BARRINGTONIOXYLON EOPTEROCARPUM SP. NOV., A FOSSIL WOOD OF LECYTHIDACEAE FROM THE DECCAN INTERTRAPPEAN BEDS OF MAHURZARI

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ABSTRACT

In this paper a fossil dicotyledonous wood from the Deccan Intertrappean beds of Mahurzari (21°13′N; 79°1′E) near Nagpur, India has been described. It has been assigned to the genus *Barringtonioxylon* Shallom (1960a) and described as *B. eopterocarpum* sp. nov. because of its marked similarity with the wood structure of *Barringtonia pterocarpa* Kurz of Lecythidaceae.

INTRODUCTION

FROM the "Survey of the Deccan Intertrappean flora" (PRAKASH, 1960), it is evident that the fossil dicotyledonous woods of the Deccan Intertrappean beds did not receive enough attention from the palaeobotanists although they are of frequent occurrence in the beds near Nagpur and Chhindwara. However, in recent years the petrified dicot woods of these beds are being intensively studied and a number of them have so far, been described from different localities (DAYAL, 1964; LAKHANPAL & DAYAL, 1962; PRAKASH, 1956, 1957, 1958, 1962a, 1962b; PRAKASH & DAYAL, 1963a, 1963b, 1964; RODE, 1936; SHALLOM, 1958, 1959, 1960a, 1960b, 1963a, 1963b; SHUKLA, 1941; VERMA, 1950).

The following is a description of a new fossil dicotyledonous wood, collected from the Deccan Intertrappean beds of Mahurzari (21°13′N; 79°1′E), about 8 miles north-west of Nagpur in Maharashtra. It is a nicely preserved piece of secondary wood showing all the anatomical structures. The wood has been studied in great detail from its ground sections, prepared from all the three planes, viz., the transverse, tangential longitudinal and radial longitudinal.

A detailed comparison of the fossil wood with the living has been made at the Wood Anatomy Branch of the Forest Research Institute, Dehra Dun. The descriptive terminology used here conforms to that of *International Glossary of Terms used in describing woods* (International Association of Wood Anatomists, 1957) and the standard terms for vessel-member length, vessel-diameter and ray width are those standardized by the International Association of Wood Anatomists (1937, 1939).

DESCRIPTION

FAMILY — LECYTHIDACEAE

***Barringtonioxylon eopterocarpum* sp. nov.**

The fossil wood described here is 5 cm. in length and 6·5 cm. in diameter. It is brown to rusty brown externally and almost black as seen on the cut surface.

TOPOGRAPHY — *Wood* diffuse-porous (PL. 1, FIG. 1). *Growth rings* not observed. *Vessels* distinct with a hand lens, small to medium-sized, mostly in radial multiples of 3-5 cells, radial multiples of 6-7 cells are also seen, (PL. 1, FIGS. 1, 4), occasionally solitary, sometimes in short double rows or small irregular clusters, evenly distributed without any pattern, upto 12 per sq. mm., contiguous with the rays usually on one, sometimes on both the sides; tyloses present (PL. 1, FIG. 2). *Parenchyma* paratracheal and apotracheal; paratracheal parenchyma sparse, as few cells about the vessels; apotracheal parenchyma abundant, occurring mostly as narrow, irregular, uniseriate tangential lines between two adjacent rays (PL. 1, FIGS. 1, 4). *Xylem rays* not visible to the naked eye, distinct with a hand lens on the cross-section of the wood, fine to broad, 1-8 cells and 20-120 μ broad, 6-8 per mm. (PL. 1, FIG. 2); ray tissue markedly heterogeneous (PL. 1, FIGS. 2, 5, 6); rays divisible on the basis of size and composition into two types, (a) the uniseriates, 3-10 or more cells and 180-525 μ high and upto 20 μ wide, homocellular, consisting of upright cells only (PL. 1, FIG. 2);

(b) the multiseriates, 2-8 (mostly 3-6) seriate, 30-120 μ wide and upto 4 mm. high, heterocellular, consisting of procumbent cells in the thickened portion with sheath cells at the flanks and marginal rows of 1-5 or more upright cells at one or both the ends (PL. 1, FIGS. 2, 5, 6); end to end ray fusion not seen. *Fibres* not clearly visible due to dark infiltration.

ELEMENTS — *Vessels* thinwalled, their common wall about 8 μ thick, t.d. 60-165 μ, r.d. 75-150 μ, round to oval in cross-section, those in radial groups flattened at the places of contact (PL. 1, FIGS. 1, 4); vessel-members of short to medium length, 270-660 μ long with truncate or tapered ends; perforations simple; intervessel pit-pairs large, 10-12 μ in diameter, bordered, alternate, with round to oval border and circular to lenticular (mostly lenticular) and horizontal apertures (PL. 1, FIG. 3); vessel-ray and vessel-parenchyma pits not preserved. *Parenchyma cells* thinwalled, t.d. 12-20 μ. *Ray cells* thinwalled; procumbent cells circular or angular in the tangential longitudinal section, t.d. 12-32 μ, r.d. 16-40 μ; upright cells t.d. 20-36 μ, r.d. 40-120 μ; sheath cells t.d. 20-28 μ, r.d. 32-96 μ. *Fibres* moderately thickwalled, non-septate; interfibre pits not observed.

AFFINITIES AND DISCUSSION

Comparison with the Living Species — There is close agreement in almost all the structural details of the present Intertrappean wood with the wood structure of the modern genus *Barringtonia* Forst. of the Lecythidaceae (METCALFE & CHALK, 1950, pp. 631-636; DIEHL, 1935, pp. 1-15). The fossil also shows a somewhat superficial resemblance, in gross features, to *Aporosa* type of woods of the Phyllanthoideae of Euphorbiaceae. However, the *Aporosa* type of woods differ from the fossil wood in having small to minute intervessel pit-pairs, mostly scalariform or both simple as well as scalariform perforation plates and in having the parenchyma commonly with chambered crystals (METCALFE & CHALK, 1950, p. 1219).

Detailed microscopic examination of the woods of the six available species of *Barringtonia* was made in order to find out the nearest living counterpart of the present fossil wood. The species examined are *B. cymosa* C.E.C. Fischer, *B. racemosa* Bl., *B. acutangula* (Linn.) Gaertn., *B. augusta* Kurz, *B. macrostachya* Kurz, and *B. pterocarpa* Kurz. Besides, published descriptions of *B. speciosa* Linn. (KANEHIRA, 1921, p. 111, PL. 22, FIGS. 128, 129; METCALFE & CHALK, 1950, p. 633; MOLL & JANSSONIUS, 1914, pp. 489-494, FIG. 196), *B. asiatica* Kurz and *B. scortechinii* King (DESCH, 1941, pp. 251-252, PL. 60, FIG. 1; SCHNEIDER, 1916, p. 178) and *B. spicata* Bl., *B. insignis* Miq. and *B. gigantostachya* Koord. et Valet. (MOLL & JANSSONIUS, 1914, pp. 494-502. FIG. 197) were also consulted.

An examination of all the available data reveals that the nearest affinity of the fossil wood within this genus is with *Barringtonia pterocarpa* Kurz.

The size of the vessels, their distribution and the preponderance of the radial multiples is similar both in the present fossil wood and the modern wood of *Barringtonia pterocarpa* Kurz (F.R.I. specimen No. B4899, slide No. 3194). In both, the perforations are simple and the intervessel pit-pairs are medium-sized to large, bordered, alternate, with usually oval border and lenticular and horizontal apertures. However, tyloses have not been seen or reported in the modern wood, but they are present in the fossil specimen.

Both in the Intertrappean fossil wood and the modern wood, the parenchyma distribution and the ray structure is almost similar. The rays are markedly heterogeneous with the multiseriate rays possessing sheath cells at the flanks. However, the rays are slightly less broad, 1-5 seriate in *Barringtonia pterocarpa*, unlike 1-8 seriate rays in the fossil wood.

It is interesting to note that in two other specimens of *B. pterocarpa* (F.R.I. Nos. B6432 & B7162) studied, the vessels are mostly solitary, unlike the first specimen (F.R.I. No. B4899) where they are mostly in radial multiples. Also the parenchyma is in thicker (2-4 or more cells broad), continuous or broken bands unlike the specimen No. B4899. The rays are also slightly broad, 1-6 seriate, in specimen No. B6432.

Because of the close resemblance of the Intertrappean wood with the wood structure of *Barringtonia* Forst., it has been assigned to the genus *Barringtonioxylon* Shallom (1960a). It is specifically named as *Barringtonioxylon eopterocarpum* in view of its close resemblance with the wood of the modern species, *Barringtonia pterocarpa* Kurz.

Comparison with the Fossil Species — So far only two fossil woods of the Lecythidaceae

are known from India and abroad. These are *Lecythioxylon brasiliense* Milanez (1935) from the Upper Cretaceous of Brazil and *Barringtonioxylon deccanense* Shallom (1960a) from the Deccan Intertrappean beds of Mahurzari. The fossil wood *Barringtonioxylon deccanense*, although resembling slightly our fossil, differs from it in a number of structural details. In the present wood the radial multiples of 3-5 vessels are very much pronounced, the uniseriate rays are not frequent and the multiseriate rays are 2-8 cells wide and upto 4 mm. high, whereas in *B. deccanense* the majority of the vessels are solitary or in radial rows of 2 or 3, the uniseriate rays are fairly abundant and the multiseriate rays are only 2-6 seriate and upto 1·5 mm. high. Moreover, *B. deccanense* possesses intercellular canals of the vertical traumatic type, a character by which alone it is distinguished from the present fossil wood. Such canals are also not known to occur in the modern woods of *Barringtonia*.

Lecythioxylon brasiliense Milanez (1935) has been compared with the modern genus *Lecythis* which grows in northern South America, Central America and the Antilles. As such, it is quite different from the present fossil wood which shows affinities with the genus *Barringtonia*.

Besides the two fossil woods mentioned above, the Lecythidaceae is also represented in the fossil state by a number of leaf and flower species. These include *Lecythis linne* Engelhardt (1891, p. 677, in BERRY, 1924) from the Lower Miocene of Chile; *Couratari aublet* Engelhardt (1895, p. 24, in BERRY, 1924) from the Pliocene of Ecuador; *Lecythidophyllum couratarоides* Berry (1923, p. 21, in ANDREWS, 1955, p. 177) from the Miocene of Palomares, Oaxaca, Mexico; and *Lecythidoanthus kugleri* Berry (1924, p. 103) from the Miocene of Trinidad, West Indies.

It is interesting to note that Berry (1924, p. 107) suggested a post-Eocene origin of the family Lecythidaceae. In support of this view he added that the fossil records of this family comprise only Miocene and Pliocene occurrences, and that the fossil record from Chile, which is Lower Miocene in age, is the oldest. According to him these fossil occurrences lend support to the idea that the family is of relatively late origin. But now we have fossil records of this family from the Upper Cretaceous of Brazil (MILANEZ, 1935) and also from the Deccan Intertrappean beds of Mahurzari in India (SHALLOM, 1960a) which are of Early Eocene in age. Therefore, in the light of these finds it is apparent that the family flourished even in the Upper Cretaceous and not originated in the post-Eocene times as was suggested by Berry.

The genus *Barringtonia* Forst. consists of about 45 species (WILLIS, 1957, p. 71) of moisture-loving trees and shrubs with mostly evergreen leaves. The genus is confind to the Old World. The species are mostly littoral and are scattered from tropical Africa through the Indo-Malayan region to Formosa, and eastwards to northern Australia and Polynesia (PEARSON & BROWN, 1932, p. 563). About 9 species are represented in the modern flora of India. *Barringtonia pterocarpa* KURZ, with which the present fossil wood shows its closest resemblance, is an evergreen tree of the tropical forests of Pegu and Martaban. In relation to the geographic locale of the fossil, the nearest living species of *Barringtonia* is *B. acutangula* Gaertn. This evergreen plant is a moderate-sized tree in Bengal, Assam, Burma and on the West Coast, and a small tree in the Central Provinces (now called the Madhya Pradesh), Khandesh, Deccan, Carnatic and in parts of Bihar and Orissa and Chota Nagpur. Indigenous from the Ganges, Bengal to Assam; in Bihar and Orissa, Chota Nagpur, Madhya Pradesh, on the East and West coasts and more scattered in the Deccan and Carnatic (PEARSON & BROWN, 1932, p. 564). It is always found along the banks of streams, round the edges of swamps and in similar moist places. It is a familiar tree in the swamps of the sub-Himalayan tract, and is also common near the coast, though not found in mangrove swamps (TROUP, 1921, p. 590).

SPECIFIC DIAGNOSIS

Barringtonioxylon eopterocarpum sp. nov.

Wood diffuse-porous. *Growth rings* not observed. *Vessels* small to medium-sized, t.d. 60-165 μ, mostly in radial multiples of 3-5 cells, tylosed; vessel-members of small to medium length; perforations simple; intervessel pit-pairs large, 10-12 μ in diameter, bordered, alternate, with round to oval border and horizontal, mostly lenticular apertures. *Parenchyma* paratracheal and

apotracheal; paratracheal parenchyma sparse, as few cells about the vessels; apotracheal parenchyma mostly as narrow, irregular, uniseriate, tangential lines between two adjacent rays. *Xylem rays* 1-8 cells and 20-120 μ broad, upto 4 mm. high, 6-8 per mm.; ray tissue markedly heterogeneous; rays divisible on the basis of size and composition into two types; the uniseriate rays, homocellular, of upright cells only; the multiseriate rays, heterocellular, consisting of procumbent cells in the thickened portion with sheath cells at the flanks and 1-5 or more rows of marginal upright cells. *Fibres* moderately thick-walled, non-septate.

Holotype — B.S.I.P. Museum No. 32778.
Locality — Mahurzari, district Nagpur, Maharashtra.
Horizon — Deccan Intertrappean Series.
Age — Early Tertiary (probably Eocene).

ACKNOWLEDGEMENTS

We are thankful to Mr. K. Ramesh Rao, Officer-in-Charge, Wood Anatomy Branch, Forest Research Institute, Dehra Dun, for laboratory and library facilities given during our stay at the Institute, and for sending us wood samples of the species of *Barringtonia*.

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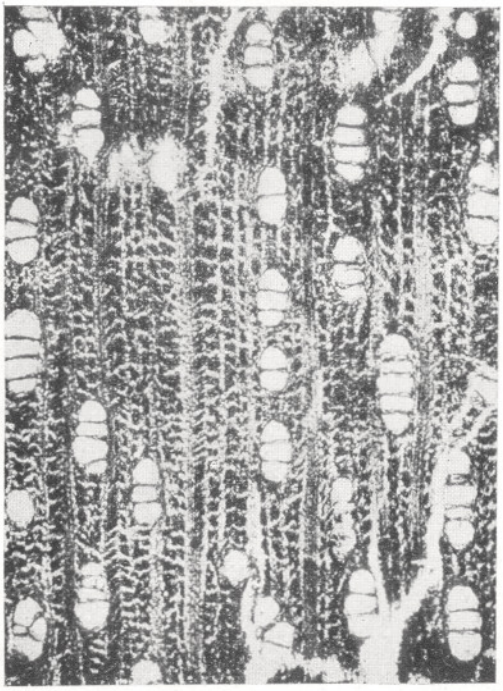

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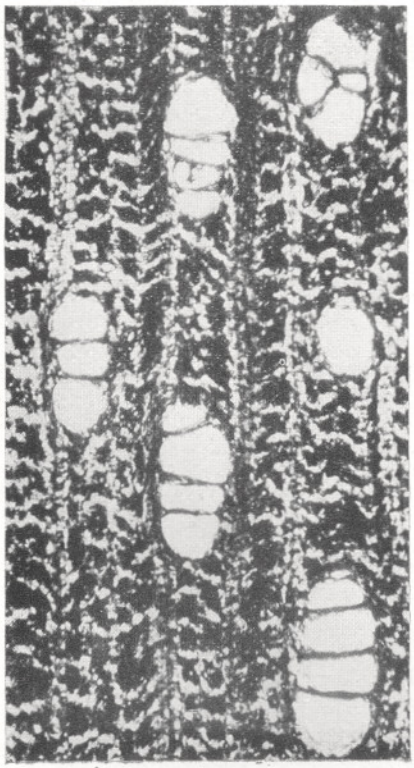

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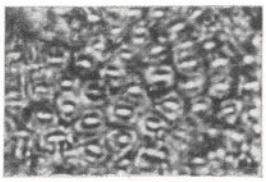

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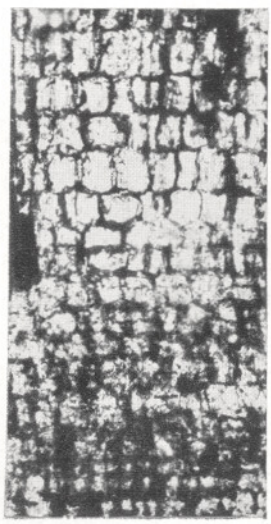

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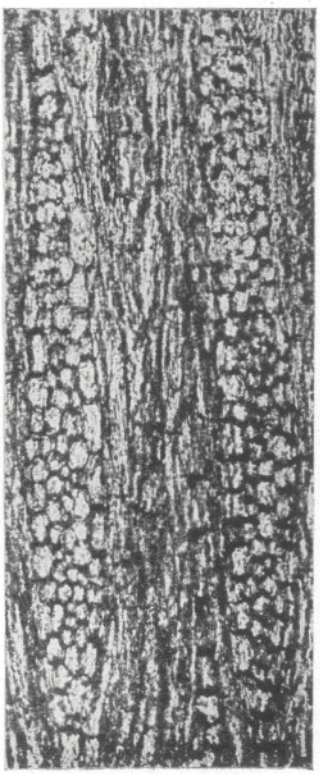

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EXPLANATION OF PLATE 1

Barringtonioxylon eopterocarpum sp. nov.

1. Cross-section to show the distribution of the vessels and parenchyma. Note the preponderance of radial multiples of vessels. × 28.
2. Tangential longitudinal section to show the tyloses and distribution of the xylem rays. × 60.
3. Intervessel pit-pairs. × 400.
4. Cross-section at higher magnification to show the shape and size of the vessels and lines of apotracheal parenchyma × 60.
5. Radial longitudinal section showing the heterogeneous ray tissue. Note the marginal rows of upright cells. × 120.
6. Tangential longitudinal section at higher magnification showing the xylem rays with sheath cells at the flanks. × 125.