

Palynostratigraphic studies of sub-surface Raniganj – Barren Measures sediments from Mand-Raigarh Coalfield, Son-Mahanadi, Madhya Pradesh, India

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ABSTRACT

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The dispersed spore and pollen grains preserved in Mand-Raigarh Coalfield, Madhya Pradesh. In the present investigation studied the bore-hole RGP-7. This bore-hole run through Raniganj-Barren Measures Formations as well as lithologically, while the palynofloral composition show the Raniganj period (Late Permian flora). The dominance of *Striatopodocarpites* and *Faunipollenites* alongwith *Alisporites*, *Crescentipollenites*, *Densipollenites*, *Rhizomaspora*, *Verticypollenites*, *Lunatisporites* etc. This palynoaessemblage is similarly found in Raniganj as well as Barren Measure sediments, hence, whole strata deposited in Late Permian time (Raniganj Formation).

Key-words—Palynostratigraphy, Correlation, Gondwana, Son-Mahanadi Graben.

सारांश

भारत के मध्य प्रदेश के सोन महानदी के थाले में स्थित मण्ड-रायगढ़ कोयला क्षेत्र से प्राप्त अधोस्तर रानीगंज, बैरेन मेज़र अवसादों का परागाणुस्तरीय अध्ययन
किन्दु लाल मीणा

परिक्षिप्त बीजाणु एवं परागकण मध्य प्रदेश के मण्ड-रायगढ़ कोयला क्षेत्र में संरक्षित हैं। वर्तमान अन्वेषण में वेध छिद्र आर.जी.पी.-7 का अध्ययन किया गया है। यह वेध छिद्र रानीगंज बैरेन मेज़र शैलसमूह के साथ आशिमक रूप से होकर जाता है, जबकि परागाणुवनस्पतिजात संघटन रानीगंज आयु (अन्तिम उपरिपरमियन वनस्पतिजात) को प्रदर्शित करता है। स्ट्रायटोपोडोकार्पाइटीज़ तथा फॉनीपोलेनाइटीज़ के साथ-साथ एलिस्पोराइटीज़, क्रीसेन्टीपोलेनाइटीज़, डेन्सीपोलेनाइटीज़, राइजोमोस्पोरा, वर्टीसीपोलेनाइटीज़, ल्यूनेटिस्पोराइटीज़ इत्यादि की प्रचुरता भी प्रदर्शित हुई है। यही परागाणु समुच्चय रानीगंज के साथ-साथ बैरेन मेज़र अवसादों में भी इसी प्रकार प्राप्त हुआ है, अतः सम्पूर्ण संस्तर अन्तिम उपरि परमियन युग (रानीगंज शैलसमूह) में निक्षेपित हुए हैं।

INTRODUCTION

GEOLGY — The Mand-Raigarh Gondwana Basin is the north western continuity of the Ib-River Coalfield of

Orissa and has more or less a similar stratigraphic and tectonic setting.

The coal measures in Mand-Raigarh Basin, however, are

exposed in three well defined patches due to erosion of the overlying Kamthi rocks along the drainage of the prominent rivers, as by Kurket and Kelo rivers about 20 km north of Raigarh Coalfield, secondly Barakar rocks crop out by Mand-River due to removal of Kamthi sediments towards north west of Raigarh Coalfield (Raja Rao, 1983). Thirdly Barakar coal exposed due to erosion of Kamthi sediments by drainage of Kelo river and Bagadia *Nala*. All these coal bearing areas, however, have common stratigraphic succession which is indicated below:

Age	Formation	Lithology
Recent		Alluvium, Soil, Laterite/Gravel and Conglomerate.
Cretaceous to Eocene	Deccan Trap	Basalt flows and dolerite.
Lower Permian to Lower Triassic	Kamthi Formation	Variogated sandstones with lenses with clay, Amaceous shale, clay beds, Carbonaceous shales and coal seams.
	Barakar Formation	Coarse to medium grained sandstones, grits, grey shales and coal seams.
	Talchir Formation	Diamictites, fine to medium grained sandstones, olive green shale, rythmitics & turbidites.
-----Unconformity-----		
Precambrian		Quartzites and red, hard, fine grained sandstones and Limestones.
-----Unconformity-----		
Archaean		Granitic gneisses, mica schists, quartzites intruded by pegmatites and quartz veins.

THE PRECAMBRIAN BASEMENT

The Gondwana sediments rest unconformably over the Precambrian basement comprising Archaean rocks in the northern part of the basin. The Proterozoic Cuddapah rocks occur at place in the northern part.

The Archaean rocks comprise biotic granite, sericite chlorite schists, quartzites, mica dolerite quartz veins and pegmatites.

TALCHIR FORMATION

The Talchir Formation occurs as a continuous strip along the northern periphery of the basin. The contact with the Archaean rocks is as erosional surface. The extent of Talchir exposures around Dharmaygarh, Siringa, Rat Khand and Laripani. Along the southern boundary discontinuous patches of Talchir rocks crop out in the vicinity of Kharsia and further southeast in the Sambalpuri *Nala* in South of Raigarh area. In this Basin the clast of granite and gneisses, the tillite contains fragments of banded hematite jasper breccia and pinkish, current bedded quartzite and the bright coloured clasts are characteristic of the tillites of the Mand Valley. A few of the clasts are highly polished and striated.

The Mand-Raigarh Basin shows widespread development of basal tillite pointing to advancement of ice from surrounding Precambrian uplands. The till fabric study points to a south eastern direction of transport in the northern part (Bharadwaj, 1971), north western in the eastern and west-north western in the southern part of the basin.

BARAKAR FORMATION

The Barakar Formation conformably overlies the Talchir sediments and comprises crudely developed cyclic sequence of arkose, grey shale, carbonaceous shale and coal seams. The sandstones are greyish, white to milky white in colour and are disposed as multi storeyed cross bedded units. They consist of subangular grains of quartz and kaolinised feldspars. Based on gross lithology, the Barakar Formation can be broadly sub divided into lower Barakar are usually coarse grained, with predominance of Kaolinised feldspar. The upper member is more argillaceous sandstones and occur as thin unit. Interlaminations of shales and siltstone are more frequent in the Upper Barakar Formation. The megafossils assemblage—*Glossopteris indica*, *G. communis* and *Schizoneura* sp. were identified by Deshmukh 1965-66 from Saria *Nala* East of Khargaon (Text-figure 1).

PLATE 1



1. *Lundbladispora brevicula*, Balme, 1963. BSIP Slide No. 12097.
2. *Horriditritiles brevis*, Bharadwaj & Salujha, 1964. BSIP Slide No. 12098.
3. *Striatipollenites obliquus*, Bharadwaj & Salujha, 1964 BSIP Slide No. 12103.
4. *Navalesporites spinosus*, Sarate & Ram-Awatar, 1984. BSIP Slide No. 12103.
- 5, 11. *Rhizomaspora indica* Tiwari, 1965. BSIP Slide No. 12102.
6. *Arcuatipollenites pellucidus* (Goubin) Maheshwari & Bose, 1975. BSIP Slide No. 12102.
- 7, 14. *Fannipollenites perexiguus*, Bharadwaj & Salujha, 1965. BSIP Slide No. 12101.
8. *Distriatites bilateris*, Bharadwaj, 1962. BSIP Slide No. 12099.
9. *Verticypollenites secretus*, Bharadwaj, 1962. BSIP Slide No. 12100.
10. *Striatites tectus*, Venkatachala & Kar, 1968. BSIP Slide No. 12099.
12. *Parasaccites bilateralis*, Tiwari, 1965. BSIP Slide No. 12098.
13. *Striatopodocarpites decorus* Bharadwaj & Salujha, 1964. BSIP Slide No. 12098.
15. *Striamonosaccites ovatus*, Bharadwaj, 1962. BSIP Slide No. 12098.
16. *Ibisporites diplosaccus*, Tiwari, 1968. BSIP Slide No. 12102.

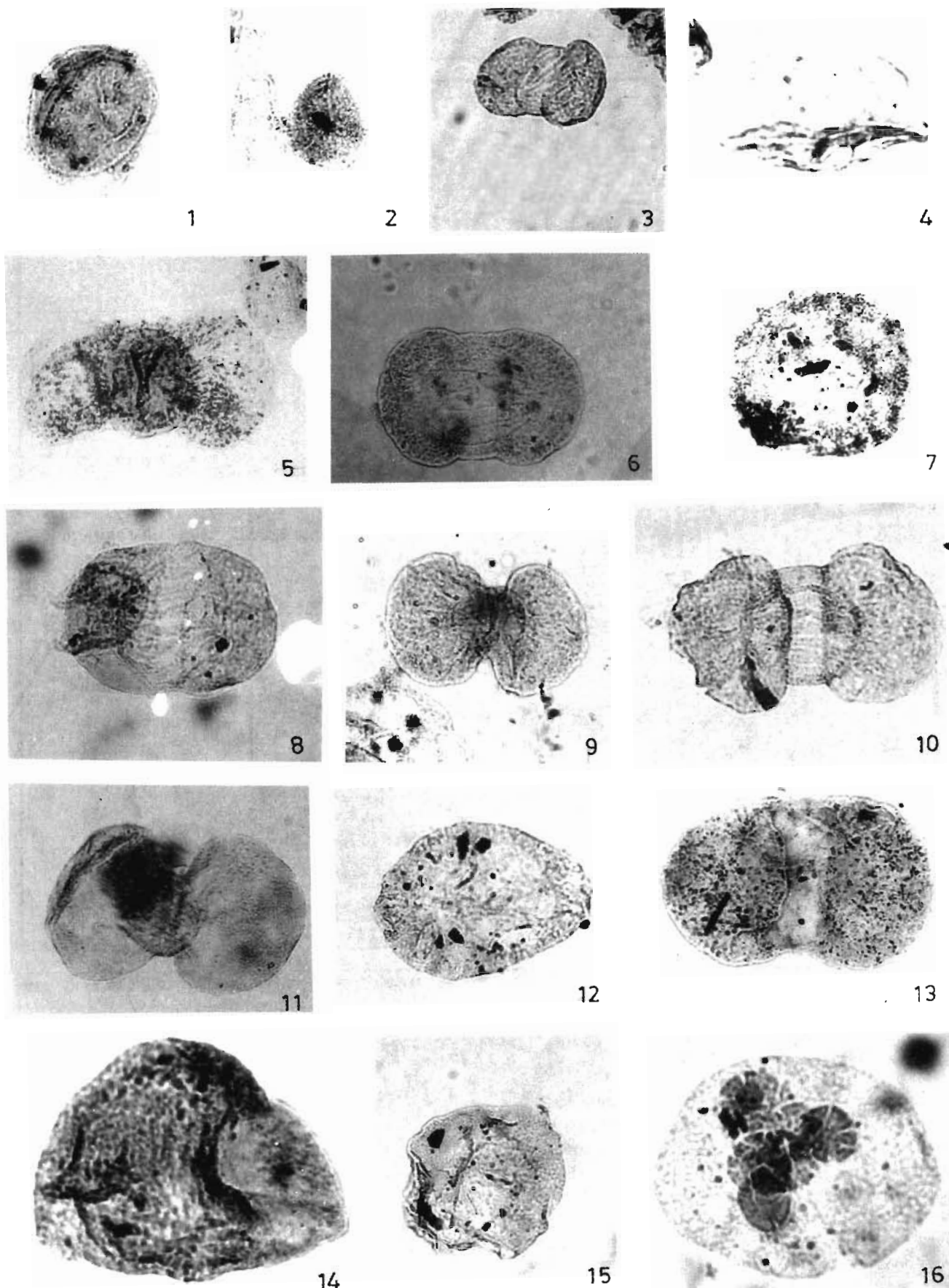
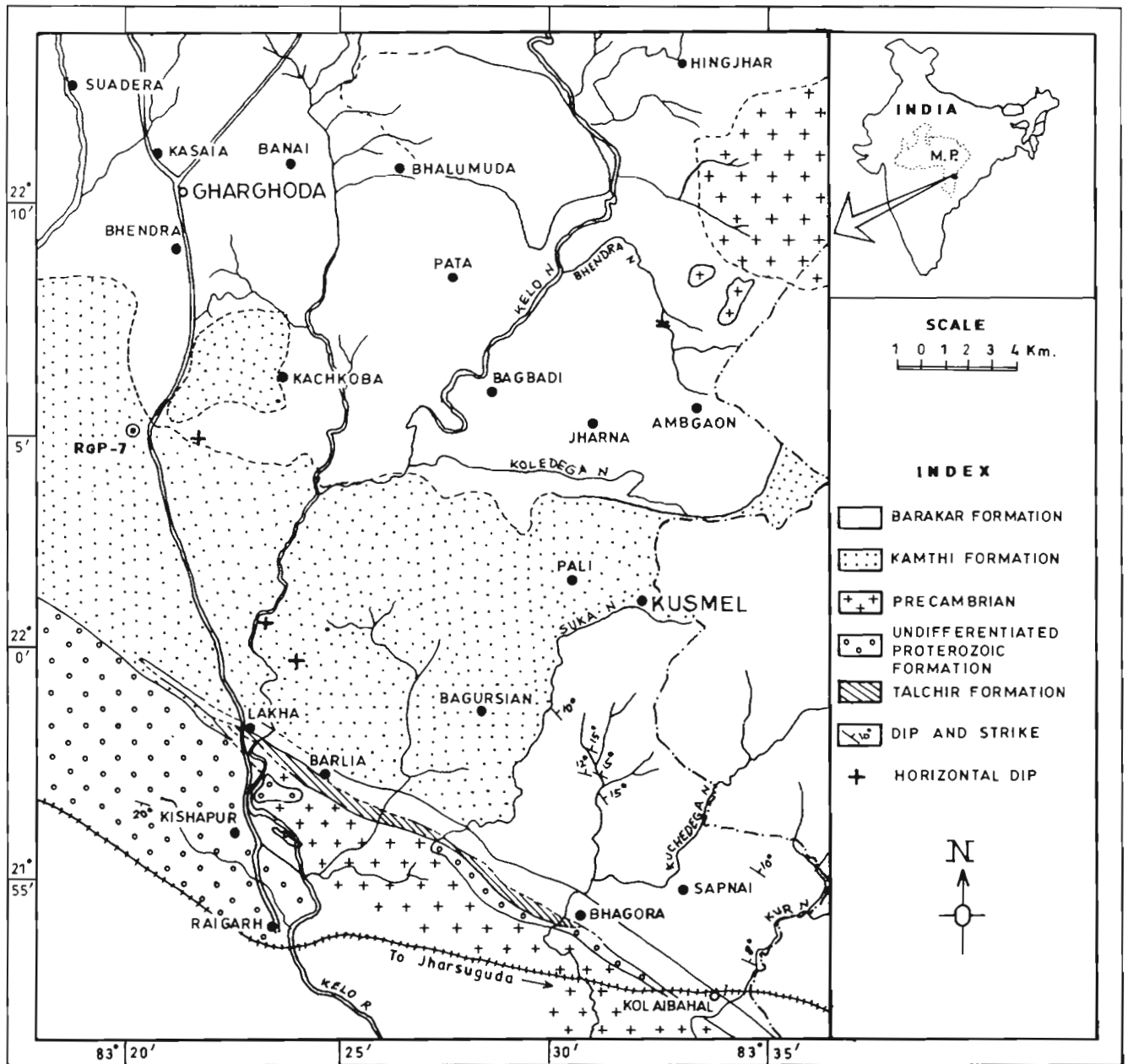


PLATE 1



Text-figure 1— Location map of bore-hole RGP-7, Raigarh Coalfield, M.P., India

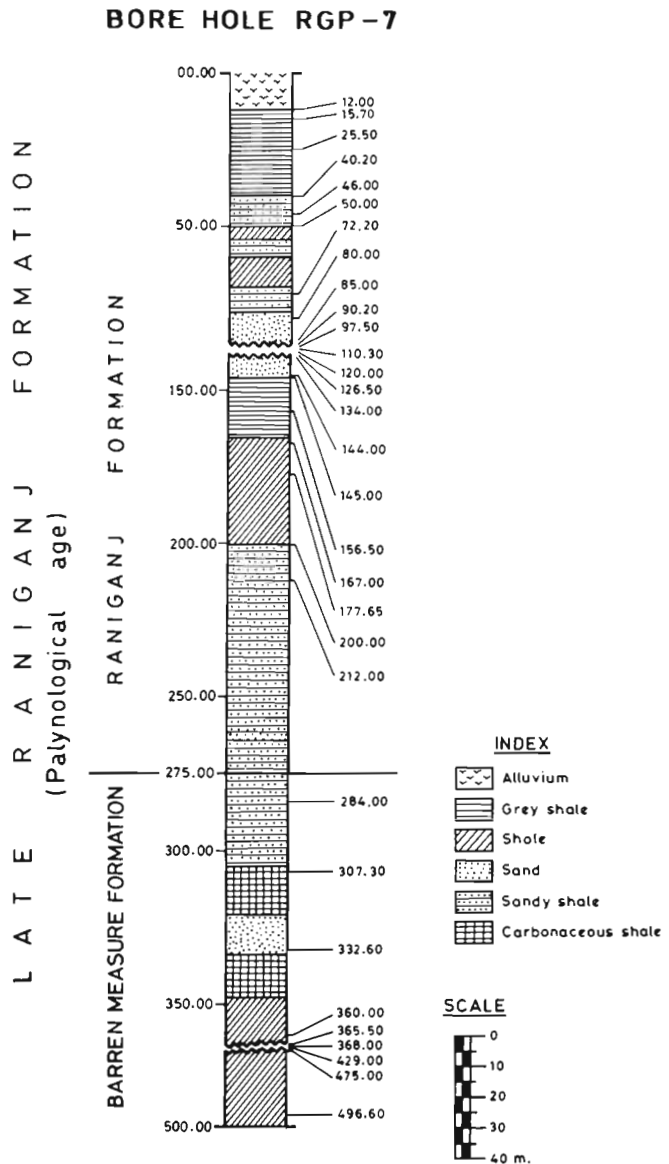
KAMTHI FORMATION

These sediments comprise dominantly coarse, friable, porous, brownish to red sandstones. The sandstones are profusely cross bedded and contain pebbles of quartz up to 12 cm in diameter. In the area north and west of Amaldiha, Carbonaceous shales interbedded with coal are found at places within the Kamthi Formation. The megafloal assemblage—*Glossopteris* sp., *Vertebraria indica*, and *Schizoneura gondwanensis* have been found. The Kamthi beds exposed north-west of Amaldiha also contain impression of

Glossopteris and *Vertebraria*.

MATERIAL AND METHOD

The bore-hole RGP7 was collected from Mand-Raigarh Basin, Madhya Pradesh. This bore-core passes lithologically through the Raniganj Formation and also Barren Measures Formation. Total 191 samples were collected from this bore-hole from different lithologies (see Text figure 2). These samples were processed for palynological study by HF, HNO₃ and Alkali treatment. The preservation of palynomorphs is

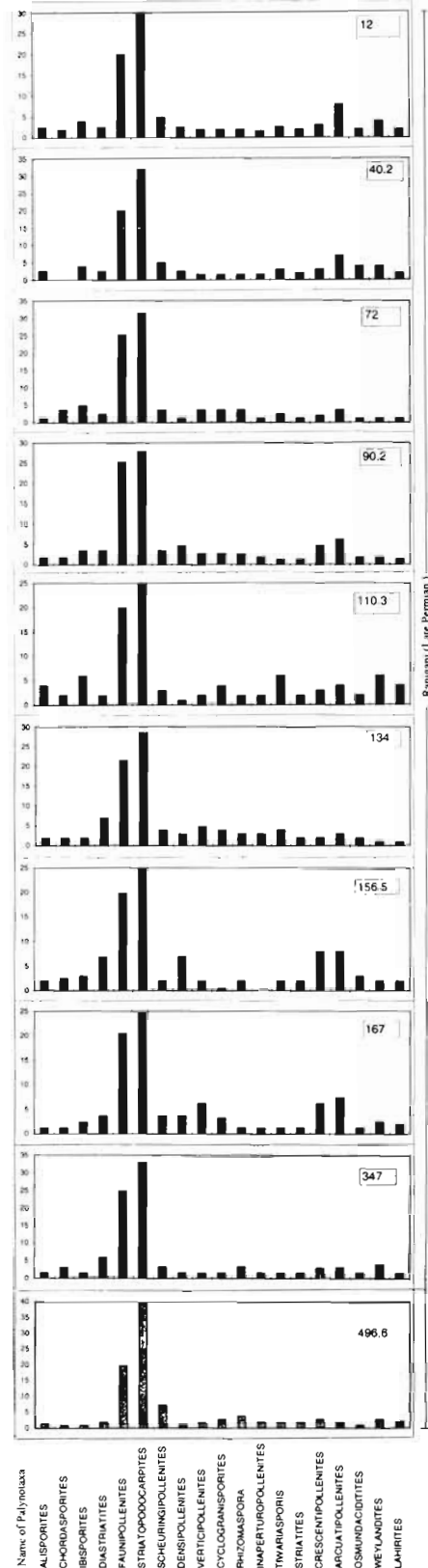


Text-figure 2—Showing the lithological details of samples from bore-hole RGP-7, Munda-Raigarh Coalfield, M.P.

very poor in 50 samples. Only 10 samples have yielded palynofossils in countable numbers as shown in Text-figure 3 (Text-figure 3). On the basis of which percentage frequencies of various palynotaxa have been plotted.

**PALYNOLOGICAL ASSEMBLAGE
BORE- HOLE RGP 7**

On the basis of quantitatively as well as qualitatively analysis significant palynological assemblage have been identified (Text-figure 3). After palynological investigation I have found the striated disaccate flora (*Striatopodocarpites* and *Faunipollenites*) is in prominence along with *Alisporites*, *Densipollenites*, *Scheuringipollenites*, *Rhizomaspora*, *Verticipo*



Text-figure 3—Histogram showing the percentage distribution of palynotaxa in subsurface samples of B.H.No. RGP-7, Mand-Raigarh Coalfield, Madhya Pradesh

pollenites, *Crescentipollenites*, *Lunatisporites*, *Striatites*, *Tiwariasporis* etc. shows the Late Permian affiliation rather than Barren Measures Formation (Depth from surface 12.00 to 496.00 m). The above thick strata is classified into Raniganj/Barren Measures according to lithology while here it is found that palynologically similar palynoassemblage is continued up to 4964 m).

COMPARISON WITH OTHER BASINS

The palynoflora from bore-hole RGP 7 designated here to be Raniganj equivalent, resemble those of Upper Permian from other basins (Bharadwaj, 1962; Bharadwaj & Tiwari, 1977; Tiwari & Singh, 1986; Tiwari & Ram-Awatar, 1989; Srivastava, 1973, 1980; Srivastava & Anand-Prakash 1984; Tiwari & Meena, 1989) in the prominence of striate disaccate (*Striatopodocarpites* and *Faunipollenites*) are in prominence along with *Alisporites*, *Crescentipollenites*, *Rhizomaspora*, *Verticypollenites*, *Striatites* etc. The absence of *Indospora*, *Thymospora* and *Gondisporites* and presence of *Densipollenites*, *Arcuatipollenites* further make that the present assemblage is different from other basins beside the results of Son-Mahanadi Graben (Tiwari & Ram-Awatar, 1989; Meena, MS). The palynoassemblage is similar to the results of bore-hole TP-9 and TP-10 from Talchir Coalfield, Orissa and bore-hole results of IBH-6 and IBSH-6 from Ib-River Coalfield, Orissa (Meena, 1997) and it is also similar with results of Johilla Coalfield reported by Tiwari & Ram-Awatar, 1989.

CONCLUSION

This bore-hole cross lithologically the Raniganj/Barren Measures formations, while, the palynological data suggest the whole sediments deposited in Raniganj period (Late Permian time). The dominance of striated disaccate palynoflora (*Striatopodocarpites* and *Faunipollenites*) alongwith *Alisporites*, *Densipollenites*, *Scheuringipollenites*, *Rhizomaspora*, *Distriatites*, *Striatites*, *Crescentipollenites*, *Arcuatipollenites* etc. shows the Late Permian affiliations rather than Barren Measure, Formation.

Table 1—Showing the details of bore-hole RGP7 samples collected from Raigarh coalfield.

Sample no.	Depth in m.	Lithology	Remarks
1	12.00	Grey shale	++
2	12.10	Silty shale	-
3	14.14	Grey shale	-
4	15.00	Sandy shale	+
5	15.50	Grey silty sst.	-
6	15.70	Grey shale	-
7	16.00	—do—	+
8	16.50	—do—	-
9	16.90	—do—	-
10	19.40	—do—	-

11	20.00	—do—	-
12	20.60	Sandy shale	-
13	21.7	—do—	-
14	24.10	—do—	-
15	25.50	—do—	++
16	26.10	Grey shale	-
17	26.60	—do—	-
18	27.00	—do—	-
19	39.70	—do—	-
20	40.20	Sandy shale	++
21	41.40	—do—	-
22	42.20	—do—	-
23	43.20	—do—	-
24	45.10	—do—	-
25	45.90	—do—	-
26	46.00	—do—	++
27	47.00	Shale with Iron band	-
28	48.00	—do—	-
29	49.50	—do—	-
30	50.00	—do—	++
31	51.10	—do—	-
32	52.00	Grey shale	-
33	53.45	—do—	-
34	54.45	—do—	-
35	55.00	—do—	+
36	56.00	—do—	-
37	57.00	—do—	-
38	58.00	—do—	+
39	58.70	Grey shale with sst.	-
40	60.00	Thin compact shale	-
41	60.50	Sandy shale	-
42	61.50	Iron content grey shale Iron sst.	+
43	62.50	Grey Shale	-
44	63.20	—do—	+
45	64.00	—do—	-
46	65.00	—do—	-
47	66.20	—do—	+
48	68.00	—do—	-
49	69.00	—do—	-
50	72.00	—do—	++
51	73.50	Grey hard shale	-
52	75.05	—do—	-
53	78.20	—do—	-
54	79.50	—do—	-
55	80.00	—do—	+++
56	81.60	Grey shale	-
57	83.40	—do—	+
58	84.50	—do—	-
59	89.25	—do—	-
60	90.20	—do—	++
61	92.20	—do—	-
62	93.00	—do—	-
63	95.00	—do—	-
64	96.00	Grey shale & sst.	-
65	97.50	F. grain sst. & shale	+++
66	100.00	Grey shale	-
67	105.50	—do—	+
68	106.50	—do—	-
69	108.25	—do—	-
70	100	—do—	+++

71	112.00	—do—	-	132	268.60	—do—	-
72	114.15	—do—	-	133	270.70	—do—	+
73	116.20	—do—	+	134	276.10	—do—	-
74	119	Grey shale hard band	+	135	277.30	—do—	-
75	120	Grey shale	+++	136	279.00	—do—	-
76	121	—do—	-	137	281.00	—do—	+
77	123	Grey shale & coal	-	138	281.75	—do—	-
78	124	—do—	+	139	283.15	—do—	+
79	125	Grey shale	-	140	284.00	—do—	+++
80	126.50	—do—	++	141	286.00	Coal	-
81	128.00	—do—	-	142	288.35	Carb. shale	+
82	129.10	—do—	-	143	289.00	Grey shale	-
83	129.80	—do—	-	144	293.00	—do—	-
84	132.10	—do—	-	145	295.00	—do—	-
85	134.00	—do—	++	146	296.00	Shale	+
86	135.15	—do—	-	147	297.50	Grey shale	-
87	142.70	—do—	-	148	304.70	—do—	-
89	144.00	—do—	+	149	305.50	Coal	-
90	146.00	—do—	-	150	307.50	Shale	+
91	147.20	—do—	+	151	314.00	Silty shale	-
92	149.30	—do—	-	152	328.00	Black shale	-
93	152.00	—do—	+	153	329.50	Micaceous sh.	-
94	154.00	—do—	-	154	331.50	Sst.	-
95	156.50	—do—	+++	155	332.60	Grey shale	+
96	159.50	—do—	-	156	334.00	Coaly shale	-
97	160.25	G. Sh + Coal streak	-	157	336.50	—do—	-
98	162.00	Grey shale	+	158	339.50	—do—	-
99	164.60	—do—	-	159	341.50	—do—	-
100	165.50	—do—	-	160	347.00	—do—	++
101	167.00	Sandy shale	++	161	350.75	—do—	-
102	168.00	—do—	-	162	354.00	Silty Sst	-
103	169.50	Grey shale	+	163	357.00	Coal streaks + sst.	-
104	175.50	—do—	-	164	358.50	Sst.	++
105	177.65	Carb. shale	+++	165	360.50	Sst.	-
106	183.75	Siltstone	-	166	362.00	Black shale	-
107	187.00	Grey shale	-	167	364.50	Black shale	-
108	190.00	Coaly streaks	+	168	365.50	Silty Grey shale	+
109	193.65	Grey shale	-	169	367.00	Grey shale	-
110	194.85	—do—	+	170	368.00	Black shale	++
111	195.85	Carb. shale	-	171	369.75	Silty shale	-
112	199.00	Grey shale	+	172	370.40	Coal streaks + Sst.	-
113	201.00	Black sh + Coal	+	173	373.00	—do—	-
114	204.00	Black shale	-	174	374.00	—do—	+
115	204.50	—do—	+	175	375.00	—do—	-
116	205.00	Grey shale	-	176	382.00	Shale	+
117	206.70	—do—	-	177	385.00	—do—	-
118	209.60	Coaly streaks	+	178	388.00	—do—	-
119	212.00	Grey shale	-	179	391.30	—do—	+
120	226.00	—do—	-	180	392.30	—do—	-
121	233.00	—do—	-	181	393.80	—do—	+
122	234.00	—do—	+	182	395.00	Black shale	-
123	237.80	—do—	-	183	403.10	Shale	-
124	241.50	Sandy shale	-	184	405.00	—do—	-
125	245.00	Black shale	+	185	429.00	—do—	+
126	247.40	Black shale	-	186	436.20	—do—	-
127	249.30	Grey shale	-	187	475.75	—do—	-
128	253.00	—do—	-	188	492.00	Shale + Sst.	+
129	254.50	—do—	+	189	492.50	—do—	-
130	259.20	Black shale	-	190	496.60	—do—	+
131	263.00	Grey shale	-				

* Barren Measures/Raniganj lithoboundary at 275 m.

Legend + = rare, ++ = common, +++ = rich, - = absent.

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