

TWO MIOSPORE ASSEMBLAGES FROM THE ARGADA SECTOR SOUTH KARANPURA COALFIELD, BIHAR, WITH REMARKS ON THEIR PROBABLE AGE

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ABSTRACT

Two miospore assemblages from the South Karanpura Coalfield are for the first time systematically described. Of these, one is from the shale associated with the Argada 'S' seam; and the other is from another shale about 70 feet above the Argada 'S' seam. The present study throws some light on the controversial question whether the basal coal-bearing beds including the Argada 'S' seam of this area belong to the Karharbaris or the Barakars.

INTRODUCTION

OUR present knowledge of the miospore flora from the South Karanpura Coalfield is confined (De, 1960; BHARADWAJ & TIWARI, 1968). In the present work two miospore assemblages are described: (A) from the shale associated with Argada 'S' seam, and (B) shale about 70 feet above the Argada 'S' seam, Argada Sector, South Karanpura Coalfield. These beds overlie the Talchir Stage. The strata are supposed to belong to the basalmost part of the Barakar stage. However, in recent years it has been pointed out (BASU, 1964) that the basal Barakar beds may belong to the Karharbari Stage. The present evidence, although not sufficient in itself, throws light on this problem.

Maceration of the shales was carried out in the usual course of H.F. followed by HNO₃ treatments. Macerates were cleared in 5 per cent KOH and slides were mounted in Canada Balsam after spreading the residue in Polyvinyl Alcohol. 500 spores were counted for obtaining the frequencies of the spore population.

DESCRIPTION

The miospore assemblages consist of 25 genera and 41 species, which are listed below. Species marked with an asterisk have only been described.

- *1. *Leiotriletes* sp.
- *2. *Leiotriletes* sp.

- *3. *Punctatisporites* sp.
- *4. *Granulatisporites* sp.
- *5. *Lophotriletes* sp.
- 6. *Latosporites colliensis* (B. & H.) Bharad.
- 7. *Plicatipollenites indicus* Lele
- 8. *P. gondwanensis* (B. & H.) Lele
- 9. *P. trigonalis* Lele
- 10. *Virkkipollenites densus* Lele
- 11. *V. obscurus* Lele
- 12. *V. mehtae* Lele
- 13. *Potonieisporites neglectus* Pot. & Lele
- *14. *Stellapollenites indicus* sp. nov.
- 15. *Crucisaccites latisulcatus* Lele & Maithy
- 16. *C. monoletus* Maithy
- 17. *Vesicaspora ovata* (B. & H.) Wills. & Venkat.
- 18. *Parasaccites korbaensis* Bharad. & Tiw.
- 19. *P. radiplicatus* Maithy
- 20. *Parastriopollenites rajmahalensis* Maheshw.
- 21. *P. gondwanensis* Maheshw.
- *22. *Cuneatisporites cf. radialis* Leschik
- *23. *C. rotatus* sp. nov.
- *24. *Cuneatisporites* sp. 'A'
- *25. *Cuneatisporites* sp. 'B'
- *26. *Cuneatisporites* sp. 'C'
- 27. *Platysaccus ovatus* Maithy
- 28. *Alisporites oblongus* Maithy
- *29. *Striatopodocarpites* sp.
- 30. *Faunipollenites varius* Bharad.
- 31. *Striatites sewardi* (Virkki) Pant
- 32. *S. notatus* Bharad. & Sal.
- 33. *S. incirus* Maithy
- *34. *Verticipollenites* sp.
- 35. *Sulcatisporites maximus* (Hart) Singh
- 36. *S. barakarensis* Tiw.
- *37. *Trochosporites* sp.
- *38. *Maculatasporites karanpurensis* sp. nov.
- *39. *Welwitschiapites canaliculus* sp. nov.
- 40. *Ginkgocycadophytus cymbatus* Pot. & Lele
- *41. *Vittatina* sp.

A. Spore Assemblage of Shale associated with Argada 'S' Seam

- Super-division** — *Sporites* H. Pot.
Division — *Triletes* (Reinsch) Pot. & Kr.
Sub-division — *Azonotriletes* Luber
Series — *Laevigati* (B. & K.) Pot. & Kr.
Genus — *Leiotriletes* (Naum.) Pot. & Kr.

Leiotriletes sp.

Pl. 1, Fig. 1

Description — Size range 37-45 μ , triangular with convex ends; exine smooth, occasionally a trilete mark perceptible, rays \pm of equal size. The limited number of specimens does not permit specific identification.

- Genus** — *Punctatisporites* Pot. & Kr.

Punctatisporites sp.

Pl. 1, Fig. 2

Description — Size range 37-80 μ ; circular, exine finely intrapunctate, sometimes a faint trilete mark perceptible, rays \pm equal in size. Grains few and rather ill preserved.

- Series** — *Apiculati* (Benn. & Kidst.)

- Genus** — *Granulatisporites* (Ibr.) Pot. & Kr.

Granulatisporites sp.

Pl. 1, Fig. 3

Description — Size range 31-40 μ , \pm circular, exine granulate, small trilete mark is perceptible, rays \pm of equal size. Very few grains are in the assemblage.

- Genus** — *Lophotriletes* (Naum.) Pot. & Kr.

Lophotriletes sp.

Pl. 1, Fig. 4

Description — Size range 85-90 μ , triangular, ends convex, exine with small spines, trilete mark distinct, rays \pm equal in size. Grains few.

- Sub-division** — *Disaccites* Cooks.

- Series** — *Podocarpoiditi* Pot., Thomas & Thiery.

- Genus** — *Cuneatisporites* Leschik

Cuneatisporites sp. 'A'

Pl. 1, Fig. 7

Description — Size range 105-117 μ , diploxytonoid; central body vertically oval,

35-40 μ , distinct, thick, exine intramicroreticulate, margin smooth, sacci hemispherical or more; three times bigger than body; attachment straight, distal sulcus narrow; saccus exine intrareticulate, muri and lumina are of equal size.

Comparison — Grains are few and they are somewhat comparable to *Cuneatisporites* sp. 'A' of Tiwari (1964, Pl. 8 Fig. 183) recorded from Korba Coalfield, Barakar Stage.

Cuneatisporites sp. 'B'

Pl. 1, Fig. 8

Description — Size range 107-112 μ , \pm diploxytonoid, body 40-50 μ , vertically oval, thick, distinct, exine intramicroreticulate, margin smooth; sacci hemispherical or less, structure intrareticulate, distal sulcus strikingly narrow.

Comparison — Differs from *Cuneatisporites* sp. 'A' in having \pm sub-hemispherical sacci and relatively larger body. Other species cannot be compared due to fewer number of spores.

- Series** — *Striatiti* Pant

- Genus** — *Striatopodocarpites* (Soritsch. & Sed.) Bharad.

Striatopodocarpites sp.

Pl. 1, Fig. 6

Description — Single specimen; size 142 μ , oval, body oval, 70 μ , 5 horizontal striations present, exine intramicroreticulate; attachment straight without any fold; sacci subspherical, structure intrareticulate, distal channel wide, 17.5 μ .

- Division** — *Aletes* Ibr.

- Sub-division** — *Azonaletes* (Luber) Pot. & Kr.

- Series** — *Reticulonapiti* (Erdtm.) Vimal

- Genus** — *Maculatasporites* Tiwari

Maculatasporites karanpurensis sp. nov.

Pl. 1, Fig. 11

Diagnosis — Size range 71-72 μ , circular to sub circular, exine reticulate, muri up to 5 μ thick, lumina 3-6 μ wide, reticulum \pm regular.

Holotype — Pl. 1, Fig. 11, Slide No. 2983/801, B.S.I.P. collection.

Locality — S. Karanpura Coalfield; Argada Sector.

Horizon — Karharbari Stage, shale associated with Argada 'S' seam.

Description — Grains are circular to circular oval, exine intrareticulate, reticulation complete on both faces. Meshes are regular, \pm polygonal in outline. Muri thick.

Comparison — In its short meshes it compares with *M. irregularis* Tiwari (1965, PL. 8, FIGS. 188-190) but differs in having a regular arrangement of meshes.

Division — *Polyplicates* Erdtm.

Genus — *Welwitschiapites* Bolchow.

? *Welwitschiapites canaliculus* sp. nov.

Pl. 1, Figs. 9-10

Diagnosis — Size range 115-127 μ , outline \pm circular, exine intramicroreticulate, 3-6 longitudinally running grooves.

Holotype — Pl. 1, Fig. 9, Slide No. 2981/801, B.S.I.P. Collection.

Locality — S. Karanpura Coalfield, Argada Sector.

Horizon — Karharbari Stage; Shale associated with Argada 'S' Seam.

Description — Grains are commonly circular in outline; occasionally they are vertically oval. Longitudinal grooves are prominent, 6 in number and are at a distance of 8-10 μ from one another.

Comparison — In the presence of prominent grooves the present grains differ from all the known species of *Welwitschiapites*. The forms are commonly circular which makes their generic assignment further doubtful.

B. *Spores assemblage of shale about 70 feet above the Argada 'S' seam*

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

Leiotriletes sp.

Pl. 1, Fig. 12

Description — Spores triangular, size range 52-62 μ . Body exine smooth; trilete mark present, rays short about 2/3 body radius. Specimens few.

Super division — *Pollenites* R. Pot.

Division — *Saccites* Erdtm.

Sub-division — *Monosaccites* (Chit.) Pot. & Kr.

Series — *Amphisacciti* Lele

Genus — *Stellapollenites* Lele

Stellapollenites indicus sp. nov.

Pl. 1, Fig. 13; Pl. 2, Fig. 15

Diagnosis — Size range 225-260 μ , shape sub-triangular to subcircular; central body large, distinct, roundly triangular in shape, exine finely intramicroreticulate, haptotypic mark not discernible; saccus attachment amphilateral, associated with prominent body folds, saccus width 10-30 μ .

Holotype — Pl. 1, Fig. 13, Slide No. 2988/800, B.S.I.P. Collection.

Locality — S. Karanpura Coalfield, Argada Sector.

Horizon — Karharbari Stage; shale 70 ft. above Argada 'S' seam.

Description — The spores are probably sub-triangular in shape but may appear subcircular or oval by preservation. Body is large, distinct, roundly triangular in outline. The size of the central body varies from 140 to 175 μ . The body exine is finely intramicroreticulate, occasionally distorted. The amphilateral attachment zones are concave and associated with prominent body infolds along the zones of attachment. Saccus is finely intrareticulate, muri and lumina are of equal size.

Comparison and Remarks — The spores compare in organization with *S. talchirensis* Lele (1965, PL. 1, FIGS. 1-4). However, they differ in the presence of a distinct, thick body and relatively wider saccus.

Stellapollenites was so far known only from the Talchir Stage of the South Rewa Gondwana basin (LELE, 1965) and the Umria Coal-bearing beds (? Karharbari Stage, MAITHY, 1966). It is for the first time recorded in beds presumably of Karharbari Barakar age.

Sub-division — *Disaccites* Cooks.

Series — *Podocarpoiditi* Pot. et al.

Genus — *Cuneatisporites* Leschik

Cuneatisporites cf. *radialis* Leschik (1955)

Pl. 2, Fig. 16

Description — Size range 105-120 μ , diploxylonoid oval, central body 37-45 μ ,

thin, oval, exine intramicroreticulate, margins undulated, sacci attachment straight leaving a narrow distal channel, saccus structure intrareticulate.

Comparison — The grains are somewhat comparable with *C. radialis* Leschik (1955).

Cuneatisporites rotatus sp. nov.

Pl. 2, Figs. 17-19

Diagnosis — Size range 170-215 μ , diploxylo-noid; central body subcircular to vertically oval, \pm distinct, 100-110 μ , exine intrareticulate; distal saccus attachment straight, no folds; distal channel usually \pm narrow; saccus structure intrareticulate.

Holotype — Pl. 2, Fig. 17, Slide No. 2/800, B.S.I.P. Collection.

Locality — S. Karanpura Coalfield, Argada Sector.

Horizon Karharbari Stage; Shale 70 ft. above Argada 'S' seam.

Description The spores are clearly diploxylo-noid. The central body is distinct, subcircular to vertically oval, 100-110 μ ; body margin may appear thick in some examples, exine intramicroreticulate, no folds near distal attachment of saccus, distal channel usually narrow but may be up to 14 μ wide in certain examples.

Comparison — *Cuneatisporites radialis* Leschik (1955) differs in having distinctly vertical oval body and hemispherical saccus. Other species are not comparable.

Cuneatisporites sp. 'C'

Pl. 2, Fig. 20

Description — Size range 135-142 μ , diploxylo-noid, laterally flattened; central body thick, oval, without any thickenings on the margin, exine intramicroreticulate, distally sacci close to each other forming narrow distal channel, structure intramicroreticulate.

Comparison — The present few grains are not comparable to any of the known species in having distinctly thick oval body and subspherical saccus.

Series — *St riati* Pant

Genus — *Verticipollenites* Bharad.

Verticipollenites sp.

Pl. 2, Fig. 21

Description — Size range 135-150 μ , \pm oval, central body \pm hexagonal, 50-60 μ ,

distinct, margin thick (equatorial rim), exine microverrucose, 8-10 horizontal forked striations, vertical inter-connections obliquely placed; saccus attenuated towards attachment forming a pitcher-like neck, distal channel narrow, sacci distally dilated; saccus structure intrareticulate, size almost equal to body.

Comparison — Specimens are scarce and therefore do not permit comparison with the known species of the genus.

Super-division — *Polysaccites* Cooks.
Series — *Triasacciti* Leschik

Genus — *Trochosporites* Wils.

Trochosporites sp.

Pl. 1, Fg. 14

Description — Single grain, size 140 μ , exine intramicroreticulate, sacci three in number, subspherical, distal attachment subequatorial, distal saccus-free area narrow triangular, sacci structure intramicroreticulate.

Division — *Monocolpates* Iverson & Troel-Smith

Sub-division — *Intortes* (Naum.) Pot.

Genus — *Vittatina* Lubert

Vittatina sp.

Pl. 2, Fig. 22

Description — Spore circular oval, size 195 μ , body with irregular folds, exine microverrucose, vertical striations running on both the surfaces of body.

CONCLUDING REMARKS

Quantitative analysis:

A quantitative study of the assemblages from the Argada 'S' shale and from the shale 70 ft. above Argada 'S' seam reveals the following features.

1. The Argada 'S' shale assemblage is rather poor in spore population. *Sulcatisporites*, *Virkkipollenites*, *Maculatasporites* and ? *Welwitschiapites* are dominant (TABLE 1). Next in order are *Potonieisporites*, *Cuneatisporites*, *Latosporites* and *Platysaccus*. *Leiotriletes*, *Punctatisporites*, *Granulatisporites*, *Lophotriletes* and *Striatopodocarpites* are rare.

2. The assemblage from the shale 70' above Argada 'S' seam is comparatively richer than the Argada 'S' shale assemblage.

TABLE 1 — PERCENTAGE FREQUENCY OF GENERA IN THE TWO SAMPLES

	SHALE ASSOCIATED WITH ARGADA 'S' SEAM	SHALE 70' ABOVE ARGADA 'S' SEAM
<i>Leiotriletes</i>	2.2	0.8
<i>Punctatisporites</i>	1.8	—
<i>Granulatisporites</i>	0.8	—
<i>Lophotriletes</i>	2.2	—
<i>Latosporites</i>	4.6	—
<i>Maculatasporites</i>	12.8	—
<i>Virkkipollenites</i>	14.4	12.0
<i>Plicatipollenites</i>	—	2.0
<i>Potoniopsisporites</i>	7.0	1.0
<i>Parasaccites</i>	—	6.0
<i>Crucisaccites</i>	—	11.0
<i>Stellapollenites</i>	—	1.4
<i>Parastriopollenites</i>	—	33.0
<i>Faunipollenites</i>	—	4.6
<i>Striatites</i>	—	3.2
<i>Striatopodocarpites</i>	1.2	—
<i>Vesicaspora</i>	—	0.6
<i>Sulcatisporites</i>	33.4	14.0
<i>Alisporites</i>	—	0.6
<i>Cuneatisporites</i>	5.2	6.8
<i>Platysaccus</i>	3.6	—
<i>Trochosporites</i>	—	0.4
<i>Vittatina</i>	—	1.2
? <i>Welwitschiapites</i>	10.8	—
<i>Ginkgocycadophytus</i>	—	0.6

The dominant genera are *Parastriopollenites*, *Sulcatisporites*, *Virkkipollenites* and *Crucisaccites* (TABLE 1). Next in order are *Cuneatisporites* and *Parasaccites*. Triletes are very poor both qualitatively and quantitatively.

Comparison of the two assemblages
(TABLE 2)

The two assemblages, when compared at generic level, bring out the following points:

1. Argada 'S' shale has the following 4 genera which are absent from the 70 ft. shale

Maculatasporites (dominant type), *Punctatisporites*, *Granulatisporites*, *Striatopodocarpites*.

2. The shale at 70 ft. has the following 13 genera which are absent from the Argada 'S' shale:

Parastriopollenites (dominant), *Crucisaccites* (dominant), *Plicatipollenites*, *Stellapollenites*, *Vesicaspora*, *Parasaccites* (Sub-

dominant), *Alisporites*, *Faunipollenites*, *Striatites*, *Verticipoollenites*, *Trochosporites*, *Vittatina* and *Ginkgocycadophytus*.

3. The only genera common to both assemblages are *Leiotriletes*, *Virkkipollenites*, *Cuneatisporites*, *Potoniopsisporites* and *Sulcatisporites*. Among these the frequencies of *Virkkipollenites* and *Cuneatisporites* are comparable in the two samples. The remainder

TABLE 2 — DISTRIBUTION OF SPECIES IN THE TWO MIOSPORE ASSEMBLAGES

SPECIES	ARGADA 'S' SEAM	70' ABOVE ARGADA 'S' SEAM
<i>Leiotriletes</i> spp.	+	+
<i>Punctatisporites</i> sp.	+	—
<i>Granulatisporites</i> sp.	+	—
<i>Lophotriletes</i> sp.	+	—
<i>Latosporites colliensis</i>	+	—
<i>Plicatipollenites indicus</i>	—	+
<i>P. gondwanensis</i>	—	+
<i>P. trigonalis</i>	—	+
<i>Virkkipollenites densus</i>	+	—
<i>V. obscurus</i>	+	+
<i>V. mehtae</i>	—	+
<i>Potoniopsisporites neglectus</i>	+	+
<i>Stellapollenites indicus</i> sp. nov.	—	+
<i>Crucisaccites latisulcatus</i>	—	+
<i>C. monoletus</i>	—	+
<i>Vesicaspora ovata</i>	—	+
<i>Parasaccites korbaensis</i>	—	+
<i>P. vadiplicatus</i>	—	+
<i>Parastriopollenites raj-</i> <i>mahalensis</i>	—	+
<i>P. gondwanensis</i>	—	+
<i>Cuneatisporites cf.</i> <i>radialis</i>	—	+
<i>C. rotatus</i> sp. nov.	—	+
<i>C. sp. A.</i>	+	—
<i>C. sp. B.</i>	+	—
<i>C. sp. C.</i>	—	+
<i>Platysaccus ovatus</i>	+	—
<i>Alisporites oblongus</i>	—	+
<i>Striatopodocarpites</i> sp.	+	—
<i>Faunipollenites varius</i>	—	+
<i>Striatites seawardi</i>	—	+
<i>S. rotatus</i>	—	+
<i>S. incirus</i>	—	+
<i>Verticipoollenites</i> sp.	—	+
<i>Sulcatisporites maximus</i>	+	+
<i>S. barakavensis</i>	—	+
<i>Trochosporites</i> sp.	—	+
<i>Maculatasporites karan-</i> <i>purensis</i> sp. nov.	+	—
? <i>Welwitschiapites</i> <i>canaliculus</i> sp. nov.	+	—
<i>Ginkgocycadophytus</i> <i>cymbatus</i>	—	+
<i>Vittatina</i> sp.	—	+

of the common genera do not compare in their incidence.

4. Both assemblages are characterized by the abundance of *Virkkipollenites* and *Sulcatisporites* together with *Cuneatisporites*. In other respects, however, the two assemblages appear different, and distinguishable in their quantitative and qualitative features. This difference may be accounted for by the relative stratigraphical level of the two assemblages as well as by the depositional conditions of the beds.

Age of the strata:

The sequence of the Argada 'S' seam overlies the Talchir beds in the South Karanpura Coalfield. The Argada 'S' seam as well as the shales 70 ft. above the seam are so far considered as representatives of the basal part of the Barakar Stage. However, some coal petrographic evidence has recently been advanced by Basu (1964) in favour of a Karharbari age for these strata. The present palynological evidence is not sufficient to permit a categorical remark on the controversy, although some points may be considered.

Of the two assemblages, the higher one (70 ft. above Argada 'S') is comparatively better known. The population, however, indicates a rather curious association of

Crucisaccites and *Virkkipollenites* with *Parastriopollenites* and *Sulcatisporites*; the former indicating a Karharbari aspect while the latter a probably younger one (Barakar).

The Argada assemblages do not compare with the known Lowermost Barakar mioflora (TIWARI, 1965) which abounds in simple, zonate and cingulate triletes. The assemblage from the Talchir Coalfield (NAVALE & TIWARI, 1966), which is probably intermediate between the Karharbari and Barakar miofloras, is also distinct in the predominance of *Parasaccites* with *Punctatisporites* and other striate forms. With the known Karharbari mioflora from the Giridih Coalfield (MAITHY, 1965), there are also not many points of close comparison. This may be due to comparatively lower stratigraphical position of the Giridih assemblage. Since we have yet no knowledge of an Upper Karharbari mioflora, it cannot be verified if any of the Argada assemblages could be of that type. The present study therefore reveals that the knowledge of a definite Upper Karharbari mioflora from the type area is essential for dating such assemblages (and others e.g. NAVALE & TIWARI, 1966), which may straddle on the boundary between the Karharbari and the Barakar stages. At the same time it is hoped that a more detailed palynological study of these problematic beds may provide better clues.

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EXPLANATION OF PLATES

(All photomicrographs are magnified $\times 500$. Slides and negatives are preserved at the Museum of Birbal Sahni Institute of Palaeobotany, Lucknow)

PLATE 1

Assemblage from the shale of Argada 'S' seam

1. *Leiotriletes* sp. Slide No. 2986.
2. *Punctatisporites* sp. Slide No. 2985.
3. *Granulatisporites* sp. Slide No. 2984.
4. *Lophotriletes* sp. Slide No. 2986.
5. *Latosporites colliensis* (B. & H.) Bharadwaj. Slide No. 2985.
6. *Striatopodocarpites* sp. Slide No. 2980.
7. *Cuneatisporites* sp. A. Slide No. 2980.
8. *Cuneatisporites* sp. B. Slide No. 2982.
9. ? *Welwitschiapites canaliculus* sp. nov. Slide No. 2981.
10. ? *Welwitschiapites canaliculus* sp. nov. Slide No. 2981.
11. *Maculatasporites karanpurensis* sp. nov. Slide No. 2983.

Assemblage from the shales about 70 feet above Argada 'S' seam

12. *Leiotriletes* sp. A. Slide No. 2990.

13. *Stellapollenites indicus* sp. nov. Slide No. 2988.

14. *Trochosporites* sp. Slide No. 2988.

PLATE 2

15. *Stellapollenites indicus* sp. nov. Slide No. 2988.

16. *Cuneatisporites* cf. *radialis* Leschik. Slide No. 2990.

17. *Cuneatisporites rotatus* sp. nov. Slide No. 2987.

18. *Cuneatisporites rotatus* sp. nov. Slide No. 2989.

19. *Cuneatisporites rotatus* sp. nov. Slide No. 2989.

20. *Cuneatisporites* sp. C. Slide No. 2991.

21. *Verticypollenites* sp. Slide No. 2991.

22. *Vittatina* sp. Slide No. 2992.



