

A new genus of podocarpaceous wood from the Lathi Formation (Early Jurassic) of Rajasthan, India

S. D. Bonde

Agharkar Research Institute, G. G. Agarkar Road, Pune-411004, India
E-mail: bondesd@rediffmail.com

ABSTRACT

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The paper reports *Prepodocarpoxyton gregussii* gen. et sp. nov., a permineralized, decorticated, coniferous stem wood from Sodakor near Jaisalmer, Rajasthan. It has a primary structure (pith and primary xylem) surrounded by a well developed secondary wood at one end of the stem and five primary structures with their secondary woods surrounding the central one at the other end indicating the whorled branching at the node. The secondary wood of all the six structures dovetails with one another. Heterocellular pith, endarch primary xylem, tracheids with uniseriate bordered pits, 2-9 cells high xylem rays and podocarpoid cross field pits suggests its resemblance with *Podocarpus*.

Key-words: *Prepodocarpoxyton*, fossil wood, Podocarpaceae, Lathi Formation, Early Jurassic, Rajasthan, India.

INTRODUCTION

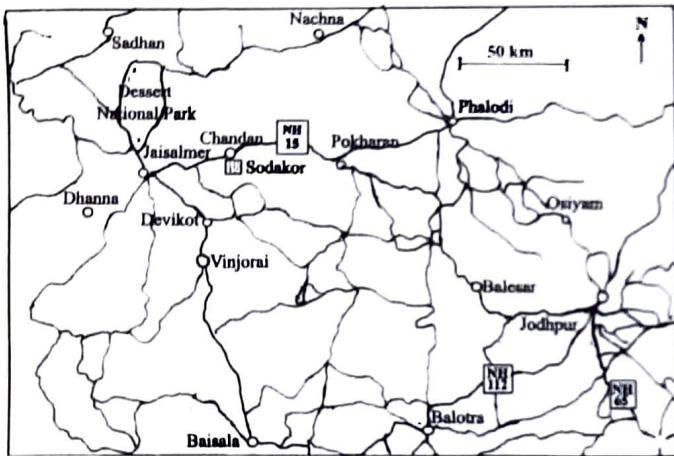
Plant remains from the Lathi Formation, Rajasthan have been recorded by Carter (1862), Blanford (1877), Dasgupta (1977) and Bhatia (1977). Verma (1960 in Narayanan et al. 1961) reported leaf impressions of *Ptilophyllum acutifolium* Morris, *Pterophyllum* sp. and *Equisetites* sp. from an area near Divikot in Barmer District. Verma (1982) reported gastropods, foraminifers, a leaf impression and petrified woods. Srivastava (1966), Lukose (1972) and Singh (1996, 2003) discovered rich pollen and spore assemblage and suggested Early Jurassic age for the Lathi Formation. The adjoining Akal area possesses in situ preserved petrified woods and has been converted into a National Fossil Wood Park by the Geological Survey of India. Sharma and Tripathi (2002) initiated the anatomical investigations of permineralized woods from this area and suggested their affinities with conifer families Podocarpaceae, Cupressaceae and Araucariaceae. The present paper describes a well

preserved, permineralized, coniferous wood from the Lathi Formation.

Western Rajasthan possesses a number of sedimentary basins deposited on Banded Gneissic Complex (B. G. C.), the Malani Igneous Suite and the Erinpura Granite. These basins include a huge thickness of marine sediments classified into Late Proterozoic to Early Cambrian Marwar Supergroup, Permian-Carboniferous Bap-Badhaura Formation, Early Jurassic Lathi Formation to Early Tertiary rocks of the Jaisalmer, Bikaner-Nagaur Basin and the Barmer areas (Datta 1983). The Lathi Formation is composed of a fluvial sequence of conglomerate and sandstone and unconformably overlies the basement rocks containing the Malani Igneous Suite, Ponglo Dolomite, Nagaur Sandstone, Bap Boulder Bed and Badhaura Sandstone. It begins with a conglomerate horizon at the base which grades upward into a coarse and ill-sorted arkosic sandstone containing hematitic nodules and thin bands of lignite having maximum thickness of 360 metres (Sinha-Roy et al. 1998).

MATERIAL AND METHOD

Dr. V. D. Borkar, a palaeontologist of the Agharkar Research Institute, Pune collected a few scattered petrified wood pieces from near Sodakor village, about 50 km from Jaisalmer on Jaisalmer-Pokharan road, Rajasthan (Text-figure 1). These woods belong to the Lathi Formation of Jaisalmer Basin. The piece of wood (S3) having better preservation and distinct characters was kindly handed over to the author for the anatomical investigations.



Text-figure 1. Map of a part of western Rajasthan showing fossiliferous locality-Sodakor.

The wood has been sectioned in transverse, radial longitudinal and tangential longitudinal planes with the help of a diamond cutting wheel. The slides were prepared by the well known technique of grinding and polishing methods. The sections were observed under Nikon Labophot-2 microscope attached with FX 35DX camera and Leica S6D Microscope attached with Canon Powershot S45 digital camera.

SYSTEMATIC DESCRIPTION

Class: Pinopsida

Order: Pinales

Family: Podocarpaceae Endlicher 1847

Genus: *Prepodocarpxylon* Bonde, gen. nov.

Type species: *Prepodocarpxylon gregussii* gen. et sp. nov.

Diagnosis: Node with many primary structures with dovetailed secondary wood; internode with single wood; pith heterocellular; primary xylem endarch; growth rings distinct or indistinct; radial pitting uniseriate, contiguous or separate; wood parenchyma present; xylem rays uniseriate; heterocellular; crossfield pits podocarpoid; bordered.

Description: Specimen S3 is a permineralized cylindrical decorticated piece of wood. It is yellowish brown in colour, 12.5 cm long and 6.0 x 9.5 cm in diameter. It has a primary structure (pith and primary xylem) surrounded by secondary wood at one end (Plate 1, figure 2) and six primary structures (pith and primary xylem) surrounded by respective secondary woods dovetailed with one another at the other end of the fossil. Of these, one in the centre is the axial wood and others are of the branches at the node (Plate 1, figure 1). The characters of pith, primary xylem and secondary xylem of the axial wood and the branches are identical.

Primary wood: Pith small, circular to elongated; 2x2-6x8 mm in size; heterocellular composed of thin-walled isodiametric parenchymatous, 120 x 150 μ m cells mixed with thick-walled sclerenchymatous, 105 x 120 μ m cells. Some of the thin-walled cells are filled with dark depositions. Primary xylem endarch. There are 16-20 primary xylem groups surrounding the pith (Plate 1, figures 2-3; Plate 2, figure 3). Some of the elements show helical and scalariform thickenings.

Secondary wood: Secondary xylem is radially continuous with the primary xylem. Growth rings are distinct, 2-4 mm wide. Autumn wood is 3-5 cells wide with tangentially elongated rectangular, 15x30 μ m tracheids. Spring wood is 160-230 cells wide having squarish to radially elongated, 30x45 μ m tracheids. There is a gradual increase in the size of tracheids from autumn to spring wood (Plate 1, figure 4, Plate 2, figure

Plate 1

1-4. *Prepodocarpxylon gregussii* gen. et sp. nov. 1. Transverse section through the nodal region showing five wood structures (2-6) and the axial one (1), x1.5. 2. The same, through the internode showing axial wood structure, x3. 3. The same, showing heterocellular pith, endarch primary xylem and secondary wood, x45. 4. The same, showing growth rings, x60.

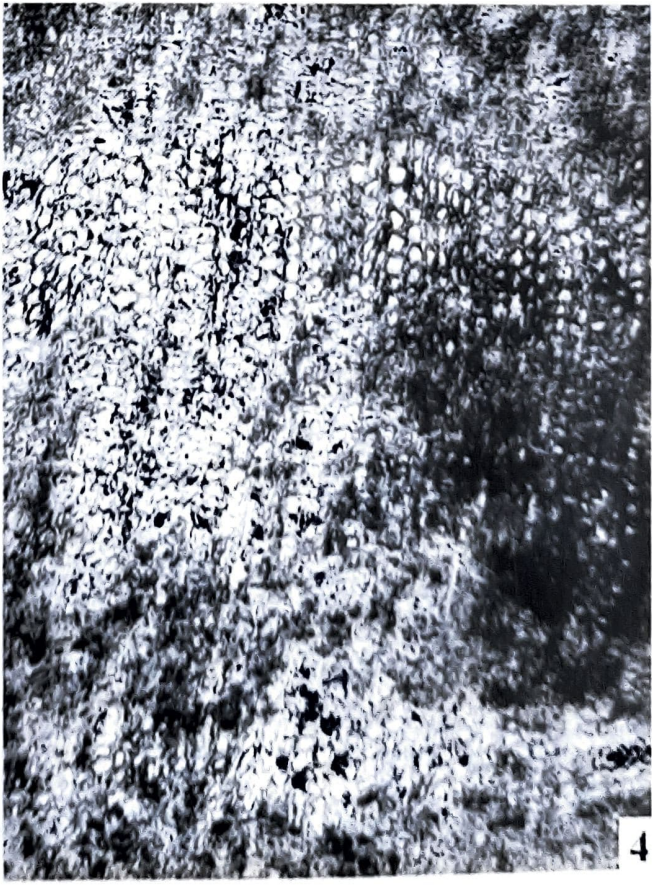
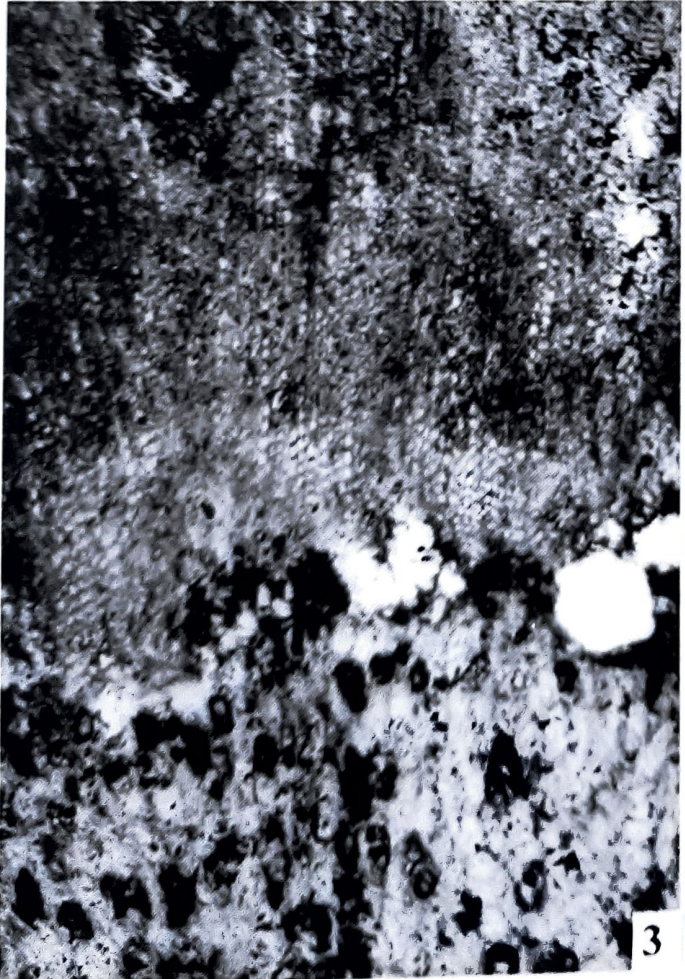
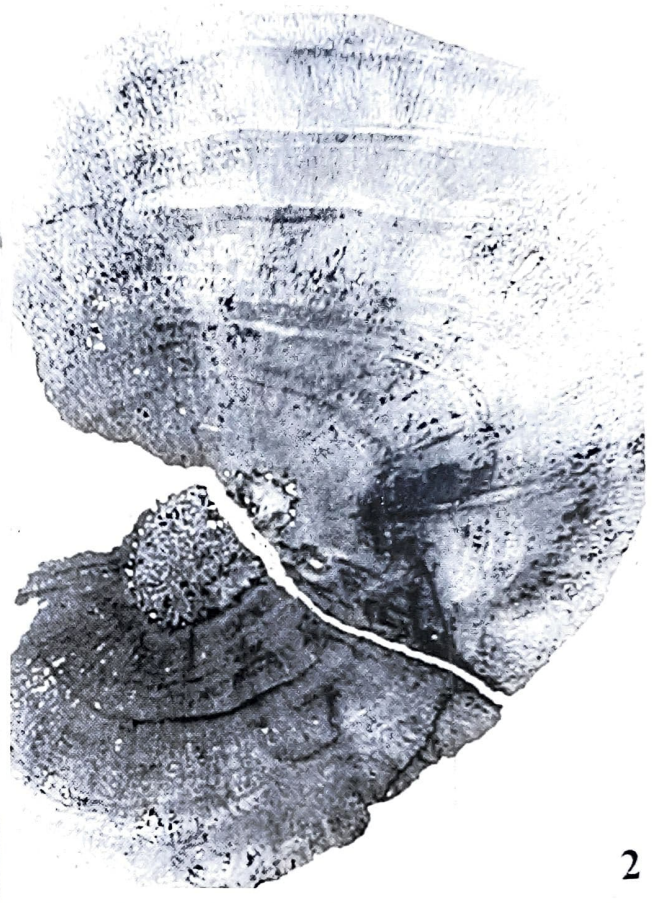
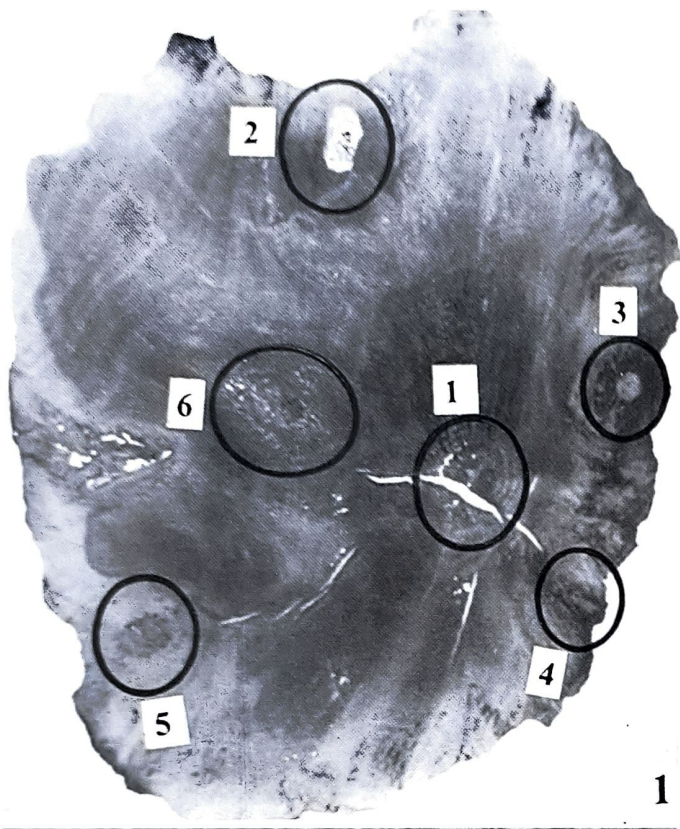


Plate 1

1). Radial pitting is invariably uniseriate. The pits are bordered, round, separate or contiguous. Round pits are $15 \times 15 \mu\text{m}$ in size with $5.2 \times 5.5 \mu\text{m}$, round to oval pore. Contiguous pits are $12.5 \times 15 \mu\text{m}$ in size with $5.2 \times 5.5 \mu\text{m}$, round to oval pore (Plate 2, figures 5-7). Xylem rays are uniseriate, homocellular, 2-9 (mostly 2-5) celled with 4 cells as the average height of 50 counts (Plate 2, figure 2). The ray cells are thin walled, 15×30 - $30 \times 60 \mu\text{m}$ in size. Xylem parenchyma is present. Resinous tracheids are common with biconvex resin plugs. Cross field pits are podocarpoid, 1-4, bordered with large oblique pit pore (Plate 2, figure 4).

Prepodocarpoxyton gregussii Bonde, gen. et sp.
nov.

Plate 1, figures 1-4; Plate 2, figures 1-7

Diagnosis: Node with six primary structures (pith and primary xylem) with dovetailed secondary wood. Internode with single wood. Pith small, circular to elongated, heterocellular. Primary xylem endarch, protoxylem groups 16-20. Growth rings distinct; autumn wood narrow, spring wood wide. Radial pitting uniseriate; pits contiguous or separate, bordered. Xylem rays uniseriate; heterocellular, 2-9 (mostly 2-5) celled. Cross field pits podocarpoid; 2-4, bordered. Xylem parenchyma abundant.

Holotype: Specimen No. S3 (Slide nos. S1-S6). Stored at the Department of Palaeobiology, Agharkar Research Institute, Pune, India.

Locality: Sodakor, Jaisalmer District, Rajasthan, India.

Horizon and age: Lathi Formation, Early Jurassic.

Etymology: The specific epithet is named after Dr. Paul Greguss.

DISCUSSION

The present permineralized decorticated wood possesses following characters: (i) presence of node and internode; (ii) internode with one primary structure (pith and primary xylem) surrounded by the secondary

wood; (iii) node with six primary structures one central surrounded by five in a ring and their dovetailed secondary woods; (iv) heterocellular pith; (v) endarch primary xylem; (vi) tracheids with uniseriate radial bordered pits; (vii) 2-9 cells high xylem rays; and (viii) podocarpoid cross field pits. These characters suggest its resemblance with *Podocarpus* (Greguss 1955, 1972). Number of primary wood structures surrounding the central one with endarch primary xylem and dovetailed secondary wood signifies whorled branching at the node whereas a single primary structure with endarch primary xylem indicate internodal region of the stem.

The permineralized woods resembling *Podocarpus* have been assigned to *Podocarpoxyton* Gothan (1905), *Protopodocarpoxyton* Eckhold (Eckhold 1923; Philippe et al. 2002) and *Metapodocarpoxyton* Dupéron-Laudoueneix & Pons (1985). *Podocarpoxyton* Gothan (= *Mesembrioxylon* Seward 1919; = *Phyllocladoxylon* Gothan 1905; = *Paraphyllocladoxylon* Holden 1913) resembles the present wood in having uniseriate radial pitting, uniseriate xylem rays and podocarpoid cross field pits. *Podocarpoxyton parthasarathyi* (Sahni 1931) Bose and Maheshwari (1974), *P. indicum* (Bharadwaj 1953) Bose & Maheshwari (1974) and *P. sarmae* (Varma 1954) Bose & Maheshwari (1974) possess primary structures along with the secondary wood. However, *P. indicum* (Bharadwaj) Bose & Maheshwari differs in having large prosenchymatous cells in the pith, few protoxylem groups, 1-5 cells xylem rays and single cross field pit. *P. sarmae* (Varma) Bose & Maheshwari differs in having a homocellular pith, 3-8 cells xylem rays and simple pits in cross field area. *P. parthasarathyi* (Sahni) Bose & Maheshwari differs in having large stone cells in the pith and 1-18 cells xylem rays. Moreover, xylem parenchyma is absent in *P. indicum* and *P. parthasarathyi*. *Protopodocarpoxyton* Eckhold differs from the present wood in having mixed type of radial pitting. *Metapodocarpoxyton* Dupéron-

Plate 2

1-7. *Prepodocarpoxyton gregussii* gen. et sp. nov. 1. Transverse section showing early wood, $\times 175$. 2. Tangential longitudinal section showing xylem rays, $\times 175$. 3. Transverse section showing heterocellular pith, $\times 175$. 4. Radial longitudinal section showing podocarpoid cross field pits, $\times 650$. 5-7. Radial longitudinal section showing uniseriate contiguous or separate bordered pits, $\times 650$.

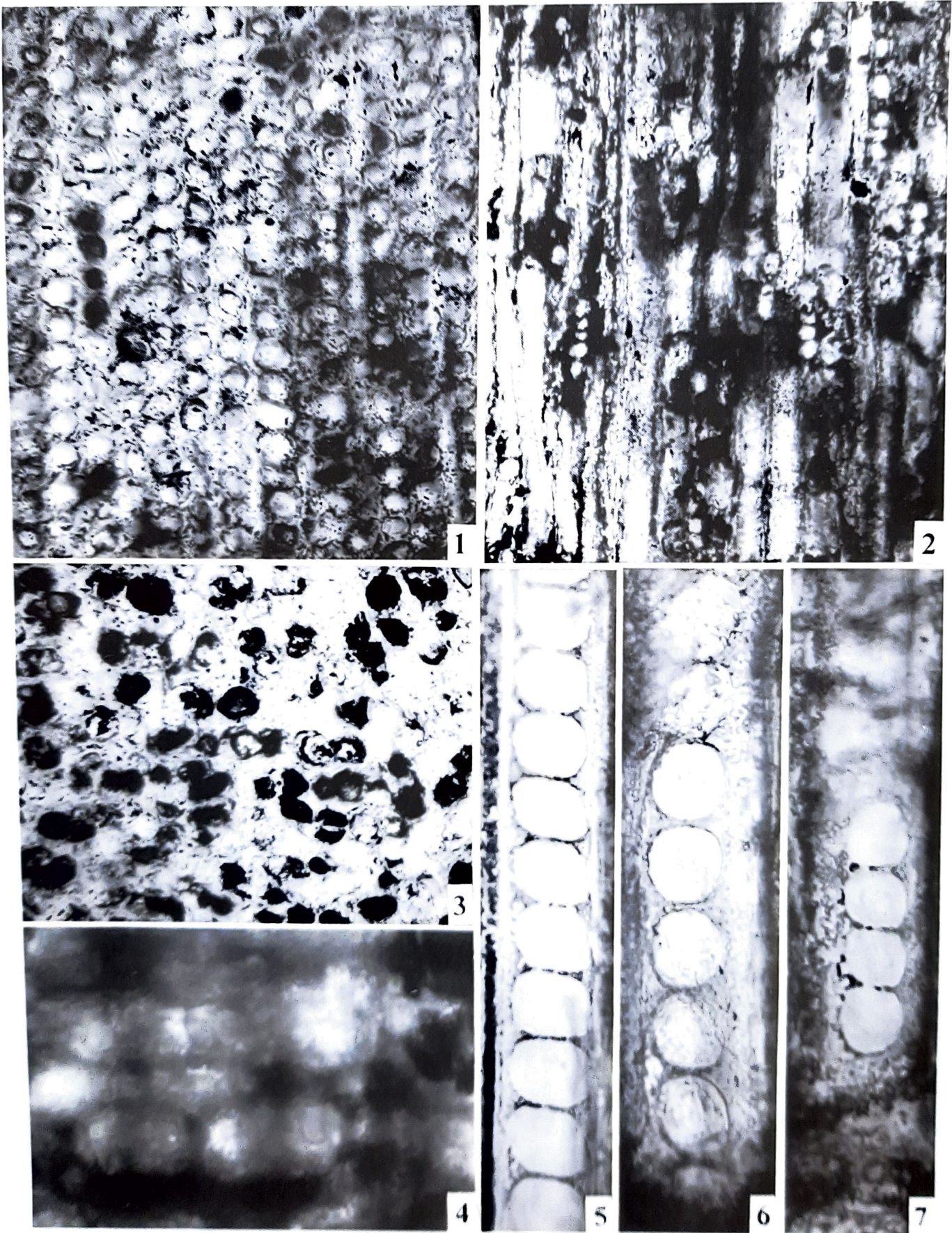


Plate 2

Laudoueneix & Pons differs in having oopores and oculipores in the cross field area. Moreover, pith and primary xylem is not known in *Protopodocarpoxyton* Eckhold and *Metapodocarpoxyton* Duperon-Laudoueneix & Pons.

Many wood structures (pith, primary and secondary xylem) have been noted for the first time in a fossil gymnospermous wood. The present wood is unique as it possesses five woods (pith, primary and secondary xylem) surrounding the axial one at one end of the fossil which probably represents the nodal region of the stem from where branches originate in a whorl as observed in number of extant conifers, whereas the single wood structure at the other end of the fossil indicates the internode region of the stem. The specimen described here belongs to the family Podocarpaceae and represents *Podocarpus* type of wood.

Podocarpus L'Herit. ex Pers. is the largest coniferous genus with 105-110 species. They are mostly tall evergreen trees or shrubs distributed from sea level to alpine conditions growing up to 3600 m height and distributed in Japan, China, Malaysia, south eastern continental Asia, Australia, the Fiji Islands and New Zealand (Florin 1963, Gray 1969). In India, it is represented by two species, viz. *Podocarpus neriifolius* D. Don growing naturally in Andamans and eastern Himalaya and *P. wallichianus* C. Presl. growing in Western Ghats, Assam and Great Nicobar Island (Sahni 1990). Permineralized wood remains of *Podocarpus* have also been reported from the later horizons of Jharkhand, Andhra Pradesh, Tamil Nadu, Rajasthan and Maharashtra suggesting that *Podocarpus* was widely distributed in past.

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