Palmoxylon of the Catahoula Formation

Mike Viney

Flowering plants or angiosperms (Magnoliophyta) make their first unmistakable appearance during the Early Cretaceous at 140 Ma (Kenrick & Davis 2004, p. 195). Traditionally, angiosperms have been divided into monocots and dicots. Woody deciduous trees such as oak, elm, and maple are familiar examples of dicots. Grasses and palms are well known examples of monocots. Among angiosperms, dicots have a more extensive fossil record than monocots. One might expect this to be the case since today dicots outnumber monocots six to one. In addition to this fact most monocots are herbaceous plants, which may not as readily fossilize as the woody dicots (Stewart & Rothwell, 1993, pp 487 & 488). The coastal states of Texas, Louisiana, Mississippi and Alabama are therefore special in that they possess late Eocene and Oligocene deposits in which the silicified remains of palm wood are common (Berry, 1916, p. 233). In fact, petrified palm wood or *Palmoxylon* is the state stone for Texas and the state fossil for Louisiana. The state stone for Mississippi is petrified wood and much of the fossil wood found in the state is *Palmoxylon*.

The genus name *Palmoxylon* is derived from the Latin word for palm tree, *palm*, and the Greek word for wood, *xylo* (Borror, 1988, p. 69 & 111). Palm trees actually do not produce wood; although, they do produce fibrous, wood-like stems. The woody cylinder stems of angiosperm dicots and gymnosperms, such as sequoias, spruce and pines are produced from secondary growth that adds girth to the stem and consists primarily of secondary xylem made of cellulose and lignin. In fact, wood is often defined as secondary xylem (Raven, Evert & Curtis, 1981, p. 664). Palm tree trunks result from only primary growth and reach their adult diameter near ground level.

Palm tree trunks consist of individual vascular bundles embedded in a groundmass of living parenchyma cells. In cross-section the vascular bundles can give a spotted appearance to the palm fiber, Figure 1.

Figure 1 *Palmoxylon* Cross-Section

Each vascular bundle or fibrovascular bundle consists of a small vascular portion of one to four (usually two) large vessels surrounded by numerous fibers that thicken into a bundle cap on one end. Fibers provide structural support. Vessels conduct water. Phloem or food conducting tissue is found between the vessels and the bundle cap, Figure 2.

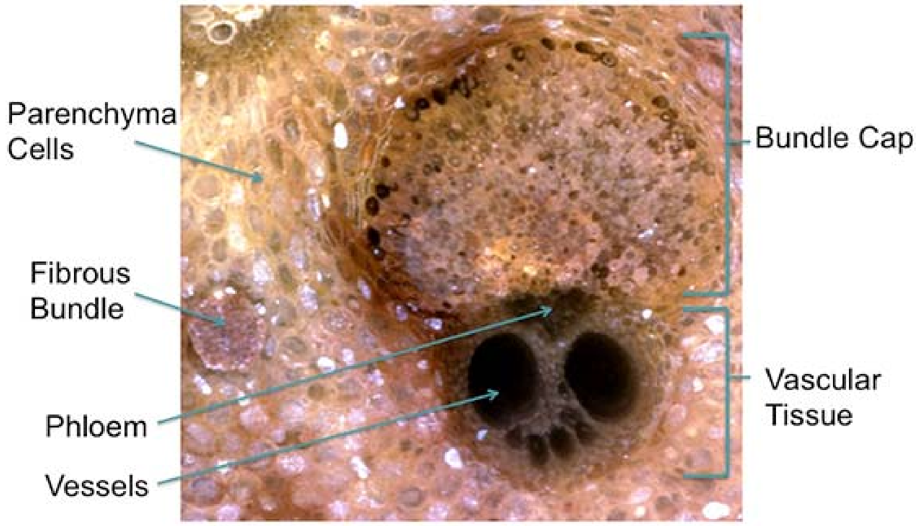

Figure 2 Fibrovascular Bundle at 200x

In the center of the stem vascular bundles are spaced far apart. Towards the periphery of the stem the vascular bundles become more numerous and crowded. Longitudinal cuts reveal that the vascular bundles form rod-like structures, Figure 3.

Figure 3 Longitudinal Section of *Palmoxylon*

In general, fossil palm fiber is easy to identify; however, monocot fiber is fairly uniform in appearance and yields little specific taxonomic information. Identification of palm tree species is difficult because their appearance is so generic. The vast majority of collectors are happy to identify their fossil specimen as belonging to the genus *Palmoxylon*.

Satisfactory palm specimens can be rare. Full rounds are unusual with most specimens representing fragments of trunks, Figure 4. Palm trunks are made from primary growth and much of the stem is composed of living parenchyma cells. The parenchyma tissue is not as resistant to decay as the wood of gymnosperms and dicot angiosperms. Thus, good preservation of intact palm trunks is less likely. The lack of good preservation combined

Figure 4 *Palmoxylon* Fiber

with the generic appearance of the palm fiber explains why there is less scientific systematic work on palms versus gymnosperms and angiosperm dicots. Still, to the keen observer differences in vascular bundle structure and ground tissue can be observed between specimens. Some species have fibrous bundles, which appear as small roundish bundles composed of sclerenchyma cells or fibers (Tidwell, 1998, p. 248). Fibrous bundles are made of the same cells that make up bundle caps, Figures 2 & 5.

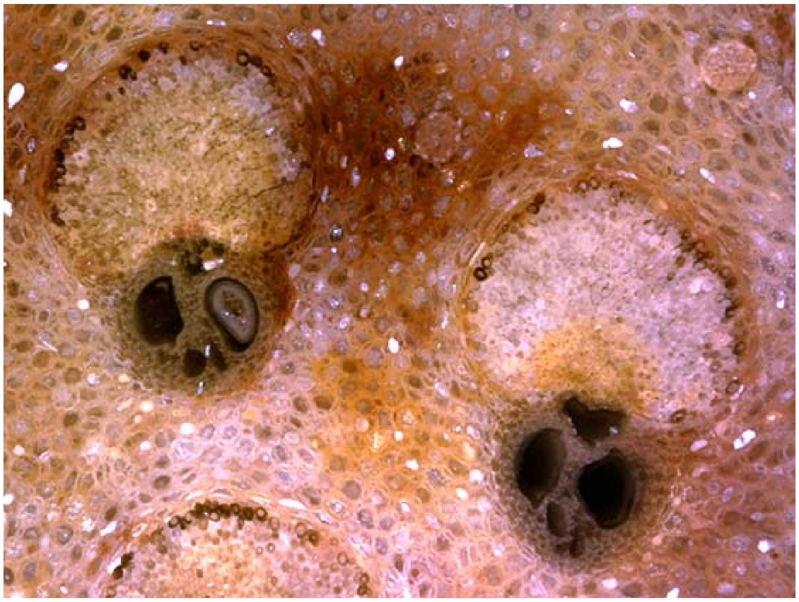

Figure 5 Fibrovascular Bundles and Fibrous Bundles at 150x

Some of the best if not the finest permineralized palm fiber, commonly known as petrified palm wood, comes from the Catahoula Formation in Louisiana, Mississippi and Texas. The Catahoula formation consists of sandstones, sand, clays, and conglomerates. Rivers and streams flowing across broad coastal plains 24 to 30 million years ago deposited sediments making up the Catahoula Formation (Matson, 1916, p. 226; Paine & Meyerhoff, 1968, p. 92; John, 2001, p. 6). These rivers were powered by an uplift of the Rockies. Volcanic activity during the Oligocene in West Texas and Central Mexico explains the volcanic origin of many types of sediments found in the Catahoula. Palms along with other tropical plants grew along a near shore environment that bordered the Oligocene Gulf of Mexico (Berry, 1916, pp 227 & 228). In Louisiana the Catahoula Formation forms a belt across the central part of the state revealing that the ancient palm groves, beaches and deltas that made up this environment lay a further 200 kilometers inland than today's coastline (Daniels & Dayvault, 2006, p. 398). This Oligocene environment had two elements necessary for forming good permineralized specimens, a chance for quick burial and a volcanic silica source.

Palmoxylon is the most abundant plant fossil from the Catahoula Formation and often exhibits excellent preservation. In the past many weathered specimens could be found on the surface or reworked in more recent deposits. Berry, in his 1916 paper, describes 7 *Palmoxylon* species from the Catahoula Formation, providing a key to their identification (p. 234). Differences in vascular bundles and ground tissue are used to key out the species. The species described include: *P. ovatum*, *P. mississippense, P. texense*, *P. lacunosum*, *P. cellulosum*, *P. remotum* and *P. microxylon*. Plates are included that provide illustrations showing cross-sections.

Louisiana *Palmoxylon* may be unmatched worldwide for its fine preservation and color. The permineralization with silica is so fine that cell structure is faithfully preserved. When tapped, specimens produce a sound not unlike fine china. The red, yellow, white and lavender colors invite our imaginations to dream of ancient sunrises and sunsets, Figure 6.

Figure 6 *Palmoxylon* Fiber

To borrow a phrase from Mary White, the finest of Louisiana *Palmoxylon* specimens are truly semi-precious gemstones that serve as keys to the geologic past. Click on the website address to visit our Oligocene Louisiana Gallery.

http://petrifiedwoodmuseum.org/OligoceneGalleryLouisiana.htm

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