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JURASSIC SPORES AND POLLEN GRAINS FROM ODROWĄŻ

Doctoral thesis
prepared in Department of Palaeobotany
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W. SZAFER INSTITUTE OF BOTANY
POLISH ACADEMY OF SCIENCES
CRACOW
2002

CONTENTS

ACKNOWLEDGEMENTS

The present dissertation is the result of suggestion made by Assistant Professor, Dr. hab. Maria Reymanówna, who showed me the terrain of investigations, gave me a run of her collections and slides, and initiated me in the difficult, but fascinating, research on the Mesozoic plants. Her person of distinction is already absent between us, but I will for ever deeply appreciate all what I obtained from her.

I would like to express cordial thanks to Professor Dr. hab. Leon Stuchlik for his agreement to be my supervisor and especially for his patience and also for the improvements inserted into the text.

I would like to express my special gratitude to Dr. Johanna H.A. van Konijnenburg-van Cittert for sending me the literature which was necessary for finishing the present paper, and also for her unusal kindness and discussion the text of manuscript.

My friend M.Sc. Elżbieta Wcisło-Luraniec is specially thanked for our many years collaboration, and particularly for her help in the research on the *Hirmeriella muensteri* pollen cones, our discussion and delivering the data on macroflora to me.

I thank very much to Mrs Małgorzata Zurzycka for initiating me in the secrets of laboratory work and the comprehensive help during the samples preparation for the palynological investigations.

M.Sc. Jacek W.Wieser found the time for drawing the maps of localities in the Holy Cross Mountains area, in spite of many occupations. I thank him very much for that.

I would like to thank heartily all the remaining colleagues from the Department of Palaeobotany, W. Szafer Institute of Botany Polish Academy of Sciences in Cracow, who extended kindness to me during writing this dissertation. Professor Dr. hab. Kazimiera Mamakowa is thanked especially for giving me the run of her computer and keeping up my spirits. Dr. Wojciech Granoszewski and Dr. Grzegorz Worobiec are thanked especially for their help in struggles with my computer.

I would like to thank very much Dr. hab. Danuta Zdebska from the Institute of Botany of the Jagiellonian University for the access to the microphotographic facilities and our discussions on the fossil plants.

Mr Antoni Pachoński and Mrs Alicja Laska are thanked adequately for taking the photographs of the *Hirmeriella muensteri* pollen cones and printing the remaining photographs of the specimens from Odrowąż.

Finally, I would like to thank all the persons who helped me in the work in any way and were not mentioned by name, and all my family for giving their various support.

INTRODUCTION

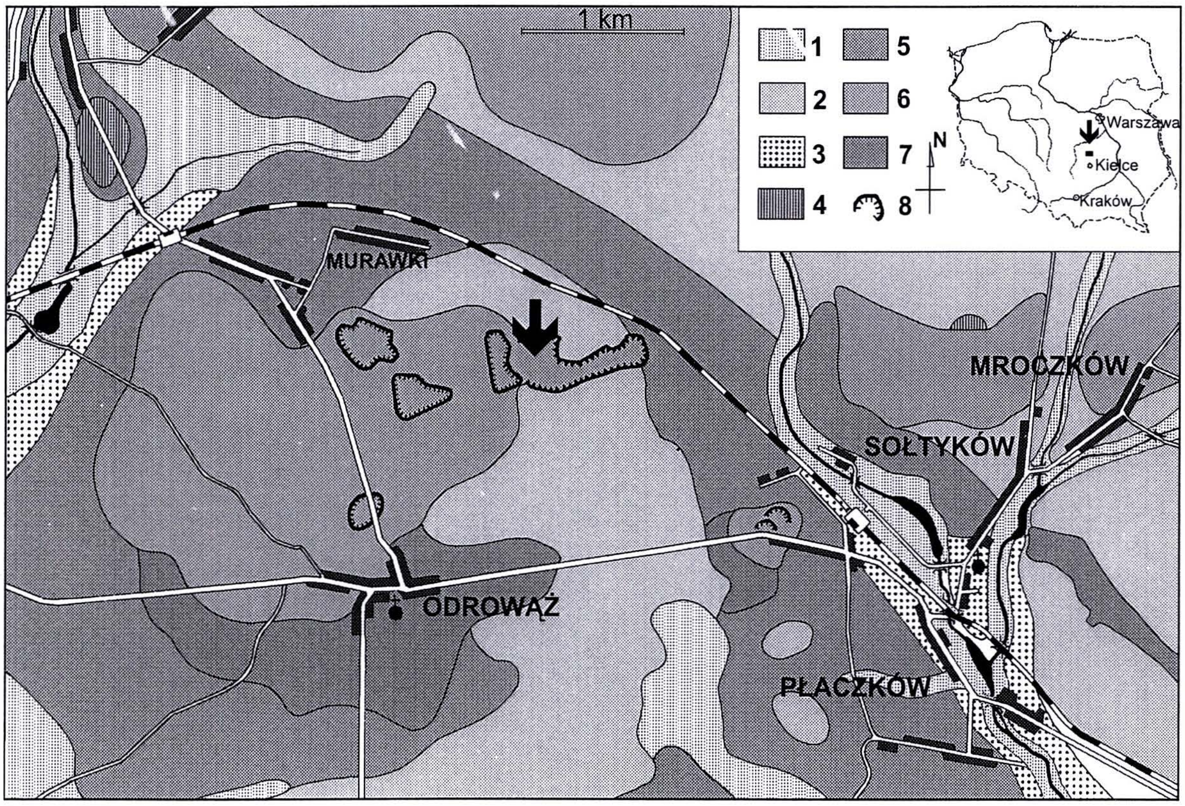
The first palinological investigations of the Jurassic sediments from the Holy Cross Mountains area were carried out by Maria Rogalska (1956). She described sediments from Mroczków and Rozwady area near Opoczno (Ryc. 2) as Liassic on the basis of spores and pollen grains. After this work investigations on the Jurassic sediments from this region were not carried out intensively. The present paper is the most detailed study of the spore and pollen composition of part of the non- marine Jurassic sediments called Zagaje series or formation from Poland, which more or less corresponds with Lower Hettangian (the lowest Jura) stage established for marine Liassic.

The aim of present paper was:

1. Determination and detailed description dispersed spores and pollen grains from the Jurassic sediments of the Odrowąż locality (known also as Sołtyków) in the Holy Cross Mountains area with regard to geographical and stratigraphical distribution and also botanical affinity.
2. Finding *in situ* spores or pollen grains from the same locality, if possible.
3. Comparision of the Jurassic macrofossils with spores and pollen grains from this locality.
4. Determination of the age of investigating sediment on the basis of spore and pollen grain assemblage.

Preliminary results of the palinological investigations from Odrowąż were published by the present author in short papers and summaries (Ichas-Ziaja 1987, Ziaja 1989, 1991, 1992).

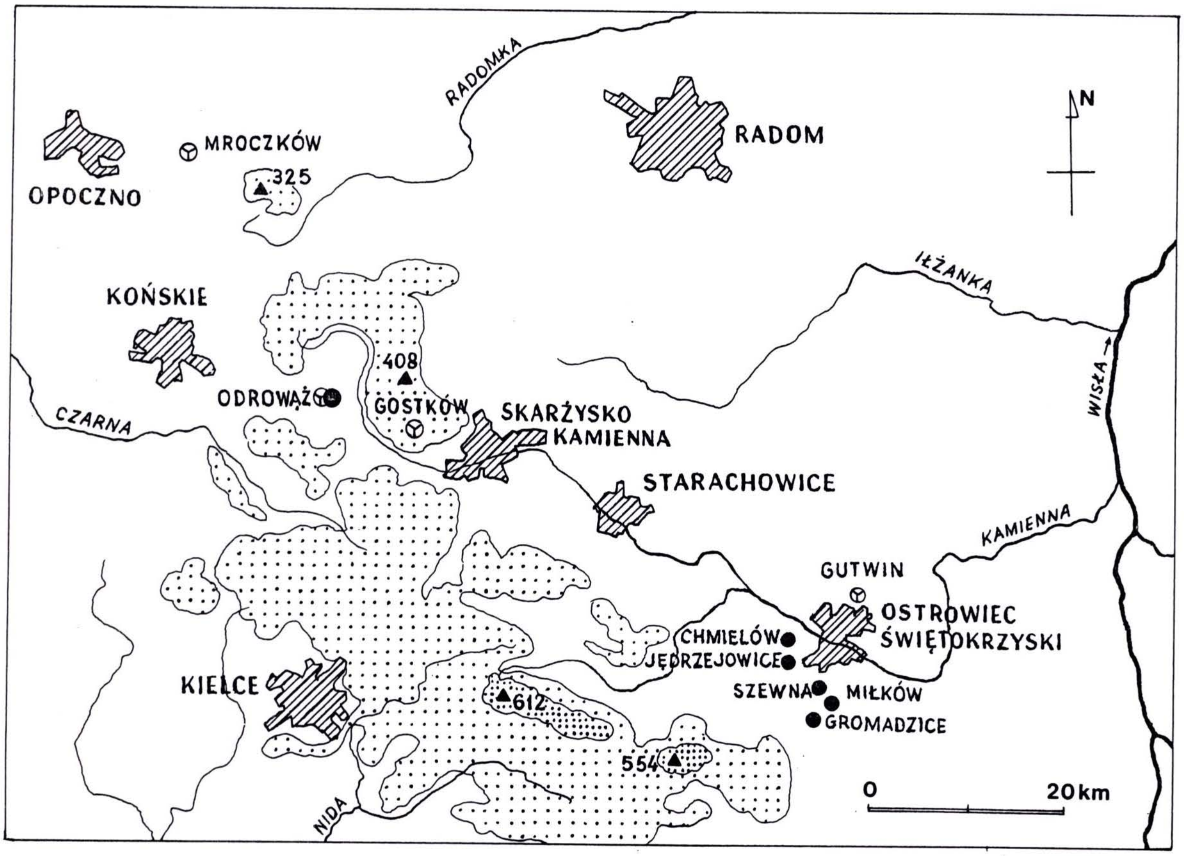
The place of investigations is situated about 20 km north of the Holy Cross Mountains (Ryc. 1) in the area of the Liassic deposits. It is a brick-pit, since 1997 a geological reserve (Ryc. 3-6). The presence of *Lycostrobus scotti* Nathorst megaspores had been reported from this locality, and this megaspore is regarded as an index species for the Lower Liassic (Marcinkiewicz 1957, Marcinkiewicz et al. 1960). Jurassic macrofossils (Reymanówna 1987, 1991a, 1991b, 1992, Reymanówna et al. 1987; Wcisło-Luraniec 1987, 1991a, 1991b, 1992a, 1992b), dinosaurs footprints (Pieńkowski & Gierliński 1987, Gierliński & Pieńkowski 1999) and insects remains (Węgierek & Zherikhin 1997) were also described from this place.



Ryc. 1. Map of locality Odrowąż (Sołtyków) according Karaszewski (1955), modified (drawing by J. W. Wieser)

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

The outcrop of the brick-pit with the Jurassic flora indicated by the arrow



Ryc. 2. Map of localities with Liassic micro- and macrofloras to the North and North East of the Holy Cross Mountains (drawing by J. W. Wieser)

● - locality with macroflora

⊗ - locality with microflora

Ryc. 3. Information board near geological reserve Odrowąż (Sołtyków) (fot. J. Ziaja, 2001 year)

Ryc. 4. General view of the investigated locality Odrowąż (fot. J. Ziaja, 1987 year)

FORMER INVESTIGATIONS OF THE LOCALITIES FROM LOWER JURASSIC IN THE HOLY CROSS MOUNTAINS AREA

Outline of the geological investigations of the Jurassic sediments in the the Holy Cross Mountains area

Lower Jurassic sediments surround the Palaeozoic core of the Holy Cross Mountains from the north, west and southwest. Determination of stratigraphy of these sediments is difficult because of insufficient amount of index species. It is a consequence of the terrestrial origin of prevailing sediments. Hence, at the beginning the stratigraphy of the Lias of the Holy Cross Mts. was based on lithological features and macroflora and afterwards palinological, palaeozoological and sedimentological investigations were also applied (Karaszewski 1962, Karaszewski & Kopik 1970). The detailed history of the geological investigations of the Lower Jurassic in the region of the Holy Cross Mountains is described by Karaszewski (1962) and Karaszewski & Kopik (1970). The current classification is local. The determined lithostratigraphical units, or series, correspond roughly to the stages determined for the marine Lias. These stages are illustrated e.g. by Haq & van Eysinga (1998) on the Geological Time Table. The only exception to that rule is dividing the oldest part of the Lias into three series: Zagaje, Skłoby and Ore-bearing one, which correspond to the Lias α_1 and α_2, i.e. Hettangian.

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 described area. Fauna is often in a bad state of preservation. The remains of molluscs and snails may by found, especially in the upper part of this series. Ostracods were evidenced too. Fossil macroflora, microflora and macrospores occur here as well.

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 the molluscs and foraminifera is evidenced in this series. There are micro- and macrospores too.

Ore-bearing series, called also **Zarzecze series**, contains clay syderites and clay shales mainly. Thickness of this series varies from 40 m to 110 m. There is a big share of he marine fauna, i. e. fishes, molluscs and foraminifera. Megaspores are known from this series too.

The next two **series**, **Ostrowiec** and **Koszorów** ones consisting of sandstones with intercalations of claystones and siltstones, correspond to Sinemurian. Theirs thickness varies from 40 m to 200 m.

The next two **series**, **Gielniów** and **Drzewica** correspond to Pliensbachian. The former one consists of claystones, sandstones and siltstones with siderites and contains numerous marine foraminifera and molluscs. The so-called Chmielów clays containing a lot of plant fossils, occur in places. Thickness of this series varies from 15 m to 70 m.

The **Drzewica series**, called also **Bronów series**, contains sandstones mainly and is 45 m - 80 m

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

Pieńkowski (1983, 1987) carried out a further research of the northern part of the Holy Cross Mountains Liassic. He classified all the series as the formations, lowered the lower boundary of the Skłoby series and renounced the Koszorów series, including it to the Ostrowiec Formation. He called Ore-bearing the Przysucha Ore-bearing Formation.

The Pieńkowski's sedimentological results are the following:

1. In the northern part of the Liassic sediments surrounding Holy Cross Mountains the lowest Liassic Zagaje Formation is a whole of terrestrial origin. This formation is similar to coal-bearing basins which were developed in alluvial plains. The fully developed facies of the formation consists of:

1/ sediments of anastomosing rivers,

2/ sediments of meandering rivers,

3/ lacustrine-boggy sediments

The other formations are mainly of the marine origin. They were sedimented in the sea basin with a low salinity and its litoral areas, barriers, lagoons and deltas.

Pieńkowski 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, the 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 occured in the beginning of the sedimentation of the Ostrowiec Formation.

Odrowąż (known also as Sołtyków) outcrop and shallow borehole were sedimentologicaly and geologicaly described by Pieńkowski (Pieńkowski & Gierliński 1987, Pieńkowski 1989). 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 Odrowąż section (not visible in the outcrop) represents flood plain of braided rivers and upper part of this section (visible in the outcrop) represents flood plain of meandering rivers in which the lower terrains were covered with *Neocalamites* plants and the higher with coniferous forest.

Macroflora

The first paper of macroflora from the Jurassic sediments surrounding the Holy Cross Mountains was published by Raciborski (1891). He described and illustrated 26 species from Equisetales, Filicales, Cycadales and Coniferales from localities Chmielów, Gromadzice and Miłków (Ryc. 2). In the second paper Raciborski (1892) described 19 species of fossil plants from this region among them new genus *Ixostrobus*. He considered age of this fossil macroflora as Rhaetic, following the then used stratigraphic scheme of Nathorst.

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 (Ryc. 2). She agreed with Raciborski that this flora belonged 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.

The Odrowąż outcrop is situated about 60 kilometres to the west from the localities mentioned above (Ryc. 2). The fossil plants occurs 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 1992, Wcisło- Luraniec 1992a, Wcisło-Luraniec - personal communication) contains:

Sphenophyta; Eqisetales: *Neocalamites* sp. 1 (stem), *Neocalamites* sp. 2 (stem)

Pteridophyta; Filicales,

Family Osmundaceae: *Todites princeps* (Presl) Gothan (leaves and rhizomes)

Family Matoniaceae: *Phleboptris angustiloba* (Presl) Hirmer & Hoerhammer (leaves)

Family Dipteridaceae: *Thaumatopteris schenki* Nathorst (leaves)

Filicales of unknown affinity (leaves)

Pteridospermophyta;

Caytoniales: *Caytonia* sp. (seed)

Corystospermales ?: *Pachypteris* sp. (leaves)

Cycadophyta;

Cycadales: *Nilssonia* sp. (leaves)

Bennettitales (= Cycadeoidales): *Otozamites* sp. (leaves), *Pterophyllum* sp. (leaves)

Ginkgophyta;

Ginkgoales: *Stachyopitys preslii* Schenk (fructification) - now attributed to *Schmeissneria microstachys* (Presl 1833) Kirchner et Van Konijnenburg-Van Cittert 1994 (Wcisło-Luraniec 1992b, Kirchner & Van Konijnenburg-Van Cittert 1994),

Coniferophyta; Coniferales

Family Ullmaniaceae ?: *Swedenborgia* sp. (scales and cones)

Podozamites sp. 1 (leaves), *Podozamites* sp. 2 (leaves)

Family Cheirolepidiaceae: *Hirmeriella muensteri* (Schenk) Jung (stem with leaves, female and male cones, ovuliferous scales)

Incertae sedis;

Desmiophyllum sp. (leaves)

Microflora

Maria Rogalska (1956) investigated Jurassic deposits in the Mroczków-Rozwady area, near Opoczno (Ryc. 2). 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. The samples were taken from 20 boreholes. According to Rogalska the geological age of the sediments of the investigated area is probably Lias α. The same author (Rogalska 1976) wrote also about stratigraphy of the Middle and Lower Jurassic sediments in Poland and determined spores, pollen grains and microplankton from four boreholes: Gorzów Wielkopolski, Międzychód, Aleksandrów Kujawski and Gutwin. The last mentioned borehole is situated northeast from the Holy Cross Mountains. Gutwin 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 determined and illustrated about 100 taxa of spores and pollen grains and several taxa of microplankton from Gutwin boring core.

Bore cores from Skarżysko-Kamienna 15 km south-east from Odrowąż and Gostków (near Odrowąż) (Ryc. 2), were palinologicaly investigated by Orłowska (Marcinkiewicz et al. 1960). This author 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). The microflora were compared with megaflora from the same place and the Lower Liassic age of sediments from Odrowąż was confirmed.

Marcinkiewicz (1957) investigated megaspores from sediments of Odrowąż, Skarżysko-Kamienna and others localities from the Holy Cross Mountains area and foud several hundred specimens *Nathorstisporites hopliticus* Jung (*Lycostrobus scotti* Nath.). It is considered as index species for the Lower Lias (Lias α) (Marcinkiewicz 1957, Marcinkiewicz et al. 1960).

Insect fauna from Odrowąż locality

Węgierek and Zherikhin (1997) collected insect remains from outcrop Odrowąż. These remains were preserved in grey to yellowish-gray sandy mudstone with plant remains (mainly *Hirmeriella* shoots). These authors collected 54 insect specimens in which 50 are beetle remains belonging to probably 15-20 aquatic and terrestrial species. According to them terrestrial beetles from the genus *Notocupes* probably lived in a coniferous forest dominated by *Hirmeriella muensteri*. Habitat preferences of the others Jurassic insects found in Odrowąż are uncertain (Węgierek & Zherikhin 1997).

Dinosaurs footprints

The presence of dinosaurs footprints in the Lower Jurassic deposits in the Holy Cross Mountains region was noted at first by Karaszewski (1969) from the Gliniany Las locality situated 20 km south-west from the Odrowąż locality. From that time several localities with dinosaurs footprints and track assemblages was described from the Holy Cross Mountains region (Gierliński & Pieńkowski 1999). One of them is Odrowąż (known also as Sołtyków). The first dinosaur footprint described from this place was found in the Lower Hettangian deposits (Zagaje series) (Pieńkowski & Gierliński 1987). Numerous dinosaurs footprints have been found since 1987 year. Now the surface with dinosaurs track assemblages is exposed (Ryc. 5), in the lower part of the Odrowąż outcrop (Gierliński & Pieńkowski 1999). Also structures tentatively interpreted as dinosaur nests and post-eggs structures were described from Lower Hettangian deposits of Odrowąż (Sołtyków) outcrop (Pieńkowski 1998). However, no dinosaur bones were found here so far (Pieńkowski 1998).

Ryc. 5. General view of the Odrowąż (Sołtyków) outcrop. There are a surface with dinosaurs footprints under the roof. (fot. J. Ziaja, 2001 year)

MATERIAL

The investigated material was obtained from the outcrop of the Jurassic plant-bearing rocks in Odrowąż. These rocks were collected by Władysław Karaszewski and Maria Reymanówna in 1975 and by Maria Reymanówna, Elżbieta Wcisło-Luraniec and Jadwiga Ziaja in 1985-1987. Janusz Luraniec, Władysław Szczepański, Krystyna Wasylikowa and Wiesław Ziaja helped in that.

The plant macrofossils from Odrowąż were preserved partly as compressions/impressions and partly as a fusain (fossil charcoal) (Reymanówna 1993, Wcisło-Luraniec 1993, Ziaja 1993, Ziaja & Wcisło-Luraniec 1998, 1999).

The best palynological samples were obtained from the gray layer of mudstones, about 14 m from the upper part of the outcrop, below dark-yellow layer of siltstones with siderite visible on the ryc. 6.

Ryc. 6. The part of outcrop in Odrowąż from which the best palynological samples were obtained (fot. J. Ziaja,1987 year)

METHODS

The state of preservation of sporomorphs is bad. Because of that a few ways of maceration were used. The samples were taken and prepared by the author according to the ways published earlier (Mädler 1964, Couper 1958, Guy 1971, Kaiser & Ashraf 1974, Lund 1977) and advices given by Maria Reymanówna from the Władysław Szafer Institute of Botany Polish Academy of Sciences in Cracow and Małgorzata Zurzycka from the Laboratory of the Palaeobotany Department of that Institute.

The following methods of maceration were used:

I. Maceration using 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.

1. 30 grams of pulverised material were set in a 200- 250 ml plastic beaker with a cover.

2. Concentrated HCl was poured the sample over. 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 were added and thus the sample was allowed to stand for 24-48 hours. During that time the sample was stirred with a glass or plastic stick one or a few times.

4. The acid was decanted and 150-200 ml of Schulze's reagent were added to the beaker. After accurate stirring the sample was allowed to stand for 24-48 hours. During that time the sample was stirred one time only. My modification was adding equal quantities of 65% HNO_3 and H_2O for 24 hours, and $KClO_3$ was added afterwards for ca. 5 hours and mixed with the sample in the beginning of that time.

5. After decanting the reagents the sample was removed 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. That was repeated until the water above the sediment became clean.

6. After decanting the water 10% solution of KOH was added to the sample, which was shakened and centrifuged for 1-3 minutes at a speed of 1000-3000 revolutions per minute. Afterwards, the reagent was decanted.

7. The distilled water was added and the sample was washed a few times.

8. The sediment was removed to the smaller tubes in which the sediment was washed with the 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 sediment was stored in that form.

14 samples were produced in the way described above. They have the following numbers: O5, O6/1, O6/2, O9/1, O10, O11/1, O11/2, O12, O13. Apart from that 3 samples numbered O7, O8, and O9/2 were made. But $KClO_3$ had been added for a period of 5 hours during the maceration (see point 4).

Two samples numbered O18 and O19, 20 g of weight, were made and left in the distilled water in order to take SEM photos.

II. Maceration with using HNO_3, NH_4OH and HF.

1. 30 grams of pulverised material were set in a 250 ml plastic beaker with a cover.

2. 65% HNO_3 was poured the sample over and the beaker was allowed to stand for 22 hours.

3. The distilled water was added to the acid and the beaker was allowed to stand for 2 hours.

4. The liquid from the beaker was decanted and distilled water was added and thus the sample was allowed to stand for about 20 hours.

5. After decanting the water several % solution of NH_3 was added to the sample for about half of hour.

6. The ammonium hydroxide from the beaker was decanted and distilled water was added and thus the sample was allowed to stand for about 3 hours.

7. After decanting the water, distilled water was added once again for about 20 hours.

8. The water was decanted and equal quantities of 40% HF and H_2O were added for about half of hour.

9. Hydrofluoric acid was decanted and distilled water was added for 3 hours.

10. The water was decanted and distilled water was added once again for 20 hours.

11. The sediment was removed to the glass tubes and thus the sample was allowed to stand for about 2 hours.

12. After decanting the water glycerine solution was added, the sample was stirred and thymol was added and the sample was stirred once again.

4 samples were produced in the way described above. They have the following numbers: O14, O15, O16, O17.

III. Maceration with using 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, 14 μm mesh filter.

1. 150 grams of pulverised material were set in a plastic container with a cover.

2. Concentrated HCl was poured over the sample and the container was allowed to stand for a few minutes.

3. The distilled water was added to the acid and the container was allowed to stand for 2 hours.

4. The liquid from the container was decanted and 40% HF was added and thus the sample was allowed to stand for 24 hours.

5. Hydrofluoric acid was decanted and Schulze's reagent was added for 20 hours.

6. The reagent was decanted and distilled water was added.

7. After decanting the water 10% solution of KOH was added to the sample.

8. The liquid was decanted and the sample was washed and sieved through a filter with distilled water several times.

It appeared that the sample had not been well macerated and because of that was exposed to the next maceration in 40 % hydrofluoric acid. Afterwards, the sample was washed in distilled water and 10% KOH, and sieved through the filter. The process was repeated until the sample became clean. The sample was stored in distilled water with thymol and signed OS_1.

The next sample signed OS_2 was macerated in the similar way but the time of maceration was longer. That maceration was made in the following way:

1. 150 grams of pulverised material were set in a plastic container with a cover.

2. 10% HCl was poured over the sample and the container was allowed to stand for about 5 minutes.

3. Distilled water was added to the acid and the container was allowed to stand for 2.5 hours.

4. The liquid from the container was decanted and 40% HF was added, and thus the sample was allowed to stand for 24 hours.

5. Hydrofluoric acid was decanted and 40% HF was added once again for about 23 hours.

6. Hydrofluoric acid was decanted and Schulze's reagent was added for 3 days (about 72 hours). During that time the sample was stirred several times with a plastic stick.

7. The reagent was decanted and distilled water was added for about 6 days (143 hours). During that time the sample was stirred one time per day with a plastic stick

8. After decanting the water, the distilled water was added once again to the sample for about 3 days (about 66 hours).

9. The water was decanted and the sample was washed and sieved through a filter with distilled water.

10. The sediment was placed in the plastic container and distilled water was added for 4 days (about 104 hours).

11. After decanting the water, the distilled water was added once again to the sample for about 2 days (about 46 hours).

12. The water was decanted and 10% solution of KOH was added to the sample for 10 minutes.

13. The sample was washed and sieved through a filter with distilled water.

14. The sediment was placed in the plastic container and distilled water was added for 24 hours.

15. After the washing and sieving through the filter with distilled water the sample was placed into contatner and distilled water was added for about 5 days (about 120 hours).

16. After the washing and sieving through the filter with distilled water the sample was placed into a container and and distilled water was added for about 5 days once again.

17. One part of sample was removed to small glass tubes in which the sediment was washed by centrifuging at a speed of 1000 revolutions per minute with the distilled water one time during 3 minutes.

18. That part of sample was imbedded in glycerine solution by centrifuging at a speed of 1000 revolutions per minute during 15 minutes.

19. The remaining part of sediment was stored with distilled water and thymol.

Table visible below shows the number of the slides from the best samples from the Jurassic sediments from Odrowąż

the kind of sediment	gray siltstones with fossil plants	siltstones with siterite and fossil plants		dark gray mudstones with fossil plants			sandstones with fossil plants		mudston es with *Neocala mites* sp.
nubmer of samples	O6	O10	OS2	O5	O8	O 15	O9	O17	O13
amount of slides	2	1	4	11	29	1	5	1	1
nubmers 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

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

The best samples (O8 and O5) were obtained after maceration of dark gray mudstone shales. Layer of this mudstones are visible on the ryc. 6. The best kind of maceration was this with using 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.

For the sample O8 maceration equal quantities of 65% HNO_3 and H_2O were used for 24 hours, and $KClO_3$ was added afterwards for ca. 5 hours and mixed with the sample in the beginning of that time. Palynological samples from others kinds of sediment from Odrowąż were scanty or without spores and pollen grains.

SYSTEMATIC SECTION

List of spores and pollen grains from Odrowąż in alphabetical order

1. *Acanthotriletes varius* Nilsson 1958 ?, Pl. 2, fig. 12
2. *Alisporites* cf. *diaphanus* (Pautsch 1958) Lund 1977, Pl. 4, fig. 13
3. cf. *Alisporites microsaccus*(Couper1958) Pocock1962, Pl. 4, fig. 15
4. *Alisporites robustus* Nilsson 1958, Pl. 4, fig. 16, Pl. 5, figs 1, 4, 6
5. *Alisporites* cf. *robustus* Nilsson 1958, Pl. 5, fig. 9
6. *Alisporites thomasii*. (Couper 1958) Nilsson 1958, Pl. 5, fig. 2
7. *Apiculatisporis ovalis* (Nilsson 1958) Norris 1965, Pl. 2, fig. 8
8. *Aratrisporites minimus* Schulz 1967, Pl. 4, figs 1-12, 14
9. cf. *Araucariacites australis* Cookson 1947 ex Couper 1953, Pl. 7, fig. 4
10. cf. *Araucariacites* sp., Pl. 7, fig. 5
11. *Auritulinasporites triclavis* Nilsson 1958, Pl. 2, fig. 9
12. *Auritulinasporites* sp., Pl. 2, fig. 7
13. *Calamospora tener* (Leschik 1955) Mädler 1964, Pl. 1, figs 15-16; Pl. 2, figs 1-2
14. *Chasmatosporites apertus* (Rogalska 1954) Nilsson 1958, Pl. 7, fig. 19
15. *Chasmatosporites* cf. *elegans* Nilsson 1958, Pl. 7, figs 16-18
16. *Chasmatosporites hians* Nilsson 1958, Pl. 8, fig. 1
17. *Chasmatosporites major* Nilsson 1958, Pl. 8, fig. 2
18. *Chasmatosporites* cf. *rimatus* Nilsson 1958, Pl. 8, fig. 3
19. *Cibotiumspora juriensis* (Balme1957) Filatoff 1975, Pl. 2, fig. 10
20. *Cingutriletes* sp., Pl. 3, fig. 12
21. *Classopollis torosus* (Reissinger 1950) Couper 1958, Pl. 8, figs 9-22, Pl. 9, figs 1-14.
22. *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958,, Pl. 9, figs 5-7, 10-11
23. *Conbaculatisporites mesozoicus* Klaus 1960, Pl. 2, fig. 11
24. *Concavisporites toralis* (Leschik 1955) Nilsson 1958, Pl. 1, figs 7-11
25. *Contignisporites problematicus* (Couper 1958) Döring 1965, Pl. 3, fig. 5
26. *Cyathidites minor* Couper 1953, Pl. 1, figs 1-4
27. cf. *Cyathidites australis* Couper 1953, Pl. 1, fig. 5
28. cf. *Cyathidites* sp., Pl. 1, fig. 6

29.cf. *Deltoidospora* sp., Pl.1, fig.12

30.*Ephedripites tortuosus* Mädler 1964(b), Pl. 8, figs 7-8

31.*Foraminisporis jurassicus* Schulz 1967, Pl. 2, fig. 14

32.*Foveotriletes* sp., Pl. 3, fig. 16

33.cf. *Inaperturopollenites* sp., Pl. 7, figs 2-3

34.*Latosporites* sp., Pl. 3, fig. 14

35.*Leptolepidites* sp., Pl. 2, fig. 16

36.*Lycopodiacidites rugulatus*(Couper 1958) Schulz 1967, Pl. 3, fig. 1

37.*Lycopodiumsporites cerniidites* (Ross 1949) Delcourt et Sprumont 1955, Pl. 3, figs 11, 15

38.*Lycopodiumsporites semimuris* Danzé-Corsin et Leveine 1963, Pl. 3, figs 2, 4

39.*Lycopodiumsporites* sp., Pl. 3, fig. 3

40.cf. *Lycospora salebrosacea* (Malj.1949) Schulz 1967, Pl. 3, fig. 9, 13

41.*Marattisporites* sp.1, Pl. 3, fig. 18

42.*Marattisporites* sp. 2, Pl. 3, fig 17

43.*Matonisporites* sp. 1, Pl. 3, figs 6-7

44.*Matonisporites* sp. 2, Pl. 3 fig. 8

45.*Monosulcites minimus* Cookson 1947, Pl. 8, fig. 4

46.*Monosulcites subgranulosus* Couper 1958, Pl. 8, fig. 5

47.*Neochomotriletes triangularis* (Bolkhovitina 1956) Reinhardt 1961, Pl. 3 fig. 10

48.*Osmundacidites* sp., Pl. 2, fig. 17

49.*Perinopollenites elatoides* Couper 1958, Pl. 7, figs 13 -15

50.? *Pinuspollenites labdacus* var. *arcuatus* Danzé - Corsin et Leveine 1963, Pl. 6, figs 7, 9

51.*Pityosporites minimus* (Couper 1958) comb. nov., Pl. 5, figs 5, 7, 8, 10, Pl. 6, figs 1, 3, 5

52.cf. *Pityosporites minimus* (Couper 1958) comb. nov., Pl. 6, figs 6, 8, Pl. 7, fig. 1

53.*Platysaccus nitidus* Pautsch 1971, Pl. 6, figs 2, 4

54.*Plicifera delicata* (Bolkh. 1953) Bolkh. 1966, Pl. 1, figs 13-14

55.*Rogalskaisporites cicatricosus* (Rogalska 1954) Danzé-Corsin & Leveine 1963, Pl. 2, figs 5-6

56.*Spheripollenites psilatus* Couper 1958, Pl. 7, fig. 6

57.*Spheripollenites subgranulatus* Couper 1958, Pl. 7, fig. 7

58.*Spheripollenites* sp., Pl. 7, figs 8-10, 12

59.*Todisporites minor* Couper 1958, Pl. 2, fig. 3

60.cf. *Todisporites* sp., Pl. 2, fig. 4

61. *Uvaesporites argentaeformis* (Bolkh. 1953) Schulz 1967, Pl. 2, fig. 15

62. cf. *Uvaesporites* sp., Pl. 2, figs 13, 18

63. *Vitreisporites pallidus* (Reissinger 1950) Nilsson 1958, Pl. 5, fig. 3

Incertae sedis no. 1, Pl. 7, fig. 11

Incertae sedis no. 2, Pl. 8, fig. 6

Incertae sedis no. 3, Pl. 13, fig. 1

Incertae sedis no. 4, Pl. 13, figs 2-3

Incertae sedis no. 5, Pl. 13, fig. 4

Incertae sedis no. 6, Pl. 13, fig. 5

Incertae sedis no. 7, Pl. 13, fig. 6

Incertae sedis no. 8, Pl. 13, fig. 7

Incertae sedis no. 9, Pl. 13, fig. 8

Incertae sedis no. 10, Pl. 13, fig. 9

Incertae sedis no. 11, Pl. 13, fig. 10

Incertae sedis no. 12, Pl. 13, fig. 11

Incertae sedis no. 13, Pl. 13, fig. 12

Incertae sedis no. 14, Pl. 13, fig. 13, cuticule

Systematics

Artifical classification system proposed by Potonié and Kremp (1954, 1955, 1956), Potonié (1956, 1958, 1960, 1966, 1970) and Dettmann (1963) is used there. Taxonomic references to genera and higher taxa are not included but are given by Dettmann (1963), Schulz (1967) and Tralau (1968)

Anteturma ***Sporites*** H. Potonié 1893

Turma ***Triletes*** Reinsch 1881 ex Schopf 1938 emend. Dettmann 1963

Suprasubturma ***Acavatitriletes*** Dettmann 1963

Subturma ***Azonotriletes*** Luber 1937 emend. Dettmann 1963

Infraturma ***Laevigati*** Bennie et Kidston 1886 emend. R. Potonié 1956

Genus *Cyathidites* Couper 1953

Cyathidites minor Couper 1953

cf. *Cyathidites australis* Couper 1953

cf. *Cyathidites* sp.

Genus *Concavisporites* Pflug in Thomson et Pflug 1953

Concavisporites toralis (Leschik 1955) Nilsson 1958

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

Deltoidospora sp.

Genus *Plicifera* Bolkhovitina 1966

Plicifera delicata (Bolkh. 1953) Bolkh. 1966

Genus *Calamospora* Schopf, Wilson et Bentall 1944

Calamospora tener (Leschik 1955) Mädler 1964

Genus *Rogalskaisporites* Danzé-Corsin et Leveine 1963

Rogalskaisporites cicatricosus (Rogalska 1954) Danzé-Corsin et Leveine 1963

Genus *Todisporites* Couper 1958

Todisporites minor Couper 1958

cf. *Todisporites* sp.

Genus *Auritulinasporites* Nilsson 1958

Auritulinasporites triclavis Nilsson 1958

Auritulinasporites sp.

Genus *Cibotiumspora* Chang 1965

Cibotiumspora juriensis (Balme1957) Filatoff 1975

Infraturma ***Apiculati*** Bennie et Kidston 1886 emend. R. Potonié 1956

Genus *Conbaculatisporites* Klaus 1960

Conbaculatisporites mesozoicus Klaus 1960

Genus *Apiculatisporis* Potonié et Kremp 1954

Apiculatisporis ovalis (Nilsson 1958) Norris 1965

Genus *Foraminisporis* Krutzsch 1959

Foraminisporis jurassicus Schulz 1967

Genus *Uvaesporites* Döring 1965

Uvaesporites argentaeformis (Bolkh. 1953) Schulz 1967

cf. *Uvaesporites* sp.

Genus *Leptolepidites* Couper 1953 emend. Schulz 1967

Leptolepidites sp.

Genus *Acanthotriletes* Naumova 1939 ex 1949 emend. Potonié et Kremp 1954

Acanthotriletes varius (Nilsson 1958) Schuurman 1977

Genus *Osmundacidites* Couper 1953

Osmundacidites sp.

Infraturma ***Murornati*** Potonié et Kremp 1954

Genus *Lycopodiacidites* Couper 1953

Lycopodiacidites rugulatus (Couper 1958) Schulz 1967

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

Lycopodiumsporites semimuris Danzé-Corsin et Leveine 1963

Lycopodiumsporites cerniites (Ross 1949) Delcourt et Sprumont 1955

Lycopodiumsporites sp.

Genus *Contignisporites* Dettmann 1963

Contignisporites problematicus (Couper 1958) Döring 1965

Infraturma ***Cingulati*** Potonié et Klaus emend Dettmann 1963

Genus *Cingutriletes* Pierce 1961 emend. Dettmann 1963

Cingutriletes sp.

Genus *Foveotriletes* Potonié 1956

Foveotriletes sp.

Genus *Lycospora* Schopf , Wilson et Bentall 1944

cf. *Lycospora salebrosacea* (Maljavkina 1949) Schulz 1967

Genus *Neochomotriletes* Reinhardt 1961

Neochomotriletes triangularis (Bolkhovitina 1956) Reinhardt 1961

Subturma ***Zonotriletes*** Waltz 1935

Infraturma ***Auriculati*** Schopf 1938 emend. Dettman 1963

Genus *Matonisporites* Couper 1958

Matonisporites sp. 1

Matonisporites sp. 2

Turma ***Monoletes*** Ibrahim 1933

Suprasubturma ***Acavatomonoletes*** Dettmann 1963

Subturma ***Azonomonoletes*** Luber 1935

Infraturma ***Psilamonoleti*** van der Hammen 1955

Genus *Latosporites* Potonié et Kremp 1954

cf. *Latosporites* sp.

Genus *Marattisporites* Couper 1958

Marattisporites sp. 1

Marattisporites sp. 2

Subturma ***Zonomonoletes*** Luber

Genus *Aratrisporites* Leschik 1955

Aratrisporites minimus Schulz 1967

Aratrisporites sp.

Anteturma ***Pollenites*** Potonié 1931

Turma ***Saccites*** Erdtman 1947

Subturma ***Disaccites abstriates*** Cookson 1947

Genus *Alisporites* Daugherty 1941 emend. Nilsson 1958

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

Alisporites robustus Nilsson 1958

Alisporites thomasii. (Couper 1958) Nilsson 1958

Genus *Platysaccus* Naumova 1937 emend. Potonié et Klaus 1954

Platysaccus nitidus Pautsch 1971

Genus *Vitreisporites* Leschik 1955

Vitreisporites pallidus (Reissinger 1950) Nilsson 1958

Genus *Pityosporites* Seward 1914 emend. Manum 1960

Pityosporites minimus (Couper 1958) comb. nov.

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

Genus *Pinuspollenites* Raatz 1937 emend. Potonié 1958

Pinuspollenites labdacus Danzé-Corsin et Leveine 1963

Turma ***Aletes*** Ibrahim 1933

Subturma ***Azonaletes*** Luber 1935 emend. Potonié et Kremp 1954

Genus *Inaperturopollenites* Pflug 1952 emend. Thomson et Pflug 1953

Inaperturopollenites sp.

Genus *Araucariacites* Cookson 1947 emend. Couper 1953

cf. *Araucariacites australis* (Cookson 1947) Couper 1953

cf. *Araucariacites* sp.

Genus *Spheripollenites* Couper 1958

Spheripollenites psilatus Couper 1958

Spheripollenites subgranulatus Couper 1958

Spheripollenites sp.

Genus *Perinopollenites* Couper 1958

Perinopollenites elatoides Couper 1958

Turma ***Plicates*** Naumova 1939 emend. Potonié 1960

Subturma ***Monocolpates*** Iversen et Troels-Smith 1950

Genus *Chasmatosporites* Nilsson 1958

Chasmatosporites apertus (Rogalska 1954) Nilsson 1958

Chasmatosporites cf. *elegans* Nilsson 1958

Chasmatosporites cf. *hians* Nilsson 1958

Chasmatosporites major Nilsson 1958

Chasmatosporites cf. *rimatus* Nilsson 1958

Genus *Monosulcites* Cookson 1947 emend. Couper 1953

Monosulcites minimus Cookson 1947

Monosulcites subgranulosus Couper 1958

Subturma ***Polyplicates*** Erdtman 1952

Genus *Ephedripites* Bolchovitina 1953

Ephedripites tortuosus Mädler 1964b

Turma ***Kryptoaperturates*** Potonié 1960

Subturma ***Circumpolles*** Pflug 1953 emend. Klaus 1960

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

Classopollis torosus (Reissinger 1950) Couper 1958

Classopollis sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958

Descriptions of the taxa

The measurements are given according to dimensions indicated in Schulz (1967, p. 555, textfig. 1)

Geographical distribution is given like in papers cited in list of synonyms for the taxon but also other places of this distribution are given like in Weiss (1989)

Cyathidites minor Couper 1953

Pl. 1, figs 1-4

1953 *Cyathidites minor* n. sp., Couper, p. 28, pl. 2, fig. 13.

1954 *Coniopteris* sp.; Rogalska, p. 10, fig. 10.

1958 *Cyathidites minor* Couper; Couper, p. 139, pl. 20, 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) n. comb., 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 & Schmidt, pp. 111, 132, 134, 136, 138, pl. 1, fig. 1.

1991 *Deltoidospora minor* (Couper) Pocock; Dybkjær, p.18, pl. 1, fig. 2.

DESCRIPTION: Spore 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 E = 27.2 µm - 54.4 µm

(9 specimens measured)

polar diameter P = 23.8 µm - 51 µm

(5 specimens measured)

MATERIAL: 10 specimens from Odrowąż.

Slides:

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, p. 139) wrote that : "Many of dispersed spores recorded here as *C. 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, p. 295) dispersed *C. minor* spores are very similar to dicksoniaceous spores *in situ* of *Coniopteris simplex*, *Coniopteris concinna*, *Coniopteris bella*, *Coniopteris hymenophylloides*, *Coniopteris murrayana*, *Kylikipteris arguta*, *Eboracia lobifolia* and *Dicksonia mariopteris*. Balme (1995, p. 251) placed affinity of dispersed *Cyathidites* (=*Deltoidospora* in part) in Filicopsida (Marattiales, Gleicheniaceae, Dipteridaceae, Dicksoniaceae, Schizeaceae, Polypodiaceae?).

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, p. 22).

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, p. 28) wrote that generic names *Leiotriletes* Naumova, *Cyathidites* Couper, and *Deltoidospora* Miner are synonyms and *Deltoidospora* has priority. According to Pocock (1970a, p. 31) *Concavisporites* Pflug is a junior synonym of *Gleicheniidites* (Ross) Delcourt & Sprumont. However Lund (1977, p. 49) placed *Leiotriletes* Naumova, *Cyathidites* Couper, *Concavisporites* Pflug and *Dictyophyllidites* Couper in *Deltoidospora* Miner. Jansonius & 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 1939 ex Ishchenko 1952 as separate genera. Triangular, trilete dispersed spores with smooth exine have not clear systematics because of various opinion 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 list of species without explanations about synonymy.

cf. *Cyathidites australis* Couper 1953

Pl. 1, fig. 5

1953 *Cyathidites australis* n. sp., Couper, p. 27, pl. 2, figs 11-12.

1958 *Cyathidites australis*; 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 mesoziocus* (Thiergart) nov. comb., 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 & Schmidt, pp. 111, 132, 134, 136, 138, 140, pl. 1, figs 2-3.

1991 *Deltoidospora australis* (Couper) Pocock; Dybkjær, p.18.

DESCRIPTION: Spore trilete. Amb triangular with almost straight sides. Exine smooth, about 2 µm thick. The specimen is cracked along the tetrad mark.

DIMENSIONS: equatorial diameter E about 70 µm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O5/2/95; 97.1/7.5

AFFINITY: The same as *Cyahidites minor* (Couper 1958). According to Van Konijnenburg-van Cittert (1989, p. 295) dispersed *C. australis* "would include spores of *Coniopteris magaretae* 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, p. 19).

REMARKS: Differences within *C. australis* and *C. minor* are in sizes not in morphology of spores. This problem is disscuss by Couper (1958, p. 139) and Weiss (1989, pp. 21-22) in detail.

cf. *Cyathidites* sp.

Pl. 1, fig. 6

DESCRIPTION: Spore triangular in equatorial outline with rounded apices and convex sides. Visible triangular dehiscence. Exine smooth.

DIMENSIONS: equatorial diameter E = 32 μm

(1 specimen measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

O5/6/95; 96.1/3.8

O10/1; 104/12

AFFINITY: Fern spores, probably from Cyatheaceae or Dicksoniaceae.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: These spores differs from *Cyathidites minor* Couper 1953 spores because of convex sides and shape of dehiscience.

Concavisporites toralis (Leschik 1955) Nilsson 1958

Pl. 1, figs 7-11

1954 *Clathropteris obovata* var. *magna* Tur.-Ket.; Rogalska, pp.11-12, pl. 3, fig. 3.

1955 *Levigatisporites toralis* n. sp., Leschik, p. 12, pl. 1, fig. 9.

1956 *Clathropteris obovata* var. *magna* Tur.-Ket.; Rogalska, p. 15, pl. 5, fig. 1.

1958 *Concavisporites toralis* (Leschik) n. comb., Nilsson, p. 34, pl. 1, figs 12-13.

1964 *Toroisporis (Toroisporis) toralis* (Leschik) n. comb., 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 n. comb.; 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. 4 E.

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.

DESCRIPTION: Spore 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 leasure. Exine smooth.

DIMENSIONS: equatorial diameter E = 23 µm - 35 µm

(6 specimens measured)

MATERIAL: 8 specimens from Odrowąż.

Slides:

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

AFFINITY: According to Leschik (1955, p. 12) these spores are similar to spores of recent ferns *Cyathea brunonis* Wall. and *Alsophila procera* Kaulf. Balme (1995) does not give an affinity

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic - Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: China, Demnark, France, Germany, Great Britain, Greenland, Hungary, Iran, Luxembourg, Norway, Poland, Sweden, Switzerland

Reported also from: Austria, Italy, Spain (Weiss 1989, p. 17).

REMARKS: *Concavisporites toralis* (Leschik 1955) Nilsson 1958 resembles *Dictyophyllidites mortoni* (de Jersey 1959) Playford et Dettmann 1965. Differences between these species of dispersed spores are not clear. According to Playford & Dettmann (1965, p. 132) *Concavisporites toralis* (Leschik 1955) Nilsson 1958 "has a thinner exine and apparently lacks elevated leasurate lips". This problem is also disscuss by Bjærke & Manum, (1977 p. 28, Achilles (1981, pp. 12, 17) and Weiss (1989, pp.12, 25). See also remarks to *Cyathidites minor* Couper 1953.

cf. *Deltoidospora* sp.

Pl. 1, fig. 12

DESCRIPTION: 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.

DIMENSIONS: equatorial diameter E = about 34 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/2; 94/17

AFFINITY: Probably spore of Filicales (? Dipteridaceae).

STRATIGRAPHICAL DISTRIBUTION: Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen resembles a fern spore of *Thaumatopteris schenkii* Nathorst (Dipteridaceae) (Harris 1931, pl.18, fig.1) in dimensions, smooth exine and shape of exinal folds visible on photograph. Detailed comparision is impossible because of the lack of description of *Thaumatopteris schenkii* spore in Harris' book. Couper (1958, p. 118) wrote that 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 & Dettmann (1965, p. 132) consider *Thaumatopteris schenkii* spore (Harris 1931, pl.18, fig.1) to be similar to dispersed spores *Dictyophyllidites mortoni* (de Jersey 1959) Playford et Dettmann 1965. According to Balme (1995, p. 165) *in situ Thaumatopteris schenkii* spores are similar to dispersed *Cyathidites/Deltoidospora* spores and this author (Balme 1995, p. 167) suggested similarity dispersed *Dictyophyllidites mortoni* (de Jersey 1959) Playford et Dettmann to *in situ Phlebopteris angustiloba* spores.

Plicifera delicata (Bolkh. 1953) Bolkh.1967

Pl. 1, figs 13-14

1953 *Gleichenia delicata* sp. nov., Bolkhovitina, p. 22, pl. 2, figs 1- 4.

1967 *Plicifera delicata* (Bolkhovitina) Bolkhovitina; Bolkhovitina, pp. 62-63, pl. 1, fig. A.

1968 *Plicifera delicata* (Bolkh.) Bolkh.; Bolkhovitina, pp. 35-36, pl. 5, figs 14-21, pl. 6, figs 1-19.

1970a *Gleicheniidites delicatus* (Bolkh.) n. comb., Pocock, p. 32, pl. 5, fig. 13.?

DESCRIPTION: Spore 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. Occasionaly folds connectet together on the apex of the spore. Exine thin and smooth.

DIMENSIONS: equatorial diameter E = 37.4 μm - 47.6 μm

(2 specimens measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

O5/5/95; 106.5/5.5

O8/2; 94.5/7

AFFINITY: Ferns from the family Gleicheniaceae, subfamily Gleichenioideae (Bolkhovitina 1953, 1967 and 1968).

STRATIGRAPHICAL DISTRIBUTION: from Upper Jurassic to Oligocene (Bolkhovitina 1968), Lower Jurassic (Odrowąż - present paper)

GEOGRAPHICAL DISTRIBUTION: Poland, Russia

REMARKS: 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 for *Gleicheniidites senonicus* Ross and ought to have 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. Balme (1995) does not give an affinity.

Calamospora tener (Leschik 1955) Mädler 1964

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

1955 *Laevigatisporites tener* n. sp., Leschik, p.13, pl. 1, fig. 20.

1955 *Punctatasporites flavus* n. sp.; Leschik, p. 31, pl. 4, fig. 2.

1956 *Calamites* sp.; Rogalska, pp. 18-19, pl. 7, fig. 5.

1958 *Calamospora mesozoica* n. sp., Couper, p. 132, pl. 15, figs 3-4.

1960 *Calamospora nathorstii* (Halle) nov. comb.; Klaus, pp. 116-118, pl. 28, fig. 1.

1964a *Calamospora tener* (Leschik) n. comb., Mädler; pp. 92- 93, pl. 8, fig. 2.

1965 *Calamospora mesozoica* Couper; Wall, p. 165.

1968 *Calamospora mesozoica* Couper; Tralau, p. 25.

1970 *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 et Bentall) Potonié et 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 & Schmidt, pp. 111, 134, 138, pl. 1, figs 12, 18.

1991 *Calamospora tener* (Leschik) Mädler; Dybkjær, p.19, pl.1, fig. 10.

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

DIMENSIONS: length about 26.4 μm to about 49.6 μm (7 specimens measured),

width 20.4 μm to 40 μm (7 specimens measured).

MATERIAL: 12 specimens from Odrowąż.

Slides:

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 Palaezoic genus *Calamospora* are comparable to spores of *Equisetites (Equisetostachys) suecicus* Nathorst and *Equisetites (Equisetostachys) nathorsti* Halle. Couper (1958, p. 132) suggests also that Mesozoic *Calamospora* may be 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, p. 93) placed Mesozoic dispersed *Calamospora* spores affinity not in Calamitales or Noeggerathiales but in Equisetales. Filatoff (1975) attributed *Calamospora* to sphenopsid spores. Balme (1995, pp. 250-251) wrote about affinity of *Calamospora* dispersed spores from Rhyniopsida (Trimerophytales); Zosterophyllopsida; Barinophytopsida (Barinophytales); Lycopsida (Sellaginellales?); Equisetopsida (Bowmanitales, Calamostachyales, Equisetales); 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 1964(a).

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, p. 33).

REMARKS: Some authors e.g. Mädler (1964), Lund (1977), Dybkjær (1991) have regarded *Calamospora tener* (Leschik) Mädler as the senior synonym to *Calamospora mesozoica* Couper. According to Filatoff (1975) *C. mesozoica* differs from *C. tener* and *C. nathorstii* by possesing 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 in general, 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 is impossible to distinguish not only *C. mesozoica* from *C. tener* but also *Inaperturopollenites* from *Calamospora* because of lack distinct tetrad mark.

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

Pl. 2, figs 5-6

1954 *Sporites cicatricosus* n. sp., Rogalska, p. 26, p. 44, pl. 12, fig. 11.

1955 *Stereisporites perforatus* n. sp., Leschik, p. 10, pl. 1, fig. 3-4.

1956 *Sporites cicatricosus* Rogalska; Rogalska, p. 41, p. 84, pl. 29, fig. 7.

1963 *Rogalskaisporites cicatricosus* (Rogalska) nov. comb., 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. emend., 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*; 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. 5 H-I.

1983 *Rogalskaisporites cicatricosus* (Rogalska) Danzé-Corsin & Laveine; Orlowska-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 & Schmidt, p.113, 134, 138, pl. 1, fig. 12, 18.

1991 *Stereisporites cicatricosus* (Rogalska) Schulz; Dybkjær, p. 19.

DESCRIPTION: Spore convexly triangular in equatorial outline. Triradiate tetrad mark distinct, extending 1/2 of the spore radius. Laesurae with margo about 2.5 µm wide. Central part of spore thick and convex on the distal side. This central thickening forms the ring with dentate margin or the ring consisting of verrucae. Verrucae 3.2 - 4.8 high and 2.4 - 3.2 wide. Exine smooth, form equatorial rim about 2.5 μm wide.

DIMENSIONS: equatorial diameter E = 27.2 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

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, p. 85)

REMARKS: Filatoff (1975, pp 38-39) disscus in detail this species. This author described and illustrated 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, adjencent 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 preservation and original development or maturity of the spore." Dentate margin of the polar crassitude or ring consisting of thick verrucae are visible in the specimen from Odrowąż.

Todisporites minor Couper 1958

Pl. 2, fig. 3

1958 *Todisporites minor* n. sp., 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 & Schmidt, pp. 111, 134.

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

DIMENSIONS: equatorial diameter E = about 34 μm

(2 specimens measured)

MATERIAL: 2 specimens from Odrowąż

Slides:

O8/3; 107/19.5

O8/50/95; 108/11

AFFINITY: Dispersed spores *Todisporites minor* Couper 1958 are similar to *in situ* spores from the Mesozoic fern *Todites princeps* (Presl) Gothan (Osmundaceae) (Couper 1958, Tralau 1968, van Konijnenburg-van Cittert 1978). Balme (1995, p. 257) 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, p.36).
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* has been found in the Liassic sediments from Odrowąż (Wcisło-Luraniec 1992a). It is possible that the dispersed spores *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 surrounding by exine folds. Leasure extending 2/3 spore radius. There are short, transversal exinal folds on the ends of leasures. Exine smooth and thin.
DIMENSIONS: equatorial diameter E = about 35 μm
(1 specimen measured)
MATERIAL: 1 specimen from Odrowąż.
Slide:
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 therefore probably immature.

Cibotiumspora juriensis (Balme1957) Filatoff 1975

Pl. 2, fig. 10

1957 *Concavisporites jurienensis* new species, Balme, pp. 20-21, pl. 2, figs 30-31.
1958 *Auritulinasporites intrastriatus* n. sp., 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 nov. comb., Arjang, pp. 110 -111, pl. 2, fig. 14.?

1975 *Cibotiumspora juriensis* (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 juriensis* (Balme) Filatoff; Hoelstad, p. 121, pl. 2, figs 9-10.

1986 *Cibotiumspora juriensis* (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 juriensis* (Balme) Filatoff; Dybkjær, p. 18, pl. 1, fig. 4.

DESCRIPTION: Spore triangular in equatorial outline with concave or the convex sides. Triradiate tetrad mark extending to the equator. The characteristic thickenning of distal side is visible. This thickening 5-6 μm wide, parallel to the sides of the spore, 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 E = about 24 - 32 μm

(2 specimens measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

O8/48; 95.1/10

O10/1; 106.5/6

AFFINITY: Balme (1957, p. 21) 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) differs 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 juriensis* (Balme) Filatoff (Filatoff 1975, pl.10, figs 8 and 10).

Auritulinasporites triclavis Nilsson 1958

Pl. 2, fig. 9

1958 *Auritulinasporites triclavis* n. sp., Nilsson, p. 36, pl. 1, figs 14-15.

1981 *Auritulinasporites triclavis* Nilsson; Guy-Ohlson, p. 235, fig. 6 F.

1986 *Auritulinasporites triclavis* Nilsson; Guy-Ohlson, p. 13.

DESCRIPTION: Spore 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 leasures, extending on apices to distal sides of spore. Thickening is the widest on apices of the spore - about 10 μm wide. Exine smooth.

DIMENSIONS: equatorial diameter E = about 34 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

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. 7

DESCRIPTION: Spore 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 E = approximately 30 μm (precise messurement is not possible because of oblique spores position)

MATERIAL: 2 specimens from Odrowąż.

Slides:

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.

Conbaculatisporites mesozoicus Klaus 1960

Pl. 2, fig. 11

1960 *Conbaculatisporites mesozoicus* n. sp., 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. 9 E.

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, figs 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, p.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: Spore triangular with rounded apices and convex or concave sides in equatorial outline. Triradiate tetrad mark extending to the equator. Exine sculptured, covered with spines about 1 μm high and bacula about 1 - 2 μm high.

DIMENSIONS: equatorial diameter E = about 32 μm to about 37 μm

(2 specimens measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

OS2/4; 111.5/15.5

O8/45/95; 97/3

AFFINITY: According to Pedersen & Lund (1980) the *Conbaculatisporites mesozoicus* type are known *in situ* from fern *Clathropteris meniscoides*, Dipteridaceae (Harris 1931, pl. 18, fig. 3). However Potonié (1956, p. 32) suggests that dispersed spores from the genus *Anemiidites* Ross are similar to spores of *Clathropteris meniscoides*, Dipteridaceae (Harris 1931, pl. 18, fig. 3). According to Playford & Dettmann (1965, p. 137) dispersed spores *Converrucosisporites cameroni* (de Jersey) Playford et Dettmann, show a striking similarity to spores illustrated by Harris (1931, pl. 18. fig. 3). Also Balme (1995, pp 163-164) wrote that *Converrucosisporites* spores are similar to spores of fern *Clathropteris meniscoides*, Dipteridaceae. Balme (1995) does not give an affinity for dispersed spores *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, p. 56).

Apiculatisporis ovalis (Nilsson 1958) Norris 1965

Pl. 2, fig. 8

1958 *Acanthotriletes ovalis* n. sp., Nilsson, pp. 40-41, pl. 2, figs 8-9.

1958 *Acanthotriletes trigonus* n. sp., 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 sculptured, covered with spines about 1 μm high and papilla about 1 μm high.

DIMENSIONS: equatorial diameter E = about 48 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/50/95; 105.5/8.5

AFFINITY: Unknown for this species. According to Balme (1995, pp. 138, 148, 151, 156) dispersed spores from 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

Foraminisporis jurassicus Schulz 1967

Pl. 2, fig. 14

1967 *Foraminisporis jurassicus* sp. n., 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 & Schmidt, 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 sculptured, covered by some verrucae 1.8 - 3.2 μm wide. Also some conical elements 1-2.4 μm high and 0.8-1.6 μm wide are visible around the equator of the spore.

DIMENSIONS: equatorial diameter E = about 41 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/58/95; 99.1/2.5

AFFINITY: Anthocerotaceae (Schulz 1967, p. 607).

STRATIGRAPHICAL DISTRIBUTION: Triassic to Middle Jurassic

GEOGRAPHICAL DISTRIBUTION: Denmark, Germany, Poland, Sweden

Reported also from: Greenland and Russia (Weiss 1989, p. 49).

REMARKS: Resembles also:

1958 *Sporites telephorus* new species, Pautsch, p. 323, pl. 1, fig. 12.

1960 *Anapiculatisporites telephorus* Pautsch n. comb.; Klaus, pp. 124-125, pl. 29, fig. 17.

1962 *Anapiculatisporites telephorus* Klaus n. comb., Jansonius, p. 45.

1964 *Carnisporites telephorus* Pautsch n. comb., Mädler, pp. 95-96, pl. 8, fig. 9.

1991 *Anapiculatisporites telephorus* (Pautsch) Klaus; Dybkjær, p. 20, pl. 3, figs 8-9.

Uvaesporites argenteaeformis (Bolkh. 1953) Schulz 1967

Pl. 2, fig. 15

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* n. sp., Reinhardt, p. 707, pl. 2, figs 1-2.

1967 *Uvaesporites argenteaeformis* (Bolchovitina) comb. nov., Schulz, p. 560, pl. 2, figs 10-11, pl. 23, fig. 2.

1968 *Uvaesporites argenteaeformis* (Bolkh.) Schulz; Tralau, pp. 68-69, pl. 3, fig. 4; pl. 4, figs 1-2.

1971 *Uvaesporites argenteaeformis* (Bolkh.) Schulz; Guy, pp. 25-26, pl. 2, fig. 1.

1972 *Uvaesporites argenteaeformis* (Bolkh.) Schulz; Tralau & Artursson, p. 59, Fig. 2M.

1973 *Uvaesporites argenteaeformis* (Bolchovitina) Schulz; Orbell, pl. 4 figs 7-8.

1974 *Uvaesporites argenteaeformis* (Bolch.) Schulz; Herngreen & De Boer, pl. 5, figs 5a - 5b.

1975 *Uvaesporites argenteaeformis* (Bolkh.) Schulz; Arjang, p. 124, pl. 5, figs 14-15.?

1975 *Leptolepidites argenteaeformis* (Bolchovitina) comb. nov., Morbey, p. 14, pl.. 3, figs 7-9.?

1975 *Uvaesporites argenteaeformis* (Bolkh.) 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* (Bolchovitina) Morbey; Ashraf, p. 31, pl. 4, figs 1-3.?

1977 *Uvaesporites argenteaeformis* (Bolchovitina) Schulz; Bjærke & Manum, p. 31, pl. 2, figs 6, 8.

1978 *Uvaesporites argenteaeformis* (Bolkh.) 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* (Bolkh.) Schulz; Guy-Ohlson, Fig. 6, I-J.

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

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

1989 *Leptolepidites reissingeri* (Bolchovitina) Morbey; Weiss, pp. 43-44, pl. 3, figs 8.?

1990 *Uvaesporites argenteaeformis* (Bolkhovitina) Schulz; Rauscher & Schmidt, pp. 113, 140, pl. 1, figs 25-26.

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

DESCRIPTION: Spore rounded triangular to almost circular in equatorial outline.Triradiate tetrad mark indistinct extending to about 3/4 of the spore radius. Exine sculptured. 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 irregular reticulum.

DIMENSIONS: equatorial diameter E = 40 µm - 60 µm

(3 specimens measured)

MATERIAL: 4 specimens from Odrowąż.

Slides:

O6/1/6; 110/9.5

O8/33; 106/6,108.5/8

O8/2; 101/13

AFFINITY: Bolkhovitina (1953, p. 51) 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, pp. 560, 606) dispersed spores *Uvaesporites argenteaeformis* (Bolkh.) Schulz are similar to spores of Ophioglossaceae ?*Botrychium*. Döring (1965, p. 39) and Balme (1995, pp. 118, 261) suggested that some dispersed spores of genus *Uvaesporites* are similar to microspores of Lycopsida (Selaginellales). Looy (2000) investigated Permo-Triassic spores from the genus *Uvaesporites* and also attributed it to Selaginellales.

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic to Lower Cretaceous

GEOGRAPHICAL DISTRIBUTION: Austria ?, Afhganistan ?, Denmark, France, Germany, Great Britain, Greenland, Iran ?, the Netherlands, Norway, Poland, Russia, Spitsbergen (Hopen), Sweden

Reported also from: America, Luxembourg, Russia (Weiss 1989, p. 44).

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

cf. *Uvaesporites* sp.

Pl. 2, figs 13, 18

Cf. *Uvaesporites* sp. is similar to:

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

1975 *Leptolepidites argenteaeformis* (Bolchovitina) 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 consists of 3 spores. Exine of spores sculptured, covered by more or less coelescent, irregular verrucae which formed 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.

MATERIAL: 1 incomplete tetrad from Odrowąż

Slide:

O8/48/95; 101.5/3

DIMENSIONS: overall length about 71µm

overall width about 52 µm

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

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: Morbey (1975) included similar tetrads to *Leptolepidites argenteaeformis* (Bolchovitina) Morbey. Pedersen & Lund (1980) to *Uvaesporites reissingeri*.

Leptolepidites sp.

Pl. 2, fig. 16

DESCRIPTION: Spore rounded triangular. Triradiate tetrad mark indistinct. Exine sculptured, covered by verrucae 1-3 μm high and 3 - 4 μm in diameter. Spore thick and dark brown in colour. Thickness of exine indistinct.

DIMENSIONS: equatorial diameter E = 37.4 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slides:

O8/5; 110.5/4.5

AFFINITY: Unknown, probably spores of Lycopodiales (Filatoff 1975, pp. 43, 48).

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: *Leptolepidites* sp. differs from *Leptolepidites verrucatus* Couper 1953 by the larger size of spore and the smaller size of verrucae.

Osmundacidites sp.

Pl. 2, fig. 17

DESCRIPTION: Spore circular in equatorial outline. Triradiate tetrad mark indistinct. Exine thin less than 1 μm, sculptured granular.

DIMENSIONS: E = about 32 - 34 μm

(2 specimens measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

O5/13/95; 97/7

O10/1; 98/6

AFFINITY: Probably spores of Marattiales. According to Couper (1953, 1958) dispersed spores of the genus *Osmundacidites* are similar to osmundaceous fern spores. Van Konijnenburg-van Cittert (1978) did not agree with him because of differences in sculpture between in situ osmundaceous spores and dispersed *Osmundacidites*. *In situ* spores are much less granulate.

Balme (1995) suggested that *Osmundacidites* dispersed spores are comparable with Filicopsida (Marattiales, Osmundaceae).

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: *Osmundacidites* sp. differs from *Osmundacidites wellmanii* Couper by its smaller sizes and is therefore probably marattiaceous spore.

Acanthotriletes varius (Nilsson 1958) Schuurman 1977

Pl. 2, fig. 12

1958 *Acanthotriletes varius* n. sp., Nilsson, p.42, pl. 2, fig.10.
1964b *Anemiidites spinosus* n. sp., 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) n. comb., 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, 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.
1990 *Conbaculatisporites spinosus* (Mädler) Lund; Dybkjær, p. 21, pl. 2, fig. 10?

DESCRIPTION: 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 sculptured, covered by spinae about 1-3.2 µm high and about 0.8 - 1.6 in diameter.

DIMENSIONS: E = about 30 - 31 µm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O5/11/95; 91/ 5

AFFINITY: Unknown

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic to Cretaceous

GEOGRAPHICAL DISTRIBUTION: Austria, Denmark?, France, Germany, Great Britain, Luxembourg, Poland, Sweden

Reported also from: Switzerland (Weiss 1989, p. 49).

Lycopodiacidites rugulatus (Couper 1958) Schulz 1967

Pl. 3, fig. 1

1958 *Perotrilites rugulatus* n. sp., Couper, p. 147, pl. 25, figs 7-8.
1961 *Trilites reissingeri* n. sp., 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
1974 *Lycopodiacidites rugulatus* (Couper) Schulz; Herngreen & De Boer, p. 357, tab. 6.
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. 378, 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 & Schmidt, pp. 111, 134, 136, pl. 2, fig. 12.

DESCRIPTION: Spore circular in equatorial outline. Triradiate tetrad mark indistinct. Exine sculptured with various rugulae about 2 to about 3 µm wide. Exine thick, about 4 µm.

DIMENSIONS: E = about 70 µm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/3; 99.5/19

AFFINITY: According to Schulz (1967, p. 607) *Lycopodiacidites rugulatus* spores are similar to spores of *Lycopodium*. Balme (1995) suggests that dispersed spores of the genus *Lycopodiacidites* are similar to spores of Filicopsida (Ophioglossales).

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic - Middle Jurassic

GEOGRAPHICAL DISTRIBUTION: Afghanistan, Austria, Denmark, France, Germany, Great Britain, Greenland, Iran, the Netherlands, Norway, Poland, Spitsbergen (Hopen), Sweden

Reported also from: Italy (Weiss, p. 75).

REMARKS: The exine of specimen from Odrowąż is thicker than that descibed by Couper (1958) and Schulz (1967).

Lycopodiumsporites cerniidites (Ross 1949) Delcourt et Sprumont 1955 ?

Pl. 3, figs 11, 15

1949 *Lycopodium cerniidites* n. spm., Ross, pp. 30-31, pl. 1, figs 1-2.

1955 *Lycopodiumsporites cerniidites* (Ross) n. comb., Delcourt et Sprumont; p. 32.

1958 *Lycopodiumsporites cerniidites* (Ross) Delcourt et Sprumont; Couper, p. 132 , pl. 15, figs 6-9.

1959 *Camerozonosporites cerniidites* (Ross) n. comb., Krutsch, p. 187.

1963 *Lycopodiacidisporites cerniidites* (Ross, Delcourt et Sprumont) comb. nov., Danzé - Corsin & Leveine, p. 77, pl. 6, figs 10-11b.

1975 *Lycopodiumsporites cerniidites* (Ross) Brenner; Filatoff, p. 47, pl. 4, figs 9-10.

1976 *Lycopodiumsporites cerniidites* (Ross) Delcourt et Sprumont; Rogalska, pl. 2, figs 26-28.

Resembles also:

1967 *Camarozonosporites insignis* sp. nov., Norris, pp. 96-97, pl. 13, figs 12-16.

1967 *Camarozonosporites* sp. cf. *C. insignis* Norris; Kemp, pp. 105-106 , pl. 19, figs 12-13.

DESCRIPTION: Spore almost circular in equatorial outline. Triradiate mark with sinuous leasures extending almost to 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.

DIMENSIONS: equtorial diameter E = 44.2 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/59/95; 107.5/17

AFFINITY: Ross 1949 wrote that dispersed spores *Lycopodium cerniidites* are similar to recent spores of the tropical *Lycopodium cernuum*. Danzé - Corsin et Leveine 1963 suggested affinity with Lycopodiales or Sellaginellales.

STRATIGRAPHICAL DISTRIBUTION: Jurassic - Cretaceous, Eocene

GEOGRAPHICAL DISTRIBUTION: Australia?, France, Germany, Great Britain, Poland, Sweden

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

According to Norris 1967 (p. 97) *Camarozonosporites insignis* sp. nov. is identical with *Lycopodiaciidites cerniidites* auct. non Ross in Brenner 1963 and similar to *Lycopodium cerniites* Ross 1949 (=*Camarozonosporites cerniidites* (Ross) Krutsch) but *C. cerniidites* (Ross) Krutsch "has labiate laesurae, a laevigate proximal face and smaller sculptural elements on the distal surface".

Lycopodiumsporites semimuris Danzé - Corsin et Leveine 1963

Pl. 3, figs 2, 4

1963 *Lycopodiumsporites semimuris* nov. sp., Danzé - Corsin & Leveine, p. 79, pl. 6, figs 15 - 17c.

1964b *Lycopodiumisporites semimuris* Danzé - Corsin et Leveine; Levet-Carette, p. 102, pl. 5, fig. 33.

1968 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Tralau, p. 52, pl. 2, fig. 4.

1971 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Guy, p. 29, pl. 2, figs 11- 12.

1974 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Herngreen & De Boer, p. 357, pl. 4, fig. 8.

1974 *Retitriletes semimuris* (Danzé - Corsin et Leveine) comb. nov., Mc Kellar, p. 14, pl. 5, fig. 6.

1975 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Morbey, text-fig. 25.

1976 *Retitriletes globosus* Pierce (ex Schulz); Rogalska, pl. 20, figs 284-288.

1977 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Lund, p.59, pl. 3, figs 11a-b.

1977 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Bjærke & Manum, p. 31, pl. 3, figs 1-3.

1977 *Retitriletes semimuris* (Danzé - Corsin et Leveine) Mc Kellar; Van Erve, pp. 56-57, pl. 4, figs 6-8.

1979 *Retitriletes semimuris* (Danzé - Corsin et Leveine) Mc Kellar; Schuurman, p. 57, pl. 3, fig. 5-7.

1980 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Pedersen & Lund, p. 18, pl.7, fig. 1.

1981 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Guy-Ohlson, p. 235.

1983 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Orłowska-Zwolińska, p. 14 - 15, pl. 12, figs 4 -5.

1984 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Achilles et al., p. 51, pl. 5, fig. 11.

1985 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Hoelstad, p. 126, pl. 3, fig. 4.

1985 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Lund & Pedersen, p. 378, pl.. 3, fig.2.

1986 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Guy-Ohlson, p. 20.

1989 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Weiss, pp. 66-67.

1990 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Rauscher & Schmidt, pp. 111, 132, 134, pl. 2, fig. 12.

1991 *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine; Dybkjær, p. 22, pl. 5, figs 9-10.

DESCRIPTION: Spore rounded triangular in equatorial outline. Tetrad mark invisible. Exine sculptured on the distal side with incomplete irregular reticulum. Muri 1 - 1.5 μm wide and about 1 μm high. Lumina 2 to 5 μm in diameter.

DIMENSIONS: equatorial diameter E = about 34 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż

Slide:

O8/45/95; 107.1/3.8

AFFINITY: Lycopodiaceous according to Danzé-Corsin and Levaine (1963, p. 79) and Levet - Carette (1964b, p. 102)

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, pp. 66-67).

REMARKS: Some authors e. g. McKellar (1974), Schuurman (1979) placed *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine 1963 in the genus *Retitriletes*.

Lycopodiumsporites sp.

Pl. 3, fig. 3

DESCRIPTION: Spore circular. Tetrad mark invisible. Exine sculptured with reticulum. 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
(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

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*.

Contignisporites problematicus (Couper 1958) Döring 1965

Pl. 3, fig. 5

1958 *Cingulatisporites problematicus* n. sp., Couper , p. 146, pl. 24, figs 11-13.

1958 *Corrugatisporites scanicus* n. sp., 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, figs 12a-12c.

1965 *Contignisporites problematicus* (Couper) n. comb., Döring; p. 51, pl. 18, figs 6-8.

1965 *Duplexisporites problematicus* (Couper) n. comb., 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.

1970 *Corrugatisporites amplectiformis* (Kara-Murza) n. comb., Pocock, pp. 59-60, pl.. 11, figs 1-4, 7-10.

1971 *Contignisporites problematicus* (Couper) Döring; Guy, p. 31, pl. 2, figs 17-18.

1973 *Contignisporites problematicus* (Couper) Döring; Orbell, tab. 3.

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, figs 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 & Schmidt, 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 sculptured 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 specimen from Odrowąż.

Slide:

O8/2; 97.5/7

AFFINITY: Unknown, but schizeaceous or dicksoniaceous origin was suggested by Nilsson (1958, p. 44).

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, pp. 71-72).

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.

Matonisporites sp. 1

Pl. 3, figs 6-7

1958 *Matonisporites equiexinus* n. sp., Couper, p. 140, pl. 20, figs 13-14.

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

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

1970 *Harrisispora equiexina* (Couper) n. comb., 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) n. comb., Juhász, p. 43 pl. 2, figs 4, 6, 9.

DESCRIPTION: Spore triangular with usually one concave and two convex sides and rounded apices. Triradiate tetrad mark extending almost to the equator. Commisuraes sinuous with exine folds 1 - 3 μm wide, extending to the equator of spore. Exine unsculptured 1 - 2.5 μm thick.

DIMENSIONS: equatorial diameter E = about 41 - 48 μm

(2 specimens measured)

MATERIAL: 3 specimens from Odrowąż.

Slides:

O5/2; 97.5/7.5

O8/1; 93/4

O8/2; 102.5/12.5

AFFINITY: According to Couper 1958 dispersed spores *Matonisporites equiexinus* are similar to spores of Mesozoic ferns from the family Matoniaceae, especially spores of *Phlebopteris angustiloba* (Presl.) Hirmer and Hoerhammer, *Selenocarpus munsterianus* (Presl.) Schenk and *Matonidium goepperti* (Ettinghausen) Schenk. Van Konijnenburg-van Cittert (1993b) 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 thickennings or folds near tetrad mark and uniformly thick exine. This author included spores *Matonisporites equiexinus* Couper into this genus but *Phlebopterisporites* Juhász is the younger synonym of *Matonisporites* Couper 1958.

Matonisporites sp. 2

Pl. 3 fig. 8

DESCRIPTION: Spore 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 E = about 30 - 42 μm

(3 specimens measured)

MATERIAL: 3 specimens from Odrowąż

Slides:

O6/1/6; 111.9/11.1

O8/1; 105/8

O8/46/95; 107/6.5

AFFINITY: Unknown but probably fern spores from Matoniaceae similar to *in situ* spores described by Van Konijnenburg-van Cittert (1993b) and Van Konijnenburg-van Cittert & Kurmann (1994) or fern spores from Dipteridaceae.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

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

cf. *Lycospora salebrosacea* (Malj.1949) Schulz 1967

Pl. 3, fig. 9, 13

1949 *Volucellina salebrosacea* sp. n., Maljavkina, p. 65, pl. 13, fig. 14.

1958 *Cingulatisporites scabratus* n. sp., Couper, p. 147, pl. 25, figs 3-4.

1958 *Aequitriradiates salebrosaceus* (Mal.) n. comb., Nilsson, p. 47, figs 8-9.

1967 *Lycospora salebrosacea* (Maljavkina) comb. nov., Schulz , p. 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: Spore convex triangular in equatorial outline consisting of: 1/ central part 19.2 - 24 μm in diameter and about 1 μm thick exine , 2/ ring - shaped thin area 1.6 - 2.4 μm wide, around the central part and 3/ cingulum about 1.6 - 5 μm wide. Sculpture of cingulum granular. Triradiate tetrad mark extending almost to equator. Exine strongly granular near the poles of the spore.

DIMENSIONS: overall equatorial diameter E = about 30 - 38 µm

(1 specimen measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

O8/1; 95/5

O8/18; 105/17.5

AFFINITY: Unknown. *Lepidostrobus* in Palaeozoic and in Mesozoic ? (Schulz 1967, p.608). According to Balme (1995) different species of dispersed *Lycospora* were belonging to Carboniferous *Lepidodendron* and *Lepidostrobus*.

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic - Middle Jurassic

GEOGRAPHICAL DISTRIBUTION: Germany, Great Britain, Denmark, Poland, Sweden

Reported also from: France (Weiss 1989, p. 87).

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

Neochomotriletes triangularis (Bolkhovitina 1956) Reinhardt 1961

Pl. 3, fig.10

1956 *Chomotriletes triangularis* sp. nov., Bolchovitina, p. 61, pl. 7, figs 98a-98c.

1961 *Neochomotriletes triangularis* (Bolchovitina) n. comb., Reinhardt, p. 708, pl.1, figs 1, 5.

1965 *Polycingulatisporites triangularis* (Bolkhovitina) n. comb., Playford & Dettmann, p. 144.

1967 *Neochomotriletes triangularis* (Bolchovitina) Reinhardt; Schulz, p. 587, pl. 14, fig. 3, pl. 23, fig. 4.

1968 *Polycingulatisporites triangularis* (Bolkhovitina) Playford & Dettmann; Tralau, p. 60, pl. 11, fig. 2.f

1971 *Polycingulatisporites triangularis* (Bolkhovitina) 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 19-20h.

1977 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Lund, p. 61, pl. 4, figs 10-11.

1980 *Neochomotriletes triangularis* (Bolch.) Reinhardt; Pedersen & Lund, p. 44, pl. 8, figs 2a-b.

1983 *Neochomotriletes triangularis* (Bolchovitina) Reinhardt; Orłowska-Zwolińska, p. 20, pl. 18, fig 1a-b.

1986 *Neochomotriletes triangularis* (Bolkhovitina) Reinhardt; Guy-Ohlson, p. 24, pl. 4, fig. 2, pl. 13, fig. 5.

1989 *Polycingulatisporites triangularis* (Bolkhovitina) Playford & Dettmann; Weiss, p. 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 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 E = 44.2 μm

(1 specimen mesured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

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, p.69).

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

Cingutriletes sp.

Pl. 3, fig. 12

DESCRIPTION: Spore circular in equatorial outline. Triradiate tetrad mark distinct, extendig to about 3/4 of the spore radius. Cingulum about 3 - 5 μm wide. Exine smooth.

DIMENSIONS: equatorial diameter E = about 37.4 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/46; 107.1/2.5

AFFINITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen resembles:

1970 *Stereisporites (Cingutriletes) infrapunctatus* sp. n., 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 differs from *Cingutriletes infrapunctatus* in a smooth instead of punctate exine.

Foveotriletes sp.

Pl. 3, fig. 16

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, foveoles 1.5 - 2.0 μm wide across and about 1 - 2 μm apart.

DIMENSIONS: equatorial diameter E = about 32 μm

(1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

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.

STRATI GRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen resembles:

1958 *Foveotriletes irregulatus* n. sp., 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, figs 1a-b.

Detailed comparision is difficult because of not good preservation of 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.

cf. *Latosporites* sp.

Pl. 3, fig. 14

DESCRIPTION: Spore almost circular in equatorial outline with one elongated aperture. Exine smooth, but pits about 1 μm in diameter are 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 specimen from Odrowąż.

Slide:

O8/2; 106.5/7.5

AFFINITY: Unknown

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: Specimen from Odrowąż resembles: 1958 *Monolites* sp. (ssp.?); Couper, p.149, pl. 25, fig. 18, but specimen from Odrowąż differs from above mentioned specimen mainly by aperture which is wider (3.5 μm) than in the case specimen described and illustrated by Couper (1958), by its folded exine and pits on the surface of the exine. These pits may by result of exine degradation, but folded exine is characterisic for spores from 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.

Marattisporites sp. 1

Pl. 3, fig. 18

DESCRIPTION: Spore monolete, oval in equatorial diameter. Laesura narrow, extending the lenght of the spore. Exine granular.

DIMENSIONS: lenght = 37.6 μm (1 specimen measured)

width = 25.6 μm (1 specimen measured)

MATERIAL 2 specimens from Odrowąż

Slides:

O5/1/95; 96/5

O8/47/95; 91/13.5

AFFINITY: Unknown, probably ferns from Maratttiaceae. Couper (1958, p. 134, pl. 15, figs 20-23) compared *Marattisporites scabratus* (which is the type species to 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.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: *Marattisporites scabratus* Couper 1958 is smaller and has more delicate sculpture in comparision to *Marattisporites* sp. spores from Odrowąż.

Marattisporites sp. 2

Pl. 3, fig. 17

DESCRIPTION: Spore monolete, oval in equatorial outline. Monolete mark visible as ridge, about 2 µm wide extending whole lenght of spore, closed. Exine two-layered. Outer layer granulate, partly broken and folded, inner smooth, not clearly visible.

DIMENSIONS: lenght = about 35 µm (1 specimen measured)

width = about 27 µm (1specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/60; 95,5/17

AFFINITY: Unknown, probably fern spore of. Marattiaceae

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

Aratrisporites minimus Schulz 1967

Pl. 4, figs 1-12, 14

1966 *Lycostrobus scotti* Nath.; Orłowska-Zwolińska, pl. 11, figs 53-54.

1967 *Aratrisporites minimus* sp. n., 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, figs 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. 4 M.

1990 *Aratrisporites minimus* Schulz; Rauscher & Schmidt, pp. 113, 132, pl. 1, fig. 27.

1991 *Aratrisporites minimus* Schulz; Dybkjær, p. 26, pl. 11, fig. 1.

DESCRIPTION: Spore oval with pointed ends in equatorial outline often similar to the shape of *Juglans regia* nuts. In lateral, slightly oblique, position boatshaped. Monolete mark extending whole lenght of spore, closed, visible as thin ridge or slightly open, always sinuous. Exine two-layered with smooth endoexine and puncate to granulate ectoexine. The two layers of the exine not always clearly visible.

DIMENSIONS: lenght = 23.2 - 47.6 μm (46 specimens measured)

width = 17.6 - 30.4μm (7 specimens measured)

MATERIAL: 87 specimens from Odrowąż

Slides:

Spores with a fine structure of the exine:

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:

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

AFFINITY: According to Schulz (1967, p. 592) the dispersed spores *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, pp. 124-125, pl. 3, fig. 5) described similar microspores associated with megaspores *Nathorstisporites hopliticus* from the Liassic of Germany. Schulz (1967, p. 529, pl. 16, figs 12-14) 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, p. 36, pl. 6, figs 1-16). Balme (1995, p. 265) wrote that dispersed spores *Aratrisporites* were belonging to Lycopsida (Pleuromeiaceae).

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Denmark, France, Germany, Greenland, Poland, Sweden

REMARKS: Nilsson (1958, pp. 53-54) compared dispersed *Chasmatosporites* spores with microspores from *Lycostrobus scotti* (Nathorst 1908) but according to Plyford & Dettmann (1965, p. 153) " 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, figs 5a-b) observed very small spinae in the surface of *Aratrisporites minimus* spores under SEM. Similar spinae have been observed in the surface of specimen from Odrowąż (Pl. 4, fig. 14).

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

Pl. 4, fig. 13

1958 *Caytoniales-Pollenites diaphanus* new species, Pautsch, p. 323, pl. 1, figs 4, 11.

1971 *Diaphanisporites diaphanus* Pautsch; Pautsch, p. 38, pl. 12, fig. 3.

1977 *Alisporites diaphanus* Pautsch, species n. comb., Lund, p. 75, pl. 8, fig. 12.

1980 *Alisporites diaphanus* (Pautsch) Lund; Pedersen & Lund, p. 45, pl. 13, figs 1a-b.

1981 *Alisporites diaphanus* (Pautsch) Lund; Guy-Ohlson, p. 235, Fig. 7 F-G.

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

DIMENSIONS: overall width = about 63.2 μm (1 specimen measured)

length of corpus = 56 μm (1 specimen measured)

width of saccus = 25.6 μm (1 specimen measured)

length of saccus = about 52 μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

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* (Couper1958) Pocock 1962

Pl. 4, fig. 15

1958 *Pteruchipollenites microsaccus* n. sp., 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 & Schmidt, 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 the reticulate thickennings, lumina about 1 μm in diameter, muri 1 μm wide or wider. Corpus granulate.

DIMENSIONS: overall width = about 43 μm (1 specimen measured)
length of corpus = about 49 μm (1 specimen measured)
length of saccus = about 40 μm (1 specimens measured)
width of saccus = about 20 μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O9/2/6; 94.5/18

AFFINITY: Couper (1958, p. 151) wrote that *Pteruchipollenites microsaccus* affinity probably lies with the Mesozoic Pteridospermae.

STRATIGRAPHICAL DISTRIBUTION: Lower Jurassic to Upper Jurassic (in Europe)
Upper Jurassic to Lower Cretaceaus (in Canada)

GEOGRAPHICAL DISTRIBUTION: Canada ?, Denmark, France, Great Britain, Greenland, Poland

REMARKS: Pocock (1962, p. 61) wrote that Canadian specimens are comparable with *Alisporites (Pteruchipollenites) microsaccus* rather than identical with this species.

Alisporites robustus Nilsson 1958

Pl. 4, fig. 16, Pl. 5, figs 1, 4, 6

1958 *Alisporites robustus* n. sp., 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. 6 A.

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 & Schmidt, p. 117, 132, 135, 142, pl. 4, fig. 7.

1991 *Alisporites robustus* Nilsson; Dybkjær, p. 26, pl. 11, fig. 8.

DESCRIPTION: Bisaccate pollen grains. Grains bilateraly 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.

DIMENSIONS: overall width = about 76 - 85 μm (2 specimens measured)

width of corpus = 30.8 - 40 μm (2 specimens measured)

width of saccus = 20 - 23.8 μm (2 specimens measured)

length of corpus = about 51 - 52 μm (2 specimens measured)

length of saccus = about 51 - 53 μm (2 specimens measured)

MATERIAL: 5 specimens from Odrowąż.

Slides:

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

AFFINITY: 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. In the 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 & 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 grain are also similar to dispersed pollen grain from the genus *Alisporites*.

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic - Middle Jurassic.

GEOGRAPHICAL DISTRIBUTION: Denmark, France, Germany, Greenland, Poland, Sweden

Reported also from: Austria, New Guinea, Scotland (Weiss 1989, p.105).

REMARKS: The specimens from Odrowaz are not well-preserved and always are visible in oblique position.

Alisporites cf. *robustus* Nilsson 1958

Pl. 5, fig. 9

DESCRIPTION: 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

DIMENSIONS: overall width = 76 μm (1 specimen measured)

width of corpus = about 34 μm (1 specimen measured)

width of saccus = about 22 μm (1 specimen measured)

length of corpus = 52 μm (1 specimen measured)

length of saccus = about 50 μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/3; 100/14

AFFINITY: Unknown, probably Pteridospermae.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: *Alisporites* cf. *robustus* differs from above described pollen grains from the genus *Alisporites* because of relatively larger corpus and shape of lumina in reticulum in the sacci.

Alisporites thomasii (Couper 1958) Nilsson 1958

Pl. 5, fig. 2

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

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

1962 *Alisporites thomasii* (Couper) n.comb., 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 & Schmidt, p. 117, 135, 136, 138, pl. 4, fig. 13.

DESCRIPTION: 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.

DIMENSIONS: overall width = 64 μm (1 specimen measured)

width of corpus = 36 μm (1 specimen measured)

width of saccus = about 20 μm (1 specimen measured)

length of corpus = 40 μm (1 specimen measured)

length of saccus = about 37 μm (1 specimen measured)

MATERIAL: 3 specimens from Odrowąż.

Slides:

O5/13/95; 106/15.5

O8/1; 97/11

O8/2; 101/14

AFFINITY: Couper (1958, p. 151) wrote that dispersed *Pteruchipollenites thomasi* are similar to those of *Pteruchus* (Mesozoic Pteridospermae). Harris (1964, pp. 170-175, fig. 67) described *in situ* bisaccate pollen grain from pteridosperm-like repoductive organ *Pteroma thomasi* from the Jurassic of Yorkshire. He noted that these *in situ* pollen grains resembles dispersed *Alisporites thomasi* pollen grains. Van Konijnenburg-van Cittert (1971, pp. 15-18) described *in situ* pollen grains from *Pteroma thomasi* in detail.

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic - Lower Cretaceous

GEOGRAPHICAL DISTRIBUTION: Afghanistan, Antarctica, Canada, Germany, Great Britain, Iran, Norway, Poland, Sweden

Reported also from: America, Mexico, Morocco (Weiss 1989, pp.105-106).

Vitreisporites pallidus (Reissinger 1950) Nilsson 1958

Pl. 5, fig. 3

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

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

1956 *Caytoniales*; Rogalska, p. 22-23, pl. 10, figs 1-2.

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

1958 *Caytonipollenites pallidus* (Reissinger) n. comb., Couper, p. 150, pl. 26, figs 7-8.

1958 *Vitreisporites pallidus* (Reissinger) n. comb., 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.

1970 *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.

1973 *Vitreisporites pallidus*; Orbell, tab. 3.

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. I.

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 & Schmidt, pp. 117, 132, pl. 4, fig. 5.

1991 *Vitreisporites pallidus* (Reissinger) Nilsson; Dybkjær, p. 26, pl. 11, fig. 3.

DESCRIPTION: Bisaccate polen grains. Corpus oval. Length of corpus almost equaling length of saccus. Exine very thin. Structure of sacci and sculpture of corpus exine indistinct.

DIMENSIONS: overall width = 24 - 26.4 μm (2 specimens measured)

width of corpus = 12 - 12. 8 μm (2 specimens measured)

width of saccus = 8.8 - 9.6 μm (2 specimens measured)

length of corpus = 11.2 - 12.8 μm (2 specimens measured)

length of saccus = 13.6 -14.4 μm (2 specimens measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

O8/45/95; 101/5.5

O10/1; 105/14

AFFINITY: Some authors (e. g. Couper 1958, p. 150, Van Konijnenburg-van Cittert 1971, p. 14) suggest that these dispersed pollen grains are similar to pollen grains from Caytoniales and also to other plants e. g. *Harrisiothecium marsiloides* (Harris) Lundblad of uncertain affinity, provisionally placed in the Pteridosperms. According to Balme (1995, p. 274) 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 spores from Caytoniales (e. g. Nilsson 1958, p. 79, Tralau 1968, p. 75, Filatoff 1975, p. 76, Van Konijnenburg-van Cittert 1971, pp. 15, 69).

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, p. 116).

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

Pityosporites minimus (Couper 1958) comb. nov.

Pl. 5, figs 5, 7, 8, 10, Pl. 6, figs 1, 3, 5

1958 *Abietinaepollenites minimus* n. sp., Couper, p. 153, pl. 28, figs 14-15.

1965 *Abietinaepollenites minimus* Couper; Wall, p. 166.

1970 *Pinuspollenites minimus* (Couper) comb. nov., Kemp, p. 116, pl . 24, figs 1-6.

1975 *Pinuspollenites minimus* (Couper) Kemp; Vigran &Thusu, p.11, pl.. 15, figs 2-3, 8.

1981 *Pinuspollenites minimus* (Couper) Kemp; Achilles, pp. 46-47, pl. 13, figs 5-7.

1981 *Pinuspollenites minimus*; Guy-Ohlson, p. 235.

1983 *Pinuspollenites minimus* (Couper) Kemp; Orłowska-Zwolińska, p. 29, pl. 33, fig. 2.

1989 *Pinuspollenites minimus* (Couper) Kemp; Weiss, pp. 108-109.

1990 *Pinuspollenites minimus* (Couper) Kemp; Rauscher & Schmidt, pp. 117, 136, pl. 4, fig. 9.

1954 Typ *Pinus silvestris* Rudolph; Rogalska, p. 18, pl. 8, figs 5-6.

1958 *Taedaepollenites scaurus* n. sp., Nilsson, pp. 87-88, pl. 7, figs 16-17.

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.

1971 *Pityosporites scaurus* (Nilsson) Schulz; Guy, p. 63, pl.5, fig. 6.

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.

1981 *Pityosporites scaurus*; Guy-Ohlson, p. 235.

1985 *Pityosporites scaurus* (Nilsson) Schulz; Hoelstad, p. 128, pl. 4, fig. 4.

1985 *Pityosporites scaurus*; Guy-Ohlson & Malmquist, Fig. 2.

1986 *Pityosporites scaurus* (Nilsson) Schulz; Guy-Ohlson, p. 28, pl. 15, fig. 1.

1989 *Pityosporites scaurus* (Nilsson) Schulz; Weiss, pp. 109-110.

Pinuspollenites minimus = *Pityosporites scaurus*

1977 *Pinuspollenites minimus* (Couper) Kemp; Lund, p. 76, pl. 9, figs 5-6b.

1980 *Pinuspollenites minimus* (Couper) Kemp; Pedersen & Lund, p. 45, pl. 14, figs 1-2.

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.

1991 *Pinuspollenites minimus* (Couper) Kemp; Dybkjær, p. 26, pl. 11, figs 5, 7.

DESCRIPTION: Bisaccate pollen grains. In lateral longitudinal view corpus oval. Exine of corpus smooth to scabrate. Sacci distally attached, infrareticulate. Reticulum with small, indistinct lumina. In oblique, almost polar view corpus broader than long or longer than broad, oval.

DIMENSIONS: overall width = 50 µm - about 80 µm (7 specimens measured) width of corpus = about 26 µm - 54 µm (7 specimens measured)

width of saccus = 20.4 µm - 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 = 28 µm - 40 µm (4 specimens measured)

height of corpus = 20.4 µm - 32 µm (4 specimens measured)

MATERIAL: 13 specimens from Odrowąż.

Slides:

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

AFFINITY: Pinaceae is suggested by Schulz (1967, p. 608) and Tralau (1968, p. 87). Coniferopsida (Pinaceae) according to Balme (1995, p. 274) for the genus *Pinuspollenites*.

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic - Lower Cretaceous

GEOGRAPHICAL DISTRIBUTION: Denmark, France, Germany, Great Britain, Greenland, Iran, Norway, Sweden, Poland

Reported also from America (Weiss 1989, p. 110) and Austria (Weiss 1989, p.109).

REMARKS: The specimens from Odrowaz are not well-preserved and the lumina of the infrareticulum of the sacci are indistinct. Couper (1958, p. 153, pl. 28, figs 14-15) described and illustrated 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, p. 114) 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 & Hills 1976 (no. 2017) mentioned that *Pinuspollenites* Raatz 1938 ex Potonié 1958 may be a junior synonym of *Pityosporites* Seward 1914. 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 6, 8; Pl. 7, fig. 1

DESCRIPTION: Bisaccate pollen grain. In lateral longitudinal view corpus oval with reticulte exine, on proximal side about 2.5 μm thick. Sacci strongly folded or not good preserved with indistinct reticulate structure.

DIMENSIONS: overall width = about 66 μm (1 specimen measured)

width of corpus = about 51 μm (1 specimen measured)

overall height = about 39 μm (1 specimen measured)

height of corpus = about 30 μm (1 specimen measured)

For the specimen illustrated on pl. 7, fig.1 in oblique position:

overall width: about 80 μm

overall height: about 60 μm

MATERIAL: 3 specimens from Odrowąż.

Slides:

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 good preserved or in oblique positions and therefore precise measurements are impossible and not all features are visible.

Platysaccus nitidus Pautsch 1971

Pl. 6, figs 2, 4

1971 *Platysaccus nitidus* n. sp., 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. In polar wiev (proximal face) corpus oval with 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 (1 specimen measured)

width of corpus = about 36 µm (1 specimen measured)

width of saccus = about 36 µm (1 specimen measured)

length of corpus = about 48 µm (1 specimen measured)

length of saccus = about 50 µm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/45/95; 103/3

AFFINITY: Unknown

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic-Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: Poland

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

? *Pinuspollenites labdacus* var. *arcuatus* Danzé - Corsin et Leveine 1963

Pl. 6, figs 7, 9

1963 *Pinuspollenites labdacus* R. Pot. 1931 var. *arcuatus* nov. var., Danzé - Corsin et Leveine, 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.

DIMENSIONS: overall width: about 82 μm (1 specimen measured)

width of corpus: about 60 μm (1 specimen measured)

overall height: about 52 μm (1 specimen measured)

height of corpus: about 28 μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/45/95; 110/4.5

AFFINITY: Danzé - Corsin and Leveine (1963, p. 102) wrote that dispersed pollen grains *Pinuspollenites labdacus* var. *arcuatus* resemble pollen grains of *Pinus banksiana*.

STRATIGRAPHICAL DISTRIBUTION: Rhaetic-Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: France, Poland

REMARKS: The specimen from Odrowąż is somewhat larger and its state of preservation is not so good but it resembles specimens *Pinuspollenites labdacus* var. *arcuatus* described and illustrated by Danzé - Corsin and Leveine (1963, especially Pl. 10, fig.15).

cf. *Inaperturopollenites* sp.

Pl. 7, figs 2-3

DESCRIPTION: 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.

DIMENSIONS: 32 - 60.8 μm x 28,8 - 41.6 μm (4 specimens measured)

MATERIAL: 5 specimens from Odrowąż.

Slides:

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

AFFINITY: Unknown. Balme (1995, pp. 134, 223) mentioned about similarity dispersed *Inaperturopollenites* to *in situ* spores from the Cretaceous *Equsetites lyelli* and to *in situ* pollen grains from isolated cone *Masculostrobus* sp. A (Araucariaceae) as described by Barale (1970).

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This kind of pollen has no clearly definite diagnosic features.

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*; 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 & Schmidt, 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 specimens from Odrowąż.

Slides:

O5/10/95; 100/18.3

O8/5; 107/13

OS_2/8; 108/18

AFFINITY: Couper (1958, p. 129) compared dispersed pollen grains *Araucariacites australis* Cookson with pollen grains of Jurassic araucarian conifer *Brachyphyllum mamillare* and wrote that these pollen grains are closely comparable to those of living species *Araucaria* and *Agathis*. Kendall (1949, p. 161, Fig. 3A) and Harris (1979, p. 8) described similar pollen grains from Jurassic *Brachyphyllum mamillare* male cones (Araucariaceae). Tralau (1968, p. 72) note that *Araucariacites australis* Cookson pollen grains have been reffered to *Podozamites* e.g. by Bolkhovitina (1956). Van Konijnenburg-van Cittert (1971, pp. 51-57) 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, pl. 31, figs 431-432, 434-439; pl. 32, fig. 441) illustrated similar pollen grains under the name cf. *Agathis* Salisbury.

Araucariaceae - type pollen grains have been discussed by van Konijnenburg-van Cittert (1971, pp. 51-57), Pocock (1970a, pp. 64- 67), Filatoff (1975, pp. 81-85) and Balme (1995, pp. 222-224) 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 & 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, p.182). Later Archangelsky (1977) instituted *Inaperturopollenites limbatus* Balme 1957 as the type species of the new genus *Balmeiopsis*.

Barale (1970, p. 93, pl.15, figs 1-2) assigned pollen grains similar to *Araucariacites* from *Masculostrobus* sp. A cones from the Jurassic of France to *Inaperturopollenites* Pflug.

cf. *Araucariacites* sp.

Pl. 7, fig. 5

DESCRIPTION: Pollen grain oval, partly broken, without germinate apertures. Exine secondary folded. Folds longitudinal and transversal. Exine granulate, about 1.5 µm thick.
DIMENSIONS: the longest diameter 76.5 µm (1 specimen measured)
MATERIAL: 1 specimen from Odrowąż.
Slide:
O9/2/6; 93/8.5
AFFINITY: Probably Araucariaceae.
STRATIGRAPHICAL DISTRIBUTION: Lower Liassic
GEOGRAPHICAL DISTRIBUTION: Poland
REMARKS: Size of cf. *Araucariacites* sp. is similar to *Araucariacites australis* Cookson ex Couper size but specimen described above differs from *Araucariacites australis* in shape of whole pollen grain and thickness of the exine. Couper (1958, p. 151) 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.

Spheripollenites psilatus Couper 1958

Pl. 7, fig. 6

1958 *Spheripollenites psilatus* n. sp., 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 (2 specimens measured)
MATERIAL: 2 specimens from Odrowąż.

Slides:

O5/3/95; 105/5.5

O8/5; 104/8

AFFINITY: Couper (1958, p. 159) suggested 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 (pp. 68-69, pl. 6, figs 2-4) and *Spheripollenites psilatus* Couper are synonyms but others e. g. Schulz (1967, pp. 599-600)) and Ashraf (1977, p. 64) 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* n. sp., 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, p. 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 & Schmidt, 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 μm (2 specimens measured)

MATERIAL: 2 specimens from Odrowąż.

Slides:

O8/1; 100/5.5

O8/5; 95/13.5

AFFINITY: Couper (1958, p. 159) suggested taxaceous affinity. Van Konijnenburg-van Cittert (1971, p. 59) note 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

REMARKS: Some dispersed *Spheripollenites subgranulatus* Couper 1958 from Odrowąż are larger than those described by Couper (1958).

Schulz (1967, pp. 599-600) wrote that *Inaperturopollenites orbiculatus* Nilsson 1958 (pp. 68-69, pl. 6, figs 2-4) and *Cupresaccites subgranulatus* Rogalska 1962 (p. 505, pl. 2, fig. 20) are synonyms of *Spheripollenites subgranulatus* Couper 1958.

Pocock (1970, p. 99) emended diagnosis of the genus *Exesipollenites* Balme 1957 and cited genus *Spheripollenites* Couper 1958 as a junior synonym.

Spheripollenites sp.

Pl. 7, figs 8-10, 12

DESCRIPTION: Outline circular to subcircular. Cracked along radial line. Exine smooth, 1 µm thick.

DIMENSIONS: the longest diameter 33.6 - 52 µm (4 specimens measured)

MATERIAL: 6 specimens from Odrowąż.

Slides:

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

AFFINITY: Unknown

STRATIGRAPHICAL DISTRIBUTION: Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: Specimens described above as *Spheripollenites* sp. resemble also *Concentrisporites hallei* (Nilsson 1958) Wall 1965 (Nilsson 1958, p. 66, pl. 5, fig. 20; Wall 1965, p. 166).

Incertae sedis no. 1

Pl. 7, fig. 11

DESCRIPTION: Specimen split into two parts and partly broken. Exine about 1.5 µm thick, smooth.

DIMENSIONS: length along split = about 54 µm

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/3; 99/11

AFFINITY: Unknown

STRATIGRAPHICAL DISTRIBUTION: Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: Orłowska-Zwolińska (1971, pp. 640-642) described dispersed circular spores *Aulisporites astigmosus* (Leschik 1955) Klaus 1960 from Keuper of Poland. She found several hundred specimens of these spores and wrote that "The spores readily split into two parts which stretch characteristically (Plate III, figs 4, 5)". Specimen from Odrowąż is very similar to *Aulisporites astigmosus* from Keuper illustrated on Plate III, fig. 5 (Orłowska-Zwolińska, 1971). However I did not find in Odrowąż specimens like *Aulisporites astigmosus* with tetrad mark. Leschik (1955, p. 22, pl.2, fig. 17) and Klaus (1960, pp. 119-120, pl. 28, figs 2-3) described only almost circular specimens of *Aulisporites astigmosus* with tetrad mark and it is possible that specimen from Odrowąż belongs to another species of dispersed spores or is even an acritarch.

Perinopollenites elatoides Couper 1958

Pl. 7, figs 13-15

1958 *Perinopollenites elatoides* n. sp., 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 & Leveine, 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 & Schmidt, 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.

DESCRIPTION: Pollen grains circular with one pore, not always visible. Exine secondary folded, with different folds, two layered. Outer layer (perine) very thin, scabrate and always partly broken. Inner layer thicker than outer, scabrate.

DIMENSIONS: overall diameter = about 25.6 μm to 41.6 μm (5 specimens measured)
diameter without outer layer = about 21.6 μm to 34.4 μm (5 specimens measured)

MATERIAL: 9 specimens from Odrowąż.

Slides:

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

AFFINITY: According to Couper (1958, pp. 129, 152) dispersed pollen grains *Perinopollenites elatoides* are comparable to pollen grains from Jurassic *Elatides williamsoni* (Brogn.) Seward (Taxodiaceae). Van Konijnenburg-van Cittert (1971, p. 59) compared pollen grains from *Elatides williamsoni* (Brogn.) Seward also with pollen grains from some recent Taxodiaceae e.g. *Cunninghamia lanceolata*. Balme (1995, p. 271) placed affinity *Perinopollenites elatoides* in Coniferopsida (Taxodiaceae).

STRATIGRAPHICAL DISTRIBUTION: Rhaetian - Upper Cretaceous

GEOGRAPHICAL DISTRIBUTION: Antarctica, Australia, Canada, Denmark, France, Germany, Great Britain, Greenland, Iran, the Netherlands, Norway, Poland, Sweden,

Reported also from: America, Libya, Morocco, Russia (Siberia), (Weiss 1989, p. 123).

REMARKS: 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).

Chasmatosporites major (Nilsson 1958) Pocock & Jansonius 1969

Pl. 8, fig. 2

1958 *Chasmatosporites major* n. sp., 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. 2 U.

1981 *Chasmatosporites major* (Nilsson) Pocock et 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 et Jansonius; Guy-Ohlson, p. 32, Fig. 4.

1991 *Chasmatosporites major* Nilsson; Dybkjær, p. 29, pl. 14, fig. 7.

DESCRIPTION: Pollen grain in equatorial outline oval with smooth to slightly irregular edge. Aperture oval with oval to triangular ends, extending almost to equator. Exine about 1.5 - 2.5 μm thick, infrareticulate.

DIMENSIONS: length = 52.8 μm (1 specimen measured)

width = 37.6 μm (1 specimen measured)

length of aperture = 48 µm (1 specimen measured)

width of aperture = 9.6 µm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O9/1/1; 109/14.5

AFFINITY: Nilsson (1958, pp. 53-54) compared dispersed *Chasmatosporites* with microspores of *Lycostrobus scotti* described by Nathorst (1908). These *in situ* microspores resembles microspores of *Isoetes* (Nathorst 1908, Couper 1958, pp. 103-104, Nilsson 1958, pp. 53-54). Schulz (1967, p. 601) however treated dispersed *Chasmatosporites* Nilsson 1958 not as monolete microspores but as monosulcate pollen grains because of infrareticulate structure of the exine. Also Pocock and Jansonius (1969, p. 156) believed that *Chasmatosporites* Nilsson 1958 represents a gymnospermous pollen grains probably from Cycadales. Dispersed pollen grains from the genus *Chasmatosporites* are similar to pollen grains of ? Cycadopsida (? Cycadales): Ginkgopsida (? Gnetales) (Balme 1995, p. 273).

STRATIGRAPHICAL DISTRIBUTION: Upper Triassic to Middle Jurassic (Aalenian) for *Chasmatosporites major* Nilsson 1958 sensu Guy-Ohlson (1986, Fig. 4)

GEOGRAPHICAL DISTRIBUTION: Canada, Denmark, Germany, Poland, Sweden

REMARKS: Nilsson (1958, p. 54) described *Chasmatosporites major* as the type species of the genus *Chasmatosporites*. Potonié (1966, pp. 99-100) formally proposed *Chasmatosporites* as a junior synonym of *Aratrisporites* Leschik 1955 emended Klaus 1960 because of similarity dispersed *Chasmatosporites* and *in situ* microspores of *Lycostrobus scotti* suggested by Nilsson (1958). Pocock and Jansonius (1969) examined original Nilsson's material as well as samples of similar age from western Canada. They emended diagnosis of *Chasmatosporites* and description of *Chasmatosporites major* Nilsson 1958 and treated *Chasmatosporites* and *Aratrisporites* as separate genera.

Van Konijnenburg-van Cittert (1971, p. 30) considered that the genus *Chasmatosporites* is rather problematic genus which is composed of monolete spores and monocolpate pollen grains and inaperturate grains like from *Androstrobus prisma*.

Morbey (1975, pp.31-33, pl. 10, fig. 16) included *Chasmatosporites major* Nilsson 1958 and other 8 species of *Chasmatosporites* in *Chasmatosporites magnolioides* (Erdtman 1948) 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, pp. 31-32) 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, p. 28-29) described *Chasmatosporites major* Nilsson 1958 as a separate species and mentioned that slides with Nilsson's type-species of *Chasmatosporites major* have been lost.

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

Chasmatosporites apertus (Rogalska 1954) Nilsson 1958

Pl. 7, fig. 19

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

1956 *Pollenites apertus* Rogalska; Rogalska, p. 44, pl. 32, figs 1-2.0

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

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

1958 *Chasmatosporites flavus* n. sp., 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. 2 S.

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, figs 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*; 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 & Schmidt, pp.115, 134, 136, 138, 140, pl. 2, fig. 11.

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

DESCRIPTION: 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 μm wide. Exine 1.6 - 3.2 μm thick.

DIMENSIONS: length of pollen grain = 36 - 36.4 μm (3 specimens measured)
width of pollen grain = 21 - 33.6 μm (3 specimens measured)
length of aperture = 23.2 - 29.6 μm
width of aperture = 8-20 μm

MATERIAL: 4 specimens from Odrowąż.

Slides:

O5/11/95; 96/10

O8/18; 102.5/19.5

O8/50; 108.5/5

O17/1; 102/5

AFFINITY: Rogalska (1954, pp. 27, 45) noted that oval specimens from dispersed *Pollenites apertus* resembles pollen grains of the genus *Cycas*. According to Schulz (1967, p. 609) dispersed *Chasmatosporites apertus* (Rogalska) Nilsson are similar to pollen grains of Cycadales and ? Bennettitales. Balme (1995, p. 273) 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, p. 124).

REMARKS: Guy Ohlson (1986, p. 32) treated all species of *Chasmatosporites* Nilsson as separate taxa but some authors e. g. Schulz (1967, p. 602) and Dybkjær (1991, p. 28) included *Chasmatosporites flavus* Nilsson 1958 and *Chasmatosporites crassus* Nilsson 1958 in the species *Chasmatosporites apertus* (Rogalska 1954) Nilsson 1958.

Chasmatosporites cf. *elegans* Nilsson 1958

Pl. 7, figs 16-18

1958 *Chasmatosporites elegans* n. sp., 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, figs 7a-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 grain 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 (7 specimens measured)
width = 19.2 - 29.6 μm (7 specimens measured)
length of aperture = 25.6 - 30.4 μm (7 specimens measured)
width of aperture = 10.4 - 20 μm (7 specimens measured)

MATERIAL: 7 specimens from Odrowąż.

Slides:

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, p. 29) wrote that "some of Nilsson's *Chasmatosporites* grains look rather like *Androstrobus prisma* pollen grains especially specimens of *Chasmatosporites elegans* and *Chasmatosporites minor* ". Jurassic cones *Androstrobus prisma* Thomas et Harris belongs to *Pseudoctenis lanei* (Cycadales).

STRATIGRAPHICAL DISTRIBUTION: Lower Jurassic (Hettangian to Pliensbachian) for *Chasmatosporites elegans* Nilsson 1958 sensu Guy-Ohlson (1986, Fig. 4).

GEOGRAPHICAL DISTRIBUTION: Denmark, Greenland, Iran, Poland, Sweden

REMARKS: Morbey (1975, pp. 31-33, pl. 10, fig. 16) included *Chasmatosporites elegans* Nilsson 1958 and other 8 species of *Chasmatosporites* in *Chasmatosporites magnolioides* (Erdtman 1948) Nilsson 1958. Some authors e. g. Weiss (1989, pp. 124-125), Ashraf (1977, pp. 65-66, pl. 17, fig. 6) agree with his opinion. Dybkjær (1991, p.28) investigated Nilsson's type-material and illustrated the holotype of *Chasmatosporites elegans* Nilsson (Dybkjær 1991, pl. 22, fig. 6). 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* n. sp., 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. fig. 4.

1977 *Chasmatosporites hians* Nilsson; Bjærke & Manum, p. 43, pl. 8, figs 10-11.

1977 *Chasmatosporites hians* Nilsson; Lund, p. 67, pl. 6, figs 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, Fig. 2, pl. 2, figs F-G.

1986 *Chasmatosporites hians* Nilsson; Guy-Ohlson, p. 32, pl. 6, figs 7-8.

1990 *Chasmatosporites hians* Nilsson; Rauscher & Schmidt, pp. 115, 134, 140.

1991 *Chasmatosporites* cf. *hians* Nilsson; Dybkjær, p. 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- 2.5 μm thick with a distinct, irregular microinfrareticulum.

DIMENSIONS: length = 44 μm (1 specimen measured)

width = 40 μm (1 specimen measured)

length of aperture = 35.2 µm (1 specimen measured)

width of aperture = 21.6 µm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O9/2/8; 106/16.5

AFFINITY: Dispersed pollen grains from the genus *Chasmatosporites* are similar to pollen grains of ? Cycadopsida (? Cycadales): Ginkgopsida (? Gnetales) (Balme 1995, p. 273).

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, Spitsbergen, Sweden

REMARKS: *Chasmatosporites hians* Nilsson 1958 has been included in *Chasmatosporites magnolioides* (Erdtman 1948) Nilsson 1958 by Morbey (1975, pp.31-33, pl. 10, fig. 16). Dybkjær (1991, p. 28) wrote that slides with Nilsson's type-specimen of *Chasmatosporites hians* have been lost. Dybkjær (1991, pp. 28-29, pl.14, figs 4-5) described *Chasmatosporites hians* Nilsson 1958 as separate species and I agree with her.

Chasmatosporites cf. *rimatus* Nilsson 1958

Pl. 8, fig. 3

1958 *Chasmatosporites rimatus* n. sp., 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.

DESCRIPTION: 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 thick with unclear infrastructure because of state of preservation.

DIMENSIONS: length = 56 µm (1 specimen measured)

width = 56 µm (1 specimen measured)

length of aperture about 48 µm (1 specimen measured) width of aperture about 28 μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O5/11/95; 104/6.5

AFFINITY: Dispersed pollen grains from the genus *Chasmatosporites* are similar to pollen grains of ? Cycadopsida (? Cycadales): Ginkgopsida (? Gnetales) (Balme 1995, p. 273).

STRATIGRAPHICAL DISTRIBUTION: Lower Jurassic to Middle Jurassic (Aalenian) for *Chasmatosporites rimatus* Nilsson 1958 sensu Guy-Ohlson (1986, Fig. 4)

GEOGRAPHICAL DISTRIBUTION: Antarctica, France, Luxembourg, Poland, Sweden

REMARKS: Morbey (1975, pp. 31-33, pl. 10, fig. 16) included *Chasmatosporites rimatus* Nilsson 1958 in *Chasmatosporites magnolioides* (Erdtman 1948) Nilsson 1958.

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, nov. comb., 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.

1970 *Cycadopites minimus* (Cookson) n. comb., 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 & Schmidt, pp.117, 132, 134, 136, 138, pl. 3, fig. 14.

1991 *Monosulcites minimus* Cookson; Dybkjær, p. 29, pl. 15, fig. 1.

DESCRIPTION: Pollen grain elliptical with rounded or slightly pointed ends in equatorial outline. Sulcus extending along almost whole length of pollen grain with folds about 4 μm - 6 μm wide. Exine smooth and about 1 μm thick.

DIMENSIONS: length = about 36 μm - 38.4 μm (2 specimens measured)

width = 18.4 μm - 29.6 μm (2 specimens measured)

MATERIAL: 2 specimens from Odrowąż

O8/60/95; 102/6.5

O8/1; 93.5/12.5

AFFINITY: Couper (1958, pp.123, 157) 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 fossil *Gingko huttoni* (Sternberg) Heer which is very abundant in this series (Couper 1958, pl. 26, fig. 21). He wrote also that pollen grains of the Jurassic *Gingko huttoni* are very similar to those of recent *Gingko biloba* (Couper 1958, p. 124). According to van Konijnenburg-van Cittert (1971, pp. 44, 48, 71) 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, p. 200) mentioned the similarity of dispersed *Monosulcites minimus* and pollen grains from Bennettitales found *in situ* but in the summary (Balme 1995, p. 275) 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*.

STRATIGRAPHICAL DISTRIBUTION: Rhaetic - Tertiary

GEOGRAPHICAL DISTRIBUTION: Antarctica, Canada, Denmark, France, Germany, Great Britain, Greenland, Iran, New Zealand, Poland, Sweden

REMARKS: Some 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.

Cycadopites Wodehouse 1933 (Jansonius & Hills 1976, No 703),

Entylissa Naumova 1939 ex Ishchenko 1952 (Jansonius & Hills 1976, No 934),

Ginkgocycadophytus Samoilovich 1953 (this genus is according to Jansonius & Hills (1976, No 934 and Jansonius & Hills No 1111) an obligate junior synonym of *Entylissa* Naumova 1939 ex Ishchenko 1952 because of the same type species),

Bennettitaceaeacuminela Maljavkina 1953 (Jansonius & Hills 1976, No 249),

Bennettiteaepollenites Potonié 1958 (Jansonius & Hills 1976, No 251),

Monocolpopollenites Pflug & Thomson in Thomson & Pflug 1953 (Jansonius & Hills 1976, No 1691),

Palmeapollenites Potonié 1953 emend. Potonié 1958 (this genus is according to Jansonius & Hills (1976, No 1868 and No 1691) an obligate junior synonym of *Monocolpopollenites* Pflug & Thomson in Thomson & Pflug 1953 because of the same type species),

Arecipites Wodehouse 1933 (Jansonius & Hills 1976, No 166).

Monosulcites subgranulosus Couper 1958

Pl. 8, fig. 5

1958 *Monosulcites subgranulosus* n. sp., Couper, p. 158, pl. 26, figs 28-30.

1965 *Cycadopites subgranulosus* (Couper) comb. nov., Clarke, p. 312, pl. 39, figs 16-17.

1965 *Gingkocycadophytus* 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 & Schmidt, pp.117, 132, 134, 136.

DESCRIPTION: Pollen grain elliptical with rounded or pointed ends in equatorial outline. Sulcus with rounded ends extending along whole length of pollen grain. Exine granular, about 1 µm thick.

DIMENSIONS: length = 51 µm - 52 µm (2 specimens measured)

width = 22 µm - 27 µm (2 specimens measured)

MATERIAL: 2 specimens from Odrowąż

Slides:

O8/62/95; 97/2.5

O17/1; 104.5/7.5

AFFINITY: Couper (1958, p. 158) wrote that affinity of *M. subgranulosus* is not known. Norris (1965, p. 257) suggested affinities with Cycadaceae. According to van Konijnenburg-van Cittert (1971, p. 44) dispersed *Monosulcites subgranulosus* Couper "include mostly bennettitalean grains".

STRATIGRAPHICAL DISTRIBUTION: Keuper - Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: Antarctica, France, Great Britain, Poland

REMARKS: This specimen resemble also *Monosulcites punctatus* Orłowska-Zwolińska 1966 but proportion length : width equals 3 :1 when adequate proportion for the specimen from Odrowąż equals 2 :1.

Incertae sedis no. 2

Pl. 8, fig. 6

DESCRIPTION: Specimen oval with probably secondary elongate aperture along the longer axis of specimen. Exine scabrate about 1.5 μm thick.

DIMENSIONS: length = 47.2 μm (1 specimen measured)

width = 42.4 μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O5/3/95; 108/2.5

AFFINITY: Unknown

STRATIGRAPHICAL DISTRIBUTION: Lower Jurassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: The aperture looks like secondary because its margin is irregular and I found a fragment of exine near this specimen whose shape is similar to the shape of the aperture.

Ephedripites tortuosus Mädler 1964b

Pl. 8, figs 7-8

1964b *Ephedripites tortuosus* n. sp., 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.

DESCRIPTION: 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 paralell 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.

DIMENSIONS: length = 54 μm (1 specimen measured)

width = 26.4 μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/49; 103.5/5.5

AFFINITY: Bolkhovitina (1953, p. 60) wrote that *Ephedripites mediolobatus* n. sp. is similar to pollen grains of recent species *Ephedra dystachya* L. and *Ephedra foliata*. The same author (Bolkhovitina, 1960, p. 26, pl. 5, figs 4a-4i) suggested that *Ephedripites mediolobatus* is very similar to some spores of Schizeaceae and treated this species as synonym *Schizaea certa* (Bolkhovitina 1956) (Bolkhovitina 1960). However Potonié (1958, p. 88) indicated *Ephedripites mediolobatus* Bolkhovitina 1953 as type species for the genus *Ephedripites* Bolkhovitina 1953 ex Potonié 1958 and according to Jansonius & Hills (1976, No 944) the generic name *Ephedripites* is valid. Schulz (1967, p. 609) placed the affinity of dispersed *Ephedripites tortuosus* Mädler in Ephedraceae or ?Schizeaceae and Balme (1995, p. 273) in Ginkgoopsida (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, Sweden

REMARKS: *Ephedripites tortuosus* Mädler 1964b resembles *Ephedripites praeclarus* (Khlonova 1961) Krutzsch 1970 (Jansonius & Hills 1976, No 947) described from the Upper Cretaceous but in *E. praeclarus* the ribs (plicae) are forming a pattern like a romboid net and in *E. tortuosus* Mädler one layer of plicae lies on the second layer.

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

Classopollis torosus (Reissinger 1950) Couper 1958

Pl. 8, figs 9-22, Pl. 9, figs 1-14.

1950 *Pollenites torosus* n. sp., Reissinger, pp. 114-115, pl. 14, fig. 20.

1953 *Classopollis declassis* n. sp., Pflug, p. 92, pl. 16, figs 16-19.

1953 *Classopollis classoides* n. sp., Pflug, p. 91, fig. 4, j-m, pl. 16, figs 20-25, 29-37.

1953 *Circumpollis pharisaeus* n. sp., Pflug, p. 92, pl. 17, figs 28-30.

1953 *Circumpollis philosophus* n. sp., Pflug, p. 92, pl. 17, figs 31-36.

1953 *Canalopollis maturus* n. sp., 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 nov. comb., 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 & Leveine, 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, figns 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.

1970 *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. 4 I-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 grain 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 internal thickenning 3.2 - 5.6 μm wide. In equatorial view the internal equatorial striae are not clearly visible. The surface of the exine visible in the SEM is granulate to verrucate.

DIMENSIONS: diameter 20 - 32.8 μm (usually about 30 μm) (20 specimens measured)

MATERIAL: 197 specimens from Odrowąż.

Slides:

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 (razem 1 okaz)

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* Maljavkina) 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 genera *Brachyphyllum* Lindley and Hutton *ex* Brogniart (in part), *Cupressinocladus* Seward (in part), *Frenelopsis* Schenk, *Hirmeriella* Hörhammer (= *Cheirolepidium* Takhtajan) *Pagiophyllum* Heer (in part), *Pseudofrenelopsis* Nathorst and *Tomaxellia* Archangelsky. Unattached male cones containing *Classopollis* pollen grains are known as *Classostrobus* Alvin, Spicer et Watson (Alvin 1982, Van Konijnenburg-van Cittert 1971, Van Konijnenburg-van Cittert 1987, Watson 1988). Hörhammer (1933, pl. IV, figs 27 Aaa, 27 Aab) 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 grains from the 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, pl. 17, fig. 28) illustrated tetrad of pollen grains from the male cone of *Hirmeriella muensteri* (Schenk) Jung from Rhaeto-Liassic of Germany. These pollen grains are according him similar to *Classopollis classoides* dispersed pollen grains. *Classopollis* pollen grains have been also found by Clement-Westerhof and van Konijnenburg-van Cittert (1991, pl. 11, fig. 3) in *Hirmeriella muensteri* (Schenk) Jung male cones from the Liassic sediments from Germany. Balme (1995, p. 271) attributed *Corallina* (invalid change in spelling *Corollina*) (=*Classopollis*) pollen grains to Coniferopsida (Cheirolepidiaceae).

Reymanówna (1992) wrote that *Hirmeriella muensteri* (Schenk) Jung shoots coverd 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 them from male cones attached or associated with *Hirmeriella muensteri* (Schenk) Jung from Odrowąż (Pl. 10, 11, 12). These pollen grains are identical with dispersed *Classopollis* pollen grains described above from Odrowąż.

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, p. 120).

REMARKS: Pollen grains similar to described above are known as *Classopollis* Pflug 1953 or *Corollina* Maljavkina 1949. It is not clear which name has priority but the most authors prefer the name *Classopollis* because the figures given by Maljavkina 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 investigeted *Classopollis* by light, transmission and scanning electron microscopy e.g. Couper 1958, Chaloner 1962, Pettitt & Chaloner 1964, Reyre 1970, Srivastava 1976, Taylor & Alvin 1984, Pocock, Vasanthy & Venkatachala 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 other (e.g. Couper 1958, Chaloner 1962, Morbey 1975) give *Classopollis torosus* (Reissinger 1950) Balme 1957 as type species of this genus. Morbey (1975, pp 32-34) 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 & Jansonius (1961, p. 441). The name *Classopollis torosus* sensu Morbey 1975 is used in this paper because of earlier date (1950) Reissinger's than Pflug's (1953) publication.

Specimens from Odrowąż visible in SEM 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).

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

Pl. 9, figs 5-7, 10-11

DESCRIPTION: Tetrads consisting of *Classopollis* pollen grains in tetrahedral configuration. Specimens in tetrads always folded with more or less regular thickenning around the equator. Cryptopore and rimula are visible on some specimens. Striations are not clearly visible except on pl. 9, fig. 7.

DIMENSIONS: whole tetrad max. 62.4 x 48 μm (3 complete tetrads measured)

single specimen in tetrad:

diameter in polar view 26.4 - 29.6 μm

in equatorial view 24 x 33.6 μm

MATERIAL: 1 group of pollen grains (6 specimens), 8 tetrads and 5 incomplete tetrads consisting of 3 specimens from Odrowąż.

Slides:

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

AFFNITY: Coniferales from the family Cheirolepidiaceae, probably *Hirmeriella muensteri* (Schenk) Jung.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: Probably these tetrads and group of pollen grains are consisting of described above *Classopollis torosus* (Reissinger) Couper pollen grains.

Incertae sedis no. 3

Pl. 13, fig. 1

DESCRIPTION: Tetrad of specimens. Exine scabrate, secondary folded and partly demaged, less than 1 μm thick

DIMENSIONS: overall length about 37 μm

overall width about 33 μm

individual specimens in the tetrad: length about 21 μm

width about 14 μm

MATERIAL: 1 tetrad from Odrowąż.

Slide:

O8/2; 102/19

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: Tetrad looks like immature because of its small dimensions and thin exine.

Incertae sedis no. 4

Pl. 13, figs 2-3

DESCRIPTION: Specimen almost circular. Sculptural elements various in shape and sizes, 3-8 μm long.

DIMENSIONS: diameter about 32 μm

MATERIAL: 1 specimen from Odrowąż.

Slide:

O5/12/95; 100.8/16.5

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: Incertae sedis no. 4 resembles *Heliosporites altmarkensis* Schulz 1962 but differs from it because of some characters: tetrad mark is not visible, the sculpture is more delicate and the diameter is smaller. The specimen from Odrowąż resembles also some dinoflagellate cysts.

Incertae sedis no. 5

Pl. 13, fig. 4

DESCRIPTION: Specimen consists of an inner body with folds and/or a colpus and a thin, transluscent outer layer. Shape irregular.

DIMENSIONS: overall length = about 31μm (1 specimen measured)

overall width = about 29 μm (1 specimen measured)

length without outer layer = 26 μm (1 specimen measured)

width without outer layer = about 21μm (1 specimen measured)

MATERIAL: 1 specimen from Odrowąż.

Slide:

O5/10/95; 109/10.5

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen resembles *Perinopollenites elatoides* Couper 1958 but posses folds or a colpus; there is no pore visible on the inner body and its shape of the pollen grain is irregular, not circular.

Incertae sedis no. 6

Pl. 13, fig. 5

DESCRIPTION: Probably bisaccate pollen grain in oblique lateral longitudinal view. Exine of corpus granular. One saccus secondary folded and partly demaged, the second with internal reticulum, lumina less than 1 μm in diameter, muri about 1 μm wide.

DIMENSIONS: length of corpus about 40 μm

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/52/95; 95.5/9

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

Incertae sedis no. 7

Pl. 13, fig. 6

DESCRIPTION: Specimen oval. Exine granular, 1 - 1.5 μm thick. Indistinct aperture resembles colpus. A transluscent, thin layer around this specimen is visible.

DIMENSIONS: length 36.8 μm

width 28 μm

MATERIAL: 1 specimen from Odrowąż. O8/52/95; 95.5/9

Slide:

O8/3; 99.5/6

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen resembles monocolpate pollen grains but posses a thin layer which may be secondary and probably did not belong to this specimen.

Incertae sedis no. 8

Pl. 13, fig. 7

DESCRIPTION: Specimen almost circular, partly broken, with probably secondary aperture and secondarily folded. Exine smooth, about 1.5 µm thick

DIMENSIONS: length = 44.8 µm (1 specimen measured)

width = 42.4 µm (1 specimen measured

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/2; 99/19

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen resembles in shape and its smooth exine, dispersed spores from the genus *Calamospora* but a tetrad mark is not visible. It resembles also dispersed pollen grains from the genus *Spheripollenites* but differs from it in its quite big size.

Incertae sedis no. 9

Pl. 13, fig. 8

DESCRIPTION: Specimen partly broken, probably originally circular. Exine smooth, about 1 µm thick.

DIMENSIONS: about 50 µm x about 43 µm

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/2; 99/19

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimens resembles dispersed *Spheripollenites* Couper 1958.

Incertae sedis no. 10

Pl. 13, fig. 9

DESCRIPTION: Specimen partly broken, cracked and secondarily folded. Exine smooth to scabrate.

DIMENSIONS: 55 µm x about 34 µm

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/49/95; 106/11

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen resembles dispersed pollen grains from the genus *Spheripollenites* but also partly broken smooth spores of Filicales.

Incertae sedis no. 11

Pl. 13, fig. 10

DESCRIPTION: Probably bisaccate pollen grain in oblique view. Sacci secondarily folded. Structure of sacci indistinct.

DIMENSIONS: about 56 µm x about 48 µm

MATERIAL:1 specimen from Odrowąż.

Slide:

O8/48/95; 100.5/5.8

AFFNITY: Unknown

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

Incertae sedis no. 12

Pl. 13, fig. 11

DESCRIPTION: Bisaccate pollen grain in oblique view. Sacci desintegrated. Corpus indistinct.

DIMENSIONS: overall width = about 72 μm

length of saccus = about 48 μm

width of saccus = about 27 μm

MATERIAL: 1 specimen from Odrowąż.

Slide:

O8/5; 98/10

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

REMARKS: This specimen looks like biodegradeted.

Incertae sedis no. 13

Pl. 13, fig. 12

DESCRIPTION: Bisaccate pollen grain in oblique, lateral longitudinal view. Exine of the corpus scabrate. Sacci with internal reticulum, lumina polygonal to almost circular, less than 1 μm in diameter, muri about 1 - 1.5 μm wide.

DIMENSIONS: length of corpus about 40 μm

length of saccus about 45 μm

width of saccus about 19 μm

MATERIAL: 1 specimen from Odrowąż.

Slide:

O5/11/95; 97/3

AFFNITY: Unknown.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

Incertae sedis no. 14

Pl. 13, fig. 13

DESCRIPTION: One fragment of cuticule consisting of several cells with characteristic sinuous walls. Stomata are not present.

MATERIAL: 1 cuticule fragment from Odrowąż.

Slide:

O5/13/95; 111/3

AFFNITY: Probably Bennettitalean type of cuticule.

STRATIGRAPHICAL DISTRIBUTION: Lower Liassic

GEOGRAPHICAL DISTRIBUTION: Poland

Some indeterminateae:

Slides:

O5/3/95; 93/17 indet.

O5/6/95; 105/5 indet.

O5/11/95; 95/19 indet.

O8/45/95; 110.5/4.5 indet.

O8/46/95; 107/6 indet.

O8/54/95; 104/4 indet.

O5/11/95; 96.5/19 indet.

O10/1; 106.5/13.5 indet.

O8/3; 103/14.2 indet.

O5/13/95; 98.5/10 indet.

O8/47; 97/2 indet.

O8/45/95; 102.5/3 indet.

O8/1; 93/8; 107/20 indet.

O5/15/95; 99/3 indet.

O5/12/95; 97/17 indet.

O5/2/95; 96/2.5 indet.

O5/6/95; 105/2 indet.

6/2/1;115/2.5 indet.

MALE CONES FROM *HIRMERIELLA MUENSTERI* (SCHENK) JUNG (CONIFERALES, CHEIROLEPIDIACEAE) WITH *CLASSOPOLLIS* POLLEN GRAINS

Material

Male cones were found attached to (pl. 10, fig. 2) or in close association with vegetative remains of *Hirmeriella muensteri* (Schenk) Jung from the Jurassic sediments of Odrowąż. The present author found 43 single cones from this sediment. One fragment of stone with about 30 male cones was also found (Pl. 10, fig. 1)

Methods

Two different ways of maceration the pollen cones of *Hirmeriella muensteri* were used. Elzbieta Wcislo – Luraniec helped with that.

I. Maceration of cones no. 1 (Pl. 11, fig. 1), no. 5, no. 43 (Pl. 10, fig. 5) using 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.

1. Cone obtained from sediment was set in small test-tube and Schulze's reagent was added and test-tube was allowed to stand for 90 minutes.
2. The liquid was drained off by pipette, distilled water was added and the cone was washed.
3. A 3% solution of KOH was added to the tube for 5 minutes.
4. After decanting, H_2O was added and the cone was washed.
5. Macerated cone fragments were put on a slide-glass in a glycerine solution with thymol.
6. After examination under optical microscope, slides were made in glycerine gelatine and sealed with paraffin.

Classopollis pollen grains were found in two (no. 1 and no. 43) male cones. These pollen grains are similar to the dispersed *Classopollis* pollen grains obtained from the Jurassic sediment from Odrowąż (Pl. 10, fig. 7; Pl. 11, fig. 6).

II. Maceration of cones no. 20 (Pl. 10, fig. 3), no. 38 (Pl. 10, fig. 4), no. 40, no. 41 (Pl. 10, fig. 6) and no. 42 using HCl, HF, HNO_3 and NH_4OH

1. A cone obtained from sediment was put in a plastic tube and a 10% solution of HCl was added to the tube for 1 hour.
2. After decanting H_2O was added and the cone was washed.
3. The water was decanted and equal quantities of 40% HF and H_2O were added for one hour.
4. The acid was decanted and the cone was washed in distilled water.
5. 40% HF were added to the tubes with cone no. 41 an no. 42 for 7 days.
6. Cones was washed with distilled water.
7. 65% solution of HNO_3 were added to all cones and thus the cones were allowed to stand for 9 hours. Distilled water was added to the solution of HNO_3 in quantities 6:1, and the tube was allowed to stand for 2 days.
8. Cones were washed with distilled water.
9. NH_4OH and H_2O were added in quantities 1:2 for 5 days.
10. Cones were washed with the distilled water.
11. Cones were imbedded in glycerine solution.

Classopollis pollen grains were found in two (no. 38 and no. 42) male cones.

Description of the male cones :

Cone simple, oval in shape, 3.8 - 6.8 mm long and 3.3 - 5.0 mm wide. Microsporophylls are spirally arranged, 14 - 20 per cone. Cuticle of abaxial surface of the microsporophyll shows stomata (Pl. 11, figs 3-4). The total shape of the microsporophyll is not clear, but its top part is rhomboidal with rounded apical margin (Pl. 11, figs 2, 3, 5). The shape of the lower part of microsporophyll is not clear because the microsporophylls fall into fragments during maceration. Isolated male cone axes have not been observed. The number of pollen sacs and place of theirs attachment is not clear. Only three groups, each consisting of six structures similar to pollen sacs, were observed after maceration of male cone no. 38. These structures were not connnected with a microsporophyll.

Description of pollen grains:

Pollen grains 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. 12, fig. 3). Subeqatorially 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 thickenning 4 - 4.8 μm wide. The surface of the exine visible in the SEM is granulate to verrucate (Pl. 12, fig. 5).

DIMENSIONS:

diameter: 30.4-36.8 μm x 24.8-30.4 μm

Disscusion: Male cones which were found attached to or or in close association with vegetative remains of *Hirmeriella muensteri* (Schenk 1867) Jung 1968, were described and illustrated by Hörhammer (1933, pp 24-25, pl. 4, figs 27, 27A; textfig. 9) under the name *Cheirolepis Münsteri* Schenk from the Rhaeto-Liassic of Germany. This author described these cones as ellipsoidal to oval, 6.5 mm wide and 7 mm long. Peltate microsporophylls and with a ring consisting of 10-12 pollensacs per microsporophyll around microsporophyll head was suggested by this autor. Harris (1957, pp 297-300) investigated charred fragments of *Cheirolepis muensteri* (Schenk) Schimper (synonym of *Hirmeriella muensteri* (Schenk) Jung) from the Rhaeto-Liassic of Wales and did not agree with Hörhammer's reconstruction of male cone. He wrote: ' The number of pollen sacs on a normal microsporophyll is not securely known, but I suggest there were only two situated below the stalk and not a ring of twelve as in Hörhammer's restoration (his fig. 9).'

Jung (1968, pp 65-66, pl. 17, fig. 30) described remains of *Hirmeriella muensteri* (Schenk) Jung from Rhaeto-Liassic sediments of Franconia (Germany) and agreed with Hörhammer's opinion about structure of male cone from this plant.

Clement-Westerhof and Van Konijnenburg-van Cittert (1990, p. 173) described *Hirmeriella muensteri* (Schenk) Jung male cones from two localities in Germany of Early Liassic age. These cones were 0.7-1.0 cm long and 0.5- 0.8 cm wide. Microsporophyll consisted of slender stalk and rhomboidal head (0.5-0.8 mm high, 0.7-1.0 mm wide). The number of pollen sacs per microsporophyll was probably 6. One of these authors re-examined Hörhammer's and Jung's original material and wrote that ' the microsporophylls are only semipeltate and carry possibly 6 pollen sacs on their lower (abaxial) surface, at the transition of the stalk to the microsporophyll head.'

Kirchner (1992) investigated fossil flora from Rhaeto-Liassic sediments of Franconia (Germany) and wrote that male cones of *Hirmeriella* are oval and small (6.70 mm x 5.75 mm from Grossbellhofen locality and 5.65 mm x 4.50 mm from Unternschreez locality). The number of microsporophylls is 10 -18 per cone. Microsporophylls consisted of a stalk and a head (1.7 mm - 2.6 mm high, 1.9 mm - 3.8 mm wide). Kirchner (1992, p. 51) discussed the reconstruction of *Hirmeriella* male cones and suggested that ripe cones lost their microsporophyll haeds and that this was a way of easier pollen dispersal. Probably Hörhammer (1933, textfig. 9) gave a reconstruction of a ripe male cone without microsporophyll haeds. Acccording to Kirchner (1992, p. 51) the pollen sacs were situated on the stalk below the haed of microsporophyll. The number of pollen sacs per microsporophyll decreased from the middle of the cone to its ends and was 12 - 6.

Cones described from Odrowąż are similar in shape and dimensions to those described from Germany found attached to or in close association with, vegetative *Hirmeriella muensteri* remains. The structure of the cones is not described in detail and the number of pollen sacs per microsporophyll is difficult to judge because of the state of preservation of the material. The structure of the pollen cones from Poland was not examined by SEM. Only *Classopollis* pollen grains were observed in this way (Pl. 12, fig. 5).

COMPARISION OF MICROFLORA WITH MACROFLORA FROM ODROWĄŻ

Preliminary results of this comparision were published by the author (Ichas-Ziaja 1987, Ziaja 1989, 1991, 1992). In that time only about 20 taxa in the microflora and 15 in megaflora have been determined. Now 63 taxa in the microflora and 16 in megaflora are determined (but several taxa, mainly leaves of Pteridophyta are not determined). Investigations on megaflora were carried out by Reymanówna (1992) and Wcisło-Luraniec (1991, 1992a, 1992b). Possibly relations between these taxa are given below.

MACROFOSSILS	**CORRESPONDS MICROFOSSILS**
	Bryophyta, Sphagnales ?
no corresponds macrofossils	*Rogalskaisporites cicatricosus* (Rogalska 1954) Danzé-Corsin & Laveine 1963
	Anthocerophyta, Anthocerotaceae ?
no corresponds macrofossils	*Foraminisporis jurassicus* Schulz 1967
	Lycophyta
	Lycopodiales ?
no corresponds macrofossils	*Foveotriletes* sp. *Lycopodiacidites rugulatus* (Couper 1958) Schulz 1967 (or Ophioglossales)?. *Lycopodiumsporites cerniidites* (Ross 1949) Delcourt et Sprumont 1955 (or Sellaginellales?) *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine 1963 *Lycopodiumsporites* sp.
	Selaginellales ?
no corresponds macrofossils	*Uvaesporites argenteaeformis* (Bolkh. 1953) Schulz 1967 cf. *Uvaesporites* sp.

Isoetales

no corresponds macrofossils	*Aratrisporites minimus* Schulz 1967

Sphenophyta

Equisetales

Neocalamites sp. 1 (stem) *Neocalamites* sp. 2 (stem)	*Calamospora tener* (Leschik 1955) Mädler 1964

Pteridophyta

Filicales

Osmundaceae

Todites princeps (Presl) Gothan (leaves and rhizoms)	*Todisporites minor* Couper 1958 cf. *Todisporites* sp.?

Matoniaceae

Phlebopteris angustiloba (Presl) Hirmer & Hoerhammer (leaves)	*Matonisporites* sp. 1 *Matonisporites* sp. 2

Dipteridaceae

Thaumatopteris schenki Nathorst (leaves)	cf. *Deltoidospora* sp.

Pteridophyta of unknown affinity

leaves	*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 (Dicksoniaceae or Schizeaceae ?) *Neochomotriletes triangularis* (Bolchowitina 1956) Reinhardt 1961(Lophosoriaceae?).

Maratttiales, Marattiaceae?

Marattisporites sp.1

Marattisporites sp. 2

Osmundacidites sp.

Filicales, Cyatheaceae, Dicksoniaceae

Cyathidites minor Couper 1953

cf. *Cyathidites australis* Couper 1953

cf. *Cyathidites* sp.

Filicales, Dicksoniaceae ?

Cibotiumspora juriensis (Balme1957) Filatoff 1975

Filicales, Cyatheaceae?

Concavisporites toralis (Leschik 1955) Nilsson 1958

Filicales, Gleicheniaceae, subfamily Gleichenioideae?

Plicifera delicata (Bolkh. 1953) Bolkh. 1966

Pteridospermophyta

Caytoniales

Caytonia sp. (seed)	*Vitreisporites pallidus* (Reissinger 1950) Nilsson 1958

Corystospermales ?

Pachypteris sp. (leaves)	*Alisporites* cf. *diaphanus* (Pautsch 1958) Lund 1977
	cf. *Alisporites microsaccus* (Couper1958) Pocock1962
	Alisporites robustus Nilsson 1958
	Alisporites cf. *robustus* Nilsson 1958

	Alisporites thomasii. (Couper 1958) Nilsson 1958

Cycadophyta

Cycadales

Nilssonia sp. (leaves)	*Chasmatosporites apertus* (Rogalska 1954) Nilsson 1958
	Chasmatosporites cf. *elegans* Nilsson 1958
	Chasmatosporites hians Nilsson 1958
	Chasmatosporites major Nilsson 1958
	Chasmatosporites cf. *rimatus* Nilsson 1958

Bennettitales (= Cycadeoidales)

Cycadeoidaceae

Otozamites sp. (leaves)	*Monosulcites subgranulosus* Couper 1958
Pterophyllum sp. (leaves)	

Ginkgophyta

Ginkgoales

Stachyopitys preslii Schenk (fructification) - now attributed to *Schmeissneria microstachys* (Presl 1833) Kirchner et Van Konijnenburg-Van Cittert 1994	*Monosulcites minimus* Cookson 1947

Gnetophyta

Gnetales

no corresponds macrofossils	*Ephedripites tortuosus* Mädler 1964b

Coniferophyta

Coniferales

Ullmanniaceae ?

Swedenborgia sp. (scales and cones)

Podozamites sp. 1 (leaves)

Podozamites sp. 2 (leaves)

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 found *in situ Classopollis* pollen grains

Taxodiaceae

no corresponds macrofossils	*Perinopollenites elatoides* Couper 1958

Araucariaceae

no correspond macrofossils	cf. *Araucariacites australis* Cookson 1947 ex Couper 1953 cf. *Araucariacites* sp.

Coniferales ?

? *Pinuspollenites labdacus* var. *arcuatus* Danzé - Corsin et 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

Desmiophyllum sp. (leaves)

Microfossils with unknown affinity:

Cingutriletes sp.

cf. *Inaperturopollenites* sp.

Latosporites sp.

Leptolepidites sp.

cf. *Lycospora salebrosacea* (Malj.1949) Schulz 1967

Platysaccus nitidus Pautsch 1971

Only one taxon of dispersed pollen grains (*Classopollis*) were found in Odrowąż *in situ* into *Hirmeriella muensteri* (Schenk) Jung male cones. Other taxa of dispersed sporomorphs are given as corresponding with macrofossils according to published data. Disscussions about dispersed sporomorphs affinities there are in systematic part of this paper.

The comparision given above shows that the major plant groups of microflora apparently correspond with plant groups represented in the macroflora. However some groups of plants which are represented in the microflora e.g. Bryophyta, Lycophyta or some Coniferophyta were not been found in the macroflora. Therefore it might be interesting to examine the question, how the Jurassic pollen grains were transported and which of their characters may be associated with a given method of transport.

For recent angiosperms the agents of transport are: 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).

Characters of angiosperm pollen grain which are correlated with transport by wind are: 1/ relatively small size - 20 -30 (-60) μm according to Faegri and Van der Pijl (1966) - though wind transported pollen grains of conifers may be of conifers may be of much larger size, but they possess air-sacs, 2/ thin walls, 3/ smooth or almost smooth surface of exine, 4/ lack of sticky substances on the surface of the exine, 5/ production of pollen grains in large quantities.

On the other hand, pollen grains transported by animals tend to be: 1/ larger, 2/ thick walled, 3/ variously sculptured, 4/ 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* are pollinated partly by wind and partly by insects (Cronquist 1988).

Assuming that also non angiospermous pollen grains showed similar correlations with transport by wind or animals, I have tried to analyse the characters of several taxa of pollen grains, and apart from this of several taxa of pteridophyte spores from Odrowąż.

Among the pollen grains found in Odrowąż the most frequent are those of *Classopollis* (Pl. 8, figs 9-22, Pl. 9, figs 1-14) which are produced by the predominant member of the fossil megafora which is the tree *Hirmeriella muensteri* of the extinct conifer family Cheirolepidiaceae.

The pollen grains of *Classopollis* possess a structure without parallel in recent pollen and this makes difficult the interpretation both of its structure and mode of distribution.

Nevertheless the small size and the large amounts of pollen produced by the male cones of *Hirmeriella* suggest distribution by wind. It is interesting to note that *Classopollis* pollen grains tend to adhere in tetrads, even if treated by standart palynological preparation methods which rather tend to break the tetrads up. According to Hughes (1976) this adhering of *Classopollis* in tetrads "appears to provide for asymetrical distibution 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 transport of *Classopollis* pollen grains (Alvin 1982, Hughes 1976).

Relatively rare in the investigated sediment is the monosulcate grainsfrom the genera *Monosulcites* (Pl. 8, figs 4 - 5) and *Chasmatosporites* (Pl. 7, figs 16 - 18; Pl. 8, figs 1 - 3) which recall pollen grains found in fructifications of Ginkgoales, Cycadales and Bennettitales. The recent *Ginkgo* is wind pollinated (Chamberlain 1935 in Crane 1986). As follows from the work of Norstog and Fawcett (1989), although cycads are regarded as wind pollinated plants, there exist observations of cycad-insect interaction. Recently these authors observed that in cultivation the cycad *Zamia furfuracea* is pollinated by the small weevil *Rhopalotria mollis*.

In Bennettitales, in connection with the structure of their flowers and probable nectar production, insect pollination is generally suggested, in particular in *Williamsoniella* and *Cycadeoidea* (Crane 1986). However, morphological characters of a fossil pollen grain do not indicate in what way it was transported.

In the sediment from Odrowąż there occur also pollen grains of seed ferns, the small *Vitreisporites pallidus* (Pl. . 5, fig. 3) which is produced by *Caytonia* and the larger from the genus *Alisporites* (Pl. 4, fig. 15-16, Tabl. 5, fig. 1, 2, 4, 6, 9) which are usually linked with the Corystospermae. Those taxa of pollen grains possess air sacs, the presence of which is usually associated with wind pollination (Crane 1986). It is known that pollen grains of *Caytonia* were produced in large quantities which can also suggest wind pollination. Nevertheless, pollen grains of *Caytonia* were found in coprolites, so they were eaten by small animals and therefore Retallack and Dilcher (1988) see the possobility of animal pollination.

Pollen grains differ from spores both in their structure and function Pollen grains have to be transferred to the stigma of the pistil - in angiosperms or to the micropyle of the ovule in gymnosperms. Spores have to be transported to a substrate in which they germinate and give origin to the gamethophyte

When Jurassic spores from Odrowąż are considered, the most frequently met are spores of pteridophytes. In pteridophytes the dissemination of spores usually takes place with the help of wind (Faegri, Van der Pijl 1966; Crane 1986). In aquatic species the spores are disseminated by water. In certain families they are actively dispersed by the movements of the dehiscing sporangia (Faegri, Van der Pijl 1966). Though, in the dissemination of those spores may take part various animals. Symbiotic ants transport spores of certain tropical ferns (Docters van Leuven 1929 in Faegri, Van der Pijl 1966).

It had been demonstrated experimentally that the spores of recent pteridophytes e. g. *Pteridium aqulinum*, having passed through the gut of the spore eating insects *Locusta migratoria*, are able to germinate. The ability to germinate is lowered about 50% in comparison with spores which were not eaten by those insects. This experiment shows that insects can transport inside their bodies spores of pteridophytes which retain the ability to germinate. The spores lying on a soil surface might survive and be ”capable of sucessful germination” (Chaloner 1976).

One on the most important elements of pollen grains when the way of their transport is considered, is the sculpture of their exine. This element can also be observed in fossil spores. It was, however, not possible to decide on the base of the literature known to me, which characters of the spore sculpture could suggest their transport by wind and which characters their interactions with insects.There exist only information about the paradox that while the transport by wind is in the gymnosperms and angiosperms associated with a smooth or almost smooth surface of pollen grains, in majority of ptridophytes the spores are sculptured, and in general transported by wind (Chaloner 1976, Crane 1986). There had been expressed the opinion that certain characters shown by the exines of vascular plants may by adaptations to the passing through the gut of spore eating organisms (Chaloner 1976). Apart from this a spore has high demands as the places where it germinates. It must have adequate humidity, sufficient light, in some cases acces to appropriate mycorrhizal symbionts.

It is possible that a sculptured spore has a better chance to remain in a suitable place on the substrate up to the time when it can be anchored there with its rhizoid and further develope than a spore without sculpture. Therefore the selection is perhaps favouring a sculptured exine (Chaloner 1976).

In the investigated sediment from Odrowąż the majority of spores, such as e.g. *Plicifera delicata* (Pl. 1 figs 13-14) or spores of the genera *Matonisporites* (Pl. 3, figs 6-8) or *Cyathidites* (Pl. 1, figs 1-6) are smooth, although there occur also, though in smaller quantities, sculptured spores of the genera *Marattisporites* (Pl. 3, figs 17-8)) *Osmundacidites* (Pl. 2, fig. 17), *Contignisporites* (Pl. 3, fig. 5) and *Conbaculatisporites* (Tabl. 2, fig. 11). Taking this into account and also considering the data from the literature, it can be assumed that these spores were rather transported by wind.

Having examined the majority of Jurassic pollen grains and spores found in Odrowąż, it can be stated that most probably all of them were transported by wind. It cannot, however be excluded that in the transport of some of them, such as the pollen grains *Vitreisporites pallidus* (Pl. 5, fig. 3), *Monosulcites* (Pl. 8, figs 4-5) or some taxa of Pteridophyta, took part insects or other animals. There is not sufficient evidence for this in the structure of pollen grains and spores, but only that is at our disposal in the fossil state, when pollen grains and spores are considerd.

AGE OF THE INVESTIGATED SEDIMENTS FROM ODROWĄŻ ON THE BASIS OF SPORES AND POLLEN GRAINS

Palynological investigations from the Holy Cross Mountains area were carried out since 1956 year (Rogalska 1956, 1976, Marcinkiewicz, Orłowska & Rogalska 1960). A megaspore *Nathorstisporites hopliticus* Jung (= megaspore *Lycostrobus scotti* Nathorst), were determined by Marcinkiewicz (1957, Marcinkiewicz et al. 1960) from sediments of Odrowąż. This megaspore is regarded as an index species for the Lower Liassic sediments.
Composition of spores and pollen grains from Odrowąż with domination of *Classopollis torosus* (Reissinger) Couper pollen grains, *Aratrisporites minimus* Schulz spores (similar to *Lycostrobus scotti* Nathorst mikrospores) and smooth spores from the genera *Concavisporites* and *Cyathidites*, is very similar to composition of *Concavisporites - Duplexisporites - Aratrisporites minimus* (= Lias α_1 and α_2) zone from Franconia in Germany (Achilles 1981). According to Achilles (1981) this zone corresoponds with :
1/ *Pinuspollenites-Trachysporites* zone from northwestern Germany and south Scandiavia (Lund 1977), 2/ *Heliosporites* zone in Great Britain (Orbell 1973), 3/ Phase 5 in northern France and southern Luxembourg (Schuurman 1977) and also in Alps in Austria and in southern Germany (Schuurman 1979), 4/ FG subzone in Kendelbachgraben in Austria (Morbey 1975).
On the basis of similarity with pollen and spores zones and the fact that according to Rogalska (1976) *Aratrisporites minimus* Schulz spores are an index species for the Lower Liassic it can be assumed that age of the sediments from the Odrowąż outcrop is Lower Liassic (Hettangian). This confirmed results of geological investigations (Karaszewski 1962, Pieńkowski 1983, Pieńkowski & Gierliński 1987, Pieńkowski 1999) and investigations of macroflora from the same locality (Reymanówna 1991, Wcisło-Luraniec 1991).

CONCLUSIONS

In the present paper 63 taxa fossil pollen grains and spores from Odrowąż (Holy Cross Mountains area in Poland) were illustrated and determined to a species or genus and 13 were determined as incertae sedis. Descriptions, illustrations, geographical and strigraphical distributions and discussions of affinities were done for these taxa. New combination of names for the *Pityosporites minimus* (Couper 1958) comb. nov. was proposed.

Detail descriptions of *Hirmeriella muensteri* (Schenk) Jung male cones and isolated from it *Classopollis* pollen grains were given. *Classopollis* pollen grains from these cones are identical with dispersed *Classopollis torosus* (Reissinger) Couper from Odrowąż.

Microflora were compared with macroflora from investigated locality. The major plant groups of the microflora apparently correspond with plant groups represented in the megaflora. Some problems of pollen dispersal were discussed.

According to the present author opinion the age of sediments from Odrowąż is Hettangian on the basis of the spores and pollen grains composition and the presence of an index species *Aratrisporites minimus* Schulz. It confirmes earlier opinion of the age of these sediments given on the basis of geological and macrofloristical investigations.

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PLATES

Explanation of plates

LM microphotographs x 1000 unless otherwise specified. Photographs were taken by the author except pl. 10, figs. 1-6 and pl. 11, fig. 1 taken by Antoni Pachoński.
SEM microphotographs were taken 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 explanations after the name of the taxon is given the name of locality, the slide number and the co-ordinates of the microscope (a Carl Zeiss Jena type Lu microscope no. 383827) cross-table indicating the position of the sporomorphs on the slide.

PLATE 1

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

PLATE 1

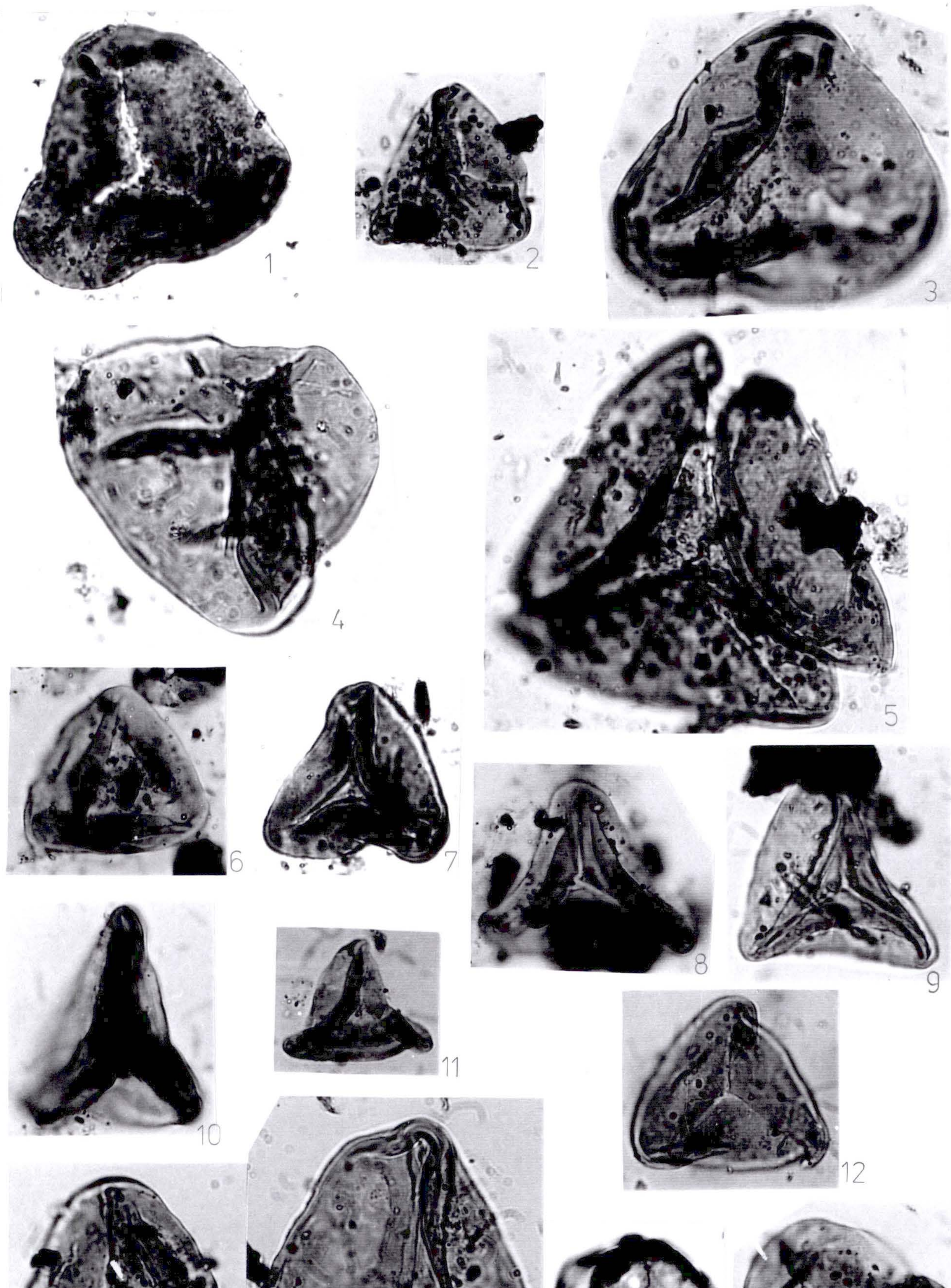

PLATE 2

1. *Calamospora tener* (Leschik 1955) Mädler 1964; Odrowąż O9/1/1; 102,5/18

2. *Calamospora tener* (Leschik 1955) Mädler 1964; Odrowąż O9/2/8; 106/16.5

3. *Todisporites minor* Couper 1958; Odrowąż O8/50; 108/11

4. cf. *Todisporites* sp.; Odrowąż O8/54; 105.5/3

5. *Rogalskaisporites cicatricosus* (Rogalska 1954) Danzé-Corsin & Laveine 1963; Odrowąż O8/49; 105.5/8

6. *Rogalskaisporites cicatricosus* (Rogalska 1954) Danzé-Corsin & Laveine 1963; Odrowąż (the same specimen as fig. 5)

7. *Auritulinasporites* sp.; Odrowąż O8/46/95; 106/8.5

8. *Apiculatisporis ovalis* (Nilsson 1958) Norris 1965; Odrowąż O8/50; 105.5/8.5

9. *Auritulinasporites triclavis* Nilsson 1958; Odrowąż O5/2/95; 95.5/6

10. *Cibotiumspora juriensis* (Balme1957) Filatoff 1975; Odrowąż O8/48; 95.1/10

11. *Conbaculatisporites mesozoicus* Klaus 1960; Odrowąż OS_2/4; 111/15.5

12. *Acanthotriletes varius* (Nilsson 1958) Schuurman 1977; Odrowąż O5/11/95; 91/5

13. cf. *Uvaesporites* sp., tetrad; Odrowąż O8/ 48/95; 101.5/3

14. *Foraminisporis jurassicus* Schulz 1967; Odrowąż O8/58/95; 99/2.5

15. *Uvaesporites argenteaeformis* (Bolkh. 1953) Schulz 1967; Odrowąż O6/1/6; 110/9.5

16. *Leptolepidites* sp.; Odrowąż O8/5; 110.5/4.5

17. *Osmundacidites* sp.; Odrowąż O5/13/95; 97/7

18. cf. *Uvaesporites* sp., tetrad; Odrowąż (the same specimen as fig. 13)

PLATE 2

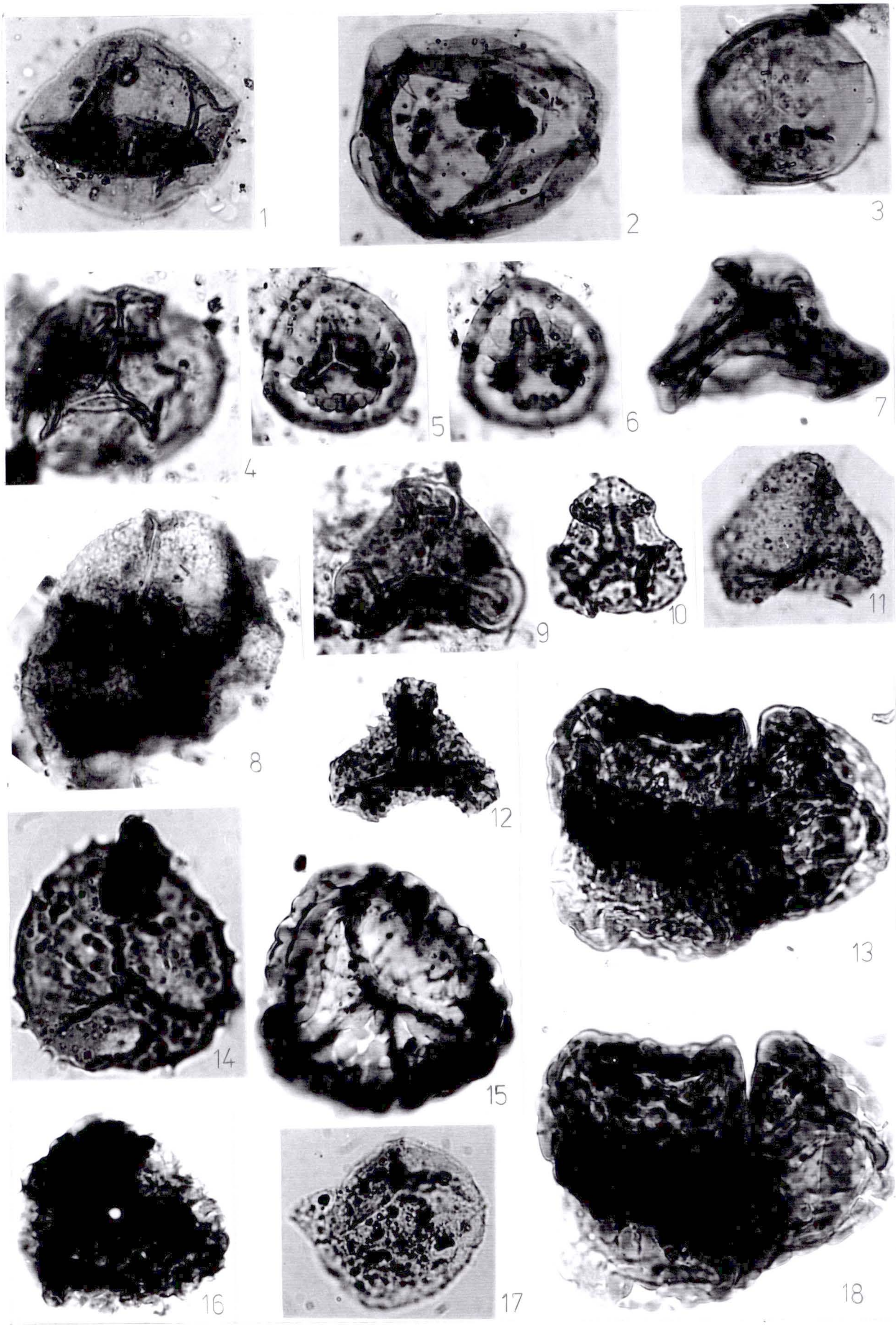

PLATE 3

1. *Lycopodiacidites rugulatus* (Couper 1958) Schulz 1967; Odrowąż O8/3; 99.5/19

2. *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine 1963; Odrowąż O8/45/95; 107.1/3.8

3. *Lycopodiumsporites* sp.; Odrowąż O5/6/95; 98.5/3.5

4. *Lycopodiumsporites semimuris* Danzé - Corsin et Leveine 1963; Odrowąż (the same specimen as fig. 2)

5. *Contignisporites problematicus* (Couper 1958) Döring 1965; Odrowąż O8/2; 97.5/7

6. *Matonisporites* sp.1; Odrowąż O8/2; 102.5/12.5

7. *Matonisporites* sp.1; Odrowąż O5/2; 97.5/ 7.5

8. *Matonisporites* sp. 2; Odrowąż O6/1/6; 111.9/11.1

9. cf. *Lycospora salebrosacea* (Malj.1949) Schulz 1967; Odrowąż O8/18; 105/17.5

10. *Neochomotriletes triangularis* (Bolch. 1956) Reinhardt 1961; Odrowąż O5/12/95; 96/19

11. *Lycopodiumsporites cerniites* (Ross 1949) Delcourt et Sprumont 1955; Odrowąż 8/59/95; 107.5/17

12. *Cingutriletes* sp.; Odrowąż O8/46; 107.1/2.5

13. cf. *Lycospora salebrosacea* (Malj.1949) Schulz 1967; Odrowąż (the same specimen as fig. 9)

14. cf. *Latosporites* sp.; Odrowąż O8/2; 106/7.5

15. *Lycopodiumsporites cerniites* (Ross 1949) Delcourt et Sprumont 1955; Odrowąż (the same specimen as fig. 11)

16. *Foveotriletes* sp.; Odrowąż O5/10/95; 109/11.1

17. *Marattisporites* sp. 2; Odrowąż O8/3; 95,5/17

18. *Marattisporites* sp. 1; Odrowąż O5/1/95; 96/5

PLATE 3

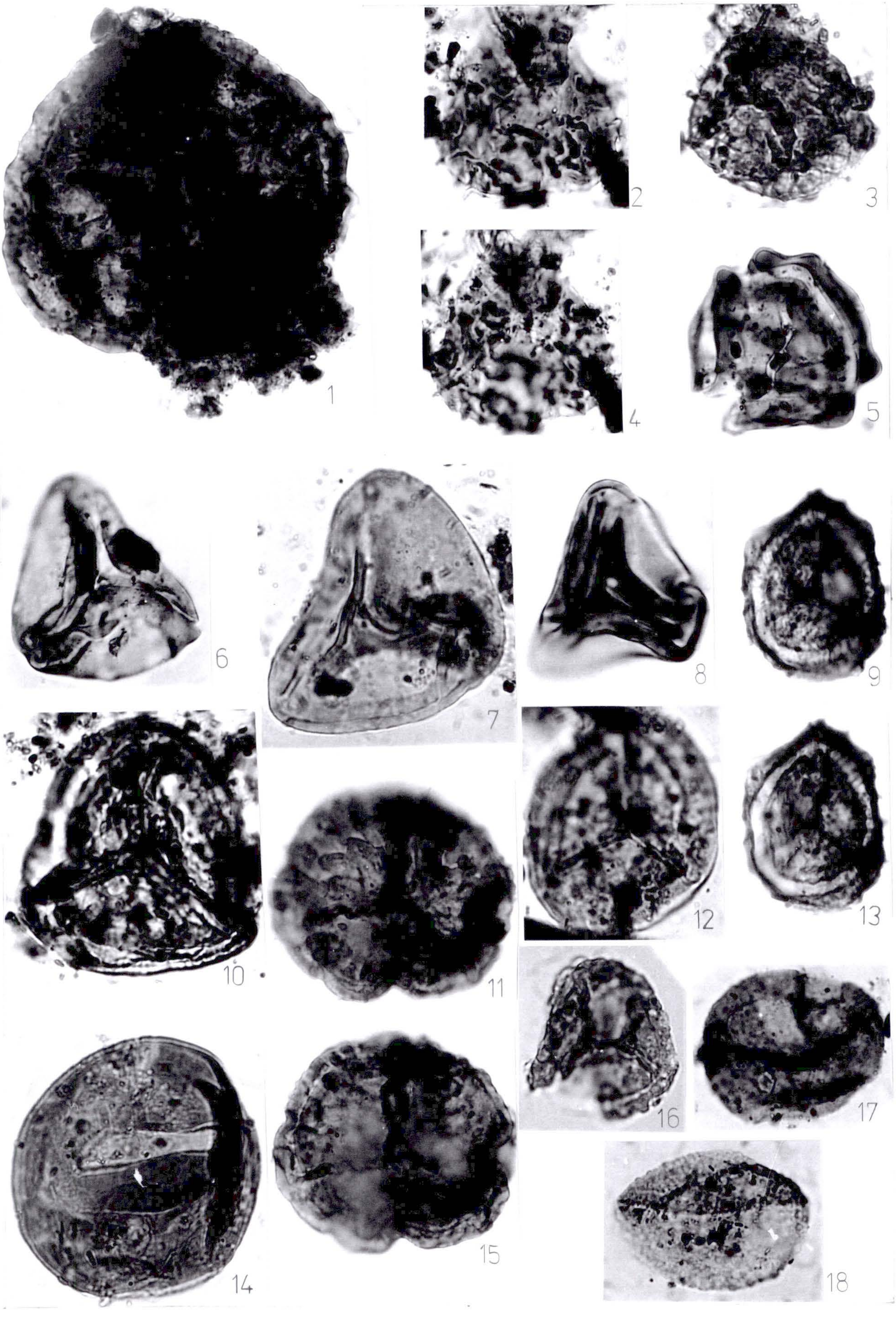

PLATE 4

1. *Aratrisporites minimus* Schulz 1967; Odrowąż O8/18; 101/14
2. *Aratrisporites minimus* Schulz 1967; Odrowąż O5/11/95; 105/14
3. *Aratrisporites minimus* Schulz 1967; Odrowąż O8/1; 102/7.5
4. *Aratrisporites minimus* Schulz 1967; Odrowąż O8/2; 105.5/13
5. *Aratrisporites minimus* Schulz 1967; Odrowąż O8/18; 96/19
6. *Aratrisporites minimus* Schulz 1967; Odrowąż O5/11/95; 106.5/1.5
7. *Aratrisporites minimus* Schulz 1967; Odrowąż O5/10/95; 100/11.5
8. *Aratrisporites minimus* Schulz 1967; Odrowąż O8/45/95; 102/3
9. *Aratrisporites minimus* Schulz 1967; Odrowąż O5/11/95; 97/6.5
10. *Aratrisporites minimus* Schulz 1967; Odrowąż (the same specimen as fig. 8)
11. *Aratrisporites minimus* Schulz 1967; Odrowąż O8/49/95; 105/4,5
12. *Aratrisporites minimus* Schulz 1967; Odrowąż O8/18; 98/10
13. *Alisporites* cf. *diaphanus* (Pautsch 1958) Lund 1977; Odrowąż O5/13/95; 102/7
14. *Aratrisporites minimus* Schulz 1967; Odrowąż; SEM, 2000 x
15. cf. *Alisporites microsaccus* (Couper 1958) Pocock 1962; Odrowąż O9/2/6; 94.5/18
16. *Alisporites robustus* Nilsson 1958; Odrowąż O5/14/95; 106/11

PLATE 4

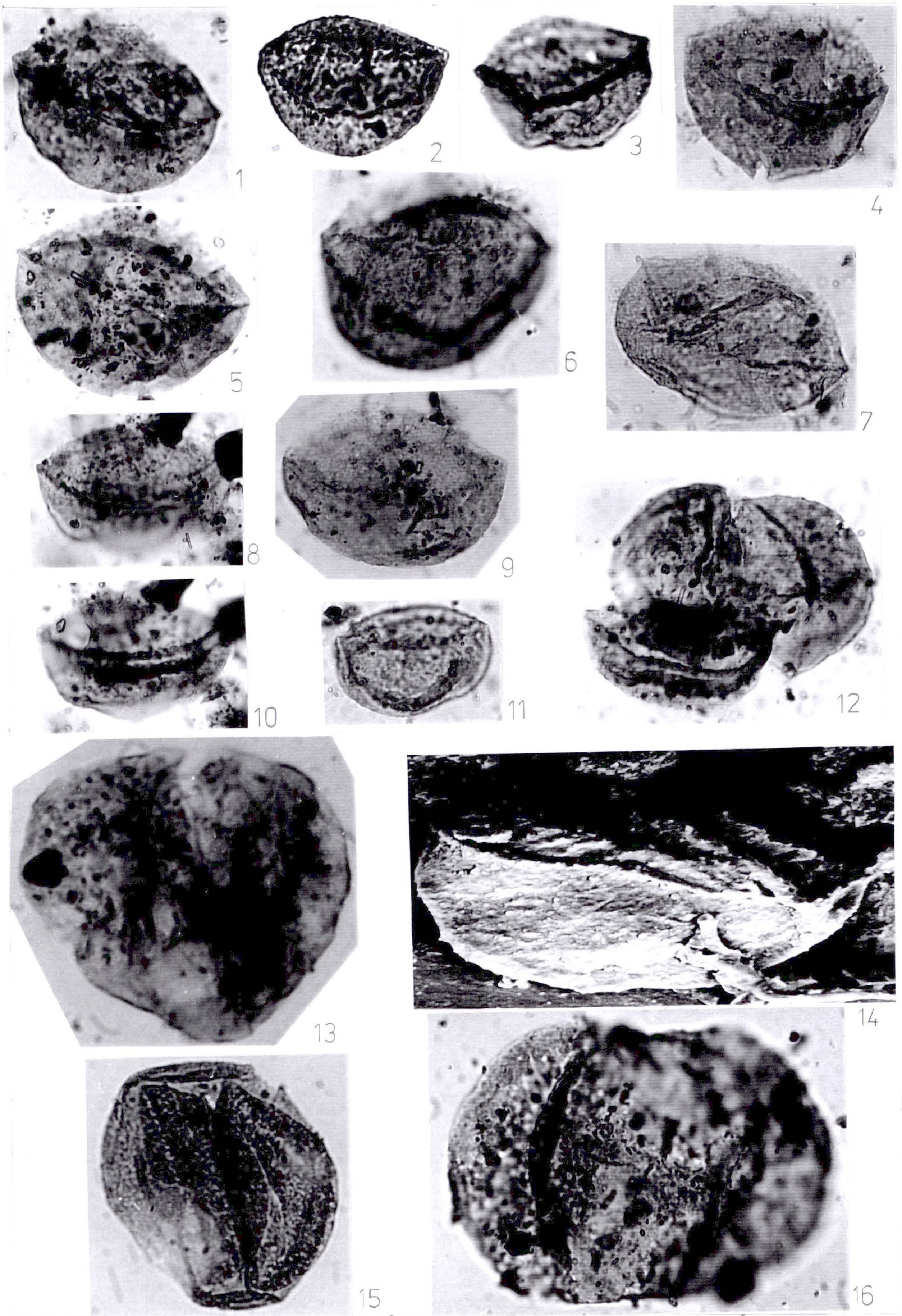

PLATE 5

1. *Alisporites robustus* Nilsson 1958; Odrowąż O5/11/95; 103.5/5.5

2. *Alisporites thomasii* (Couper 1958) Nilsson 1958; Odrowąż O8/2; 101/13

3. *Vitreisporites pallidus* (Reissinger 1950) Nilsson 1958; Odrowąż O10/1; 105/14

4. *Alisporites robustus* Nilsson 1958; Odrowąż O8/58; 103.5/3.5

5. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O8/3; 101.5/22

6. *Alisporites robustus* Nilsson 1958; Odrowąż O8/3; 97/11.5

7. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O8/54/95; 101/2

8. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O8/18; 109/13

9. *Alisporites* cf. *robustus* Nilsson 1958; Odrowąż O8/3; 100/14

10. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O8/46/95; 107/1.5

PLATE 5

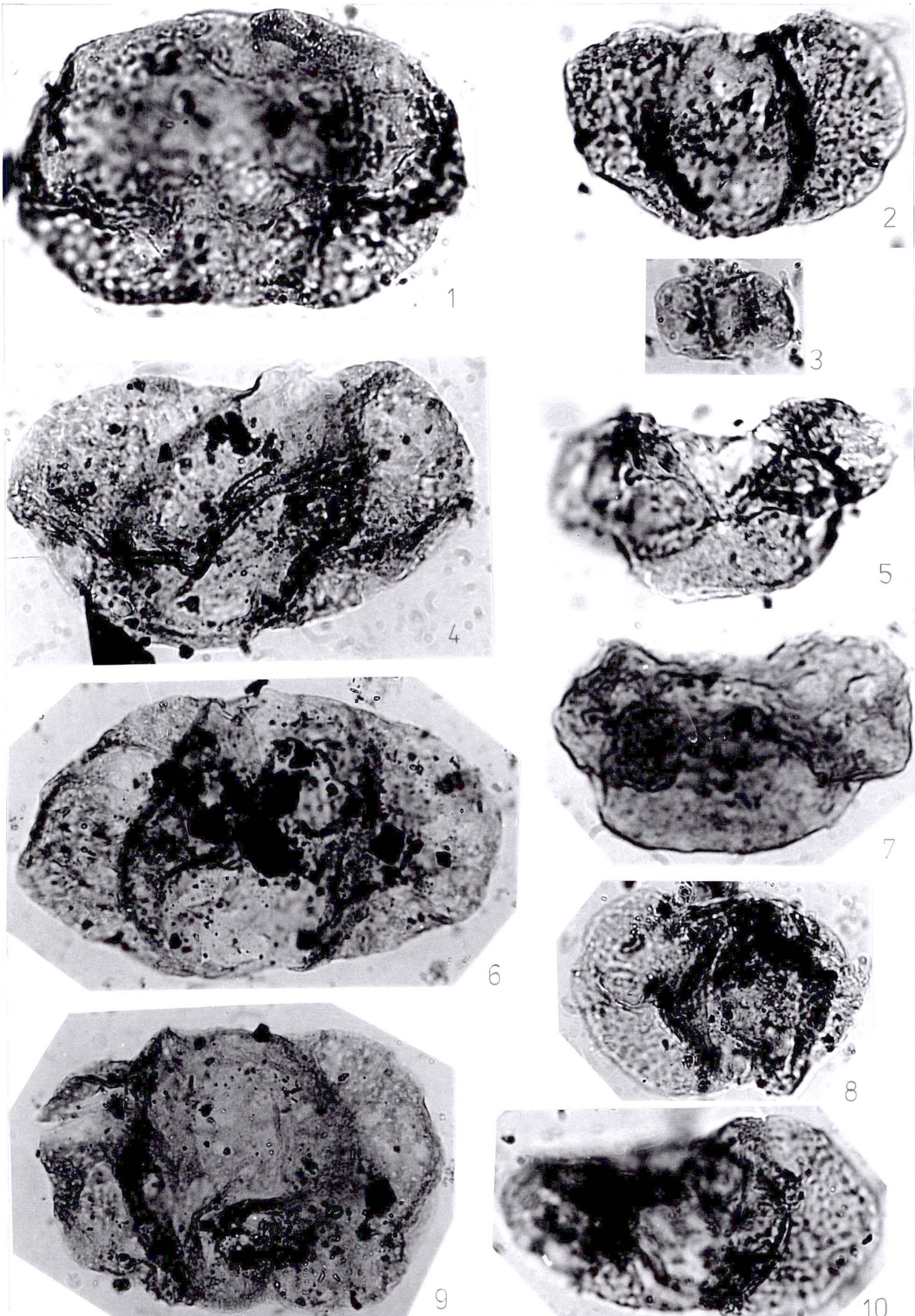

PLATE 6

1. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż OS_2/15; 92/6
2. *Platysaccus nitidus* Pautsch 1971; Odrowąż O8/45/95; 103/3
3. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O8/2; 104.5/18
4. *Platysaccus nitidus* Pautsch 1971; Odrowąż (the same specimen as fig. 2)
5. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O8/45/95; 110/11
6. cf. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O9/1/1; 103.5/18.5
7. ? *Pinuspollenites labdacus* var. *arcuatus* Danzé - Corsin et Leveine 1963; Odrowąż O8/45/95; 110/4.5
8. cf. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O8/48/95; 102. 5/6
9. ? *Pinuspollenites labdacus* var. *arcuatus* Danzé - Corsin et Leveine 1963; Odrowąż (the same specimen as fig. 7)

PLATE 6

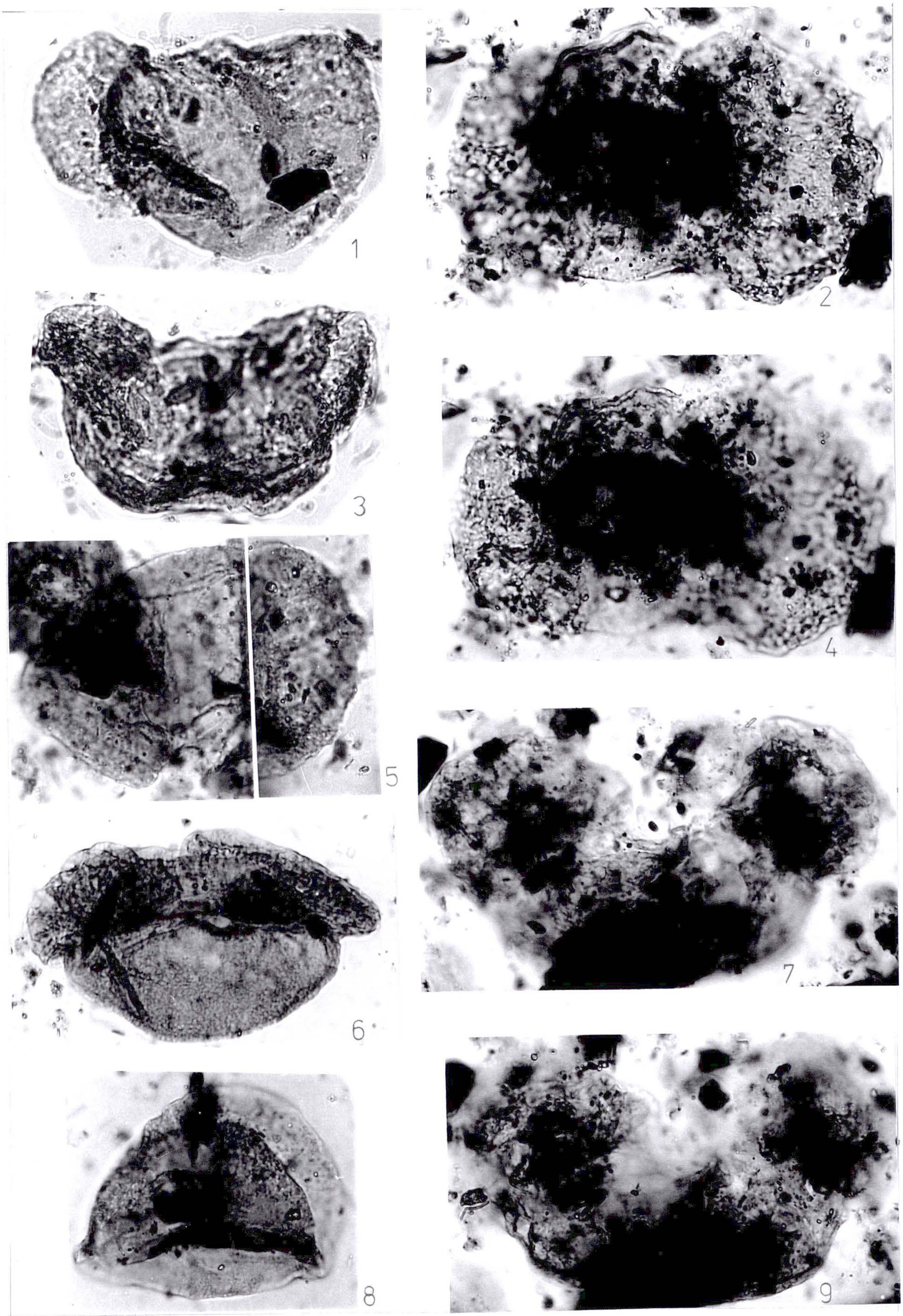

PLATE 7

1. cf. *Pityosporites minimus* (Couper 1958) comb. nov.; Odrowąż O5/11/95; 95.2/5
2. cf. *Inaperturopollenites* sp.; Odrowąż O8/54/95; 103/5
3. cf. *Inaperturopollenites* sp.; Odrowąż O5/15/95; 99/3
4. cf. *Araucariacites australis* Cookson 1947 ex Couper 1953; Odrowąż O5/10/95; 100/18.3
5. cf. *Araucariacites* sp.; Odrowąż O9/2/6; 93.5/8.5
6. *Spheripollenites psilatus* Couper 1958; Odrowąż O5/3/95; 105/5.5
7. *Spheripollenites subgranulatus* Couper 1958; Odrowąż O8/5; 95/13.5
8. *Spheripollenites* sp.; Odrowąż O8/3; 100.5/9
9. *Spheripollenites* sp.; Odrowąż O5/6/95; 102.5/2
10. *Spheripollenites* sp.; Odrowąż O5/6/95; 94/1
11. Incertae sedis no.1; Odrowąż O8/3; 109,5/10
12. *Spheripollenites* sp.; Odrowąż O8/2; 100/16
13. *Perinopollenites elatoides* Couper 1958; Odrowąż O5/10/95; 104/15
14. *Perinopollenites elatoides* Couper 1958; Odrowąż O5/13/95; 103.5/15.5
15. *Perinopollenites elatoides* Couper 1958; Odrowąż O8/2; 98/10.5
16. *Chasmatosporites* cf. *elegans* Nilsson 1958; Odrowąż O8/2; 101/4.5
17. *Chasmatosporites* cf. *elegans* Nilsson 1958; Odrowąż O8/18; 103.5/12.5
18. *Chasmatosporites* cf. *elegans* Nilsson 1958; Odrowąż O10/1; 113.5/15
19. *Chasmatosporites apertus* (Rogalska 1954) Nilsson 1958; Odrowąż O8/18; 102.5/19.5

PLATE 7

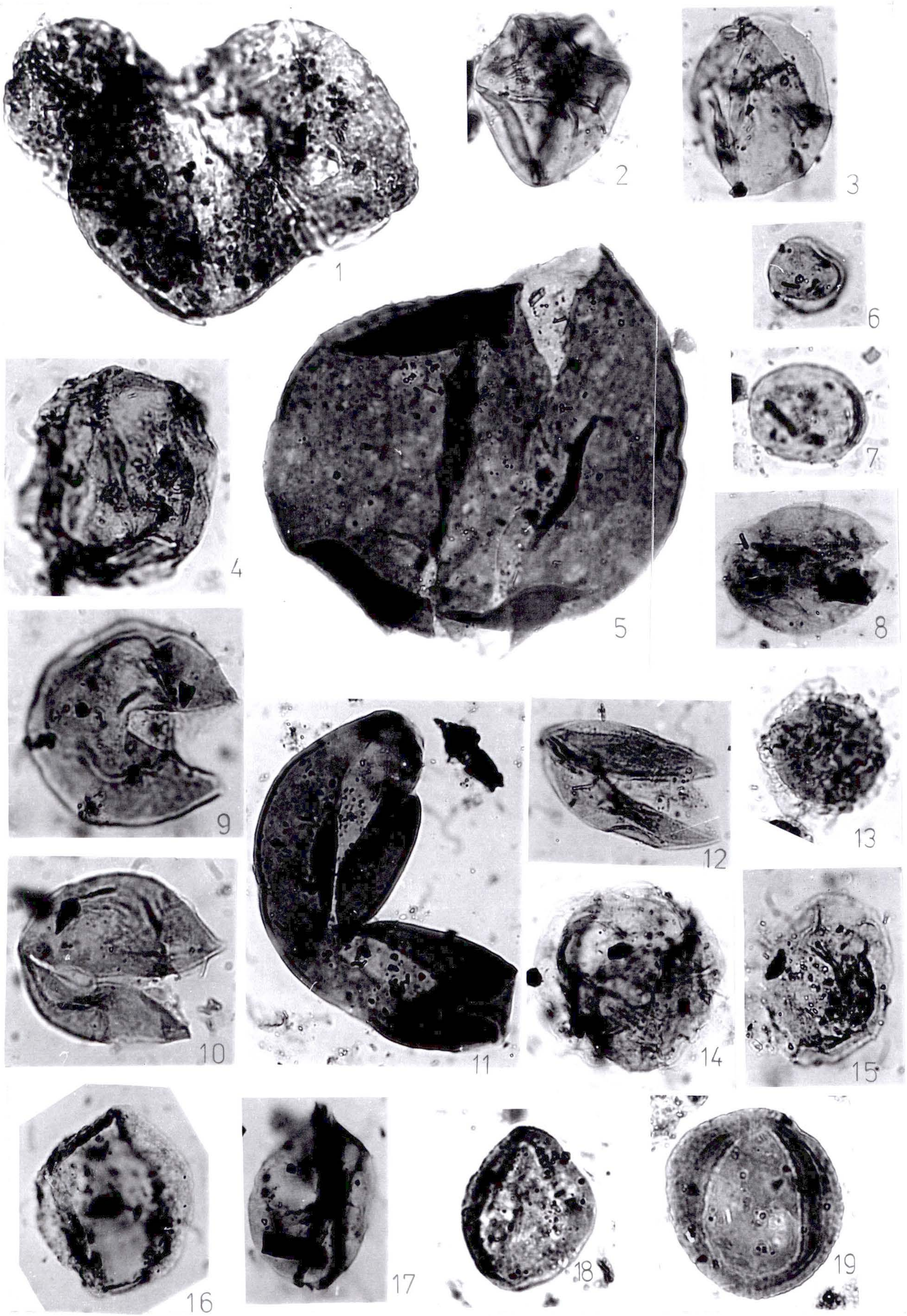

PLATE 8

1. *Chasmatosporites hians* Nilsson 1958; Odrowąż O9/2/8; 106/16.5

2. *Chasmatosporites major* Nilsson 1958; Odrowąż O9/1/1; 109/14.5

3. *Chasmatosporites* cf. *rimatus* Nilsson 1958; Odrowąż O5/11/95; 104/6.5

4. *Monosulcites minimus* Cookson 1947; Odrowąż O8/60/95; 102/6.5

5. *Monosulcites subgranulosus* Couper 1958; Odrowąż O17/1; 105/8

6. Incertae sedis no. 2; Odrowąż O5/3/95; 108/2.5

7. *Ephedripites tortuosus* Mädler 1964; Odrowąż O8/49; 103,5/5.5

8. *Ephedripites tortuosus* Mädler 1964; Odrowąż (the same specimen as fig. 7)

9. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/4; 99.5/17.5

10. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż;OS_2/13; 92.5/20

11. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/54; 104.2/3.5

12. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O9/2/6; 100/9

13. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O9/2/6; 100/9

14. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O5/10/95; 102/20

15. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; (the same specimen as fig. 14)

16. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/2; 109/14

17. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/18; 104.5/13.5

18. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/3; 104/19

19. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/54; 101.5/2.5

20. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O5/10/95; 97/13

21. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O5/11/95; 93/12

22. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/2; 108/12.5

PLATE 8

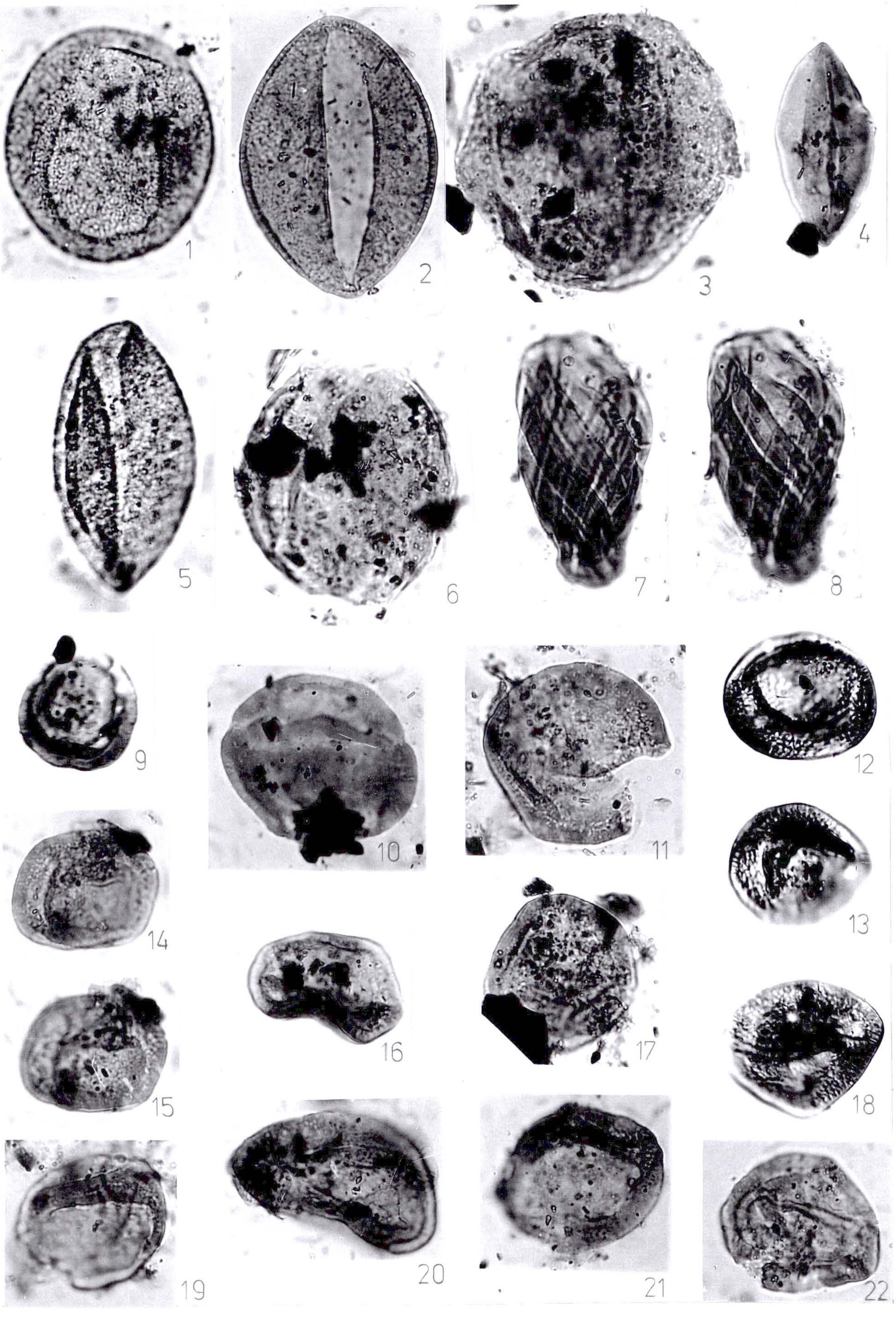

PLATE 9

1. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O5/13/95; 103/16

2. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O6/1/6; 103.1/3.1

3. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż (the same specimen as fig. 2)

4. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; O8/49/95; 106/12.5

5. *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, tetrad; Odrowąż; O5/6/95; 98.5/5

6. *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, tetrad; Odrowąż O5/10/95; 96.5/20

7. *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, tetrad; Odrowąż (the same specimen as fig. 6)

8. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż O5/10/95; 108/9.5

9. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż O5/10/95; 102.1/14,2

10. *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż O5/11/95; 104.5/8.5

11. *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż (the same specimen as fig. 10)

12. *Classopollis* sp. cf. *Classopollis torosus* (Reissinger 1950) Couper 1958, tetrad; Odrowąż O8/4 100/19

13. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; SEM, about 1300 x

14. *Classopollis torosus* (Reissinger 1950) Couper 1958; Odrowąż; SEM, 2000 x

PLATE 9

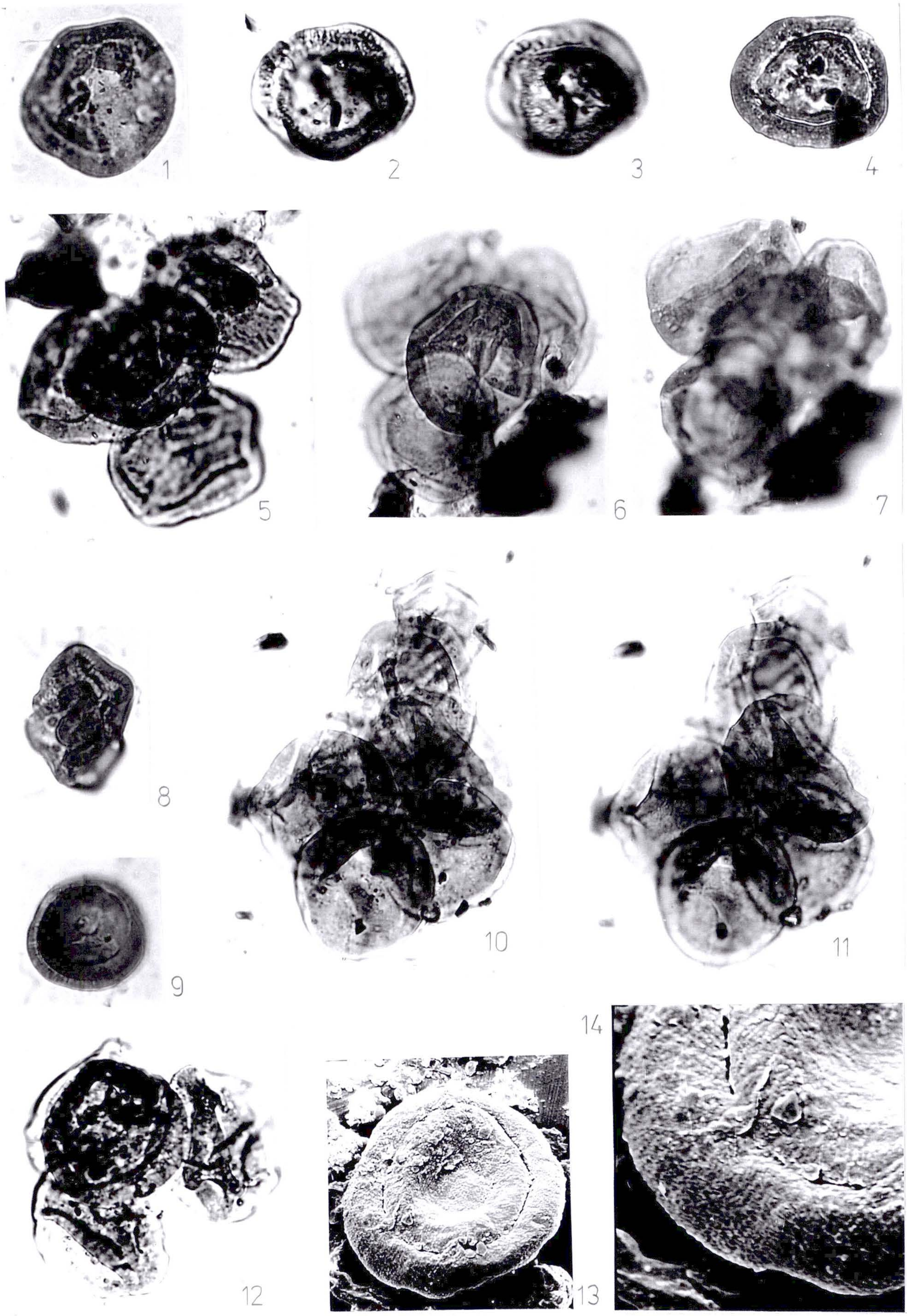

PLATE 10

1. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cones on the rock; Odrowąż, specimen PMS 68/118, natural size

2. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone attached to fragment of the branch; Odrowąż, specimen PMS 68/119, about 7 x

3. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no. 20; Odrowąż, about 7 x

4. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no. 38; Odrowąż, about 7 x

5. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no. 43; Odrowąż, about 7 x

6. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no. 41; Odrowąż, about 7 x

7. *Classopollis in situ* pollen grains and fragment of the microsporophyll from *Hirmeriella muensteri* (Schenk 1867) Jung 1968; pollen cone no. 43; Odrowąż, 102/10.5;1000 x

PLATE 10

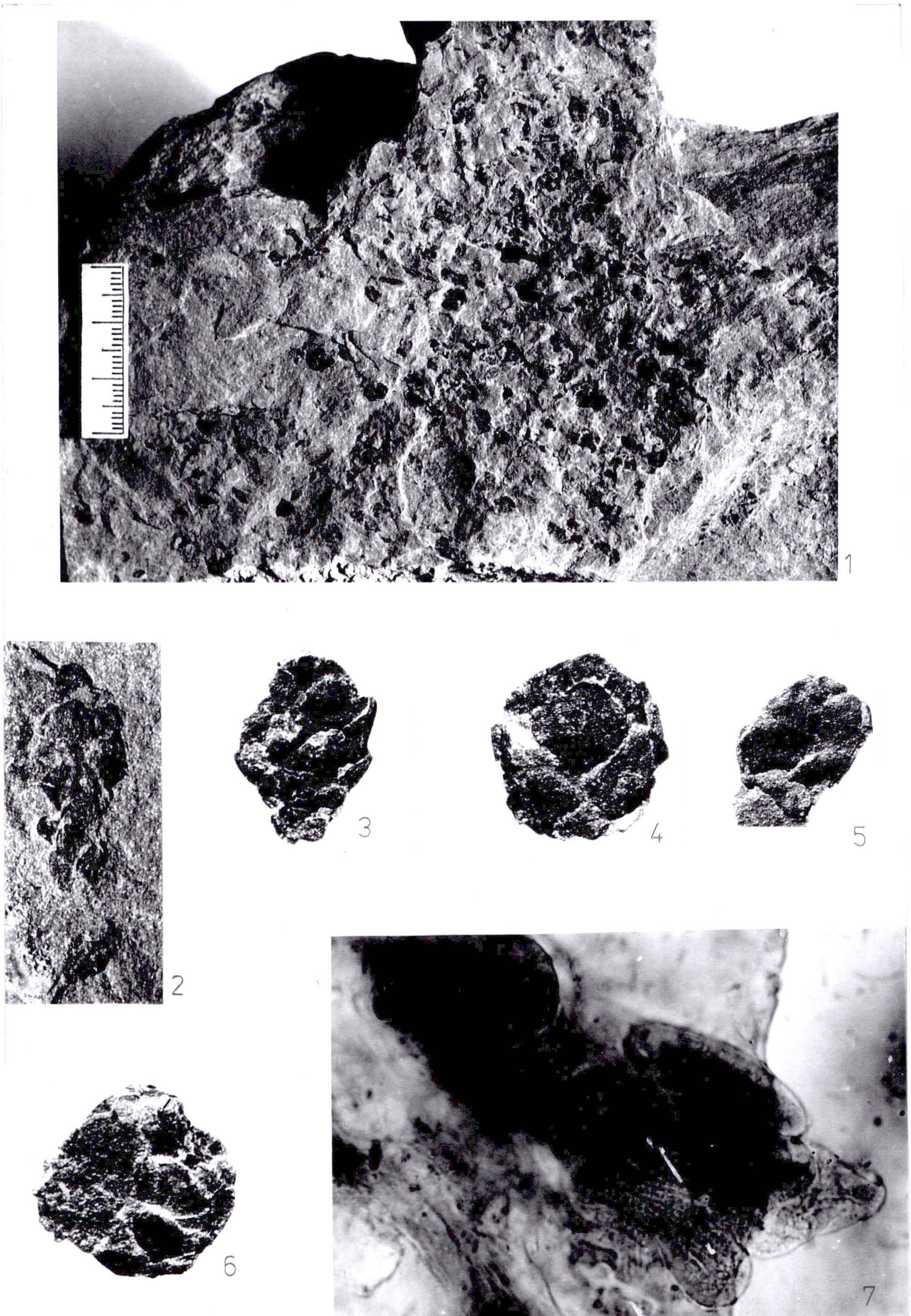

PLATE 11

1. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no.1 on the rock before maceration; Odrowąż, about 7 x

2. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no.1, fragment of microsporophyll after maceration; Odrowąż, 103/12; 200 x

3. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no.1, fragment of microsporophyll (the same as fig. 2), with stomata after maceration; Odrowąż, 103/12; 100 x

4. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no.1, fragment of microsporophyll after maceration, (the same as fig. 2), stoma; Odrowąż, 103/12; 1000 x

5. *Hirmeriella muensteri* (Schenk 1867) Jung 1968, pollen cone no.1 after maceration, fragment of apical margin of microsporophyll; Odrowąż, 103/12; 1000 x

6. *Classopollis* in situ pollen grains isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone no. 1; Odrowąż, 102/14;1000 x

PLATE 11

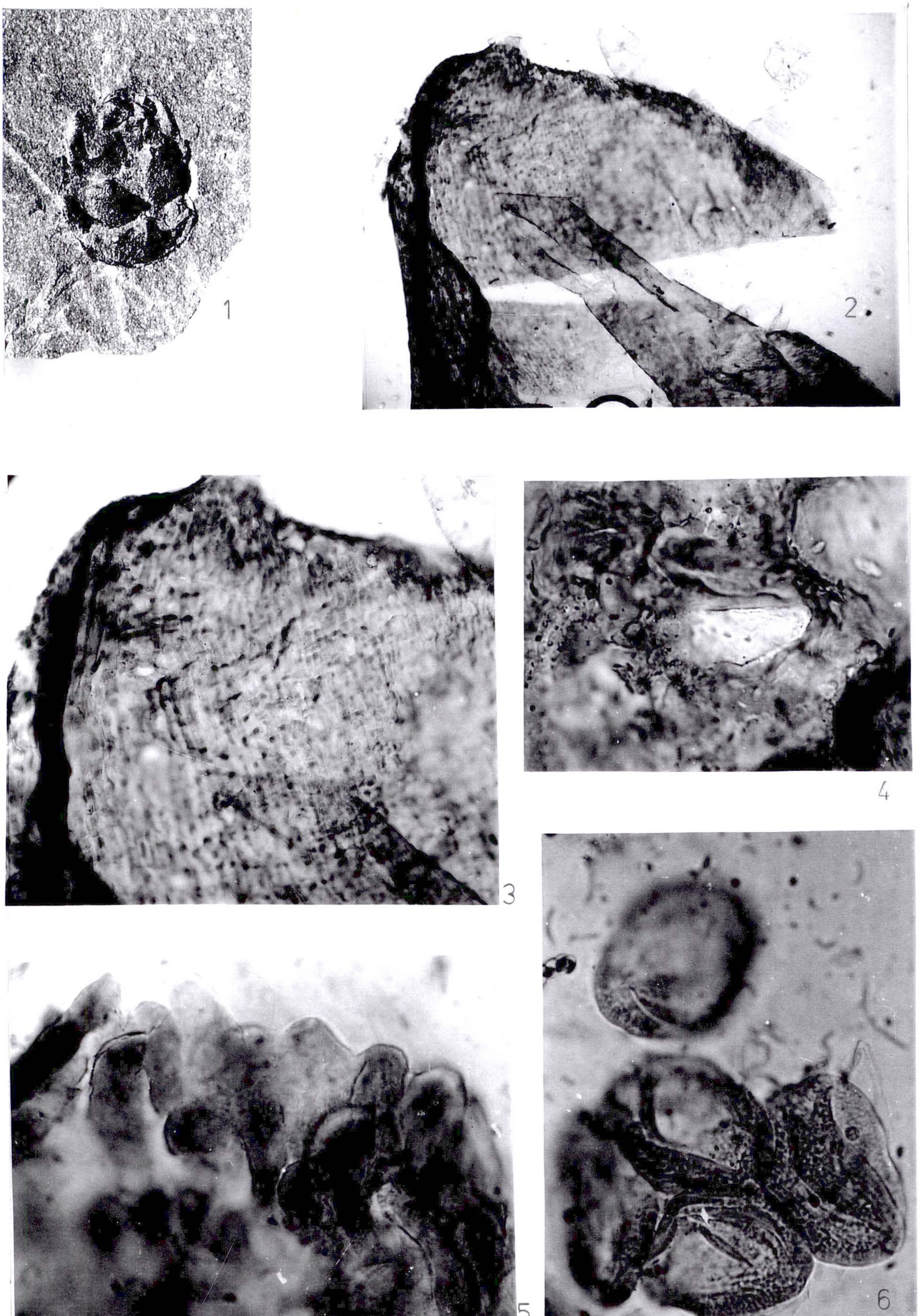

PLATE 12

1. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; Odrowąż 1975, male cone A, fragment of microsporophyll; 105.5/12, (Material prepared by M. Reymanówna), 1000 x

2. *Classopollis* in situ pollen grains (immature tetrad ?) isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; Odrowąż, male cone 29; 106/10 (Material prepared by M. Reymanówna), 1000 x

3. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; Odrowąż male cone 29; 106/11, (Material prepared by M. Reymanówna), 1000 x

4. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; Odrowąż 1975; male cone A, fragment of microsporophyll; 105/11 (Material prepared by M. Reymanówna), 1000 x

5. *Classopollis* in situ pollen grain isolated from *Hirmeriella muensteri* (Schenk 1867) Jung 1968 pollen cone; Odrowąż; (Material prepared by M. Reymanówna), SEM, about 1300 x

PLATE 12

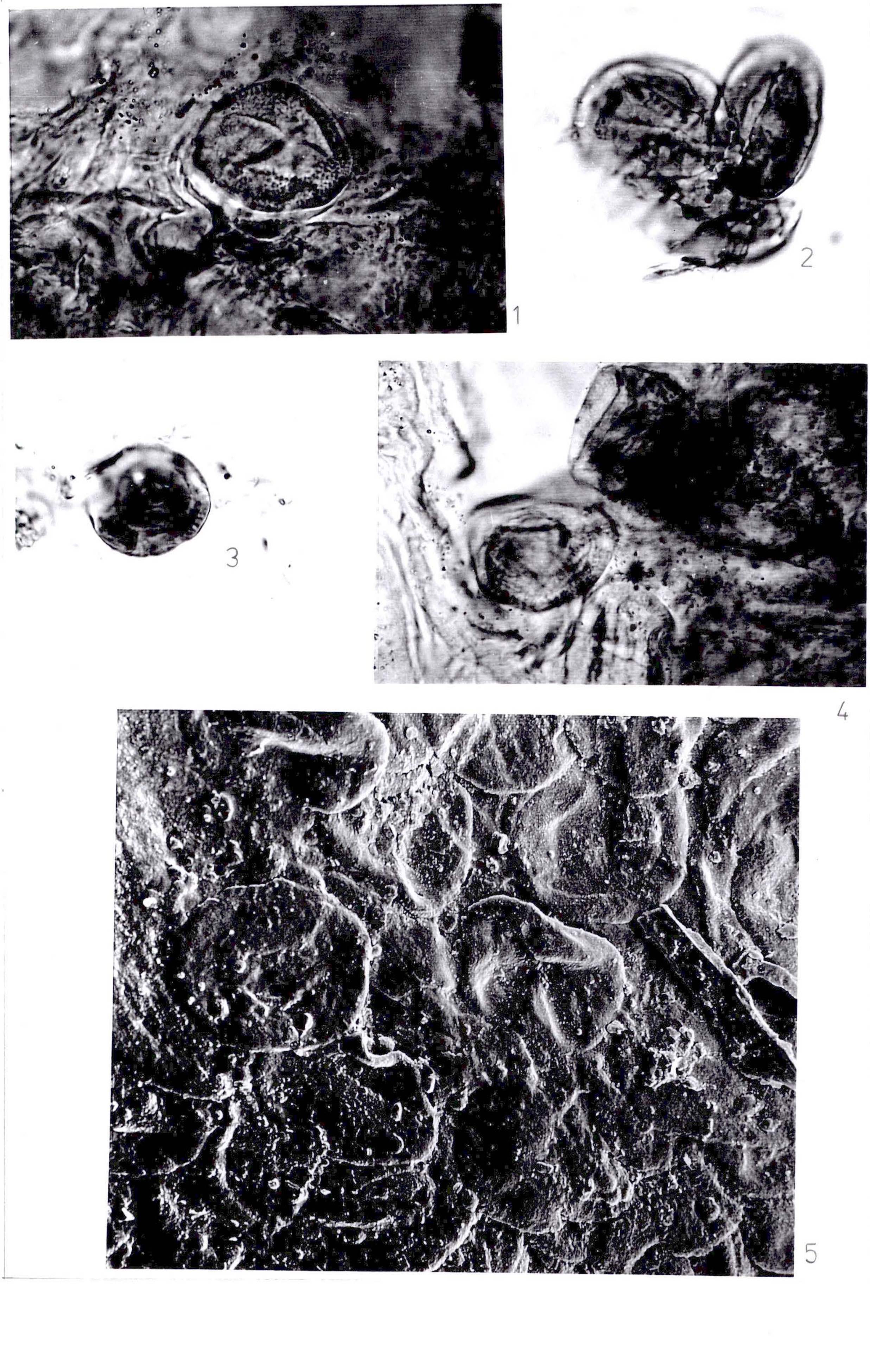

PLATE 13

1. Incertae sedis no. 3, tetrad of spores; Odrowąż O8/2; 102/19
2. Incertae sedis no. 4; Odrowąż O5/12/95; 100.8/16.5
3. Incertae sedis no. 4; Odrowąż (the same specimen as fig.2)
4. Incertae sedis no. 5; Odrowąż O5/10/95; 109/10.5
5. Incertae sedis no. 6; Odrowąż O8/52/95; 95.5/9
6. Incertae sedis no. 7; Odrowąż O8/3; 99.5/6
7. Incertae sedis no. 8; Odrowąż O8/2; 99/19
8. Incertae sedis no. 9; Odrowąż O5/11/95; 105/9
9. Incertae sedis no. 10; Odrowąż O8/49/95; 106/11
10. Incertae sedis no. 11, bisaccate pollen grain; Odrowąż O8/48/95; 100.5/5.8
11. Incertae sedis no. 12, bisaccate pollen grain; Odrowąż O8/5; 98/10
12. Incertae sedis no. 13, bisaccate pollen grain; Odrowąż O5/11/95; 97/3
13. Incertae sedis no. 14, bennettitalean type of cuticule, Odrowąż O5/13/95; 111/3

PLATE 13