

Differences in hemicellulose composition and pectin detection in Eocene and Miocene xylites

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The composition of hemicelluloses differ considerably in extant hardwood and softwood. In this study, we demonstrate that there are also significant differences between the hemicellulose composition of angiosperm and gymnosperm fossil wood (Eocene to Miocene). Because of the excellent preservation and high hemicellulose contents, Fourier-transform infrared (FT-IR) spectroscopy of xylites shows bands that are characteristic of various hemicelluloses and pectin (despite the overlapping of cellulose and lignin IR bands). In particular, fossil softwood samples show IR bands typical of mannose-containing hemicellulose. The composition of hemicellulose is determined through methanolysis gas chromatography–mass spectrometry (GC–MS). The results correspond with those of extant softwood and hardwood hemicelluloses because of the excellent preservation of 13–35 Myr fossil wood deposited under reducing marine conditions. The main saccharide building blocks found in angiosperm Eocene and Miocene wood are glucose and xylose. In contrast, mannose, galactose, and glucose are dominant in gymnosperms. The relationship among xylose, mannose, and rhamnose suitably differentiates both fossil and extant woods. Moreover, the relatively high contents of rhamnose and galacturonic acid identified mainly in angiosperms indicate the presence of preserved pectin, which has not been previously documented in fossil organic matter. Nuclear magnetic resonance (NMR) spectroscopy reveals the presence of xylogalacturonan fragments in a separate fraction of the angiosperm Eocene wood. The presence of pectin, a significantly labile carbohydrate polymer, confirms the perfect preservation of fossil wood in marine deposits. This study sheds new light on the identification of xylite affinities based on their hemicellulose composition and promotes research toward the palaeochemotaxonomy of fossil plants.

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