

Late Early Triassic microfossils from the Panchet Formation of East Bokaro Coalfield, India

Pankaj K. Pal & Amit K. Ghosh*

Botany Department, Burdwan University, Burdwan - 713104, India

*Birbal Sahni Institute of Palaeobotany, Lucknow - 226 007, India

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THE section of rocks exposed in the Lugu Hill in East Bokaro Coalfield is represented by Panchet and Mahadeva (Supra-Panchet) Formations (Sastri *et al.* 1977). The Panchet Formation, exposed at the base of Lugu Hill, comprises predominantly yellowish-brown micaceous arkosic sandstones intercalated with red shales. The Panchet Formation in this area disconformably overlies the uppermost beds of Raniganj Formation and in turn is conformably overlain by Mahadeva Sandstone. Lithologically the Panchet rocks in the Lugu Hill are comparable with the Deoli (Hirapur) Member of the Panchet Formation in the type area (Raniganj Coalfield). Moreover, the distinct disconformity with the underlying Raniganj Formation and apparent conformity with the overlying Mahadevas indicate that this lithohorizon exposed at the base of Lugu Hill represents the youngest part of the Panchet Formation in East Bokaro Coalfield.

Bharadwaj, Tiwari and Anand-Prakash (1979) and later Tiwari and Rana (1981) reported a microfossil assemblage dominated by *Lunatisporites*, *Chordasporites*, *Densoisporites* and *Lundbladisporea* from a shale (Panchet Formation) exposed on the northern bank of Dhardharia Nala, about 0.5 km NWW of Jurwa Village in East Bokaro Coalfield. Palynological succession through the Panchet sequence has also been worked out by Tiwari and Rana (1981, 1984). The Panchet beds exposed at the base of Lugu Hill, being the youngest horizon of the Panchet Formation in East Bokaro Coalfield, are of considerable stratigraphic importance. In view

of this, a fresh collection of samples was made from a section exposed on the southern bank of Dhardharia Nala, at the base of Lugu Hill (Map 1), about 1 km west of Jurwa village (23° 44' 58" N : 85° 45' 57" E). Out of the eight samples, four samples of khaki micaceous shales have yielded satisfactorily preserved and well diversified miospores. A critical qualitative and quantitative analyses reveals that all the four samples comprise a single microfossil assemblage.

The *spores dispersae* have been assigned to 37 species belonging to 23 genera out of which one species of *Lunatisporites* is new. The overall assemblage is listed below according to the major groups, besides description of the new species, *Lunatisporites panchetensis* and nomenclatural remarks on the new combination *Crescentipollenites multistriatus* (marked with an asterisk).

NONCAVATE TRILETES

Callumispora fungosa (Balme) Bharadwaj & Srivastava 1969

Orbella indica Tiwari & Rana 1981

Ringosporites ringus Tiwari & Rana 1981

R. fossulatus (Balme) Tiwari & Rana 1981

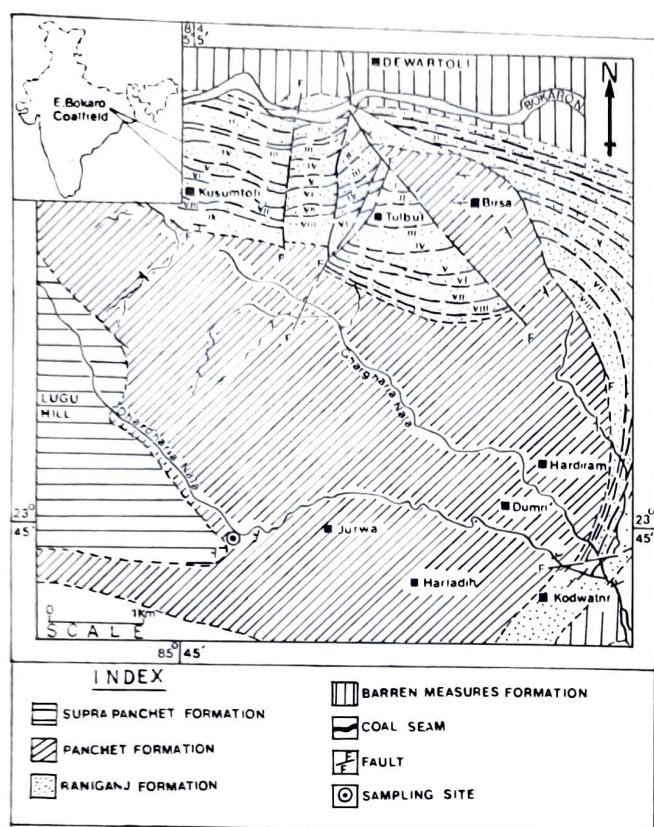
Cyclogranisporites gondwanensis Bharadwaj & Salujha 1964

Guttatisporites ambiguus Tiwari & Rana 1980

Verrucosisporites bosei Maheshwari & Banerji 1975

V. triassicus Bharadwaj & Tiwari 1977

Osmundacidites senectus Balme 1963



Map 1. Geological map of a part of East Bokaro Coalfield showing sampling site (After - C.S. Rajarao 1987)

Brevitriletes communis Bharadwaj & Srivastava 1969

CAVATE TRILETE

Lundbladispora brevicula Balme 1963

L. obsoleta Balme 1970

L. raniganjensis Tiwari & Rana 1981

L. warti Tiwari & Rana 1981

Lundbladispora sp.

Indotriradites saeptatus (Balme) Bharadwaj & Tiwari 1977

I. mammilatus Bharadwaj & Tiwari 1977

Densoisporites playfordii (Balme) Dettmann 1963

D. contactus Bharadwaj & Tiwari 1977

MONOSACCATE

Playfordiaspora cancellosa Maheshwari & Banerji 1975 emend. Vijaya 1995

Goubinispota morondavensis Tiwari & Rana 1981

NONSTRIATE BISACCATE

Cuneatisporites mirabilis Tiwari & Rana 1981

Platysaccus queenslandii de Jersey 1962

Alisporites indicus Bharadwaj & Srivastava 1969

Alisporites landianus Balme 1970

Alisporites sp.

STRIATE BISACCATE

Striatites sidhiensis Bharadwaj & Srivastava 1962

S. panchetensis Tiwari & Rana 1981

Faunipollenites varius Bharadwaj 1962

Crescentipollenites bengalensis (Maheshwari & Banerji) Tiwari & Rana 1981

* *Crescentipollenites multistriatus* (Banerji & Maheshwari) Pal & Ghosh comb. nov.

TAENIATE BISACCATE

* *Lunatisporites panchetensis* Pal & Ghosh sp. nov.

Lunatisporites noviaulensis (Leschik) Scheuring 1970

L. ovatus (Goubin) Maheshwari & Banerji 1975

Chordasporites australiensis de Jersey 1962

COLPATE

Pretricolpipollenites bharadwajii Balme 1970

INAPERTURATE

Inaperturopollenites nebulosus Balme 1970

Lunatisporites panchetensis Pal & Ghosh sp. nov.

Figs 1-2

Diagnosis - Pollen grains bisaccate, slightly diploxylonoid, 54-76 μm X 46-60 μm ; central body distinct, \pm dense, circular to vertically oval in outline, 46-58 μm in diameter, bearing 4 massive taeniae, 8-14 μm broad, intrapunctate; sacchi less than hemispherical, sacchi overlap almost double than the sacchi off-lap; distal saccus attachment \pm straight, associated with distinct vertical fold, saccus-free area quite narrow, 2-5 μm in width; sacchi exine intrareticulate, intermingled with puncta.

Holotype - Fig. 1, Slide No. L1/70 - (9) of Palaeobotany and Palynology Section, Botany Department, Burdwan University.

Type Locality - Dhardharia Nala Section, Lugu Hill, East Bokaro Coalfield, India.

Horizon & Age - Panchet Formation; Late Early Triassic.

Comparison - The presently described species of *Lunatisporites* is comparable with *Lunatisporites acutus* Leschik emend. Scheuring (1970) and *Lunatisporites novimundi* (Jansonius) Kumaran & Maheshwari (1980) in being slightly diploxylonoid. But the present species is readily distinguishable in

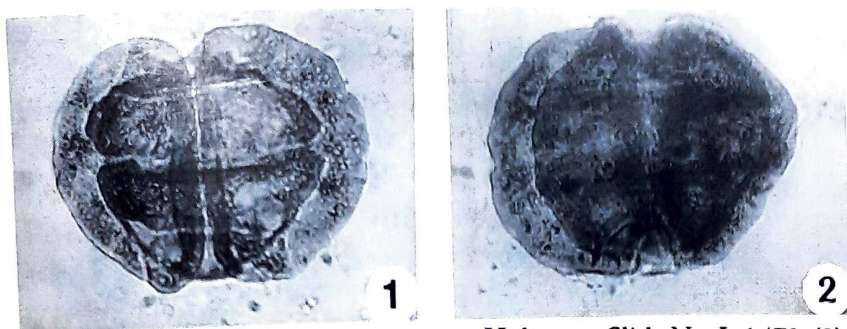


Fig. 1. *Lunatisporites panchetensis* sp. nov. Holotype, Slide No. L-1/70- (9). X 500; Fig. 2. *Lunatisporites panchetensis* sp. nov. Slide No. L-1/65 - (13a). X 500.

having a very narrow saccus-free area and distal saccus attachment associated with vertical folds. *Lunatisporites noviaulensis* (Leschik) Scheuring (1970) and *Lunatisporites asansoliensis* Tiwari & Rana (1981) are also comparable with *Lunatisporites panchetensis* sp. nov. in having crescent folds at the saccus attachment zones and being slightly diploxytonoid, but both of them, unlike *L. panchetensis*, possess broad saccus-free area.

The specific name is after the Panchet Forma-



Fig. 3. *Crescentipollenites multistriatus* (Banerji & Maheshwari) comb. nov. Slide No. L-1/66-(23d). X 500.

tion.

Crescentipollenites multistriatus (Banerji & Maheshwari) Pal & Ghosh comb. nov.

Fig. 3

Basionym - *Gondwanipollenites multistriatus* Banerji & Maheshwari, *Palaeobotanist* 22 (2), 1975, p. 161, Pl. 3, Fig. 31

Remarks - Due to the presence of semilunar folds along the distal saccus attachment zones this species has been assigned to *Crescentipollenites* Bharadwaj *et al.* Based on same criterion another species of *Gondwanipollenites*, *G. bengalensis* Maheshwari & Banerji (1975), has also been transferred to *Crescentipollenites* by Tiwari and Rana (1981).

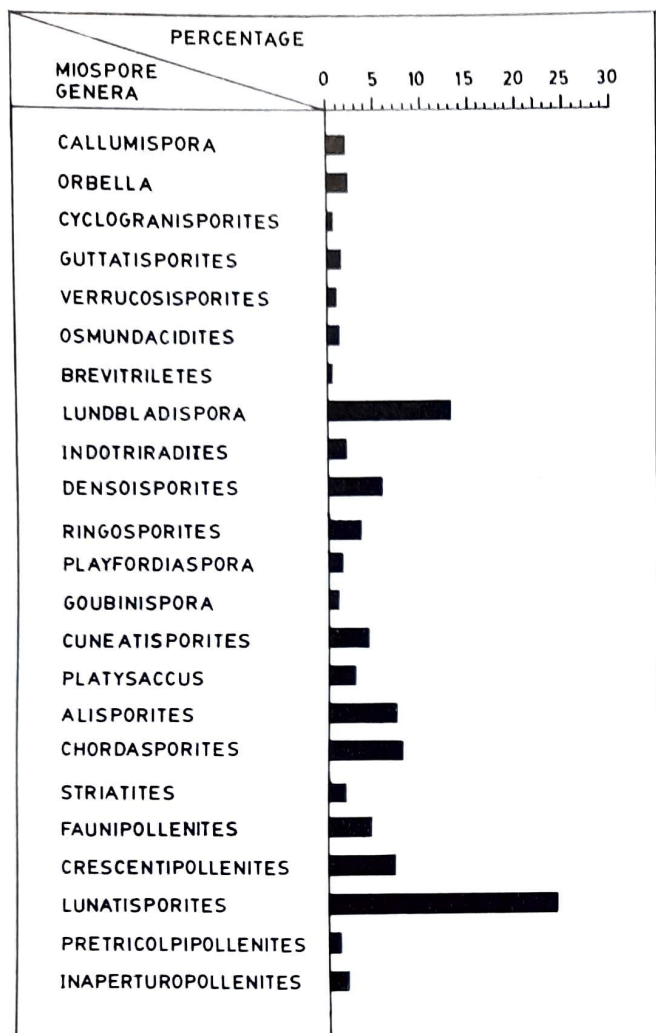
Percentage frequencies of different species in each of the four productive samples have been

determined based on a count of at least two hundred fifty specimens. The miospore contents qualitatively as well as quantitatively are more or less similar in all of the four samples excepting few minor variations. Therefore, it has been concluded that all the four samples represent a single miofloral assemblage. The mean percentage frequencies of miospores at generic level (Text-fig.1)

depicts that the assemblage is dominated by *Lunatisporites* (24.2%) and *Lundbladispora* (13.4%). The genera *Chordasporites* (7.7%), *Alisporites* (7.5%), *Crescentipollenites* (6.9%), *Densosporites* (5.7%), *Faunipollenites* (1.6%), *Guttatisporites* (1.5%), *Osmundacidites* (1.5%), *Verrucosisporites* (1.2%), *Pretricolpipollenites* (1.2%) and *Goubinispora* (1%) are quantitatively significant forms in decreasing order. *Cyclogranisporites* and *Brevitriletes* are rather rarely met with (1%) and sometimes found to be absent in one or the other sample.

Considering the major groups of the miospores, the taeniate bisaccate pollen grains (31.9%) and cavate-cingulate trilete spores (24.3%) have been found to be most predominant forms. Non-striate bisaccate (5%), striate bisaccate pollens (13.2%) and azonate trilete spores (10.1%) are commonly occurring elements in decreasing order, monosaccate (2.6%), inaperturate (2.1%) and colpate (1.2%) pollen grains are rare. Not a single monolet spore has been found to be present in any sample.

Miofloral assemblage of the Panchet Formation in Damodar Valley Basin have previously been studied by Kar (1970a, 1970b), Sarbadhikari (1977, 1979), Maheshwari and Banerji (1975), Banerji and Maheshwari (1977), Bharadwaj and Tiwari (1977), Tiwari (1979a, 1979b), Bharadwaj, Tiwari and Anand Prakash (1979), Rana and Tiwari (1980), Tiwari and Rana (1980, 1981, 1984) and Tiwari and Singh (1983, 1986). Out of these the late Early Triassic assemblages (Bharadwaj, Tiwari & Anand Prakash, 1979; Tiwari & Rana, 1980, 1981, 1984; Tiwari & Singh, 1986 and Tiwari & Singh 1983, 1986) resemble the present one in many respects. Tiwari and Rana (1980) and Tiwari and Singh (1986) have synthesized the available data on the miofloral succession of Panchet Formation in the Raniganj Coalfield. The present miofloral assemblage has been compared with the previously



Text-Fig. 1. Percentage frequencies of miospore genera in Panchet Formation, exposed in Dhardharia Nala near Jurwa village, East Bokaro Coalfield.

recorded one by Bharadwaj *et al.*, (1979) from same locality. The present assemblage consists of 37 species belonging to 23 genera, whereas, Bharadwaj *et al.* (1979) reported earlier 28 genera without any specific epithet. However, in the present mioflora some more stratigraphically important taxa viz., *Goubinispora*, *Ringosporites*, *Orbella* etc. have been recorded. Quantitatively the assemblage is comparable with that of Bharadwaj *et al.* (*loc. cit.*) in having dominance of *Lunatisporites* and *Lundbladispota*. But in the present assemblage percentage frequencies of *Lunatisporites*, *Lundbladispota* and *Alisporites* enhance alongwith the decline of *Densoisporites* and *Chordasporites*. Bharadwaj *et al.* suggested that the age of the shale bed which yielded *Lunatisporites* - *Chordasporites* - *Densoisporites* - *Lundbladispota* - palynoassemblage from the East Bokaro Coalfield is well towards the younger reaches of Panchet Formation. The present

assemblage from the Panchet Formation of East Bokaro Coalfield (in being dominated by the general *Lunatisporites* and *Lundbladispota* with qualitatively significant occurrence of *Densoisporites*, *Alisporites*, *Ringosporites* and *Orbella*) is closely comparable with Assemblage - 3 of Tiwari and Rana (1980) and Assemblage P-IVB of Tiwari and Singh (1986). Both the latter assemblages have been considered to be the youngest assemblage of Panchet Formation and dated as late Early Triassic. Like the present assemblage the genus *Lunatisporites* continues as the most predominant form in the early Middle Triassic assemblage known from the Supra-Panchet Formation of Raniganj Coalfield (Assemblage - 4 of Tiwari & Rana 1980). But cavate-cingulate forms which are predominant in the present assemblage decline abruptly in the Assemblage - 4 of Tiwari and Rana (1980). Moreover, *Goubinispora*, the characteristic early Middle Triassic taxon is rather rare in the presently described one. Thus, the present assemblage appears to be slightly older than the early Middle Triassic assemblage. The incidence of *Goubinispora* in the assemblage is significant. This monosaccoid form which becomes more prominent in the early middle Triassic strata, did originate in the later part of the Panchet Formation and flourished during the overlying Mahadevas.

The Australian Early Triassic miofloras (de Jersey 1968, 1970; Dolby & Balme 1976) like the present assemblage are also characterised by taeniate and cavate-cingulate forms. However, the genus *Aratrisporites* which is a frequently occurring form in the Australian assemblage is totally absent in the present one. Moreover, *Goubinispora*, though rare, has been found to be present in the Lugu Hill assemblage.

The Early Triassic assemblage from Salt Range, West Pakistan (Balme 1970) has a predominance of the genus *Lunatisporites* (*Taeniaesporites*) in association with *Densoisporites* and *Lundbladispota*, but frequencies of these genera decline at the level of late Early Triassic. In Damodar Valley Basin of India on the other hand, these groups of miospores remain prominent till the late Early Triassic time. This sort of discordance may be due to different sets of ecological conditions of the two floral provinces as has already been described by Tiwari and Rana (1980).

A perusal of the foregoing account reveals that Panchet Formation in the Dhardharia Nala Section of East Bokaro Coalfield appears to be of late Early Triassic age.

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