

Palynostratigraphy of sub-surface Lower Gondwana, Pali sediments, Sohagpur Coalfield, M.P., India

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ABSTRACT

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Two palynoassemblages have been identified in B.H. SKM 6, from Mithauri-Kelmania Sector of Sohagpur Coalfield, M.P. The Palynoassemblage I (254.00-163.40 m), of Late Early Permian age reveals the dominance of *Scheuringipollenites* and *Faunipollenites* in association with *Barakarites*, *Parasaccites*, *Ibisporites*, *Rhizomaspora*, *Potonieisporites*, *Arcuatipollenites*, *Tiwariasporis* and *Brevitriletes*. The Palynoassemblage II (157.40-77.90 m), contains striate disaccate pollen, viz., *Faunipollenites*, *Striatopodocarpites* and *Crescentipollenites* in prominence. Besides, *Arcuatipollenites*, *Densipollenites*, *Gondisporites*, *Distriatites*, *Striatites*, *Hamiapollenites*, *Guttulapollenites*, *Dicappipollenites* and *Alisporites* have also been recorded, with sporadic occurrence of *Goubinispora*, *?Brachysaccus*, *Trabeculosporites*, *Densoisporites*, *Playfordiaspora*, *Lundbladispota*, *Satsangisaccites*, *Krempipollenites*, *Falcisporites*, *Nidipollenites* and *Kamthisaccites* which suggest a Late Permian age of the assemblage. The significant outcome of the present study is recorded by identifying the Late Permian palynofloral assemblage for the first time in this part of the Sohagpur Coalfield, which is corroborate with the Middle Pali Member of the Pali Formation, in the South Rewa Basin, M.P.

Key-words—Palynostratigraphy, Pali Formation, Late Permian, Sohagpur Coalfield.

भारत में मध्य प्रदेश के सोहागपुर कोयला क्षेत्र के पाली अवसादों के अधस्तल अथो गोंडवाना का परागाणुस्तरीकी विज्ञान

राम अवतार, ए. मुखोपाध्याय एवं एस. अधिकारी

सारांश

मध्य प्रदेश प्रान्त के सोहागपुर कोयला क्षेत्र के मिथौरी-केलमानिया सेक्टर से वेध छिद्र एस.के.एम. 6 में दो परागाणु समुच्चय अभिनिर्धारित किए गए हैं। परागाणु समुच्चय-प्रथम (254.0-163.40 मी.) में पश्च प्रारंभिक परमियन आयु की बराकेराइटीज, पैरासेक्काइटीज, इबीसपोराइटीज, राइज़ोमासपोरा, पोटोनीसपोराइटीज, आर्क्यूआटिपोलिनाइटीज, तिवारीसपोरिस एवं ब्रेविट्रीलिटीज के साहचर्य में स्यूरिंगीपोलेनाइटीज एवं फॉनीपोलेनाइटीज की प्रमुखता प्रदर्शित करती है। परागाणु समुच्चय-द्वितीय (157.40-77.90 मी.) में रेखित द्विसकोषी परागाणु फॉनीपोलेनाइटीज, स्ट्रॉएटोपोडोकार्पाइटीज एवं क्रीसेन्टीपोलेनाइटीज प्रमुखता में है। इसके अतिरिक्त आर्क्यूआटीपोलेनाइटीज, डेन्सीपोलेनाइटीज, गोंडीसपोराइटीज, डाइस्ट्रीएटाइटीज, स्ट्रीएटाइटीज, हेमियापोलेनाइटीज, गुट्टुलापोलेनाइटीज, ल्यूकिस्पोराइटीज एवं एलीसपोराइटीज भी अभिलिखित किए गए हैं गोविनीसपोरा, ? ब्रेकीसेक्कस, ट्रेविकुलोसपोराइटीज, डेन्सोइसपोराइटीज, प्लेफोर्डियासपोरा, लुन्डब्लेडीसपोरा, सत्संगीसेक्काइटीज, क्रेम्पीपोलेनाइटीज, फॉल्सीसपोराइटीज, निदीपोलेनाइटीज एवं कामथीसेक्काइटीज की कदाचनिक उपस्थिति समुच्चय की पश्च परमियन आयु का संकेत करती है।

क्रेम्यीपोलेनाइटीज़, फॉल्सीस्योराइटीज़, निदीपोलेनाइटीज़ एवं कामथीसेक्काइटीज़ की कदाचनिक उपस्थिति समुच्चय की पश्च परमियन आयु का संकेत करती है।

वर्तमान अध्ययन के सार्थक परिणाम सोहागपुर कोयला क्षेत्र से प्रथम बार पश्च परमियन परागाणु वनस्पतिजात समुच्चय की पहचान अभिलिखित की गई है जो कि मध्यप्रदेश प्रान्त के दक्षिण रीवा द्रोणी में पाली शैलसमूह के मध्य पाली सदस्य के साथ संशोध्य है।

संकेत शब्द —परागाणुस्तरीकीविज्ञान, पाली शैलसमूह, पश्च परमियन, सोहागपुर कोयला क्षेत्र।

INTRODUCTION

THE South Rewa Basin occupies the central part of the Indian peninsula, comprising Umaria, Johilla, Korar, Sohagpur, Tatapani-Ramkola, Singrauli, Sonhat and Jhilimili

coalfields. The Sohagpur Coalfield is the biggest coal-bearing area which lies between latitude 23°05' : 23°30' N and 81°13' : 81°12' E longitude. The total area of the coalfield measure 3100 sq km, spanning from eastern M.P. to southern U.P., and exhibits a full development of the Gondwana sediments.

Age	Formation	Lithology
Upper Cretaceous to Eocene	Deccan Trap	Basalt flow and dolerite dykes.
Upper Cretaceous	Lameta Bed (30 m)	White impure marlstone, pinkish to white sandstone.
Lower Cretaceous	Chandia Bed (70 m)	White clay and sandstone.
Lower Jurassic	Hartala Formation (300 m)	Coarse to pebbly sandstone. Mostly massive with very large scale cross stratification; at places red clay and sandstone.
—Unconformity—		
Early Triassic to Rhaetic	Tiki-Parsora (400 m)	Very coarse to coarse, medium to fine and even-grained quartzite sandstone, cross laminated, ferruginous, with red claystone.
—Unconformity—		
Middle to Upper Permian	Pali (300 m)	(Up. Pali) Very coarse to coarse feldspathic sandstone with fresh feldspar, greenish sandstone, grey shale, mottled clay, red clay with coaly to carbonaceous shale.
		(Lr. Pali) Medium grained ferruginous sandstone and red clay.
Lower Permian	Barakar (350-250 m)	Sandstone, shales and two major coal-seams.
Lower Permian	Talchir (+275 m)	Diamictite, sandstones, drop-stones and green shale.
—Unconformity—		
Precambrian		Granite, gneisses and quartzite.

Fig. 1—Generalised geological succession of Sohagpur Coalfield.

The first petro-palynological report of Sohagpur Coalfield was given by Navale and Tiwari (1967) from Barakar coals of Churcha Seam. Subsequently, Bharadwaj and Srivastava (1971) established a correlation of coal seams of Bhaskarpara, Kutkona and Batura blocks on the basis of plynofossils. Recently, Ram-Awatar (1993, 1996) also recorded the palynofloral assemblages in the bore-holes (SPB 17, 18) and correlated the Pali sediments of Sohagpur Coalfield. In the present communication, a Late Early Permian and a Late Permian palynoassemblages have been recovered in B.H. SKM 6, in Mithauri-Kelmania Sector of this coalfield.

GEOLOGY

The Sohagpur Coalfield is an assemblage of three well-defined sub-basinal structures i.e., Jhagrakhand in the east, Kotma-Jamuna in the middle and Burhar-Amlai in the west. The generalised lithological succession in the coalfield comprises—Talchir, Karharbari, Barakar and Supra-Barakar formations. Recently, a number of palaeosols have been identified within the Barren Measures at the top of the Barakar Seam No. V indicating a hiatus (Mukhopadhyay & Mukhopadhyay, 1999). A generalised lithological succession of the Sohagpur Coalfield has been given in Fig. 1 (after Mitra, 1993; Bandhopadhyay, 1999).

MATERIALS

Seventy samples were collected from B.H. SKM 6, in Mithauri-Kelmania Sector of Sohagpur Coalfield, District

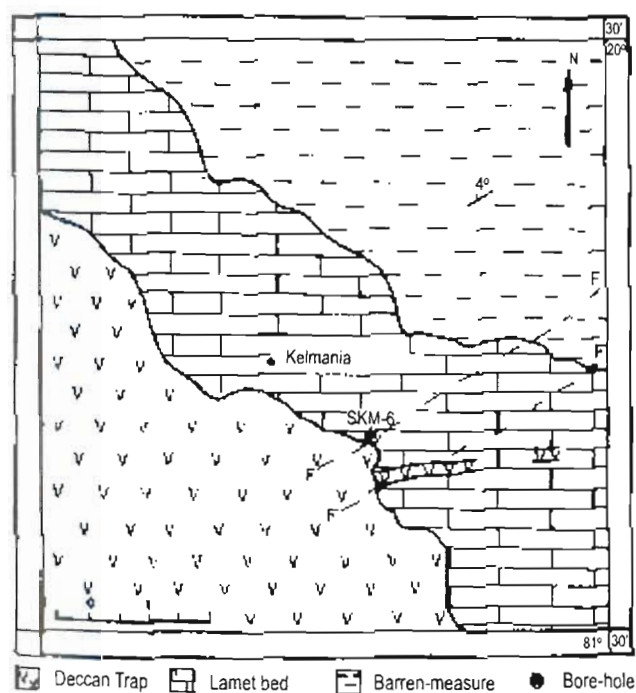


Fig. 2—Showing the location of B.H. SKM 6, Sohagpur Coalfield, M.P.

Shahdol, M.P. (Fig. 2). Twenty-five samples from Pali Formation yielded the palynofossils. A list of samples has been given below:

Sl. No.	Sample No.	Depth (m)	Lithology	Preservation
1.	SKM 6/1	77.90	Carbonaceous shale	*
2.	SKM 6/2	78.90	Coaly shale	—
3.	SKM 6/3	79.40	Coal	—
4.	SKM 6/4	80.95	Grey shale	+
5.	SKM 6/5	—	Missing sample	—
6.	SKM 6/6	—	Missing sample	—
7.	SKM 6/7	81.60	Grey shale	+
8.	SKM 6/8	81.90	Grey shale	—
9.	SKM 6/9	82.30	Carbonaceous shale	+
10.	SKM 6/10	82.70	Claystone	—
11.	SKM 6/11	83.20	Laminated sst	*
12.	SKM 6/12	83.60	Laminated sst	—
13.	SKM 6/13	84.65	Carbonaceous shale	*
14.	SKM 6/14	85.15	Carbonaceous shale	—
15.	SKM 6/15	85.45	Carbonaceous shale	—
16.	SKM 6/16	85.75	Carbonaceous shale	+
17.	SKM 6/17	86.30	Carbonaceous shale	*
18.	SKM 6/18	88.10	Fine-grained sst	—
19.	SKM 6/19	91.70	Fine-grained sst	—
20.	SKM 6/20	92.70	Fine-grained sst	—
21.	SKM 6/21	93.80	Fine-grained sst	*
22.	SKM 6/22	95.30	Carbonaceous shale	—
23.	SKM 6/23	95.45	Carbonaceous shale	—
24.	SKM 6/24	96.15	Carbonaceous shale	*
25.	SKM 6/25	96.30	Shale	—
26.	SKM 6/26	96.50	Claystone	—
27.	SKM 6/27	97.30	Claystone	—
28.	SKM 6/28	97.50	Grey shale	—
29.	SKM 6/29	98.65	Carbonaceous shale	—
30.	SKM 6/30	99.25	Carbonaceous shale	—
31.	SKM 6/31	99.90	Carbonaceous shale	—
32.	SKM 6/32	100.90	Clay	+
33.	SKM 6/33	102.50	Carbonaceous shale	—
34.	SKM 6/34	103.40	Shale	—
35.	SKM 6/35	103.80	Shale	—
36.	SKM 6/36	105.10	Grey shale	—
37.	SKM 6/37	105.95	Shale	—
38.	SKM 6/38	106.55	Shale	*
39.	SKM 6/39	107.30	Laminated shale	—
40.	SKM 6/40	108.20	Fine-grained sst	—
41.	SKM 6/41	108.90	Shale	—
42.	SKM 6/42	110.80	Laminated sst	+
43.	SKM 6/43	111.10	Carbonaceous shale	—
44.	SKM 6/44	112.10	Shale	—
45.	SKM 6/45	112.90	Fine-grained sst	—
46.	SKM 6/46	115.50	Carbonaceous shale	—
47.	SKM 6/47	115.75	Carbonaceous shale	*
48.	SKM 6/48	116.75	Carbonaceous shale	—
49.	SKM 6/49	119.05	Shale	-
50.	SKM 6/50	121.30	Shale	+
51.	SKM 6/51	133.75	Claystone	*
52.	SKM 6/52	134.30	Claystone	*
53.	SKM 6/53	137.15	Claystone	—
54.	SKM 6/54	138.15	Grey shale	*
55.	SKM 6/55	139.50	Carbonaceous shale	—
56.	SKM 6/56	142.60	Carbonaceous shale	—
57.	SKM 6/57	143.60	Claystone	—
58.	SKM 6/58	145.35	Claystone	—

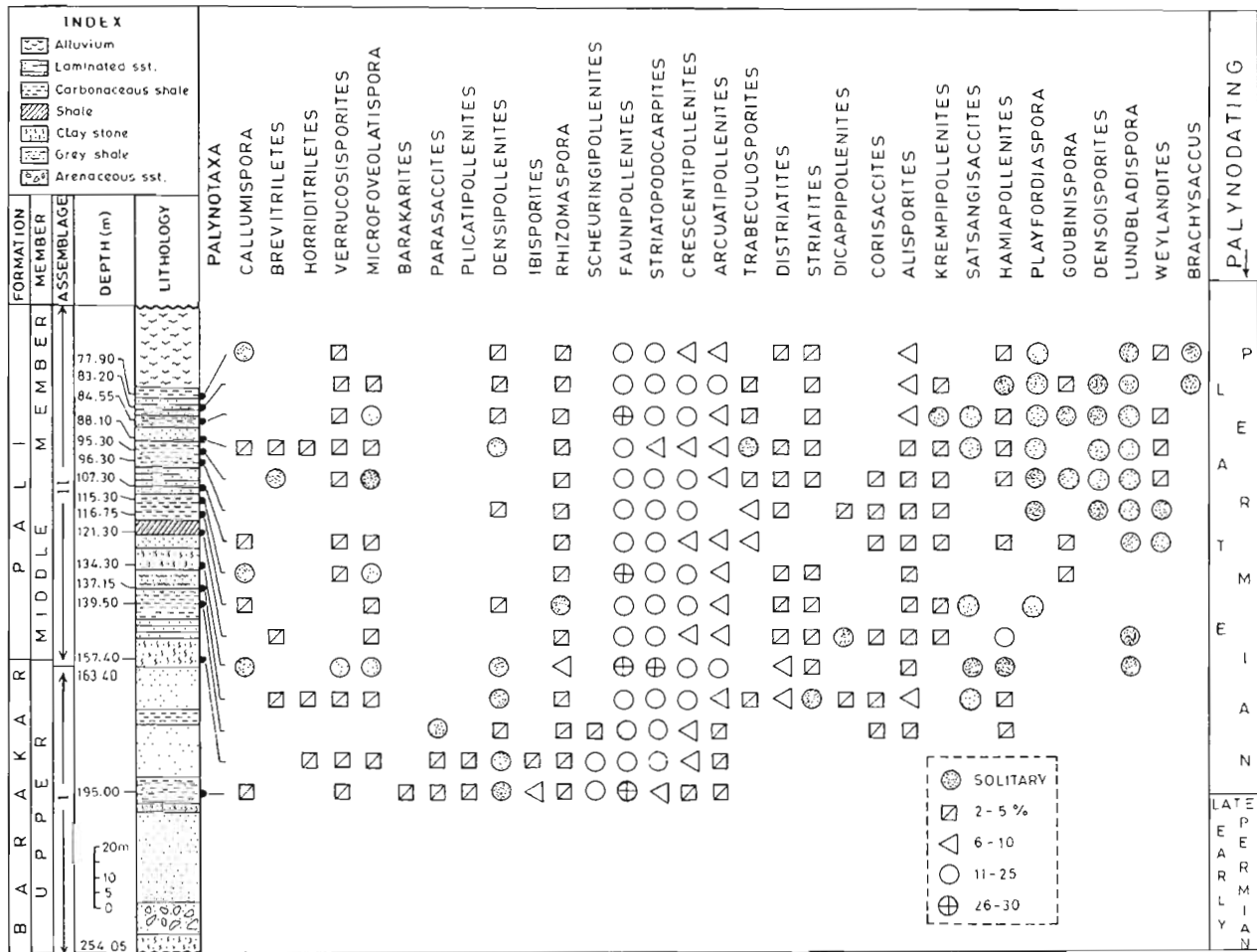


Fig. 3—Percentage frequency of significant spore/pollen taxa recovered from B.H. SKM6.

PLATE 1

(All photomicrographs, magnified ca x 500, taken on Olympus Microscope B.H. 2, Model, No. 233189)

- Faunipollenites various* Bharadwaj 1962 emend. Tiwari *et al.* 1989; co-ordinate. 9 x 127.
- Scheuringipollenites tentulus* Tiwari 1973; co-ordinate. 11 x 119.
- Striatopodocarpites decorus* Bharadwaj & Salujha 1964; co-ordinate. 21 x 137.
- Distriatites bilateralis* Bharadwaj 1962; co-ordinate. 10 x 105.
- Faunipollenites singrauliensis* Sinha emend. Tiwari *et al.* 1989; co-ordinate. 20 x 142.
- Crescentipollenites fuscus* (Bharadwaj) Bharadwaj *et al.*, 1974; co-ordinate. 9 x 119.
- Ibisporites diplosaccus* Tiwari 1968; co-ordinate. 19 x 129.
- Dicappipollenites singhii* Tiwari & Vijaya 1995 (*Lueckisporites* Pot. & Kl. emend. Klaus. 1963); co-ordinate. 6 x 143.
- Microfoveolatispora bokaroensis* Tiwari 1965; co-ordinate. 12 x 116.
- Gondisporites raniganjensis* Bharadwaj 1962; co-ordinate. 7 x 123.
- Gutulapollenites* sp. Goubin emend. Venkatachala *et al.*, 1967; co-ordinate. 5 x 136.
- Verticipollenites crassus* Bharadwaj & Srivastava 1964; co-ordinate. 17 x 137.
- Scheuringipollenites barakarensis* Tiwari 1973; co-ordinate. 12 x 143.
- Distriatites insolitus* Bharadwaj & Srivastava 1969; co-ordinate. 12 x 115.
- Striatopodocarpites decorus* Bharadwaj & Salujha 1964; co-ordinate. 10 x 127.
- Striatites notus* Bharadwaj & Salujha 1964. co-ordinate. 6 x 134.
- Arcuatipollenites ovatus* Tiwari & Vijaya 1995; co-ordinate. 32 x 140.
- Tiwariasporis flavatus* Maheshwari & Kar 1967; co-ordinate. 10 x 127.
- Striamonosaccites* sp. Bharadwaj 1962; co-ordinate. 8 x 141.
- Precolpipollenites nidpurensis* Bharadwaj & Srivastava 1969; co-ordinate. 22 x 140.

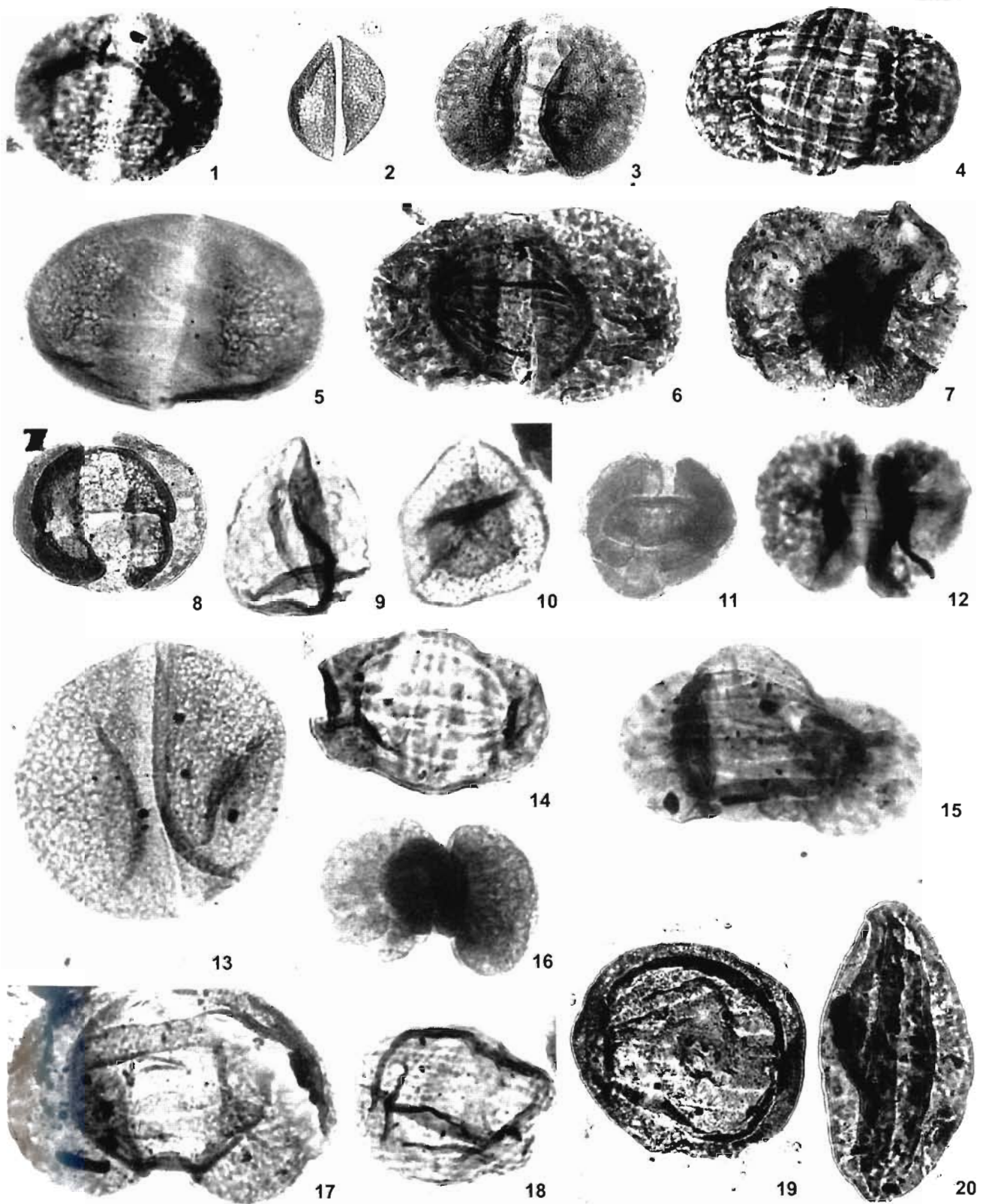


PLATE 1

59. SKM 6/59	148.10	Laminated sst	—	<i>Plicatipollenites</i>	Lele, 1964
60. SKM 6/60	150.30	Laminated sst	—	<i>Potonieisporites</i>	Bharadwaj emend. Bharadwaj, 1964
61. SKM 6/61	151.50	Laminated sst	+	<i>Barakarites</i>	Bharadwaj & Tiwari, 1964
62. SKM 6/62	151.80	Claystone	—	<i>Densipollenites</i>	Bharadwaj, 1962
63. SKM 6/63	156.10	Carbonaceous shale	*	<i>Kamthisaccites</i>	Srivastava & Jha, 1986
64. SKM 6/64	157.40	Micaceous sst	—	<i>Striomonosaccites</i>	Bharadwaj, 1962
65. SKM 6/65	163.40	Fine-grained sst	*	<i>Goubinispota</i>	Tiwari & Rana, 1980 *
66. SKM 6/66	195.00	Carbonaceous shale	—	<i>Ibisporites</i>	Tiwari, 1968*
67. SKM 6/67	196.00	Clay	+	<i>Scheuringipollenites</i>	Tiwari, 1973 *
68. SKM 6/68	247.50	Sandstone	—	<i>Rhizomaspora</i>	Wilson, 1962
69. SKM 6/69	249.00	Arenaceous shale	+	<i>Striatopodocarpites</i>	Soritsch & Sedova emend. Bharadwaj & Salujha, 1964*
70. SKM 6/70	254.05	Claystone	—	<i>Faunipollenites</i>	Bharadwaj emend. Tiwari <i>et al.</i> , 1989*

(+) Poor preservation, (*) Good preservation, (—) Barren. Sandstone (sst)

PALYNOSTRATIGRAPHY

The following spore/pollen genera have been recovered from the sediment of B.H. SKM 6. Some of the qualitatively significant palynotaxa have been illustrated in Pl. 1 & 2.

<i>Callumispota</i>	Bharadwaj & Srivastava emend. Tiwari <i>et al.</i> , 1989
<i>Brevurilletes</i>	Bharadwaj & Srivastava emend. Tiwari & Singh, 1981
<i>Cyclogranisporites</i>	Potonié & Kremp, 1954
<i>Horriditriletes</i>	Bharadwaj & Salujha, 1964
<i>Microbaculispora</i>	Bharadwaj emend. Tiwari & Singh, 1981
<i>Microfoveolatispora</i>	Bharadwaj emend. Tiwari & Singh, 1981*
<i>Verrucosisporites</i>	Ibrahim emend. Smith, 1971
<i>Osmundacidites</i>	Couper, 1953
<i>?Densoisporites</i>	Weyland & Krieger emend. Dettmann, 1963
<i>Gondisporites</i>	Bharadwaj, 1962 *
<i>Lundbladispota</i>	Balme emend. Playford, 1963 *
<i>Playfordiaspora</i>	Maheshwari & Banerji emend. Vijaya, 1995 *
<i>Parasaccites</i>	Bharadwaj & Tiwari emend. Tiwari <i>et al.</i> , 1989
<i>Striatites</i>	Pant emend. Bharadwaj, 1962*
<i>Crescentipollenites</i>	Bharadwaj <i>et al.</i> , 1974 *
<i>Hamiapollenites</i>	Wilson emend. Tschudy & Kosanke, 1966*
<i>Distriatites</i>	Bharadwaj, 1962 *
<i>Nidipollenites</i>	Bharadwaj & Srivastava, 1969
<i>Satsangisaccites</i>	Bharadwaj & Srivastava, 1969 *
<i>Alisporites</i>	Daugherty emend. Jansonius, 1971*
<i>Falcisporites</i>	Leschik emend. Klaus, 1963 *
<i>Krempipollenites</i>	Tiwari & Vijaya, 1995 *
<i>Protoeusaccites</i>	Tiwari <i>et al.</i> , 1995 *
<i>?Brachysaccus</i>	Mädler, 1964 *
<i>Arcuatipollenites</i>	Tiwari & Vijaya, 1995 *
<i>Corisaccites</i>	Venkatachala & Kar, 1966 *
<i>Guttulapollenites</i>	Goubin emend. Venkatachala <i>et al.</i> , 1967*
<i>Dicappipollenites</i>	Tiwari & Vijaya, 1995
<i>Chordasporites</i>	Klaus, 1960*
<i>Trabeculosporites</i>	Trivedi & Misra emend. Tiwari & Ram-Awatar, 1986 *
<i>Weylandites</i>	Bharadwaj & Srivastava, 1969*
<i>Tiwariasporis</i>	Maheshwari & Kar, 1967*
<i>Pretricolpipollenites</i>	Bharadwaj & Srivastava, 1969 *
<i>Ginkgocycadophytus</i>	Samoilovich emend. Balme & Hennelly, 1956

Taxa marked with (*) are illustrated in Pl. 1 & 2

PLATE 2

(All photomicrographs, magnified ca x 500, taken on Olympus Microscope B.H. 2, Model. No. 233189)

- Arcuatipollenites paliensis* (Tiwari & Ram-Awatar) emend. Tiwari & Vijaya 1995; co-ordinate, 9 x 128.
- Goubinispota morondavensis* (Goubin) Tiwari & Rana 1981; co-ordinate, 5 x 114.
- Alisporites ansolensis* Maheshwari & Banerji 1975; co-ordinate, 21 x 120.
- Dicappipollenites singrauliensis* (Sinha) Tiwari & Vijaya 1995 (*Lueckisporites* Pot. Kl.) emend. Klaus 1963; co-ordinate, 10 x 112.
- Krempipollenites indicus* Tiwari & Vijaya 1995 (*Klausipollenites* Jansonius) emend. Klaus 1962; co-ordinate, 18 x 111.
- ?Brachysaccus ovalis* Mädler 1964; co-ordinate, 13 x 146.
- Lundbladispota brevicula* Balme 1963; co-ordinate, 8 x 140.
- Protoeusaccites rewaensis* Tiwari *et al.*, 1995; co-ordinate, 7 x 129.
- Satsangisaccites nidpurensis* Bharadwaj & Srivastava 1969; co-ordinate, 12 x 122.
- Playfordiaspora cancellosa* (Maheshwari & Banerji) Vijaya 1996; co-ordinate, 10 x 112
- Weylandites circularis* Bharadwaj & Srivastava 1969; co-ordinate, 14 x 136.
- Satsangisaccites* sp. Bharadwaj & Srivastava 1969; co-ordinate, 10 x 106.
- Arcuatipollenites damudicus* Tiwari & Rana emend. Tiwari & Vijaya 1995; co-ordinate, 7 x 115.
- Hamiapollenites* sp. Wilson emend. Tshudy Kosanke 1969; co-ordinate, 8 x 116.
- Chordasporites magnus* Klaus 1964; co-ordinate, 5 x 135.
- Falcisporites nuthallensis* Balme 1970; co-ordinate, 7 x 130.
- Arcuatipollenites pellucidus* (Goubin) Tiwari & Vijaya 1995; co-ordinate, 12 x 122.
- Trabeculosporites* (Trivedi & Misra) emend. Tiwari & Ram-Awatar 1987; co-ordinate, 10 x 123.

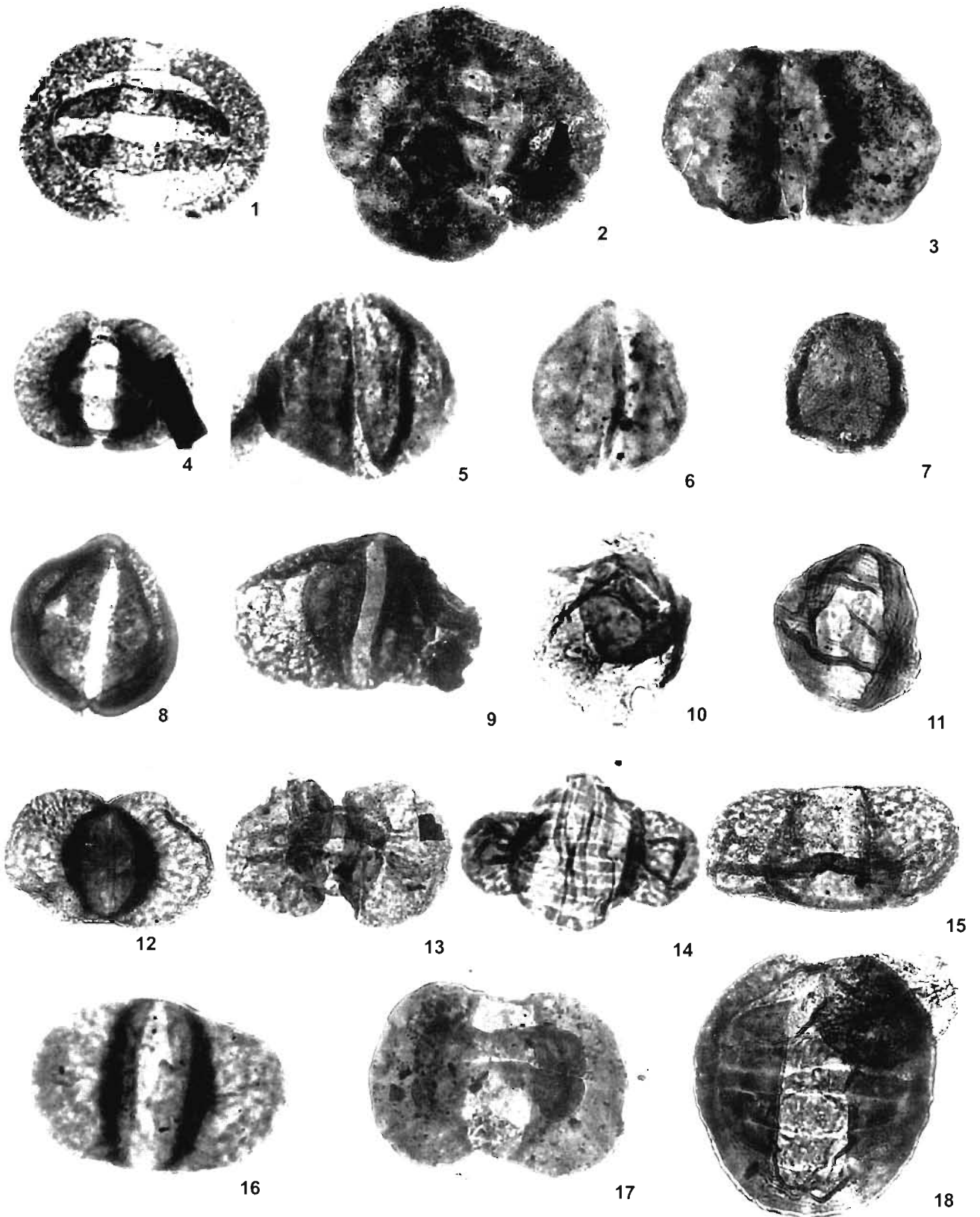


PLATE 2

PALYNOASSEMBLAGES

On the basis of qualitative and quantitative analyses of the spore/pollen taxa, two palynoassemblages have been identified which are given below (see also Fig. 3).

Assemblage I

Depth—254.05-163.40 m.

Characteristic Palynotaxa

Dominant—*Faunipollenites*.

Sub-Dominant—*Scheuringipollenites*.

Common—*Striatopodocarpites* and *Ibisporites*.

Others—*Callumispora*, *Verrucosiporites*, *Brevitriletes*, *Rhizomaspora*, *Plicatipollenites*, *Parasaccites*, *Barakarites*, *Crescentipollenites*, *Arcuatipollenites* and *Densipollenites*.

Index Species—*Barakarites barakarensis*.

Palynodating—Late Early Permian.

Assemblage II

Depth—157.40-77.90 m.

Characteristic Palynotaxa

Dominant—*Faunipollenites* and *Striatopodocarpites*.

Sub-dominant—*Crescentipollenites*, *Arcuatipollenites* and *Hamiapollenites*.

Common—*Horriditriletes*, *Microfoveolatispora*, *Rhizomaspora*, *Distriatites*, *Scheuringipollenites*, *Arcuatipollenites*, *Lueckisporites*, *Alisporites*, *Corisaccites*, *Krempipollenites* and *Striatites*.

Others—*?Densoisporites*, *Playfordiaspora*, *Trabeculosporites*, *Lundbladispota*, *Satsangisaccites*, *Goubinispora*, *Weylandites*, *?Brachysaccus* and *Kamthisaccites*.

Index Species—*Gondisporites indicus*.

Palynodating—Late Permian.

COMPARISON

Assemblage I—The genus *Faunipollenites* is dominating in the assemblage (Fig. 3). The other marker palynotaxa are *Scheuringipollenites*, *Ibisporites*, *Striatopodocarpites*, *Microfoveolatispora*, *Verrucosiporites*, *Brevitriletes*, *Callumispora*, *Rhizomaspora*, *Plicatipollenites*, *Barakarites*, and *Crescentipollenites* with solitary occurrence of *Densipollenites*. This composition of palynoassemblage correlates with *Faunipollenites varius* zone of Tiwari and Tripathi, 1992 (Text fig. 1; zone-VI-B), as *Scheuringipollenites barakarensis* (Tiwari, 1973), *Faunipollenites varius* (Tiwari *et al.*, 1989), *Barakarites indicus* (Bharadwaj & Tiwari, 1964), *Microfoveolatispora foveolata* (Tiwari & Singh, 1984) and *Brevitriletes communis* (Bharadwaj & Srivastava, 1969) are also recorded in the assemblages. The present

palynoassemblage is also comparable with the Upper Barakar palynofloras of the Raniganj Coalfield (Tiwari, 1973), and the Umaria and Johilla coalfields (Srivastava & Anand-Prakash, 1984; Tiwari & Ram-Awatar, 1989). The FADs (first appearance datum) of *Densipollenites indicus* (Bharadwaj, 1962), *Microfoveolatispora foveolata* (Tiwari & Singh, 1984) and *Arcuatipollenites pellucidus* (Tiwari & Vijaya, 1995) delimit the upper strata of the Barakar Formation. The occurrence of monosaccate pollen *Parasaccites* and *Plicatipollenites* in the Barakar Formation is quite significant (Fig. 3), as similar trends have also been observed in the Johilla Coalfield, M.P. (Tiwari & Ram-Awatar, 1989).

Assemblage II—It is characterised by the preponderance of *Faunipollenites* and *Striatopodocarpites* (Fig. 3). The other significant genera are *Crescentipollenites*, *Arcuatipollenites*, *Nidipollenites*, *Distriatites* and *Hamiapollenites* in association with *Verrucosiporites*, *Corisaccites* and *Alisporites*. Besides, *?Brachysaccus*, *Kamthisaccites*, *Trabeculosporites*, *Weylandites*, *Densoisporites*, *Playfordiaspora*, *Goubinispora* and *Lueckisporites* have also been recorded in this assemblages.

In the Raniganj Formation, Tiwari (1999) recognised two playno-zones. The older one is marked by *Gondisporites raniganjensis* in association with *Didecitriletes ericianus* (Venkatachala & Kar, 1965), *Lophotriletes rarus* (Kar, 1968) and *Vestigisporites dissectus* (Tiwari & Singh, 1984) while the younger one is characterised by the presence of *Densipollenites magnicarpus* (Tiwari & Rana, 1984) in association with *Crescentipollenites gondwanensis* (Bharadwaj *et al.*, 1974), *Cyclobaculisporites indicus* (Bharadwaj & Salujha, 1964) and *Indospora macula* (Bharadwaj & Salujha, 1964); these are the characteristic forms of Late Permian. The most important feature to demarcate the Raniganj palynoflora, is the FADs palynotaxa which are common in the overlying Panchet; these are- *?Densoisporites complicatus* (Balme, 1970), *Lundbladispota brevicula* (Balme, 1963), *Osmundacidites senectus* (Balme, 1963), *Arcuatipollenites ovatus* (Tiwari & Vijaya, 1995), *Callumispora fungosa* (Bharadwaj & Tiwari, 1977), *Goubinispora moroundavensis* (Tiwari & Rana, 1980), *Krempipollenites indicus* (Tiwari & Vijaya, 1995), *Playfordiaspora cancellosa* (Maheshwari & Banerji, 1975) and *Weylandites indicus* (Bharadwaj & Srivastava, 1969). Most of these forms are recorded in the B.H. SKM 6, except *Didecitriletes ericianus* (Venkatachala & Kar, 1965), *Indospora macula* (Bharadwaj & Salujha, 1964) and, therefore, the present palynoassemblage resembles *Densipollenites magnicarpus* Zone of Tiwari & Tripathi (1992), Tiwari & Ram-Awatar (1986) and Ram-Awatar (1996).

DISCUSSION

The palynofloral composition of B.H. SKM 6, around Mithauri-Kelmania Sector of Sohagpur Coalfield, reveals a diversified spore/pollen complex. The Palynoassemblages I &

It show a clear relationship with Late Early Permian (Upper Barakar) and Late Permian (Raniganj) microfioral assemblages, respectively, as also recorded in other basins of the Indian Gondwana. Adhikari and Hore (1989), first identified a palaeosol bed, in bore-holes and out-crop sections within the Barren Measure sequence, lying above the Barakar Formation in Mithauri-Kelmania Sector of the Sohagpur Coalfield. Recently Mukhopadhyay and Mukhopadhyay (1999), separated the Raniganj strata from over-lying Pali Bed on the basis of the palaeosol and compared it with the Barren Measures sequence of the Damodar Basin. However, *Densipollenites magnicarpus* palynozones (Tiwari & Tripathi, 1992), characteristic of the Barren Measures has not been recorded in B.H. SKM 6. It is possible that the Barren Measures sediments lying above the Barakar Formation are either absent (?) or because of the taphonomic factor, the palynofossils could not be preserved. Yet, in the B.H. SKM 6, the record of the Late Early Permian (Upper Barakar) and a Late Permian (Raniganj) palynofloral assemblage is significant, though the Barren Measures palynoflora have not been encountered in this sector of Sohagpur Coalfield.

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