MIOSPORE ASSEMBLAGE IN SOME COALS OF BARAKAR STAGE (LOWER GONDWANA) OF INDIA*

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ABSTRACT

Sporae dispersae have been referred to 53 miospore genera with 131 species out of which 59 species are new. For each species a large number of specimens have been studied and the probable range of variation in the qualitative as well as quantitative characters within a species has been determined. For specific delimitation the association of morphographic characters has been given primary importance. New species have been diagnosed, described and compared in detail.

The qualitative and quantitative compositions of the assemblages from Korba Coalfield and W. Bokaro Coalfield have been compared. It has been concluded that the mioflora of Korba Coalfield is divisible into an older and a younger assemblage. The younger assemblage shows some closeness with the mioflora of W. Bokaro Coalfield.

INTRODUCTION

BARAKAR Stage, belonging to the Damuda Series of Lower Gondwana, is one of the major coal bearing strata of India. Successively it is overlain by Barren Measures and Raniganj Stage of Damuda Series but overlies the Karharbari and the Talchir Stages of the Talchir Series. The sporological studies of these beds were mostly neglected in the past but in recent years some workers have described spore assemblages from the various sediments of Barakar Stage (for references *see* TIWARI 1964). In the present work an exhaustive analysis of a large number of dispersed microspores and pollen grains, recovered by maceration out of some Barakar coals has been done. A part of the results including the correlation aspect has been published elsewhere (*see* BHARADWAJ & TIWARI 1964a, 1964b, & TIWARI 1964) while a complete account of *sporae dispersae* is being given here, which includes the circumscription of various species met with in the assemblage.

MORPHOGRAPHY

During the study of the miospore morphography, a large number of specimens were studied, tabulated and compared — individually as well as group-wise and the degree of importance of the association of more usual characters was always kept in view.

The various miospore characters taken into taxonomic considerations have been discussed at length by Bharadwaj (1962) and Bharadwaj and Salujha (1964) and in the present work almost similar lines have been followed. In the new forms and in some others the morphographic characters considered important for specific circumscription are as given below.

The flanged trilete genus *Indotriradites* Tiwari, bears coni or spinae of various shapes and sizes on distal side. The nature of these processes, their size and density, the width and nature of flange and nature of Y-mark are some of the important characters determined in this genus to evaluate the species. So also in *Dentatispora* Tiwari, besides the size and shape of the spore, the nature, size and density of distal processes, nature and width of cingulum (TEXT-FIG. 3) and the nature of Y-mark and exine structure are the different characters considered useful for the specific circumscription.

Monosaccate miospore genera found in the present assemblage are quite interesting as well as complicated in their organizational construction and other characters. For the specific delimitation in the genus *Barakarites* Bharad. & Tiwari, the extent of saccus from the body equator, the size of polygonal areas, the nature of saccus whether even or undulating, fine or coarsely intrareticulate structure with or without marginal thickening and the nature of inner body, have been considered important. In *Parasaccites* Bharad. & Tiwari, the distinct or obscure nature of the body-outline and

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Y-mark, nature of exine and the nature and span of saccus have been utilized to define the specific limits.

Disaccate reticuloid-striated genera *Rhizomaspora* Wilson, *Primuspollenites* and *Direticuloidispora* (TIWARI 1964) have been extensively studied and the overall shape of the central body, presence or absence of equatorial rim, nature of reticuloid striations, shape of distal sulcus and the nature of saccus intrareticulation are some of the characters where the variations have been considered important for defining the species. Another genus *Korbapollenites* Tiwari, though rarely represented in the assemblage, possesses important characters such as distal infolding of the saccus, its intrareticulation and the peripheral folds in the central body.

Maculatasporites Tiwari (1964), is a subcircular to subtriangular alete spore with extrareticulation all over the body. The muri, as far as known in this genus are complete, narrow, evenly or unevenly wide forming narrow to wide, pit-like or regular polygonal meshes. The shape of the grain, nature of meshes, muri, and their marginal extension, are some of the important characters considered in detail in this genus.

The circumscription of the genus *Potonieisporites* (Bhard.) Bharad., conforms to the revision based on a recent study of the genus and similar forms by Bharadwaj (1964a,b). Some of the forms as were referred to *Sahnites* in the correlation studies of Korba Coalfield (BHARADWAJ & TIWARI 1964b) have been now incorporated into *Potonieisporites*.

Bharadwaj (1964b) has also suggested the inclusion of *Vestigisporites* — type of forms in *Potonieisporites* on the basis of variation studied in the *in-situ* grains. However, purely on the basis of morphographic characters, as applied in the present study of *sporae dispersae*, the genotype of *Vestigisporites* illustrated by Balme and Hennelly (1955, PL. 6, FIG. 54 — first illustration of the genus) may not find its place in *Potonieisporites* (*see* BHARADWAJ, 1964a, PL. 1, FIGS. 1-7; PL. 2, FIGS. 8-14; 1964b), and hence in the present work pollen grains showing the following morphographic characters have been described under *Vestigisporites* (sensu BALME & HENN. 1955).

"Bilateral, bisaccate, occasionally with lateral narrow continuations of sacci, central body generally distinct, proximally bearing a vestigial horizontal monolete slit, which occasionally appearing as thinner area or merely a fold; body exine smooth or microverrucose. Sacci proximally equatorially attached distally inclined; distal zones of attachment ill-defined and usually not accompanied by secondary body folds. Lateral continuations of the sacci, may or may not present, in former case also never changing the overall symmetry."

Specimens referable to the genus *Illinites*, in accordance with the emendment by Grebe & Schweitzer (1962), also occur in the present mioflora.

For the disaccate striated grains Hart (1964) has given a long list of synonyms under the genus *Striatopodocarpites* which also includes *Lahirites* Bharad., *Hindipollenites* Bharad. and *Verticipollenites* Bharad. The study of a large number of striated specimens from Raniganj and Barakar Stages, reveals that the latter two genera definitely show different organizations in having pitcher-shaped sacci (see BHARADWAJ 1962). Besides this, the differentiation of these genera is also based upon the structure of the body-exine, to which no importance has been given by Hart (*loc.cit.*), and consequently he has proposed to merge all of them under a single generic group. However, this does not seem to be a positive approach in the morphographic study of dispersed miospores, since such dumping may lead to a masking of the different lines of variation in miospore morphology and consequently may result into stratigraphical errors. Keeping these facts in view, the delimitations of striated disaccate genera proposed by Bharadwaj (1962) have been followed in the present work.

MATERIAL AND METHODS

The present study is based upon 35 bore hole coal samples from Korba Coalfield, Madhya Pradesh (for Map, sampling data and other details *see* BHARADWAJ & TIWARI 1964b) and 21 coal samples from Pindra, Datma and Topa seams in the West Bokaro Coalfield (85°25′-85°35′ Longitude E; 23°42′-23°52′ Latitude N), Bihar (TABLE 1). Both the coalfields belong to the Barakar Stage (Lower Gondwana) of India.

The maceration was done by usual technique, using commercial nitric acid and 10 per cent KOH solution. In general, the method is the same as described by Bharadwaj (1962) and Bharadwaj and Salujha

TABLE 1 – COAL SAMPLES STUDIED FROM W. BOKARO COALFIELD, BIHAR

Lab. Sample No.	Seam	Colliery	Position	Cat. No.
P_1	Pindra	Pindra	Dull & bright coal 3′	6157
P_2	,,	,,	From roof top of shaly band 3′4″	6150
P_3	,,	Pindra Ramgarh	Shaly & dull coal 1′4″	6229
P_4	,,	,,	Dull coal 4′	6158
DP_1	Pindra	Datma	Coal bottom 3′	6153
DP_2	,,	,,	Coal 3′-6′	6154
DP_3	,,	,,	Coal 6′-9′6″	6147
DP_4	,,	,,	Roof	6149
D_1	Datma	,,	Dull coal & shale bottom to 3′8″	6152
D_2	,,	,,	Dull & light coal 2′8″	6155
D_3	,,	,,	Coal 2′ collected between 16′-24′	6148
TQ_1	Topa Village	Quarry	Dull coal 1′1″ sample 5	6156
TQ_2	,,	,,	Shale & Dull coal 6″ sample 3	31698
TQ_3	,,	,,	Shale & Coal 6′1″	31648
TQ_4	,,	,,	Top roof shale	31653
TQ_5	,,	,,	—	31645
TQ_6	,,	,,	Sample 8	31644
TQ_7	,,	,,	Dull coal sample 2	31647
TM_1	Topa	Mangardaha	Coal bottom to 3′	31652
TM_2	,,	,,	Coal 1st quarry 3′-5′7″	6231
TM_3	,,	,,	2 quarry	31651

(1964). The bore-hole samples from Korba Coalfield were available in finely powdered form. 10 gm of this material was taken for each maceration. The material from West Bokaro Coalfield consisted of coal lumps. It was crushed into pieces 3 to 6 mm in size. About 50 gm of coal was taken for each sample. Usually the coal investigated by me required 3-5 days of acid treatment.

SYSTEMATIC DESCRIPTION

The dispersed miospores considered in the present study have been assigned to 53 genera and 131 species out of which 59 species are new.

In the details regarding occurrence of species, *Assemblages A-E* as described by Bharadwaj and Tiwari (1964b) for Korba Coalfield, and alphabets as given in Table 1 for Lab. Sample Nos. for West Bokaro Coalfield, have been referred to. The occurrence of only more common species has been given in the following account.

Anteturma – ***Sporites*** **H. Pot. 1893**
Turma – ***Triletes*** **(Reinsch) Pot. & Kr. 1954**
Subturma – ***Azonotriletes*** **Luber 1935**
Infraturma – ***Laevigati*** **(Benn. & Kids) Pot. 1956**

Genus *Leiotriletes* (Naum.) Pot. & Kr. 1954

Genotype — *Leiotriletes sphaerotriangulus* (Loose) Pot. & Kr.

Leiotriletes virkkii sp. nov.

Pl. 1, Figs. 2, 3

Holotype — Pl. 1, Fig. 2

Type Locality — India, (M.P.), Korba Coalfield, (1008C Bore-hole G-214), Barakar Stage.

Diagnosis — Known size 52-78 μ; exine laevigate, unstructured or finely structured, 1-1·5 μ thick, *extrema lineamenta* smooth;

Y-mark distinct, rays thin, reaching almost up to the angles.

Description — Subtriangular, miospores generally with straight to convex sides and round angles, holotype 72 μ in size; Y-mark distinct, rays 33-44 μ long, reaching almost up to the periphery, sometimes folded, labra thin, vertex low. Exine 1-1·5 μ thick in optical section, laevigate, unstructured or finely structured.

Comparison — *L. directus* Balme & Henn. (1956b) has been transferred to *Microfoveolatispora* Bharad. (1962), on the basis of its foveolate nature of exine. Spore-type 20, described by Virkki (1946; PL. 7, FIG. 101) resembles the present species to a greater extent.

Occurrence — Korba Coalfield — *Assemblage C*; W. Bokaro Coalfield — P, DP, D

Leiotriletes sp.

Pl. 1, Fig. 1

Remarks — Specimens range from 30-45 μ in size, generally folded either along the trilete rays or at the periphery. Y-mark thin, distinct, rays 22-28 μ long, reaching up to the angles of the miospore; exine thin, laevigate, sometimes finely intramicropunctate but never sculptured.

This species resembles to *Leiotriletes* sp. described by Bharadwaj and Salujha (1964; p. 189). *L. virkkii* differs from this species in having thicker exine.

For other specimen see Bharadwaj and Tiwari (1964b) Pl. 1, Fig. 2.

Occurrence — Korba Coalfield — *Assemblages A, B, C*; W. Bokaro Coalfield — P, D

Genus *Eupunctisporites* Bharad. 1962

Genotype — *Eupunctisporites poniatiensis* Bharad. 1962

Eupunctisporites sp.

Pl. 1, Fig. 4

Description — Subtriangular miospores size 90-129 μ; Y-mark distinct, rays $\pm$ 2/3 the radius long, lips prominent, vertex low, ends blunt; exine $\pm$ 3 μ thick in optical section, coarsely punctate, pits being $\pm$ 2 μ in size, closely set.

Remarks — *E. poniatiensis* Bharad., possesses sparsely arranged smaller puncta, and in *E. gravus* Bharad. & Salujha, the trilete mark is generally obscure and puncta are sparser in arrangement.

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

Genotype — *Punctatisporites punctatus* Ibr. 1933

Punctatisporites gretensis Balme & Henn. 1956b

Pl. 1, Fig. 5

Holotype — Balme & Henn. 1956b; Pl. 2, Fig. 11

Remarks — Specimens studied here are circular to subcircular in flattened condition, 60-110 μ in size; Y-mark is distinct but inconstant in its position. Rays are more than 2/3 radius long, labra being thick and vertex generally slightly raised. Exine is 2-4 μ thick in optical section, finely intramicropunctate and without any sculpture.

Balme and Hennelly described the nature of exine as psilate or finely granulate (B. & H. 1956b; p. 245), although the exine appears to be structured in the first figure of the species (B. & H. 1956b; PL. 2, FIG. 11), given by them. Bharadwaj (1962) thinks that *Punctatisporites* includes spores with laevigate but structured exine. In view of these facts, the specimens studied here have been included in *P. gretensis* B. & H.

For other specimen see Bharadwaj & Tiwari (1964b) Pl. 1, Fig. 1.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, TQ

Genus *Retusotriletes* Naumova 1953

Genotype — *Retusotriletes simplex* Naum. 1953

Retusotriletes diversiformis (Balme & Henn.) Bharad. 1962

Pl. 1, Figs. 6, 7

Holotype — Balme & Henn. 1956b; Pl. 2, Fig. 14

Remarks — Bharadwaj (1962) has made a new combination of *Calamospora diversiformis* B. & H. as *Retusotriletes diversiformis* on the basis of the well defined contact area or its curvature present on the proximal face of the miospores, and Bharadwaj & Salujha (1964) have given a diagnosis for it.

The specimens studied by me range from 24-40 μ in size. They are circular to broadly subtriangular in shape, exine being $\pm$ 1 μ thick. Y-mark is distinct; rays are thin, 1/2 to 2/3 radius long. Curvature of *area contigionis* is generally well defined. *Extrema-lineamenta* is smooth.

In the centre of the miospore, a small triangular area (15-20 μ in size) is generally present. In some of the specimens (*see* BHARAD. & TIWARI 1964b, PL. 1, FIG. 6; BHARAD. & SALUJHA 1964, PL. 1, FIG. 18) this area, apparently an interradial thickening, is more distinct and slightly denser than the rest of the body exine. Also, in the photographs given by Balme and Hennelly (1956b; PL. 2, FIGS. 14-16) presence of small, triangular, slightly denser area is evident.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — DP, D

Infraturma — *Apiculati* (Benn. & Kids.) Pot. 1956
Subinfraturma — *Granulati* Dyb. & Jacho. 1957

Genus *Cyclogranisporites* Pot. & Kr. 1954

Genotype — Cyclogranisporites leopoldii (Kr.) Pot. & Kr. 1954

Cyclogranisporites gondwanensis Bharad. & Salujha 1964

Pl. 1, Figs. 8, 9

Holotype — Bharad. & Salujha 1964; Pl. 1, Fig. 19

Remarks — The specimens studied by me are 28-33 μ in size and are generally circular to subcircular. Y-mark is generally subdued by the closely set grana, rays ranging from 2/3 to 3/4 of the radius length.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, DP, D, TQ, TM

Subinfraturma — *Verrucati* Dyb. & Jacho. 1957

Genus *Verrucosisporites* (Ibr.) Pot. & Kr. 1954

Genotype — Verrucosisporites verrucosus Ibr.

Verrucosisporites distinctus sp. nov.

Pl. 1, Figs. 10-12

Holotype — Pl. 1, Fig. 10

Type Locality — India, (M.P.), Korba Coalfield, 420(B)E; Borehole G-26, Barakar Stage.

Diagnosis — Size 61-95 μ, miospores subcircular to subtriangular; Y-mark distinct, rays 1/2 to 2/3 radius long, thin, ends tapering, exine 1-3 μ thick, densely covered with small verrucae.

Description — Holotype $\pm$ 95 μ. Miospores generally subcircular or broadly subtriangular with distinct Y-mark on the proximal face; rays 1/2 to 2/3 the body-radius long, one slightly longer than the other two; labra thin, vertex low, lips mostly subdued by verrucae. Exine 1-3 μ thick when seen in optical section, closely placed small, $\pm$ 1-2 μ verrucae, which in some specimens becoming slightly bigger in size on the distal side. Occasionally exine folded.

Comparison — *Verrucosisporites pseudoreticulatus* B. & H. 1956b, has been included in *Microfoveolatispora* Bharad. by Bharadwaj (1962); *V. bullatus* B. & H. differs in having bulbous processes on the exine; *V. trisacatus* has baculate ornamentation. *V. parmatus* B. & H. also possesses baculate rather than verrucose ornamentation. Moreover, it is smaller in size with the Y-rays reaching up to the periphery and shows a distinct contact area on the proximal side.

The present species, characterized by its distinct trilete-mark, $\pm$ 2/3 radius long rays and $\pm$ 2 μ thick and finely verrucose exine, is considered new among the known species of the genus from Lower Gondwana horizons.

Subinfraturma — *Nodati* Dyb. & Jacho. 1957
Genus *Lophotriletes* (Naum.) Pot. & Kr. 1954

Genotype — Lophotriletes gibbosus (Ibr.) Pot. & Kr.

Lophotriletes frequensus sp. nov.

Pl. 1, Figs. 13, 14

Holotype — Pl. 1, Fig. 14

Type Locality — India, (Bihar), West Bokaro Coalfield, Pindra Seam, Datma Colliery, Barakar Stage.

Diagnosis — Miospores 61-85 μ in size, triangular in overall shape, Y-mark distinct, rays $\pm$ 2/3 radius long; exine densely covered with $\pm$ 2 μ high, pointed as well as blunt coni.

Description — Miospores triangular with concave to convex sides and broadly rounded corners. Holotype $\pm$ 63 μ. Y-mark distinct, mostly open; rays 2/3 radius long, labra thin, vertex low; exine thin, covered with closely packed, 1-2 μ high and equally broad at the base, pointed or blunt coni. No similar coni can find place inbetween the two. 35-48 coni counted on the *extrema lineamenta*.

Comparison — Among the species described by Bharadwaj and Salujha (1964), *L. rectus* is very small, measuring only 22-40 μ, with sparsely disposed coni on the exine; *L. rarus* has a thickened border along the rays of Y-mark and *L. pseudogranus* is smaller in size-range, with rays reaching up to the corners and there are up to 60 coni on the *extrema lineamenta*.

Occurrence — W. Bokaro Coalfield — P, DP, D, TQ, TM

Lophotriletes sp.

Pl. 1, Figs. 15, 16

Description — Specimens 30-36 μ in size, triangular in shape with straight to concave inter-radial sides and round angles; Y-mark distinct, rays reaching up to the corners. Labra thin and vertex low. Coni ± 1 μ high and equally broad at the base, tips being pointed, sparse and 18-22 in number on *extrema lineamenta*.

Remarks — Balme and Hennelly have described comparable forms under *Acanthotriletes tereteangulatus* (1956b; PL. 2, FIGS. 27-29). Similar specimen is figured by Bharadwaj and Salujha (1964; PL. 2, FIG. 29).

For other specimen see Bharadwaj & Tiwari 1964b; Pl. 1, Fig. 12.

Occurrence — Korba Coalfield — *Assemblage E*; W. Bokaro Coalfield — D, TM

Genus *Apiculatisporis* (Ibr.) Pot. & Kr. 1956

Genotype — *Apiculatisporis* (Syn. *Apiculatisporites*) *aculeatus* (Ibr.) Pot. & Kr. 1956.

Apiculatisporis levis Balme & Henn. 1956b

Pl. 1, Figs. 17, 18

Holotype — Balme & Henn. 1956b; Pl. 2, Fig. 20

Remarks — Specimens studied by me are mostly subcircular, rarely roundly subtriangular in overall shape, 18-33 μ in size. Y-mark is generally not very distinct due to ornamentation; rays reach up to the periphery and are 11-13 μ long; coni are up to 1 μ high and equally broad at base. In some specimens contact area is faintly discernible. Exine is ± 1 μ thick.

For other specimen see Bharadwaj and Tiwari (1964b) Pl. 1, Fig. 13.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, DP, D, TM

Genus *Acanthotriletes* (Naum.) Pot. & Kr. 1954

Genotype — *Acanthotriletes ciliatus* (Knox) Pot. & Kr. 1954

Acanthotriletes filiformis (Balme & Henn.) comb. nov.

Pl. 1, Figs. 19, 20

Syn.— *Apiculatisporites filiformis* Balme & Henn. 1956b

Holotype — Balme & Henn. 1956b; Pl. 2, Fig. 22

Diagnosis — (emend.) Miospores roundly subtriangular; known size 23-46 μ. Y-mark distinct, rays reaching up to the periphery. Exine covered with 2-5 μ long and 1-2 μ wide at base, sparse spines.

Comparison — Genus *Apiculatisporis* includes the circular, trilete bearing spores with coni all over the body, while in the present species, the processes are spinae, their length being generally twice the width at the base, hence a new combination is proposed here.

The present species is characterized by its roundly subtriangular shape, size and sparsely disposed spines.

Acanthotriletes sp.

Pl. 1, Figs. 21, 22

Remarks — Specimens are 19-41 μ in size and subtriangular with broad, round corners. Y-mark is distinct and rays reach up to the periphery. Spines are sparse, 2-6 μ in length and straight or curved at their tips.

Subinfraturma — *Baculati* Dyb. & Jacho. 1957

Genus *Horriditriletes* Bharadwaj & Salujha 1964

Genotype — *Horriditriletes curvibaculosus* Bharad. & Salujha 1964

Horriditriletes curvibaculosus Bharad. & Salujha 1964

(*See* BHARAD. & TIWARI 1964b, PL. 1, FIG. 5)

Holotype — Bharad. & Salujha 1964; Pl. 2, Fig. 34

Remarks — Specimens studied by me are 34-38 μ in size. Y-mark is distinct with rays reaching almost up to the corners; bacula are sparse, 3-6 μ long and blunt; ± 20 bacula are on the margin.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, DP

Horriditriletes bulbosus sp. nov.

Pl. 1, Figs. 25-27

Holotype — Pl. 1, Fig. 27

Type Locality — India, (Bihar), West Bokaro Coalfield, Pindra Seam, Pindra Colliery; Barakar Stage.

Diagnosis — Triangular miospores; bacula big, truncate or with bulbous head, sparsely distributed. Trilete mark distinct, rays more than 2/3 of the radius long.

Description — Known size 40-50 μ. Holotype 45 μ. Miospores triangular in shape, angles being round and sides slightly convex; Y-mark distinct, rays thin, tapering, 20-22 μ long, not reaching up to the periphery. Bacula 3-6 μ long, 2-4 μ broad with blunt, truncate or bulbous ends (TEXT-FIG. 1b), 14-16 in number on periphery.

Comparison—H. curvibaculosus Bharad. & Salujha, the genotype, is much smaller in size and possesses mostly curved and longer bacula; *H. brevis* Bharad. & Salujha is only 20-24 μ in size possessing 2 μ long, blunt coni. *H. ramosus* (Balme & Henn.) Bharad. & Salujha, differs in having blunt as well as pointed conical processes.

The present species differentiates itself in having massive, blunt or bulbose, sparse bacula.

Occurrence — Korba Coalfield — *Assemblage C*; W. Bokaro Coalfield — P, DP, D, TQ

Horriditriletes novus sp. nov.

Pl. 1, Figs. 23, 24

Holotype — Pl. 1, Fig. 23

Type Locality — India, (Bihar), West Bokaro Coalfield, Topa Village Quarry; Barakar Stage.

Diagnosis — Known size 45-53 μ. Subtriangular; Y-mark distinct, rays 2/3 radius long; ornamentation of mixed type, having 2-3 μ high blunt coni as well as bacula.

Description — Miospores subtriangular, holotype 48 μ; Y-mark generally distinct, sometimes obscure due to ornamentational processes; mixed type of ornamentation present, bacula 2-3 μ long and uniformly broad with blunt tips and 2-3 μ long conical processes with round tips; 21-23 processes counted along the margin.

Comparison — Among the species described by Bharadwaj and Salujha 1964, *H. curvibaculosus* is smaller in size and possesses 3-4 μ long, sparsely arranged curved bacula; *H. ramosus*, differs in possessing longer bacula (up to 6 μ) and *H. brevis* differs in being much smaller in size (only 20-24 μ). In *H. bulbosus* sp. nov., the bacula are big, sparse and truncate or bulbous-headed. (The nature of ornamentational processes in the species of *Horriditriletes* is given in TEXT-FIG. 1).

TEXT-FIG. 1 — Nature of bacula in the species of *Horriditriletes* Bharad. & Salujha. a, *H. curvibaculosus*. b, *H. bulbosus*. c, *H. novus*. d, *H. ramosus*. e, *H. brevis*.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — All groups

Cf. *Horriditriletes unicus* sp. nov.

Pl. 1, Figs. 28-30

Holotype — Pl. 1, Fig. 30

Type Locality — India, (M.P.), Korba Coalfield, [498(D)E Bore-hole G-22], Barakar Stage.

Diagnosis — Known size 37-48 μ; subtriangular; body equator thickened, Y-mark distinct, rays reaching almost up to the angles, generally accompanied by narrow secondary folds; bacula sparse, conical blunt tipped, only on distal face.

Description — Miospores subtriangular with convex sides and broadly round angles, holotype 48 μ. Y-mark well defined; thin, narrow secondary folds accompanying the rays; labra thin, ends sharply pointed; rays 17-22 μ long, almost reaching up to the periphery; bacula 2-4 μ long, 1-3 μ broad at base, straight, sparsely disposed, 13-18 in number along the periphery proximally not seen.

Comparison—Horriditriletes curvibaculosus Bharad. & Salujha, possesses bigger bacula with blunt and curved tips; *H. ramosus* (B. & H.) Bharad. & Salujha, has longer bacula, and *H. brevis* Bharad. & Salujha, is smaller in size with smaller bacula. The presence of thin folds along the trilete rays, thick exine and restricted sparse bacula

in *H. unicus* makes this species different from the other species of *Horriditriletes*.

Genus *Microbaculispora* Bharad. 1962

Genotype — Microbaculispora gondwanensis Bharad. 1962

Microbaculispora cf. *villosa* (Balme & Henn.) Bharad. 1962

Pl. 2, Fig. 31

Syn.— Acanthotriletes villosus Balme & Henn. 1956b

Holotype — Balme & Henn. 1956b; Pl. 3, Fig. 38

Remarks — The specimen studied by me measures 128 μ; Y-mark is not clear; exine is thin and covered with closely packed, uniformly arranged 3-4 μ long and ± 2 μ broad simple bacula. The specimen compares well with *M. villosa* in arrangement and the size of bacula, but it is much bigger in size and hence described here as *M.* cf. *villosa*.

Microbaculispora barakarensis sp. nov.

Pl. 2, Fig. 32

Holotype — *See* Bharad. & Tiwari 1964b; Pl. 1, Fig. 8.

Type Locality — India, (M.P.), Korba Coalfield, 208 (II Seam) E; Bore-hole G-2; Barakar Stage.

Diagnosis — Triangular miospores with closely set, 2-2·5 μ broad and 1-1·5 μ high, truncate bacula. Exine 1·5-2 μ thick.

Description — Size 75-83 μ. Miospores triangular, generally with convex sides and somewhat angular corners. Holotype 76 μ, Y-mark distinct, rays thin, ± straight reaching almost to the corners, 50 μ long in holotype; secondary folds along the rays very narrow, sometimes indistinct; labra thin, vertex low. Exine covered with 2-2·5 μ broad and 1-1·5 μ high, truncate, closely packed bacula (TEXT-FIG. 2c). Exine 1·5-2 μ thick in optical section (excluding the height of bacula). Number of bacula counted along the margin 70-90.

Comparison — M. gondwanensis Bharad. possesses thinner exine, 1 μ broad and up to 2 μ high non-truncate, closely disposed bacula, ± 200 in number along the periphery (counted in holotype); *M. villosa* (Balme & Henn.) Bharad., possesses 1 μ broad and 3-4 μ long, non-truncate bacula and thinner exine.

The present species is characterized by its broader than long, closely set, truncate bacula.

Occurrence — Korba Coalfield — *Assemblages A, B.*

Microbaculispora indica sp. nov.

Pl. 2, Figs. 33, 34

Holotype — *See* Bharadwaj and Tiwari 1964b, Pl. 1, Fig. 8.

Type Locality — India, (M.P.), Korba Coalfield, 200 (II Seam), Bore-hole R-48; Barakar Stage.

Diagnosis — Known size 44-72 μ. Subtriangular; bacula ± 1 μ high and 1-1·5 μ broad, non-truncate with round ends; exine 1·5-2 μ thick in optical section.

Description — Miospores subtriangular with convex interradial sides and round angles. Holotype 61 μ. Y-mark distinct; rays reaching almost up to the corners, generally accompanied by narrow secondary folds, labra thin, vertex low; bacula small, generally seen on periphery as small projections; closely set, 55-75 counted along the margin.

Comparison — M. gondwañensis Bharad., differs from the present species in having narrower and longer (1 μ broad and 1·5-2 μ long), very closely set (± 200 along the periphery as counted in the holotype) bacula and in having thinner body exine. *M. villosa* (B. & H.) Bharad. possesses 1 μ broad but 3-4 μ long bacula and thinner exine. *M. barakarensis* sp. nov., differs in having bigger and truncate bacula.

The present species distinguishes itself by having 1 μ high and 1-1·5 μ broad, non-truncate, closely set bacula.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P

Microbaculispora tentula sp. nov.

Pl. 2, Figs. 35-37

Holotype — Pl. 2, Fig. 35.

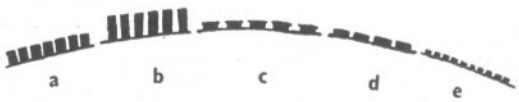
Type Locality — India, (M.P.), Korba Coalfield, NS/165/S ; Bore-hole K-63; Barakar Stage.

Diagnosis — Triangular, known size 37-56 μ, bearing closely set, 1×1 μ bacula.

Description — Miospores triangular, mostly with straight sides and narrow round corners;

holotype 43 μ. Y-mark distinct, rays reaching up to the corners, rarely open, 14-26 μ in length, labra thin, vertex low, secondary folds narrow; exine ± 1 μ thick in optical section, covered with closely set 1×1 μ bacula.

Comparison—Microbaculispora gondwanensis Bharad. is bigger in size, having longer and broader bacula. So also *M. villosa* (B. & H.) Bharad., differs in having 3-4 μ long bacula besides other details. *M. indica* sp. nov. and *M. barakarensis* sp. nov. are bigger in size-range, former species possessing broader than long, truncate bacula and latter one having also bigger bacula (*see* TEXT-FIG. 2).



TEXT-FIG. 2 — Nature of bacula in the species of *Microbaculispora* Bharad. a, *M. gondwanensis*. b, *M. villosa*. c, *M. barakarensis*. d, *M. indica*. e, *M. tentula*.

The present species differs from all the species of the genus in its triangular shape with ± straight sides, smaller size-range and very small, closely set bacula on its exine.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — D.

Genus *Cyclobaculisporites* Bhardwaj 1955

Genotype — Cyclobaculisporites grandiverrucossus (Kos.) Bhardwaj 1955

Cyclobaculisporites minutus Bharad. & Salujha 1964

Pl. 2, Figs. 38, 39

Holotype — Bharad. & Salujha 1964; Pl. 2, Fig. 47

Remarks — The specimens studied here are generally subcircular, exine being mostly subjected to folding, 50-72 μ in size. Y-mark is either clearly seen or obscure due to the closely set bacula, when clear the ray-length varies from 1/2 to 2/3 the radius; ray-ends are pointed. Exine is covered with closely packed, upto 2 μ broad bacula.

Occurrence — Korba Coalfield — *Assemblages — D, E*; W. Bokaro Coalfield — P, DP, TQ, TM

Infraturma — *Murornati* Pot. & Kr. 1954

Genus *Microfoveolatispora* Bharad. 1962

Genotype—Microfoveolatispora raniganjensis Bharad. 1962.

Microfoveolatispora bokaroensis sp. nov.

Pl. 2, Figs. 43, 44

Holotype — Pl. 2, Fig. 44

Type Locality — India, (Bihar), West Bokaro Coalfield; Pindra Seam, Datma Colliery; Barakar Stage.

Diagnosis — Size 72-120 μ. Triangular with convex sides and rounded angles; Y-mark distinct, rays thick-lipped; exine ± 3 μ thick in optical section; foveolae up to 1·5 μ in diameter, muri low, less than 1 μ broad.

Description — Holotype 106 μ. Miospores subtriangular in overall shape; Y-mark distinct; rays 48-54 μ long, ending generally just before the corners, labra ± 2 μ thick, vertex low; secondary folds prominent. Foveolae 1-1·5 μ in diameter, uniformly distributed; muri low, less than 1 μ broad; exine ± 3 μ thick in optical section.

Comparison — The present species differs from the genotype in being larger in size, in having thicker ray-lips, thicker exine and smaller foveolae. The other species of the genus, diagnosed by Bharadwaj (1962, p. 82) differ from the present species either in having smaller foveola, thinner exine and thinner labra of the trilete-rays or in the latter two characters only.

Occurrence — W. Bokaro Coalfield — P, DP, D, TM

Microfoveolatispora foveolata sp. nov.

Pl. 2, Figs. 40-42

Holotype — Pl. 2, Fig. 40

Type Locality — India, (Bihar), West Bokaro Coalfield; Pindra Seam, Pindra Ramgarh Colliery; Barakar Stage.

Diagnosis — Size 41-56 μ, subtriangular; Y-mark thin; foveolae 1-1·5 μ across in diameter, very distinct, muri less than 1 μ broad, *extrema lineamenta* regularly wavy.

Description — Holotype 55 μ; miospores subtriangular with slightly convex sides and broadly rounded angles, Y-mark distinct, labra thin, vertex low, rays generally accompanied by small secondary folds, reaching to the corners, 22-28 μ long; foveolae 1-1·5 μ across in diameter, distinct,

± circular; muri less than 1 μ broad and also less than 1 μ high, distinctly seen on the *extrema lineamenta* giving it a wavy appearance.

Comparison — *M. trisina* (B. & H.) Bharad., *M. pseudoreticulata* (B. & H.) Bharad., and *M. raniganjensis* Bharad. include bigger miospores (*see* BHARADWAJ 1962, p. 82). *M. directa* (B. & H.) Bharad., is very faintly and minutely foveolate. *M. bokaroensis* sp. nov. is bigger in size, having very thick ray-lips and thicker exine.

The present species is characterized by its relatively smaller size with coarser, distinct foveolae.

Occurrence — Korba Coalfield — *Assemblages B, C*; W. Bokaro Coalfield — P, DP, D

Genus *Indospora* Bharad. 1962

Genotype — *Indospora clara* Bharad. 1962.

Indospora clara Bharad. 1962

Pl. 2, Fig. 45

Holotype — Bharadwaj 1962; Pl. 3, Fig. 54

Remarks — Specimens studied here are triangular with straight to slightly convex sides. Size range is 40-57 μ (excluding projections). Y-mark is distinct. Rays end shortly before the equator; rarely Y-mark is open. Exine is thin, faintly microverrucose with few to many, 1-5 μ long blunt bacula. Distal muri form one to four polygonal meshes around the distal polar region.

Indospora is poorly represented in the present miospore assemblage and is restricted to the samples from West Bokaro Coalfield.

Anteturma — *Sporites* H. Pot. 1893
Turma — *Zonales* (Benn. & Kids.) Pot. 1956
Subturma — *Zonotriletes* Waltz 1935
Infraturma — *Cingulati* Pot. & Kl. 1954

Genus *Dentatispora* Tiwari 1964

Genotype—Dentatispora indica Tiwari 1964.

Dentatispora gondwanensis sp. nov.

Pl. 2, Figs. 48, 49

Holotype — Pl. 2, Fig. 48

Type Locality — India, (M.P.) Korba Coalfield, 763(C); Bore-hole G-150, Barakar Stage.

Diagnosis — Subtriangular. Y-mark distinct, distal face of the central body covered with densely disposed long spines and coni. Cingulum with large number of spines.

Description — Miospores subtriangular in overall shape; holotype 66 μ; central body 41-55 μ in size, subtriangular, thin; Y-mark well-defined, rays thin, slightly wavy. Distal processes relatively smaller on body than those of the cingulum, 4-9 μ long and 3-9 μ broad at the bases; cingulum densely covered with long spines fusing at their bases (*see* TEXT-FIG. 3b). Inner body thin, folded.

Comparison — *Dentatispora indica* the genotype has relatively sparsely arranged, smaller conical processes and a dentate cingulum.

Occurrence — *D. indica*: Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — DP, D, TQ; *D. gondwanensis*: Korba Coalfield — *Assemblage C*.

Dentatispora crassa sp. nov.

Pl. 2, Fig. 52, Pl. 3, Fig. 53

Holotype — Pl. 2, Fig. 52

Type Locality — India, (M.P.) Korba Coalfield, 703(C_2-C_7), Bore-hole G-110, Barakar Stage.

Diagnosis — Size 60-117 μ. Subtriangular miospores with distinct Y-mark. Exine coarsely intrapunctate, distal processes sparse, blunt coni; cingulum with few big and blunt conical processes.

Description — Broadly subtriangular in overall shape. Holotype 83 μ in size. Central body distinct, thin; Y-mark well marked, rays wavy with slightly thick lips. Exine coarsely intrapunctate, sometimes puncta being fused; distally only few, 3-8 μ × 2-8 μ, blunt or round-tipped conical processes present. Cingulum 8-16 μ broad with thick glossy and blunt conical processes on its margin (Text-Fig 3c).

Comparison — The present species differs from *Dentatispora indica* and *D. gondwanensis* in having coarser intrapunctation of exine, and broader and fewer blunt processes on distal side as well as along the cingulum margin.

Occurrence — Korba Coalfield — *Assemblage C*.

Dentatispora implicata sp. nov.

Pl. 2, Figs. 46, 47

Holotype — Pl. 2, Fig. 47

Type Locality — India (M.P.), Korba Coalfield, 570(C); Bore-hole G-103, Barakar Stage.

Diagnosis — Small subtriangular, 40-66 μ. Body with narrow, unevenly wide, thick cingulum; distal side covered with very small, 2×2 μ, closely packed, mostly partially confluent bacula.

Description — Roundly subtriangular miospores with a narrow, unevenly broad, glossy cingulum; holotype 43 μ in size; Y-mark distinct, thin, rays ± straight, reaching up to the inner margin of the cingulum rarely broader at the ends, exine thin, finely intramicropunctate; distal surface densely covered with small bacula generally partially fusing with each other to form a matting, inter-baculate spaces irregular in appearance. Inner-body small, triangular, with peripheral folds.

Comparison — *D. implicata* differs from other species in the nature of its cingulum and the distal ornamentation. In fact, the cingulum in the present species is not a 'true crenate' type as in others but an incipient trend towards a unevenly broad cingulum with wavy outline, is evident (*see* TEXT- FIG. 3). The nature of distal ornamentation is also characteristic in the present species.

TEXT-FIG. 3 — Nature of cigulum in the species of *Dentatispora* Tiwari. a, *D. indica*. b, *D. gondwanensis*. c, *D. crassa*. d, *D. implicata*. e, *D. lacunata*.

Occurrence — Korba Coalfield — *Assemblage C*.

Dentatispora lacunata sp. nov.

Pl. 2, Figs. 50, 51

Holotype — Pl. 2, Fig. 50.

Type Locality — India (M.P.), Korba Coalfield, 763(C); Bore-hole G-150, Barakar Stage.

Diagnosis — 41-58 μ. Subtriangular, Y-mark distinct, distal processes 2-7 μ high ×2-6 μ broad bacula partially fused to leave irregular inter-spaces. Cingulum narrow, irregularly thickened, width being not uniform.

Description—Miospores subtriangular with broadly round angles and convex sides. Holotype 48 μ. Body distinct, mostly thin; exine finely intramicropunctate; Y-mark clear, rays thin to slightly thick-lipped, sometimes the ray-ends being broader; distal side covered with densely arranged, big, broader than high, round-tipped bacula, partially fused with each other, inter-baculate spaces linear and irregular. Cingulum narrow, 3-5 μ broad in holotype, thick glossy and unevenly broad; inner-body triangular thin, folded.

Comparison — *Dentatispora indica* possesses sparser coni and distinctly crenate cingulum; *D. gondwanensis* has densely disposed elongated spinose processes on the distal side as well as on cingulum; *D. crassa* has coarsely intrapunctate exine and sparser processes on the distal face and *D. implicata* possesses smaller distal bacula and relatively regularly thickened cingulum.

D. lacunata distinguishes itself from other species in being smaller in size, having uneven width of the narrow cingulum and bigger, mostly fused with each other, broader than high, round headed bacula.

For other specimen see Tiwari 1964; Pl. 1, Fig. 3.

Occurrence — Korba Coalfield — *Assemblage C*

Dentatispora sp.

Pl. 3, Fig. 54

Description — Big subtriagngular spore, ± 115 μ in size, Y-rays thin, slightly wavy, distinct, ± 44 μ long. Exine thin, finely intramicropunctate; on distal side 4-6 μ × 2-3 μ coni present, fusing at their bases to form a coarse, complete reticulation all over. Cingulum 9 μ broad with crenate outline, processes being fused at bases. Inner body thin very much folded.

Comparison — The characteristic feature of this species is the fusion of distal ornamentation, thus resulting in a reticulate sculpture. In this respect it differs from all other species described above.

Infraturma — *Zonati* Pot. & Kr. 1954

Genus *Cirratriradites* Wils. & Coe 1940

Genotype — Cirratriradites saturni (Ibr.) S. W. & B.

Cirratriradites gondwanensis sp nov.

Pl. 3, Figs. 55, 56

Holotype — Pl. 3, Fig. 55

Type Locality — India, (Bihar), West Bokaro Coalified, Datma Seam, Datma Colliery, Barakar Stage.

Diagnosis — Miospores subtriangular, 58-94 μ in size. Body outline distinct due to 4-6 μ broad denser zone along its equator; body exine thin, finely intramicropunctate; Y-mark clear, rays reaching up to the outer margin of the flange; flange thin, 8-17 μ broad. Inner body generally present.

Description — Miospores subtriangular with convex sides and round broad corners; holotype 79 μ; body well marked, thin-walled, but with a 4-6 μ broad denser equatorial band; Y-mark well defined, rays with slightly thick lips, sometimes attenuating, reaching apparently up to the margin of the flange. Exine thin, intramicropunctate. No ornamentation. Flange thin, uniformly broad, structureless, margin smooth. Thin small, subtriangular inner body present.

Comparison — In the present study, forms comparable to *Cirratriradites* are found, both with and without distal ornamentational processes. Balme & Hennelly (1956b) have described those forms under the genus *Cirratriradites*, which possess the distal ornamentation. Such forms have been separated by me (TIWARI, 1964) and described under *Indotriradites*. In *Cirratriradites* only those forms are included which do show smooth, punctate or microgranulose nature of exine.

The present species differs from many other species of *Cirratriradites* described from Northern Hemisphere in having no foveola in the body exine. *C. rarus* (Ibr.) S. W. & B. has a broader flange with distinctly serrate margin.

The present species is characterized by the definite broad equatorial denser zone in the body, well marked trilete mark and simple, thin equatorial flange.

Occurrence — W. Bokaro Coalfield — P, D

Genus *Indotriradites* Tiwari 1964

Genotype — Indotriradites korbaensis Tiwari 1964

Indotriradites sparsus sp. nov.

Pl. 3, Figs. 59, 60

Holotype — Pl. 3, Fig. 59

Type Locality — India (M. P.), Korba Coalfield, 208 (II Seam)E; Bore-hole G-2, Barakar Stage.

Diagnosis — Known size 61-95 μ; subtriangular. Central body distinct, thin walled. Y-mark well-defined. Distal face covered with sparsely placed coni and spinae.

Description — Miospore subtriangular with convex interradial sides and broad round corners. Holotype 75 μ. Central body well-defined, subtriangular, outline parallel to that of flange, 44-72 μ in size; exine distinctly intramicropunctate; Y-mark well-defined, rays reaching almost up to the outer margin of the flange, straight or slightly wavy, labra thin or slightly thick, vertex low. Central body distally ornamented with 3-8 μ long × 2-5 μ broad at the base, sparsely arranged conical processes, generally being 2-5 μ apart from each other; flange 7-12 μ broad, basal thickening generally well marked, surface smooth or apparently minutely granulose, margin entire or slightly wavy.

Comparison — Present species differs from *Indotriradites korbaensis* in having sparsely arranged distal processes. In the latter species they are closely set so that similar one cannot find place in between the two. Specimen illustrated by Hart (1960; Pl. 1, Fig. 17) resembles this species to a greater extent.

Occurrence — I. korbaensis: Korba Coalfield — *Assemblages A-D*;

I. sparsus: Korba Coalfield — *Assemblages A-D*.

Indotriradites surangei sp. nov.

Pl. 3, Figs. 57, 58

Holotype — Pl. 3, Fig. 57

Type Locality — India (M. P.), Korba Coalfield, 207 (II Seam); Bore-hole G-1, Barakar Stage.

Diagnosis — 48-66 μ in size, subtriangular. Basal thickening of the flange generally not prominent, distally closely set, small, 1-3 μ × 1-2 μ coni.

Description — Miospores subtriangular. Holotype 63 μ. Central body distinct, thin, subtriangular; Y-mark well marked, rays prominent, slightly wavy, labra thick, vertex low or slightly raised; proximal exine distinctly intramicropunctate; distal side covered with closely set, small, 1-3 μ × 1-2 μ coni. Flange 5-10 μ broad, width being ± uniform, slightly thicker at attachment zone. Inner body present.

Comparison — *Indotriradites korbaensis* and *I. sparsus* possess distinctly bigger processes on the distal side and more prominent thickening at the basal region of the flange.

Occurrence — Korba Coalfield — *Assemblages A-C.*

Remarks — Hart (1963) has subdivided the species *Cirratriradites splendens* Balme & Henn. in to three different species viz. *C. splendens, C. australiaensis and C. africaensis.* On the basis of their discription and illustrations, these species are referable to the genus *Indotriradites* Tiwari (1964). However, these species differ from the species described here, by the nature of sculptural elements and other details.

Turma — *Monoletes* Ibr. 1933
Subturma — *Azonomonoletes* Luber 1935
Infraturma — *Laevigatomonoleti* Dyb. & Jacho. 1957

Genus *Latosporites* Pot. & Kr. 1954

Genotype — *Latosporites latus* (Kos.) Pot. & Kr. 1954

Latosporites colliensis (B. & H.) Bharadwaj 1962

Pl. 3, Fig. 61

Holotype — Balme & Hennelly 1956a; Pl. 1, Fig. 1.

Remarks — Specimens studies by me are mostly longish oval in shape ranging from 53-110 μ in size along the longer axis. Monolete mark is distinct, 44-75 μ long. Generally monolete mark is 2/3 the length of the spore, but sometimes it is even more; exine is smooth and frequently folded.

For other specimen see Bharadwaj & Tiwari 1964b; Pl. I, Fig. 17.

Occurrence — Korba Coalfield — *Assemblages A, D, E;*

W. Bokaro Coalfield — All groups.

Latosporites sp.

Pl. 3, Figs. 62, 63

Description — 72-87 μ in size. Monolete mark generally obscure due to folding in the exine, ± 2/3 of the longer axis in length, lips generally thick. Exine laevigate, ± 2 μ thick in optical section; folds along the longer axis common.

Comparison — This species differs from *L. colliensis* in having thicker exine and thicker ray lips. Only few specimens were recovered from the present assemblage, hence described here as *Latosporites* sp.

Anteturma — *Pollenites* R. Pot. 1931
Turma — *Saccites* Erdtm. 1947
Subturma — *Monosaccites* (Chit.) Pot. & Kr. 1954
Infraturma — *Monosaccireticuloidi* Inf. nov.

Diagnosis of the infraturma — Trilete pollen grains with equatorial girdling monosaccus, having reticuloid striations on the saccus free areas of the central body.

Remarks — The presence of reticuloid striations on saccus free area of the central body which bears an equatorial girdling saccus is an important character which separates such forms as *Barakarites* Bharad. & Tiwari, from genera as *Plicatipollenites* Lele, *Virkkipollenites* Lele, *Parasaccites* Bharad. & Tiwari, and other. Hence, a new *infraturma* is being proposed here.

Genus *Barakarites* Bharad. & Tiwari 1964a

Genotype — *Barakarites indicus* Bharad. & Tiwari 1964a

Barakarites crassus sp. nov.

Pl. 3, Fig. 64

Holotype — *See* Bharad. & Tiwari 1964a; Pl. 1, Fig. 6

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Roundly subtriangular in shape; central body thin subtriangular, Y-rays thin, 2/3 body radius long, labra thin vertex low; exine relatively coarsely intramicropunctate, reticuloid striations forming areas 5-15 μ in size, generally exine folded on flattening. Saccus uniformly broad with indistinct narrow equatorial thickening. Inner body thin distinct.

Description — Size 130-190 μ. Holotype 190 μ. Central body thin, subtriangular, 75-130 μ in size, not well demarcated outline; Y-mark visible, rays thin, reaching about 2/3 the radius of the central body, labra thin, vertex low; exine relatively coarsely intramicropunctate, thin, with reticuloid striations forming a network, areas bound by striations 5-15 μ; exine generally folded along the striations; saccus ± uniformly broad, 14-24 μ wide, finely intrareticulate with a ± 5 μ broad outer thicker but indistinctly demarcated zone. Inner body big, well marked and thin.

Comparison — *Barakarites indicus* Bharad. & Tiwari, has finer intrapunctation of the exine, the areas bound by reticuloid striations are smaller and the saccus is finely intrareticulate with a distinct outer thickened zone. *B. rotatus* (Balme & Henn.) Bharad. & Tiwari is subcircular in overall shape with finer polygonal areas, broader and well-defined marginal thickening of the outer zone in saccus and finer intrapunctation of the saccus.

Occurrence — *B. indicus*: W. Bokaro Coalfield — TQ;

B. crassus: W. Bokaro Coalfield — P, DP, TQ.

Barakarites implicatus sp. nov.

Pl. 3, Figs. 66-68

Holotype — Pl. 3, Fig. 66

Type Locality — India (Bihar), W. Bokaro Coalfield, Pindra Seam, Datma Colliery, Barakar Stage.

Diagnosis — Size 130-170 μ. Central body big, thin; trilete rays ± 1/2 the radius long, polygonal areas 5-15 μ in size. Saccus 4-8 μ broad on proximal side, distally 20-30 μ broad; no marginal thickening. Inner body thin, distinct.

Description — Miospores subcircular to broadly subtriangular in overall shape, holotype ± 130 μ; central body big circular to subtriangular, ± 115 μ in holotype; exine thin; reticuloid striations demarcating 5-15 μ wide areas, generally irregular folds present. Y-mark weakly developed, rays generally 1/2 the body radius long, labra thin, vertex low. Saccus characteristically narrow on the proximal side, being uniformly 4-8 μ broad, but up to 30 μ broad distally, finely intrareticulate. No marginal thickening present. Inner body thin, well defined, generally folded.

Comparison — The present species distinguishes itself from others in having a big central body and narrow, uniformly wide saccus without any marginal thickening.

Occurrence — W. Bokaro Coalfield — DP, TQ

Barakarites densicorpus sp. nov.

Pl. 4, Figs. 69, 70

Holotype — Pl. 4, Fig. 70

Type Locality — India (Bihar), W. Bokaro Coalfield, Pindra Seam, Pindra Ramgarh Colliery, Barakar Stage.

Diagnosis — Broadly sutriangular; Central body thin, Y-mark clear, rays 1/2 the body radius long, thin reticuloid striations demarcating the polygonal areas 5-15 μ in size; saccus without any zonal thickening, uniformly wide. Inner body subtriangular, dense, ± 2 μ thick in optical section, well-defined.

Description — Holotype 130 μ. Subcircular to broadly subtriangular in overall shape; central body thin, broadly subtriangular, Y-mark thin, rays 1/2 the body radius long, 24 μ in holotype, labra thin, vertex low; ploygonal areas 5-15 μ in size; exine thin, finely intramicropunctate, saccus 8-15 μ broad, uniform, finely intrareticulate. No marginal thicker zone. Inner body showing a tendency towards a thickened nature, generally dense, 2 μ thick, well-defined.

Comparison — *Barakarites indicus*, the genotype and *B. rotatus* possess a definite thickened zone in saccus, a thinner inner body and a thicker central body along with the finer nature of intrapunctation of body and structure of saccus. *B. crassus* has a thinner inner body and a marginal thickening in saccus; *B. implicatus* also differs in having a narrower saccus and thinner inner body. The present species is distinguished by dense, well marked inner body and uniform saccus without any thickened zone.

For other specimen see Bharadwaj & Tiwari 1964a; Pl. 2, Fig. 5.

Occurrence — W. Bokaro Coalfield — P, DP, TM.

Barakarites triquetrus sp. nov.

Pl. 4, Fig. 71

Holotype — *See* Bharadwaj & Tiwari 1964a; Pl. 1, Fig. 3.

Type Locality — India (Bihar), W. Bokaro Coalfield, Pindra Seam, Datma Colliery, Barakar Stage.

Diagnosis — Size 130-165 μ. Subtriangular pollen grains with a thin, ± subcircular distinct central body. Y-mark weakly developed, rays 1/2 to 2/3 the body radius long. Saccus narrower at the inter radial sides and broader at the points of the rays, finely intrareticulate. No thickened zone in saccus.

Description — Pollen grains generally subtriangular with round broad angles; holotype ± 130 μ; central body ± circular thin, distinct, 105-123 μ in size. Y-mark not well developed, sometimes open, rays 1/2 to 2/3 the body radius long, labra thin, vertex low; polygonal areas 5-15 μ in size. Saccus narrower at the inter radial sides of the body, measuring 8-15 μ while broader at three angles, finely intrareticulate with ± 1 μ thick muri. Inner body thin.

Comparison — *Barakarites indicus* and *B. rotatus* possess a sharply defined thickened zone around a uniformly broad equatorial saccus. *B. implicatus* has a uniformly wide, narrower saccus without a thickening at the margin. *B. crassus* has a uniformly broad saccus with an ill-defined marginal zone and *B. densicorpus* along with the uniformly broad saccus, possesses a denser inner body.

The present species distinguishes itself by the presence of a saccus broader at the angles and narrower at the inter-radial sides and by the absence of a marginal thickening.

Occurrence — W. Bokaro Coalfield — DP, D, TQ.

Barakarites decorus sp. nov.

Pl. 3, Fig. 65

Holotype — *See* Bharadwaj & Tiwari 1964a; Pl. 1, Fig. 4.

Type Locality — India (Bihar), W. Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Broadly subtriangular. Central body distinct, subtriangular; Y-mark weakly developed, rays thin ± 2/3 the body-radius long; reticuloid striations forming very small (2-5 μ in size) polygonal areas. Saccus undulating or frilly in appearance, uniformly broad. Inner body with diffused outline.

Description — Size range 113-135 μ, holotype 117 μ. Miospores subtriangular with broad, round angles and convex sides; central body distinct, 92 μ in holotype, body wall ± 2 μ thick, polygonal areas small, mostly 2-5 μ in size (*see* TEXT-FIG. 1, BHARAD. & TIWARI 1964a); Y-mark distinct, labra thin, vertex low; saccus characteristically frilly in appearance, 15 μ broad in holotype, undulating in nature with wavy outline and radial folds, finely intrareticulate. Inner body apparent with diffused outline. No distinct marginal thickening in saccus.

Comparison — The present species differs from all other species of *Barakarites*, by having a saccus frilly in appearance and by smaller polygonal areas on the body exine.

Occurrence — W. Bokaro Coalfield — P, DP, D, TQ

Infraturma — *Amphisacciti* Lele 1965

Genus *Parasaccites* Bharad. & Tiwari 1964a

Genotype — *Parasaccites korbaensis* Bharad. & Tiwari 1964a

Parasaccites obscurus sp. nov.

Pl. 4, Figs. 74, 75

Holotype — Pl. 4, Fig. 75

Type Locality — India (M. P.), Korba Coalfield, 207 (II Seam); Bore-hole G-1, Barakar Stage.

Diagnosis — Subcircular; central body outline not distinguishable; exine thick, without wrinkles or folds, Y-mark generally distinct, closed or open into a triangular window, rays 1/2 to 2/3 radius long; saccus narrow, finely intrareticulate with radially arranged muri.

Description — Size 107-165 μ; holotype 130 μ. Central body outline indistinct, body exine mediumly thick without folds, intramicroreticulate structured. Y-mark generally distinct, rays 1/2 to 2/3 radius long, labra thin, vertex low, may be open, characteristically with the inter-ray exine rolling outwards producing a triangular gap or opening as in holotype. Saccus uniformly broad, 28 μ in holotype, evenly invading the body on both the sides; zones of saccus attachment diffused, saccus intrareticulation fine with radially arranged muri.

Comparison — *Parasaccites korbaensis* Bharad. & Tiwari differs from the present species in having a well-defined central body.

Occurrence — *Parasaccites korbaensis*: Korba Coalfield — *Assemblages A, B, C*; W. Bokaro Coalfield — TQ., *P. obscurus*; Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, DP, TQ, TM.

Parasaccites distinctus sp. nov.

Pl. 4, Figs. 76, 77

Holotype — Pl. 4, Fig. 77

Type Locality — India (Bihar), W. Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Subcircular to broadly subtriangular. Body outline distinct, Y-mark generally obscure or weakly developed, exine thin with many microfolds or wrinkles; saccus narrow, uniformly broad, radially arranged fine muri; zone of saccus attachment almost indistinct.

Description — 66-139 μ in size; holotype 116-136 μ. Subcircular to broadly subtriangular in overall shape. Central body distinct, thin, generally subcircular or broadly subtriangular, ± 90 μ in holotype. Exine very thin, finely intramicroreticulate, characteristically wrinkled in appearance due to the presence of many irregular microfolds; Y-mark obscure or weakly developed; when visible, rays 2/3 the radius of central body long, labra thin, vertex low; saccus narrow, 13-28 μ broad, equally encroaching the body proximally and distally, zones of attachment being diffused; finely intrareticulate, muri arranged in radial pattern, outline slightly wavy.

Comparison — *Parasaccites korbaensis*, the genotype, has a distinct body with unwrinkled, thicker exine; *P. obscurus* has also thicker body exine without microfolds or wrinkles and body outline is indistinct. The present species is characterized by having distinctly defined body with thin wrinkled exine.

For other specimens see Bharadwaj & Tiwari 1964a; Pl. 2, Figs. 9, 10.

Occurrence — Korba Coalfield — *Assemblages C, D*; W. Bokaro Coalfield — P, TQ

Parasaccites diffusus sp. nov.

Pl. 4, Fig. 72

Holotype — *See* Bharadwaj & Tiwari 1964a; Pl. 2, Fig. 11.

Type Locality — India (M. P.), Korba Coalfield (NS/165/S_2, Bore-hole K-63), Barakar Stage.

Diagnosis — Circular; central body ill-defined and exine thin with many microfolds. Y-mark generally not well-defined. Saccus narrow, uniform with radially arranged muri, zones of saccus attachment being diffused.

Description — Size 118-176 μ. Holotype 145 μ. Miospores generally circular; central body big, ill-defined; Y-mark not prominent, generally obscure; exine very thin with many microfolds or wrinkles; saccus 25-35 μ, uniformly broad, ± 20 μ in holotype; intrareticulation fine, muri with ± radial pattern; zones of saccus attachment somewhat irregular and diffused.

Comparison — *Parasaccites korbaensis* possesses a distinct central body with unwrinkled thicker exine; in *P. obscurus* the body is diffused but its exine is thicker and without microfolds. In *P. distinctus* the body outline is distinct. *P. diffusus* distinguishes itself in having a big, diffused body with folded exine and in having poorly developed or obscure mark.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — All groups.

Parasaccites bilateralis sp. nov.

Pl. 4, Fig. 73

Holotype — *See* Bharadwaj & Tiwari 1964a; Pl. 2, Fig. 12.

Type Locality — India (Bihar), W. Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Central body subcircular faintly visible; exine thin, Y-mark not seen. Zones of saccus attachment ill-defined. Saccus broader at the terminal sides while narrower at the lateral sides, finely intrareticulate with ± radial arrangement of muri.

Description — Size 124-192 μ (horizontal axis) × 68-128 μ (vertical axis), holotype 148 × 90 μ, bilaterally oval in outline; central body thin, almost illdefined, rarely with partially visible outline; Y-mark not visible, presumably absent. Saccus narrower along the lateral sides of the central body (being 5 to 15 μ broad), while broader at the terminal sides (21 to 42 μ). Zones of saccus attachment subequatorial on both faces of the body, diffused, leaving ± equal subcircular areas free. Saccus intrareticulation fine, muri radially arranged enclosing elongated meshes.

Comparison — This species differs from all other species in its characteristic bilaterally oval shape with its saccus narrower at the lateral sides, and in the presumable absence of Y-mark.

For other specimen see Bharadwaj & Tiwari 1964a; Pl. 2, Fig. 13.

Occurrence — Korba Coalfield — *Assemblages A-C*; W. Bokaro Coalfield — P, TQ.

Parasaccites sp.

Pl. 4, Fig. 78

Description — Subcircular to horizontally ovoidal, 100-160 μ in size. Central body generally subcircular well-defined, 100-140 μ in size. Saccus narrow, 10-30 μ wide, attached subequatorially on both the sides of the body but the zones of attachment on one face delimiting a broadly oval area lying ± perpendicular to the similar area delimited by distal attachment zones. Saccus intrareticulation fine.

Comparison — The present species is characterized by the tendency of its saccus to encroach upon the body more from the two opposite sides of the periphery on one face of the central body. On the other face the encroachment is from the remaining two opposite sides of the periphery. In other species of this genus the invasion of the saccus upon the body is ± equal and uniformly wide on both proximal and distal faces. This equal and opposite encroachment of saccus on the central body is a tendency towards the organization as found in the genus *Crucisaccites* Lele & Maithy (1965). However, no typical *Crucisaccites* — like forms having two pairs of crossfolds along the zones of saccus attachment, have been found in the present assemblage. Morever, only few specimens showing this incipient trend have been recovered and hence they are being described here as *Parasaccites* sp.

Infraturma — *Apertacorpiti* Lele 1964

Genus *Plicatipollenites* Lele 1964

Genotype — *Plicatipollenites indicus* Lele 1964.

Plicatipollenites indicus Lele 1964

Pl. 5, Fig. 87

Holotype — Lele 1964; Pl. 1, Fig. 6

Remarks — Specimens referable to *Plicatipollenites indicus* Lele, are found in fairly large number in the present material. These are generally circular or subcircular, 73-165 μ in size; central body is thin to mediumly thick, ± circular, distinct and 52 to 105 μ in diameter. Y-mark is thin; rays are 1/2 to 2/3 the body-radius long; generally one ray is longer than the other two and sometimes all the three are equal. Labra are thin, vertex is low and ends taper off. Exine of the central body is thin to mediumly thick and finey intramicrore iculate. Monosaccus is proximally equatorially attached being 10-28 μ broad, but distally subequatorially attached. The zone of saccus attachment is regularly ± circular, distinct and always accompanied by a single, 6-13 μ broad, ringlike prominent fold of the body exine. Saccus has fine to mediumly coarse intrareticulation, muri are thin and narrow and meshes are generally arranged in radial manner, being up to 2·5 μ long.

Other specimen referred to *P. indicus* — Bharadwaj & Tiwari 1964b; Pl. I, Fig. 9.

Occurrence — Korba Coalfield — *Assemblages A-C*; W. Bokaro Coalfield — TQ.

Plicatipollenites gondwanensis (Balme & Hennelly) Lele 1964

Pl. 5, Figs. 88, 89

Holotype — *Nuskoisporites gondwanensis* Balme & Henn. 1956b; Pl. 7, Fig. 66.

Remarks — Specimens studied by me range from 80-154 μ in size. Central body is circular, thin, distinct and 60-105 μ in diameter. Y-mark is generally ill-defined or poorly developed. Rays are short, 1/2 to 2/3 body-radius long. Labra are thin, vertex is low and ends are tapering. Exine of the central body is thin, finely intramicroreticulate; in some specimens microfolds or wrinkles are also present in the exine imparting a corrod appearance. Saccus is ± uniformly broad around the body, generally 2/3 the body-radius wide with subequatorial distal attachment zone. The distal overlapping of saccus is generally less than 1/3 the body-radius, rarely it is more. Zone of saccus attachment is distinct and accompanied by 3-6 folds of the body exine. Saccus is finely intrareticulate, muri being radially arranged. In some of the specimens a narrow, almost diffused, thickened zone in the peripheral region of the saccus is seen.

Occurrence — Korba Coalfield — *Assemblages A-C, E*; W. Bokaro Coalfield — P, TQ.

Plicatipollenites magnus sp. nov.
Pl. 5, Figs. 91, 92

Holotype — Pl. 5, Fig. 91.

Type Locality — India (M.P.), Korba Coalfield, 208 (II Seam)E; Bore-hole G-2, Barakar Stage.

Diagnosis — Subcircular to broadly subtriangular grains, known size-range 152-184 μ. Central body broadly subtriangular, distinct, 99-116 μ in size, thin; Y-mark generally open, rays 1/2 the body-radius long; body exine thin, finely intramicroreticulate; saccus generally slightly narrower at the angles, 26-50 μ broad, finely intrareticulate; distal zone of saccus attachment subequatorial leaving a ± triangular area free from saccus, mostly 3 folds present along the attachment zone.

Description — Pollen grains big, broadly subtriangular in overall shape; holotype ± 184 μ in size. Central body subtriangular with slightly convex sides and broad round ends, thin, distinct, 116 μ in holotype; exine thin, finely intramicroreticulate; Y-mark mostly open to form a triangular rent, rays almost 1/2 the body-radius long, labra thin, vertex low; saccus generally narrower at the side of body corners, 3/4 or equal the body radius wide, finely intrareticulate; distal zone of saccus attachment forming a triangular area, 3 distinct semilunar folds always present.

Comparison — *P. indicus* Lele, is a circular form with a circular body and forming a single circular fold along the distal zone of saccus attachment. *P. gondwanensis* (B. & H.) Lele, is ± circular in shape with ± circular body and polygonal infold system. *P. trigonalis* Lele, though resembles the present species in general shape of the central body and overall shape, is smaller in overall size (range of miospore size 97-145 μ × 94-134 μ, and body 60-90 μ; after Lele), possesses a denser body with a continuous triangular distal fold and a narrower saccus (1/3 the body radius) uniformly broad all-round.

Occurrence — Korba Coalfield — *Assemblages A, B.*

Plicatipollenites sp.
Pl. 5, Fig. 90

Description — Size 138-165 μ. Circular miospores with ± circular, thin and well-defined central body, size of body 88-91 μ, exine thin, indistinctly structured, with many irregular microfolds; Y-mark not clear, sometimes a broadly open area visible; saccus 30-41 μ uniformly broad alround, distally subequatorially attached, attachment line not distinct; fold system not clearly seen. Saccus with very coarse intrareticulation, 3-7 μ broad meshes and 1-1·5 μ thick muri, reticulum complete.

Comparison — Remarkably coarse intrareticulation of the saccus is an important character which separates these specimens from all the other described species. However, the nature of the Y-mark, the structure of the body exine as well as the nature of infolds in body-exine are not very clear in the specimens recovered from the samples under study, and hence they are described here as *Plicatipollenites* sp.

Genus *Virkkipollenites* Lele 1964

Genotype — *Virkkipollenites triangularis* (Mehta) Lele 1964.

Virkkipollenites densus Lele 1964
Pl. 5, Fig. 93

Holotype — Lele 1964; Pl. 2, Fig. 19.

Remarks — Specimens studied by me are subcircular to broadly subtriangular in overall shape and 74-127 μ in size. Central body is ± circular, dense, distinctly marked and 48-100 μ in size. Exine is thick, dark brown and finely intramicroreticulate. Y-mark is either obscure or faintly descernible, rays being 2/3 the body-radius long. Labra are thin, vertex is low and ends are pointed. Saccus is ± uniformly, 11-23 μ broad and finely intrareticulate and proximally equatorially but distally subequatorially attached. Distal zone of attachment is apparently circular, diffused and without body infolds along it. Saccus intrareticulation is fine; muri are generally radially elongated. Outline is slightly irregular.

For other specimen see Bharadwaj & Tiwari 1964b; Pl. 1, Fig. 15.

Infraturma — *Vesiculomonoraditi* (Pant) Bhard. 1956

Genus *Potonieisporites* (Bhard.) Bharad. 1964b

Genotype — *Potonieisporites novicus* Bhard. 1954.

Potonieisporites concinnus sp. nov.
Pl. 4, Figs. 79-81

Holotype — Pl. 4, Fig. 80.

Type Locality — India (Bihar), W. Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Bilaterally oval; central body subcircular to oval, thin, distinct; monolete mark poorly developed. Exine thin, finely intramicropunctate, saccus narrower at the lateral sides, distal zone of saccus attachment accompanied by thin folds of body exine encircling a wide, ± polygonal area. Saccus intrareticulation fine to mediumly coarse, with many strongly radiating folds.

Description — Size 160-230 μ×121-156 μ. Holotype 238×156 μ. Central body thin with distinct outline, circular, subcircular or broadly oval in outline, 95 μ in holotype. Monolete mark not very prominent, generally weakly developed or represented by only a thin fold or thinning of the exine. Body exine thin, with many irregular microfolds. Saccus mediumly intrareticulate, narrower at the lateral sides (30 μ in holotype) and broader on the terminal sides (± 55 μ in holotype), characteristically folded, folds being radially arranged; distally inclined to attach itself subequatorially with body; meshes radially arranged. Zone of saccus attachment forming a wide, polygonal, subcircular or oval area, accompanied by 4-6 folds of the body exine.

Comparison — The present species differs from the genotype in being bigger in size, in having only one set of body folds and in the nature of the saccus. *P. neglectus* Pot. & Lele, apart from being smaller in size, possesses a well-defined monolete mark, ± polygonal central body and a evenly flattened saccus.

Occurrence — Korba Coalfield — *Assemblage C*; W. Bokaro Coalfield — DP, TQ.

Potonieisporites triangulatus sp. nov.

Pl. 4, Figs. 82-84

Holotype — Pl. 4, Fig. 83.

Type Locality — India (M.P.), Korba Coalfield (511D, Bore-hole G-101), Barakar Stage.

Diagnosis — Pollen grains oval; central body distinct, subtriangular, one end narrower, other broadly round, monolete mark poorly developed; distal zone of saccus attachment forming a triangular to boat-shaped area; saccus narrower at the lateral sides, finely intrareticulate.

Description — Holotype 149×127 μ; central body distinct, thin, subtriangular. Monolete mark generally ill-defined, mostly represented by thin area or fold, body exine thin, showing fine intrapunctation; saccus narrower at the lateral sides, inclined distally to form a ± subtriangular area, zone of attachment accompanied by 3-4 folds of the body exine; shallow lateral notches in the saccus rarely present; reticulation fine.

Comparison — *P. novicus* Bhard. has a subcircular central body, well-defined monolete mark and two sets of folds. *P. neglectus* Pot. & Lele differs in having ± polygonal central body, polygonal distal bladder-free area and a well-defined monolete mark. *P. concinnus* differs in having a circular to broadly oval central body and subcircular saccus free area distally.

Occurrence — Korba Coalfield — *Assemblages B, C*; W. Bokaro Coalfield — TQ.

Potonieisporites barrelis sp. nov.

Pl. 4, Figs. 85, 86

Holotype — *See* Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 31.

Type Locality — India (M.P.), Korba Coalfield, 207 (I Seam) Bore-hole G-1, Barakar Stage.

Diagnosis — Bilaterally oval; known size-range 118-169 μ×74-106 μ. Central body vertically broadly oval with flat lateral ends resulting in a shape like a barrel with equally wide flat ends, 70×85 μ in holotype; exine thin or mediumly thick. Monolete mark distinct; distal sulcus 40-65 μ wide in the centre, zones of saccus attachment ± straight to slightly convex, laterally wide, almost meeting the angles of the body ends. Lateral continuations narrow. Sacci hemispherical with mediumly coarse intrareticulation.

Description — Holotype 127×96 μ in size. Pollen grains bilaterally oval with narrow lateral continuations of sacci. Central body distinct, mostly thin-walled, barrel-shaped, 57-89 μ×61-95 μ in size. Sacci inclined distally to form a wide, distinct sulcus. Zones of attachment accompanied by 5-18 μ wide secondary folds, lateral extremities of attachment zones coinciding with the angles of the flat ends of the body. Sacci hemispherical, laterally continuous, width of lateral continuations being 2-12 μ, generally without any notch. Intrareticulation of

sacci mediumly coarse, rarely fine, meshes 2-4 μ in size, muri thick.

Comparison — The present species differs from all the other species of *Potonieisporites* in its characteristic barrel-shaped body.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, DP, TQ, TM.

Infraturma — *Aletesacciti* Lesch. 1955

Genus *Densipollenites* Bharadwaj 1962

Genotype—Densipollenites indicus Bharad. 1962.

Densipollenites indicus Bharad. 1962

Pl. 5, Fig. 95

Holotype — Bharadwaj 1962; Pl. 6, Fig. 103.

Remarks — Specimens studied by me range in size from 128 to 140 μ and are circular to subcircular in overall shape. Central body is circular, 40-60 μ in size, thin but with distinct outline. Saccus intrareticulation is fine to medium sized, meshes being 1-4 μ wide. Thickened zone in the saccus is not seen.

Densipollenites invisus Bharad. & Salujha 1964

Pl. 5, Fig. 94

Holotype — Bharadwaj & Salujha 1964; Pl. 4, Fig. 74.

Remarks — Specimens studied by me range in size from 130-172 μ along the longer axis. Overall shape is subcircular to broadly ovoidal. Central body is very thin, hardly visible, apparently big and subcircular in shape. Saccus intrareticulation is mediumly course, meshes being upto 4 μ in size.

Infraturma — *Striasacciti* Bharad. 1962

Genus *Striomonosaccites* Bharad. 1962

Genotype—Striomonosaccites ovatus Bharad. 1962

Striomonosaccites circularis Bharad. & Salujha 1964

Pl. 5, Fig. 96

Holotype — Bharadwaj & Salujha 1964; Pl. 4, Fig. 77.

Remarks — Specimens studied here are circular to ovalish in overall shape, 101-142 μ×84-120 μ in size; central body is circular, thin, distinct and 52-75 μ in size; exine is thin and finely intramicroreticulate. Proximally 5-8 unbranched, longitudinal striations are present. Saccus is slightly narrower at the two sides while broader at the ends of the longer axis and is 1/2 to 2/3 the body radius broad and distally slightly inclined to attach subequatorially with body leaving a ± circular area uncovered. Saccus reticulation is fine.

Subturma — *Disaccites* Cookson 1947

Infraturma — *Striareticuloiditi* Tiwari 1964

Genus *Korbapollenites* Tiwari 1964

Genotype — *Korbapollenites novus* Tiwari 1964. Specimen referred to *K. novus* — Pl. 5, Figs. 97, 98.

Occurrence —Korba Coalfield — *Assemblages D, E*; W. Bokaro Coalfield — P.

Genus *Fimbriaesporites* Lesch. 1959

Genotype—Fimbriaesporites globosus Lesch.

Fimbriaesporites sp.

Pl. 5, Fig. 99

Description — Size 100-110 μ. Bilateral pollen grains, central body generally subcircular, thick, ± 40 μ. Proximally reticuloid striations present, exine thick, finely microverrucose; saccus subspherical, distally inclined to form a narrow, almost ill defined sulcus, zone of attachment full length, laterally ± close to each other. Saccus finely intrareticulate.

Remarks — The specimens showing the microverrucose sculpture on body exine along with reticuloid striations are referred here to the genus *Fimbriaesporites* Lesch. Only a few specimens were recovered and hence they are described as *Fimbriaesporites* sp.

Genus *Rhizomaspora* Wilson 1962

Genotype — *Rhizomaspora radiata* Wilson 1962.

Rhizomaspora indica sp. nov.

Pl. 5, Figs. 100-103

Holotype — *See* Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 24.

Type Locality — India (M.P.), Korba Coalfield, 5/179 (I Seam)E; Bore-hole R-26, Barakar Stage.

Diagnosis — Known size-range 93-154 μ. Central body circular to subcircular, 44 μ in holotype, dense, polygonal areas distinct, 1-5 μ in size forming a reticuloid pattern; distal attachment zones ill-defined, apparently close to each other forming a narrow almost ill-defined sulcus; saccus laterally deeply notched or continuous, intrareticulation double.

Description — Pollen grains disaccate with or without monosaccoidal construction of sacci, bilateral; holotype 144×95 μ. Central body circular to subcircular, dense, distinct, 36-54 μ in size. Reticuloid striations distinctly marked forming 1-5 μ wide, nearly polygonal areas all over the proximal face; exine thick, finely intramicropunctate; no ornamentation. Sacci slightly invading the body on proximal face, attachment zones being diffused, many radiating folds of saccus continuing from body subequatorial region into the saccus. Distal sulcus generally ill-defined and narrow. Sacci subspherical or ± hemispherical in shape laterally either adjacent or with broad continuations; double nature of intrareticulation apparent.

Comparison — The specimens from the present assemblage described under *Rhizomaspora* Wilson, differ from the species described by Wilson (1962), in showing a tendency of sacci to invade the body proximally. All the more, the present species differs from *R. radiata* Wilson, in having no equatorial thickening in the body and in the arrangement of proximal thickenings; *R. divaricata* Wilson, has an equatorial rim, broader, thinner sulcus area and laterally apart sacci. *R. lemniscata* Wilson, also differs in having subparallel rather than ± polygonal areas unlike the present species.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — All groups.

Rhizomaspora fimbriata sp. nov.

Pl. 5, Figs. 104, 105

Holotype — Pl. 5, Fig. 105.

Type Locality — India (Bihar), W. Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Distinctly bisaccate construction of sacci. Holotype 101×71 μ. Central body ± circular mediumly thick, equatorial rim 2-4 μ broad generally with wavy outline, polygonal areas faintly visible, small-sized, 1-5 μ; distal sulcus broad slightly convex, zones of attachment laterally wide; sacci subspherical, laterally 5-15 μ apart, finely intrareticulate.

Description — Pollen grains bisaccate; central body ± circular 42-53 μ in diameter, thick; equatorial rim 2-4 μ broad, thick, characteristic wavy outline generally seen. Exine mediumly thick, finely intramicropunctate, polygonal areas faint, reticuloid striations thin and faint; distal sulcus broad, thin, 18 μ in holotype; attachment zones faint, laterally 15 μ apart in holotype. Sacci subspherical, laterally apart from each other, finely intrareticulate.

Comparison — Among the species described by Wilson (1962), *R. divaricata* resembles with the present species in the laterally separated sacci but the latter does not show the wavy outline of equatorial rim and the sulcus is completely obscure and narrow.

Occurrence — W. Bokaro Coalfield — DP, TQ.

Rhizomaspora singula sp. nov.

Pl. 5, Figs. 106, 107

Holotype — Pl. 5, Fig. 106.

Type Locality — India (Bihar), W. Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Known size 113-138 μ. Central body big, ± circular and dense, ± 75 μ in holotype; a narrow, wavy equatorial rim present. Proximally, striations reticuloid to subparallel forming 3-8 μ wide, polygonal to somewhat rectangular areas. Distal sulcus narrow, ill-defined; saccus more than hemispherical in shape with fine to mediumly coarse intrareticulation with thick muri.

Description — Pollen grains bilateral; laterally the sacci generally adjacent to each other. Holotype 121×100 μ; central body 51-75 μ across the radius, circular or subcircular with thick wall. Equatorial rim alround, 2-3 μ broad, slightly uneven in width appearing somewhat wavy; body exine thick, finely intramicropunctate. Proximally, distinctly demarcated, regularly or irregularly arranged ± polygonal areas present; striations well-defined, reticuloid to subparallel in arrangement, generally radiating in the peripheral region of the body. Saccus showing minor radiating folds. Distal sulcus ill-defined, apparently narrow,

the distal zone of saccus attachment being faint or obscure. Sacci more than hemispherical in shape, laterally adjacent to each other; fine to mediumly coarse intrareticulation, muri ± 1 μ thick, somewhat thicker near the periphery of the saccus lobes.

Comparison — Among the species described by Wilson (1962) *R. radiata* though resembles the present species in the nature of reticuloid striations, differs in having much smaller central body and in the body bladder ratio. Moreover, in the present species the muri of sacci are characteristically thicker. *R. divaricata* Wilson, shows the presence of thinner and wider distal sulcus, laterally apart sacci and smaller central body, thus differs from the present species. So also, *R. lemniscata* Wilson, is different in having smaller body in relation to bigger sacci and in the presence of thinner muri of sacci, apart from other details.

R. indica, and *R. fimbriata* possess smaller central body and smaller polygonal areas apart from other details, thus differ from the present species.

The present species is characterized by its bigger and thick central body, well marked subparallel and radiating striations forming ± polygonal to rectangular areas and the characteristic thick muri enclosing fine meshes.

Occurrence — W. Bokaro Coalfield — DP, TQ.

Genus *Primuspollenites* Tiwari 1964

Genotype — *Primuspollenites levis* Tiwari 1964.

For specimen referred to *P. levis* see Bharadwaj & Tiwari 1964b; Pl. 1, Fig. 16.

Primuspollenites densus sp. nov.

Pl. 5, Fig. 108

Holotype — Pl. 5, Fig. 108.

Type Locality — India (M.P.), Korba Coalfield, 202 (II Seam)E; Bore-hole R-34, Barakar Stage.

Diagnosis — Known size-range 112-154 μ × 79-106 μ. Central body dense, vertically oval, well marked; reticuloid striations very distinct, areas being 1-6 μ in size. Known body size 38-48 μ × 51-72 μ. Saccus distally inclined to form a narrow, convex sulcus; prominent thickening along the zone of distal attachment; laterally sacci continuous generally with shallow constrictions rarely completely notched, intrareticulation double in nature, apparently fine.

Description — Holotype 138 × 96 μ. Pollen grains bilateral in overall shape; central body dark brown, vertically oval, distinct, in holotype 42 × 57 μ in size, exine thick; saccus proximally subequatorially attached, invading the body by 2-3 μ, attachment zone diffused, generally with fine radiating folds; distal channel narrow, convex, 13-23 μ broad in the centre; distal zone of attachment well-defined, accompanied by 2-4 μ broad thickenings. Laterally sacci continuous, 6-18 μ broad, much narrower than the saccus span at the terminal sides, slightly or completely notched on both sides, rarely on one of the lateral sides. Saccus hemispherical to more than hemispherical, apparently finely intrareticulate, with indistinct double intrareticulation.

Comparison — The present species differs from *Primuspollenites levis* in having a denser body and more distinct reticuloid striations.

Occurrence — *P. levis*: Korba Coalfield — *Assemblages D, E*; W. Bokaro Coalfield — P, DP, TQ; *P. densus*: Korba Coalfield — *Assemblages A, D, E.*

Primuspollenites dicavus sp. nov.

Pl. 5, Figs. 111, 112

Holotype — Pl. 5, Fig. 111.

Type Locality — India (M.P.), Korba Coalfield 202 (II Seam)E; Bore-hole R-34, Barakar Stage.

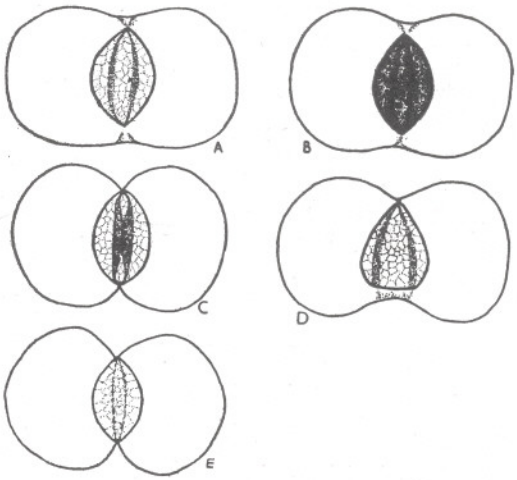
Diagnosis — Known size-range 103-154 μ × 75-112 μ. Central body vertically oval, thick and well-defined; reticuloid striations distinct, forming small sized (1-6 μ) areas; distal sulcus well marked, straight to slightly convex, known width in the centre being 11-19 μ; distal zones of attachment accompanied by 2-4 μ broad thickenings which narrowing out at the lateral ends resulting in dumb-bell shaped appearance. Saccus mostly without lateral continuations, subspherical, finely intrareticulate, double intrareticulation rarely apparent.

Description — Pollen grains bilateral; holotype 106 × 89 μ. Central body vertically oval, mostly with narrow round ends, well marked, generally mediumly thick rarely very thick; 33 × 51 μ in holotype. Reticuloid striations distinct, polygonal areas

well-defined, 1-6 μ in size. Sacci slightly invading the body proximally, the attachment zone being diffused; distal sulcus straight to slightly convex; zones of saccus attachment accompanied by narrow thickenings, forming two key-hole shaped areas at the lateral ends of the sulcus. Sacci distinctly subspherical, laterally generally close, finely intrareticulate, double-intrareticulation apparent in some cases.

Comparison—*Primuspollenites levis* differs from the present species in having a thinner body and a typically convex sulcus with poorly developed thickening at the attachment zone. *P. densus* though possesses a thick oval body, differs in having a convex sulcus and in the absence of its characteristic dumb-bell shape.

Occurrence — Korba Coalfield — *Assemblages D, E.*



TEXT-FIG. 4 — Diagrams showing the nature of sulcus in the species of *Primuspollenites* Tiwari. A, *P. levis*. B, *P. densus*. C, *P. dicavus*. D, *P. linterus*. E, cf. *P. obscurus*.

Primuspollenites linterus sp. nov.

Pl. 6, Figs. 113, 114

Holotype — Pl. 6, Fig. 114.

Type Locality — India (M.P.), Korba Coalfield 5/179 (I Seam)E; Bore-hole R-26, Barakar Stage.

Diagnosis — Known size 100-140 μ. Central body oval with one end narrower and the other broadly round, resulting in a ± subtriangular shape having one side smaller, well marked, and without marginal ridge; reticuloid striations forming small sized polygonal areas on proximal face; distal sulcus boat-shaped; sacci laterally continuous with or without notches, or just meeting, wall with double nature of intrareticulation.

Description — Holotype 118×78 μ. Pollen grains with characteristic, nearly subtriangular body and boat-shaped distal sulcus. Central body distinct, 34-45 μ ×41-57 μ, generally mediumly thick, vertically oval with one end narrower and the other broadly round (TEXT-FIG.4 D); polygonal areas well marked, 1-6 μ in size; sacci generally invading proximal body face, attachment being diffused, distal attachment well-defined, zones of attachment being close to each other at the narrower end of the body while 18-26 μ apart at the broader end, accompanied by well-defined 3-6 μ broad thickening; width of sulcus in the middle 12-25 μ; sacci generally laterally continuous, narrower than the saccus width at the sides, notched or without notch, rarely just meeting; apparently finely intrareticulate.

Comparison — *P. levis* and *P. densus* differ from the present species in possessing a vertically oval body with narrow lateral ends and a convex sulcus; *P. dicavus* also possesses a vertically oval body with ± straight sulcus and characteristic dumb-bell shaped appearance of the sulcus.

The present species distinguishes itself by its vertically oval body with one broadly round and other narrower ends and the characteristic boat-shaped sulcus.

Occurrence — Korba Coalfield — *Assemblages A, D, E*; W. Bokaro Coalfield — TQ.

Cf. *Primuspollenites obscurus* sp. nov.

Pl. 5, Figs. 109, 110

Holotype — Pl 5, Fig. 110.

Type Locality — India (M.P.), Korba Coalfield 202 (I Seam)E; Bore-hole R-34, Barakar Stage.

Diagnosis — Known size 110-150 μ. Body outline ill-defined, apparently vertically oval, exine thin, reticuloid striations forming indistinct polygonal areas. Distal sulcus narrow. Sacci big, subspherical; intrareticulation double, apparently fine.

Description — Holotype 125×100 μ, pollen grains bilateral with almost indistinct, apparently vertically oval thin central body, reticuloid striations generally faintly marked,

rarely well defined forming 2-6 μ wide nearly polygonal areas. Distal channel 10-23 μ wide, convex. Sacci hemispherical 85-104 μ along the lateral axis, laterally just meeting with each other. Intrareticulation double in nature, the coarser meshes mostly merging and ill-defined thus apparent as finely intrareticulate.

Comparison — From *Primuspollenites levis* and *P. densus* the present species differs in having an ill-defined outline of the central body. Apart from this, *P. linterus* and *P. dicavus* differ from the present species in the nature of distal sulcus.

Occurrence — Korba Coalfield — *Assemblages D, E.*

Genus *Direticuloidispora* Tiwari 1964

Genotype — Directiculoidispora indica Tiwari 1964.

Pl. 6, Fig. 116 referred to *D. indica*

Directiculoidispora triangula sp. nov.

Pl. 6, Fig. 115

Holotype — See Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 21.

Type Locality — India (M.P.), Korba Coalfield 5/179 (I Seam)E; Bore-hole R-26, Barakar Stage.

Diagnosis — Bilaterally oval. Central body vertically oval, one end narrow to pointed and the other broadly round to ± flat. Body outline distinct, proximal and distal polygonal areas 1-5 μ in size; distal sulcus boat-shaped, well defined; sacci generally with broad lateral continuations, with or without shallow notches, apparently finely intrareticulate.

Description — Known size 114-143 μ × 86-111 μ. Holotype 126 × 96 μ. Pollen grains bilateral in symmetry with laterally continuous sacci. Central body 42-51 μ (horizontal axis in the middle) × 35-58 μ (vertical axis), 42 × 45 μ in holotype; distinctly marked, vertically elongated with one lateral end ± acute while other broadly round. Exine thin to mediumly thick, intramicropunctate; proximal polygonal areas equal or bigger than those on the distal face. Sacci generally invading the body a little proximally, attachment zone diffused, distally inclined to form a more or less boat-shaped sulcus, the narrower end of the 'boat' lies at the narrower end of the body. Sulcus width 18-36 μ in the middle while 18-42 μ at the broader end. Zone of distal attachment prominent, slightly thicker; lateral continuations 12-30 μ wide with or without notches. Intrareticulation of sacci indistinctly double, apparently fine, meshes being 0·5-1·5 μ in size.

Comparison — Directiculoidispora indica differs in having a vertically rhomboidal central body and typically biconvex distal sulcus.

Occurrence — D. indica: Korba Coalfield — *Assemblages B, D, E*; *D. triangula*: Korba Coalfield — *Assemblages D, E.*

Infraturma — *Striatiti* Pant 1954

Genus *Lueckisporites* (Pot. & Kl.) Klaus 1963

Genotype — Lueckisporites virkkii Pot. & Kl. 1954.

Lueckisporites sp.

Pl. 6, Fig. 119

Description — Bilateral, 84 × 58 μ in size, central body thin, horizontally oval, 69 × 52 μ; exine thin distinctly intramicroreticulate, proximal exine divided in two halves by a median, 10 μ broad horizontal laesur, distally the sacci lying 23 μ apart from each other; saccus small, only ± 7 μ broad proximally on terminal sides, distally invading the body up to 27 μ, laterally 23 μ apart from each other, finely intrareticulate.

Remarks — *L. virkkii* and *L. microgranulatus* as described by Klaus (1963) differ in the nature of saccus and its intrareticulation as well as in the structure of body exine. *Lueckisporites tattooensis* Jans. (Jansonius 1962; Pl. 3, Fig. 8) compares well with the present species except that the sacci are thicker without distinct reticulation in the former one. Spore type 5, described by Virkki (1946; Pl. 1, Fig. 5) resembles the present specimen to a greater extent.

Genus *Striatites* (Pant) Bharad. 1962

Genotype — Striatites sewardii (Virkki) Pant.

Remarks — Recently Klaus (1963) has described 4 species of disaccate striated forms under *Striatites* after emending the generic diagnosis. He emphasized that the specimens having less than hemispherical sacci should only be included in this genus (Klaus 1963 p. 320). However the shape of the saccus—haploxylonoid or diploxylonoid—does not seem to be of much importance in

view of the presence of both types in grains morphographically similar and occurring together in one assemblage. Moreover, Klaus described the exine of the central body in *Striatites* as infrastructured while it is described to have microverrucose sculpture by Bharadwaj (1962). In the present paper, delimitation proposed by Bharadwaj (1962) is being followed.

Striatites rhombicus Bharad. & Salujha 1964

Pl. 6, Fig. 122

Holotype — Bharad. & Salujha 1964; Pl. 5, Fig. 88.

Remarks — The specimens observed in the present assemblage are 100-105 μ along the longer axis. Central body is thin and vertically oval to rhomboidal with broad lateral ends. Exine is thin and finely microverrucose; marginal ridge is distinct, ± 3 μ broad. Horizontal striations are ± 8 in number with 4-6 vertical partitions in between them. Distal channel is 17-21 μ wide, slightly convex and zones of sacci attachment are ± 10 μ apart laterally. Sacci are subspherical with fine to mediumly coarse intrareticulation.

Striatites communis Bharad. & Salujha 1964

Pl. 6, Fig. 123

Holotype — Bharad. & Salujha 1964; Pl. 7, Fig. 105.

Remarks — Specimens studied in the present assemblage range in size from 64-124 μ. Central body is vertically oval or subcircularly rhomboidal, 31-44 μ × 35-47 μ in size, without any equatorial ridge; 5-8 horizontal branched or unbranched striations are present. Vertical partitions are absent. Exine of the central body is thin and finely microverrucose. Distal channel is 10-20 μ broad in the middle while it is narrower at the two lateral ends. Sacci are subspherical and finely intrareticulate.

Occurrence — Korba Coalfield — *Assemblages A-E.*

Striatites multistriatus (Balme & Henn.) comb. nov.

Pl. 6, Figs. 117, 118

Syn.—*Lueckisporites multistriatus* Balme & Henn. 1956.

Holotype — Balme & Hennelly 1955; Pl. 2, Fig. 16.

Remarks — According to the circumscription of the genus *Striatites* by Bharadwaj (1962), disaccate pollen grains with horizontal striations on the proximal face of the central body, with or without vertical partitions and with *microverrucose* exine should be included in this genus. *Lueckisporites* differs in having no striations, apart from other details. Thus, after the study of specimens similar to *L. multistriatus* illustrated by Balme & Hennelly (1955; Pl. 2, Figs. 16-20), a new combination is being proposed as *Striatites multistriatus*, the holotype being the first illustration given by them (B. & H., 1955; Pl. 2, Fig. 16).

Description — Pollen grains small, bilateral; Central body ± circular distinct 40-44 μ in size. Exine thin, finely microverrucose, proximal face bearing 13-17 distinct horizontal striations without any vertical partitions inbetween them. Saccus small, ± 1/2 the body radius broad at the sides, distally inclined to leave a wide sulcus; laterally ± 11 μ apart, more or less hemispherical in shape, finely intrareticulate.

Comparison — *Striatites sewardii* (Virkki) Pant, as well as *S. notus* and *S. subtilis* Bharad. & Salujha, possess denser central body as compared to *S. multistriatus*, with marginal ridge, bearing lesser number of horizontal striations with vertical partitions. *S. rhombicus* Bharad. & Salujha, is bigger in size having a marginal ridge on body and few vertical partitions. *S. solitus* and *S. communis* Bharad. & Salujha though possess a thin circular central body, differ from the present species in having lesser number of horizontal striations. Other species of *Striatites* described form the present assemblage, also differ in having lesser number of horizontal striations as well as in the body bladder ratio apart from other details.

S. multistriatus, the species under discussion, is characterized by its smaller size, ± circular thin body, 1/2 the body radius broad sacci, many (13-17) horizontal striations without any vertical partition, and broad distal channel.

Occurrence—W. Bokaro Coalfield—P, TQ.

Striatites tentulus sp. nov.

Pl. 6, Figs. 120, 121

Holotype — Pl. 6, Fig. 120.

Type Locality — India (M.P.), Korba Coalfield 208 (II Seam)E; Bore-hole G-2, Barakar Stage.

Diagnosis — Size 56-90 μ. Central body circular to subcircular, without any equatorial ridge, 25-40 μ in size, dark brown; proximally 5-7 horizontal striations without any vertical partition inbetween; distal sulcus narrow, slightly convex; sacci subspherical, finely intrareticulate, laterally 5-10 μ apart.

Description — Holotype 70×46 μ in size. Pollen grains with circular to subcircular, dense central body, ± 32 μ in holotype, without equatorial rim; exine thick, finely microverrucose; proximal face bearing 5-7 horizontal branched or unbranched striations, no vertical partitions present. Sacci subspherical, laterally 5-10 μ apart distally inclined to form a convex, 9-15 μ broad distal sulcus. Saccus intrareticulation fine.

Comparison — The present species differs from *S. sewardii* in the absence of lateral ridge and vertical partitions. So also, apart from other details, *S. rhombicus*, *S. notus*, *S. subtilis* and *S. obtusus* (all spp. after BHARAD. & SALUJHA 1964) differ from the present species in having complete or partial equatorial ridge in the body and in the presence of vertical partitions. *S. solitus* and *S. communis* (BHARAD. & SALUJHA 1964) have thinner central body. *S. multistriatus* (B. & H.) comb. nov. possesses thinner body, wider sulcus and more horizontal striations. The distinguishing features of the present species are thick circular central body without any marginal ridge, no vertical partitions, and narrow distal sulcus.

Occurrence — Korba Coalfield — *Assemblages A, B, D, E*; W. Bokaro Coalfield — P, D, TQ.

Striatites parvus sp. nov.

Pl. 6, Figs. 124, 125

Holotype — Pl. 6, Fig. 125.

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Seam, Mangardah Colliery; Barakar Stage.

Diagnosis — Pollen grains small, known size-range 43-68 μ; central body circular to oval or even slightly rhomboidal, 22-34 μ ×27-34 μ, thin-walled, with an equatorial ridge alround. Proximal face bearing 4-7 horizontal striations without any vertical partitions in between them. Distal sulcus straight to slightly convex; sacci subspherical with fine intrareticulation, laterally slightly apart.

Description — Holotype 55-34 μ. Grains with thin-walled circular, subcircular or slightly rhomboidal central body, equatorial ridge 1-3 μ broad, sometimes irregular in appearance. Proximal face of the body bearing 4-7 horizontal, generally unbranched striations, without any vertical partitions inbetween them, exine thin, finely microverrucose; distal zones of saccus attachment 7-11 μ apart from each other, forming a ± straight to slightly convex sulcus; Sacci 3-12 μ apart at the lateral sides, small, subspherical in shape, finely intrareticulate.

Comparison — Among the species described by Bharadwaj and Salujha 1964, as having no vertical partitions in between the horizontal striations, *S. obtusus* is bigger in size and possesses lateral ridges and not the complete equatorial ridge, hence differs from the present species. In *S. solitus* and *S. communis* Bharad. & Salujha, the body is without equatorial or lateral ridge. *S. tentulus* sp. nov. differs in having thicker central body without any marginal ridge and *S. multistriatus* (B. & H.) comb. nov. possesses more horizontal striations, wider sulcus and no equatorial ridge, thus differs from the present species.

Spore type 66 described by Virkki (1946; PL. 6, FIGS. 85, 86) has got a greater resemblance with *S. parvus*.

Occurrence — W. Bokaro Coalfield — P, DP, D, TM.

Striatites reticuloidus sp. nov.

Pl. 6, Figs. 126, 127

Holotype — Pl. 6, Fig. 127.

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Known size 70-137 μ. Central body subcircular to roundly oval, thin, with an equatorial rim; horizontal striations 5-8, vertical partitions 10-30, generally somewhat irregularly arranged towards the lateral regions of central body; sulcus 10-18 μ wide, convex in shape. Sacci subspherical, laterally slightly apart, finely intrareticulate.

Description — Pollen grains bilateral. Holotype 85×61 μ. Central body subcircular or vertically broadly oval, 30-56 μ ×30-65 μ in size, thin-walled, well-defined; equatorial rim 2-3 μ broad; exine thin, finely microverrucose; horizontal striations branched as well as unbranched, inter-

connecting; vertical partitions many (10-30) sometimes arranged irregularly at places (irregular pattern more common towards lateral regions of the body). Distal channel convex, 10-18 μ wide; sacci subspherical, laterally 2-10 μ apart, finely intrareticulate.

Comparison — The presence of regular horizontal striations as well as irregular reticuloid type of striations at some regions on the body, is a character of great importance. Out of the species having vertical partitions in between the horizontal striations, *S. notus* Bharad. & Salujha (1964), possesses thick body and many (16-32) vertical partitions but they never form a partial irregular pattern or a partial network as found in the present case. Other species have lesser number of vertical portions with regular arrangement.

Occurrence — W. Bokaro Coalfield — P, DP, D, TQ.

Striatites irregularis sp. nov.

Pl. 6, Fig. 128

Holotype — *See* Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 22.

Type Locality — India (M.P.), Korba Coalfield, 200 (II Seam), Bore-hole R-48, Barakar Stage.

Diagnosis — Known size 113-137 μ. Central body vertically oval to rhomboidal. Horizontal striations 6-11, mostly branched, faint and irregularly interconnecting, vertical partitions few. Distal sulcus well-defined, 26-46 μ wide, slightly convex. Sacci ± hemispherical, lateral continuations generally present. Intrareticulation of saccus fine to mediumly coarse.

Description — Holotype 137×90 μ in size. Pollen grains with distinctly visible, vertically oval central body, the lateral ends being broadly rounded. Size of the body 64-84 μ×77-109 μ. Exine thin, generally faintly microverrucose. Horizontal striations not deeply marked, faint and branched; vertical partitions 1-5 in number, complete or incomplete. Distal sulcus broad, slightly convex, laterally 10-20 μ wide; sacci ± hemispherical, lateral continuations 1-6 μ broad, generally on both the sides, rarely on one of the sides; intrareticulation fine to mediumly coarse.

Comparison — *Striatites sewardii* (Virkki) Pant, *S. notus* and *S. subtilis* Bharad. & Salujha (1964), apart from other details, possess a ± circular, thick central body with marginal rim and well-defined regularly arranged striations. Moreover, no lateral continuations of sacci are present in these species. Among the other species described by Bharadwaj and Salujha (1964), *S. solitus* and *S. rhombicus* differ from the present species in having a distinct marginal rim around the central body, well marked striations and laterally apart sacci. *S. communis* differs in the presence of thin ± circular body and definite, regularly arranged striations and in the absence of vertical partitions and lateral continuations of sacci. Among the species described from this assemblage *S. tentulus* and *S. parvus* differ in being much smaller in size, having smaller, ± circular body possessing regular horizontal striations, apart from other details. *S. reticuloidus* differs from the present species in having a large number of vertical partitions resulting in a partial reticuloid pattern of striations at places. In addition to this, the narrower sulcus and absence of lateral continuations of sacci differentiate *S. reticuloidus* from the present species.

Occurrence — Korba Coalfield — *Assemblages A, B.*

Striatites sp.

Pl. 6, Figs. 129, 130

Description — Known size 91-112 μ ×100-105 μ; pollen grains horizontally ovoidal to subcircular in overall shape characteristic in having very narrow sacci and big, subcircular central body occupying most of the area, body size 88-108 μ; exine generally thin or mediumly thick, finely microverrucose; proximal face bearing 7-9 horizontal striations which generally converge at the ends. No vertical partitions. Sacci 4-10 μ broad, laterally almost close and distally invading the body up to the middle region, leaving a narrow, straight or slightly convex distal sulcus; reticulation of saccus fine to mediumly coarse.

Comparison — The specimens assigned to this species are very much similar to those of *S. irregularis* sp. nov., described earlier except that in the former the sacci do not seem to be fully inflated while in the latter they are completely blown up. The other differences are the presence of narrower sulcus and more defined striations in the present case.

Genus *Verticipollenites* Bharadwaj 1962

Genotype — *Verticipollenites secretus* Bharad. 1962.

Verticipollenites sp.

Pl. 6, Fig. 138

Description — Pollen grain 72×40 μ in size, central body subcircular ± 33 μ, thin distinct; an irregular narrow equatorial rim present; horizontal striations 7, no vertical partitions; exine thin, microverrucose; distal attachment partial, leaving a slit like narrow distal area free, sacci pitcher shaped, finely intrareticulate, laterally widely separated.

Comparison — *V. secretus* Bharad. is bigger in size and shows the presence of many vertical partitions in between the horizontal striations; *V. gibbosus* Bharad. is also bigger with denser horizontally oval body and *V. oblongus* Bharad. has many vertical partitions and a wider channel.

Genus *Verticipollenites* is poorly represented in the present assemblage.

Genus *Lahirites* Bharadwaj 1962

Genotype — *Lahirites raniganjensis* Bharad. 1962.

Lahirites incertus Bharad. & Salujha 1964

Pl. 6, Fig. 132

Holotype — Bharad. & Salujha 1964; Pl. 8, Fig. 122.

Remarks — The specimen assigned to this species measures 128×79 μ. Central body is thin and subcircular, ± 55 μ, with a 3 μ broad equatorial rim alround. Proximal face bears 7 branched horizontal striations with 11 vertical partitions; a few vertical partitions are incomplete. Distal sulcus is 27 μ wide in the middle and 15 μ wide laterally. Sacci are finely intrareticulate.

Lahirites rarus Bharad. & Salujha 1964

Pl. 6, Fig. 131

Holotype — Bharad. & Salujha 1964; Pl. 9, Fig. 128.

Remarks — Specimens observed by me are 105-108 μ×68-77 μ in size. Central body is subcircular, 50-54 μ×44-51 μ in size, dark brown and without equatorial rim. Exine is thick and finely intramicropunctate; 5-6 horizontal, unbranched striations are present; vertical partitions are absent. Distal sulcus is 8-12 μ broad in the middle and slightly convex. Sacci are subspherical, finely intrareticulate and 5-7 μ apart laterally. Only a few specimens of *L. rarus* are found in the present assemblage.

Lahirites bokaroensis sp. nov.

Pl. 6, Figs. 135, 136

Holotype — Pl. 6, Fig. 135.

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Pollen grains oval to subcircular in overall shape; 66-111 μ×66-105 μ in size. Central body big, subcircular 55-77 μ in size, thin or mediumly thick; exine uniformly intramicropunctate; 7-9 horizontal striations, no vertical partitions. Distal sulcus narrow, almost ill-defined. Sacci narrow, ± 13 μ broad in holotype, less than hemispherical, distally deeply inclined, zones of attachment being close and ill-defined, laterally close, finely intrareticulate with generally thick, short muri.

Description — Holotype 94×84 μ. Pollen grains subcircular to bilaterally oval in outline; central body big, generally subcircular, 77 μ in holotype, thin or mediumly thick-walled, without any equatorial rim; horizontal striations 7-9, generally unbranched, deeply marked; no vertical partitions; exine thin to mediumly thick, finely and uniformly intramicropunctate. Span of sacci on sides very little being 7-13 μ in width, laterally close, distally deeply inclined to form an ill-defined narrow sulcus; saccus generally infolded along distal attachment zone. Intrareticulation of saccus very fine with relatively thicker muri giving it an intrapunctate appearance in some specimens.

Comparison — The present species differs from other species of *Lahirites* so far described, in having a bigger central body in relation to smaller and narrower, less than hemispherical sacci, almost ill-defined narrow sulcus and fine intrareticulation of sacci with thicker muri.

Occurrence — W. Bokaro Coalfield — P, DP, TQ.

Lahirites fractus sp. nov.

Pl. 6, Figs. 133, 134

Holotype — Pl. 6, Fig. 134.

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Known size-range 100-165 μ. Central body circular to subcircular, thick-walled, distinctly marked, 66×55 μ in holotype; 2-4 μ broad equatorial rim present; 6-9 horizontal striations, many (15-25) vertical partitions; distal sulcus narrow, obscure; sacci laterally close to each other, finely intrareticulate with thick and short muri; generally a narrow, almost diffused, thicker zone present in the peripheral region of saccus.

Description — Pollen grains bilateral. Holotype 116×96 μ. Central body circular to subcircular, 55-77 μ in size, dark brown, thick, equatorial rim 2-4 μ broad, generally wavy or irregular in appearance; exine thick restrictedly intramicropunctate; horizontal striations well-defined straight to slightly zigzag in appearance; many vertical partitions (15-25) resulting sometimes into an irregular arrangement; distal zones of saccus attachment mostly obscure, apparently close to each other, meeting or fusing with each other at the lateral regions of the body thus forming apparently a slit like, ill-defined sulcus; laterally sacci adjacent to each other, subspherical in shape, finely intrareticulate with thick and short muri enclosing fine meshes resulting in a punctate appearance; near the periphery of the saccus a 2-4 μ broad, thicker zone generally present.

Comparison — Ill-defined nature of the narrow sulcus, the intrareticulation of sacci with thicker muri and occasional presence of peripheral zone in saccus distinguish the present species from other species of *Lahirites*. *L. raniganjensis* Bharad., the closely commarable species of the genus although possesses many vertical partitions, differs in having a distinct zone of distal attachment and a clearly seen sulcus. Among the species described by Bharadwaj and Salujha 1964, *L. singularis* and *L. incertus* have a thin body with few vertical partitions and *L. rotundus* differs in having only few vertical partitions and only laterally developed rim in the body. *L. rarus* also differs in having no vertical partitions in between the horizontal striations, in possessing smaller central body, well defined distal channel and medium sized meshes of the saccus without any thickened zone. *L. bokaroensis* sp. nov. has a bigger circular central body in relation to the smaller sacci and no vertical partitions.

Occurrence — W. Bokaro Coalfield — P, DP, TQ, TM.

Lahirites sp.

Pl. 6, Fig. 137

Description — Size 154×114 μ. Central body vertically oval with broad round ends, 85×96 μ; thin, distinct; 3 μ broad equatorial rim present. Proximally 8 horizontal striations with 8 vertical partitions present; exine thin, coarsely intramicropunctate, distal sulcus 32 μ broad, slightly convex; sacci more than hemispherical, laterally 10-18 μ apart, intrareticulation coarse, muri 2 μ thick, meshes ± 4 μ.

Comparison — *L. singularis* and *L. incertus*, (BHARAD. & SALUJHA 1964) though possess a thin body with equatorial rim and vertical partitions, they are much smaller in size and do not show a coarse reticulation of saccus.

Genus *Hindipollenites* Bharad. 1962

Genotype — *Hindipollenites indicus* Bharad. 1962.

Hindipollenites sp.

Pl. 6, Fig. 142

Description — Size 157×75 μ. Central body thin, horizontally oval, 87×70 μ in size, equatorial rim ± 3 μ broad; exine thin, intramicropunctate; 7 horizontal, well marked striations present, inter-striation spaces appearing as bands or strips, no vertical partition. Distal attachment of sacci partial, along more than 3/4 of the vertical axis of the body; sulcus slit like; sacci laterally ± 22 μ apart, pitcher shaped, coarse intrareticulation, muri being thick and ± radially arranged.

Comparison — *H. indicus* Bharad., does not show the presence of an equatorial rim, possesses a ± circular body and fewer vertical partitions.

Genus *Hindipollenites* Bharad. is poorly represented in the present assemblage.

Genus *Lunatisporites* (Lesch.) Bharadwaj 1962

Genotype — *Lunatisporites acutus* Lesch.

Lunatisporites fuscus Bharad.

Pl. 7, Fig. 143

Holotype — Bharadwaj 1962; Pl. 14, Figs. 189, 190.

Remarks — The specimens assigned to *L. fuscus* are 98-125 μ in size; central body is

thin, distinct, vertically oval to slightly rhomboidal with narrow lateral ends, 48-66 μ $\times$54-68 μ in size. Body exine is thin, intramicroreticulate. Proximally central body bears 6-10 horizontal, branched or unbranched striations without any vertical partitions. Distal channel is 18-33 μ wide and convex. Lateral ledges are narrow. Intrareticulation of sacci is fine to mediumly coarse; muri are somewhat radially arranged.

Occurrence — Korba Coalfield — *Assemblages A, B, C*; W. Bokaro Coalfield — TQ, TM.

Lunatisporites notabilis sp. nov.

Pl. 7, Fig. 146

Holotype — *See* Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 27.

Type Locality — India (M.P.), Korba Coalfield, 202 (II Seam)E; Bore-hole R-34, Barakar Stage.

Diagnosis — Known size 98-143 μ. Central body vertically oval to rhomboidal, well-defined. Horizontal striations 5-8, no vertical partitions; distal channel $\pm$ straight, 15-21 μ wide in the middle, body folds along the attachment zones almost meeting in the centre but narrowing out and getting apart from each other laterally, appearing almost as a dumb-bell. Sacci subspherical with fine to mediumly coarse intrareticulation.

Description—Holotype 122$\times$93 μ. Pollen grains bilateral, generally diploxylonoid; central body vertically oval to rhomboidal with narrow lateral ends, thin-walled, well-defined, 48-64 $\mu\times$53-96 μ in size, proximally bearing 5-8 branched or unbranched horizontal striations without any vertical partitions in between them. Distal sulcus straight to slightly convex, narrow; zones of saccus attachment well-defined, secondary folds along them being widest in the middle almost meeting each other but gradually becoming narrower at the lateral ends to form a $\pm$ dumb-bell-shaped area. Sacci adjacent to each other laterally, subspherical, with fine to medium sized intrareticulation.

Comparison — *Lunatisporites fuscus* Bharad. differs from the present species in having a convex distal channel with narrow lateral ends.

The nature of the secondary folds running along the distal zones of saccus attachment, resulting in the formation of a dumb-bell-shaped area, is an important distinguishing feature of the present species.

Occurrence — Korba Coalfield — *Assemblages A, D, E*; W. Bokaro Coalfield — P.

Lunatisporites korbaensis sp. nov.

Pl. 7, Figs. 144, 145

Holotype — Pl. 7, Fig. 145.

Type Locality — India (M.P.), Korba Coalfield 202 (II Seam)E; Bore-hole R-34, Barakar Stage.

Diagnosis — Known size 125-144 μ $\times$90-105 μ. Central body thin-walled, subcircularly rhomboidal, vertical axis being equal or slightly longer than the horizontal axis. Proximally 6-8 horizontal striations; no vertical partitions; distal channel convex, narrow and distinct. Sacci more than hemispherical, finely intrareticulate.

Description — Holotype 144$\times$105 μ. Central body thin, distinct, rhomboidish oval, vertical axis of the body being equal or slightly longer than the horizontal axis; known size of the body 57-60 $\mu\times$57-63 μ. Exine thin, finely intramicroreticulate. Horizontal striations branched or unbranched without any vertical partitions in between them; distal sulcus convex, 12-18 μ broad, zonal folds arcuate. Sacci more than hemispherical, laterally either forming 8-6 μ broad continuations with shallow to deep notches or adjacent to meet each other broadly. Intrareticulation fine, meshes being 1-5 μ in size.

Comparison — *Lunatisporites fuscus* Bharad. differs in having a typically vertically elongated oval body with pointed ends and in the presence of lateral narrow ledges rather than continuations. *L. notabilis* sp. nov. also differs, apart from the body shape, in having straight narrow sulcus and a characteristic dumb-bell-shaped area in the sulcus formed by zonal folds.

The present species distinguishes itself by circularly rhomboidal shape of the body, narrow well-defined sulcus and laterally broadly meeting or continuous sacci.

Occurrence — Korba Coalfield — *Assemblage A*.

Lunatisporites sp.

Pl. 7, Fig. 147

Remarks — Pollen grains are bilateral, diploxylonoid, 123-143 μ in size. Central body is thin, distinct and vertically oval to rhomboidal. Proximally 5-9 branched or unbranched striations are present. Vertical

partition are absent. Distal channel is 21-30 μ wide and convex; sacci are more than hemispherical, laterally adjacent and possess fine to mediumly coarse intrareticulation.

Genus *Striatopodocarpites* (Soritsch. & Sedowa) Bharad. 1962

Genotype — *Striatopodocarpites antiquus* (LESCH.) Pot.

Remarks — Many workers have recently concentrated their studies on the taxonomy of disaccate striated pollen grains, among which the contributions by Wilson (1962), Bharadwaj (1962), Jansonius (1962), Jizba (1962), Klaus (1963), Hart (1964) and Bharadwaj & Salujha (1964) are noteworthy.

Strotersporites Wilson has been emended by Klaus (1963) and according to him the '*haupt* Laesur' in median region of the body is one of the important generic characters of this genus. Wilson (1962) also noticed similar laesur in most of the specimens of *Strotersporites* if not in all. However, he did not give much importance to it. Bharadwaj (1962) and Bharadwaj & Salujha (1964) have not noticed any such laesur in the numerous *Striatiti* from Raniganj Stage. However, in the present assemblage, few forms are metwith which show a median horizontal groove or laesur along with the striations, and hence they have been described under *Strotersporites* Wilson.

Hart (1964) has given a long list for the synonyms of *Striatopodocarpites*. However, in view of the presence of highly diversified forms in the disaccate striated genera, such dumping together is likely to hamper the morphographic approach in the study of *sporae dispersae*.

Venkatachala and Kar (1964) have pointed out some nomenclatural difficulties in accepting the name *Striatopodocarpites* as valid, consequently they have combined the species of *Striatopodocarpites* described from Raniganj Stage, with the genus *Strotersporites*. However, the generic diagnosis of the latter genus given by Wilson (1962; p. 18) as such, does not accommodate the specimens described as *Striatopodocarpites* by Bharadwaj (1962), Bharadwaj and Salujha (1964) or those which are being described in the present paper. Moreover, as emphasized by Klaus (1963) if the median laesur is given due morphographic importance, the differences between these two genera become all the more prominent. In view of these facts, *Striatopodocarpites* as emended by Bharadwaj (1962) may ultimately need a new designation. In the following account *Striatopodocarpites* has been described *sensu* Bharadwaj (1962).

Striatopodocarpites crassus sp. nov.

Pl. 7, Figs. 151, 152

Holotype — Pl. 7, Fig. 151.

Type Locality — India (Bihar), West Bokaro Coalfield, Pindra Seam, Datma Colliery, Barakar Stage.

Diagnosis — Bilaterally oval, known size 113-172 μ × 97-135 μ. Central body big roundly oval to fusoid, thin-walled, outline distinct; 6-8 horizontal striations present, no vertical partitions; distal sulcus 30-50 μ wide, ± straight, sacci small, less than hemispherical, double intrareticulation, occasionally appearing as fine.

Description — Holotype 157 × 125 μ in size. Pollen grains bilaterally oval in overall shape. Central body big, subcircularly ovoidal with round ends or somewhat vertically fusoid, 80-125 μ × 100-135 μ in size, outline well-defined; exine thin, finely intramicroreticulate; horizontal striations 6-8 in number, well marked, mostly unbranched and not connected by vertical partitions, slightly converging inwards at their ends. Sacci less than hemispherical in shape, proximally 20 μ wide at sides in holotype, distally inclined to leave 30-50 μ wide, ± straight area free, laterally widely apart. Intrareticulation of sacci double in nature, the coarser meshes ranging up to 8 μ in size enclosing finer (0·5-1·5 μ) meshes in-between them, sometimes appearing as fine.

Comparison—Among the species described by Bharadwaj and Salujha (1964) and regrouped by Venkatachala and Kar (1964), *S. decorus* has a rhomboidal body with truncate ends, *S. magnificus* is bigger in size having a broader distal sulcus, and *S. diffussus* has a dense ± hexagonal central body, thus differ from the present species.

Occurrence — W. Bokaro Coalfield — DP, TQ.

Striatopodocarpites labrus sp. nov.

Pl. 7, Figs. 148, 149

Holotype — Pl. 7, Fig. 149.

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis—Known size 91-120 μ. Central body broadly oval to rhomboidal with a prominent marginal ridge; proximally 6-9 horizontal striations without any vertical partitions. Distal sulcus 18-30 μ wide, ± straight; sacci more than hemispherical laterally widely apart with fine to mediumly coarse intrareticulation.

Description — Holotype 120×75 μ in size. Pollen grains bilateral, diploxylonoid, central body 50-60 μ×55-68 μ, oval to rhomboidal with broad round ends and a prominent, 2-4 μ broad, complete equatorial rim; proximally 6-9 horizontal, mostly unbranched striations present; vertical partitions absent; body exine thin, finely intramicroreticulate; distal channel straight to slightly convex, 18-30 μ wide. Sacci more than hemispherical, 10-20 μ apart laterally; intrareticulation fine or medium sized, meshes being up to 3 μ in size, muri narrow, somewhat radially arranged.

Comparison — *S. crassus* sp. nov. is bigger in size having roundly oval, bigger central body without any marginal ridge and less than hemispherical, doubly intrareticulate sacci.

The present species is differentiated from other species by its oval to rhomboidal, thin central body with a prominent equatorial rim, horizontal striations without any vertical partition, and 18-30 μ wide, ± straight sulcus.

Occurrence — W. Bokaro Coalfield — D, TQ, TM.

Striatopodocarpites sp. A

Pl. 7, Fig. 153

Remarks — The specimens range in size from 85-100 μ×66-73 μ. Central body is vertically oval with broad round ends, thin, distinct and 51-60 μ×70-84 μ in size. Proximally 5-8 horizontal striations are present without any vertical partitions; distal sulcus is narrow and ± uniformly wide. Sacci are smaller or equal in height to the body and with fine to mediumly coarse intrareticulation. A median vertical slit is generally present.

Occurrence — Korba Coalfield — *Assemblages A-C*; W. Bokaro Coalfield — P, DP, TQ.

Striatopodocarpites sp. B

Pl. 7, Fig. 154

Remarks — Specimens range from 62-66 μ in size. Central body is small, subcircular, thin and ± 36 μ in size. Horizontal striations are 5-7 in number, unbranched and without any vertical partitions. Distal channel is 14-16 μ wide. Attachment zones are straight to slightly convex. Sacci are small, subspherical in shape and finely intrareticulate. A median vertical slit is present distally.

S. sp. A has a bigger, vertically fusoid body, sacci being smaller than the body height. Bharadwaj (1962; Pl. 19, Figs. 242, 245) has illustrated few specimens referable to *Striatopodocarpites* sp. B.

Occurrence — Korba Coalfield — *Assemblages A, B, D, E*; W. Bokaro Coalfield — P, TQ.

Striatopodocarpites sp. C

Pl. 7, Fig. 150

Remarks — Known size is 124-138 μ × 60-76 μ. Central body is horizontally oval, thin, 60-69 μ×50-60 μ; with equatorial rim horizontal striations are 5-8 in number; without vertical partitions; exine is thin and finely intramicroreticulate; distal sulcus is 22-27 μ broad and straight. Sacci are subspherical laterally widely apart and finely intrareticulate.

This species shows the presence of an equatorial rim on the oval and thin central body, hence differs from *S.* sp. A. *S.* sp. B is much smaller, possesses a narrower sulcus and shows no rim, along with other differentiating characters. *S. crassus* sp. nov., is bigger in size having bigger, vertically ovoidal central body without any rim and has less than hemispherical sacci showing double intrareticulation. *S. labrus* sp. nov., resembles the present species in other respects except the central body shape. Only a few specimens have been recovered, hence they are described as *Striatopodocarpites* sp. C.

Genus *Strotersporites* (Wilson) Kl. 1963

Genotype—Strotersporites communis Wilson 1962.

Strotersporites indicus sp. nov.

Pl. 6, Figs. 139-141

Holotype — Pl. 6, Fig. 140.

Type Locality — India (M.P.), Korba Coalfield, 1008(C), Bore-hole G-214, Barakar Stage.

Diagnosis — Bilaterally oval, known size-range 98-154 μ×68-110 μ. Central body

thin-walled, vertically oval to rhomboidal with flat to broadly round lateral ends, 94×110 μ in holotype. Horizontal striations 4-8; a 'monolete mark' or a median horizontal slit present; no vertical partitions, distal channel 25-40 μ wide, well-defined, straight to slightly convex. Sacci ± hemispherical with narrow to broad lateral continuations and fine to mediumly coarse intrareticulation.

Description — Holotype 154×110 μ. Overall shape bilaterally oval; central body broadly oval to rhomboidal, generally with 10-18 μ broad, flat or broadly round ends, well-defined, known size of the body 60-94 μ ×66-110 μ; horizontal striations 4-8, branched or unbranched, generally faint; a median 'main laesur' present, rarely represented by a median horizontal fold or rupture; vertical partitions absent. Body exine thin, finely intramicroreticulate; distal sulcus well-marked, zones of saccus attachment being well-defined, 25-40 μ apart in the middle and 10-27 μ apart laterally, accompanied by secondary body-folds. Lateral ends of the zones of saccus attachment meeting with the angles of lateral body-ends; sacci ± hemispherical, generally connected with 1-5 μ broad lateral continuations on both the lateral sides, with fine to mediumly coarse intrareticulation.

Comparison — *Stroterspories communis* Wilson, differs from the present species in having more or less circular central body, wider sulcus and more than hemispherical sacci. *S. richteri* Klaus, has a horizontally oval, dense central body and vertical partitions in between the horizontal striations. *S. wilsonii* and *S. jansonii* (Klaus 1963) also differ from the present species in the nature of central body, distal sulcus and saccus intrareticulation, apart from other details.

Occurrence — Korba Coalfields — *Assemblage C*.

Genus *Faunipollenites* Bharadwaj 1962

Genotype—*Faunipollenites varius* Bharad. 1962.

Faunipollenites varius Bharad.

Pl. 7, Fig. 155

Holotype — Bharadwaj 1962; Pl. 18, Fig. 230.

Remarks — Specimens observed by me range in size from 74-125 μ×58-104 μ and are horizontally ovoidal in shape. Central body is obscure but apparently subcircular. Horizontal striations are 5-8 in number, unbranched and without any vertical partitions. Body exine is thin and finely intramicroreticulate. Distal sulcus is ill-defined but apparently uniformly wide. Sacci are ± hemispherical and finely intrareticulate.

For other specimen see Bharadwaj & Tiwari 1964b; Pl. 1, Fig. 18.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — All groups.

Faunipollenites parvus sp. nov.

Pl. 7, Figs. 156-159

Holotype Pl. 7, Fig. 158.

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis — Small, bilaterally oval pollen grains, known size 53-70 μ×33-51 μ. Central body small, thin, obscure, apparently subcircular; known number of horizontal striations 5-7, no vertical partitions; distal channel narrow, not clearly marked, 8-9 μ broad when slightly apparent; sacci ± hemispherical finely intrareticulate.

Description — Holotype 60×37 μ. Pollen grains small bilaterally oval; central body almost ill-defined, apparently subcircular thin, finely intramicroreticulate. Horizontal striations unbranched without any vertical partitions. Distally, saccus free area thin, narrow, apparently uniformly broad, only in few cases measurable, 8-9 μ broad. Sacci small, ± hemispherical, finely intrareticulate.

Comparison — Present species resembles *F. varius*, the genotype, in overall shape and in the nature of the central body but the latter is bigger in size, the range recorded so far being 74-156 μ×58-104 μ (Holotype 106×64 μ, Bharadwaj 1962; p. 95), possesses a wider distal sulcus and more horizontal striations on the body.

The other species of *Faunipollenites* differ from the present species in being much bigger in size, apart from other details.

Occurrence — Korba Coalfield — *Assemblage A*; W. Bokaro Coalfield — P, DP, TQ.

Faunipollenites sp.

Pl. 7, Fig. 160

Remarks — Specimens are bilaterally oval in shape. Known size is 90-154 μ×78-121 μ.

Central body is almost ill-defined but apparently subcircular. Striations generally converge towards the horizontal axis at their ends, 5-8 in number, branched or unbranched and are deeply marked; vertical partitions are absent. Exine is thin, distinctly intramicroreticulate; distal sulcus is wide, ill-defined or slightly convex thinner area. Sacci are ± hemispherical in shape, laterally continuous to form 2-9 μ broad, unnotched lateral continuations. Intrareticulation of sacci is medium coarse; muri are ± 2 μ thick with up to 3 μ wide meshes.

Infraturma — *Rectistriati* Bharadwaj 1962

Genus *Striapollenites* Bharadwaj 1962

Genotype — *Striapollenites saccatus* Bharad.

Striapollenites sp.

Pl. 7, Fig. 161

Description — Pollen grain biwinged, bilateral, 117×75 μ in size; central body thin, vertically oval with round ends, 45×63 μ, exine thin intramicroreticulate; 5 vertical striations on proximal face, sacci slightly inclined distally, zones of sacci attachment ill-defined, 30 μ wide in the middle, slightly convex, laterally 18 μ apart; sacci slightly more than hemispherical, finely intrareticulate.

Remarks — This specimen is comparable to the genotype except that in the latter case the sacci are separated only on one of the lateral sides thus forming a boat-shaped sulcus while in the present case sacci are widely and equally separated on both the lateral sides and distal sulcus is slightly convex.

Genus *Distriatites* Bharad. 1962

Genotype — *Distriatites bilateralis* Bharad. 1962.

Distriatites sp.

Pl. 7, Fig. 162

Description — Specimen bilateral having four small lobes of sacci, two lateral sacci being very small; size 100×70 μ; central body subcircularly oval, thin 48×57 μ; exine intramicroreticulate. Proximal face bearing 7 horizontal striations and distal face bearing 4 vertical striations; sacci at terminal sides hemispherical, each ± 24 μ broad, sacci lobes at the lateral sides narrow, ledge like in shape, ± 10 μ broad, distally slightly inclined to attach themselves subequatorially to the body, leaving a wide, ill-defined uncovered area. Saccus intrareticulation fine.

Remarks — This specimen possesses symmetrically arranged additional lobes of sacci, thin body-exine and proximally 7 horizontal and distally 4 vertical striations, while the genotype has only one additional saccus lobe, 7 proximal horizontal and 7 distal vertical striations and thicker body exine.

Infraturma — *Disaccimonoleti* Klaus 1963

Genus *Illinites* (Kosanke) Pot. & Kr. 1954

Genotype — *Illinites unicus* Kosanke 1950.

Illinites delasaucei (Pot. & Kl.) Grebe & Schweitzer 1962

Pl. 7, Figs. 163-166

Holotype — *Pityosporites delasaucei* Pot. & Klaus 1954, Pl. 10, Fig. 6.

Description — Size 62-110 μ×39-64 μ. Pollen grains bilaterally oval in overall shape, mostly haploxylonoid. Central body subcircular to roundly oval in shape, well-defined 36-50 μ×40-50 μ. Exine thin or thick, finely microverrucose; proximally a weakly developed horizontal slit present which sometimes appearing as a fold. Sacci proximally equatorially attached, distally inclined, laterally ± 1-2 μ wide continuations present; distal zones of attachment generally well marked, straight to slightly convex, accompanied by 2-4 μ broad secondary folds, laterally widely apart forming an ill- to well-defined, straight to slightly convex broad sulcus. Sacci generally with narrow lateral continuations, equal or less than the body height in flattened grains, finely intrareticulate.

Remarks — Grebe and Schweitzer (1962; pp. 12-14) have given a complete account of various forms of grains obtained in the cones of *Ullmannia frumentaria* and listed a number of species previously assigned to different genera as synonym of *I. delasaucei*. The forms recovered in the present assemblage, although show a certain degree of variation in morphographic characters, broadly answer to the variation recorded in the pollen grains of *U. frumentaria*, and hence described here as *Illinites delasaucei sensu* Grebe and Schweitzer (1962).

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — DP.

Genus *Vestigisporites* Balme & Henn. 1955

Genotype — *Vestigisporites rudis* Balme & Henn. 1955.

Vestigisporites rudis B. & H. 1955

Pl. 8, Figs. 167, 168

Holotype — Balme & Hennelly 1955; Pl. 6, Fig. 54.

Remarks — Specimens studied by me measure 55-88 μ×35-53 μ. Central body is circular to subcircular, 32-52 μ in size. Exine is generally thick and finely microverrucose; equatorial rim is absent. Proximal slit is small and not well developed. Sacci are hemispherical to slightly more than hemispherical with 2-4 μ broad lateral continuations and distally inclined to leave a broad, ill-defined sulcus. Zones of saccus attachment are not sharply defined and are not accompanied by secondary body folds. Saccus intrareticulation is fine.

Vestigisporites novus sp. nov.

Pl. 8, Figs. 169, 170

Holotype — *See* Bharadwaj & Tiwari 1964b, Pl. 2, Fig. 28.

Type Locality — India (M.P.), Korba Coalfield 202 (III Seam)E; Bore-hole R-34, Barakar Stage.

Diagnosis — Bilaterally oval, known size 55-88 μ×35-53 μ. Central body circular to roundly oval, dense, 32-52 μ in size. No equatorial rim; distal sulcus almost ill-defined, apparently wide, attachment zones diffused, sacci smaller than the body, generally less than hemispherical, lateral continuations 1-3 μ broad; finely intrareticulate.

Description — Holotype 66×45 μ. Pollen grains bilaterally oval in overall shape. Central body circular, subcircular or roundly oval, dense, well defined, ± 42 μ in holotype; no equatorial rim present, exine finely microverrucose; horizontal slit short, well to ill-marked, rarely obscure; sacci inclined distally, sulcus obscure due to ill-defined nature of attachment zones, apparently wide, ± straight, lateral continuations of sacci 1-3 μ broad, well marked; sacci small, less than hemispherical, ± 12 μ broad in holotype, mostly crescent in shape, finely intrareticulate.

Comparison — *Vestigisporites rudis* B. & H. differs in being bigger in size, in having thinner central body and hemispherical or more than hemispherical, bigger sacci. *V. hennellyi* Hart (1960) possesses very thin body-exine and hence differs from the present species.

Vestigisporites sp. A., illustrated by Balme and Hennelly (1955; Pl. 6, Fig. 58), resembles the present species to a greater extent.

Remarks — Hart (1960) has redefined the genus and tried to delimit it on the basis of absence or presence of lateral sacci-continuations and their width. However, such a circumscription is not agreeable in view of the findings of *in-situ* disaccate grains and the dispersed spores as well, where a long range of variation occurs showing none, narrow or broad lateral continuations of sacci. On the basis of similar observations in the specimens of *Vestigisporites*, it has been described here *sensu* Balme and Hennelly (1955).

Occurrence — Korba Coalfield — *Assemblages A, B, C*; W. Bokaro Coalfield — P, DP, D.

Infraturma — *Disacciatrileti* (Lesch.) Pot. 1958

Genus *Vesicaspora* Schemel 1951

Genotype — *Vesicaspora wilsonii* Schemel 1951.

Remarks — The specimens, studied here, find their place in the new circumscription of the genus given by Wilson and Venkatachala (1963). However, the present specimens are disaccate grains with narrow lateral continuations of equatorially or subequatorially attached sacci, which might envelop the central body a little in equatorial region.

Vesicaspora distincta sp. nov.

Pl. 8, Figs. 171, 172

Holotype — Pl. 8, Fig. 172.

Type Locality — India (Bihar), West Bokaro Coalfield, Pindra Seam, Pindra Ramgarh Colliery, Barakar Stage.

Diagnosis—Size 109-135 μ. Central body, vertically oval to rhomboidal, thin-walled, distinct, without any equatorial rim; sacci generally hemispherical with narrow lateral continuations, distally more inclined to form a 15-35 μ broad, convex sulcus. Saccus intrareticulation double, medium to coarse, meshes being 2-5 μ in size.

Description — Holotype 118×95 μ, central body 42-68 μ×51-83 μ in size, well defined,

exine indistinctly intramicroreticulate; lateral continuations of sacci 3-20 μ wide, with or without constrictions. Sacci doubly intrareticulate, coarser meshes enclosing finer meshes in between.

Comparison — The present species differs from *V. wilsonii* Schemel, in having bigger vertically oval central body with narrow ends, well defined distal sulcus and ill-defined proximal sacci encroachment.

Occurrence — W. Bokaro Coalfield — P, DP.

Vesicaspora indica sp. nov.

Pl. 8, Figs. 173, 174

Holotype — Pl. 8, Fig. 173.

Type Locality — India (Bihar), West Bokaro Coalfield, Topa Village Quarry, Barakar Stage.

Diagnosis—Bilateral; known size 120-144 μ × 85-100 μ. Central body vertically oval, equatorial region thicker, 60-72 μ × 73-98 μ in size. Sacci less than hemispherical, lateral continuations narrow, distinct, distally inclined to form a slit like narrow sulcus; intrareticulation of saccus medium to coarse.

Description—Pollen grains bilaterally oval, the body height being equal or more than the saccus height. Holotype 120 × 94 μ. Central body vertically oval with broad round ends, 60 × 92 μ in holotype; body exine thin but body equatorial region denser; sacci hemispherical or less than hemispherical; laterally 1-6 μ broad continuations present; diatally sacci inclined, attachment zones being close to each other in the median region of the body, resulting in the formation of a slit like distal sulcus. Saccus intrareticulation medium to coarse, meshes being 2 to 6 μ in size.

Comparison — The present species differs from *V. wilsonii* Schemel, in having bigger central body with thicker, narrow equatorial region and in coarser intrareticulation of sacci. *V. distincta* sp. nov. possesses a thinner oval body, convex broader sulcus and double intrareticulation of sacci.

Specimens described as *Pityosporites zapfei* by Potonié & Klaus (1954; Pl. 10, Figs. 9, 10) compare to some extent with the present species by showing the thickening at the body equatorial region but differ in being smaller in size, in having ± circular central body, no lateral continuations of sacci, and a wider distal channel.

Occurrence—W. Bokaro Coalfield—D, TQ.

Vesicaspora ovata (Balme & Henn.) Hart 1960

Pl. 8, Figs. 181, 182

Holotype — Balme & Hennelly 1955; Pl. 5, Fig. 50.

Remarks — *Florinites ovatus* Balme & Henn. (1955) has been recombined as *Sulcatisporites ovatus* by Bharadwaj (1962) and as *Vesicaspora ovata* by Hart (1960). Photographs given by Balme & Hennelly (1955; Pl. 5, Figs. 49-52) of the specimens referred to this species, show a more or less distinct body and so also those illustrated by Bharadwaj (1962; Pl. 19, Figs. 249, 251). So, it is proposed here that its combination with *Vesicaspora* Schemel, is more appropriate. Specimens recovered in the present assemblage also show a ± distinct central body and an ill-defined, apparently narrow distal sulcus, hence are referred here to *V. ovata* (B. & H.) Hart.

These specimens are small and bilaterally oval in overall shape. Known size is 41-61 μ × 33-44 μ Central body is distinct, very thin subcircular to vertically broadly oval. Sacci are small, ± hemispherical and distally inclined to leave free a narrow, ill-defined area. Infolding of saccus is not common. Saccus intrareticulation is fine; meshes are up to 2 μ broad.

Occurrence — Korba Coalfield — *Assemblages A-C*; W. Bokaro Coalfield — TQ.

Genus *Sulcatisporites* (Lesch.) Bharad. 1962

Genotype — *Sulcatisporites interpositus* Lesch. 1955.

Sulcatisporites barakarensis sp. nov.

Pl. 8, Figs. 175, 176

Holotype — Pl. 8, Fig. 176.

Type Locality — India (M.P.), Korba Coalfield, 202 (II Seam)E; Bore-hole R-34, Barakar Stage.

Diagnosis — Bilaterally oval, known size 102-176 μ × 76-134 μ. Central body very thin, diffused, apparently oval; distal sulcus represented by narrow thinner area, obscure; sacci distally inclined, laterally gradually merging with body exine, ± hemispherical. Intrareticulation double in nature, apparently fine.

Description — Holotype 131 × 121 μ. Pollen grains bilateral in outline; central body very thin, outline almost ill-defined, apparently vertically oval in shape; distal

saccus-infoldings not seen; lateral position of sacci obscure, apparently merging gradually with body wall. Sacci ± hemispherical, doubly intrareticulate with 2-6 μ broad coarser meshes with finer meshes in between, sometimes appearing as fine intrareticulation.

Comparison — *S. interpositus* Lesch. is ± circular in overall shape and shows the distinct saccus infolding distally. *S. splendens* Lesch., possesses a more definite and wider sulcus.

Occurrence — Korba Coalfield — *Assemblages A, D, E*; W. Bokaro Coalfield — P, DP, D, TQ.

Sulcatisporites maximus (Hart) Singh 1964

Pl. 8, Fig. 177

Holotype — *Vesicaspora maxima* Hart 1960; Pl. 3, Fig. 33.

Remarks — The specimens are circular to subcircular, measuring 105-150 μ in size. Central body is obscure, very thin, but apparently vertically oval. Channel ill-defined narrow to wide; median infoldings of sacci are generally present (*see* BHARAD. 1962; p. 98). Sacci are less than hemispherical, laterally merging with the body exine and finely intrareticulate.

Sulcatisporites interpositus Lesch., differs in having a well-defined distal sulcus.

Other specimens referable to *Sulcatisporites maximus* — Bharadwaj & Tiwari 1964b, Pl. 2, Fig. 29; Bharadwaj 1962, Pl. 20 Figs. 254, 255, 258; Bharadwaj & Salujha 1964, Pl. 12. Fig. 161,

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — All groups.

Sulcatisporites sp.

Pl. 8, Figs. 178-180

Remarks — The specimens are more or less circular, sacci being narrow and less than hemispherical. Known size-range is 44-65 μ. Distal sulcus is very narrow with distinct infoldings which get apart laterally. Sacci are less than hemispherical and finely intrareticulate.

This species, although resembles *Sulcatisporites maximus* (Hart) Singh, in general characters, is much smaller in size.

Genus *Pityosporites* (Seward) Pot. & Klaus 1954

Genotype — *Pityosporites antarticus* Seward 1914.

Pityosporites sp.

Pl. 8, Fig. 186

Description — Pollen grains bilateral in symmetry, ± oval in overall shape, 77-80 μ in size. Central body well-defined, vertically oval with broad, round lateral ends, 39-47 μ in size; exine thin, finely intramicroreticulate, no striations or mark present, distal sulcus wide, ill-defined, saccus inclination being very little; attachment zones ill-defined; lateral continuations of saccus 1-2 μ broad. Saccus shape hemispherical or less than hemispherical, intrareticulation fine.

Comparison — *P. giganteus* Balme & Henn. differs in being bigger in size and in having thicker microgranulose body exine.

Infraturma — *Podocarpoiditi* Pot., Thoms. & Thierg. 1950

Genus *Cuneatisporites* Lesch. 1955

Genotype — *Cuneatisporites radialis* Lesch. 1955.

Remarks — Genus *Cuneatisporites* includes pollen grains with vertically oval central body, intramicroreticulate exine and convex distal sulcus. No marks or striations are present on the central body. Only a few specimens showing these characters have been recovered from the present assemblage.

Cuneatisporites sp. A

Pl. 8, Fig. 183

Description — Known size 100-128 μ. Pollen grains with vertically oval to rhomboidal, distinct central body measuring 34-37 μ × 40-53 μ, exine thin intramicroreticulate; no mark or striations present. Sacci distally inclined forming a 10-15 μ wide convex sulcus; distal zones of sacci attachment well marked, laterally ± close to each other. Sacci subspherical, laterally showing 2-5 μ broad continuations, notches prominent; intrareticulation fine.

Comparison—Specimens of *Cuneatisporites* (BHARAD. 1962; PL. 20, FIG. 264), described from Raniganj Stage, differ from the present species in having a thicker central body and ± hemispherical, laterally apart sacci.

Cuneatisporites sp. B

Pl. 8, Figs. 184, 185

Description — Size ± 165 × 93-121 μ. Pollen grains bilateral with vertically oval, ± 72 × 76 μ central body. Exine thin,

finely intramicroreticulate; distal sulcus convex, 45-50 μ wide in the middle and ± 17 μ at the lateral ends; zones of saccus attachment well-defined, slightly convex accompanied by narrow, thin folds. Sacci subspherical, lateral continuations 3-8 μ broad, distinctly notched, intrareticulation fine.

Comparison — *Cuneatisporites* sp. A described above, differs in being smaller in size and in having laterally close, narrower distal sulcus.

Turma — ***Aletes* Ibr. 1933**
Subturma — ***Azonaletes* (Luber) Pot. & Kr. 1954**
Infraturma — ***Psilonapiti* Erdtm. 1947**

Genus *Pilasporites* Balme & Henn. 1956a

Genotype — *Pilasporites calculus* Balme & Henn. 1956a.

Pilasporites plurigenus B. & H.

Pl. 9, Fig. 202

Holotype — Balme & Henn. 1956a; Pl. 3, Fig. 57.

Remarks — Specimens observed by me are circular to subcircular, 19-44 μ in size. Exine is 1-2 μ thick, laevigate or finely granulose, generally unevenly thickened and rarely folded. No mark or striations are present.

For other specimen see Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 26.

Occurrence — Korba Coalfield — *Assemblages A-C*; W. Bokaro Coalfield — P, DP, TQ.

Infraturma — *Reticulonapiti* (Erdtm.) Vimal 1952

Genus *Maculatasporites* Tiwari 1964

Genotype—Maculatasporites indicus Tiwari 1964.

For specimen referred to *M. indicus* see Pl. 8, Fig. 187.

Maculatasporites gondwanensis sp. nov.

Pl. 8, Figs. 191, 192

Holotype — Pl. 8, Fig. 192.

Type Locality — India (M.P.), Korba Coalfield 202 (III Seam)E; Bore-hole R-34, Barakar Stage.

Diagnosis — Size 31-43 μ. Cicrular thin miospores; reticulum complete, on both the faces; meshes broad, 5-10 μ across, regularly polygonal, muri 1-1·5 μ thick; 2-4 μ wide marginal extension.

Description — Holotype 36 μ, miospores usually circular, thin, yellow in colour; reticulation regular and complete, forming nearly polygonal meshes; muri uniform slightly projecting at the periphery where the connecting muri appearing as a thin, 2-4 μ broad, membranous extension. Exine of the body laevigate.

Comparison — *Maculatasporites indicus* Tiwari, differs from the present species in having thicker, denser and irregular muri enclosing circular or elongated meshes.

Occurrence — *M. indicus*: Korba Coalfield — *Assemblages B, C*; *M. gondwanensis*: Korba Coalfield — *Assemblage A*; W. Bokaro Coalfield — DP.

Maculatasporites irregularis sp. nov.

Pl. 8, Figs. 188-190

Holotype — Pl. 8, Fig. 188.

Type Locality — India (M.P.), Korba Coalfield 208 (II Seam) E; Bore-hole G-2, Barakar Stage.

Diagnosis — Known size 41-56 μ. Circular to subcircular; meshes 1-5 μ in size, irregularly subcircular or narrow and elongated; muri dense, 1-3 μ broad and ± 5 μ high projecting prominently at the equator, appearing as closely set bacula; margin broken.

Description — Holotype 56 μ. Miospore generally circular or subcircular, dark brown due to the thick nature of muri. Reticulation complete on both faces, meshes generally irregular, ± circular to polygonal or elongated in shape; muri massive, projecting at the periphery. Muri at the margin apparently not connecting hence appearing as bacula giving the margin a broken and irregular appearance.

Comparison — *Maculatasporites indicus* Tiwari, resembles the present species in the nature of meshes but the muri in former appear as connected to form a thin marginal extension. Moreover, the margin is wavy but not ' broken ' in *M. indicus* along with a tendency to acquire a roundly subtriangular shape on flattening. *M. gondwanensis* sp. nov. differs in having thinner muri, regular ± polygonal, bigger meshes and thin extention of the connecting muri at the periphery.

Occurrence — Korba Coalfield — *Assemblage B*.

Turma — ***Plicates*** **(Naum.) Pot. 1960**
Subturma — ***Polyplicates*** **Erdtm. 1952**

Genus *Welwitschiapites* Bolchowitina 1953

Genotype — *Welwitschiapites magniolobatus* Bolchowit. 1953.

Welwitschiapites tenuis Bharad. & Salujha 1964

Pl. 9, Figs. 196, 197

Holotype — Bharadwaj 1962; Pl. 5, Fig. 90.

Remarks — The specimens found in the present assemblage are oval with round ends ranging in size from 84-98 $\mu \times 62$-63 μ. Horizontal striations are 7-9 in number without any vertical partitions. Exine is ± 2 μ thick in optical section. *Extrema lineamenta* is smooth. No protrusion of exoexine or vestigial saccus is present.

Occurrence — W. Bokaro Coalfield — DP, TQ.

Welwitschiapites gondwanensis sp. nov.

Pl. 8, Figs. 194, 195

Holotype — Pl. 8, Fig. 195.

Type Locality — India (M.P.), Korba Coalfield, 202 (IV Seam); Bore-hole R-34, Barakar Stage.

Diagnosis — Bilateral oval; known size 72-100 $\mu \times 40$-66 μ; exine thick microverrucose, on one face bearing many (16-18) horizontal, interconnecting, generally irregular striations; many vertical partitions present; on other face striations becoming almost reticuloid in pattern, exine ± 2 μ thick along the longer equatorial lines while at two poles 3-8 μ broad, appearing as rudimentary sacci.

Description — Grains bilaterally ovoid in overall shape, holotype 95×53 μ in size. Exine quite thick, brown in colour, microverrucose, verrucae being closely set; many horizontal, branched and interconnecting striations along with many vertical partitions present; on one side striations generally more irregular and forming a sort of reticuloid network. Exine ± 2 μ thick in optical section along the equator except at the two poles of longer axis where it extends to form 3-8 μ broad, small protuberances.

Comparison — Bharadwaj (1962) and Bharadwaj & Salujha (1964) have reported *Welwitschiapites* from Raniganj Stage. The present species differs from the forms illustrated and described by them (Bharadwaj 1962; Pl. 5, Figs. 88-91, Bharad. & Salujha 1964; Pl. 12, Figs. 164-167) in having thicker exine, two protrusions of the exoexine at the terminal ends and more horizontal grooves (striations) as well as vertical partitions. *W. magniolobatus* Bolchowit., is smaller in size, possesses fewer strips or deeply marked horizontal grooves without any vertical partitions and shows no protuberance of exoexine at ends. *W. alekhinii* Bolchowit., though shows the presence of protuberances, differs in having lesser number of horizontal as well as vertical grooves besides other details.

Occurrence — Korba Coalfield — *Assemblages A-C*; W. Bokaro Coalfield — DP.

Welwitschiapites sipmlex sp. nov.

Pl. 8, Fig. 193, Pl. 9, Figs. 200, 201

Holotype — Pl. 9, Fig. 200.

Type Locality — India (M.P.), Korba Coalfield 214, Bore-hole R-69 Barakar Stage.

Diagnosis — Known size-range 57-100 $\mu \times 42$-72 μ. Bilaterally oval, exine mediumly thick, microverrucose; many horizontal striations (15-24), many vertical partitions, no definite equatorial thickening present; protuberances at ends absent; outline slightly irregular.

Description — Grains $\pm$ oval in overall shape. Holotype 85×62 μ in size. Exine generally thick, microverrucose, verrucae being closely set; many horizontal, thin striations along with many vertical partitions present on both the faces of the flattened specimen; generally striations becoming more irregular on one side; exine ± 1 μ thick, no definite rim or thickening present. No protuberance of exoexine seen. Outline of the pollen grains minutely irregular.

Comparison — *W. gondwanensis* sp. nov. differs in having protrusions of exoexine at the poles of longer axis and thicker exine. *Welwitschiapites tenuis* Bharad. & Salujha (1964) is bigger in size with lesser number of longitudinal striations and no vertical partitions. *W. extansus* Bharad. & Salujha, is much smaller in size and possesses lesser striations without partitions. *W. magniolobatus* Bolchowit., possesses fewer horizontal striations, and no vertical partitions. *W. alekhinii* Bolchowit. differs in having protrusions at the two poles.

Occurrence — Korba Coalfield — *Assemblage A*; W. Bokaro Coalfield — P, DP, D.

Welwitschiapites sp.

Pl. 9, Figs. 198, 199

Description — Bilaterally oval pollen grains; known size 71-81 μ × 54 μ. Exine finely intrapunctate, proximally bearing 10-11 horizontal mostly branched striations; vertical partitions absent. Very small (5-15 μ wide) rudimentary sacci or narrow protuberances present at the two ends of the longer axis; distal area of the body smooth, thin.

Comparison — This species differs from those described earlier in having striations only on one of the faces.

Subturma — *Monocolpates* Iver. & Troels-Smith 1950
Infraturma — *Intortes* (Naum.) Pot. 1958
Genus *Vittatina* (Luber) Wilson 1962

Genotype — *Vittatina subsaccata* Samoilovich.

Vittatina cf. *striata* (Luber & Valts) Samoil.

Pl. 9, Fig. 203

Description — Oval, measuring 86-95 μ × 58-72 μ; exine thin, microverrucose, many horizontal striations, ± 2 μ apart from each other, connected by few to many vertical partitions; horizontal striations continuing distally to run perpendicular to the longer axis, leaving a 40-50 μ broad, distal area free. *Extrema lineamenta* minutely irregular.

Remarks — The specimens studied by me resemble *V. striata* (Luber & Valts) Samoil., in the presence of distal striations at two ends, crossing the proximal horizontal striations at right angles. Jansonius (1962) gave a new description to the species and emphasized the character of 'distal ribs crossing the proximal ones at right angles'. However, the presence of many vertical partitions in between the horizontal striations differentiates the present specimens, from *V. striata*, hence the species has been described here as *V.* cf. *striata*.

Vittatina permegna sp. nov.

Pl. 9, Figs. 206-208

Holotype — Pl. 9, Fig. 206.

Type Locality — India (M.P.), Korba Coalfield (214, Bore-hole R-69), Barakar Stage.

Diagnosis — Known size 100-182 μ × 75-120 μ ± oval in shape; exine thin, finely intramicropunctate; Many (10-20 counted) horizontal and many vertical partitions present on both faces. On one of the faces, striations forming somewhat irregular to verrucose pattern and near the ends, generally two small flap-like infoldings present, folds being perpendicular to the longer axis and full length or partial in relation to the vertical axis of the grain, widely separated. Equatorial rim uniformly ± 2 μ broad.

Description — Pollen grains bilaterally elongated, oval in shape with broad round ends. Holotype 144 × 94 μ. Exine thin, intramicropunctate. On one face (presumably proximal) many striations present along the longer axis of the grain, slightly converging at two ends; many connecting vertical partitions present; on the other face (presumably distal) these striations resulting in almost an irregular pattern. Equatorial rim ± 2 μ, evenly broad, outline being ± smooth. Flap like infoldings present on the distal side, near both or one end, folds being perpendicular to the horizontal axis and up to 10 μ broad.

Comparison — *V. striata* (Lub. & Valts) Samoil., and *V. vittifera* (Lub. & Valts) Samoil., are smaller forms possessing distal striations running perpendicular to the longer axis and not the infolds, unlike present species. *V. scutata* (B. & H.) Bharad., and *V. fasciolata* (B. & H.) Bharad., are smaller forms with thicker exine and closer overlaping folds.

Figure 19 (Pl. 15) given by Jansonius (1962) for *V. striata* resembles the present species but former is smaller in size and possesses distal striations perpendicular to the proximal horizontal striations and lacks vertical partitions.

The present species is characterized by its bigger size and ovoid shape, many horizontal striations and many vertical partitions on both the faces, ± 2 μ broad equatorial rim, intramicropunctate exine and distal infoldings near the ends and hence differs from all other species of the genus.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, TQ.

Genus *Ginkgocycadophytus* Samoilovich 1953

Syn.— *Entylissa* Naumova 1937.

Genotype — *Ginkgocycadophytus caperatus* (Luber) Samoilvich 1953.

Ginkgocycadophytus vetus B. & H. 1956a

Pl. 9, Figs. 210, 211

Syn.— *Entylissa vetus* B. & H.

Holotype — Blame & Henn. 1956a; Pl. 3, Fig. 49.

Remarks — Specimens studied by me are small, oval in shape ranging in size from 25-30 μ×18-20 μ. Exine is thin and smooth to granulose. Colpus is narrow and slightly wider at the ends.

Ginkgocycadophytus cymbatus (B. & H.) Pot. & Lele 1961

Pl. 9, Fig. 209

Syn.— *Entylissa cymbatus* B. & H. 1956a.

Holotype — Balme & Henn. 1956a; Pl. 3, Fig. 55.

Remarks — Specimen is 61×29 μ in size, oval with round ends; having a colpus narrower in the middle and wider at the two corners. Figures 85, 91 & 92 given by Potonié & Lele (1961; Pl. 3) resemble this specimen to a greater extent.

For other specimen see Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 30.

Ginkgocycadophytus korbaensis sp. nov.

Pl. 9, Figs. 212-214

Holotype — Pl. 9, Fig. 214.

Type Locality — India (M.P.), Korba Coalfield, 510(D)E; Bore-hole G-71, Barakar Stage.

Diagnosis — Elongated with narrow ± round ends, size 50-66 μ×24-37 μ. Exine ± 2 μ thick in optical section, finely intramicropunctate; colpus running from pole to pole, narrow, uniformly broad, not becoming wider at poles.

Description — Grains bilaterally elongated with narrow, round ends. Holotype 50×28 μ in size. Exine ± 2 μ thick, finely intramicropunctate; no sculpture; colpus 2-10 μ uniformly broad, running along the longer axis, distinctly marked; folds rarely present.

Comparison — These specimens differ from other species of *Ginkgocycadophytus* in their nature of colpus as well as in the exine structure, where the colpus is characteristically narrower in the centre and broader at the poles, base line continuing with equator; moreover, the exine is granulose and not structured as in the present case.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, DP.

Cf. *Ginkgocycadophytus* sp.

Pl. 9, Figs. 215-217

Description — Elongated grains with narrow ends, generally folded along the longer axis thereby hiding the nature of colpus. Exine thin, finely intramicropunctate.

Remarks — The nature of colpus is not ascertainable due to the presence of folds.

Infraturma — *Monoptyches* (Naum.) Pot. 1958

Genus *Decussatisporites* (Lesch.) Jansonius 1962

Genotype — *Decussatisporites delineatus* Lesch. 1955.

Decussatisporites sp.

Pl. 9, Figs. 204, 205

Description — Bilaterally oval, 45-56 μ ×37-45 μ. Many longitudinal striations running along the shorter axis of the grain and continuing on other side to run perpendicular to the former direction. Sulcus ± 10 μ uniformly broad, running along the longer axis; exine thin, ± laevigate.

Remarks — *D. lucifer* Bharad. & Salujha (1964), differs from the present species in being ± circular in shape and in possessing thicker exine. *D. delineatus* Lesch., differs in having very narrow, slit like sulcus and faint, more closely placed striations.

For other specimen see Bharadwaj & Tiwari 1964b; Pl. 2, Fig. 23.

Occurrence — Korba Coalfield — *Assemblages A-E*; W. Bokaro Coalfield — P, DP, D, TQ.

DISCUSSION

Preceding account of *sporae dispersae* has revealed that the mioflora in the samples under study, is highly diversified being represented by trilete, monolete, monosaccate, striated disaccate and nonstriated disaccate, alete and monocolpate miospore genera. As has been seen in the foregoing systematic description, some of the trilete flanged and cingulate spores and monosaccate as well as disaccate pollen grains are morphologically interesting and distinctive. The various associations of these genera along with some others, are individualistic and form well defined assemblages which can easily be distinguished from others.

Miospore Assemblage in Korba Coalfield — An exhaustive miospore analysis of the bore-hole samples from three sectors of Korba Coalfield has been done and five distinct miospore assemblages have been discovered by Bharadwaj and Tiwari (1964b, Histograms I-V, TEXT-FIG. 1). The complete list of quantitatively important miospore genera has already been given in the above mentioned paper (BHARADWAJ and TIWARI 1964b, p. 1131). Qualitatively, among the well represented forms the association of following miospore genera is typical of the Korba coals studied.

Punctatisporites
Lophotriletes
Apiculatisporis
Horriditriletes
Microbaculispora
Indotriradites
Dentatispora
Latosporites
Parasaccites
Potonieisporites
Plicatipollenites
Rhizomaspora
Primuspollenites
Striatites
Striatopodocarpites
Faunipollenites
Vesicaspora
Sulcatisporites

Among the rare forms, the presence of following genera is also important when considered along with the other constituents of the type-assemblage:

Retusotriletes
Microfoveolatispora
Illinites
Vestigisporites
Ginkgocycadophytus
Korbapollenites
Direticuloidispora

A closer study of the five different assemblages found in this coalfield, throws some light on the vertical distribution of miospore genera. It reveals that the lower most seam (*Assemblage C*, Histogram III, *see* BHARAD. & TIWARI 1964b) is characterized by the prominence of spore genera *Dentatispora* and *Punctatisporites*. In the next younger seam (II from below, *Assemblage B*, Histogram II, BHARAD. & TIWARI 1964b) the genus *Indotriradites* is dominating while *Dentatispora* is characteristically rare but *Punctatisporites* is fairly represented. As we go to the next younger seam i.e. *Assemblage A* (seam III from below), it shows incomming of *Faunipollenites* and *Sulcatisporites* as prominent genera along with *Indotriradites* in fair frequency. So also *Assemblage D* (seam IV from below) is characterized by the dominance of *Faunipollenites* in association with *Parasaccites* and *Sulcatisporites* and few trilete spore genera; in *Assemblage E* (seam V, top most) the dominant genus is *Sulcatisporites* with the other prominent genera such as *Faunipollenites*, *Latosporites* and a few trilete forms.

Thus, we see that *Dentatisporites* is characteristic of the lower most seam (I) being scantily represented in the remaining upper seams. *Punctatisporites* is quite fairly represented in the lower most (I) and the next upper (II from below) seams, while sporadic in the remaining upper three seams. *Indotriradites* is significantly dominating in seam II from below (*Assemblage B*) and also fairly represented in seam III but very meagre in the remaining two upper seams (IV and V). Genus *Faunipollenites* is dominating in seam IV, and *Sulcatisporites* in the V — the upper most seam. It is interesting to note that the genera *Indotriradites*, *Punctatisporites* and *Dentatispora* are sporadic in the upper two seams while they are either dominating or fairly well represented in the lower three seams (see Histogram 1).

Successionally the five seams of Korba Coalfield studied here fall into two distinct horizons the lower (horizon A) represented by trilete dominated assemblages and comprised of seams I to III (*see* Histogram 1-KA) and the upper (horizon B) represented by saccate dominated assemblages and comprised of seams IV and V (Histogram 1-KB).

Miospore Assemblage in West Bokaro Coalfield — These coals also show the presence of a rich and diversified mioflora.

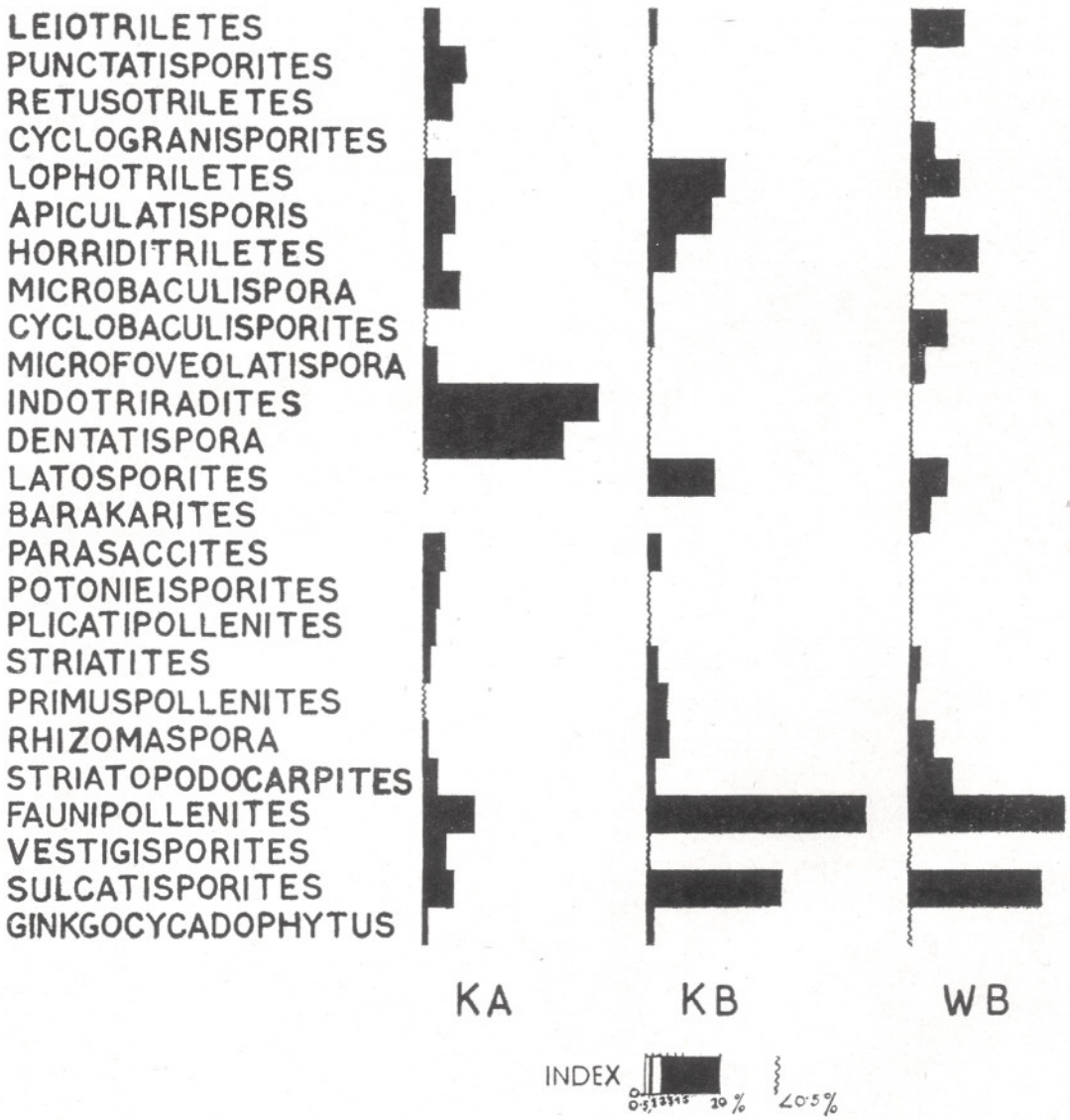
The following genera are quantitatively important:

Leiotriletes
Cyclogranisporites
Lophotriletes
Horriditriletes
Cyclobaculisporites
Microfoveolatispora
Latosporites
Barakarites
Striatites
Primuspollenites
Rhizomaspora
Lahirites

Striatopodocarpites
Faunipollenites
Vesicaspora
Sulcatisporites

In addition to the above genera, the following are also present but they are rare or irregular in occurrence.

Eupunctisporites
Punctatisporites
Retusotriletes
Verrucosisporites
Apiculatisporis
Acanthotriletes
Indospora
Microbaculispora
Cirratriradites
Indotriradites
Dentatispora



HISTOGRAM 1 — Comparative histogram showing the mean percentage frequency of important miospore genera in horizons A and B of Korba Coalfield and in West Bokaro Coalfield. KA — Horizon A: Mean percentage of *Assemblages A,B,C* of Korba Coalfield vide Bharadwaj and Tiwari 1964b. KB.— Horizon B: Mean percentage of *Assemblages D, E* of Korba Coalfield vide Bharadwaj and Tiwari 1964b. WB.— Mean percentage in West Bokaro Coal samples.

Parasaccites
Potonieisporites
Plicatipollenites
Virkkipollenites
Densipollenites
Striomonosaccites
Cuneatisporites
Lunatisporites
Verticipollenites
Striapollenites
Distriatites
Illinites
Vestigisporites
Pityosporites
Welwitschiapites
Vittatina
Decussatisporites
Ginkgocycadophytus
Maculatasporites
Pilasporites

The average frequency of well represented genera in 21 coal samples under study, is given in Histogram 1 (WB). The mean has been calculated after counting five hundred specimens from each sample. A look at the histogram reveals that *Faunipollenites* and *Sulcatisporites* are the most prominent genera in this assemblage. Other fairly well represented forms are:

Leiotriletes
Lophotriletes
Horriditriletes
Cyclobaculisporites
Latosporites
Rhizomaspora
Striatopodocarpites

Miofloristic Comparison between Korba and West Bokaro Coalfields — Qualitatively, among the miospore assemblages of Korba Coalfield, those of horizon B are somewhat comparable to those of West Bokaro Coalfield excepting that *Barakarites* which is very characteristically present in all the samples from Bokaro Coalfield is totally absent from Korba Coalfield.

Quantitatively, among the important genera, *Faunipollenites* and *Sulcatisporites* are quite abundant in the West Bokaro coals (mean 21·5% and 17% respectively; Histogram 1-WB), and thus, are very much comparable to their frequency in the horizon B (Histogram 1-KB) of Korba Coalfield (*Assemblages D* and *E* BHARADWAJ & TIWARI 1964b), but there is difference in the incidence of *Leiotriletes*, *Cyclograni-sporites* and *Cyclobaculisporites*.

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EXPLANATION OF PLATES

(*All figures unless otherwise stated are* 500 ×)

PLATE 1

1. *Leiotriletes* sp., Ph. No. 269/6.

2, 3. *Leiotriletes virkkii* sp. nov., Ph. Nos. 355/15 (Holotype), 358/13.

4. *Eupunctisporites* sp., Ph. No. 287/20 (250 ×).

5. *Punctatisporites gretensis* Balme & Henn. Ph. No. 286/27.

6, 7. *Retusotriletes diversiformis* Balme & Henn., Ph. Nos. 312/22, 365/33.

8, 9. *Cyclogranisporites gondwanensis* Bharad. & Salujha, Ph. Nos. 267/12, 361/7.

10-12. *Verrucosisporites distinctus* sp. nov., Ph. Nos. 290/29 (Holotype), 290/1, 306/8.

13, 14. *Lophotriletes frequensus* sp. nov., Ph. Nos. 359/9, 272/35 (Holotype).

15, 16. *Lophotriletes* sp., Ph. Nos. 272/15, 365/16.

17, 18. *Apiculatisporis levis* Balme & Henn., Ph. Nos. 286/9, 221/31.

19, 20. *Acanthotriletes filiformis* (B. & H.) comb. nov., Ph. Nos. 248/26, 287/23.

21, 22. *Acanthotriletes* sp., Ph. Nos. 349/8, 322/18.

23, 24. *Horriditriletes novus* sp. nov., Ph. Nos. 364/11 (Holotype), 361/28.

25-27. *Horriditriletes bulbosus* sp. nov., Ph. Nos. 267/10, 269/29, 314/1A (Holotype).

28-30. Cf. *Horriditriletes unicus* sp. nov., Ph. Nos. 357/16, 247/25, 357/33 (Holotype).

PLATE 2

31. *Microbaculispora* cf. *villosa* (B. & H.) Bharad., Ph. No. 361/17.

32. *Microbaculispora barakarensis* sp. nov., Ph. No. 348/26.

33, 34. *Microbaculispora indica* sp. nov., Ph. Nos. 290/27 (Holotype), 288/21.

35-37. *Microbaculispora tentula* sp. nov., Ph. Nos. 349/5 (Holotype), 359/15, 348/28.

38, 39. *Cyclobaculisporites minutus* Bharad. & Salujha, Ph. Nos. 314/13, 273/18.

40-42. *Microfoveolatispora foveolata* sp. nov., Ph. Nos. 314/20 (Holotype), 271/4, 361/9.

43, 44. *Microfoveolatispora bokaroensis* sp. nov., Ph. Nos. 272/27, 315/10 (Holotype).

45. *Indospora clara* Bharad., Ph. No. 380/31.

46, 47. *Dentatispora implicata* sp. nov., Ph. Nos. 357/24, 358/1 (Holotype).

48, 49. *Dentatispora gondwanensis* sp. nov., Ph. Nos. 247/11 (Holotype), 313/7.
50, 51. *Dentatispora lacunata* sp. nov., (50 Proximal view, 50A Distal view; 51 Proximal view, 51A Distal view), Ph. Nos. 313/9-313/10 (Holotype), 357/32, 357/31.
52. *Dentatispora crassa* sp. nov., Ph. No. 357/15 (Holotype).

PLATE 3

53. *Dentatispora crassa* sp. nov. (contd.), Ph. No. 284/23.
54. *Dentatispora* sp., Ph. No. 356/1.
55, 56. *Cirratriradites gondwanensis* sp. nov., Ph. Nos. 314/32 (Holotype), 364/30.
57, 58. *Indotriradites surangei* sp. nov. (57 Proximal view, 57A Distal view) Ph. Nos. 287/21-287/22 (Holotype), 287/4.
59, 60. *Indotriradites sparsus* sp. nov., Ph. Nos. 286/36 (Holotype), 243/6.
61. *Latosporites colliensis* (B. &. H) Bharad., Ph. No. 315/32.
62, 63. *Latosporites* sp., Ph. Nos. 357/1, 356/35.
64. *Barakarites crassus* sp. nov., Ph. No. 317/18 (250 ×).
65. *Barakarites decorus* sp. nov., Ph. No. 360/3 (250 ×).
66-68. *Barakarites implicatus* sp. nov., Ph. Nos. 361/27 (Holotype), 315/37, 361/20 (all 250 ×).

PLATE 4

69, 70. *Barakarites densicorpus* sp. nov., Ph. Nos. 361/19, 359/28 (Holotype) (all 250 ×).
71. *Barakarites triquetrus* sp. nov., Ph. No. 315/27 (250 ×).
72. *Parasaccites diffusus* sp. nov., Ph. No. 286/6 (250 ×).
73. *Parasaccites bilateralis* sp. nov., Ph. No. 314/9 (250 ×).
74, 75. *Parasaccites obscurus* sp. nov. Ph. Nos. 290/13, 287/18 (Holotype) (all 250 ×).
76, 77. *Parasaccites distinctus* sp. nov., Ph. Nos. 363/16, 363/2 (Holotype) (all 250 ×).
78. *Parasaccites* sp., Ph. No. 378 (250 ×).
79-81. *Potonieisporites concinnus* sp. nov., Ph. Nos. 316/37, 362/25 (Holotype), 313/27 (all 250 ×).
82-84. *Potonieisporites triangulatus* sp. nov., Ph. Nos. 363/14, 313/36 (Holotype), 312/20 (all 250 ×).
85, 86. *Potonieisporites barrelis* sp. nov., Ph. Nos. 356/9, 313/2 (all 250 ×).

PLATE 5

87. *Plicatipollenites indicus* Lele, Ph. No. 379/19 (250 ×).
88, 89. *Plicatipollenites gondwanensis* (B. & H.) Lele, Ph. Nos. 349/16, 218/33 (all 250 ×).
90. *Plicatipollenites* sp., Ph. No. 286/11 (250 ×).
91, 92. *Plicatipollenites magnus* sp. nov., Ph. Nos. 286/28 (Holotype), 287/15 (all 250 ×).
93. *Virkkipollenites densus* Lele, Ph. No. 357/11 (250 ×).
94. *Densipollenites invisus* Bharad. & Salujha, Ph. No. 364/36 (250 ×).
95. *Densipollenites indicus* Bharad., Ph. No. 369/19 (250 ×).
96. *Striomonosaccites circularis* Bharad. & Salujha, Ph. No. 316/27 (250 ×).
97, 98. *Korbapollenites novus* Tiwari Ph. Nos. 350/23, 289/8 (all 250 ×).
99. *Fimbriaesporites* sp., Ph. No. 350/11 (250 ×).
100-103. *Rhizomaspora indica* sp. nov., Ph. Nos. 289/21, 289/23, 239/22, 350/13 (all 250 ×).
104, 105. *Rhizomaspora fimbriata* sp. nov., Ph. No. 365/19, 362/13 (Holotype) (all 250 ×).
106, 107. *Rhizomaspora singula* sp. nov., Ph. Nos. 363/23 (Holotype), 365/19 (all 250 ×).
108. *Primuspollenites densus* sp. nov., Ph. No. 289/29 (Holotype) (250 ×).
109, 110. Cf. *Primuspollenites obscurus* sp. nov., Ph. Nos. 220/26, 220/8 (Holotype) (all 250 ×).
111, 112. *Primuspollenites dicavus* sp. nov., Ph. Nos. 347/15 (Holotype), 347/23 (all 250 ×).

PLATE 6

113, 114. *Primuspollenites linterus* sp. nov., Ph. Nos. 220/7, 350/8 (Holotype) (all 250 ×).
115. *Direticuloidispora triangula* sp. nov., Ph. No. 378/10 (250 ×).
116. *Directiculoidispora indica* Tiwari, Ph. No. 379/36 (250 ×).
117, 118. *Striatites multistriatus* (B. & H.) comb. nov., Ph. Nos. 364/10, 314/5.
119. *Lueckisporites* sp., Ph. No. 317/20.
120, 121. *Striatites tentulus* sp. nov., Ph. No. 317/32 (Holotype), 349/33.
122. *Striatites rhombicus* Bharad. & Salujha, Ph. No. 365/16 (250 ×).
123. *Striatites communis* Bharad. & Salujha, Ph. No. 348/22 (250 ×).
124, 125. *Striatites parvus* sp. nov., Ph. Nos. 275/4, 317/35 (Holotype).
126, 127. *Striatites reticuloidus* sp. nov., Ph. Nos. 267/15, 365/21 (Holotype).
128. *Striatites irregularis* sp. nov., Ph. No. 350/1 (250 ×).
129, 130. *Striatites* sp., Ph. Nos. 287/35, 288/7 (all 250 ×).
131. *Lahirites rarus* Bharad. & Salujha, Ph. No. 360/14 (250 ×).
132. *Lahirites incertus* Bharad. & Salujha, Ph. No. 362/2 (250 ×).
133, 134. *Lahirites fractus* sp. nov., Ph. Nos. 316/29, 363/18 (Holotype) (all 250 ×).
135, 136. *Lahirites bokaroensis* sp. nov., Ph. Nos. 317/21 (Holotype), 310/38 (all 250 ×).
137. *Lahirites* sp., Ph. No. 362/34 (250 ×).
138. *Verticipollenites* sp., Ph. No. 317/36.
139-141. *Strotersporites indicus* sp. nov., Ph. Nos. 357/34, 356/10 (Holotype), 313/6 (all 250 ×).
142. *Hindipollenites* sp., Ph. No. 317/6 (250 ×).

PLATE 7

143. *Lunatisporites fuscus* Bharad., Ph. No. 360/35 (250 ×).
144, 145. *Lunatisporites korbaensis* sp. nov., Ph. Nos. 350/33, 218/39 (Holotype) (all 250 ×).
146. *Lunatisporites notabilis* sp. nov., Ph. No. 290/30 (250 ×)
147. *Lunatisporites* sp., Ph. No. 287/31 (250 ×).
148, 149. *Striatopodocarpites labrus* sp. nov., Ph. Nos. 363/25, 363/20 (Holotype) (all 250 ×).

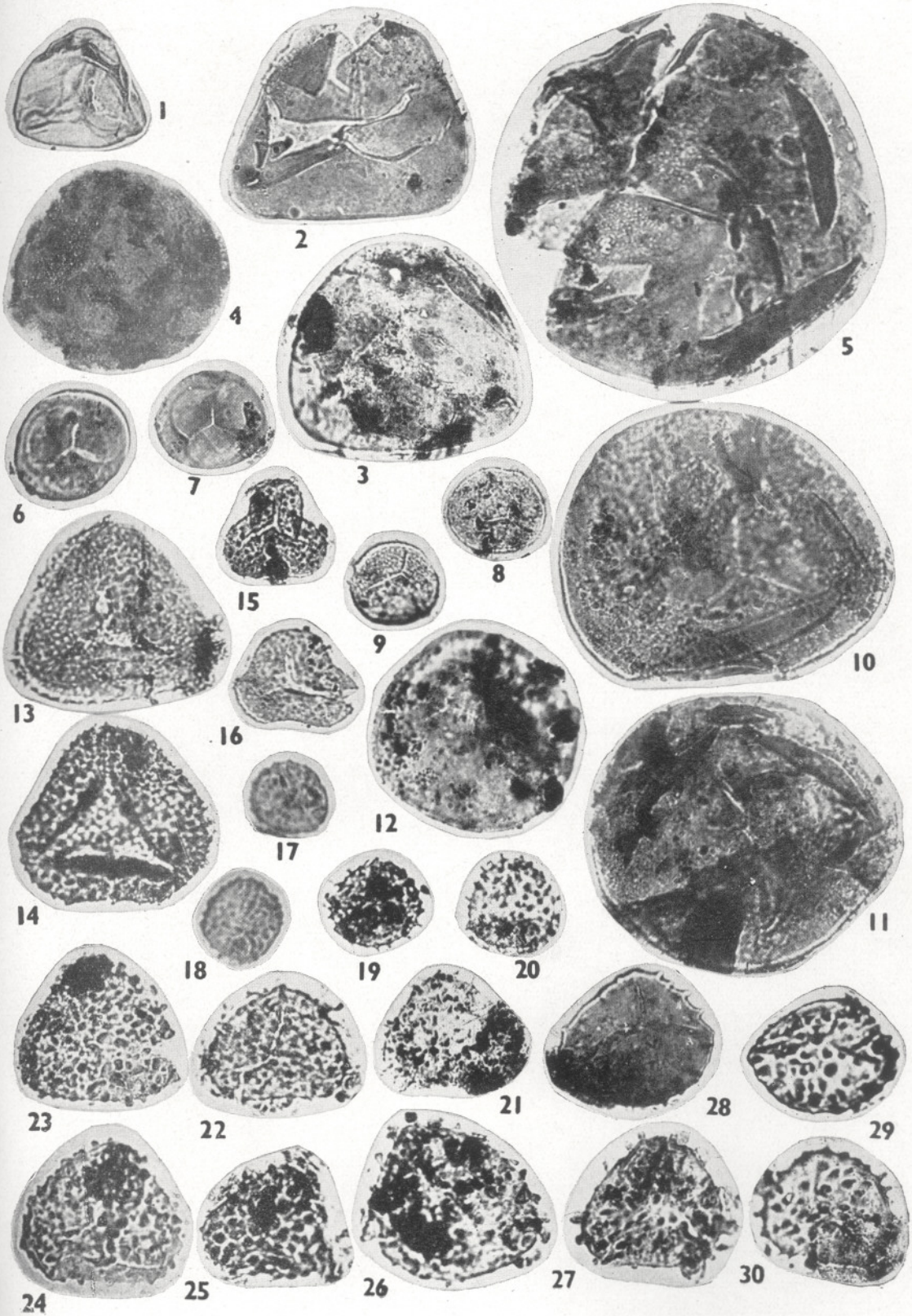
150. *Striatopodocarpites* sp. C, Ph. No. 362/35 (250 ×).
151, 152. *Striatopodocarpites crassus* sp. nov., Ph. Nos. 361/18 (Holotype), 316/35 (all 250 ×).
153. *Striatopodocarpites* sp. A, Ph. No. 317/3.
154. *Striatopodocarpites* sp. B, Ph. No. 348/13.
155. *Faunipollenites varius* Bharad., Ph. No. 221/29.
156-159. *Faunipollenites parvus* sp. nov., Ph. Nos. 272/34, 317/32, 316/8 (Holotype), 363/21.
160. *Faunipollenites* sp., Ph. No. 316/24.
161. *Striapollenites* sp., Ph. No. 276/28.
162. *Distriatites* sp., Ph. No. 361/26.
163-166. *Illinites delasaucei* (Pot. & Kl.) Grebe & Schweitz., Ph. Nos. 314/16, 348/14, 242/4, 312/33.

Plate 8

167, 168. *Vestigisporites rudis* Balme & Henn., Ph. Nos. 357/29, 248/19.
169, 170. *Vestigisporites novus* sp. nov., Ph. Nos. 286/14, 222/7.
171, 172. *Vesicaspora distincta* sp. nov., Ph. Nos. 360/15, 360/1 (Holotype) (all 250 ×).
173, 174. *Vesicaspora indica* sp. nov., Ph. Nos. 363/6 (Holotype), 362/18 (all 250 ×).
175, 176. *Sulcatisporites barakarensis* sp. nov., Ph. Nos. 290/1, 289/33 (Holotype) (all 250 ×).
177. *Sulcatisporites maximus* (Hart) Singh, Ph. No. 315/25 (250 ×).
178-180. *Sulcatisporites* sp., Ph. Nos. 361/15, 349/19, 289/19.
181, 182. *Vesicaspora ovata* (B. & H.) Hart, Ph. Nos. 362/7, 313/16.
183. *Cuneatisporites* sp. A, Ph. No. 360/16 (250 ×).
184, 185. *Cuneatisporites* sp. B, Ph. Nos. 313/22, 313/18 (250 ×).
186. *Pityosporites* sp., Ph. No. 273/14.
187. *Maculatasporites indicus* Tiwari, Ph. No. 312/9.
188-190. *Maculatasporites irregularis* sp. nov., Ph. Nos. 287/1 (Holotype), 287/2, 350/28.
191, 192. *Maculatasporites gondwanensis* sp. nov., Ph. Nos. 288/26, 222/14 (Holotype).
193. *Welwitschiapites simplex* sp. nov., Ph. No. 315/29.
194, 195. *Welwitschiapites gondwanensis* sp. nov., Ph. Nos. 350/8, 241/20 (Holotype).

Plate 9

196, 197. *Welwitschiapites tenuis* Bharad. & Salujha, Ph. Nos. 360/32, 364/15.
198, 199. *Welwitschiapites* sp., Ph. Nos. 248/21, 247/26.
200, 201. *Welwitschiapites simplex* sp. nov., Ph. Nos. 290/17 (Holotype), 290/19.
202. *Pilasporites plurigenus* Balme & Henn., Ph. No. 356/32.
203. *Vittatina* cf. *striata* (L. & V.) Samoil. Ph. No. 247/26.
204, 205. *Decussatisporites* sp. 267/24, 217/16.
206-208. *Vittatina permegna* sp. nov., Ph. Nos. 239/11 (Holotype), 313/30, 379/17.
209. *Ginkgocycadophytus cymbatus* (B. & H.) Pot. & Lele, Ph. No. 243/5.
210, 211. *Ginkgocycadophytus vetus* Balme & Henn., Ph. Nos. 271/18, 355/2.
212-214. *Ginkgocycadophytus korbaensis* sp. nov., Ph. Nos. 355/3, 287/6, 312/28 (Holotype).
215-217. Cf. *Ginkgocycadophytus* sp., Ph. Nos. 248/6, 356/12, 357/3.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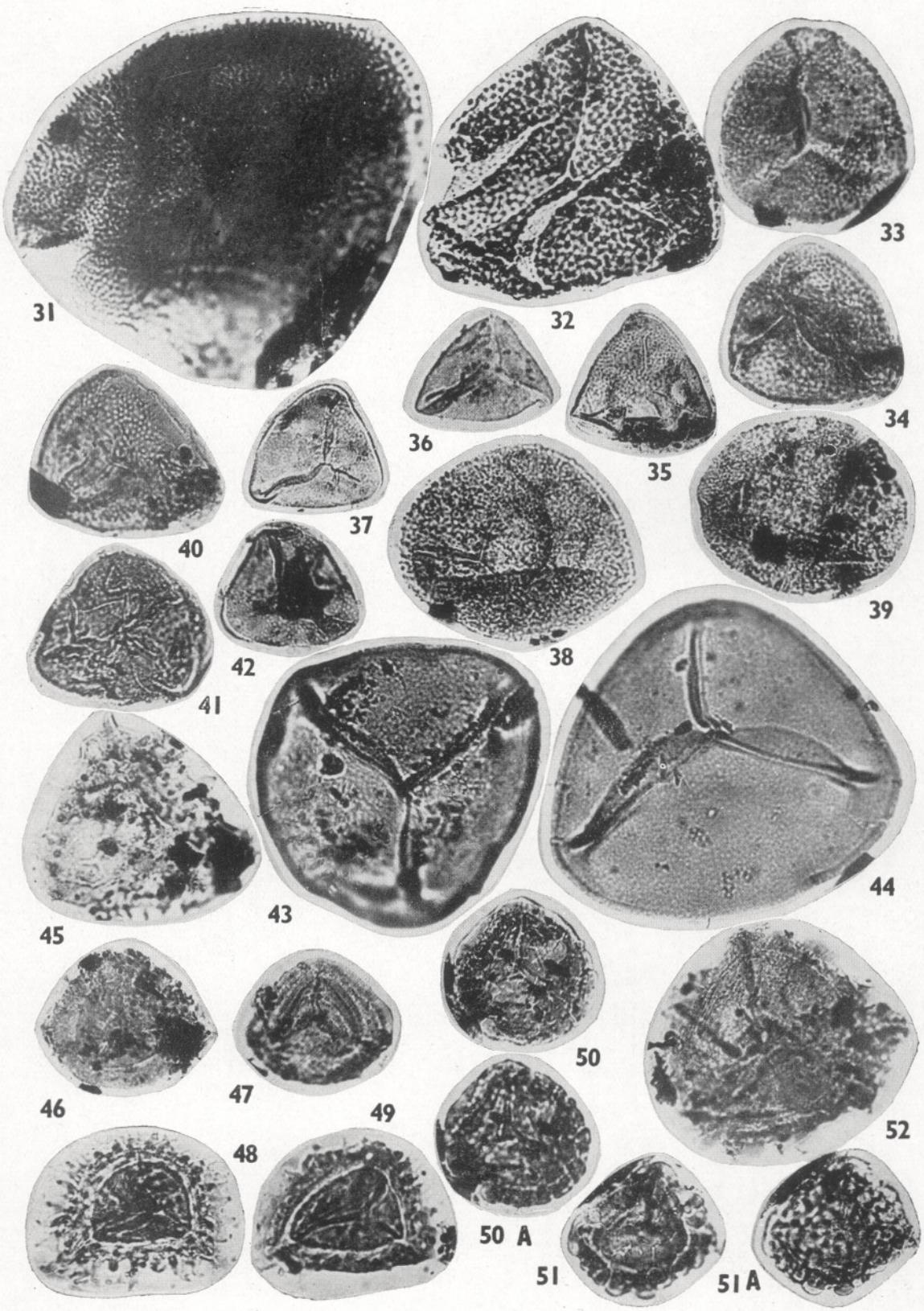
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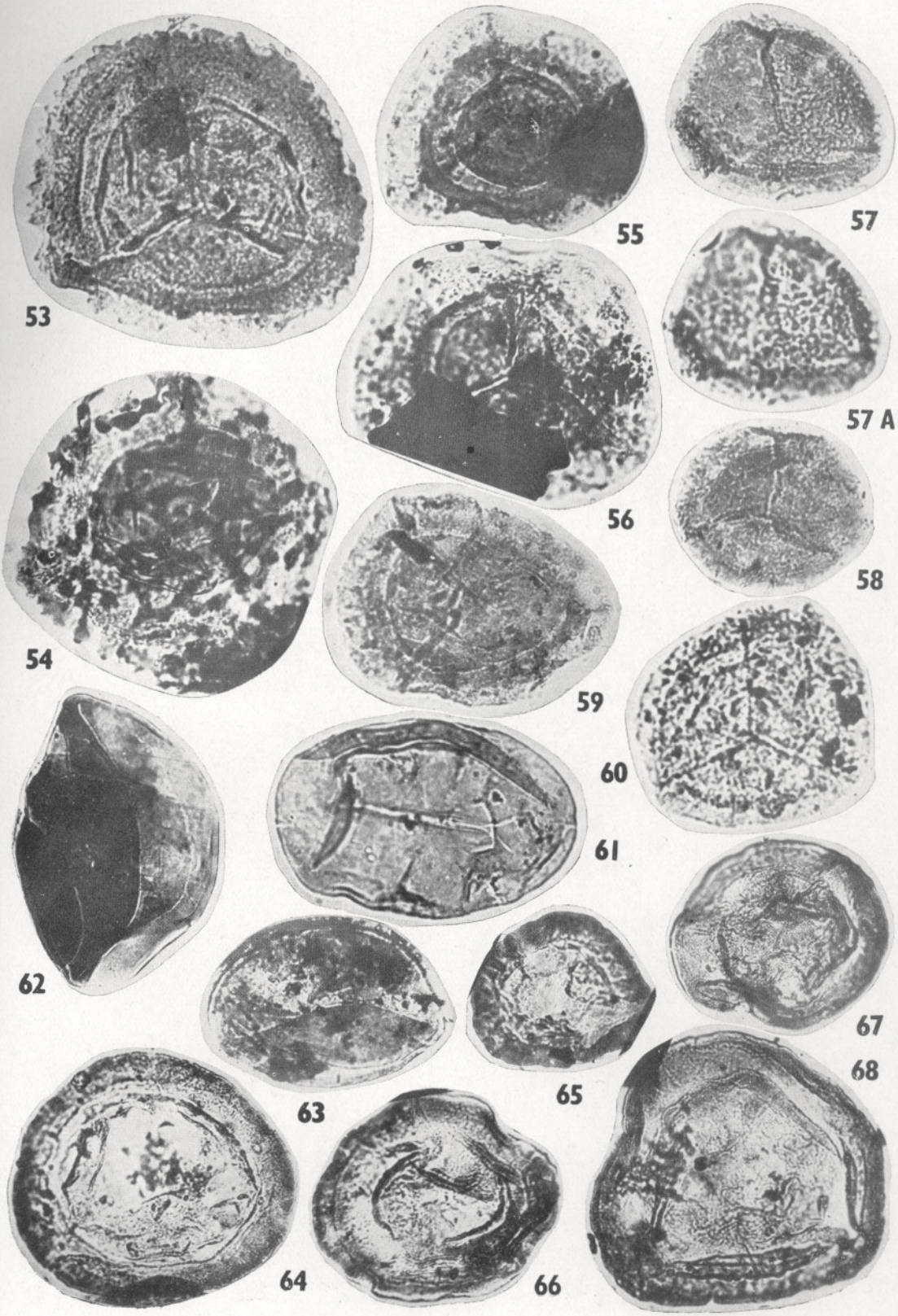
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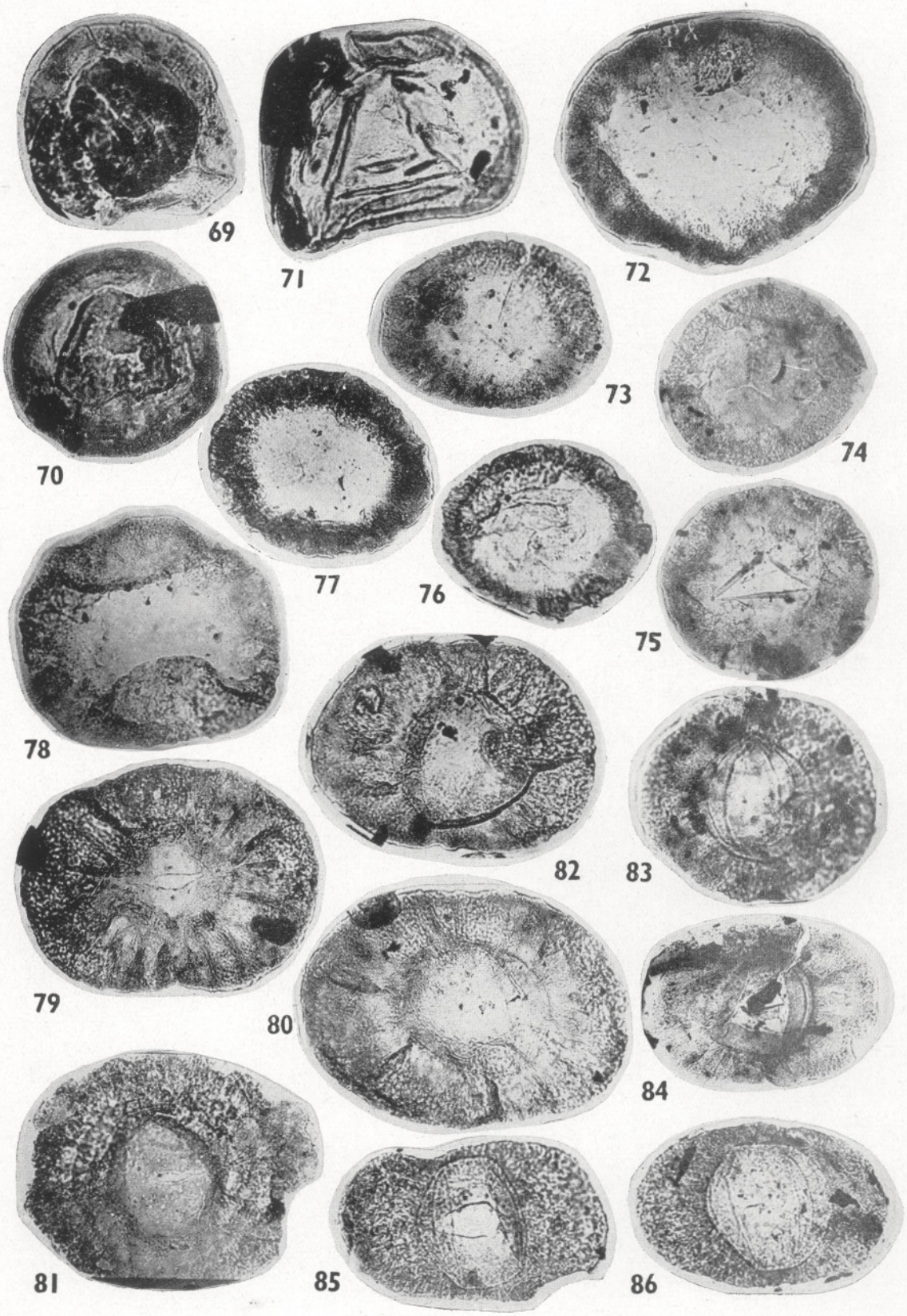
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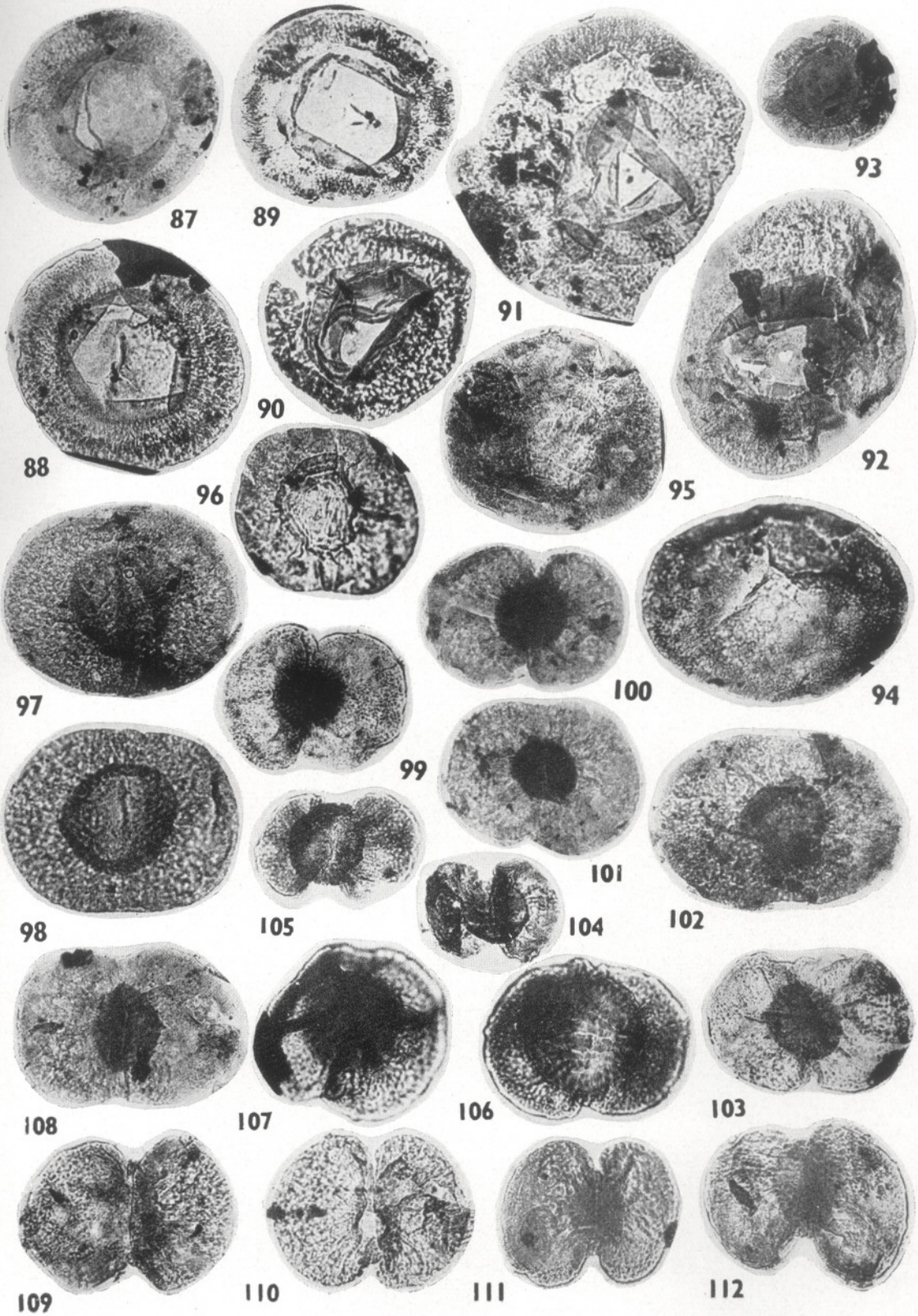
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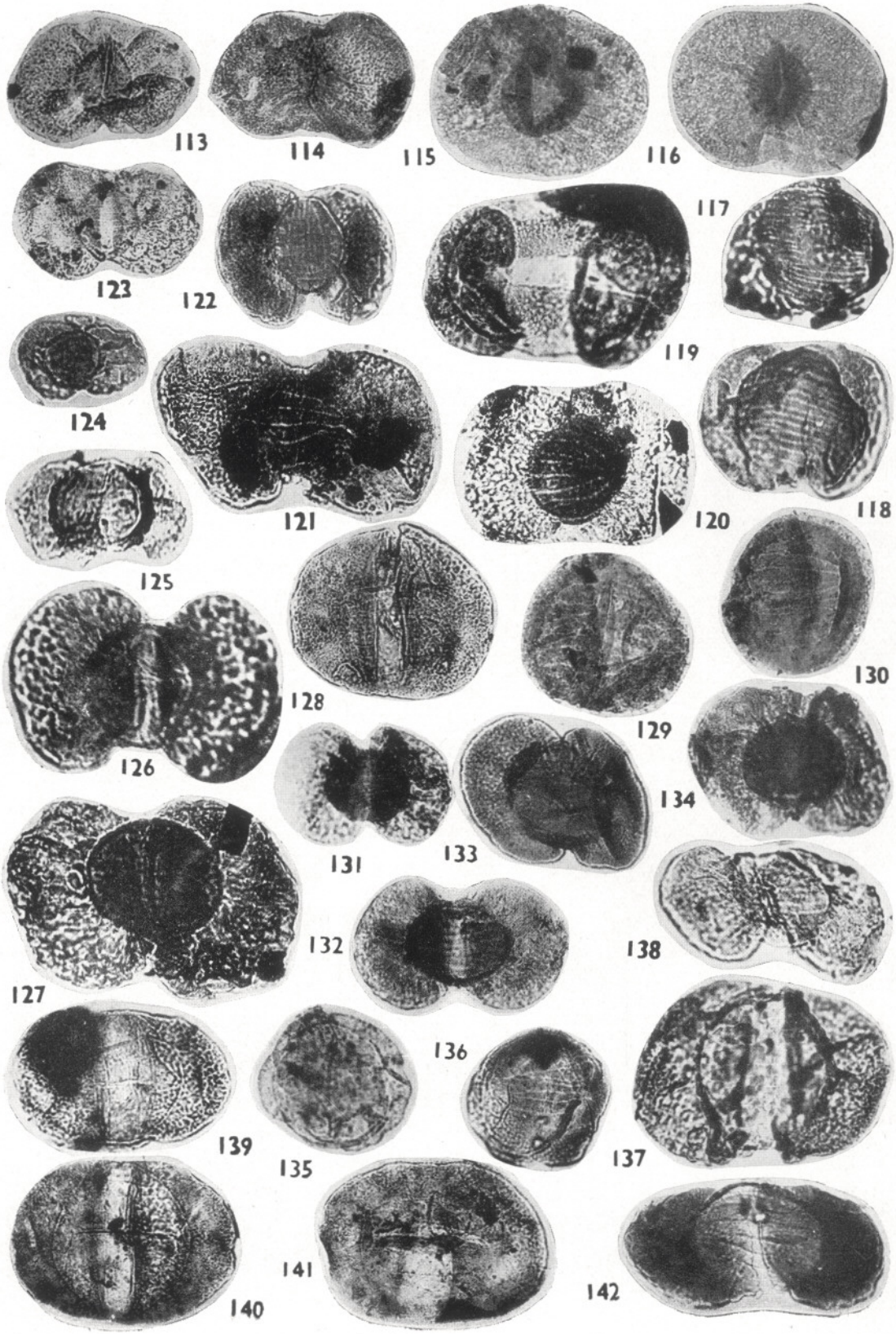
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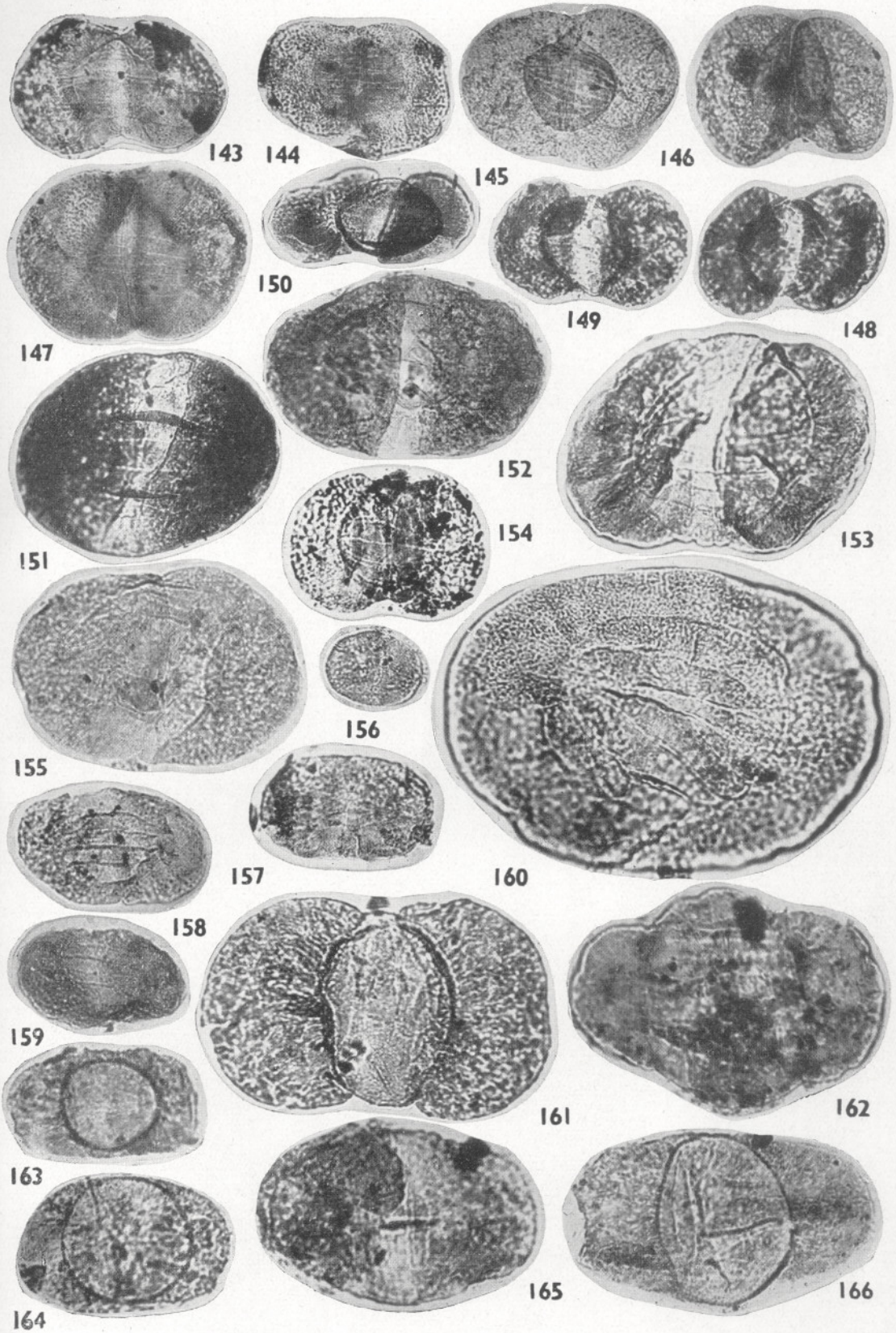
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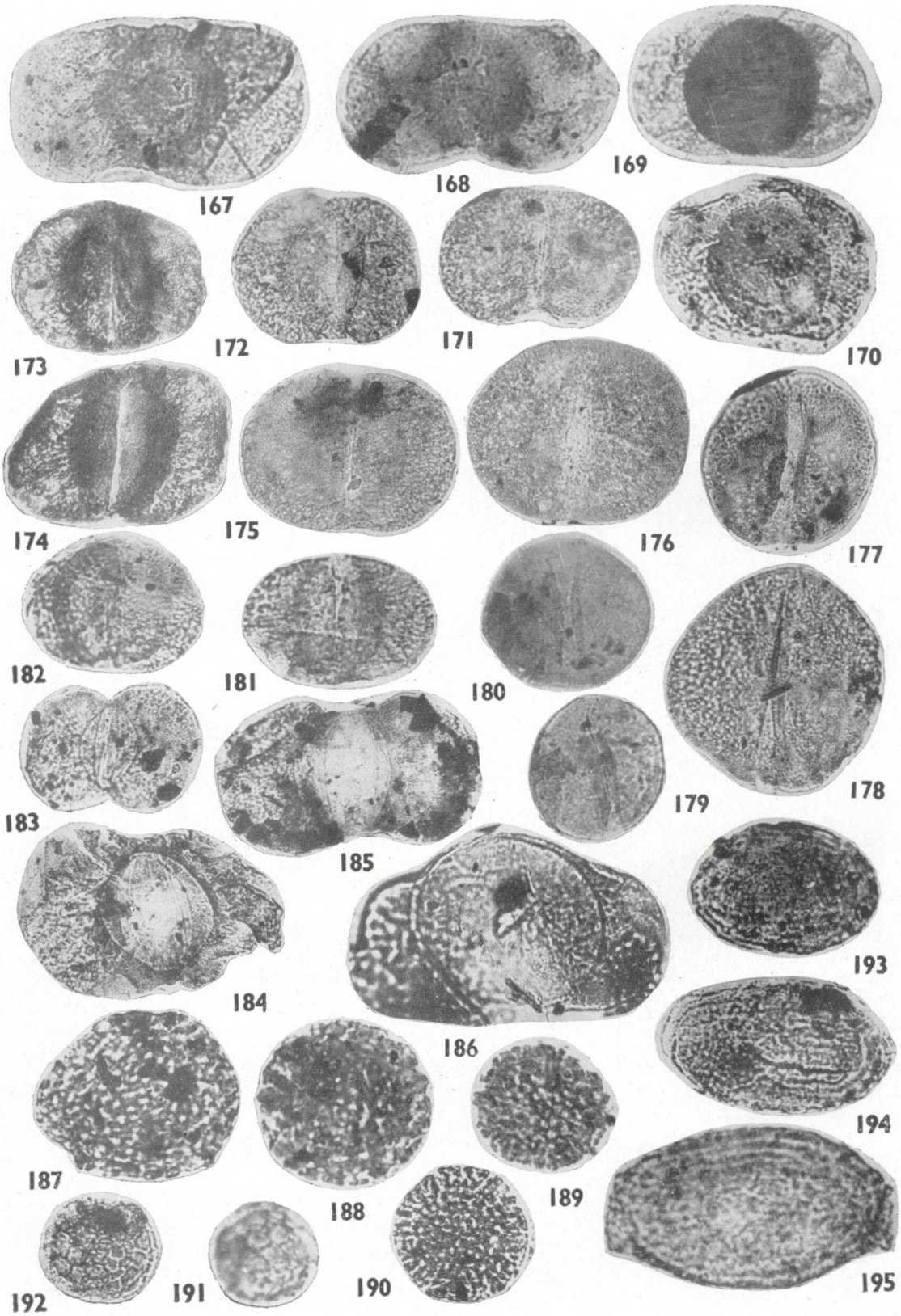
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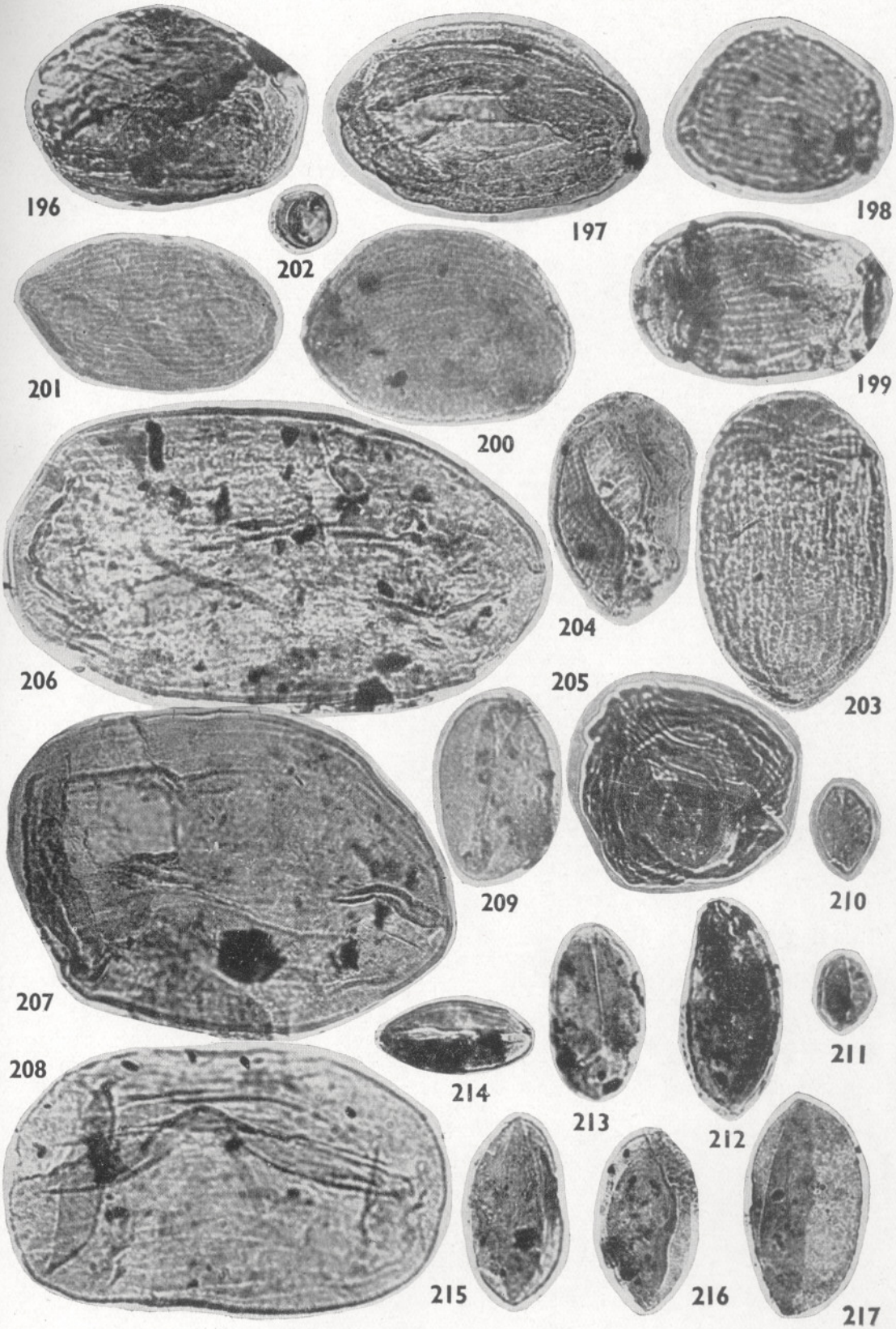
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