CHAPTER V

MEGASPORES FROM THE DEOLI MEMBER OF PANCHET FORMATION

IN EAST BOKARO COALFIELD, BIHÁR
INTRODUCTION

The only record of megaspores from the Panchet Formation is by Maheshwari and Banerji (1975). Maheshwari and Banerji (1975) described Banksisporites gondwanensis Maheshwari & Banerji, B. granulosus Maheshwari & Banerji, B. minuticorpus Maheshwari & Banerji, Biharisporites maiturensis Maheshwari & Banerji, Biharisporites sp., Verrutriletes distinctus (Maheshwari & Banerji) Banerji, Kumaran & Maheshwari, V. obscurus (Maheshwari & Banerji) Banerji, Kumaran & Maheshwari, Pantiella bosei Maheshwari & Banerji, P. bharadwajii Maheshwari & Banerji, P. waltonii (Pant & Srivastava) Maheshwari & Banerji, Srivastavaesporites panchetensis Maheshwari & Banerji, Talchirella dubia Maheshwari & Banerji, T. sinuata Maheshwari & Banerji, Maiturisporites indicus Maheshwari & Banerji, M. distinctus Maheshwari & Banerji, M. spinotriletus Maheshwari & Banerji and ?Nathorstisporites sp. from the Maitur Member of Panchet Formation exposed on the north-western branch of Nonia Nala about 2 km north-west of Asansol, Raniganj Coalfield, West Bengal. So far, this was the only record of a megaspore assemblage from the Panchet Formation and that too was from the Maitur Member of the Formation. From the overlying Deoli Member of Panchet Formation no megaspore has been described earlier. With a view to fill this gap of knowledge, shale samples belonging to the Deoli Member of Panchet Formation exposed on the southern bank of Dhardharia Nala Section at the base of the Lugu Hill, about 1 km west of Jurwa Village; East Bokaro Coalfield, Bihar (Map-3) were analysed and 152 well preserved megaspores were isolated. Bright Field Microscopy with incident as well as
transmitted light and Scanning Electron Microscopy reveal that the assemblage is represented by nine species belonging to seven genera, out of which three species are new.

**SYSTEMATIC DESCRIPTION**

*Anteturma Proximegerminantes* Potonie 1970

*Turma Triletes* Reinsch emend. Dettmann 1963

*Subturma Azonotriletes* Luber 1935 emend. Dettmann 1963


**Genus** - *Banksisporites* Dettmann 1961

**Type species** - *Banksisporites pinguis* (Harris) Dettmann 1961

*Banksisporites tenuis* (Dijkstra) Dettmann 1961

Pl. 6, figs: 1-2

**DESCRIPTION** - Trilete megaspores, amb subcircular (equatorial diameter 310-330 μm in dry state and 390-400 μm in wet condition); trilete laesurae distinct (± 20 μm wide and about 20 μm high in dry state), ± uniform throughout, extending upto about 2/3 of the spore radius and at places little undulated; exosporium smooth to very finely granulose, occasionally folded especially along the margins of the contact areas; mesosporium indistinct (probably occupying the whole spore cavity).

**REMARKS** - Altogether three specimens in the present assemblage morphographically resemble that of *Banksisporites tenuis* (Dijkstra) Dettmann, described by Banerji, Kumaran and Maheshwari (1978) from the Tiki Formation (Upper Triassic) of India. However, the present specimens are little smaller in size than that of Banerji et al. (1978).
**Banksisporites dettmannae** Banerji, Kumaran & Maheshwari 1978

Pl. 6, figs. 3-5

**DESCRIPTION** - Trilete megaspores, amb subcircular to oval (equatorial diameter 280-430 μm in dry state and 430-640 μm in wet condition); laesurae straight, at places little undulated, well developed (15-20 μm wide and same in height in dry state), uniform throughout and reaching up to the margin of contact area; contact area well defined by distinct arcuate ridge; exosporium uniformly granulose, occasionally folded; mesosporium distinct, spherical, occupying 2/3 of the spore cavity (diameter of mesosporium in wet condition 280-430 μm).

**REMARKS** - This species is represented by altogether twenty-eight specimens in the present collection. The specimens resemble in all morphographic features those of *Banksisporites dettmannae* Banerji, Kumaran & Maheshwari (1978) described from the Upper Triassic of Tiki Formation, India.

**Banksisporites sp. cf. B. gondwanensis** Maheshwari & Banerji 1975

Pl. 6, figs. 6-7

**DESCRIPTION** - Trilete megaspores, circular to oval in sub-equatorial view (equatorial diameter 240-275 μm in dry state and 280-320 μm in wet condition); laesurae distinct (in dry state 15-20 μm wide and almost equally high), straight, extending 1/2 to 2/3 of the spore radius, very gradually tapering to a rather blunt end; contact area ill defined; exosporium granulose to finely verrucose; mesosporium distinct, occupying ± 3/4 of the spore cavity (mesosporium 200-235 μm in diameter in wet condition), smooth, slightly darker than the exosporium.
REMARKS - The above description is based on twelve specimens which are comparable with those of Banksisporites gondwanensis Maheshwari & Banerji (1975) described from the Maitur Member of the Panchet Formation. However, the present specimens differ from typical B. gondwanensis in having granulose microverrucose exosporium and also smaller in size.

Infraturma Apiculati Bennie & Kidston emend. Potonié 1956


Type species - Biharisporites spinosus (Singh) Potonié 1956

Biharisporites luguensis sp. nov.

Pl. 6, figs. 8-9

DIAGNOSIS - Trilete megaspores, amb subtriangular to subcircular (240-360 μm in diameter in dry state and 350-560 μm in wet condition); trilete laesurae well developed, little sinuous at places, gradually tapering towards ends, extending upto 3/4 of the spore radius; contact area marked by a low and narrow sub-equatorial arcuate ridge; exosporium ornamented with closely set coni (6-8 μm high and almost equal in width at base) which are relatively large in the inter-ray areas; mesosporium distinct, ± circular in outline (270-430 μm diameter in wet condition), smooth.

COMPARISON AND REMARKS - Biharisporites luguensis sp. nov. is represented by nine specimens in the present collection. In having coniate exosporium Biharisporites distinctus Bharadwaj & Tiwari (1970) from Barakar Formation, Biharisporites maiturensis Maheshwari & Banerji (1975) from the Panchet Formation and Biharisporites sparsus Banerji, Kumaran & Maheshwari (1978) from the Tiki Formation resemble B. luguensis. But unlike B. luguensis, B.
distinctus bear elongated tapering setae intermingled with coni. B. maiturensis and B. sparsus can be distinguished from B. luguensis by the absence of arcuate ridges and the presence of large inner bodies occupying whole of the spore cavity.

HOLOTYPE - SEM Stub no. LM/3/6; (Negative No. LM-S3/30).

TYPE LOCALITY - Dhardharia Nala Section, Lugu Hill; East Bokaro Coalfield, Bihar, India.

HORIZON AND AGE - Deoli Member, Panchet Formation; Lower Triassic.

Genus - Verrutriletes van der Hammen ex Potonie' 1956

Type species - Verrutriletes compositipunctatus (Dijkstra) Potonie' 1956

Verrutriletes punctatus sp. nov.

Pl. 6, figs. 10-12

DIAGNOSIS - Trilete megaspores, roundly triangular in polar view (equatorial diameter 240-260 μm in dry condition and 290-330 μm in wet condition); trilete laesurae distinct, straight, sometimes slightly sinuous, ± uniform throughout (about 18 μm high and ± same in width in dry condition), reaching upto the subequatorial arcuate ridge marking the contact areas; arcuate ridge distinct (about 15 μm wide and 10 μm high in dry condition); exosporium verrucate; verrucae (10-15 μm wide and 10-15 μm high in dry state) relatively sparse over the proximal contact areas than those on the distal face; general surface of the exosporium uniformly punctate, mesosporium indiscernible.

COMPARISON AND REMARKS - Verrutriletes punctatus sp. nov. is based on six specimens, one proximodistally and the others are equatorially preserved.
In having distinct arcuate ridge this species can be compared with *Verrutriletes utilis* described from the Rhaeto-Liassic of Poland (Marcinkiewicz, 1971). However, *V. punctatus* is readily distinguishable from *V. utilis* by its distinctly punctate exosporium. Among the known Indian species *V. punctatus* resembles to some extent *V. obscurus* described by Banerji, Kumaran and Maheshwari (1978) from the Panchet and Tiki formations but the former differs from the latter in having a distinct arcuate ridge and punctate exosporium.

**HOLOTYPE** - SEM Stub no. LM/1/1; (Negative no. LM-S1/16).

**TYPE LOCALITY** - Dhardharia Nala Section, Lugu Hill; East Bokaro Coalfield, Bihar, India.

**HORIZON AND AGE** - Deoli Member, Panchet Formation; Lower Triassic.


*Talchirella deoliensis* sp. nov.

Pl. 7, figs. 1-4.

**DIAGNOSIS** - Trilete megaspores, **amb** roundly triangular (equatorial diameter 230-280 \(\mu m\) in dry state and 340-480 \(\mu m\) in wet condition); trilete laesurae straight to little undulated, more or less uniformly thick (15 \(\mu m\) wide in dry state), extending upto the margin of contact area; contact area well defined by a distinct arcuate ridge; exosporium granulose to microverrucose; mesosporium distinct, relatively darker in colour, subcircular (diameter of mesosporium 240-280 \(\mu m\) in wet condition),
proximally bearing numerous (70-80 in number) cushions in a triangular fashion around the trilete laesurae; cushions typically circular in outline, 5-10 μm in diameter.

COMPARISON AND REMARKS - This species is quite common at Lugu Hill, represented by twenty specimens in the present collection. In having trigonally arranged cushions *Talchirella deoliensis* sp. nov. resembles *Talchirella trivedii* Pant & Srivastava described from Indian Permian strata (Pant and Srivastava, 1961; Bharadwaj and Tiwari, 1970). But in *T. deoliensis* exosporium is granulose to microverrucose, whereas in *T. trivedii* the exosporium is with 8-15 μm wide verrucae. In its reduced nature of ornamentation the present species can be compared with *Talchirella nitens* and *Talchirella flavata* described by Bharadwaj and Tiwari (1970) from the Indian Permian strata, but the present species differs from the other two in the nature and arrangement of cushions on the mesosporium.

HOLOTYPE - Slide no. LM/50.

TYPE LOCALITY - Dhardharia Nala Section, Lugu Hill, East Bokaro Coalfield, Bihar, India.

HORIZON AND AGE - Deoli Member, Panchet Formation; Lower Triassic.

Genus - *Srivastavaesporites* Bharadwaj & Tiwari 1970

Type species - *Srivastavaesporites karanpuraensis* Bharadwaj & Tiwari 1970

*Srivastavaesporites panchetensis* Maheshwari & Banerji 1975

Pl. 7, figs. 5-8

DESCRIPTION - Trilete megaspores, more or less spherical (equatorial
diameter 280-310 μm in dry state and 320-420 μm in wet condition); trilete laesurae distinct (15-20 μm wide and 15-20 μm high in dry state), more or less equally broad throughout, extending up to ± 2/3 of the spore radius; contact areas well defined by mediumly developed arcuate ridge; exosporium ± 10 μm thick, granulose to microverrucose, sometimes the verrucae over the proximal contact areas depicting negative reticulation; mesosporium often distinct, occupying about half to three fourth of the spore cavity (diameter of mesosporium in wet condition 230-300 μm).

REMARKS - Out of fifty-one specimens recovered, twelve are compressed proximodistally and the rest are subequatorially preserved. The specimens resemble those of Srivastavaesporites panchetensis, described by Maheshwari and Banerji (1975) from the Maitur beds of Panchet Formation near Asansol and by Banerji, Kumaran and Maheshwari (1978) from the Tiki Formation, India. In some of the present specimens over the contact areas of the exosporium some sort of negative reticulation is visible (Pl. 7, fig. 7) as has been drawn by Maheshwari and Banerji (1975, text-fig. 7c). This species was originally described under the genus Srivastavaesporites Bharadwaj & Tiwari by Maheshwari and Banerji (1975). Later on, Banerji et al. (1978) opined that the genus Srivastavaesporites Bharadwaj & Tiwari is indistinguishable from Banksisporites Dettmann and accordingly they described this species as Banksisporites panchetensis (Maheshwari & Banerji) Banerji, Kumaran & Maheshwari. However, presence of distinct ornamentation (verrucae) over the exosporium distinguishes Srivastavaesporites Bharadwaj & Tiwari from Banksisporites Dettmann and thus Srivastavaesporites should be considered as a valid genus as pointed out by
Pant and Mishra (1986). Therefore, the present species has been described here as Srivastavaesporites panchetensis Maheshwari & Banerji.

**Genus - Pantiella Maheshwari & Banerji 1975**

**Type species - Pantiella bosei Maheshwari & Banerji 1975.**

**Pantiella bharadwajii Maheshwari & Banerji 1975**

Pl. 8, figs. 1-2

**DESCRIPTION** - Trilete megaspore, subtriangular in proximal polar view (equatorial diameter 330 μm in dry state and 420 μm in wet condition); trilete laesurae distinct (20 μm wide in dry and 30 μm wide in wet condition), almost straight, quite high, reaching up to the margin of the contact area; contact area well defined by subequatorial arcuate ridge; exosporium ornamented with coniate-mamillate processes (10 μm wide at base and 15-18 μm high in dry condition), uniformly distributed all over the surface; mesosporium faintly visible, trianguloid (180 μm in diameter in wet condition), provided with two rows of faint cushion-like structures along the trilete laesurae.

**REMARKS** - The solitary specimen in all available features resembles Pantiella bharadwajii Maheshwari & Banerji (1975) described from the Maitur Member of the Panchet Formation, Raniganj Coalfield, India.

**Infraturma Muronati Potonie' & Kremp 1954**

**Genus - Maiturisporites Maheshwari & Banerji 1975**

**Type species - Maiturisporites indicus Maheshwari & Banerji, 1975**

**Maiturisporites distinctus Maheshwari & Banerji 1975**

Pl. 8, figs. 3-8

**DESCRIPTION** - Trilete megaspores, subcircular in polar view (equatorial
diameter 270-360 μm in dry state and 380-460 μm in wet condition); trilette laesurae distinct (± 10 μm in width near the trijuncture in dry condition), little narrowing towards ends, reaching upto the margin of contact area; contact area distinct by a prominent subequatorial arcuate ridge; exine reticulate, lumina of reticulum more or less polygonal (20 μm in dry and 30-35 μm in wet condition), muri of reticulum quite high in dry state and 20-30 μm high in wet condition), muri wide at base (20-30 μm in wet condition) and gradually becoming pointed at top, at each trijuncture of the muri a cone like projection (± 40 μm high in wet condition) present; mesosporium usually filling almost the entire spore cavity (300-350 μm in diameter in wet condition).

REMARKS - The specimens in all features resemble those of Maiturisporites distinctus Maheshwari & Banerji (1975) described from the Maitur Member of the Panchet Formation, Raniganj Coalfield, India. At Lugu Hill this species is fairly common, represented by twenty-two specimens in the present collection.

QUANTITATIVE ANALYSIS OF THE MEGASPORES

An estimation based on 152 specimens reveals that the megaspore assemblage is overwhelmingly dominated by Srivastavaesporites panchetensis (33%) followed by Banksisporites dettmanae (18%), Maiturisporites distinctus (14%) and Talchirella deoliensis (13%). Banksisporites sp. cf. B. gondwanensis (8%), Biharisporites luguensis (6%) and Verrucosisporites punctatus (4%) are commonly occurring forms. Banksisporites tenuis (2%) and Pantiella Bharadwajii (<1%) are rather rare in occurrence. However, when the frequency distribution of the assemblage is considered at the
Bar-diagram - 3. Percentage frequencies of megaspore species

Bar-diagram - 4. Percentage frequencies of megaspore genera
generic level then the genus Banksisporites (28%) appears to be almost codominant with Srivastavaesporites (30%) with frequent occurrence of Maiturisporites (14%) and Talchirella (13%), [Bar-diagram 3 and 4].

**DISCUSSION**

The megaspore assemblage recovered from the Deoli Member of Panchet Formation exposed on the southern bank of Dhardharia Nala Section, East Bokaro Coalfield described in this thesis comprises Banksisporites tenuis (Dijkstra) Dettmann, Banksisporites dettmannae Banerji, Kumaran & Maheshwari, Banksisporites sp. cf. B. gondwanensis Maheshwari & Banerji, Biharisporites luguensis sp. nov., Verrutriletes punctatus sp. nov., Talchirella deoliensis sp. nov., Srivastavaesporites panchetensis Maheshwari & Banerji, Pantiella bharadwajii Maheshwari & Banerji, Maiturisporites distinctus Maheshwari & Banerji, Quantitatively Srivastavaesporites and Banksisporites are most predominant forms, Maiturisporites and Talchirella are commonly met with, whereas, Biharisporites, Verrucosisporites and Pantiella are rather rare in occurrence.

Among the known Indian megaspore assemblages the present assemblage is most closely comparable with that from the Maitur Member (early Lower Triassic) of Panchet Formation, in Raniganj Coalfield, West Bengal, described by Maheshwari and Banerji (1975) and later modified by Banerji, Kumaran and Maheshwari (1978). Both the Maitur and the presently described Deoli assemblage are characterised by many common genera viz., Banksisporites, Biharisporites, Verrutriletes, Talchirella,
Srivastavaesporites, Pantiella and Maiturisporites. Even at least three species, Srivastavaesporites panchetensis, Pantiella bharadwajii and Maiturisporites distinctus are also common. However, the frequencies of occurrence of megaspore taxa in Maitur rocks are not known. Therefore, comparison of the two assemblages, based on quantitative data, is not possible. Unlike the Maitur assemblage, Banksisporites dettmannae is present in the Deoli assemblage. This species is so far known from the Upper Triassic rocks only. Thus, the Deoli assemblage appears to be little younger than that known from the Maitur Member.

The assemblages described by Banerji, Kumaran and Maheshwari, 1978 and Pal, 1991a from the Tiki formation (Upper Triassic) is comparable with the present assemblage in having Banksisporites tenuis, Banksisporites dettmannae and Srivastavaesporites panchetensis. But, the presence of characteristic Rhaeto-Liassic elements, Banksisporites pinguis, Horstisporites areolatus, Erlansonisporites triassicus and Nathorstisporites hopliticus in the Tiki assemblage indicates that the Deoli assemblage is much older than the Tiki one.

The assemblage described by Pant and Basu (1979b) from the Nidpur beds of South Rewa Godwana Basin is characterised by Srivastavaesporites, Grambastisporites, Trikonia, Mamillaespora and Nidhitriletes. Excepting Srivastavaesporites and Mamillaespora rest of the genera are unique to the Nidpur beds and not known so far from elsewhere. Though the genus Srivastavaesporites is common to both Deoli and Nidpur assemblage, its species in the two assemblages are different. Therefore, there is a very little resemblance between the Nidpur and Deoli assemblages.
The foregoing account reveals that the megaspore assemblage recovered from the Deoli Member of Panchet Formation, exposed on the southern bank of Dhardharia Nala Section, Lugu Hill; East Bokaro Coalfield, Bihar, ascribes little younger age to the Deoli Member than that of Maitur one. The Maitur Member has been dated as early Lower Triassic (Maheshwari and Banerji, 1975; Maheshwari, Kumaran and Bose, 1978). Thus, on the basis of megaspore content the Deoli Member of the Panchet Formation appears to be of Late Lower Triassic age.