

# Leaf impressions from Oligocene sediments of Manmao, Tirap District, Arunachal Pradesh, India

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## ABSTRACT

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A new fossiliferous locality Manmao has recently been discovered in Tirap District of Arunachal Pradesh. The leaf impressions recorded from the area are considered of Oligocene in age. As no plant megafossil is known from these beds, for the first time three fossil leaf impressions, namely *Palmacites* sp. of Palmae, *Alstonia arunachalensis* sp. nov. of Apocynaceae and *Dicotylophyllum oligocenicum* sp. nov. have been reported from here.

**Key-words**—Leaf impressions, Barail Group, Oligocene, Palmae, Apocynaceae.

भारत के अरुणाचल प्रदेश के तिरप जनपद के मनमाओ नामक स्थान के ओलिगोसीन युगीन अवसादों से प्राप्त पर्ण मुद्राश्म

राकेश चन्द्र मेहरोत्रा एवं भगवान दास दोमाजी मण्डावकर

सारांश

अरुणाचल प्रदेश के तिरप जनपद के मनमाओ नामक स्थान से एक नई पादपाश्ममय संस्थिति की हाल ही में खोज की गई। यह संस्थिति ओलिगोसीन युगीन पर्ण मुद्राश्मों की उपस्थिति को प्रदर्शित करती है। इस संस्तर से कोई भी पादप गुरुपादपाश्म ज्ञात नहीं हुआ है, परन्तु पॉमी की *पामेसाइटीज़ ओलिगोसेनिकस* नव प्रजाति, एपोसाइनेसी की *एल्सटोनिया अरुणाचलेन्सिस* नव प्रजाति तथा *डाइकॉटिलोफिल्लम ओलिगोसीनिकम* नव प्रजाति नामक तीन पादप पर्ण मुद्राश्म यहाँ से अंकित किये गये हैं।

**संकेत शब्द**—पर्ण मुद्राश्म, बरेल समूह, ओलिगोसीन, पॉमी, एपोसाइनेसी

## INTRODUCTION

A large number of plant megafossils are known from the Neogene sediments of Arunachal Pradesh belonging to Clusiaceae, Dipterocarpaceae, Rhamnaceae, Sterculiaceae,

Sapindaceae, Anacardiaceae, Fabaceae, Combretaceae, Lecythidaceae, Lythraceae, Sapotaceae, Ebenaceae, Lauraceae, Bischofiaceae and Moraceae (Awasthi & Mehrotra, 1993, 1997; Mehrotra *et al.*, 1999). Contrary to it, a very few plant fossils have been described from Palaeogene sediments



Fig. 1—A map showing the fossil locality of Manmao, Tirap District, Arunachal Pradesh.

of this area. Tripathi *et al.* (1981) reported some fragments of dicot leaf impressions from the Geku Formation of the Dihang Valley, Siang District. Earlier Jain and Thakur (1978) considered these sediments as of Yinkiyong Formation and assigned the Pre Cambrian age to them. Tripathi *et al.* (1981), on the basis of these dicot leaf impressions, considered them of Tertiary. To record the megafossils from the Palaeogene sediments of Arunachal Pradesh, an extensive search was made by one of us (BDM) and collected several leaf impressions from the Oligocene sediments of Manmao, Tirap District (Fig. 1). The impressions are mostly fragmentary in nature, however, a few better preserved ones are being described in the present communication. They belong to Tikak Parbat Formation of Barail Group (Raja Rao, 1981).

## MATERIAL AND METHODS

The material is mostly in the form of impressions which were first cleared by using chisel and hammer. They were then put under low power microscope.

## SYSTEMATICS

**Family**—PALMAE Bentham and Hooker f.

**Genus**—PALMACITES Brongniart, 1822

**Species**—PALMACITES sp.

Pl. 1-4

**Diagnosis**—Preserved lamina length 9.5 cm, maximum preserved width 4.8 cm; apex and base broken; form appearing palmate; texture appearing coriaceous; lamina consisting of at least 3 plicate fused segments or leaf-lets, each about 1.5 cm in width with a prominent mid-rib in the middle.

**Holotype**—Specimen No. BSIP 38083.

**Occurrence**—Barail Group; Manmao, Tirap District, Arunachal Pradesh; Oligocene.

**Affinities**—Read and Hickey (1972, p.130) have provided a list of characters which alone or in various combinations are necessary for the identification of true fossil palm leaves. The fused plicate segments or leaf-lets having a distinct midrib

## PLATE 1

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|---|---|
| <p>1. <i>Alstonia arunachalensis</i> sp. nov.; a fossil leaf showing shape, size and venation pattern. x 0.9; Specimen no. BSIP 38084.</p> <p>2. <i>Dicotyophyllum oligocenicum</i> sp. nov.; a fossil leaf showing shape, size and venation pattern. x 1; Specimen no. BSIP 38085.</p> | <p>3. <i>Alstonia scholaris</i>; a modern leaf showing similar venation pattern as found in fossil (Pl. 1.1). x 1.</p> <p>4. <i>Palmacites</i> sp.; showing plicate fused segments of lamina. x 1; Specimen no. BSIP 38083.</p> |
|---|---|

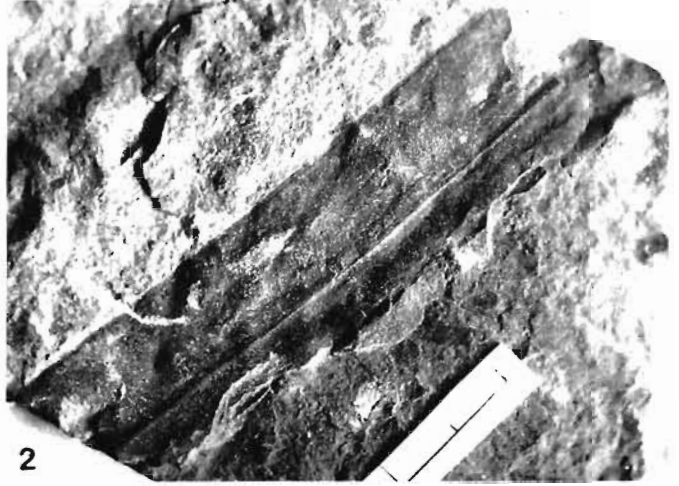


PLATE 1

indicate that the fossil belongs to a true palm (Read & Hickey, 1972). As the present fossil specimen is incomplete, no attempt has been made to trace its affinities up to the generic level.

The fossil palms and palm-like leaves are known from various Tertiary exposures of the world under different generic names. Read and Hickey (1972) have reclassified them and accordingly our fossil has been placed under the genus *Palmacites* Brongniart (1822). From the Indian Tertiary sediments its only species, *P. khariensis* Lakhanpal and Guleria (1982), is known from Khari Nadi bed of Kachchh and is represented by the basal part of lamina. Another similar form known from the Indian Tertiary has been described as *Sabalites* sp. (Sahni, 1964). Unfortunately, its description was not given for comparison. Therefore, the present fossil specimen is being described under *Palmacites* sp.

**Family**—APOCYNACEAE Bentham and Hooker f.

**Genus**—ALSTONIA Robert Brown

**Species**—ALSTONIA ARUNACHALENSIS sp. nov.

Pl. 1·1

**Diagnosis**—Preserved lamina length about 10 cm, maximum width 4·5 cm, symmetrical, narrow elliptical, apex and base absent; margin entire to slightly wavy; texture appearing chartaceous; venation pinnate eucamptodromous; primary vein moderately thick, more or less straight; secondary veins fine, alternate, 7-9 mm apart, angle of divergence wide acute to right angles (80°-90°), straight to uniformly curved, unbranched; intersecondary veins present simple; tertiary venation not visible.

**Etymology**—From Arunachal Pradesh.

**Holotype**—Specimen No. BSIP 38084.

**Occurrence**—Barail Group; Manmao, Tirap District, Arunachal Pradesh; Oligocene.

**Affinities**—The diagnostic characters of the fossil leaf, such as entire margin, eucamptodromous venation with secondaries having wide acute to right angle of divergence and presence of intersecondary veins indicate its resemblance with the genus *Alstonia* R.Br. of Apocynaceae (Pl. 1·3). The fossil shows maximum resemblance with *Alstonia scholaris* Brown (Herbarium Sheet No. FR1 4359).

Three species of *Alstonia* are known from the Indian Tertiary sediments. These are *Alstonia scholaris* from the late Cenozoic of Palamu District, Bihar (Bande & Srivastava, 1990), *A. mioscholaris* from the Himalayan foot hills of Darjeeling District, West Bengal (Antal & Awasthi, 1993) and *A. oligocenica* from the Makum Coalfield, Assam (Awasthi & Mehrotra, 1995). A detailed comparison revealed that our fossil specimen is different from all the known fossil species in shape, size and distance between the two secondary veins. Therefore it is being described here as a new species of *Alstonia*

- *Alstonia arunachalensis* sp. nov., the specific name indicating its occurrence in Arunachal Pradesh.

The genus *Alstonia* consists of 30 species of trees, rarely shrubs, distributed in the Indo-Malayan region extending to Australia and Polynesia. *A. scholaris* is distributed mostly in deciduous forests from Yamuna eastwards through Uttar Pradesh, Bengal and Assam. It is rare in Bihar, Orissa and Chotanagpur but common in West Coast (Pearson & Brown, 1932; Brandis, 1971).

**Genus**—DICOTYLOPHYLLUM Saporta, 1894

**Species**—DICOTYLOPHYLLUM OLIGOCENICUM

sp. nov.

Pl. 1·2

**Diagnosis**—Preserved lamina length 8·5 cm, preserved width 2·3 cm; probably lorate, symmetrical; apex and base absent; margin entire; texture seemingly chartaceous; venation pinnate, simple craspedodromous; primary vein stout, straight; secondary veins visible at places, angle of divergence moderately acute (55°-60°), upper pairs more acute than lower, fine, more or less straight, closely placed (about 2-4 mm apart), slightly bent near the point of origin, intramarginal vein observed below the margin.

**Etymology**—From Oligocene.

**Holotype**—Specimen No. BSIP 38085.

**Occurrence**—Barail Group; Manmao, Tirap District, Arunachal Pradesh; Oligocene.

**Affinities**—The characteristic features of the fossil are: entire margin, craspedodromous venation, straight and stout primary vein, closely placed secondaries with moderately acute angle of divergence and intramarginal vein. However, due to the absence of its base and apex it is not possible to assign it to the generic level.

In absence of any definite fossil records, fragmentary evidences become important in resolving the stratigraphic puzzles, as shown by Tripathi *et al.* (1981), therefore such remains should be recorded. It is with the same intention the present fragmentary leaf impressions are recorded. Saporta (1894) instituted the genus *Dicotylophyllum* for fossil dicot leaves of uncertain affinities. Since then a number of species of the genus are recorded from the Indian Tertiary sediments and have been listed by Guleria and Mehrotra (1999). Intramarginal vein, a characteristic feature of present fossil, is known in two species, namely *Dicotylophyllum cordatum* Lakhanpal and Guleria (1981) and *Dicotylophyllum* sp. (Specimen No. 4 of Nambudiri, 1966). However, both are different from our fossil in shape, size and other details. Therefore, a new specific name *Dicotylophyllum oligocenicum*, has been assigned to it. The specific epithet is after its occurrence during Oligocene.

## DISCUSSION

The Neogene flora of the North east India is very well known but it is devoid of any palm leaf record. However, these leaves are commonly found in the Palaeogene flora of this region. Therefore, its presence is significant as it indicates Palaeogene age of the sediments. Moreover, the occurrence of *Alstonia* which is also known from the Oligocene deposits of nearby Makum Coalfield, gives an indication that the sediments belong to Oligocene thus supporting Raja Rao (1981). In order to reconstruct the palaeoenvironment a rich collection of plant megafossils is required from this area which appears to be potentially rich for them.

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