PALYNOSTRATIGRAPHIC STUDIES OF SUB-SURFACE SUPRA-BARAKAR SEDIMENTS FROM KORAR COALFIELD, SON VALLEY, MADHYA PRADESH

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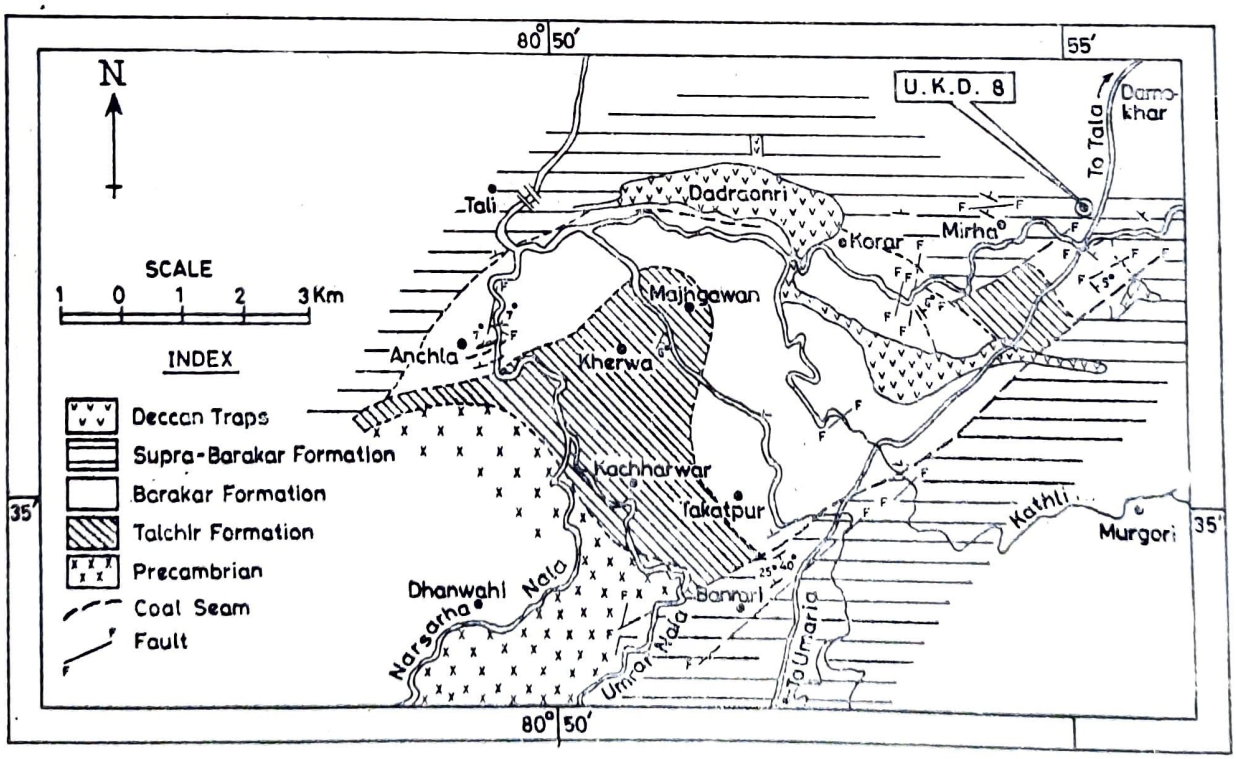
Abstract

From Korar Coalfield, which is the smallest coalfield of Son Valley in Madhya Pradesh region, the first palynological report is communicated. Varied types of pollen and spores, viz., *Faunipollenites*, *Striatopodocarpites*, *Gondisporites*, *Lundbladispora*, *Densipolleniles*, *Lunatisporites*, *Nidipolleniles*, *Satsangisaccites*, *Infernopollenites*, have been recovered in samples from bore-hole UKD-8. On the basis of miofloral assemblages these yielding horizons (depth from surface 41 to 193 m) have been dated to be Late Permian to Early Triassic in age. This finding is significant because it fills one more gap in the palynostratigraphic succession of Gondwana Sequence in Son Valley.

Introduction

The name Korar Coalfield was introduced by Hughes in the year 1884 after the village Korar-Kotalwar (23°37′ · 80°53′), (Map-1) which is situated about 11.5 km N.E. of Umaria Railway Station, Katni-Bilaspur line of the Central Railway in M.P. The total area of this coalfield is about 25.6 sq km.



Map 1—Geological map of Korar Coalfield, showing the location of Bore-hole UKD-8 on the Umaria-Tala Road.

The Barakar rocks comprise grey and yellowish felspathic sandstone, beds of carbonaceous shale and coalseams. They are overlain by Supra-Barkar sequence having mainly yellow, reddish, whitish sandstone with clayey shale and shale-bands. These sediments are proved only in subsurface.

There is no record of plant mega- or microfossils from any horizon of this coalfield; consequently, their age has not yet been determined precisely, although on lithological and stratigraphical grounds they are classified as Talchir, Barakar and Supra-Barakar. An attempt for search of palynofossils in bore-hole UKD-8 was made and few samples at 41 to 193 m depth were found to yield a fairly well-preserved palynological assemblage. These yielding beds are from Supra-Barkar levels, which all the more makes it a purposeful study for age determination. At the same time, one more gap in the succession of Gondwana palynostratigraphy is filled through this record in Son Valley.

Material and Methods

The material for the present investigation was collected from bore-hole UKD-8 (Map.1) drilled by Geological Survey of India, at about 2 km North of Forest check-post, on Umaria-Tala road and about 2 km South of Dhamokhar Village. Thirty-two samples were collected, out of which only six samples were found to contain palynofossils (See Table-1).

Palynological Assemblage

The following genera were found in the assemblage.

Triletes

Callumispora Bharadwaj & Srivastava 1969 ; *Brevitriletes* Bharadwaj & Srivastava 1969; *Horriditriletes* Bharadwaj & Salujha 1964; *Microfoveolatispora* Bharadwaj 1962 (Plate-1, Fig. 6) ; *Microbaculispora* Bharadwaj 1962; *Verrucosisporites* Ibrahim 1933 emend. Smith *et al.* 1937; *Osmundacidites* Couper 1953; *Indotriradites* Tiwari 1964; *Gondisporites* Bharadwaj 1962; *Lundbladispora* Balme emend. Playford 1965.

Monoletes

Laevigatosporites Ibrahim emend. Schopf, Wilson & Bentall 1944.

Alete Type

Pl. 1, fig. 9

Monosaccates

Parasaccites Bharadwaj & Tiwari 1964; *Densipollenites* Bharadwaj 1962; *Plicatipollenites* Lele 1964; *Potonieisporites* Bhradwaj emend. Bharadwaj 1955; *Barakarites* Bharadwaj & Tiwari 1964 (Plate-1, Fig. 3) ; *Playfordiaspora* Maheshwari & Banerji 1975; *Striamonosaccites* Bharadwaj 1962.

Non-striate disaccate pollen

Podocarpidites Cookson emend. Potonié 1954; *Satsangisaccites* Bharadwaj & Srivastava 1969 (Plate 1, Fig. 8); *Alisporites* Daugherty 1941 emend. Somers 1958; *Caheniasaccites* Bose & Kar 1966; *Chordasporites* Klaus 1960; *Scheuringipollenites* Tiwari 1975; *Ibisporites* Tiwari 1968.

Table 1—List of samples collected from Bore-hole No. UKD—8

Sample No.	Lithology	Depth in meter from surface	Remarks
UKD 8/1	Argillaceous Sandstone	25.15-29.00	Supra Barakar
,, 8/2	Argillaceous Sandstone	35.90	
,, 8/3	Greenish grey clay	35.90	
,, *8/4	Sandy Shale with carbonaceous streak	41.50	
,, 8/5	Argillaceous sst (current bedded)	61.80-64.80	
,, *8/6	Argillaceous sst (current bedded)	69.70	
,, 8/7	Argillaceous sst	75.70	
,, 8/8	Clay	87.70	
,, 8/9	Clay	92.70	
,, 8/10	Clay	102.75	
,, 8/11	Clay	111.75	
,, 8/12	Sandy shale	117.75	
,, 8/13	Sandstone	134.75	
,, 8/14	Clay	142.75	
,, *8/15	Sandstone & shale	152.30	
,, *8/16	Carbonaceous shale	155.30	
,, *8/17	Shaly sandstone	161.30-164.0	
,, *8/18	Grey shale	193.35	
,, 8/19	Clay	202 65	
,, 8/20	Sandstone	205.00	
,, 8/21	Clay	210.35	
,, 8/22	Greenish sandstone	218.60	
,, 8/23	Greenish clay	216.45	
,, 8/24	Fine-grained sandstone (greenish)	225.35-226.25	
,, 8/25	Clay	261 45	
,, 8/26	Clay	264.45	
,, 8/27	Clay	269.45-270.45	
,, 8/28	Clay	282.00	
,, 8/29	Sandstone	285.25	
,, 8/30	Sandy shale	323.25	Supra Barakar
,, 8/31	Carbonaceous shale	331.0-332.70	Barakar Formation
,, 8/32	Carbonaceous shale	335.05	

Note : Asterisk (*) mark indicates yielding samples.

Nidipollenites Bharadwaj & Srivastava 1969; *Vestigisporites* Balme & Hennelley emend. Tiwari & Singh 1984; *Sahnites* Pant emend. Tiwari & Singh 1984.

STRIATE DISACCATE POLLEN

Rhizomaspora Wilson 1962; *Faunipollenites* Bharadwaj 1962 (Plate-1, Fig. 2) ; *Striatopodocarpites* Soritsch. & Sedova emend. Bharadwaj 1962 (Plate-1, Fig. 4); *Distriatites* Bharadwaj 1962; *Lahirites* Bharadwaj 1962; *Striatites* Bharadwaj 1962; *Crescentipollenites* Bharadwaj, Tiwari & Kar 1974 (Plate-1, Fig. 5); *Striasulcites* Venkatachala & Kar 1968; *Hemiapollenites* Wilson, 1962.

TAENIATE DISACCATE POLLEN

Lunatisporites Leschik 1955 emend. Scheuring 1970; *Corisaccites* Venkatachala & Kar 1966 (Plate-1, Fig. 7); *Guttulapollenites* Goubin emend. Venkatachala & Kar 1966; *Lueckisporites* Klaus 1963, *Infernopollenites* Scheuring 1970.

OTHER

Ephedripites Bolkhovitina, 1953 (Plate-1, Fig. 1);
Weylandites Bharadwaj & Srivastava 1969.

Quantitative Analysis

The percentage frequency of important pollen and spore genera, depicted in Histogram-I, reveals that there are two distinct assemblages in the sequence:

Assemblage-I : Contained by the older samples-UKD-8/18 (193.35 m), UKD-8/17 (164.00m), UKD-8/16 (155.0), UKD-8/15 (152.30) and *Assemblage-II:* Contained by the younger samples-UKD-8/6 (69.70m), UKD-8/4 (41.50m). A perusal of Histogram-I, reveals that in Assemblage-1, the abundant taxa are-*Striatopodocarpites* (11.7%), while common genera are *Microbaculispora* (1.7%), *Microfoveolatispora* (1.5%), *Densipollenites* (2.7%), *Parasaccites* (7.7%), *Plicatipollenites*, (1.7%), *Barakarites* (2%), *Potonieisporites* (1.7%), *Striamonosaccites* (2.5%), *Laevigatosporites* (1.7%), *Sahnites* (1.2%), *Vestigisporites* (1.5%), *Cuneatisporites* (3.1%), *Scheuringipollenites* (8.2%), *Faunipollenites* (9.2%), *Striatites* (2%), *Chordasporites* (1.5), *Crescentipollenites* (3.5%), *Osmundacidites* (1.2%), *Corisaccites* (1.7%), *Indotriradites* (1.1%), *Callumispora* (1.5%), *Verrucosisporites* (1.3%), *Lundbladispora* (3.2%), *Alisporites* (1.2%), *Lunatisporites* (3.2%), *Infernopollenites* (4.5%) and Alete type grains are about 6.4%. Rare elements are *Gondisporites* (0.5%), *Rhizomaspora* (0.3%), *Laricoidites* (0.5%), *Weylandites* (0.5%). The genus *Satsangisaccites* is spoardic being less than 0.5% in the presently described Assemblage-1.

In Assemblage-II, the appearance of taxa are somewhat different than the Assemblage-I; here the abundant taxa are *Densipollenites* (20%), *Striatopodocarpites* (17%). Common genera are *Gondisporites* (1.2%), *Vestigisporites* (1.7%), *Scheuringipollenites* (8.5%), *Faunipollenites* (9%), *Crescentipollenites* (2.5%), *Osmundacidites* (2.5%), *Corisaccits* (6%) *Lundbladispora* (1.5%), *Alisporites* (3%), *Satsangisaccites* (8%), *Nidipollenites* (1.5%), *Lunatisporites* (1.5%) and Alete type is about (1.5%). The rare elements in Assemblage-2 are—*Laevigatosporites* (0.7%), *Sahnites* (0.7%), *Chordasporites* (0.5%), *Verrucosisporites* (0.7%) and the sporadic forms which are less than 1% are—*Parasaccites*, *Plicatipollenites*, *Potonieisporites*, *Striamonosaccites*, *Cuneatisporites*, *Indotriradites* and *Weylandites*.

At a glance, it appears that all the six samples which yielded miospores contain a continuous assemblages; some of the major elements, viz., *Scheuringipollenites*, *Faunipolle-*

nites, *Striatopodocarpites*, and most of the less represented forms, such as—*Plicatipollenites*, *Laevigatosporites*, *Sahnites*, *Chordasporites*, *Crescentipollenites*, *Lunatisporites*, etc. are uniformly present in them. However, *Densipollenites*, *Corisaccites*, *Nidipollenites* and *Satsangisaccites* are better represented in Assemblage-II while *Microbaculispora*, *Parasaccites* and *Barakarites* are more abundnt in Assemblage-I.

Execept for the above nuance in certain generic incidences, it appears that the sequence is continuous as there seems to be no sudden miofloral break between the two assemblages proposed here. However, the pattern of change and alteration in quality being evident, two distinct assemblages have been identified here.

Comparison

The present assemblages, when compared with the already known assemblages from the Gondwana sequence of India, show a fair degree of resemblance with the miofloras of the Raniganj Stage (Upper Permian) because the elements, like-*Faunipollenites*, *Striatopodocarpites*, *Densipollenites* and *Gondisporites* are abundant in the present assemblage; moreover, qualitatively significant genera, viz., *Callumispora*, *Microbaculispora*, *Microfoveolatispora*, *Parasaccites*, *Plicatipollenites*, *Barakarites*, *Sahnites*, etc., are also present which indicate Permian affinities (see Bnaradwaj, 1962; Bnaradwaj, Tiwari & Anand-Prakash, 1979; Kar, 1970; Sarbadhikari, 1972; Maheshwari & Banerji, 1975; Bharadwaj & Tiwari, 1977; Tiwari & Rana, 1980; Tiwari & Ram-Awatar, 1986.)

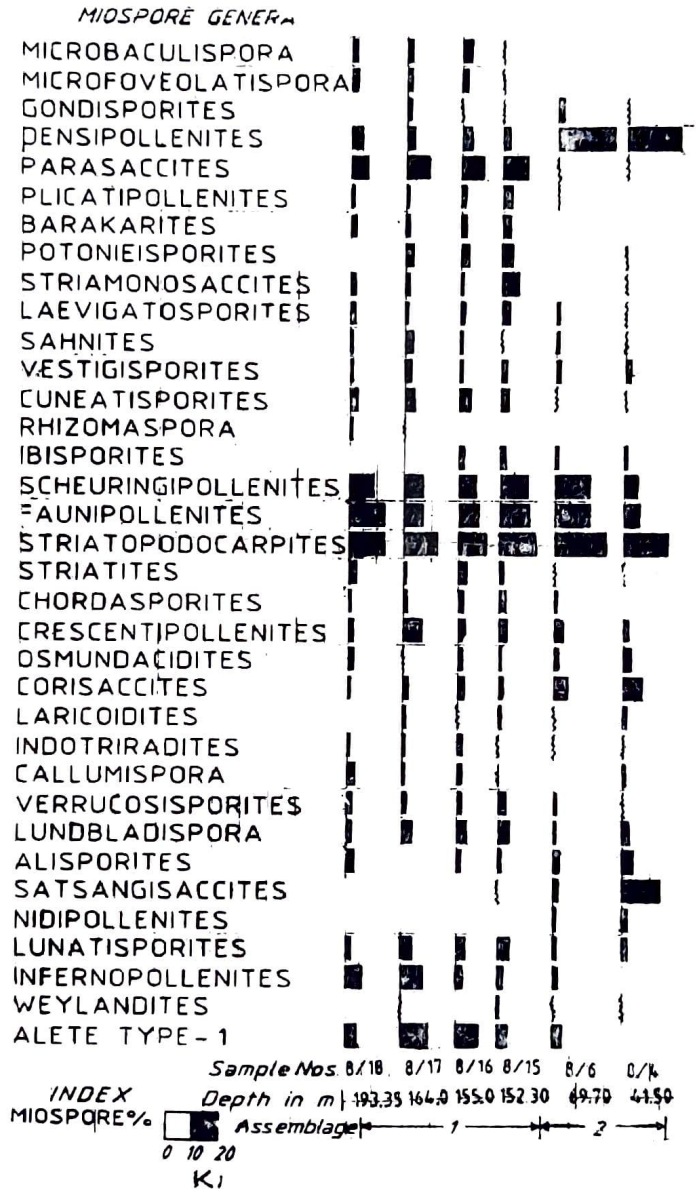
Among the other set of palynomorphs, the genera *Alisporites*, *Lundbladispora*, *Nidipollenites*, *Infernopollenites*, *Playfordiaspora*, *Podocarpidites* and *Weylandites* are some of the important taxa which have been found in the presently described two assemblages; these genera are indicator of younger affinity than those which are found in Upper Permian. The above mentioned forms are mostly reported from the Lower to Middle Panchet Formation. But even then, the Late Lower Triassic and Early Middle Triassic assemblages so far known from the Damodar Graben area do not exactly coincide with the Assemblages I & II of the Korar Coalfield. The former has qualifiying taxa—*Pyramidosporites*, *Pretricolpipollenites*, *Goubinispora*, *Ringosporites*, *Orbella*, *Cuneatisporites*, *Carnisporites*, *Aratrisporites*, *Muerrigerisporites*, etc. (Tiwari & Rana, 1980, Table 3) while in the latter they are absent.

There are some important data on the Supra-Barakar palynological assemblages known from Son Valley Graben of Madhya Pradesh region (cf. South Rewa Gondwana Basin); these are from Nidpur, Tharipathar and Ghiar, Janar Nala, Pali and Parsora (near-Dargaon).

When compared with the Nidpur Flora (Bharadwaj & Srivastava, 1969), the presently described assemblages are older and do not match with it; however, the beginning of fair occurrence of *Nidipollenites*, *Satsangisaccites* and rare incidences of *Weylandites* reflect some relationship with Nidpur flora.

The palynological assemblage from Tharipathar and Ghiar (Maheshwari & Kumaran, 1979) has been designated as *Staurosaccites tharipatharensis* and *Rimaesporites potoniae* assemblages; They consist of *Staurosaccites*, *Samaropollenites*, *Rimaesporites*, *Aulisporites*, *Camerosporites*, *Duplicisporites*, etc. and many other taxa which are not encountered in the presently studied Korar assemblage. In fact, the Tharipathar-Ghiar flora are much younger to the presently described one.

The other mioflora known from this region is of Janar Nala (Kumaran & Maheshwari, 1980) which is still younger than the two described above in having *Convolutispora*, *Clava-*



Text-fig. 1

tisporites, *Dicytyophyllidites*, *Lycopodiacidites*, *Cernisporites*, *Uvaesporites*, *Tikisporites*, etc. The comparson is, therefore, not close.

The assemblage from a bore-core samples whose level has been referred to Pali Formation has been described from Johilla River Coalfield to contain major genera, as, *Faunipollenites*, *Striatopodocarpites*, *Striatites* and *Lahirites*; other rare forms are *Densipollenites*, *Barakarites*, *Parasaccites*, *Sahnites*, *Microfoveolatispora*, etc. Some taxa, viz., *Satsangisaccites*, *Podocarpidites*, *Lunatisporites*, etc. are rare and sporadic but indicate an younger string. (Tiwari & Ram-Awatar, 1986). This assemblage has been dated to be Late Permian

(Raniganj) and it compares well with the Assemblage-I described presently. However, the latter has a somewhat younger affinity than the former within the Upper Permian frame-work. The Assemblage-II of the present report is relatively younger.

Tiwari and Ram-Awatar (1987) also studied a miofloral assemblage from Johilla River section near Dorgaon to which a Permian—Triassic transition age was assigned. This assemblage contained *Striatopodocarpites*, *Densipollenites*, *Lundbladispora*, *Lunatisporites*, *Playfordiaspora*, *Satsangisaccites*, *Nidipollenites*, etc. In its consitituion, fair similarity with the presently described assemblages I and II is evident.

In spite of the basic composition of the presently recorded two assemblages to have their Raniganj affinities, certain elements, like, *Lunatisporites*, *Chordasporites*, *Nidipollenites*, *Satsangisaccites*, *Playfordiaspora*, *Lundbladispora*, etc. try to give an younger aspect qualifying for the Panchet miofloras; nevertheless, these taxa are normally very rare, inconsistant and sporadic in the UKD-8 assemblage no. II. This fact corroborates with our findings elsewhere (in the Raniganj Coalfield) that rare incidence of these younger elements start almost at the beginning of the Panchet Formation.

It is conteded here, after thoughtful matching, that the Assemblage-I has more of Latest Permian characters while Assemlage-II inclines more to the earliest Triassic. This may not suggest directly that we are handling the Permo-Triassic bounadry, but it is certain that we are in that zone, and the physical gap of about 80 m in between the assemblage-I and II might have unlocked mystry of a change, if it would have yielded palynofossils.

The Supra-Barakar miofloras thus known from the Son Velley area of M.P. (South Rewa Gondwana Basin) are sequentially positioned in the ascending order and the tier of presently recorded Assemblage I and II has been allocated in the following manner.

6. Tharipathar, Ghiar, Janar Nala.	Tiki Formation. Maheshwari & Kumaran, 1979 and Kumaran & Maheshwari, 1980.
5. Nidpur bed Assemblage	Gopad River near Nidpur Village; Bharadwaj & Srivastava, 1969
4. Assemblage in Johilla River Section in between Dorgaon and Salaia villages	Tiwari & Ram-Awatar, 1987
3. Assemblage-II Assemblage-I	Presently recorded in Bore-hole UKD-8 of Korar Coalfield
2. Assemblage in Bore-hole JHL-27A; Pali Formation; Tiwari & Ram-Awatar, 1986	
1. Barakar—coal bearing horizons (Anand-Prakash & Srivastava, 1984)	

This sequence is not yet complete and many intervening assemblages are yet to be known. Only their relative positioning with relation to each other has been depicted. This has been derived on the basis of age affinities of certain miospore taxa.

Conclusion

The Korar Coalfield although a small patch of deposition, appears to have the sequence of Barakar and Supra-Barakar, the latter encompassing formations equivalent to Pali and Parsora. Although the yielding samples are not many which could build up a continuous, complete sequence, this is the first report from this area having an interesting data which is important for comparison as well as age determination. The palyno-

fossils in strata in B.H. UKD-8 between 41.50-193.50 depth resemble Upper most Raniganj and Lower Panchet palynoflora. The above mentioned strata, therefore, represent a Late Permian to Early Triassic deposits. Thus, a transition of Permo-Triassic periods is probably being dealt here, as was the case in the Dorgaon exposures in Johilla river (Tiwari & Ram-Awatar, 1987). The Permo-Triassic boundary as depicted in Damodar Valley (Tiwari & Singh, 1983) has not been demarcated here in this basin; neither it is expected by seeing the trends of the microfossils that the behaviour pattern will be repeated in the Son Valley. The Korar assemblage I and II are from the transitional zone.

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References

Anand-Prakash & Srivastava, S.C. (1984). Miofloral studies of the Lower Gondwana sediments in Johilla Coalfield, Madhya Pradesh, India. *Palaeobotanist*, **32**(**3**) : 243-252.

Bharadwaj, D. C. (1962). The miospore genera in the coals of Raniganj Stage (Upper Permian) India. *Palaeobotanist*, **9**(1 & 2) : 68-106.

Bharadwaj, D. C. & Tiwari, R. S. (1977). Permian-Triassic miofloras from the Raniganj Coalfield, India. *Palaeobotanist*, **24**(1) : 26-49.

Bharadwaj, D. C. & Srivastava, S. C. (1969). A Triassic mioflora from India. *Palaeontographica*, **152B** : 119-149.

Bharadwaj, D. C., Tiwari, R. S. & Anand-Prakash (1979). Permo-Triassic palynostratigraphy and lithological characteristic in Damodar Basin. India. *Biol. Mem.*, **4**(1-2) : 49-82.

Kar, R. K. (1970). Palynological distinction between Upper Permian and Lower Triassic in the Raniganj Coalfield, Bengal, India. *Palaeobotanist*, **18**(2) : 113-126.

Kumaran, K. P. N. & Maheshwari, H. K. (1980). Upper Trassic *Sporae dispersae* from Tiki Formation—2 : Miospore from the Janar Nala Section, South Rewa Gondwana Basin, India. *Palaeontographica*, **173B** (1-3) . 26-84.

Maheshwari, H. K. & Banerji, J. (1975). Lower Triassic palynomorphs from the Maitur Formation, West Bengal, India. *Palaeontographica*, **152B** : 149-190.

Maheshwari, H. K. & Kumaran, K. P. N. (1979). Upper Trassic *sporae dispersae* from Tiki Formation—I. Miospores from the Son River Section between the Thariapathar and Ghiar, South Rewa Gondwana Basin. *Palaeontographica*, **171B**(4 & 6) : 1-26.

Sarbadhikari, T. R. (1972). Gondwana miofloras from a bore-hole in Raniganj Coalfield, India. *Bull. Geol. min. metall. Soc. India*, **45**(1-2) : 1-26.

Tiwari, R. S. & Ram-Awatar (1986). Late Permian palynofossils from Pali Formation, South Rewa Gondwana Basin, Madhya Pradesh. *Bull. Geol. Min. Met. Soc. India*. No. **54** : 250-255.

Tiwari, R. S. & Ram-Awatar (1987). A palynological assemblage from Parsora Formation, Johilla coalfield, South Rewa Gondwana Basin, Madhya Pradesh *Geophytology* **17**(1) : 104-109.

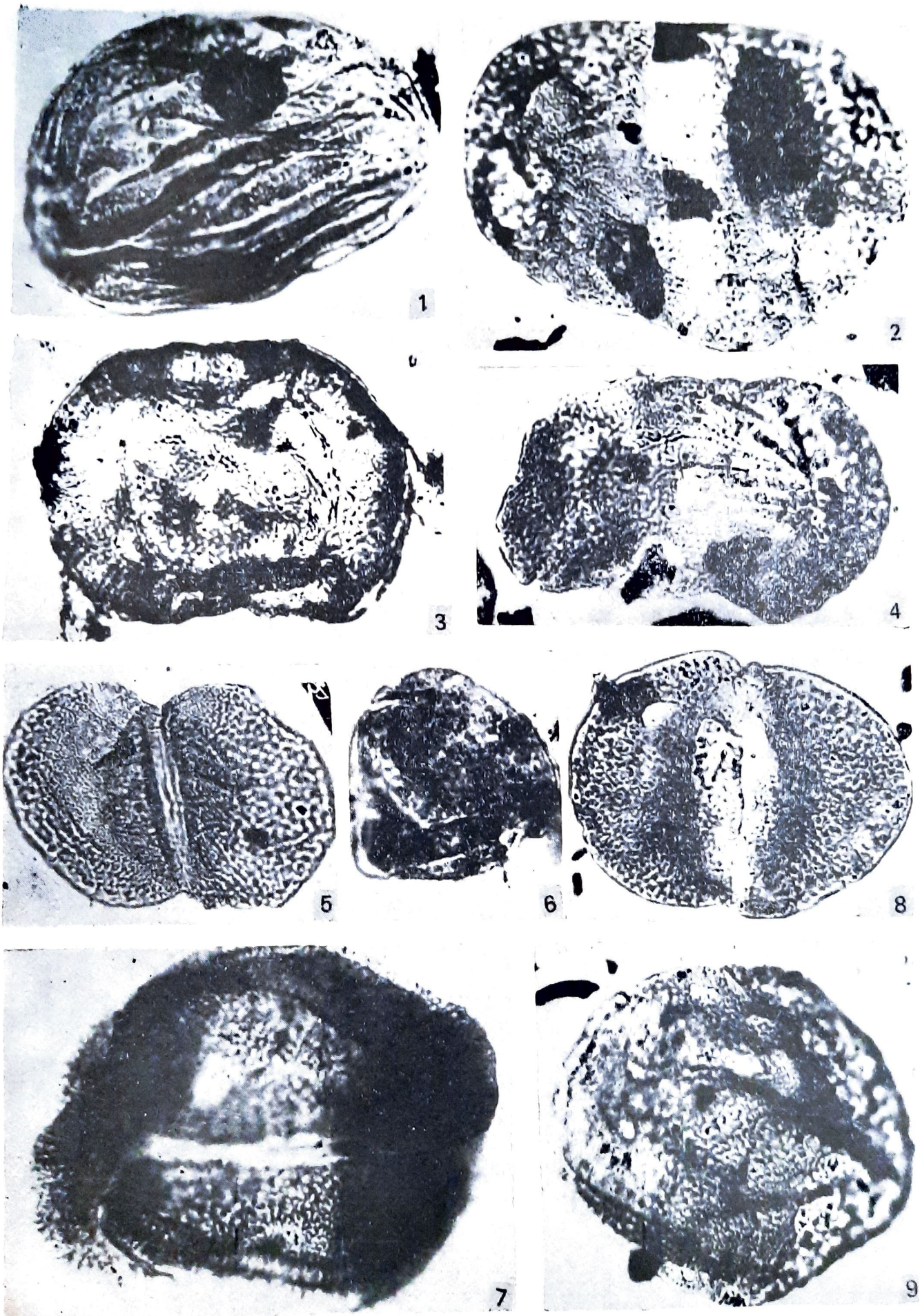
Tiwari, R. S. & Rana, Vijaya (1980). A Middle Triassic mioflora from India. *Biol. Mem.*, **5**(1) : 30-35.

Tiwari, R. S. & Singh, Vijaya (1981). *Sporae dispersae* of some Lower and Middle Triassic sediments from Damodar Basin, India. *Palaeobotanist*, **27**(2) : 190-220.

Explanation of Plate

PLATE 1

1. *Ephedripites* Bolkhovitina 1953; Coordination No. 78 × 9; Regd. Slide No. 9060
2. *Faunipollenites* Bharadwaj 1962; Coordination No. 91 × 8; Regd. Slide No. 9059
3. *Barakarites* Bharadwaj & Tiwari 1964; Coordination No. 76 × 17; Regd. Slide No. 9061
4. *Striatopodocarpites* Soritsch. & Sedova emend. Bharadwaj 1962; Coordination No. 69 × 10; Regd. Slide No. 9059
5. *Crescentipollenites* Bharadwaj, Tiwari & Kar 1974; Coordinatioan No. 77 ×4; Regd. Slide No. 9060
6. *Microfoveolatispora* Bharadwaj 1962; Coordination No. 84 × 3; Regd. Slide No. 9061
7. *Corisaccites* Venkatachala & Kar 1966; Coordination No. 92 × 8; Regd. Slide No. 9061
8. *Satsangisaccites* Bharadwaj & Srivastava 1969; Coordination No. 78 × 4; Regd. Slide No. 9061
9. Alete Type-1, Coordination No. 63 × 3; Regd. Slide No. 9061.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