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# Late Lower Jurassic palynomorph assemblage in the Dubrajpur sediments, Birbhum District, West Bengal, India

VIJAYA[1] AND ATANU ROY[2]

[1]*Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India.*
[2]*Coal Wing, Geological Survey of India, Salt Lake City,Calcutta 700 064, India.*

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## ABSTRACT

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This is the first palynological study of the Dubrajpur sediments exposed near the village Murgadangal within the Birbhum Coalfield of West Bengal. The grey shales and off-white sandy claystones have yielded characteristic palynomorph assemblages. At the base of the succession, which consist of coaly shales, the genus *Densipollenites* is prominent along with striate bisaccate pollen (Palynozone I). In the same assemblage, the first occurrence of *Kremipollenites indicus, Arcuatipollenites pellucidus* and *Goubinispora indica*, is significant. This suggests the end Permian level for the Barakar coal deposits. Subsequently genus *Callialasporites* makes its first occurrence at the transition of Barakar and Dubrajpur formations and attains fair presentation in the up-section (Palynozone II) replacing *Densipollenites*. Definite occurrence of *Callialasporites turbatus/dampieri* in the presently investigated Dubrajpur strata along with *Foraminisporis tribulosus, Klukisporites* sp. suggest late Lower Jurassic age for Dubrajpur Formation, and the non-diversified palynomorph composition evidences shallow deposition for this outcrop section.

**Key-words**—Barakar Formation, Permian, Dubrajpur Formation, Triassic-Jurassic, Birbhum Coalfield, Miospores.

## पश्चिमी बंगाल के बीरभूमि जिले के दुबराजपुर अवसादों से प्राप्त अन्तिम अधो जुरासिक युगीन परागाणुरूप समुच्चय

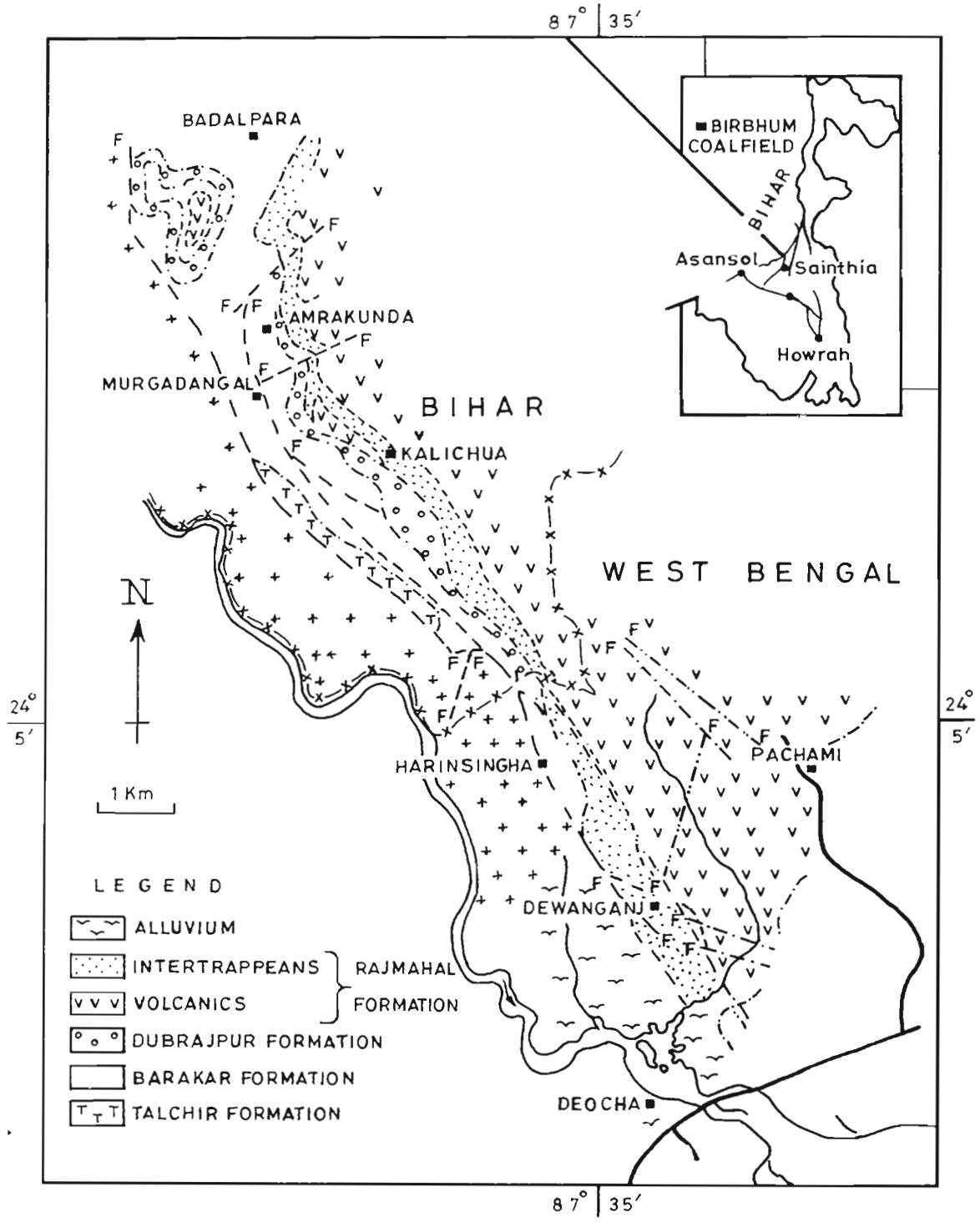
विजया एवं अतनु रॉय

### सारांश

इस शोध पत्र के माध्यम से पश्चिम बंगाल के बीरभूमि कोयला क्षेत्र में मुरगादंगल ग्राम के निकट अनावरित दुबराजपुर अवसादों का पहली बार परागाणविक अध्ययन प्रस्तुत किया गया है. धूसर शेल तथा निकटस्थ श्वेत बलुई मृत्तिका प्रस्तरों में अभिलक्षणिक परागाणु समुच्चयों की लब्धि है. अनुक्रम के आधार पर जहाँ कोयले के शेल हैं, वहाँ रेखित द्विसकोशी परागकणों (पराग मण्डल-I) के साथ साथ *डेन्सीपोलेनाइटीज़* वंश की प्रमुखता है. इसी समुच्चय में *क्रेमीपोलेनाइटीज़ इण्डिकस, आर्क्यूएटीपोलेनाइटीज़ पेल्यूसिडस* तथा *गौबिनीस्पोरा इण्डिका* की प्रथम बार प्राप्त उपस्थिति महत्त्वपूर्ण है. इससे बराकर कोयला निक्षेपों के लिए अन्तिम परमियन स्तर प्रस्तावित होता है. इसके परवर्ती *कैलियालेस्पोराइटीज़* वंश बराकर एवं दुबराजपुर शैलसमूहों के संक्रमण स्थल पर अपनी प्रथम बार उपस्थिति प्रदर्शित करता है तथा उपरि परिच्छेद में (परागाणु मण्डल-2) में *डेन्सीपोलेनाइटीज़* को विस्थापित कर उचित प्रतिनिधित्व प्राप्त कर लेता है. *फ़ोरैमिनीस्पोरिस ट्राइबुलोसस, क्लूकीस्पोराइटीज़* प्रजातियों के साथ-साथ वर्तमान में विश्लेषित किए गये दुबराजपुर स्तर में *कैलियालेस्पोराइटीज़ टर्बेटस/*डेम्पिएरी

की सुनिश्चित उपस्थिति से दुबराजपुर शैलसमूह के लिए अन्तिम जुरासिक आयु प्रस्तावित होती है तथा विविधरूपण विहीन परागाणुरूप संघटन से इस दृश्यांश परिच्छेद हेतु उथले निक्षेप का होना प्रमाणित होता है.

**संकेत शब्द**—बराकर शैलसमूह, परमियन, दुबराजपुर शैलसमूह, ट्रायसिक-जुरासिक, बीरभूमि कोयला क्षेत्र, मायोस्पोर.



## INTRODUCTION

GEOLOGICAL mapping in the southern extension of the Brahmani area of Birbhum District, West Bengal, has led to the discovery of a concealed Gondwana Basin named the Birbhum Coalfield. This comprises a narrow strip of Gondwana rocks referrable to the Dubrajpur Formation (Upper Triassic-Jurassic), occurring between Badalpara and Dewanganj (Fig.1). On the east of this coalfield, the Dubrajpur Formation overlaps the Barakar Formation (Upper Permian) unconformably (Sen *et al.*, 1987; Bandyopadhyay, 1990).

The purpose of this paper is to present evidence for dating the Dubrajpur sediments. The section examined lies near the village Murgadangal. It is a road-side cutting approximately 8 m thick, and is referrable to two lithological units. The older part represents Barakar Formation Upper Permian, followed in upsection by Dubrajpur Formation Upper Triassic-Jurassic in age. However, the contact between the two units is always unconformable, and is not discernible. The base of Barakar Formation is not exposed here, and the oldest level is admixture of coaly shales and grey shales. Overlying this are alternate bands of light and dark grey shales. Nine samples were collected from this part (Pl.1·1). Following the direction of dip, the sediments higher up in the succession comprise of medium grain sandstones, off-white mixed with buff claystone and sandy clay, which represents the younger horizon, i.e., Dubrajpur Formation, further ten samples (10-19) were taken from this part (Pl.1·2).

## PALYNOZONATION

All the nineteen samples (Fig. 2) were processed for the spore-pollen analysis, but only six yielded reasonable assemblages; the others proved to contain a few or no spores and pollen grains. The relative abundance of those identified are indicated in Figure 3, and illustrated in Plate 2. The figured slides are deposited in the repository of Birbal Sahni Institute of Palaeobotany, Lucknow. The relative abundance of *Striatopodocarpites, Densipollenites* and *Callialasporites*, and first occurrences of a few of the species have enabled two palynozones to be identified.

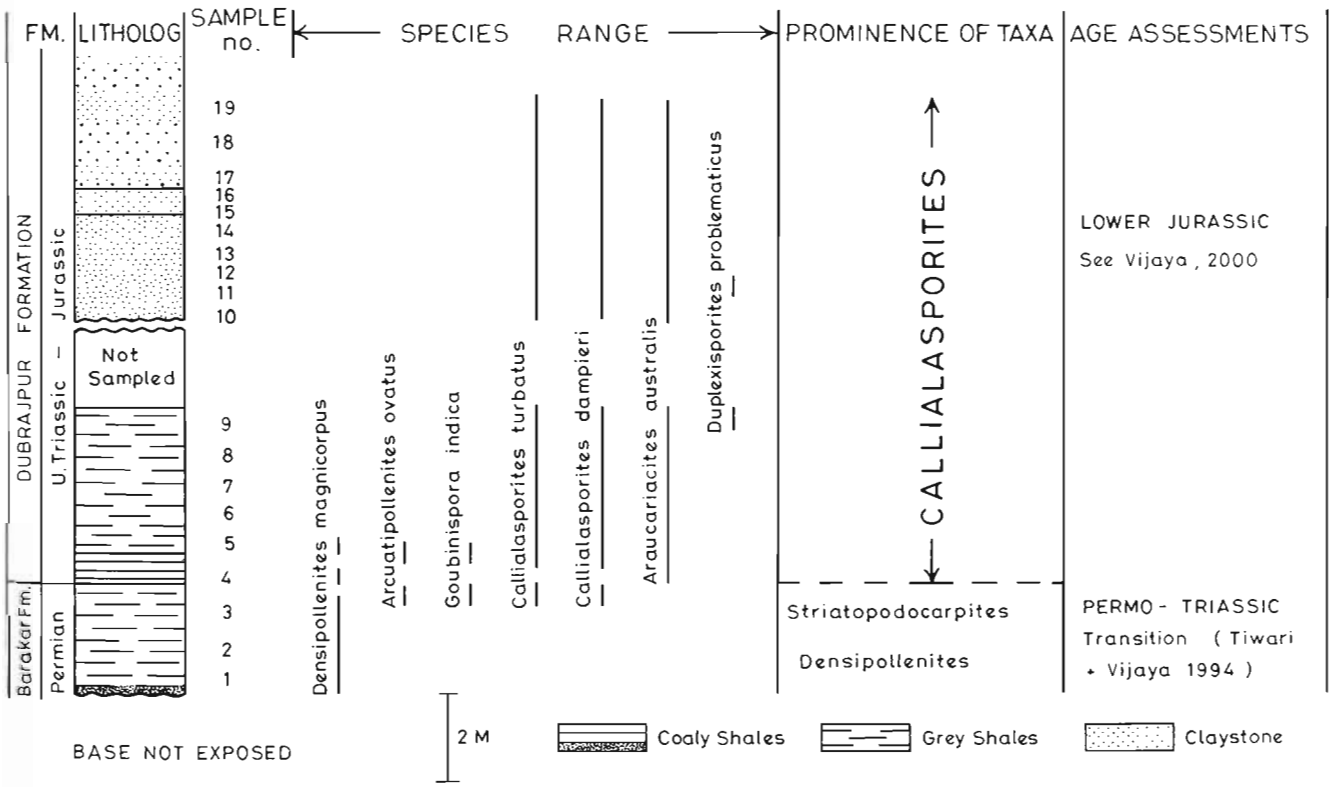
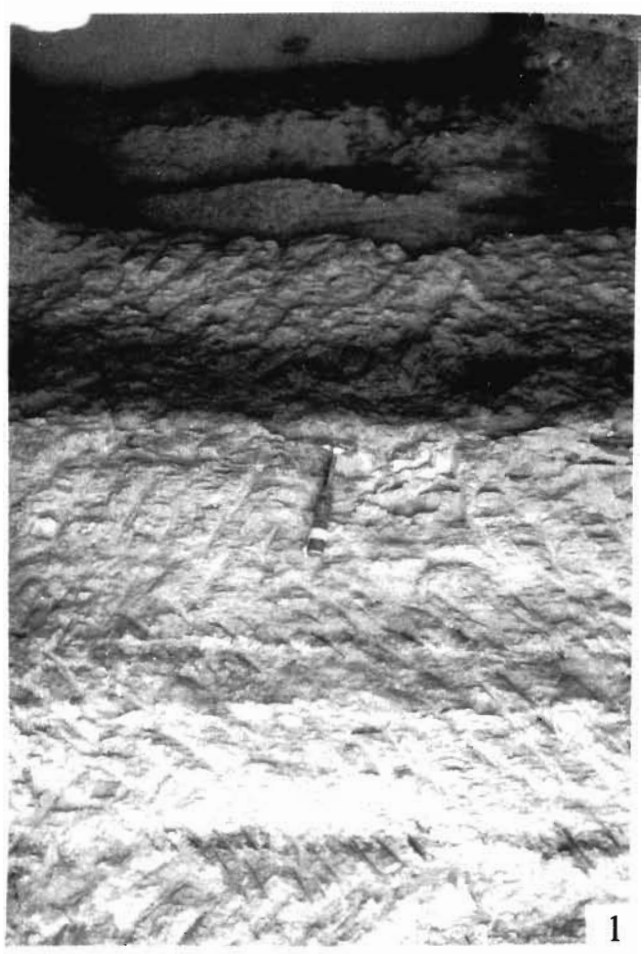



Fig. 2— Lithological column of the outcrop section to show lithofacies variation and occurrence of characteristic spore-pollen species as biohorizon markers.

Fig. 1— Geological map to show the location of the exposure of Dubrajpur sediments near the village Murgadangal, Birbhum Coalfield, West Bengal (from Sen *et al.*, 1987).



## PLATE 1

1 Outcrop section at the road-side cutting near the village Murgadangal It shows alternate bands of light and dark grey shales This rock strata comprises two lithological units At the base level about 2 m thick strata represents the Barakar Formation Upper Permian The sediments higher up in the section are referred to Dubrajpur Formation Upper Triassic-Jurassic There must be a disconformity between the two i.e., Barakar Formation and the overlying Dubrajpur Formation, but it is not distinctly demarcated here.

2 Following the direction of dip from the first exposure, lies this rock strata, comprising of off-white mixed with buff colour sandstones, claystones and sandyclay This makes the younger part in Dubrajpur Formation of the same outcrop.

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*Palynozone I - Samples 1-3, Grey, Coaly shales:* The grey shales in contact with the coaly shales at the base of the section (Sample 1) yielded a spore-pollen assemblage that is rich in *Densipollenites* and the striate bisaccate pollen *Striatopodocarpites, Faunipollenites* and *Crescentipollenites* but contains very few trilete spores. Sample 3, yielded an assemblage of similar composition but with significant differences in species content. *Kremipollenites indicus,*

## PLATE 2

1 *Densipollenites magnicorpus* x 600, Slide no. BSIP 12442.
2 *Alisporites opii* x 600, Slide no BSIP 12437
3 *Primuspollenites densus* x 500, Slide no BSIP 12437
4 *Striasulcites* sp x 600, Slide no BSIP 12439
5 *Crescentipollenites fuscus* x 600, Slide no BSIP 12439
6 *Araucariacites ghuneriensis* x 600, Slide no BSIP 12440
7 cf *Landbladispora* sp x 500, Slide no BSIP 12438
8 *Duplexisporites problematicus* x 500, Slide no BSIP 12444
9. *Araucariacites australis* x 500, Slide no BSIP 12440
10 *Callialasporites turbatus* x 500, Slide no BSIP 12440
11 *Callialasporites segmentatus* x 500, Slide no BSIP 12441
12 *Densipollenites densus* x 400, Slide no. BSIP 12436
13 *Dictyophyllidites harrissi* x 400, Slide no. BSIP 12443
14. *Callialasporites monoalasporus* x 600, Slide no BSIP 12440
15 *Striomonosaccites ovatus* x 400, Slide no BSIP 12438
16 *Satsangisaccites nidpurensis* x 600, Slide no BSIP 12438

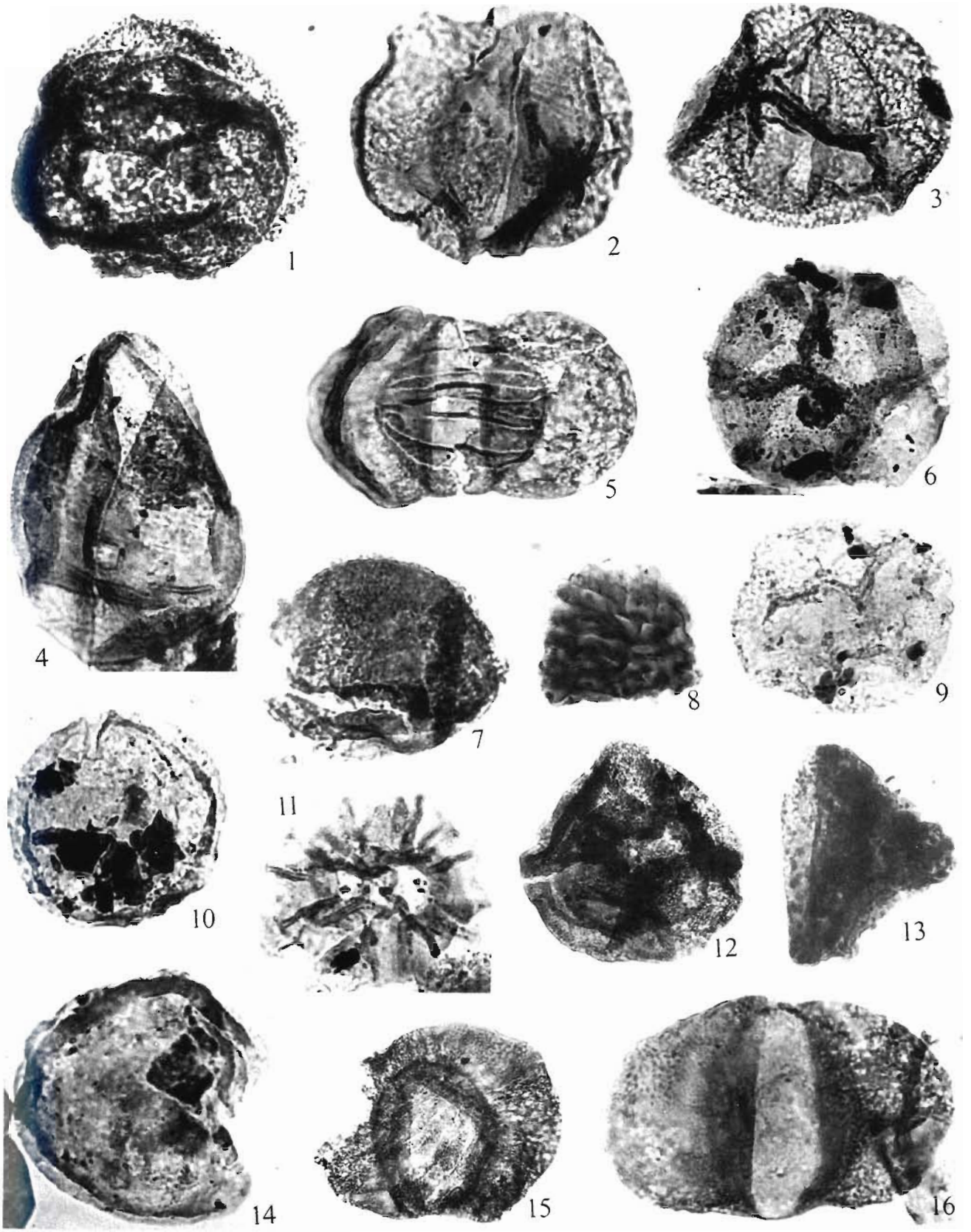


**PLATE 2**

| Spore-Pollen species\ Sample No. | 1 | 2 | 3 | 4 | 5 | 6 | 9 | 14 | 16 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Apiculatisporis* sp. | + | | | | | | | | | | |
| *Horriditriletes brevis* Bharadwaj & Salujha 1964 | + | | | | | | | | | | |
| *Scheuringipollenites maximus* (Hart) Tiwari 1973 | @ | | * | | | | | | | | |
| *Faunipollenites varius* Bharadwaj 1962 | @ | | @ | | + | | | | | | |
| *Crescentipollenites gondwanensis* (Mahesh) Tiwari & Rana 1981 | @ | | @ | * | + | | | | | | |
| *Striatopodocarpites magnificus* Bharadwaj & Salujha 1964 | P | | P | * | + | | | | | | |
| *Distriatites bilateralis* Bharadwaj 1962 | + | | + | | | | | | | | |
| *Striasulcites* sp. | # | | | | | | | | | | |
| *Verticipollenites gibbosus* Bharadwaj 1962 | + | | + | | | | | | | | |
| *Rhizomaspora indica* Tiwari 1965 | + | | | | | | | | | | |
| *Weylandites circularis* Bharadwaj & Srivastava 1969 | * | | * | | | | | | | | |
| *Dicappipollenites singrauliensis* (Sinha) Tiwari & Vijaya 1995 | | | + | | | | | | | | |
| *Striomonosaccites ovatus* Bharadwaj 1962 | | | + | | * | | | | | | |
| *Densipollenites indicus* Bharadwaj 1962 | P | | P | * | * | | | | | | |
| *D. densus* Bharadwaj 1962 | P | * | P | * | * | | | | | | |
| *D. magnicorpus* Tiwari & Singh 1980 | P | * | P | * | + | | | | | | |
| *Alisporites opii* Jansonius 1971 | + | | * | | | | | | | | |
| *Satsangisaccites nidpurensis* Bharadwaj & Srivastava 1969 | + | | # | | # | | | | | | |
| *Krempipollenites indicus* Tiwari & Vijaya 1995 | + | | * | | + | | | | | | |
| *Arcuatipollenites pellucidus* Tiwari & Vijaya 1995 | | | * | | + | | | | | | |
| *Goubinispora indica* Tiwari & Rana 1981 | | | * | | * | | | | | | |
| *Callialasporites turbatus* (Balme) Schulz 1967 | | | + | # | | # | * | + | + | + | * |
| *C. dampieri* (Balme) Dev 1961 | | | | # | * | # | * | + | * | + | * |
| *Araucariacites australiensis* Cookson 1947 | | | | # | * | | * | + | + | + | * |
| *A. ghuneriensis* Singh, Srivastava & Roy 1964 | | | | * | * | | * | | | | + |
| *Concavissimisporites penolaensis* Dettmann 1963 | | | | | | | + | | | | + |
| *Foraminisporis tribulosus* Playford & Dettmann 1965 | | | | | | | + | | | + | |
| *Duplexisporites problematicus* Playford & Dettmann 1965 | | | | | | | + | + | | + | |

Fig. 3 — Occurrence and relative abundance of spore-pollen species in the Dubrajpur sediments exposed near the village of Murgadangal. + = Present, * = 1-5 specimens, @ = up to 10 specimens, # = 11-15 specimens, P = more than 15 specimens.

*Goubinispora indica* and *Arcuatipollenites pellucidus* occur along with first record of *Callialasporites turbatus.*

*Palynozone II - Samples 4-19; light and dark grey shales, off-white sandstone and sandy clay:* The base of this zone is indicated by a sharp decline in the number of specimens of *Densipollenites* and striate bisaccate pollen within the grey shales (Sample 4). Instead *Callialasporites turbatus, C. dampieri* and *Araucariacites australis* are common. In addition, *Densipollenites magnicorpus* and *Crescentipollenites* have continued from the older sample three. The over all size of specimens is reduced.

*Callialasporites* spp. occur in the younger samples (5-19) along with fewer specimens of *Foraminisporis tribulosus, Klukisporites* sp. *Duplexisporites problematicus* and *Alisporites opii* (Fig. 3). Preservation of these specimens is rather poor.

## PALYNODATING

The relative abundances of the spore-pollen species that have some biostratigraphic significance (Fig. 2, Pl. 2·1-16) are discussed below.

The prominence of *Densipollenites magnicorpus* in the *Striatopodocarpites-Densipollenites* dominated assemblage, recovered from Sample 1, indicates the presence of an Upper Permian palynoflora (see Vijaya & Tiwari, 1987). The incoming of *Krempipollenites indicus, Goubinispora indica* and *Arcuatipollenites pellucidus* in Sample 3, are the key species that mark the Permo-Triassic transition in the Raniganj palynoflora and are important in the Lower Triassic Panchet palynoflora. (Tiwari & Vijaya, 1994). It is suggested, therefore that the part of Barakar Formation examined here correlates with the closing phase for coal deposits in the Raniganj Formation in Damodar Basin at the end of the Permian (Tiwari & Vijaya, 1992).

The occurrence of *Callialasporites turbatus/dampieri* in Sample 3, is significant. Because the first appearance datum (FAD) of this taxon is considered to indicate the onset of Jurassic sedimentation in Mesozoic sequence of Australia and Indian peninsula (Filatoff, 1975; Vijaya & Tiwari, 1992). The strata in Dubrajpur Formation represented by samples (4-19) contain common of *Callialasporites turbatus, C. segmentatus* and *C. dampieri*. This certainly suggests that Jurassic deposits are present in Dubrajpur Formation but belonging to which part of Jurassic sequence, remains to be determined. The spore-pollen assemblage is impoverished (Fig. 3), hence, no precise age correlation can be suggested. Species, that are important in Jurassic palynomorph zonations, such as *Classopollis classoides* prominence in the Lower Jurassic and the FAD of *Contignisporites cooksoniae* and *Murospora florida* in the Upper Jurassic (Burger, 1995; Vijaya, 2000) have not been recovered from Dubrajpur Formation in Murgadangal section. Therefore, it is better to consider the Dubrajpur sediments in this section, a part of late Early Jurassic sequence in having fair occurrence of *Callialasporites* spp., and specimens of *Foraminisporis tribulosus, Duplexisporites problemeticus, Klukisporites* sp. (Helby *et al.*, 1987). However, from this study, it is evidenced that the Barakar sediments unconformably overlapped by Dubrajpur strata indicate the interval of denudation between the two periods of depositions, i.e., Permian and Lower Jurassic. The non-diversified palynocomposition in grey shales and off-white sandy clay in this outcrop section favours shallower mode of deposition for the exposure (Traverse, 1994).

## CONCLUSIONS

The Murgadangal exposure comprises varied lithofacies. The palynological assemblages recovered from the samples examined suggests –

That the base of coal horizon (Barakar Formation) is Late Permian in age affinity.

Subsequent record of age marker spore species for Lower Triassic in Palynozone I, supports Permian-Triassic transition at the closing -end of coal deposites (Barakar Formation).

Record of *Callialasporites* species and other few species in Dubrajpur strata evidences late Early Jurassic deposits, although the palynomorph composition is less diversified. Absence of biomarker species — *Contignisporites cooksoniae* and *Murospora florida* in grey shales and off-white sandy clay negates Middle or Upper Jurassic age for Dubrajpur Formation in this section particularly.

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