ABSTRACT

Two miofloral assemblages—one from the base and the other from the top of the Talchir Formation—are described from a single sequence in the Dudhi River, West Bokaro Coalfield. The impoverished nature of the early Talchir assemblage is reflected by very limited number and variety of taxa (8 genera & 14 species)—chiefly Parasaccites, Plicatipollinutes and Potoniieisporites and some apiculate triletes. Disaccates—especially Striatiti—are strikingly absent. Leiosphaeridia and spicule-like microfossils are significantly associated.

The late Talchir mioflora, on the contrary demonstrates distinct improvement both in diversity and quantity of miospores (14 genera & 29 species). Besides the stronghold of Parasaccites, Plicatipollinutes and Potoniieisporites, several genera make new appearance, viz., Jayantisporites, Tuberisaccites, Caheniasaccites, Limitisporites and especially all the striate disaccates like Crescentipollinutes, Faunipollinutes and Striatoparvisaccites gen. nov. A number of species are apparently represented only in the late Talchir. Leiosphaeridia are rare and spicule-like bodies are absent.

In the light of the present study, and from an assessment of the better known Talchir miofloras, it is suggested that not one but two miofloral assemblages—of early and late Talchir age respectively—are evident in the Talchir Formation.

INTRODUCTION

The earliest Lower Gondwana microfloras from India are found in the Talchir Formation. Although extensively developed in almost all coalfields, the Talchir sediments reveal relatively scanty evidence of plant life, especially in the earlier part of the formation. This is due obviously to the severe conditions initiated by the Permo-Carboniferous glaciation. In the later part of the Talchir, miofloral evidences are comparatively more widespread and they provide a glimpse of a definite improvement and diversification in the flora with the progressive amelioration of climate. It is thus clear that for a proper understanding of the floral history, climatic setting and palynostratigraphic implications of the Talchir flora, every piece of evidence, especially from the earlier Talchir, should be well documented both by appropriate descriptions and illustrations of the fossils so as to make the data sufficiently expedient for an open appraisal of stratigraphical as well as morphological problems.

The Talchir mioflora from the Dudhi River section in the West Bokaro Coalfield was rather briefly reported in an earlier review by me (Lele, 1966). This stratigraphic section is important because here we have found some evidence of what may be one of the very oldest known Talchir miofloras, occurring close to the base of the formation. Furthermore, in the same section towards its top (and close to the Barakar junction) a thick siltstone bed has yielded a substantially rich mioflora that obviously represents the later part of the Talchir. The whole miofloral evidence has thus considerable implication on the floristics and palynostratigraphy of the Talchir Formation. It is, therefore, considered appropriate to present in this paper a more detailed and well-illustrated account of these early and late Talchir miofloral assemblages. New palynomorphs are systematically described and the known ones are supplemented with brief descriptions or remarks.

MATERIAL AND METHOD

Geological Background of Samples

The Talchir Formation, ideally exposed in the Dudhi River section of the West Bokaro Coalfield, has earlier been mapped by Dutt (1949). Ghosh (1962) carried out some sedimentological studies on this succession which is estimated to be about 700 ft thick.

From palynostratigraphic point of view, the salient features of the sequence were described by me (Lele, 1966). In brief,
TEXT-FIG. 1 — Portion of the geological map of the West Bokaro Coalfield showing location of palynological samples in the Talchir Formation exposed in the Dudhi River section.

Thus, there are relatively very few miospores in sample B19/662 (Bed 2) which lies immediately above the tillite. In the sample B17/662 (Bed 4), miospores increase in number, although the foral assemblage is still rather impoverished in aspect. The tillite (B20/662) and Bed 3 (B18/662) did not yield any recognisable palynomorphs so far.

The miospores from Beds 2 and 4 (Samples B19/662 & B17/662) constitutes the early Talchir assemblage.

Towards the middle part of the Dudhi River section, typical Talchir Needle shales, showing varying colours of blue, Khaki-green and violet are encountered in association with finely laminated siltstones, thin calcareous bands and occasional coaly streaks.

the Talchir begins with a typical Talchir Boulder Bed—a tillite characterised by ill-assorted polymicts ranging from pebbles to huge boulders set in a greenish-gray clayey to sandy matrix. The bed rests unconformably on the Archaeans. Close to this junction, the following section is exposed (Lele, 1966, p. 87).

1. Talchir Boulder Bed (Sample B20/662)
   Palynological contents from beds 2 and 4 were earlier recorded by me (Lele, 1966) but an error has crept in that record which is corrected here. Actually the assemblage of bed 2 belongs to bed 4 and vice versa.
The terminal part of the Talchir sequence is also interesting. Near the Talchir-Barakar contact, which is apparently some what disturbed, the uppermost Talchir is represented by a thick bed of somewhat calcareous bluish-green siltstone (Sample B9/662). This bed has yielded a fairly rich population of miospores and fragmentary plants which, therefore, represent the late Talchir assemblage. Associated with the siltstone (B9/662) is another boulder bed (second and younger in the Dudhi River sequence). This boulder bed is closely similar to the one found at the Metamorphic boundary but it chiefly differs in the lack of out-sized boulders.

The palynostratigraphic interest of the Dudhi River section lies in the finding of two miospore assemblages—one close to the Talchir-Metamorphic boundary (Early Talchir) and the other near the Talchir-Barakar boundary (Late Talchir).

Method—For the extraction of microfossils the samples were generally treated with HF for 3-6 days. After several washings in water, the fine residues were spread on microslides in polyvenyl alcohol. Finally permanent mounts were made in Canada balsam. Figured slides and holotypes are preserved in the Museum, Birbal Sahni Institute of Palaeobotany, Lucknow (Regd. Nos. 4744-4763).

SYSTEMATIC PALYNOLOGY

The basic scheme of Potonié & Kremp is followed for describing the miospores. However, in the classification of monosaccates, some concepts of Dibner (1973) are found useful.

Anteturma — Sporites H. Potonié, 1893
Turma — Triletes (Reinsch) Potonié & Kremp, 1954
Subturma — Azonotriletes Luber, 1935
Infraturma — Laevigati (Bennie & Kidston) Potonié & Kremp, 1956
Genus — Leiotriletes (Naumova) Potonié & Kremp, 1954

Leiotriletes sp.
Pl. 2, fig. 24

Remarks — Subtriangular spore. Size ± 40 µ. Exine laevigate, 1 µ thick, secondarily folded. Infrastructure obscure.

Trilete rays thin, about 3/4 of spore radius in length.

Occurrence — Very rare; Sample B9/662 (Late Talchir).

Genus — Callumispora Bharadwaj & Srivastava, 1969

Remarks—Recently Bharadwaj and Varma (1974) have emended the diagnosis of Punctatisporites to include only such trilete-bearing forms that are triangular in outline and possess a finely sculptured punctate exine. In their view Leiotriletes is distinguishable by its sculptureless exine and Callumispora Bharadwaj & Srivastava, 1969 by its circular (spherical) shape and structured, laevigate exine. Admittedly, a clear-cut resolution of these genera would seem considerably difficult in practice with the light microscope, especially where fine features like infrapunctation (structure) is to be distinguished from fine punctation (sculpture). The need of combined scanning electron and transmission electron microscopy is imperative in resolving these genera. In the present material, simple unsulptured or finely structured spores are very few and the problem is less serious.

Callumispora gretensis (Balme) Bharadwaj & Srivastava, 1969
Pl. 2, fig. 23

Description—Thick-walled, circular spore. Size ± 80 µ. Rays 3/4 of spore radius in length, simple. Exine 2-5-3 µ thick, infrastructure indistinct. No structural or sculptural differentiation in inter-ray area.

Occurrence — Rare; Sample B9/662 (Late Talchir).

Infraturma — Apiculati (Bennie & Kidston) Potonié & Kremp, 1956
Genus — Cyclogranisporites Potonié & Kremp, 1954

Cyclogranisporites sp.
Pl. 1, figs. 2, 3

Description — Size 20-30 µ, circular to subcircular. Rays distinct, may be asso-
ciliated with lip development, 2/3 of spore radius in length or slightly longer. Exine ± 1 μ thick with minor folds. Comprehensive sculpture of irregular, closely packed granae, ± 1 μ in diameter and nearly as much apart; generally rounded but occasionally mixed with conate to verrucate elements. Sculpture hardly visible along spore margin.

**Occurrence** — Very rare; Sample 17/662 (Early Talchir).

**Genus — Verrucosisporites Ibrahim emend. Smith & Butterworth, 1967**

*Verrucosisporites cf. donarii* Potonie & Kremp, 1955

*Pl. 1, fig. 1*

**Description** — Medium thick-walled, circular spore. Size 50-60 μ. Rays 3/3 of spore radius in length, simple, often obscured by sculpture. Comprehensive sculpture of closely set, ± uniform, hemispherical to conate verrucae, 1-2 μ high and 1-5-3 μ broad; about 50-70 μ elements along spore margin.

**Comparison** — Among the species of comparable size, *V. donarii* approaches closer to the present specimens in respect of ray features, and in the shape size and distribution of verrucae.

**Occurrence** — Rare; Sample 17/662 (Early Talchir).

**Verrucosisporites sp.**

*Pl. 2, fig. 25*

**Description** — Size ± 40 μ; ± circular. Exine 1-1.5 μ thick. Trilete rays 2/3 to 3/4 of spore radius in length, elevated by folds. Comprehensive sculpture of closely packed small irregular verrucae occasionally mixed with basulate or conate elements, sculpture up to 1.5 μ (rarely slightly greater) in width and as high or less. About 50 elements seen along spore margin.

**Remarks** — The specimens differ from *Verrucosisporites cf. donarii* in their smaller size and in the finer grade and ± irregular shape of the ornament.

**Occurrence** — Very rare; Sample B9/662 (Late Talchir).

**Genus — Apiculatisporis Potonie & Kremp, 1956**

*Apiculatisporis* sp.

*Pl. 1, fig. 4*

**Description** — Medium thick-walled, circular to subcircular spore. Size 41-73 μ. Rays simple, 3/4 of spore radius in length. Exine 1.5-2 μ thick, secondary folds uncommon, covered with sparse conate to verrucate discrete elements, up to 3 μ broad and as high or higher, hardly visible at spore margin.

**Remarks** — The sculpture is not well-preserved due probably to erosion of exine.

**Occurrence** — Very rare; Sample B17/662 (Early Talchir).

**Genus — Jayantisporites Lele & Makada, 1971**

*Jayantisporites cf. conatus* Lele & Makada, 1971

*Pl. 2, fig. 26*

**Description** — Roundly triangular spore. Size 50 μ. Triangular inner body developed, size 30 μ. Pseudozonate structure almost continuous, appearing as a ±5 μ wide border. Distal sculpture of discrete or partially fused broad-based conate elements, 2-5 μ broad and up to 5 μ high, occasionally with short setose tips (up to ±5 μ long); sculpture well projected at spore margin.

**Remarks** — The ornament is like *J. conatus* in shape. Enough specimens are, however, not available to confirm the strong fusion tendency in the elements which is characteristic of the species.

**Occurrence** — Very rare; Sample B9/662 (Late Talchir).

**Genus — Plicatipollenites Lele, 1964**

*Plicatipollenites indicus* Lele, 1964

*Pl. 2, fig. 32*

**Remarks** — Generally the saccus width is less than 1/2 body radius but there are
few exceptions which are included in the species.

**Occurrence** — Rare and ill-preserved; Sample B17/662 (Early Talchir).
Frequent; Sample B9/662 (Late Talchir); Pl. 2, fig. 32.

**Plicatipollenites trigonalis** Lele, 1964
Pl. 2, fig. 28

**Occurrence** — Common; Sample B9/662 (Late Talchir).

**Plicatipollenites densus** Srivastava, 1970
Pl. 2, fig. 30

**Occurrence** — Common; Sample B9/662 (Late Talchir).

**Plicatipollenites gondwanensis** (Balme & Hennelly) Lele, 1964
Pl. 1, fig. 5; Pl. 2, fig. 31

**Remarks** — Figured specimen from the early Talchir sample (Pl. 1, fig. 5) is ill-preserved but shows the characteristic angular body-infolds. Figured specimen from the late Talchir appears slightly oval due to compression.

**Occurrence** — Common; Sample B17/662 (Early Talchir), Pl. 1, fig. 5.
Rare; Sample B9/662 (Late Talchir); Pl. 1, fig. 31.

**Plicatipollenites maculatus** Lele & Karim, 1971
Pl. 2, fig. 29

**Remarks** — Size 150×137. Body size subcircular, 105×95 μ, infold-system irregular. Saccus roots deep distally; double reticulum not evident.

**Occurrence** — Rare; Sample B9/662 (Late Talchir).

**Genus — Virkhipollenites** Lele, 1964

**Remarks** — Some workers have regarded Virkhipollenites as a junior synonym of Cannanoropollis Potonié & Sah, 1961, while others have included both taxa under Cordaitina (see review by Lele, 1974). There is reason to believe that Cannanoropollis was created on reworked or contaminated grains of Virkhipollenites or Parasaccites type in the Tertiary lignites of Conmanore. Recent studies carried out on kannanore lignite (Personal communication — Dr. C. G. K. Ramanujam) do not confirm the presence of Cannanoropollis. In view of this, it seems most appropriate to drop the use of Cannanoropollis in preference to the well-established genus Virkhipollenites. Monosaccate grains of Virkhipollenites seem to occur as reworked fossils in post-palaeozoic deposits of south India at other localities also, e.g. Mesozoic strata of Cauvery Basin (Venkatachala & Sharma, 1975). It is possible to identify such grains and place them in other known taxa instead of making them a basis for instituting new names which may create stratigraphic contradictions.

**Virkhipollenites mehtae** Lele, 1964
Pl. 2, fig. 33

**Occurrence** — Rare; Sample B9/662 (Late Talchir).

**Virkhipollenites triangularis** (Mehta)
Lele, 1964
Pl. 2, fig. 34

**Occurrence** — Rare; Sample B9/662 (Late Talchir).

**Virkhipollenites sp.**
Pl. 1, fig. 6

**Description** — Oval miospore. Size 148×104 μ. Body apparently ± dark, oval; size 133×98 μ. Exine 2 μ thick, with ± peripheral compression folds. Tetrad mark not seen. Saccus conspicuously narrow, about 10-12 μ wide all around body, saccus roots obscure; intra-reticulum fine. Saccus surface ± unfrilled.

**Remarks** — Known species of Virkhipollenites (Lele, 1974) lack a thick and large oval body. There is some apparent resemblance with Parasaccites but para-condition of saccus attachment is not demonstrable in the grain.

**Occurrence** — Very rare; Sample B17/662 (Early Talchir).
Genus — *Potonieisporites* Bharadwaj, 1954

emend. 1964

*Potonieisporites neglectus* Potonié & Lele, 1964

Pl. 1, fig. 10

Occurrence — Rare; Sample B17/662 (Early Talchir). Pl. 1, fig. 10. Common; Sample B9/662 (Late Talchir).

*Potonieisporites crassus* Lele & Chandra, 1973

Pl. 1, fig. 9; Pl. 2, fig. 37

Remarks — The early Talchir specimens are larger than the Late Talchir ones.

Occurrence — Rare; Sample B17/662 (Early Talchir). Pl. 1, fig. 9. Rare; Sample B9/662 (Late Talchir). Pl. 2, fig. 37.

*Potonieisporites lelei* Maheshwari, 1967

Pl. 2, fig. 36

Occurrence — Rare; Sample B9/662 (Late Talchir).

*Potonieisporites mutabilis* Lele & Chandra, 1973

Pl. 1, fig. 8

Occurrence — Rare; Sample B17/662 (Early Talchir). Pl. 1, fig. 8. Rare; Sample B9/662 (Late Talchir).

*Potonieisporites magnus* Lele & Karim, 1971

Pl. 1, fig. 7; Pl. 2, fig. 35

Occurrence — Rare; Sample B17/662 (Early Talchir). Pl. 1, fig. 7. Rare; Sample B9/662 (Late Talchir).

*Potonieisporites monosaccoides* (Bose & Maheshwari, 1968) comb. nov.

Pl 1, fig. 11

Remarks — From the descriptions and figures of this species (Bose & Maheshwari, 1968), the grains show a definite basic mono-saccate construction. Therefore, they can be better allocated under *Potonieisporites* rather than *Limitisporites* which is distinctly disaccate. In this species there may be a couple of vertical crescentic body infolds which seem to show a tendency to close up towards their lateral ends. Such features of transition are common in *Potonieisporites*

The figured specimen from W. Bokaro Coalfield is clearly haploxylonoid and shows a single continuous, laterally narrow saccus as in *Potonieisporites monosaccoides*. Monolete mark is not clear in the specimen. The body is circular to subcircular in outline in the present examples as well as in the original figures of the species.

Occurrence — Rare; Sample B17/662 (Early Talchir). Pl. 1, fig. 7. Rare; Sample B9/662 (Late Talchir).

Infraturma — *Parasaccini* Dibner, 1971

Remarks — The infraturma *Clauiscorpini* Dibner, 1971 is considered synonymous with *Parasaccini* as the differences are chiefly quantitative in nature.

*Parasaccites densicorpus* sp. nov.

Pl. 1, figs. 13, 14; Pl. 3, figs. 42-47

1964 — *Virkhinopollenites densus* Lele, Pl. 2, figs. 20. Rephotographed here in Pl. 3, fig. 46.

1968 — *Parasaccites* sp. A., Maheshwari; Pl. 43; Pl. 8, fig. 6.

Holotype — Pl. 3, fig. 42.

Type locality — West Bokaro Coalfield, Bihar; Dudi River Section. Sample B9/662 (Late Talchir).

Age & Horizon — Talchir Formation (Perm-Carboniferous), Lower, Gondwana.

Diagnosis — Circular-oval or roundly triangular miospore. Size 50-100 μ. Central body intramicropunctate to intramicroreticulate, 1.5-2 μ thick, outline distinct and smooth. Shape circular to roundly triangular, generally conforming with overall outline. Size 45-60 μ. Tetrad mark simple, weak to ± clear, rays 1/3 to 2/3 of body radius in length, with a tendency to become bilate or rarely monolete. Saccus width about 1/2 of body radius or more, prominently frilled by radial pleats arising from saccus roots, especially distally. Distal saccus overlap deep (about 2/3-1/3 of body radius), ± clear, roots ± fimbriate and may be associated with partial exine folds or thickening (compressional); proximal saccus overlap narrow and relatively indistinct.
Remarks — The body and the saccus both show a variation in shape from roundly triangular to circular or slightly oval. Usually the outline of the body follows the saccus outline but exceptionally some examples may have a triangular body but a round saccus or vice versa. Thus, there are at least four body/saccus shape variants (Text-fig. 2) of possibly intra-specific nature. Biometric analysis reveals that (i) spores with conformable body/saccus outline are in majority (90%). Among these the circular outline predominates (62%) and the triangular shape follows next (28%). (ii) spores with disconformable body/saccus outline (Text-fig. 2-C, D) are strikingly minor in proportion, probably of transitional character (10%). The general impression gained from the study is that the variation in the shape of the body may be due to its somewhat anisopolar construction.

Observations on the heteromorphism of the tetrad mark suggest that a trilete suture is more linked with a triangular body whereas the shift towards monolete finds favour with a circular to oval body (Pl. 3, fig. 44). Similar heteromorphism is well known in other monosaccate genera like *Plicatipollenites* (e.g. *P. indicus* Lele, 1964) and *Potonieisporites* (*P. neglectus* Potonié & Lele, 1961). The shift in tetrad symmetry appears to be related to a corresponding shift in the tetrad symmetry (Lele, 1974). The states of preservation of the grains appear to give rise to a variety of artifacts and were it not for the abundant material available for study, some more species or even genera could be mistaken. For instance, a considerable number of specimens in the preparation are very probably immature grains which is borne out by their underdeveloped saccus size and structure (Pl. 3, fig. 47). Such specimens tend to resemble *Pachysaccus* Lele & Maithy, 1969. The central body tends to get partly or wholly detached from the saccus and such bodies with tetrad mark may appear like simple trilete or monolete spores. Saccus frills, features of saccus root and the general infrastructure is found to be variously obliterated or nearly lost by preservation factors (Pl. 3, figs. 43, 45). Specimen in Pl. 1, fig. 14 is probably an extreme case where the whole appearance of the grain has been smoothened out causing loss of some important generic details. In Pl. 1, fig. 13, although the preservation is relatively better, an artifact is evident in the window-like oval gap of the polar body exine. The outline of the window is fairly regular, being situated close to the saccus root, but still the artifact is likely to give wrong impression.

Comparison — *Virkkipollenites densus* Lele, 1964 is superficially very similar to *Parasaccites densicorpus* sp. nov. Re-examination of the type material reveals that the specimen in Pl. 2, fig. 10 (Lele, 1964 and rephotographed here in Pl. 3, fig. 46) does show a para-condition of saccus attachment identical with that of *Parasaccites densicorpus* sp. nov. besides other similarities in body exine thickness saccus frills and in the extent and nature of saccus overlap on the two sides of body. The holotype of *Virkkipollenites densus* Lele (1964, Pl. 2, fig. 19), however, fails to demonstrate a para-condition with any degree of certainty and the saccus lacks prominent frills, though the muri are radially disposed. In view of this situation, *Virkkipollenites densus* is provisionally retained but the specimen in

**Text-fig. 2** — Four types of body/saccus shape variants of *Parasaccites densicorpus* sp. nov. and their relative proportion.
Pl. 2, fig. 20 of Lele (1964) is reallocated under Parasaccites densicorpus sp. nov.

Parasaccites talchirensis Lele & Makada, 1971 differs in the possession of a distinct trilete mark which is practically without any heteromorphism. Other important differences are that the body outline of P. talchirensis is visibly broken and ± flared in appearance where as it is quite smooth and continuous in P. densicorpus sp. nov.

**Occurrence** — Rare; Sample B17/66? (Early Talchir), Pl. 1, figs. 13, 14. Frequent; Sample B9/662 (Late Talchir). Pl. 3, figs. 42-45 & 47.

*Parasaccites bilaterialis* Tiwari, 1965

**Occurrence** — Rare; Sample B9/662 (Late Talchir).

*Parasaccites fimbriatus* Maheshwari, 1969

Pl. 2, fig. 38

**Remarks** — Miospores are characterised by a ± indistinct body, weak trilete mark and conspicuously frilled broad saccus, showing fimbriate roots.

**Occurrence** — Common; Sample B9/662 (Late Talchir).

*Parasaccites diffusus* Tiwari, 1965

Pl. 1, fig. 12; Pl. 2, fig. 39

**Occurrence** — Very rare; Samples B17/662, B19/662 (Early Talchir), Pl. 1, fig. 12. Frequent; Sample B9/662 (Late Talchir), Pl. 2, fig. 39.

**Genus — Tuberisaccites** Lele & Makada, 1972

*Tuberisaccites tuberculatus* (Maheshwari) Lele & Makada, 1972

Pl. 2, fig. 40

**Remarks** — Three small, rounded to hemispherical, partly hollow protuberances are seen in the contact area. Each protuberance appears to lie in inter-radial position of what may be rays of a possible trilete mark. The saccus shows para-condition of attachment and radial frills.

**Occurrence** — Very rare; Sample B9/662 (Late Talchir).

**Genus — Caheniasaccites** Bose & Kar, 1966

*Caheniasaccites densus* Lele & Karim, 1971

Pl. 2, fig. 41

**Remarks** — Para-condition of saccus attachment is discernible by L. O. analysis. The thick body shows a 2-3-5 wide rim at the margin. The grains are somewhat larger than recorded from the type material.

**Occurrence** — Rare; Sample B9/662 (Late Talchir).

**InfraTurma — Disaccimonoleti** Leschik, 1956

**Genus — Limitisporites** Leschik, 1956

*Limitisporites diversus* Lele & Karim, 1971

Pl. 3, fig. 49

**Description** — Overall size range 70-87 μ (length) × 85-55 μ (breadth). Body size range 37-44 × 44-55 μ. Outline of the body varies from subhexagonal to subcircular or vertically oval. Sacci roots widely separated. Monolete mark not always clear.

**Occurrence** — Rare; Sample B9/662 (Late Talchir).

*Limitisporites (Sahnites) thomasi* (Pant) comb. nov.

Pl. 3, fig. 48

1955 — *Sahnites thomasi* Pant. p. 760, pl. 19, figs. 1, 7, 6, 7.

**Description** — Haploxyl'netic, disaccate miospore. Size 82 × 73 μ. Body characteristically ellipsoid-rhomboid, size 42 × 72 μ; infrastructure fine, indeterminate. Proximal monolete mark long, ± irregular. Distal body infolds along sacci roots crescentic, circumscribing a fusiform sulcoid germinal area. Sacci hemispherical or less, overlap equal or less than off-lap, intrareticulation fine to medium-sized.

**Remarks** — The figured specimen is close to the holotype of the species. In view of the clearly disaccate construction, the species is better reallocated under *Limitisporites*.

*Sahnites* Pant was probably meant for monolete-bearing bilateral monosaccates, showing para-condition of attachment, the sacci-roots being distally associated with a body infold system (Bharadwaj & Tiwari, 1965).

**Genus — Cahniasaccites** Bose & Kar, 1966
1964). If this concept is true, the genotype Sahnites gondwanensis (Mehta) Pant would seem to fall within the circumscription of Gondwanopolis Lele & Maithy, 1969 which occurs in the same locality (Ganjra Nala, South Rewa Basin). Since the geoholotype of Sahnites is lost, it is now preferable to use Gondwanopolis instead.

**Occurrence** — Very rare; Sample B9/662 (Late Talchir).

**Subturma — Disaccites** Cookson, 1947

**Infraurma — Disacciatrileti** (Leischik)

Potion 1958

Genus — *Pityosporites* (Seward) Manum, 1960

*Pityosporites* sp. nov.

**Pl. 1, fig. 15**

**Description** — Diploxylonoid miospore. Size 72 × 50 μ. Body obscure, probably circular, about 40 μ; striations or other features on the proximal side apparently absent. Sacci more than hemispherical, one of them appears to be pinched into a neck-like structure near root. Germinal area ± straight, narrow.

**Occurrence** — Very rare; Sample B17/662 (Early Talchir).

*Faunipollenites* cf. *parvus* Tiwari, 1965

**Pl. 3, fig. 50**

**Description** — Size 82 × 58 μ. Body broadly elliptical, ± indistinct; size 54 × 44 μ. Striations 6-7, mostly simple. Germinal area narrow, tending to widen towards one of the lateral sides.

**Remarks** — *Faunipollenites varius* Bharadwaj, 1962 has a comparable size but differs in its wide germinal area. *Faunipollenites parvus* Tiwari, 1965 is somewhat smaller (53-70 μ × 33-51 μ) but agrees in the more important character of the germinal area.

**Occurrence** — Very rare; Sample B9/662. (Late Talchir).

**Genus — Crescentipollenites** Tiwari & Kar, 1975

*Crescentipollenites talchirensis* sp. nov.

**Pl. 3, figs. 51-53**

**Holotype** — Pl. 3, fig. 51.

**Type Locality** — West Bokaro Coalfield, Bihar; Dudhi River Section. Sample B9/662 (Late Talchir).

**Age & Horizon** — Talchir Formation (Permo-Carboniferous), Lower Gondwana.

**Diagnosis** — Haploxylonoid miospore. Size 65-88 × 42-72 μ. Central body broadly elliptical, occasionally slightly denser, intramicroreticulate, proximally bearing 6-8, simple to rarely branched striations. Sacci hemispherical, overlap nearly equal to or smaller than off-lap, distal roots ± straight to slightly convex, associated with distinct body infolds. Sulcus nearly half of body width or narrower (5-10 μ wide).

**Comparison** — *Crescentipollenites* (Leischiksporites) *limpidus* (Balme & Hennelly, 1955) comb. nov. has thinner body and indistinct striations. *Crescentipollenites* *brevis* (Bose & Kar) Bharadwaj et al., 1975 is smaller (50-54 × 42-54 μ), has a more fusiform body, distinctly biconvex sulcus and fewer and more obscure striations. *Crescentipollenites* *globosus* (Maithy, 1965) comb. novo is much larger (120-136 μ).

**Occurrence** — Rare; Sample B9/662 (Late Talchir).

**Genus — Striatoparvisaccites** gen. novo.

**Type species** — *Striatoparvisaccites indicus* sp. novo.

**Diagnosis** — Under-diploxylonoid, disaccate, striate miospore; characterised by a large, infrastructured, distinct central body and relatively dwarfed sacci. Proximal striation so body sample or branched, generally without vertical partitions. Distal germinal area ill-defined and unspecialised, variably wide.

**Discussion** — In disaccate miospores, a diploxylonoid condition can result in two important manners: (1) where the sacci are wider than the body. This condition (Text-fig. 3A), here called ‘over-diploxylonoid’, is prevalent in disaccates and (2) where the body is wider than the sacci. This condition (Text-fig. 3B), here called ‘under-diploxylonoid’, is comparatively less widely known in fossil miospores. The nonstriate Permo-Triassic genus *Aliospollenites* Thiergart demonstrates this condition very characteristically (see Hart, 1965, p. 69). In the extant pollen of *Alios* the sacci are typically smaller than the body and are distinctly placed on the distal (ventral) side.

In the first kind of saccl/body relationship (over-diploxylonoid) the sacci are, generally attached along the full width (vertical extent...
TEXT-Fig. 3 — Two distinct modes of diploxylo-noid condition A-Over-diploxylonoid and B-Under-diploxylonoid.

in polar view) of the body on the distal side and the corresponding germinal area or sulcus is also generally coextensive. However, in the second kind of sacchi/body relationship (under-diploxylonoid) where the distal roots of the sacchi are essentially shorter than body width, there need not exist any correlation between the extent (width) of the sacchi roots and the germinal area (if present).

The two categories are thus distinct from organizational and evolutionary points of view and can be recognised at least at the level of the genus, if not higher.

The above considerations have necessitated the institution of the new taxon Striatoparvisaccites which clearly demonstrates the contrast between the stubby sacchi and the large body, exemplifying an 'under-diploxylonoid' condition. There are other differences relating to the germinal area which distinguish these miospores from other striated disaccates, including Striatites (Pant) Bharadwaj. It is notable, for instance, that Striatoparvisaccites shows no recognisable sulcus; the germinal area is ill-defined and unspecialised (like a leptoma). On the contrary, several Lower Gondwana striate disaccates, including Striatites, have a well-defined sulcoid, germinal area.

The distal sacchi roots in Striatoparvisaccites are not far removed from the body equator which suggests that the sacchi have a small distal inclination. Sometimes the small sacchi almost over-ride the large body during compression. Occasionally the sacchi tend to be partly or wholly detached from the body — the latter appearing somewhat like a polyplicate grain.

Comparison — Two genera, viz., Protodiploxypinus and Protocedrus, instituted by Samoilovich (1961) from the Russian Permian are closely similar to Striatoparvisaccites gen. nov. in having typically under-diploxylonoid contour. However, these genera are essentially distinct as they apparently possess on the body a proximal cap-like thickening ('crest' sensu Samoilovich, e.g. pl. 7, figs. 1a & 2) which is differentiated into ribs of taeniate appearance (e.g. Samoilovich, pl. 7, fig. 1c). In both taxa the body is granular (or 'ribbed-granular' sensu Samoilovich) and in Protocedrus, the sculpture may be absent on the distal side of the body. As opposed to these features the body of Striatoparvisaccites is evenly smooth all over and is finely infrastructured. It is also apparent that Protodiploxypinus and Protocedrus have more ventrally (distally) placed sacchi on the body than in Striatoparvisaccites. Lastly, Protodiploxypinus has a much greater size range (36-172 μ). In view of these differences, the present miospores are placed under a new generic name.

Striatoparvisaccites indicus sp. nov.
Pl. 3, figs. 54, 55; Text-fig. 4

Holotype — Pl. 3, fig. 54.
Type Locality — West Bokaro Coalfield, Bihar; Dudhi River Section. Sample B9/662 (Late Talchir).
Age & Horizon — Talchir Formation (Permo-Carboniferous); Lower Gondwana.
Diagnosis — Under-diploxylonoid miospores. Size 55-70×35-40 μ. Central body horizontally oval, indistinctly intrapunctate to intramicroreticulate, 2-2.5 μ thick, dense, with occasional compression folds. Size 45-50×34-40 μ. Proximal striations 8-10, distinct, simple or occasionally branched,
without vertical partitions. Sacci subhe- 
nospherical or smaller, distinctly dwarfed 
and thinner in contrast to body, width of 
sacci 24-30 μ (about 1/2-2/3 of body width); 
proximal attachment along the body equator, 
distal roots not very deep. Germinal area 
(leptoma), ill-defined, ± 
broad. Saccus 
intra reticulation fine.

Remarks — The grains are easily distin-
guishable by their characteristically large 
oval, dense body and rather stubby sacci. 
The distal sacci roots are not accompanied 
by any clear body-infold system. A sulcus 
is not developed in these grains; the ger-
minal area is more like an ill-defined, ± 
broad leptoma. The body appears extern-
ally smooth but may indistinctly show a 
fine infrastructure of microreticulum or 
micropuncta. Minor exinal folds of irre-
gular orientation may develop on the body 
by compression. In some cases, the sacci 
have apparently been detached, party or 
wholly, from the body (Pl. 3, fig. 55).

Comparison — Striatoparvisaccites (Leucki-
sportes) multistriatus (Balme & Hennelly, 
1955) comb. nov. (Lectoholotype Pl. 2, fig. 
16 as selected by Tiwari, 1965 p. 192) is 
distinguishable by its ± circular (subhe-
xagonal) and relatively thinner body and 
a larger number of striations (13-17). This 
pecies was earlier allocated under Striatites 
by Tiwari (1965). However, the charac-
teristic under-diploxylonoid contour of the 
grains and the ill-defined germinal area of 
this species make its transfer possible under 
Striatoparvisaccites. Some specimens in the 
original photographs of Balme and Hennelly 
(1955) possess an oval body, which conforms 
more with the description of the original 
authors rather than with the lectoholotype.

In both forms, with oval or circular body, 
the number of striations is, however, uni-
formly larger than in Striatoparvisaccites 
indicus sp. nov.

Occurrence — Rare; Sample B9/662 (Late 
Talchir).

Striatoparvisaccites circularis 
sp. nov.

Pl. 3, figs. 56, 57

Holotype — Pl. 3, fig. 56.

Type Locality — West Bokaro Coalfield, 
Bihar, Dudhi River Section. Sample B9/ 
662 (Late Talchir).

Age & Horizon — Talchir Formation 
(Permo-Carboniferous), Lower Gondwana.

Diagnosis — Under-diploxylonoid mios-
pores. Size 80-100 μ x 50-62 μ. Body large, 
circular to subhexagonal or subcircular, 
± 50-60 μ in diameter, distinct, occasionally 
slightly dense. Exine about 1-5-2 μ thick 
with occasional compression folds; intra-
microreticulate. Proximal striations simple, 
6-8 not consistently clear. Sacci hemisph-
erical or less, distal overlap usually smaller 
than off-lap. Germinal area ill-defined, 
broad (22-28 μ). Minor compression folds 
present on body.

Comparison — This species is distinguish-
able from the type species (S. indicus sp. 
nov.) by the circular to subhexagonal (radial) 
configuration of the body and its somewhat 
larger size. Occasionally the body is de-
tached from the sacci and bears scars of 
sacci roots (Pl. 3, fig. 57). As expressed 
earlier, Striatoparvisaccites multistriatus 
(Balme & Hennelly) comb. nov. has a 
thinner body and a conspicuously larger 
number of striations.

Occurrence — Rare; Sample B9/662 (Late 
Talchir).

Trisaccate miospore

Pl. 3, fig. 58

Description — Outline subtriangular, size 
± 117 μ (average). Body ± 64 μ, subtri-
gular, dense, intramicroreticulate. No tetrad 
mark or striations seen. Sacci three, one of 
them smaller than others (52×75 μ); attach-
ment apparently on both sides of body 
subequatorially, roots on one side associated 
with triangular body-infold system.

Remarks — Crustaceouspora Leschik is 
trisaccate but has striations on body. The 
solitary specimen represents a distinct form
but it remains uncertain if it was a normal grain.

Occurrence — Very rare; Sample B9/662 (Late Talchir).

Group — Acritarcha Evitt, 1933
Subgroup — Sphaeromorphitae Downie & Sargeant, 1963
Genus — Leiosphaeridia (Eis). Downie & Sargeant, 1963

Leiosphaeridia bokaroensis sp. nov.

Holotype — Pl. 1, fig. 18.
Type Locality — West Bokaro Coalfield, Bihar; Dudhi River section. Sample B17/662 (Early Talchir)
Age & Horizon — Talchir Formation (Permo-Carboniferous), Lower Gondwana.
Diagnosis — Vesicles originally spherical, shape variously modified by compression. Size range 50-100 μ (diameter). Wall ±2 μ thick, laevigate to indistinctly infrastructure (infrapunctate?), strongly folded; folds irregular, prominent. Pilome absent.
Comparison — Leiosphaeridia sp. described by Maithy (1969) from the Vindhyan is comparable in wall compression folds but the forms are described to have a densely punctate wall which is not seen in the present species. Leiosphaeridia indica Lele & Chandra (1972) compares in size but distinguishes by its thinner wall and lack of prominent folds.
Occurrence — Frequent; Sample B-17/662 (Early Talchir), Pl. 1, figs. 16-18. Rare; Sample B9/662 (Late Talchir), Pl. 3, fig. 60.

Leiosphaeridia talchirensis Lele & Karim, 1971

Pl. fig. 22; Pl. 3, fig. 59

Remarks — This species is characterised by small-sized moderately thin vesicles with strongly folded wall.
Occurrence — Common; Sample B17/662 (Early Talchir), Pl. 1, fig. 22. Rare; Sample B9/662 (Late Talchir), Pl. 3, fig. 59.

Some tracheids (Pl. 1, fig. 21) showing pits are present in the early Talchir samples (B19/662 & B17/662). They also occur in the late Talchir sample (B9/662) but in addition, there are a few fragments of leaf cuticles (Pl. 2, fig. 27) with well-preserved epidermal cells but no stomata.

Leiosphaeridia talchirensis Lele & Karim, 1971

Pl. 1, fig. 22; Pl. 3, fig. 59

Remarks — This species is characterised by small-sized moderately thin vesicles with strongly folded wall.
Occurrence — Common; Sample B17/662 (Early Talchir), Pl. 1, fig. 22. Rare; Sample B9/662 (Late Talchir), Pl. 3, fig. 59.

DISCUSSION

Miofloral Composition — In general composition the miofloras of the Dudhi River section are characterized by a striking dominance of monosaccate miospores. Triletes (Pteridophytic) and disaccates are in contrasting minority.

From comparative standpoint the miofloral aspect of the early Talchir samples (B19/662 & B17/662) is significantly different.
from that of the late Talchir sample (B9/662). The differences are not only quantita
tive but obviously of qualitative nature as well.

In the early Talchir sample, the miospore assemblage is markedly poor, being re­stricted to 8 genera and 14 species (Tables 1 & 2). The population does not permit a reliable percentage assessment of the distribution pattern of these taxa. Miospores commonly seen belong to *Verrucosisporites* (1 sp.), *Parasaccites* (2 spp.), and *Potonieis­porites* (5 spp.). *Plicatipollenites* (2 spp.) and *Virkkipollenites* (1 sp.) stand next. Only one example of *Pityosporites* is found, but striate disaccates are strikingly missing. Equally noteworthy is the common asso­ciation of *Leiosphaeridia* and in one sample of spicule-like microfossils.

In sharp contrast to the above, the late Talchir miosflora is not only quantitatively rich but is also substantially diversified in genera and species. A total of 15 genera and 29 species is recognisable (Tables 1 & 2). Of these 10 genera are represented in the frequency counts based on 200 specimens. The rare, unaccounted genera are *Leiotri­letes*, *Verrucosisporites*, *Jayantisporites* and *Tuberisaccites*. As is clear from Table 2 and Histogram 1A & B, the monosaccates

| TABLE I — OCCURRENCE (+) AND PERCENTAGE DISTRIBUTION OF PALYNOMORPHS IN THE EARLY AND LATE TALCHIR SAMPLES, WEST BOKARO COALFIELD |
|----------------------------------------------------------|-----------------|-----------------|
| Palynomorphs                                             | Early Talchir   | Late Talchir    |
|                                                          | B17/662         | B19/662         |
|                                                          |                 | B9/662          |
| 1. Callumispora gretensis                                | +               | 1·0             |
| 2. Plicatipollenites indicus                             | +               | 23·0            |
| 3. P. densus                                              | +               | 3·0             |
| 4. P. gondwanensis                                       | 3·0             |
| 5. P. trigonalis                                          | +               | 4·5             |
| 6. P. maculatus                                          | +               | 2·0             |
| 7. Virkkipollenites triangularis                         | +               | 0·5             |
| 8. V. mehta                                              | 1·5             |
| 9. Potonieisporites neglectus                            | +               | 4·0             |
| 10. P. magnus                                            | +               | 1·0             |
| 11. P. monosaccoides                                     | +               | 1·0             |
| 12. P. lelei                                             | +               | 1·0             |
| 13. P. crassus                                           | +               | 0·5             |
| 14. P. mutabilis                                         | +               | 0·5             |
| 15. Parasaccites diffusus                                | +               | 20·0            |
| 16. P. densiscorpus                                      | +               | 25·0            |
| 17. P. jimbratus                                         | +               | 4·5             |
| 18. P. bilateralis                                       | +               | 0·5             |
| 19. Caheniasaccites densus                               | +               | 1·5             |
| 20. Limitisporites diversus                              | +               | 1·0             |
| 21. Faunipollenites cf. parvus                           | +               | 0·5             |
| 22. Crescantisporites talchirensis                        | +               | 0·5             |
| 23. Striatoparasaccites indicus                           | +               | 0·5             |
| 24. S. circularis                                        | +               | 0·5             |
| 25. Leiotrites sp.                                       | +               | 0·5             |
| 26. Verrucosisporites sp.                                | +               | 0·5             |
| 27. Jayantisporites cf. conatus                          | +               | 0·5             |
| 28. Tuberaisaccites tuberculatus                         | +               | 0·5             |
| 29. Limitisporites thomasi                               | +               | 0·5             |
| 30. Cuticles                                             | +               | 0·5             |
| 31. Cyclogranisporites sp.                               | +               | 0·5             |
| 32. Verrucosisporites cf. donarii                         | +               | 0·5             |
| 33. Apiculatisporis sp.                                  | +               | 0·5             |
| 34. Virkkipollenites sp.                                 | +               | 0·5             |
| 35. Pityosporites sp.                                    | +               | 0·5             |
| 36. Spicule-like bodies                                  | +               | 0·5             |
| 37. Leiosphaeridia bokaronei                             | +               | 0·5             |
| 38. L. talchirensis                                      | +               | 0·5             |
| 39. Tracheids                                            | +               | 0·5             |
TABLE 2 — OCCURRENCE (+) AND PERCENTAGE DISTRIBUTION OF MIOSPORE GENERA AND MAJOR GROUPS IN THE EARLY AND LATE TALCHIR SAMPLES, WEST BOKARO COALFIELD

<table>
<thead>
<tr>
<th>Early Talchir</th>
<th>Genera</th>
<th>Late Talchir</th>
<th>Major Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>B17/662, B19/662</td>
<td></td>
<td>B9/662</td>
<td></td>
</tr>
<tr>
<td>1. Callunispora</td>
<td>+</td>
<td>1.0</td>
<td>Triletes</td>
</tr>
<tr>
<td>2. Parasaccites</td>
<td>+</td>
<td>50.0</td>
<td>Monosaccates</td>
</tr>
<tr>
<td>3. Plicatipollenites</td>
<td>+</td>
<td>33.0</td>
<td></td>
</tr>
<tr>
<td>4. Potoniesporites</td>
<td>+</td>
<td>8.0</td>
<td>Disaccates</td>
</tr>
<tr>
<td>5. Virkipollenites</td>
<td>+</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>6. Caheniasaccites</td>
<td>+</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>7. Limitisporites</td>
<td>+</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>8. Faunipollenites</td>
<td>+</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>9. Crescentipollenites</td>
<td>+</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>10. Striatoparvisaccites</td>
<td>+</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>11. Leiotriletes</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Jayantisporites</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>13. Tuberasaccites</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>14. Cyclogranisporites</td>
<td>+</td>
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<tr>
<td>15. Apiculatisporis</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Pityosporites</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Verrucosisporites</td>
<td>+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

are the predominant constituents whereas the disaccates and triletes are very rare, though significant by their presence. Among the monosaccates, Parasaccites (50%), Plicatipollenites (33%) and Potoniesporites (8%) make the major contribution. Several species of these genera are unknown in the early Talchir sample, viz., Plicatipollenites densus, P. maculatus, Potoniesporites lelei, Parasaccites fimbriatus and P. bilateralis. A number of genera also make their first appearance in the late Talchir sample, viz., Jayantisporites, Caheniasaccites, Tuberasaccites, and Limitisporites. Above all, the disaccate Striatitii is for the first time recognisable in the late Talchir by the genera Faunipollenites, Crescentipollenites and Striatoparvisaccites gen. nov. Leiosphaeridia become very rare and spicule-like microfossils are not encountered.

Comparisons — Mioflorules representing earlier part of the Talchir are known from very few places, e.g. in the Manendragarh Coalfield (Lele & Chandra, 1972). This assemblage, containing only 7 genera, also gives the impression of a more or less impoverished flora similar to the early Talchir assemblage from West Bokaro Coalfield (Sample B19/662, B17/662). Both are essentially monosaccate-dominant (+ 96%) miofloras characterised by a very limited number of species belonging chiefly to Parasaccites, Plicatipollenites and Potoniesporites. Very low amount of Caheniasaccites (2%) and Faunipollenites (1%) is also present in the Manendragarh assemblage but these genera are not found in the early Talchir of West Bokaro. On the whole, the nonstriate and striate disaccates appear to be inconsistent or absent in the earlier Talchir sediments. Trilete spores are very sporadic.

The late Talchir mioflora is so far best known from the South Rewa Basin (Potonié & Lele 1961; Lele, 1966) in the Jhilla River section where it occurs close to the Barakar (or Karharbari) boundary — a situation closely paralleling that of the West Bokaro Coalfield. Perhaps, the Talchir assemblage from Mangthar in the same area (Lele & Chandra, 1973) may also be fairly younger than the early Talchir in view of the fact that the samples lie almost at the Barakar junction rather than the Archaean boundary. Another good mioflora of late Talchir appearance is known from the Javanti Coalfield (Lele & Karim, 1971; Lele & Makada, 1972). These floras of more or less later Talchir age, despite their differences in stratigraphic levels and local floristic peculiarities, are by and large of the same kind as the late Talchir assemblage now found in the West Bokaro Coalfield (Sample B9/662). Clearly all of them show a definite and substantial improvement by way of proliferation and diversification in the population. Parasaccites, Plicatipollenites and Potoniesporites continue to maintain their
stronghold, but additionally several genera and species and more especially the striate disaccates seem to make a recognizable appearance in the late Talchir and become stable constituents of the mioplora. This is also borne out by the evidence from the West Bokaro Coalfield.

**BIOSTRATIGRAPHIC CONSIDERATIONS**

An important point that emerges from the above discussion is that there seem to exist recognizable differences of qualitative and quantitative nature between the mioploras of the early and late Talchir. These differences have an obvious correlation with the changing pattern of climate in the Talchir Stage-commencing with adverse cold but subsequently ameliorating to a cool, temperate condition towards the late Talchir. Plant life was conceivably more restricted in the early Talchir with limited manifestations, but after a considerable lapse of time, in the later part of
the Talchir a number of new elements appeared on the scene and proliferated rather rapidly. It would not, therefore, be surprising to expect distinct differences between the early and late Talchir floras. It seems now highly probable, especially in the light of the evidence from the West Bokaro Coalfield, that there could be two palaeofloral assemblages — and not one as hitherto believed — in the Talchir Formation: one occurring in the early Talchir and the other in the late Talchir. Precise biostatigraphical circumscription of these assemblages, based both on ranges of taxa and their frequencies, is a task worthy of further detailed investigation.

REFERENCES


EXPLANATION OF PLATES

PLATE 1

(Early Talchir Miosflora)

LELE – STUDIES IN THE TALCHIR FLORA OF INDIA

11. Potonieisporites monosaccoides (Maheshwari) comb. no. Slide Regd. No. 4753. x 250.
13. Parasaccites densicorpus sp. nov. Slide Regd. No. 4752. x 500.

PLATE 2

(Late Talchir Mioflora)

27. Cuticle with distinct epidermal cells. Slide Regd. No. 4761. x 100.
33. Verrhipollenites mehtae Lele Slide Regd. No. 4761. x 500.
40. Tubisaccites tuberculatus (Mahesh.) Lele & Makada. Slide Regd. No. 4761. x 500.

PLATE 3

(Late Talchir Mioflora)

42-45 & 47. Parasaccites densicorpus sp. nov. Slide Regd. Nos. 4762, 4757, 4755, 4762, 4756, 4762. x 500.
47. Limitisporites thomasi (Pant) comb. nov. Slide Regd. No. 4757. x 500.
51-53. Crescentipollenites talchirensis sp. nov. Slide Regd. Nos. 4763 (Holotype), 4758, 4762. x 500.
55. Striatoparvisaccites indicus gen. et. sp. nov. The body is apparently detached from sacci. Slide Regd. No. 4755. x 500.
56. Striatoparvisaccites circularis gen. et. sp. nov. Slide Regd. No. 4761 (Holotype). x 500.
57. Striatoparvisaccites circularis gen. et sp. nov. The body is apparently detached from sacci. Slide Regd. No. 4657. x 500.
60. Leiosphaeridia bokaroensis sp. nov. Slide Regd. No. 4757. x 500.