

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

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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*, *Verrucosiporites*, *Playfordiaspora* and *Arcuatipollenites* (*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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सारांश

दामोदर एवं औरंगा घाटियों में परमियन-ट्रायैसिक सीमा पर वनस्पतिजातीय परिवर्तन

जयश्री बैनर्जी

परमियन-ट्रायैसिक सीमा पर गुरुवनस्पतिजातीय परिवर्तन स्पष्ट है परन्तु आकस्मिक नहीं है। अधरि ट्रायैसिक काल में कुछ विशेष वर्गकों जैसे लेपिडॉप्टेरिस एवं डाइक्रोयडियम के प्रादुर्भाव को छोड़कर उपरि परमियन-अधरि ट्रायैसिक काल में वनस्पतिजात की संरचना लगभग एक जैसी ही है। पंचेत संस्तरो में ग्लॉसॉप्टेरिस की पत्तियाँ आकार में छोटी पाई गई हैं। अधरि ट्रायैसिक काल के ऊपरी भाग में लेपिडॉप्टेरिस की अपेक्षा डाइक्रोयडियम कुछ बाद में विकसित हुआ। पंचेत संस्तरो के परागाणविक अध्ययन से प्रदर्शित होता है कि रेखीय द्विकोष्ठीय सूक्ष्मवनस्पतिजात धीरे-धीरे कम हो गया तथा कुछ नये अवयवों डेसिस्पोरिस, वेरुकोसिस्पोराइटिस, प्लेफोर्डियास्पोरा एवं आर्कुएटीपोलिनाइटिस का प्रादुर्भाव हुआ है। पंचेत शैल-समूह में केवल बैकसिस्पोराइटिस, मैटुरिस्पोराइटिस एवं पन्तियैल्ला नामक गुरुबीजाणु मिलते हैं।

FLORISTIC CHANGE ACROSS P/T BOUNDARY Damodar Valley (Raniganj Basin)

THE Raniganj Basin is one of the significant Gondwana basins of India, which contains plant mega- and micro-remains of Early Permian to Late Triassic age. The generalised stratigraphic sequence in the Raniganj Basin is as follows :

	Formation
	Supra Panchet
Triassic	-----Unconformity-----
	Panchet
	-----Unconformity-----
	Raniganj
Permian	Kulti
	Barakar
	Talchir
	-----Unconformity-----
Precambrian	

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 mangaliensis* 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. linearis* 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*, *Macrotaeniopteris sp.*, ? *Dicroidium/Lepidopteris sp.*, *Podozamites sp. cf. P. lanceolatus*, *Cordaitcarpus sp.* and ? *Lepidopteris*.

The Panchet megafloora has more or less same forms as found in the Raniganj megafloora, except for the presence of *Pecopteris concinna*, *Cyclopteris pachyrachis*, *Podozamites sp.* and ? *Dicroidium/Lepidopteris sp.* Thus there is no clear cut distinction between the Raniganj and Panchet assemblages at the level where the lithostratigraphical 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 sedimenta-

tion 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—*Verrucosporites*, *Decisporis*, *Playfordiaspora* and *Arcuatipollenites (Lunatisporites)*. The characteristic forms of Raniganj Formation, viz., *Indospora*, *Gondisporites*, *Microbaculispora*, *Microfoveolatispora* 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 still 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.

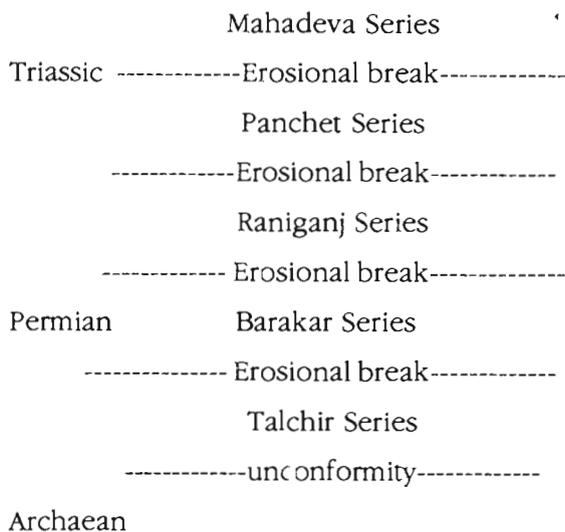
Tiwari and Singh (1986) suggested that Permian-Triassic boundary should be in between the *Striatopodocarpites-Crescentipollenites* zone and *Striatopodocarpites-Klaustipollenites* cf. *Lunatisportites* zone. The palynological boundary is thus the shale-sandstone unit while the lithological boundary 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 *Banksisportites*, *Panttella* and *Matturisportites*. Four genera, viz., *Biharisportites*, *Jhartatrilites*, *Srtvastavaesportites* 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., *Matturisportites* and *Panttella* are also new, whereas, the other two genera—*Banksisportites* and *Nathorstisportites* 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):



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 *Estheria* 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 megafloral assemblage from the Panchet sediments exposed near Deobar. The forms include *Gangamopteris cyclopteroides*, *Rhipidopsts denstneruts*, *Trizygia spectosa* and *Dicroidium sabniti*. Bose (1974) remarked that probably this assemblage is a mixed assemblage and needs restudy. Later, Bose and Banerji (1976) described megafossils, viz., *Trizygia spectosa*, *Schizoneura gondwanensis*, *Glossopteris angustifolia*, *G. communis*, *G. indica*, *Vertebraria indica*, ? *Noeggerathtopsts* sp. and *Dicroidium* sp. from Deobar. In addition to these, a

few detached pinnules with cuticle like *Lepidopteris* have been described from Sukri River near Tubed. Nandi (1992) has confirmed the occurrence of *Lepidopteris* 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*, *Protohaploxyptinus*, *Arcuatipollenites* (*Lunatisporites*), *Striatites*, *Rhizomaspora*, *Alisporites*, *Klaustipollenites* and *Falcisporites* 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, atleast in the Raniganj Coalfield is marked below the *Estheria* horizon. Megafloristically, *Glossopteris* starts declining in frequency, new elements, viz., *Lepidopteris* 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 striate bisaccate assemblage shows gradual decline and later it is replaced by trilete (*Lundbladisporea*, *Decisporites*), monosaccate (*Playfordiaspora*), non-striate disaccate (*Alisporites*, *Falcisporites*, *Arcuatipollenites* and taeniate forms (*Lunatisporites*).

REFERENCES

- Ball V 1878. On the Auranga and Hutar coalfields and the Iron ores of Palamau and Toree. *Mem. geol. Surv. India* **15**(1) : 55-90.
- Banerji Jayasri & Bose MN 1977. Some Lower Triassic plant remains from Asansol region, India. *Palaeobotanist* **24** : 202-210.
- Banerji Jayasri & Maheshwari HK 1974. Palynology of the Panchet Group exposed in the Nonia Nala, near Asansol, West Bengal. *Palaeobotanist* **21** : 368-372.
- Banerji Jayasri & Maheshwari HK 1975. Palynomorphs from the Panchet Group exposed in Sukri River, Auranga Coalfield, Bihar. *Palaeobotanist* **22** : 158-170.
- Banerji Jayasri & Maheshwari HK 1977. A mioflorule from Maitur Formation near Junut, West Bengal. *Palaeobotanist* **24** : 146-148.
- Bhattacharyya AK 1963. The assemblage of mega plant fossil from the Lower Gondwana rocks of the western part of the Auranga Valley Coalfield, Palamau District, Bihar. *Q. Jl. geol. Min. metall. Soc. India* **35**(2) : 123-128.
- Bose MN 1974. Triassic flora. In : Surange KR, Lakhanpal RN & Bharadwaj DC (Editors)—*Aspect and appraisal of Indian Palaeobotany* : 285-293. Birbal Sahni Institute of Palaeobotany, Lucknow.
- Bose MN & Banerji Jayasri 1976. Some fragmentary plant remains from the Lower Triassic of Auranga Valley, district Palamau. *Palaeobotanist* **23** : 139-144.
- Feistmantel O 1880. The fossil flora of the Gondwana System- II. The flora of the Damuda and Panchet divisions. *Mem. geol. Surv. India Palaeont. indica ser.12* **3**(2) : 1-77.
- Feistmantel O 1886. The fossil flora of the Gondwana System-2. The fossil flora of some of the coalfields in western Bengal. *Mem. geol. Surv. India Palaeont. indica ser. 12* **4**(2) : 1-71.
- Gee ER 1930. New fossil localities within the Panchet series of the Raniganj Coalfield. *Rec. geol. Surv. India* **63** : 205-207.
- Gee ER 1932. The geology and coal resources of the Raniganj Coalfield. *Mem. geol. Surv. India* **61** : 1-343.
- Kar RK 1970a. Sporae dispersae from Panchet (Lower Triassic) in the bore-core No. RE9 Raniganj Coalfield, West Bengal. *Palaeobotanist* **18** : 50-62.
- Maheshwari HK 1974. Raniganj-Panchet Boundary. In : Surange KR, Lakhanpal RN & Bharadwaj DC (Editors)—*Aspects and appraisal of Indian Palaeobotany*: 408-420. Birbal Sahni Institute of Palaeobotany, Lucknow.
- Maheshwari HK & Banerji Jayasri 1975. Lower Triassic palynomorphs from the Maitur Formation, West Bengal, India. *Palaeontographica* **B152** : 149-190.
- Nandi A 1992. New find of *Lepidopteris* in Panchet Formation of Gondwana sequence from Auranga Coalfield, Bihar. *Indian Min.* **2** : 165-166.
- Rizvi SRA 1972. Geology and sedimentation trends in Palamau Coalfield, Bihar, India. *Mem. geol. Surv. India* **104** : 1-108.
- Sarbadhikari TR 1972. Gondwana miospores from a bore-hole in the Raniganj Coalfield, India. *Bull. geol. Min. metall. Soc. India* **45** : 1-26.
- Satsangi PP, Chandra A & Singh G 1972. Sporological analysis of Panchet Series, Raniganj Coalfield and its bearing on Permo-Triassic transition. *Rec. geol. Surv. India* **99**(2) : 101-108.
- Singh G & Shah SC 1971. Lower Gondwana palynology and related stratigraphic problems. *Abst. Seminar Palaeopalynol. Indian Stratigr. Calcutta 1971* : 17.
- Singh V & Tiwari RS 1982. Pattern of miofloras through Permo-Triassic transition in bore-hole RAD-2, East Raniganj Coalfield, W. Bengal. *Geophytology* **12** : 181-186.
- Srivastava RN & Pawde MB 1962. Palynological study of bore hole R.O. 1(B), Ondal, West Bengal. *Rec. geol. Surv. India* **91**(2) : 269-384.
- Tiwari RS & Rana V 1981. Sporae dispersae of some Lower and Middle Triassic sediments from Damodar Basin, India. *Palaeobotanist* **27** : 190-220.
- Tiwari RS & Singh V 1986. Palynological evidence for Permo-Triassic boundary in Raniganj Coalfield, Damodar Basin, India. *Bull. geol. Min. metall. Soc. India* **54** : 256-264.
- Vijaya & Tiwari RS 1987. Role of spore pollen species in demarcating the Permo-Triassic boundary in Raniganj Coalfield, West Bengal. *Palaeobotanist* **35** : 242-248.