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Early Cretaceous megaflora from Bartala Hill, Rajmahal Basin, India

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ABSTRACT

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The present paper deals with megafloral investigation of Bartala locality of Rajmahal Basin. Nine taxa are recorded for the first time from this locality : *Hausmannia, Taeniopteris, Anomozamites, Pterophyllum, Pseudoctenis, Dictyozamites, Ginkgoites, Desmiophyllum, Elatocladus* and *Brachyphyllum*. The assemblage is dominated by cycadophytes, pteridophytes and conifers are scarcely represented. Predominance of *Anomozamites* in this assemblage perhaps shows the local variation. On the basis of assemblage correlation, an Early Cretaceous age has been suggested.

Key-words— Megafossils, Bartala, Rajmahal Basin, Early Cretaceous.

भारत की राजमहल द्रोणी की बरताला पहाड़ियों से प्राप्त प्रारंभिक क्रिटेशस युगीन गुरूवनस्पतिजात

जयश्री बनर्जी एवं बृजेन्द्र नाथ जाना

सारांश

प्रस्तुत शोध पत्र में राजमहल द्रोणी की बरताला संस्थिति का गुरूवनस्पतिजातीय विश्लेषण किया गया है.नौ वर्गकों, जिन्हें इस संस्थिति से पहली बार अंकित किया गया है, के नाम *हौसमानिया, टीनियाप्टेरिस, एनोमोज़ैमाइटीज़, टेरोफ़िल्लम, स्यूडॉक्टीनिस, डिक्ट्योज़ैमाइटीज़, गिंग्वॉयटीज़, डेस्मियोफ़िल्लम, इलेटोक्लैडस* एवं *ब्रैकीफ़िल्लम* हैं. समुच्चय में साइकैडोफ़ाइटों तथा टेरिडोफ़ाइटों की प्रचुरता है तथा शंकुधर अत्यल्प मात्रा में निरूपित हैं. इस समुच्चय में *एनोमोज़ैमाइटीज़* की प्रारंभ से प्रचुरता सम्भवतः स्थानीय विविधता को प्रदर्शित करती है. समुच्चय सहसम्बन्धन के आधार पर इस हेतु प्रारंभिक क्रिटेशस आयु प्रस्तावित की जाती है.

संकेत शब्द—गुरूपादपाश्म, बरताला, राजमहल द्रोणी, प्रारंभिक क्रिटेशस.

INTRODUCTION

THE megafloral assemblage recovered from the Bartala locality of Rajmahal Basin is investigated here in detail. Bartala locality is about 1·5 km south south east of Mirzachowki Railway Station (see Fig. 1). Sahni and Rao (1933) recorded numerous megafossils from three different spots south of Mirzachowki i.e., from Butaha Pahar, Balbhadri Pahar and from quarry dump. Sahni and Rao (1934) reported *Dadoxylon* (*Araucarioxylon*) sp. cf. *D. rajmahalense* from this locality. Later, Sen Gupta (1988) described a few more taxa viz., *Equisetum rajmahalense, Marattiopsis macrocarpa, Cladophlebis indica, C. srivastavae, Sphenopteris rajmahalense, Thinnfeldia indica* and *Pterophyllum princeps*

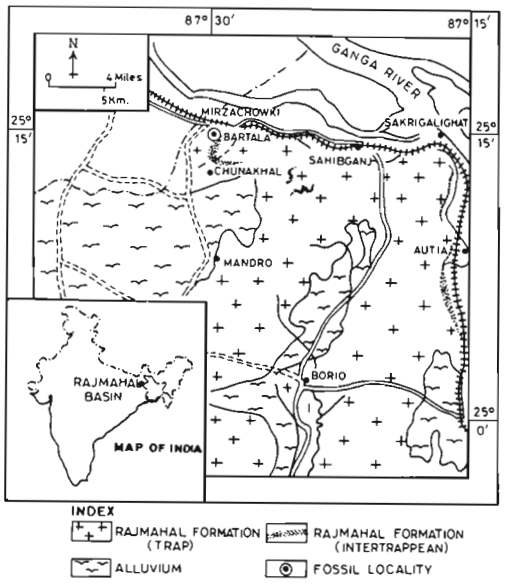

Fig. 1— Fossil locality at Bartala in Rajmahal Basin, Bihar.

from this locality and also considered the fossiliferous intertrappean sequence around Bartala village belonging to second intertrappean bed of northern sector of Rajmahal Basin. The present paper further adds the following genera to this assemblage besides the already known taxa mentioned above

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1. *Hausmannia* sp.
2. *Taeniopteris* sp.
3. *Anomozamites fissus* & *A. anarjolense*
4. *Pseudoctenis* sp.
5. *Dictyozamites* sp. cf. *D. sahnii*
6. *Ginkgoites rajmahalensis*
7. *Desmiophyllum* sp.
8. *Elatocladus tenerrimus* & *E. plana*
9. *Brachyphyllum* sp.

Plant remains are preserved as impressions on yellowish soft sandstone and shale.

SYSTEMATICS

Order— EQUISETALES

Family—EQUISETACEAE

Genus—EQUISETITES Sternberg, 1833

EQUISETITES RAJMAHALENSIS Oldham & Morris, 1863

(Pl. 1·1)

Description—Stem pieces preserved as impression, length varies, maximum preserved width is 2·8 cm, nodes are with 32-42 leaves, joined at base forming a leaf sheath. Nodes are 5 cm apart, internodes with faint impression of ridges and furrows. Leaf sheath borne at nodes, consists of approximately 32-42 incomplete leaf segments, appressed. Leaf segments linear, gradually pointed towards apex.

Order—FILICALES

Family—OSMUNDACEAE

Genus—CLADOPHLEBIS Brongniart, 1849

CLADOPHLEBIS sp.

(Pl. 1·2)

Description :- A small frond fragment and a detached pinnae are present in the collection. Pinnae 2·1 cm in length and 0·5 cm in width, lanceolate, base narrow, apex sub-acute, margin entire. Midvein distinct upto apex, laterals arise at an angle of 45°-50°, mostly once forked at different levels.

Order—FILICALES

Family—DIPTERIDACEAE

Genus—HAUSMANNIA Dunker, 1846

HAUSMANNIA sp.

(Pl. 1·3)

Description—Leaf fragment 2·8 cm in length, showing distinct reticulate venation pattern with free veinlet ends. Two distinct veins visible in which one forked at distal end. From these primary veins secondaries are coming out at 80°-90°, secondaries give rise to tertiaries which form rectangular-square meshes with ultimate veinlet ends in the square meshes.

Remarks—From Rajmahal Basin, Gupta (1955) described *Hausmannia indica* from Nipania locality which has later been transferred under *H. crenata* (Nathorst) Moller by Bose and Sah (1968) along with another specimen recovered

PLATE 1

1. *Equisetites rajmahalensis*, Specimen no. BSIP 37703. x 1
2. *Cladophlebis* sp., Specimen no. BSIP 37705. x 2.
3. *Hausmanna* sp., lamina with reticulate venation, Specimen no. BSIP 37706. x 2.
4. *Thumfeldia indica*, Specimen no. BSIP 37707. x 1
5. *Ptilophyllum tenerrimum*, Specimen no. BSIP 37710. x 1
6. Sporangium, Specimen no. BSIP 37715. x 2.
7. *Taeniopteris* sp., Specimen no BSIP 37712. x 2.
8. *Dictyozamites* sp. cf. *D. sahnii*, Specimen no BSIP 37723a. x 3
9. *Ginkgoites rajmahalene*, Specimen no. BSIP 37722. x 2
10. *Brachyphyllum* sp., Specimen no. BSIP 37726. x 2.
11. *Anomozamites fissus*, Specimen no. BSIP 37714. x 2.
12. *Desmiophyllum* sp., Specimen no. BSIP 37724. x 1.5.
13. *Anomozamites anarjolensis*, Specimen no. BSIP 37718 x 2.
14. *Elatocladus plana* Specimen no BSIP 37725. x 1
15. *Pseudoctenis* sp , Specimen no BSIP 37716 x 1

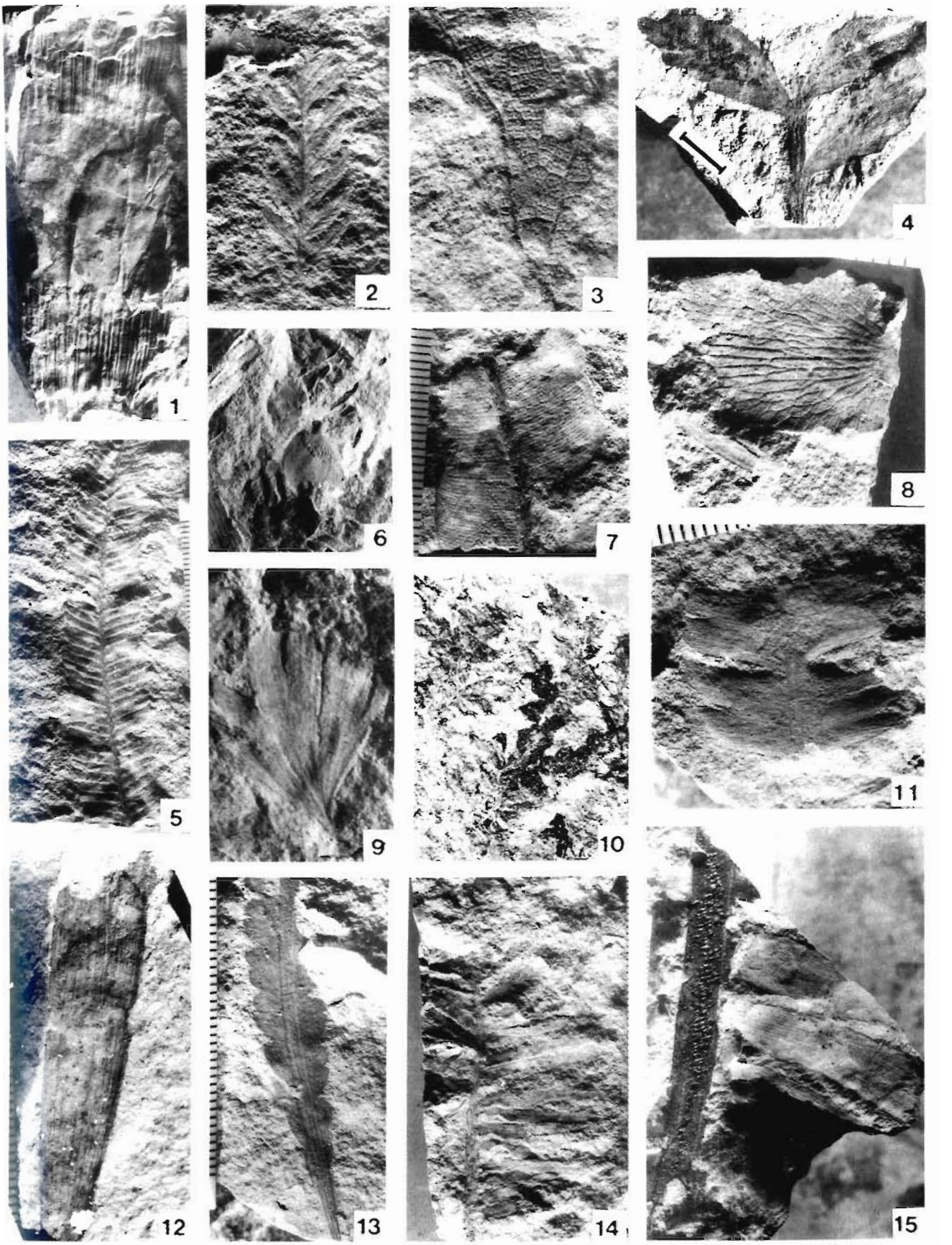

PLATE 1

from Chilgojuri. Specific identification could not be made for want of better preserved material.

Order—PTERIDOSPERMALES

Family—CORYSTOSPERMACEAE

Genus—THINNFELDIA Ettingshausen, 1852

THINNFELDIA INDICA Feistmantel, 1876

(Pl. 1·4)

Description—Three specimens are present in the collection. The best frond fragment is 2·5 cm long with three alternately attached pinna at angles of 45°. Pinnae lanceolate, lamina seems to be thick, measuring 3·3 x 1·2 cm at widest region. Rachis 0·2 cm broad with a median groove. Midvein distinct almost up to apex, at extreme end evanescent. Base of pinnae narrow, basiscopic basal margin decurrent, margin wavy or broadly dentate, lateral vein arise at an acute angle, variously forked once or twice at different levels, vein concentration 14-18 per cm at margin.

Comparison—Bartala specimens of *Thinnfeldia indica* are exactly similar to *Thinnfeldia indica* described and figured by Feistmantel (1877) and Zeba-Bano *et al.* (1979) from Buskoghat, Burio and Pathargama localities of Rajmahal Basin.

Order—BENNETTITALES

Genus—PTILOPHYLLUM Morris, 1840

PTILOPHYLLUM TENERRIMUM Feistmantel, 1877

(Pl. 1·5)

PTILOPHYLLUM sp.

Genus—DICTYOZAMITES Oldham, in Oldham & Morris, 1863

DICTYOZAMITES sp. cf. **D. SAHNII** Gupta & Sharma,1968

(Pl. 1·8)

Description—Two pinnae fragments are present in the collection, largest pinna fragment available is 2·5 cm in length and 1·2 cm in width, margin entire, lamina with polygonal to elongated areoles. Meshes in the centre measuring 5-6 x 0·8 mm and towards margin measuring 2-3 x 1 mm, no. of veins running across broadest region is 14-17 per cm.

Remarks—Dictyozamites is reported from Bartala locality for the first time. Besides this locality, this species has earlier been reported from Onthea (Gupta & Sharma,1968), Sitalpur, Kendua and Sakrigalighat (Sen Gupta, 1988) localities of Rajmahal Basin and thus showing its wide distribution in Rajmahal Basin .

Genus—ANOMOZAMITES Schimper, 1870

ANOMOZAMITES AMARJOLENSE Sharma, Surana & Singh, 1971

(Pl. 1·13)

Description—About a dozen of leaf-fragments are collected as impression. Leaf linear in shape, up to 6·3 cm in length, lamina segmented. Rachis 1·2-1·5 mm broad. Lamina segments 3·5-4·0 mm in length as well as width, attached by broad base, apices round, distal margin wavy-notched, notch shallow-deep, sometimes up to median region of lamina, acroscopic and basiscopic basal margins curved upward and downward at places and continuous with upper and lower lamina. Veins simple or forked, forking mostly at base, veins 18-24 per cm.

Remarks—Anomozamites amarjolense is so far recorded from Balbhadri Hill, Burio and Amarjola localities of Rajmahal Basin (Bose & Banerji, 1981). This is the first record of *Anomozamites amarjolense* from Bartala Hills. This species occurs frequently in the assemblage.

ANOMOZAMITES FISSUS Feistmantel, 1879

(Pl. 1·11)

Remarks—Many fragments of leaves are preserved but none of them show morphological nature of apex. Lamina segments are almost twice as long as broad and distal margin segmented or deeply notched. The specimens match closely *Anomozamites fissus* Feistmantel described by Bose & Banerji (1981) from Basgo Bedo, Borio, Bindaban, Onthea and Amarjola in Rajmahal Basin.

Order—CYCADALES

Family—CYCADACEAE

Genus—PSEUDOCTENIS Seward, 1911

PSEUDOCTENIS sp.

(Pl. 1·15)

Description—Single specimen with counterpart preserved as an impression. Rachis 0·8 cm broad, striated at places. Pinnae incomplete, 1 cm in width, seems to be linear, apex not preserved, margin entire, base broad. Vein concentration 14-16 per cm at base. Veins running parallel-subparallel.

Remarks—In general features the Bartala specimen could be placed under *Pseudoctenis* sp. as it is a pinnate leaf with linear segments having parallel, unforked-rarely forked veins. Due to lack of cuticle it is difficult to ascertain its exact generic identity and at present tentatively placed under *Pseudoctenis* sp. till the better specimens are available.

Genus—TAENIOPTERIS Brongniart, 1828a

TAENIOPTERIS sp.

(Pl. 1·7)

Description—Largest leaf fragment 4 cm in length and 2·3 cm in width. Lamina with a distinct midrib, 1·5 mm broad and medianly grooved. Leaf margin entire-wavy, lateral veins mostly unforked, concentration of veins 24-26 per cm.

Order—GINKGOALES

Family—GINKGOACEAE

Genus—GINKGOITES Seward, 1919

GINKGOITES RAJMAHALENSIS Sah & Jain, 1965

(Pl. 1·9)

Description—Leaves wedge-shaped, 2 cm broad and about 2·2 cm long, dissected into six segments. Segments linear-spatulate, apex acutely rounded, margin entire. Veins arising from base of segments and repeatedly forked twice to four times. Petiole prominent, incomplete, 0·8 mm broad.

Remarks—The Bartala specimen of *Ginkgoites rajmahalensis* is exactly similar to smaller leaves of *Ginkgo rajmahalensis* Sah & Jain (1965) described by Zeba-Bano *et al* (1979, pl. 2, fig. 11, fig. 3c) in size, shape and venation pattern.

Order—CONIFERALES

Family—PODOCARPACEAE

Genus—ELATOCLADUS Halle, 1913

ELATOCLADUS PLANA (Feistmantel) Seward, 1919

(Pl. 1·14)

Description—Shoot with spirally arranged linear leaves. Leaves measuring 1·2-2 cm long, 1·5-2 mm broad, laterally disposed almost at right angle, base narrow constricted, margin entire, apex acute, midvein faintly visible.

ELATOCLADUS TENERRIMUS (Feistmantel) Sahni 1928

Remarks—Shoot with spirally disposed leaves and a cone attached in the axil of leaf. Due to bad preservation its exact nature i.e. male or female cone is difficult to ascertain.

Genus—BRACHYPHYLLUM Lindly & Hutton ex Brongniart 1828b

BRACHYPHYLLUM sp.

(Pl. 1·10)

Remarks—About 7 cm long shoot with rhomboidal leaves measuring 2 x 2 mm and leaves possessing a distinct median keel. Lack of clearity and further details restrict its specific identification.

INCERTAE SEDIS

Genus—DESMIOPHYLLUM Lesquereux, 1878

DESMIOPHYLLUM sp.

(Pl. 1·12)

? Sporangium

(Pl. 1·6)

Remarks—Single specimen of sporangium recovered in this assemblage. Sporangium spherical in shape, showing polygonal depressions at the apical region and distal region is with distinct fine striations. Its sporangial affinity is doubtful due to lack of spores.

FLORAL COMPARISON & REMARKS

The present assemblage recovered from Bartala locality of Rajmahal Formation, comprises about 15 taxa belonging to various families of pteridophytes, viz., Equisetaceae Osmundaceae, Marattiaceae and Dipteridaceae and gymnosperms belonging to Bennettitales, Cycadales, Pteridospermales, Ginkgoales and Coniferales. Bennettitales are well diversified and mainly represented by *Ptilophyllum, Anomozamites, Dictyozamites* and *Pterophyllum*. Amongst these *Anomozamites* is the dominant genus followed by *Ptilophyllum, Pterophyllum* and *Dictyozamites* respectively. Conifers are represented by two genera viz., *Elatocladus* and *Brachyphyllum*. *Thinnfeldia indica* represents pteridosperms and is very frequent in its occurrence in this assemblage. Ginkgoales is represented by single genus - *Ginkgoites*. Over all dominance of Bennettitales in the Bartala assemblage shows its similarity with Pathargama assemblage of Rajmahal Basin. But in Pathargama, *Thinnfeldia* is the most common element, whereas in Bartala assemblage, it is *Anomozamites*. *Thinnfeldia* is comparatively less frequent than *Anomozamites* in Bartala assemblage. The common elements in both the assemblages are - *Taeniopteris, Ptilophyllum, Pterophyllum, Thinnfeldia, Ginkgoites* and *Elatocladus*.

Bartala assemblage can also be compared with Balidih assemblage of Rajmahal Basin. Balidih assemblage also shows dominance of *Thinnfeldia* as in Pathargama assemblage. Bartala and Balidih megafloral assemblages also have certain common elements viz., *Equisetites, Thinnfeldia, Ptilophyllum, Anomozamites, Taeniopteris, Pterophyllum* and *Elatocladus* in them. Moreover, the dominance of *Thinnfeldia* in Balidih and Pathargama and *Anomozamites* in Bartala perhaps shows local variations within the flora. These three floras might be contemporaneous floras and show comparatively older aspect than Nipania and Sonajori flora. The older floras show overall dominance of cycadophytes with qualitatively rich pteridophytic remains and less conifers. But the younger Nipania and Sonajori floras show dominance of conifers alongwith qualitatively rich pteridophytic and Pentoxylalean remains. According to Sen Gupta (1988) both the fossiliferous beds at Bartala and Balidih stratigraphically belong to second

intertrappean bed and floristically they also show somewhat similar megafloral assemblage.

The overall view of the present assemblage indicates affinity with the Utatur Plant Bed of Tiruchirapalli District, Tamil Nadu described by Feistmantel (1879), Gopal, Jacob and Jacob (1957), Mamgain, Sastry and Subbaraman (1973) and Maheshwari (1986). The common elements are - *Thinnfeldia indica, Taeniopteris spathulata, Elatocladus, Brachyphyllum* and *Ginkgoites* sp.

In generic comparison it shows close similarity with early Cretaceous flora of Koonwarra, Victoria (Drinnan & Chambers, 1986) and seems to represent a transitional flora between the zone B and C of Victoria's early Cretaceous flora (Douglas, 1969). The common taxa are *Ptilophyllum, Taeniopteris, Thinnfeldia, Hausmannia* and *Ginkgoites*. On the basis of assemblage correlation an early Cretaceous age has been suggested for the Bartala megafossil assemblage of Rajmahal Basin.

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