

***ANOGEISSOXYLON REHMANENSE* SP. NOV., A NEW FOSSIL SPECIES OF THE FAMILY COMBRETACEAE FROM REHMAN DHORO, DISTRICT JAMSHORO, SINDH, PAKISTAN**

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**Abstract**

*Anogeissoxylon rehmanense* sp.nov., a new silicified wood is described from Tertiary deposits of Bara formation exposed near Rehman dhoro district Jamshoro, Sindh, Pakistan. The xylotomical features of the present fossil show close affinities with the genus *Anogeissus* of the family Combretaceae. The modern comparable forms of this taxon indicate a tropical climate in which the plant in question was growing.

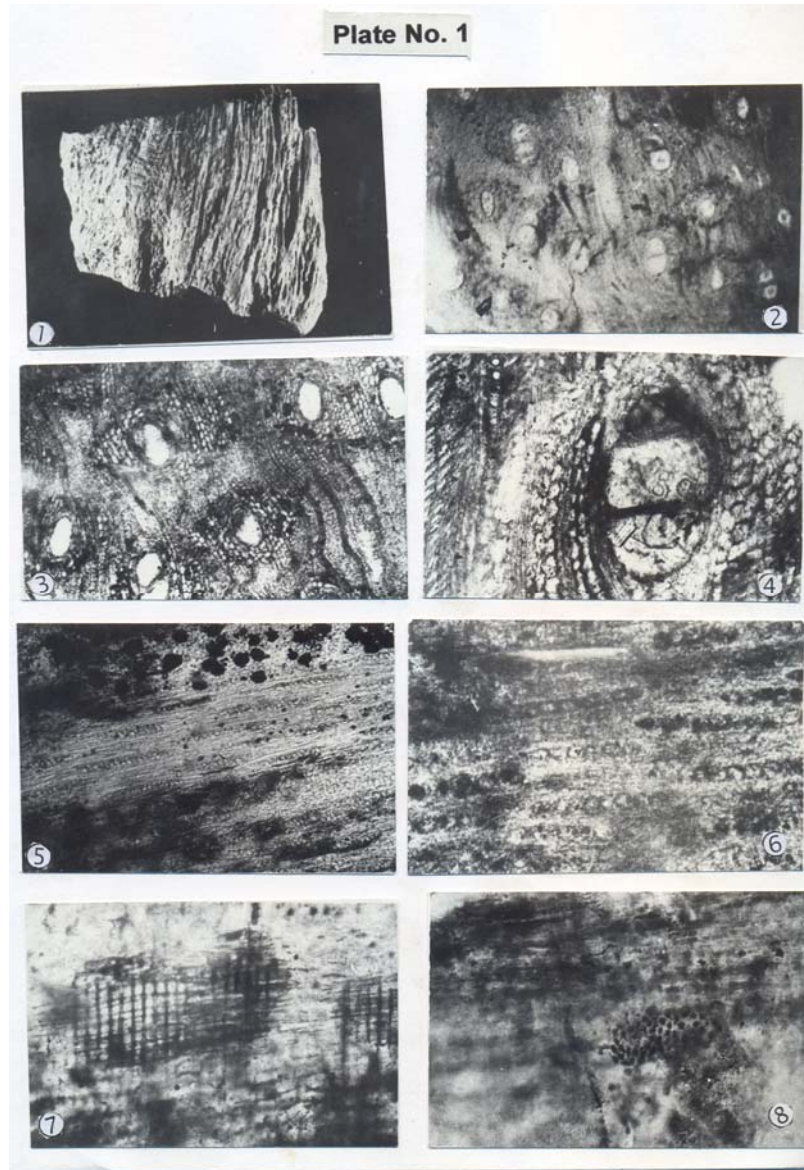
**Introduction**

The presence of the petrified woods in the upper Tertiary and Quaternary deposits of Sindh is known since the early report of Blanford (1879). So far 17 fossil woods have been identified and described from Sindh, Pakistan viz., *Sapindoxylon petaroensis* Khan & Rahmatullah, *Albizioxylon dhaproense* Khan & Rahmatullah, *Palmoxylon amriense* Khan *et al.*, *Laurinoxylon rehmanense* Khan & Rajput, *Palmoxylon surangei* Rehmatullah *et al.*, *Cynometroxylon ranikotensis* Rajput & Khan, *Pterocarpoxyylon ranikotensis* Rajput & Khan, *Arucarioxylon* sp. Rajput & Khan, *Cynometroxylon indicum* Saeed *et al.*, *Myristicoxylon ranikotensis* Rajput *et al.*, *Laurinoxylon ellipticum* Ahmed *et al.*, *Duabangoxylon pakistanicum* Ahmed *et al.*, *Sidreinium pitensis* Ahmed *et al.*, *Mangiferoxylon pakistanicum* Ahmed *et al.*, *Terminalioxylon sindensis* Ahmed *et al.*, *Lagarstromiaxylon ranikotensis* Bhutto *et al.*, and *Anogeissoxylon ranikotensis* Ahmed *et al.*

The present work deals with the anatomical description and the affinities of a fossil wood collected from Bara formation exposed near Rehman dhoro, district Jamshoro, Sindh, Pakistan (Lat. 26°.07' N. Long. 67°.53' E.). The age of the rocks involved may be Paleocene.

**Materials and Methods**

The specimen No. RD. 54 material used in this investigation was collected by the senior authors from Rehman dhoro, district Jamshoro, Sindh, Pakistan. The fossil wood (RK 54) is a small piece of mature secondary xylem measuring 7 cm. in length and 4 cm in diameter. The colour of fossilized wood is brown (Plate No. 1, Fig.1). Three-dimensional sections of the fossil petrified wood were prepared by the conventional Rock cutting and grinding technique (Weatherhead, 1938). Most of the preliminary investigations were made with the light microscope and photographs were taken with Urtholux Microscope.



*Anogeissoxylon rehmanense* sp. nov.

Fig. 1. Macrophotograph of fossil wood.

Fig. 2. Cross section showing general distribution of vessels and parenchyma. X 40.

Fig. 3. Cross section showing vessels with aliform parenchyma. X 63.

Fig. 4. Cross section showing enlarged vessel parenchyma cells. X 150.

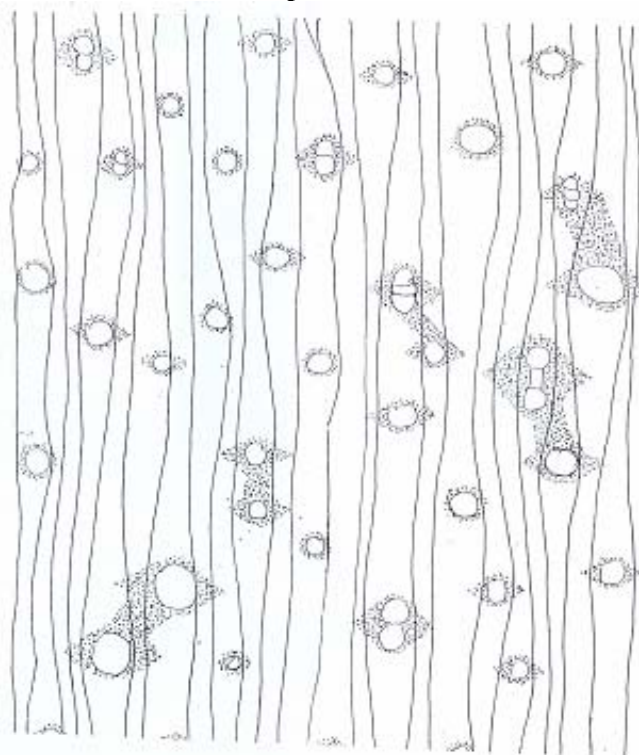
Fig. 5. Tangential longitudinal section showing distribution of xylem rays. X 100.

Fig. 6. Tangential longitudinal section showing nature of xylem rays. X 150.

Fig. 7. Radial longitudinal section showing xylem ray cells. X 250.

Fig. 8. Radial longitudinal section showing pits on the wall of the vessel. X 400.

## Text plate No. 1



*Anogeissoxylon rehmanense* sp. nov.

Cross section showing general distribution of vessels, rays and parenchyma.

***Anogeissoxylon rehmanense* sp. nov.**

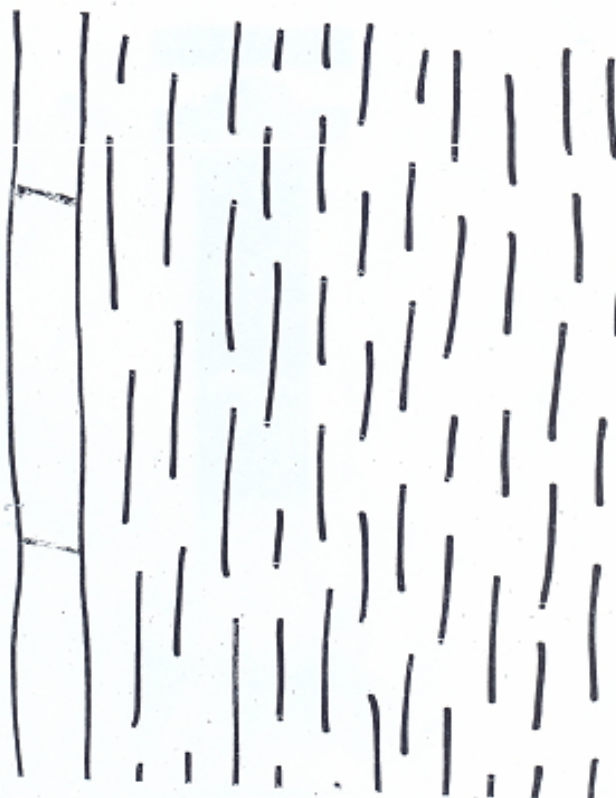
**Morphological description:** The fossil wood consist of one piece of silicified wood, measuring ca. 9 cm. long and 14 cm. broad. The colour of fossilized wood is brown due to hydrated iron oxide. (Plate No. 1, Fig. 1).

**Anatomical description**

**Plate 1 Figs. 2-8; text plates 1,2 & 3**

**Topography:** Wood diffuse porous. Growth rings present delimited by smaller vessels and poorly defined terminal parenchyma. Vessels small to medium sized, solitary as well as in radial multiples of 2, occasionally 3; round to oval in shape, those in multiples, flattened at the place of contact, unevenly distributed in the ground mass, lumens of vessels mostly empty. Distribution of vessels is 4-7 per sq. mm. Tylosis are absent. Wood parenchyma paratracheal, vasicentric to aliform, forming 3-5 celled sheath around the vessels. Xylem rays numerous, uniseriate forming canal like structure present after 2-4 cells of fibres. Ray tissue homogeneous, ray homocellular consisting wholly of Procumbent cells, ray 55-300  $\mu\text{m}$ , and 3-16 cells high. Fibres polygonal thick walled aligned in the radial rows between the two consecutive xylem rays.

## Text plate No. 2.



*Anogeissoxylon rehmanense* sp.nov.

Tangential longitudinal section showing distribution of xylem rays and end walls.

Vessels composed of elongated cells having truncate ends. Radial diameter of the vessels range from 70-200  $\mu\text{m}$  and tangential diameter range 60-170  $\mu\text{m}$ . Length of the radial multiples of 2 is 150-280  $\mu\text{m}$  and multiples of 3 is 210-410  $\mu\text{m}$ . Vessel member length range from 250-1050  $\mu\text{m}$  and breadth 60-130  $\mu\text{m}$ . Vessels are irregularly distributed, perforation simple, vessel ends transverse. The inter-vessel pits vestured and minute. Parenchyma cells round to oval in shape, diameter ranges 5-10  $\mu\text{m}$ , diameter of the fibre cells is 10-16  $\mu\text{m}$ . Xylem rays numerous, exclusively uniseriate, about 12-32 rays per mm. Xylem rays made up of procumbent cells, diameter of procumbent cells ranges 12-20  $\mu\text{m}$  radial diameter ranges 14-23  $\mu\text{m}$ . Fibres are non-septate 8-16  $\mu\text{m}$  in diameter and length of the fibres ranges 450-900  $\mu\text{m}$ .

**Comparison with the living species:** The moderate sized vessels, paratracheal and vasicentric parenchyma, uniseriate rays, elongated fibres characters leads one to compare these fossil woods with family Leguminosae, Anacardiaceae, Sapindaceae and Combretaceae. These fossils show certain similarities with some members of leguminous wood in having medium sized vessels and paratracheal vasicentric parenchyma (Metcalf & Chalk, 1950). Leguminous wood however, differs in many features by having fairly large to medium sized vessels. In Leguminosae woods parenchyma exhibits variation in

shape and size, which is conspicuous. The paratracheal parenchyma ranges aliform to confluent to zonate type forming bands in regular series, but in the fossils under investigation, the paratracheal parenchyma is not of diverse type, and is usually vasicentric to aliform. The rays in Leguminosae are generally multi-seriate, but in this fossil which is under investigation rays are exclusively uniseriate. This specimen show certain anatomical similarities to family Anacardiaceae. However, in family Anacardiaceae, generally vessels are fairly large and of ring porous type (Metcalf & Chalk, 1950). They do not have any vestured pits. The presence of gum canals and multi-seriate rays are also different as compared to these fossils. Some genera of Sapindaceae are showing resemblance with the present fossils by having uniseriate rays and medium to small sized vessels, but differ in the amount of parenchymatous tissues developed, which is generally very scanty in the family Sapindaceae. Among family Combretaceae the genus *Terminalia* and *Anogeissus* show close affinity to this fossil. Due to the presence of following characters viz., vessels generally medium sized and diffuse with vestured pits, parenchyma usually paratracheal vasicentric and aliform. Fibres are elongated and often non-septate. Ray are generally uniseriate. The relationships of the fossil in question have close similarities with the genus *Anogeissus* and hence the specimen can be assigned to genus *Anogeissoxylon* Navale (1964).

The genus *Anogeissus* is confined to Old World and consists of 8-10 species of trees, shrubs with alternate or falsely opposite entire leaves and capitate inflorescence. One species has a wide range in Africa, second occurs in Arabia, and the remainders are scattered through Southern Asia from Western India and Ceylon to Indo-China. (Pearson & Brown, 1932). In Pakistan it is represented by only one species and this species is not reported from Sindh (Qaisar & Qaisar, 1978).

**Comparison with the fossil taxa:** Detailed comparative studies (Table 1.) with the known species of *Anogeissoxylon* indicate that fossil specimen under investigation differ from already described woods in many respect and therefore can be identified as new species *Anogeissoxylon rehmaneses* sp. nov.

The specific epithet refer to the locality from *Rehman dhoro* for where fossil wood was collected.

**Diagnosis of the new species:** Wood diffuse porous. Growth rings present, delimited by smaller vessels and poorly defined terminal parenchyma. Vessels small to medium, t.d. 60-170  $\mu\text{m}$ , r.d. 70-200  $\mu\text{m}$ , solitary as well as in radial multiples of 2-3; mostly oval in shape; 4-7 per sq. mm.; perforation simple, perforation plate nearly horizontal to oblique; intervessel pit-pairs small. Parenchyma vasicentric, aliform some times confluent. Rays exclusively uniseriate some time biseriate, about 12-32 rays per mm., homogeneous. Fibres libriform septate to non-septate.

**Holotype:** Pakistan, Rehman Dhoro, 33 Km. in west of Amri railway station, district Jamshoro, sindh, Pakistan, Basir Ahmed, RD-54, 1991,(Paleobotany museum, University of Sindh, Jamshoro, Sindh, Pakistan).

**Horizon:** Bara Formation.

**Age:** Paleocene.

Table 1. Comparison of fossil wood related to organ genus *Anageissoxylon* Navale, 1964, along with Geographical and stratigraphical break-up.

Species	Wood	Vessels	Wood parenchyma	xylem	Fibres
<i>Anageissoxylon indicum</i> Navale, 1964 Madras, India, Tertiary	Diffuse Porous	Small, 80-96 µm, solitary as well as in radial multiples of 2-3	Paratracheal, aliform, & confluent.	Mostly uniseriate & also biseriate, upto 20 cells high.	<b>Libriform</b>
<i>Anageissoxylon bussonii</i> Louvet, 1965 Algeria, Africa, Eocene	Diffuse Porous	Small to medium, 70-130 µm solitary as well as in radial multiples of 2-4	Paratracheal, confluent	Mostly uniseriate, 1-22 cells high heterogeneous.	Libriform
<i>Anageissoxylon thailandicum</i> Prakash 1979 Thailand, Tertiary	Diffuse Porous	Small to medium, 60-135µm, solitary as well as in radial multiples.	Paratracheal, scanty vascentric rarely aliform.	Mostly uniseriate, rarely biseriate 10-43 cells high heterogeneous.	Libriform
<i>Anageissoxylon ranikotensis</i> Ahmed & Khan Sindh, Pakistan Sub-recent to pliestocene	Diffuse Porous	Medium 60-130 µm, solitary as well as in radial multiples of 2 rarely 3.	Paratracheal, vascentric aliform.	Mostly uniseriate, 3-16 cells high heterogeneous.	Libriform form separate to non-separate
<i>Anageissoxylon rehmanence</i> sp. nov. Rehman Dhoro, Sindh, Pakistan Paleocene	Diffuse Porous	Medium, 70-200 µm, solitary as well as in radial multiples of 2 rarely 3.	Paratracheal, vascentric aliform and confluent.	Mostly uniseriate, 8-16 cells high heterogeneous.	Libriform form separate to non-separate

## Text plate No. 3.



*Anogeissoxylon rehmanense* sp. nov.

Tangential longitudinal section showing enlarged xylem rays and fibres.

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