Palynozonation of Middle Pali Member in Sohagpur Coalfield, Madhya Pradesh

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Ram-Awatar 1996. Palynozonation of Middle Pali Member in Sohagpur Coalfield, Madhya Pradesh. *Palaeobotanist* **43**(3): 96-101.

Three palynological assemblages have been identified in a Bore-hole SPB- 18 (26.0-163.80 m depth) in the Middle Member of the Pali Formation. The older two assemblages contain the abundance of striate-disaccate pollen, i.e., *Faunipollenites* and *Striatopodocarpites* which are followed by *Crescentipollenites*. Besides, *Gondisporites*, *Corisaccites*, *Lunatisporites* and *Chordasporites* are other important genera which indicate a Late Permian age of the horizon. Presence of Leiospherids at the top of the sequence (Assemblage-I) suggests a probable marine influence in the area. In the Assemblage-II, a new disaccate pollen—*Protoeusaccites* has been recorded which exhibits a transitionary phase from protoeusaccate to eusaccate in the development of saccus.

Key-words—Palynology, Palynozonation, Middle Pali Member, Late Permian (India).

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सारॉंश

मध्य प्रदेश में सोहागपुर कोयला-क्षेत्र में मध्य पाली सदस्य का परागाणविक मंडलन

राम अवतार

पाली शैल-समूह के मध्य सदस्य में एस.पी.बी. 18 नामक वेध-छिद्र से प्राप्त परागाणुवनस्पतिजात में तीन परागाणविक समुच्चय अभिनिर्धारित की गई हैं। पुरानी दो समुच्चयों में रेखीय धारीदार परागकणों का आधिक्य है जिनमें *फ़ॉनीपोलिनाइटिस* एवं *स्ट्रआटोपोडोकार्पाइटिस* मुख्य हैं। इनके बाद *क्रीसेन्टीपॉलिनाइटिस* क्रम में आता है । इसके अतिरिक्त *गोन्डिस्पोराइटिस, कोरिसेक्काइटिस, लूनाटिस्पोराइटिस* एवं *कोर्डास्पोराइटिस* नामक अन्य मुख्य वर्गक हैं जो कि इस संस्तर की अंतिम परमियन आयु इंगित करते हैं। अनुक्रम-1 के ऊपरी भाग में लिओस्फेरिड़ों की उपस्थिति से इस क्षेत्र में समुद्री प्रभाव प्रस्तावित होता है। समुच्चय–2 से एक नया द्विकोष्ठीय परागकण *प्रोटोयूसेक्काइटिस* उपलब्ध हुआ है जो कोष्ठकों के विकास की दृष्टि से अत्यन्त महत्वपूर्ण है।

IN Sohagpur Coalfield, the coal-bearing area lies between the latitude 23°05': 23°30'and longitude 81°13': 82°12'. The palynological studies were carried out in this area by Navale and Tiwari (1967) and Bharadwaj and Srivastava (1971), but these studies were confined only up to Barakar Formation; from the younger strata (i.e., Middle Pali) only one record is so far available (Ram-Awatar, 1993) from Burhar area.

In the present study, three palynological assemblages have been identified and their correlations have been made with other peninsular basins of Indian Gondwana.

GENERAL GEOLOGY

The lithological characteristic and structural set up of the Sohagpur Coalfield have been given below (Datta, 1988-89; Mitra, 1993).

Age	Formations/ Member	Thickness (m)	Lithology
Eocene-Cretaceous	Basic rock	20	Shill, dyke and gabbroic in nature.
Triassic	Parsora	350	Coarse to very coarse ferruginated sandstone, cross bedded, red sandstone, occasionally with clasts of mottled clay. Sometimes pale yellow, white siltstone, violet to lavender silty claystone.

			Basal conglomerate mainly with quartz pebbles and feldspar have also been recorded.
----------UNCONFORMITY----------			
Early Triassic/ Late Permian	Upper Pali Member	350	Coarse to very coarse ferruginated gritty sandstone; feldspathic sandstone, red sandstone, occasionally pale yellow, white to grey colour siltstone have also been recorded. Violet to lavender colour clay stones are also common.
Late Permian	Middle Member	200-250	Fine to medium grained sandstone; micaceous sandstone, buff to grey colour sandstone, carbonaceous shale and thin coal seams.
Middle Permian	Lower Member	300	Multistoreyed crossbedded, fine to medium grained sandstone predominated with argillaceous unit with alternate bands of red and green clays with medium to coarse grained arkosic sandstone.
Permian	Barakar	300	Fine to coarse feldspathic sand stone, interbedded with thick and good quality coal seams and carbonaceous shale.
Early Permian	Talchir	648?	Green shale, siltstone, sandstone, etc.
----------UNCONFORMITY----------			
Precambrian	Metamorphic Basement		Granite, gneisses, metabasic, etc.

Ninety samples have been collected from Borehole SPB-18, located 1.1 km south-west of Burhar town (Map 1), District Shahdol, Madhya Pradesh. Only 20 samples listed in Table 1 have yielded the spores and pollen grains.

Table 1

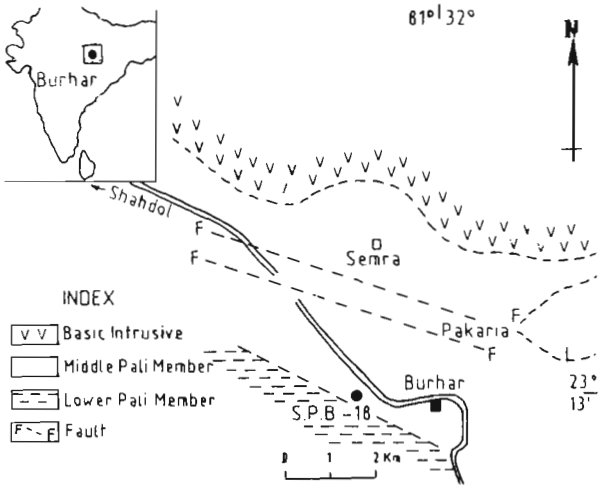
Sample no.	Depth in meter	Lithology	References
SPB-18/28	163.80-163.20	Clay	
SPB-18/46	111.85-110.85	Shale between sandstone	
SPB-18/48	92.40-90.00	Carbonaceous shale	
SPB-18/57	80.50-77.50	Fine grained sandstone	
SPB-18/59	76.50-75.50	Fine grained sandstone	
SPB-18/60	75.50-74.50	Fine grained sandstone	
SPB-18/70	53.25-53.00	Coal	
SPB-18/71	53.00-52.50	Carbonaceous shale	
SPB-18/72	52.50-50.15	Shale within sandstone	
SPB-18/74	49.15-48.15	Carbonaceous shale	
SPB-18/76	47.35-43.45	Fine to coarse grained sandstone	
SPB-18/77	43.45-40.10	Carbonaceous shale	
SPB-18/78	38.05-37.35	Fine to coarse grained sandstone	
SPB-18/81	36.00-35.00	Coal	
SPB-18/82	35.00-34.50	Carbonaceous shale	
SPB-18/83	34.50-34.00	Carbonaceous shale	
SPB-18/84	34.00-33.00	Carbonaceous shale	
SPB-18/88	36.60-29.35	Carbonaceous shale	Fragmentary
SPB-18/89	29.35-28.95	Carbonaceous shale	fossils
SPB-18/91	27.85-26.00	Carbonaceous shale	

PALYNOASSEMBLAGES

In all, fortysix spore-pollen taxa have been identified in the productive samples. After qualitative and quantitative analyses three palynoassemblages have been identified on the basis of stratigraphically important taxa which has been depicted in Text-figure 1.

Assemblage I

Leiosphaeridia Palynozone (depth 26.00- 27.85 m; Sample no. 18/91)—This assemblage is charac-



Map 1—A portion of the geological map of Pakaria Block showing the location of Bore hole SPB 18, Sohagpur Coalfield, Madhya Pradesh.

terised by the dominance of *Leiosphaeridia* (80%). The other associated taxa which have not been depicted in Text-figure 1, are *Verrucosisporites* (1%) and *Indotriradites* (2%); occurrence of *Leiosphaeridia* in such a high percentage in the Middle Pali Member is significant as it reflects a marine influence in the area.

Assemblage II

Scheuringipollenites-Faunipollenites Palynozone (depth 29.35-49.15 m; Sample nos. 18/74-89)—The assemblage is marked by the preponderance of *Scheuringipollenites* and *Faunipollenites*, followed by *Striatopodocarpites* as a subdominant taxa in the sequence. The other taxa which have not been shown in the Text-figure 1 are — *Falcisporites* (1%), *Striasulcites* (1%), *Dentatispora* (1%), *Ibisporites* (1%), *Ephedripites* (2%), *Plicatipollenites* (3%), *Pretricolpipollenites* (2%), *Sahnites* (2%), *Verrucosisporites* (1%), and *Indotriradites* (2%) due to their sporadic nature of the occurrence. Besides, a new taxon—*Protoeusaccites* has also been recorded in two samples — 18/78, 18/82, which is rare but very significant in evolutionary trends of saccus development.

Assemblage III

Faunipollenites-Striatopodocarpites Palynozones (depth 50.15-163.20 Sample no. 18/28-72)—The dominance of striate-disaccate pollen remains similar in the preceding assemblage, however, *Scheuringipollenites* declines. The other significant taxa which are sporadic but not mentioned in the Text-figure 1 are *Dentatispora* (1%), *Indotriradites* (3%), *Sahnites* (1%), *Vestigisporites* (1%), *Verticipollenites* (2%), *Tiwariasporis* 91%), *Verrucosisporites* (1%), *Klausi-pollenites* (1%) and *Hamiapollenites* (1%).

DATING AND CORRELATION

The palynoflora recovered in Bore-hole SPB-18 from Middle Pali Member exhibits overall dominance of striate disaccate pollen, hence the entire sequence has been equated with the Raniganj palynoflora of Damodar graben. However, *Indospora* and *Spinosporites* are absent in the present assemblage. Tiwari and Singh (1986) described the Permian-Triassic boundary on the basis of palynotaxa, which coincides with the change of lithology in Damodar Basin. The Palynoassemblages II and III of Middle Pali Member show a fair resemblance with (R-IIA, table 2 of Tiwari & Singh) in having *Striatopodocarpites* and *Faunipollenites* as the dominant elements.

The Palynoassemblage-I, described by Srivastava and Jha (1988) from Kamthi Formation (Middle Member), is comparable with Assemblage-II of the Middle Member of Pali Formation, as in both the basins the striate-disaccates are in preponderance; but here *Densipollenites* and *Lueckisporites* are absent.

The palynofloras described from the Middle Pali Member from Johilla, Umaria, Korar and Singrauli coalfields exhibits a fair degree of resemblance in having striate-disaccates alongwith nonstriate *Scheuringipollenites* (Tiwari & Ram-Awatar, 1986, 1987a, b, 1990; Ram-Awatar, 1993, 1994). However, in the former assemblages *Klausipollenites, Satsangisaccites, Lueckisporites* and *Nidipollenites* are present but in the presently described assemblages (II & III) these taxa are absent, hence it indicates an older affinity.

PLATE 1

(All photomicrographs are enlarged, ca x 500 ; coordinates on Olympus Microscope no. 233189).

1. *Lunatisporites* sp., Slide. no. BSIP 11281; Coordinates 10 x 120.
2. *Hamiapollenites insolitus*, Slide no. BSIP 11277; Coordinates 10 x 134.
3. *Weylandites* sp., Slide no. BSIP 11238; Coordinates 6 x 110.
4. *Crescentipollenites gondwanensis*, Slide no. BSIP 11281; Coordinates 10 x 117.
5. *Protoeusaccites rewaensis*, Slide no. BSIP 11251; Coordinates 9 x 123 (Veneox Microscope).
6. *Striatopodocarpites subcircularis*, Slide no. BSIP 10715; Coordinates 23 x 110.
7. *Alisporites indicus*, Slide no. BSIP 11280; Coordinates 23 x 113.
8. *Faunipollenites perexiguus*, Slide no. BSIP 10278; Coordinates 20 x 126.
9. *Klausipollenites* sp., Slide no. BSIP 11279; Coordinates 10 x 126.
10. *Microfoveolatispora* sp., Slide no. BSIP 11280; Coordinates 14 x 116.
11. *Faunipollenites varius*, Slide no. BSIP 11282; Coordinates 6 x 112.
12. *Leiosphaeridia* sp., Slide no. BSIP 11284; Coordinates 19 x 115.
13. *Scheuringipollenites barakarensis*, Slide no. BSIP 11281; Coordinates 10 x 114.

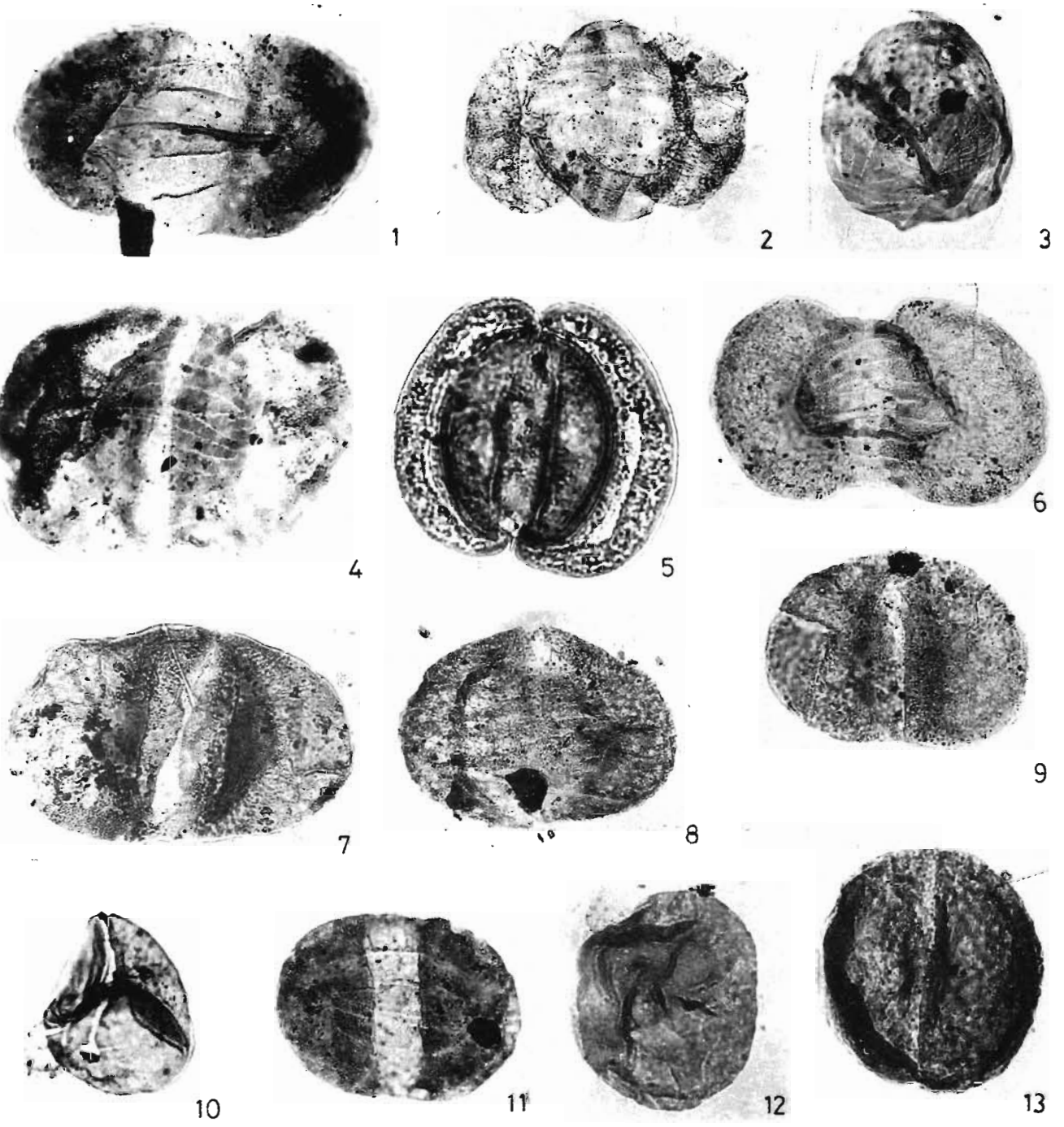
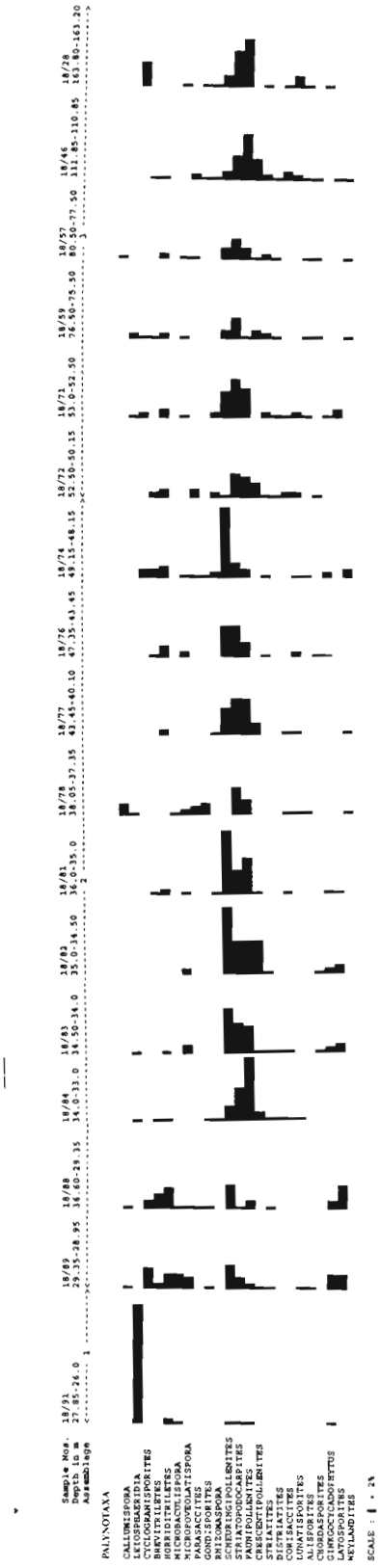


PLATE 1



Text-figure 1—Percentage frequency of important palynotaxa recovered from Bore-hole SPB 18 in Sohagpur Coalfield, Madhya Pradesh.

DISCUSSION

Though lithologically it has been proved that Lower Pali Member is equivalent to Barren Measures, but palynologically it could not be supported so far, due to their profuse ferruginated and coarse size of sandstone. The mottled clays are of red, chocolate and green colour and have not yielded any pollen. Regarding the Middle Pali Member much of the palynological data has been accumulated from Johilla and Sohagpur coalfields (Tiwari & Ram-Awatar, 1986, 1987a, 1990; Ram-Awatar, 1993); but no sharp change has been observed in these two members. The lower limit of Upper Pali Member passes the P/Tr Boundary (Tiwari & Ram-Awatar, 1990) but the upper limit of the Upper Pali Member has to be defined.

Regarding the classification of Pali Formation there are two opinions existing in the Geological Survey of India. According to Chakraborti (1982), Mitra (1993) and Kundu *et al.* (1993) Pali Formation is a tripartite division, while Datta (1988-89, 1982) suggests that it is divisible into two members. Both the views are based on the constitution of rocks and their own interpretation. In the present study, the Middle Pali Member has been divided into three finer zones and the Lower Pali Member did not yield the palynofossils.

The occurrence of Leiospherids in the Middle Pali Member has been recorded in association with striate-disaccate pollen which evidence a probable marine influence during the deposition of Middle Pali sediments in Sohagpur Coalfield; yet more data is awaited for confirming for the same result. Three palynological zones in the Middle Pali Member (Bore-hole SPB-18) indicate a Late Permian age, while occurrence of Leiosphaerids suggests a shallow marine influence in the Basin.

ACKNOWLEDGEMENT

During the collection of Bore-core samples, help rendered by the authorities of the Geological Survey of India, camping at Sohagpur Coalfield is gratefully acknowledged.

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