variable. It seems possible that there are mature and immature spores. However, the shape of the spores is always clear and enables assignment to this species.

Achilles (1981, p. 41, pl. 11, fig. 5a–b) observed very small spinae on the surface of *Aratrisporites minimus* spores under SEM. Similar spinae have been observed on the surface of specimen from Odrowąż (Pl. 4, fig. 12).

Anteturma Pollenites Potonié 1931

Turma Saccites Erdtman 1947

Subturma Disaccites abstriates Cookson

Genus ***Alisporites*** Daugherty 1941 emend. Nilsson 1958

Type. *Alisporites opii* Daugherty 1941, p. 98, pl. 34, fig. 2

Alisporites* cf. *diaphanus (Pautsch 1958) Lund 1977

Pl. 4, fig. 13

1958 *Caytoniales-Pollenites diaphanus* sp. nov., Pautsch, p. 323, pl. 1, figs 4, 11.
1971 *Diaphanisporites diaphanus* Pautsch; Pautsch, p. 38, pl. 12, fig. 3.
1977 *Alisporites diaphanus* Pautsch, comb. nov., Lund, p. 75, pl. 8, fig. 12.
1980 *Alisporites diaphanus* (Pautsch) Lund; Pedersen & Lund, p. 45, pl. 13, fig. 1a–b.
1981 *Alisporites diaphanus* (Pautsch) Lund; Guy-Ohlson, p. 235, Fig. 7F–G.

Description. Bisaccate pollen grain. Sacci almost symmetrical. Length of sacci less than length of corpus. Sacci reticulate, reticulum indistinct with very small lumina. Exine of corpus scabrate, very thin, less than 1 µm.

Dimensions. Overall width about 63.2 µm, length of corpus 56 µm, width of saccus 25.6 µm, length of saccus about 52 µm.

Material. 1 pollen grain.

Slide. KRAM-P O5/13 [102/7].

Affinity. Unknown, probably Pteridospermae (Nilsson 1958, Tralau 1968).

Stratigraphical distribution. Upper Triassic – Lower Liassic.

Geographical distribution. Denmark, Germany, Greenland, Poland, Sweden.

Remarks. This specimen has a very thin exine and the reticulum on the sacci is indistinct, but it resembles *Alisporites diaphanus* in size and shape.

cf. ***Alisporites microsaccus*** (Couper 1958) Pocock 1962

Pl. 4, fig. 14

1958 *Pteruchipollenites microsaccus* sp. nov., Couper, p. 151, pl. 26, figs 13–14.
1962 *Alisporites* cf. *A. microsaccus* (Couper) comb. nov., Pocock, p. 61, pl. 9, figs 138–139.
1985 *Alisporites microsaccus* (Couper) Pocock; Lund & Pedersen, p. 380, pl. 4, fig. 8.
1990 *Alisporites microsaccus* (Couper) Pocock; Rauscher & Schmitt, p. 117, 135, 138, pl. 4, fig. 12.
1991 *Alisporites microsaccus* (Couper) Pocock; Dybkjær, p. 26.

Description. Pollen grain bisaccate, partly broken. Saccus longer than wide with reticulate thickenings, lumina about 1 µm in diameter, muri 1 µm wide or wider. Corpus granulate.

D i m e n s i o n s. Overall width about 43 µm, length of corpus about 49 µm, length of saccus about 40 µm, width of saccus about 20 µm.

M a t e r i a l. 1 pollen grain.

S l i d e. KRAM-P O9/2/6 [94.5/18].

A f f i n i t y. Couper (1958) wrote that *Pteruchipollenites microsaccus* affinity probably lies with the Mesozoic Pteridospermae.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Jurassic to Upper Jurassic (in Europe), Upper Jurassic to Lower Cretaceaus (in Canada).

G e o g r a p h i c a l d i s t r i b u t i o n. Canada, Denmark, France, Great Britain, Greenland, Poland.

R e m a r k s. Pocock (1962) wrote that Canadian specimens are comparable with *Alisporites (Pteruchipollenites) microsaccus* rather than identical with this species.

Alisporites robustus Nilsson 1958

Pl. 4, fig. 15, Pl. 5, figs 1–3

1958 *Alisporites robustus* sp. nov., Nilsson, pp. 82–83, pl. 8, figs 2–3.
1965 *Alisporites robustus* Nilsson; Wall, p. 166.
1968 *Alisporites robustus* Nilsson; Tralau, pp. 70–71, pl. 21, fig. 1.
1971 *Alisporites robustus* Nilsson; Guy, p. 62, pl. 5, fig. 3.
1977 *Alisporites robustus* Nilsson; Lund, p. 75, pl. 9, figs 1–2.
1978 *Alisporites robustus* Nilsson; Guy-Ohlson, p. 16, 20, 23, 25, pl. 1, figs 1–2.
1980 *Alisporites robustus* Nilsson; Pedersen & Lund, p. 44, pl. 12, fig. 4.
1981 *Alisporites robustus* Nilsson; Achilles, pp. 44–45, pl. 12, fig. 2.
1981 *Alisporites robustus* Nilsson; Guy-Ohlson, p. 235, fig. 6A.
1985 *Alisporites robustus* Nilsson; Guy-Ohlson & Malmquist, p. 19, Fig. 2.
1985 *Alisporites robustus* Nilsson; Hoelstad, p. 128, pl. 4, fig. 3.
1986 *Alisporites robustus* Nilsson; Guy-Ohlson, p. 27, pl. 4, fig. 9.
1986 cf. *Alisporites robustus* Nilsson; Ichas, p. 16, pl. 2, figs 4, 7.
1989 *Alisporites robustus* Nilsson; Weiss, pp. 104–105.
1990 *Alisporites robustus* Nilsson; Rauscher & Schmitt, p. 117, 132, 135, 142, pl. 4, fig. 7.
1991 *Alisporites robustus* Nilsson; Dybkjær, p. 26, pl. 11, fig. 8.

D e s c r i p t i o n. Bisaccate pollen grains, bilaterally symmetrical. Length of corpus almost equal to length of saccus. Corpus longer than broad, elliptical. Sacci with indistinct internal reticulum. Exine of corpus finely granulate.

D i m e n s i o n s. Overall width about 76–85 µm, width of corpus 30.8–40 µm, width of saccus 20–23.8 µm, length of corpus about 51–52 µm, length of saccus about 51–53 µm (2 specimens measured).

M a t e r i a l. 5 pollen grains.

S l i d e s. KRAM-P O5/11/95 [103.5/5.5], O5/13/95 [113/5.5], O5/14/95 [105.9/11], O8/3 [97/11.5], O8/58 [103.5/3.5].

A f f i n i t y. Mesozoic pteridosperms (Nilsson 1958, Tralau 1968). According to Balme (1995) dispersed pollen grains belonging to *Alisporites* sensu lato are similar to Ginkgopsida (Peltaspermales), Coniferopsida (Podocarpaceae, Ullmaniaceae, Voltziales s.l.) pollen grains. Mesozoic pollen grains similar to *Alisporites* have been found mainly in the pollen organs of seed ferns. Townrow (1962) described in situ bisaccate pollen grains from pollen organs of *Pteruchus* (seed ferns, Corystospermales), that are similar to *Alisporites* dispersed spores. Osborn and Taylor (1993) described and illustrated the morphology and ultrastructure of in situ pollen grains from *Pteruchus*-like pollen organs from the Triassic of Antarctica in detail. These pollen grains are also similar to dispersed pollen grains of the genus *Alisporites*.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Upper Triassic – Middle Jurassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Denmark, France, Germany, Greenland, Poland, Sweden. Reported also from Austria, New Guinea, Scotland (Weiss 1989).

R e m a r k s. The specimens from Odrowąż are not well-preserved and always are visible in oblique position.

Alisporites cf. ***robustus*** Nilsson 1958

Pl. 5, fig. 4

D e s c r i p t i o n. Bisaccate pollen grain. Corpus oval, longer than broad, partly broken.

Exine of corpus scabrate. Sacci with internal reticulum. Lumina polygonal to oval, less than 1 μm wide

D i m e n s i o n s. Overall width 76 μm, width of corpus about 34 μm, width of saccus about 22 μm, length of corpus 52 μm, length of saccus about 50 μm.

M a t e r i a l. 1 pollen grain.

S l i d e. KRAM-P O8/3 [100/14].

A f f i n i t y. Unknown, probably Pteridospermae.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Liassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

R e m a r k s. *Alisporites* cf. *robustus* differs from the above described pollen grains of the genus *Alisporites* by relatively larger corpus and shape of lumina in the reticulum on the sacci.

Alisporites thomasii (Couper 1958) Nilsson 1958

Pl. 5, fig. 5

1958 *Pteruchipollenites thomasii* sp. nov., Couper, pp. 150–151, pl. 26, figs 10–12.

1958 *Alisporites thomasii* (Couper) comb. nov., Nilsson, pp. 83–84, pl. 8, fig. 1.

1962 *Alisporites thomasii* (Couper) comb. nov., Pocock, pp. 62–63, pl. 9, figs 142–144.

1965 *Pteruchipollenites thomasii* Couper; Norris, pp. 253–254, figs 3c, 39, 40, 42.

1965 *Alisporites thomasii* (Couper) Nilsson; Wall, p. 166.

1970 *Alisporites thomasii* (Couper) Pocock; Kemp, p. 120.

1971 *Alisporites thomasii* (Couper) Nilsson; van Konijnenburg-van Cittert, pp. 15–18, pl. 2, fig. 5.

1973 *Alisporites thomasii* (Couper) Nilsson; Orbell, pp. 13–14, pl. 1, fig. 9.

1975 *Alisporites thomasii* (Couper) Pocock; Arjang, p. 133, pl. 7, figs 1–2, pl. 8, fig. 6.

1975 *Alisporites thomasii* (Couper) Pocock; Vigran & Thusu, p. 9, pl. 14, fig. 9, pl. 15, figs 4, 6.

1977 *Alisporites thomasii* (Couper) Pocock; Ashraf, p. 60, pl. 15, figs 9–16.

1981 *Alisporites thomasii* (Couper) Pocock; Achilles, p. 45, pl. 12, figs 3–4.

1982 *Alisporites thomasii* (Couper) Nilsson; Guy-Ohlson, p. 15, pl. 2, fig. 12.

1984 *Alisporites thomasii* (Couper) Pocock, Achilles et al., p. 64, pl. 8, fig. 8.

1986 cf. *Alisporites thomasii* (Couper) Nilsson; Ichas, pp. 16–17, pl. 2, fig. 6.

1989 *Alisporites thomasii* (Couper) Pocock; Weiss, pp. 105–106.

1990 *Alisporites thomasii* (Couper) Pocock; Rauscher & Schmitt, p. 117, 135–136, 138, pl. 4, fig. 13.

D e s c r i p t i o n. Bisaccate pollen grains. Corpus of grain longer than broad, elliptical. Exine of corpus scabrate. Sacci with internal reticulum, muri about 1 μm wide, lumina polygonal, about 0.8 μm in diameter.

D i m e n s i o n s. Overall width 64 μm, width of corpus 36 μm, width of saccus about 20 μm, length of corpus 40 μm, length of saccus about 37 μm (1 specimen measured).

M a t e r i a l. 3 pollen grains.

S l i d e s. KRAM-P O5/13/95 [106/15.5], O8/1 [97/11], O8/2 [101/14].

A f f i n i t y. Couper (1958) wrote that dispersed *Pteruchipollenites thomasii* pollen grains are similar to those of the genus *Pteruchus* (Mesozoic Pteridospermae). Harris (1964) described in situ bisaccate pollen grains from the pteridosperm repoductive organ *Pteroma thomasii* from the Jurassic of Yorkshire. He noted that these in situ pollen grains resemble dispersed *Alisporites thomasi* pollen grains. Van Konijnenburg-van Cittert (1971) described in situ pollen grains from *Pteroma thomasii* in detail.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Upper Triassic – Lower Cretaceous.

Geographical distribution. Afghanistan, Antarctica, Canada, Germany, Great Britain, Iran, Norway, Poland, Sweden. Reported also from America, Mexico, Morocco (Weiss 1989).

Genus ***Vitreisporites*** Leschik 1955

T y p e. *Vitreisporites signatus* Leschik 1955, p. 53, pl. 8, fig. 10

Vitreisporites pallidus (Reissinger 1950) Nilsson 1958

Pl. 5, fig. 6

1938 *Pityosporites pallidus* Reissinger; Reissinger p. 14 (not illustrated).

1950 *Pityopollenites pallidus* (Reissinger) Reissinger, Reissinger pp. 109–110, pl. 15, figs 1–5.

1956 *Caytoniales*; Rogalska, pp. 22–23, pl. 10, figs 1–2.

1957 *Pityosporites palllidus* Reissinger; Balme, pp. 36–37, pl. 10, figs 112–113.

1958 *Caytonipollenites pallidus* (Reissinger) comb. nov., Couper, p. 150, pl. 26, figs 7–8.
1958 *Vitreisporites pallidus* (Reissinger) comb. nov., Nilsson, pp. 77–78, pl. 7, figs 12–14.
1962 *Vitreisporites pallidus* (Reissinger) Nilsson; Pocock, pp. 58–59, pl. 9, figs 134–135.
1965 *Vitreisporites pallidus* (Reissinger) Nilsson; Norris, pp. 251–252, figs 37–38.
1965 *Vitreisporites pallidus* (Reissinger) Nilsson; Playford & Dettmann, p. 156, pl. 17, fig. 58.
1965 *Vitreisporites pallidus* (Reissinger) Nilsson; Wall, p. 166.
1967 *Vitreisporites pallidus* (Reissinger) Nilsson; Norris, pp. 100–101, pl. 14, fig. 15.
1968 *Caytonipollenites pallidus* (Reissinger) Couper; Tralau, p. 75, pl. 20, figs 1, 3.
1970 *Vitreisporites pallidus* (Reissinger) Nilsson; Kemp, p. 121, pl. 26, figs 11–14.
1970b *Vitreisporites pallidus* (Reissinger) Nilsson; Pocock, p. 87, pl. 18, figs 15–22, 24.
1971 *Caytonipollenites pallidus* (Reissinger) Couper; Guy, p. 64, pl. 5, fig. 16.
1971 *Caytonipollenites pallidus* (Reissinger) Couper; Pautsch, p. 36, pl. 6, figs 4–5.
1971 *Vitreisporites pallidus* (Reissinger) Nilsson; van Konijnenburg-van Cittert, pp. 15, 69, pl. 1, fig. 6.
1974 *Vitreisporites pallidus* (Reissinger) Nilsson; Herngreen & De Boer, pp. 348, 359.
1974 *Vitreisporites pallidus* (Reissinger) Nilsson; McKellar, p. 39.
1975 *Vitreisporites pallidus* (Reissinger) Nilsson; Arjang, p.131, pl. 6, figs 15–16.
1975 *Vitreisporites pallidus* (Reissinger) Nilsson; Filatoff, p. 76, pl. 22, figs 1–3.
1975 *Vitreisporites pallidus* (Reissinger) Potonié; Vigran & Thusu, p. 11, pl. 12, figs 11–12.
1977 *Vitreisporites pallidus* (Reissinger) Nilsson; Lund, pp. 74–75, pl. 8, fig. 9.
1977 *Vitreisporites pallidus* (Reissinger) Nilsson; Schuurman, p. 208, pl. 17, fig. 4.
1977 *Vitreisporites pallidus* (Reissinger) Nilsson; van Erve, pp. 69–70, pl. 16, figs 4–5.
1980 *Vitreisporites pallidus* (Reissinger) Nilsson; Pedersen &Lund, p. 45, pl. 13, fig. 4.
1981 *Vitreisporites pallidus* (Reissinger) Nilsson; Achilles, p. 46, pl. 13, figs 2–4.
1981 *Caytonipollenites pallidus* (Reissinger) Couper; Guy-Ohlson, p. 235, Fig. 6E.
1981 *Vitreisporites pallidus* (Couper) comb. nov., Shang, p. 435, pl. 2, figs 2–3.
1983 *Caytonipollenites pallidus* (Reissinger) Couper; Orłowska-Zwolińska, p. 29, pl. 30, fig. 9.
1984 *Vitreisporites pallidus* (Reissinger) Nilsson; Achilles et al., p. 66, pl. 9, figs 6–7.
1985 *Vitreisporites pallidus* (Reissinger) Nilsson; Guy-Ohlson & Malmquist, p. 21, Fig. 2, pl. 2, fig. 1.
1985 *Vitreisporites pallidus* (Reissinger) Nilsson; Hoelstad, p. 128, pl. 3, fig. 15.
1985 *Vitreisporites pallidus* (Reissinger) Nilsson; Lund & Pedersen, p. 380, pl. 4, fig. 4.
1986 *Vitreisporites pallidus* (Reissinger) Nilsson; Guy-Ohlson, p. 29, pl. 5, figs 6–7, pl. 14, fig. 3.
1986 *Vitreisporites pallidus* (Reissinger) Couper; Ichas, p. 17, pl. 2, fig. 3.
1989 *Vitreisporites pallidus* (Reissinger) Nilsson; Weiss, p. 116.
1990 *Vitreisporites pallidus* (Leschik) Jansonius; Rauscher & Schmitt, pp. 117, 132, pl. 4, fig. 5.
1991 *Vitreisporites pallidus* (Reissinger) Nilsson; Dybkjær, p. 26, pl. 11, fig. 3.

Description. Bisaccate pollen grains. Corpus oval. Length of corpus almost equalling length of saccus. Exine very thin. Structure of sacci and sculpture of corpus exine indistinct.

Dimensions. Overall width 24–26.4 µm, width of corpus 12–12. 8 µm, width of saccus 8.8–9.6 µm, length of corpus 11.2–12.8 µm, length of saccus 13.6–14.4 µm (2 specimens measured).

Material. 2 pollen grains.

Slides. KRAM-P O8/45/95 [101/5.5], O10/1 [105/14].

Affinity. Some authors (e.g. Couper 1958, van Konijnenburg-van Cittert 1971) suggest that these dispersed pollen grains are similar to pollen grains from Caytoniales and also to those from other plants e.g. *Harrisiothecium marsiloides* (Harris) Lundblad of uncertain affinity, provisionally placed in the Pteridosperms. According to Balme (1995) dispersed pollen grains from the genus *Vitreisporites* are similar to pollen grains of Ginkgopsida (Caytoniales, Peltaspermales). Most authors wrote that dispersed pollen grains from the genus *Vitreisporites* are similar to pollen grains from Caytoniales (e.g. Nilsson 1958, Tralau 1968, van Konijnenburg-van Cittert 1971, Filatoff 1975).

Stratigraphical distribution. Upper Triassic – Upper Cretaceous.

Geographical distribution. Anctarctica, Australia, Canada, China, Denmark, France, Germany, Great Britain, Greenland, Iran, Italy, the Netherlands, Norway, Poland, Sweden. Reported also from America, Austria, Egypt, Israel, Libya, New Guinea (Weiss 1989).

Remarks. These pollen grains are very characteristic because of their relatively small dimensions.

Genus *Pityosporites* Seward 1914 emend. Manum

T y p e. *Pityosporites antarcticus* Seward 1914, p. 23, pl. 8, fig. 45

Pityosporites minimus (Couper 1958) comb. nov.

Pl. 5, figs 7–10, Pl. 6, figs 1–3

1954 Typ *Pinus silvestris* Rudolph; Rogalska, p. 18, pl. 8, figs 5–6.
1958 *Abietinaepollenites minimus* sp. nov., Couper, p. 153, pl. 28, figs 14–15.
1958 *Taedaepollenites scaurus* sp. nov., Nilsson, pp. 87–88, pl. 7, figs 16–17.
1965 *Abietinaepollenites minimus* Couper; Wall, p. 166.
1967 *Pityosporites scaurus* (Nilsson) comb. nov., Schulz, pp. 595–596, pl. 17, figs 12–13.
1968 *Pityosporites scaurus* (Nilsson) Schulz; Tralau, p. 87, pl. 21, fig. 3.
1970 *Pinuspollenites minimus* (Couper) comb. nov., Kemp, p. 116, pl. 24, figs 1–6.
1971 *Pityosporites scaurus* (Nilsson) Schulz; Guy, p. 63, pl. 5, fig. 6.
1975 *Pinuspollenites minimus* (Couper) Kemp; Vigran &Thusu, p. 11, pl. 15, figs 2–3, 8.
1975 *Pityosporites* cf. *scaurus* (Nilsson) Schulz; Arjang, p. 131, pl. 7, fig. 4.
1977 *Pityosporites scaurus* (Nilsson) Schulz; Bjærke & Manum, p.41, pl. 8, figs 1–2.
1977 *Pinuspollenites minimus* (Couper) Kemp; Lund, p. 76, pl. 9, figs 5–6.
1980 *Pinuspollenites minimus* (Couper) Kemp; Pedersen & Lund, p. 45, pl. 14, figs 1–2.
1981 *Pityosporites scaurus*(Nilsson) Schulz; Guy-Ohlson, p. 235.
1981 *Pinuspollenites minimus* (Couper) Kemp; Achilles, pp. 46, 47, pl. 13, figs 5–7.
1981 *Pinuspollenites minimus*(Couper) Kemp; Guy-Ohlson, p. 235.
1983 *Pinuspollenites minimus* (Couper) Kemp; Orłowska-Zwolińska, p. 29, pl. 33, fig. 2.
1984 *Pinuspollenites minimus* (Couper) Kemp; Achilles et al., pp. 66–67, pl. 9, figs 8–9.
1985 *Pinuspollenites minimus* (Couper) Kemp; Lund & Pedersen, p. 380.
1985 *Pityosporites scaurus* (Nilsson) Schulz; Hoelstad, p. 128, pl. 4, fig. 4.
1986 *Pityosporites scaurus* (Nilsson) Schulz; Guy-Ohlson, p. 28, pl. 15, fig. 1.
1989 *Pinuspollenites minimus* (Couper) Kemp; Weiss, pp. 108–109.
1989 *Pityosporites scaurus* (Nilsson) Schulz; Weiss, pp. 109–110.
1990 *Pinuspollenites minimus* (Couper) Kemp; Rauscher & Schmitt, pp. 117, 136, pl. 4, fig. 9.
1991 *Pinuspollenites minimus* (Couper) Kemp; Dybkjær, p. 26, pl. 11, figs 5, 7.

D e s c r i p t i o n. Bisaccate pollen grains. Corpus oval in lateral longitudinal view. Exine of corpus smooth to scabrate. Sacci distally attached, infrareticulate. Reticulum with small, indistinct lumina. Corpus broader than long or longer than broad, oval in oblique, almost polar view.

Dimensions. Overall width 50–about 80 µm (7 specimens measured), width of corpus about 26–54 µm (7 specimens measured), width of saccus 20.4–34 µm (6 specimens measured), length of corpus 32–37 µm (2 specimens measured), length of saccus about 36–44 µm (2 specimens measured), overall height of saccus 28–40 µm (4 specimens measured), height of corpus 20.4–32 µm (4 specimens measured).

M a t e r i a l. 13 pollen grains.

S l i d e s. KRAM-P O5/2/95 [97/6.1], O5/10/95 [101.5/2, 108/21], O5/11/95 [105/11], O8/2 [104.5/18], O8/3 [101.5/22], O8/18 [102/95], O8/54 [101/2.5], O8/18 [101/3.5], O8/45/95 [110/11], O8/46 [107/1.5], O8/58/95 [103.5/3.5], OS_2/15 [92/6].

A f f i n i t y. Pinaceae is suggested by Schulz (1967) and Tralau (1968). Coniferopsida (Pinaceae) according to Balme (1995) for the genus *Pinuspollenites*.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Upper Triassic – Lower Cretaceous.

G e o g r a p h i c a l d i s t r i b u t i o n. Denmark, France, Germany, Great Britain, Greenland, Iran, Norway, Sweden, Poland. Reported also from America and Austria (Weiss 1989).

R e m a r k s. The specimens from Odrowąż are not well-preserved and the lumina of the infrareticulum of the sacci are indistinct. Couper (1958) described and illustrated a specimen with a distinct infrareticulum.

In most papers specimens named *Pinuspollenites minimus* (Couper) Kemp or *Pityosporites scaurus* (Nilsson) Schulz are figured in lateral longitudinal view in photographs.

Some authors (e.g. Lund 1977, Achilles et al. 1984) consider *Pinuspollenites minimus* the synonym of *Pityosporites scaurus* but others (e.g. Hoelstad 1985, Weiss 1989) use these names separately. Kemp (1970) wrote that "preference must be given to genera of which the original definition is sufficient to enable adequate interpretation of grain morphology in all orientation to be made. This reservation must exclude from consideration *Pityosporites* Seward", because the type species of this genus "is based on a specimen in fixed orientation". However Jansonius and Hills (1976, No. 2017) mentioned that *Pinuspollenites* Raatz ex Potonié 1958 may be a junior synonym of *Pityosporites* Seward. In this case the correct name of these dispersed pollen grains is *Pityosporites minimus* (Couper 1958) comb. nov. and therefore, this new combination is proposed here.

cf. ***Pityosporites minimus*** (Couper 1958) comb. nov.

Pl. 6, figs 4, 5; Pl. 7, fig. 1

Description. Bisaccate pollen grains. Corpus oval in lateral longitudinal view with a reticulate exine, on proximal side about 2.5 µm thick. Sacci strongly folded or not well preserved with indistinct reticulate structure.

Dimensions. Overall width about 66 µm, width of corpus about 51 µm, overall height about 39 µm, height of corpus about 30 µm (1 specimen measured). For the specimen illustrated on Pl. 7, fig. 1 in oblique position: overall width is about 80 µm, overall height is about 60 µm.

Material. 3 pollen grains.

Slides. KRAM-P O5/11/95 [95.2/5], O8/48/95 [102.5/6], O9/1/1 [103.5/18.5].

Affinity. Unknown, probably Coniferales (?Pinaceae).

Stratigraphical distribution. Lower Jurassic.

Geographical distribution. Poland.

Remarks. These pollen grains from Odrowąż resemble *Pityosporites minimus* (Couper 1958) comb. nov. but are not well preserved in oblique positions and therefore precise measurements are impossible and not all features are visible.

Genus ***Platysaccus*** Naumova ex Ishchenko emend. Potonié & Klaus 1954

Type. *Platysaccus papilions* Potonié & Klaus 1954, p. 540, pl. 10, fig. 12 (neotype, proposed by Potonié & Klaus 1954)

Platysaccus nitidus Pautsch 1971

Pl. 6, fig. 6

1971 *Platysaccus nitidus* sp. nov., Pautsch, p. 45, pl. 16, fig. 2, pl. 17, fig. 3.

1973 *Platysaccus nitidus* Pautsch; Pautsch, p. 140, pl. 5, figs 9–10.

1983 *Platysaccus nitidus* Pautsch; Orłowska-Zwolińska, p. 29, pl. 32, fig. 2.

Description. Bisaccate pollen grain. Corpus oval in polar view (proximal face) with a circular secondary fold (2–3 µm wide) around the corpus. Corpus partly broken, scabrate. Sacci folded with internal reticulum, lumina indistinct, elongated to almost isodiametric.

Dimensions. Overall width about 82 µm, width of corpus about 36 µm, width of saccus about 36 µm, length of corpus about 48 µm, length of saccus about 50 µm.

Material. 1 pollen grain.

Slide. KRAM-P O8/45/95 [103/3].

Affinity. Unknown.

Stratigraphical distribution. Upper Triassic-Lower Jurassic.

Geographical distribution. Poland.

Remarks. In the specimen from Odrowąż the corpus is not darker than the sacci but on the photograph (Pl. 6, figs 2, 4) fragment of unmacerated tissue is visible on the corpus.

Genus ***Pinuspollenites*** Raatz emend. Potonié 1958

Type. *Pinuspollenites labdacus* (Potnié) Raatz ex Potonié 1958

Pollenites labdacus Potnié 1931, p. 5, fig. 32

?***Pinuspollenites labdacus* var. *arcuatus*** Danzé-Corsin & Laveine 1963

Pl. 6, fig. 7

1963 *Pinuspollenites labdacus* R. Potnié var. *arcuatus* nov. var., Danzé-Corsin & Laveine, pp. 101–102, pl. 10, figs 15–21.

Description. Bisaccate pollen grain in lateral longitudinal view. Exine of corpus on proximal side about 2–3 µm thick, granulate, on distal side thin, less than 1 µm. Sacci with indistinct structure, partly broken, probably because of biodegradation.

D i m e n s i o n s. Overall width about 82 µm, width of corpus about 60 µm, overall height about 52 µm, height of corpus about 28 µm.

M a t e r i a l. 1 pollen grain.

S l i d e. KRAM-P O8/45/95 [110/4.5].

A f f i n i t y. Danzé-Corsin and Laveine (1963) wrote that dispersed pollen grains *Pinuspollenites labdacus* var. *arcuatus* resemble pollen grains of recent *Pinus banksiana*.

S t r a t i g r a p h i c a l   d i s t r i b u t i o n. Rhaetic – Lower Jurassic.

G e o g r a p h i c a l   d i s t r i b u t i o n. France, Poland.

R e m a r k s. The specimen from Odrowąż is somewhat larger and its state of preservation is not so good but it resembles specimens of *Pinuspollenites labdacus* var. *arcuatus* described and illustrated by Danzé-Corsin and Laveine (1963, especially pl. 10, fig. 15).

Turma Aletes Ibrahim

Subturma Azonaletes Luber emend. Potonié & Kremp 1954

Genus ***Inaperturopollenites*** Pflug & Thomson in Thomson & Pflug 1953

T y p e. *Inaperturopollenites dubius* (Potonié & Venitz) Thomson & Pflug 1953, p. 64

Pollenites magnus f. *dubius* Potonié & Venitz 1934, p. 17, pl. 2, fig. 21 (holotype indicated in Potonié 1958, p. 77)

cf. ***Inaperturopollenites*** sp.

Pl. 7, figs 2, 3

D e s c r i p t i o n. Pollen grains irregular, more or less oval, without apertures. Exine thin, scabrate to granulate, with secondary folds. Folds irregular, transversal, longitudinal or oblique in relation to longer axis of the grain.

D i m e n s i o n s. Diameter 32–60.8 × 28,8–41.6 µm (4 specimens measured).

M a t e r i a l. 5 pollen grains.

S l i d e s. KRAM-P O5/13/95 [96.5/5.5], O5/14/95 [105.5/19.5], O5/15/95 [99/3], O8/54/95 [103/5], O9/1/1 [102.5/8].

A f f i n i t y. Unknown. Balme (1995) mentioned similarity of dispersed *Inaperturopollenites* to in situ spores from the Cretaceous *Equisetites lyelli* and to in situ pollen grains from the isolated cone *Masculostrobus* sp. A (Araucariaceae) as described by Barale (1970).

S t r a t i g r a p h i c a l   d i s t r i b u t i o n. Lower Liassic.

G e o g r a p h i c a l   d i s t r i b u t i o n. Poland.

R e m a r k s. This kind of pollen has no clearly defined diagnosic features.

Genus ***Araucariacites*** Cookson 1947 emend. Couper 1953

T y p e. *Araucariacites australis* Cookson 1947 ex Couper, p. 130, pl. 13, fig. 3 (lectotype designed by Potonié 1958, p. 81)

cf. ***Araucariacites australis*** Cookson 1947 ex Couper 1953

Pl. 7, fig. 4

1953 *Araucariacites australis* Cookson, Couper, p. 39.
1957 *Araucariacites australis* Cookson; Balme, p. 31, pl. 7, figs 81–82.
1958 *Araucariacites australis* Cookson; Couper, p. 151, pl. 27, figs 3–5.
1963 *Araucariacites australis* Cookson; Dettmann, pp. 105–106, pl. 26, fig. 15.
1965 *Araucariacites* cf. *A. australis* Cookson; Norris, p. 255, fig. 48.
1968 *Araucariacites australis* Cookson; Tralau, pp. 71–72, pl. 17, fig. 2.
1971 *Araucariacites australis* Cookson; Guy, p. 66, pl. 5, fig. 13.
1971 *Araucariacites australis* Cookson; van Konijnenburg-van Cittert, pp. 51–57, pl. 12, fig. 5.
1975 *Araucariacites australis* Cookson; Filatoff, p. 82, pl. 23, figs 10–11.
1975 *Araucariacites australis* Cookson; Vigran &Thusu, p. 9, pl. 13, fig. 15.
1977 *Araucariacites australis* Cookson; Lund, p. 72, pl. 7, fig. 12.
1977 *Araucariacites* cf. *australis* Cookson; Lund, p. 72, pl. 7, fig. 13.
1978 *Araucariacites australis* Cookson; Guy-Ohlson, p. 25, pl. 1, fig. 3.
1980 *Araucariacites australis* Cookson; Pedersen & Lund, p. 45, pl. 18, fig. 1.
1980 *Araucariacites* cf. *australis* Cookson; Pedersen & Lund, p. 45, pl. 18, fig. 2.

1981 *Araucariacites australis* Cookson ex Couper; Achilles, p. 50, pl. 14, figs 13–14.
1981 *Araucariacites australis* Cookson; Guy-Ohlson, p. 235.
1982 *Araucariacites australis* Cookson; Guy-Ohlson, p. 16.
1985 *Araucariacites australis* Cookson; Guy-Ohlson & Malmquist, p. 19, Fig. 2.
1985 *Araucariacites australis* Cookson; Lund & Pedersen, p. 380.
1986 *Araucariacites australis* Cookson; Guy-Ohlson, pp. 30–31, pl. 6, fig. 3.
1987 *Araucariacites australis* Cookson; Schrank, p. 257, pl. 3, fig. 15.
1990 *Araucariacites australis* Cookson; Rauscher & Schmitt, pp. 115, 134, 136, 138, pl. 3, fig. 13.
1991 *Araucariacites australis* Cookson; Dybkjær, p. 27.

Description. Pollen grains almost circular, without apertures. Exine with various secondary folds, granulate, about 0.8 µm thick.

Dimensions. The longest diameter 40–43.2 µm (2 specimens measured).

Material. 3 pollen grains.

Slides. KRAM-P O5/10/95 [100/18.3], O8/5 [107/13], OS_2/8 [108/18].

Affinity. Couper (1958) compared dispersed pollen grains of *Araucariacites australis* Cookson with pollen grains of the Jurassic araucariaceous conifer *Brachyphyllum mamillare* Brogniart and wrote that these pollen grains are closely comparable to those of living species *Araucaria* and *Agathis*. Kendall (1949) and Harris (1979) described similar pollen grains from Jurassic *Brachyphyllum mamillare* male cones (Araucariaceae). Tralau (1968) note that *Araucariacites australis* Cookson pollen grains have been reffered to *Podozamites* e.g. by Bolkhovitina (1956). Van Konijnenburg-van Cittert (1971) found two types of pollen grains in Jurassic *Brachyphyllum mamillare* Brogniart male cones and also in recent *Araucaria araucana*. The first type resembles dispersed *Araucariacites australis* Cookson and the second dispersed pollen grains from the genus *Callialasporites* Sukh-Dev 1961. Pollen grains similar to *Araucariacites australis* Cookson are also known from *Masculostrobus graiterensis* Allenbach & van Konijnenburg-van Cittert 1997 (Coniferales, Araucariaceae) Jurassic male cone from Switzerland. Rogalska (1976) illustrated similar pollen grains under the name cf. *Agathis* Salisbury.

Araucariaceae-type pollen grains have been discussed by van Konijnenburg-van Cittert (1971), Pocock (1970a), Filatoff (1975) and Balme (1995) in detail.

Stratigraphical distribution. Rhaetic – Tertiary.

Geographical distribution. Antarctica, Australia, Denmark, Egypt, France, Germany, Greenland, Great Britain, New Zealand, Norway, Poland, Sweden.

Remarks. The most of *Araucariacites australis* Cookson ex Couper pollen grains are bigger than specimen described from Odrowąż but e.g. Vigran and Thusu (1975, pl. 13, fig. 15) illustrated similar, small (about 40 µm) pollen grains under the name *Araucariacites australis* Cookson.

Balme (1957) described the new species *Inaperturopollenites limbatus* which according to him "is distinguished from *Araucariacites australis* by its thicker exine, finer ornament, and the colour differentiation of its exine". This type of pollen grains has been found in the *Brachyphyllum irregulare* Archangelsky cone from the Lower Cretaceous of Argentina (Archangelsky & Gamerro 1967). Later Archangelsky (1977) instituted *Inaperturopollenites limbatus* Balme 1957 as the type species of the new genus *Balmeiopsis*. Barale (1970) assigned to *Inaperturopollenites* Pflug pollen grains similar to *Araucariacites* from the cones of *Masculostrobus* sp. A, from the Jurassic of France.

cf. ***Araucariacites*** sp.

Pl. 7, fig. 5

Description. Pollen grain oval, partly broken, without apertures. Exine secondary folded. Folds longitudinal and transversal. Exine granulate, about 1.5 µm thick.

Dimensions. The longest diameter 76.5 µm.

Material. 1 pollen grain.

Slide. KRAM-P O9/2/6 [93/8.5].

Affinity. Probably Araucariaceae.

Stratigraphical distribution. Lower Liassic.

Geographical distribution. Poland.

Remarks. The size of this cf. *Araucariacites* sp. pollen is similar to *Araucariacites australis* Cookson ex Couper size but the specimen described above differs from *Araucariacites australis* in the shape of whole pollen grain and thickness of the exine. Couper (1958) wrote that thicknes of *Araucariacites australis* exine is 0.5–0.75 µm while thickness of the exine of specimen from Odrowąż is about 1.5 µm.

Genus ***Spheripollenites*** Couper 1958

Type. *Spheripollenites scabratus* Couper 1958, p. 158, pl. 31, fig. 12

Spheripollenites psilatus Couper 1958

Pl. 7, fig. 6

1958 *Spheripollenites psilatus* sp. nov., Couper, p. 159, pl. 31, figs 4–8.
1968 *Spheripollenites psilatus* Couper; Tralau, p. 90, pl. 16, figs 6–7.
1976 *Spheripollenites psilatus* Couper; Rogalska, p. 42.
1991 *Spheripollenites psilatus* Couper; Dybkjær, p. 28, pl. 13, fig. 7.

Description. Pollen grains almost circular, without distinct apertures. Exine smooth, secondary folded, about 1–1.5 µm thick.

Dimensions. The longest diameter 16–28 µm.

Material. 2 pollen grains.

Slides. KRAM-P O5/3/95 [105/5.5], O8/5 [104/8].

Affinity. Couper (1958) suggested a coniferous affinity, probably Cupressaceae. Algal origin is also mentioned (Dybkjær 1991). See also affinity of *Spheripollenites subgranulatus*.

Stratigraphical distribution. Jurassic – Lower Cretaceous.

Geographical distribution. Denmark, Great Britain, Poland, Sweden.

Remarks. Some authors e.g. Dybkjær (1991) suggested that *Inaperturopollenites orbiculatus* Nilsson 1958 and *Spheripollenites psilatus* Couper are synonyms but others e.g. Schulz (1967) and Ashraf (1977) wrote that *Inaperturopollenites orbiculatus* Nilsson 1958 is the synonym of *Spheripollenites subgranulatus* Couper 1958.

Spheripollenites subgranulatus Couper 1958

Pl. 7, fig. 7

1958 *Spheripollenites subgranulatus* sp. nov., Couper, pp. 158–159, pl. 31, figs 9–11.
1962 *Spheripollenites subgranulatus* Couper; Pocock, p. 73.
1967 *Spheripollenites subgranulatus* Couper; Schulz, pp. 599–600, pl. 19, fig. 5.
1968 *Spheripollenites subgranulatus* Couper; Tralau, pp. 89–90, pl. 16, fig. 5.
1971 *Spheripollenites subgranulatus* Couper; Guy, p. 67, pl. 5, fig. 15.
1971 *Spheripollenites (= Exesipollenites) subgranulosus* Couper; van Konijnenburg-van Cittert, p. 59, pl. 13, fig. 5.
1976 *Spheripollenites subgranulatus* Couper; Rogalska, pl. 53, figs 673, 675.
1977 *Spheripollenites subgranulatus* (Couper) Jansonius; Ashraf, p. 64, pl. 17, figs 9–10.
1978 *Spheripollenites subgranulatus* Couper; Guy-Ohlson, pp. 18, 24, pl. 6, fig. 57.
1981 *Spheripollenites subgranulatus* Couper; Guy-Ohlson, p. 235.
1985 *Spheripollenites subgranulatus* Couper; Guy-Ohlson & Malmquist, pp. 15, 20.
1986 *Spheripollenites subgranulatus* Couper; Guy-Ohlson, p. 31, pl. 6, fig.4, pl. 14, fig. 2.
1990 *Spheripollenites subgranulatus* Couper; Rauscher & Schmitt, pp. 115, 134, 138, pl. 3, fig. 2.
1991 *Spheripollenites subgranulatus* Couper; Dybkjær, pp. 27–28.

Description. Pollen grains circular to oval, without distinct apertures. Exine about 1 µm thick, sculptured with small granules.

Dimensions. The longest diameter 22.4–32.0 µm.

Material. 2 pollen grains.

Slides. KRAM-P O8/1 [100/5.5], O8/5 [95/13.5].

Affinity. Couper (1958) suggested taxaceous affinity. Van Konijnenburg-van Cittert (1971) noted that dispersed pollen grains from the genus *Spheripollenites* Couper (= *Exesipollenites* Balme 1957) may have had very different origins, for example the "inner bodies" of *Classopollis*-type pollen grains or of Jurassic *Elatides williamsoni* (Taxodiaceae).

Stratigraphical distribution. Rhaetic – Lower Cretaceous.

Geographical distribution. Afghanistan, Canada, France, Denmark, Germany, Great Britain, Poland, Sweden.

R e m a r k s. Some dispersed *Spheripollenites subgranulatus* Couper 1958 from Odrowąż are larger than those described by Couper (1958). Schulz (1967) wrote that *Inaperturopollenites orbiculatus* Nilsson 1958 and *Cupressaccites subgranulatus* Rogalska 1962 are synonyms of *Spheripollenites subgranulatus* Couper 1958. Pocock (1970b) emended the diagnosis of the genus *Exesipollenites* Balme 1957 and cited the genus *Spheripollenites* Couper 1958 as a junior synonym.

Spheripollenites sp.

Pl. 7, figs 8–11

D e s c r i p t i o n. Outline circular to subcircular. Cracked along radial line. Exine smooth, 1 µm thick.

D i m e n s i o n s. The longest diameter 33.6–52 µm (4 specimens measured).

M a t e r i a l. 8 pollen grains.

S l i d e s. KRAM-P O5/3/95 [107/3.5], O5/5/95 [111/9], O5/6/95 [94/1, 102.5/2], O5/10/95 [100.5/5.5], O5/11/95 [104/5], O8/2 [100/16], O8/3 [100/5].

A f f i n i t y. Unknown.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Jurassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

R e m a r k s. Specimens described above as *Spheripollenites* sp. resemble also *Concentrisporites hallei* (Nilsson 1958) Wall 1965.

Genus ***Perinopollenites*** Couper 1958

T y p e. *Perinopollenites elatoides* Couper 1958, p. 152, pl. 27, fig. 9

Perinopollenites elatoides Couper 1958

Pl. 7, figs 12–14

1958 *Perinopollenites elatoides* sp. nov., Couper, p. 152, pl. 27, figs 9–11.
1962 *Perinopollenites elatoides* Couper; Pocock, p. 60, pl. 9, figs 136–137.
1963 *Perinopollenites elatoides* Couper; Danzé-Corsin & Laveine, p. 89, pl. 8, figs 3–6.
1964a *Perinopollenites elatoides* Couper; Levet-Carette, p. 273, pl. 10, figs 26–27.
1964b *Perinopollenites elatoides* Couper; Levet-Carette, p. 107, pl. 6, fig. 10.
1965 *Perinopollenites elatoides* Couper; Norris, p. 259, figs 4c, 63.
1967 *Perinopollenites elatoides* Couper; Norris, p. 110, pl. 18, fig. 23.
1968 *Perinopollenites elatoides* Couper; Tralau, pp. 86–87, pl. 18, figs 1–3.
1971 *Perinopollenites elatoides* Couper; Guy, p. 67, pl. 5, fig. 11.
1974 *Perinopollenites elatoides* Couper; Herngreen & De Boer, p. 359.
1974 *Perinopollenites elatoides* Couper; McKellar, pp. 43–44, pl. 13, fig. 14.
1975 *Perinopollenites elatoides* Couper; Vigran & Thusu, p. 10, pl. 13, figs 11, 16–17.
1976 *Perinopollenites elatoides* Couper; Rogalska, pl. 52, figs 659, 662, pl. 53, figs 663, 672, 674.
1977 *Perinopollenites elatoides* Couper; Lund, p. 71, pl. 7, fig. 10.
1978 *Perinopollenites elatoides* Couper; Guy-Ohlson, pp. 18, 26, pl. 6, fig. 53.
1980 *Perinopollenites elatoides* Couper; Pedersen & Lund, p. 45, pl. 18, fig. 3.
1980 *Perinopollenites* cf. *elatoides* Couper; Pedersen & Lund, p. 45, pl. 18, fig. 4.
1981 *Perinopollenites elatoides* Couper; Achilles, p. 50, pl. 14, fig. 15, pl. 15, fig. 1.
1981 *Perinopollenites elatoides*; Guy-Ohlson, p. 235.
1982 *Perinopollenites elatoides* Couper; Guy-Ohlson, p. 17.
1983 *Perinopollenites elatoides* Couper; Orłowska-Zwolińska., p. 30, pl. 33, fig. 11.
1984 *Perinopollenites elatoides* Couper; Achilles et al., p. 69, pl. 10, fig. 3.
1985 *Perinopollenites elatoides* Couper; Hoelstad, p. 129, pl. 4, fig. 16.
1985 *Perinopollenites* cf. *elatoides* Couper; Hoelstad, p. 129, pl. 4, fig. 15.
1985 *Perinopollenites elatoides* Couper; Guy-Ohlson & Malmquist, p. 20, Fig. 2.
1985 *Perinopollenites elatoides* Couper; Lund & Pedersen, p. 380, pl. 5, fig. 3.
1986 *Perinopollenites elatoides* Couper; Guy-Ohlson, p. 31.
1989 *Perinopollenites elatoides* Couper; Weiss, pp. 122–123, pl. 10, fig. 10.
1990 *Perinopollenites elatoides* Couper; Rauscher & Schmitt, pp. 115, 132, 134, pl. 4, fig. 10.
1991 *Perinopollenites elatoides* Couper; Dybkjær, p. 27, pl. 12, figs 4–6.
1991 *Perinopollenites* cf. *elatoides* Couper; Dybkjær, p. 27, pl. 12, figs 7–9.

D e s c r i p t i o n. Pollen grains circular with one pore, not always visible. Exine secondarily folded, with different folds, two layered. Outer layer (perine) very thin, scabrate and always partly broken. Inner layer thicker than outer, scabrate.

D i m e n s i o n s. Diameter 25.6–41.6 µm, diameter without outer layer about 21.6–34.4 μm (5 specimens measured).

M a t e r i a l. 9 pollen grains.

S l i d e s. KRAM-P O5/15/95 [101/2], O5/10/95 [104/15], O5/13/95 [103.5/15.5], O8/2 [98/10.5, 100/16, 109/19.5], O8/3 [100.5/9], O8/49/95 [106/3, 106/10].

A f f i n i t y. According to Couper (1958) dispersed pollen grains of *Perinopollenites elatoides* are comparable to pollen grains from the Jurassic conifer *Elatides williamsoni* (Brongn.) Seward (Taxodiaceae). Van Konijnenburg-van Cittert (1971) compared pollen grains from *Elatides williamsoni* (Brogn.) Seward also with pollen grains from some recent Taxodiaceae e.g. *Cunninghamia lanceolata*. Balme (1995) placed the affinity of *Perinopollenites elatoides* in Coniferopsida (Taxodiaceae).

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Rhaetian – Upper Cretaceous.

G e o g r a p h i c a l d i s t r i b u t i o n. Antarctica, Australia, Canada, Denmark, France, Germany, Great Britain, Greenland, Iran, the Netherlands, Norway, Poland, Sweden. Reported also by Weiss (1989) from America, Libya, Morocco, Russia (Siberia).

R e m a r k s. Pollen grains described and illustrated under the name *Perinopollenites elatoides* Couper 1958 are variable in shape but are very characteristic because of very thin outer layer (perine) of exine.

Turma Plicates Naumova 1939 emend. Potonié 1960

Subturma Monocolpates Iversen & Troels-Smith 1950

Genus ***Chasmatosporites*** Nilsson 1958

T y p e. *Chasmatosporites major* Nilsson 1958, p. 54, pl. 3, fig. 12

Chasmatosporites apertus (Rogalska 1954) Nilsson 1958

Pl. 7, fig. 18

1954 *Pollenites apertus* sp. nov., Rogalska, pp. 27, 45, pl. 12, figs 13–15.

1956 *Pollenites apertus* Rogalska; Rogalska, p. 44, pl. 32, figs 1–2.

1958 *Chasmatosporites apertus* (Rogalska) comb. nov., Nilsson, p. 56, pl. 4, figs 5–6.

1958 *Chasmatosporites crassus* sp. nov., Nilsson, p. 57, pl. 5, fig. 3.

1958 *Chasmatosporites flavus* sp. nov., Nilsson, p. 57, pl. 5, fig. 4.

1965 *Chasmatosporites apertus* Nilsson; Wall, p. 166.

1967 *Chasmatosporites apertus* (Rogalska) Nilsson; Schulz, p. 602, pl. 19, figs 14–15.

1968 *Chasmatosporites apertus* (Rogalska) Nilsson; Tralau, pp. 77–78, pl. 23, fig. 2.

1972 *Chasmatosporites apertus* (Rogalska) Nilsson; Tralau & Artursson, p. 62, fig. 2S.

1973 *Chasmatosporites apertus* (Rogalska) Nilsson; Orbell, p. 16.

1974 *Chasmatosporites apertus* (Rogalska) Nilsson; Herngreen & De Boer, p. 359, pl. 5, fig. 6.

1975 *Chasmatosporites apertus* (Rogalska) Pocock & Jansonius; Vigran & Thusu, p. 9, pl. 12, figs 1, 6.

1976 *Chasmatosporites apertus* (Rogalska) Nilsson; Rogalska, p. 41, pl. 47, figs 587–589.

1977 *Pollenites apertus* Rogalska; Ashraf, p. 67, pl. 18, fig. 15.

1977 *Chasmatosporites apertus* (Rogalska) Nilsson; Lund, p. 67, pl. 6, fig. 9a–b.

1977 *Chasmatosporites apertus* (Rogalska) Nilsson; Bjærke & Manum, p. 43, pl. 8, fig. 9.

1978 *Chasmatosporites apertus* (Rogalska) Nilsson; Guy-Ohlson, pp. 20, 25, pl. 3, figs 18–19.

1980 *Chasmatosporites apertus* (Rogalska) Nilsson; Pedersen & Lund, p. 46, pl. 19, fig. 5.

1981 *Chasmatosporites apertus* (Rogalska) Nilsson; Achilles, p. 50, pl. 15, figs 2–3.

1981 *Chasmatosporites apertus* (Rogalska) Nilsson; Guy-Ohlson, p. 235.

1981 *Chasmatosporites apertus* (Rogalska) Nilsson; Shang, p. 430, pl. 1, fig. 41.

1983 *Chasmatosporites apertus* (Rogalska) Nilsson; Orłowska-Zwolińska, pl. 36, fig.4.

1984 *Chasmatosporites apertus* (Rogalska) Nilsson; Achilles et al., p. 70, pl. 10, fig. 5.

1984 *Chasmatosporites apertus* Nilsson; Guy-Ohlson & Malmquist, p. 19, Fig. 2.

1985 *Chasmatosporites apertus* (Rogalska) Nilsson; Lund & Pedersen, p. 382.

1986 *Chasmatosporites apertus* (Rogalska) Nilsson; Guy-Ohlson, p. 32, pl. 6, figs 5–6.

1989 *Chasmatosporites apertus* (Rogalska) Nilsson; Weiss, p. 124.

1990 *Chasmatosporites apertus* (Rogalska) Nilsson; Rauscher & Schmitt, pp. 115, 134, 136, 138, 140, pl. 2, fig. 11.

1991 *Chasmatosporites apertus* (Rogalska) Nilsson; Dybkjær, p. 28, pl. 14, fig. 3.

D e s c r i p t i o n. Pollen grains circular to oval in equatorial outline with circular to oval aperture. Edge of pollen grains and edge of aperture irregular, undulating. Folds or thickenings around aperture 1.6–4.0 µm wide. Exine 1.6–3.2 µm thick.

Dimensions. Length of pollen grain 36–36.4 µm, width of pollen grain 21–33.6 µm, length of aperture 23.2–29.6 µm, width of aperture 8–20 µm (3 specimens measured).

Material. 4 pollen grains.

Slides. KRAM-P O5/11/95 [96/10], O8/18 [102.5/19.5], O8/50 [108.5/5], O17/1 [102/5].

Affinity. Rogalska (1954) noted that oval specimens of dispersed *Pollenites apertus* resemble pollen grains of the genus *Cycas*. According to Schulz (1967) dispersed *Chasmatosporites apertus* (Rogalska) Nilsson pollen grains are similar to pollen grains of Cycadales and ?Bennettitales. Balme (1995) wrote that dispersed pollen grains from the genus *Chasmatosporites* are similar to pollen grains of ?Cycadopsida (?Cycadales): Ginkgopsida (?Gnetales).

Stratigraphical distribution. Upper Triassic – Middle Jurassic (Callovian) for *Chasmatosporites apertus* (Rogalska) Nilsson sensu Guy-Ohlson (1986, fig. 4).

Geographical distribution. Afghanistan, China, Denmark, France, Germany, Great Britain, Greenland, Iran, the Netherlands, Norway, Poland, Spitsbergen, Sweden. Reported also from Canada (Weiss 1989).

Remarks. Guy-Ohlson (1986) treated all species of *Chasmatosporites* Nilsson as separate taxa but some authors e.g. Schulz (1967) and Dybkjær (1991) included *Chasmatosporites flavus* Nilsson 1958 and *Chasmatosporites crassus* Nilsson 1958 in *Chasmatosporites apertus* (Rogalska 1954) Nilsson 1958.

***Chasmatosporites* cf. *elegans* Nilsson 1958**

Pl. 7, figs 15–17

1958 *Chasmatosporites elegans* sp. nov., Nilsson, p. 58, pl. 4, figs 11–12.
1975 *Chasmatosporites* cf. *elegans* Nilsson; Arjang, p. 137, pl. 7, fig. 19.
1977 *Chasmatosporites elegans* Nilsson; Lund, p. 67, pl. 6, fig. 7, 8.
1980 *Chasmatosporites elegans* Nilsson; Pedersen & Lund, p. 46, pl. 19, fig. 3.
1981 *Chasmatosporites elegans* Nilsson; Guy-Ohlson, p. 235.
1985 *Chasmatosporites elegans* Nilsson; Guy-Ohlson & Malmquist, p. 19, Fig. 2.
1986 cf. *Chasmatosporites elegans* Nilsson; Guy-Ohlson, p. 32, pl. 6, fig. 9
1991 *Chasmatosporites elegans* Nilsson; Dybkjær, p. 28, pl. 14, fig. 6; pl. 22, fig. 6.

Description. Pollen grains oval in equatorial outline. Aperture oval more or less wide open. Folds around aperture 1.6–2.5 µm wide. Exine about 1–1.6 µm thick, infrapunctate to infrareticulate.

Dimensions. Length 25.6–38.4 µm, width 19.2–29.6 µm, length of aperture 25.6–30.4 µm, width of aperture 10.4–20.0 µm.

Material. 7 pollen grains.

Slides. KRAM-P O5/6/95 [95/1], O5/11/95 [100/11.5, 107/4], O8/2 [101/4.5], O8/18 [103.5/12.5], O10/1 [102.5/13, 113.5/15].

Affinity. Van Konijnenburg-van Cittert (1971) wrote that "some of Nilsson's *Chasmatosporites* grains look rather like *Androstrobus prisma* pollen grains especially specimens of *Chasmatosporites elegans* and *Chasmatosporites minor* ". The Jurassic cone *Androstrobus prisma* Thomas & Harris belongs to *Pseudoctenis lanei* from the Cycadales (Harris 1964).

Stratigraphical distribution. Lower Jurassic (Hettangian to Pliensbachian) for *Chasmatosporites elegans* Nilsson 1958 sensu Guy-Ohlson (1986, fig. 4).

Geographical distribution. Denmark, Greenland, Iran, Poland, and Sweden.

Remarks. Morbey (1975) included *Chasmatosporites elegans* Nilsson 1958 and other 8 species of *Chasmatosporites* in *Chasmatosporites magnolioides* (Erdtman 1948) Nilsson 1958. Some authors e.g. Weiss (1989), Ashraf (1977) agree with his opinion. Dybkjær (1991) investigated Nilsson's type-material and illustrated the holotype of *Chasmatosporites elegans* Nilsson (Dybkjær 1991). She described *Chasmatosporites elegans* Nilsson and treated *Chasmatosporites elegans* Nilsson 1958 and *Chasmatosporites minor* Nilsson 1958 as synonyms.

Some specimens from Odrowąż are smaller than those described by Nilsson (1958) and (Dybkjær 1991) and infrastructure of the exine is not clearly visible.

***Chasmatosporites hians* Nilsson 1958**

Pl. 8, fig. 1

1958 *Chasmatosporites hians* sp. nov., Nilsson, p. 55, pl. 4, figs 3–4.

1968 *Chasmatosporites hians* Nilsson; Tralau, pp. 78–79, pl. 23, fig. 1.
1971 cf. *Chasmatosporites hians* Nilsson; Guy, p. 68, pl. 5, fig. 17.
1974 *Chasmatosporites hians* Nilsson; Herngreen & De Boer, p. 359, pl. 5, fig. 4.
1977 *Chasmatosporites hians* Nilsson; Bjærke & Manum, p. 43, pl. 8, figs 10–11.
1977 *Chasmatosporites hians* Nilsson; Lund, p. 67, pl. 6, fig. 6a–b.
1980 *Chasmatosporites hians* Nilsson; Pedersen & Lund, p. 46, pl. 19, fig. 2.
1981 *Chasmatosporites hians* Nilsson; Guy-Ohlson, p. 235.
1981 *Chasmatosporites hians* Nilsson; Shang, p. 430, pl. 1, fig. 51.
1985 *Chasmatosporites hians* Nilsson; Guy-Ohlson & Malmquist, p. 19, pl. 2, figs F–G.
1986 *Chasmatosporites hians* Nilsson; Guy-Ohlson, p. 32, pl. 6, figs 7–8.
1990 *Chasmatosporites hians* Nilsson; Rauscher & Schmitt, pp. 115, 134, 140.
1991 *Chasmatosporites* cf. *hians* Nilsson; Dybkjær, pp. 28, 29, pl. 14, figs 4–5.

Description. Pollen grain in equatorial outline almost circular with slightly irregular edge. Aperture oval and wide open. Exine about 1.0–2.5 µm thick with a distinct, irregular micro infrareticulum.

Dimensions. Length 44 µm, width 40 µm, length of aperture 35.2 µm, width of aperture 21.6 µm.

Material. 1 pollen grain.

Slide. KRAM-P O9/2/8 [106/16.5].

Affinity. After Balme (1995).dispersed pollen grains from the genus *Chasmatosporites* are similar to pollen grains of ?Cycadopsida (?Cycadales), Ginkgopsida (?Gnetales).

Stratigraphical distribution. Upper Triassic to Middle Jurassic (Callovian) for *Chasmatosporites hians* Nilsson 1958 sensu Guy-Ohlson (1986, fig. 4).

Geographical distribution. China, Denmark, France, Germany, the Netherlands, Poland, and Spitsbergen, Sweden.

Remarks. *Chasmatosporites hians* Nilsson 1958 has been included in *Chasmatosporites magnolioides* (Erdtman 1948) Nilsson 1958 by Morbey (1975). Dybkjær (1991) wrote that the slide with Nilsson's type specimen of *Chasmatosporites hians* has been lost. Dybkjær (1991) described *Chasmatosporites hians* Nilsson 1958 as a separate species.

Chasmatosporites major (Nilsson 1958) Pocock & Jansonius 1969

Pl. 8, fig. 2

1958 *Chasmatosporites major* sp. nov., Nilsson, p. 54, pl. 3, figs 10–15.
1967 *Chasmatosporites major* Nilsson; Schulz, p. 602, pl. 20, figs 2–3.
1969 *Chasmatosporites major* Nilsson, emend., Pocock & Jansonius, p. 157, pl. 2, figs 44–45.
1972 *Chasmatosporites major* Nilsson; Tralau & Artursson, p. 62, Fig. 2U.
1981 *Chasmatosporites major* (Nilsson) Pocock & Jansonius; Guy-Ohlson, p. 235.
1985 *Chasmatosporites major* Nilsson; Guy-Ohlson & Malmquist, p. 19, Fig. 2, pl. 2, fig. H.
1986 *Chasmatosporites major* (Nilsson) Pocock & Jansonius; Guy-Ohlson, p. 32, Fig. 4.
1991 *Chasmatosporites major* Nilsson; Dybkjær, p. 29, pl. 14, fig. 7.

Description. Pollen grain oval in equatorial outline with a smooth to slightly irregular edge. Aperture oval with oval to triangular ends, extending almost to the equator. Exine about 1.5–2.5 µm thick, infrareticulate.

Dimensions. Length 52.8 µm, width 37.6 µm, length of aperture 48 µm, width of aperture 9.6 µm.

Material. 1 pollen grain.

Slide. KRAM-P O9/1/1 [109/14.5].

Affinity. Nilsson (1958) compared dispersed *Chasmatosporites* pollen grains with microspores of *Lycostrobus scotti* described by Nathorst (1908). These in situ microspores resemble microspores of *Isoëtes* (Nathorst 1908, Couper 1958, Nilsson 1958). Schulz (1967) however, treated dispersed *Chasmatosporites* Nilsson 1958 not as monolete microspores but as monosulcate pollen grains because of the infrareticulate structure of the exine. Also Pocock and Jansonius (1969) believed that *Chasmatosporites* Nilsson 1958 represents gymnospermous pollen grains probably from Cycadales. After Balme (1995) dispersed pollen grains from the genus *Chasmatosporites* are similar to pollen grains of ?Cycadopsida (?Cycadales): Ginkgopsida (?Gnetales).

Stratigraphical distribution. Upper Triassic to Middle Jurassic (Aalenian) for *Chas-*

matosporites major Nilsson 1958 sensu Guy-Ohlson (1986, fig. 4).

G e o g r a p h i c a l   d i s t r i b u t i o n. Canada, Denmark, Germany, Poland, and Sweden.

R e m a r k s. Nilsson (1958) described *Chasmatosporites major* as the type species of the genus *Chasmatosporites*. Potonié (1966) formally proposed *Chasmatosporites* as a junior synonym of *Aratrisporites* Leschik 1955 emended Klaus 1960 because of similarity between dispersed *Chasmatosporites* and in situ microspores of *Lycostrobus scotti* suggested by Nilsson (1958). Pocock and Jansonius (1969) examined the original material of Nilsson as well as samples of similar age from western Canada. They emended the diagnosis of *Chasmatosporites* and the description of *Chasmatosporites major* Nilsson 1958 and treated *Chasmatosporites* and *Aratrisporites* as separate genera.

Van Konijnenburg-van Cittert (1971) considered that the genus *Chasmatosporites* is rather a problematic genus, which is composed of monolete spores, and monocolpate pollen grains and inaperturate grains like from *Androstrobus prisma*. Now she is of opinion that *Chasmatosporites* is a genus of pollen grains probably of Cycadopsida affinity (van Konijnenburg-van Cittert pers. comm.

Morbey (1975) included *Chasmatosporites major* Nilsson 1958 and other 8 species of *Chasmatosporites* in *Chasmatosporites magnolioides* (Erdtman) Nilsson 1958.

Authors who used this name: 1975 *Chasmatosporites magnolioides* (Erdtman) Nilsson; Morbey, p. 31, pl. 10, fig. 16; 1977 *Chasmatosporites magnolioides* (Erdtman) Nilsson; Ashraf, pp. 65, 66, pl. 18, fig. 6; 1981 *Chasmatosporites magnolioides* (Erdtman) Nilsson; Achilles, pp. 50, 51, pl. 15, figs 4–6; 1984 *Chasmatosporites magnolioides* (Erdtman) Nilsson; Achilles et al., p. 70, pl. 10, figs 6, 7; 1985 *Chasmatosporites magnolioides* (Erdtman) Nilsson; Hoelstad, p. 129, pl. 4, fig. 17.

However, Guy-Ohlson (1986) examined Nilsson's original preparations and noted that in Swedish microfloras "several of Nilsson's species could not only be determined but also occurred in relatively large numbers of individuals per species per investigated sample". She proposed "to retain the following separately and as designated by Nilsson (1958) instead of lumping them together... for the purposes of local biostratigraphy correlation". Dybkjær (1991) described *Chasmatosporites major* Nilsson 1958 as a separate species and mentioned that slide with Nilsson's type specimen of *Chasmatosporites major* has been lost.

The specimen from Odrowąż is smaller than *Chasmatosporites major* described by Nilsson (1958) and Dybkjær (1991) but is very similar in polar view and structure.

***Chasmatosporites* cf. *rimatus* Nilsson 1958**

Pl. 8, fig. 3

1958 *Chasmatosporites rimatus* sp. nov., Nilsson, p. 55, pl. 4, figs 1–2.

1965 *Chasmatosporites* cf. *Ch. rimatus* Nilsson; Norris, figs 2g, 33.

1966 *Chasmatosporites rimatus* Nilsson; Orłowska-Zwolińska, pl. 11, fig. 59.

1977 *Chasmatosporites rimatus* Nilsson; Schuurman, p. 213, pl. 21, fig. 3.

1981 *Chasmatosporites rimatus* Nilsson; Guy-Ohlson, p. 235.

1985 *Chasmatosporites rimatus* Nilsson; Guy-Ohlson & Malmquist, p. 19, Fig. 2.

1986 *Chasmatosporites rimatus* Nilsson; Guy-Ohlson, p. 33.

D e s c r i p t i o n. Pollen grains almost circular in equatorial outline with irregular edge. Aperture almost circular. Folds around aperture about 2.4–5.6 µm wide. Exine about 1.5–2.5 µm thick with unclear infrastructure because of state of preservation.

D i m e n s i o n s. Length 56 µm, width 56 µm, length of aperture about 48 µm, width of aperture about 28 µm.

M a t e r i a l. 1 pollen grain.

S l i d e. KRAM-P O5/11/95 [104/6.5].

A f f i n i t y. After Balme (1995) dispersed pollen grains from the genus *Chasmatosporites*, are similar to pollen grains of ?Cycadopsida (?Cycadales): Ginkgopsida (?Gnetales).

S t r a t i g r a p h i c a l   d i s t r i b u t i o n. Lower Jurassic to Middle Jurassic (Aalenian) for *Chasmatosporites rimatus* Nilsson 1958 sensu Guy-Ohlson (1986, fig. 4).

G e o g r a p h i c a l   d i s t r i b u t i o n. Antarctica, France, Luxembourg, Poland, and Sweden.

R e m a r k s. Morbey (1975) included *Chasmatosporites rimatus* Nilsson 1958 in *Chasmatosporites magnolioides* (Erdtman 1948) Nilsson 1958.

Genus ***Monosulcites*** Cookson 1947 emend. Couper 1953

T y p e. *Monosulcites minimus* Cookson 1947 ex Couper 1953 (designed by Couper)

Monosulcites minima Cookson 1947, p. 135, pl. 15, fig. 48 (lectotype designed by Potonié 1958, p. 95)

Monosulcites minimus Cookson 1947 ex Couper 1953

Pl. 8, fig. 4

1953 *Monosulcites* aff. *minimus* Cookson; Couper, p. 65, pl. 8, figs 130–131.
1956 cf. *Ginkgo biloba* L.; Rogalska, p. 26, pl. 11, figs 1–2.
1958 *Monosulcites minimus* Cookson; Couper, p. 157, pl. 26, figs 23–25.
1962 *Monosulcites* cf. *M. minimus* Cookson; Jansonius, p. 79, pl. 16, figs 11–13.
1962 *Monosulcites minimus* Cookson; Pocock, p. 77, pl. 13, figs 206–208.
1964b *Monosulcipollenites minimus* Cookson, comb. nov., Levet-Carette, p. 112, pl. 6, figs 33–34.
1965 *Monosulcites* aff. *minimus* Cookson; Norris, p. 258, figs 54–55.
1970 *Monosulcites minimus* Cookson; Kemp, p. 124, pl. 28, figs 27–28.
1970b *Cycadopites minimus* (Cookson) comb. nov., Pocock, p. 108, pl. 26, figs 21–24, 26–28.
1971 *Monosulcites (= Cycadopites) minimus* Cookson; van Konijnenburg-van Cittert, pp. 44, 48, 71, pl. 7, fig. 1.
1975 *Cycadopites (Monosulcites) minimus* (Cookson) Pocock; Arjang, p. 135, pl. 7, fig. 14.
1976 *Monosulcites minimus* Couper; Rogalska, pp. 35, 42, pl. 52, figs 649, 651–654, 657–658, 660, 661.
1977 *Monosulcites minimus* Couper; Lund, p. 67, pl. 6, fig. 10.
1980 *Monosulcites minimus* Couper; Pedersen & Lund, p. 46, pl. 19, figs 4, 6.
1981 *Monosulcites minimus* Couper; Achilles, p. 51, pl. 15, fig. 9.
1981 *Monosulcites minimus* Couper; Guy-Ohlson, p. 235, Fig. 5D.
1982 *Monosulcites minimus* Couper; Guy-Ohlson, p. 17.
1983 *Monosulcites minimus* Cookson; Orłowska-Zwolińska, pp. 32–33, pl. 36, figs 7–9.
1984 *Monosulcites minimus* Couper; Achilles et al., p. 71, pl. 10, figs 11–12.
1985 *Monosulcites minimus* Couper; Guy-Ohlson & Malmquist, p. 20, Fig. 2.
1985 *Monosulcites minimus* Cookson; Lund & Pedersen, p. 382, pl. 6, fig. 3.
1990 *Monosulcites minimus* Cookson; Rauscher & Schmitt, pp. 117, 132, 134, 136, 138, pl. 3, fig. 14.
1991 *Monosulcites minimus* Cookson; Dybkjær, p. 29, pl. 15, fig. 1.

D e s c r i p t i o n. Pollen grains elliptical with rounded or slightly pointed ends in equatorial outline. Sulcus extending almost along the whole length of pollen grain with folds about 4–6 μm wide. Exine smooth and about 1 μm thick.

D i m e n s i o n s. Length about 36–38.4 μm, width 18.4–29.6 μm.

M a t e r i a l. 2 pollen grains.

S l i d e s. KRAM-P O8/60/95 [102/6.5], O8/1 [93.5/12.5].

A f f i n i t y. Couper (1958) considered that dispersed *Monosulcites minimus* pollen grains are similar to pollen grains from fossil ginkgoalean, cycadalean and bennettitalean fructifications. He noted that many specimens of *Monosulcites minimus* from the Upper Deltaic Series (Middle Jurassic) of Yorkshire are almost certainly of ginkgoalean origin and very similar to pollen grains of the fossil *Ginkgo huttoni* (Sternberg) Heer which is very abundant in this series (Couper 1958). He wrote also that pollen grains of the Jurassic *Ginkgo huttoni* are very similar to those of recent *Ginkgo biloba* (Couper 1958). According to van Konijnenburg-van Cittert (1971) dispersed *Monosulcites (= Cycadopites) minimus* included pollen of the Ginkgoales, Bennettitales and Cycadales and she "believes that *C. minimus* pollen grains of ginkgoalean origin can be distinguished from *C. minimus* pollen grains of cycadalean or bennettitalean origin because of more elongate outline and acute ends of the pollen grains". Balme (1995) mentioned the similarity of dispersed *Monosulcites minimus* and pollen grains from Bennettitales found in situ but in the summary (Balme 1995) placed the affinity dispersed *Monosulcites* in Liliopsida (?Arecales) just as on p. 248 for in situ material. Balme (1995) placed cycadalean, ginkgoalean and bennettitalean type pollen in the dispersed genus *Cycadopites*.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Rhaetic – Tertiary.

G e o g r a p h i c a l d i s t r i b u t i o n. Antarctica, Canada, Denmark, France, Germany, Great Britain, Greenland, Iran, New Zealand, Poland, Sweden.

R e m a r k s. Some others genera of dispersed monocolpate pollen grains were been created for specimens which resembles in situ pollen grains from Gymnospermae (Ginkgoales, Bennettitales and Cycadales) and also from Angiospermae (e.g. Monocotyledones, Palmae). Jansonius & Hills (1976) wrote about synonymy of these genera.

Monosulcites subgranulosus Couper 1958

Pl. 8, fig. 5

1958 *Monosulcites subgranulosus* sp. nov., Couper, p. 158, pl. 26, figs 28–30.
1965 *Cycadopites subgranulosus* (Couper) comb. nov., Clarke, p. 312, pl. 39, figs 16–17.
1965 *Ginkgocycadophytus* cf. *G. subgranulosus* (Couper) comb. nov., Norris, p. 257, figs 4e, 58–60.
1971 *Monosulcites subgranulosus* Couper; van Konijnenburg-van Cittert, p. 44, pl. 8, fig. 4.
1973 *Cycadopites subgranulosus* (Couper) Clarke; Orbell, p. 17.
1990 *Monosulcites subgranulosus* Couper; Rauscher & Schmitt, pp. 117, 132, 134, 136.

D e s c r i p t i o n. Pollen grains elliptical with rounded or pointed ends in equatorial outline. Sulcus with rounded ends extending along the whole length of pollen grain. Exine granulate, about 1 µm thick.

D i m e n s i o n s. Length 51–52 µm, width 22–27 µm.

M a t e r i a l. 2 pollen grains.

S l i d e s. KRAM-P O8/62/95 [97/2.5], O17/1 [104.5/7.5].

A f f i n i t y. Couper (1958) wrote that affinity of *Monosulcites subgranulosus* is not known. Norris (1965) suggested affinities with Cycadaceae. According to van Konijnenburg-van Cittert (1971) dispersed *M. subgranulosus* Couper “include mostly bennettitalean grains”.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Keuper – Lower Jurassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Antarctica, France, Great Britain, and Poland.

R e m a r k s. This specimen resembles also *Monosulcites punctatus* Orłowska-Zwolińska 1966 but proportion length to width equals 3:1 when adequate proportion for the specimen from Odrowąż equals 2:1.

Subturma Polyplicates Erdtman 1952

Genus ***Ephedripites*** Bolch. 1953 ex Potonié 1958

T y p e. *Ephedripites mediolobatus* Bolch. 1953 ex Potonié 1958

Ephedripites mediolobatus Bolch. 1953, p. 60, pl. 9, fig. 15 (type indicated by Potonié 1958, p. 88)

Ephedripites tortuosus Mädler 1964

Pl. 8, fig. 6

1964b *Ephedripites tortuosus* sp. nov., Mädler, p. 194, pl. 3, fig. 17.
1967 *Ephedripites tortuosus* Mädler; Schulz, p. 604, pl. 22, figs 1–3, pl. 26, fig. 5.
1972 *Gnetaceapollenites tortuosus* (Mädler) comb. nov., Fisher 1972, pl. 8, fig. 7.
1975 *Gnetaceapollenites tortuosus* (Mädler 1964) Fisher 1972; Morbey, pl. 10, figs 7–8.
1977 *Ephedripites torosus* Mädler; Lund, p. 69, pl. 7, fig. 1.
1989 *Ephedripites tortuosus* Mädler; Weiss, p. 123, pl. 10, fig. 11.

D e s c r i p t i o n. Pollen grain polyplicate, outline oval without apertures. Plicae smooth, about 3 to 5.6 µm wide, oblique in relation to the longer axis of pollen. The outer layer of plicae, which are almost parallel to each other, lies on the inner layer of the plicae. The angle between the pliceae of both layers is 50–60°. In the outer layer 5 plicae are visible and in the inner 7 plicae.

D i m e n s i o n s . Length 54 µm, width 26.4 µm.

M a t e r i a l. 1 pollen grain.

S l i d e. KRAM-P O8/49 [103.5/5.5].

A f f i n i t y. Bolkhovitina (1953) wrote that *Ephedripites mediolobatus* sp. nov. is similar to pollen grains of recent species *Ephedra dystachya* L. and *E. foliata*. The same author (Bolkhovitina 1961) suggested that *Ephedripites mediolobatus* is very similar to some spores of Schizaeaceae and treated this species as synonym *Schizaea certa* (Bolch. 1956) Bolch. 1961. However, Potonié (1958) indicated *Ephedripites mediolobatus* Bolch. 1953 as type species for the genus *Ephedripites* Bolch. 1953 ex Potonié 1958 and according to Jansonius and Hills (1976, No. 944) the generic name *Ephedripites* is valid. Schulz (1967) placed the affinity of dispersed *Ephedripites tortuosus* Mädler in

Ephedraceae or Schizeaceae and Balme (1995) in Ginkgopsida (Peltaspermales, Gnetales). Van Konijnenburg-van Cittert (1992) described in situ pollen grains from microsporophyll *Piroconites kuespertii* (Gothan) van Konijnenburg-van Cittert (Gnetales, Chlamydospermae) from the Liassic of Germany comparable to dispersed *Ephedripites tortuosus* Mädler.

Stratigraphical distribution. Rhaetian – Lower Jurassic.

Geographical distribution. Austria, Denmark, Germany, Great Britain, Poland, and Sweden.

Remarks. *Ephedripites tortuosus* Mädler 1964b resembles *Ephedripites praeclarus* (Khlonova) Krutzsch (Jansonius & Hills 1976, No. 947) described from the Upper Cretaceous but in *E. praeclarus* the ribs (plicae) are forming a pattern like a rhomboid net and in *E. tortuosus* Mädler one layer of plicae lies over the second layer.

Some authors described similar specimens under the name *Gnetaceapollenites tortuosus* but according to Jansonius amd Hills (1976, No. 1139) the name *Gnetaceapollenites* is to be avoided as a nomen ambiguum.

Turma Kryptoaperturates Potonié 1960

Subturma Circumpolles Pflug 1953 emend. Klaus 1960

Genus ***Classopollis*** Pflug 1953 emend. Pocock & Jansonius 1961

Type. *Classopollis torosus* (Reissinger) Couper 1958, p. 156, pl. 28, fig. 5 (neotype designated by Morbey 1975)

Classopollis torosus (Reissinger 1950) Couper 1958

Pl. 8, figs 7–19, Pl. 9, figs 1–3, 6, 7, 10

1950 *Pollenites torosus* sp. nov., Reissinger, pp. 114–115, pl. 14, fig. 20.
1953 *Classopollis declassis* sp. nov., Pflug, p. 92, pl. 16, figs 16–19.
1953 *Classopollis classoides* sp. nov., Pflug, p. 91, fig. 4, j–m, pl. 16, figs 20–25, 29–37.
1953 *Circumpollis pharisaeus* sp. nov., Pflug, p. 92, pl. 17, figs 28–30.
1953 *Circumpollis philosophus* sp. nov., Pflug, p. 92, pl. 17, figs 31–36.
1953 *Canalopollis maturus* sp. nov., Pflug, p. 93, pl. 17, figs 48–60.
1954 *Cheirolepidiaceae*, Rogalska, p. 23, pl. 11, figs 1–10.
1955 *Classopollis* cf. *classoides* Pflug; Krutzsch, p. 72, pl. 2, fig. 23.
1955 *Classopollis* Pflug; Krutzsch, p. 74, pl. 4, fig. 42.
1955 cf. *Classopollis* Pflug; Krutzsch, p. 74, pl. 4, figs 51–52.
1955 Un-named specimens, Krutzsch, p. 74, pl. 4, figs 43–44, 48–50, 53–54.
1957 *Classopollis* cf. *torosus* Reissinger, Balme, pp. 37, 38, pl. 11, figs 114–119.
1958 *Classopollis torosus* Reissinger; Couper, pp. 156, 157, pl. 28, figs 2–7.
1958 *Classopollis torosus* (Reissinger) Couper; Nilsson, pp. 74, 75, pl. 7, figs 6–8.
1960 *Corollina torosus* Reissinger comb. nov., Klaus, pp. 167–168.
1962 *Classopollis torosus* (Reissinger) Balme; Chaloner, pp. 19–23, pl. 2, figs 1, 2.
1962 *Classopollis classoides* (Pflug) Pocock & Jansonius; Pocock, p. 71, pl. 11, figs 171–175.
1963 *Classopollenites classoides* (Pflug) Pocock & Jansonius, nov. nom., Danzé-Corsin & Laveine, pp. 105–106, pl. 11, figs 3–6.
1964a *Classopollenites classoides* (Pflug) Pocock & Jansonius; Levet-Carette, p. 279, pl. 11, figs. 9–11.
1965 *Classopollis torosus* (Reissinger) Couper; Döring, p. 61, pl. 17, fig. 3.
1965 *Classopollis torosus* (Reissinger) Balme; Norris, pp. 259, 260, figs 64–66, 68.
1965 *Classopollis classoides* (Pflug) Pocock & Jansonius; Playford & Dettmann, p. 159, pl. 17, figs 59–60.
1965 *Classopollis torosus* (Reissinger) Couper; Wall, p. 166.
1967 *Classopollis torosus* (Reissinger) Balme; Norris, p. 110, pl. 18, fig. 24.
1970b *Classopollis classoides* (Pflug) Pocock & Jansonius; Pocock, pp. 103–104, pl. 23, figs 9, 12, 14, 22.
1970 *Classopollis torosus* (Reissinger) Couper; Kemp, p. 125, pl. 29, fig. 12.
1970 *Classopollis chateaunovi* sp. nov., Reyre, p. 313, pl. 55, figs 11–14.
1972 *Classopollis torosus* (Reissinger) Balme; Fisher, pl. 8, figs 15–16.
1973 *Classopollis torosus* (Reissinger) Balme; Orbell, p. 16, pl. 1, fig. 7.
1975 *Classopollis torosus* (Reissinger) Balme emend., Morbey, pp. 32, 34, pl. 12, figs 1–4, pl. 13, figs 3–5.
1975 *Classopollis chateaunovi* Reyre; Filatoff, p. 85, pl. 26, figs 10–11, pl. 27, figs 8–11, pl. 28, figs 3, 4.
1976 *Classopollis torosus* (Reissinger) Couper; Rogalska, pp. 24, 41, 55, 57, pl. 48, figs 598–600, pl. 49, figs 601–606, 608–610.
1977 *Classopollis torosus* (Reissinger) Morbey; Ashraf, pp. 64–65, pl. 17, figs 11–15.

1977 *Corollina torosus* (Reissinger) Klaus; Lund, pp. 69, 70, pl. 7, figs 2–4b.
1980 *Corollina torosus* (Reissinger) Klaus; Pedersen & Lund, p. 46, pl. 21, figs 1–2.
1981 *Corollina torosus* (Reissinger) Klaus; Achilles, pp. 48–49, pl. 14, figs 4–5.
1981 *Corollina torosus* (Reissinger) Klaus; Guy-Ohlson, p. 235, Fig. 4I–J.
1984 *Corollina torosus* (Reissinger) Klaus; Achilles et al., pp. 68–69, pl. 9, figs 16–17.
1985 *Corollina torosus* (Reissinger) Klaus; Hoelstad, p. 129, pl. 4, fig. 19.
1985 *Corollina torosus* (Reissinger) Klaus; Lund & Pedersen, p. 382.
1989 *Classopollis torosus* (Reissinger) Morbey; Weiss, pp. 119–120, pl. 10, figs 6–7.
1991 *Corollina torosus* (Reissinger) Klaus; Dybkjær, p. 29, pl. 15, figs 2–5.

Description. Pollen grains circular to oval in polar view with circular cryptopore (3.2–4.8 µm in diameter) on the distal pole and triangular scar with concave sides on the proximal pole. Subeqatorially to the distal side there is circular groove or thinning, parallel to the equator of pollen grain – the rimula – about 1 µm wide. Equatorial region with an internal thickening 3.2–5.6 µm wide. The internal equatorial striae are not clearly visible in equatorial view. The surface of the exine visible in the SEM is granulate to verrucate.

Dimensions. Diameter (usually about 30 µm) 20–32.8 µm (20 specimens measured).

Material. 197 pollen grains.

Slides. KRAM-P O5/1/95 [96.5/2, 98/16, 97.5/4, 100/20], O5/2/95 [94.5/5, 95/3 (2 specimens), 95.5/6, 96.5/4.5, 97/8.5, 97.5/5, 97.5/8, 98/10.5, 98.5/15, 100/16, 100/18 (2 specimens), 102.5/12], O5/3/95 [107/2.3, 108/3, 109/2], O5/5/95 [110/8.5], O5/6/95 [97/10.5, 98.1/4, 99/5.5, 102/3.5], O5/10/95 [97/13, 102.1/14.2, 106/9, 102.5/17, 102/19.5, 108/9.5, 111.2/15, 104/18, 104.5/13, 107.5/13.5], O5/11/95 [93/12, 94.5/15.5, 94.5/16.5 (2 specimens), 96.5/7.5, 98/1.5, 99.5/3, 100/3, 101.5/7, 102/8, 102/13.5, 104/6 (2 specimens), 105.5/10.5], O5/12/95 [92/12.5 (2 specimens)], O5/13/95 [97/4 (2 specimens), 97/6, 98.8/9.5, 103/16, 110/8, 111/4, 113/7.5], O5/14/95 [109/18], O5/15/95 [98/2.5 (2 specimens), 103/1.5], O6/1/6 [98.5/4, 102.5/5, 103.1/2.5, 105/7, 108/7.5, 109.5/6, 110/11(2 specimens), 111/10, 114/12], O6/2/1 [100/3.5, 100/17.5, 103/3, 106/2.5, 109.5/17.5, 110/3, 113.2/6, 114/2 (2 specimens), 114.5/2, 114.8/5 (2 specimens), 115/17], O8/1 [92.5/7.5, 93.5/5, 94/3, 94.5/12, 94.5/14, 95/6.5, 98/16.5 (2 specimens), 107.5/4.5, 107.5/13], O8/2 [93/9, 95.5/8.5, 98.5/11, 90.9/7.5 (3 specimens), 100/13.5 (2 specimens), 101/17.5, 102.5/9, 103.5/9, 105/8 (2 specimens), 108/12.5, 109/14, 109/15.5], O8/3 [95/18, 104/19, 110.7/7, 110.7/18, 114.5/20, 115.5/16], O8/4 [97/12, 99.5/17.5], O8/5 [93.5/17 (2 specimens), 94/17.5, 95/13, 95/15.5, 95.5/16, 96/16.5, 97/12.5], O8/18 [94/4.5, 96/13, 98/18.5, 98.5/18.5, 99/15, 99.5/18.5 (2 specimens), 100/5, 101.5/13, 103/21, 104/6, 104.5/13.5, 105.5/16.5, 107.5/8.5, 109/8 (2 specimens)], O8/46 [105/4, 105.5/12.5], O8/47 [95/1], O8/48 [95/8.5, 97/4, 99/4, 101/3, 101.5/4.5 (2 specimens), 102.5/2 (2 specimens), 102.5/5], O8/49 [104/4, 106/12.5, 108.5/6.5, 109/8.5], O8/50 [98/3], O8/52 [94/4.5], O8/54 [102.5/3, 104/3, 104.5/3, 104.2/3.5, 98/3], O8/58 [97/16, 97.5/10, 99.1/15 (2 specimens)], O8/59 [98.2/3.5, 108.9/7.5], O8/62 [104/3], O9/1/1 [95.5/13.5], O9/2/5 [101.5/6, 103.5/13 (2 specimens), 104.5/14.5], O9/2/8 [94/11.5, 105.5/12.5], O9/2/6 [99.5/8 (3 specimens)], O10/1 [104.5/17, 107.5/7, 108.5/10.5, 111.5/14], OS_2/4 [105.5/12.5 (2 specimens), 109.8/7, 110/14.5], OS_2/8 [108/19, 113/19], OS_2/13 [92.5/20, 96/17], O17/1 [96.5/13.5].

Affinity. In situ pollen grains similar to dispersed *Classopollis* (= *Corollina* Malyavkina) pollen grains have been found in male cones attached or associated with vegetative shoots of extinct conifer family Cheirolepidiaceae. *Classopollis* pollen grains are known from male cones attached to or associated with the genera *Brachyphyllum* Lindley & Hutton ex Brogniart (pro parte), *Cupressinocladus* Seward (pro parte), *Frenelopsis* Schenk, *Hirmeriella* Hörhammer (= *Cheirolepidium* Takhtajan) *Pagiophyllum* Heer (pro parte), *Pseudofrenelopsis* Nathorst and *Tomaxellia* Archangelsky. Unattached male cones containing *Classopollis* pollen grains are known as *Classostrobus* Alvin, Spicer & Watson (Alvin 1982, van Konijnenburg-van Cittert 1971, van Konijnenburg-van Cittert 1987, Watson 1988). Hörhammer (1933) illustrated pollen grains in tetrads and groups which were obtained from male cones attached to *Cheirolepis muensteri* Schenk – now *Hirmeriella muensteri* (Schenk) Jung – from Germany. Harris (1957) investigated a Rhaeto-Liassic flora from South Wales. He described pollen grain from charred fragments of male cones associated with *Cheirolepis muensteri* (Schenk) Schimper shoots. Chaloner (1962) found fragments of *Cheirolepis muensteri* with associated pollen grains determined by him as *Classopollis torosus* (Reissinger) Balme, from southern England. Jung (1968) illustrated a tetrad of pollen grains from the male cone of *Hirmeriella muensteri* (Schenk) Jung from Rhaeto-Liassic of Germany. These pollen grains are according to him similar to *Classopollis classoides* dispersed pollen grains. *Classopollis* pollen grains have been also found by Clement-Westerhof and van Konijnenburg-van Cittert (1991) in *Hirmeriella muensteri* (Schenk) Jung male cones from the Liassic sediments from Germany. Balme (1995) attributed *Corallina* (invalid change in spelling *Corollina* = *Classopollis*) pollen grains to Coniferopsida (Cheirolepidiaceae).

Reymanówna (1992) wrote that *Hirmeriella muensteri* (Schenk) Jung shoots covered with leaves, cone scales and male cones are the most frequent plant remains in the Odrowąż macroflora. Reymanówna and later the present author obtained single pollen grains and tetrads of those from male cones attached or associated with *Hirmeriella muensteri* (Schenk) Jung from Odrowąż (Pl. 10). These pollen grains are identical with dispersed *Classopollis* pollen grains described above from Odrowąż.

Description of in situ *Classopollis* pollen grains from Odrowąż:

Pollen grain oval to circular in polar view. Circular cryptopore 4.8 µm in diameter on the distal side and triangular scar with concave sides on the proximal pole is visible on some specimens (Pl. 10, fig. 3). Subequatorially to the distal side there is circular groove or thinning, parallel to the equator of the pollen grain – the rimula, about 1 µm wide. Equatorial region with internal thickening, 4.0–4.8 µm wide. The surface of the exine visible in the SEM is granulate (Pl. 10, fig. 5).

Dimensions. Diameter 30.4–36.8 × 24.8–30.4 µm

Stratigraphical distribution. Late Triassic – Cretaceous.

Geographical distribution. Afghanistan, Antarctica, Australia, Austria, Canada, Denmark, France, Great Britain, Germany, Greenland, Iran, Poland, Sweden. Reported also from America, Israel, Italy, Libya, New Guinea, the Netherlands, Norway (Weiss 1989).

Remarks. Pollen grains similar to the described above are known as *Classopollis* Pflug 1953 or *Corollina* Malyavkina 1949. It is not clear which name has priority but the most authors prefer the name *Classopollis* because the figures given by Malyavkina are of such poor quality that it is very difficult to say if the genus *Corollina* is validly published. These pollen grains are one of the best known fossil pollen grains. Numerous authors investigated *Classopollis* by light, transmission and scanning electron microscopy e.g. Couper (1958), Chaloner (1962), Pettitt and Chaloner (1964), Reyre (1970), Srivastava (1976), Taylor and Alvin (1984), Pocock et al. (1990).

The correct name of the type species of the genus *Classopollis* Pflug is controversial because of poor description and illustration in Reissinger's (1950) paper and inadequate description in Pflug's (1953) paper. Some authors (e.g. Pocock & Jansonius 1961, Jansonius & Hills 1976, no. 504, Srivastava 1976) prefer *Classopollis classoides* Pflug 1953 but others (e.g. Couper 1958, Chaloner 1962, Morbey 1975) give *Classopollis torosus* (Reissinger 1950) Balme 1957 as the type species of this genus. Morbey (1975) selected the specimen illustrated by Couper (1958, pl. 28, fig. 5) as neotype until the time a lectotype is designated because Reissinger's holotype (1950, pl. 14, fig. 20) is no longer in existence according to Pocock and Jansonius (1961). The name *Classopollis torosus* sensu Morbey 1975 is used in this paper because of the earlier date of Reissinger's (1950) than Pflug's (1953) publication.

Specimens from Odrowąż visible in SEM (Pl. 9, fig. 10, Pl. 10, fig. 5) are similar but not identical with *Classopollis chateaunovi* Reyre 1970 from Hettangian of Massif Central, France (Reyre 1970, p. 313, pl. 55, figs 11–14).

cf. ***Classopollis torosus*** (Reissinger 1950) Couper 1958, tetrads

Pl. 9, figs 4, 5, 8, 9

Description. Tetrads consisting of *Classopollis* pollen grains in tetrahedral configuration. Specimens in tetrads always folded with a more or less regular thickening around the equator. Cryptopore and rimula are visible on some specimens. Striations are not clearly visible except on the photo (Pl. 9, fig. 7).

Dimensions. The whole tetrad maximum 62.4 × 48 µm (3 complete tetrads measured), single specimen in tetrad: diameter in polar view 26.4–29.6 µm, in equatorial view 24 × 33.6 µm.

M a t e r i a l. 1 group of pollen grains (6 specimens), 8 tetrads and 5 incomplete tetrads consisting of 3 specimens.

S l i d e s. KRAM-P O5/11/95 [104.5/8 (group of pollen grains consisting of 6 specimens)], O5/2/95 [97/6 (tetrad)], O5/6/95 [99/4 (tetrad)], O5/10/95 [96.5/20 (tetrad), 102.5/20 (incomplete tetrad consisting of 3 specimens)], O5/11/95 [96/4 (incomplete tetrad consisting of 3 specimens), 102/7 (tetrad), 102.5/3.5 (incomplete tetrad consisting of 3 specimens)], O6/2/1 [113/14.5 (incomplete tetrad consisting of 3 specimens)], O8/4 [100/19 (tetrad)], O8/18 [98.5/18 (tetrad)], O8/45/95 [109/4.5 (incomplete tetrad consisting of 3 specimens), 111/6 (tetrad)], O10/1 [103/12 (tetrad)].

A f f i n i t y. Coniferales from the family Cheirolepidiaceae, probably *Hirmeriella muensteri* (Schenk) Jung.

S t r a t i g r a p h i c a l d i s t r i b u t i o n. Lower Liassic.

G e o g r a p h i c a l d i s t r i b u t i o n. Poland.

R e m a r k s. Probably these tetrads and groups of pollen grains are consisting of described above *Classopollis torosus* (Reissinger) Couper pollen grains.

COMPARISION OF THE MICROFLORA WITH THE MACROFLORA FROM ODROWĄŻ

In the flora of Odrowąż the major plant groups of the microflora correspond with plant groups represented in the macroflora (Table 3). However, sporomorphs of Bryophyta, Lycophyta and some Coniferophyta have no counterparts in the macroflora. This difference may be explained by the fact that sporomorphs originate mostly from a longer distance transport, while macroscopic plant remains represent first of all the vegetation of the sedimentation basin and its close surroundings.

Table 3. Comparison of macro and microfossils.

Macrofossils	Microfossils
Bryophyta, ?Sphagnales	
no coresponding macrofossils	*Rogalskaisporites cicatricosus* (Rogalska 1954) Danzé-Corsin & Laveine 1963
Anthocerophyta, ?Anthocerotaceae	
no coresponding macrofossils	*Foraminisporis jurassicus* Schulz 1967
Lycophyta, ?Lycopodiales	
no coresponding macrofossils	*Foveotriletes* sp., *Leptolepidites* sp., *Lycopodiacidites rugulatus* (Couper 1958) Schulz 1967 (or Ophioglossales?), *Lycopodiumsporites cerniidites* (Ross 1949) Delcourt & Sprumont 1955 (or Sellaginellales?), *Lycopodiumsporites semimuris* Danzé-Corsin & Laveine 1963, *Lycopodiumsporites* sp.
?Selaginellales	
no coresponding macrofossils	*Uvaesporites argenteaeformis* (Bolch. 1953) Schulz 1967, cf. *Uvaesporites* sp.
Isoëtales	
no coresponding macrofossils	*Aratrisporites minimus* Schulz 1967
Sphenophyta, Equisetales	
Neocalamites sp. 1 (stem) *Equisetites* sp. (stem)	*Calamospora tener* (Leschik 1955) Mädler 1964
Pteridophyta, Osmundales, Osmundaceae	
Todites princeps (Presl) Gothan (leaves and rhizoms)	*Todisporites minor* Couper 1958, cf. *Todisporites* sp.?, *Osmundacidites* sp.
Filicales, Matoniaceae	
Phlebopteris angustiloba (Presl) Hirmer & Hoerhammer (leaves)	*Matonisporites* sp. 1, *Matonisporites* sp. 2
Filicales, Dipteridaceae	
Thaumatopteris schenki Nathorst (leaves) *Dictyophyllum* sp.	cf. *Deltoidospora* sp.

Table 3. Continued

Macrofossils	Microfossils
	Pteridophyta of unknown affinity
Woodwardites microlobus Schenk (leaves) and leaves not yet determined	*Acanthotriletes varius* Nilsson 1958, *Apiculatisporis ovalis* (Nilsson 1958) Norris 1965, *Auritulinasporites triclavis* Nilsson 1958, *Auritulinasporites* sp., *Conbaculatisporites mesozoicus* Klaus 1960, *Contignisporites problematicus* (Couper 1958) Döring 1965 (Pteridaceae, Dicksoniaceae or ?Schizaeaceae), *Neochomotriletes triangularis* (Bolch. 1956) Reinhardt 1961 (?Lophosoriaceae), Maratttiales, ?Marattiaceae, *Marattisporites* sp. 1, *Marattisporites* sp. 2
	Filicales, Cyatheaceae, Dicksoniaceae, *Cyathidites minor* Couper 1953, cf. *Cyathidites australis* Couper 1953, cf. *Cyathidites* sp.
	Filicales, ?Dicksoniaceae ?*Cibotiumspora jurienensis* (Balme 1957) Filatoff 1975
	Filicales, ?Cyatheaceae, Matoniaceae, Dicksoniaceae, *Concavisporites toralis* (Leschik 1955) Nilsson 1958
	Filicales, Gleicheniaceae, subfamily ?Gleichenioideae, *Plicifera delicata* (Bolch. 1953) Bolch. 1966
	Pteridospermophyta, Caytoniales
Caytonia sp. (seed)	*Vitreisporites pallidus* (Reissinger 1950) Nilsson 1958
	Pteridospermophyta, ?Corystospermales
Pachypteris lanceolata Brongniart (leaves)	*Alisporites* cf. *diaphanus* (Pautsch 1958) Lund 1977, cf. *Alisporites microsaccus* (Couper 1958) Pocock 1962, *Alisporites robustus* Nilsson 1958, *Alisporites* cf. *robustus* Nilsson 1958, *Alisporites thomasii* (Couper 1958) Nilsson 1958
	Cycadophyta, Cycadales
no coresponding macrofossils	*Chasmatosporites apertus* (Rogalska 1954) Nilsson 1958, *Chasmatosporites* cf. *elegans* Nilsson 1958 *Chasmatosporites hians* Nilsson 1958, *Chasmatosporites major* Nilsson 1958, *Chasmatosporites* cf. *rimatus* Nilsson 1958
	Cycadophyta, Bennettitales (= Cycadeoidales), Cycadeoidaceae
Otozamites brevifolius (leaves), *Pterophyllum* sp. (leaves)	*Monosulcites subgranulosus* Couper 1958
	Ginkgophyta, Ginkgoales
Schmeissneria microstachys (Presl) Kirchner & van Konijnenburg-van Cittert 1994	*Monosulcites minimus* Cookson 1947
	Gnetophyta, Gnetales
no coresponding macrofossils	*Ephedripites tortuosus* Mädler 1964b
	Coniferophyta, Coniferales, ?Ullmanniaceae
Swedenborgia sp. (scales and cones), *Podozamites* sp. 1 (leaves)	
	Coniferophyta, Coniferales, Cheirolepidiaceae
Hirmeriella muensteri (Schenk) Jung (stem with leaves, female and male cones, ovuliferous scales)	dispersed, *Classopollis torosus* (Reissinger 1950) Couper 1958, *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958 and *Classopollis* in situ pollen grains
	Coniferophyta, Coniferales, Taxodiaceae
no coresponding macrofossils	*Perinopollenites elatoides* Couper 1958
	Coniferophyta, Coniferales, Araucariaceae
no corresponding macrofossils	cf. *Araucariacites australis* Cookson 1947 ex Couper 1953, cf. *Araucariacites* sp.
	?Coniferales
	?*Pinuspollenites labdacus* var. *arcuatus* Danzé-Corsin & Leveine 1963, *Pityosporites minimus* (Couper 1958) comb. nov., cf. *Pityosporites minimus* (Couper 1958) comb. nov.
	Spheripollenites psilatus Couper 1958, *Spheripollenites subgranulatus* Couper 1958, *Spheripollenites* sp.
Macrofossils with unknown affinity	Microfossils with unknown affinity
Leaves not yet determined	*Cingutriletes* sp., cf. *Inaperturopollenites* sp., *Latosporites* sp., cf. *Lycospora salebrosacea* (Malj. 1949) Schulz 1967, *Platysaccus nitidus* Pautsch 1971

PRESUMED WAYS OF SPOROMORPH DISPERSION OF PLANTS FOUND IN JURASSIC SEDIMENTS FROM ODROWĄŻ

Pollen grains of extant angiosperms may be dispersed by wind, water, insects of various orders, birds, bats, and even nonflying mammals, such as placental and marsupial mice, flowers may also be self-pollinated (Cronquist 1988).

The following characters of angiosperm pollen grains, after Faegri and van der Pijl (1966), are correlated with wind transportation:

– relatively small size, 20–30(–60) µm, though wind transported pollen grains of conifers with air-sacs may be of much larger size,

– thin pollen grain walls,

– smooth or almost smooth surface of exine,

– lack of sticky substances on the surface of the exine,

– production of pollen grains in large quantities.

On the other hand, pollen grains transported by animals, according to the same authors tend to be:

– of large size,

– thick-walled,

– variously sculptured,

– with sticky substances on the surface of the exine.

There is, however, no strict border-line between those two types and e.g. certain pollen grains transported by wind are sculptured, while some transported by insects are smooth. In addition, certain species e. g. *Solidago speciosa* may be pollinated partly by wind and partly by insects (Cronquist 1988).

It seems very likely that also non-angiospermous pollen grains showed similar adaptations to wind or animal transportation. Therefore, the characters of some of the fossil pollen grains and spores from Odrowąż were examined from point of view of their presumed association with particular kinds of dispersion.

Among the pollen grains found in Odrowąż the most frequent are those of *Classopollis*, produced by the *Hirmeriella muensteri*, the conifer tree from the extinct family Cheirolepidiaceae. The structure of *Classopollis* pollen grains has no analogues in recent pollen flora. Nevertheless, the small size and the large amount of pollen produced by male cones of *Hirmeriella* suggest wind dispersal. It is interesting to note that *Classopollis* pollen grains tend to remains in tetrads, even if treated by standard palynological preparation methods, which rather tend to break the tetrads up. According to Hughes (1976) this clustering of *Classopollis* in tetrads "appears to provide for asymetrical distribution of potential germinal apertures", though it could also have a special function. It is possible that not only wind but also insects took part in the transportation of *Classopollis* pollen grains (Alvin 1982, Hughes 1976).

Relatively rare in the investigated sediment are monosulcate grains from the genera *Monosulcites* and *Chasmatosporites*, which resemble pollen grains found in fructifications of Ginkgoales, Cycadales, and Bennettitales. The extant *Ginkgo* is wind pollinated (Chamberlain 1935 in Crane 1986). The cycads are regarded as wind pollinated plants, but there exist also observations of cycad-insect interaction. Recently these authors observed that in cultivation the cycad *Zamia furfuracea* is pollinated by the small weevil *Rhopalotria mollis* (Norstog & Fawcett 1989). In Bennettitales, in connection with the structure of their flowers and probable nectar production, insect pollination is generally suggested, in particular in *Williamsonia* and *Cycadeoidea* (Crane 1986). However, morphological characters of a fossil pollen grain do not indicate in what way the pollen was transported.

In the sediment from Odrowąż there occur also pollen grains of seed ferns, small in size pollen of *Vitreisporites pallidus*, produced by the *Caytonia* plants and the larger pollen grains from the genus *Alisporites*, which are usually linked with the Corystospermae. Pollen grains of those both taxa have air sacs, which suggest wind pollination. It is well-known fact that pollen grains of *Caytonia* were produced in large quantities, which may also confirm their wind dispersal. Nevertheless, the *Caytonia* pollen grains together with fruits, seeds and leaf remains were found in coprolites, therefore they possibly were eaten by animals (Retallack & Dilcher 1988).

Among the spores from Jurassic of Odrowąż, the Pteridophyte spores occur most frequently. In this group of plants the dispersion of spores usually takes place with the help of wind (Faegri & van der Pijl 1966, Crane 1986), whereas in aquatic species water dispersion prevails. In certain families spores are actively dispersed by the movements of the dehiscing sporangia (Faegri & van der Pijl 1966). Various animals, e.g. ants, may also take part in spore dispersal, for instance spores of certain tropical ferns (Docters van Leuven 1929 in Faegri & van der Pijl 1966).

In the investigated sediment from Odrowąż the majority of spores, such as e.g. *Plicifera delicata*, *Matonisporites* or *Cyathidites* are smooth, although there occur also, though in smaller quantities, sculptured spores of *Marattisporites*, *Osmundacidites*, *Contignisporites*, and *Conbaculatisporites*. Both spore types were probably transported by wind.

Morphological characteristics of Jurassic pollen grains and spores found in Odrowąż indicate that most of them were probably dispersed by wind. It cannnot, however, be excluded that insects or other animals took part in the dispersal of some of them, for instance of *Vitreisporites pallidus* and *Monosulcites* pollen grains or some Pteridophyta spores.

STRATIGRAPHICAL POSITION OF THE INVESTIGATED SEDIMENTS FROM ODROWĄŻ ON THE BASIS OF SPORE AND POLLEN ANALYSIS

Palynological investigations from the Holy Cross Mountains area were carried out since 1956 (Rogalska 1956, 1976, Marcinkiewicz et al. 1960). The megaspore species *Nathorstisporites hopliticus* Jung (= megaspore from *Lycostrobus scotti* Nathorst) was determined by Marcinkiewicz (1957, Marcinkiewicz et al. 1960) from the sediments of Odrowąż. This megaspore is regarded as an index species for the Lower Liassic sediments.

The sporomorph assemblage from Odrowąż, dominated by *Classopollis torosus* (Reissinger) Couper pollen grains, *Aratrisporites minimus* Schulz spores (similar to *Lycostrobus scotti* Nathorst microspores), and smooth spores from the genera *Concavisporites* and *Cyathidites*, is very similar to the composition of the *Concavisporites-Duplexisporites-Aratrisporites minimus* (= Lias α_1 and α_2) zone from Franconia in Germany (Achilles 1981). According to Achilles (1981) this zone corresponds to:

– *Pinuspollenites-Trachysporites* zone from northwestern Germany and south Scandinavia (Lund 1977),

– *Heliosporites* zone in Great Britain (Orbell 1973),

– Phase 5 in northern France and southern Luxembourg (Schuurman 1977) and also in Alps in Austria and in southern Germany (Schuurman 1979),

– FG subzone in Kendelbachgraben in Austria (Morbey 1975).

On the basis of the similarity with pollen and spore zones and the fact that according to Rogalska (1976) *Aratrisporites minimus* Schulz is an index species for the Lower Liassic it can be assumed that the sediments from the Odrowąż outcrop are of the Lower Liassic (Hettangian) age. This age estimation confirms the results of geological investigations (Karaszewski 1962, Pieńkowski 1983, Pieńkowski & Gierliński 1987, Pieńkowski 1998, Pieńkowski 2004) as well as the conclusions based on the investigations of macroflora from the same locality (Reymanówna 1991 b, Wcisło-Luraniec 1991 a).

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PLATES

Plate 1

LM microphotographs ×1000 unless otherwise specified. Co-ordinates of the microscope in the brackets [ ].

1. *Cyathidites minor* Couper 1953, KRAM-P O10/1 [105.5/12]
2. *Cyathidites minor* Couper 1953, KRAM-P O8/48 [105/6]
3. *Cyathidites minor* Couper 1953, KRAM-P O5/6/95 [97.5/3]
4. *Cyathidites minor* Couper 1953, KRAM-P O8/2 [96.5/10]
5. cf. *Cyathidites australis* Couper 1953, KRAM-P O5/2/95 [97.5/7]
6. *Cyathidites* sp., KRAM-P O10/1 [104/12]
7. *Concavisporites toralis* (Leschik 1955) Nilsson 1958, KRAM-P O10/1 [106/14]
8. *Concavisporites toralis* (Leschik 1955) Nilsson 1958, KRAM-P O8/46/95 [104.5/12]
9. *Concavisporites toralis* (Leschik 1955) Nilsson 1958, KRAM-P O5/2/95 [96.5/12.5]
10. *Concavisporites toralis* (Leschik 1955) Nilsson 1958, KRAM-P OS_2/4 [108.5/6]
11. *Concavisporites toralis* (Leschik 1955) Nilsson 1958, KRAM-P O8/3 [103/8]
12. cf. *Deltoidospora* sp., KRAM-P O8/2 [94/17]
13. *Plicifera delicata* (Bolch. 1953) Bolch. 1966, KRAM-P O5/5/95 [106.5/5.5]
14. *Plicifera delicata* (Bolch. 1953) Bolch. 1966, KRAM-P O8/2 [94.5/7]
15. *Calamospora tener* (Leschik 1955) Mädler 1964, KRAM-P O10/1 [107.5/10]
16. *Calamospora tener* (Leschik 1955) Mädler 1964, KRAM-P O5/11/95 [99.8/6]

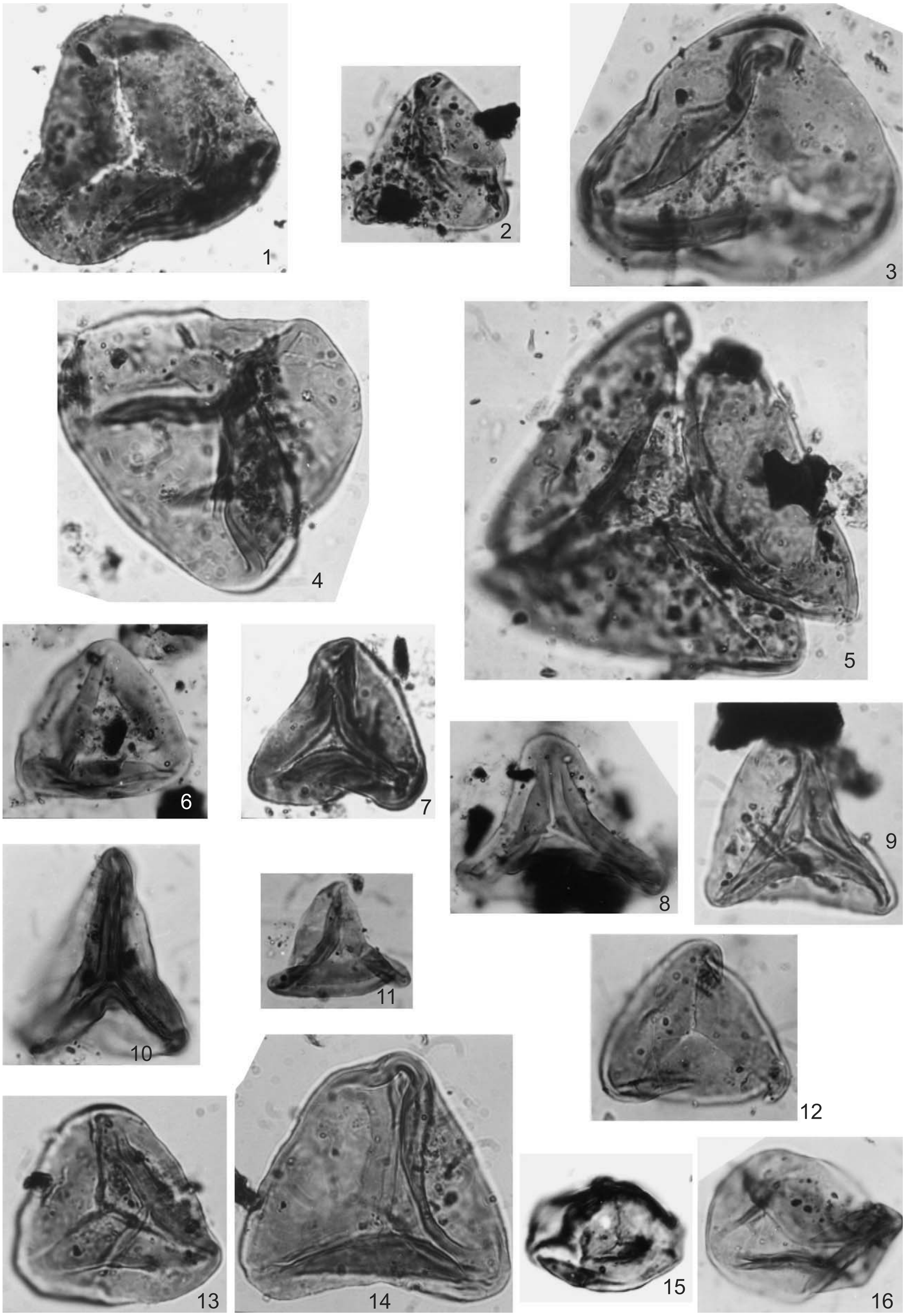
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Plate 2

1. *Calamospora tener* (Leschik 1955) Mädler 1964, KRAM-P O9/1/1 [102.5/18]
2. *Calamospora tener* (Leschik 1955) Mädler 1964, KRAM-P O9/2/8 [106/16.5]
3. *Todisporites minor* Couper 1958, KRAM-P O8/50 [108/11]
4. cf. *Todisporites* sp., KRAM-P O8/54 [105.5/3]

5a, b. *Rogalskaisporites cicatricosus* (Rogalska 1954) Danzé-Corsin & Laveine 1963, KRAM-P O8/49 [105.5/8]

6. *Auritulinasporites* sp., KRAM-P O8/46/95 [106/8.5]
7. *Apiculatisporis ovalis* (Nilsson 1958) Norris 1965, KRAM-P O8/50 [105.5/8.5]
8. *Auritulinasporites triclavis* Nilsson 1958, KRAM-P O5/2/95 [95.5/6]
9. *Cibotiumspora jurienensis* (Balme 1957) Filatoff 1975, KRAM-P O8/48 [95.1/10]
10. *Conbaculatisporites mesozoicus* Klaus 1960, KRAM-P OS_2/4 [111/15.5]
11. *Acanthotriletes varius* (Nilsson 1958) Schuurman 1977, KRAM-P O5/11/95 [91/5]

12a, b. cf. *Uvaesporites* sp., tetrad, KRAM-P O8/ 48/95 [101.5/3]

13. *Foraminisporis jurassicus* Schulz 1967, KRAM-P O8/58/95 [99/2.5]
14. *Uvaesporites argenteaeformis* (Bolch. 1953) Schulz 1967, KRAM-P O6/1/6 [110/9.5]
15. *Leptolepidites* sp., KRAM-P O8/5 [110.5/4.5]
16. *Osmundacidites* sp., KRAM-P O5/13/95 [97/7]

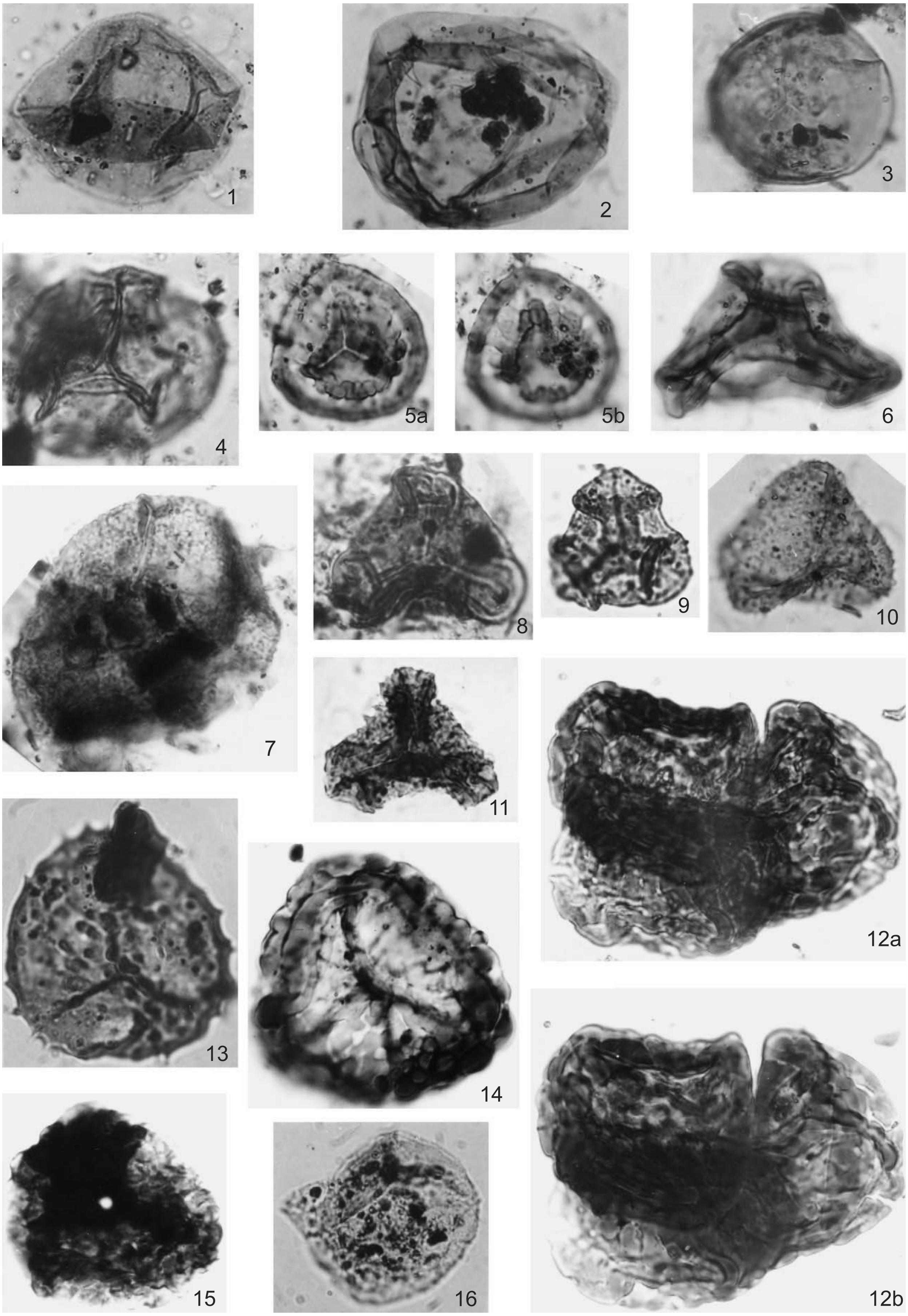
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Plate 3

1. *Lycopodiacidites rugulatus* (Couper 1958) Schulz 1967, KRAM-P O8/3 [99.5/19]
2a, b. *Lycopodiumsporites semimuris* Danzé-Corsin & Leveine 1963, KRAM-P O8/45/95 [107.1/3.8]
3. *Lycopodiumsporites* sp., KRAM-P O5/6/95 [98.5/3.5]
4. *Contignisporites problematicus* (Couper 1958) Döring 1965, KRAM-P O8/2 [97.5/7]
5. *Matonisporites* sp. 1, KRAM-P O8/2 [102.5/12.5]
6. *Matonisporites* sp. 1, KRAM-P O5/2 [97.5/7.5]
7. *Matonisporites* sp. 2, KRAM-P O6/1/6 [111.9/11.1]
8a, b. cf. *Lycospora salebrosacea* (Maljavkina 1949) Schulz 1967, KRAM-P O8/18 [105/17.5]
9. *Neochomotriletes triangularis* (Bolch. 1956) Reinhardt 1961, KRAM-P O5/12/95 [96/19]
10a, b. *Lycopodiumsporites cerniidites* (Ross 1949) Delcourt & Sprumont 1955, KRAM-P 8/59/95 [107.5/17]
11. *Cingutriletes* sp., KRAM-P O8/46 [107.1/2.5]
12. cf. *Latosporites* sp., KRAM-P O8/2 [106/7.5]
13. *Foveotriletes* sp., KRAM-P O5/10/95 [109/11.1]
14. *Marattisporites* sp. 2, KRAM-P O8/3 [95.5/17]
15. *Marattisporites* sp. 1, KRAM-P O5/1/95 [96/5]

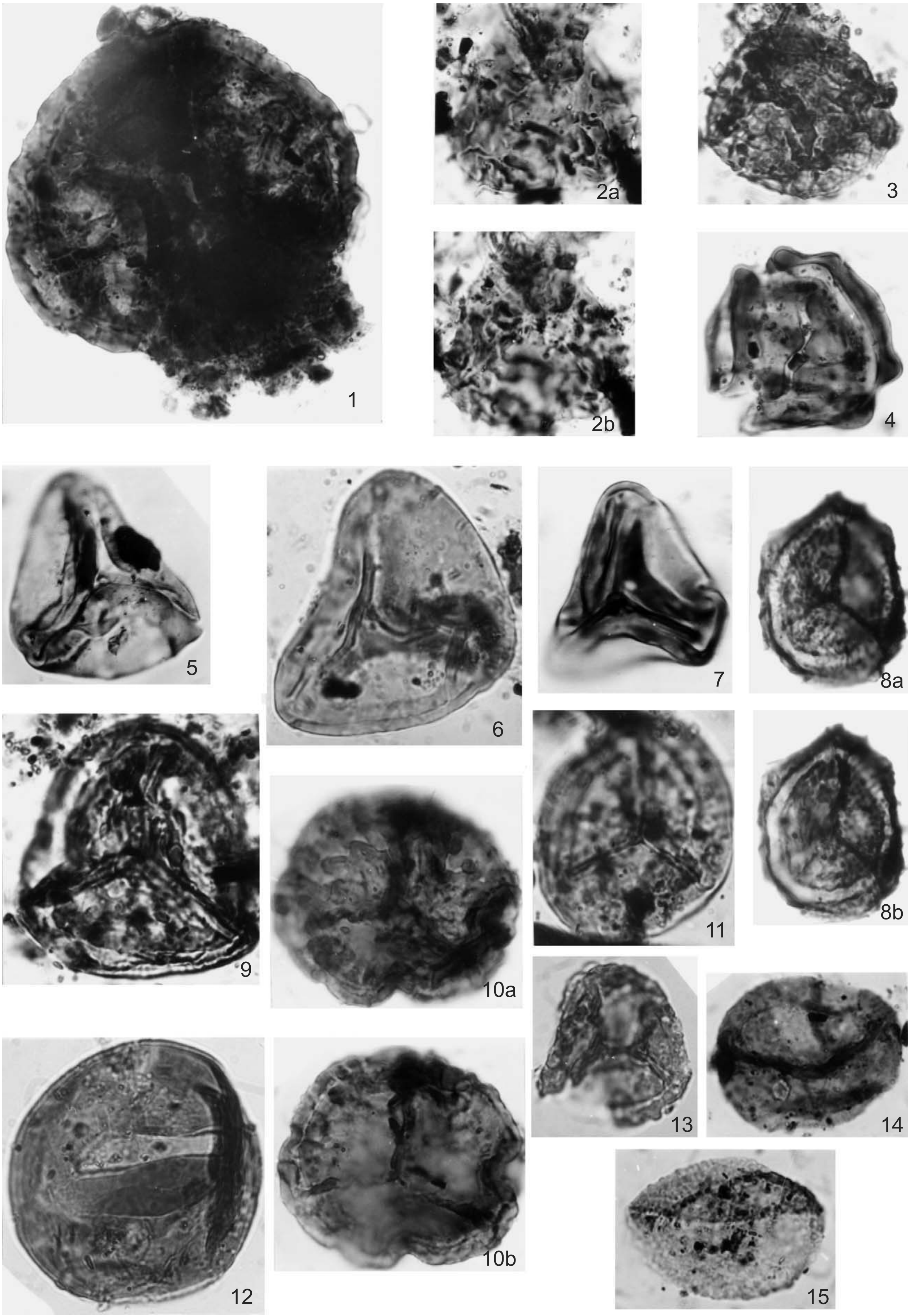
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Plate 4

1. *Aratrisporites minimus* Schulz 1967, KRAM-P O8/18 [101/14]
2. *Aratrisporites minimus* Schulz 1967, KRAM-P O5/11/95 [105/14]
3. *Aratrisporites minimus* Schulz 1967, KRAM-P O8/1 [102/7.5]
4. *Aratrisporites minimus* Schulz 1967, KRAM-P O8/2 [105.5/13]
5. *Aratrisporites minimus* Schulz 1967, KRAM-P O8/18 [96/19]
6. *Aratrisporites minimus* Schulz 1967, KRAM-P O5/11/95 [106.5/1.5]
7. *Aratrisporites minimus* Schulz 1967, KRAM-P O5/10/95 [100/11.5]

8a, b. *Aratrisporites minimus* Schulz 1967, KRAM-P O8/45/95 [102/3]

9. *Aratrisporites minimus* Schulz 1967, KRAM-P O5/11/95 [97/6.5]
10. *Aratrisporites minimus* Schulz 1967, KRAM-P O8/49/95 [105/4.5]
11. *Aratrisporites minimus* Schulz 1967, KRAM-P O8/18 [98/10]
12. *Aratrisporites minimus* Schulz 1967, SEM, 2000×
13. *Alisporites* cf. *diaphanus* (Pautsch 1958) Lund 1977, KRAM-P O5/13/95 [102/7]
14. cf. *Alisporites microsaccus* (Couper 1958) Pocock 1962, KRAM-P O9/2/6 [94.5/18]
15. *Alisporites robustus* Nilsson 1958, KRAM-P O5/14/95 [106/11]

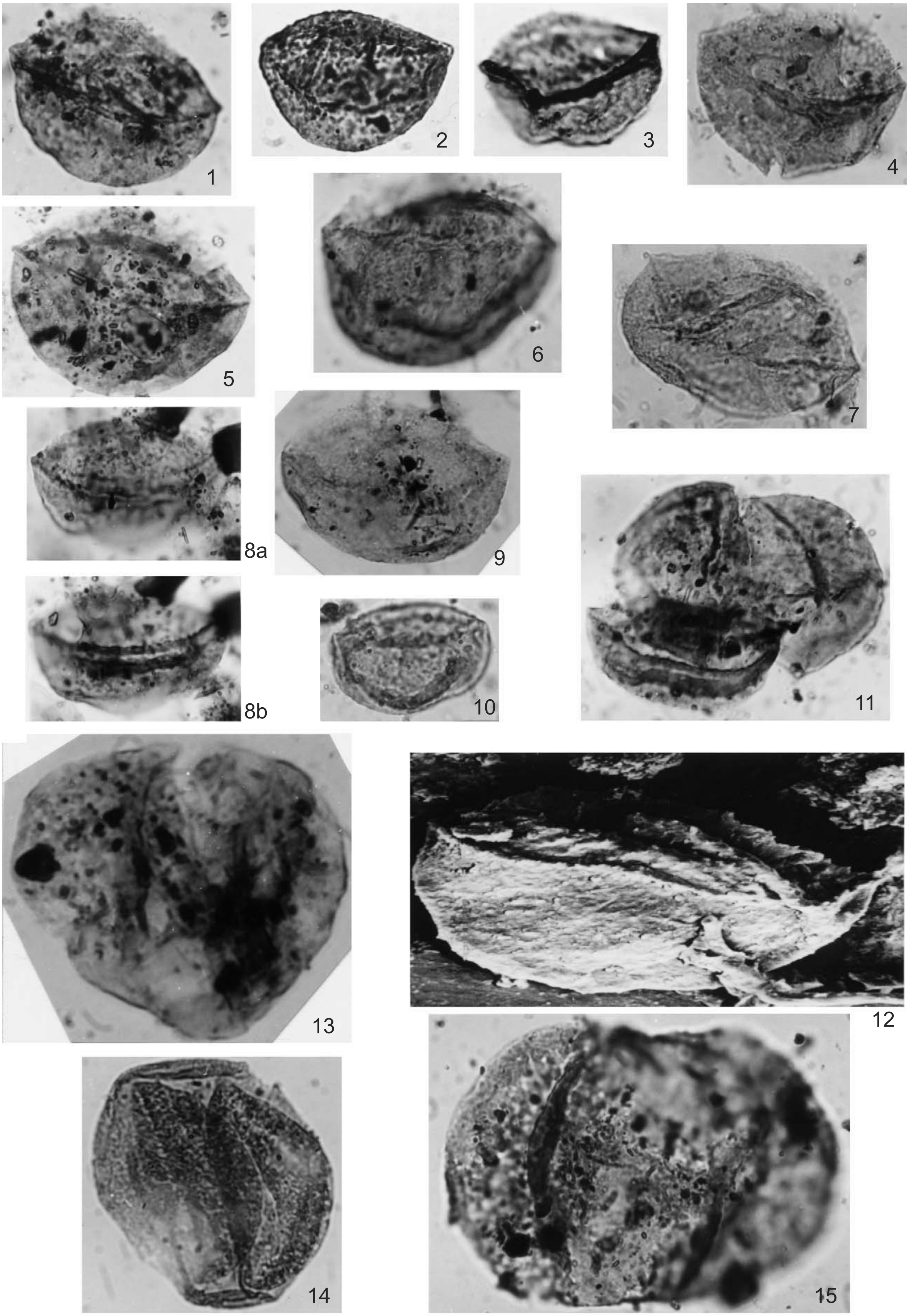

Plate 5

1. *Alisporites robustus* Nilsson 1958, KRAM-P O5/11/95 [103.5/5.5]
2. *Alisporites robustus* Nilsson 1958, KRAM-P O8/58 [103.5/3.5]
3. *Alisporites robustus* Nilsson 1958, KRAM-P O8/3 [97/11.5]
4. *Alisporites* cf. *robustus* Nilsson 1958, KRAM-P O8/3 [100/14]
5. *Alisporites thomasii* (Couper 1958) Nilsson 1958, KRAM-P O8/2 [101/13]
6. *Vitreisporites pallidus* (Reissinger 1950) Nilsson 1958, KRAM-P O10/1 [105/14]
7. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O8/3 [101.5/22]
8. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O8/54/95 [101/2]
9. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O8/18 [109/13]
10. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O8/46/95 [107/1.5]

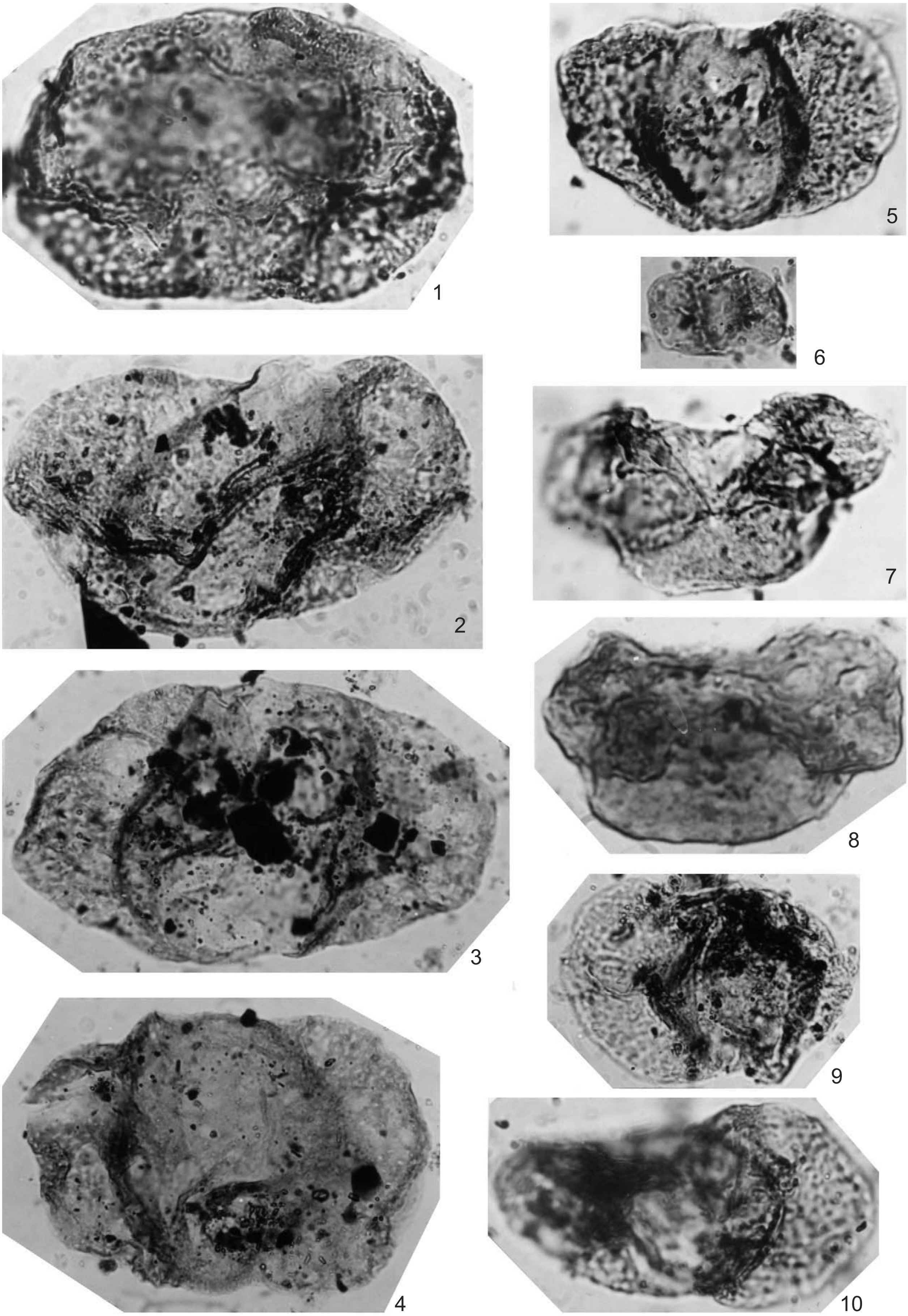
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Plate 6

1. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P OS_2/15 [92/6]
2. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O8/2 [104.5/18]
3. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O8/45/95 [110/11]
4. cf. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O9/1/1 [103.5/18.5]
5. cf. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O8/48/95 [102.5/6]

6a, b. *Platysaccus nitidus* Pautsch 1971, KRAM-P O8/45/95 [103/3]

7a, b. ?*Pinuspollenites labdacus* var. *arcuatus* Danzé-Corsin & Leveine 1963, KRAM-P O8/45/95 [110/4.5]

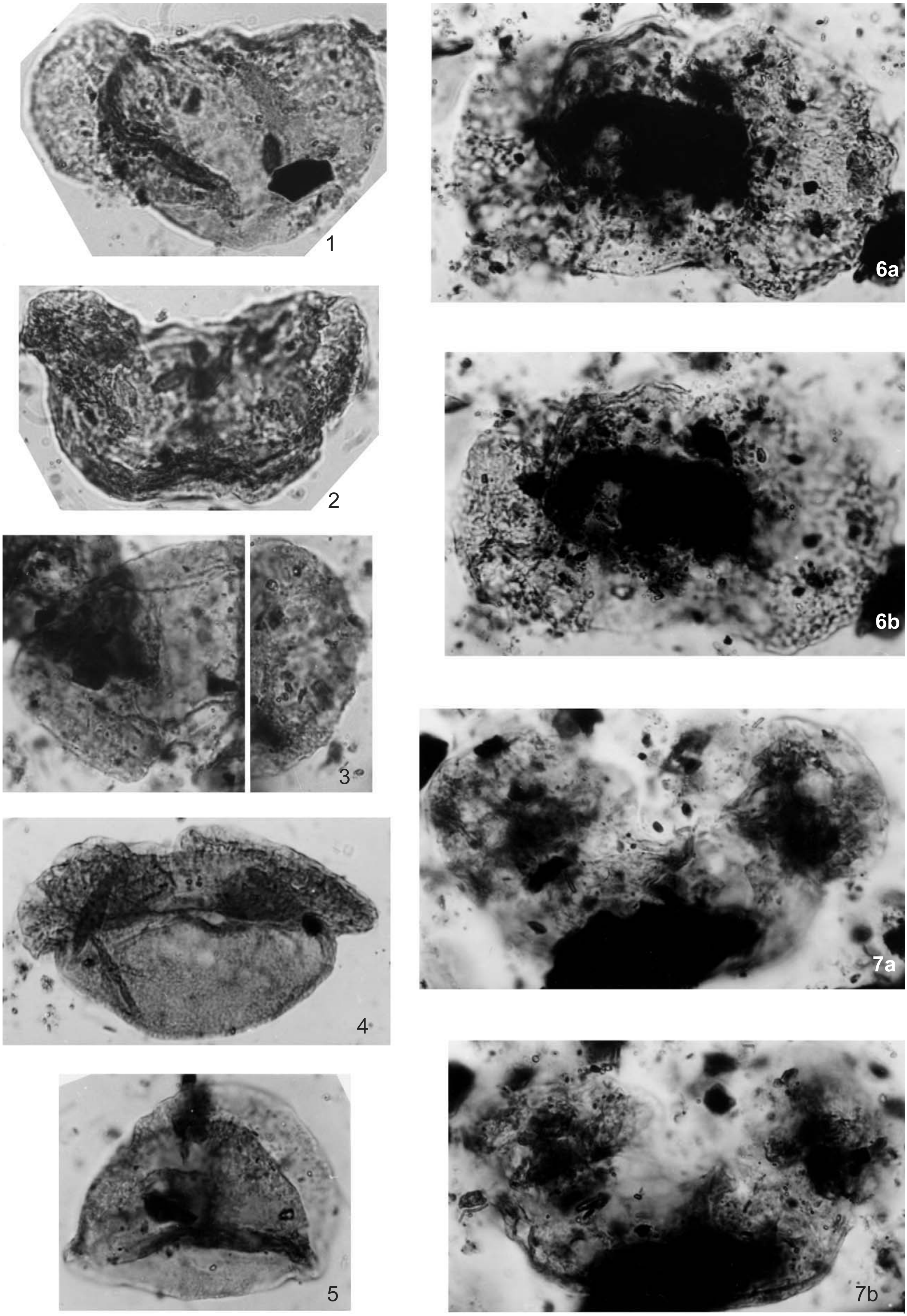

Plate 7

1. cf. *Pityosporites minimus* (Couper 1958) comb. nov., KRAM-P O5/11/95 [95.2/5]
2. cf. *Inaperturopollenites* sp., KRAM-P O8/54/95 [103/5]
3. cf. *Inaperturopollenites* sp., KRAM-P O5/15/95 [99/3]
4. cf. *Araucariacites australis* Cookson 1947 ex Couper 1953, KRAM-P O5/10/95 [100/18.3]
5. cf. *Araucariacites* sp., KRAM-P O9/2/6 [93.5/8.5]
6. *Spheripollenites psilatus* Couper 1958, KRAM-P O5/3/95 [105/5.5]
7. *Spheripollenites subgranulatus* Couper 1958, KRAM-P O8/5 [95/13.5]
8. *Spheripollenites* sp., KRAM-P O8/3 [100.5/9]
9. *Spheripollenites* sp., KRAM-P O5/6/95 [102.5/2]
10. *Spheripollenites* sp., KRAM-P O5/6/95 [94/1]
11. *Spheripollenites* sp., KRAM-P O8/2 [100/16]
12. *Perinopollenites elatoides* Couper 1958, KRAM-P O5/10/95 [104/15]
13. *Perinopollenites elatoides* Couper 1958, KRAM-P O5/13/95 [103.5/15.5]
14. *Perinopollenites elatoides* Couper 1958, KRAM-P O8/2 [98/10.5]
15. *Chasmatosporites* cf. *elegans* Nilsson 1958, KRAM-P O8/2 [101/4.5]
16. *Chasmatosporites* cf. *elegans* Nilsson 1958, KRAM-P O8/18 [103.5/12.5]
17. *Chasmatosporites* cf. *elegans* Nilsson 1958, KRAM-P O10/1 [113.5/15]
18. *Chasmatosporites apertus* (Rogalska 1954) Nilsson 1958, KRAM-P O8/18 [102.5/19.5]

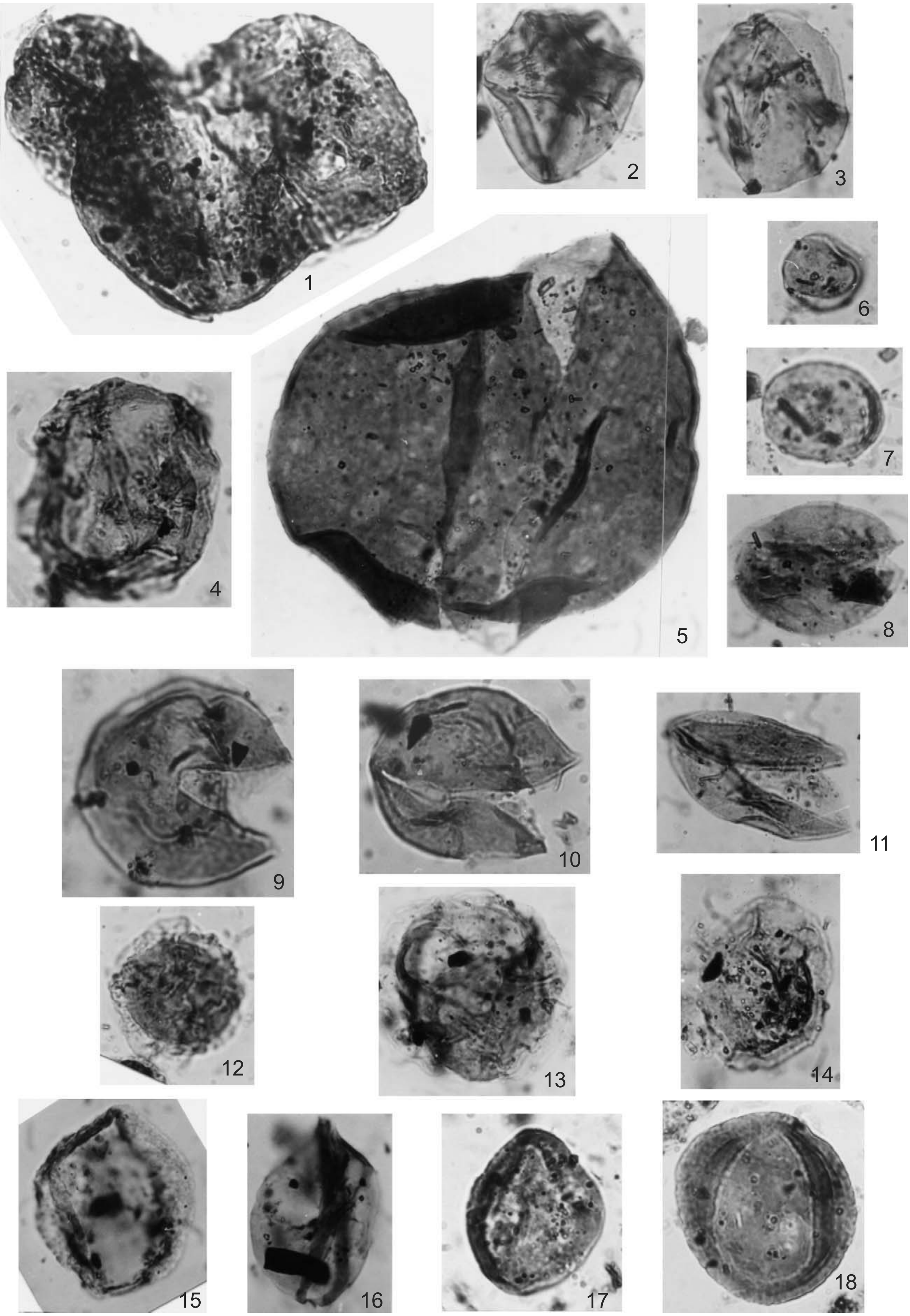
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Plate 8

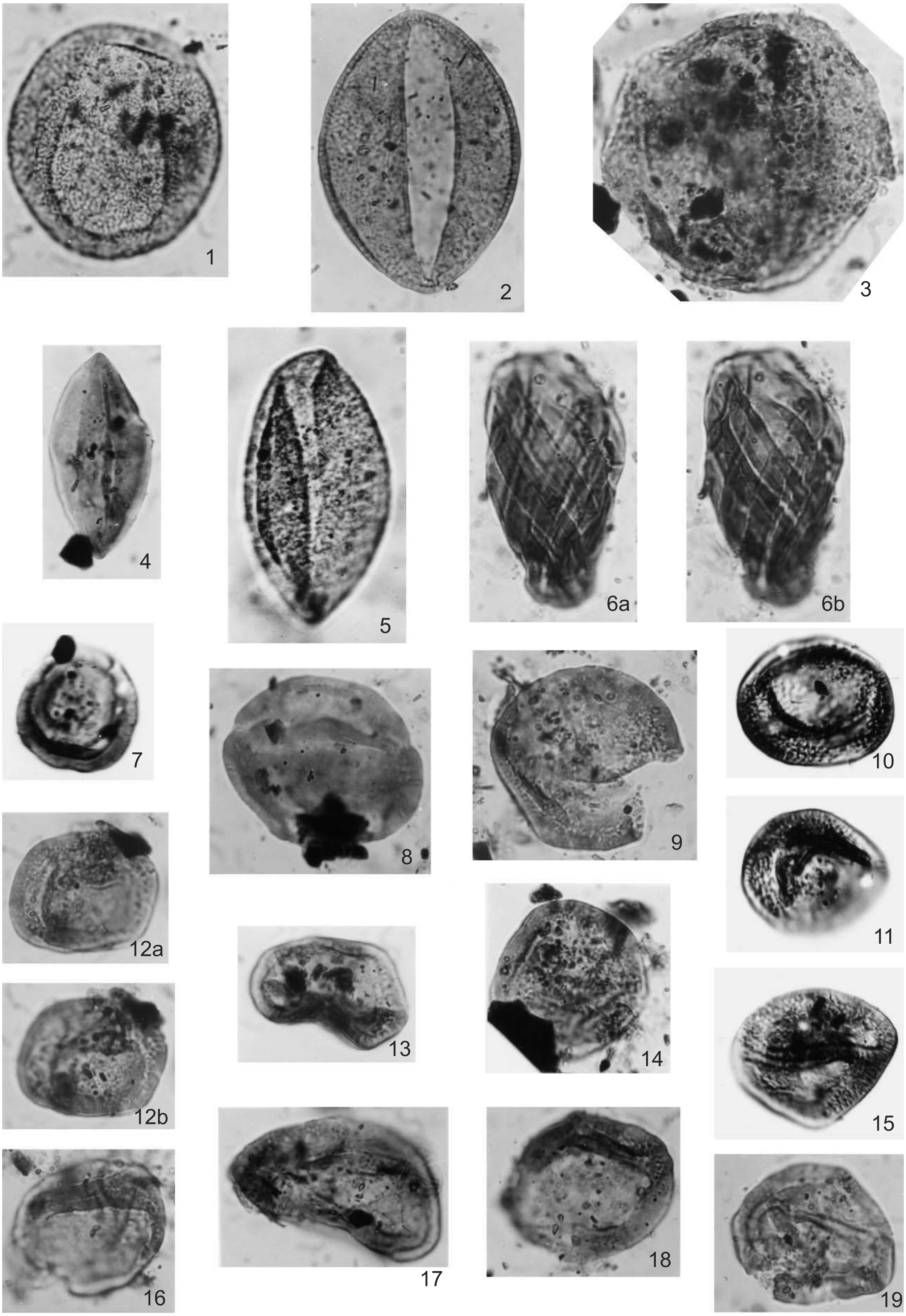
1. *Chasmatosporites hians* Nilsson 1958, KRAM-P O9/2/8 [106/16.5]
2. *Chasmatosporites major* (Nilsson 1958), Pocock & Jansonius 1969, KRAM-P O9/1/1 [109/14.5]
3. *Chasmatosporites* cf. *rimatus* Nilsson 1958, KRAM-P[1] O5/11/95 [104/6.5]
4. *Monosulcites minimus* Cookson 1947 ex Couper 1953, KRAM-P O8/60/95 [102/6.5]
5. *Monosulcites subgranulosus* Couper 1958, KRAM-P O17/1 [105/8]

6a, b. *Ephedripites tortuosus* Mädler 1964, KRAM-P O8/49 [103.5/5.5]

7. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/4 [99.5/17.5]
8. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P OS_2/13 [92.5/20]
9. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/54 [104.2/3.5]
10. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O9/2/6 [100/9]
11. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O9/2/6 [100/9]

12a, b. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O5/10/95 [102/20]

13. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/2 [109/14]
14. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/18 [104.5/13.5]
15. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/3 [104/19]
16. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/54 [101.5/2.5]
17. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O5/10/95 [97/13]
18. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O5/11/95 [93/12]
19. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/2 [108/12.5]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6a
6b
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12a
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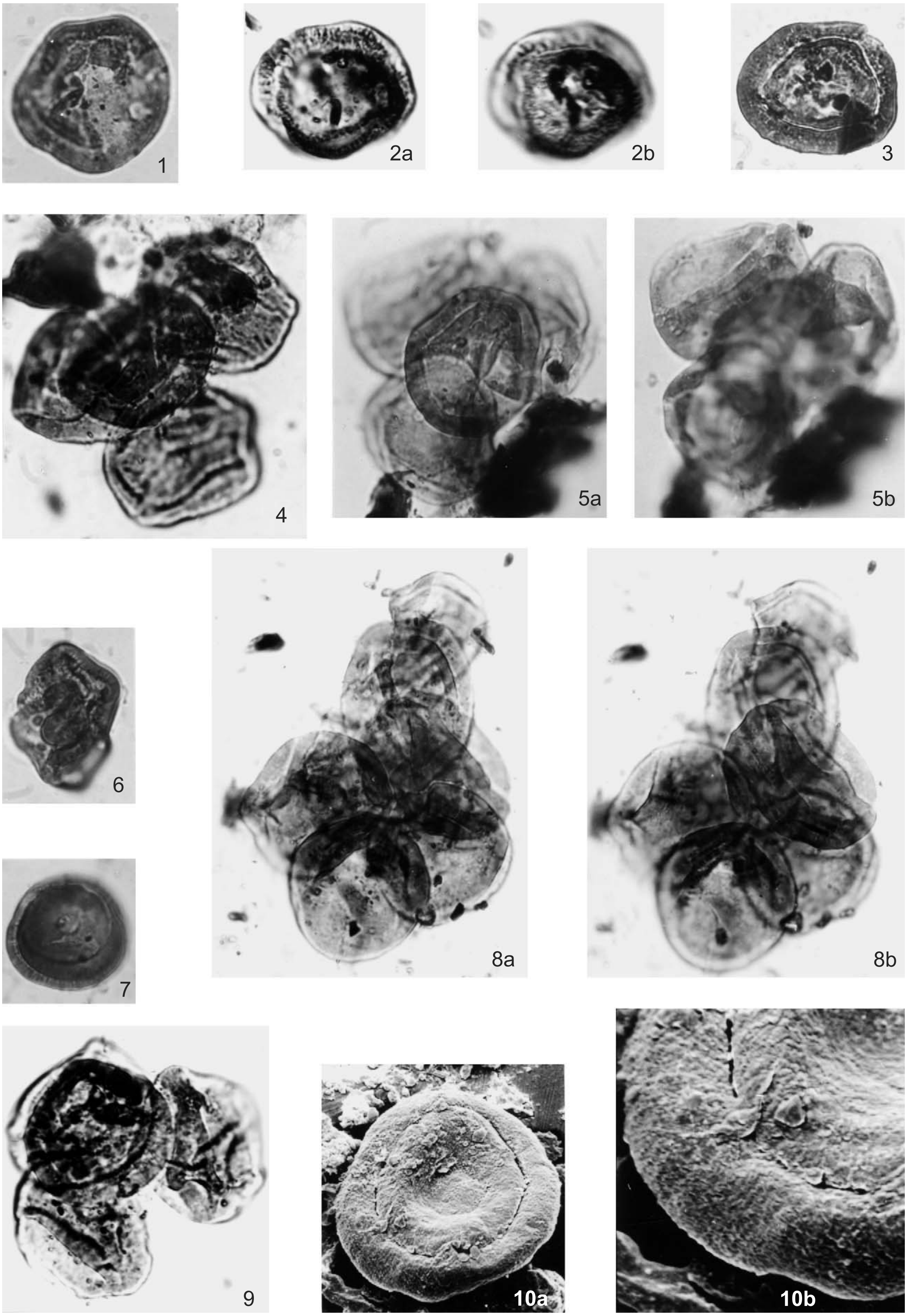
19

Plate 9

1. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O5/13/95 [103/16]
2a, b. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O6/1/6 [103.1/3.1]
3. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O8/49/95 [106/12.5]
4. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, tetrad, KRAM-P O5/6/95 [98.5/5]
5a, b. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, tetrad, KRAM-P O5/10/95 [96.5/20]
6. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O5/10/95 [108/9.5]
7. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O5/10/95 [102.1/14.2]
8a, b. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, KRAM-P O5/11/95 [104.5/8.5]
9. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, tetrad, KRAM-P O8/4 [100/19]
10a, b. *Classopollis torosus* (Reissinger 1950) Couper 1958, SEM, a × ca 1300, b ×2000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8a
8b
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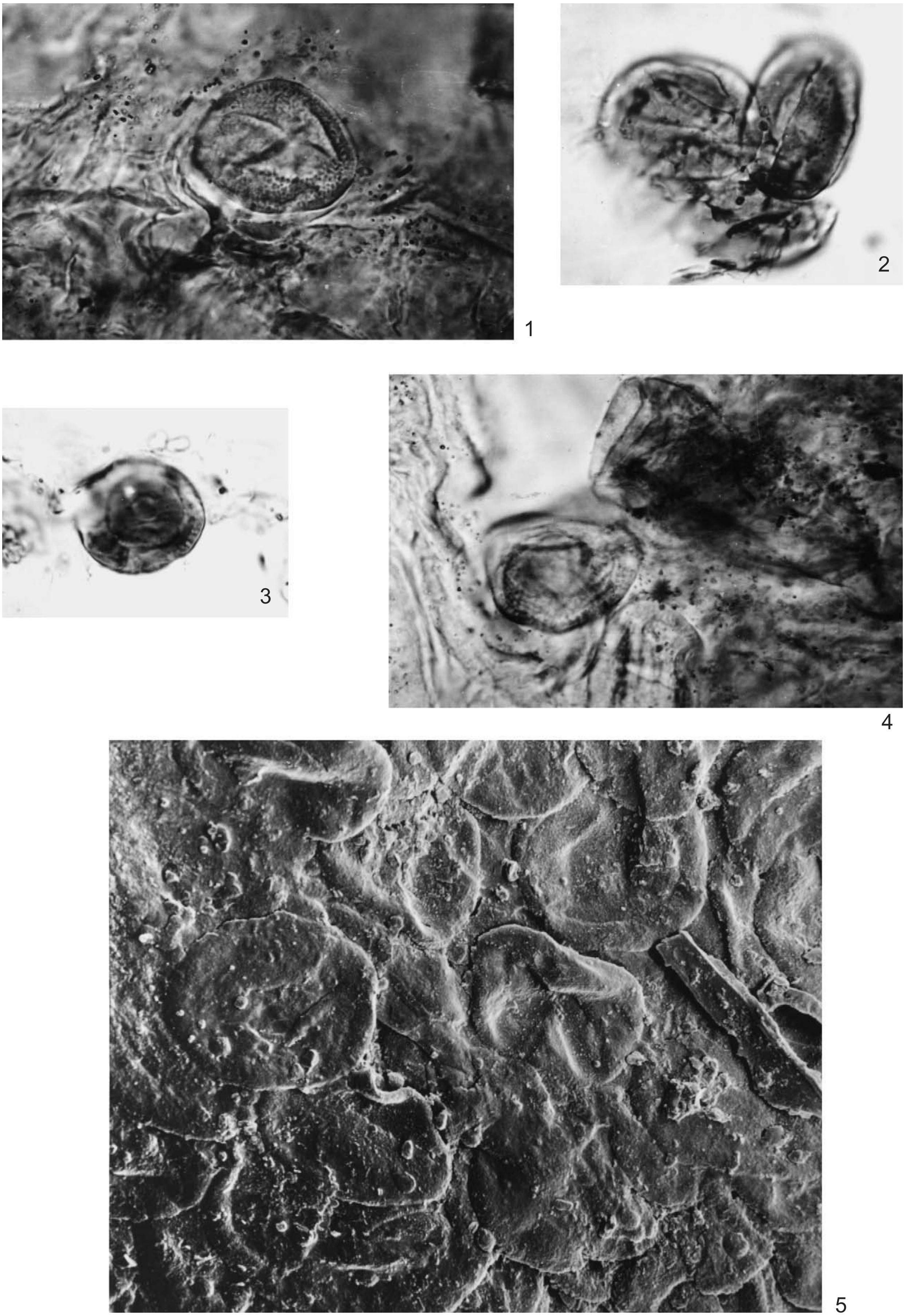
10a
10b

Plate 10

1. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; KRAM-P No. 68/1296 [105.5/12]
2. *Classopollis* in situ pollen grains (immature tetrad?) isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; KRAM-P No. 68/1297 [106/10]
3. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; KRAM-P No. 68/1297 [106/11]
4. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; KRAM-P No. 68/1296 [105/11]
5. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; SEM, × ca 1300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