

Fossil woods from the Deccan Intertrappean beds of Madhya Pradesh

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Three fossil woods, namely *Elaeocarpoxyylon ghughuensis* sp. nov. and *E. mandlaensis* Lakhanpal *et al.* of Elaeocarpaceae and *Turraeanthus deccanensis* sp. nov. of Meliaceae, are described from the Deccan Intertrappean beds of Madhya Pradesh. Of these, the fossil wood of *Turraeanthus* is recorded for the first time from India. It is phytogeographically important because its modern counterpart is presently growing in South Africa.

Key-words- Fossil woods, Elaeocarpaceae, Meliaceae, Deccan Intertrappean beds, Upper Cretaceous-Palaeocene, India.

INTRODUCTION

FOSSIL woods are of common occurrence in the Deccan Intertrappean beds of Central India. Those being described in the present communication were collected from the known localities, Mohgaon Kalan and Ghughua of Chhindwara and Mandla districts respectively. The woods are closely comparable to *Elaeocarpus* and *Sloanea* (*Echinocarpus*) of Elaeocarpaceae and *Turraeanthus* of Meliaceae.

SYSTEMATIC DESCRIPTION

Family: Elaeocarpaceae

Genus: *Elaeocarpoxyylon* Prakash & Dayal emend.

Prakash & Tripathi, 1975

Elaeocarpoxyylon ghughuensis sp. nov.

Pl. 1, figs 1-3, 8,9

Description: Wood diffuse-porous. Growth rings distinct (Pl.1, fig.1). Vessels mostly small to medium sized, t.d. 24-120 μm , r.d. 24-180 μm , solitary and mostly in radial multiples of 2-5 or more, round to oval when solitary and flattened at the places of contact when in multiples; tyloses absent, vessels 16-20 per sq mm; vessel members short, 140-400 μm long with oblique ends; perforation simple; intervessel pit-pairs small, alternate, 4-6 μm in diameter (Pl.1, fig. 8); vessel-parenchyma pits

slightly bigger in size, opposite to alternate (Pl.1, fig. 7). Parenchyma not clearly visible, very sparse, a few cells associated with some of the vessels (Pl.1, fig. 1). Rays 1-3 seriate; ray tissue heterogeneous, uniseriate rays made up of upright cells only, 6-10 cells or 140-400 μm long; multiseriate rays made up of procumbent cells in the centre with 1-4 rows of upright cells at one or both the ends, 12-28 cells or 280-600 μm long (Pl.1, fig. 2); end to end ray fusion clearly seen; procumbent cells 8-16 μm in tangential height and 16-24 μm in radial length, upright cells 48-60 μm in tangential height and 16-20 μm in radial length (Pl.1, fig. 3). Fibres aligned in radial rows between two consecutive rays, semi-libriform, 16-20 μm in diameter, non-septate to occasionally septate (Pl.1, fig.2).

Holotype : Specimen no. BSIP 37373.

Locality : Ghughua near Shahpura, Mandla District, Madhya Pradesh.

Age : Upper Cretaceous-Palaeocene.

Affinities - The above mentioned features of the fossil wood indicate its affinity with *Elaeocarpus* L. and *Sloanea* L. (*Echinocarpus* Bl.) of the family Elaeocarpaceae (Pearson & Brown, 1932; Metcalfe & Chalk, 1950; Desch, 1957; Chowdhury & Ghosh, 1958). Wood slides of a number of species of *Elaeocarpus* and *Sloanea* (*Echinocarpus*) were examined in addition to their published descriptions and photographs (Moll & Janssonius, 1908;

Kanehira, 1921; Record, 1925; Lecomte, 1926; Pearson & Brown, 1932; Kukachka & Rees, 1943; Metcalfe & Chalk, 1950; Desch, 1957; Chowdhury & Ghosh, 1958; Gasson, 1996). It was found that the fossil wood shows close resemblance with xylogically similar species of *Elaeocarpus*, viz., *E. recurvatus* Corner (*E. ferrugineus* Bedd., BSIP W no. 246), *E. floribundus* Bl. (BSIP W no. 438) and *E. tectorius* (Lour.) Poir (*E. robustus* Roxb., BSIP W no. 247) in most of the characters.

Three fossil woods showing affinities with *Elaeocarpus* and *Sloanea* (*Echinocarpus*) are known from India. These are *Elaeocarpoxyton antiquum* Prakash & Dayal (1964) and *E. mandlaensis* Lakhanpal *et al.* (1978) from the Deccan Intertrappean beds of Mahurzari and Mohgaon of Nagpur and Mandla districts respectively and *E. hailakandiense* Prakash & Tripathi (1975) from the Tipam Series of Assam. *E. antiquum* differs from the present fossil wood in having traumatic gum canals and septate fibres. On critical examination of its type slides it was observed that, unlike *Elaeocarpus*, the fossil possesses large amount of parenchyma in the form of broken tangential lines. Hence, the affinity of this wood with Elaeocarpaceae is questionable. *E. hailakandiense* also differs in having slightly bigger vessels (t.d. 25-190 μ m, r.d. 52-210 μ m), broader xylem rays (1-8 seriate) and crystalliferous fibres as against 1-3 seriate xylem rays and fibres without crystals in the present fossil wood. *E. mandlaensis* differs significantly from the present fossil mostly in having smaller vessels (t.d. 30-75 μ m) and broader xylem rays (1-8, mostly 6-8 seriate).

Since the present fossil wood is quite distinct from all the previously known species of *Elaeocarpoxyton*, it is being described as a new species, *E. ghughuensis*, the specific name indicates its occurrence in Ghughua.

Elaeocarpoxyton mandlaensis Lakhanpal *et al.* 1978

Pl. 1, figs 4-7; Pl.2, fig. 1

Figured specimen: Specimen no. BSIP 37374

Locality: Mohgaon Kalan, Chhindwara District, Madhya Pradesh.

Age: Uppr Cretaceous - Palaeocene.

Material: Two specimens measuring 2.2 cm in diameter and 8 cm in length show fairly good preservation.

Remarks: The anatomical details of fossil woods show their affinities with *Elaeocarpoxyton mandlaensis* Lakhanpal *et al.* (1978) resembling the modern species *Sloanea assamica* Reh. & with (*Echinocarpus assamicus* Benth.) and *S. sigun* K. Schum (*E. sigun* Bl.) from Deccan Intertrappean beds of Mandla district. However, the present fossil woods differ from *E. mandlaensis* in having growth rings demarcated by a thin band of thick-walled fibres, bigger vessels (t.d. 40-120 μ m) and longer xylem rays (upto 2160 μ m). Since these all the variable characters, the fossil woods are being placed under the same species.

Family : Meliaceae

Genus - *Turraeanthus* Baill.

Turraeanthus deccanensis sp. nov.

Pl.2, figs 2-6

The material consists of a piece of secondary wood measuring 7 cm in length and 5.5 cm in width.

Description: Wood diffuse-porous. Growth rings not observed (Pl.2, fig. 2). Vessels mostly small to medium-sized, rarely very small or large, t.d. 42-170 μ m, r.d. 56-210 μ m, solitary as well as in radial multiples of 2-4, rarely in clusters, usually circular to oval when solitary, evenly distributed, 6-11 per sq. mm; tyloses absent (Pl.2, figs 2,4); vessel members 250-580 μ m long with oblique to horizontal ends; perforations simple; inter-vessel pits bordered, alternate, about 8 μ m in diameter, angular in shape with lenticular apertures (Pl.2, fig. 6). Parenchyma scanty paratracheal, parenchyma cells thin walled, 50-85 μ m in length and 28-30 μ m in diameter (Pl.2, figs 3,4).

Plate 1

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| <ol style="list-style-type: none"> 1. <i>Elaeocarpoxyton ghughuensis</i> sp. nov. - Cross section showing shape, size and distribution of the vessels, x 60; Slide no. BSIP 37373 - I. 2. <i>E. ghughuensis</i> sp. nov. - Tangential longitudinal section showing structure of the xylem rays and fibres, x 60; Slide no. BSIP 37373-II. 3. <i>E. ghughuensis</i> sp. nov. - Radial longitudinal section showing heterogeneous ray tissue, x 120; Slide no. BSIP 37373-III. 4. <i>E. mandlaensis</i> Lakhanpal <i>et al.</i> - Cross section showing shape, size and distribution of the vessels, x 60; Slide no. BSIP 37374-I. 5. <i>E. mandlaensis</i> Lakhanpal <i>et al.</i> - Tangential longitudinal section | <ol style="list-style-type: none"> 6. <i>E. mandlaensis</i> Lakhanpal <i>et al.</i> - Tangential longitudinal section enlarged showing details of xylem rays and fibres, x 100; Slide no. BSIP 37374-II. 7. <i>E. mandlaensis</i> Lakhanpal <i>et al.</i> - Radial longitudinal section showing heterogeneous ray tissue, x 100; Slide no. BSIP 37374-III. 8. <i>E. ghughuensis</i> sp. nov. - Intervessel pits magnified, x 400; Slide no. BSIP 37373-III. 9. <i>E. ghughuensis</i> sp. nov. Vessel parenchyma pits enlarged, x 400; Slide no. BSIP 37373-III. |
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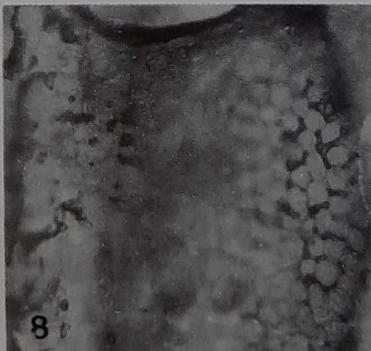
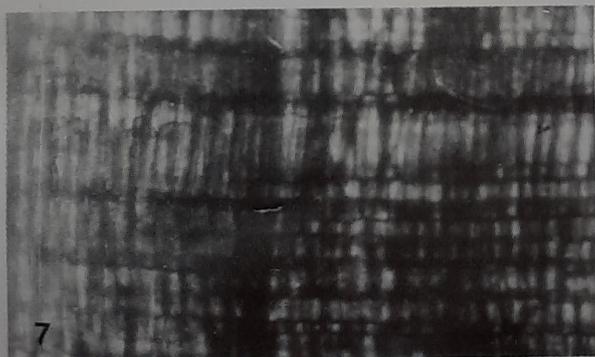
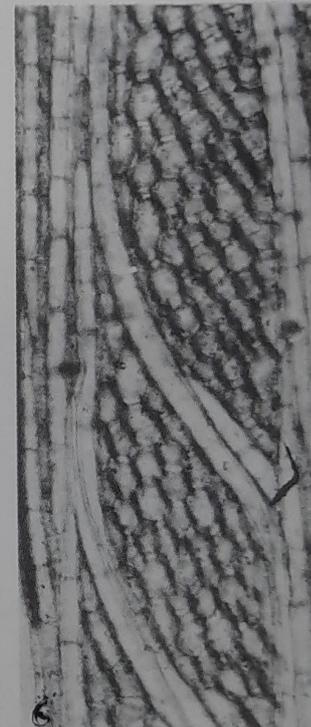
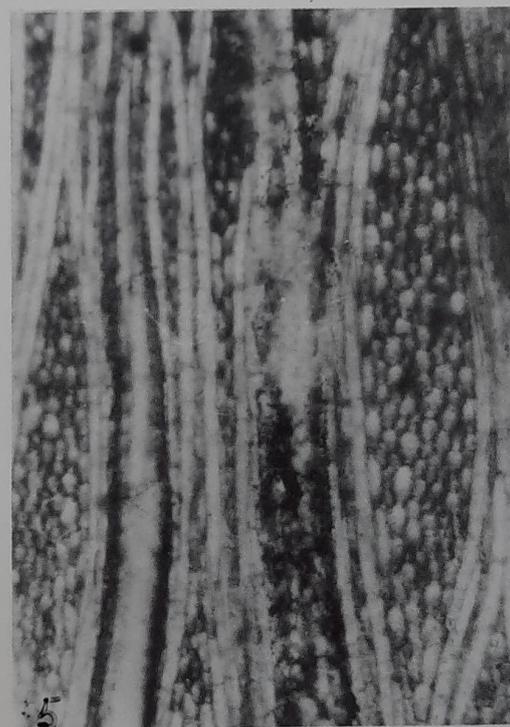
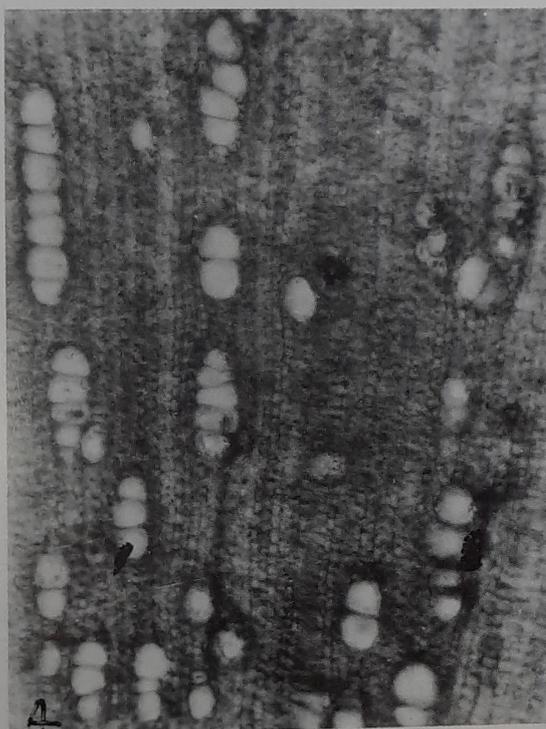
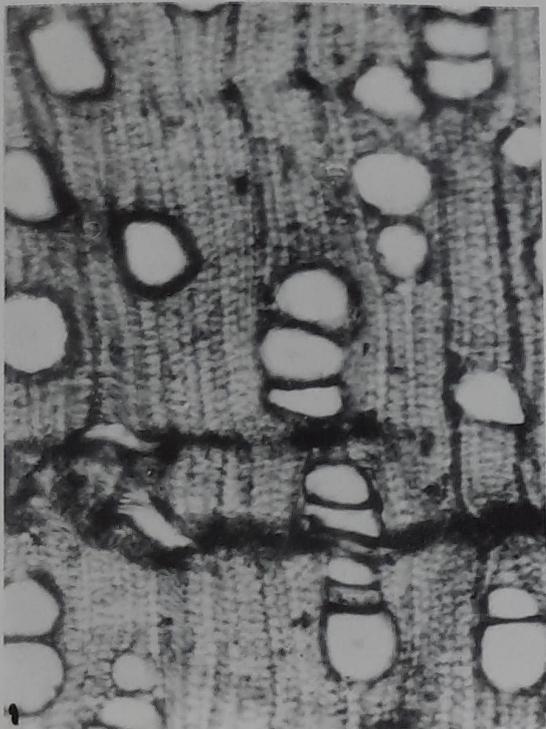


Plate 1

Xylem rays 1-3 (mostly 2) seriate, 5-10 per mm; ray tissue weakly heterogeneous (Pl.2, fig. 6); uniseriate rays made up of either upright cells or both upright and procumbent cells, 12-16 μm in width and 2-10 cells or 60-190 μm in height; multiseriate rays made up of procumbent cells in the central portion and 1-3 rows of upright cells at the ends, 25-55 μm in width and mostly 9-16 (rarely 27) cells or 150-550 μm in height (Pl.2, fig. 3); end to end ray fusion observed; procumbent cells 32-42 μm in radial length and 12-20 μm in tangential height; upright cells 12-20 μm in radial length and 28-40 μm in tangential height (Pl.2, fig. 5). *Fibres* polygonal in cross section, non-libriform to semi-libriform, non-septate, 12-20 μm in diameter and 280-600 μm in length (Pl.2, fig. 3).

Holotype : Specimen no. BSIP 36710.

Locality : Ghughua near Shahpura, Mandla District, Madhya Pradesh.

Age : Upper Cretaceous-Palaeocene.

Affinities - The important anatomical features of the fossil, such as small to medium sized vessels, scanty paratracheal parenchyma, 1-3 (mostly 2) seriate xylem rays and non-septate fibres, indicate its affinity with the genus *Turraeanthus* Baill. of the family Meliaceae (Metcalfe & Chalk, 1950; Normand, 1955; Kribs, 1959; Lebacqz, 1963; Miles, 1978). The fossil wood resembles closely with *T. africanus* (Welu. ex C. DC) Pellegr. (Syn. *T. vignei* Hutch. & Datz.) in most of the structural details although the inter-vessel pits are slightly smaller in the extant species.

So far, there is no record of fossil wood belonging to the genus *Turraeanthus*, therefore it is being placed under *Turraeanthus deccanensis* sp. nov., the specific name indicates its occurrence in the Deccan Intertrappean beds.

DISCUSSION

Elaeocarpus L. is a large genus of 350 species, widely distributed in the Old World. Most of them are distributed in the Indo-Malaysian region, out of which 25 species occur in Indian sub-continent. *E. recurvatus* Corner (*E. ferrugineus* Bedd.) grows in the forests of

Western Ghats, in the Nilgiris, Anamalais, Pulney hills and hills of Travancore, while *E. floribundus* Bl. and *E. tectorius* (Lour.) Poir (*E. robustus* Roxb.) are found in North Bengal, Sikkim, Assam, Chittagong and Myanmar (Chowdhury & Ghosh, 1958). The genus *Sloanea* L. consists of about 150 species, distributed in Madagascar, tropical Asia to Australia and South America. *S. assamica* Rehd. & Wib. (*Echinocarpus assamicus* Benth.) gregariously grows on river banks of Assam and Sikkim, while *S. sigun* K. Schum (*Echinocarpus sigun* Bl.) is found in Assam, Myanmar, Cambodia and Java.

The genus *Turraeanthus* Baill. consists of about 6 species distributed in South Africa.

The modern equivalents of the fossils support the fact that the evergreen to semi-evergreen types of forests were existing in central India under very warm and humid climate during Upper Cretaceous - Palaeocene time.

Ever since the discovery of *Rodeites dakshini* Sahnii (1943), a number of plants of other continents are known from the Deccan Intertrappean beds (Bande *et al.*, 1986). The presence of an African element in the Deccan Intertrappean flora is evidenced by the genus *Hyphaene* known from Ghughua. Although one species of this genus still grows in India, all other 40 species are distributed in tropical and subtropical Africa. Similarly, the occurrence of *Chrysalidocarpus* from the same locality, a genus presently growing in Madagascar, is another evidence in the same direction.

Occurrence of Tropical African genera *Hyphaene* and *Turraeanthus* in the Deccan Intertrappean beds (Late Cretaceous - Early Tertiary) of central India supports phytogeographical relationship between India and Africa before they broke apart (Smith & Briden, 1979). The genus *Turraeanthus* and most species of *Hyphaene* later became extinct from India due to changes in the climatic condition.

Plate 2

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| 1. | <i>Elaeocarpoxyylon mandlaensis</i> Lakhanpal <i>et al.</i> - Intervessel pits enlarged, x 400; Slide no. BSIP 37374-II. | 36710 -II. |
| 2. | <i>Turraeanthus deccanensis</i> sp. nov. - Cross section showing shape, size and distribution of the vessels, x 60; Slide no. BSIP 36710-I. | 4. |
| 3. | <i>T. deccanensis</i> sp. nov. - Tangential longitudinal section showing structure of the xylem rays and fibres, x 100; Slide no. BSIP | 5. |
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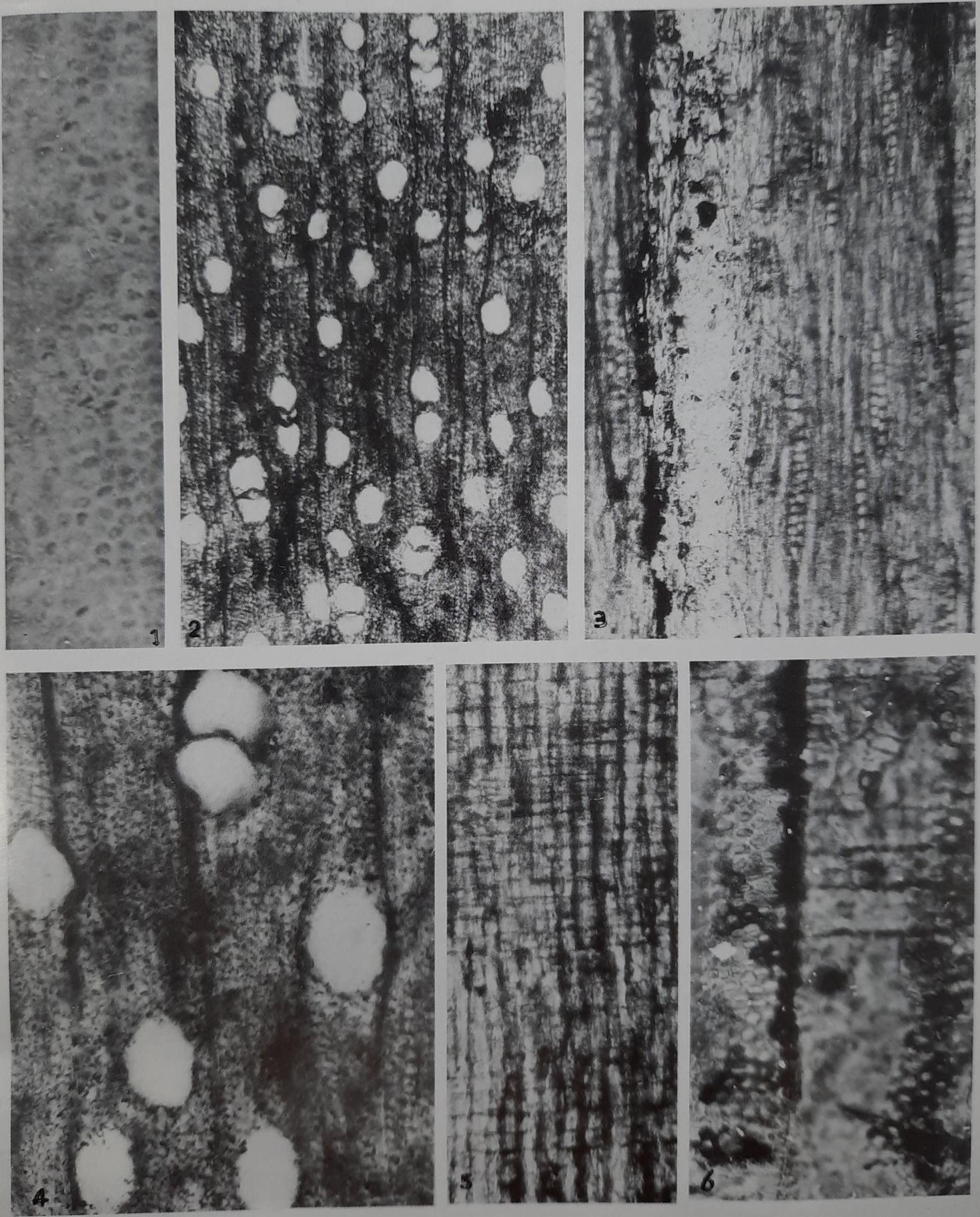


Plate 2

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