Carbon and hydrogen isotopes of taraxerol in mangrove leaves and sediment cores: Implications for paleo-reconstructions

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Reconstructing past climate change in mangrove swamps contextualizes ongoing and future developments in these globally important ecosystems. Taraxerol, a well-recognized lipid biomarker for mangroves, is a promising target compound for calibration since it is relatively refractory and well preserved in sediments and since mangrove lipid delta H-2 and delta C-13 values have been shown to respond to salinity changes. Here we investigate the delta H-2 and delta C-13 values of taraxerol in leaves of two mangrove species (Rhizophora mangle and Laguncularia racemosa) and three dated mangrove cores along a spatial transect from the Shark River Estuary of South Florida, USA, to constrain its applicability for hydroclimate reconstructions. The net H-2 discrimination between surface water and taraxerol increased by 1.0 parts per thousand ppt(-1) over a salinity range of 0.7-32 ppt for both R. mangle and L. racemosa. Although the delta C-13 values of taraxerol showed a significant positive correlation with salinity in L. racemosa, the inverse trend was observed in R. mangle. The isotopic signature and spatial trends of taraxerol observed in mangrove leaves were well imprinted in mangrove surface sediments. In addition, we further tested if the isotopic signal of taraxerol from mangrove leaves could be preserved in sediment cores on a time scale of ca. 300 yrs. No strong evidence of significant diagenetic alteration was observed for delta H-2 values of taraxerol. In contrast, an increase up to similar to 1.1 parts per thousand was observed for delta C-13, excluding the Suess effect. Considering the consistent salinity-dependent discrimination of H-2 to salinity, and no significant diagenetic alteration of taraxerol delta H-2 values on centennial time scales, taraxerol H isotopes are a promising proxy for hydroclimate reconstruction in mangrove and mangrove-adjacent systems. However, the interpretation of delta C-13 values of taraxerol should be treated with caution since its correlation with salinity may be species-specific and a slight diagenetic enrichment in C-13 may occur.
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