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A fossil dicotyledonous wood of Ochnaceae from the Deccan Intertrappean sediments of Mahurzari, Nagpur District, Maharashtra, India

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ABSTRACT

Ramteke DD & Kapgate DK 2016. A fossil dicotyledonous wood of Ochnaceae from the Deccan Intertrappean sediments of Mahurzari, Nagpur District, Maharashtra, India. The Palaeobotanist 65(2): 297–303.

The paper describes anatomical details of fossil wood of family Ochnaceae, *Ochnaceoxylon tertiera* from the Deccan Intertrappean sediments. The wood is preserved in silicified chert from the Deccan Intertrappean beds exposed in a quarry near the village of Mahurzari, India about 14 km from Nagpur (lat. 21°13.280' N, long. 79°0.84' E). The wood described here is silicified measures about 10.5 cm in length and 4.6 cm in diameter. Its detailed anatomy is studied through Transverse Section (T.S.), Tangential Longitudinal Section (T.L.S.) and Radial Longitudinal Section (R.L.S.) planes. The wood is diffuse porous, vessels are mostly solitary and few are in multiples of two to three. Perforation plate is simple and obliquely placed; rays are biseriate to multiseriate and heterogenous, tyloses present. The wood is compared with modern families like Apocynaceae, Dipterocarpaceae, Ochnaceae and Ericaceae. The reported fossil wood shows close resemblance with modern family Ochnaceae. Members of the family Ochnaceae are evergreen, mainly small trees or shrubs, and are presently distributed in tropical and subtropical forests and Savannas. The existence of wood shows the palaeoecological evidence during Maastrichtian.

Key–words—Deccan Intertrappean beds, Fossil wood, *Ochnaceoxylon tertiera*, Palaeoecological.

महाराष्ट्र, भारत में जिला नागपुर, महुरज़री के दक्कन अतःट्रेपी अवसादों से प्राप्त ऑकनेसी की जीवाश्म द्विबीजपत्री काष्ठ

डी. डी. रामटेके एवं डी. के. कपगटे

सारांश

दक्कन अंतःट्रेपी अवसादों से प्राप्त *ऑकनेसीऑक्सीलॉन टरशिरा,* ऑकनेसी कुटुंब की जीवाश्म काष्ठ का यह शोध पत्र वर्णन करता है। काष्ठ भारत में नागपुर (21°13.280' उत्तर, 79°0.84' पूर्व) से लगभग 14 किमी महुरज़री के समीप ग्राम की खदान में अनावरित दक्कन अंतःट्रेपी से प्राप्त सिलिकीभूत चर्ट में परिरक्षित है। यहाँ वर्णित सिलिकीभूत काष्ठ 10-5 सेमी लंबी और 4-6 सेमी व्यास की है। इसका विस्तृत शारीरीय अध्ययन छिलका खंड़ों के माध्यम से किया गया है जो टी.एस., टी.एल.एस. एवं आर.एल.एस. समतल के साथ लिए गए थे। काष्ठ विसरित सरंध्र है, वाहिकाएं ज्यादातर एकल हैं तथा कुछ दो या तीन की गुणज हैं। छिद्रण आधार पट्टिका साधारण है और तिर्यकता से स्थापित है; किरणें दविपंक्तिबद्ध से बहुपंक्तिबदध एवं विषमांगी, टाइलोज विद्यमान हैं। काष्ठ एपोनेसी, डिप्टेरोकार्पेसी, ऑकनेसी एवं एरिकेसी जैसे आधुनिक कुटुबों के तुल्य है। प्रस्तुत जीवाश्म काष्ठ आधुनिक कुटुंब ऑकनेसी के साथ निकट सदृशता दर्शाता है। ऑकनेसी कुटुंब के सदस्य सदाहरित खासतौर पर छोटे पेड़ या झाड़ियाँ हैं। फिलहाल विश्व के उष्णकटिबंधीय और उपउष्णकटिबंधीय वनों एवं सवाना में वितरित है। काष्ठ का अस्तित्व मास्ट्रीक्शियन वनस्पति–जात के दौरान पुरापारिस्थितिकीय प्रमाण दर्शाता है।

सूचक शब्द—दक्कन अंतःट्रेपी संस्तरें, जीवाश्म काष्ठ, *ऑकनेसीऑक्सीलॉन टरशिरा,* पुरापारिस्थितिकीय।

INTRODUCTION

ANATOMICAL details of the well preserved petrified dicotyledonous fossil wood of family Ochnaceae is described in this paper. Ochnaceae family comprises 53 genera and some 600 species of tropical trees and shrubs, and a few genera of herbs. The tropical African and Asian genus *Ochna* has nearly 90 species.

The megafossil record of the Ochnaceae reveals an intriguing biogeographical pattern. Fossils are known currently from only two Palaeogene sites: leaves from the Early Eocene, Mississippi (Danehy *et al.,* 2007) and the *Paleoochna* fruits (Stefanie *et al.,* 2015) from the Late Palaeocene. We lack direct evidence of family Ochnaceae from Deccan Intertrappean beds of central India.

The Deccan Intertrappean beds in which *Ochnaceoxylon* occurs are sedimentary strata of lacustrine and fluviatile deposition, interbedded between successive basalt flows. The basalts were formed during the latest Cretaceous and Palaeocene as a result of volcanic eruptions and outpouring and subsequent cooling of lava which spread over a greater part of central, south–east and south–west of the peninsular India covering an area of about 525,000 sq km. These eruptions occurred over an interval of about 3 million years (ca 67–64 Ma; Hooper *et al*., 2010). Biogeographic affinities of the Deccan flora are of interest because the Indian subcontinent had not yet affixed to Asia, and is expected to contain elements of Gondwanan affinity, possibly reflecting former connection with Madagascar, and/or unique taxa that differentiated while the subcontinent was isolated from other land masses (Bajpai, 2010).

The petrified well preserved fossil angiospermous dicotyledonous wood collected during field visit from Deccan Intertrappean Sedimentary beds lies at Mahurzari, about 14 km from Nagpur (lat. 21°13.280' N, long. 79°0.84' E) (Fig. 1). However, angiosperms are abundant during the Deccan volcanism and the studies advocated that most of the Intertrappean exposures are Maastrichtian in age. The Deccan Intertrappean flora of India occupies a unique position in the palaeovegetational history of India. The fossil flora is represented by a variety of well–preserved woods, leaves, fruits, flowers belonging to all major plant groups (Prakash, 1960; Chitaley, 1962; Bande *et al*., 1988; Bande & Chandra, 1990; Kapgate, 2005).

So far, fossil megafloral records from this locality, include a monocot fruit *Viracarpon sahnii* (Chitaley *et al.,* 1969), a flower *Sahnipushpam* Shukla (Kapgate *et al.,* 2011) oldest fruits of the grape family–Vitaceae (Manchester *et al.,* 2013), monocot wood *Palmoxylon eocenum* (Prakash,

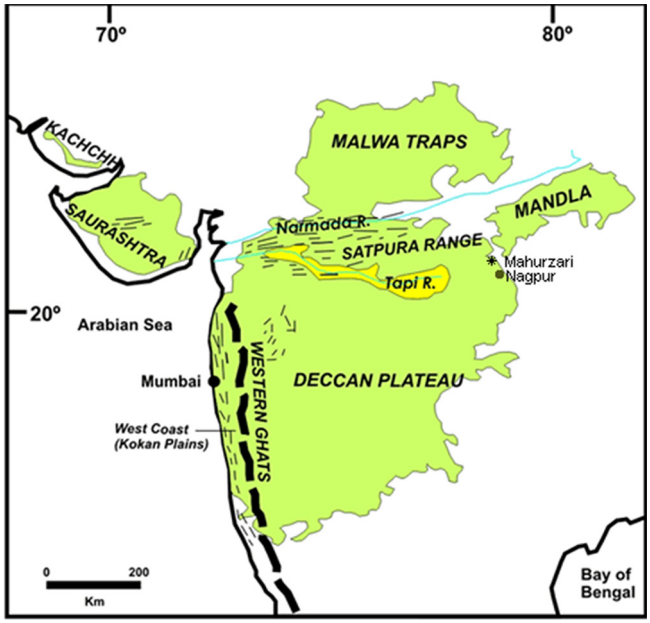

Fig. 1—Western and central India showing extent of Deccan basalts (green), showing fossil locality Mahurzari (marked by star). Base map modified from GSI.

1962a), few dicot leaf impressions (Trivedi, 1956) and dicot woods like *Ailanthoxylon mahurzariense* (Shallom, 1959b; Idem, 1961), *Anacardioxylon semicarpoides* (Prakash & Dayal, 1965b), *Aeschynomene tertiara* (Prakash, 1962b, 1963, Idem, 1962), wood of Rutaceae (Chitaley & Shallom, 1962), *Elaeocarpoxylon antiquum* (Prakash & Dayal, 1964), *Grewioxylon mahurzariense* (Prakash & Dayal, 1963), *Simarubaceoxylon mahurzarii* (Idem, 1959; Shallom, 1959a), *Simarubaceoxylon indicum* (Prakash, 1962c), *Barringtonioxylon eopterocarpum* (Prakash & Dayal, 1965a), *Hibiscoxylon intertrappeum* (Trivedi & Ambwani, 1971), *Erythroxylon mahurzarii* (Kapgate, 2007), *Burseraceoxylon barbadense* (Sheikh, 2011). The present investigation of fossil wood resembling the Ochnaceae from this locality is discussed.

MATERIAL AND METHODS

A well preserved silicified piece of fossil wood is collected in in–situ condition. The specimen is cut in transverse, tangential longitudinal and radial longitudinal plane for revealing xylotomical characters. Peel sections are taken after etching with hydrofluoric acid and thoroughly washed with water (Darrah, 1936; Joy *et al*., 1956; Stewart & Tylor, 1965; Holmes & Lopez, 1986; Kapgate *et al.,*

PLATE 1

1. T.S. of fossil wood showing distribution of vessels. × 50.
2. T.L.S. showing distribution of xylem rays, fibres and vessels. × 50.
3. T.L.S. showing xylem rays and xylem parenchyma. × 100.
4. R.L.S. showing heterogenous nature of the rays. × 100.
5. Perforation plates on the vessel. × 180.
6. Intervessel pit pairs. × 250.

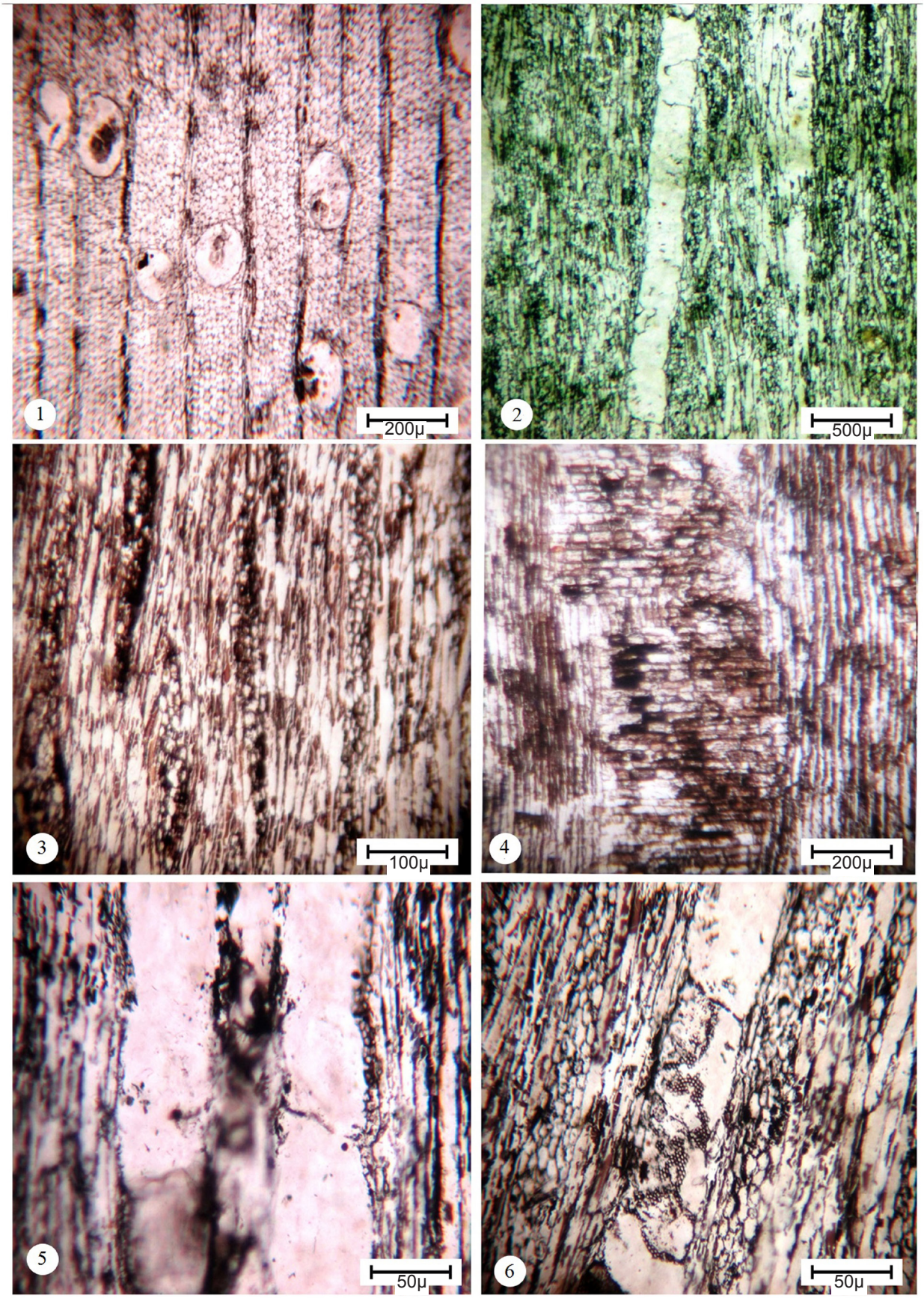

PLATE 1

2011). The peels were mounted in DPX and observed under microscope for detail study.

Description—Fossil wood specimen measures about 4.6 cm in diameter and 10.5 cm in length. The primary tissue and growth rings are absent. The secondary wood is diffuse porous. It consists of vessels, wood parenchyma, wood rays and wood fibres (Pl. 1).

Vessels—Vessels are of medium sized, mostly solitary; few are in radial multiples of 2–5, circular in transverse plane, with single layer boundary wall (Pl. 1.1, Fig. 2.1). The tangential diameter of the vessels is 100–180 µm and radial diameter 90–160 µm. The vessel frequency is 12–15 per square mm. Vessel parenchyma present. Perforation plates are oblique and simple (Pl. 1.5). Intervascular pit pairs are opposite, bordered and polygonal, measure about 25–30 µm in diameter (Pl. 1.6, Fig. 2.2). Pit pores are oval in shape. Tyloses present (Pl. 1.1, Fig. 2.1).

Xylem parenchyma—The wood parenchyma cells are thin walled, paratracheal, vasicentric and single layered around the vessel. Cells of wood parenchyma are elongate (Pl. 1.3), 40–50 µm in diameter and 40–110 µm in length.

Wood rays—Rays are heterogenous, small and contiguous with vessels (Pl. 1.4, Fig. 2.5). Perforation plates are simple. The rays are biseriate to multiseriate (Pl. 1.3, Figs 2.3, 4). The biseriate xylem rays are 16–25 cells in height and measure up to 40–50 µm in diameter. The multiseriate xylem rays are 24–40 cells in height and measure up to 90–120 µm in diameter. The frequency of xylem rays is measures 8–10 per square mm. Bordered pitting observed in the few cells of the rays. Narrow and broad rays are clearly differentiated. Narrow rays are comparatively abundant. Broad rays are few. Both the types of xylem rays are intermixed with each other.

Wood fibres—The wood fibres are thin walled and elongated. They form a major mass of the wood. In transverse section they are squarish to hexagonal in shape (Pl. 1.3), usually non septate, few are septate and measure up to 250–560 µm in length and 40–50 µm. in diameter. All these fibres are storied. Simple pits are present on the fibre wall.

DISCUSSION AND IDENTIFICATION

From the above study the fossil wood specimen shows following anatomical features.

- Diffuse porous wood.
- Mostly solitary vessels with few in multiple of two to five.
- Simple and obliquely placed perforation plate.
- Paratracheal, vasicentric xylem parenchyma.
- Biseriate to multiseriate and heterogenous rays.
- Bordered and opposite intervascular pit.
- Squarish to hexagonal, non septate fibres, sometimes septate and storied.
- Multiseriate, heterogenous and contiguous wood rays with bordered pits.
- Tyloses present.

By considering above features, for identification of the present fossil wood, key given by Records and Chattaway (1939), Metcalfe & Chalk (1950) and Shallom (1963) were used. The characters of the specimen mentioned above suggest its relationship to the wood of the following families (Metcalfe & Chalk, 1950; Esau, 1970; Fahn, 1989).

- Acanthaceae
- Apocynaceae
- Dipterocarpaceae
- Ochnaceae
- Ericaceae

COMPARISON

The present wood resembles those of family Acanthaceae in possessing characters like, diffuse porous wood, mostly solitary vessels, simple perforation plates, alternate pitting and presence of tyloses. But this family differs in presence of small size vessels, variable parenchyma, commonly verse space or absent, exclusively uniseriate homogenous rays with conspicuous intercellular spaces and septate fibres.

It also resembles family Apocynaceae in possessing characters like mostly solitary vessels, simple perforation, paratracheal, vesicentric parenchyma, heterogenous rays, typically 2–3 cells wide, thin walled fibres, elongated, pitting with small or distinct borders of medium to moderately short length. But this family differs in exclusively uniseriate rays, sometimes 3–5 cells wide and more than 1 mm high.

The present wood specimen is also comparable with family Dipterocarpaceae in possessing characters like few to numerous vessels, simple perforation plates, alternate intervascular pitting, paratracheal, vasicentric parenchyma, heterogenous rays, fibres with simple or distinctly bordered pits and presence of tyloses. But this family differs in scattered parenchyma, radial multiples of 4 or more cells, fibriform vessel members, typically apotracheal parenchyma, up to 4–8 cells wide rays, variable in height, more than 1 mm high and presence of intercellular canals.

The present wood also shows affinities with family Ericaceae in possessing characters like solitary vessels, simple perforation plates, paratracheal parenchyma, intervascular pitting opposite, heterogenous rays, ray frequency is 10–15 per sq. mm, fibres septate, pits simple. But this family differs in very small vessels, more than 1 mm high bordered interfibre pits and 3–10 cells wide rays.

The present wood sample shows greatest resemblance to the wood of family Ochnaceae in having vessels of medium size (100 µ) with 10–15 per square mm frequency, typically simple and oblique bordered perforation plates, presence of tyloses, abundantly paratracheal vasicentric parenchyma, biseriate to multiseriate, heterogenous medullary rays and distinctly bordered pitting fibres of medium length. Thus as

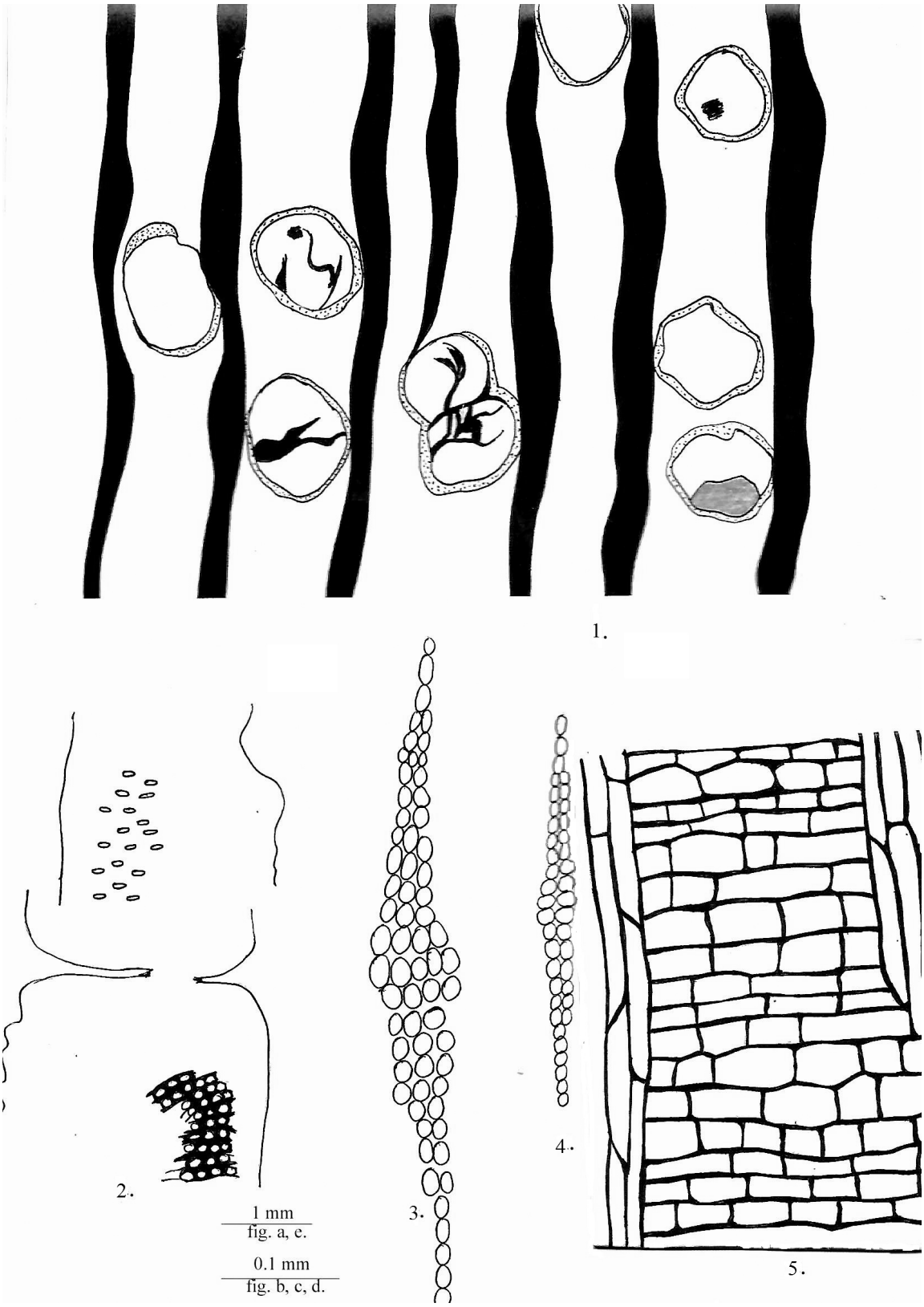

Fig. 2—1. T.S. of wood showing distribution of vessels and fibres, 2. intervascular pit pairs, 3. multiseriate wood ray, 4. biseriate wood ray, 5. R.L.S. of wood showing heterogenous wood rays.

compared to other families, the present fossil wood closely resembles the family Ochnaceae.

Generic diagnosis

Ochnaceoxylon gen. nov.

Wood diffuse porous, growth rings absent, vessels medium sized, mostly solitary, perforation plate simple and oblique, intervascular pit pairs opposite and bordered, xylem parenchyma paratracheal vasicentric, wood rays heterogenous, bi– to multiseriate, fibre non septate, few are septed and storied.

Specific diagnosis

Ochnaceoxylon tertiera gen. et sp. nov.

Central pith is not distinguished. Growth rings are absent. Vessels are of medium sized, solitary, few are radial multiple of two to five. Vessel having tangential diameter 100–180 µm, radial diameter 90–160 µm. Their boundary walls are thick. Vessel frequency 12–15 per square mm. Rays are contiguous with vessels. Perforation plates are oblique and simple. Intervascular pit pairs opposite, bordered and polygonal. Pit pores are oval in shape. Xylem parenchyma cells are thin walled, paratracheal, vasicentric and one layer around the vessel. Xylem rays are heterogenous and are bi– to multiseriate. Biseriate rays are of 16 to 25 cells in height and 40–50 µm in diameter. Multiseriate rays are 24 to 40 cells in height and 90–120 µm in diameter. Frequency of xylem ray is 8 to 10 per square mm. Narrow rays are comparatively abundant than broad rays. Both narrow and broad rays are intermingled with each other. Wood fibres are non–septate, few are septate and storied, elongated, square to hexagonal, 250–560 µm in length, 40–50 µm in diameter.

Holotype—DDR/Deposited at Botany Department, J.M. Patel College, Bhandara.

Horizon—Deccan Intertrappean Series of India.

Locality—Mahurzari, near Nagpur (M.S.) India.

Age—Maastrichtian–Palaeogene.

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