Two fossil woods from Miocene sediments of Changki, Mokokchung district, Nagaland

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Two fossil woods *Pahudioxylon sahnii* and *Lagerstroemioxylon eoflosreginum* resembling extant genera *Afzelia-Intisa* and *Lagerstroemia* are described from Changki Formation of Nagaland.

Key-words — Fossil wood, M. decene, Nagaland.

A well developed Tertiary stratigraphic sequence, comprising of Tikak Parbat, Changki and Tipam Sandstone formations (in the ascending order) is exposed at Changki (26°25'15"N; 94° 23' 30"E), in Mokokchung district, Nagaland (Raja Rao 1981).

A number of workable coal seams belonging to the Tikak Parbat Formation are found between Changki and Chonglymsen (26° 25' 43" N; 94° 25' 47" E). *In situ* fossil woods are found in the Changki Formation. Of these, two types of wood are described here. The type specimens are deposited in the museum of the Birbal Sahni Institute of Palaeobotany, Lucknow.

DESCRIPTION

Family—Fabaceae

Genus—*Pahudioxylon* Chowdhury, Ghosh & Kazmi, 1960

Pahudioxylon sahnii Ghosh & Kazmi, 1961

Pl. 1, Figs 5-9

Material—The description is based on a well preserved piece of fossil wood.

Description—Wood diffuse-porous. *Growth rings* distinct, delimited by terminal parenchyma. *Vessels* mostly medium to large, occasionally small in size, t.d. 60-220 μm, r.d. 60-280 μm, mostly solitary, occasionally in radial multiples of 2-3, round to oval when solitary, with flat contact walls when in multiples, 2-6 per sq mm, filled with yellowish gummy deposit; vessel members 160-320 μm long with truncated or tailed ends; perforations simple; intervessel pit-pairs vestured, 6-8 μm in diameter, alternate. *Parenchyma* terminal and paratracheal; terminal parenchyma 1-2 celled thick, paratracheal parenchyma mostly aliform with wing like extensions, sometimes confluent joining 2-4 vessels, sheath 4-5 celled thick; cells 20-32 μm in diameter and 40-160 μm in length. *Xylem rays* 1-3 (mostly 2) seriate, 12-36 μm in width and 4-15 cells or 60-280 μm in height, 5-9 per mm, sometimes storied, made up of procumbent cells only; cells 28-40 μm in radial length and 12-20 μm in tangential height. *Fibres* aligned in radial rows, moderately thick walled, nonseptate, angular in cross section, 12-16 μm in diameter and 320-400 μm in length.

Figured Specimen—BSIP Specimen No. 38928.

Horizon and Locality—Changki Formation; Changki, Mokokchung District, Nagaland.

Age—Early Middle Miocene.

Remarks—The important characters of the fossil wood, viz., terminal and aliform-confluent parenchyma with wing-like extensions, 1-3 seriate homocellular xylem rays showing storied nature at places, vestured pits and non-septate fibres indicate its affinities with

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xylotomically inseparable taxa *Afzelia* Sm. and *Intsia* Thou. of Fabaceae.

Fossil woods showing affinities with *Afzelia* and *Intsia* are usually assigned to the genus *Pahudioxylon* Chowdhury, *et al.* (1960). So far, 5 species of this genus are known from the Indian Tertiary sediments. These are: *Pahudioxylon bankurensis* Chowdhury *et al.* (1960) from the Late Miocene sediments of West Bengal and Late Tertiary sediments of Arunachal Pradesh (Mehrotra *et al.*, 1999); *P. sahnii* Ghosh & Kazmi (1961) from the Miocene sediments of Tripura, Late Tertiary sediments of Deomali, Arunachal Pradesh (Prakash, 1966), Late Miocene sediments of Jaipur, Assam (Prakash & Awasthi, 1971), Late Tertiary sediments of Pondicherry (Awasthi, 1975) and Pliocene of Kachchh (Guleria, 1984); *P. deomaliense* Prakash (1965) from the Late Tertiary sediments of Deomali, Arunachal Pradesh; *P. assamicum* Prakash & Tripathi (1975) from the Late Miocene of Hailakandi, Assam and from Pliocene sediments of Kachchh (Guleria, 1984); and *P. indicum* Prakash (1979) from the Lower Siwalik of Himachal Pradesh. Our fossil is identical to *P. sahnii* in almost all the xylotomical features, hence assigned to it.

Family—Lythraceae

Genus—*Lagerstroemioxylon* Mädler, 1939

Lagerstroemioxylon eoflosreginum Prakash & Tripathi, 1970

Pl. 1, Figs 1-4

Material—The description is based on a solitary piece of fossil wood measuring 6 cm in length and 2 cm in width.

Description—Wood porous. *Growth rings* distinct, marked by terminal bands of parenchyma and large spring wood vessels. *Vessels* small to large, usually bigger vessels in the early wood and grading abruptly into smaller vessels in the late wood, t.d. 60-240 µm, r.d. 48-280 µm, solitary as well as in radial multiples of 2-3, 8-12 per sq mm, tylosed occasionally; vessel members 140-400 µm in height with oblique to horizontal ends; perforations simple; intervessel pit pairs vestured, 8-10 µm in size, alternate, appearing oval to polygonal due to crowding. *Parenchyma* both paratracheal and apotracheal; paratracheal abundant, vasicentric to confluent-banded, bands 4-10 celled thick; apotracheal parenchyma usually terminal; parenchyma cells 32-40 µm in diameter and 60-120 µm in height. *Xylem rays* more or less uniseriate of procumbent cells, 12-16 µm in width and 6-13 cells or 160-320 µm in height, 12-15 per mm; ray tissue homogeneous; ray cells 48-80 µm in radial length and 24-32 µm in tangential height. *Fibres* aligned in radial rows, thick-walled, septate, polygonal in cross section, 12-20 µm in diameter.

Figured Specimen—BSIP Specimen No. 38929.

Horizon and Locality—Changki Formation; Changki, Mokokchung District, Nagaland.

Age—Early Middle Miocene.

Remarks—The fossil wood is more or less identical to *Lagerstroemioxylon eoflosreginum* Prakash

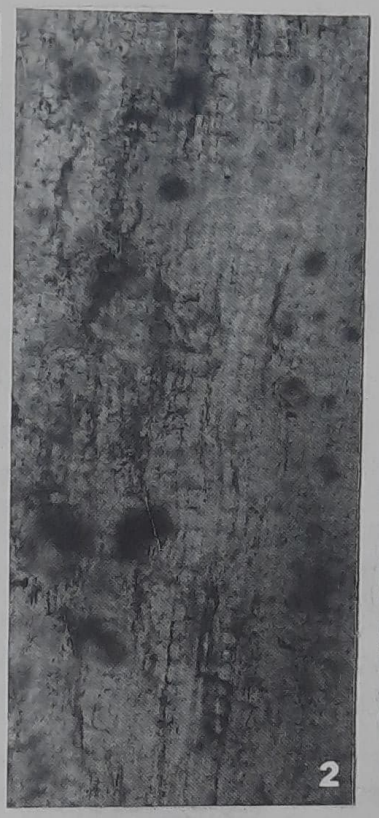
PLATE 1

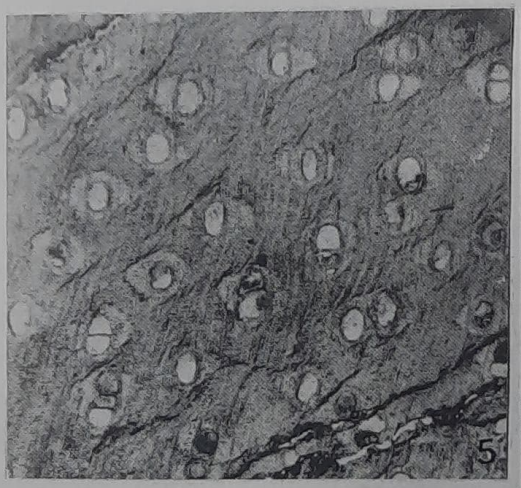
1-4. *Lagerstroemioxylon eoflosreginum* Prakash & Tripathi, 1970

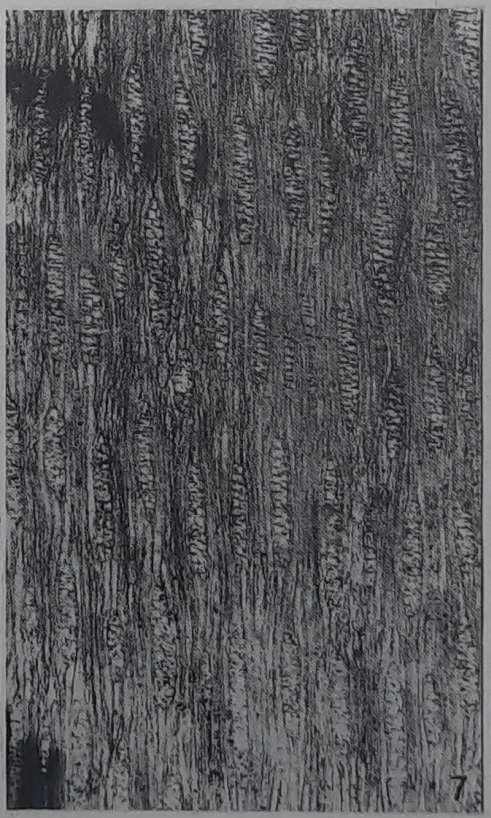
1. Cross section of the fossil wood showing ring-porosity. x60; Slide No. BSIP 38929-I.
2. Tangential longitudinal section of the fossil showing uniseriate xylem rays. x100; Slide No. BSIP 38929-II.
3. Radial longitudinal section of the fossil showing homogeneous ray tissue. x100; Slide No. BSIP 38929-III.
4. Intervessel pit-pairs of the fossil wood. x250; Slide No. BSIP 38929-II.

5-10. *Pahudioxylon sahnii* Ghosh & Kazmi, 1961

5. Cross section of the fossil wood in low power, showing shape, size and distribution of vessels. x26; Slide No. BSIP 38928-I.
6. Cross section magnified to show parenchyma pattern. x40; Slide No. BSIP 38928-I.
7. Tangential longitudinal section of the fossil showing the distribution of xylem rays. x60; Slide No. BSIP 38928-II.
8. Radial longitudinal section of the fossil wood showing homogeneous ray tissue. x100; Slide No. BSIP 38928-III.
9. Tangential longitudinal section enlarged to show the structure of xylem rays. x100; Slide No. BSIP 38928-II.
10. Intervessel pit-pairs of the fossil wood. x250; Slide No. BSIP 38928-II.







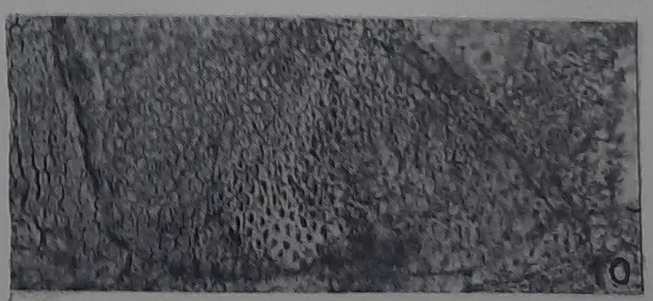


PLATE 1

& Tripathi (1970) described from the Tipam Sandstone of Hailakandi, Cachar District, Assam. This species has also been recorded from the Khari Series (Early Miocene) of Kutch, Gujarat, the Mar Formation (probably Pliocene) of Rajasthan (Guleria, 1992) and from the Tipam Group of Mizoram (Tiwari & Mehrotra, 2000). The present finding supports its presence in India since Early Miocene.

DISCUSSION

The genus *Afzelia* Sm. consists of 14 species distributed in tropical Africa and Asia, whereas *Intsia* Thou. comprises 9 species found in offshore islands of tropical East Africa, Madagascar and tropical Asia (Willis, 1973). In India only *A. bijuga* A. Grey and *A. retusa* Kurz are found. The fossil occurrence of *Afzelia-Intsia* indicates littoral and swampy forests (Gamble, 1902) in the vicinity of the fossil site during the deposition of beds.

The genus *Lagerstroemia* Linn. consists of over 50 species of trees and shrubs which are confined to the old world. Its centre of distribution is in Southeast Asia but the genus extends from Madagascar through Southeast Asia and East Indies to tropical eastern Australia, China and Japan (Pearson & Brown, 1932). Only 7 species of this genus grow in India. *L. flosreginae* Retz., the modern counterpart of the fossil (Prakash & Tripathi, 1970), is found in Assam Valley, Bangladesh and Myanmar (Gamble, 1902) in evergreen to semi-evergreen forests. Therefore, its occurrence in the fossil state is indicative of warm and humid climate in the region.

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