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High resolution stable carbon and oxygen isotope ratios in the mangrove *Rhizophora mucronata* : what do they tell us ?

A. Verheyden (1,4), G. Helle (2), G. H. Schleser (2), F. Dehairs (3), H. Beeckman (1) and N. Koedam (4)

(1) Royal Museum for Central Africa (RMCA), Laboratory of Wood Biology and Xylarium, Tervuren, Belgium (anouk.verheyden@africamuseum.be), (2) Forschungszentrum Jülich GmbH, Institut für Chemie und Dynamik der Geosphäre, ICG-V Sedimentäre Systeme, Jülich, Germany, (3) Vrije Universiteit Brussel, Laboratory of Analytical and Environmental Chemistry (ANCH), Brussels, Belgium, (4) Vrije Universiteit Brussel, Laboratory of General Botany and Nature Management (APNA), Brussels, Belgium

Mangroves are tropical forests inhabiting the inter-tidal areas of estuaries, lagoons and beaches protected from wave action. Worldwide, sudden die-off and an increased structural degradation of the forests have been reported. It has been hypothesized that the degradation results from a reduction in the freshwater input caused by drought, reduction of the groundwater outflow and/or redirection of rivers. However, the lack of long-term environmental data makes it difficult to prove a causal relationship. Stable oxygen and carbon isotope ratios of tree rings have been proven on several occasions to be valuable proxies for environmental (including climatic) conditions. In this study we investigate the high-resolution profiles of stable carbon and oxygen isotope ratios in the mangrove *Rhizophora mucronata* and evaluate their potential as proxies for environmental conditions.

High-resolution stable carbon and oxygen isotope profiles in three *R. mucronata* stems revealed a remarkable annual cyclicity, similar to the signals observed in temperate tree species (see for example Helle and Schleser, 2004). However, in this evergreen tropical tree which lacks distinct growth ring boundaries (Verheyden et al., 2004), this annual cyclicity was unexpected. The annual cyclicity, together with a conspicuous isotope pattern appearing in the event year 1997 (El Niño), promises a high potential for tropical dendrochronology. However, both profiles could only partially

be explained by the current models of isotope fractionation in plants and our current knowledge on mangrove physiology. In particular, the decrease of the carbon isotopic signal during the dry season is contradictory to increasing soil water salinity and decreasing atmospheric relative humidity. A remarkable similarity was observed in the seasonal patterns of the carbon and oxygen isotopes in the wood of *R. mucronata*, suggesting that similar driving forces are responsible for carbon and oxygen isotope discrimination in these trees.

The results of this study indicates that high-resolution stable carbon and oxygen isotope ratios offer high potential for tropical dendrochronology in general and for dendrochemistry of mangroves in particular, however additional research is needed to determine the driving force(s) responsible for the seasonal pattern in *R. mucronata* wood before environmental information can be extracted. In particular, more research should be carried out on the possible influence of post-photosynthetic processes (such as the remobilization of starch) on the carbon and oxygen isotopic composition of the wood and how important these processes contribute to the isotopic signal in this tropical tree species.

References

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