

Fossil flora from Gollapalli Formation (Early Cretaceous) of Errayagudem in West Godavari District, Andhra Pradesh, India

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ABSTRACT

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Upper Gondwana sediments are exposed in patches all along the east coast of India. Floristic elements were collected from the Gollapalli Formation (Early Cretaceous) encountered at Errayagudem in West Godavari District, Andhra Pradesh. The present paper deals with morphology and taxonomy of plant fossils collected from Errayagudem. The flora includes members of pteridophytes and gymnosperms.

Key-words: Fossil plants, Gollapalli Formation, Upper Gondwana, Early Cretaceous, West Godavari District, Andhra Pradesh, India.

INTRODUCTION

Along the east coast of India, several Upper Gondwana fossil localities are found in Odisha, Andhra Pradesh and Tamil Nadu. The present paper deals with plant fossils collected from Errayagudem, a little known fossil locality, in West Godavari district, Andhra Pradesh. Baksi (1964) found that the area near Kannapuram in West Godavari district is fossiliferous. He also mentioned occurrence of plant fossils near Errayagudem village (Lat. 17°09'11"N; Long. 81°25'16"E). Recently, the authors visited Errayagudem and collected plant fossils belonging to pteridophytes and gymnosperms.

MATERIAL AND METHODS

All the specimens of fossil plant impressions,

described here, were collected from white to grey fossiliferous sandstones belonging to the Gollapalli Formation (Early Cretaceous). These sediments are exposed in a canal section near Errayagudem village which is located on Koyyalagudem-Polavaram road, at a distance of 7 km north of Koyyalagudem in West Godavari district, Andhra Pradesh (Text-figure 1). The plant fossils were photographed under incident light. The plant impressions were identified by carefully comparing them with identical fossils already available in published literature. Altogether, 12 plant impressions have been identified and described. The flora is dominated by gymnosperms followed by pteridophytes and pteridosperms.

OBSERVATIONS

Cycadophyta

Bennettitales

Genus: *Ptilophyllum* Morris 1840

Ptilophyllum sp. cf. *P. sahnii* Gupta & Sharma
1968b

Plate 1, figure 1

Description: The specimen (ERG/5/2013) is a pinnate leaf, measuring 3.3 cm in length and 1.2 cm in breadth. Rachis is 1 mm thick and partially covered by pinnae bases on the upper surface. Pinnae are oblong in shape, closely set and arranged alternately. They are attached to rachis at an angle of 60°-70° and measure 0.7 cm long and 0.3 cm broad. Episcopic margin rounded and basiscopic margin decurrent. Apex is obtuse, veins 5 in number, run parallel and show forking.

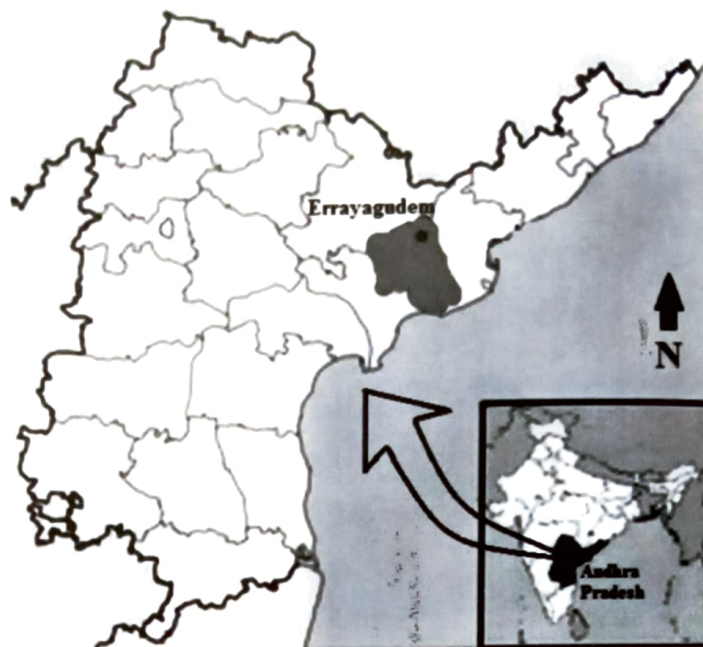
Comparison: The specimen resembles *P. sahnii* Gupta & Sharma, described by Bose and Kasat (1972). It is compared with *Ptilophyllum* sp. cf. *P. sahnii* described by Mahabale and Satyanarayana (1979) from Raghudevapuram in East Godavari district of Andhra Pradesh. The specimen is reported for the first time from Errayagudem in West Godavari district. This suggests wider distribution of *P. sahnii* in Godavari region.

Ptilophyllum cutchense Morris 1840

Plate 1, figure 2

Description: The specimen (ERG/ 14/ 2013) is a fragmentary pinnate leaf measuring 1.5 cm in length and 1 cm in breadth. Rachis is slender and 1 mm thick. It is concealed by pinna bases on the upper surface. Pinnae are short oblong and linear in shape and arranged in opposite manner. They measure 6 mm long and 2 mm broad and are attached to the rachis at an angle of 60°. Margins are falcate. Apex is pointed and curved upwards. Veins 4-5 in number, arise from the base, run parallel and fork near the apex.

Comparison: The specimen resembles with characters of *P. cutchense* Morris described by Bose and Banerji (1984) from Kachchh. It also resembles with *P. cutchense* described by Mahabale and Satyanarayana (1979) from Raghudevapuram in East



Text-figure 1. Showing location of fossiliferous locality Errayagudem, West Godavari district, Andhra Pradesh, from where plant fossils were collected.

Godavari district, Andhra Pradesh. This suggests that *P. cutchense* is quite common in the Godavari region.

Genus: *Pterophyllum* Brongniart 1828

Pterophyllum sp.

Plate 1, figure 3

Description: The specimen (ERG/12/2013) is a fragmentary pinnate leaf, measuring 2.5 cm in length and 2 cm in breadth. Rachis is 2 mm thick and longitudinally striated. Pinnae are observed on one side of rachis. They are linear in shape and measure 1.5 cm long and 0.2 cm broad. Veins are parallel, simple and 4 in number. Apex is missing. Pinnae are laterally attached to rachis at an angle of 70°.

Comparison: The specimen resembles *Pterophyllum* Brongniart at generic level in having lateral attachment of pinnae to the rachis and parallel simple veins. Due to its fragmentary condition, other details could not be observed. It is also comparable with *P. distans* Morris in having 4 veins per segment.

Genus: *Dictyozamites* Oldham 1863

Dictyozamites sahnii Gupta & Sharma 1968a

Plate 1, figure 4

Description: The specimen (ERG/7/2013) is a pinnate frond, measuring 2.8 cm long and 5.2 cm wide.

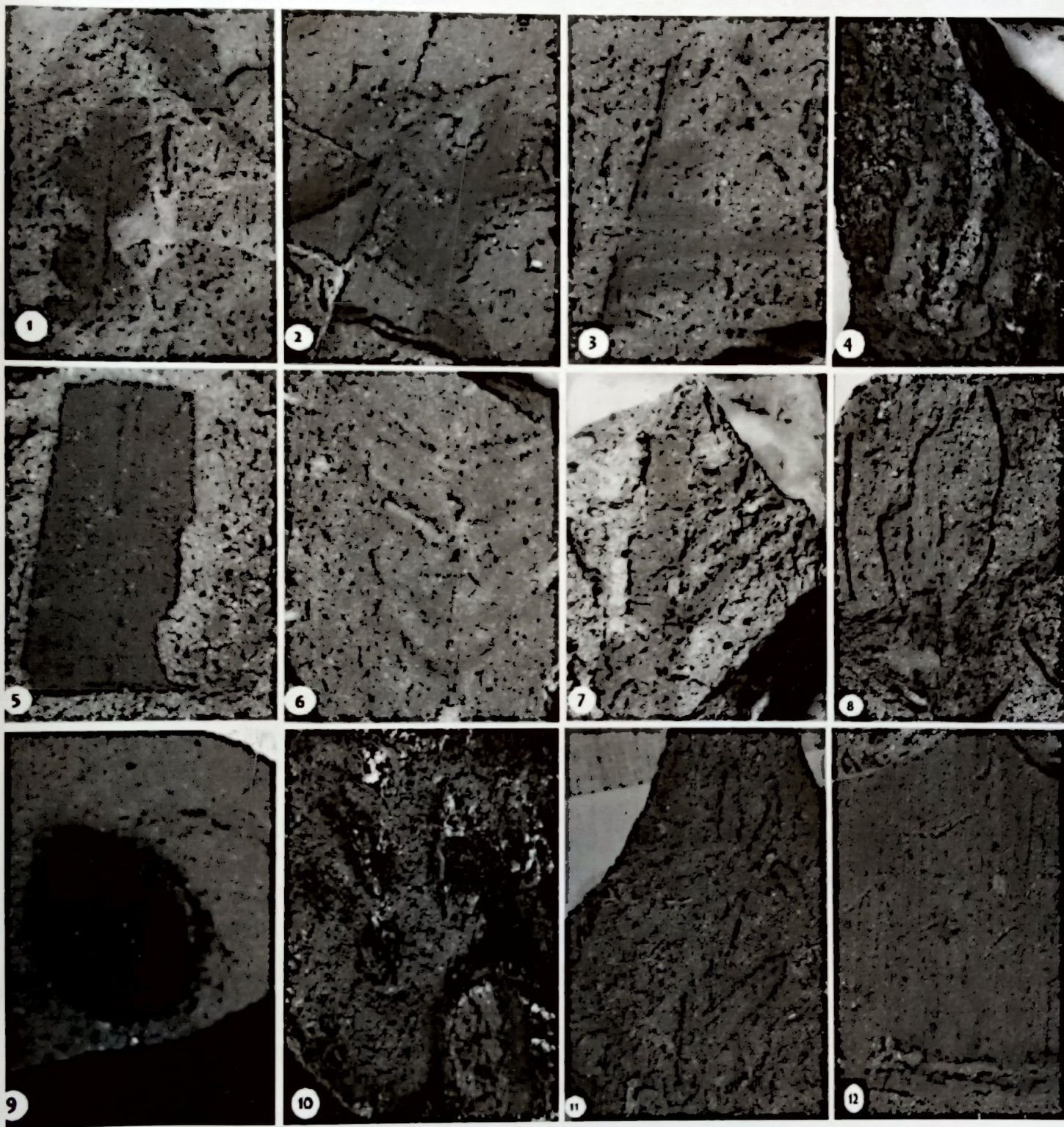


Plate 1

1. *Ptilophyllum* sp. cf. *P. sahnii* Gupta & Sharma, x1.2. 2. *Ptilophyllum cutchense* Morris, x2.6. 3. *Pterophyllum* sp., x2. 4. *Dictyozamites sahnii* Gupta & Sharma, x2. 5. *Taeniopteris spatulata* McClelland, x3. 6. *Elatocladus conferta* Sahnii, x0.7. 7. *Brachyphyllum rhombicum* (Feistmantel) Sahnii, x0.8. 8. *Desmiophyllum indicum* Sahnii, x0.7. 9. *Araucarites minutus* Bose & Maheshwari, x6. 10. *Conites* sp. cf. *C. verticillatus* Sahnii, x7. 11. *Pachypteris indica* (Oldham & Morris) Bose & Roy, x0.65. 12. *Equisetites* sp., x2.

Rachis is 6 mm thick. Pinnae are linear and laterally attached to the rachis by a middle part of the base at an angle of 30° . It is auriculate in shape. Pinnae measure 5.2 cm long and 0.5 cm broad near base. Apex is acute.

Margins are entire. Veins arise from pinna base and divide to form reticulate venation.

Comparison: The specimen resembles *D. sahnii* Gupta & Sharma in having auriculate base, linear pinnae,

acute apex and reticulate venation. It is compared with *D. sahnii* described by Mahabale and Satyanarayana (1979) from Raghudevapuram, in East Godavari district, Andhra Pradesh. Recovery of this species from Errayagudem, West Godavari district suggests wider distribution of *D. sahnii* in Godavari region of Andhra Pradesh.

Cycadales

Genus: *Taeniopteris* Brongniart 1832

Taeniopteris spatulata McClelland 1850

Plate 1, figure 5

Description: The specimen (ERG/9/2013) contains leaves which are simple, linear and strap shaped. Length 1.5-2 cm and breadth 0.9-1 cm. Apex is missing and margins are entire. Midrib is 1 mm thick. Lateral veins parallel, arising from the midrib at an angle of 85° and divide near the midrib.

Comparison: The specimen resembles *T. spatulata* in having strap shape and distinct midrib, venation showing lateral veins arising from the midrib at an angle of 85° and show forking near the midrib. *T. spatulata* is quite commonly found along the east coast. Sukh-Dev and Rajanikanth (1988) described it from Sivaganga Formation of Tamil Nadu; Mahabale and Satyanarayana (1979) reported it from Raghudevapuram in East Godavari district of Andhra Pradesh. Pandya and Sukh-Dev (1990) reported this species from Gollapalli Formation of Krishna district of Andhra Pradesh. This species therefore appears widely along east coast (Venkatachala & Rajanikanth 1987). The present report suggests even wider distribution of this species.

Coniferophyta

Coniferales

Podocarpaceae

Genus: *Elatocladus* Halle 1913

Elatocladus conferta Sahnii 1928

Plate 1, figure 6

Description: The specimen (ERG/11/2013) is an unbranched shoot having oblong leaves and measure 8 cm long and 3.2 cm broad. Leaves are spirally arranged and spread in two planes. Each leaf shows distinct

midrib running throughout the lamina. Apex is acute. Leaf base is contracted and decurrent. Leaves arise from the stem at an angle of 40° and are smaller near the basal part of the stem.

Comparison: The specimen resembles *E. conferta* described by Sahnii (1928) in having shape of leaves, leaves spreading in two rows, distinct midrib and acute apex. Baksi (1964) reported *Elatocladus* from Kannapuram in West Godavari district, Andhra Pradesh. Present specimen, collected from Errayagudem in West Godavari district, is a new addition to fossil flora of this area. Along the east coast, *E. conferta* is known from Sivaganga and Sriperambudur in Tamil Nadu. It appears that *E. conferta* shows wider distribution along the east coast.

Araucariaceae

Genus: *Brachyphyllum* Brongniart 1828

Brachyphyllum rhombicum (Feistmantel) Sahnii 1928

Plate 1, figure 7

Description: The specimen (ERG/15/2013) is a branched twig, measuring 6.5 cm long and 5.5 cm broad. Branches arise from the stem at an angle of 40-50°. Leaves are spirally disposed at an angle of 50-60°. They are rhomboidal in shape and measure 2 mm long and 1 mm broad. Margins are entire and apex is acute.

Comparison: The specimen agrees with the characters of *Brachyphyllum rhombicum* given by Sahnii (1928) in having sparsely branching pattern and rhomboidal leaves having acute apex. Leaves are appressed on the stem. *B. rhombicum* has also been reported from Sriperambudur, Tamil Nadu. Baksi (1964) mentioned occurrence of *Brachyphyllum* near Kannapuram in West Godavari district. Baksi (1968) reported it from Raghavapuram in West Godavari district, Andhra Pradesh. The present report of *B. rhombicum* suggests its wider distribution on the east coast.

Genus – *Desmiophyllum* Lesquereux 1878

Desmiophyllum indicum Sahnii 1928

Plate 1, figure 8

Description: The specimen (ERG/18/2013) is a

strap shaped leaf, measuring 3.5 cm long and 0.5 cm broad. Apex is obtuse. The leaf shows 8-10 parallel lines. Margins are entire.

Comparison: The specimen agrees with the characters of *D. indicum* given by Sahni (1928). It is a detached leaf and nature of its attachment is not known. It shows a broad range of plant groups, viz. conifers, cycads, Ginkgoales and Cordaitales. According to Bose and Maheshwari (1974), it shows affinities with Araucariaceae. According to Sahni (1928), *Desmiophyllum* occurs along Sher River in Madhya Pradesh and Raghavapuram in Andhra Pradesh. Vagyani (1984) reported it from Ommevaram in Prakasam district, Andhra Pradesh. These reports, along with the present one, indicate that it is a common element of Upper Gondwana flora of east coast as well as of other parts of India.

Genus: *Araucarites* Presl

Araucarites minutus Bose & Maheshwari 1973

Plate 1, figure 9

Description: The specimen (ERG/17/2013) is a detached obcuneate cone scale, measuring 6 mm long and 5 mm broad. Base narrows into pointed end on the proximal side and becomes broader on the distal side. Seed is placed in the centre and is 2 mm long and 1 mm broad.

Comparison: The specimen closely resembles *Araucarites minutus* described by Bose and Maheshwari (1973) from Sher River in Madhya Pradesh. It is smaller in size than *Araucarites cutchense* Feistmantel. *A. cutchense* is widely distributed in the Upper Gondwana flora of India. It is comparable with *A. minutus* described by Bose and Banerji (1984) from Kachchh in size shape and other characters.

Genus: *Conites* Sternberg 1833

Conites sp. cf. *C. verticillatus* Sahni 1928

Plate 1, figure 10

Description: The specimen (ERG/1/2013) is an impression of cone, cut in transverse plane. It shows sessile cone scales, touching each other by their lateral sides. They are arranged around an axis. The cone is circular in shape and 2 cm in width. There are 6 cone scales around the axis. They are cuneate in shape

showing narrower apex, measuring 0.8 cm long and 0.5 cm broad. Axis is 3 mm thick.

Comparison: The specimen resembles *C. verticillatus* Sahni 1928. It is preserved in transverse plane. *C. verticillatus* shows three distinct whorls. Axis is not seen. It is comparable with *Conites* sp. described by Baksi (1968) from Raghavapuram in West Godavari district of Andhra Pradesh.

Pteridophyta

Equisetales

Equisetaceae

Genus: *Equisetites* Sternberg 1833

Equisetites sp.

Plate 1, figure 12

Description: The specimen (ERG/9/2013) is a fragmentary stem showing jointed nature. It measures 3 cm long and 2.2 cm broad. Stem shows single node. It is swollen and marked by leaf sheaths. There are 20 leaf sheaths which are narrower near the tip.

Comparison: The specimen resembles *Equisetites* at generic level in having jointed nature of stem. Stem is marked by ridges and furrows and node showing leaf sheaths. Due to fragmentary nature of the specimen and presence of single node, it could not be assigned to any species. The present specimen was compared with *Equisetites* sp. described by Sukh-Dev and Rajanikanth (1988) from Sivaganga Formation in Tamil Nadu. Their specimen shows nodes and internode whereas the present specimen shows a single node.

Pteridospermophyta

Corystospermaceae

Genus: *Pachypteris* Brongniart

Pachypteris indica (Oldham & Morris) Bose & Roy 1968

Plate 1, figure 11

Description: The specimen (ERG/13/2013) is a bipinnate leaf, measuring 9 cm in length and 6 cm in breadth. Rachis is 0.6 cm thick and pulvinus near the base. Pinnae are lanceolate in shape and measure 2 cm long and 0.3 cm broad. They are alternately arranged and arise at an angle of 40°. Pinnules are lanceolate,

closely set and measure 2 cm long and 0.3 cm broad. Margins are entire and apex is acute. Midrib is distinct.

Comparison: The specimen resembles *P. indica* (Oldham & Morris) Bose & Roy (1968) in having bipinnate frond, shape of pinnules, nature of pinna rachis and angle of attachment. Pandya and Sukh-Dev (1990) described *P. indica* from Gollapalli Formation of Krishna district in Andhra Pradesh.

DISCUSSION

The present fossil flora was compared with the Raghavapuram flora of West Godavari district. The two floras show some similarities as well as differences. The similarities are: 1. Cycadophytes and conifers are dominant; 2. Reproductive organ *Conites* is found in both; and 3. *Pachypteris*, a pteridosperm, is found in both. The differences are: 1. Ginkgoales are present in Raghavapuram flora whereas they are absent from the present flora; and 2. Pteridophytes are represented by two members whereas in the present flora only *Equisetites* is found. Baksi (1964) considered Errayagudem sediments belonging to Gollapalli Formation and suggested an Early Cretaceous age. Pandya and Sukh-Dev (1990) also suggested Early Cretaceous age to Gollapalli Formation. The present Errayagudem flora is therefore considered here as belonging to Early Cretaceous age.

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