Subsurface Palynological Succession From Katol Area, Nagpur, Maharashtra

Pramod Kumar and Neerja Jha

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

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Four distinct palynoassemblages have been identified in 261 m thick sequence of bore-core MKH-5 from Katol area, near Nagpur in Maharashtra State. Assemblage I, the oldest, is dominated by radial monosaccates (*Parasaccites, Plicatipollenites*) and shows Talchir affinity. Assemblage II, dominated by *Parasaccites* in association with *Scheuringipollenites* and striate disaccates belongs to Upper Karharbari palynozone. Occurrence of some taxa, viz. *Falcisporites, Lundbladispora, Goubinispora, Chordasporites, Lunatisporites, Kamthisaccites, Crescentipollenites, Densipollenites* alongwith dominance of striate disaccates in Assemblage III suggests Raniganj affinity (Late Permian). Assemblage IV, the youngest in the succession, containing high percentage of *Callumispora* alongwith some stratigraphically important taxa, viz. *Falcisporites, Lundbladispora, Chordasporites* and *Lunatisporites,* compares Panchet palynoflora.

High incidence of *Parasaccites* alongwith striate disaccate in Assemblage III and high percentage of *Callumispora* in Assemblage IV suggests that the climate towards the end of Permian time tended to become colder and this evidence supports the contention of a third glacial phase during Late Permian/Early Triassic time.

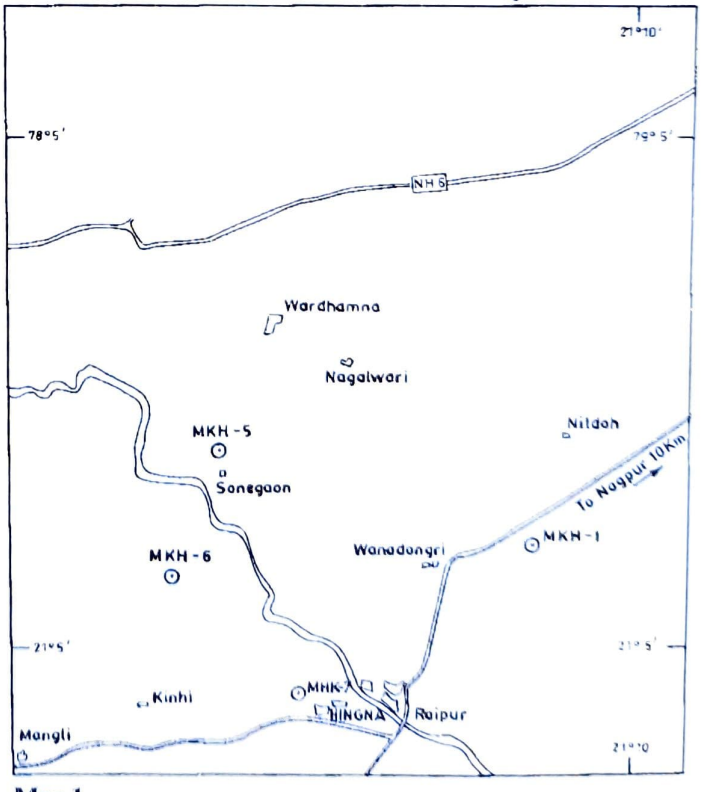
Key-words : Palaeopalynology, Permian-Triassic, Katol, India.

INTRODUCTION

THE Gondwana sediments of Godavari Valley extend uninterruptedly northwards into the drainage system of Wardha River and its tributaries.Thus, the Wardha Valley coalfields represent the northwestern extension of Godavari Graben. The geological succession in Wardha Valley coalfields in general remains the same as that of Godavari Graben described by the Geological Survey of India (see Raja Rao, 1982), however, very little is known of the sedimentary sequences in areas away from the main working coalfields because of widespread overlap of the Kamthi sediments. In order to date and correlate the coal-bearing and associated sediments a bore core MKH-5 (Map 1) drilled by Mineral Exploration Corporation Limited at Katol area near Nagpur was analysed palynologically. The bore hole cuts across the Permian sediments including coal. The lithological succession includes Ist Trap from 0-55.0 m, IInd Trap 55.5-63.0 m with an inter-trap between 55.0-55.5 m. Medium to coarse-grained highly silicified ferruginous sandstone between 63-110 m represent the ?Kamthi Formation. Sediments between 110-261 m include succession of sandstone, coaly shale, coal and carbonaceous shale representing Barakar Formation in the area. The lithological details and palynological composition of samples analysed have been given in Table -1.

PALYNOASSEMBLAGES

Four palynoassemblages have been identified in the 261 m deep sequence of sedimentary rocks in bore



Map 1

core MKH-5 from Katol area near Nagpur on the basis of quantitative dominance and also qualitative variance of different palynotaxa :

Assemblage I : This palynoassemblage has been identified at 253-258 m depth in fine grained argillaceous sandstone and is dominated by radial monosaccates chiefly *Parasaccites* (60%) and *Plicatipollenites* (20%). The other monosaccate taxa identified include *Divarisaccus, Caheniasaccites, Tuberisaccites* in low percentages. Striate disaccate pollen are rare.

Assemblage II : Palynoassemblage between 161.0-139.0 m shows the dominance of *Parasaccites* and subdominance of nonstriate pollen genus *Scheuringipollenites*. Among striate disacates *Faunipollenites* is present in rare amounts. High percentage of *Balmeella* (36%) and *Leiosphaeridia* (8%) has been recorded at 159 m.

Assemblage III : Sediments between 133.0-130.0 m shows the dominance of striate disaccate pollen chiefly *Striatopodocarpites* and *Faunipollenites*. The associated important taxa included *Densipollenites magnicorpus, Crescentipollenites, Corisaccites, Kamthisaccites* and *Lacinitriletes* in low percentages. The rare ones yet significant are *Falcisporites, Goubinispora, Densoisporites, Lundbladispora, Lunatisporites,* and *Chordasporites*.

The radial monosaccate genus *Parasaccites* is present in high percentage (20 %) at 113.0-116.0 m depth while at 130.0 m it is reduced to 6.0 percent. At the latter depth trilete spores are fairly well represented both qualitatively as well as quantitatively and include *Horriditriletes* (2%), *Lophotriletes* (6%), *Microfoveolatispora* (1%), *Brevitriletes* (10%), *Lacinitriletes* (3%) and *Lundbladispora* (1%).

Assemblage IV : This palynoassemblage is present between 55.0-110.0 m and shows dominance of *Callumispora* (more than 50.0%). Presence of *Falcisporites, Chordasporites, Kamthisaccites, Lunatisporites* and few unidentified cingulate spores have been recorded in low percentages. This assemblage occurs in medium to coarse-grained highly silicified ferruginous sandstone at 63.0-110.0 m and a clay band at 55.0-55.5 m between the two traps.

COMPARISON AND DISCUSSION

The dominance of radial monosaccates, chiefly *Parasaccites* and *Plicatipollenites*, in Assemblage I (253.0-258.0 m) suggests affinity with the known Talchir palynozones in India (Tiwari & Tripathi 1992). This palynoassemblage has also been recorded in Godavari Graben (Srivastava & Jha 1995, 1998) and many other basins and represent the Early Permian palynoflora.

The dominance of *Parasaccites* has also been observed in Assemblage II at 139.0-161.0 m but its association with *Scheuringipollenites* and striate disaccates, viz. *Faunipollenites, Striatopodocarpites* and *Crescentipollenites* lends younger aspect to the palynoflora. This palynoassemblage is correlatable with the Upper Karharbari palynozone of the main Godavari Graben (Srivastava & Jha 1995, 1998), Korba Coalfield (Bhardawaj & Srivastava 1973- Zone 2), Raniganj Coalfield (Tiwari 1973) and Pathakhera Coalfied (Sarate 1986).

Parasaccites is again present in high percentages in Assemblage III but its association here is with striate disaccate pollen grains in dominance. In addition to these some of the stratigraphically significant taxa have appeared in this assemblage in low percentage *viz. Falcisporites, Lundbladispora, Lunatisporites, Kamthisaccites,Goubinispora, Kendosporites*. This association characterises Late Permian. The occurrence of high percentage of *Parasaccites* in association with striate disaccates has been recorded in bore-core GJ-6 from Bhopalpalli Area (Srivastava & Jha 1998), bore-core GRK-25 from Ramakrishnapuram Area, bore-core GJP-1 from Jaipuram Area (Srivastava & Jha 1992) of Godavari Graben. In South Rewa basin Assemblage-5 of bore-core JHL-24, JHL-25 (Tiwari & Ram-Awatar 1989) and Assemblage I of bore-core UKD-8 (Tiwari & Ram-Awatar 1987) also shows high incidence of *Parasaccites*. However, in Raniganj Formation of Damodar Valley *Parasaccites* is present in *Striatopodocarpites-Densipollenites* Assemblage in low percentages. Occurrence of *Parasaccites* in high percentage is known in Early Permian glacial/periglacial sediments -

Table 1 : List of samples with details of lithological succession in bore core MKH-5 and palynological composition of yielding samples

Sample nos. & depth	Lithological succession			Palynoassemblage	Remarks	
	Depth (m)	Lithology & Horizon				
1. (55 m)	00-55.00	Trap		No Spore		
	55-55.50	Clay		Dominance of *Callumispora* (more than 50%), presence of *Falcisporites* (3%), *Kamthisaccites* (1%), *Lunatisporites*, *Parasaccites*, *Faunipollenites Leiosphaeridia*, *Chordasporites* and one unidentified cingulate grain	Panchet	Early Triassic
2. (63m)	55.50-63	Trap		No spore		
3. (109 m)	63-110	Medium-coarse grained, highly silicified, ferruginous sandstone	K A M T H I	Dominance of *Callumispora* (more than 50%), presence of *Parasaccites* (3%), *Falcisporites*, *Lundbladispora* (3%), unidentified cingulate grains	Panchet	Early Tirassic
4. (113m)	110-130	Sandstone shale intercalation	R	Dominance of striate disaccates chiefly *Striatopodocarpites* (20%) and *Faunipollenites* (8%), subdominance of *Scheuringipollenites* (24%), *Parasaccites* (20%) and *Corisaccites* (18%), presence of *Chordasporites* (1%), *Falcisporites* (2%), *Lunatisporites* (1%), *Goubinispora* (1%), *Striasulcites* (2%), *Microfoveolatispora* (1%), *Microbaculispora* (1%), *Weylandites* (2%)	Raniganj	Late Permian
5. (116m)		Intercalated shale	A K R	Dominance of striate disaccates chiefly *Striatopodocarpites* (20%), and *Faunipollenites* (12%), subdominance of *Scheuringipollenites* (25%), *Parasaccites* (12%), presence of *Falcisporites* (1%), *Densoisporites* (1%), *Corisaccites* (2%) *Crescentipollenites* (4%), *Lunatisporites* (1%), *Lundbladispora* (2%), *Kamthisaccites* (1%), and *Densipollenites magnicorpus* (2%), *Verticipollenites* (2%), *Microfoveolatispora* (1%), *Lophotriletes* (1%), *Ibisporites* (3%), *Horriditriletes* (1%), *Ginkgocycadophytus* (2%), *Kendosporites* (1%)		
6. (130)		Carb shale	A B	Dominance of striate disaccates chiefly *Striatopodocarpites* (10%) and *Faunipollenites* (24%), subdominance of *Scheuringipollenites* (20%), *Parasaccites* (6%), *Brevitriletes* (10%), presence of *Falcisporites* (2%), *Lundbladispora* (1%), *Chordasporites* (1%), *Lacinitriletes* (3%), *Corisaccites* (1%), *Horriditriletes* (2%), *Lophotriletes* (6%), *Microbaculispora* (1%), *Alisporites* (5%)	Raniganj	Late Permian
7. (132)		Coal		Very poor in pollen and spores, abundance of trachieds, few grains of *Scheuringipollenites*	Poor yield,	
8. (133m)		Shaly coal		Very poor in spore, few grains of *Callumispora*		
9. (138 m)		Sandstone and intercalated coal		Poor yield		
10. (139m)		Sandstone and intercalated coal	R A	Dominance of *Parasaccites* (61%), *Scheuringipollenites* (5%), *Caheniasaccites* (8%), *Vesicaspora* (2%), *Divarisaccus* (2%), *Tiwariasporis* (8%), *Striatopodocarpites* (1%), *Sahnites* (1%), *Faunipollenites* (10%), *Crescentipollenties* (2%)	Karharbari	Early Permian
11. (158m)		Shaly coal		Very poor in spore, abundance of trichieds, presence of *Callumispora*, *Balmeela, Leilsphaeridia*		
12. (159m)		Shaly coal	K	Dominance of *Balmeella* (60%), and *Leiosphaeridia* (20%), *Callumispora* (20%)		
13. (161m)		Carb shale	R	Poor in spore, Presence of *Indotriletes*, *Balmeella*, *Leiosphaeridia*	Karharbari	Early Permian
14. (253)	161-261	Coarse to fine grained white sandstone and carbonaceous layering	A	Dominance of radial monosaccates chiefly *Parasaccites* (50%), *Plicatipollenites* (11%), *Callumispora* (11%), *Jayantisporites* (14%), *Circumstriatites* (1%), *Caheniasaccites* (5%), *Divarisaccus* (%), *Sahnites* (3%), *Tuberisaccites* (1%), *Weylandites* (1%)	Talchir	Early Permian
15. (258m)		Argillaceous Sandstone	B	Dominance of radial monosaccates chiefly *Parasaccites* (60%), *Plicatipollenites* (20%), *Callumispora* (8%), *Jayantisporites* (4%), *Microbaculispora* (1%), *Brevitriletes* (1%), *Divarisaccus* (2%), *Sahnites* (1%), *Striatopodocarpites* (1%).	Talchir	Early Permain

Talchir Formation and also coal-bearing Karharbari formations. Its recurrence towards the end of Late Permian (Raniganj Formation) also suggests cooling of the climate.

The youngest palynoassemblage in the succession of bore-core MKH-5 is domianted by *Callumispora* (Assemblage IV). Here its association with *Lundbladispora, Falcisporites* and other cingulate taxa is significant suggesting Panchet (Early Triassic) affinity (Bharadwaj 1975).

Occurrence of *Parasaccites* and *Callumispora* in high percentage during Late Permian-Early Triassic time has been interpreted to suggest cooling of the climate subtending glaciation (Bharadwaj 1975, Srivastava & Jha 1998). This evidence tends to support the contention of Bharadwaj (1975) of a third phase of glaciation towards the end of Late Permian/ Early Triassic time. However, lithological evidences of this glaciation in India is not available till now. Talchir-like climate has also been suggested during Upper Raniganj and Lower Panchet by Tiwari and Tripathi (1987). Similar palynoassemblage has also been recorded from Late Permian/Early Triassic sediments of Sri Lanka which are considered to be glacial in origin (Dahanayake *et al.* 1989). Though there is no lithological evidence of this glaciation during Late Permian/Early Triassic in India yet there is an indication of return of cooler climate by the presence of undecomposed felspar found in the sandstone of Panchet Group. Undecomposed felspar is characteristic of the sandstone associated with Talchir Boulder Bed. Hence similar conditions may have reccured during Late Permian/Early Triassic though with lesser intensity.

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