

Ougenioxylon chinjiensis sp. nov., a New Fossil Species of the Family Leguminosae from Chinji Formation Salt Range, Punjab Pakistan

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Abstract

This work is comprised of anatomical study of fossil wood collected from Chinji formation (72°22'E, 32°41'N) of Miocene age exposed at Chinji National Reservoir. The material consists of a single piece of petrified wood dark brown in colour. The three dimensional sections were prepared by ground thin section technique. Microscopic examination of the characters was compared with modern and fossil wood and found comparable with the family Leguminosae. The closest resemblance of our fossil wood is with the wood of *Ougenia*. This fossil wood shows close resemblance in respect of vessels, fibers, parenchyma and xylem rays character. Therefore it is considered as new species and it is named *Ougenioxylon chinjiensis* sp. nov. The specific epithet refers to Chinji formation to which fossil wood belongs.

Keywords

Ougenia chinjiensis, Fossil Wood, Salt Range, Punjab Pakistan

1. Introduction

The presence of fossilized plant remaining in the Tertiary deposits of Pakistan has been known since 1879, when Balanford [1] reported them while working on the geology of Sindh region. However no effort was made to investigate and identify these plant fossils from this region. Prof. K. M. Khan established Paleobotany research lab at Institute of Plant Sciences (formerly Department of Botany) and along with his co-workers reported a number of petrified woods from different fossiliferous localities of Sindh province (Khan & Rahmatullah, 1968 [2];

Khan *et al.*, 1971 [3]; Khan & Rahmatullah, 1972 [4]; Khan & Rajput, 1976 [5]; Rehmatullah *et al.*, 1984 [6]; Rajput & Khan, 1982 [7]; Rajput & Khan, 1984 [8]; Saeed *et al.*, 1984 [9]; Rajput *et al.*, 1985 [10]; Ahmed *et al.*, 1989 [11]; Ahmed *et al.*, 1991 [12] [13]; Ahmed *et al.*, 1993 [14]; Bhutto *et al.*, 1993 [15]; Ahmed *et al.*, 2007 [16] [17]; Shar *et al.*, 2007 [18]). No attempt was made to explore the other provinces of Pakistan.

The present work deals with the first systematic study of a petrified wood from Punjab province, Pakistan. The petrified wood sample was collected from the fossiliferous locality of Chinji National Reservoir district Khushab, which is 50 km away from Khushab City and 175 km in northwest of Faisalabad in the heart of Salt range. Fossil woods are buried on the slopes of sedimentary rocks. Some of these fossils are in complete log of 4 - 6 m long. The present work deals with the anatomical description and the affinities of a fossil wood.

2. Material and Methods

The specimen No. TR. 20, **Plate 1(a)**. The material (TR. 20 silicified wood was collected by the first author from Chinji National Reserve, district Khushab, Punjab Pakistan. The wood was a small piece of mature secondary xylem fossil about 9 cm in length and 4 cm in diameter. The colour of fossilized wood was brown the anatomical sections, of required direction were prepared by the conventional Rock cutting and grinding thin sections technique [19]. Most of the preliminary investigations were made with the Lietz Ortholux II light microscope and Lietz Steriozome microscope. Photographs were taken with Ortholux II Microscope at the Paleobotany lab, Institute of Plant Science, University of Sindh, Jamshoro, Pakistan.

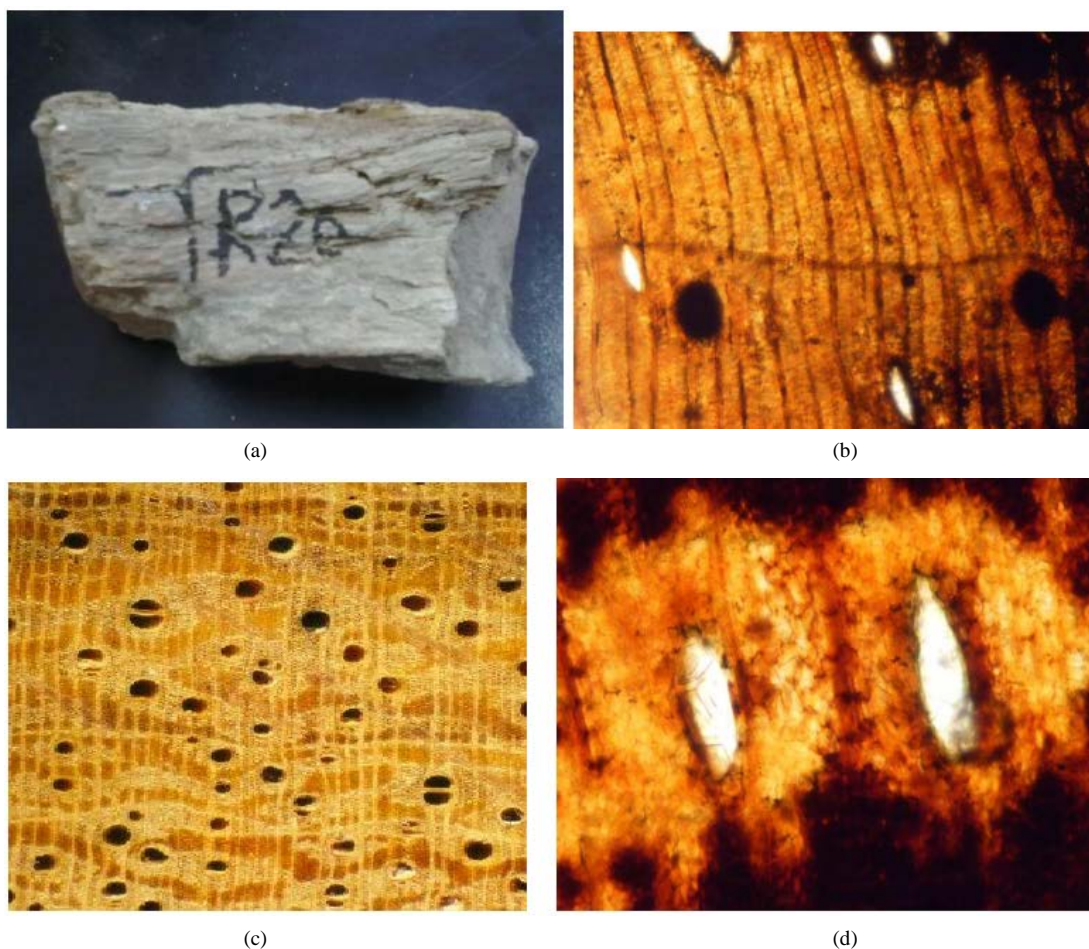


Plate 1. *Ougenioxylon chinjiensis* sp. nov. (a) Tangential longitudinal section showing distribution of xylem rays and end wall of vessels, $\times 100$; (b) Tangential longitudinal section showing arrangement of xylem rays, $\times 40$; (c) Radial longitudinal section showing the nature of xylem rays, $\times 160$; (d) Radial longitudinal section showing the pits on the wall of vessels, $\times 600$.

3. Diagnosis

3.1. *Ougeniaxylon chinjiensis*

Wood diffuse porous. Growth rings distinct. Vessel small to medium sized, mostly solitary as well as in radial multiples of 2 cells, t.d. 40 - 130 μm , 3 - 7 per sq. mm, r.d. 60 - 297 μm vessel members storied, short with truncated or tailed ends perforation simple intervessel pit pairs small perforation simple; intervessel pit small to medium sized, simple, alternate, circular and crowded. Tylosis absent. Parenchyma paratracheal and apotracheal parenchyma paratracheal parenchyma copious, vasicentric to aliform few aliform-confluent, apotracheal parenchyma diffuse as scattered cells and terminal, xylem rays 1 - 3 mostly Biseriate, 12 - 18 per mm, 10 - 25 cells high; ray tissue homogeneous ray homocellular cells, consisting of procumbent cells. Fibres mostly libriform small, polygonal, septate, thick walled, 5 - 10 μm in diameter.

3.2. Holotype

Thati Rest House, Chinji National Park, district Khushab, Punjab, Pakistan.

Basir Ahmed Arain, TR20, 1993 (Paleobotany museum, Institute of Plant Science, University of Sindh, Jamshoro, Sindh, Pakistan).

Horizon: Chinji Formation.

Age: Late Miocene.

3.3. Morphological Description

Fossil wood consist of a single piece of silicified wood which is ca. 22 cm long and 8 cm broad. The colour of fossilized wood is dark brown (**Plate 1(a)**).

3.4. Anatomical Description

3.4.1. Cross Section

Plates 1(b)-(d)

Wood diffuse porous. Growth rings distinct, delimited by 1 - 2 cells thick lines of terminal parenchyma. Vessels small to medium sized, oval in shape, unevenly distributed in ground mass, solitary as well as in radial multiples of 2, 3 - 7 per sq. mm. Radial diameter ranges from 60 - 297 μm tangential diameter ranges from 40 - 130 μm tyloses absent wood parenchyma paratracheal and apotracheal, paratracheal abundant, mostly vesicentric to aliform occasionally aliform to confluent. Apotracheal diffuse as solitary or arranged in uniseriate thick lines, delimiting growth rings. The shape of parenchyma cells round to oval, diameter ranges from 10 - 25 μm . Fiber cells are polygonal in shape, thick walled, diameter ranges from 5 - 13 μm . Xylem rays are mostly thin running on either side of the vessels

3.4.2. Tangential Longitudinal Section

Plate 2(a), Plate 2(b)

Vessels composed of elongated cells, their length ranges from 140 - 260 μm with truncate to tailed ends. Vessels are irregularly distributed. Solitary vessels oval in shape those in radial multiples flattened at the places of contact. Xylem rays are numerous, mostly biseriate, homogenous consisting of procumbent cells, 10 - 25 cells high, diameter ranges from 15 - 30 μm 10 - 18 rays per mm. Intervessel pits are simple, alternate, circular to oval and some are elliptical in shape and crowded.

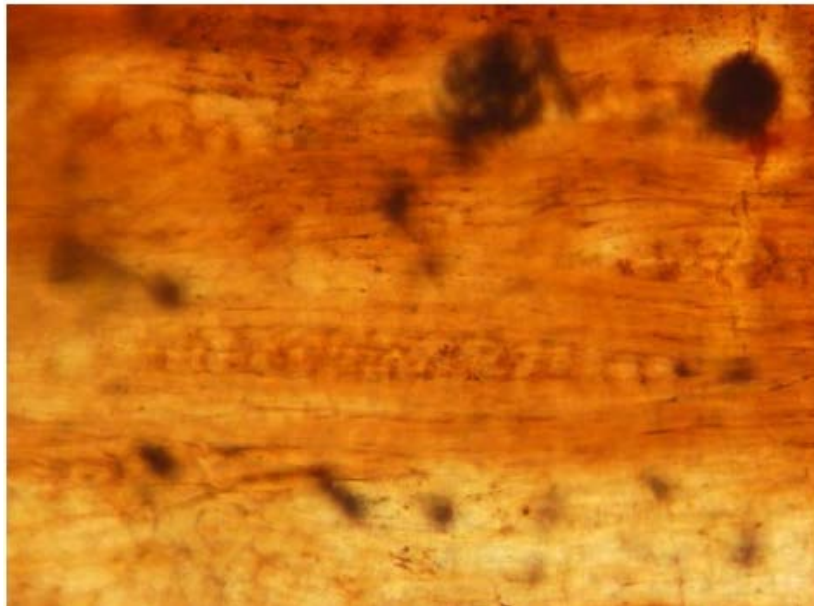
3.4.3. Radial Longitudinal Section

Plate 3(a), Plate 3(b)

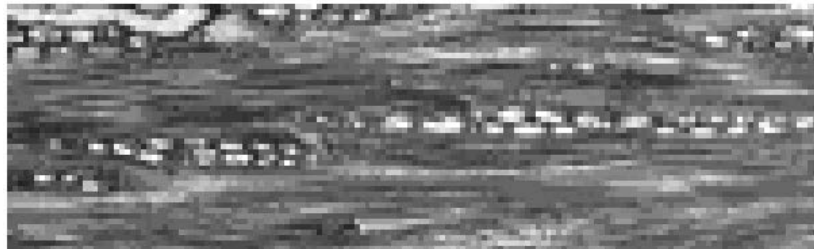
Vessels segments elongated, length of vessels member ranges from 140 - 260 μm , and breadth ranges from 110 - 360 μm . End wall transverse, perforation simple, pits cells rounded alternate. The wood fibers are septate.

3.5. Comparison with Modern Wood

There is a close resemblance in almost all anatomical attributes of the discussed fossil wood with the wood structure of modern genus *Ougenia* Benth, belonging to the family Leguminosae. After the examination of



(a)

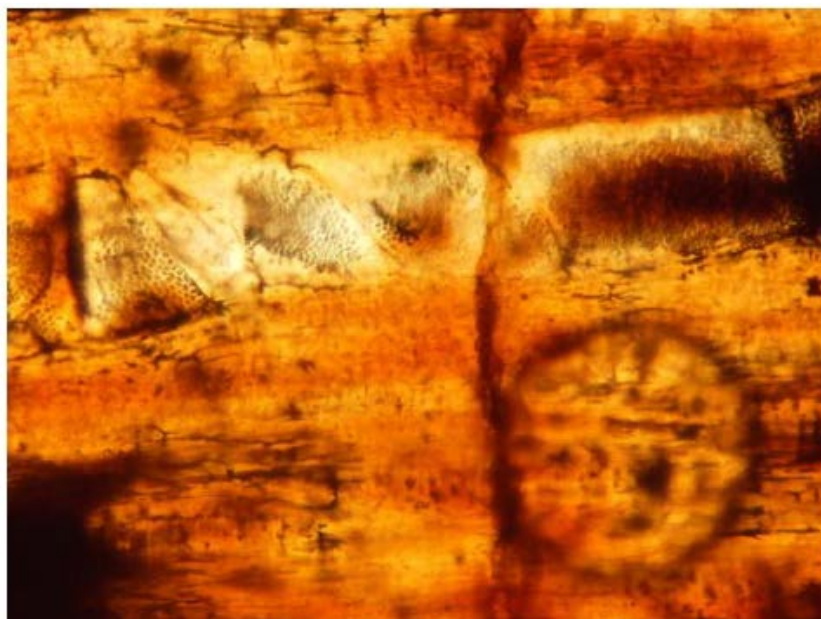


(b)

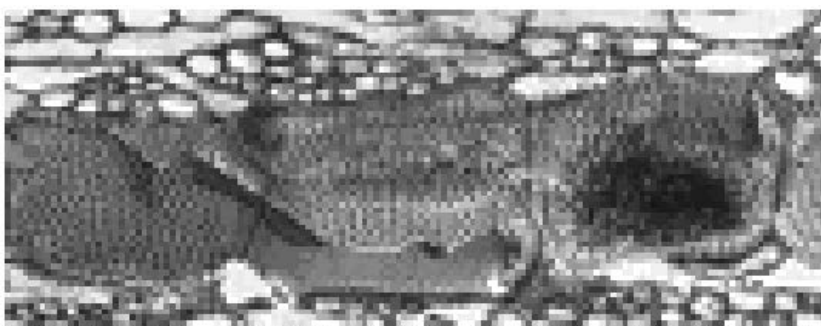


(c)

Plate 2. *Ougenioxylon chinjiensis* sp. nov. (a) Tangential longitudinal section showing distribution of xylem rays and end wall of vessels, $\times 100$; (b) Tangential longitudinal section showing arrangement of xylem rays, $\times 40$.



(a)



(b)

Plate 3. *Ougenioxylon chinjiensis* sp. nov. (a) Radial longitudinal section showing the nature of xylem rays and pits on the wall of vessels, $\times 100$; (b) Radial longitudinal section showing the pits on the wall of vessels of the living *Ougenia* (Inside wood).

anatomical structure on published description and photographs of the modern wood of *Ougenia* Benth, indicates closest resemblance with wood anatomical structure of *Ougenia dalbergioides* Benth [20] [21].

In both, the fossil wood and the modern wood *Ougenia dalbergioides* the growth rings are marked by terminal parenchyma, the vessels are small to large mostly solitary, often short radial of 2 - 4. The parenchyma mostly vasicentric to aliform occasionally aliform to confluent. The xylem rays are storied, 1 - 4 (mostly 2 - 3) seriate and composed of procumbent cells only and the fibers are semi libriform to libriform and septate.

Due to close resemblance of the fossil wood with the wood structure of the modern genus *Ougenia* Benth. It has been assigned to the genus *Ougenioxylon*.

The genus *Ougenia* Benth comprises of with 2 species, distributed in India and Pakistan, represented locally by only 1 species.

3.6. Comparison with Fossil Woods

Hitherto only one species of *Ougenia dalbergioides* is reported from Tertiary deposits of Assam. The detailed comparison of this reported species with fossil wood under investigation is given in **Table 1**.

As the fossil wood described in the contribution shows differences from other described species of *Ougenioxylon*, therefore it is considered as new species and it is named *Ougenioxylon chinjiensis* sp. nov. (**Table 2**).

Table 1. Comparison of fossils related to *Ougenioxylon*.

Species	Wood	Vessels	Parenchyma	Xylem	Fibres
<i>Ougenioxylon tertiarum</i> Parakash & Tripathi (1975) [22]	Diffuse porous	Small to large t.d. 40 - 260 μ m 3 - 7 vessels/sq. mm mostly solitary as well as in radial multiple of 2 - 4 inter vessel pit-pairs small, vested, border oval to elliptical with lenticular orifices.	Paratracheal and apotracheal; Vascicentric, aliform to confluent; apotracheal parenchyma diffuse as scattered cells and terminal; parenchyma strands storied and crytalliferous.	Rays 1 - 4 (mostly 2 - 3) seriate procumbent 3 - 20 ccells high, 8 - 10 rays/mm homogeneous, and homocellular.	Septate
<i>Ougenioxylon chinjiensis</i> sp. nov.	Diffuse porous	Small to medium, 40 - 130 μ m in diameter, 3 - 7 vessels/sq. mm, mostly solitary as well as in radial multiples of 2, inter vessel pits are alternate circular, oval to elliptical.	Paratracheal and apotracheal; Mostly vascicentric, aliform to confluent; apotracheal parenchyma form thick lines of terminal parenchyma; parenchyma strands storied.	Mostly biseriate, occasionally 3 seriate 10 - 20 cells high, 10 - 19 rays/mm homogenous, homocellular procumbent.	Septate

Table 2. Graphical and stratigraphical break-up of fossils related to the genus *Ougenia* Benth.

Species	Reported by and Year	Locality	Geological age
<i>Ougenioxylon tertiarum</i>	Prakah & Tripathi, 1975 [22]	Assam, India	Miocene
<i>Ougenioxylon chinjiensis</i> sp. nov.	Soomro <i>et al.</i>	Punjab, Pakistan	Miocene

The specific epithet refers to Chinji Formation to which fossil wood belongs.

4. Conclusion

The anatomical character of the fossil wood indicates that it has diffuse porous wood and the growth rings are absent or indicated by terminal parenchyma. These characters indicate the existence of tropical type of climate of that time.

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