

RAJMAHALISPORA, A NEW CINGULATE SPORE GENUS FROM THE TRIASSIC OF RAJMAHAL BASIN, INDIA

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ABSTRACT

A new trilete-bearing cingulate miospore genus with rugulate ornamentation from the Triassic sediments of Rajmahal Hills, India is described.

Key-words — Palynology, *Rajmahalispora*, Rajmahal Basin, Triassic (India).

सारांश

राजमहल द्रोणी (भारत) के त्रिसंधी कल्प से एक नवीन मेखलित बीजाणु वंश : राजमहलिसपोरा - राम शंकर तिवारी, अर्चना त्रिपाठी एवं प्रमोद कुमार

भारत में राजमहल पहाड़ियों के त्रिसंधी अवसादों से उपलब्ध रूगीय अलंकरण से युक्त एक नवीन त्रिसंधीय मेखलित बीजाणु वंश का इस शोध-पत्र में वर्णन किया गया है।

INTRODUCTION

PALYNOLOGICAL record known from the Upper Gondwana horizons of Rajmahal Basin, India is meagre. Rao (1953) and Vishnu-Mittre (1954) described few spore-types from thin sections of Nipania Chert. Sah and Jain (1965) studied the *sporae dispersae* from Basko and Sakrigali Ghat assigning the microfossils a Jurassic age, but no record of the Triassic palynomorphs is yet available from this area. As regards the trilete, cingulate miospore genera from the Triassic sediments in other basins, a few on record are: *Lundbladispora* Balme, 1963: emend. Playford, 1965; *Densosporites* Weyland & Krieger, 1953 emend. Bharadwaj & Kumar, 1976; *Cingulizonates* Dybova & Jachowicz, 1957 emend. Butterworth, Jansonius, Smith & Staplin, 1964; *Densosporites* Berry, 1937 emend. Butterworth, Jansonius, Smith & Staplin, 1964 and *Discisporites* Leschik, 1955 emend. de Jersey, 1964. The presently described taxon is an addition to the above mentioned group of cingulate sporomorphs.

The present communication is based on the study of material from a bore-hole from the north-eastern part of Rajmahal Basin. This bore-hole (No. RJR-2) was drilled

by the Coal Division, Geological Survey of India. The samples were processed by usual maceration method using hydrofluoric acid and nitric acid followed by suitable alkali, as and when required. The excess of silica of the shale samples was removed by the heavy-liquid (Iodide solution) separation method.

SYSTEMATIC DESCRIPTION

Anteturma—*Proximegerminantes* Potonié, 1975

Turma — *Zonales* Bennie & Kidston, 1886 emend. Potonié, 1956

Subturma — *Zonotriletes* Waltz, 1935

Infraturma — *Cingulati* Potonié & Klaus, 1954 emend. Dettmann, 1963

Genus—*Rajmahalispora* gen. nov.

Type species — *Rajmahalispora rugulata* sp. nov.

Generic Diagnosis — Cingulate, trilete miospores with rugulate exine, rugulae sometimes anastomose to form reticulation. Central body distinct. Cingulum smooth, unstructured, not massive in construction, usually denser towards the peripheral region. Inner body not seen.

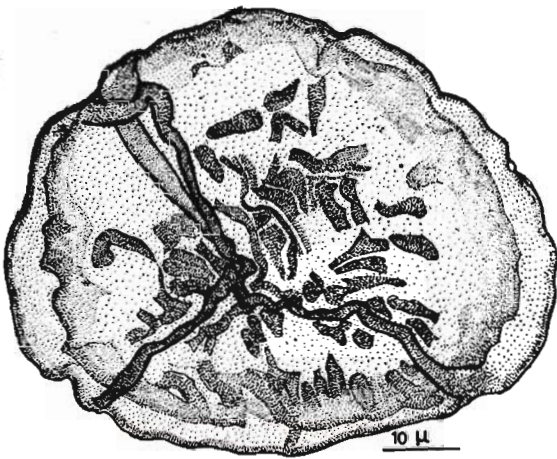
Description—Cingulate miospores, triangular to subtriangular, mostly the latter shape prevailing. Trilete mark usually distinct, in some cases may be less distinct; rays usually with thin lips, may be slightly elevated, sometimes associated with fold or parallel ridge, sinuous, reaching up to the equatorial margin of the spore (Pl. 1, figs 2, 6; Text-fig. 1). In some cases the trilete rays appearing to bifurcate at their ends forming a curvature-like structure; in others the contact area being not well-defined. Central body distinct, conforming to the overall shape of the specimen, equatorially thickened. Cingulum distinct, well developed equatorial in position (Text-fig. 2A, B), never massive in nature, its outer-half being thicker than the inner one. Exine generally plain on the proximal side but bearing rugulae of different shapes and sizes on the distal surface of the body as well as the cingulum; proximally rare and low ridges seen, rugulae may be straight, curved or wavy, simple, bifurcated (Pl. 2, figs 10-12) or forming reticuloid pattern (Pl. 1, figs 8, 9) densely or sparsely disposed. Under SEM the rugulae appearing to be uneven in thickness and showing low conical projections (Pl. 4, figs 30, 31). Exine of the body and cingulum in most of the specimens unstructured; some indeterminate faint structures seen in a few specimens (Pl. 1, fig. 2); *extrema lineamenta* smooth.

Comparison—It is, thus, evident from the above observations that this genus is characterized by the rugulate-reticuloid pattern of ornamentation, equatorial cingulum of simple nature and unstructured exine.

From amongst the comparable forms, the genus *Addosporites* erected by Scott, in 1971, although resembles the genus *Rajmahalispora* gen. nov. in having rugulate-verrucate pattern of muri, differs in having a massive cingulum and complex trilete ridges bearing small, isolated or joined verrucae. However, this group of spores was latter described under the genus *Interulobites* Paden Phillips (in Paden Phillips & Felix, 1971) by Scott himself. *Interulobites* too differs from the present genus in having massive distal ornament elements which more or less fuse with each other, more so at the equator, heavy trilete rays with very broad lips and wide thickend, undemarcated cingulum (see Type specimen—Brenner, 1963; pl. 17, fig. 3).

The genus *Densoisporites* Weyland & Krieger, 1953 emend. Dettmann, 1963 is not comparable with the present genus because the former includes un-ornamented spores. However, Scott (1976) illustrated few specimens under two species of this genus, viz., *Densoisporites perinatus* Couper 1958 and *D. corrugatus* Archangelsky & Gamero, 1956 which apparently are comparable with the present genus, but a critical assessment of the photomicrographs and the description reveal that these two species differ in having spongy structured exine, massive cingulum and an inner body—and hence they differ.

The genus *Calliasporites* Sukh Dev, 1961 emend. Bharadwaj & Kumar, 1976 apparently resembles *Rajmahalispora* in shape, size and general appearance. However, *Calliasporites* is a monosaccate pollen, with trinotched tendency (Pl. 4, fig. 33), with microsculptured exine (Pl. 4, fig. 34) and subequatorially attached frilled saccus with generally radial folds indicating its vesiculate nature. On the contrary, the new genus described here is a cingulate trilete spore with rugulate, unstructured exine (Pl. 2, figs 10-13) having distinct equatorial development of the cingulum. Thus, we are dealing with separate organization. Only apparent resemblance is due to a tendency in *Rajmahalispora* gen. nov.



TEXT-FIG. 1—*Rajmahalispora rugulata* gen. et sp. nov. showing the nature of trilete mark and rugulae.

in which the cingulum becomes slightly narrower at the angles, that too in the quasi-laterally flattened specimens (Pl. 1, fig. 1; Pl. 3, figs 20, 23); this gives a trinotched look to the outline seemingly comparable with some species of *Callialasporites*. But the differences are well-defined as enumerated above.

Rajmahalispora rugulata sp. nov.

Pl. 1, figs 1-5; Pl. 2, figs 10-13; Pl. 3, figs 16, 17-25;
Text-fig. 1

Holotype — Pl. 1, figs 1-3; slide no. BSIP 8089.

Isotype — Pl. 1, figs 4, 5; slide no. BSIP 8089.

Locus Typicus — Bore-hole RJR-2, sample no. 108, depth 836-842 m, Rajmahal Basin, India.

Age & Horizon — Triassic, Dubrajpur Formation.

Diagnosis — Triangular to subtriangular miospores, Y-mark distinct, rays with thin lips 1 to 2 μm wide, slightly elevated, sinuous, reaching up to outer margin of cingulum, sometimes associated with narrow folds. In semilaterally preserved specimens, Y-rays appearing to exhibit area contagionis at their ends, hence at times a notched condition simulated. Central body distinct conforming to the overall shape, thickened equatorially. Exine proximally as well as distally rugulate, rugulae dense; of various

shapes and sizes, straight, curved or wavy, simple or bifurcated, 3 to 2 μm in length and 2 to 3 μm in width. Scanning electron micrographs showing uneven thickening of rugulae with conic-like small projections sparsely disposed on rugulae. Cingulum well-defined, 2.5 to 8 μm wide, never massive, outer-half along periphery thicker than inner one, equatorial thickening limb-like in appearance, less than 1 μm wide. Exine of central body and cingulum unstructured. Inner body not seen.

Dimensions — Overall spore 62-70 μm , holotype 69.5 μm ; central body 50.5-60 μm .

Rajmahalispora triassicus sp. nov.

Pl. 1, fig. 6; Pl. 3, figs 14, 26; Pl 4, fig. 32;
Text-fig. 3A

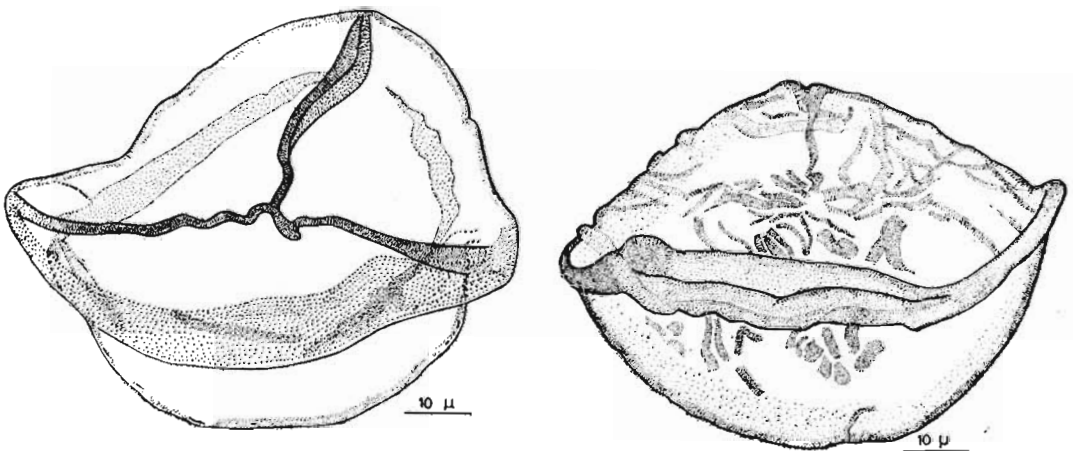
Holotype — Pl. 1, fig. 6; slide no. BSIP 8088.

Isotype — Pl. 3, fig. 26; slide no. BSIP 8089.

Locus Typicus — Bore-hole RJR-2, sample no. 108, depth 836-842 m, Rajmahal Basin, India.

Age & Horizon — Triassic, Dubrajpur Formation.

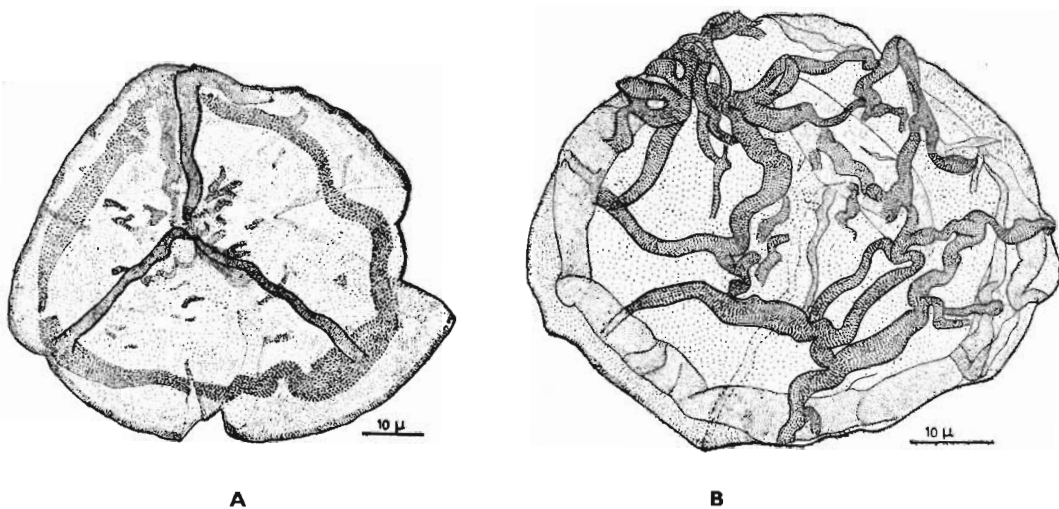
Diagnosis — Miospores triangular with convex sides and broadly rounded angles. Y-mark distinct, rays with thin lips, 0.4 to 3 μm wide, slightly elevated, sinuous,



A

B

TEXT-FIG. 2 — A, Showing the equatorial nature of cingulum in semilaterally flattened grain, and B, laterally flattened grain.



TEXT-FIG. 3 — A, *Rajmahalispora triassicus* sp. nov. showing the nature of trilete mark, central body and few rugulae; B, *Rajmahalispora reticulata* sp. nov. showing the nature of rugulae, some of which are anastomosed.

reaching cingulum, rays sometimes associated with folds. Central body distinct, conforming with overall shape of the specimens distinctly thickened equatorially. Exine proximally and distally rugulate. Rugulae sparse, very few in number may be straight, curved or wavy, simple or bifurcated, 3 to 6 μm in length and 1 to 3 μm in width, cingulum well-defined, 3 to 12.5 μm wide, never massive, outer half thicker than inner one; equatorial thickening 1.25 μm wide. Exine of central body and cingulum unstructured. Inner body not seen.

Dimensions — Overall spore 62-77 μm , holotype 68 μm ; central body 54-58.50 μm .

Comparison — The present species differs from the type species, *R. rugulata* sp. nov., in rarity and less developed nature of the rugulae.

Rajmahalispora reticulata sp. nov.

Pl. 1, figs 7-9; Pl. 3, figs 16, 27-29; Text-fig. 3B

Holotype — Pl. 1, figs 8, 9; slide no. BSIP 8087.

Isotype — Pl. 1, fig. 7; slide no. BSIP 8087.

Locus Typicus — Bore-hole RJR-2, sample no. 108, depth 836-842 m, Rajmahal Basin, India.

Age & Horizon — Triassic, Dubrajpur Formation.

Diagnosis — Subtriangular to subcircular miospores, Y-mark not very distinct. Central body conforming to overall shape, thickened equatorially. Exine proximally and distally rugulate, some rugulae anastomose to form incomplete to complete reticulum, rugulae 0.6 to 4 μm wide and 1 to 3 μm high. Cingulum well-defined, 2.5 to 4.5 μm wide, never massive, peripheral-half being thicker than inner half, limbus-like equatorial thickening less than 1 μm thick. Exine of central body and cingulum unstructured, inner body not seen.

Dimensions — Overall size 59-67 μm , holotype 59 μm . Central body size 56-59 μm .

Comparison — *Rajmahalispora reticulata* sp. nov. differs from the other two species in the nature of rugulae, some of which anastomose to form incomplete to complete reticulum.

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EXPLANATION OF PLATES

(All the slides are deposited in the BSIP Museum)

PLATE 1

- 1-5. *Rajmahalispora rugulata* gen. et sp. nov.
1. Holotype—Distal face, rugulae in focus, slide no. 8089. × 750.
2. Holotype—Proximal face showing the nature of trilete mark. × 750.
3. Holotype in Differential Phase Contrast (DPC) showing the rugulae on the distal face. × 750.
- 4, 5. Isotype—Showing the trilete mark and rugulae, slide no. 8089. × 500.
6. *Rajmahalispora triassicus* sp. nov.; Holotype, slide no. 8088. × 750.
- 7-9. *Rajmahalispora reticulata* sp. nov., slide no. 8087.
7. Isotype—Slide no. 8087. × 750.
- 8, 9. Holotype—Showing the anastomosing rugulae, slide no. 8087. × 750.

PLATE 2

- 10-13. *Rajmahalispora rugulata* sp. nov. Distal face showing the nature of rugulae. × 1500, slide nos. 8088 and 8089, Fig. 13 in DPC, slide no. 8088.

PLATE 3

14. Tetrad of spores of *Rajmahalispora*, slide no. 8089. × 500.

- 15, 16. Semi-laterally and laterally flattened grain showing the equatorial nature of the cingulum and rugulae (fig. 16) on proximal and distal face, slide no. 8088. × 500.
- 17-25. *Rajmahalisporarugulata* gen. et sp. nov. × 500.
21. Showing folds along trilete ray, fig. 20 in slide no. 8089, figs 18, 24 in slide no. 8090, figs 17, 19, 21, 22, 23, 25 in slide no. 8088.
26. *Rajmahalispora triassicus* sp. nov. showing the central body (Isotype), slide no. 8089. × 500.
- 27-29. *Rajmahalispora reticulata* sp. nov., slide nos. 8089 and 8088. × 500.

PLATE 4

- 30-32. Scanning Electron Micrographs of *Rajmahalispora*.
30. Nature of trilete mark and rugulae on proximal face. × 1550.
31. Portion of fig. 30 enlarged to show conical-like projections on the rugulae. × 3100.
32. Distal face of another specimen having small and big rugulae and the smooth cingulum.
33. *Callialasporites* showing the triradiate ridge and the saccate nature of the spore. × 750.
34. Portion of specimen in fig. 33 in DPC to show the granulose ornamentation, slide no. 8091. × 1500.

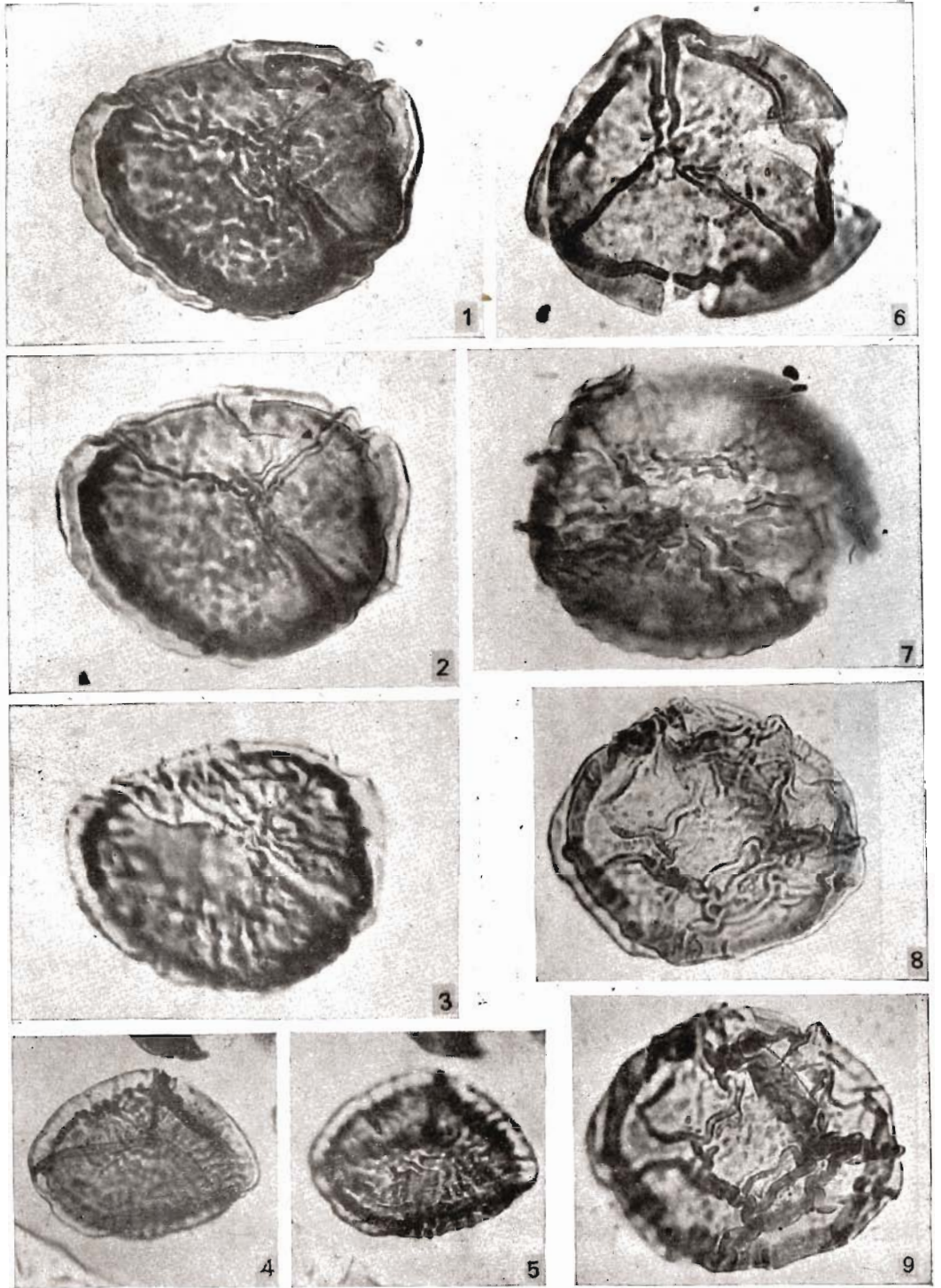


PLATE I

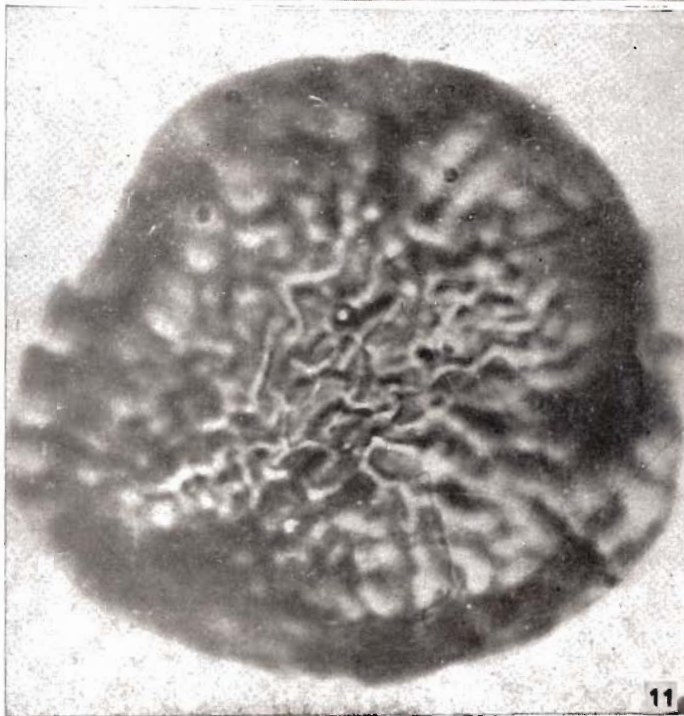


PLATE 2

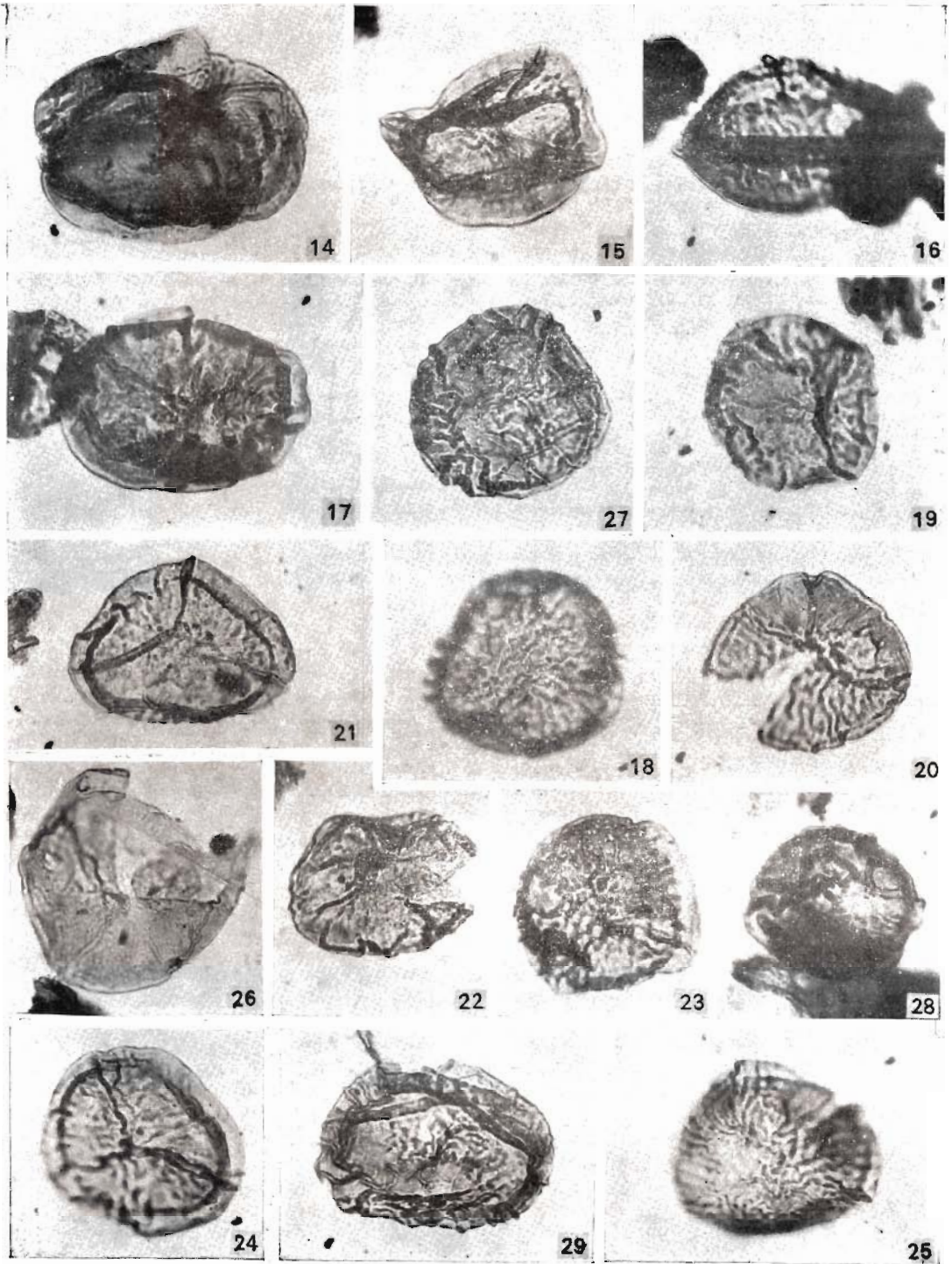


PLATE 3

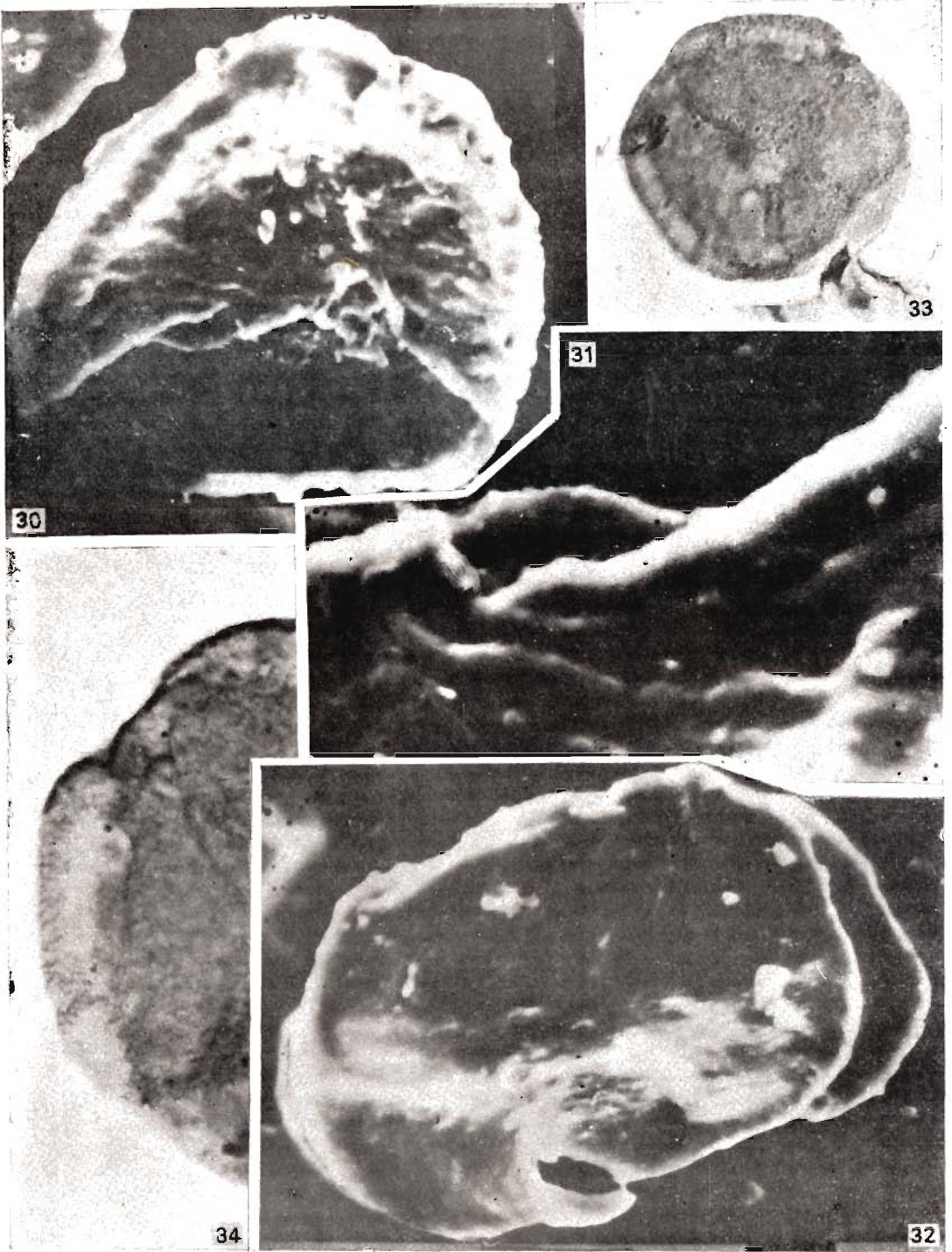


PLATE 4