

ORMOSIOXYLON CHINJIENSIS SP. NOV., A NEW FOSSIL WOOD OF FAMILY FABACEAE FROM THE CHINJI FORMATION SALT RANGE PUNJAB, PAKISTAN

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Abstract

The present work deals with anatomical study of fossil wood collected from the Chinji formation (72°22' E, 32° 4' N) of Miocene age exposed at the Chinji National Reserve at salt Range Punjab, Pakistan. The material consisted of a single piece of petrified wood. Taxonomical characters of the fossil wood were compared with modern and fossil wood. The sample wood was found comparable to the family Fabaceae. The closest resemblance of the fossil wood was with the wood of *Ormosia*. The fossil wood under investigation showed close resemblance of vessels, fibers, parenchyma and xylem rays, with the genus *Ormosia* but shows differences from already reported species of this genus. Hence it is described as a new species as *Ormosioxylon chinjiensis* sp. nov. The specific epithet refers to Chinji Formation from which the fossil wood is collected.

Key words: *Ormosioxylon chinjiensis* sp.nov. Fabaceae, Fossil wood, Chinji formation, Pakistan.

Introduction

The present work deals with the anatomical description and the affinities of a fossil wood. The presence of fossilized plant remains in the Tertiary deposits of Pakistan has been known since 1879, when Balanford reported them while working on the geology of Sindh region. However, no efforts were made to investigate and identify these plant fossils from this region until 1962. Many papers were contributed during this period by Paleobotanists from various parts of the Indo-Pak subcontinent as well as from other regions of the world. In Pakistan, a number of fossil species are reported from different fossiliferous localities by Khan and Rehmatullah (1968, 1971) Khan *et al.* (1972); Khan & Rajput (1976), Rehmatullah *et al.* (1984); Ahmed *et al.* (1989, 1991a, 1991b, 1991c, 1993, 2001, 2003, 2007a & 2007b), Bhutto *et al.* (1992) and Majeeda *et al.* (2007), Sooro *et al.* (2014). They described monocot, dicot and gymnosperm wood from Sindh region.

Major work on fossils has been done in Sindh province, a few reports are available from other provinces of Pakistan. Species of *Terminalioxylon*, (*T. burmense* and *T. sulaimanense*) de Franceschi *et al.* (2008) were reported from the lower parts of the Chitarwal Formation (Zinda Pir Dome, Sulaiman Range, Eastern Baluchistan).

In this study the wood samples were collected from the fossiliferous locality of Chinji National Reserve, district Khushab, which falls in the heart of the Salt Range about 50 km from Khushab city and 175 km in the north-west of Faisalabad city. Fossil woods were buried on the slopes of sedimentary rocks. Some of these fossils were in complete log of 4-6 m. The present work deals with the identification and the affinities of the fossil wood, collected from salt range.

Materials and Methods

The silicified wood specimen (TR. 11) were collected by the first author from Chinji National Reserve, district Khushab, Punjab, Pakistan. The petrified wood was a small piece of mature secondary xylem fossil about 9 cm. in length and 4 cm. in diameter, brown in color. Anatomical sections of required direction were prepared by the conventional rock cutting machine and grinding technique, as described by Weatherhead (1938). Most of the preliminary investigations were made with a simple light microscope and stereozoom microscope. Photographs were taken with an Urtholux Microscope in the Paleobotany laboratory at the Institute of Plant Sciences, University of Sindh, Jamshoro (Figs. 1 & 2).

Systematic position

Class: Magnoliopsida

Sub-Class: Rosidae

Order: Ferales

Family: Fabaceae

Genus: *Ormosioxylon* Bande & Prakash, 1980

Species: *Ormosioxylon chinjiensis* sp. nov.

Diagnosis: Wood diffuse porous. Growth rings absent. Vessel medium to large sized, mostly solitary, sometimes in radial multiple of 2-5, round to oval, t.d. 110-214 µm. and r.d. 180-300 µm, 5-8 per sq. mm., Perforation simple; intervessel pits small to medium sized, 4-6 µm in size simple, alternate, linear in shape. Tylosis absent. Parenchyma paratracheal, aliform to confluent, cells are thin walled 12-24 µm in diameter and 32-60 µm in length. Rays 1-5 (mostly 4seriate), 4-8 per mm, 9-19 cells or 30-420µm. Ray cells are mostly procumbent, only in some places with 1-2 rows of upright cells. Fibre cells small, 5-12 µm in diameter, nonseptate, thick walled.

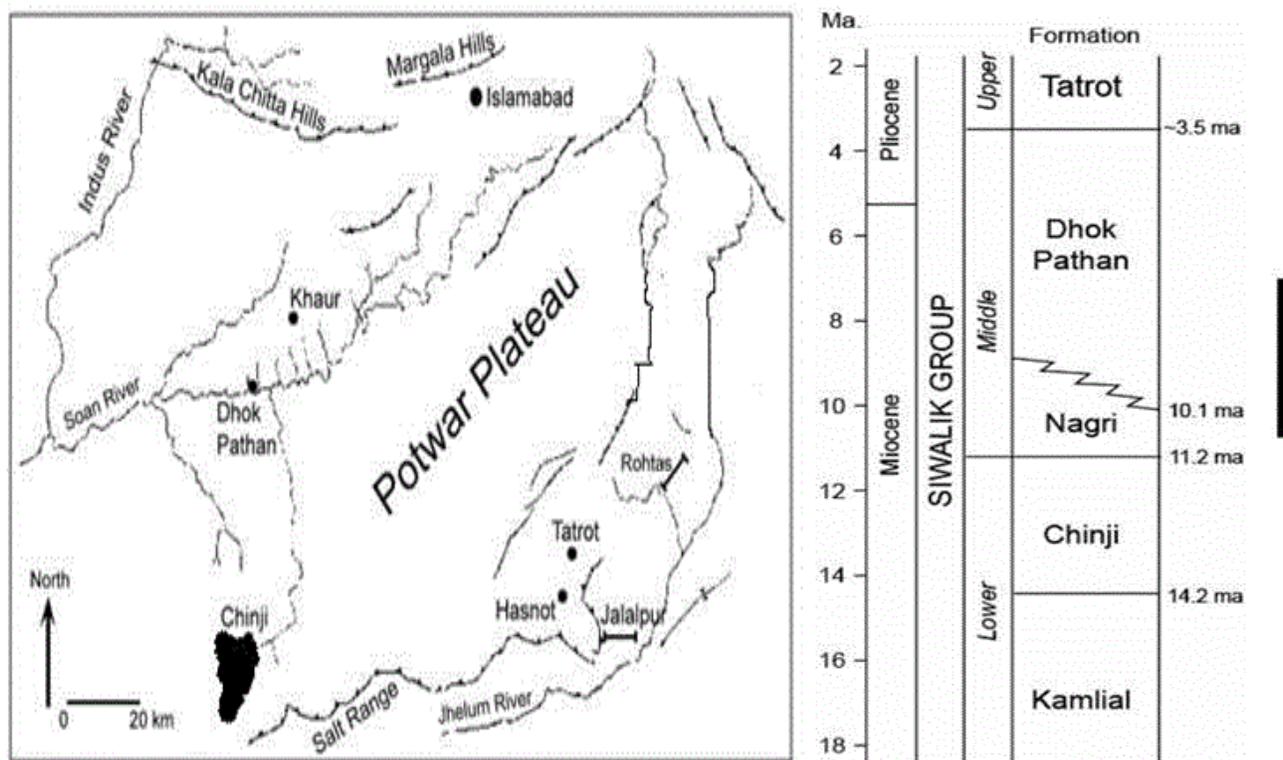


Fig. 1. Location map showing Chinji Fossiliferous locality with schematic profile.

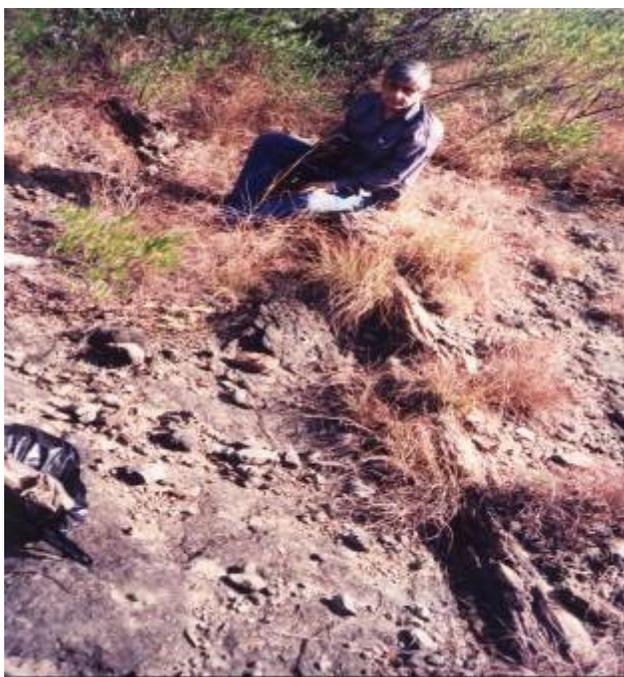


Fig. 2. Showing huge log of fossil wood lying in the fossiliferous locality of chinji formation.

Morphology: Wood consist of a single piece of silicified wood ca. 22 cm. long and 8 cm broad. The color of fossilized wood is dark brown in color (Fig. 3).

Anatomy: Wood diffuse-porous. Growth rings absent. Vessels medium to large sized, round to oval in shape, evenly distributed in ground mass, mostly solitary or in multiple of 2-5, 5-8 per sq. mm. Radial diameter ranges from 180-300 μm tangential diameter ranges from 110-214

μm . Tyloses absent Wood parenchyma paratracheal aliform to confluent, mostly regular, ranges from 7-8 cells. Parenchyma cells oval, diameter ranges from 10-25 μm (Figs. 4-5). Fibre cells polygonal, thick walled, diameter ranges from 5-13 μm . Rays fine (up to 5 cells) running on either side of the vessels.

In tangential section the vessels are composed of elongated cells, their height ranges from 300-725 μm and thickness ranges from 110-214 μm The rays are numerous, 1-5 cells wide (mostly 4 cells, rarely uniseriate), density 4-8 rays per mm tangential, and height of 9-19 cells (=30-420 μm). Ray tissue weakly heterogeneous, rays composed either of procumbent cells only or with 1-2 rows of upright cells at one or both of the ends (Figs. 7, 9, 10).

In radial section the vessel elements are elongated, their length ranges from 310-735 μm , and breadth ranges from 115-225 μm end walls transverse. Perforation simple, intervessel pits small to medium sized, 4-6 μm in size, simple, alternate, linear in shape. Fibres thick walled, non septate, 5-12 μm in diameter (Figs. 11, 12).

Comparison with modern woods: Detailed study of the three standard sections, enumerates the important anatomical characters: diffuse porous wood, vessels small to medium sized, aliform to confluent parenchyma, medullary rays 1-5 cells wide, mostly 4 cell wide.

The above anatomical attributed features could be compared with the family Combretaceae in which the wood parenchyma is confluent to aliform but the medullary rays are mostly uniseriate. It is comparable with family Moraceae by the vessels and wood parenchyma as well as the medullary rays. But in members of family Moraceae the medullary rays are heterogeneous, whereas in fossil under investigation the rays are homogeneous. Anatomically fossil in question shows resemblance with the members of family Fabaceae.



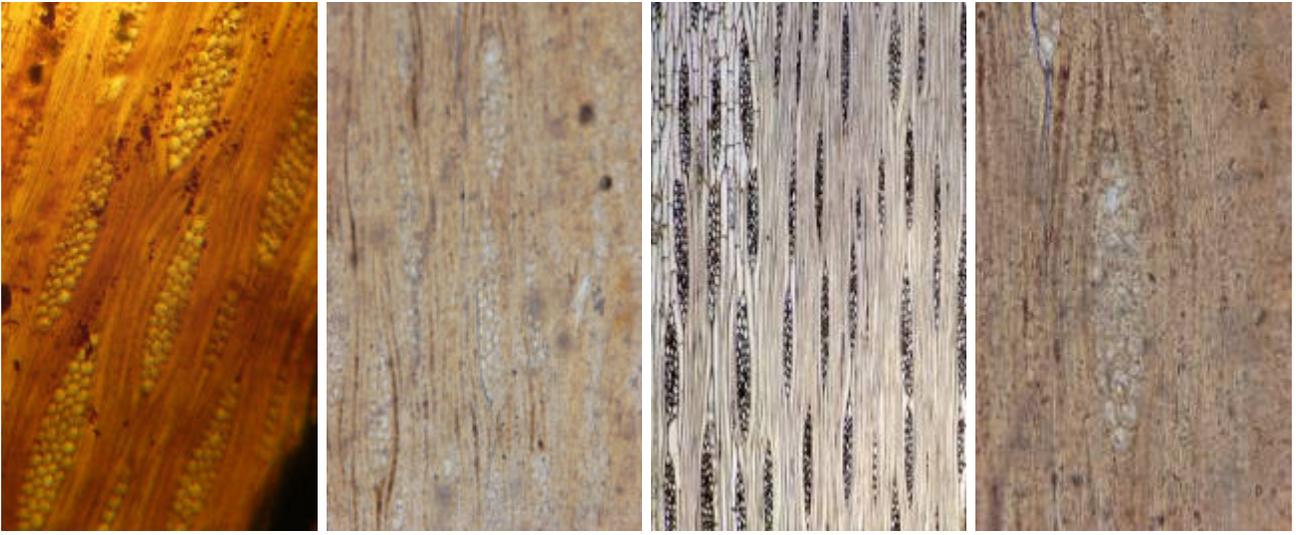
***Ormosioxylon chienjensis* sp. nov.**

Fig. 3. Macro photograph of Holotype of the fossil wood (TR 11).

Fig. 4. Cross section showing general distribution of vessels and parenchyma. X 100.

Fig. 5. Cross section showing solitary and multiple vessels with aliform to confluent parenchyma and xylem rays. X 200.

Fig. 6. *Ormosia coccinea* Cross section showing shape, size, and distribution of vessels of living taxa similar to those of Fossil (from website).



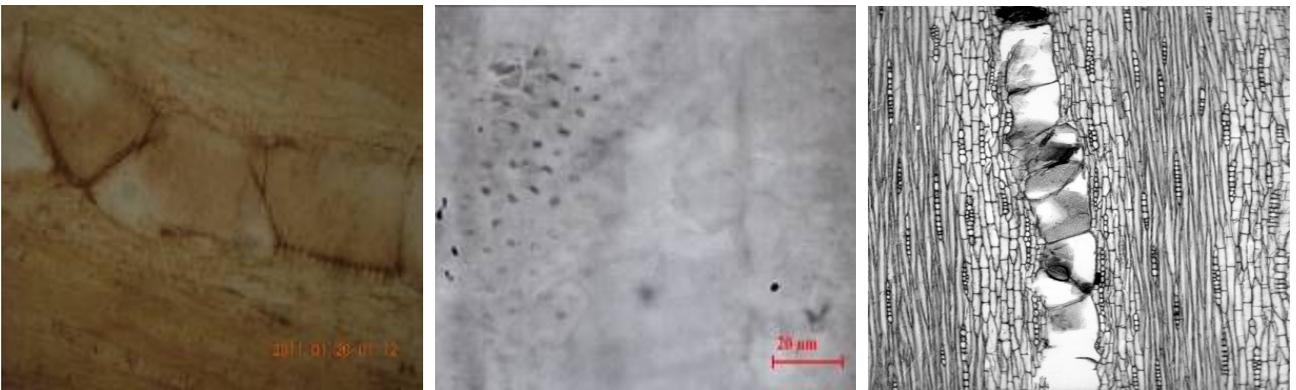
***Ormosioxylon chienjensis* sp. nov.**

Fig. 7. Tangential longitudinal section showing distribution of xylem rays X100.

Fig. 8. *Ormosia robusta* tangential longitudinal section showing rays similar to those of fossil. (from Insidewood Web site)

Fig. 9. Tangential longitudinal section showing distribution of xylem rays X100.

Fig. 10. Another view of Tangential longitudinal section showing distribution of xylem rays X200



***Ormosioxylon chienjensis* sp. nov.**

Fig. 11. Radial longitudinal section showing oblique end wall of the Xylem rays X100.

Fig. 12. Intervessel pits X400.

Fig. 13. *Ormosia robusta* Radial longitudinal section with Intervessel pits similar to the fossil wood (from website).

Taxonomic affinities

In family Fabaceae the genera *Pericopsis*, *Andira*, *Desmodium*, *Albizia* and *Ormosia* are comparable with fossil under investigation, but wood *Albizia* can be separated from our fossil wood by having septate fibers and the arrangement of parenchyma tissues. In *Pericopsis* the growth ring boundaries are distinct, and axial parenchyma are present in marginal bands. The size and the shape of vessels are different from the fossil under investigation, fibers are thin to thick walled in *Andira* and *Desmodium*. Rays mostly 4-10 seriate, with larger cells, while in the fossil wood under study ray are mostly 4 seriate. The anatomical features of the taxa under study shows closest resemblance with two species of genus *Ormosia*, namely *Ormosia coccinea*, *Ormosia robusta* (Figs. 6, 8, 13).

The genus *Ormosia* G. Jacks consists of ca. 110 living species, Willis (1988) mostly trees or large shrubs distributed throughout the tropical regions of the world,

some extending into temperate zones, especially in east Asia (Wikipedia).

Comparison with reported fossil woods: Hitherto only one species of *Ormosioxylon* viz., *O. bengalensis*, has been reported from Tertiary deposits of India, by Bande & Parkash (1980). As the fossil wood described shows differences from already described species of *Ormosioxylon* by having small to moderately large vessels while the fossil under investigation have medium to large sized vessels. Rays of *Ormosioxylon bengalensis* are 1-4 (mostly 3) seriate, while the rays in reported species are mostly 1-5 mostly 4 seriate, and 4-8 per mm. The detailed comparison of reported species with the fossil wood under investigation is given in Table 1. The taxonomical character found of the fossil wood under investigation shows characters which are strong enough to recognize it as a new species hence it is named *Ormosioxylon chinjiensis* sp. nov. The specific epithet refers to Chinji Formation from where the holotype is collected.

Table 1. Comparison of new species with already reported species of *Ormosioxylon*.

Species	Wood	Vessels	Parenchyma	Xylem	Fibres	Geological age
<i>Ormosioxylon bengalensis</i> Bande & Prakash 1980	Diffuse porous	Small to moderately large 105-210 µm. 8-12 vessels/ sq.mm with mostly solitary as well as in radial multiple of 2-5 vessel pit-pairs small, vestured, alternate 6-10 µm in size with linear to lenticular apperture	Paratracheal, aliform cells thin walled 13-24 µm in diameter	Rays 1-4 (mostly 3) seriate ray tissue weakly heterogeneous rays composed either procumbent cells only 4-45 cells high, 5-8 rays/ mm. one to two rows of upright cell at one or both ends	Non Septate	Miocene
<i>Ormosioxylon chinjiensis</i> sp.nov.	Diffuse porous	Small to medium, 40-130 µm in diameter, 3-7 vessels / sq.mm, mostly solitary as well as in radial multiples of 2, in diameter 32-60 µm in diameter intersessel pits are alternate circular, oval to elliptical	Paratracheal, aliform thin walled 12-24 µm in diameter	Rays mostly 1-5 mostly 4 seriate, 4-8 per mm, 9-19 cells; or 30-420µm high. Rays are mostly procumbent cells only in some places with 1-2 rows of upright cells	Non Septate	Miocene

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