

# Plant megafossils from Athgarh Formation near Bouda, Cuttack District, Orissa

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Plant megafossils comprising *Equisetites rajmahalensis* Oldham & Morris, *Coniopteris* sp., *Cladophlebis kathiawarensis* (Roy) Bose & Banerji, *Brachyphyllum rhombicum* (Feistm.) Sahnii, *Pagiophyllum grantii* Bose & Banerji, *Pagiophyllum* sp., *Araucarites cutchensis* Feistmantel and *Coniferocaulon rajmahalense* Gupta are described from Bouda, Cuttack District, Orissa. On floral comparisons, the Athgarh Formation has been assigned to Lower Cretaceous.

**Key-words**—Megafossils, Athgarh Formation, East Coast, Lower Cretaceous, India.

## INTRODUCTION

THE Upper Gondwana sediments are exposed in isolated patches along the East coast of India. The outcrops of Athgarh Formation occur in Cuttack and Puri districts of Orissa. They have yielded megafossils described by Ball (1877), Adyalkar and Rao (1963), Jain (1968), Pandya and Patra (1968), Patra (1973a, 1973b, 1980, 1982, 1983, 1985, 1987, 1989, 1990a, 1990b), Patra and Patnaik (1974) and Pandya (1987).

The Athgarh Formation rests unconformably on the Precambrian rocks observed in the north and west of the basin, but Tiwari *et al.* (1987) have proved, on the basis of palynofossils, that some Olive Green shales unconformably underlie the Athgarh Formation in the south-western corner of the basin. The Athgarh Formation consists of medium to coarse-grained sandstones, clayey sandstones, conglomerates, grit, fireclay, ferruginous shale, carbonaceous shales, yellow and pink shales. The sandstones and ferruginous shales are often lateritised which, along with alluvium, concealed a sizeable portion of the Athgarh Formation in different parts of the basin.

Ball (1877) had collected a few megafossils from the type locality Ghantikhal (Map 1) and categorically remarked that the Athgarh Formation is poor in fossils. During the last 25 years, a good number of plant remains from as many as 12 localities (Patra, 1982) have been reported covering a major portion of the Athgarh Basin. During the course of field work a fossil locality near Bouda

has been discovered. Bouda ( $20^{\circ} 28' : 85^{\circ} 37'$ ) is about 8 km south east of Athgarh town (Map 1) in Cuttack District, Orissa. A number of fireclay pits are seen to the left of Athgarh-Kandarpur road near Bouda. In these pits three fire-clay horizons are observed with sandstone intercalations. The following stratigraphic succession has been recorded near Bouda fire-clay pits:

Sandstone  
Fireclay (poorly fossiliferous)  
Ferruginous shale (moderately fossiliferous)  
Fireclay (richly fossiliferous)  
Sandstone  
Fireclay (fairly fossiliferous)  
Sandstone  
Base not seen

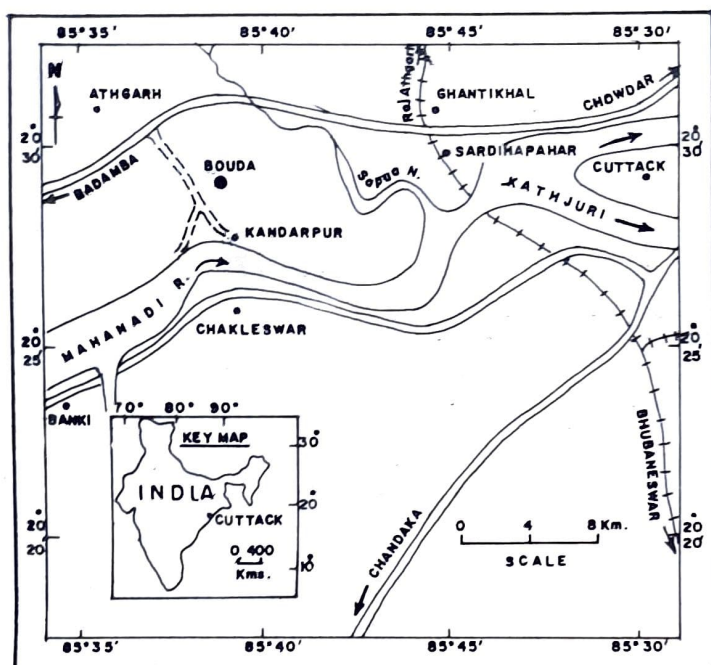
Out of three fireclay horizons, the lower and middle ones are thicker than the upper. The ferruginous shale underlies the upper clay horizon. All these four horizons are fossiliferous containing plant remains which have been preserved as faint impressions only, having little or no contrast with the matrix.

## SYSTEMATIC DESCRIPTION

### Equisetales

Genus—*Equisetites* Sternberg 1833

*Equisetites rajmahalensis* Oldham & Morris 1863  
Pl. 1, figs 1,2; Text-fig. 1A



Map 1. Showing plant fossil locality Bouda (●). Cuttack District, Orissa.

**Description**—Stems unbranched, maximum available length 5.5 cm. and width 1.4 cm near nodal region, widest available stem 3.5 cm in diameter, internodal region striated with 6-15 alternating ridges and grooves. Leaf segments delicate, faintly preserved; nodal diaphragm circular, 1.3 cm in diameter with 20-25 tubercles arranged in a ring.

**Collection**—Specimen nos. UUGL BD/B45, BD/B50A and BD/B 21.

**Locality**—Bouda, near Athgarh, Cuttack District, Orissa.

**Horizon & Age**—Athgarh Formation; Lower Cretaceous.

**Remarks**—Pal (1988) stated that *Equisetites rajmahalensis* is the only known fossil Equisetaceae in India. However, recently Singh *et al.* (1990) have reported a new species of *Equisetites*, i.e., *Equisetites sehoraensis* from Jabalpur Formation of Narasinghpur District, Madhya Pradesh.

## Filicales

### Genus- *Coniopteris* Brongniart 1849

*Coniopteris* sp.

Pl. 1, fig. 3; Text-fig. 1B

**Description**—Detached pinna, 3.7 cm long, linear-lanceolate. Pinna, rachis 1 mm wide, showing a longitudinal depression extending from base to apex. Pinnules alternate, arising at an angle of 30°-45°, 7 x 3 mm in size, rhomboidal or wedge-shaped, mostly pentalobed, apex rounded; venation indistinct.

**Collection**—Specimen no. UUGL BD/B 46.

**Locality**—Bouda, near Athgarh, Cuttack District, Orissa.

**Horizon & Age**—Athgarh Formation; Lower Cretaceous.

**Comparison**—The present specimen is similar to *Coniopteris* cf. *C. hymenophylloides* Bose & Banerji (1984) described from Kachchh, Gujarat.

## Unclassified Ferns

### Genus-*Cladophlebis* Brongniart 1849

*Cladophlebis kathiawarensis* (Roy) Bose & Banerji 1984

Pl. 1, fig. 4; Text-figs. 1C,D

**Description**—Nature of frond not known. Pinnae detached, linear to lanceolate; rachis 0.5-1.0 mm wide, centrally grooved. Pinnules closely set, 0.5-0.6 cm long with uniform width of about 0.3 cm, alternate to suboppositely attached by broad base at an angle of 50°-80°, basiscopic margin decurrent; lateral margin near base entire, crenulated towards apex; apex acute or sub-acute; mid-vein prominent, secondary veins arising at 45°-60°, usually once forked.

**Collection**—Specimen nos. UUGL BD/B17, BD/B 17A, BD/B 24A, BD/B28.

## Plate 1

- Equisetites rajmahalensis* Oldham & Morris. Specimen no. UUGL BD/B21, X 2.
- Equisetites rajmahalensis* Oldham & Morris. showing nodal diaphragm, Specimen no. UUGL BD/A 50A, X6.
- Coniopteris* sp. Specimen no. UUGL BD/B46, X2.
- Cladophlebis kathiawarensis* (Roy) Bose & Banerji. Specimen no. UUGL BD/B17, X2.
- Brachyphyllum rhombicum* (Feistmantel) Sahni, Specimen no. UUGL BD/B74, X2.
- Pagiophyllum grantii* Bose & Banerji. Specimen no. UUGL BD/A 20, X2.
- Pagiophyllum* sp. Specimen no. UUGL BD/B 20, X2.
- Araucarites cutchensis* Feistmantel. Specimen no. UUGL BD/B5, X4.
- Coniferocaulon rajmahalense* Gupta, Specimen no. UUGL BD/B 110, X2.



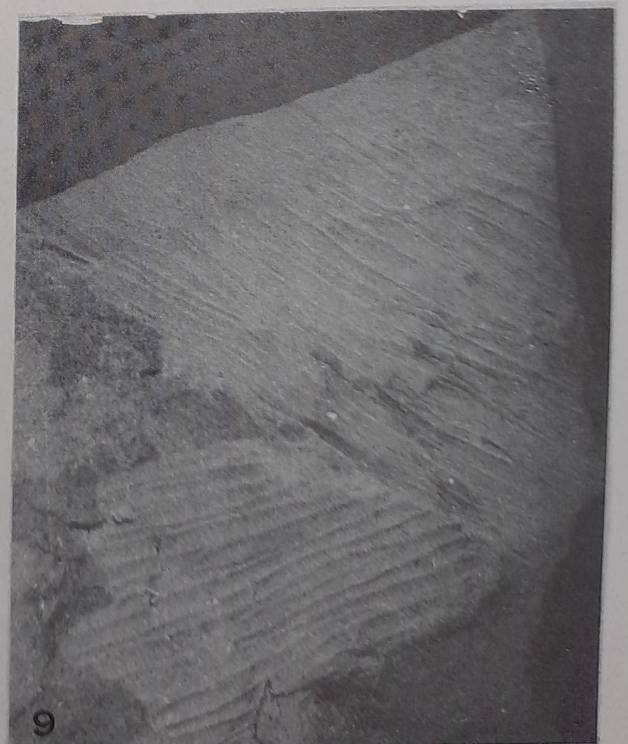
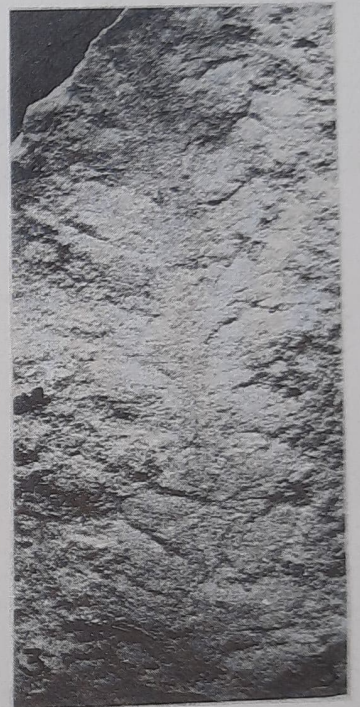


Plate 1



*Locality*—Bouda, near Athgarh, Cuttack District, Orissa.

*Horizon & Age*—Athgarh Formation; Lower Cretaceous.

*Comparison*—The present specimens match with *Cladophlebis kathiwarensis* Bose & Banerji (1984) described from Kachchh, Gujarat.

### Coniferales

#### Genus- *Brachyphyllum* Brongniart 1828

*Brachyphyllum rhombicum* (Feistm.) Sahnii 1928  
Pl. 1, fig.5

*Description*—Shoot linear, unbranched, available length 6.1 cm, width 0.8cm, uniform throughout. Leaves spirally arranged, mostly rhomboidal in shape, keeled.

*Collection*—Specimen no. UUGL BD/B 74.

*Locality*—Bouda, near Athgarh, Cuttack District, Orissa.

*Horizon & Age*—Athgrah Formation; Lower Cretaceous.

*Remarks*—The leaf is poorly preserved and is not possible to give further details.

#### Genus- *Pagiophyllum* Heer 1881

*Pagiophyllum grantii* Bose & Banerji 1984  
Pl. 1, fig.6; Text-fig. 1E

*Description*—Shoots branched in all directions at an angle of  $45^{\circ}$ - $60^{\circ}$  from main axis. Leaves spirally arranged, 3 mm x 1.5mm in size, falcate, apical region inwardly curved, margin entire, apex acute, base decurrent, a distinct midrib persists upto apex.

*Collection*—Specimen nos. UUGL BD/A 20, BD/A 20A.

*Locality*—Bouda, near Athgarh, Cuttack District, Orissa.

*Horizon & Age*—Athgarh Formation; Lower Cretaceous.

*Comparison*—In all the morphological features the present specimens from Bouda are very similar to *Pagiophyllum grantii* Bose & Banerji (1984) described from Kachchh, Gujarat.

*Pagiophyllum* sp.  
Pl. 1, fig.7

*Description*—Available portion of twig 2.7 cm in length, bears spirally arranged leaves arising at about  $30^{\circ}$ - $50^{\circ}$ ; leaves 3mm x 2mm in size, deltoid, margin entire, apex acute to obtuse, bases mostly concealed by the leaves lying below.

*Collection*—Specimen no. UUGL BD/B 20.

*Locality*—Bouda, near Athgarh, Cuttack District, Orissa.

*Horizon & Age*—Athgarh Formation; Lower Cretaceous.

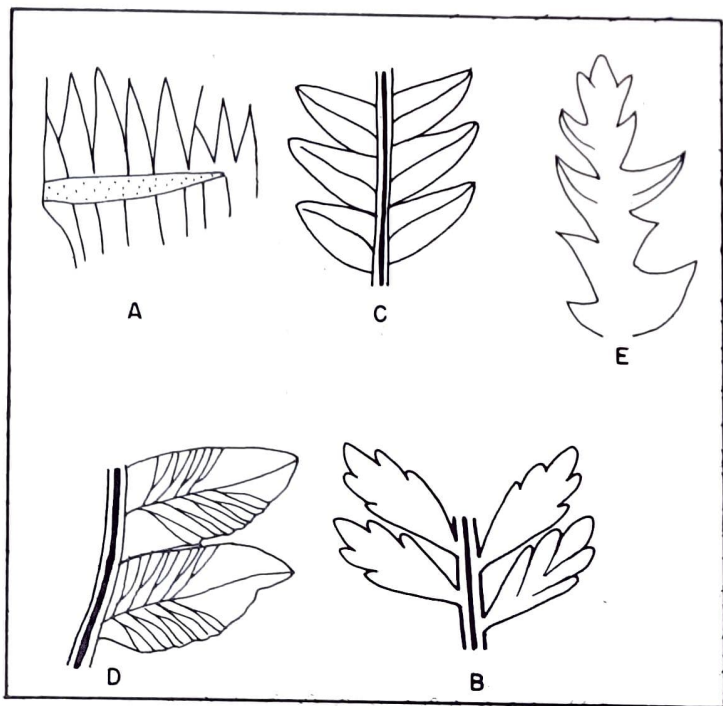
#### Genus- *Araucarites* Presl 1838

*Araucarites cutchensis* Feistmantel 1876  
Pl. 1, fig.8

*Description*—Detached cone scale, size 11mm x 5mm, triangular, margin entire; seed elliptical, 8mm x 2mm in size, tip acute, base rounded, surface longitudinally striated.

*Collection*—Specimen no. UUGL BD/B5.

*Locality*—Bouda, near Athgarh, Cuttack District, Orissa.



**Text figure 1-A.** *Equisetites rajmahlensis* Oldham & Morris, showing nodal region with leaf-sheath, specimen no. UUGL BD/B 45, X3; **B.** *Coniopteris* sp., a portion of pinna enlarged, specimen no. UUGL BD/B 46, X3; **C.** *Cladophlebis kathiwarensis* (Roy) Bose & Banerji, specimen no. UUGL BD/B 17, X2; **D.** part of the same specimen showing venation X3; **E.** *Pagiophyllum grantii* Bose & Banerji, apical portion of a twig enlarged, specimen no. UUGL BD/A 20, X3.

*Horizon & Age*—Athgarh Formation: Lower Cretaceous.

*Comparison*—The present specimen matches with those of *Araucarites cutchensis* Feistmantel described by Bose & Banerji (1984) from Kachchh, Gujarat.

#### Genus- *Conifero-caulon* Fliche 1900

*Conifero-caulon rajmahalense* Gupta 1954  
Pl. 1, fig.9

*Description*—Available portion of a stem 3.7 cm x 2.5 cm in size, surface irregularly grooved in transverse direction, grooves alternate with fine ridges having rounded or elliptical protuberances of very small size.

*Collection*—Specimen no. UUGL BD/B110.

*Locality*—Bouda, near Athgarh, Cuttack District, Orissa.

*Horizon & Age*—Athgarh Formation: Lower Cretaceous.

*Comparison*—The present solitary specimen resembles *Conifero-caulon rajmahalense* Gupta (1954) described from Rajmahal Hills, Bihar.

### CONCLUSION

All the four horizons (three of fireclays and one of ferruginous shale) of Bouda locality are fossiliferous. The megafossil assemblage consists of pteridophytes and conifers. The cycadophytes are totally absent in this assemblage. The lower and middle fireclay horizons are rich in conifers and pteridophytes respectively whereas the ferruginous shale contains both. The upper fireclay horizon is poor in fossils.

Ghantikhil (Map 1), the type locality of Athgarh Formation near Saradiapahar, was the only known fossil locality in the Athgarh Basin for a quite long time. Patra (1982) reported three more fossils localities, near Ghantikhil railway station, Dhurusia and Rautrapur to the north of Mahanadi.

It has been observed that the cycadophytes are generally rare in the Athgarh Basin. Sukh-Dev (1987), in his synergistic analysis of Mesozoic floral assemblages of India, has suggested 12 megafossil assemblage zones and their relative ages. Bouda assemblage consists of seven genera, three of them are pteridophytes and the remaining four are conifers. Pteridosperms and Cycadophytes are totally absent. Recently, *Onychiopsis* has been found from Ghantikhil, the type locality, while *Onychiopsis*, *Phlebopteris*, *Hausmannia*, *Gleichenia*, *Cycadopteris*, *Brachyphyllum* and *Pagiophyllum* are already reported from south of Mahanadi in Athgarh Basin (Patra,

1973a, 1980, 1982; Pandya 1987). In view of this Athgarh megafossil assemblage as a whole can be compared with the floral zone-10 of Sukh-Dev (1987), i.e., *Weichselia*—*Onychiopsis*—*Gleichenia* assemblage zone whose age is Early Cretaceous.

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