Floral change across the Permian-Triassic Boundary, in Damodar and Auranga Valleys

Jayasri Banerji


Megafloral change across the Permian-Triassic boundary is distinct but not very abrupt. The general composition of the flora is more or less similar in the Upper Permian-Lower Triassic time slice except for the appearance of a few significant taxa in the Lower Triassic, such as, *Lepidopteris* and *Dicroidium*. The size of *Glossopteris* leaves becomes smaller in the Panchet beds. *Dicroidium* appeared a little later than *Lepidopteris* in the uppermost part of Lower Triassic. Palynological studies of Panchet beds (Maitur Formation) indicate that striate disaccate rich mioflora gradually declines accompanied by the emergence of some new elements like—*Decisporis*, *Verrucosissiopes*, *Playfordiaspora* and *Arcuatipollinia* (*Lunatisporites*). The megaspores — *Banksisporites*, *Maiturisporites* and *Pantiella* are confined to Panchet Formation only.

Key-words—Megaflora, Palynology, Permian-Triassic transition, India.

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**FLORISTIC CHANGE ACROSS P/T BOUNDARY**

**Damodar Valley (Raniganj Basin)**

In the Raniganj Basin, the Permian-Triassic boundary is usually recognised on the basis of lithological changes between Raniganj and Panchet Formations which are best exposed in Nonia Nala section in the vicinity of Asansol and southwards across the Damodar River, and at Junut, north of Damodar River. The Raniganj Formation is usually characterised by alternating sequence of sandstones, shales and coal seams which is overlain conformably by the Panchet Formation. The contact between the two formations is marked at places by a minor angular unconformity. The Panchet Formation is characterised by a thick sequence of yellow or buff to khaki-green medium to coarse-grained sandstone with cross-stratification, greenish shales and sandstones. There is a distinct change between the lower Panchet (Maitur Formation) and the upper Panchet (Hirapur Formation). The upper Panchet is characterised by...
the appearance of red clay bands while the lower beds (Maitur Formation) comprise thick khaki-green silty shale and greenish-brown mudstone (Gee, 1930). The Raniganj–Panchet boundary in the Raniganj Coalfield is represented by a minor unconformity above the fossil wood sandstone of Kumarpur. The only criterion to fix the boundary between Raniganj and Panchet is the presence or absence of calcareous material in them; the Panchet is completely devoid of carbonaceous matter. Fresh water *Estheria mangalensis* is common in the Panchet Formation and hence faunistically, the Raniganj–Panchet boundary may be fixed below the first occurrence of *Estheria*.

Plant megafossils of the Panchet Formation are known from a locality near Maitur Village (Feistmantel, 1880). The assemblage includes *Schizoneura gondwanensis*, *Vertebraria indica*, *Pecopteris concinna*, *Cyclopteris pachyrachis*, *Glossopteris angustifolia*, *G. communis*, *G. conspicua*, *G. indica*, *G. intermedia*, *G. browniana*, *G. lineata* and *G. retifera*. Banerji and Bose (1977) described some plant remains from north-western branch of Nonia Nala, east of Kumarpur and northern branch of Nonia Nala near ‘Indigo’ factory road bridge near Asansol. This assemblage includes *Schizoneura gondwanensis*, *Glossopteris browniana*, *G. angustifolia*, *G. sp. cf. G. intermedia*, *Macrotaentopteris* sp., *?Dicroidium/Leptopteris* sp., *Podozamites* sp. cf. *P. lanceolatus*, *Cordaicarpus* sp. and *? Lepidoterpis*.

The Panchet megaflora has more or less same forms as found in the Raniganj megaflora, except for the presence of *Pecopteris concinna*, *Cyclopteris pachyrachis*, *Podozamites* sp. and *?Dicroidium/Leptopteris* sp. Thus there is no clear cut distinction between the Raniganj and Panchet assemblages at the level where the lithostatigraphical boundary lies. The Panchet flora is comparatively scarce and the new forms appear slightly late in the Maitur Formation.

Extensive palynological studies have been carried out on Panchet Group of Raniganj Coalfield. Srivastava and Pawde (1962) studied bore-hole R.O. 1 (B) in Ondal area of West Bengal. In their range table it is observed that there is a sudden and significant change in the mioflora at 3.49 metre depth. It indicates an appreciable gap in sedimentation and this confirms the view of Gee (1932) that in this area the rocks of Upper Raniganj directly underlie the strata of Upper Panchet and Maitur Formation is missing here. Kar (1970) described a miofloral assemblage from greenish-grey shales of the Panchet Group in bore-hole No. RE9. The assemblage includes 80 per cent trilete spores with dominance of *Decisporis* and *Divaripunctites*; disaccates are comparatively less. Sarbadhikari (1972) investigated a mioflora from Panchet Formation in the Laudoha bore-hole RE-1. The assemblage is dominated by trilete spores which is in contrast to the striate-disaccate rich Raniganj mioflora. Satsangi, Chandra and Singh (1972) studied the miofloral assemblage from khaki-green shales overlying the Raniganj Formation showing dominance of bisaccate pollen. Maheshwari and Banerji (1975) investigated the palynomorphs from the Maitur Formation exposed in Nonia Nala, east of Kumarpur. According to them the bed above the Raniganj–Panchet contact has abundance of striate bisaccate pollen as in the underlying Raniganj beds. In the beds further above the contact, the number of trilete forms gradually increases and striate bisaccate pollen decrease in frequency. The significant taxa of Maitur Formation are—*Verrucostsporites, Decisporis, Playfordispispora* and *Arcuatipollenites (Lunatisporites)*. The characteristic forms of Raniganj Formation, viz., *Indospora, Gondisporites, Microbaculispora, Microfoveolatisspora* and *Vittatina*, etc. are absent.

The miofloral assemblage from Maitur Formation exposed on the northern bank of the Damodar River near the village Junut (Banerji & Maheshwari, 1977) is very much similar to Lower Triassic assemblage of Nonia Nala. Here, the boundary between the Raniganj and Maitur Formations is marked by a small unconformity which occurs immediately above the fossil wood horizon. Plant remains are rare and unidentifiable.

Tiwari and Rana (1981) studied the *sporae dispersae* of some Lower and Middle Triassic sediments from Damodar Basin and observed that there was a gradual but definite change in the miofloral pattern from Permian through Triassic sediments in India. Miofloral study carried out by Singh and Tiwari (1982) from bore-hole RAD-2, East Raniganj Coalfield shows a quick and sharp change in spore-pollen spectrum at the Permian-Triassic boundary.
which indicates a probable gap in the deposition in this region.

There is a definite but insignificant miofloral change above the Raniganj-Panchet boundary in Raniganj Coalfield, but whether this change took place in the Late Palaeozoic or at the Permian-Triassic boundary is not clearly known. Singh and Shah (1971) and Maheshwari (1974) suggested that if the Permian-Triassic boundary in India is taken as fixed on lithological evidence, then the flora of the Upper Permian and Lower Triassic is very similar except some minor differences. On the other hand, if the boundary is considered on the floral contents alone, it should be extended into the Maitur Formation. Thus, it may be concluded that there is a definite, though insignificant miofloral change at the Raniganj-Maitur boundary, but whether this change took place in the Late Palaeozoic or at the Permian-Triassic boundary is still a question to solve.

Tiwari and Singh (1986) suggested that Permian-Triassic boundary should be in between the *Striatopodocarpites-Crescentipollenites* zone and *Striatopodocarpites-Klausipollenites* cf. *Lunatisportes* zone. The palynological boundary is thus the shale-sandstone unit while the lithological boundary is at the top of the sandstone bed. Further, Vijaya and Tiwari (1987) have tried to demarcate the Permian-Triassic boundary in Raniganj Coalfield on the basis of selected palynofossils at specific level.

Megaspore assemblage described by Maheshwari and Banerji (1975) from Maitur Formation exposed at Nonia Nala includes several species belonging to eight genera. The characteristic genera, viz., of Maitur Formation are *Bankstisportes*, *Pantiella* and *Maiturisportes*. Four genera, viz., *Bihartsportes*, *Jhartatriletes*, *Sravastavaesportes* and *Talchirella* are also found in the older formations but the species of these genera, viz., in the Maitur Formation are new. Two genera, viz., *Maiturisportes* and *Pantiella* are also new, whereas, the other two genera—*Bankstisportes* and *Nathorstisportes* are known from the Mesozoic rocks.

**Auranga Valley**

The Auranga Coalfield is the largest and complicated coalfield of Palamau District of Bihar. The sedimentary sequence in the coalfield is as follows (Rizvi, 1972):

<table>
<thead>
<tr>
<th>Series</th>
<th>Boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahadeva Series</td>
<td>Erosional break</td>
</tr>
<tr>
<td>Triassic</td>
<td>Erosional break</td>
</tr>
<tr>
<td>Panchet Series</td>
<td>Erosional break</td>
</tr>
<tr>
<td>Raniganj Series</td>
<td>Erosional break</td>
</tr>
<tr>
<td>Permian</td>
<td>Erosional break</td>
</tr>
<tr>
<td>Barakar Series</td>
<td>Erosional break</td>
</tr>
<tr>
<td>Talchir Series</td>
<td>unconformity</td>
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</tbody>
</table>

Archaean

The Raniganj and Panchet rocks are mostly conformable and the transition from Raniganj to Panchet is not well marked and the boundary consequently is arbitrary (Ball, 1878, p. 83) The Panchet Formation comprises alternating bands of coarse grained highly feldspathic sandstone and white to yellowish green sandy shales with rare calcareous and ferruginous lenses. Some of the thin micaceous shaly sandstones resemble the *Estherta* beds of the Raniganj Coalfield. Ball (1878) reported some plant fossils from rocks occurring on the northern face of the Latehar Hill. Feistmantel (1886) believed that it represents his 'Transitional beds' probably homotaxial with the 'Parsora Stage' of the South Rewa Basin. He recorded several taxa, viz., *Schizoneura gondwanensis*, *Vertebraria indica*, *Glossopteris communis*, *G. damudica*, *G. indica*, *Gangamopteris* sp., scales and winged seeds from these rocks. Bhattacharyya (1963) recorded a floral assemblage from the Panchet sediments near Deobar. The forms include *Gangamopteris cyclopteroidea*, *Rhiptidopsis densinervis*, *Trityzia spectosa* and *Dicroidium sahni*.

Bose (1974) remarked that probably this assemblage is a mixed assemblage and needs restudy. Later, Bose and Banerji (1976) described megafossils, viz., *Trityzia spectosa*, *Schizoneura gondwanensis*, *Glossopteris angustifolia*, *G. communis*, *G. indica*, *Vertebraria indica*, *? noeggerathiopsis* sp. and *Dicroidium* sp. from Deobar. In addition to these, a
few detached pinnules with cuticle like *Leptidopteris* have been described from Sukri River near Tubed. Nandi (1992) has confirmed the occurrence of *Leptidopteris* in Panchet Formation of Auranga Coalfield, Bihar.

The palynological assemblage from the Panchet rocks exposed in the Sukri River near Kaima on the whole is dominated by striate bisaccate pollen, non-striate bisaccate pollen and the pteridophytic spores share nearly equal percentage (Banerji & Maheshwari, 1975). The characteristic forms are *Punctatisporites, Decisporites, Verrucosporites, Playfordiaspora, Gondwanipollenites, Protohaploxypinus, Arcuatipollenites* (*Lunatisporites*), *Striatites, Rhizomaspora, Altsporites, Klausipollenites* and *Falcastepos* which are similar to Maitur Formation palynomorphs of Lower Triassic age.

**CONCLUSION**

On the basis of above studies it has been suggested that lithologically the basal limit of the Maitur Formation (Lower Panchet) is demarcated by the occurrence of undecomposed feldspar and absence of carbonaceous streaks. Faunistically the Raniganj-Panchet boundary vs. Permo-Triassic boundary, at least in the Raniganj Coalfield is marked below the *Estheria* horizon. Megafossilically, *Glossopteras* starts declining in frequency, new elements, viz., *Leptidopteris* and *Dicroidium* start appearing a little late so the boundary may extend into the Panchet and the flora changes gradually in the upper part of Early Triassic across the lithological P/T boundary. Miofloristically the dominance of strate bisaccate assemblage shows gradual decline and later it is replaced by trilette (*Lundbladispora, Decisporites*), monosaccate (*Playfordiaspora*), non-striate disaccate (*Altsporites, Falcastepos, Arcuatipollenites* and taeniate forms (*Lunatisporites*).

**REFERENCES**


