SPORAE DISPERSAE FROM JHINGURDAH SEAM, SINGRAULI COALFIELD (M.P.), INDIA

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ABSTRACT

Jhingurdah seam, the top most seam of Singrauli Coalfield, Madhya Pradesh has been sporologically investigated. The *Sporae dispersae* represented in this seam consists of a large variety of trilete, monolete, monosaccate, disaccate and alete miospores. In all 110 species belonging to 49 genera have been described, out of which 35 species are new. The fundamental approach behind the generic and specific circumscriptions is based upon the detailed study of various morphographic characters borne by different individuals.

INTRODUCTION

IN the present paper the taxa of *Sporae dispersae*, as obtained from the Jhingurdah seam of the Singrauli Coalfield, Madhya Pradesh, have been taxonomically described.

The general geography and geology of the area has already been dealt with in an earlier paper (BHARADWAJ & SINHA, 1969a) in which the palynological succession and the age of the Jhingurdah seam and associated strata have been discussed. Bharadwaj and Sinha (1969b) have described some new miospore genera from this area. Sinha (1969) has reported some acritarchs from the same materials.

In recent years much work has been done on the *Sporae dispersae* of different strata of the Gondwanaland. The results have been summarized from India by Bharadwaj (1966), Tanganyika by Hart (1960), Congo by Bose and Kar (1966), Australia by Balme (1964), Brazil by Tiwari and Navale (1967) and by others.

MATERIAL AND METHODS

The present investigations are based on a 165 metre thick bore core (Bore hole No. NCSJ-4) belonging to Jhingurdah seam. For details of the material see Bharadwaj and Sinha (1969b).

The technique followed for the maceration and preparation of slides was same as employed by Bharadwaj and Salujha (1964). For the taxonomic studies 6 slides per sample were prepared in glycerine jelly. Slides were thoroughly scanned and all the well preserved specimens were photographed on 35 mm film. The type slides have been deposited at the Museum of the Birbal SahniI nstitute of Palaeobotany, Lucknow, India.

TAXONOMIC CONSIDERATIONS

The *Sporae dispersae* obtained from the Jhingurdah seam comprises a large variety of trilete, monolete, monosaccate and disaccate miospores. In the present study qualitative as well as quantitative analyses of various morphographic characters have been utilized for generic and specific circumscriptions. The qualitative and quantitative characters taken into taxonomic considerations are same as already discussed by Bharadwaj and Salujha (1964) and Tiwari (1965).

In description of the *Sporae dispersae* the artificial system of classification as proposed and elaborated by Potonie (1956, 1958, 1960) has been followed as, due to lack of knowledge about the *in situ* spores a phylogenetic consideration of the present *Sporae dispersae*, on the lines proposed by Schopf, Wilson and Bentall (1944), was not possible.

Amongst the triletes, a new organization has been recorded in the genus *Brevitriletes* Bharad. & Sriv., 1969 wherein the exine sculpture is present only on the distal face and consists of coni and spines. The nature of sculpture and their distribution have been considered to be of specific importance.

In the zonates, *Potonieitriradites* Bharad. & Sinha, 1969a has been described. Nature of distal ornamentation which varies from microgranulose to tuberculate, width and nature of the flange and the nature of the trilete mark have been utilized in specific delimitations.

In the monosaccate genus *Tuberisaccites* Lele & Karim (MS), a new character has been recorded which was not reported by

the original authors. It is the presence of tuberous outgrowths of the exine on both the proximal as well as the distal faces of the central body.

Pollen grains referred to genus *Corisaccites* Venkat. & Kar, 1966b have been included in the older genus *Lueckisporites*.

Disaccate striated pollen grains are the most well represented group in the present assemblage, both qualitatively as well as quantitatively. The size of the pollen grain has been taken as the length of pollen grain from one end of the saccus to the other × the breadth of the saccus. The size of the central body has been taken as width (along the direction of one saccus to other) × length. The saccus intrareticulation has been observed to be of four types, viz., fine intrareticulate (meshes ± 1 μ), medium intrareticulate (meshes ± 2 μ), coarse intraticulate (thick muri and large meshes) and double intrareticulation (5-8 μ reticulum enclosing finer reticulations). The general important characters considered among such pollen grains are the overall shape and size; central body shape, nature of the central body exine, presence or absence of equatorial rim; number of striations, presence or absence of vertical inter-connections in between the striations, their number; distal attachment of sacci to central body, width and shape of sulcus; lateral position of sacci, their shape and nature of intrareticulation.

Genus *Faunipollenites* Bharad., 1962 has been maintained to include the straited pollen grains, with an indistinct outline of the central body, from the Gondwana formations.

Genus *Illinites* (Kos.) Pot. & Kl., 1954 as considered here includes all the smaller forms hitherto described under *Potonieisporites*, *Vestigisporites*, *Sahnites* and *Illinites*. However, the bigger forms previously described under the above genera are included in *Potonieisporites* (Bhard.) Bharad., 1964.

A new organization has been found in striate monocolpate pollen grains referred to the genus *Distriomonocolpites* Bharadwaj & Sinha, 1969a. The characteristic feature of this genus is the laevigate and depressed nature of the colpus due to which folds or thickening are found along the zone of colpus. The grains show proximal horizontal striations with vertical interconnections uniting at the lateral ends and forming a closed ring; distally vertical striations are found.

SYSTEMATIC DESCRIPTION

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

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

Genotype — *Leiotriletes sphaerotriangulus* (Loose) Potonié & Kremp, 1954

Remarks — Genus *Leiotriletes* (Naum.) Pot. & Kr. is known from the Permian of southern as well as northern hemispheres. There is another genus, viz. *Deltoidospora* (Miner) Pot., 1956 which has almost similar generic diagnosis as *Leiotriletes*, but the former is mostly confined to Jurassic and Triassic periods. *Leiotriletes directus* Balme & Henn., 1956 was transferred to the genus *Microfoveolatispora* as *M. directa* by Bharadwaj (1962) in view of the microfoveolate nature of the exine and the presence of secondary folds along the trilete mark. Later Hart (1960) transferred this species to *Deltoidospora* as *D. directus*. However, the the microfoveolate exine and the secondary folds along the trilete rays are the characteristic features of *Microfoveolatispora* unlike the smooth exine and simple rays of *Deltoidospora*.

Leiotriletes brevis sp. nov.
P. 1, Figs. 1, 2

Holotype — Pl. 1, Fig. 1, Slide No. 4093

Locus typicus — Bore hole No. NCSJ-4, Sample No. 78.

Diagnosis — Miospores small, trilete, triangular; size range 19-25 μ; trilete mark distinct, rays 1/2 radius to almost upto apices; exine thin, laevigate; *extrema lineamenta* smooth.

Description — Miospores are triangular with usually concave, rarely straight interradial sides and rounded corners. Holotype measures 25 μ. Trilete mark is distinct, rays reach 1/2 the spore radius, or upto the corners, usually all the three rays are equal in length. Exine is thin, laevigate and mostly structureless. *Extrema lineamenta* is without any ornamentation.

Comparison — *Leiotriletes brevis* sp. nov. differs from *L. virkkii* Tiwari, 1965 in its smaller size and mostly laevigate structureless exine. *Leiotriletes* sp. of Bharadwaj (1962; Pl. 1, Figs. 1-3) is larger in size and

appears to be intrastructured. *Leiotriletes* sp. of Bharadwaj and Salujha (1964; Pl. 1, Fig. 1) is roundly triangular in shape and larger in size. *Leiotriletes* sp. of Tiwari (1965; Pl. 1, Fig. 1) is also larger in size. Species of genus *Leiotriletes* described by Kar and Bose (1967) differ from the present species in having thick exine and larger size range.

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

Genotype — Punctatisporites punctatus Ibrahim, 1932

cf. *Punctatisporites* sp.
Pl. 1, Fig. 3

Description — Miospores are circular to subcircular in shape, size ranges from 70× 65 μ-100×84 μ. Trilete mark is distinct, rays 1/2 to 1/3 (13-35 μ) spore radius long; labra are mostly thick, rarely thin and vertex is low to high. Exine is 2-4 μ thick, laevigate, mostly structureless. *Extrema lineamenta* is smooth.

Remarks — The genus *Punctatisporites* (Ibr.) Pot. & Kr., 1954 is characterized by the intrapunctate exine structure whereas in the present specimens the exine is mostly structureless. However, as the number of such specimens in the present assemblage is small, these have been referred to the genus *Punctatisporites*.

Infraturma — *Apiculati* (Benn. & Kidst.) Pot., 1956
Subinfraturma — *Granulati* Dyb. & Jachow., 1954
Genus — *Cyclogranisporites* Pot. & Kr., 1954

Genotype — Cyclogranisporites leopoldii (Kremp) Potonié & Kremp, 1954

Cyclogranisporites barakarensis Sriv. (1970)
Pl. 1, Fig. 4

Remarks — Maxima of *C. barakarensis* is 22 μ, while in the specimens studied here, it is 25 μ. However, the mean size of the specimens studied by Srivastava (1970) and the presently described specimens are 24 μ. Size of grana in both cases is less than 1 μ.

Genus — *Planisporites* (Knox) Pot. & Kr., 1954

Genotype — Planisporites granifer (Ibrahim) Knox, 1950

cf. *Planisporites* sp. A
Pl. 1, Fig. 5

Description — Miospores are circular to subcircular; ± 78-85 μ in diameter. Trilete mark is distinct; rays are 22-35 μ long, labra are thick and vertex is low. Exine is thick, 2-3 μ in optical section, indistinctly punctate, covered with small, ± 2 μ circular to irregular sculptural elements which are sparsely and irregularly distributed. *Extrema lineamenta* is smooth, except at the places where one or two sculptural elements are present.

Remarks — The irregular distribution and nature of sculptural elements make the present specimens very characteristic but as the number of such specimens recovered from present assemblage is less, they are referred to the genus *Planisporites*.

cf. *Planisporites* sp. B
Pl. 1, Fig. 6

Description — Miospores are subcircular in shape. Size ranges from 63-68 μ. Trilate mark is distinct, rays reaching up to the periphery, labra are thick and vertex is low. Exine is ± 3 μ thick, micropunctate and is sparsely covered with 3-5 μ wide circular tubercles. 8-10 tubercles can be counted along the *extrema lineamenta*.

Remarks — The bigger size of sculptural elements make the present specimens different from cf. *Planisporites* sp. A.

Subinfraturma — *Nodati* Dyb. & Jachow., 1957

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

Genotype — Lophotriletes gibbossus (Ibrahim) Potonié & Kremp, 1954

Lophotriletes rectus Bharad. & Sal., 1964
Pl. 1, Fig. 7

Remarks — Bharadwaj and Salujha (1964) have referred three specimens to *Lophotriletes rectus*, out of which Pl. 2, Fig. 28 is bigger in size with bulging inter-radial sides and sparse ornamentation and appears to be different from the holotype. The size of sculptural elements in the present specimens is smaller than that of the specimens described by Bharadwaj and Salujha.

Subinfraturma — *Baculati* Dyb. & Jachow., 1957

Genus — *Horriditriletes* Bharad. & Sal. 1964

Genotype — Horriditriletes curvibaculosus Bharadwaj & Salujha, 1964

Horriditriletes curvibaculosus Bharad. & Sal., 1964

Pl. 1, Fig. 8

Remarks — In present specimens, number of the curved bacula is lesser than that of the straight bacula.

Horriditriletes brevis Bharad. & Sal., 1964

Pl. 1, Fig. 9

Remarks — Miospores studied here have mostly concave or straight inter-radial sides, while those recorded by Bharadwaj and Salujha (1964) show mostly convex inter-radial sides.

Horriditriletes novus Tiw., 1965

Pl. 1, Fig. 10

Remarks — The specimens studied here are smaller in size. In other characters the present specimens compare closely with the holotype.

Horriditriletes pseudoseptatus sp. nov.

Pl. 1, Figs. 11, 12

Holotype — Pl. 1, Fig. 12, Slide No. 4100
Locus typicus — Bore hole No. NCSJ-4, Sample No. 82
Diagnosis — Triangular miospores; trilete mark distinct; exine thin, usually ornamented with septate bacula, sometimes intermixed with coni.
Description — Miospores are triangular with straight to convex inter-radial sides and round apices. Size ranges from 25-50 μ; holotype measures ± 50 μ. Trilete mark is distinct, rays are 9-15 μ long, labra are thin and vertex is low. Exine is thin, ornamented with 2-7 μ ×2-5 μ high bacula and 2-3 μ blunt coni. Usually a few, sometimes all, of the bacula and coni are septate with many septa.
Reconstruction — See Text-fig. 1
Comparison — Present species resembles with *Horriditriletes novus* Tiw., 1965 in having mixed type of ornamentation comprising bacula and coni, but differs in having few to many septate bacula along with simple ornamentation.

Genus — *Cyclobaculisporites* Bharad., 1955

Lectogenotype — Cyclobaculisporites saarensis Bharad., 1966

Pl. 1, Fig. 13

Cyclobaculisporites minutus Bharad. & Sal., 1964
Remarks — The specimens differe from those of Bharadwaj and Salujha (1964) in mostly having an obscure trilete mark.

Infraturma — *Varitrileti* Venkat. & Kar, 1965

Genus — *Brevitriletes* Bharad. & Sriv., 1969

Genotype — Brevitriletes Communis Bharadwaj & Srivastava, 1969

Brevitriletes communis Bharad. & Sriv., 1969

Pl. 1, Fig. 14

Remarks — The specimens studied here show a close similarity with the holotype, but for their slightly smaller size range.

Brevitriletes jhingurdahiensis sp. nov.

Pl. 1, Figs. 15, 16

Holotype — Pl. 1, Fig. 15, Slide No. 4102
Locus typicus — Bore hole No. NCSJ-4, Sample No. 53
Diagnosis — Miospores subcircular; 19-36 μ in size, trilete mark distinct or obscure; distally ornamented mostly with a mixed type of sculpture, comprising blunt verrucae, coni or even blunt spines, proximal exine smooth and laevigate.
Description — Miospores are mostly subcircular; rarely triangular or circular. Holotype measures 31 μ. Trilete mark is obscure or distinct, rays reaching upto corners, labra are thin and vertex is low. Sculpture is present only on the distal face, comprising blunt verrucae, spines or coni, measuring 1-3 μ×1 μ. Proximally exine is smooth and laevigate. *Extrema lineamenta* is uneven.
Reconstruction — See Text-fig. 2.
Comparison — Presently described species resembles *Brevitriletes communis* Bharad. & Sriv., 1969 in its overall size range but differs in the absence of equatorial thickening. Other species of the genus *Brevitriletes* differs

from *B. jhingurdahiensis* sp. nov, in being bigger in size.

Remarks — *Brevitriletes communis* and *B. jhingurdahiensis* include specimens having varied type of sculptural elements. It is because of the fact, that the spines are blunt tipped, the lower half of which resemble a blunt coni or verrucae while the upper portion is straight and blunt just like a baculum. It has been observed that the upper portion of the spine is easily detachable and when it is detached the remaining part of the spine appears like coni or verrucae. So it is assumed here that coni and verrucae are actually blunt spines whose upper part has been lost.

Brevitriletes crassus sp. nov.
Pl. 1, Figs. 17, 18

Holotypes — Pl. 1, Fig. 18, Slide No. 4103
Locus typicus — Bore hole No. NCSJ-4, Sample No. 13

Diagnosis — Subcircular to subtriangular miospores; 15-30 μ size; trilete mark obscure or distinct; ornamentation only on distal face, comprising very low to indistinct sculpture; equatorial thickening present.

Description — Miospores are mostly subcircular, rarely circular or triangular; holotype measures 22 μ. Trilete mark is mostly obscure, rarely seen, rays reaching upto the margins. Exine is thin, proximally smooth and laevigate; distally it is ornamented with irregular, very low sculpture which is hardly discernible over the *extrema lineamenta*. In LO analysis, the sculptural elements give appearance of circular, big puncta which indicate hollow nature of sculptural elements. ± 1-2 μ thick equatorial rim is present along the *extrema lineamenta*.

Reconstruction — See Text-fig. 3

Comparison — *Brevitriletes crassus* sp. nov. differs from *B. communis* Bharad. & Sriv. and *B. jhingurdahiensis* sp. nov. in having very low, indistinct sculpture. Among the other species, *B. levis* Bharad. & Sriv., *B. unicus* (Tiw.) Bharad. & Sriv. are characterized by the presence of a distinct trilete mark and bigger size.

Brevitriletes baculatus sp. nov.
Pl. 1, Figs. 19, 20

Holotype — Pl. 1, Fig. 19, Slide No. 4104
Locus typicus — Bore hole No. NCSJ-4, Sample No. 13

Diagnosis — Subcircular to circular miospores; ± 20-26 μ size; trilete mark obscure; distally ornamented with big, blunt bacula.

Desciption of specimens studied — Miospores are circular to subcircular; holotype measures 21×24 μ. Trilete mark is obscure. Exine is thin, proximally laevigate and smooth, distally it is ornamented with ± 2 μ high, mostly blunt, rarely with swollen topped bacula. Bacula are uniformly wide or sometimes slightly wider at the base. 7-25 bacula counted over the *extrema lineamenta*.

Reconstruction — See Text-fig. 4.

Comparison — The present species differs from *Brevitriletes unicus* (Tiw.) Bharad. & Sriv. and *B. communis* Bharad. & Sriv. in having an indistinct trilete mark and in smaller size range. *B. communis* Bharad. & Sriv., *B. jhingurdahiensis* and *B. crassus* although resemble the present species in its size range but differs in the nature of sculptural elements.

Genus — *Microbaculispora* Bharad., 1962

Genotype — *Microbaculispora gondwanensis* Bharadwaj, 1962

Microbaculispora tentula Tiw., 1965
Pl. 1, Fig. 21

Remarks — Among the specimens studied, a few are bigger in size as compared to the biggest specimen (56 μ) seen by Tiwari (1965).

Genus — *Microfoveolatispora* Bharad., 1962

Genotype — *Microfoveolatispora raniganjensis* Bharadwaj, 1962

Microfoveolatispora bokaroensis Tiw., 1965
Pl. 1, Fig. 22

Remarks — Miospores recovered from Jhingurdah seam are usually flattened in polar view. However, in other morphological characters they resemble closely with the holotype.

Microfoveolatispora indica sp. nov.
Pl. 1, Figs. 23, 24

1956 — *Granulatisporites trisinus* Balme & Hennelly, Pl. 1, Pigs. 7, 8
1962 — *Microfoveolatispora directa* Bharadwaj, Pl. 2, Figs. 45-47

1964 — *Microfoveolatispora* sp., Bharadwaj & Salujha, Pl. 2, Fig. 50

Holotye — Pl. 1, Fig. 23, Slide No. 4107

Locus typicus — Bore hole No. NCSJ-4, Sample No. 82

Diagnosis —Triangular miospores, known size 53-95 μ; trilete mark distinct, Y-rays accompanied by thin folds; exine covered with faint to distinct, 1 μ wide foveolae.

Description — Miospores are triangular with straight to slightly concave sides and round apices. Holotype measures 60 μ. Trilete mark is distinct, Y-rays reaching ± upto margins and are associated with thin folds. Exine is thin, ± 2 μ in optical section and is mostly covered with faint, 1 μ wide foveolae. *Extrema lineamenta* is smooth.

Comparison — Microfoveolatispora indica sp. nov, differs from *M. trisina* (B. & H.) Bharad., 1962 in its smaller size range and faint foveolae. *M. raniganjensis* Bharad., 1962 has got wider foveolae and meshes. *M. pseudoreticulatus* (BALME & HENN.) Bharad., 1962 has been transferred to a new genus *Pseudoreticulatispora* by Bharadwaj and Srivastava (1969).

Remarks — Bharadwaj (1962) included presently described specimens in *Microfoveolatispora directa* (BALME & HENN.) Bharad. and transferred the specimens of *Leiotriletes directus* Balme & Henn., 1956 in *M. directa*. It has been found that the size range of *Leiotriletes directus* is only 26-36 μ, secondary folds along trilete rays appears to be very narrow (See BALME & HENNELLY, 1956b; Pl. 1, Figs. 1, 2) and the exine is faintly foveolate. So here it is proposed to maintain two species of *Microfoveolatispora*. First is *M. indica* sp. nov. having a bigger size range, including all the specimens of *M. directa* by Bharadwaj (1962) and the second species is *M. directa*. In view of these facts the specific diagnosis of the latter species should be read as below:

"Triangular, trilete miospores; size ranging from 23-26 μ, trilete rays accompanied by very narrow secondary folds; exine covered with less than 1 μ wide foveolae; *extrema lineamenta* smooth". Figure 1 on Plate 1 of Balme and Hennelly (1956b) is suggested to be the holotype for *M. directa*.

Infraturma — Zonati Pot. & Kr., 1954
***Potonieitriradites* Bharad. & Sinha (1969a)**

Genotype — Potonieitriradites barakarensis Bharadwaj & Sinha (1969a)

Potonieitriradites tuberculatus sp. nov.
Pl. 1, Figs. 25, 26

Holotype — Pl. 1, Fig. 25; Slide No. 4108.

Locus typicus — Bore hole No. NCSJ-4, Sample No. 62

Diagnosis — Subtriangular to roundly triangular miospores; size range 56-90 μ; central body distinct, conforming to the overall outline of the miospore; proximal exine finely microgranulose, distally with a large number of warty processes. Zona thin, subequatorially attached to the central body on both the faces, warty processes present over the zona also, equatorial rim distinct; inner body usually present.

Description — Miospores are subtriangular to roundly triangular in shape with bulging inter-radial sides and broad rounded apices; holotype measures 83 μ. Central body is distinct, subtriangular to subcircular, usually conforming to the overall outline of the miospore, measuring from 36-55 μ; in holotype it measures 45 μ. Proximal exine is finely microgranulose and distal exine is set with a large number of warty processes, sparsely distributed, measuring ± 2-3 μ, sometimes coalescent with each other. Proximally central body bears a trilete mark, rays reaching ± upto outer margin of the zona, usually thick lipped and sinuous, labra are thick and vertex is high. Zona is thin, 10-15 μ wide, finely microgranulose on both the faces, warty processes are present on distal side, margin is microdentate to smooth. Zona is subequatorially attached on both the faces over the central body, thickened at the inner margin, forming ± 3-6 μ wide, distinct equatorial thickening. Inner body is usually present, circular to subcircular, measuring 34-45 μ, smooth and laevigate.

Comparison — Potonieitriradites tuberculatus sp. nov. differs from *P. barakarensis* Bharadwaj & Sinha (1969a) in having warty processes on the distal face. The specimens referred by Balme & Hennelly (1956, Pl. 6, Figs. 60, 61) as *Cirratriradites splendense* compare closely with the present species in the nature of distal exine ornamentation.

Potonieitriradites subtilis sp. nov.
Pl. 1, Figs. 27, 28

Holotype — Pl. 1, Fig. 27, Slide No. 4110

Locus typicus — Bore hole No. NCSJ-4, Sample No. 62

Diagnosis — Subtriangular miospores; size range 65-102 μ; central body thin, distinct; finely microgranulose on both the faces; proximally bearing trilete mark, Y-rays thick lipped, reaching upto the outer margin of the zona, straight to sinuous. Zona thin, flimsy, subequatorially attached on both the faces, thickened at the inner margin, forming an equatorial rim around the central body; inner body mostly present.

Description — Miospores are subtriangular, sometimes subcircular in shape with bulging sides and rounded apices; holotype measures 80 μ. Central body is distinct, subtriangular to subcircular, usually conforming to the overall outline of miospore, measuring from 43-75 μ, in holotype it measures 53 μ. Exine is thin, finely microgranulose on both the faces. Trilete mark is distinct, reaching ± upto outer margin of the zona, rays always thick lipped, usually straight or sinuous, labra are thick and vertex is high. Zona is thin, ± 8-15 μ wide, flimsy; microgranulose on both the faces, margin dentate to smooth, subequatorially attached on both the faces, thickened at the inner margin, forming a distinct, ± 3-6 μ wide equatorial thickening. Inner body is usually present, subcircular to circular, thin, laevigate and smooth, measuring 35-45 μ.

Comparison — *Potonieitriradites barakarensis* Bharadwaj & Sinha (1969a) differs from present species in having a thick zona, thick central body with differential ornamentation on the proximal and distal faces. *P. tuberculatus* sp. nov. has tubercles over the distal surface. The specimens described by Tiwari (1965; Pl. 3, Figs. 55, 56) compare with the present species in their general organisation.

Turma — *Monoletes* Ibr., 1933

Subturma — *Azonomonoletes* Lub., 1935

Infraturma — *Laevigatomonoleti* Dyb. & Jach., 1957

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

Genotype — *Latosporites latus* (KOSANKE) Potonié & Kremp, 1954

Species recorded

Latosporites colliensis (BALME & HENN.) Bharad., 1962, Pl. 2, Fig. 29

Anteturma — *Pollenites* Pot., 1931
Turma — *Saccites* Erdt., 1947
Subturma — *Monosaccites* (Chit.) Pot. & Kr., 1954
Infraturma — *Monosaccireticuloidi* Tiw., 1965

Genus — *Barakarites* Bharad. & Tiw., 1964

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

Barakarites sp. cf. *B. indicus* Bharad. & Tiw., 1964

Pl. 2, Fig. 30

Description — Pollen grains are subtriangular to subcircular in shape and measure 70-103 μ. Central body is distinct, conforms with the overall shape of pollen grain, measuring 60-80 μ. Proximally it bears 5-10 μ wide, distinct and raised polygonal areas delimited by narrow grooves. The polygonal meshes are restricted to a central portion conforming to the overall shape of the central body. Distally polygonal areas are ill defined, with larger meshes. Exine is intramicropunctate. Trilete mark is distinct, rays reaching upto 1/2 radius of the central body. Saccus is proximally equatorially and distally subequatorially attached, saccus exine is thick and intramicroreticulate.

Remarks — The present specimens compare closely in general with *Barakarites indicus* but differ in being smaller in size and in having a thicker saccus exine. However, the number of specimens being only two, it is not possible to asses the taxonomic value of these differences so as to distinguish them from *B. indicus*.

Barakarites sp.

Pl. 2, Fig. 31

Description — Pollen grain is subcircular in shape and measures 126 μ in size. Central body outline is ill defined, but apparently confroms to the overall shape of the pollen grain. Body exine is intramicroreticulate. Proximally it bear 4-6 μ wide, polygonal to irregularly shaped areas which are bound by narrow grooves forming a negative reticulum. The polygonal areas are more prominent in the central portion. Distally body exine is intramicroreticulate. Trilite mark is distinct and open, labra are thick

and vertex is high, rays reaching upto 1/2 the radius of the central body. Saccus exine is ±6 μ thick, finely intrapunctate.

Remarks — The most characteristic feature of *Barakarites* sp. is its very thick saccus exine at the equator. In this feature alone it differs from *B. indicus* Bharad. & Tiw., 1964 and *B.* sp. cf. *B. indicus*. In this respect it compares rather closely with *B. rotatus* (BALME & HENN.) Bharad. & Tiw., 1964.

Infraturma — *Parasacciti* Maheshw., 1967

Genus — *Parasaccites* Bharad. & Tiw., 1964

Genotype — *Parasaccites korbaensis* Bharadwaj & Tiwari, 1964

Parasaccites diffusus Tiw., 1965
Pl. 2, Fig. 32

Remarks — Present specimens closely compare with the original diagnosis, but for their slightly smaller size range.

Parasaccites bilateralis Tiw., 1965
Pl. 2, Fig. 33

Remarks — Specimen is smaller in size than the earlier reported specimens.

Parasaccites singrauliensis sp. nov.
Pl. 2, Figs. 34, 35

Holotype —Pl. 2, Fig. 34; Slide No. 4116
Locus typicus — Bore hole No. NCSJ-4, Sample No. 114

Diagnosis — Circular to subcircular pollen grains, 65×60 μ-110×95 μ in size. Central body outline distinct, conforms with overall outline of pollen grain; exine thin, finely microreticulate and without wrinkles. Trilete mark obscure to distinct. Saccus narrow, subequatorially attached both proximally as well as distally.

Description — Pollen grains are circular to subcircular in overall shape. Holotype measures 78×83 μ. Central body is distinct, circular to subcricular, 50×45 μ-85×75 μ in size, in holotype it measures 85×75 μ. Exine is thin, finely microreticulate and without wrinkles. Trilete mark is mostly obscure and is rarely seen. Saccus is thicker in comparison to central body, narrow, 12-20 μ wide and is subequatorially attached on both the faces, sometimes it is slightly displaced on one side.

Comparison — *Parasaccites obscurus* Tiw., 1965 and *P. diffusus* Tiw., 1965 have distinct central body. *P. distinctus* Tiw., 1965 although possesses a distinct central body has wrinkled body exine. *P. korbaensis* Bharad. & Tiw., 1964 though closely compares with the present species, has a bigger size range.

Parasaccites irregularis sp. nov.
Pl. 2, Figs. 36, 37

Holotype — Pl. 2, Fig. 37; Slide No. 4119
Locus typicus — Bore hole No. NCSJ-4, Sample No. 115.

Diagnosis — Subcircular, 75×48 μ-128×117 μ in size. Central body outline distinct; exine thick, mediumly intrareticulate, muri ± radially arranged; zones of saccus attachment bilateral on both the faces, leaving an irregular, narrow to wide saccus free area.

Description — Pollen grains are subcircular in overall shape. Holotype 90×75 μ in size. Central body is distinct, subcircular, thick, 58×60 μ-110×100 μ in size, mediumly microreticulate. Trilete mark is obscure. Saccus is narrow, uniformly broad around the central body, coarsely intrareticulate, muri ± radially arranged. Zones of saccus attachment are bilateral in the same direction on both the sides, leaving an irregular, narrow to wide saccus free area over the central body.

Comparison — Present species differs in its mode of saccus attachment from all the described species of the genus *Parasaccites*, where the saccus free area are ± circular. The characteristic mode of saccus attachment seen in *P. irregularis* sp. nov, appears to have arisen due to additional encroachment of the saccus on two opposite sides.

Genus — *Parastriopollenites* Maheshw., 1967

Genotype — *Parastriopollenites rajmahalensis* Maheshwari, 1967

Parastriopollenites gondwanensis Maheshw., 1967
Pl. 2, Fig. 38

Remarks — The specimens assigned to this species from the present assemblage closely compare with the holotype of *P. gondwanensis* Maheshw., 1967 in most of the cha racters.

Parastriopollenites limbatus Maheshw., 1967

Pl. 3, Fig. 39

Remarks — In the present specimens a very interesting feature has been observed, that is the presence of proximal subtriangular shield. After re-examining the holotype (MAHESHWARI, Pl. 2, Fig. 22) it was found that this shield is also present in the holotype.

Parastriopollenites irregularis sp. nov.

Pl. 3, Figs. 40, 41

Holotye — Pl. 3, Fig. 40; Slide No. 4121.
Locus typicus — Bore hole No. NCSJ-4, sample No. 125.

Diagnosis — Overall shape subcircular to circular; size range 115-170 μ. Central body outline distinct, conform to overall outline of pollen grain; exine thin, irregular big meshes present on both faces. Trilete usually indistinct. Saccus thin, finely intramicroreticulate; subequatorially attached both proximally and distally.

Description — Pollen grains are subcircular to circular in overall shape. Holotype measures 130 μ. Central body outline is subcircular to circular, distinct and measures 98-130 μ. Central body exine is thin, finely microreticulate, irregular and big meshes are present on both the faces. Trilete mark is usually not visible. Saccus is thin, narrow, 15-24 μ broad, finely intramicroreticulate, and subequatorially attached on both the faces.

Comparison — *Parastriopollenites rajmahalensis* Maheshw., 1967 although closely compares with the present species, differs in having a distinct trilete mark and small well defined polygonal areas on the central body. *P. gondwanensis* Maheshw., 1967 also differs in having a distinct fold around the central body.

Infraturma — *Amphisacciti* Lele, 1964

Genus — *Tuberisaccites* Lele & Karim, (1969)

Genotype — *Tuberisaccites varius* Lele & Karim, 1969

Tuberisaccites jhingurdahiensis sp. nov.

Pl. 3, Figs. 42, 43

Holotye — Pl. 3, Fig. 42; Slide No. 4121. sample No. 122.

Diagnosis — Subcircular pollen grains; size range ± 86-90 μ; central body distinct, conforms to overall shape of miospore; proximally as well as distally bears big, circular, tuber-like processes, nine to many on each face; saccus narrow, equatorially attached on one face and subequatorially on the other.

Description — Pollen grains are circular to subcircular in shape. Holotype measures 96 μ. Central body is distinct, conforms with overall shape of miospore and 60-79 μ in size. Nine to many large tuber like processes are present on both the faces, processes measures 4-12 μ. Exine is coarsely intramicroreticulate. Saccus is narrow, ± 6 μ wide, coarsely intramicroreticulate, saccus attachment is equatorial on one face and subequatorial on the other.

Comparison —*Tuberisaccites jhingurdahiensis* sp. nov. differs from *T. varius* Lele & Karim and *T. lobatus* Lele & Karim in being smaller in size and in having tuber-like processes on both proximal as well as distal faces. The attachment of saccus in the present species is equatorial on one face and subequatorial on the other, unlike the paracondition found by Lele and Karim (MS).

Infraturma — *Divarisacciti* Venkat. & Kar, 1966a

Genus — *Divarisaccus* Venkat. & Kar., 1966a

Genotype — *Divarisaccus lelei* Venkatachala & Kar, 1966a

Divarisaccus strengeri Bose & Kar, 1966

Pl. 3, Fig. 44

Remarks — The specimens described from the present assemblage compare lcosely in all the morphographical characters with the original description of the species.

Infraturma — *Striasacciti* Bharad., 1962

Genus — *Striomonosaccites* Bharad., 1962

Genotype — *Striomonosaccites ovatus* Bharad., 1962

Striomonosaccites sp.

Pl. 3, Fig. 45

1962 — *Striomonosaccites* Bharadwaj, Pl. 7, Figs. 110-111

Description — Pollen grain is subcircular and 110×80 μ in size. Central body is dis-

tinct, subcircular, 77×64 μ in size and thick walled. Exine is fine microreticulate and proximally bears 8 horizontal striations (2 of them branched). Saccus is equatorially attached on the proximal face while distally it is subequatorially attached, leaving a circular saccus free area. Saccus is thick and is finely intramicroreticulate.

Remarks — This specimen differs from *S. ovatus* Bharadwaj, 1962 thick walled central body. *S. circularis* Bharad. & Sal., 1964 has a bigger size range and faint body striations. The specimens described by Bharadwaj (1962; Pl. 7, Figs. 110-111) closely compare with the present specimen.

Subturma — *Disaccites* Cooks, 1964
Infraturma — *Striareticuloiditi* Tiw., 1964

Genus — *Korbapollenites* Tiw., 1964

Genotype — *Korbapollenites novus* Tiwari, 1964

Korbapollenites sp.
Pl. 4, Fig. 46

Description — Pollen grain is bilaterally oval and 127×103 μ in size. Central body is distinct, horizontally oval, 85×62 μ in size, on the proximal face ± 3 μ wide polygonal areas are present and an ill defined, narrow, ±2μ wide rim is seen around the central body margin. Distal exine is structured. Saccus is continuous on lateral sides, giving a monosaccoid appearance to the pollen grain. Sacci are distally inclined forming a biconcave, ±25 μ wide sulcus. Saccus exine is mediumly intrareticulate.

Remarks — *Korbapollenites novus* Tiw., 1964 differs from *Korbapollenites* sp. in being subcircular in shape, with a circular central body having a distinct marginal rim.

Genus — *Primuspollenites* Tiw., 1964

Genotype — *Primuspollenites levis* Tiwari, 1964

Primuspollenites singrauliensis sp. nov.
Pl. 4, Figs. 47, 48

Holotype – Pl. 4, Fig. 47; Slide No. 4126
Locus typicus — Bore hole No. NCSJ-4, sample No. 125.

Diagnosis — Bilateral pollen grains. Size range 68×60 μ-105×60 μ. Central body distinct, subcircular to oval, proximally bearing distinct reticuloid striations (2-5 μ) and a distinct rim around equator. Distal sulcus well defined, edges straight or oblique. Sacci mediumly intrareticulate.

Description — Pollen grains are bilateral; holotype measures 68×56 μ. Central body is distinct with a well defined outline, subcircular to oval in shape, measuring 27×28 μ-35×45 μ. Proximally it bears distinct reticuloid striations forming 2-5 μ wide, ± polygonal areas. Exine is micropunctate. A distinct 2-5 μ wide rim is always present around the central body on the proximal surface. Sacci are distally inclined forming a distinct, narrow to wide (2-10 μ) sulcus. Usually the zone of saccus attachment is accompanied by a narrow thickening, giving quite varied shapes to sulcus. Sacci exine is medium intrareticulate, sometimes double intrareticulation is also observed.

Comparison — *Primuspollenites singrauliensis* sp. nov. differs from all the species of the genus *Primuspollenites* Tiw. in having a distinct, proximal rim around the central body, a character not recorded in any of the species described earlier.

Primuspollenites distinctus sp. nov.
Pl. 4, Figs. 49, 50

Holotype — Pl. 4, Fig. 49; Slide No. 4127
Locus typicus — Bore hole No. NCSJ-4, Sample No. 125

Diagnosis — Bilateral pollen grains, 69×58μ-125×80 μ in size. Central body thick, circular. Reticuloid striations distinct, proximal rim absent. Sacci distally inclined, forming a narrow to wide sulcus, sometime zones of saccus attachment accompained with narrow thickenings. Sacci medium intrareticulate.

Description — Pollen grains are bilateral in overall shape, notched on both the lateral sides. Holotype size is 95×66 μ. Central body is thick, ± circular in overall shape, 26×30 μ-28×38 μ in size, 34 μ in the holotype. Reticuloid striations are distinct, binding nearly polygonal areas, 2-5 μ in size. Proximal rim is absent. Sacci are proximally equatorially attached, distally inclined forming a straight to irregular, distinct, 5-13 μ wide sulcus. Sometimes the zone of saccus attachment is accompanied by narrow thickenings giving varied appearance to the sulcus. Sacci are medium intrareticulate. In some specimens double

intrareticulation is also found in the saccus exine.

Comparison —*Primuspollenites levis*, the genotype, and *P. densus* Tiw., 1965 have vertically oval central body and the sulcus is biconvex. *P. linterus* Tiw., 1965 and *P. dicavus* Tiw., 1965 have boat shaped and dumb-bell shaped sulcus along with the subtriangular and vertically oval central body respectively. *P. singrauliensis* differs from the present species in having a distinct, marginal rim around the central body.

P. distinctus sp. nov. is characterized by the presence of a distinct circular central body.

Primuspollenites brevicorpus sp. nov.
Pl. 4, Figs. 51, 52

Holotype —Pl. 4, Fig. 51; Slide No. 4128
Locus typicus—Bore hole No. NCSJ-4, Sample No. 102

Diagnosis — Bilateral pollen grains, 85×46 μ-108×52 μ in size; central body dense, vertically oval, thick walled; proximally distinct polygonal areas present; distally sacci inclined forming a narrow sulcus with distinctly thickened lateral zones. Sacci usually laterally continuous.

Description — Pollen grains are bilateral in overall shape. Holotype measures 90×72 μ. Central body is distinct, vertically oval, dense, dark coloured and thick walled. It is 24×35 μ-28×34 μ in size; 24×35 μ in holotype. Reticuloid striations are distinct, forming ± 2 μ wide polygonal areas. Proximal saccus attachment is diffused, distal attachment being well defined, forming a straight to irregular, narrow, 1-3 μ wide sulcus. Zone of saccus attachment is accompanied by narrow thickening. Sacci are usually laterally continuous, and are medium intrareticulate, sometimes finer muri within the meshes are also found.

Comparison — Present species compares favourably with *P. densus* Tiw, 1965 in having a dense central body, but the size range and the body sacci ratio is smaller in the former. *P. levis* Tiw., 1964 has a bigger size range and thin central body with ± biconvex sulcus. *P. linterus* Tiw., 1965 has a characteristic boat-shaped sulcus with almost subtriangular central body, while *P. dicavus* Tiw., 1965 is characterized by dumb-bell shaped sulcus, along with comparatively larger, vertically oval, central body, thus differing from the present species.

P. brevicorpus sp. nov. is characterized by having a small, dense, vertically oval central body with a narrow and straight sulcus.

Primuspollenites ovatus sp. nov.
Pl. 4, Figs. 53, 54

Holotype — Pl. 4, Fig. 53; Slide No. 4129
Locus typicus - Bore hole No. NCSJ-4, Sample No. 84.

Diagnosis — Bilateral pollen grains; 66×48 μ-115×80 μ in size. Central body vertically oval with one or both ends acute; proximally bearing ± 1·5 μ, indistinct, reticuloid striations; sacci distally inclined forming a distinct, narrow, sometimes wide sulcus; zone of saccus attachment being usually thickened.

Description — Pollen grains are bilateral in overall shape. Holotype measures 92×55 μ. Central body is distinct, vertically oval, usually having lateral acute ends. It ranges from 26×36 μ-45×65 μ in size and is 34×42 μ in holotype. Proximal reticuloid striations are always ill-defined never forming distinct polygonal areas which are apparently ± 1·5-2 μ in size. Indistinct, irregular marginal rim is sometimes present around central body. Sacci are diploxylonoid, distally inclined forming, a narrow to wide, 1-10 μ broad sulcus. The zone of saccus attachment is often thickened but sometimes thickening absent.

Comparison — *Primuspollenites ovatus* sp. nov. has a smaller size range as compared to all the species described by Tiwari (1965). Moreover, the present species can be further distinguished from other species of *Primuspollenites* by its ill defined reticuloid striations.

Primuspollenites sp.
Pl. 4, Fig. 55

Description — Pollen grain is small, bilateral, 40×22 μ in size. Central body is thick, circular 20 μ in size. Small reticuloid striations are present over the proximal face, forming 1-3 μ broad polygonal areas. Central body exine is structured. Sacci are diploxylonoid, finely intrareticulate and distally inclined forming a distinct, ± 3 μ wide sulcus.

Comparison — The very small size of *Primuspollenites* sp. makes it different from all the other described species of the genus .

Genus — *Rhizomaspora* Wils., 1962

Genotype — *Rhizomaspora radiata* Wilson, 1962

Rhizomaspora singula Tiw., 1965
Pl. 4, Fig. 56

Remarks — The holotype of *R. singula* Tiw., 1965 appears to possess a central body with very big, distinct, radiating reticuloid striations which in case of my specimens are smaller and do not show a radial arrangement. However, in other morphographic characters my specimens compare very closely with the original description of Tiwari (1965). The arrangement of reticuloid striations has not been considered as an important character hence the specimens from the present assemblage have been included in *R. singula.*

Rhizomaspora sp. cf. *R. fimbriata* Tiw., 1965
Pl. 4, Fig. 57

Description — Pollen grain is bilateral, 125×70 μ in size. Central body is thick, circular, 57×55 μ in size and proximally bears 5 horizontal striations, which in the middle form 18 polygonal areas; exine is structured. 1 thick, 5 μ wide, frilled rim is present around the central body. Sacci is medium and imperfect intrareticulation, diploxylonoid and zone of saccus attachment are diffused but wide.

Remarks — *R. fimbriata* Tiw., 1965 differs from presently described specimen in having ill defined, smaller, polygonal area. However, in other morphographic characters it compares closely with the holotype.

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

Genus — *Platysaccus* (Naum.) Pot. & Kl., 1954

Genotype — *Platysaccus papilionis* Potonié & Klaus, 1954

Platysaccus sp. A
Pl. 4, Fig. 58

Description — Pollen grains are bilaterally oval. Size ranges from 92×67 μ-123×85 μ. Central body is distinct, ± circular, measuring ± 34-47 μ. Exine is mostly laevigate. Sacci are diploxylonoid, broadly connected on lateral sides. Proximally the saccus is equatorially attached, but distally it is inclined forming a narrow and straight sulcus. Saccus intrareticulation is medium sized.

Remarks — *Platysaccus papilionis* Pot. & Kl. possesses a dense central body without any lateral continuations of the sacci. *P. leschiki* Hart, 1960 has a vertically oval central body and a narrow distal sulcus. *P. ovatus* Maithy, 1965 also possesses a dense vertically oval central body. Only few specimens have been found in the present assemblage, hence, described here as *Platysaccus* sp. A.

Platysaccus sp. B
Pl. 4, Fig. 59

Description — Pollen grains are bilaterally oval. Size range from 76×52 μ-100×62 μ. Central body is distinct, ± subcircular, measuring 40-45 μ. Exine is thick and microverrucose. Sacci are diploxylonoid, lateral continuations are narrow or absent; distally the sacci are inclined forming an ill defined broadly biconvex sulcus. Sacci intrareticulation is medium.

Remarks — *Platysaccus* sp. A differ from *P.* sp. B in having a circular central body with broad lateral continuations of the sacci and a narrow, straight sulcus. The present species is also very meagre in occurrence.

Genus — *Cuneatisporites* Lesch., 1955

Genotype — *Cuneatisporites radialis* Leschik, 1955

Cuneatisporites sp.
Pl. 5, Fig. 60

Description — Pollen grains are bilaterally oval in overall shape. Size ranges from 80×52 μ-135×87 μ. Central body is distinct, vertically oval to rhomboid, measuring 40×50 μ-60×87 μ. Exine is thick, fine microreticulate. Sacci are diploxylonoid, distally inclined forming a distinct, ± straight, 6-8 μ wide sulcus. Sacci are medium intrareticulate.

Remarks — *Cuneatisporites exiguus* Salujha, 1965 has got vertically oval central body with a thin marginal rim. *C.* sp. A of

Tiwari (1965) possesses vertically oval central body with acute lateral ends and a narrow sulcus with narrow thickening along the zone of distal saccus attachment. *C.* sp. B of Tiwari (1965), although possesses ± rhomboidal central body, differs in having distal zone of saccus attachment associated with vertical semilunar folds.

Infraturma — *Striatiti* Pant, 1954

Genus — *Lueckisporites* Pot. & Kl., 1963

Genotype — *Lueckisporites virkkii* Pot. & Kl., 1954

Remarks — While examining a number of pollen grains from the present assemblage, it was found that distally the central body is very thin and laevigate but proximally it bears two ± reniform, thick, taeniae, in which the intrareticulation is of the same nature as in the sacci. The thinner wall of the central body is often lost during the course of maceration. Thus, the taeniae which are attached only to central body and not to the sacci assume different shapes as soon as central body is lost.

Genus *Corisaccites* Venkat. & Kar, 1966 represents presumably such specimens of *Lueckisporites* in which the thinner wall of the central body is lost and what Venkatachala and Kar (1966b) describe as a central body (divided into two parts) actually represents the two proximal taeniae.

Lueckisporites singrauliensis sp. nov.
Pl. 5, Figs. 61, 62

Holotype — Pl. 5, Fig. 61; Slide No. 4134

Locus typicus — Bore hole No. NCSJ-4, Sample No. 112.

Diagnosis — Bilateral pollen grains. Size range from 69×65 μ-90×90 μ. Central body small, exine thin, laevigate, proximally bearing two reniform taeniae. Sacci diploxylonoid, proximally equatorially attached, distally inclined forming a straight and narrow sulcus. Sacci as well as taeniae finely intrareticulate.

Description — Pollen grains are bilateral, disaccate with notched lateral sides. Holotype measures 87×60 μ. Central body is distinct, very thin, small circular to subcircular in overall shape, 36×40 μ-52×52 μ in size; in holotype it measures 44×39 μ. Exine is thin, laevigate, two almost equal taeniae are present over the proximal face. Size of both the taeniae is equal to that of the central body. Sacci are diploxylonoid, subspherical; proximally equatorially attached but distally inclined forming a distinct, narrow and mostly straight sulcus. Sacci and taeniae are finely intrareticulate.

Comparison — *Lueckisporites virkkii* (Pot. & Kl.) Leschik, 1954 has got a wider, ill defined sulcus, bigger central body and smaller body-sacci ratio. *L. microgranulatus* Klaus, 1963 possesses reniform taeniae, leaving a horizontally biconvex space over the central body and a wide sulcus. *L. globosus* Klaus, 1963 has vertically oval central body with smaller taeniae so as to have lateral empty spaces over central body. *L. parvus* Klaus, 1963 is smaller in size, sacci and taeniae appears to be of the same size. *L. junior* Klaus, 1963 is distinctively monosaccoid and distal sulcus appears to be ill defined.

Lueckisporites crassus sp. nov.
Pl. 5, Figs. 63, 64

1965 — *Lueckisporites* sp., Tiwari, Pl. 13, Fig. 119.

Holotype —Pl. 5, Fig. 63; Slide No. 4136

Diagnosis — Subcircular to bilateral pollen grains. Size ranging from 48×42 μ-88×70 μ. Central body thin, laevigate; proximally bearing two ± equal taeniae, coarse intrareticulate and leathery; sacci ± diploxylonoid; distal sulcus straight, wide to narrow; sacci coarse intrareticulate, intrareticulation of the same nature as of proximal taeniae; meshes and muri indistinct.

Description — Circular to bilateral pollen grains, mostly being subcircular with two opposite notches. Holotype measures 66×50 μ in size. Central body is thin, laevigate, circular to subcircular in overall shape, 38×40 μ-70×68 μ in size, in holotype it measures 40×50 μ. The body bears two reniform, ± equal taeniae over the proximal face. Usually both the taeniae are 2-7 μ apart from each other. ± 3 μ thick zone in usually present around the outer margin of each taeniae. The exine taeniae is thick and coarse intrareticulate. Sacci are usually slightly taller than the central body. Proximally the sacci are equatorially attached but distally nearer to the pole. The zone of saccus attachment is well defined on both the faces. Sulcus is distinct, ± straight, 5-20 μ wide. Sacci are coarse intrareticulate, usually the intrareticulation is of the same nature as in the taeniae; muri

and meshes are ill defined forming irregular coarse reticulation.

Comparison — *Lueckisporites crassus* sp. nov, compares favourably with *L. parvus* Klaus, 1963 in its overall shape, but the latter species has smaller size range and the size of taeniae and sacci is ± same. Other species of *Lueckisporites* differ from present species in having distinctly bilateral symmetry and thicker central body.

Lueckisporites sp.

Pl. 5, Fig. 65

Description — Pollen grain is bilateral, notched on both the lateral sides; 100×70 μ in size. Exine is thin and laevigate. Proximally central body bears two, ± equal taeniae; each taeniae is frilled at its lateral end. Sacci are distinctly diploxylonoid, more than a hemisphere; proximal attachment is equatorial but distally inclined forming a 5-28 μ wide, biconvex sulcus. Sacci exine is mediumly thick; fine intrareticulate with distinct muri and meshes.

Remarks — This specimen differs from all the known species of the genus *Lueckisporites* in having a bigger body — sacci ratio and a distinct biconvex sulcus.

Genus — *Taeniaesporites* (Lesch.) Klaus, 1963

Genotype — *Taeniaesporites krauseli* Leschik, 1955

Taeniaesporites sp.

Pl. 5, Fig. 66

Description — Pollen grains are bilaterally oval, 98×57 μ-130×60 μ in size. Central body is distinct, horizontally oval, measuring 66×50 μ-90×45 μ. Proximal face bears 4 horizontally extended exoexinal bands. Each band has mediumly intramicroreticulate exine. Sacci are usually haploxylonoid and proximally equatorially attached but distally inclined forming a distinct, ± straight, 20-22 μ wide sulcus. Sacci intrareticulation is of medium size.

Remarks — *Taeniaesporites* sp. compares favourably with *T. ortisei* Klaus, 1963 in its horizontally oval central body, number of taeniae and a straight and wide sulcus. The number of such specimens recovered from present assemblage was less, hence they are described here as *Taeniaesporites* sp.

Genus — *Schizopollis* Venkat. & Kar, 1964

Genotype — *Schizopollis woodehousei* Venkatachala & Kar, 1964

Remarks — The exine of central body is intrapunctate in the presently studied specimens. A re-examination of the type material and genotype also reveals that the central body exine is micropunctate and not granulose sculptured as described by Venkatachala and Kar (1964).

Schizopollis extremus Venkat. & Kar, 1964

Pl. 5, Fig. 67

Remarks — The specimens compare very closely with the original description of the species except for the size, which is bigger in the presently studied specimens.

Schizopollis distinctus sp. nov.

Pl. 5, Figs. 68-70

Holotype — Pl. 5, Figs. 68, 69; Slide No. 4138

Locus typicus — Bore hole No. NCSJ-4, Sample No. 61+62

Diagnosis — Bilaterally oval pollen grains; known size 65×70 μ to 105×70 μ. Central body outline distinct, proximally bearing horizontal striations (a few branched), striations not reaching the body margin and ends joining those of the adjacent-ones forming a ring like pattern; exine micropunctate, puncta restricted in arrangement. Sacci haploxylonoid, proximally equatorially attached; distally inclined and forming a distinct sulcus. The saccus base along the zone of saccus attachment convoluted due to variation in the extent of blowing up, giving varied appearances to pollen grains.

Description — Disaccoid pollen grains with horizontally or vertically oval overall shape. Holotype measures 84×64 μ. Central body outline is distinct, usually horizontally oval, sometimes vertically oval; measuring 46×65 μ-80×82 μ in overall size; in holotype it is 66×68 μ. Proximal horizontal striations are distinct, 8-11 in number (a few are branched) and do not reach upto the body margin, usually converge to form a ring like pattern. Exine between striations is intramicropunctate, puncta restricted in arrangement. Sacci are usually haploxylonoid, occasionally

diploxylonoid. Proximal attachment of sacci is equatorial, but distally inclined forming upto 15 μ wide, distinct but irregular sulcus. Sacci convoluted at and near the zone of saccus attachment giving varied appearance to pollen grains. Sacci exine is thick and coarse intramicropunctate.

Comparison — Schizopollis woodehousei Venkat & Kar, 1964 and *Schizopollis disaccoides* Venkat. & Kar, 1964 are characterized by a distinct central body with proximal reticuloid strations and an ill dfined sulcus and hence, differ from the present species. *S. extremus* Venkat. & Kar, 1964 although possesses distinct horizontal strations is monosaccoid in appearance. All the more, the present species is distinguished by its distinct disaccoid shape, converging horizontal striations with restrictedly arranged puncta and coarse intrapunctate sacci.

Schizopollis jhingurdahiensis sp. nov.
Pl. 5, Figs. 71, 72

Holotype — Pl. 5, Fig. 71; Slide No. 4140

Locus typicus — Bore hole No. NCSJ-4, Sample No. 121.

Diagnosis — Bilateral pollen grains; 60×41 μ-105×75 μ in size. central body thick, subcircular, proximally bearing horizontal striations, which in the centre give rise to distinct, ± polygonal areas; exine micropunctate. Sacci usually diploxylonoid, leathery, thick, finely intrapunctate; sacci slightly convoluted at the well defined distal zone of the saccus attachment.

Description — Pollen grains are bilateral. Holotype measures 105×75 μ. Central body is distinct, thick walled, circular to subcircular in shape, 41×45 μ-60×55 μ, in the holotype it measures 60×55 μ. Proximally it bears horizontal striations, which in the centre form ± polygonal areas. Exine is micropunctate on both the faces; usually puncta are restrictedly arranged. Rim around the central body is absent. Sacci are usually diploxylonoid, thicker than the central body, leathery, finely intrapunctate, *extrema lineamenta* (outer margin of sacci) is smooth; zone of saccus attachment is irregular, usually forming a distinct, broad to narrow sulcus; sacci are slightly convoluted at or near the place of saccus attachment on the distal face.

Comparison — Schizopollis jhingurdahiensis sp. nov. differs from *S. extremus* in being typically disaccoid in nature. *S. woodehousei* and *S. disaccoides* are though ± dissacoid in appearance, have saccus convolutions more pronounced and the reticuloid striations are ill defined. *S. distinctus* sp. nov. possesses distinctly circumscribed horizontal striations and ± diploxylonoid sacci with more pronounced convoluted sacci along the zone of saccus attachment. The present species is characterized by strations forming reticuloid pattern in the centre of the body and comparatively less convoluted sacci along or near the zone of saccus attachment.

Schizopollis sp.
Pl. 5, Fig. 73

Description — Pollen grain is bilateral, disaccoid; 78×60 μ in size. Central body is distinct, horizontally oval, 64×54 μ in size. Proximal striations are distinct, 11 in number; horizontal striations are connected by many vertical partitions, forming a ± reticuloid pattern, exine is intramicropunctate. Sacci are diploxylonoid and proximally ± equatorially attached. Distally sacci are inclined forming a distinct, ± 15 μ wide sulcus. Sacci base is convoluted forming many lobed sacci.

Remarks — The specimen differs from all the known species of the genus *Schizopollis* in having distinct horizontal striations with many vertical interconnections. Similarly organized pollen grains have also been noted in the type material of the genus from North Karanpura Coalfield.

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

Genotype — Striatites sewardii (Virkki) Pant, 1955

Striatites parvus Tiw., 1965
Pl. 5, Fig. 74

Remarks — Specimens compare with the holotype in all the morphographical characters.

Striatites tentulus Tiw., 1965
Pl. 5, Fig. 75

Remarks — Some of the specimens are smaller in size as compared to the original diagnosis. However, in other morphographic characters the present specimens compare closely with the holotype.

Striatites reticuloidus Tiw., 1965
Pl. 5, Fig. 76

Remarks — The reticuloid striations are better developed in the present specimens than in the type material of Tiwari (1965).

Striatites barakarensis sp. nov.
Pl. 6, Figs. 77, 78

Holotype — Pl. 6, Fig. 77; Slide No. 4144
Locus typicus — Bore hole No. NCSJ-H, Sample No. 72.
Diagnosis — Bilateral pollen grains. Size range 60×40 μ-112×75 μ. Central body ± rhomboid with a distinct marginal rim. Horizontal striations 7-11, without any vertical partitions; exine microverrucose. Sacci diploxylonoid, distally inclined, forming a ± straight and narrow sulcus.
Description — Pollen grains are bilaterally oval in overall shape. Holotype measures 93×55 μ. Central body is distinct, ± rhomboid in shape, measures 30×34 μ-50×55 μ. A distinct, ± 1·5-3 μ wide marginal rim is present around the central body. Proximal horizontal striations are distinct, 7-11 in number, usually unbranched. Vertical partitions in between the horizontal striations are absent. Exine is microverrucose. Sacci are diploxylonoid, proximally equatorially attached, but distally coming near to each other forming a ± straight and narrow (1-6 μ) sulcus. Sacci intrareticulation is medium.
Comparison — Among the species described by Bharadwaj and Salujha (1964), *S. notus*, *S. rhombicus*, *S. subtillis* and *S. obtusus* are characterized by the presence of vertical partitions in between the horizontal striations. *S. solitus* and *S. communis* have ± subcircular central body without a distinct marginal rim around the central body. *S. parvus* Tiw., 1965 and *S. tentulus* Tiw., 1965 are smaller in size. *S. fractus* has got many vertical partitions in between the horizontal striations. *S. karharbarensis* Maithy, 1965 has also not vertical connections in between horizontal striations. *S. densus* Maithy, 1965 is characterized by the presence of a denser central body without a marginal rim and hence differs from the present species.
S. barakarensis sp. nov. is characterized by the presence of a ± rhomboid central body and horizontal striations without vertical partitions.

Genus — *Verticipollenites* Bharad., 1962

Genotype — *Verticipollenites secretus* Bharadwaj, 1962

Verticipollenites sp. cf. *V. gibbosus* Bharad., 1962
P. 6, Fig. 79

Description — Pollen grains are bilaterally oval in overall shape. Size ranges from 60×37-174×50 μ. Central body is distinct, ± circular to rhomboidal measuring 22×24-30 μ with equatorial rim around the body. Proximal striations are distinct, 5-8 in number, unbranched and without vertical partitions. Exine is microverrucose. Sacci are diploxylonoid, pitcher-shaped with a narrow neck. Proximally equatorially attached to central body, but distally inclined forming a narrow and straight sulcus, zones of saccus attachment not full length to central body. Sacci are fine intrareticulate.

Genus — *Lahirites* Bharad., 1962

Genotype — *Lahirites raniganjensis* Bharadaj, 1962

Lahirites rarus Bharad. & Sal., 1964
Pl. 6, Fig. 80

Remarks — The specimens compare favourably with those of Bharadwaj and Salujha (1964), except that a few specimens are slightly larger in size.

Lahirites rotundus Bharad. & Sal., 1964
Pl. 6, Fig. 81

Remarks — Present specimen resembles with the holotype, in most of the morphographic characters.

Lahirites reticuloidus sp. nov.
Pl. 6, Figs. 82, 83

Holotype — Pl. 6, Fig. 82; Slide No. 4147
Locus typicus — Bore hole No. NCSJ-3, Sample No. 106.
Diagnosis — Bilateral pollen grains. Size ranging from 60×55 μ-88×55 μ. Central body distinct, thick walled, ± subcircular, measures 45×45 μ-55×48 μ; proximal striations distinct, 5-8 in number, vertical partitions many, exine uniformly micropunctate. Sacci diploxylonoid, distal attach-

ment inclined, zone of saccus attachment ill defined and narrow. Sacci finely intramicropunctate to intrareticulate.

Description — Pollen grains are bilaterally oval in overall shape. Holotype measures 80×73 μ. Central body is distinct, slightly dense, big, ± subcircular, 50×45 in holotype. Proximal horizontal striations are distinct, 5-8 in number, usually a few are branched, vertical partitions many, more pronounced in the middle, forming ± reticuloid pattern. Exine is uniformly micropunctate. Sacci are diploxylonoid, ± hemispherical, distally sacci coming closer to each other forming a narrow ill defined sulcus. Sacci are fine intrapunctate to intrareticulate.

Comparison — *Lahirities raniganjensis*, the genotype, differs from the present species in having a comparatively small central body, less vertical partitions and a distinctly broad sulcus. Among the species described by Bharadwaj and Salujha (1964), *L. singularis*, *L. parvus*, and *L. incertus* differ from *L. reticuloidus* sp. nov., in having a distinct, broad marginal equatorial rim around the central body, apart from the other differences. *L. rarus* lacks vertical partitions in between the horizontal striations and *L. rotundus* has lesser number of vertical partitions and the equatorial rim is defined on two lateral ends. *L. bokaroensis* Tiw., 1965 has a bigger central body and horizontal striations are without vertical partitions. *L. fractus* Tiw., 1965 has a smaller central body with many vertical partitions and a distinct marginal rim. *L. rhombicus* Maithy, 1965 possesses a denser central body and the horizontal striations lack vertical partitions.

Lahirites singrauliensis sp. nov.

Pl. 6, Figs. 84, 85

Holotype — Pl. 6, Fig. 84, Slide No. 4150

Locus typicus — Bore hole No. NCSJ-4, Sample No. 81.

Diagnosis — Bilateral pollen grains. Size range 70×54 μ-132×75 μ; central body ± rhomboid with a distinct marginal rim; 5-11 proximal horizontal striations without any vertical partitions; exine uniformly intrapunctate. Sacci diploxylonoid; distal sulcus wide, straight and distinct; sacci medium intrareticulate.

Description — Pollen grains are bilaterally oval in overall shape. Holotype measures 87×55 μ. Central body is distinct, ± rhomboid to subcircular, measuring 40×47 μ-65×60 μ; marginal rim is well defined. Proximal striations are 6-10 in number, a few striations are branched, vertical partitions are absent. Sacci are diploxylonoid; distal attachment is inclined forming a distinct, straight, usually wide, 2-10 μ sulcus. Sacci intrareticulations are medium.

Comparison — Present species can be compared with *L. singularis* Bharad. & Sal., 1965b as both of them possess a ± rhomboid to subcircular central body with a distinct marginal rim. However, the latter possesses vertical partitions which are absent in the former. Among the others species of Bharadwaj and Salujha (1965b), *L. rarus* has a ± subcircular body without a marginal rim; *L. incertus* and *L. rotundus* have horizontal striations with vertical partitions. *L. parvus* has ± circular central body with a distinct rim and restrictedly arranged puncta. *L. bokaroensis* Tiw., 1965 as well as *L. rhombicus* Maithy, 1965 lacks the marginal rim around the central body. *L. fractus* Tiw., 1965 has horizontal striations with many vertical partitions.

Lahirites barakarensis sp. nov.

Pl. 6, Figs. 86, 87

Holotype — Pl. 6, Fig. 86; Slide No. 4146

Locus typicus — Bore hole No. NCSJ-4, Sample No. 8.

Diagnosis — Bilateral pollen grains; size range 71×54 μ-116×66 μ. Central body rhomboid to subcircular, marginal rim absent; 4-10 horizontal striations, many zig-zag irregular partitions forming a reticuloid pattern in between the horizontal striations; sacci diploxylonoid, distal sulcus ± straight narrow and well defined, sacci exine medium intrareticulate.

Description — Pollen grains are bilaterally oval in overall shape. Holotype measures 105×65 μ. Central body is distinct, ± rhomboid to subcircular, measuring 28×36 μ-58×52 μ. Marginal rim is usually absent. proximal striations are distinct, 4-10 in number, a few are branched. In between the horizontal striations many zig-zag partitions are present forming a reticuloid pattern. Sacci are diploxylonoid, proximal attachment is equatorial, distally inclined forming a ± straight and narrow sulcus. Sacci intrateticulation is medium.

Comparison — Present species can be distinguished from other species of *Lahirites* in having a ± rhomboid to subcircular central body with reticuloid pattern in between the horizontal striations. *Lahirites reticuloidus* differs from *L. barakarensis* sp. nov. in having many vertical partitions in between horizontal striations forming more pronounced reticuloid pattern in the centre of the body which is markedly denser too. *L. fractus* Tiw., 1965 possesses many vertical partitions and a distinct marginal rim. *Lahirites bokaroensis* Tiw., 1965, *L. rarus* Bharad. & Salujha, 1964, *L. parvus* Bharad. & Sal., 1964 and *L. rhombicus* Maithy, 1965 lack partitions in between the horizontal striations. *L. rhombicus*, *L. incertus*, *L. rotundus* are characterized by the presence of few vertical partitions in between the horizontal striations thus differ from the present species.

Lahirites rhombicus Maithy, 1965 var. *junior* var. nov.
Pl. 6, Fig. 88

Holotype — Pl. 6, Fig. 88; Slide No. 4152.
Locus typicus — Bore hole No. NCSJ-4, Sample No. 68.

Diagnosis — Bilateral pollen grains. Size range 73×45 μ-112×78 μ. Central body thin, ± rhomboid, bearing 5-9 horizontal striations without any vertical partition, rim around central body absent. Exine finely micropunctate. Sacci diploxylonoid, distally inclined forming a distinct and wide sulcus, zones of saccus attachment being thickened.

Description — Pollen grains are bilaterally oval in overall shape. Holotype measures 100×65 μ. Central body is distinct. ± rhomboid, measuring 28×35 μ-50×60 μ; marginal rim is absent, in holotype it measures 40×36 μ. Proximal horizontal striations 5-9 in number; a few are rarely branched, vertical partitions are absent. Exine is finely, uniformly micropunctate. Sacci are diploxylonoid, proximally equatorially attached but distal attachment is inclined forming a distinct, 5-15 μ wide sulcus, zone of saccus attachment with narrow linear thickenings. Sacci intrareticulation is medium.

Comparison — Present species can be compared with *Lahirites rhombicus* Maithy, 1965 in its general organization and shape of the body but the latter is bigger in size with a dense central body, thus, differs from the present species. Other species of *Lahirites* differ from the present species either in the presence of vertical partitions in between the horizontal striations or a marginal rim around the central body.

Lahirites sp.
Pl. 6, Fig. 89

Description — Pollen grains are bilateral in overall shape. Size ranging from 75×53 μ-82×54 μ. Central body is ± circular to subcircular with a distinct marginal, ± 2 μ wide rim. Central body size 32×39 μ-36×36 μ. Proximal horizontal striations are 5-8 in number with many zig-zag partitions in between the horizontal striations forming a ± reticuloid pattern. Exine is finely micropunctate. Sacci are diploxylonoid, ± hemispherical, distally inclined and laterally coming nearer to each other. Sulcus is ± straight and narrow, sacci are medium intrareticulate.

Comparison — *Lahirites barakarensis* sp. nov. is the only other species with reticuloid striations in between the horizontal striations. This can be distinguished from *Lahirites* sp. by the presence of a ± circular central body without any marginal rim.

cf. *Lahirites* sp.
Pl. 6, Fig. 90

Description — Pollen grains are ± subcircular in overall shape. Size ranging from 55×50 μ-65×62 μ. Central body is big, ± subcircular. Proximal horizontal striations are 6-9 in number. Vertical partitions are many, more pronounced in the middle. Exine is thin and micropunctate. Sacci are vestigial, proximally equatorially attached to central body, but distally it covers the body; sulcus is ill defined. Sacci appear to be intrapunctate.

Comparison — In the absence of distinct sacci these specimens differ from the genus *Lahirites*. In the absence of sufficient number of specimens a detailed study in the morphographic characters was not possible. Hence, these specimens have been provisionally placed under the genus *Lahirites*.

Genus — *Lunatisporites* (Leschik) Bharad., 1962

Genotype — *Lunatisporites acutus* Leschik, 1955

Lunatisporites barakarensis sp. nov.
Pl. 7, Fig.s 93, 94

Holotype — Pl. 7, Fig. 93; Slide No. 4152
Locus typicus — Bore hole No. NCSJ-4, Sample No. 1.

Diagnosis — Bilateral pollen grains; size range 80×47 μ-167×110 μ. Central body vertically oval with narrow lateral ends. Exine thin, fine microreticulate; proximally bearing 5-8 horizontal striations. Sacci diploxylonoid, distal sulcus biconvex, Sacci intrareticulation medium.

Description — Pollen grains are bilateral in overall shape. Holotype measures 113×75 μ. Central body outline is distinct, vertically oval with narrow lateral ends; 40×40 μ-85×100 μ in size, in holotype it measures 60×55 μ. Exine is thin, fine microreticulate. The proximal horizontal striations are distinct, 5-8 in number, reaching upto the margins of the body. Sacci are diploxylonoid, notched on both the lateral sides, lateral continuations are very narrow. Distal attachment of sacci is full length, accompanied with semilunar folds in the body. Sulcus is biconvex, 8-23 μ wide. Sacci intrareticulation is medium sized.

Comparison — *Lunatisporites fuscus* Bharad., 1962 differs from present species in having a mediumly thick, horizontally oval central body with deeply grooved horizontal striations. Moreover, the sacci are also slightly thicker in the former and laterally join by narrow to wide ledges. *L. notabilis* Tiw., 1965 has a narrow sulcus with the secondary folds running along the zone of saccus attachment forming a dumb-bell shaped area. *L. korbaensis* Tiw., 1965 is distinguished by circular-rhomboid shape of the body, narrow, well defined sulcus and laterally continuous sacci.

Genus — *Striatopodocarpites* (Soritsch. & Sed.) Bharad., 1962

Genotype — *Striatopodocarpites antiquus* (Leschik) Potonié, 1958

Striatopodocarpites magnificus Bharad. & Sal., 1964
Pl. 7, Fig. 95

Remarks — In many specimens the number of horizontal striations is lesser as compared to the specimens of Bharadwaj and Salujha (1964).

Striatopodocarpites labrus Tiw., 1965
Pl. 7, Fig. 96

Remarks — The present specimens compare closely with *S. labrus* in all the morphographical characters.

Striatopodocarpites crassus Tiw., 1965
Pl. 7, Fig. 97

Remarks — These specimens differ from the holotype of *Striatopodocarpites crassus* in having a slightly biconcave sulcus and a bigger size range, but for which they compare well with the holotype.

Striatopodocarpites brevis sp. nov.
Pl. 6, Figs. 91, 92

Holotype — Pl. 6, Fig. 91; Slide No. 4154
Locus typicus — Bore hole No. NCSJ-4, Sample No. 122.

Diagnosis — Bilateral pollen grains. Size range from 45×28 μ-60×35 μ. Central body distinct, subcircular to oval. Proximal striations distinct, 3-6 in number; saccus proximally equatorially attached, distally inclined forming a wide sulcus.

Description — Pollen grains are bilateral. Holotype measures 56×40 μ. Central body is distinct, subcircular to oval in overall shape, 20×28 μ-35×40 μ in size. Proximal striations are distinct, 3-6 in number, a few are branched, reaching upto the margin of the body. Sacci are usually slightly diploxylonoid. Proximal attachment of sacci is equatorial while distally it is inclined forming usually a straight and 5-7 μ wide sulcus. Sacci intrareticulation is fine.

Comparison — Present species can be distinguished from the other described species of the genus *Striatopodocarpites* by its smaller size. Even *S. venustus* Bharad. & Sal., 1965b which has also small size (66-74 μ) is bigger than the present species. The sulcus is also wider in *S. venustus* being 12-17 μ.

Striatopodocarpites ovalis sp. nov.
Pl. 7, Figs. 98, 99

Holotype — Pl. 7, Fig. 98; Slide No. 4119
Locus typicus — Bore hole No. NCSJ-4, Sample No. 106.

Diagnosis — Bilateral; 58×62 μ-100×77 μ size; central body vertically oval with

acute lateral ends; 6-8 distinct proximal horizontal striations, exine fine microreticulate; sacci diploxylonoid; distal sulcus narrow and straight.

Description — Pollen grains are bilateral in overall shape. Holotype measures 58× 62 μ. Central body is distinct, vertically oval with mostly acute lateral ends, measuring 34×45 μ-45×62 μ; exine is finely microreticulate. Proximal striations are distinct, 4-9 in number, usually an incomplete rim is present around the body. Sacci are distinctly diploxylonoid, generally less than hemisphere, distal attachment is straight and close to the pole forming a distinctly narrow slit like sulcus. Sacci intrareticulation is medium.

Comparison — Among the species described by Tiwari (1965), *S. labrus* has a distinct rim around the central body and *S. crassus* has a bigger size range and a wider sulcus, thus, differing from the present species. *S. magnificus* Bharad. & Sal., 1964 is bigger in size and the central body is ± subcircular with a wider sulcus. *S. decorus* Bharad. & Sal., 1964 although possesses rhomboid central body, its lateral ends are broad. *S. diffusus* Bharad. & Sal., 1964 is characterized by a thick central body with a diffused outline.

The present species can be distinguished from the other species by its vertically oval central body with acute lateral ends and a narrow, distinct sulcus.

Striatopodocarpites subcircularis sp. nov.
Pl. 7, Figs. 100, 101

Holotype — Pl. 7, Fig. 100; Slide No. 4125
Locus typicus — Bore hole No. NCSJ-4, Sample No. 126.

Diagnosis — Pollen grains bilateral, size range 90×59 μ-110×80 μ; central body subcircular, proximally bearing 4-8 horizontal striations; exine fine microreticulate; sacci diploxylonoid, distally inclined forming a distinct but narrow sulcus; sacci exine medium intrareticulate.

Description — Pollen grains are bilateral and notched on both the lateral sides. Holotype measures 100×85 μ. Central body is distinct, ± subcircular, 50×45 μ-70 ×60 μ in size. Proximal striations are distinct, 5-8 in number, sometimes a few are branched; vertical partitions are absent; exine is fine microreticulate. Sacci are diploxylonoid, ± hemispherical; proximal attachment is equatorial but distally the sacci are inclined leaving a straight, ± 2 μ wide saccus free area over the body. Sacci intrareticulation is medium.

Comparison — *S. magnificus* Bharad. & Sal., 1964 has a subcircular central body in overall shape. *S. subcircularis* sp. nov. can be distinguished by the presence of a narrow and straight sulcus and smaller saccus as compared to the body.

Genus — *Faunipollenites* Bharad., 1962

Genotype — *Faunipollenites varius* Bharadwaj, 1962

Remarks — After *Faunipollenites* had been instituted by Bharadwaj in 1962, Hart (1964, 1965) included this genus as a synonym of *Protohaploxypinus* (Samoil.) Hart, 1964, of which the genotype is *P. latissimus* (Luber & Valtz) Samoil., 1953. The description of *P. latissimus* given by Hart (1964) based upon his examination of the type material does not state positively the ill defined outline of the central body in it. Hart's figure of *P. latissimus* (HART, 1965; FIG. 53) shows a well defined outline of the central body and so also do all the other species of *Protohaploxypinus* illustrated by him (HART, 1965, FIGS. 54-67). In this respect *Faunipollenites* tends to differ from the genotype of *Protohaploxypinus* significantly. Even otherwise *Protohaploxypinus* has been described from a different floral province than that of *Faunipollenites*. As such, this geographical and floral disparity may not be of much consequence taxonomically but in view of the growing realization that the Angara flora and Gondwana flora though superficially similar in their members are at total variance when details are considered. The absence of an ill defined central body in *Protohaploxypinus* as compared to its presence in *Faunipollenites* is significant. Unfortunately the paper of Luber and Valtz (1941) illustrating the diplotype of the genus (LUBER & VALTZ, 1941, PL. 13, FIG. 221) is not accessible to me. Hence, it is difficult to decide if Hart's figure of the genotype species is a correct representation to avoid any further confusion it is preferable to maintain *Faunipollenites* for the description of Indian species of the genus.

Faunipollenites varius Bharad, 1962
Pl. 7, Fig. 102

Remarks — Presently described specimens compare well in all the morphographic characters with the holotype.

Faunipollenites parvus Tiw., 1965
Pl. 7, Fig. 103

Remarks — The specimens resemble *F. parvus* in all the morphographical characters.

Faunipollenites perexiguus Bharad, & Sal., 1965
Pl. 7, Fig. 104

Remarks — The specimens compare with the holotype in overall shape but differ by having lesser, ill defined horizontal striation in the central body.

Faunipollenites singrauliensis sp. nov.
Pl. 7, Figs. 105, 106

Holotype — Pl. 7, Fig. 105; Slide No. 4160
Locus typicus — Bore hole No. NCSJ-4, Sample No. 126.
Diagnosis — Horizontally oval, bilateral pollen grains. Size 64×50 μ-100×70 μ. Central body ill defined, proximally bearing well defined horizontal striations, 5-10 in number. Sacci haploxylonoid, zone of distal saccus attachment diffused, a median vertical groove or slit present.
Description — Pollen grains are bilaterally oval. Holotype meaure 95×67 μ. Central body outline is ill defined, apparently ± subcircular in shape, exine is finely microreticulate. Sacci are haploxylonoid, proximal attachment is equatorial, distally it is inclined; zone of saccus attachment is ill defined. A median, vertical slit or groove is present, occasionally a fold along the groove may be present. Sacci are medium intramicroreticulate.
Comparison — *Faunipollenites varius* Bharad. 1962 is characterized by the presence of an ill defined, broad sulcus. *F. parvus* Tiw., 1965 is smaller in size and *F. perexiguus* Bharadwaj & Sal., 1965 is ± subcircular in overall shape. The new species can be distinguished from other species of genus *Faunipollenites* by the presence of a median, vertical slit or a groove combined with ill defined zones of saccus attachment.

Infraturma — *Rectistriati* Bharad., 1962

Genus — *Distriatites* Bharad., 1962

Genotype — *Distriatites bilateralis* Bharadwaj, 1962
Remarks — The genera *Distriatites* Bharad., 1962 and *Hamiapollenites* Wils., 1962 are similar in important morphographical characters such as the occurrence of horizontal striations on the body proximally and vertical striations distally. Both the genera are dissacate and haploxylonoid. The only difference known is that in the genotype of *Distriatites* the sacci are only slightly smaller than the central body in height. This difference being minor as well as quantitative, for practical purposes the two genera are synonymous. Unfortunately, both the genera were published simultaneously in February 1962, hence, none can be considered as a synonym of the other. Some authors seem to think that *Hamiapollenites* has a priority over *Distriatites* following Hart (1966) who dated Bharadwaj's publication as 1963. Hart (1964) considered *Distriatites* as a monstrosity while regarding *Hamiapollenites* as a normal genus. Evidently, misreporting and lack of critical evaluation of facts, has led to some confusion. In view of the stalemate I prefer to use the genus *Distriatites* for the spores of Gondwana continents, till the two authors agree to a joint proposal regarding the two genera.

Distriatites distinctus sp. nov.
Pl. 8, Figs. 107, 108

Holotype — Pl. 8, Fig. 107; Slide No. 4165
Diagnosis — Pollen grains bilateral, bisaccate; size 110×55 μ-30×50 μ; central body outline distinct, oval to subcircular, proximally as well as distally bearing a number of horizontal and vertical striations respectively; sacci haploxylonoid but ± equal in length to central body, zone of saccus attachment usually distinct, ± 90 μ wide.
Description — Pollen grains are bilateral and normally bisaccate. Holotype measures 105×62 μ. Central body outline is distinct and oval to subcircular in shape; exine is thin, finely microreticulate, proximally bearing 6-15 horizontal striations, distally 4-5 vertical striations present at right angles to the proximal ones. Sacci are haploxylonoid, ± equal in length to the

central body, distal zone of sacci attachment are subequatorial and well defined, leaving a ± 50 μ wide saccus free area. Sacci are medium intrareticulate.

Comparison — As compared to *D. bilateris*, *D. distinctus*, is normally smaller in size and has comparatively more striations proximally and less distally.

Distriatites indicus sp. nov.
Pl. 8, Figs. 109, 110

1964 — *Distriatites* sp., Tiwari, Pl.. 7, Fig. 162

Holotype — Pl. 8, Fig. 110; Slide No. 4169

Locus typicus — Bore hole No. NCSJ-4, Sample No. 114.

Diagnosis — Pollen grians bilateral, bisaccate; size 90×68 μ-125×70 μ. Central body outline distinct to diffuse, vertically elongated with rounded or ± beaked lateral ends; proximally as well distally bearing a number of horizontal and vertical striations respectively; sacci haploxylonoid, distal zones of sac attachment ± diffuse, saccus free area ± 65 μ wide.

Description — Miospores are bilateral, bisaccate. Holotype measures 125×70 μ. Central body outline is distinct to diffuse; shape is vertically oval to subcircular, lateral ends are pointed or rounded, usually one pole is beaked, 50×65 μ-78×84 μ in size. Exine is thin, fine microreticulate, sometimes micropunctate. The body bears proximally 7-11 horizontal striations and distally 4-6 vertical striations at right angles to proximal ones. Sacci are markedly haploxylonoid, height being less than that of the body and are subequatorially attached to the central body distally. Zones of saccus attachment are usually not clear; no distinct sulcus is seen, the area being striated. Sacci intrareticulation is fine to medium. The place of saccus attachment on each of the lateral side is characterized by dents or shallow notches.

Comparison — *Distriatites bilateralis* Bharad., 1962 is characterized by the presence of ± 7 striations on both the faces. *D. insolitus* Bharad. & Sal., 1964 is distinctly diploxylonoid and has only upto 25 μ distal saccus free area. The present species is distinguished by the presence of distinctly haploxylonoid sacci and 7-11 proximal, 4-6 distal striations. Although *D. indicus* sp. nov. is ± of the same size as *D. distinctus*, it differs in having vertically oval central body with protruding lateral ends, ill defined sulcus and by the presence of two notches at each of the lateral sides.

Infraturma — *Disaccimonoleti* Klaus, 1963

Genus — *Illinites* (Kos.) Pot. & Kl. in Pot. & Kr., 1954

Genotype — *Illinites unicus* Kosanke, 1950

Illinites hennellyi (HART, 1960) comb. nov.
Pl. 8, Fig. 111

1960 — *Vestigisporites hennellyi* Hart, 1960; Pl. 2, Fig. 23

1960 — *Vestigisporites disectus* Hart, 1960; Pl. 2, Fig. 28

1965 — *Illinites delasaucei*, Tiwari, 1965; Pl. 6, Figs. 163, 164

Holotype — *Vestigisporites hennellyi*, Hart, 1960; Pl. 2, Fig. 23

Remarks — Tiwari (1965) described some specimens as *Illinites delasaucei* (Pot. & Kr.) Grebe & Schw., 1962 which appear to be different from the holotype. Moreover, *I. delasaucei* is a species of Northern Hemisphere. *Vestigisporites hennellyi* Hart, 1960 an existing species, resembles very closely with the present specimens and with the specimes of Tiwari referred to *Illinites delasaucei*. Hence, the specimens described by Tiwari (1965; Pl. 7, Figs. 163, 164) are transferred to *Illinites hennellyi* (Hart) comb. nov., *Vestigisporites hennellyi* Hart, 1960 and *Vestigisporites disectus* Hart, 1960 are also transferred to *I. hennellyi* as they do not show any significant deviation.

Infraturma — *Disacciatrileti* (Leschik) Pot., 1958

Genus — *Vesicaspora* (Schemel) Wils. & Venk., 1963

Genotype — *Vesicaspora wilsonii* Schemel. 1951

Vesicaspora distincta Tiw., 1965

Remarks — Distinct central body along with wide sulcus make the present specimens quite comparable to the holotype.

Vesicaspora ovata (Balme & Henn.) Wils. & Venkat., 1963
Pl. 8, Fig. 112

Remarks — Bharadwaj 1962 had put this species in *Sulcatisporites*. But with the

later restudy of *Vesicaspora* by Wilson and Venkatachala (1963) such pollen grains should be preferably described under *Vesicaspora*.

Vesicaspora brevis sp. nov.

Pl. 8, Figs. 113, 114

Holotype — Pl. 8, Fig. 114; Slide No. 4094
Locus typicus — Bore hole No. NCSJ-4, Sample No. 83.
Diagnosis — Bilaterally oval; size 31×22 μ-42×26 μ; central body well defined; sacci distally inclined forming an ill defined sulcus, sacci continuing on two lateral sides.
Description — Miospores are bilaterally oval in overall shape. Holotype measures 38×36 μ. Central body is ill defined, outline being diffuse, apparently vertically oval, 16×19 μ-28×32 μ in size; exine is finely microreticulate. The sacci are distally inclined forming a ± diffuse sulcus, straight or oblique edged, 4-6 μ wide when straight, 1-12 μ when oblique, sacci laterally connected, less than a hemisphere, exine finely intrareticulate.
Comparison — Present species differs from *Vesicaspora wilsonii* Pant and *V. indica* Tiw., 1965 in being distinctly smaller in size. *V. distincta* Tiw., 1965 is also larger in size along with a distinct central body. The present species is characterized by its smaller size and ill defined central body.

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

Genotype — *Sulcatisporites interpositus* Leschik, 1955.

Sulcatisporites maximus (Hart) Singh, 1964

Pl. 8, Fig. 115

Remarks — The specimens from present assemblage compare closely with the holotype.

Sulcatisporites barakarensis Tiw., 1965

Pl. 8, Fig. 116

Remarks — The specimens studied here are quite comparable with the holotype in all the morphographical characters.

Sulcatisporites minutus sp. nov.

Pl. 8, Fig. 117

Holotype — Pl. 8, Fig. 117; Slide No. 4172.
Locus typicus — Bore hole No. NCSJ-4, Sample No. 122.
Diagnosis — Circular to oval; 26×25 μ-40×47 μ; central body indistinct; sacci less than a hemisphere, distally inclined forming a well defined biconcave sulcus.
Description — Pollen grains are circular to oval; holotype measures 43×37 μ. Central body is indistinct; thin, appears to be vertically oval, finely microreticulate; sacci distally inclined forming a well defined, ±3 μ wide sulcus, which appears narrower in the middle due to saccus infolding but is widely open at the lateral ends, giving a biconcave appearance. Sacci are fine intrareticulate and less than a hemisphere in extent.
Comparison — *Sulcatisporites barakarensis* Tiw., 1965 has a diffuse sulcus, *S. interpositus* Leschik, 1955 and *S. maximus* (Hart) Singh, 1964 are bigger in size, while the present species is very small in size having an indistinct central body and a distinct sulcus. Evidently, these specimens represent a new species of *Sulcatisporites*.

Genus — *Ibisporites* Tiw., 1968

Genotype — *Ibisporites diplosaccus* Tiwari, 1968.

Ibisporites jhingurdahiensis sp. nov.

Pl. 8, Figs. 118, 119

Holotype — Pl. 8, Fig. 118; Slide No. 4171.
Locus typicus — Bore hole No. NCSJ-4, Sample No. 122.
Diagnosis — Bilateral pollen grains; 71×50 μ-115×94 μ in size; central body indistinct; sacci diploxylonoid encroaching upon central body proximally, distally inclined forming a narrow furrow like sulcus; sacci intrareticulation medium.
Description — Pollen grains are bilaterally oval. Holotype measures 100×85 μ. Central body is indistinct, sacci are diploxylonoid, coming close to each other on the lateral sides. Proximally the sacci encroach upon the central body covering a significant part of it too. Distally the sacci cover the body leaving only a straight and narrow furrow like sulcus. Sacci intrareticulation is medium sized.

Comparison — The species described here differs from *Ibisporites diplosaccus* Tiw., 1968 by having an indistinct central body and narrow furrow like sulcus.

Subturma — *Monocoplates* Ivers. & Troels-Smith, 1950
Infraturma — *Intortes* (Naum.) Pot., 1958

Genus — *Vittatina* (Luber) Tschudy & Kos., 1966

Genotype — *Vittatina subsaccata* Samoilovich, 1953.

Vittatina africana Hart, 1966
Pl. 8, Fig. 120

Remarks — The specimens described by Hart (1966) as *V. africana* resemble the present specimens in their general organization.

Vittatina sp.
Pl. 8, Fig. 121

Description — Pollen grains are bilateral and oval. Size ranges from 25×46 μ-64×48 μ, 12-15 horizontal striations are present on the proximal surface, exine is thin, intrapunctate.

Remarks — The present pollen grains do not compare with any of the known species. The number of such specimens were less and their correct taxonomic position could not be assessed.

Genus — *Ginkgocycadophytus* Samoil., 1953

Genotype — *Ginkgocycadophytus caperatus* (Luber) Samoilovich, 1953.

cf. *Ginkgocycadophytus* sp.
Pl. 8, Fig. 122

Description — Pollen grains are elongated with narrow ends. Size ranges from 56×34 μ- 72×40 μ. Folded along the direction of longer axis, nature of colpus is not defined. Exine is thin, fine and negative sculptured.

Remarks — Present specimens resemble with cf. *Ginkgocycadophytus* sp. of Tiwari (1965) in the ill defined nature of colpus due to folding. However, it is very likely that these specimens are normal species of *Ginkgocycadophytus*.

Ginkgocycadophytus sp.
Pl. 8, Fig. 123

Description — Pollen grains are elongated with narrow, rounded ends. Size ranges from 34×22 μ-44×28 μ. Colpus is narrow in the middle, 5-10 μ wide towards ends. Exine is finely microgranulose.

Remarks — As the number of such specimen was less, a detailed morphographic study and comparison could not be made.

Genus — *Distriamonocolpites* Bharad. & Sinha, 1969a

Genotype — *Distriamonocolpites ovalis* Bharad. & Sinha, 1969a.

Distriamonocolpites circularis sp. nov
Pl. 8, Fig. 124

Holotype — Pl. 8, Fig. 124; Slide No. 4105.

Locus typicus — Bore hole No. NCSJ-4, Sample No. 13.

Diagnosis — Pollen grains subcircular, size ranging from 75×83 μ-140×115 μ. Colpus distinct, ±biconcave. Exine thick, inatramicropunctate; proximally bears 6-11 distinct horizontal striations, distal striations faint, 2-4 μ in number.

Description — Pollen grains are ±subcircular in overall shape. Holotype measures 100×108 μ. Colpus is distinct, biconcave, extending from one lateral end to the other, narrower in the middle and broadens towards the lateral ends, 5-35 μ wide. Exine is thick, finely intrapunctate; ±2 μ thick along the edge of colpus and outer exine of the pollen grain. Proximal striations are distinct, 6-11 in number. Striation ends are joined by vertical connections forming a closed ring. Distal striations are 2-4 in number, one or two on either side of colpus, faint running along the direction of colpus.

Comparison — *Distriamonocolpites ovalis* sp. nov. differ from present species in having a distinctly oval overall shape.

REFERENCES

Balme, B. E. (1964). The palynological record of Australian pre-Tertiary floras. *Ancient Pacific Floras*: 49-80.

Balme, B. E. & Hennelly, J. P. F. (1956). Trilete spromorphs from Australian Permian sediments. *Aust. J. Bot.*, **4**(8): 240-260.

BHARDWAJ, D. C. (1955). The spore genera from the Upper Carboniferous coals of the Saar and their value in stratigraphical studies. *Palaeobotanist.* **4**: 119-149.

Idem (1962). The miospore genera in the coals of Raniganj Stage (Upper Permian), India. *Ibid.* **9**(1 & 2): 68-106.

Idem (1964). *Potonieisporites* Bharad., Ihre Morphologie, Systematik und Stratigraphie. *Fortschr. Geol. Rheinld Westf.* **12**: 45-54.

Idem (1966). Distribution of spores and pollen grains dispersed in the Lower Gondwana formations of India. *Symp. Floristics Stratigr. Gondwld, Sahni Inst. Palaeobot.* 1964: 69-84.

BHARADWAJ, D. C. & SALUJHA, S. K. (1964). Sporological study of Seam VIII — Raniganj Coalfield, Bihar (India)— Part I. Description of *Sporae dispersae. Palaeobotanist.* **12**(2): 181-215.

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

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

BHARADWAJ, D. C. & SINHA, V. (1969a). Some new miospores from Jhingurdah seam, Singrauli Coalfield, M.P. India. *Sen Memorial Vol.* 7-16.

Idem (1969b). Sporological succession and age of the Jhingurdah seam, Singrauli Coalfield, M.P. India. *Palaeobotanist* **17**(3): 275-287.

BHARADWAI, D. C. & SRIVASTAVA, S. C. (1969). Some new miospores from Barakar Stage, Lower Gondwana, India. *Ibid.* **17**(2): 220-229

BHARADWAJ, D. C. & TIWARI, R. S. (1964). On two new monosaccate genera from Barakar Stage of India. *Ibid.* **12**(2): 139-146.

BOSE, M. N. & KAR, R. K. (1966). Palaeozoic *Sporae dispersae* from Congo. I. Kindu-Kalima and Walikale regions. *Annls. Mus. r. Afr. Centr.* Ser in 8°. **53**: 1-238.

GREBE, H. & SCHWEITZER, H. J. (1962). Die *Sporae dispersae* des niederrheinschen Zechstein. *Fortschr. Geol. Rheinld. Westf.*: 1-23.

HART, G. F. (1960). Microfloral investigations of the Lower Coal Measures (K_3): Ketewaka-Mchuchuma Coalfield, Tanganyika. *Bull. geol. Surv. Tanganyika.* **30**: 1-18.

Idem (1964). A review of the classification and distribution of the Permian miospore: Disaccate striatiti. *C. r.* 3 *Int. Congr. Carb. Stratigr. geol.* 1171-1199.

Idem (1965). The systematics and distribution of Permian miospores. Johannesburg.

Idem, G. F. (1966). *Vittatina africana,* a new miospore from Lower Permian of South Africa. *Micropalaeontology.* **2**(1): 37-42.

KAR, R. K. & BOSE, M. N. (1967). Palaeozoic *Sporae dispersae* from Congo. III. Assise des Schistes noirs de la Lukuga. *Annls. Mus. r. Afr. Centr.* Ser in 8°. **54**: 1-67.

KLAUS, W. (1963). Sporen aus dem südalpinen Perm. *Geol. Jber.* **106**: 229-363.

LELE, K. M. (1964). Studies in the Talchir flora of India: 2. Resolution of the spore genus *Nuskoisporites* Pot. & Kl. *Palaeobotanist.* **12**(2): 147-148.

LELE, K. M. & KARIM, R. (1969). Discovery of Talchir miospore floras in the Jayanti Coalfield, Bihar. *Curr. Sci.* **38**(18): 436.

Idem (MS). Studies in the Talchir flora of India-5. Two new saccate miospores from the Jayanti coalfield, Bihar. *Q. Jl. geol. Min. metall. Soc. India. N. N. Chatterjee Comm. Vol.* (in press).

LESCHIK, G. (1959). Sporen aus den "Karru-Sandsteinen" von Norronaub (südwest-Afrika). *Senckenberg. leth.* **40**(12): 51-95.

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

MAITHY, P. K. (1965). Studies in the Glossopteris flora of India-27. *Sporae dispersae* from the Karharbari beds in Giridih Coalfield, Bihar. *Ibid.,* **13**(3): 291-307.

PANT, D. D. (1954). Suggestions for classifications and nomenclature of fossil spores and pollen grains. *Bot. Rev.* **20**: 33-50.

Idem (1955). On two new disaccate spores from the Bacchus Marsh Tillite, Victoria (Australia). *Ann. Mag. nat. Hist.* **12**(8): 757-764.

POTONIÉ, R. (1956). Synopsis der Gattungen der *Sporae dispersae* Pt. I. *Beih. geol. Jb.* **23**: 1-103.

Idem (1958). Synopsis der Gattungen der *Sporae dispersae* Pt. II. *Ibid.* **31**: 1-114.

Idem (1960). Synopsis der Gattungen der *Sporae dispersae* — Pt. III. *Ibid.* **39**: 1-189.

POTONIÉ, R. & KREMP, G. (1954). Die Gattungen der palaeozoischen *Sporae dispersae* und ihre Stratigraphie. *Geol. Jber.* **68**: 517-546.

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

SINHA, V. (1969). Some "Acritarchs" and other microfossils from Barakar Stage of Lower Gondwanas, India. *Palaeobotanist.* **17**(3): 326-331.

SINGH, H. P. (1964). A miospore assemblage from the Permian of Iraq. *Palaeontology.* **7**(2): 240-265.

SRIVASTAVA, S. C. (1970). Miofloral investigations in some coals of Talcher Coalfield (Orissa), India. *Palaeobotanist.* **18**(2): 154-166.

TIWARI, R. S. (1964). New miospore genera in the coals of Barakar stage (Lower Gondwana) of India. *Palaeobotanist.* **13**(1): 250-259.

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

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

VENKATACHALA, B. S. & KAR, R. K. (1964). *Schizopollis* Venkat. & Kar, a new pollen genus from the Permian of North Karanpura Coalfield, Bihar, India. *Grana palynol.* **5**: 413-424.

Idem (1965). Two new trilete spore genera from the Permian of India. *Palaeobotanist.* **13**(3): 337-340.

Idem (1966a). *Divarisaccus* gen. nov., a new saccate pollen genus from the Permian sediments of India. Ibid **15**(1 & 2): 102-106.

Idem (1966b). *Corisaccites* gen. nov., a new saccate pollen genus from the Permian of Salt Range, West Pakistan. *Ibid.* **15**(1 & 2): 107-109.

WILSON, L. R. (1962). Permian plant microfossils from the Flowerpot Formation, Greer County, Oklahoma. *Circ. Okla. geol. Surv.* **49**: 5-50.

EXPLANATION OF PLATES

(All photomicrographs magnified 500 ×)

Plate 1

1. *Leiotriletes brevis* sp. nov., Holotype; Slide No. 4093.
2. *L. brevis* sp. nov. Slide No. 4093.
3. cf. *Punctatisporites* sp. Slide No. 4094.
4. *Cyclogranisporites barakarensis* Bharad. & Sriv. Slide No. 4096.
5. cf. *Planisporites* sp. A. Slide No. 4095.
6. cf. *Planisporites* sp. B. Slide No. 4098.
7. *Lophotriletes rectus* Bharad. & Sal. Slide No. 4096.
8. *Horriditriletes curvibaculosus* Bharad. & Sal. Slide No. 4097.
9. *H. brevis* Bharad. & Sal. Slide No. 4100.
10. *H. novus* Tiw. Slide No. 4098.
11. *H. pseudoseptatus* sp. nov. Slide No. 4099.
12. *H. pseudoseptatus* sp. nov., Holotype. Slide No. 4100.
13. *Cyclobaculisporites minutus* Bharad. & Sal. Slide No. 4101.
14. *Brevitriletes communis* Bharad. & Sriv. Slide No. 4101.
15. *B. jhingurdahiensis* sp. nov., Holotype; Slide No. 4102.
16. *B. jhingurdahiensis* sp. nov. Slide No. 4102.
17. *B. crassus* sp. nov. Slide No. 4103.
18. *B. crassus* sp. nov., Holotype. Slide No. 4103.
19. *B. baculatus* sp. nov., Holotype. Slide No. 4104.
20. *B. baculatus* sp. nov. Slide No. 4105.
21. *Microbaculispora tentula* Tiw. Slide No. 4104.
22. *Microfoveolatispora bokaroensis* Tiw. Slide No. 4106.

22. *M. indica* sp. nov., Holotype. Slide No. 4107.
24. *M. indica* sp. nov. Slide No. 4107.
25. *Potonieitriradites tuberculatus* sp. nov., Holotype. Slide No. 4108.
26. *P. tuberculatus* sp. nov. Slide No. 4109.
27. *P. subtilis* sp. nov., Holotype. Slide No. 4110.
28. *P. subtilis* sp. nov. Slide No. 4112.

Plate 2

29. *Latosporites colliensis* (Belm. & Henn.) Bharad. Slide No. 4111.
30. *Barakarites* sp. cf. *B. indicus* Bharad. & Tiw. Slide No. 4112.
31. *Barakarites* sp. Slide No. 4113.
32. *Parasaccites diffusus* Tiw. Slide No. 4114.
33. *P. bilateralis* Tiw. Slide No. 4115.
34. *P. singrauliensis* sp. nov., Holotype. Slide No. 4116.
35. *P. singrauliensis* sp. nov. Slide No. 4117.
36. *P. irregularis* sp. nov. Slide No. 4118.
37. *P. irregularis* sp. nov., Holotype. Slide No. 4119.
38. *Parastriopollenites gondwanensis* Maheshw. Slide No. 4124.

Plate 3

39. *Parastriopollenites limbatus* Maheshw. Slide No. 4123.
40. *P. irregularis* sp. nov., Holotype. Slide No. 4121.
41. *P. irregularis* sp. nov. Slide No. 4120.
42. *Tuberisaccites jhingurdahiensis* sp. nov., Holotype. Slide No. 4121.
43. *T. jhingurdahiensis* sp. nov. Slide No. 4122.
44. *Divarisaccus strengeri* Bose & Kar. Slide No. 4123.
45. *Striomonosaccites* sp. Slide No. 7124.

Plate 4

46. *Korbapollenites* sp. Slide No. 4125.
47. *Primuspollenites singrauliensis* sp. nov., Holotype. Slide No. 4126.
48. *P. singrauliensis* sp. nov. Slide No. 4126.
49. *P. distinctus* sp. nov., Holotype. Slide No. 4127.
50. *P. distinctus* sp. nov. Slide No. 4127.
51. *P. brevicorpus* sp. nov., Holotype. Slide No. 4128
52. P. *brevicorpus* sp. nov. Slide No. 4131.
53. *P. ovatus* sp. nov., Holotype. Slide No. 4129.
54. *P. ovatus* sp. nov. Slide No. 4132.
55. *Primuspollenites* sp. Slide No. 4130.
56. *Rhizomaspora singula* Tiw. Slide No. 4125.
57. *R.* sp. cf. *R. fimbriata* Tiw. Slide No. 4131.
58. *Platysaccus* sp. A. Slide No. 4132.
59. *Platysaccus* sp. B. Slide No. 4133.

Plate 5

60. *Cuneatisporites* sp. Slide No. 4105.
61. *Lueckisporites singrauliensis* sp. nov., Holotype. Slide No. 4134.
62. *L. singrauliensis* sp. nov. Slide No. 4136.
63. *Lueckisporites crassus* sp. nov., Holotype. Slide No. 4136.
64. *L. crassus* sp. nov. Slide No. 4136.
65. *Lueckisporites* sp. Slide No. 4136.
66. *Taeniaesporites* sp. Slide No. 4139.
67. *Schizopollis extremus* Venkat. & Kar. Slide No. 4137.
68. *S. distinctus* sp. nov., Holotype. Proximal view. Slide No. 4138.
69. *S. distincttus* sp. nov., Holotype, Distal view. Slide No. 4138.
70. *S. distinctus* sp. nov. Slide No. 4139.
71. *S. jhingurdahiensis* sp. nov., Holotype. Slide No. 4140.
72. *S. jhingurdahiensis* sp. nov. Slide No. 4141.
73. *Schizopollis* sp. Slide No. 4143.
74. *Striatites parvus* Tiw. Slide No. 4141.
75. *S. tentulus* Tiw. Slide No. 4142.
76. *S. reticuloidus* Tiw. Slide No. 4143.

Plate 6

77. *Striatites barakarensis* sp. nov., Holotype. Slide No. 4144.
78. *S. barakarensis* sp. nov. Slide No. 4145.
79. *Verticipollenites* sp. cf. *V. gibbosus* Bharad. Slide No. 4146.
80. *Lahirites rarus* Bharad. & Sal. Slide No. 4147.
81. *L. rotundus* Bharad. & Sal. Slide No. 4148.

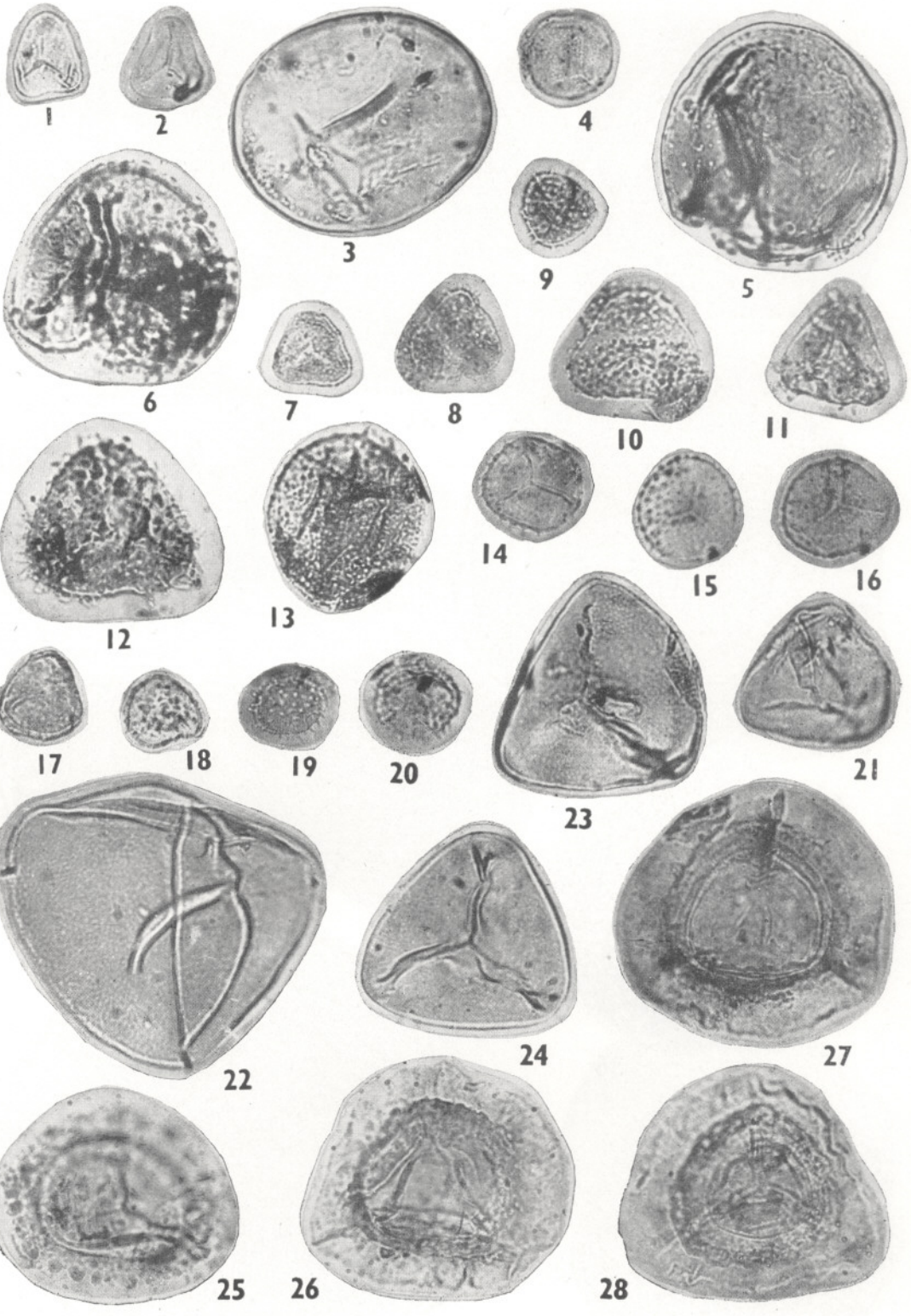
82. *L. reticuloidus* sp. nov., Holotype. Slide No. 4147.
83. *L. reticuloidus* sp. nov. Slide No. 4149.
84. *L. singrauliensis* sp. nov., Holotype. Slide No. 4150.
85. *L. singrauliensis* sp. nov. Slide No. 4151.
86. *L. barakarensis* sp. nov., Holotype. Slide No. 4146.
87. *Lahirites barakarensis* sp. nov. Slide No. 4152.
88. *L. rhombicus* Maithy var. *junior* var. nov., Holotype. Slide No. 4152.
89. *Lahirites* sp. Slide No. 4159.
90. cf. *Lahirites* sp. Slide No. 4153.
91. *Striatopodocarpites brevis* sp. nov., Holotype. Slide No. 4154.
92. *S. brevis* sp. nov. Slide No. 4155.

PLATE 7

93. *Lunatisporites barakarensis* sp. nov., Holotype. Slide No. 4152.
94. *L. barakarensis* sp. nov. Slide No. 4156.
95. *Striatopodocarpites magnificus* Bharad. & Sal. Slide No. 4157.
96. *S. labrus* Tiw. Slide No. 4158.
97. *S. crassus* Tiw. Slide No. 4117.
98. *S. ovalis* sp. nov., Holotype. Slide No. 4119.
99. *S. ovalis* sp. nov. Slide No. 4159.
100. *S. subcircularis* sp. nov., Holotype. Slide No. 4125.
101. *S. subcircularis* sp. nov. Slide No. 4160.
102. *Faunipollenites varius* Bharad. Slide No. 4161.
103. *F. parvus* Tiw. Slide No. 4162.
104. *F. perexiguus* Bharad. & Sal. Slide No. 4163.
105. *F. singrauliensis* sp. nov., Holotype. Slide No. 4160.
106. *F. singrauliensis* sp. nov. Slide No. 4164.

PLATE 8

107. *Distriatites distinctus* sp. nov. Holotype. Slide No. 4165.
108. *D. distinctus* sp. nov. Slide No. 4168.
109. *D. indicus* sp. nov. Slide No. 4166.
110. *D. indicus* sp. nov., Holotype. Slide No. 4169.
111. *Illinites hennellyi* (Hart) comb. nov. Slide No. 4167.
112. *Vesicaspora ovata* (Balme & Henn.) Wils. & Venkat. Slide No. 4168.
113. *V. brevis* sp. nov. Slide No. 4169.
114. *V. brevis* sp. nov., Holotype. Slide No. 4094.
115. *Sulcatisporites maximus* (Hart) Singh. Slide No. 4108.
116. *S. barakarensis* Tiw. Slide No. 4170.
117. *S. minutus* sp. nov., Holotype. Slide No. 4172.
118. *Ibisporites jhingurdahiensis* sp. nov. Holotype. Slide No. 4171.
119. *I. jhingurdahiensis* sp. nov. Slide No. 4170.
120. *Vittatina africana* Hart. Slide No. 4155.
121. *Vittatina* sp. Slide No. 4102.
122. cf. *Ginkgocycadophytus* sp. Slide No. 4093.
123. *Ginkgocycadophytus* sp. Slide No. 4172.
124. *Distriamonocolpites cirularis* sp. nov., Holotype. Slide No. 4105.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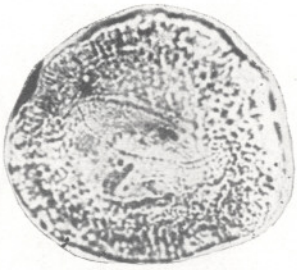

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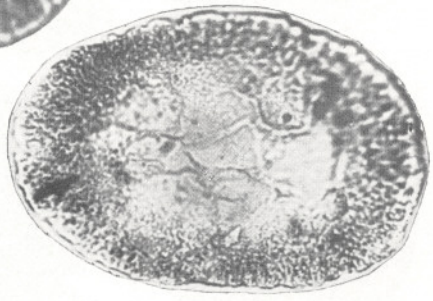

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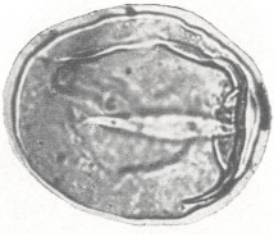

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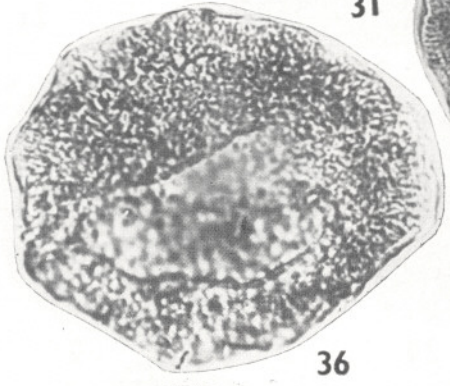

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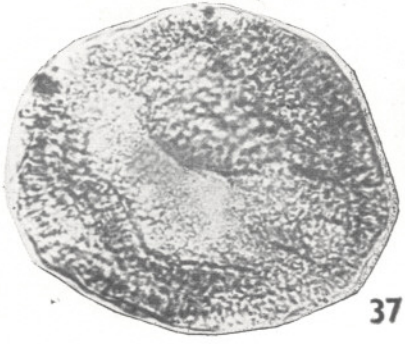

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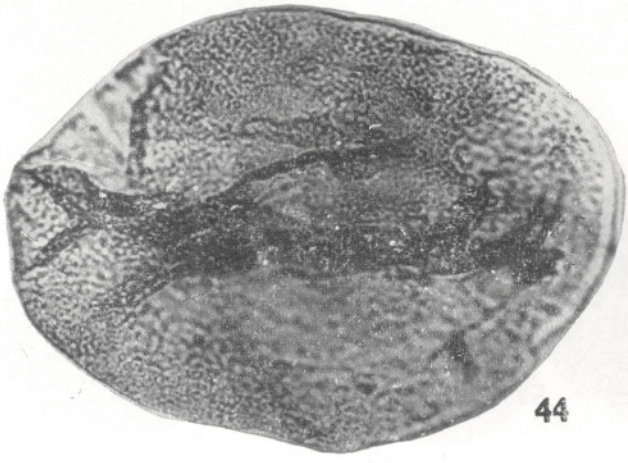

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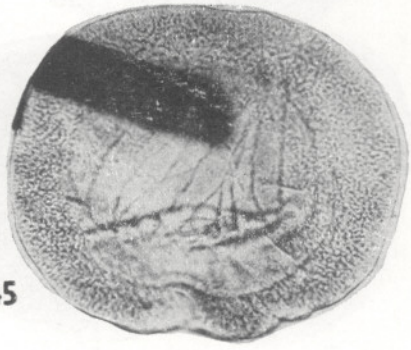

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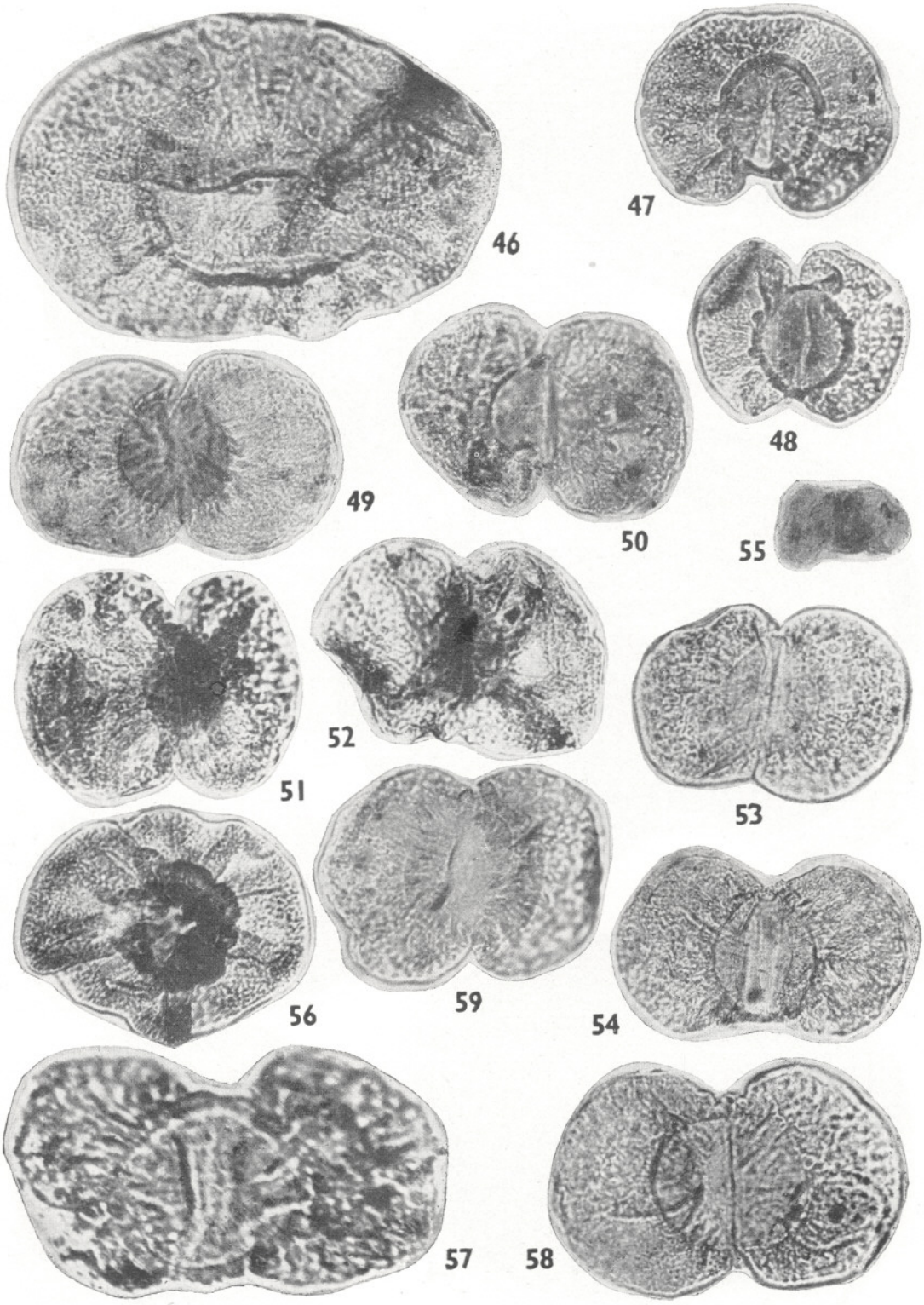
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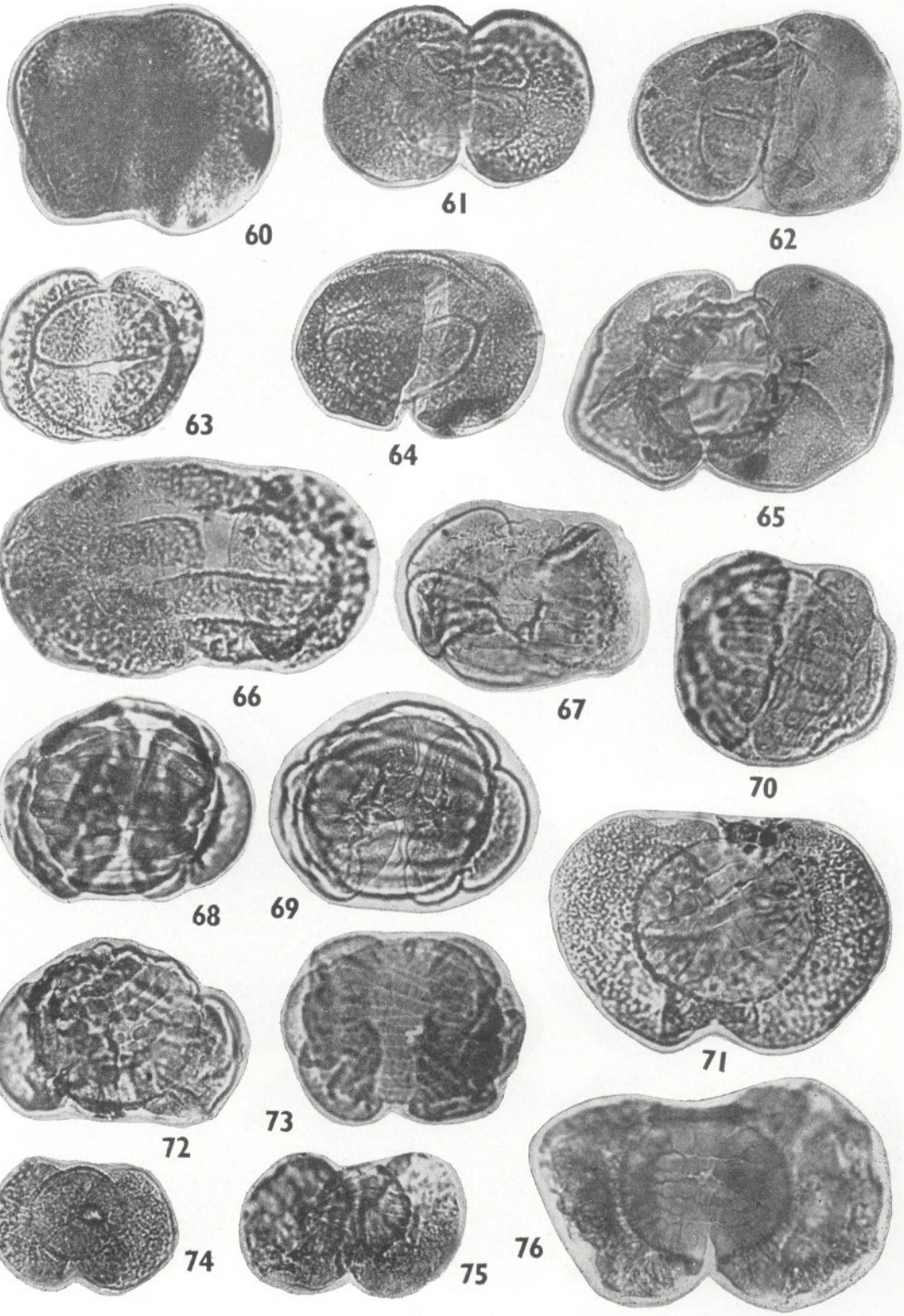
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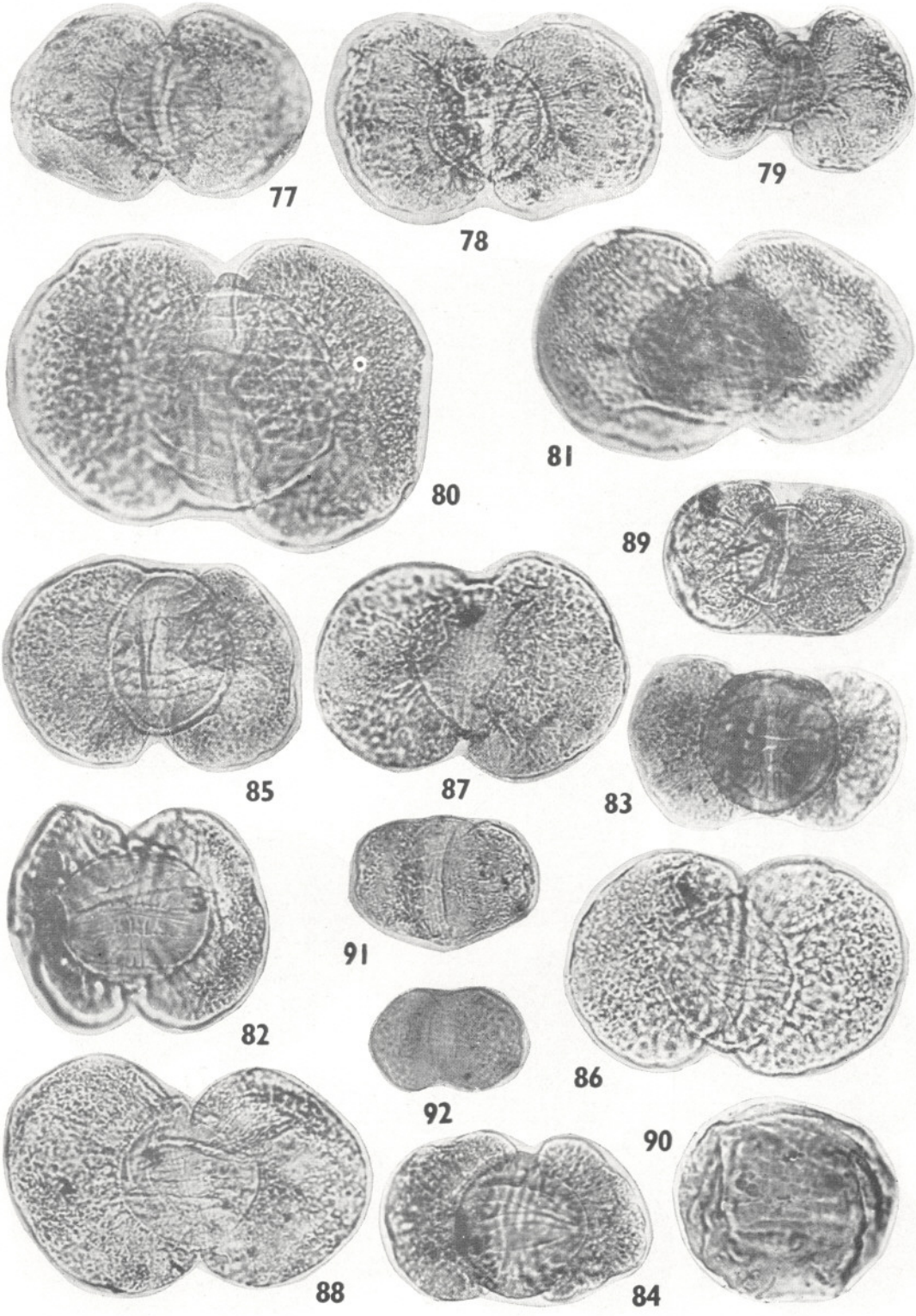
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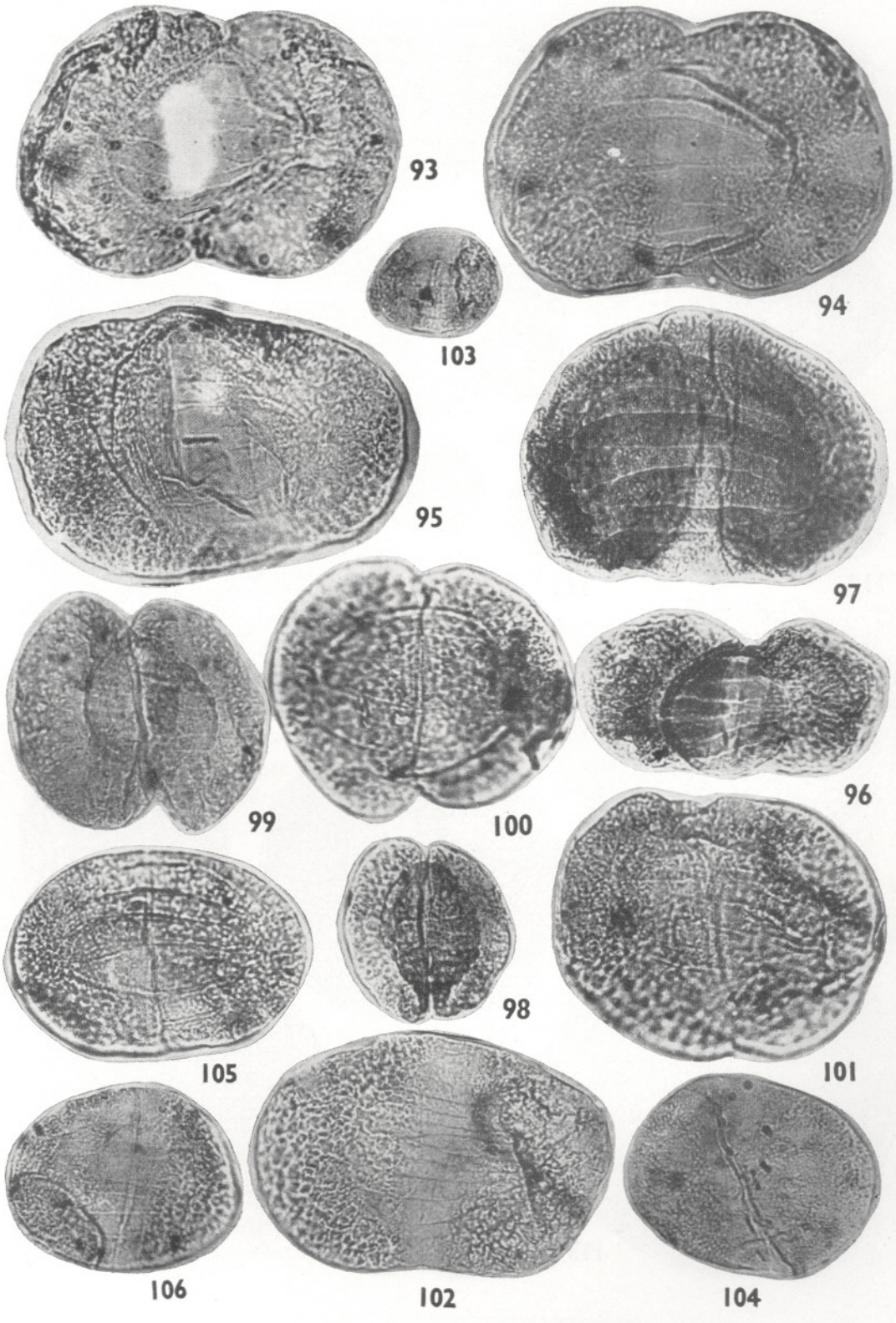
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