SPORAE DISPERSAE FROM PANCHET (LOWER TRIASSIC) IN THE BORE-CORE NO. RE9, RANIGANJ COALFIELD, WEST BENGAL

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ABSTRACT

The present investigation deals with the dispersed spores from Panchet (Lower Triassic) in the bore-core No. RE9, located in the eastern part of Raniganj coalfield, W. Bengal. The palynological assemblage comprises 24 spores-pollen genera. Out of these 13 genera belong to trilete spores and 7 to bisaccate pollen. The assemblage is dominated by trilete and striate bisaccate pollen come next in abundance. Monolete and monosaccate are meagrely represented while colpate and polyplicates are not found in the assemblage. Three new trilete genera, viz. *Divaripunctites, Decisporis, Subverrusporis* and one new alete genus, viz. *Rimaspora,* have been instituted. In all the samples *Divaripunctites, Decisporis, Rimaspora, Stroteršporites* and *Striatopiceites* are found in good number while *Eupunctisporites, Anapiculatisporites, Subverrusporis, Discisporites, Ghoshiasporites, Densipollenites, Podocarpidites, Verticipollenites* and *Striapollenites* are meagrely represented. The present palynological assemblage has also been compared with the known Triassic assemblage of Argentina, Australia, India and Madagascar.

INTRODUCTION

PALYNOLOGICAL investigation of the Triassic sediments in India has been carried out by Srivastava and Pawde (1962), Satsangi *et al.* (1968) and Bharadwaj and Srivastava (1969). The present paper deals with the dispersed spores from Panchet (Lower Triassic) in the eastern part of Raniganj coalfield, W. Bengal. The microfossils were recovered from the bore-core No. RE9, located in Laudoha area (23°40′ and 87°20′) and comprises Raniganj (Upper Permian), Panchet and Pleistocene sediments. The bore-core was kindly supplied by Shri P. K. Ghosh, Director, Coal Division, Geological Survey of India, Calcutta.

The Raniganj stage comprises carbonaceous-grey shales and sandstone (89·35 m.-85 m.). The shales yielded a rich palynological assemblage dominated by striate bisaccate pollen grains. *Stroteršporites, Striatopiceites, Striatites* and *Verticipollenites* are quite common while the trilete spores are meagrely represented in this assemblage.

The lithology of the Panchet sediments as supplied by Geological Survey of India is as follows:

Depth (in metres)	Description	Spores-pollen present/absent
30·90-31·00	Pink shale, clayey	—
35·40-35·50	Red shale with green patches	—
48·00-48·10	Greenish, sandy clay	—
79·00-79·10	Sandstone with shale patches	—
82·10-82·15	Green shale	+
82·50-82·55	Green shale	+
83·00-83·05	Greenish-grey shale	+
84·00-84·05	Greenish-grey shale	+

DESCRIPTION

The spores-pollen recovered from these samples have been placed in the following genera:

Genus — *Biretisporites* (Delc. & Sprum.) Delc. *et al.*, 1963

Biretisporites sp.

Pl. 1, Fig. 1

Description — Spore subtriangular, 54 μ. Apices rounded, interapical margins ± convex. Trilete, rays raised, extending up to three-fourths radius; commissure well defined. Exine 1·5 μ thick, laevigate, irregularly folded.

Comparison —*Biretisporites potoniaei* Delc. & Sprum. (1955) is distinguished from the present species by its larger size and thicker exine. *A. spectabilis* Dettm. (1963) is also bigger in size and has 11-14 μ raised trilete rays. *Biretisporites* sp. described by Playford (1965) is ± subcircular in shape.

Genus — *Dictyophyllidites* (Coup.) Dettm., 1963

Dictyophyllidites decus sp. nov.

Pl. 1, Figs. 2-3

Holotype — Pl. 1, Fig. 2. Size 50 μ. Slide No. 3461.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores triangular-subtriangular, 40-68 μ. Trilete, rays well developed. Exine sculptured with verrucae-grana around haptotypic mark, laevigate at rest area.

Description — Spores mostly triangular, sometimes subtriangular in polar view. Apices rounded, interapical margins straight-convex. Trilete very well developed, rays 4-10 μ broad, extending up to equator; commissure distinct, raised. Exine 2-3 μ thick, sculptured with grana, coni and verrucae along trilete rays, may be irregularly folded.

Comparison — *Dictyophyllidites harrisii* Coup. (1958) closely resembles the present species in shape and size range but is distinguished by its laevigate exine also in the contact area. *D. surangei* Bharad. & Singh (1964) and *D. major* Bharad. & Singh (*l.c.*) are comparable to the present species in shape, size range and extension of the trilete rays but are differentiated by their non-sculptured inter-radial areas. In *D. cymbatus* Venkat. & Gócz. (1964) trilete rays extend only up to two-thirds radius. *D. pectinataeformis* (Bolkhov.) Dettm. (1963) has sculptured haptotypic area but is readily separated from the present species by its thick exine (up to 5 μ).

Genus — *Punctatisporites* (Ibr.) Pot. & Kr., 1954

Punctatisporites sp.

Pl. 1, Fig. 4

Description — Spore subcircular, 73 μ. Trilete open. Exine about 1 μ thick, irregularly folded, intrapunctate.

Comparison — *Punctatisporites leighensis* Playf. & Dettm. (1965) resembles the present species in size but is distinguished by its prominent trilete mark.

Genus — *Eupunctisporites* Bharad., 1962

Eupunctisporites sp.

Pl. 1, Fig. 5

Description — Spore subcircular, folded, 70 μ. Trilete not traceable. Exine about 1 μ thick, punctate, puncta up to 2 μ, not very closely placed, uniformly distributed, interpunctal exine laevigate.

Comparison — *Eupunctisporites poniatiensis* Bharad. (1962) has well-developed trilete and thicker exine. *E. gravus* Bharad. & Sal. (1964) has ill-developed trilete, thicker exine (4 μ) and coarse puncta. *Eupunctisporites* sp. described by Bharadwaj and Salujha (1965a) has also very thick exine (6-7 μ) and distinct trilete mark.

Genus — *Divaripunctites* gen. nov.

Type Species — *Divaripunctites globosus* sp. nov.

Diagnosis — Spores subcircular-circular in polar view. Trilete strongly developed. Exine proximally punctate, distally laevigate, with or without folds.

Description — Spores mostly subcircular, sometimes circular; when folded may take various shapes. Trilete rays well developed, 3-12 μ broad, uniform or slightly tapering at ends, raised, extending half of radius to equator; commissure distinct. Puncta on proximal side 1-2 μ, generally closely placed in inter-radial areas. Distal exine mostly irregularly folded, foldings may be a few — numerous.

Comparison — *Aulisporites* (Lesch.) Kl. (1960) resembles the present genus in shape but is distinguished by its very ill-developed trilete rays (1/7 radius) and laevigate to punctate exine on both surfaces. *Eupunctisporites* Bharad. (1962) is comparable to the present species in shape, size and strongly developed trilete but is distinguished by its punctate exine on both the surfaces. *Punctatisporites* (Ibr.) Pot. & Kr. (1954) is intrapunctate. *Calamospora* Schopf *et al.* (1944) approximates the present genus in shape and folded exine but is differentiated by its ± laevigate exine.

Divaripunctites globosus sp. nov.

Pl. 1, Figs. 6a-8

Holotype — Pl. 1, Figs. 6a-6b. Size 62 μ. Slide No. 3472.

Type Locality — Bore-core No. RE9, depth 82·5 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores subcircular-circular in polar view, 45-70 μ. Trilete strongly developed. Exine 2-4 μ thick, proximally punctate, distally laevigate.

Description — Spores mostly subcircular. Trilete, rays equal, 3-10 μ broad, ± uniform or slightly tapering at ends, extending up to three-fourths radius; commissure distinct. Puncta on proximal side distinct, ±1 μ, generally more closely placed on inter-radial areas. Distal exine laevigate and not much folded.

Divaripunctites plicatus sp. nov.

Pl. 1, Figs. 9a-10

Holotype — Pl. 1, Figs. 9a-9b. Size 50 μ. Slide No. 3464.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores subcircular-circular, 40-65 μ. Trilete well developed. Exine up to 1·5 μ thick, proximally punctate, distally laevigate, much folded.

Description — Spores mostly subcircular but may be variously shaped due to foldings. Trilete, rays 2-6 μ broad, equal, ± uniform or slightly tapering, extending up to three-fourths radius, commissure distinct. Puncta on proximal side mostly distinct, generally densely placed on inter-radial areas. Distal exine laevigate, minute folds numerous.

Comparison — *Divaripunctites globosus* closely resembles the present species in shape and size range but the latter is distinguished by its thinner and much folded exine.

Genus — *Cyclogranisporites* Pot. & Kr., 1954

Cyclogranisporites triletus sp. nov.

Pl. 1, Figs. 12-13

Holotype — Pl. 1, Fig. 13. Size 60 μ. Slide No. 3463.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores subcircular-circular, 45-70 μ. Trilete broad, raised, well developed; exine closely granulose.

Description — Spores mostly subcircular, sometimes circular. Trilete rays, 3-8 μ broad, equal, raised, extending up to three-fourths radius, gulate in some folded specimens; commissure distinct. Exine up to 2·5 μ thick, may be irregularly folded, grana ± 1 μ high, very closely placed keeping hardly any place in between.

Comparison — *Cyclogranisporites gondwanensis* Bharad. & Sal. (1964) resembles the present species in shape but is smaller in size range. *C. optimus* Bharad. & Sal. (1965a) resembles the present species in size but is distinguished by its hardly discernible trilete rays.

Genus — *Apiculatisporis* Pot. & Kr., 1956

Apiculatisporis sp. A

Pl. 1, Fig. 11

Description — Spores subcircular, 28-32 μ, folded at margin. Trilete, rays ill-developed, extending three-fourths to radius; commissure indistinct. Exine ± 1 μ thick, sculptured with coni, coni not more than 1 μ high, closely placed, evenly distributed.

Comparison — *Apiculatisporis levis* Balme & Henn. (1956a) resembles the present species in shape but the latter is distinguished by its closely spaced sculptural elements. *Apiculatisporis* sp. described by Venkatachala and Kar (1968b) is bigger in size and the coni are not so closely placed. *Apiculatisporis* sp. A described by Kar (1968b) approximates the present species in size but is differentiated by its sparsely placed, high (3-4 μ) coni. *A. bullensis* Henn. (1958) is distinguished by its thicker exine and sparsely placed coni.

Apiculatisporis sp. B

Pl. 1, Fig. 17

Description — Spore subcircular, 50 μ. Trilete, rays ill-developed, not extending more than half radius. Exine about 1·5 μ thick, sculptured with coni, coni ± 1 μ high, not very closely placed, 2-3 μ apart, evenly distributed.

Comparison — *Apiculatisporis globosus* (Lesch.) Playf. & Dettm. (1965) resembles the present species in size and shape but is separated by its well-developed trilete rays extending up to three-fourths the radius and comparatively robust sculptural elements. *Apiculatisporis* sp. A is distinguished by its smaller size and extension of the trilete rays up to the margin.

Genus — *Anapiculatisporites* Pot. & Kr., 1954

Anapiculatisporites sp.

Pl. 1, Fig. 14

Description — Spore circular, 64 μ. Trilete, rays unequal, not raised, extending

three-fourths radius. Exine 2 μ thick, proximally laevigate, strongly built coni present on distal side, coni up to 3 μ high, 3-5 μ apart, evenly distributed.

Comparison — *Anapiculatisporites cooksonae* Playf. (1965) resembles the present species in shape but the former is distinguished by its smaller size and presence of broadly based spines on distal surface.

Genus — *Osmundacidites* Coup., 1953

Osmundacidites panchetensis sp. nov.

Pl. 1, Figs. 15-16

Holotype — Pl. 1, Fig. 15. Size 70 μ. Slide No. 3468.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores circular-subcircular, 60-90 μ. Trilete. Exine with spines, papilla and coni.

Description — Spores mostly circular, sometimes irregularly folded. Trilete, rays ill-developed, hardly perceptible in most specimens; sometimes ruptures in contact area. Exine up to 2 μ thick, spines, papilla and coni interspersed with each other, sparsely placed, evenly distributed.

Comparison — *Osmundacidites wellmanii* Coup. (1953) resembles the present species in shape but differs in size range and granular-papillate sculptural elements. *O. fissus* (Lesch.) Playf. (1965) is also smaller in size range than the present species and has distinct trilete mark and granulose exine. *O. comaumensis* (Cooks.) Balme (1957) resembles the present species in size range but differs in the presence of closely spaced grana and well-developed trilete mark. *O. alpinus* Kl. (1960) is much smaller in size (25-33 μ) and has closely placed sculptural elements.

Genus — *Decisporis* gen. nov.

Type Species — *Decisporis variabilis* sp. nov.

Diagnosis — Spores triangular-subtriangular in polar view, with or without inner body. Trilete well developed. Exine proximally ± laevigate, distally variously sculptured with grana, microverrucae, coni, spines, bacula and verrucae. Exoexine may form incipient flange in some cases.

Description — Spores mostly triangular, sometimes subtriangular or subcircular forms also found. Apices rounded, interapical margins ± straight-convex. Trilete, rays strongly developed, straight or sinuous, raised, equal, ± uniformly broad, extending mostly up to margin. Commissure generally well pronounced. Inner body while found mostly ill-developed and indistinct. Exine up to 3 μ thick, exoexine may form an incipient flange in some specimens, it is translucent, not uniformly broad, inconsistent, granulose-microverrucose. Distally exine ornamented variously; spines, coni, grana-microverrucae interspersed each other, sometimes a few bacula and verrucae also found; exine may be minutely folded on distal side to appear as rugose in some cases.

Comparison — *Lukugasporites* Kar & Bose (1967) closely resembles the present genus in shape, size but is distinguished by the presence of well developed spines on distal side. *Ceratosporites* Cooks. & Dettm. (1958) is distally baculate. *Altitriletes* Venkat. & Kar (1968b) is comparable to the present genus in well-developed trilete mark and variously sculptured distal side but is differentiated by its predominantly circular shape. *Microbaculispora* Bharad. (1962), *Didecitriletes* Venkat. & Kar (1965), *Lacinitriletes* Venkat. & Kar (1965) are all associated with regular fold system along with the haptotypic mark. *Lundbladispora* (Balme) Playf. (1965) is predominantly distally sculptured but mostly circular in shape and the exoexine forms a very distinct, regular cingulum. It may be mentioned here that Balme (1963) while instituting the genus stressed on the distinct cingulum, papillate intexine and presence of sculptural elements on distal and equatorial region. *Kraeuselisporites* (Leschik) Jans. (1962) and *Indotriradites* Tiw. (1964) are distinctly cingulate and thus they are readily separated from the present genus. *Lycospora* (Schop. *et al.*) Pot. & Kr. (1954) has carina-shaped equatorial flange. *Anapicuatisporites* Pot. & Kar. (1954) has mostly coni on distal surface and the trilete is not so strongly developed as in the present genus.

Decisporis variabilis sp. nov.

Pl. 1, Figs. 18-19

Holotype — Pl. 1, Fig. 18. Size 47 μ. Slide No. 3477.

Type Locality — Bore-core No. RE9, depth 84 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores triangular-subtriangular, 38-56 μ. Trilete well developed. Exine proximally ± laevigate, distally sculptured mostly with spines; interspinal space granulose microverrucose.

Description — Spores mostly triangular, sometimes subtriangular in polar view. Apices rounded, interapical margins ± convex-straight. Trilete, rays raised, equal, uniformly broad, straight or sinuous, extending up to equator; commissure well recognizable. Incipient inner body may be present in some specimens. Exine distally spinose, some verrucae and bacula also seen, grana and microverrucae occupy the space in between them.

Decisporis panchetensis sp. nov.

Pl. 1, Figs. 22-23, 27

Holotype — Pl. 1, Fig. 22. Size 50 μ. Slide No. 3475.

Type Locality — Bore-core No. RE9, depth 82·5 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores triangular subtriangular, 40-62 μ. Trilete well developed. Exine proximally laevigate, distally sculptured mostly with grana-microverrucae.

Description — Spores mostly triangular, sometimes subtriangular in polar view. Apices rounded, interapical margins ± straight — slightly convex. Trilete, rays slightly raised, equal, uniformly broad, extending up to equator; commissure well defined. Exine up to 2·5 μ thick, grana-microverrucae closely placed on distal side, interspersed with few spines or bacula. Ill-developed inner body may be present in some specimens.

Comparison — *Decisporis variabilis* closely resembles the present species in shape and size, the latter is, however, differentiated by its mostly granulose-microverrucose sculptural elements on distal side.

Decisporis rudis sp. nov.

Pl. 1, Figs. 20-21

Holotype — Pl. 1, Fig. 20. Size 54 μ. Slide No. 3471.

Type Locality — Bore-core No. RE9, depth 82·5 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores subtriangular-triangular, 45-65 μ. Trilete well developed. Exine proximally laevtgae, distally variously sculptured, minutely folded to appear as rugose. Exoexine generally forms an incipient, inconsistent flange.

Description —Spores mostly subtriangular, sometimes triangular in polar view. Apices rounded, interapical margins convex. Trilete, rays raised, equal, uniformly broad, extending up to three-fourths to equator; commissure well defined. Incipient inner body may be found in some specimens. Exine distally sculptured with spines, verrucae, grana and microverrucae. Exoexine forms an ill-defined, translucent, ununiformly broad, granulose-microverrucose flange. It is hardly traceable in some specimens. Minute foldings distributed all over on distal side.

Comparison — *Decisporis variabilis* and *D. panchetensis* resemble the present species in shape but are distinguished by absence of distal foldings which appear as rugae and presence of exoexinal ill-defined flange.

Genus — *Baculatisporites* Thoms. & Pfl., 1953

Baculatisporites sp.

Pl. 1, Fig. 25

Description — Spore subtriangular in polar view, 74 μ. Trilete, rays well developed, ± tapering at ends, extending not more than three-fourths radius. Exine ± 3 μ thick, baculate, bacula 3-7 μ long, uniformly broad, strongly built, closely placed, uniformly distributed.

Comparison — *Baculatisporites claveoides* Sah & Jain (1965) closely resembles the present species in shape and size, the latter is, however, distinguished by its thicker exine and robustly built bacula. *B. emarginatus* Sah & Jain (*l.c.*) is smaller in size and the bacula are weakly built and more or less sparsely distributed.

Genus — *Subverrusporis* gen. nov.

Type Species — *Subverrusporis rudis* sp. nov.

Diagnosis — Spores triangular-subtriangular in polar view. Trilete. Exine thin, subverrucose.

Description — Spores mostly roundly triangular, 70-160 μ. Apices bluntly rounded, interapical margins ± convex-straight. Trilete, rays ill-developed, ± uniformly broad extending three-fourths radius-equator;

commissure not distinct. Exine thin, not more than 2·5 μ thick, with or without inner body, subverrucose, verrucae not raised, sparsely placed, uniformly distributed, interverrucose space mostly laevigate, sometimes granulose-microverrucose.

Comparison — *Verrucosisporites* (Ibr.) Smith *et al.* (1964) resembles the present genus in verrucose exine but is differentiated by circular-subcircular shape. *Conosmundasporites* Kl. (1960) is subtriangular and has conied granulose exine.

Subverrusporis rudis sp. nov.
Pl. 1, Fig. 26; Pl. 2, Fig. 48

Holotype — Pl. 2, Fig. 48. Size 98 μ. Slide No. 3473.

Type Locality — Bore-core No. RE9, depth 82·5 m., Raniganj coalfield, W. Bengal.

Diagnosis — Spores subtriangular, 100-160 μ. Trilete, rays ill-developed. Exine thin, subverrucose.

Description — Spores mostly subtriangular, sometimes triangular in polar view. Apices bluntly rounded, interapical margins ± straight — slightly convex. Trilete rays equal or unequal, hardly traceable in some specimens, generally extending three-fourths to equator. Exine up to 2 μ thick, exoexine sometimes traceable, ± translucent. Exine subverrucose, verrucae not raised, sparsely placed, ± uniformly distributed, space between verrucae mostly laevigate, sometimes granulose-microverrucose.

Subverrusporis sp.
Pl. 1, Fig. 24

Description — Spore triangular, 70 μ. Apices rounded, interapical margins slightly convex. Trilete, rays narrow, distinct, extending up to equator. Exine about 1·5 μ thick, ± subverrucose, grana and microverrucae also mixed with. Incipient inner body present.

Comparison — *Subverrusporis rudis* is somewhat comparable to the present species in shape but is distinguished by its larger size.

Genus — *Discisporites* (Lesch.) de Jers., 1964

Discisporites triassicus sp. nov.
Pl. 2, Figs. 27a-27b

Holotype —Pl. 2, Figs. 27a-27b. Size 41 μ. Slide No. 3464.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Spores triangular-subtriangular in polar view, 30-50 μ. Trilete, rays strongly developed. Exine thick, mostly verrucose, a circular, thin, depressed area present distally in central region.

Description — Spores mostly triangular, apices rounded, interapical margins slightly convex-straight. Trilete, rays equal, up to 6 μ broad, extending almost up to margin. Commissure well defined, raised up to 8 μ. Exine 2-6 μ thick, verrucae 2-6 μ high, sometimes mixed with coni, spines or bacula, sculptural elements closely placed, evenly distributed. Circular, depressed area is distinct in most specimens.

Comparison — *Discisporites niger* Lesch. (1955) is distinguished from the present species by its granulose —conied sculpture.

Discisporites sp.
Pl. 2, Figs. 28a-28b

Description — Spore originally triangular, but cup-shaped in tilted condition. Trilete, rays strongly developed, extending up to margin. Exine 3 μ thick, sparsely verrucose, verrucae mixed with coni. Circular, depressed area is conspicuous on distal side.

Comparison — *Discisporites triassicus* is comparable to the present species in shape, size and strongly developed trilete rays but is distinguished by the presence of closely placed verrucae.

Spore type — 1
Pl. 2, Figs. 29a-29b

Description — Spore seems to be originally subcircular but turned rectangular due to strong fold. Trilete not seen. Exine ± 2 μ thick, verrucose, verrucae 3-8 μ high, present only on one surface, closely placed, evenly distributed.

Genus — *Ghoshiasporites* Kar, 1969

Ghoshiasporites didecus Kar, 1969.

Genus — *Rimaspora* gen. nov.

Type Species — *Rimaspora plicata* sp. nov.

Diagnosis — Microspores circular-subcircular. Exine ± laevigate, generally

folded at equator. A suture present in middle region. Microspores hardly rupture in two complete halves.

Description — Spores mostly circular, sometimes subcircular. Exine thin, not more than 2 μ thick, mostly laevigate, sometimes may be ± granulose-microverrucose, intrastructure not clearly discernible. A regular, circular fold at equatorial margin or parallel to it observed in most specimens. The fold may be throughout circumference or major part of it. Some other irregular folds may also be occasionally present. Suture generally distinct, always found in middle region extending from one end to other. Suture may also look like a striation in some cases. Spores do not completely break into two halves along suture, though in some cases at one end it may partially rupture. Partially ruptured specimens in other regions also seen in the present preparation. It seems that suture is formed along radial plane and not equator.

Comparison — *Pilasporites* (Balme & Henn.) Tiw. & Nav. (1967) resembles the present genus in shape and psilate exine, the former is, however, distinguished by its irregular rupture zone and differentially thickened exine which may be up to 8 μ thick (Balme & Hennelly, 1956b). *Schizosporis* Cooks. & Dettm. (1959) has an equatorial line or furrow along which it separates in two equal halves. Mention may be made that Venkatachala and Kar (1968a) have already pointed out that *Schizosporis* should be used in the restricted sense as highly sculptured and non-sculptured forms have been put in the same genus. *Spheripollenites* (Coup.) Jans. (1962) is with or without indistinct germinal apparatus, distinctly sculptured or structured and not regularly folded. It seems that *Spheripollenites* is mostly porate because some of the specimens illustrated by Couper (1958, Pl. 31, Figs. 5, 13) distinctly show pore-like opening. *Brazilea* Tiw. & Nav. (1967) is pitted and intramicropunctate and splits generally into two equal halves. *Psilospora* Venkat. & Kar (1968a) is oval-elliptical in shape and has generally more than one suture. *Kagulubeites* Bose & Maheshw. (1968) is sculptured with verrucae, bacula, spines or warty projections and generally splits into two equal halves along a weak zone. *Psiloschizosporis* Jain (1968) generally splits longitudinally in two concave halves and is devoid of regular fold system at equatorial margin.

Rimaspora plicata sp. nov.

Pl. 2, Figs. 30-32

Holotype — Pl. 2, Fig. 30. Size 32 μ. Slide No. 3466.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Microspores circular-subcircular, 38-70 μ. Exine thin, ± laevigate, mostly folded along or parallel to equator. A suture present in middle region.

Description — Spores mostly circular, sometimes subcircular. Exine not more than 2 μ thick, generally folded at equator throughout margin or most part of it. Exine generally laevigate, sometimes weakly granulose-microverrucose; intrastructure indistinct. Suture seems to be in radial plane, mostly distinct, more or less extending from one end to other. Spores do not split completely in two equal halves along suture though it may be partially ruptured at one end.

Remarks — *Schizosporis spriggi* Cooks. & Dettm. (1959) is comparable to the present species in shape and psilate exine. But the former generally splits in two equatorial halves. Moreover, in the opinion of Cookson and Dettmann (*l.c.*) the sexine is thicker than nexine in this species and seems to be angiospermous. Jain (1968), however, included this species into *Psiloschizosporis* while instituting the genus.

Genus — *Granuloperculatipollis* Venkat. & Gócz., 1964

Remarks — *Granuloperculatipollis* Venkat. & Gócz. (1964) closely resembles *Discisporites* Lesch. (1955) in shape, size range, vestigeal trilete mark and distal operculum. The sculptural elements in the former are, however, very closely placed and evenly distributed. In *Discisporites* ornamentational pattern seems to be weakly built and hardly perceptible.

Granuloperculatipollis flavatus sp. nov.

Pl. 2, Figs. 34-35

Holotype — Pl. 2, Fig. 35. Size 58 μ. Slide No. 3473.

Type Locality — Bore-core No. RE9, depth 82 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Pollen grains circular-subcircular, 45-65 μ, distally operculate, closely granulose.

Description — Pollen grains mostly circular. Exine up to 2·5 μ thick, mostly granulose, sometimes interspersed with coni, sculptural elements ± 1 μ high, closely placed, evenly distributed. Operculum mostly distinct.

Comparison — *Discisporites niger* Lesch. (1955) closely resembles the present species in shape and ornamentational pattern, but can be distinguished by its smaller size and presence of vestigeal trilete mark.

Remarks — Mention may be made here that in none of the specimens assigned to the present species trilete mark is discernible. The other characters are, however, in accordance with *Granuloperculatipollis* so it has been included in this genus.

Granuloperculatipollis problematicus sp. nov.

Pl. 2, Fig. 33

Holotype — Pl. 2, Fig. 33. Size 62 μ. Slide No. 3462.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Pollen grains circular-subcircular, 48-72 μ. Exine with coni and spines. A circular, thin, depressed area present in middle region.

Description — Pollen grains mostly circular. Exine up to 2 μ thick, coni strongly built, interspersed with spines, closely placed, evenly distributed, forming pseudoreticulum in surface view. Exine occasionally irregularly folded. Depressed area in central region distinct in most specimens.

Comparison — *Granuloperculatipollis flavatus* closely resembles the present species in shape and size range, the latter is, however, differentiated by its presence of coni and spines as sculptural elements. *G. rudis* Venkat. & Gócz. (1964) is granulose and smaller in size.

Genus — *Densipollenites* Bharad., 1962

Densipollenites sp.

Pl. 2, Fig. 44

Description — Monosaccate, subcircular, 100 μ. Central body indistinct, ± circular. Saccus not much folded, coarsely intrareticulate.

Comparison — *Densipollenites indicus* Bharad. (1962) resembles the present species in shape but is distinguished by its dense central body and bigger size range. *D. invisus* Bharad. & Sal. (1964) approximates the present species in ill-defined central body but is larger in size range and the saccus is differentially intrareticulate. *Densipollenites* sp. described by Bharadwaj and Salujha (1964) resembles the present species in size but is separated by its very dense central body.

Remarks — *Florinites eremus* Balme & Henn. (1955) and *Schorisporites indicus* Dev (1961) closely resemble *Densipollenites* in organization.

Genus — *Podocarpidites* Cooks. ex Coup., 1953

Podocarpidites sp.

Pl. 2, Fig. 36

Description — Bisaccate, bilaterally symmetrical pollen, partially broken. Central body distinct, subcircular, 44×40 μ, intramicroreticulate. Proximal attachment of sacci to central body equatorial, distally subequatorial; sulcus wide. Sacci hemispherical, intrareticulate.

Comparison — The present species is distinguished from *Podocarpidites ellipticus* Cooks. (1947) by its subequatorial distal attachment and wide sulcus. *Podocarpodites* sp. 1 described by Venkatachala and Góczán (1964) approximates the present species in size and nature of distal attachment but is distinguished by its laevigate-intrapunctate central body.

Genus — *Striatites* (Pant) Bharad., 1962

Striatites communis Bharad. & Sal., 1964.

Genus — *Verticipollenites* Bharad., 1962

Verticipollenites debilis Venkat. & Kar, 1968.

Genus — *Strotersporites* Wils., 1962

Strotersporites decorus (Bharad. & Sal.) Venkat. & Kar, 1964.

S. lentisaccatus Kar, 1968.

Strotersporites raniganjensis sp. nov.

Pl. 2, Figs. 37-38

Holotype — Pl. 2, Fig. 37. Size 80×44 μ. Slide No. 3478.

Type Locality — Bore-core No. RE9, depth 84 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Pollen grains 60-90 × 50-78 μ. Central body vertically oval-rhomboidal, ± distinct, intramicroreticulate, horizontal striations present only in middle region. Distal attachment juxtaposed, straight, sacci intrareticulate.

Description — Bisaccate, bilaterally, symmetrical pollen grains. Central body mostly vertically oval, sometimes rhomboidal, not very distinct, laevigate and intramicroreticulate, horizontal striations 6-13, situated only in middle region of central body, ± straight, rarely branched, extending from one end to other. Proximal attachment of sacci to central body equatorial, distally covering almost whole central body except a narrow part in middle. Sacci well developed, hemispherical, intrareticulate.

Comparison — *Strotersporites lentisaccatus* Kar (1968) resembles the present species in size and presence of only horizontal striations but is distinguished by its broad sulcus. *S. ovatus* Maheshw. (1967) and *S. perfectus* Maheshw. (*l.c.*) are differentiated by their larger size. *S. raniganjensis* is readily separated from all known species of the genus by its horizontal striations which are placed only in the middle region of the central body.

Genus — *Striatopiceites* (Zorich. & Sed.) Sed., 1956

Striatopiceites varius (Bharad.) Venkat. & Kar, 1968b.

S. minutus Venkat. & Kar, 1968b.

Striatopiceites clarus sp. nov.

Pl. 2, Figs. 40-42

Holotype — Pl. 2, Fig. 40. Size 72 × 64 μ. Slide No. 3470.

Type Locality — Bore-core No. RE9, depth 83 m., Panchet (Lower Triassic), Raniganj coalfield, W. Bengal.

Diagnosis — Pollen grains 65-95 × 40-70 μ. Central body ill-defined, horizontally striated, intramicroreticulate. Distal attachment straight, sacci leathery, intrareticulate.

Description — Bisaccate, bilaterally symmetrical pollen grains. Central body seems to be vertically oval-subcircular, intramicroreticulate structure well — ill-developed, horizontal striations 6-12, mostly well developed, straight, hardly branched. Proximal attachment of sacci to central body obscure, distal attachment zone well defined, sulcus generally well recognizable. Sacci hemispherical, leathery — intrareticulate.

Comparison — *Striatopiceites minutus* Kar (1968) resembles the present species in size range but the latter is distinguished by its shape. *S. digredius* Kar (1968) is distinguished by its distal attachment which is closely placed at one end while diverging on other.

Genus — *Striapollenites* Bharad., 1962

Striapollenites sp.

Pl. 2, Fig. 45

Description — Bisaccate, bilaterally symmetrical pollen grain, 64 × 44 μ. Central body vertically oval, 44 × 35 μ, intramicroreticulate, not distinct, obliquely vertically striated, striations ± 6 in number, ill-defined. Distal attachment of sacci ± straight, sulcus ill-defined. Sacci intrareticulate.

Comparison — *Striapollenites saccatus* Bharad. (1962) resembles the present species in vertically oval central body and number of striations but is much larger in size. *S. obliquus* Bharad. & Sal. (1964) is also larger in size and has more vertical striations. *Striapollenites* sp. described by Tiwari (1965) is also distinguished from the present species by its larger size and well-developed striations.

Genus — *Sulcatisporites* (Lesch.) Bharad., 1962

Sulcatisporites ovatus Balme & Henn., 1955.

Incertae sedis

Spore attacked by fungal bodies.

Pl. 2, Fig. 43

Description — Spore subcircular, 70 μ, laevigate, ruptured, perhaps due to attack of fungal bodies. They are translucent, subcircular-circular, 2-10 μ, mostly found on surface in colony, bigger bodies have ± stalked, circular bud-like structure around them.

Remarks — The wall of the spores-pollen is highly resistive to outer agencies and

insoluble in acid. For these reasons, bacteria, viruses, algae and fungi can hardly do any harm to them. Moore (1963), however, reported that bacteria, algae and fungi attacked spore wall of the Palaeozoic, while Elsik (1966a, 1966b) reported the same from the Mesozoic and the Tertiary. Barghoorn (1942), Gaumann (1952) and Goldstein (1960) opined that the extant spores-pollen are also destroyed by the fungi mostly belonging to Chytridales and Blastocladiales (Phycomycetes) in some cases.

PALYNOLOGICAL COMPOSITION

The palynological assemblage is dominated by trilete spores both in quantity as well as quality. They vary from 71 to 80 per cent in the assemblage. The monolete spores are, however, not found within the counted specimens. Alete spores are solely represented by *Rimaspora* and are found 5-10 per cent in the present material. Monosaccate pollen are hardly met with in the assemblage. Bisaccate pollen are next in abundance to trilete spores and represent 13-22 per cent. Operculate pollen do not contribute more than 3 per cent in the assemblage (*see* TABLE 1).

TABLE 1 — SHOWING THE PERCENTAGE OF DIFFERENT GROUPS PRESENT IN THE ASSEMBLAGE

GROUPS	DEPTH 84 M.	DEPTH 83 M.	DEPTH 82·5 M.
Trilete	71%	74%	80%
Monolete	0	+	+
Alete	6%	10%	5%
Monosaccate	1%	0	0
Bisaccate	22%	13%	13%
Operculate	+	3%	2%

+ Sign indicates the presence of group in the assemblage but absent in the count.

TABLE 2 — SHOWING THE PERCENTAGE OF DIFFERENT GENERA PRESENT IN THE ASSEMBLAGE

GENERA	DEPTH 84 M.	DEPTH 83 M.	DEPTH 82·5 M.
Biretisporites	1%	3%	3%
Dictyophyllidites	4%	4%	4%
Punctatisporites	3%	3%	3%
Eupunctisporites	+	1%	
Divaripunctites	4%	48%	18%
Cyclogranisporites	3%	3%	4%
Apiculatisporis	2%	2%	3%
Anapiculatisporites		1%	+
Osmundacidites	+	3%	2%
Decisporis	52%	4%	43%
Baculatisporites	1%	+	+
Subverrusporis	1%	+	
Discisporites		2%	+
Ghoshiasporites		+	+
Rimaspora	6%	10%	5%
Granuloperculatipollis	+	3%	2%
Densipollenites	1%		
Podocarpidites			+
Striatites	2%	1%	2%
Verticipollenites	1%	+	+
Strotersporites	9%	1%	6%
Striatopiceites	9%	9%	3%
Striapollenites	1%	+	
Sulcatisporites	+	2%	2%

+ Sign indicates the presence of genus in the assemblage but absent in the count.

The sample at the depth of 84 m. is dominated by *Decisporis* which contributes 52 per cent to the assemblage. *Strotersporites* and *Striatopiceites* are next in abundance and each contributes 9 per cent. The sample at the depth of 83 m. is, however, dominated by *Divaripunctites* (48 per cent); *Rimaspora* and *Striatopiceites* are also frequently found and represent 10 and 9 per cent respectively. *Decisporis* occupies again dominant position at the depth of 82 m. contributing 43 per cent to the assemblage while *Divaripunctites* represents 18 per cent. *Strotersporites* contributes 6 per cent and *Rimaspora* 5 per cent to this assemblage. *Eupunctisporites, Baculatisporites, Subverrusporis, Discisporites, Ghoshiasporites, Densipollenites, Verticipollenites* and *Striapollenites* are meagrely represented within the counted specimens in all the samples (*see* TABLE 2).

DISCUSSION

The present palynological assemblage represents 24 dispersed spores-pollen genera. Out of these 13 genera belong to trilete, 1 monolete, 1 alete, 1 monosaccate, 2 non-striate bisaccate, 5 striate bisaccate and 1 operculate pollen. The monocolpate and polyplicate pollen grains are not encountered in the present preparations. The assem-

blage is dominated by trilete spores mostly represented by *Decisporis* and *Divaripunctites*. The striate bisaccate pollen are next in abundance in the present material. The monolete, monosaccate and operculate pollen are meagrely represented.

The assemblage resembles the Raniganj one in the presence of *Punctatisporites, Eupunctisporites, Apiculatisporis, Anapiculatisporites, Cyclogranisporites, Ghoshiasporites, Densipollenites, Striatites, Verticipollenites, Strotersporites, Striatopiceites* and *Sulcatisporites* (BHARADWAJ, 1962; BHARADWAJ & SALUJHA, 1964, 1965a, 1965b; SALUJHA, 1965; KAR, 1969).

The present assemblage is, however, readily distinguished from the Raniganj by *Biretisporites, Dictyophyllidites, Baculatisporites, Osmundacidites, Divaripunctites, Subverrusporis, Decisporis, Discisporites, Rimaspora* and *Granuloperculatipollis*. It may be mentioned here that in the Raniganj stage striate bisaccate pollen are in abundance and operculate pollen are completely missing.

Satsangi *et al.* (1968), however, observed that in Panchet also the assemblage is dominated by striate bisaccate and the trilete spores are next in abundance. The Triassic mioflora described by Bharadwaj and Srivastava (1969) is also dominated by bisaccate pollen and the trilete spores are hardly represented. Moreover, some of the genera described by them are also completely missing in the present assemblage. Operculate pollen characteristic of Mesozoic (KLAUS, 1959; KRUTZSCH, 1960; MÄDLER, 1964; VENKATACHALA, 1966) have also not met by Bharadwaj and Srivastava.

The dominance of trilete spores in the Panchet has been observed by Srivastava and Pawde (1962) while studying the palynological assemblage of bore-core R.O.I.(B), near Andal, W. Bengal. They also remarked that in the bore-core containing Raniganj stage bisaccate pollen are in abundance and hence the demarcation between the Panchet and the Raniganj can easily be demarcated by means of palynological fossils.

The present investigation also supports their view though the two assemblages cannot be compared as Srivastava and Pawde (*l.c.*) did not illustrate trilete spores from Panchet extensively.

Hennelly (1958) also found the dominant of trilete spores in the Permo-Triassic transition in New South Wales. *Quadrisporites* which is one of the dominant genera in that assemblage is, however, not found in the present one.

Balme (1963) concluded that the Lower Triassic mioflora is markedly different from Upper Permian assemblage. The abundance of trilete spores like *Lundbladispora, Kraeuselisporites, Osmundacidites* and *Punctatisporites* along with bisaccate pollen *Taeniaesporites* readily distinguish the Lower Triassic from the Upper Permian one in western Australia. The present assemblage though dominated by trilete spores does not resemble much the assemblage described by Balme (*l.c.*) from the Kockatea shale as *Kraeuselisporites, Lundbladispora, Taeniaesporites* and *Crustaesporites* are not found.

The Upper Triassic spores-pollen described by de Jersey (1964) from the Bundamba group of Queensland is readily separated from the present assemblage by the abundance of *Alisporites, Leiotriletes* and *Granulatisporites*.

The Lower Triassic mioflora described by Goubin (1965) from the Morondava basin of Madagascar does not approximate the present assemblage as it contains *Striomonosaccites, Protohaploxypinus, Taeniaesporites, Vitreisporites, Platysaccus* and *Cycadopites*.

The Middle Triassic palynological assemblage studied by Jain (1968) from the Cacheuta formation of Argentina is readily distinguished from the present one by its rarity of trilete spores and abundance of nonstriate bisaccate, alete and monocolpate pollen.

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REFERENCES

BALME, B. E. (1963). Plant microfossils from the Lower Triassic of western Australia. *Palaeontology*. **6** (1): 12-40.

BALME, B. E. & HENNELLY, J. P. F. (1955). Bisaccate sporomorphs from Australian Permian coals. *Aust. J. Bot.* **3**: 89-98.

Idem (1956a). Monolete, monocolpate and alete sporomorphs from Australian Permian sediments. Ibid. **4** (1): 54-67.

Idem (1956b). Trilete sporomorphs from Australian Permian sediments. Ibid. **5**: 240-260.

BARGHOORN, E. S. (1942). The occurrence and significance of marine cellulose destroying fungi. *Science, N.Y.* **96**: 358-359.

BHARADWAJ, D. C. (1962). The miospore genera in the coals of Raniganj Stage (Upper Permian), India. *Palaeobotanist.* **9** (1 & 2): 68-106, 1960.

BHARADWAJ, D. C. & SALUJHA, S. K. (1964). Sporological study of seam VIII in Raniganj Coalfield, Bihar, India. Part 1. Description of the *Sporae dispersae*. Ibid. **12** (3): 181-215, 1963.

Idem (1965a). A sporological study of seam VII (Jote Dhemo Colliery) in the Raniganj Coalfield, Bihar (India). Ibid. **13** (1): 30-41, 1964.

Idem (1965b). Sporological study of seam VIII in Raniganj Coalfield, Bihar (India). Part II — Distribution of *Sporae dispersae* and correlation. Ibid. **13** (1): 57-73, 1964.

BHARADWAJ, D. C. & SINGH, H. P. (1964). An Upper Triassic miospore assemblage from the coals of Lunz, Austria. Ibid. **12** (1): 28-44, 1963.

BHARADWAJ, D. C. & SRIVASTAVA SHYAM, C. (1969). A Triassic mioflora from India. *Palaeontographica*. **125 B:** 119-149.

BOSE, M. N. & MAHESHWARI, H. K. (1968). Palaeozoic *Sporae dispersae* from Congo — VII. Coal measures near Lake Tanganyika, south of Albertville. *Annls Mus. r. Afr. cent. Ser.* 8°. **60:** 1-116.

COOKSON, I. C. (1947). Plant microfossils from the lignites of Kerguelen Archipelago. *Rep. B.A.N.Z. antarct. Res. Exped. Ser. A*. **2**: 127-142.

COOKSON, I. C. & DETTMANN, M. E. (1958). Some trilete spores from Upper Mesozoic deposits in the eastern Australian region. *Proc. R. Soc. Vict.* **70**: 95-128.

COOKSON, I. C. & DETTMANN, M. E. (1959). On *Schizosporis*, a new genus from Australean Cretaceous deposits. *Micropaleontology*. **5** (2): 213-216.

COUPER, R. A. (1953). Upper Mesozoic and Cainozoic spores and pollen grains from New Zealand. *N.Z. geol. Surv. palaeont. Bull.* **22**: 1-77.

Idem (1958). British Mesozoic microspores and pollen grains. A systematic and stratigraphic study. *Palaeontographica*. **103B**: 75-179.

DE JERSEY, N. J. (1959). Jurassic spores and pollen grains from the Rosewood Coalfield. *Qd Govt. Min. J.* **60**: 346-366.

Idem (1964). Triassic spores and pollen grains from the Bundamba group. *Geol. Surv. Qd Publs. No.* **321**: 1-21.

DELCOURT, A. & SPRUMONT, G. (1955). Les spores et grains de pollen du Wealdien du Hainaut. *Mem. Soc. Belg. Geol.* **4**: 1-73.

DETTMANN, M. E. (1963). Upper Mesozoic microfloras from south-eastern Australia. *Proc. R. Soc. Vict.* **77** (1): 1-148.

DEV, S. (1961). The fossil flora of the Jabalpur Series-3. Spores and pollen grains. *Palaeobotanist.* **8** (1 & 2): 43-56, 1959.

ELSIK, W. C. (1966a). Degradation of arci in a fossil *Alnus* pollen grains. *Nature, Lond.* **209** (5025): 825.

Idem (1966b). Biologic degradation of fossil pollen grains and spores. *Micropaleontology*. **12** (4): 515-518.

GAUMANN, E. A. (1952). The fungi. A description of their morphological features and evolutionary development. (translated by Wynd, F. L.). *New York*.

GOLDSTEIN, S. (1960). Degradation of pollen by *Phycomycetes*. *Ecology*. **41** (3): 543-545.

GOUBIN, N. (1965). Description et répartition des principaux pollenites Permiens, Triasiques et Jurassiques des sondages du basin de Morondava (Madagascar). *Rev. Inst. Fr. Pétrol. Annls. Combust. Liqd.* **20** (10): 1415-1461.

HENNELLY, J. P. F. (1958). Spores and pollens from a Permian-Triassic transition. *N.S.W. Proc. Linn. Soc.* **83** (3): 363-369.

JAIN, R. K. (1968). Middle Triassic pollen grains and spores from Minas de Petroleo beds of the Cacheuta formation (Upper Gondwana), Argentina. *Palaeontographica*. **122B**: 1-47.

JANSONIUS, J. (1962). Palynology of Permian and Triassic sediments. Peace river area, western Canada. Ibid. **110B**: 35-98.

KAR, R. K. (1968). Palynology of the Barren Measures sequence from Jharia Coalfield, Bihar, India. 2. General Palynology. *Palaeobotanist.* **16** (2): 115-140, 1967.

Idem (1969). Palynology of the North Karanpura basin, Bihar, India. 5. Palynological assemblage of the bore-core no. K_2, Raniganj Stage (Upper Permian). Ibid. **17:** 101-120.

KAR, R. K. & BOSE, M. N. (1967). Palaeozoic *Sporae dispersae* from Congo III. — Assise des schistes noirs de la lukuga. *Annls Mus. r. Afr. cent. Ser.* 8°. **54**: 1-84.

KLAUS, W. (1959). Sporenfunde in der Karnischen Stufe der alpinen Trias. *Verh. geol. Bundesanst., Wien* **2**: 160-163.

Idem (1960). Sporen der Karnischen Stufe der ostalpinen Trias. *Jb. Geol.* **5**: 107-183.

KOTOVA, I. Z. (1968). Melobie spori iz gruppie Hilates. *Truoty geol. Inst. Akad. Nayuk SSSR.* **191**: 17-30 (in Russian).

KRUTZSCH, W. (1960). Present state of spore stratigraphy of the German Mesozoic. *Annls Inst. Geol. Publs. Hung.* **49** (1): 327-329.

LESCHIK, G. (1955). Die Keuper-flora von Neuewelt bei Basel. II. Iso- und Mikrosporen. *Schweiz. palaent. Abh.*: 1-70.

MÄDLER, K. (1964). Die geologische Verbreitung von Sporen und Pollen in der Deutschen Trias. *Beih. geol. Jb.* **65**: 1-147.

MAHESHWARI, H. K. (1967). Studies in the Glossopteris Flora of India — 29. Miospore assemblage from the Lower Gondwana exposures along Bansloi river in Rajmahal hills, Bihar. *Palaeobotanist.* **15** (3): 258-280, 1966.

MOORE, L. R. (1963). Microbiological colonization and attack on some Carboniferous miospores. *Palaeontology*. **6** (2): 349-372.

PLAYFORD, G. (1965). Plant microfossils from Triassic sediments near Poatina, Tasmania. *J. geol. Soc. Aust.* **12** (2): 173-210.

PLAYFORD, G. & DETTMANN, M. E. (1965). Rhaeto-Liassic plant microfossils from the Leigh Creek coal measures, South Australia. *Senckenberg. leth.* **46**: 127-181.

POCOCK, S. A. J. & JANSONIUS, J. (1961). The pollen genus *Classopollis* Pflug, 1953. *Micropalaeontology*. **7** (4): 439-449.

POTONIÉ, R. & KREMP, G. O. W. (1954). Die Gattungen der palaeozoischen *Sporae dispersae* und ihre Stratigraphie. *Geol. Jb.* **69**: 111-194.

SAH, S. C. D. & JAIN, K. P. (1965). Jurassic spores and pollen grains from the Rajmahal hills, Bihar, India: with a discussion on the age of the Rajmahal intertrappean beds. *Palaeobotanist.* **13** (3): 264-290, 1964.

SALUJHA, S. K. (1965). Miospore assemblage of seam IX of East Raniganj Coalfield (India). Ibid. **13** (3): 227-238, 1964.

SATSANGI, P. P., CHANDRA, A. & SINGH, G. (1968). Sporological analysis of the Panchet Series and its bearing on the Permian — Triassic transition. *Curr. Sci.* **37** (4): 116-117.

SCHOPF, J. M., WILSON, L. R. & BENTALL, R. (1944). An annotated synopsis of Palaeozoic fossil spores and the definition of the generic groups. *Rep. Illinois St. geol. Surv.* **91**: 1-66.

SMITH, A. H. V. *et al.* (1964). Report of C.I.M.P. Working Group No. 6. *Verrucosisporites* (Ibrahim) emend. *C.r.* 5 *Congr. Strat. Geol. Carbon.* **3**: 1071-1077.

SRIVASTAVA, R. N. & PAWDE, M. B. (1962). Palynological study of bore hole R.O. 1(B), Ondal, West Bengal. *Rec. geol. Surv. India.* **91** (2): 369-384.

TIWARI, R. S. (1964). New miospore genera in the coals of Barakar Stage (Lower Gondwana) of India. *Palaeobotanist.* **12** (3): 250-259, 1963.

Idem (1965). Miospore assemblage in some coals of Barakar Stage (Lower Gondwana) of India. Ibid. **13** (2): 168-214, 1964.

TIWARI, R. S. & NAVALE, G. K. B. (1967). Pollen and spore assemblage in some coals of Brazil. *Pollen Spores* **9** (3): 583-605.

VENKATACHALA, B. S. (1966). Mesozoic operculate pollen and their morphology. *Palaeobotanist.* **15** (1 & 2): 98-101.

VENKATACHALA, B. S. & GÓCZÁN, F. (1964). The spore-pollen flora of the Hungarian "Kössen Facies". *Acta Geol.* **8** (1-4): 203-228.

VENKATACHALA, B. S. & KAR, R. K. (1965). Two new trilete spore genera from the Permian of India. *Palaeobotanist.* **13** (3): 337-340, 1964.

Idem (1967). *Katrolaites* gen. nov., a new fossil from the Jurassic rocks of Kutch, India. *Curr. Sci.* **36** (22): 613-614.

Idem (1968a). *Psilospora* gen. nov., a new fossil pollen genus from the Mesozoic rocks of Kutch, W. India. Ibid. **37** (15): 442-443.

Idem (1968b). Palynology of the Karanpura sedimentary basin, Bihar, India. 1. Barakar stage at Badam, Hazaribagh district. *Palaeobotanist.* **16** (1): 56-90, 1967.

EXPLANATION OF PLATES

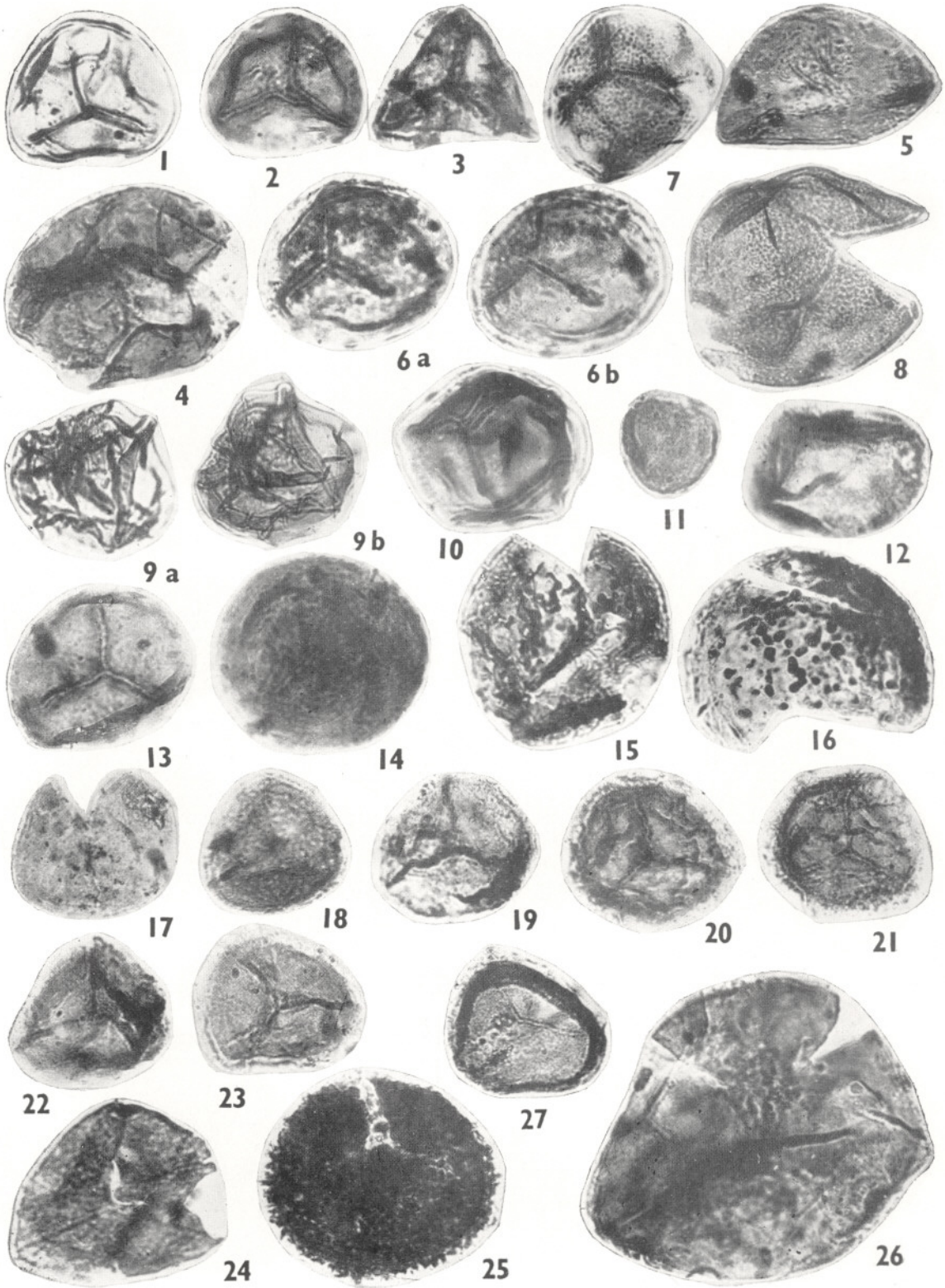
(All photomicrographs are enlarged *ca.* × 500)

PLATE 1

1. *Biretisporites* sp., Slide No. 3460.
2-3. *Dictyophyllidites decus* sp. nov., Slide Nos. 3461, 3462.
4. *Punctatisporites* sp., Slide No. 3463.
5. *Eupunctisporites* sp., Slide No. 3465.
6a-8. *Divaripunctites globosus* gen. et sp. nov., Slide Nos. 3472, 3460, 3462.
9a-10. *Divaripunctites plicatus* sp. nov., Slide Nos. 3464, 3461.
11. *Apiculatisporis* sp. A, Slide No. 3476.
12-13. *Cyclogranisporites triletus* sp. nov., Slide Nos. 3472, 3463.
14. *Anapiculatisporites* sp., Slide No. 3467.
15-16. *Osmundacidites panchetensis* sp. nov., Slide Nos. 3468, 3469.
17. *Apiculatisporis* sp. B, Slide No. 3466.
18-19. *Decisporis variabilis* sp. nov., Slide Nos. 3477, 3478.
20-21. *Decisporis rudis* sp. nov., Slide Nos. 3471, 3476.
22-23, 27. *Decisporis panchetensis* sp. nov., Slide No. 3475.
24. *Subverrusporis* sp., Slide No. 3477.
25. *Baculatisporites* sp., Slide No. 3473.
26. *Subverrusporis rudis* gen. et sp. nov., Slide No. 3473.

PLATE 2

27a-27b. *Discisporites triassicus* gen. et sp. nov., Slide No. 3464.
28a-28b. *Discisporites* sp., Slide No. 3470.
29a-29b. *Spore type* — 1, Slide No. 3468.
30-32. *Rimaspora plicata* gen. et sp. nov., Slide Nos. 3466, 3468, 3479.
33. *Granuloperculatipollis problematicus* sp. nov., Slide No. 3462.
34-35. *Granuloperculatipollis flavatus* sp. nov., Slide Nos. 3465, 3473.
36. *Podocarpidites* sp., Slide No. 3471.
37-38. *Stroterisporites raniganjensis* sp. nov., Slide Nos. 3478, 3468.
39. *Striatopiceites varius* (Bharad.) Venkat. & Kar, Slide No. 3468.
40-42. *Striatopiceites clarus* sp. nov., Slide Nos. 3470, 3464.
43. Spore attacked by fungal bodies, Slide No. 3460.
44. *Densipollenites* sp., Slide No. 3477.
45. *Striapollenites* sp., Slide No. 3476.
46. *Striatopiceites minutus* Venkat. & Kar, Slide No. 3461.
47. Tetrad of *Decisporis rudis* sp. nov., Slide No. 3477.
48. *Subverrusporis rudis* gen. et sp. nov., Slide No. 3473.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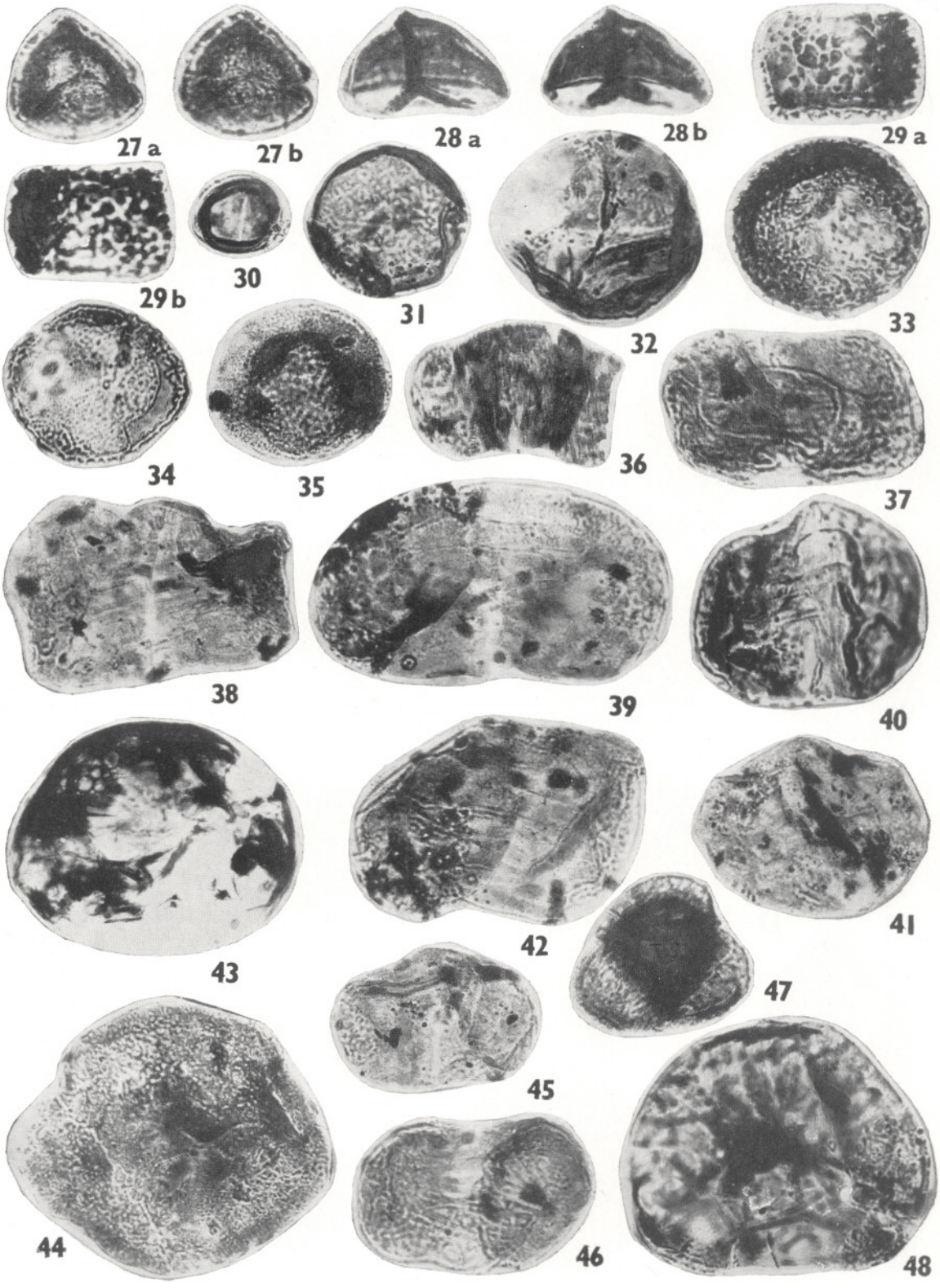
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