

## **ARAUCARIOXYLON, A SILICIFIED GYMNOSPERM WOOD FROM MANCHHAR FORMATION.**

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### **Abstract**

Fossil silicified gymnosperm wood is described here as a *Araucarioxylon* species from Manchhar Formation exposed at Ranikot Fort area of Sind, Pakistan.

### **Introduction**

The first systematic examination of fossil woods collected from the Ranikot Fort area of Sind, Pakistan were initiated by Khan & Rajput (1976) and *Cynometroxylon ranikotense* and *Pterocaryoxylon ranikotense* Rajput & Khan (1982), and *Myristicoxylon ranikotense* (*unpublished*) have been identified and described from Ranikot Fort area. On the basis of the anatomical structure of the fossil wood described in the systematic description and of the stratigraphic position of the locality, it can be established that the fossilized plants were growing under the tropical and sub-tropical climatic conditions that prevailed in the corresponding periods in the present province of Sind, Pakistan.

### **Geography and Geology of the site**

Ranikot is said to be the largest Fort in this region. It is on the right hand side of the Indus River, which is about 117 Km north-west of Dadu city on top of the hill. The general geologic and geomorphic setting of the site have been described by Farshori (1972). The general geological succession of the area is as under:—

DADA Conglomerates		Pleistocene to recent
Manchhar Formation		Miocene to Pleistocene
	---unconformity---	
Laki Formation		Lower Eocene
	---disconformity---	
Ranikot Formation		Paleocene.

The occurrence of plant fossil in the Tertiary Rocks of Sind, was reported by Blanford (1879). These plant remains are well seen in Ranikot Fort area, Rehman dhoro and Bra nai areas particularly in the former locality, where large stem and trunk pieces are seen scattered in the out-crop of Manchhars.

Manchhar Formation is well developed in Sind and occupy a large area in the Laki Range particularly in the synclinal valleys in north and west of Laki Range. The Formation attains maximum thickness of about 10,000 feet, near Manchhar Lake. The thickness diminishes eastward of Laki Range. The Manchhar Formation is chiefly composed of Sandstone, shale, clay and conglomerate. The sandstone predominates in the upper part. The shale and clay increases towards Karachi area (Farshori, 1972). The conglomerate consists of nodules of clay and soft sandstone derived from the same formation. Though the conglomerate is small in proportion, but it is an important indication of the orogenic uplift and erosion in the region. Well preserved organic remains are common in these Rocks, and numerous well preserved fossilized bones and teeth of mammals together with silicified trunks of the trees have been collected from the conglomerate beds which are 37 meters above the lower contact. Marine fossils are not common, only the rolled Oyster shells and crustacean fossils such as *Balanus* sp. are found in the sandstone bed near the contact in the lower part.

#### Material and Method

The material under investigation was collected by the authors in 1974, from the Manchhar Rocks, exposed at Ranikot Fort area of Sind, Pakistan. The fossil consists of one piece of well preserved brown silicified wood of ca 11 cm in length and 15 cm in diameter. Fossil wood was roughly cylindrical bearing irregularly eroded ridges running longitudinally (Fig. 1). The slides of the fossil wood under investigation were prepared following the standard techniques (for details see Rajput & Khan, 1982)

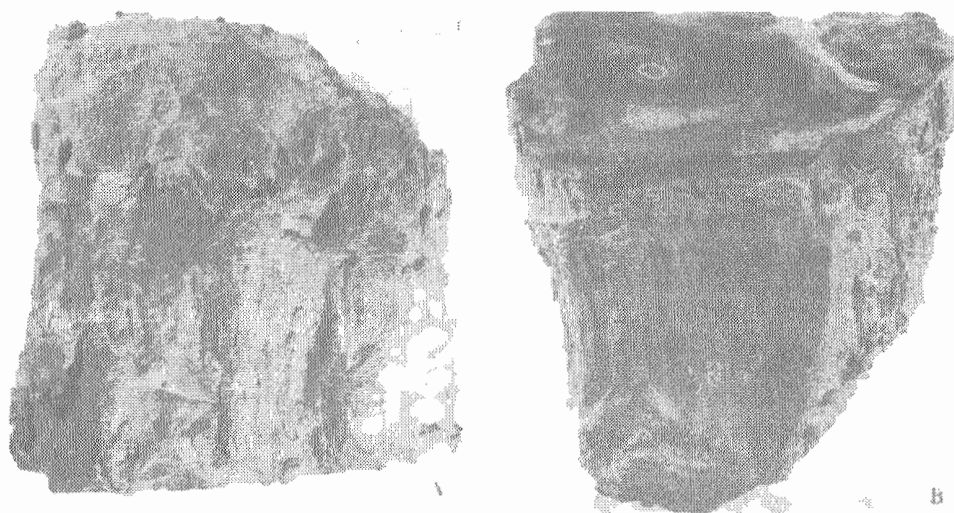


Fig. 1. A. A silicified gymnosperm wood of *Araucarioxylon* sp.  $\times 5$   
B. Transverse view of the wood showing resin canal.  $\times 5$

## **Anatomical Description**

### *Transverse section*

Vessels, pith and growth rings are completely absent. Xylem mainly composed of tracheids which are thick walled, mostly rounded, (Fig. 2, ACD) rarely rectangular or polygonal (Fig. 2, C) with rounded corners having wide lumen partially filled with deposits, (Fig. 2, B). Tracheids diameter 20 – 39  $\mu\text{m}$ , average diameter is 29  $\mu\text{m}$ . Rays are multiseriate, 29 – 48  $\mu\text{m}$  wide. The intervening walls between the two tracheids are thick, and their thickness varies from 13 – 20  $\mu\text{m}$ , average thickness is 16  $\mu\text{m}$ . Medullary rays are placed at an interval of 5 to 9 tracheids. Wood parenchyma absent. Resin canals are quite prominent (Fig. 1, B Fig. 2, A B) and filled with crystalline deposits.

### **Tangential section**

Rays are numerous, multiseriate, homogenous (Fig. 3, A & B; Fig. 4, A), 3 to 5 cell wide, 16 to 37 cell high, average 26 cell high. Ray cells are polygonal to oval in shape (Fig. 3, A), average diameter 21  $\mu\text{m}$ . Mostly the upper and lower ends of the rays are suddenly tapering.

### **Radial section**

Vessels are completely absent. Tracheids are elongated tube like structures with blunt and pointed ends, which are placed end to end (Fig. 3, D). Tracheids length 195 – 616  $\mu\text{m}$ , with an average of 405  $\mu\text{m}$ , partially filled with brownish deposits. Breadth of the tracheids 20 – 42  $\mu\text{m}$ , with an average of 27  $\mu\text{m}$ .

Resin canals are prominent (Fig. 3, C), mostly filled with a crystalline whitish substance. Pits on the radial walls of the tracheids are uniseriate and biseriate. Uniseriate pits are mostly separate and circular (Fig. 3 C, 4, B), biseriate pits are sometimes found in cluster and in some pits border is not visible due to poor preservation. Uniseriate pits are alternately arranged and are more abundant near the ends. Pit apertures are circular or roughly angular.

## **Interpretation and Discussion**

Fossil wood under investigation was a gymnosperm of the conifer type. The important xylotomical attributes viz., complete absence of vessels, wood parenchyma and pith, no conspicuous annual boundary, distinct resin canal, multiseriate homogenous rays with upper and lower ends suddenly tapering, and tracheids with uniseriate and biseriate pits shows resemblances with the following families of gymnosperm eg., Ginkgoaceae, Pinaceae and Araucariaceae.

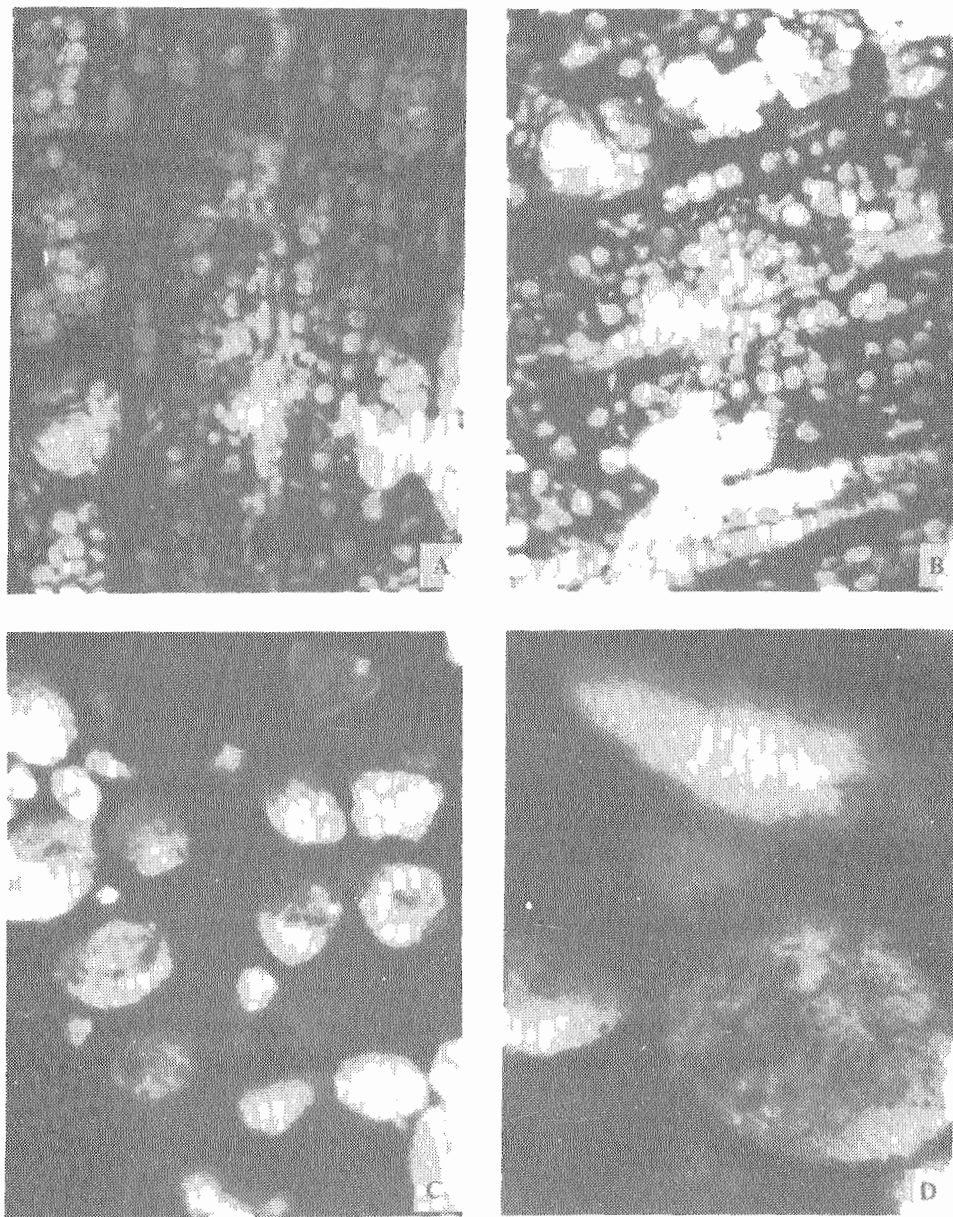


Fig. 2. A. Transverse section showing the tracheids and resin canal,  $\times 130$   
B. Transverse section showing resin canal and tracheids which are partially filled with deposits,  $\times 140$   
C. Enlarged transverse section showing rounded to polygonal tracheids,  $\times 450$   
D. Enlarged portion of transverse section showing rounded tracheids,  $\times 1000$ .

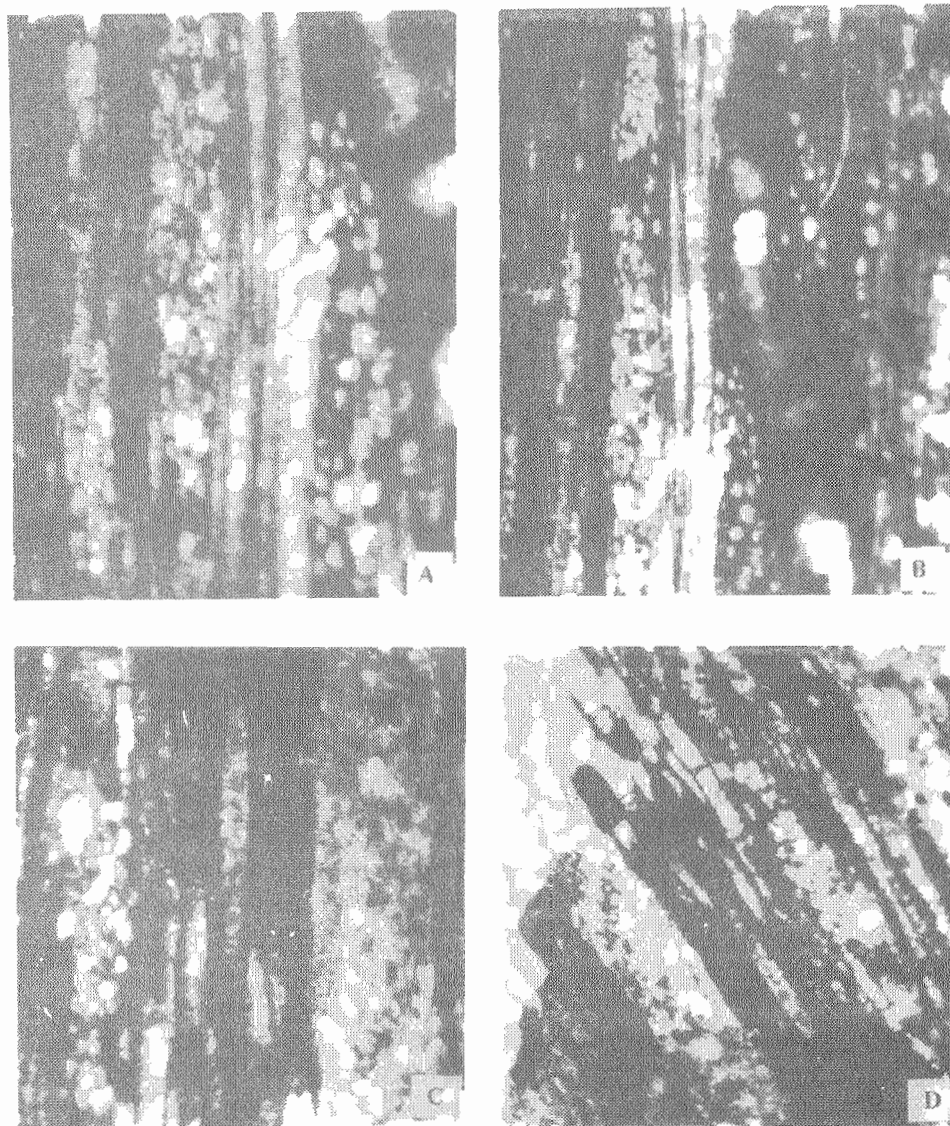


Fig. 3. A. Tangential section showing enlarged ray cell,  $\times 150$   
 B. Tangential section showing the multiseriate rays,  $\times 130$   
 C. Enlarged radial section showing the tracheids with circular pits and resin canal,  $\times 400$ .  
 D. Radial section showing the tracheids and resin canal,  $\times 140$

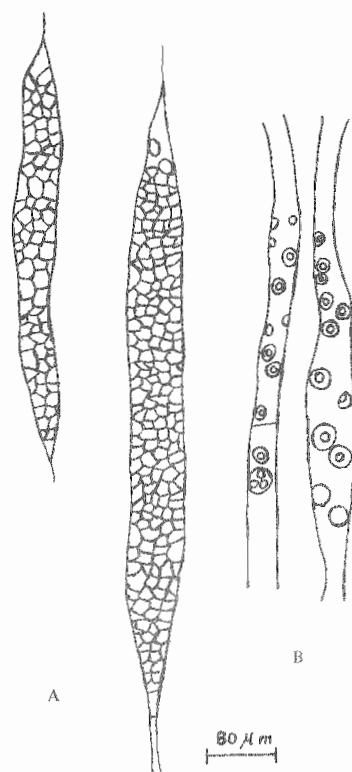


Fig. 4, A. Camera Lucida sketch, showing the multiseriate rays.

B. Camera Lucida sketch, showing the tracheids with pits.

The fossil in question shows some similarities viz., the absence of wood parenchyma and the nature of the rays with *Baiera* of the family Ginkgoaceae but it differs from it in having well developed pith and annual rings. The fossil stem under investigation therefore, does not belong to the family Ginkgoaceae.

Some xylotomical properties eg., distinct resin canal, thick walled tracheids, and nature of rays, can also be comparable with the family Pinaceae. However, family Pinaceae is characterized by the presence of abietineous pits (Easu, 1959), which are absent in the fossil under investigation. Family Pinaceae therefore, can easily be eliminated. On the other hand, the anatomical characters, eg., parenchyma absent, thick walled tracheids with rounded corners having uniseriate and biseriate pits, distinct resin canal, upper and lower ends of the rays suddenly tapering, which is a typical araucarian structure, are comparable with the anatomy of the stem of family Araucariaceae (cf. Phillips, 1948 & Greguss, 1955). As the anatomy of the fossil stem resembles strongly with that of *Araucaria*, the fossil stem under investigation is therefore assigned to *Araucarioxylon*, discovered for the first time from Pakistan.

The fossil wood was collected from Ranikot Fort area of Manchhar Formation, where these fossil are seen scattered along the bedding planes. The mode of occurrence and complete absence of root fossils indicates that the plants from which these fossils have developed were not growing *in situ* but they were transported from some other locality, however, the heavy and large sized fossil indicates, that the source area was not far away from the present site.

Distribution of genus *Araucaria* is mostly restricted from tropical to subtropical condition and living *Araucaria* spp. are commonly found in Australia. Moreover, the complete absence of annual rings also proves our findings regarding the geographical and paleoclimatic conditions i.e., the fossil wood under investigation was also probably growing under tropical and sub-tropical climate.

Another interesting phenomenon can also be established by the presence of resin canals that the plants from which the fossil in question have developed had lived in sunny and warm areas, the oil and latex contents being probably due to the economy of evaporation.

#### Diagnosis

No conspicuous annual ring boundary present. Xylem composed of tracheids with rounded corners. Pits uniseriate and biseriate, uniseriate pits are alternately arranged, pit aperture are circular to triangular. Wood parenchyma absent. Resin canal distinct. Rays with suddenly tapering ends, ray cell are polygonal to oval in shape.

Horizon:	Manchhar Formation.
Age:	Tertiary.
Holotype:	Ranikot Fort Area, District Dadu, Sind, Pakistan; Rajput, M.T.M. & Khan, K.M., R.K. 14, Paleobotany Museum, Department of Botany, University of Sind, Jamshoro, Sind, Pakistan.

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