

Identification of Fossil Wood from Samarinda, East Borneo

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ABSTRACT

This study aims to identify the anatomical structure of petrified wood discovered in Samarinda, East Borneo. The material consists of a single piece of petrified wood, grey, and white—the ground thin-section technique prepared three-dimensional sections (transverse, tangential, and radial). Microscopic characters of the fossil wood were compared with the present wood species. The existence of wood pores characterizes specimens microscopically identified as the petrified wood of hardwood. Further, the xylotomical characters were comparable with the family Dipterocarpaceae. The fossil wood shows a close resemblance with the genus of *Shoreaxylon* in respect of size and arrangement of pores, rays, and axial parenchyma. The similarity was found on two preparates of *Shorea*'s anatomical properties, which are used as comparisons. Therefore, based on these properties, the species of this petrified wood is undoubtedly the genus of *Shoreoxylon*.

Keywords: Morphological, Anatomical, Fossil wood

1. INTRODUCTION

In Indonesia, petrified wood is found almost everywhere, in districts and cities or forest areas, as reported and published by [1-6]. Fossil wood in this research is a single log of petrified wood with 1-meter length, discovered in Mugirejo village, Samarinda, about 5 km away from the city center. The log's

position was in the foothills (Figure 1). A land digger found the fossil in the elevation of 29 m. A fossil in Indonesia came from the Miocene to Pliocene, 25 million years BP (Before Present) to 2 million years BP. The local geologist estimated that this fossil wood-aged less than 2 million years [2,3]. This is based on the analysis of soil formation around the fossils found.

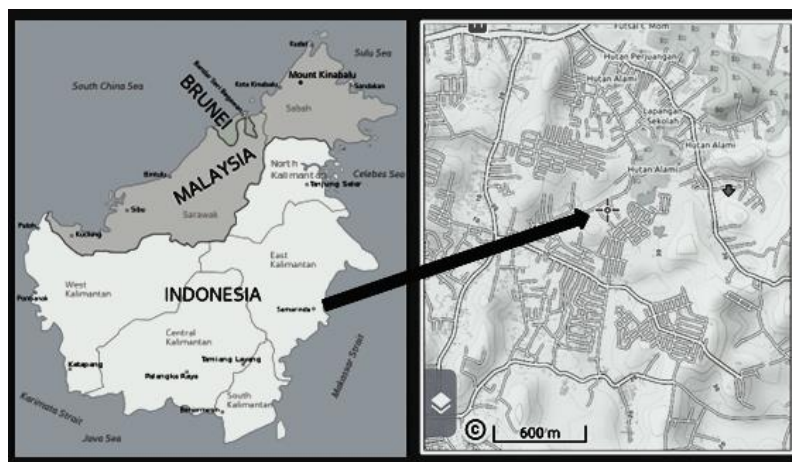


Figure 1 Fossil Site in Mugirejo Village, Samarinda, East Borneo

2. MATERIAL AND METHOD

The fossil wood specimen was from Mugirejo village, Samarinda, East Borneo. The specimen was cut in the dimension of 6x5x5cm. And it has a grey and white color. Transverse, tangential, and radial sections were prepared by ground thin-section technique at the laboratory of geological Museum, Bandung, West Java, with the procedure as follows: 1) The petrified wood was cut into three sections, transverse, tangential, and radial and cleaned with water to remove dust and mud. The petrified wood was then polished using hand sanders with different coarseness, beginning with the most coarse), increasing to a medium, and its anatomical structure at the same time was observed by microscope. 2) Each piece of each petrified wood

section took approximately 10-15 minutes to polish until the specimens' anatomical structure was seen clearly.

Photographs for macroscopical analysis were taken by Microscopic camera (Canon Coolpix D8400), of all three sections and analyzed with light microscope Eclipse E400, and for detail anatomical structure were examined by light microscope (Olympus BH2), in the laboratory of wood biology, Forestry Faculty, University of Mulawarman, Samarinda, East Borneo. The petrified wood pattern was then compared to some preparates pictures of present wood, picture of wood in the reference materials [7] and compare with two preparates of the Genus *Shorea* and analyzed further using xylarium's wood identification method, Bogor.



Figure 2 A Piece of Petrified Wood and Research Equipments

3. RESULT AND DISCUSSION

3.1. Morphological Description

One piece of wood fossil is with a dimension 6x5x5cm. The color of fossilized wood is grey and

striped black and white on the surface, and the hardness was 3-3,5Mohs. The wood fiber's line can still be seen clearly, and the specimens are easy to cut (Figure 2). Almost all transverse surface pores were filled with a white and yellow substance (Fig.3) but not seen in both the tangential and radial sections.

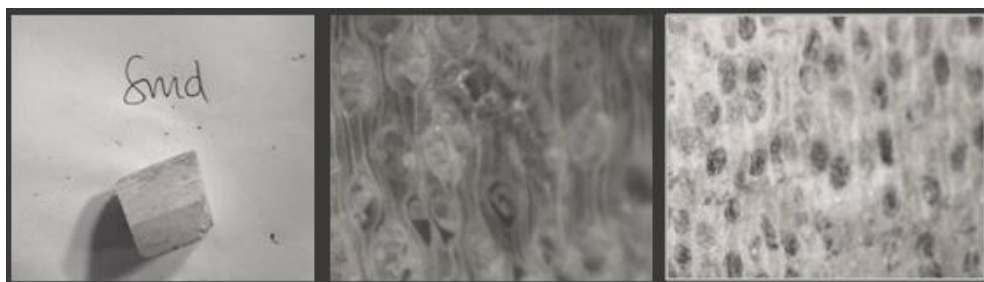


Figure 3 Macroscopical feature: small specimen and pores filled with substance

3.2. Anatomical Description

3.2.1. Transverse section

The specimen is a porous wood with growth ring boundaries indistinct or absent. Vessels round and oval, diffuse-porous arrangement, some in diagonal and radial pattern, tangential diameter varies from 149-250µm; solitary vessels (more) and double vessels (fewer), amount of pores 6-10 per square mm); some pores filled with a yellow substance (Figure 3). In the type of present Dipterocarp, this yellow substance is known as gum. Perforation and axial parenchyma on this surface area are indistinct—broad rays and straight to the radial direction. As seen in figure (4), the arrangement of the intercellular axial canal was spread unevenly. This structure is commonly found in the Hardwood group belonging to the family of Dipterocarpaceae. Still, the certainty that the fossil wood was seen as a Dipterocarpaceae species could not be ascertained because this research is still in progress.

3.2.2. Tangential section

Vessels in tangential are unlike in the transverse surface unfilled (empty of material). It has simple perforation. The length of vessel elements is 257 µm - 470 µm. Rays are long and moderate with multiseriate type, mostly 3-5 cells: rays width 25 µm and 230 µm in high. Amount of rays are 6-10 cell per mm. Xylem rays are heterogeneous due to the different sizes inside the cell rays, and they can be seen clearly.

3.2.3. Radial section

In the tangential section, vessels in the radial section are also not filled with any substance. Vessels segments are elongated, having truncated ends. The vessel's length ranges from 222-361 µm and 131-266 µm in width, the vessel with simple perforation. Axial parenchyma cells are diffuse—heterogeneous rays parenchyma, with several rows of upright and square marginal cells.

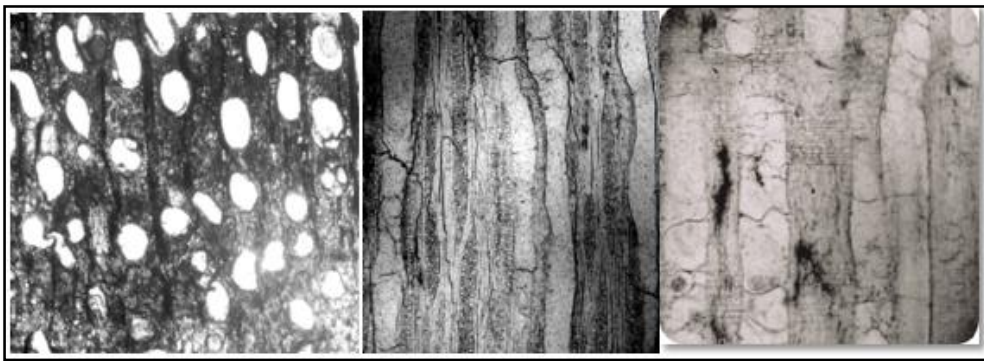


Figure 4 Microscopical Feature, Tranverse, Tangential and Radial Section of Wood Fossil



Figure 5 Microscopical Feature of Shoreoxylon from [2]

3.3. Comparison with Present Wood

The most important anatomical features exhibited by the fossil wood are wood diffuse-porous vessels, mostly solitary or double 2-3, but rare; Axial parenchyma diffuse: rays moderate, 3-5 seriate heterogeneously. Considering the above-mentioned xybotomical characters show its affinity with the wood of

Shoreoxylon, family Dipterocarpaceae. But further can be distinguished by the arrangement of the radial pores which have placed the fossil wood under investigation nearer to the family Myrtaceae. The fossil under investigation shows similarities in most anatomical detail with the genus *Shoreoxylon*, family Dipterocarpaceae.

Table 1. Comparison of Wood Fossil related to *Genus Shorea*

Species	Porous Wood	Vessel	Parenchyma	Rays
<i>Shorealeprosula</i>	diffuse-porous	Medium size diameter 155–350 μm , most solitary, rare in multiples, commonly short (2–3 vessels). The average number of vessels/ mm^2 4-8. Simple Perforation.	Axial parenchyma rarely apotracheal, or paratracheal. Apotracheal axial parenchyma diffuse.	Rays 4–8 per tangential mm, multiseriate, 2–6 cells wide. Height of large rays commonly 500 to 1000 μm , or over 1000 μm . Rays are composed of two or more cell types, heterocellular.
<i>Shoreaovata</i>	diffuse-porous.	Vessels in multiples, commonly short (2–3 vessels) in radial rows. Average tangential diameter 150–295 μm . Average number/ mm^2 3–9. Simple Perforation. pits alternate, with distinct borders or with reduced borders.	Rarely, banded (axial resin canals embedded in parenchyma bands). apotracheal, or paratracheal. Apotracheal diffuse and diffuse-in-aggregates. Paratrachealvasicentric, aliform, and unilateral. Average number of cells per axial parenchyma strand 4.	Multiseriate, 4–8 per tangential mm, 2–6 cells wide. Height of large rays commonly 500 to 1000 μm , or over 1000 μm . Heterocellular rays with square and upright cells restricted to marginal rows, mostly 1 marginal row of upright or square cells or mostly 2–4 marginal rows of upright
Fossil wood	Diffuse porous	Medium size, 149-266 μm in diameter, few 6-10 vessels / sq.mm, mostly solitary and rare double, simple perforation	Axial parenchyma rarely apotracheal, or paratracheal. Apotracheal axial parenchyma diffuse.	Multiseriate rays, medium 2-5 seriate, 2- 10 cells high,6-10 rays/ mm^2 .

To identify more details of this wood fossil's genus, the identification method of Bogor's xylarium was used. The result showed that the characteristics found on the wood fossil preparate are characteristics number: 02,05,10,13, 42,58,69,76, 97,106,107, 115,127 where these characters belong to the genus of Shoreoxylon.

4. CONCLUSION

The wood fossils found in Samarinda belong to the hardwood class (broadleaf) and more resembles the genus Shoreoxylon, the family of Dipterocarpaceae, characterized by the diffuse pores (vessels) arrangement, which was seen on the transverse section, as well as their multiseriate rays line. Paratracheal and apotracheal rare axial parenchyma arrangement, multiseriate heterogeneous rays type, and diffuse interseluler axial (axial canal) are typical features Shorea, is found in the transversal section in this wood fossil specimen.

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