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Palynology of the Nýřany Member (Westphalian D) in the Mšeno Basin

Palynologie nýřanských vrstev mšenské pánve (vestfál D)

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Abstract: The Nýřany Member, the coal bearing horizon of the Lower Grey Formation in the Bohemian Carboniferous Basin was palynologically studied in the Mšeno Basin. In the coals here designated as Vavřineč group of seams rich assemblages of miospores and megaspores were established and systematically studied. Eleven species are probably new and described but not specifically named, others are referable or comparable to previously described types.

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Introduction

In recent years palynological investigation of the Jelenice Member (Stephanian) has been done (1978). The present paper deals with the occurrence of megaspores and miospores of the Nýřany Member (Westphalian D) especially from the coals.

Geology: The Late Paleozoic Mšeno Basin occurs in the eastern continuation of the Central Bohemian Permo-Carboniferous in the area between Mělník, Dubá near Doksy, Mladá Boleslav and Nymburk. The Nýřany Member (Westphalian D) forms the basal part of the stratal sequence in the Carboniferous. [The underlying Radnice Member [Westphalian C] is only developed in a small south-western part of the basin in the Mělník area.] The Nýřany coal seams occur in four main coal bearing horizons in the lower two thirds of the Nýřany Member. The name of the Vavřineč group of seams was for them proposed (Kalibová-Kaiserová 1982).

Material and methods: The samples of coals and claystones were obtained from boreholes drilled in the Mělník—Benátky area of the Mšeno Basin by the Geological Survey, Prague. The material was normally subjected to fumic nitric and hydrofluoric acid treatment for isolation of megaspores and miospores separately. Permanent slides were made in glycerin gel and were statistically analyzed.

Spore systematics

The samples yielded a rich palynological assemblage comprising trilete and monolete spores, monosaccate and disaccate pollen grains.

The megaspores and miospores obtained have been placed under the following genera and species arranged according to the classification of POTONIÉ and KREMP (1954) supplemented by other workers.

As the botanical affinity of the genera occurring in the Jelenice Member was discussed in the publication concerning this Member (KALIBOVÁ 1978), in the Nýřany Member it is now discussed only at the genera that do not occur in the Jelenice Member.

Superdivisio (Anteturma) *Sporonites* (R. POTONIÉ) IBRAHIM 1933

Genus *Sporonites* IBRAHIM 1933

S. sp. (pl. XXIV, fig. 13)

Genus *Reticulatasporites* (IBRAHIM) POTONIÉ & KREMP 1954

R. sp. (pl. V, fig. 4)

Superdivisio (Anteturma) *Sporites* H. POTONIÉ 1893

Divisio (Turma) *Triletes* (REINSCH) POTONIÉ & KREMP 1954

Subdivisio (Subturma) *Azonotriletes* LUBER 1953

Genus *Leiotriletes* (Naumova) POTONIÉ & KREMP 1954

L. adnatoides POTONIÉ & KREMP 1956 (pl. I, figs. 8—9, pl. III, fig. 1)

Remarks: Nearly all specimens of the species are a little larger in size than stated in the diagnosis (30—40 μm). After PI-RADONDY - DOUBINGER (1968) the diameter ranges from 45—50 μm.
Prominent folds frequently accompany the laesurae.

L. adnatus (KOSANKE) POTONIÉ & KREMP 1954 (pl. I, figs. 1, 2)

L. convexus (KOSANKE) POTONIÉ & KREMP 1954 (pl. I, fig. 5)

L. gulaferus POTONIÉ & KREMP 1954 (pl. I, figs. 3, 6—7)

L. sphaerotriangulus (LOOSE) POTONIÉ & KREMP 1954 (pl. I, fig. 4)

L. tumidus BUTTERWORTH & WILLIAMS 1954 (pl. I, fig. 10; pl. III, fig. 2)

L. spp. (pl. I, fig. 11)

Genus *Punctatisporites* (IBRAHIM) POTONIÉ & KREMP 1954

P. bifurcatus KALIBOVÁ 1965 (pl. I, figs. 12–14)

P. cf. *minutus* KOSANKE 1950 (pl. I, fig. 16)

P. obliquus KOSANKE 1950

P. cf. *punctatus* IBRAHIM 1933 (pl. III, fig. 7)

P. spp. (pl. I, fig. 15, pl. XXIV, fig. 13)

Genus *Calamospora* SCHOPF, WILSON & BENTALL 1944

C. breviradiata KOSANKE 1950 (pl. III, figs. 5, 6)

C. cf. *liquida* KOSANKE 1950

C. microrugosa (IBRAHIM) SCHOPF, WILSON & BENTALL 1944 (pl. I, figs. 21, 22, 24, pl. III, fig. 8)

C. mutabilis (LOOSE) SCHOPF, WILSON & BENTALL 1944 (pl. II, figs. 1–6, pl. III, fig. 10)

C. cf. *mutabilis* (LOOSE) SCHOPF, WILSON & BENTALL 1944 (pl. II, fig. 7)

C. pallida (LOOSE) SCHOPF, WILSON & BENTALL 1944 (pl. I, figs. 22, 23)

C. parva GUENNEL 1958 (pl. I, fig. 19)

C. perrugosa (LOOSE) SCHOPF, WILSON & BENTALL 1944

C. pusilla PEPPERS 1964

C. saariana BHARADWAJ 1957 (pl. I, figs. 17, 18)

C. straminea WILSON & KOSANKE 1944 (pl. III, figs. 13, 14)

C. sp. (pl. II, fig. 8)

Genus *Variouxisporites* ALPERN 1959

V. spp. (pl. IV, fig. 1, pl. XXIV, fig. 14)

Genus *Laevigatisporites* (IBRAHIM) POTONIÉ & KREMP 1954

L. glabratus (ZERNDT) POTONIÉ & KREMP sensu DIJKSTRA

Genus *Granulatisporites* (IBRAHIM) POTONIÉ & KREMP 1954

G. granulatus IBRAHIM 1933 (pl. V, figs. 5, 6)

G. cf. *granulatus* IBRAHIM 1933 (pl. IV, fig. 6)

G. minutus POTONIÉ & KREMP 1955

G. cf. *minutus* POTONIÉ & KREMP 1955

G. cf. *pannosites* PEPPERS 1964 (pl. VI, fig. 1)

G. parvus (IBRAHIM) POTONIÉ & KREMP 1955 (pl. IV, figs. 2, 3)

G. sp.

Genus *Cyclogranisporites* POTONIÉ & KREMP 1954

C. aureus (LOOSE) POTONIÉ & KREMP 1955 (pl. IV, figs. 8, 10—14; pl. V, figs. 2, 3)

C. cf. *aureus* (LOOSE) POTONIÉ & KREMP 1955 (pl. V, fig. 8)

C. jelenicensis KALIBOVÁ 1978 (pl. III, fig. 3)

C. orbicularis (KOSANKE) POTONIÉ & KREMP 1955 (pl. IV, figs. 4, 7)

C. orbiculus POTONIÉ & KREMP 1955

C. sp. A (pl. III, figs. 11, 12, 15; pl. IV, fig. 9; pl. V, fig. 1)

Description: Amb circular or subcircular due to secondary folds. Size 80—110 μm; suturae one-half of radius, grana 1 μm in diameter, 100—120 project at the margin.

Comparison: *Cyclogranisporites* sp. A has a finer ornament than *C. aureus*, which is also smaller in size (50—80 μm); in the work of SMITH & BUTTERWORTH (1967) occasional specimens of *C. aureus* up to 99 μm have been recorded.

C. sp. (pl. IV, figs. 5, 15, 16)

Genus *Triletisporites* (R. POTONIÉ) POTONIÉ & KREMP 1954

Botanical affinity: Unknown.

T. tuberculatus (ZERNDT) POTONIÉ & KREMP 1954

Genus *Converrucosisporites* POTONIÉ & KREMP 1954

C. sp.

?*C.* sp. (pl. VI, fig. 14)

Genus *Verrucosisporites* (IBRAHIM) SMITH & BUTTERWORTH 1967

V. cf. *compactus* HABIB 1966 (pl. V, fig. 14)

V. donarii POTONIÉ & KREMP 1955 (pl. V, fig. 15)

V. cf. *donarii* POTONIÉ & KREMP 1955 (pl. V, fig. 17; pl. VI, fig. 4)

V. grandiverrucosus (LOOSE) SMITH & al. 1964 (pl. V, fig. 22; pl. VI, fig. 8)

V. cf. *grandiverrucosus* (LOOSE) SMITH & al. 1964 (pl. VI, fig. 6)

V. microtuberosus (LOOSE) SMITH & BUTTERWORTH 1967 (pl. V, fig. 21)

V. sifati (IBRAHIM) SWITH & BUTTERWORTH 1967 (p. VI, fig. 9)

V. cf. *sinensis* IMGRUND 1952 (pl. VI, figs. 10,11)

V. verrucosus IBRAHIM 1933 (pl. V, fig. 23)

V. sp. A (pl. VI, figs. 2, 3)

Description: Amb circular, subcircular or oval. Size 40—48 μm. The trilete rays are distinct and equal in length to about two thirds of radius. Verrucae 1—2 μm in diameter.

Comparison: *Verrucosisporites* sp. A is similar to *V. cerosus* (HOFFMEISTER, STAPLIN and MALLOY) BUTTERWORTH and WILLIAMS, but is usually smaller in size and has more numerous verrucae.

V. sp. (pl. VI, fig. 5)

Genus *Kewaneesporites* PEPPERS 1970

K. sp. (pl. V, fig. 18)

Genus *Lophotriletes* (NAUMOVA) POTONIÉ & KREMP 1954

L. gibbosus (IBRAHIM) POTONIÉ & KREMP 1954 (pl. V, figs. 10, 11)

L. pseudoaculeatus POTONIÉ & KREMP 1955 (pl. V, fig. 14)

L. spp. (pl. V, figs.7, 12, 13)

Genus *Apiculatisporis* POTONIÉ & KREMP 1955

A. abditus (LOOSE) POTONIÉ & KREMP 1955 (pl. V, fig. 19)

A. setulosus (KOSANKE) POTONIÉ & KREMP 1954

A. variusetosus (PEPPERS) KALIBOVÁ 1978 (pl. VII, figs. 1—3)

A. sp. (pl. V, fig. 20)

?*A.* sp.

Genus *Acanthotriletes* (NAUMOVA) POTONIÉ & KREMP 1954

A. sp.

Genus *Apiculatasporites* (IBRAHIM) SMITH & BUTTERWORTH 1967

A. spinulistratus (LOOSE) IBRAHIM 1933 (pl. VI, figs. 16—18)

Genus *Planisporites* (KNOX) POTONIÉ 1960

P. spp. (pl. VI, figs. 12—15; pl. VII, figs. 4—6)

Genus *Pustulatisporites* POTONIÉ & KREMP 1954

P. crenatus GUENNEL 1958 (pl. V, fig. 9)

Genus *Tuberculatisporites* (IBRAHIM) POTONIÉ & KREMP 1955

T. mamillarius (BARTLETT) POTONIÉ & KREMP 1955

Genus *Raistrickia* (SCHOPF, WILSON & BENTALL) POTONIÉ & KREMP 1954

R. aculeata KOSANKE 1950 (pl. IX, figs. 12, 13)

R. aculeolata WILSON & KOSANKE 1944 (pl. VIII, figs. 10, 11; pl. IX, figs. 1—5)

R. cf. *aculeolata* WILSON & KOSANKE 1944 (pl. IX, figs. 14—17)

R. crinita KOSANKE 1950 (pl. IX, fig. 8)

R. cf. *crinita* KOSANKE 1950 (pl. VIII, fig. 9)

R. cf. *crocea* KOSANKE 1950 (pl. IX, fig. 11)

Description: Spore circular to oval, 45—60 μm in size. Trilete rays not visible. Exine is covered with regularly spaced bacula 8—12 μm in length and 2.5—6 μm in width, occasionally twisted.

Comparison: *R. crocea* is very similar, but usually greater in size and has longer and wider bacula. Approximately 15 projections extend beyond the spore margin.

R. cf. *dispar* PEPPERS 1970 (pl. IX, figs. 7, 9, 10)

Description: Amb roundly triangular. Laesurae simple, about three fourths of the radius. The spore coat is covered with not closely spaced projections of various shapes and sizes, 2—6 μm wide at their bases and 3—6 μm long. About 20—30 ornaments extend beyond the margin.

Comparison: The projections of *R. dispar* are more closely spaced.

R. cf. *fibrata* (pl. VIII, fig. 4)

R. lacerata PEPPERS 1970 (pl. VIII, figs. 13, 17)

R. cf. *lacerata* PEPPERS 1970 (pl. VIII, fig. 12)

R. solaris WILSON & HOFFMEISTER 1956 (pl. VIII, fig. 19)

R. superba (IBRAHIM) SCHOPF, WILSON & BENTALL 1944 (pl. VIII, figs. 2, 3)

R. cf. *superba* (IBRAHIM) SCHOPF, WILSON & BENTALL 1944 (pl. VIII, fig. 5)

Description: Amb round to oval; leasurae three quarters of radius. Ornaments irregularly distributed; at their top ends the bacula are rounded. 20—30 projecting from the margin.

Comparison: They agree with *R. superba* in possessing various types of ornament of variable density, but not including cone-shaped bacula.

R. sp. A (pl. VIII, fig. 6)

Description: Amb roundedly triangular, size 40—45 μm. Suturae simple, about two thirds of radius. Ornament of bacula, 8—10 μm in length and 3—4 μm in breadth, 15—20 occur around the margin.

Comparison: *R.* sp. A differs from other species in its form and relatively large bacula.

R. sp. B (pl. VIII, figs. 14—16, 18)

Description: Amb circular to subcircular, size 60—70 μm, suturae simple, one half of radius. Bacula about 4 μm in length, taper from the base and are rounded; they almost cover the entire exine, bases may be in contact.

Comparison: *R.* sp. B differs from *R. aculeata* mainly in possessing broader and closely spaced processes.

R. spp. (pl. VIII, fig. 1)

?*R.* cf. *baculata* KALIBOVÁ 1978 (pl. IX, fig. 6)

Description: Amb circular, size 75—85 μm, suturae not visible. Club-shaped processes are closely spaced and are not longer than wide. They have coarsely reticulate appearance. Their apices are flat or rounded.

Comparison: *R. baculata* is smaller in size.

Remarks: ?*R. baculata* has been assigned to the genus *Raistrickia* provisionally for the different shape of processes. (The character of the bacula is comparable to that described by BHARADWAJ (1955) in the genus *Cyclobaculisporites*, which is invalid because the ornament of the holotype *C. grandiverrucosus* BHARADWAJ is verrucose.)

Genus *Microreticulatisporites* (KNOX) POTONIÉ & KREMP 1954 non sensu BHARADWAJ 1955

M. nobilis (WICHER) KNOX 1950 (pl. X, figs. 1—4)

M. spp. (pl. VII, fig. 8; pl. X, fig. 13)

Genus *Convolutispora* HOFFMEISTER, STAPLIN & MALLOY 1955

C. sp. 2 PEPPERS 1970

Description: The spore is radial and subcircular in outline. The suture is indistinct. The exine is covered with irregular obvermiculate ridges 3.5 μm in height. Size 45—52 μm.

Comparison: After PEPPERS (1970) *C.* sp. 2 is quite similar to the specimen described by HOFFMEISTER, STAPLIN and MALLOY (1955) as *Convolutispora* type A.

C. sp. B (pl. X, figs. 6, 7)

Description: Amb subcircular to oval, size 48—60 μm. The trilete rays are straight and extend to two thirds of the length of the radius. Vermiculate ridges on the spore surface are videly spaced and are up to 5 μm wide and 3 μm tall.

Comparison: *Convolutispora* sp. B is comparable with *C. florida* HOFFMEISTER, STAPLIN & MALLOY 1955 which has a relatively coarse ornament, and with *C.* sp. 2 PEPPERS 1964 which is smaller in size.

C. spp. (pl. X, figs. 8, 9)

Genus *Reticulatisporites* (IBRAHIM) POTONIÉ & KREMP 1954

R. lacunosus KOSANKE 1950 (pl. X, figs. 15, 16)

R. muricatus KOSANKE 1950 (pl. X, fig. 17)

Genus *Savitrisporites* BHARADWAJ 1955

S. majus BHARADWAJ 1957 (pl. X, fig. 12)

S. sp.

Genus *Camptotriletes* (NAUMOVA) POTONIÉ & KREMP 1954

C. sp.

Genus *Dictyotriletes* (NAUMOVA) POTONIÉ & KREMP 1954

D. mediareticulatus (IBRAHIM) POTONIÉ & KREMP 1955 (pl. X, fig. 11)

D. camptotus ALPERN 1958

Genus *Knoxisporites* POTONIÉ & KREMP 1954

K. sp.

Genus *Triquitrites* (WILSON & COE) POTONIÉ & KREMP 1954

T. bransonii WILSON & HOFFMEISTER 1956 (pl. XI, figs. 7–11)

T. cf. *bransonii* WILSON & HOFFMEISTER 1956 (pl. XI, figs. 13–18)

Remarks: Spores distinguish from *T. bransonii* by shortes suturae, extending to two thirds till three quaters of the radius.

T. bucculentus GUENNEL 1958 (pl. XI, figs. 1–3)

T. exiguus WILSON & KOSANKE 1944 (p. XI, figs. 4–6)

T. pulvinatus KOSANKE 1950 (pl. XI, fig. 23)

T. verrucosus ALPERN 1959 (pl. XI, figs. 31–33)

T. sculptilis (BALME) SMITH & BUTTERWORTH 1967

T. spp. (pl. XI, figs. 12, 19, 28)

Genus *Firmysporites* PI-RADONDY & DOUBINGER 1968

Botanical affinity: Unknown.

F. irregularis PI-RADONDY & DOUBINGER 1968 (pl. XI, figs. 26, 27)

Genus *Ahrensisporites* POTONIÉ & KREMP 1954

A. sp. (pl. XI, fig. 34)

Genus *Mooreisporites* NEVES 1958

Botanical affinity: Unknown.

M. inusitatus (KOSANKE) NEVES 1958 (pl. XIV, fig. 19)

M. cf. *inusitatus* (KOSANKE) NEVES 1958 sensu SMITH & BUTTERWORTH 1967 (pl. XIV, figs. 16–18)

Remarks: Few specimens are smaller in size (50–60 μm) than *M. inusitatus* and correspond with *M.* cf. *inusitatus* by SMITH & BUTTERWORTH 1967.

Genus *Valvisisporites* (IBRAHIM) LACHKAR 1968

V. auritus (ZERNDT) BHARADWAJ 1957

Subdivisio (Subturma) *Zonotriletes* WALTZ 1945

Genus *Lycospora* (SCHOPF, WILSON & BENTALL) POTONIÉ & KREMP 1954

L. brevijuga KOSANKE 1950 (pl. XII, figs. 6, 9, 10)

L. brevis BHARADWAJ 1957

L. denticulata BHARADWAJ 1957

L. granulata KOSANKE 1950 (pl. XII, fig. 9, 10)

L. parva KOSANKE 1950 (pl. XII, figs. 16–18)

L. cf. *pressoides* POTONIÉ & KREMP 1956 (pl. XII, figs. 21, 22)

L. pseudoannulata KOSANKE 1950 (p. XI, figs. 1, 2)

L. punctata KOSANKE 1950 (pl. XII, figs. 3–5)

L. pusilla (IBRAHIM) SCHOPF, WILSON & BENTALL 1944 (pl. XII, figs. 8, 11, 12)

L. subjuga BHARADWAJ 1957 (pl. XII, fig. 20)

L. triangulata BHARADWAJ 1957

L. spp. (pl. XI, fig. 31; pl. XII, fig. 14)

Genus *Stenozonotriletes* (NAUMOVA) POTONIÉ 1958

Botanical affinity: Unknown.

S. lycosporoides (BUTTERWORTH & WILLIAMS) SMITH & BUTTERWORTH 1967 (pl. XII, fig. 15)

Genus *Crassispora* BHARADWAJ 1957

C. kosankei (POTONIÉ & KREMP) BHARADWAJ 1957 (pl. XII, fig. 23)

C. sp.

Genus *Densosporites* (BERRY) POTONIÉ & KREMP 1954

D. sphaerotriangularis KOSANKE 1950 (pl. XI, fig. 38)

D. sp.

Genus *Cadiospora* (KOSANKE) VENKATACHALA & BHARADWAJ 1964

C. magna (KOSANKE) KALIBOVÁ 1978

C. magna forma *minor* KALIBOVÁ 1978 (pl. XVI, fig. 6)

C. magna forma *maior* KALIBOVÁ 1978 (pl. XII, fig. 27, pl. XIII, figs. 1–6)

C. butterworthi (KALIBOVÁ) KALIBOVÁ 1972 (pl. XII, fig. 28)

Genus *Gillespieisporites* CLENDENING 1969

G. discoideus (KOSANKE) KALIBOVÁ 1978 (pl. XIV, figs. 5, 7–12)

Remarks: Some specimens are developed in gulaferous form.

G. spinosus KALIBOVÁ 1978 (pl. XI, figs. 29, 30; pl. XIV, figs. 1–4, 14, 15)

Genus *Vestispora* (WILSON & HOFFMEISTER) WILSON & VENKATACHALA 1963

Botanical affinity: Spores of the character of *Vestispora* have been found in ? *Noeggerathiopsida* (LEVITTAN and BARGHOORN 1948) and in *Sphenopsida* (MAMAY 1954, REMY 1955, REMY 1959 and BRUSH & BARGHOORN 1964).

V. costata (BALME) SPODE 1968 (pl. XV, figs. 1–8, 15)

V. fenestrata (KOSANKE & BROKAW) WILSON & VENKATACHALA 1963 (pl. XV, figs. 13, 14; pl. XII, fig. 30)

V. pseudoreticulata SPODE 1968 (pl. XV, fig. 12)

V. quaesita (KOSANKE & BROKAW) WILSON & VENKATACHALA 1963 (pl. XII, figs. 24–26)

V. cf. *profunda* WILSON & HOFFMEISTER 1956 (pl. XV, figs. 9–11)

Genus *Westphalensisporites* ALPERN 1959

Botanical affinity: Unknown.

W. irregularis ALPERN 1959 (pl. XI, fig. 35)

Genus *Bentzisporites* (ZERNDT) POTONIÉ & KREMP 1954

B. tricollinus (ZERNDT) POTONIÉ & KREMP 1954

Genus *Cirratriradites* WILSON & COE 1940

Botanical affinity: ZEILLER (1900) and later CHALONER (1954) found the forms of *Cirratriradites* at *Selaginellites suissei* ZEILLER and HOSKINS & ABBOTT (1956) at *Selaginellites crassicinctus* HOSKINS & ABBOTT (*C. anulatus* KOSANKE & BROKAW) together with megaspores corresponding with *Triangulatisporites triangulatus* (ZERNDT) POTONIÉ & KREMP.

C. saturni (IBRAHIM) SCHOPF, WILSON & BENTALL 1944 (pl. XVI, figs. 2–5)

C. annuliformis KOSANKE & BROKAW 1950 (pl. XVI, figs. 7–8)

Genus *Angulisporites* BHARADWAJ 1954

Botanical affinity: Unknown.

A. sp. (pl. XVI, fig. 1)

Genus *Triangulatisporites* POTONIÉ & KREMP 1954

Botanical affinity: *Selaginellites suissei* ZEILLER (LACHKAR 1971) contains spores of the type *Triangulatisporites*. They were also found at *S. primaevus* (GOLDENBERG) HALLE and *S. crassicinctus* HOSKINS & ABBOTT (1956).

T. triangulatus (ZERNDT) POTONIÉ & KREMP 1954

Subdivisio (Subturma) *Lagenotriletes* (POTONIÉ & KREMP) BHARADWAJ 1957

Genus *Lagenoisporites* (LOOSE) POTONIÉ & KREMP 1954

L. rugosus (LOOSE) POTONIÉ & KREMP 1954

Subdivisio (Subturma) *Cystites* POTONIÉ & KREMP 1954

Genus *Cystosporites* SCHOPF 1938

C. giganteus (ZERNDT) SCHOPF 1938

C. varius (WICHER) DIJKSTRA 1946

Divisio (Turma) *Monoletes* IBRAHIM 1933

Subdivisio (Subturma) *Azonomonoletes* LUBER 1935

Genus *Laevigatosporites* IBRAHIM 1933

L. desmoinesensis (WILSON & COE) SCHOPF, WILSON & BENTALL 1944

L. medius KOSANKE 1950

L. cf. *medius* KOSANKE

L. sp. C KALIBOVÁ 1963 (pl. XVII, fig. 1)

Remarks: The spore designated as *Laevigatosporites* sp. C characterises a thick fold parallel with the longitudinal axis of the spore.

L. sp. D KALIBOVÁ 1963 (pl. XVII, fig. 2)

Remarks: *Laevigatosporites* sp. D I have designated the spores of the size range of 15—21 μm.

L. sp. E KALIBOVÁ 1970

Remarks: *Laevigatosporites* sp. E was described from the borehole MB-5 (KALIBOVÁ 1970). The size is 62 × 35 μm, monolete mark one half of radius,spots sparsely scattered on the exine.

L. sp. (pl. XVII, fig. 2)

Genus *Latosporittes* POTONIÉ & KREMP 1954

L. globosus (SCHEMEL) POTONIÉ & KREMP 1956

L. cf. *globosus* (SCHEMEL) POTONIÉ & KREMP (pl. XVII, fig. 23)

Remarks: As *L.* cf. *globosus* I designate the specimens with monolete mark longer than two thirds of the spore diameter.

L. latus (KOSANKE) POTONIÉ & KREMP 1956

L. sp.

Genus *Punctatosporites* IBRAHIM 1933

P. minutus IBRAHIM 1933

P. oculus SMITH & BUTTERWORTH 1967

P. pygmaeus (IMGRUND) POTONIÉ & KREMP 1956 (pl. XVII, figs. 8, 9)

P. speciosus KALIBOVÁ 1970 (pl. XVII, figs. 3–7)

P. sp. (pl. XIV, fig. 5)

Genus *Spinosporites* ALPERN 1959)

Botanical affinity: Unknown.

S. spinosus ALPERN 1959 (pl. XVII, fig. 21)

S. sp. (pl. XVII, fig. 22)

Genus *Speciososporites* POTONIÉ & KREMP 1954

S. minor ALPERN 1959 (pl. XVII, figs. 10–17)

S. infrapunctatus KALIBOVÁ 1978 (pl. XVII, figs. 19, 20)

?*S.* cf. *triletoides* ALPERN 1959 (pl. XVII, fig. 18)

S. sp.

Superdivisio (Anteturma) *Pollenites* POTONIÉ 1941

Divisio (Turma) *Saccites* ERDTMAN 1947

Subdivisio (Subturma) *Monosaccites* (CHITALEY) POTONIÉ & KREMP 1954

Genus *Endosporites* WILSON & COE 1940

E. formosus KOSANKE 1950 (pl. XIV, fig. 5, pl. XVIII, figs. 1, 2)

E. cf. *globiformis* (IBRAHIM) SCHOPF, WILSON & BENTALL 1944 (pl. XVIII, fig. 7)

E. sp. (pl. XVIII, fig. 10)

Genus *Microsporites* DIJKSTRA 1946 (= *Spencerisporites* CHALONER 1951)

M. gracilis (ZERNDT) DIJKSTRA 1946

Genus *Wilsonites* KOSANKE 1950

W. delicatus KOSANKE 1950 (pl. XVIII, fig. 4, 8)

W. vesicatus KOSANKE 1950 (pl. XVIII, fig. 3)

W. spp. (pl. XVIII, figs. 5, 9, 11; pl. XXIV, fig. 3)

Genus *Latensina* LUBER 1953

L. triletus ALPERN 1959

L. sp. (pl. XVII, figs. 28, 29, 31, 32)

Genus *Florinites* SCHOPF, WILSON & BENTAL 1944

F. antiquus SCHOPF 1944 (pl. XIX, fig. 9)

F. cf. *diversiformis* KOSANKE 1950 (pl. XX, fig. 1)

F. junior POTONIÉ & KREMP 1956

F. mediapudens (LOOSE) POTONIÉ & KREMP 1956 (pl. XXI, fig. 4)

F. cf. *mediapudens* (LOOSE) POTONIÉ & KREMP 1956 (pl. XIX, fig. 12)

F. piérarti KALIBOVÁ 1965 (pl. XIX, fig. 8)

F. plicatus KALIBOVÁ 1965 (pl. XIX, figs. 5–9, pl. XX, fig. 3)

F. pumicosus (IBRAHIM) SCHOPF, WILSON & BENTALL 1944

F. similis KOSANKE 1950 (pl. XIX, fig. 4)

F. visendus (IBRAHIM) SCHOPF, WILSON & BENTALL 1944

F. cf. *volans* (LOOSE) POTONIÉ & KREMP 1956

F. spp. (pl. XIX, fig. 1, 10, 11; pl. XX, fig. 2)

Genus *Potonieisporites* (BHARADWAJ) BHARADWAJ 1964

Remarks: BHARADWAJ (1964) discusses the morphology, systematics and stratigraphy of *Potonieisporites*. He reports that the form of *Potonieisporites* extends from circular coronal to increasingly bilateral. He considers it proven that *Sahnisporites* PANT 1955 is indistinguishable from *Potonieisporites* and thus concludes that *Sahnites* is a synonym of *Potonieisporites*. HART (1965) places *Sahnites* in part to *Vestigisporites* (BALME and HENNELLY) HART 1960, and in part to *Limitisporites* (LESCHIK) POTONIÉ 1958. Some specimens of *Florinites* SCHOPF, WILSON & BENTALL 1944 are mistaken easily for some specimens of *Potonieisporites* when the former does not possess visible suturae, or when the latter does not possess a monolete mark. NYGREEN and BOURN (1967) describe and illustrate numerous specimens of *Potonieisporites* from a single sample, which show a wide range of morphological variations. The germinal feature of the material studied exhibits considerable variation in form, beginning as a rectilinear monolete mark and ending as a trilete mark.

P. novicus BHARADWAJ 1954 (pl. XXI, fig. 3; pl. XXII, fig. 1)

P. novicus forma *grandis* KALIBOVÁ 1978 (pl. XXI, figs. 2, 5; pl. XXII, figs. 2, 3)

P. cf. *elegans* (WILSON & KOSANKE) WILSON & VENKATACHALA 1964

P. spp. (pl. XIX, fig. 1; pl. XX, fig. 5; pl. XXI, fig. 1)

?*Potonieisporites* sp. (pl. XII, fig. 1; pl. XXIV, fig. 2)

Genus *Bascanisporites* BALME & HENNELLY 1956

B. parvisaccus PI-RADONDY & DOUBINGER 1967 (pl. XVII, fig. 27)

Genus *Candidispora* VENKATACHALA 1961

Botanical affinity: Unknown.

C. cf. *candida* VENKATACHALA 1961 (pl. XIX, fig. 2)

Subdivisio (Subturma) *Disaccites* COOKSON 1947

Remarks: Disaccate *Pollenites* underwent a period of explosive evolution at the end of the Paleozoic era and one finds numerous differentiating lines evolving. A consequence of this is that many of the early forms are difficult to sub-divide into series (infraturma), genera, or often species.

Many genera and species were lately described. In the late Carboniferous there are scarce finds and it is not easy to differentiate the species. Some palynologists described their specimens and proposed them as new species, others compared their find with the known species or announced them only with a question mark.

The three series (indraturmae) Disacciatrileti, Disaccitrileti and Striatiti are easy to differentiate and can be conveniently dealt with as a distinct group. Finer subdivisions appear not to be useful for Carboniferous miospores.

Genus *Alisporites* DAUGHERTY 1941

Botanical affinity: The spores found in *Caytoniales* (by HARRIS 1941 in *Caytonanthus oncodes*) have the character of *Alisporites*.

A. sp. A (pl. XXIII, figs. 6, 7)

Description: Bisaccate spore roundedly tetragonal or broadly circular, central body vertically oval; a vertical slit lying transversely to the long axis of the spore. Size 50—60 × 35—40 µm. Bladders intrareticulate, with single folds.

Comparison: *Alisporites* is closely related with *Illinites* and differs from it in having trilete mark on the proximal side (not always visible). *Alisporites saarensis* BHARADWAJ is very similar to *A.* sp. A, but smaller in size.

Genus *Vesicaspora* (SCHEMEL) WILSON & VENKATACHALA 1963

Botanical affinity: Unknown.

Remarks: From the emended diagnosis by the authors it is not clear that *Vesicaspora* can be well distinguished from other genera.

V. sp. A (pl. XXIII, figs. 8, 10)

Description: Spores with circular overall shape, 70—80 µm in size. Central body faintly discernible, outline not defined. The median region shows vertical folds frequently. Sacci distally inclined and mostly infolded in a characteristic way, saccus exine infrareticulate.

V. sp. (pl. XVII, fig. 30)

Genus *Sulcatisporites* (LESCHIK) BHARADWAJ 1960

S. spp.

Single finds of various size can be assigned to this genus.

Genus *Tumoripollenites* BHARADWAJ 1960

Botanical affinity: The structure of the body has the character of *Podocarpaceae* (POTONIÉ 1966).

T. cf. *baccatus* BHARADWAJ 1960 (pl. XXIV, fig. 6)

Description: Bisaccate spores, size 75—80 μm, with circular to oval central body, 35—40 μm in diameter, bearing tubercles with rounded heads, more numerous nearer the equator and less as well as smaller nearer the centre.

Comparison: *Tumoripollenites baccatus* differs from *T.* cf. *baccatus* in having sacci smaller than the central body.

T. sp. A (pl. XXIV, figs. 4, 5, 9)

Description: Bisaccate spores 50—68 μm in diameter, central body 30 to 40 μm, circular to horizontally oval, proximally thickwalled, bearing close and uniformly spaced bacula-like tubercles, up to 4 μm broad, with rounded heads. A split on a fold running along the longest axis. Sacci infrareticulate and distally attached.

Comparison: Tumoripollenites baculatus is greater in size and has sacci smaller than the central body in height.

Genus *Illinites* KOSANKE 1950

Botanical affinity: REIMANN (1975) mentioned the possible relation of *Illinites* with *Callipteris conferta* STERNBERG.

I. sp. A (pl. XXIII, figs. 12, 16)

Description: Bisaccate miospore, size 70—85 μm, central body 34—40 μm × × 40—50 μm, ellipsoid, having a narrow sulcus on the distal side parallel to the lateral axis. Bladders are intrareticulate, equatorially attached to central body on proximal side. Trilete mark is not visible.

Comparison: *Illinites unicus* KOSANKE is smaller and has distinct trilete mark. The spores are also comparable with the spores described by BHARADWAJ (1955) as *Kosankeisporites*, distinguishing from *Illinites* by zigzag rugulae and the sulcus having been formed due to overlapping of the bladder upon the central body.

Genus *Striatites* (PANT) BHARADWAJ 1960

S. sp.

Genus *Protohaploxypinus* (SAMOILOVICH) HART 1964

? *P.* sp. (pl. XXIV, fig. 11)

Description: Bisaccate striate spore, haploxylonoid or slightly diploxylonoid in outline, 90—100 μm long and 50—58 μm wide. The central body is oval. The

proximal cap possesses six or more longitudinal ribs in polar view. The sacci are about semi-circular in shape and smaller than the central body in size. The sacci structure is infrareticulate.

Remarks: Striate grains previously assigned to *Lueckisporites* POTONIÉ & KLAUS 1954, *Lunatisporites* LESCHIK 1956 and *Striatites* PANT 1955 are synonyms of *Protohaploxypinus*.

Genus *Kosankeisporites* BHARADWAJ 1955

K. elegans (KOSANKE) BHARADWAJ 1955

? *K.* sp. A (pl. XXIV, fig. 10)

Description: Bisaccate miospores 90—100 μm × 65—70 μm with two large, distally inclined bladders, infrareticulate with small mesches not exceeding 1 μm in diameter. Central body oval, on the proximal side the surface shows thin grooves (rugulae); the sulcus on the distal side parallel to the lateral side is not distinguished.

Comparison: *Kosankeisporites elegans* is smaller in size and its central body is characterized by the presence of a wall-shaped sulcus on distal side. The genus *Illinites* can be distinguished by having trilete mark and lack of rugulae on the proximal side.

Comparison: *Illinites unicus* KOSANKE is smaller in size (56—70 μm) and has distinct trilete mark. *Illinites* sp. A is also comparable with the spores described by BHARADWAJ (1955) as *Kosankeisporites*, distinguishing from *Illinites* by zigzag rugulae and the sulcus having been formed due to overlapping of the bladder upon the central body.

Genus *Limitisporites* LESCHIK 1956

Botanical affinity: Unknown.

L. sp. A (pl. XXIII, figs. 2, 3)

Description: Bisaccate miospore oval, 60—75 × 55—60 μm in size, central body distinct, 42—55 × 30—40 μm, laevigate. Monolete mark well-developed, extending nearly the central body. Proximal attachment of saccus to central body equatorial. Saccus intrareticulate.

Comparison: *Limitisporites* sp. A resembles *L. plicatus* BOSE & CAR. and *T. leschiki* KLAUS, of which it is distinguished by its large size.

L. sp. (pl. XXII, figs. 4, 6; pl. XXIII, fig. 4)

Subdivisio (Subturma) *Polysaccites* COOKSON 1947

Genus *Alatisporites* IBRAHIM 1933

A. sp.

Divisio (Turma) *Plicates* POTONIÉ 1960

Subdivisio (Subturma) *Praecolpates* POTONIÉ & KREMP 1954

Genus *Schopfipollenites* POTONIÉ & KREMP 1954

S. ellipsoides (IBRAHIM) POTONIÉ & KREMP 1954 (pl. XVI, fig. 11)

Subdivisio (Subturma) *Polyplicates* ERDTMAN 1952

Genus *Vittatina* (Luber) WILSON 1962

Botanical affinity: probably of *Welwitschiaceae.*

?*Vittatina* sp. (pl. XXIV, fig. 7)

The miospore floras of the coal seams are rich in species, most of which are considered to be derived from vegetation growing within the basin of peat deposition. Only few miospores are transported from distant sources.

The miospore assemblages are dominated by the genus *Lycospora,* which is with its 44 % the commonest. *Laevigatosporites* and *Punctatosporites* are next in abundance and each represents 11,9 % of the assemblage total. Also *Calamospora* and *Triquitrites* become significant members of the miospore floras and are represented by frequency of 5.5 and 5.7 %. The miospore *Endosporites formosus* with the megaspore *Valvisisporites auritus* may be locally common. Stratigraphically important *Vestispora costata, V. fenestrata* and *V. qaesita* are more or less equally distributed (3 %). It is interesting to note that *Cirratriradites saturni* only exceptionally occurs in the frequency greater than 1 % and is often absent. There are horisons reaching higher percentage in the species of *Punctatisporites* (average 3 %) and *Florinites* (average 7 %). The typical species of *Raistrickia* are meagerly represented. Bisaccate spores are commonly present in higher coals. Other genera with various species were locally distributed in small frequency. The most common species of megaspores are *Lagenoisporites rugosus* and *Triangulatisporites triangulatus.* More interesting is the lack of *Tuberculatisporites mamillarius* and the occurrence of *Laevigatisporites glabratus* and a low number of *Triletisporites tuberculatus* in the lowest coals.

Table 1

Occurrence of the miospore and megaspore species in the Nýřany Member

Sporonites sp.	x
Reticulatasporites sp.	x
Leiotriletes adnatoides	xx
Leiotriletes adnatus	xx
Leiotriletes convexus	x
Leiotriletes gulaferus	xx
Leiotriletes sphaerotriangulus	x
Leiotriletes tumidus	xx
Punctatisporites bifurcatus	xx
Punctatisporites cf. *minutus*	x
Punctatisporites obliquus	x
Punctatisporites cf. *punctatus*	x
Calamospora breviradiata	xx
Calamospora cf. *liquida*	x
Calamospora microrugosa	xx
Calamospora mutabilis	xx
Calamospora cf. *mutabilis*	xx
Calamospora pallida	xx
Calamospora parva	x
Calamospora perrugosa	x
Calamospora pusilla	x
Calamospora saariana	xx
Calamospora straminea	xx
Variouxisporites spp.	xx
Laevigatisporites glabratus	xxx
Granulatisporites granulatus	xx
Granulatisporites cf. *granulatus*	x
Granulatisporites minutus	x
Granulatisporites cf. *minutus*	x
Granulatisporites cf. *pannosites*	x
Granulatisporites parvus	xx
Cyclogranisporites aureus	xx
Cyclogranisporites cf. *aureus*	xx
Cyclogranisporites jelenicensis	x
Cyclogranisporites orbicularis	xx
Cyclogranisporites orbiculus	x
Cyclogranisporites sp. A	xx
Triletisporites tuberculatus	xxx
Converrucosisporites sp.	x
Verrucosisporites cf. *compactus*	x
Verrucosisporites donarii	x
Verrucosisporites cf. *donarii*	xx
Verrucosisporites grandiverrucosus	xx
Verrucosisporites cf. *grandiverrucosus*	x
Verrucosisporites microtuberosus	x
Verrucosisporites sifati	x
Verrucosisporites cf. *sinensis*	xx
Verrucosisporites verrucosus	x
Verrucosisporites sp. A	x
Kewaneesporites sp.	x
Lophotriletes gibbosus	xx
Lophotriletes pseudoaculaetus	x
Apiculatisporis abditus	x
Apiculatisporis setulosus	x
Apiculatisporis variusetosus	x

xxx important; xx common; x rare

Table 1 (*continued*)

Acanthotriletes sp.	x
Apiculatasporites spinulistratus	xx
Planisporites spp.	xx
Pustulatisporites crenatus	x
Tuberculatisporites mamillarius	x
Raistrickia aculeata	xx
Raistrickia aculeolata	xx
Raistrickia cf. *aculeolata*	xx
Raistrickia crinita	x
Raistrickia cf. *crinita*	x
Raistrickia cf. *crocea*	x
Raistrickia cf. *dispar*	xx
Raistrickia cf. *fibrata*	x
Raistrickia lacerata	xx
Raistrickia cf. *lacerata*	x
Raistrickia solaris	x
Raistrickia superba	xx
Raistrickia cf. *superba*	x
Raistrickia sp. A	x
Raistrickia sp. B	xx
?*Raistrickia* cf. *baculata*	x
Microreticulatisporites nobilis	xx
Convolutispora sp. 2	xx
Convolutispora sp. B	x
Reticulatisporites lacunosus	x
Reticulatisporites muricatus	xx
Savitrisporites maius	x
Camptotriletes sp.	x
Dictyotriletes mediareticulatus	x
Dictyotriletes camptotus	x
Knoxisporites sp.	x
Triquitrites bransonii	xxx
Triquitrites cf. *bransonii*	xx
Triquitrites bucculentus	xx
Triquitrites exiguus	xxx
Triquitrites pulvinatus	x
Triquitrites verrucosus	xx
Triquitrites sculptilis	xx
Firmysporites irregularis	x
Ahrensisporites sp.	x
Mooreisporites inusitatus	x
Mooreisporites cf. *inusitatus*	xx
Valvisisporites auritus	xxx
Lycospora brevis	x
Lycospora denticulata	x
Lycospora granulata	xx
Lycospora parva	xx
Lycospora cf. *pressoides*	xx
Lycospora pseudoannulata	xx
Lycospora punctata	xx
Lycospora pusilla	xxx
Lycospora subjuga	xx
Lycospora triangulata	x
Stenozonotriletes lycosporoides	x
Crassispora kosankei	x
Densosporites sphaerotriangularis	x
Cadiospora magna	xxx
Cadiospora butterworthi	x
Gillespieisporites discoideus	xxx

Table 1 (*continued*)

Gillespieisporites spinosus	xxx
Vestispora costata	xxx
Vestispora fenestrata	xxx
Vestispora pseudoreticulata	xx
Vestispora quaesita	xxx
Vestispora cf. *profunda*	x
Westphalensisporites irregularis	x
Bentsisporites tricollinus	x
Cirratriradites saturni	xx
Cirratriradites annuliformis	x
Angulisporites sp.	x
Triangulatisporites triangulatus	xxx
Lagenoisporites rugosus	xx
Cystosporites giganteus	x
Cystosporites varius	x
Laevigatosporites desmoinesensis	xx
Laevigatosporites medius	x
Laevigatosporites cf. *medius*	x
Laevigatosporites sp. C	x
Laevigatosporites sp. D	x
Laevigatosporites sp. E	x
Laevigatosporites globosus	xx
Latosporites cf. *globosus*	x
Latosporites latus	x
Punctatosporites minutus	xx
Punctatosporites oculus	xxx
Punctatosporites pygmaeus	xx
Punctatosporites speciosus	xxx
Spinosporites spinosus	x
Speciososporites minor	xxx
Speciososporites infrapunctatus	xx
?*Speciososporites* cf. *triletoides*	xxx
Endosporites formosus	xxx
Endosporites cf. *globiformis*	x
Microsporites gracilis	x
Wilsonites delicatus	xx
Wilsonites vesicatus	x
Latensia triletus	x
Florinites antiquus	x
Florinites cf. *diversiformis*	x
Florinites junior	x
Florinites mediapudens	xx
Florinites cf. *mediapudens*	x
Florinites piérarti	x
Florinites plicatus	xx
Florinites pumizosus	x
Florinites similis	xx
Florinites visendus	x
Florinites cf. *volans*	x
Potonieisporites novicus	xxx
Potonieisporites novicus forma *grandis*	xxx
Potonieisporites cf. *elegans*	xx
Bascanisporites parvisaccus	x
Candidispora cf. *candida*	x
Alisporites sp. A	x
Vesicaspora sp. A	x
Sulcatisporites spp.	x
Tumoripollenites cf. *baccatus*	x
Tumoripollenites sp. A	xx

Table 1 (*continued*)

Illinites sp. A	xx
Striatites sp.	x
?Protohaploxypinus sp.	x
Kosankeisporites elegans	x
?Kosankeisporites sp. A	x
Limitisporites sp. A	x
Alatisporites sp.	x
Schopfipollenites ellipsoides	x
?Vittatina sp.	x

Comparison

Another coal-bearing succession above the Nýřany Member (Westphalian D) is the Jelenice Member (Stephanian B) with the Mělník Main and Mělník Upper coal seams which were palynologically studied before (1978). The general aspect of the spore assemblages recorded in the Mělník seams appears to be comparable with assemblages found in the Vavřineč group of seams in this area.

The most abundant genera in both cases are *Laevigatosporites* and *Lycospora* but the predominating genus in the Mělník seams is *Laevigatospories* and *Lycospora* in the Nýřany seams. The difference lies in greater percentage of the genera *Cyclogranisporites*, *Verrucosisporites*, *Crassispora* and *Endosporites* in the first case, and *Punctatosporites* and *Triquitrites* in the second one. There are large numbers of spore types occurring in small quantities with no regularity in seams formed during a restricted period. The spores characterizing the assemblages are locally common but never abundant. Typical species that have been recognized only in Mělník seams are *Cyclogranisporites jelenicensis*, *Verrucosisporites sinensis*, *Apiculatisporis conatus*, *Savitrisporites maius*, *Crassispora* spp. (non *C. kosankei*), *Lagenoisporites levis*, *Latosporites melnicensis*, *Speciososporites infrapunctatus*, *Endosporites grandisaccatus* and *Microsporites gracilis*.

Presence in more or less constant but sometimes slightly increased frequency of *Vestispora fenestrata*, *V. costata*, *V. quaesita*, *Cirratriradites saturni*, *Triquitrites bransonii*, *T. exiguus*, *T. sculptilis*, *Punctatosporites minutus* is characteristic of the assemblage of the Nýřany Member.

The Vavřineč group of seams in the Mšeno Basin represents the higher part of the Nýřany Member and is characterized by the following species which have not been recognized in coals in the lower part of this member in other basins: *Laevigatosporites glabratus*, *Triletisporites tuberculatus*, *Raistrickia lacerata*, *Triquitrites verrucosus*, *Firmysporites irregularis*, *Gillespieisporites discoideus*, *G. spinosus*, *Cadiospora magna*, *Punctatosporites speciosus*, *Spinosporites spinosus*, *Speciosporites minor*, *S. infrapunctatus*, *Latensina triletus*, *Candidispora* cf. *candida*, *Potonieisporites novicus* and the genera of disaccate spores.

In the coals in the lower part of the Nýřany Member (developed e.g. in Kladno

and Plzeň Basins) has been noted species which has not been found in higher horizons. There were reported the Westphalian C species, and a sharp increase in the number of *Punctatosporites* spp. (mainly *P. microgranifer*) has been observed. *Torispora securis* and *T. laevigata* are regularly distributed throughout the sequence. Many samples yielded specimens of *Reticulatasporites* cf. *facetus*, *Acanthotriletes* sp., *Anapiculatisporites* sp., *Dictyotriletes cingulatus*, *Westphalensisporites irregularis* and two interesting not described types ?*Camptotriletes* and ?*Vallatisporites* sp. A relatively large number of *Tuberculatisporites mamillarius* has been recorded from several horizons.

The palynological data so far accumulated from the upper seams of the Nýřany Member in the Kladno, Plzeň (Chotíkov and Nevřeň group of seams), Manětín and Roudnice Basins and also from the Svatoňovice Member in the Intrasudetic Basin show the same composition and distribution of miofloras as in the Nýřany Member of the Mšeno Basin.

Palynological zonig

From the palynological viewpoint the Nýřany Member in the Central Bohemian Carboniferous is divided into two palynozones on the basic of megaspore and miospore associations: the lower zone was designated after the megaspore species *Tuberculatisporites mamillarius* and miospore *Torispora securis* as TM-TS, and the upper zone LG-PS after the megaspore species *Laevigatosporites glabratus* and the miospore *Punctatosporites speciosus*. In the Mšeno Basin (the Vavřineč group of seams) just as in the Nýřany Member in the Kladno, Plzeň, Manětín, Roudnice and Intrasudetic Basins the upper palynological zone LG-PS is present. The lower palynological zone TM-TS is known in the Nýřany Member from the Kladno, Plzeň and Manětín Basins as well as from the Carboniferous relics surrounding the Plzeň Basin and from Intrasudetic and Zwickau-Lugau-Oelsnitz (the G.D.R.) Basins.

The miospore associations of the two zones involve a number of genera and species that are also known from other Carboniferous areas of Europe. The Bohemian associations, however, differ from them in lacking miospores of the genus *Thymospora* (except for isolated finds). The zones can be correlated with the zones of the West European and Polish Carboniferous and with the C-VL Zone in the Donec Basin and the W6 Zone of the Dobrudja Basin.

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Explanation of plates

All photographs by the author

Pl. I

1. *Leiotriletes adnatus*, 2 MB-5/1, CLXIX/34.
2. *L. adnatus*, 2 MB-5/4, CLXX/6.
3. *L. gulaferus*, 9 MB-5/3, 172/23.
4. *L. sphaerotriangulus*, 2 MB-3/2, CLXXV/9.
5. *L. convexus*, 2 MB-7/2, CLXXX/19.
6. *L. gulaferus*, 14-MJ-1/1, CXII/23.
7. *L. gulaferus*, 25 MJ-1/2, CIII/67.
8. *L. adnatoides*, 1 MB-7/5, CLXXXI/29.
9. *L. adnatoides*, 3 MB-3/3, CLXXV/15.
10. *L. tumidus*, 2 MB-7/5, CLXXX/11.
11. *L.* sp., 2 MB-5/1, CLXIX/35.
12. *Punctatisporites bifurcatus*, 25 MJ-1/3, CII/35.
13. *P. bifurcatus*, 1 MB-21/1, CLXXV/20.

14. *P. bifurcatus*, 21 MJ-1/2, C/57.
15. *P.* sp., 12 MB-5/1, CLXXIII/5.
16. *P.* cf. *minutus*, 6 MB-5/1, CLXX1/29.
17. *Calamospora saariana*, 1 MB-3/1, CLXXV/2.
18. *C. saariana*, 1 MB-3/1, CLXXV/2.
19. *C. parva*, 8 MB-5/3, CLXXII/23.
20. *C. microrugosa*, 2 MB-5/4, CLXX/7.
21. *C. microrugosa*, 8 MB-5/3, CLXXII/19.
22. *C. pallida*, 2 MB-5/7, CLXIX/21.
23. *C. pallida*, 12 MB-5/1, 173/5.
24. *C. microrugosa*, 11 MB-5/3, 173/1.

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Pl. II

1. *Calamospora mutabilis*, 3 MB-5/4, CLXX/36.
2. *C. mutabilis*, 2 MB-5/1, CLXIX/36.
3. *C. mutabilis*, 8 MB-5/3, CLXXII/18.
4. *C. mutabilis*, 3 MB-5/3, CLXX/33.
5. *C. mutabilis*, 3 MB-5/1, CLXX/19.
6. *C. mutabilis*, 3 MB-5/3, CLXX/28.
7. *C.* cf. *mutabilis*, 3 MB-3/1, CLXXV/6.
8. *C.* sp., 1 MB-9/4, CLXXIII/15.

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Pl. III

1. *Leiotriletes adnatoides*, 8 MJ-7/2, CXXIV/50.
2. *L. tumidus*, 12 MJ-7/1, 126/47.
3. *Cyclogranisporites jelenicensis*, 1 MJ-8/3, CLXXIV/10.
4. ?*C.* sp., 25 MJ-1/4, CIII/33.
5. *Calamospora breviradiata*, 8 MJ-7/2, CXXIIII/1.
6. *C. breviradiata*, 5 MJ-8/4, CLXXIV/33.
7. *Punctatisporites* cf. *punctatus*, 5 MJ-8/4, CLXXIV/35.
8. *Calamospora microrugosa*, 5 MJ-10/2, CXXIX/11.
9. *C.* cf. *breviradiata*, 9 MJ-10/5, CXXX/2.
10. *C. mutabilis*, 2 MJ-7/4, CXXV/6.
11. *Cyclogranisporites* sp. A, 1 MJ-7/2, CXXIV/12.
12. *C.* sp. A, 1 MJ-7/2, CXXIV/18.
13. *Calamospora straminea*, 7 MJ-7/1, CXXX/41.
14. *C. straminea*, 8 MJ-7/3, CXXV/87.
15. *Cyclogranisporites* sp. A, 1 MJ-7/2, CXXIV/22.

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Pl. IV

1. *Variouxisporites* sp., 4 MB-5/3, CLXX1/11.
2. *Granulatisporites parvus*, 2 MB-9/3, CLXXIII/34.
3. *G. parvus*, 1 MB-9/4, CLXXIII/23.
4. *Cyclogranisporites orbicularis*, 1 MB-21/2, CLXXV/30.
5. *C.* sp., 11 Be-1/2, CLX/10.
6. *Granulatisporites* cf. *granulatus*, 9 MB-5/1, CLXXII/26.
7. *Cyclogranisporites orbicularis*, 2 MB-20/3, CLXXV/18.
8. *C. aureus*, 23 Be/6, CLXIX/20.
9. *C.* sp. A, 4 MB-5/1, CLXXI/7.

10. *C. aureus* et *Triquitrites bransonii*, 1 MB-3/4, CLXXV/4.
11. *C. aureus*, 4 MB-5/4, CLXX1/17.
12. *C. aureus*, 4 MB-5/3, CLXX1/13.
13. *C. aureus*, 4 MB-5/3, CLXX1/10.
14. *C. aureus*, 8 MB-5/3, CLXXII/32.
15. *C.* sp., 27 Be-1/1, CLXVI/3.
16. Tetrad of *C.* sp., 12 MB-5/3, CLXXIII/9.

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Pl. V

1. *Cyclogranisporites* sp. A, 1 MJ-7/1, CXXIV/16.
2. *C. aureus*, 11 MJ-7/2, CXXVI/75.
3. *C. aureus*, 12 MJ-7/2, CXXVII/85.
4. *Reticulatasporites* sp., 11 MJ-7/1, CXXVI/49.
5. *Granulatisporites granulatus*, 3 MJ-7/3, CXXV/49.
6. *G. granulatus*, 2 MJ-7/4, CXXV/69.
7. *Lophotriletes* sp., 1 MB-21/2, CLXXV/26.
8. *Cyclogranisporites* cf. *aureus*, 2 MB-7/3, CLXXX/22.
9. *Pustulatisporites crenatus*, 1 MB-3/1, CLXXIV/37.
10. *Lophotriletes gibbosus*, 1 MB-3/1, CLXXV/1.
11. *L. gibbosus*, 2 MJ-7/3, CXXV/71.
12. Tetrad of *Lophotriletes* sp., 2 MB-3/2, CLXXV/12.
13. *L.* sp., 9 MB-5/2, CLXXII/24.
14. *L. pseudoaculeatus*, 3 MB-5/1, CLXX/20.
15. *Verrucosisporites donarii*, 3 MB-5/1, CLXX/80.
16. *V.* cf. *papulosus*, 8 MJ-7/2, CLXXV/17.
17. *V.* cf. *donarii*, 2 MB-7/3, CLXXX/20.
18. *Kewaneesporites* sp., 2 MB-9/2, CLXXIII/26.
19. *Apiculatisporis abditus*, 7 MJ-10/2, CXXX/68.
20. *A.* sp., 12 MJ-7/2, CXXVII/65.
21. *Verrucosisporites microtuberosus*, 30 MJ-1/1, CIV/17.
22. *V. grandiverrucosus*, 3 MB-9/1, CLXXIII/36.
23. *V. verrucosus*, 3 MB-9/1, CLXXIII/39.

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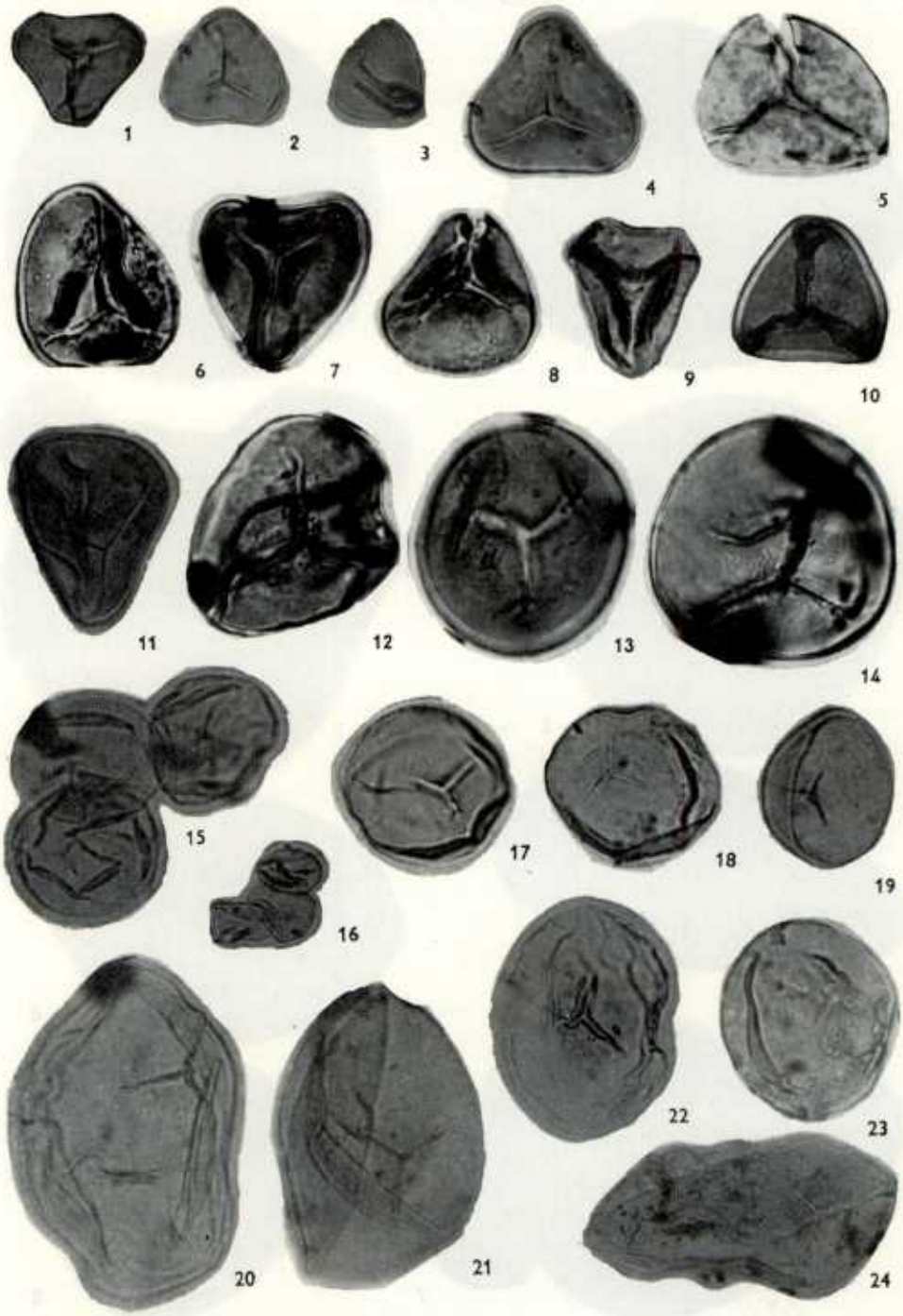
Pl. VI

1. *Granulatisporites* cf. *pannosites*, 8 MB-5/3, CLXXII/22.
2. *Verrucosisporites* sp. A, 3 MJ-8/1, CLXXIV/29.
3. *V.* sp. A, 2 MJ-7/4, CXXV/61.
4. *V.* cf. *donarii*, 8 MJ-10/3, CXXX/46.
5. *V.* sp., 11 MJ-7/2, CXXVI/77.
6. *V.* cf. *grandiverrucosus*, 1 MJ-8/1, CLXXIV/9.
7. *V. microtuberosus*, 11 MJ-7/2, XXXVI/87.
8. *V. grandiverrucosus*, 9 MJ-10/5, CXXX/18.
9. *V. sifati*, 10 MJ-10/3, CXXXI/13.
10. *V.* cf. *sinensis*, 9 MJ-7/2, CXXVI/17.
11. *V.* cf. *sinensis*, 8 MJ-7/2, CXXV/2.
12. *Planisporites* sp., 1 MJ-7/2, CXXIV/88.
13. *P.* sp., 2 MB-3/2, CLXXV/11.
14. *P.* sp. et ?*Converrucosisporites* sp., 1 MB-9/5, CLXXIII/19.
15. *P.* sp., 5 MJ-10/3, CXXX/88.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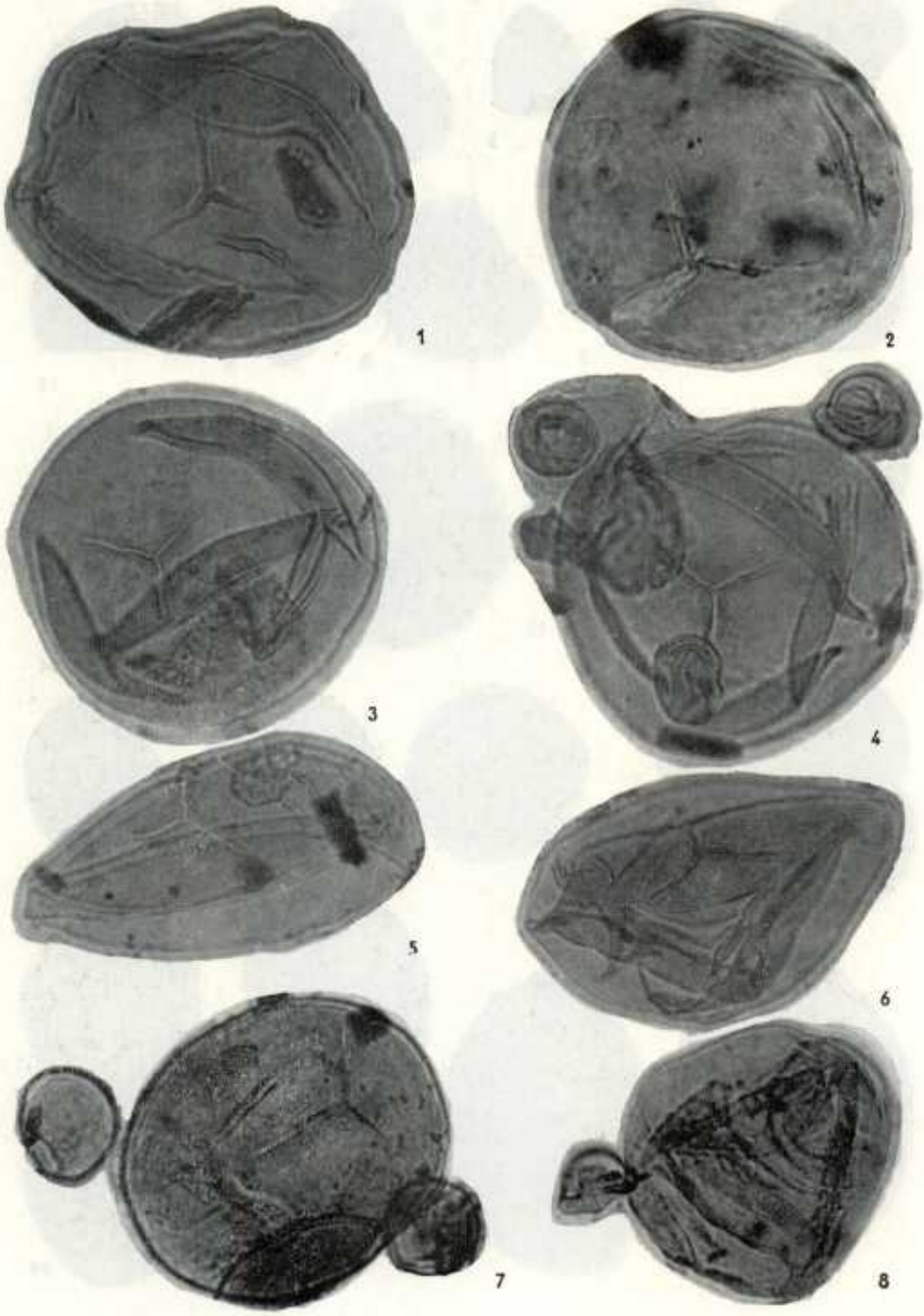
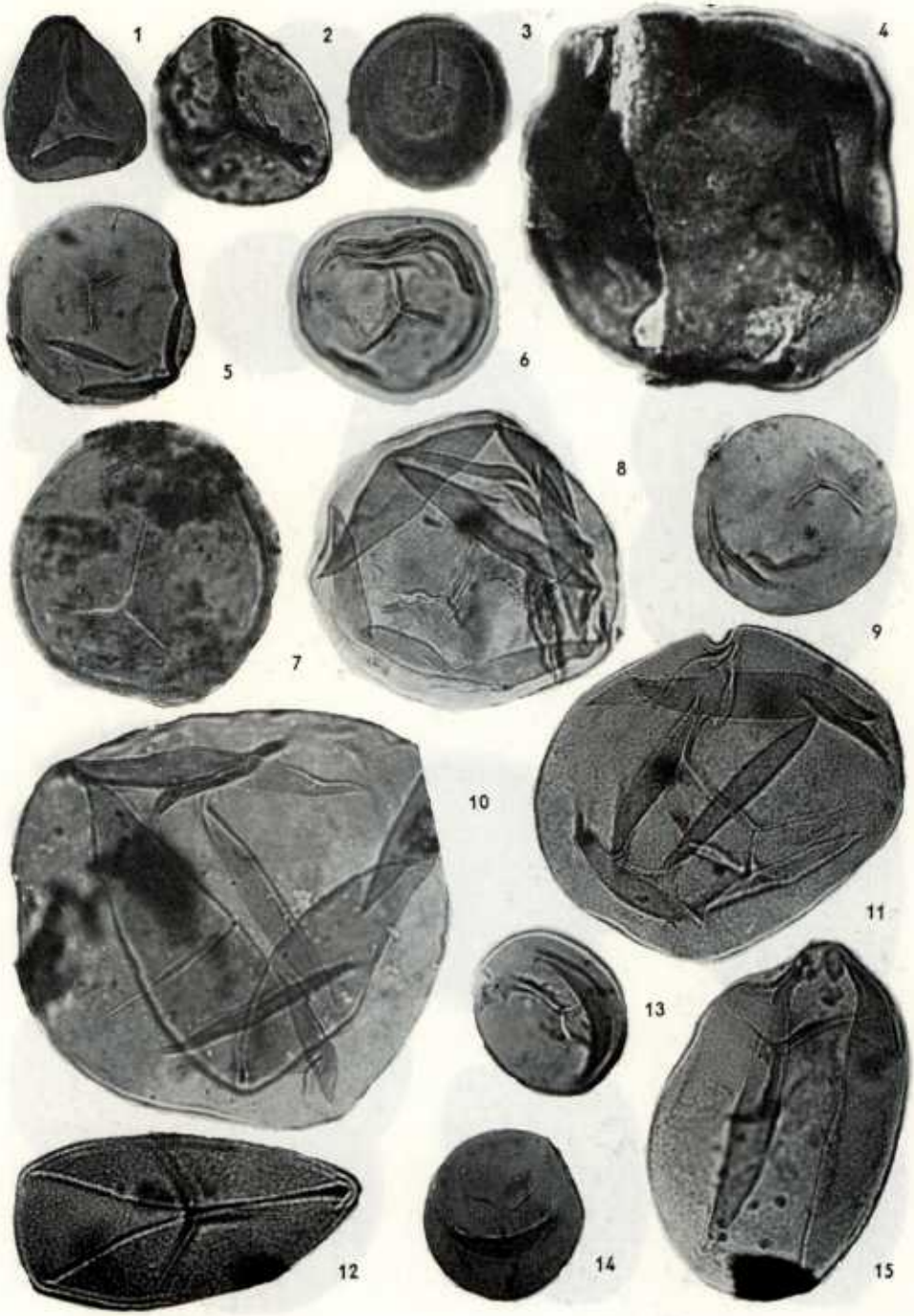
Pl. II

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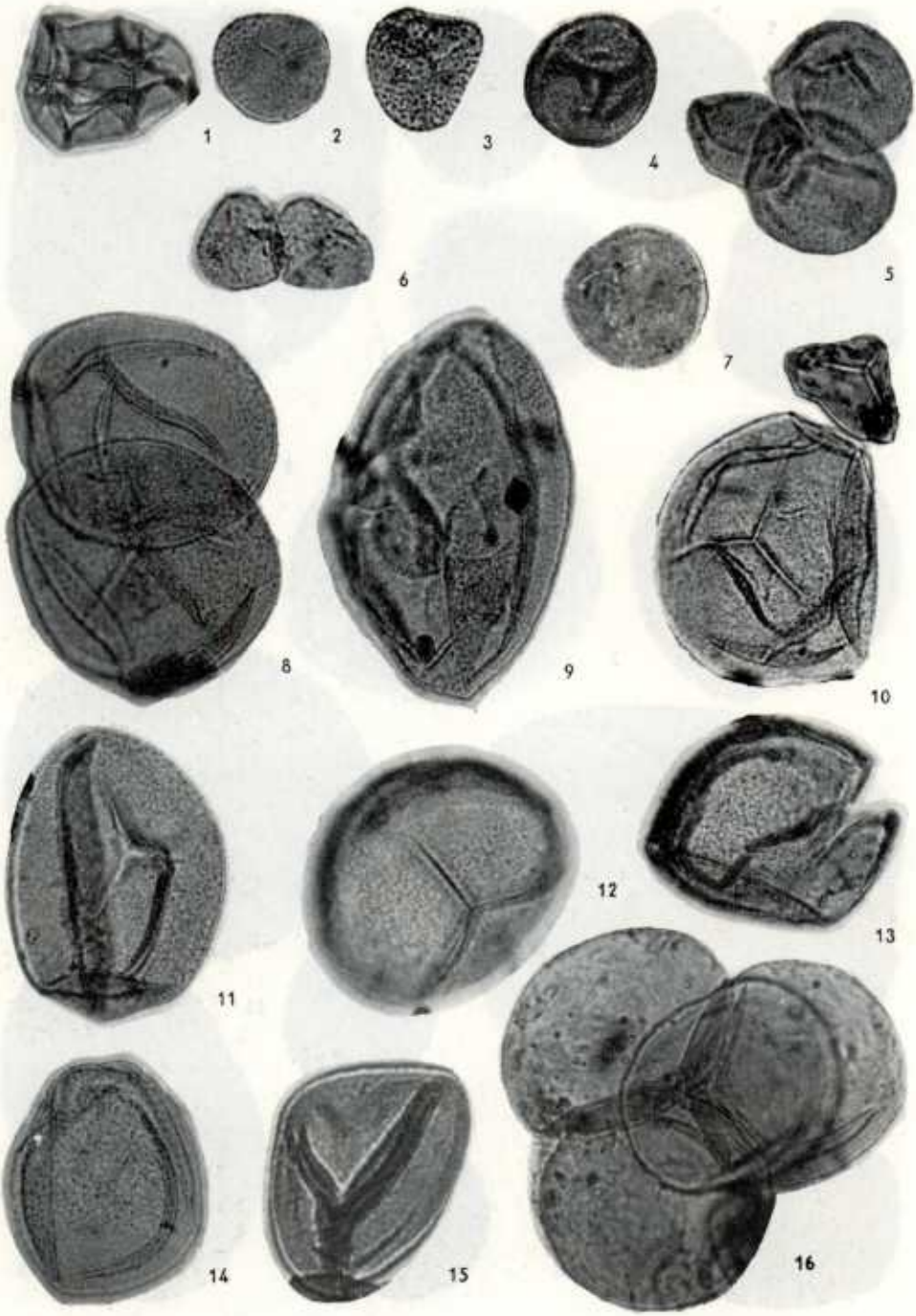

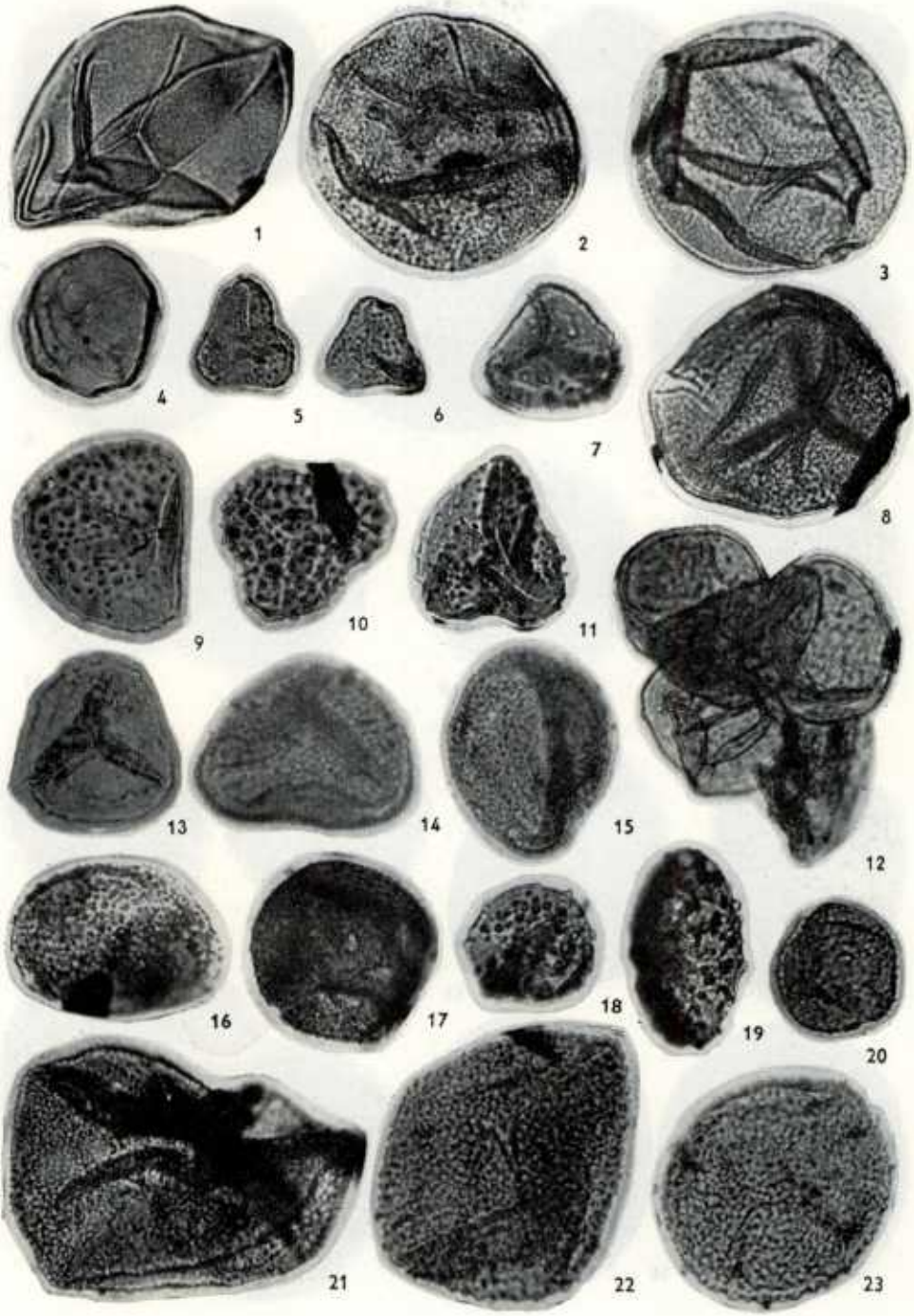
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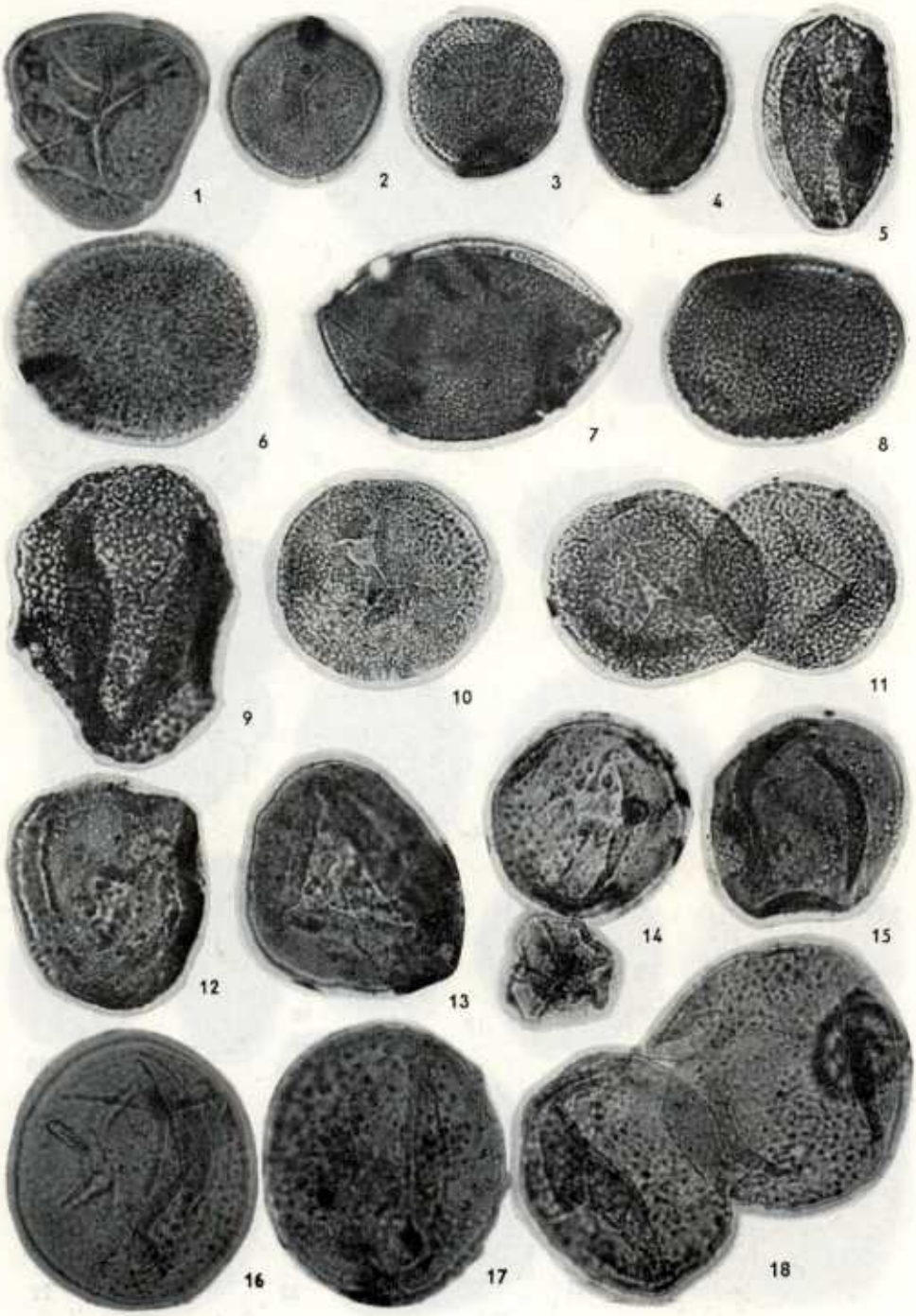
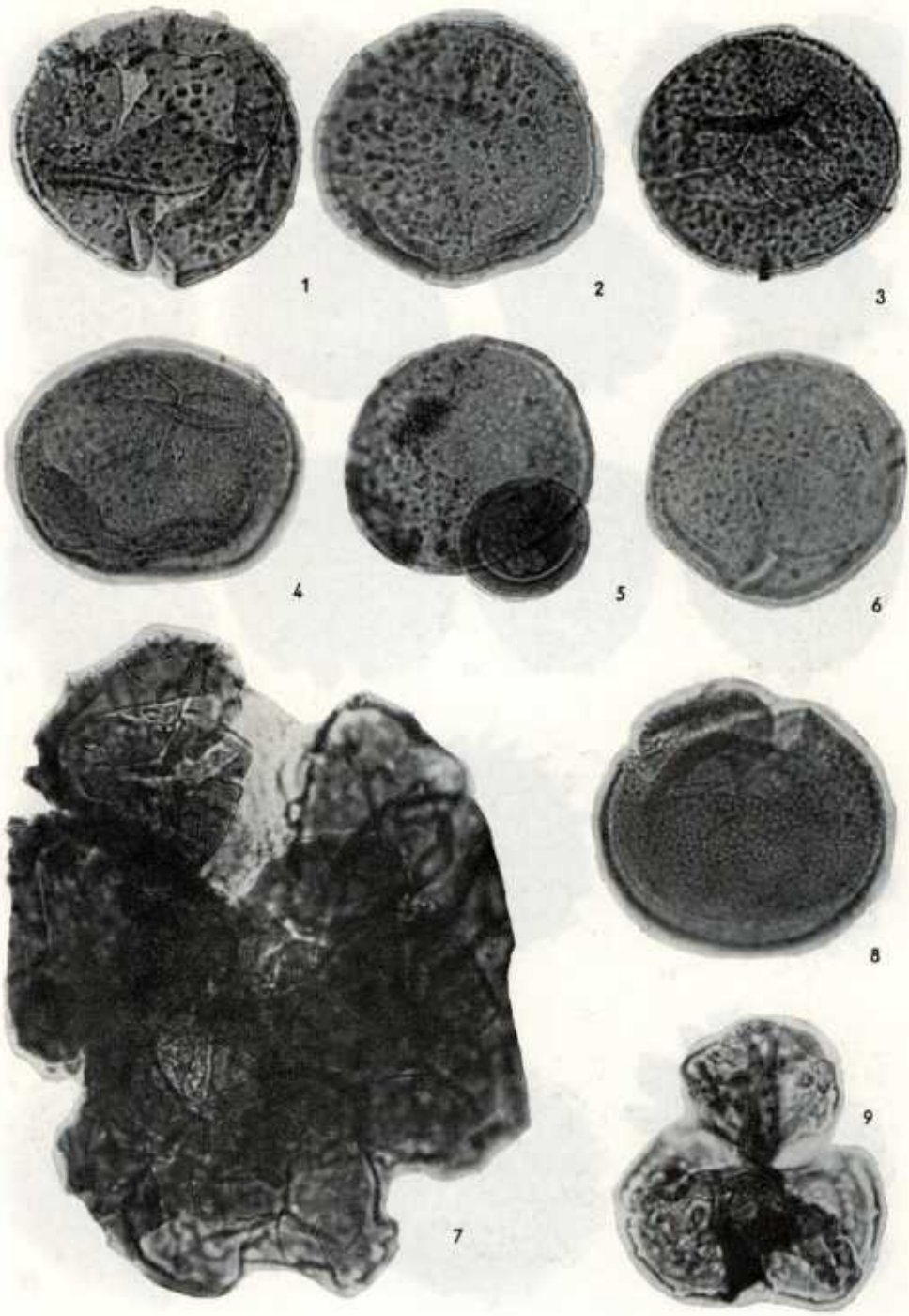
Pl. VI

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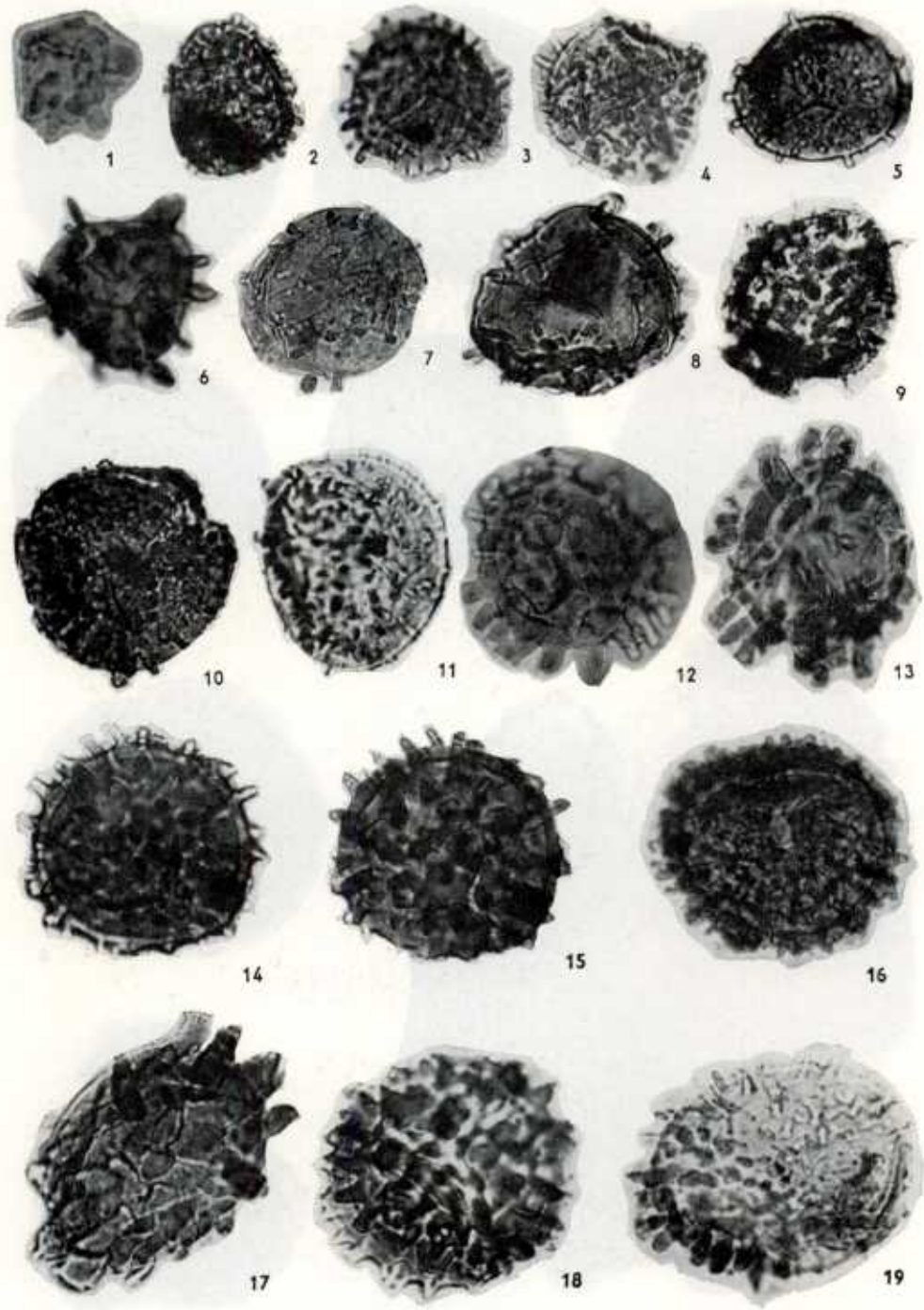

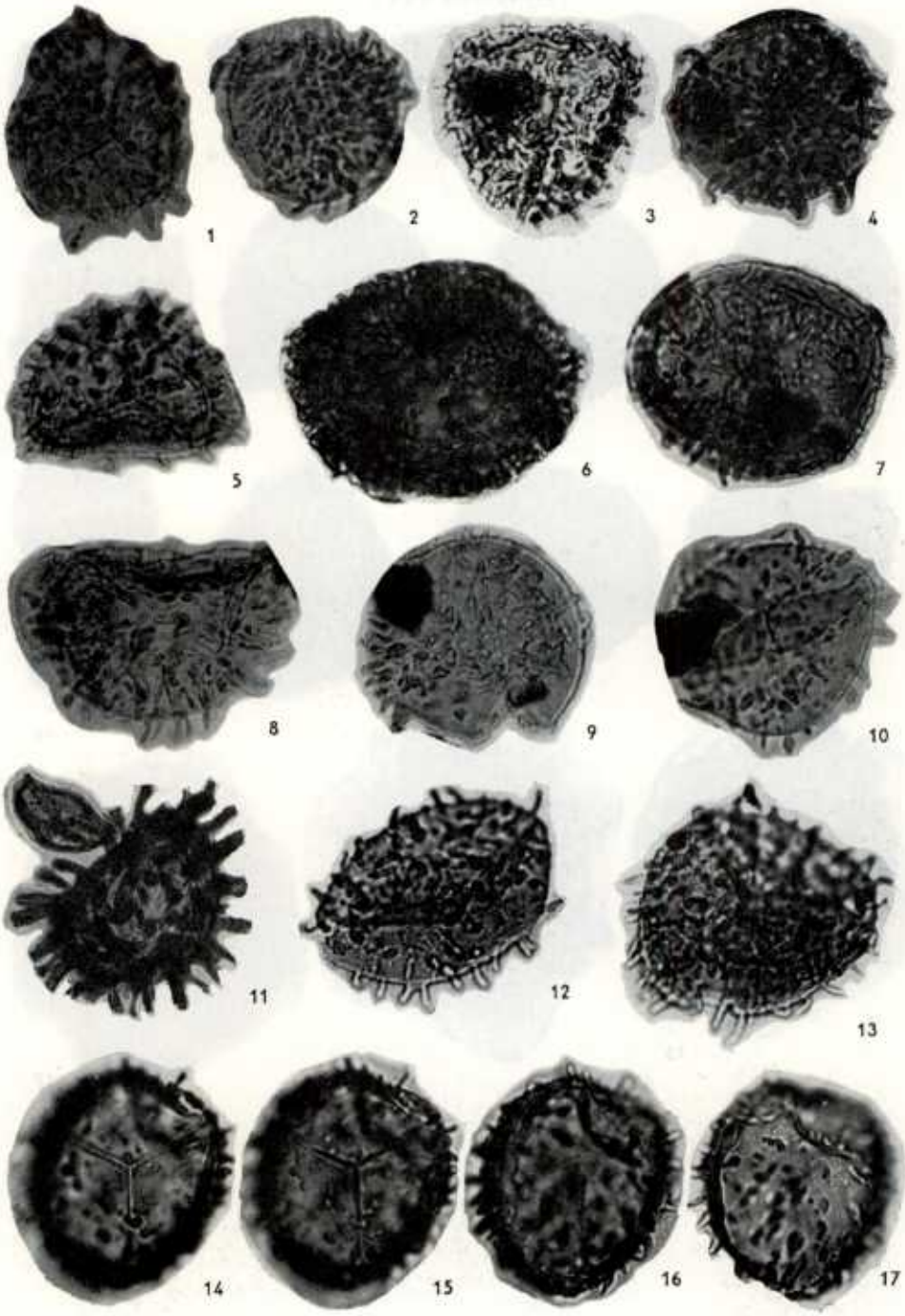
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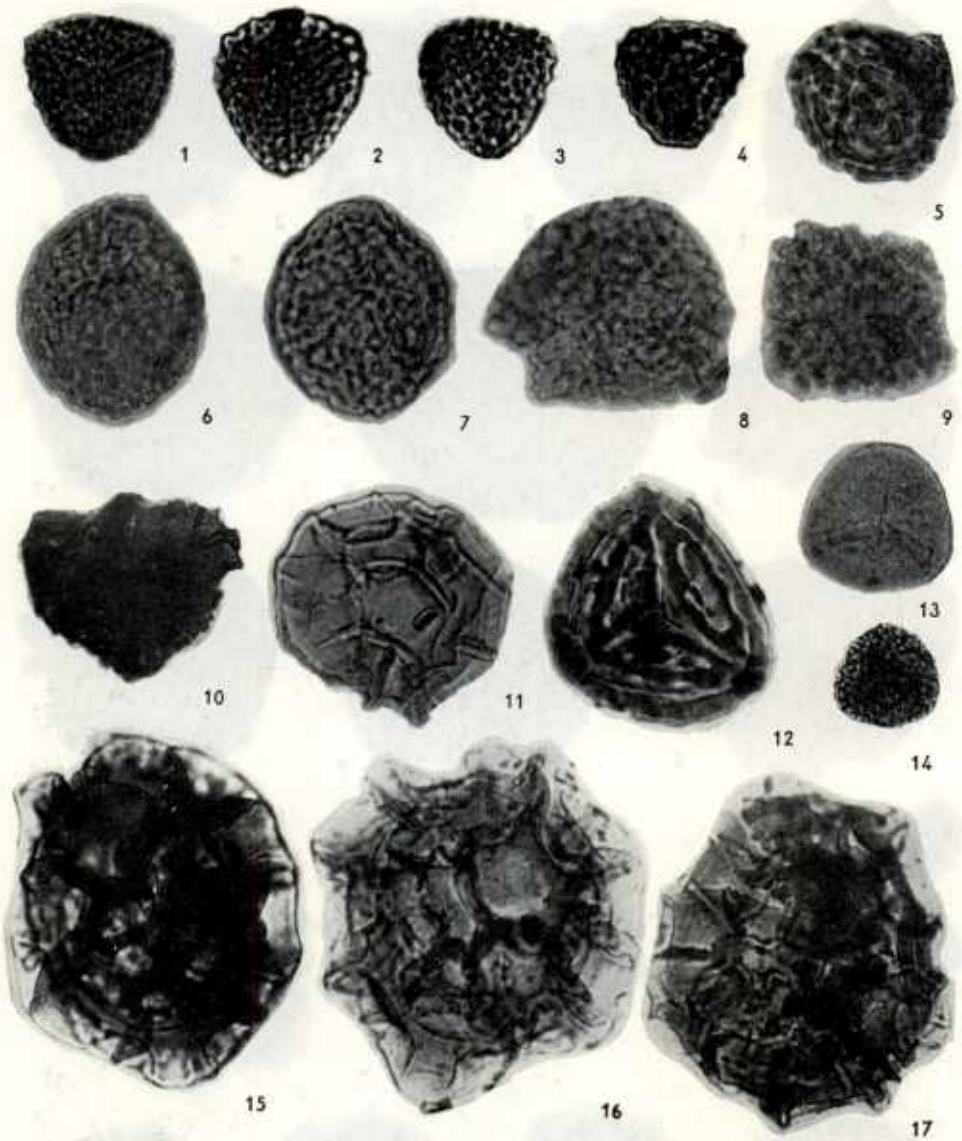

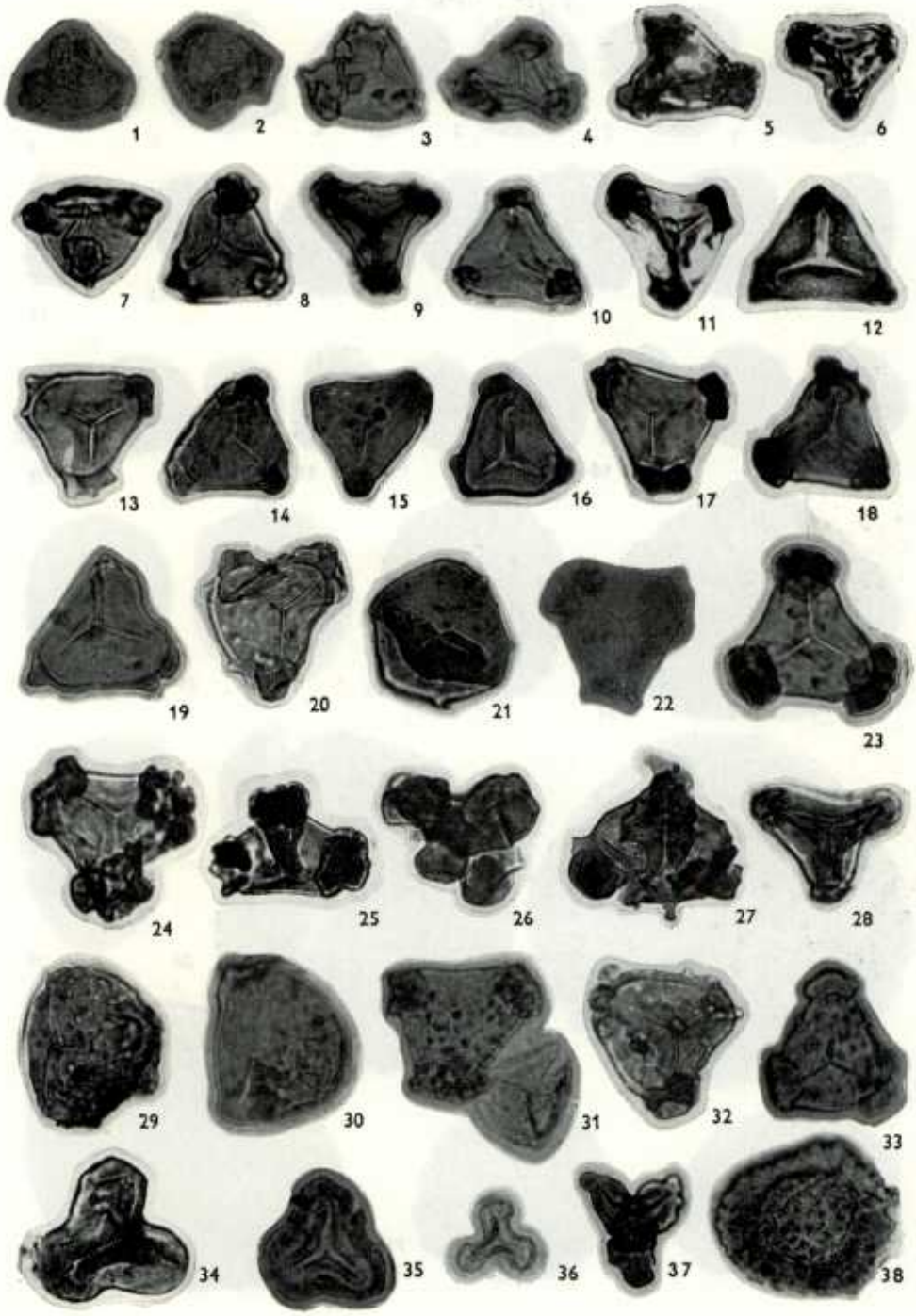
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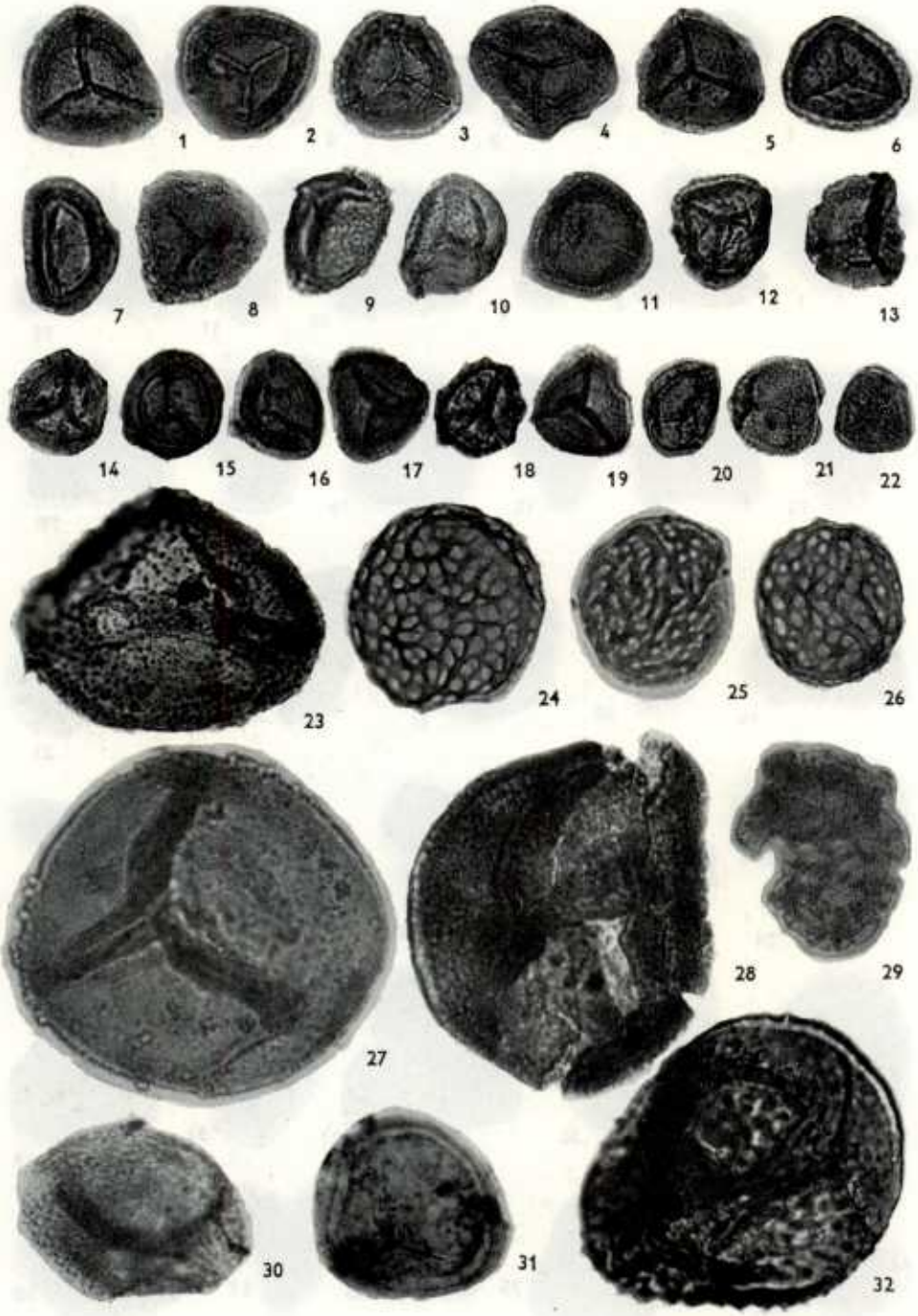
Pl. XII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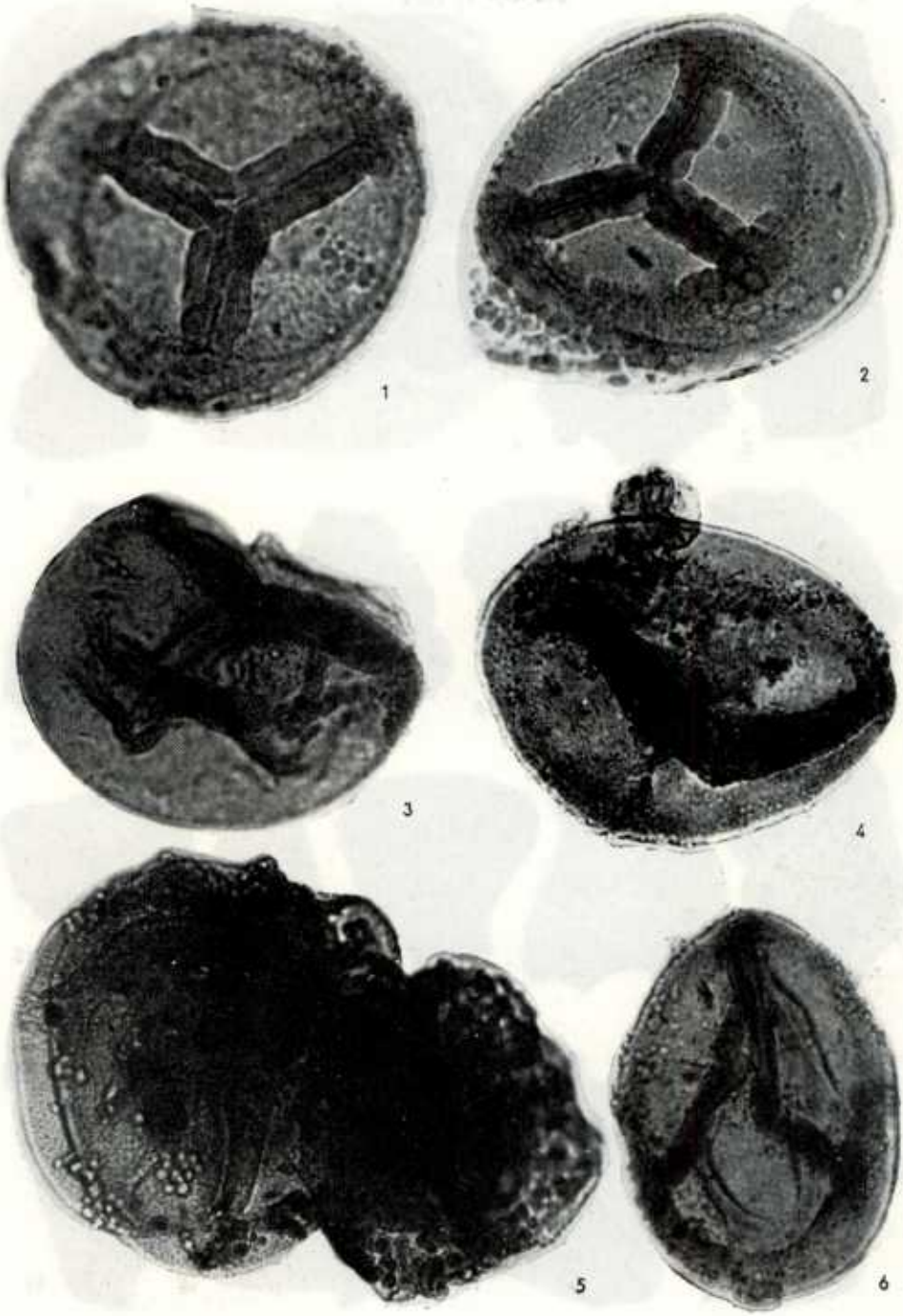
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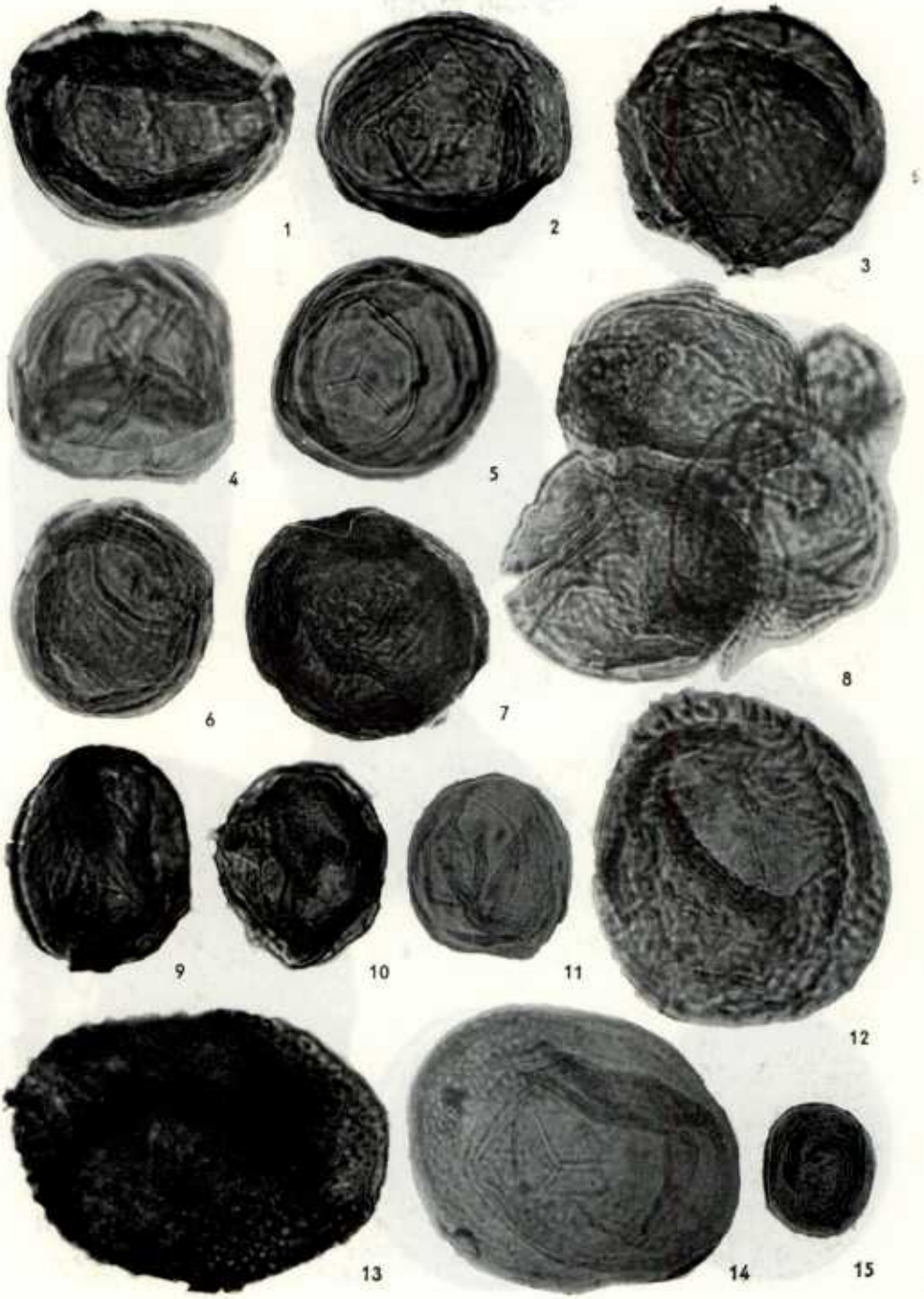
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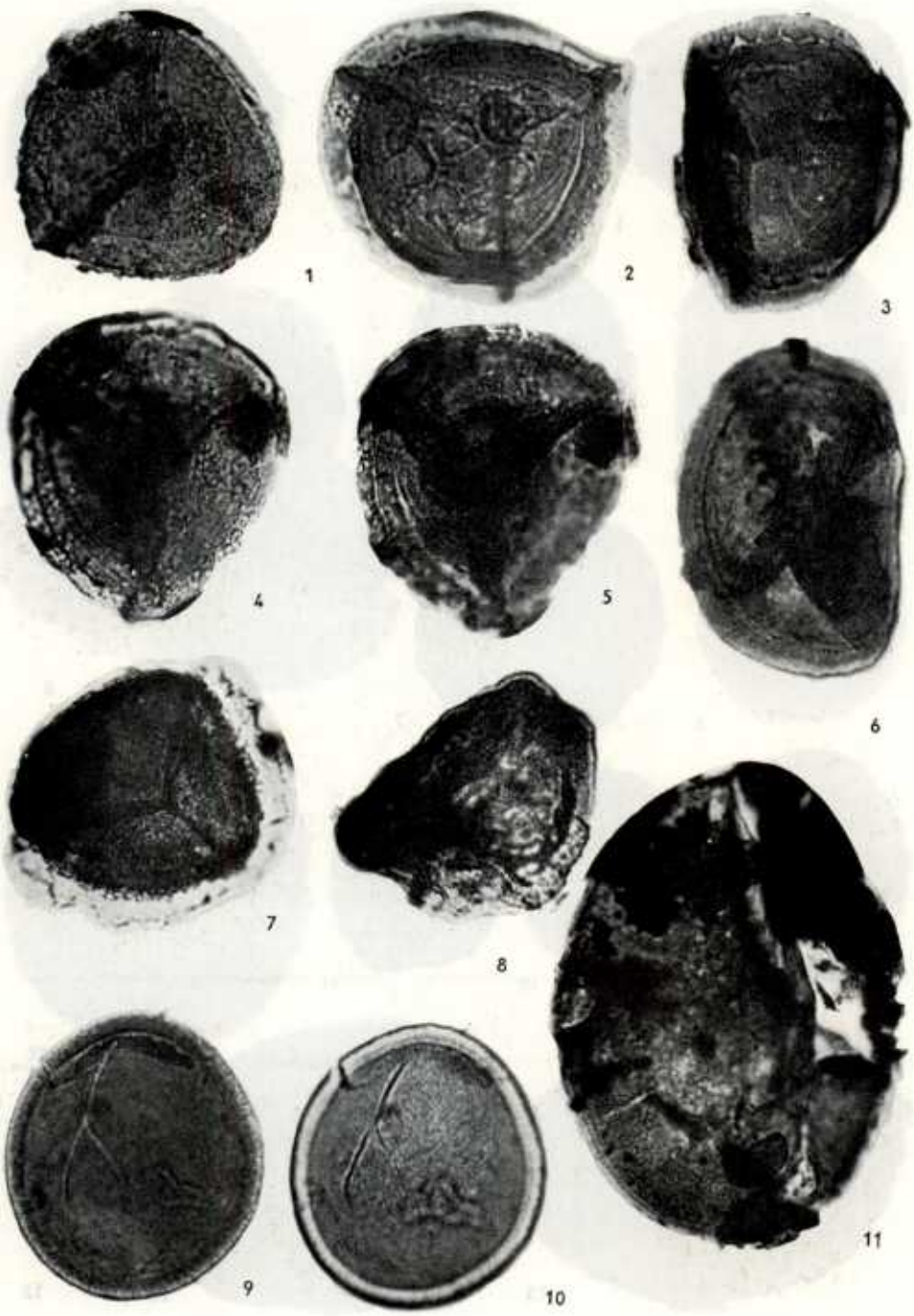
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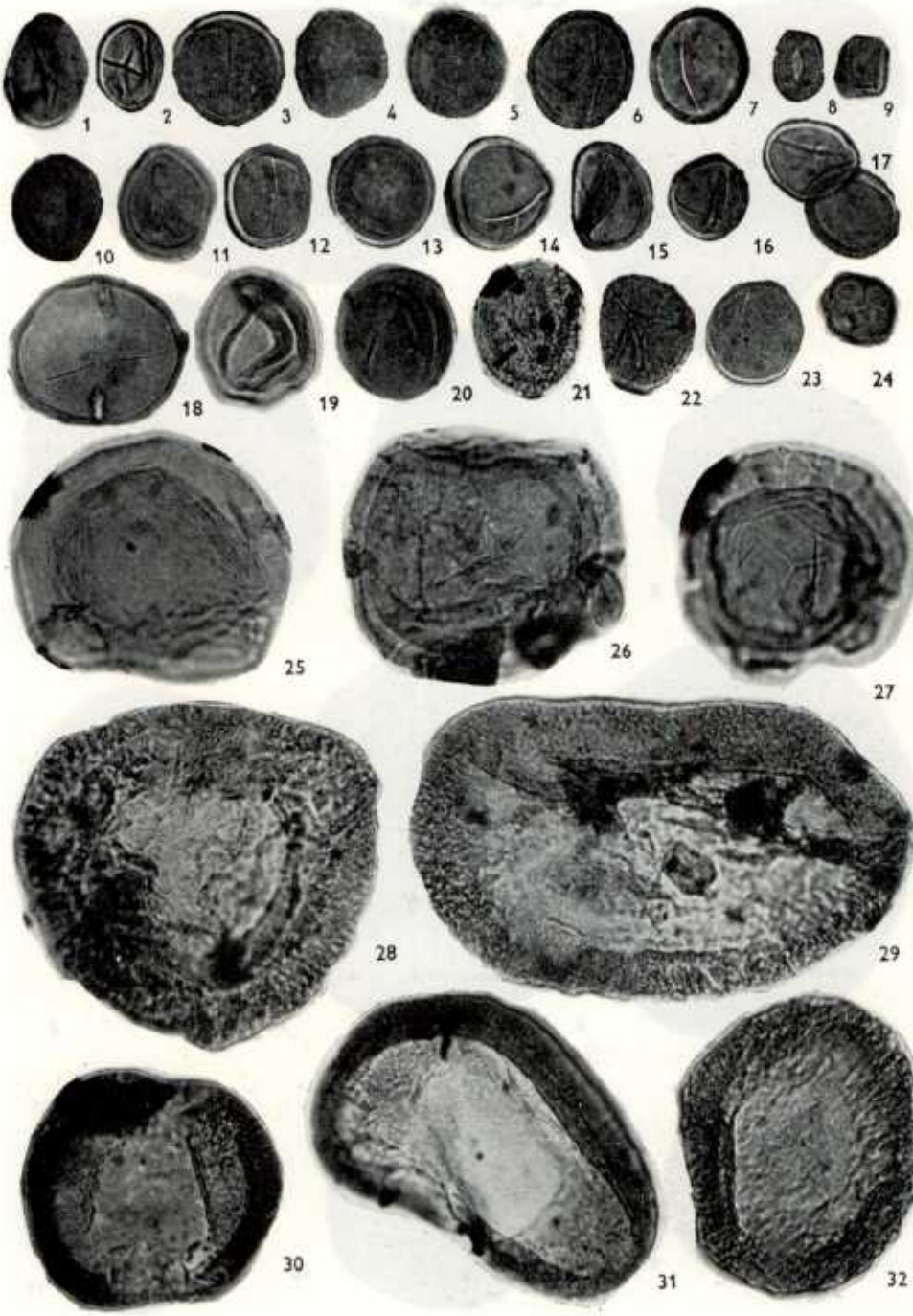
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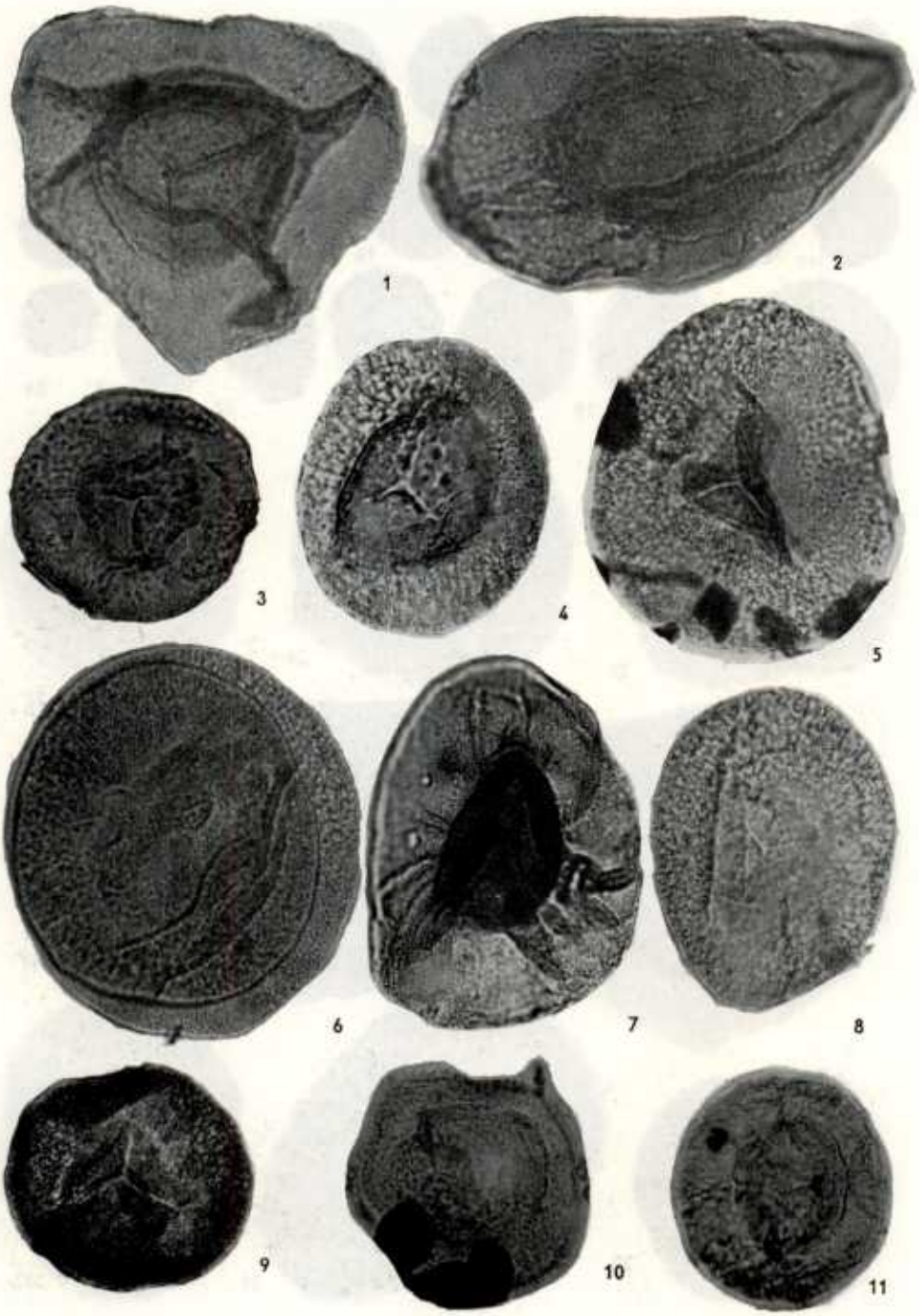
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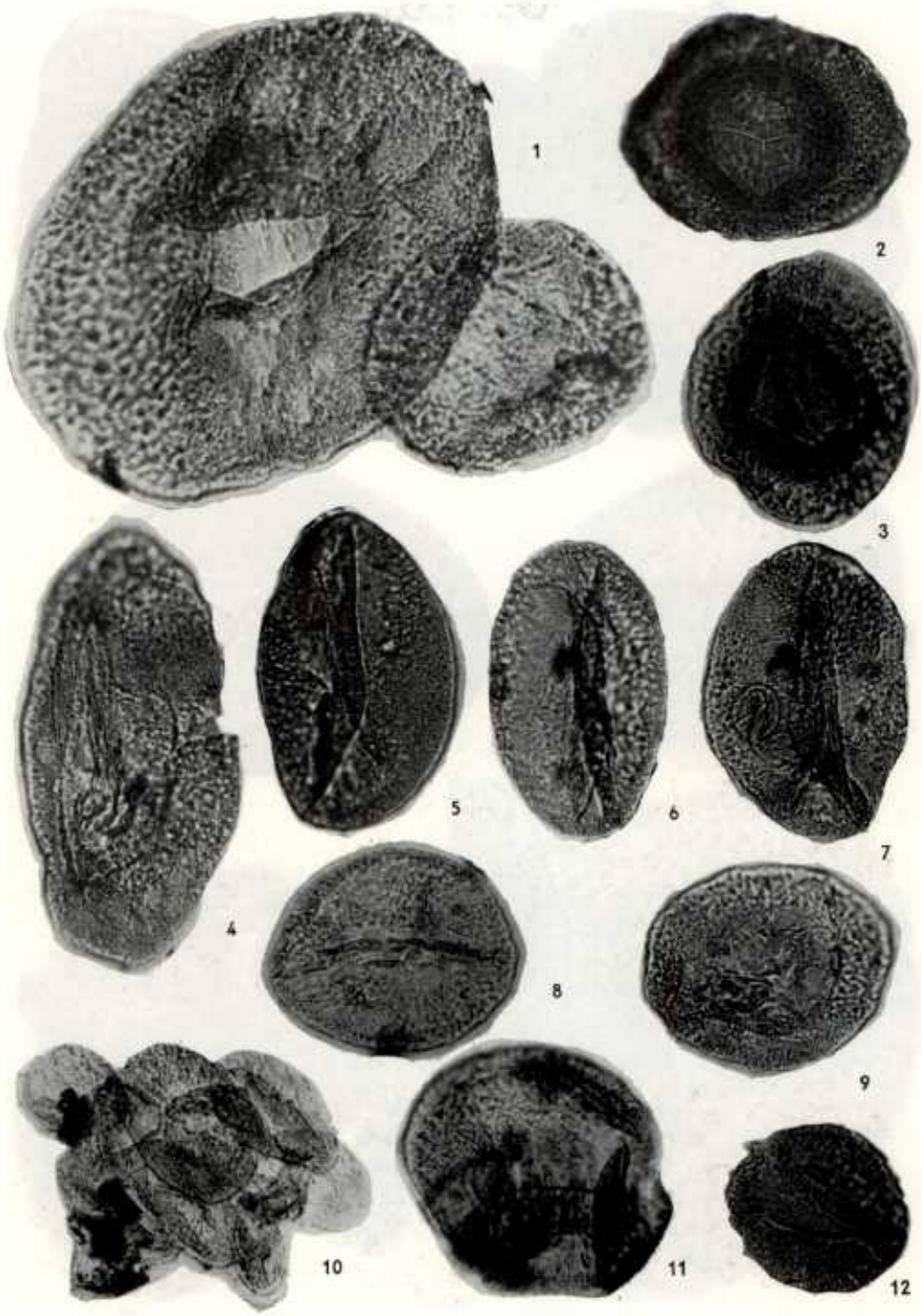
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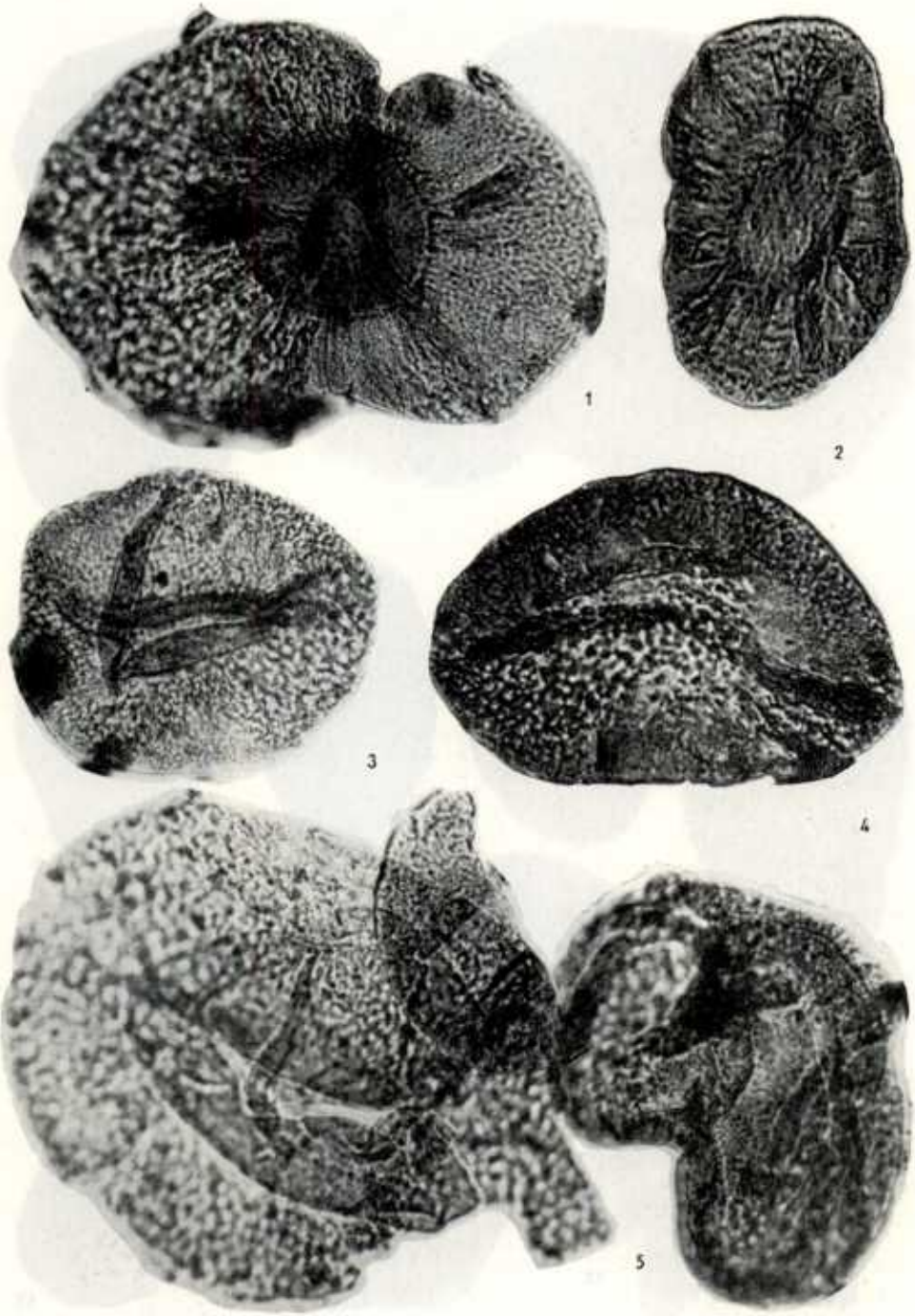
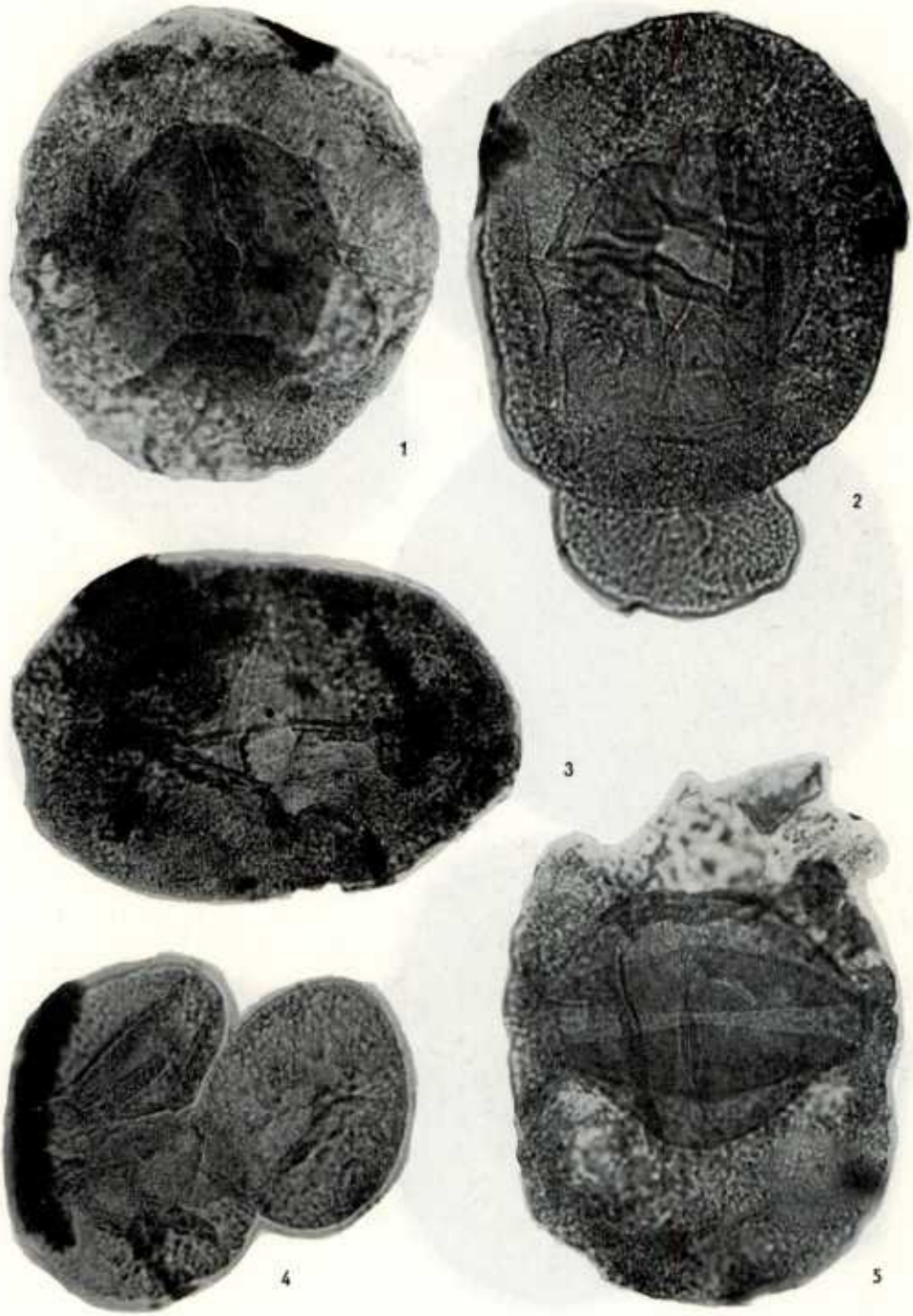
Pl. XX

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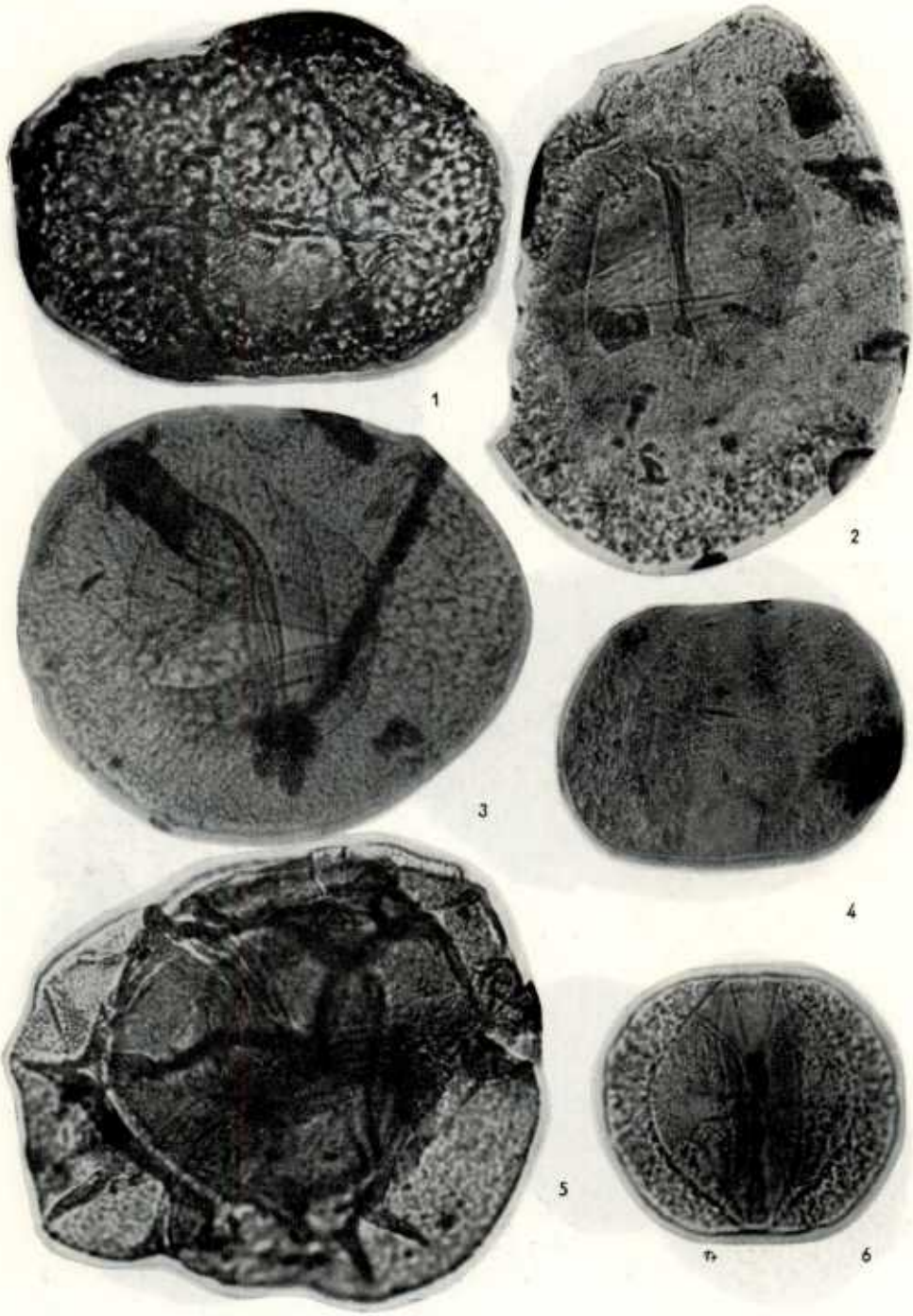
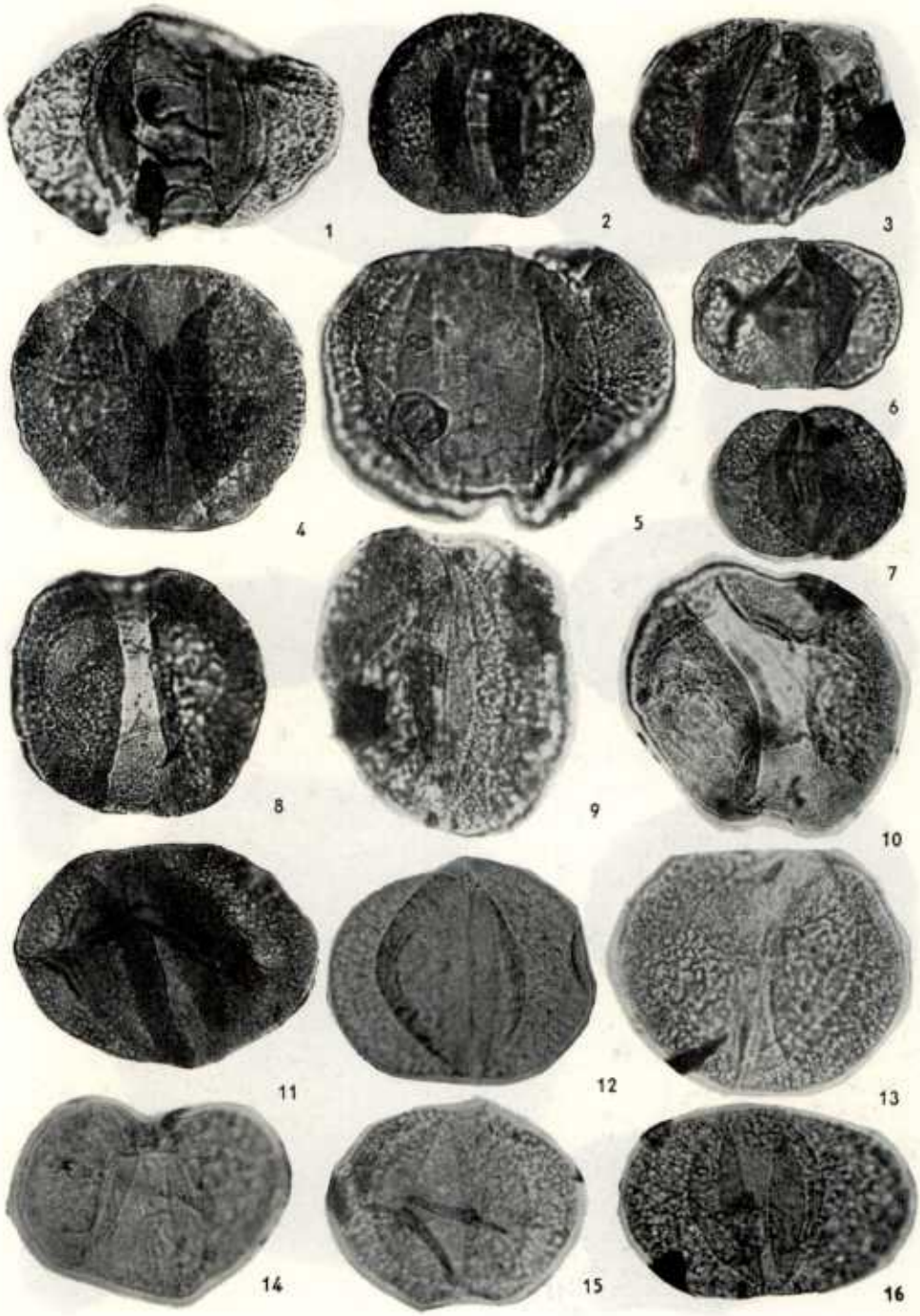
Pl. XXII

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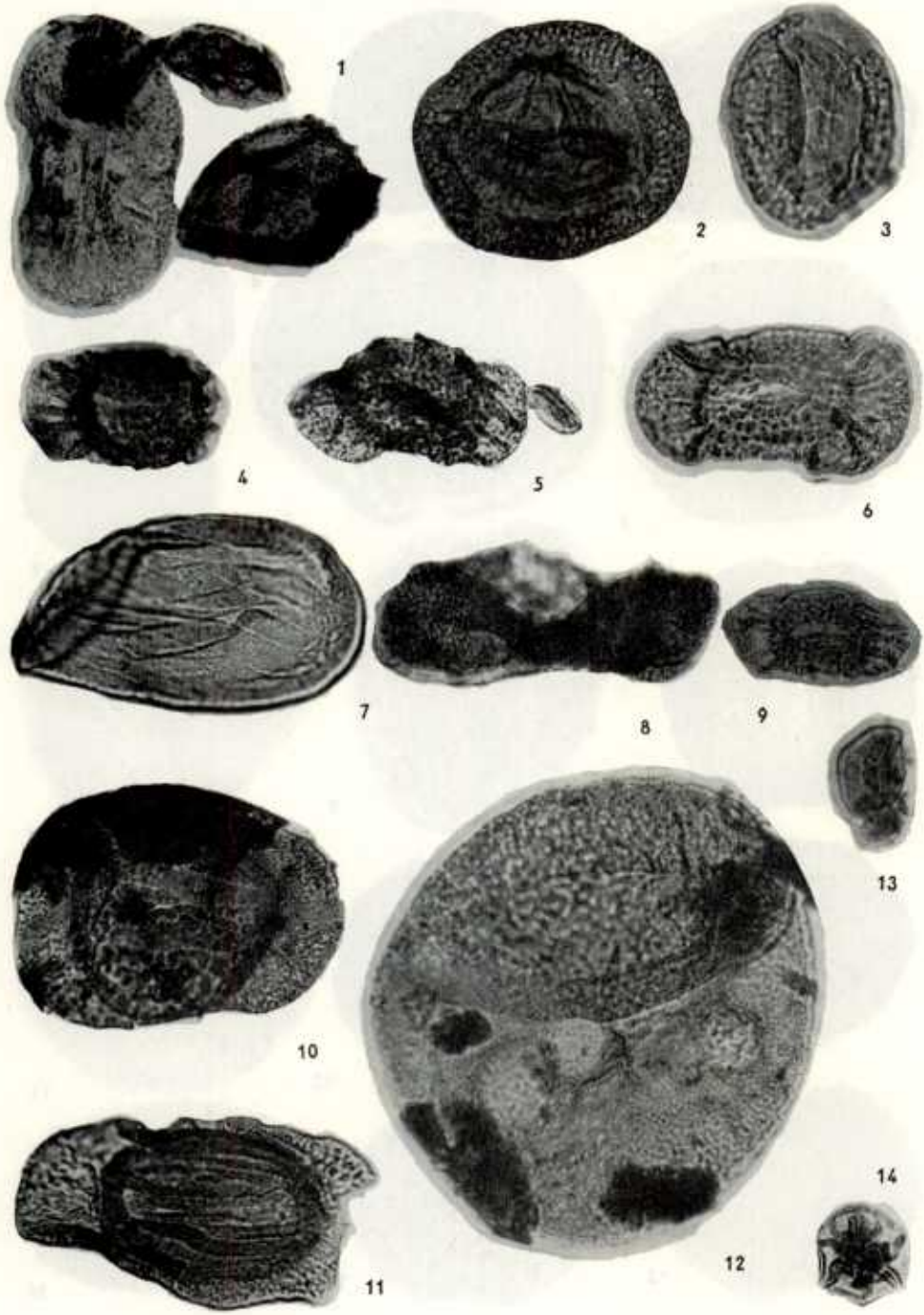
Pl. XXIV



16. *Apiculatasporites spinulistratus*, 7 MB-5/1, CLXXI/34.
17. *A. spinulistratus*, 5 MB-5/1, CLXXI/20.
18. *A. spinulistratus*, 5 MJ-8/1, CLXXIV/30.

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Pl. VII

1. *Apiculatisporis variusetosus*, 3 MB-9/2, CLXXIII/37.
2. *A. variusetosus*, 8 MB-5/3, CLXXII/17.
3. *A. variusetosus*, 5 MJ-8/1, CLXXIV/37.
4. *Planisporites* sp., 4 MB-9/2, CLXXIV/4.
5. *P.* sp., 4 MB-9/2, CLXXIV/4.
6. *P.* sp., 2 MB-5/2, CLXX/X2.
7. *Gillespieisporites discoideus*, 52 MJ-1, CIX/55.
8. *Microreticulatisporites* sp., 5 MJ-8/1, CLXXIV/32.
9. *Gillespieisporites* sp., 9 MJ-10/5, CXXX/6.

×500

Pl. VIII

1. *Raistrickia* sp., 11 MB-5/2, CLXXII/39.
2. *R. superba*, 7 MJ-10/2, CXXX/58.
3. *R. superba*, 8 MJ-10/2, CXXX/48.
4. *R.* cf. *fibrata*, 8 MJ-7/2, CXXV/29.
5. *R.* cf. *superba*, 1 MB-7/4, CLXXXI/26.
6. *R.* sp. A, 2 MB-7j1, CLXXX/8.
7. *R.* sp. B, 8 MJ-7/3, CXXV/85.
8. *R.* sp. B, 8 MJ-10/2, CXXV/25.
9. *R.* cf. *crinita*, 2 MB-7/2, CLXXX/16.
10. *R. aculeolata*, 8 MJ-10/3, CXXV/89.
11. *R. aculeolata*, 1 MB-7/4, CLXXXI/24.
12. *R.* cf. *lacerata*, 2 MB-5/1, CLXIX/37.
13. *R. lacerata*, 1 MB-3/1, CLXXIV/39.
14. *R.* sp. B, 8 MJ-7/2, CXXV/15.
15. *R.* sp. B, 8 MJ-7/2, CXXV/13.
16. *R.* sp. B, 1 MJ-8/4, CLXXIV/24.
17. *R. lacerata*, 1 MJ-7/1, CXXIV/76.
18. *R.* sp. B, 9 MJ-10/5, CXXX/4.
19. *R. solaris*, 7 MJ-7/2, CXXVI/21.

×500

Pl. IX

1. *Raistrickia aculeolata*, 7 MB-5/1, 1LXXI/37.
2. *R. aculeolata*, 8 MB-5/1, CLXXII/13.
3. *R. aculeolata*, 1 MB-7/4, CLXXXI/27.
4. *R. aculeolata*, 1 MJ-8/1, CLXXIV/10.
5. *R. aculeolata*, 1 MB-7/1, CLXXV/27.
6. ?*R.* cf. *baculata*, 2 MJ-7/4, CXXV/5.
7. *R.* cf. *dispar*, 1 MB-21/2, CLXXV/37.
8. *R. crinita*, 7 MB-5/1, CLXXII/5.
9. *R.* cf. *dispar*, 12 MB-5/3, CLXXIII/10.
10. *R.* cf. *dispar*, 7 MB-5/1, CLXXII/3.
11. *R.* cf. *crocea*, 2 MB-7/3, CLXXX/21.
12. *R. aculeata*, 8 MJ-10/1, CXXIX/13.

13. *R. aculeata*, 8 MJ-7/3, CXXX/31.
14. *R.* cf. *aculeolata*, 7 MB-25, CCXXIV/62.
15. *R.* cf. *aculeolata*, at higher focus, 7 MB-25, CCXXIV/63.
16. *R.* cf. *aculeolata*, at higher focus, 7 MB-25, CCXXIV/64.
17. *R.* cf. *aculeolata*, at higher focus, 7 MB-25, CCXXIV/65.

×500

Pl. X

1. *Microreticulatisporites nobilis*, 3 MB-3/3, CLXXV/16.
2. *M. nobilis*, 8 MJ-7/1, CXXIV/40.
3. *M. nobilis*, 12 MJ-7/2.
4. *M. nobilis*, 11 MJ-7/3, CXXVI/65.
5. *Convolutispora* sp. 2 PEPPERS, 2 MJ-8/2, CLXXIV/28.
6. *C.* sp. B, 5 MB-5/5, CLXXI/25.
7. *C.* sp. B, 5 MB-5/5, CLXXI/26.
8. *C.* sp., 3 MB-5/1, CLXX/18.
9. *C.* sp., 3 MB-5/2, CLXX/22.
10. Undetermined spore, 3 MB-5/1, CLXX/17.
11. *Dictyotriletes mediareticulatus*, 1 MB-6/2, CLXXIV/7.
12. *Savitrisporites maius*, 2 MB-3/2, CLXXV/10.
13. *Microreticulatisporites* sp., 2 MB-5/3, CLXX/3.
14. *Verrucosisporites* cf. *compactus*, 9 MJ-10/1, CXXX/28.
15. *Reticulatiosporites lacunosus*, 3 MJ-10/5, CXXIX/33.
16. *R. lacunosus*, 2 MB-3/1, CLXXV/7.
17. *R. muricatus*, 3 MJ-10/3, CXXIX/51.

×500

Pl. XI

1. *Triquitrites bucculentus*, 9 MB-5/3, CLXXII/31.
2. *T. bucculentus*, 9 MB-5/3, CLXXII/39.
3. *T. bucculentus*, 2 MB-5/4, CLXIX/9.
4. *T. exiguus*, 12 MB-5/4, CLXX/11.
5. *T. exiguus*, 11 MJ-7/2, CXXVI/85.
6. *T. exiguus*, 1 MB-7/5, CLXXX/30.
7. *T. bransonii*, 7 MJ-7/1, CXXV/43.
8. *T. bransonii*, 3 MJ-1/L, CXII/33.
9. *T. bransonii*, 3 MB-3/1, CLXXV/13.
10. *T. bransonii*, 1 MB-9/4, CLXXIII/20.
11. *T. bransonii*, 2 MB-7/2, CLXXX/17.
12. *T.* sp., 2 MB-7/2, CLXXX/15.
13. *T.* cf. *bransonii*, 12 MJ-7/2, CXXVII/77.
14. *T.* cf. *bransonii*, 1 MJ-7/2, CXXIV/90.
15. *T.* cf. *bransonii*, 1 MJ-7/2, CXXIV/2.
16. *T.* cf. *bransonii*, 12 MJ-7/2, CXXVII/65.
17. *T.* cf. *bransonii*, 12 MJ-7/1, CXXVI/51.
18. *T.* cf. *bransonii*, 2 MB-7/2, CLXXX/9.
19. *T.* sp., 11 MB-5/4, CLXXIII/4.
20. *Gillespieisporites* sp., 1 MJ-7/1, CXXIV/20.
21. *G.* sp., 1 MJ-7/2, CXXIV/8.
22. *T.* cf. *subspinosus*, 9 MB-5/3, CLXXIII/32.
23. *T. pulvinatus*, 1 MB-3/1, CLXXV/3.

24. *T.* sp. A, 11 MB/5/4, CLXXIII/4.
25. *T.* sp. A, 1 MJ-7/1, CXXIV/20.
26. *Firmysporites irregularis*, 1 MJ-7/2, CXXIV/8.
27. *F. irregularis*, 9 MB-5/3, CLXXII/32.
28. *Triquitrites* sp., 1 MB-3/1, CLXXV/3.
29. *Gillespieisporites spinosus*, 12 MJ-7/3, CXXVII/57.
30. *G. spinosus*, 1 MB-7/1, CLXXXI/23.
31. *Triquitrites verrucosus* et *Lycospora* sp., 1 MJ-7/2, CXXIV/6.
32. *T. verrucosus*, 1 MJ-7/2, CXXIV/4.
33. *T. verrucosus*, 12 MJ-7/1, CXXVI/45.
34. *Ahrensisporites* sp., 8 MJ-10/2, CXXX/54.
35. *Westphalensisporites irregularis*, 5 MB-5/4, CLXXI/27.
36. ?*Ahrensisporites* sp., 4 MB-5/1, CLXX/38.
37. ?*Firmysporites* sp., 8 MJ-10/3, CXXX/44.
38. *Densosporites sphaerotriangularis*, 8 MB-5/2, CLXXII/14.

×500

Pl. XII

1. *Lycospora pseudoannulata*, 12 MJ-7/1, CXXVI/59.
2. *L. pseudoannulata*, 12 MJ-7/2, CXXVII/89.
3. *L. punctata*, 8 MJ-7/2, CXXIV/54.
4. *L. punctata*, 11 MJ-7/3, CXXVI/73.
5. *L. punctata*, 8 MJ-7/1, CXXIV/48.
6. *L. brevijuga*, 11 MJ-7/2, CXXVI/89.
7. *L. brevijuga*, 12 MJ-7/1, CXXVI/41.
8. *L. pusilla*, 12 MJ-7/1, CXXVI/33.
9. *L. brevijuga*, 3 MJ-7/1, CXXV/59.
10. *L. brevijuga*, 2 MJ-7/2, CXXV/79.
11. *L. pusilla*, 8 MJ-7/2, CXXIV/44.
12. *L. pusilla*, 11 MJ-7/3, CXXVI/67.
13. *L.* sp., 3 MJ-7/1, CXXV/55.
14. *L.* sp., 11 MJ-7/2, CXXVI/81.
15. *Stenozonotriletes lycosporoides*, 12 MJ-7/1, CXXVI/43.
16. *L. parva*, 11 MJ-7/1, CXXVI/3.
17. *L. parva*, 2 MJ-7/1, CXXIV/68.
18. *L. parva*, 11 MJ-7/3, CXXVI/71.
19. *L. subjuga*, 2 MJ-7/1, CXXIV/66.
20. *L. subjuga*, 11 MJ-7/3, CXXVI/69.
21. *L.* cf. *pressoides*, 2 MJ-7/2, CXXVI/75.
22. *L.* cf. *pressoides*, 12 MJ-7/1, CXXVI/53.
23. *Crassispora kosankei*, 18 MJ-1/2, CXII/9.
24. *Vestispora quaesita*, 2 MB-7/2, CLXXX/14.
25. *V. quaesita*, 1 MB-6/1, CLXXIV/5.
26. *V. quaesita*, 12 MJ-7/3, CXXVII/59.
27. *Cadiospora magna* f. *maior*, 2 MJ-8/4, CLXXIV/26.
28. *C. butterworthi*, 25 MJ-2/3, CII/57.
29. Undetermined spore, 12 MB-5/3, CLXXIII/8.
30. *Vestispora fenestrata*, 6 MJ-10/1, CXXX/74.
31. Underermined spore, 1 MB-20/1, CLXXV/17.
32. ?*Cadiospora* sp., 6 MJ-7/3, CXXV/3.

×500

Pl. XIII

1. *Cadiospora magna* f. *maior*, 4 MB–21/1, CLXXV/39
2. *C. magna* f. *maior*, 4 MB-21/1, CLXXV/38.
3. *C. magna* f. *maior*, 1 MJ-8/4, CLXXIV/21.
4. *C. magna* f. *maior*, 1 MB-7/4, CLXXXI/25.
5. *C. magna* f. *maior*, 10 MJ-10/1, CXXX/22.
6. *C. magna* f. *maior*, 1 MJ-8/1, CLXXIV/11.

× 500

Pl. XIV

1. *Gillespieisporites spinosus*, 1 MJ-7/3, CXXIV/82.
2. *G. spinosus*, 1 MJ-7/3, CXXIV/86.
3. *G. spinosus*, 7 MJ-7/1, CXXV/37.
4. *G. spinosus*, 1 MJ-7/3, CXXIV/80.
5. *G. discoideus*, *Endosporites formosus* et *Punctatosporites* sp., 50 MJ-1/1, CVIII/49.
6. *G.* sp. forma *gulaferus*, 9 MB-5/2, CLXXII/25.
7. *G. discoideus*, 11 MB-5/2, CLXXII/3.
8. *G. discoideus*, 5 MB-5/1, CLXXI/19.
9. *G. discoideus*, 2 MB-3/2, CLXXV/8.
10. *G. discoideus*, 1 MJ-7/2, CXXIV/7.
11. *G. discoideus*, 7 MB-5/5, CLXXII/7.
12. *G. discoideus*, 7 MB-5/1, CLXXII/6.
13. *G. spinosus*, 6 MB-5/2, CLXXI/31.
14. *G. spinosus*, 8 MJ-10/2, CXXX/5.
15. *G. spinosus*, 1 MJ-7/3, CXXIV/78.
16. *Mooreisporites* cf. *inusitatus*, 2 MB-5/4, CLXX/10.
17. *M.* cf. *inusitatus*, 3 MB-5/2, CLXX/23.
18. *M.* cf. *inusitatus*, 7 MB-5/1, CLXXIXXI/33.
19. *M. inusitatus*, 7 MB-5/1, CLXXI/XXXIII.

× 500

Pl. XV

1. *Vestispora costata*, 9 MJ-10/4, CXXX/8.
2. *V. costata*, 8 MJ-7/4, CXXV/9.
3. *V. costata*, 5 MJ-10/4, CXXX/86.
4. *V. costata*, 3 MB-5/3, CLXX/29.
5. *V. costata*, 8 MB-5/3, CLXXII/20.
6. *V. costata*, 2 MB-9/2, CLXXIII/27.
7. *V. costata*, 11 MJ-7/1, CXXVI/5.
8. *V. costata*, 1 MB-9/4, XCLXXIII/16.
9. *V.* cf. *profunda*, 2 MJ-7/1, CXXIV/65.
10. *V.* cf. *profunda*, 11 MJ-7/1, CXXVI/7.
11. *V.* cf. *profunda*, 4 MB-5/1, CLXXI/5.
12. Undetermined spore, 1 MB-9/2, CLXXIII/13.
13. *V. fenestrata*, 16 MJ-10/1, CXXX/74.
14. *V. fenestrata*, 7 MB-5/1, CLXXII/1.
15. *V. costata*, 9 MB-9/2, CLXXIII/29; magnification 250 ×.

× 500 unless otherwise stated.

Pl. XVI

1. *Angulisporites* sp., 8 MJ-7/3, CXXV/83.
2. *Cirratriradites saturni*, 7 MJ-7/1, CXXVI/23.

3. *C. saturni*, MJ-1 (600. 60—600.90 m)5, CXII/64.
4. *C. saturni*, 8 MJ-7/4, CXXV/5; high focus.
5. *C. saturni*, 8 MJ-7/4, CXXV/7; same specimen shown in figure 4 but low focus.
6. *Cadiospora magna* f. *minor*, 8 MJ-7/2, CXXIV/39 .
7. *Cirratriradites annuliformis*, 2 MB-7/2, CLXXX/12.
8. *C. annuliformis*, 25 MJ-1/3, CII/4.
9. ?*Punctatosporites* sp., MJ-1(600.60—600.90 m)5, CXI/72; high focus.
10. ?*Punctatosporites* sp., MJ-1(600.60—600.90 m)5, CXI/70; same specimen shown in figure 4 but low focus.
11. *Schopfipollenites ellipsoides*, 2 MJ-1/1, IC/43; magnification 250×.

×500 unless otherwise stated.

Pl. XVII

1. *Laevigatosporites* sp. C, 1 MJ-7/3, CXXIV/84.
2. *L.* sp. D, 3 MJ-7/3, CXXV/51.
3. *Punctatosporites speciosus*, 1 MJ-7/1, CXXIV/14.
4. *P. speciosus*, 11 MJ-7/2, CXXVI/1.
5. *P. speciosus*, 2 MB-7/2, CLXXX/19.
6. *P. speciosus*, 12 MJ-7/1, CXXVI/37.
7. *P. speciosus*, 7 MJ-7/2, CXXVI/19.
8. *P. pygmaeus*, 1 MJ-7/2, CXXIV/10.
9. *P. pygmaeus*, 8 MJ-7/1, CXXIV/52.
10. *Speciososporites minor*, 2 MB-7/2, CLXXX/3.
11. *S. minor*, 1 MB-6/4, CLXXIV/8.
12. *S. minor*, 12 MJ-7/1, CXXVI/55.
13. *S. minor*, 11 MJ-7/3, CXXVI/63.
14. *S. minor*, 7 MJ-7/1, CXXV/39.
15. *S. minor*, 12 MJ-7/1, CXXVI/39.
16. *S. minor*, 8 MJ-7/1, CXXIV/52.
17. *S. minor*, 2 MJ-7/3, CXXV/73.
18. ?*S.* cf. *triletoides*, MJ-10/2, CXXX/64.
19. *S. infrapunctatus*, 7 MJ-7/1, CXXV/45.
20. *S. infrapunctatus*, 11 MB-5/4, CXXIIII/2.
21. *Spinosporites spinosus*, 2 MB-21/2, CLXXV/34.
22. *S.* sp., 7 MJ-10/2, CXXX/66.
23. *Latosporites* cf. *globosus*, 8 MJ-7/1, CXXIV/56.
24. Undetermined, 7 MB-5/5, CLXXII/8.
25. *Hymenospora* sp., 3 MB-5/4, CLXX/35.
26. *H. paucirugosa*, 1 MB-21/2, CLXXV/24.
27. *H.* sp. A, 1 MB-3/4, CLXXV/5.
28. *Latensina* sp., 2 MB-9/2, CLXXIII/31.
29. *L.* sp., 1 MB-21/2, CLXXV/29.
30. *Sulcatisporites* sp., 1 MB-21/1, CLXXV/22.
31. *Latensina* sp., 1 MJ-7/1, CXXV/47.
32. *L.* sp., 1 MJ-8/4, CLXXIV/19.

×500

Pl. XVIII

1. *Endosporites formosus*, 1 MB-9/2, CLXXIII/12.
2. *E. formosus*, 9 MJ-7/3, CXXVI/9.
3. *Wilsonites vesicatus*, 12 MJ-7/2, CXXVII/79.

4. *W. delicatus*, 12 MJ-7/2, CXXVII/79.
5. *W.* sp., 1 MB-21/2, CLXXV/32.
6. Undetermined spore, 4 MB-21/1, CLXXV/36.
7. *Endosporites* cf. *globiformis*, 8 MJ-7/1, CXXIV/46.
8. *Wilsonites delicatus*, 8 MJ-8/4, CLXXIV/25.
9. *W.* sp., 2 MB-7/2, CLXXX/10.
10. *Endosporites* sp., 12 MB-5/1, CLXXIII/7.
11. *Wilsonites* sp., 1 MJ-8/3, CLXXIV/14.

×500

Pl. XIX

1. *Potonieisporites* sp. et *Florinites* sp., 1 MB-21/3, CLXXV/33.
2. *Candidispora* cf. *candida*, 7 MJ-10/2, CXXX/56.
3. *C.* sp., 2 MB-9/4, CLXXIII/35.
4. *Florinites similis*, 9 MJ-7/1, CXXVI/13.
5. *F. plicatus*, 9 MJ-7/3, CXXVI/11.
6. *F. plicatus*, 12 MJ-7/1, CXXVII/57.
7. *F. plicatus*, 2 MJ-7/2, CXXV/77.
8. *F. piérarti*, 2 MB-5/1, CLXIX/32.
9. *F. antiquus*, 9 MJ-10/1, CXXX/30.
10. *F.* sp., 1 MJ-8/4, CLXXIV/20; magnification 250×.
11. *F.* sp., 1 MB-9/4, CLXXIII/17.
12. *F.* cf. *mediapudens*, 2 MJ-10/2, CLXXIX/55.

×500 unless otherwise stated.

Pl. XX

1. *Florinites* cf. *diversiformis*, 1 MB-9/4, CLXXIII/22.
2. *F.* sp., 1 MJ-8/4, CLXXIV/18.
3. *F. plicatus*, 1 MB-21/3, CLXXV/33.
4. Undetermined spore, 6 MJ-10/0, CXXV/81.
5. *Potonieisporites* sp. et undetermined saccate spore, 1 MJ-8/3, CLXXIV/13.

×500

Pl. XXI

1. *Potonieisporites* sp., 1 MB-6/2, CLXXIV/6.
2. *P. novicus* forma *grandis*, 2 MJ-7/2, CXXV/67.
3. *P. novicus*, 2 MB-20/2, CLXXV/19.
4. Tetrad of *Florinites mediapudens*, 2 MD-9/3, CLXXIII/33.
5. *Potonieisporites novicus* forma *grandis*, 12 MJ-7/2, CXXVII/75.

×500

Pl. XXII

1. *Potonieisporites novicus*, 2 MJ-1/1, IC/47.
2. *P. novicus* forma *grandis*, 3 MB-9/4, CLXXIII/40.
3. *P. novicus* forma *grandis*, 1 MB-9/5, CLXXIII/18.
4. *Limitisporites* sp., 4 MB-9/1, CLXXIV/2.
5. Undetermined saccate spore, 9 MJ-7/1, CXXVI/15.
6. *Limitisporites* sp., 3 MJ-10/3, CXXIX/45.

×500

Pl. XXIII

1. *Kosankeisporites* sp. A, 8 MJ-7/2, CXXV/19.
2. *Limitisporites* sp. A, 9 MJ-10/3, CXXIX/43.

3. *L.* sp. A, 1 MB-21/1, CLXXV/21.
4. *L.* sp., 3 MJ-10/3, CXXIX/47.
5. *Kosankeisporites* sp. A, 8 MJ-10/5, CXXX/38.
6. *Alisporites* sp. A, 3 MJ-10/1, CXXIX/37.
7. *A.* sp. A, 12 MJ-7/2, CXXVII/1.
8. *Vesicaspora* sp. A, 7 MJ-10/2, CXXX/60.
9. ?*Kosankeisporites* sp., 1 MB-9/1, CLXXIII/11.
10. *Vesicaspora* sp. A, 1 MB-9/4, CLXXIII/21.
11. *Illinites* sp. A, 3 MJ-10/4, CXXV/39.
12. *I.* sp. A, 4 MB-9/1, CLXXIV/1.
13. *I.* sp. A, 4 MB-5/1, CLXX/39.
14. *I.* sp. A, 2 MB-5/5, CLXX/16.
15. *I.* sp. A, 3 MB-5/3, CLXX/32.
16. *I.* sp. A, 1 MJ-8, CLXXIV/22.

×500

Pl. XXIV

1. Undetermined spores, 1 MJ-8/4, CLXXIV/23; ×250.
2. ?*Potonieisporites* sp., 12 MJ-7/2, CXXVII/81.
3. *Wilsonites* sp., 1 MJ-8/3, CLXXIV/15.
4. *Tumoripollenites* sp. A, 12 MJ-7/2, CXXVII/65.
5. *T.* sp. A, 11 MJ-7/2, CXXVI/73.
6. *T.* cf. *baccatus*, 1 MB-21/2, CLXXV/23.
7. *Vittatina* sp., 12 MJ-7/1, CXXVI/31.
8. Undetermined disaccate spore, 1 MB-21/2, CLXXV/25.
9. *Tumoripollenites* sp. A, 5 MB-5/4, CLXXI/28.
10. ?*Kosankeisporites* sp. A, 11 MJ-7/2, CXXVI/83.
11. ?*Protohaploxypinus* sp., 3 MJ-10/1, CXXX/57.
12. Undetermined monosaccate spore, 2 MB-9/2, CLXXIII/30.
13. *Punctatisporites* sp. et *Sporonites* sp., 9 MB-5/1, CLXXII/27.
14. *Variouxisporites* sp., 1 MB-7/4, CLXXXI/28.

×500 unless otherwise stated.

Palynologie nýřanských vrstev mšenské pánve (vestfál D)

(*Résumé anglického textu*)

MILADA KALIBOVÁ

Předloženo 9. dubna 1985

V předložené práci jsou systematicky zpracovány disperzní spory z uhelných slojí nýřanských vrstev mšenské pánve, které jsou nazývány vavřinečské souslojí (1982). Byly získány z materiálu vrtů provedených Ústředním ústavem geologickým. Jde vesměs o známé rody a druhy miospor a megaspor, příp. o druhy s nimi srovnatelné, a o 11 dalších druhů miospor, které byly nově popsány, ale nepojmenovány. Botanická příbuznost je uvedena jen u těch rodů, které nebyly zastoupeny v mělnických slojích jelenických vrstev mšenské pánve (KALIBOVÁ 1978).

Pokud jde o kvantitativní zastoupení miospor, dominuje v nich rod *Lycospora* se 44 procenty. Hojně se uplatňují rody *Laevigatosporites* a *Punctatosporites*, které oba dosahují v průměru 11,9 procent. Významné zastoupení mají i rody *Calamospora* (5,5 %) a *Triquitrites* (5,7 %). V některých polohách ve slojích dochází k nahromadění megaspor druhu *Valvisisporites auritus* a miospor druhu *Endosporites formosus*. K dalším běžně se vyskytujícím rodům patří *Vestispora* s druhy *V. costata*, *V. fenestrata* a *V. quaesita* (3 %). Druh *Cirratriradites saturni* jen zřídka přesahuje jedno procento, často i chybí. Jen v některých polohách rod *Puctatisporites* dosahuje tří a *Florinites* sedmi procent. Disakátní spory jsou běžné v nejvyšších slojích.

Z megaspor je nejrozšířenějším druhem *Lagenoisporites rugosus* a místy i *Triangulatisporites triangulatus*, běžnými druhy jsou i *Calamospora* sp. a *Cystosporites giganteus*. Omezené zastoupení, avšak stratigrafický význam mají druhy *Laevigatisporites glabratus* a *Triletisporites tuberculatus*.

Miospory druhů *Torispora securis* a *Thymospora* spp., jakož i megaspora druhu *Tuberculatisporites mamillarius*, typická pro spodnější souslojí našeho vestfálu D, se ve slojích mšenské pánve vůbec nevyskytují.

Uhelné sloje v mšenské pánvi mají značně vysokou pozici v nýřanských vrstvách. Obdobné postavení v nich mají i příslušná souslojí v pánvích kladenské, plzeňské, manětínské i roudnické. Jsou s nimi palynologicky dobře korelovatelné také uhelné sloje ve svrchních svatoňovických vrstvách v pánvi vnitrosudetské.

Vavřinečské souslojí náleží z hlediska palynologického zónování do svrchní zóny, kterou označujeme LG-PS podle megasporového druhu *Laevigatisporites glabratus*

a miosporového druhu *Punctatosporites speciosus*, který je společně s dalšími druhy tohoto rodu a hlavně pak přechodnými formami k rodům *Cyclogranisporites* a *Speciososporites* pro svrchní zónu typický.

Палинология ныржанских слоев (вестфал D) Мшенского бассейна

Ныржанские слои, угленосная единица нижней серой свиты каменноугольных отложений в средней Чехии, изучались палинологически в Мшенском бассейне. В угольных пластах, называемых здесь вавржинечской свитой пластов, установлено и изучено палинологически богатое сообщество миоспор и мегаспор. Описано, однако, таксономически не названо, 11 вероятно новых видов миоспор, остальные из установленных относятся к описанным уже раньше видам или же с ними сопоставляются.

Přeložil A. Kříž