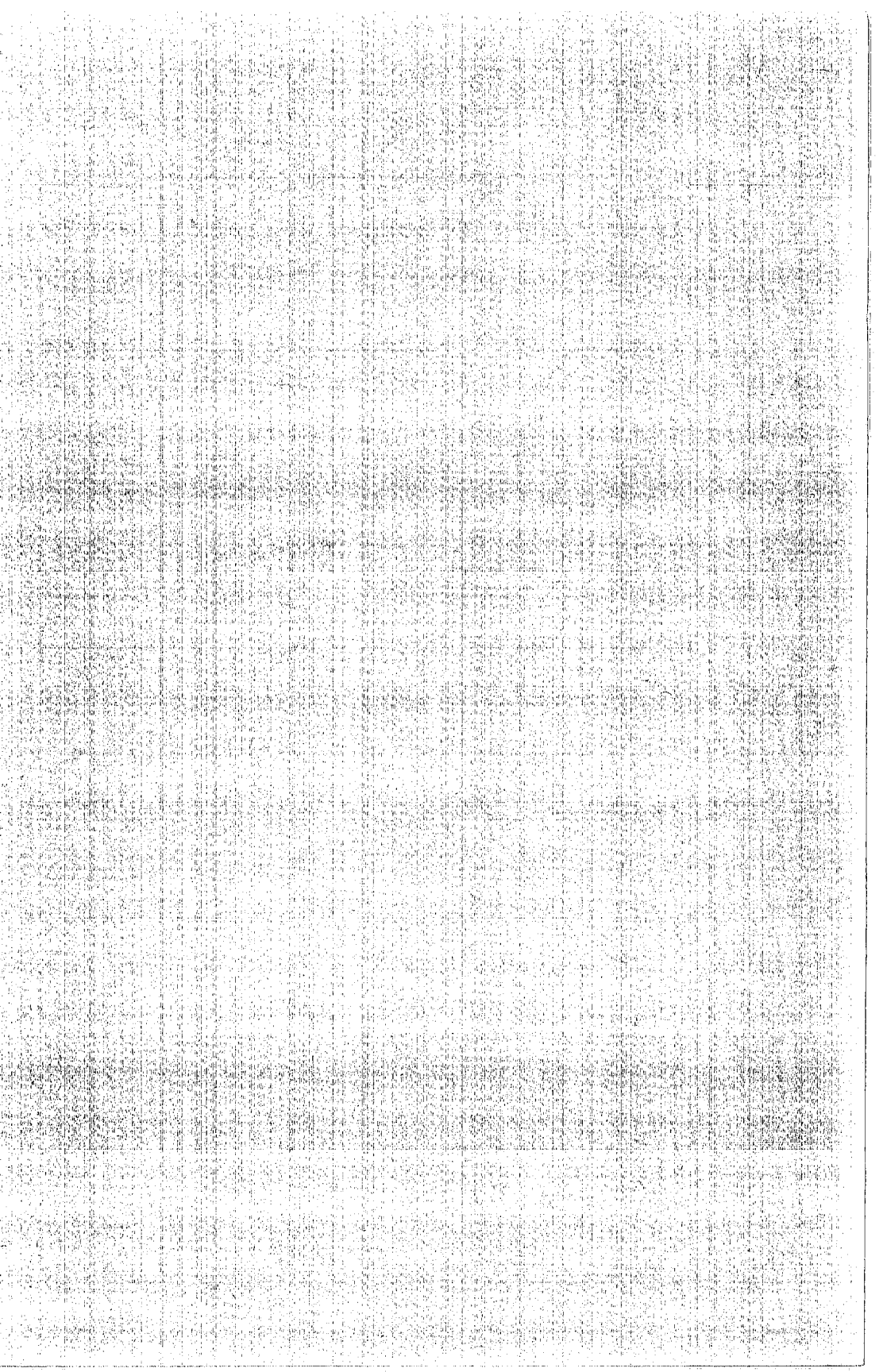


GEOLOGY STUDIES

Volume 22, Part 1—September 1975

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Elaeocarpus Chitaleyi, sp. nov., from the Deccan Intertrappen Beds of India

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ABSTRACT.—A woody dicotyledonous stem from the Deccan Intertrappen beds of India closely resembles wood of the extant genus *Elaeocarpus* L. but differs sufficiently from the fossil *Elaeocarpoxylon antiquum* Prakash and Dayal and recent *Elaeocarpus* species to designate it a new species, *E. chitaleyi*.

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INTRODUCTION

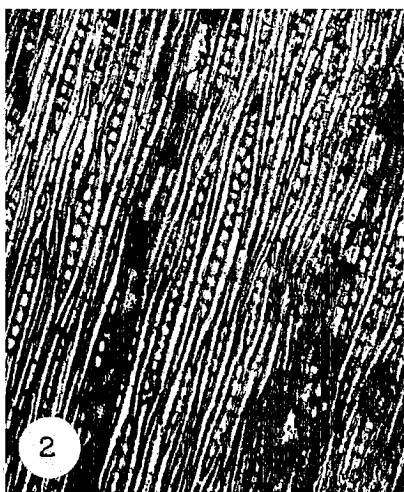
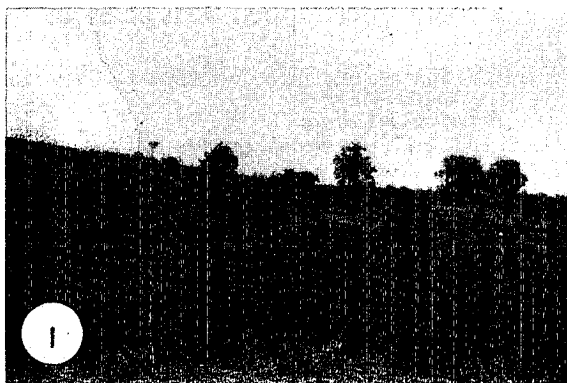
Elaeocarpus chitaleyi sp. nov. was collected from a black chert in the Deccan Intertrappean beds of Mohgoan Kalan, Chhindwara district, Madhya Pradesh, India (Pl. 1, fig. 1). Dicotyledonous woods from this and other localities in this formation were reported by Rode (1936), Verma (1950), Prakash (1956; 1958), Shallom (1960), and others. Prakash and Dayal (1963) described *Elaeocarpoxylon antiquum* from the Mahurzari locality near Nagpur and compared it with 33 living species of *Elaeocarpus*. They decided that the nearest affinities of the fossil are with *E. ferrugineus* Bedd and *E. ganitrus* Roxb. but that *Elaeocarpoxylon antiquum* is closer to the former. No other species of *Elaeocarpoxylon* or petrified *Elaeocarpus* have been described from Mohgaon Kalan beds.

MATERIALS AND METHODS

The stem of *Elaeocarpus chitaleyi* is 13.5 mm in diameter (Pl. 2, fig. 1) and shows good preservation. It is complete with epidermis, cortex, phloem, secondary and primary xylem, and pith. The anatomical descriptions were made from studying several acetate-peels and thin-sections of transverse, tangential, and radial sections.

DESCRIPTIONS

The epidermis consists of one cell layer and occurs in broken patches around the stem. Each cell is 15 μ m wide in radial section and 27 μ m long in tangential view. Cuticle is present, and the cortex, separated from the wood at several places, is 305 μ m thick. It is differentiated into an outer layer of



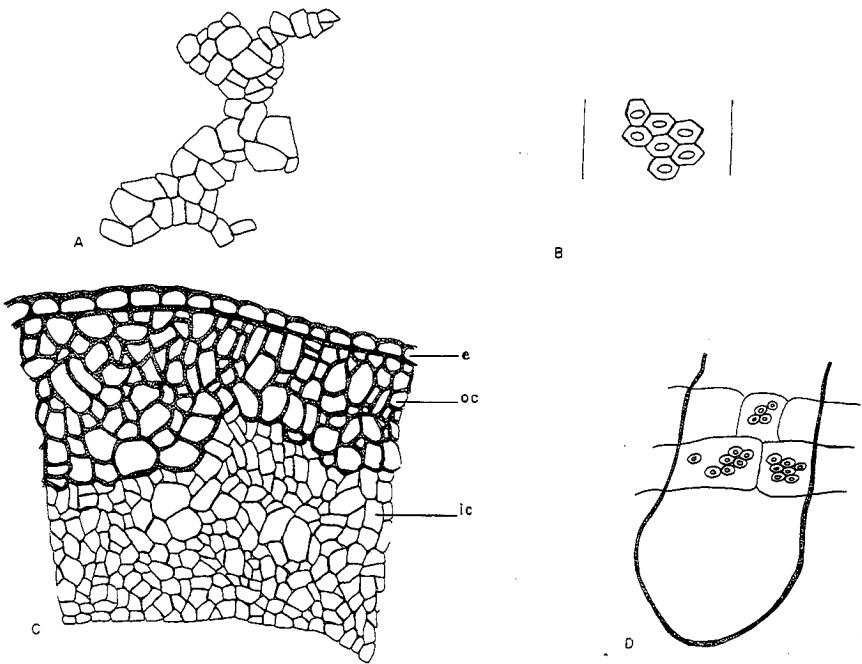
EXPLANATION OF PLATE 1

Elaeocarpus chitaleyii

FIG. 1.—Locality in the Deccan Intertrappean beds at Mohgaon Kalan, India.

FIG. 2.—Tangential section showing the types of wood rays (250 X).

FIG. 3.—Radial section of protoxylem vessels (px) with spiral thickenings (300 X).



TEXT-FIGURE 1.—*Elaeocarpus chitaley*. (a) Tangential section of phloem cells (120 X). (b) Closeup of a portion of a vessel element showing intervacular pit pairs (400 X). (c) Transverse section of stem showing epidermis (e), outer cortex (oc) and inner cortex (ic) (150 X). (d) Radial section illustrating crossfield pits (400 X).

thick-walled cells and an inner layer of thin-walled cells (Text-fig. 1c). Cortical cells are polygonal in longitudinal section and polygonal to round in transverse section. Their transverse diameter varies from $14\ \mu\text{m}$ to $28\ \mu\text{m}$, and intercellular spaces may or may not be present.

The phloem (Text-fig. 1a; Pl. 2) is continuous around the outer perimeter of the xylem, but primary and secondary phloem cannot be differentiated. In transverse section the phloem contains polygonal, thin-walled parenchymatous cells that vary from $28\ \mu\text{m}$ to $42\ \mu\text{m}$ in diameter. In longitudinal section short sieve tubes can be distinguished among the polygonal cells.

The secondary xylem is $4500\ \mu\text{m}$ thick with 6 visible growth rings. It is diffuse porous (Pl. 2, fig. 4). Vessels are thin walled ($2\ \mu\text{m}$ thick) and circular to oval in outline. Averaging $51.7\ \mu\text{m}$ in radial and $45\ \mu\text{m}$ in tangential diameters, the vessels are typically arranged in chains of 2 to 6 but are occasionally solitary and lack tyloses. They are $200\ \mu\text{m}$ in length, having oblique simple perforation-plates (Pl. 2, fig. 5) and intervacular pits (Pl. 2, fig. 3; Text-fig. 1b) which are bordered and alternately arranged. The intervacular pits vary from $4\ \mu\text{m}$ to $7\ \mu\text{m}$ in diameter and are predominantly contiguous and hexagonal (rarely oval) in outline. Their apertures are horizontal and

lenticular. Cross field pits (Text-fig. 1d) are similar to the intervacular pits. Vessel to axial parenchyma pitting cannot be observed.

Rays average about 20 μm high and 5 μm wide with the shorter types being exclusively uniseriate. The longer may be up to triseriate (Pl. 2, fig. 2). The larger rays are heterogenous, composed of both procumbent and upright cells.

Wood fibres average about 4.3 μm in diameter and 88.5 μm long. Septate and nonseptate types are both present. The interfibre pitting is not clear. In the primary xylem the vessels average 7 μm in diameter. Protoxylem elements are spirally thickened (Pl. 1, fig. 3), whereas the metaxylem elements are pitted.

The pith region, 405 μm in diameter (Pl. 2, fig. 2), is composed of thick- and thin-walled parenchyma cells. The thick-walled cells are compactly arranged and comprise the majority of the pith, whereas the thin-walled cells are loosely arranged.

DIAGNOSIS

Elaeocarpus chitaley sp. nov.

(Pl. 1, figs. 1-3; Pl. 2, figs. 1-5; Text-fig. 1)

Dictyodendrous axis, epidermis single layered, 27 μm thick, cuticle present; cortex with two regions, outer cortical cells thick walled, inner thin walled; phloem thin walled with short sieve tubes; secondary xylem diffuse porous, growth rings distinct; vessels in radial chains up to 6 cells long, occasionally solitary, about 200 μm long, radial diameter averages 51.7 μm , tangential diameter averages 45 μm ; intervacular pits medium to large, hexagonal or oval with horizontal lenticular apertures; crossfield pits similar to intervacular pits; axial parenchyma terminal; fibres septate and nonseptate; protoxylem with spiral thickenings, pith composed of thick- and thin-walled parenchyma cells.

Holotype No.—MOH 6/N (to be deposited at the BSIP, Lucknow, India).

Locality.—Mohgaon Kalan.

Horizon.—Deccan Intertrappean Series.

Age.—Early Eocene.

DISCUSSION

Our specimen was compared with other woods described from the Deccan Intertrappean beds, but since it was closest to *Elaeocarpus* L., we made detailed comparisons (Table 1) with *Elaeocarpoxyton antiquum* Prakash and Dayal

EXPLANATION OF PLATE 2

Elaeocarpus chitaley

FIG. 1.—Transverse section of stem with growth rings (7.5 X).

FIG. 2.—Transverse section of a closeup of pith and primary xylem (180 X).

FIG. 3.—Closeup of vessel element showing intervacular pit pairs (400 X).

FIG. 4.—Transverse section of the wood illustrating arrangement of vessels, terminal parenchyma (tp) and growth rings (40 X).

FIG. 5.—Closeup of vessel element having a simple perforation plate (250 X).

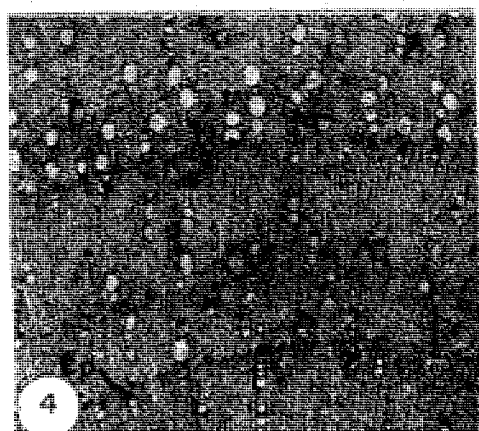
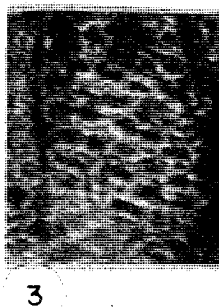
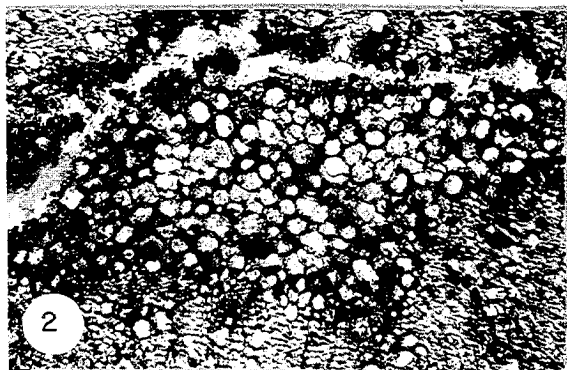
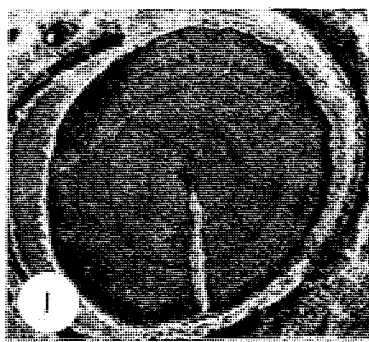


TABLE 1
ANATOMICAL COMPARISONS

Character	<i>Elaeocarpylon antiquum</i> Prakash & Dayal.	<i>Elaeocarpus chitaley</i> sp. nov. (Present specimen)	<i>Elaeocarpus ganirius</i> Roxb.
Epidermis	Not described	A single layer of cells	A single layer of cells
Cortex	Not described	Five to six layers of thin- and thick-walled parenchymatous cells, with or without intercellular spaces, sizes varying 14 μ m to 28 μ m in diameter	Made up of thin-walled parenchymatous cells with intercellular spaces; at places patches of sclerenchyma seen
Phloem	Not described	Made up of thin-walled polygonal cells, 28 to 42 μ m	Thin-walled polygonal cells
Nature of wood	Diffuse porous	Diffuse porous	Diffuse porous
Size	Small to medium	Small	Small to moderately large
Arrangement	Radial multiples of 2-9, solitary or in pairs	Radial rows of 2-6, sometimes solitary or in tangential pairs	Mostly solitary or in radial rows of 2-7
Diameter	60-150 μ m (t.d.), 30-145 μ m (r.d.)	51 μ m (t.d.), 45 μ m (r.d.)	42-50 μ m (t.d.), 45 μ m (r.d.)
Shape of vessel in T.S.	Circular, elliptic, or flat	Circular or oval	Circular or oval
Thickness of wall	Thin walled, 4 μ m thick	Thin walled, 2 μ m	Thin walled
Perforation plate	Simple; horizontal or slightly oblique	Simple, oblique	Simple, oblique
Intervascular pit pairs	Large; 8-12 μ m in diameter, bordered, round oval or hexagonal; usually alternate	Alternate, bordered; medium to large, 4 μ m to 7.2 μ m, mostly hexagonal contiguous	Alternate, bordered; 8.3 μ m in diameter, hexagonal contiguous, large
Aperture	Lenticular, horizontal	Lenticular, horizontal	Linear, lenticular, horizontal

Primary xylem	Vessel parenchyma pits	Large	Not observed	Not observed
	Vessel ray pits	Not described	Similar to intervascular pit pairs	Similar to intervascular pit pairs
	Rays	Medium to fine, contiguous, heterocellular, uniseriate to triseriate	Medium to fine, heterocellular, uniseriate to triseriate	Medium fine or extremely fine, uniseriate to triseriate
Primary xylem	Frequency/mm ²	5-14/mm ²	12/mm ²	24/mm ²
	Vessels	12-18/mm ²	18/mm ²	22/mm ²
	Rays	Septate, thin walled, angular, t.d. 12-32 μ m, r.d. 12-28 μ m	Septate and nonseptate, polygonal; t.d. 4.3 μ m	Septate and nonseptate, t.d. 14 μ m
Pith	Fibres	Not described	Not seen	Not seen
	Interfibre pits	Traumatic	Traumatic	Absent
	Intercellular canals	Present	Absent	Absent
Pith	Tyloses	Paratracheal	Terminal	Terminal
	Parenchyma	Not described	Present, protoxylem with spiral thickenings	Present, protoxylem with spiral thickenings
		Not described	Parenchymatous, thin and thick walled	Parenchymatous, thin walled

(1963) and *Elaeocarpus ganitrus* Roxb. *Elaeocarpus chitaley* differs from *Elaeocarpoxydon antiquum* by having growth rings, shorter vessels, and exclusively oblique perforation plates and by lacking paratracheal axial parenchyma.

Elaeocarpoxydon antiquum was shown to resemble certain extant *Elaeocarpus* woods (Prakash and Dayal, 1963). However, Chowdhury (1965) suggested a reinvestigation of the genus *Elaeocarpoxydon* because he considered its resemblance with *Elaeocarpus* not strong. He based his conclusion primarily on the heterogeneous wood structure of *Elaeocarpus* and other genera of Elaeocarpaceae. He stated that the wood of *Elaeocarpoxydon antiquum* also resembles some woods of *Echinocarpus* Bl., a genus closely affiliated with *Elaeocarpus*. Prakash and Dayal (1963) mentioned that traumatic intercellular canals reported in *Elaeocarpus* by Record (1925) and Desch (1941) are not present in *Echinocarpus*. They also described these canals in *Elaeocarpoxydon*. The presence or absence of these canals and differences between the arrangement of their axial parenchyma distinguishes *Elaeocarpoxydon* from *Echinocarpus*. The axial parenchyma in *Echinocarpus* is confluent, whereas it is paratracheal in *Elaeocarpoxydon*. The terminal parenchyma is also characteristic of *Elaeocarpus chitaley* but not of *Echinocarpus*.

Similarities between *Elaeocarpus chitaley* and *E. ganitrus* Roxb. include the possession of diffuse porous wood, simple perforation plates, and intervascular pit pairs with lenticular or horizontal apertures. However, there are noteworthy differences between our fossil wood and *E. ganitrus* (Table 1). Major differences are (1) the cortex is uniform with scattered patches of sclerenchymatous cells in *E. ganitrus* but is differentiated into an outer and inner layer in the fossil and (2) the fibres are longer in the fossil than in the living species. Considering these differences, our fossil stem is included under the genus *Elaeocarpus* L. as *Elaeocarpus chitaley* sp. nov. The specific epithet is given in honor of Dr. S. D. Chitaley, an eminent Indian botanist.

Prakash and Dayal (1963) reviewed previous reports of fossil remains assigned to *Elaeocarpus*. *Elaeocarpus mackayi* Kirchheimer (1935) are Tertiary fruit remains from Australia. Reports from the Tertiary of Europe and Japan, however, do not show unquestioned affinities with this genus.

Although *Elaeocarpus* is a genus of over one hundred species of trees that are widely distributed geographically, most members of this genus grow in the Indo-Malayan region. *Elaeocarpus ganitrus* Roxb., the living species closest to *E. chitaley*, is commonly known as the rudai tree. These medium to large trees have been reported from various parts of India, Nepal, Assam, North Bengal, Chittagong, Tenasserim and also the Malaysian Peninsula, Java, and Celebes (Chowdhury and Ghosh, 1958).

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