Geophysical Research Abstracts
Vol. 16, EGU2014-12391, 2014
EGU General Assembly 2014

Gradual aridification of the Sahara during the last 11,000 years revealed by plant wax δD analyses of Lake Yoa (Chad)

Janet Rethemeyer (1), Stefan Kröpelin (2), Jens Karls (1), Matthias Thienemann (1), Martin Melles (1), and Enno Schefuß (3)

(1) Unversity of Cologne, Geology and Mineralogy, Geosciences, Cologne, Germany (janet.rethemeyer@uni-koeln.de), (2) University of Cologne, Institute of Prehistoric Archaeology - African Archaeology, Cologne, Germany, (3) University of Bremen, MARUM - Center for Marine Environmental Sciences, Bremen, Germany

It is still an ongoing debate whether the transition of the last 'green Sahara' period to today's large desert during the Holocene, the African Humid Period (AHP), was a progressive or an abrupt change in hydrological conditions. Several climate records mainly from East Africa suggest a rapid decline of moisture availability at the end of the AHP including new data from a marine sequence off the Horn of Africa (Tierney & deMenocal, 2013). Other archives including sedimentological, geochemical and palynological data from the central North African Lakes Chad and Lake Yoa point to a gradual rather than an abrupt transition near 5,000 years ago (Amaral et al., 2013; Kröpelin et al., 2008). The discrepancy of the available paleo-hydrological reconstructions underline the importance of proxy parameters directly related to hydrological conditions for accurate assessment of continental rainfall changes.

Here, we present the first molecular-isotopic data from Lake Yoa documenting the hydrologic evolution over the entire Holocene. Compound-specific carbon and hydrogen isotope analyses were performed on long-chain n-alkanes. Our data indicate relative high but variable contributions of plant-derived long-chain n-alkanes carrying a distinct leaf-wax signature, i.e. a high Carbon Preference Index (CPI). A trend towards higher CPI values since 7,300 years ago suggests declining soil degradation and vegetation cover under increasingly drier conditions. In parallel, the average-chain-length of the long-chain n-alkanes increases gradually towards the present implying higher relative contributions from grasses. Compound-specific carbon isotope data confirm this finding, indicating a mixed C3/C4 contribution in the early and mid-Holocene changing towards a C4-grass dominated vegetation in the late Holocene. Most importantly, compound-specific hydrogen isotope data reveal a continuous increase from 8,100 years ago towards the present, reflecting a gradual aridification. The large amplitude of about 40 per mil change from the early to late Holocene reflects the retreating influence of moisture derived from the West Africa monsoon from the area, in accordance with isotopic modelling studies (Tierney et al., 2011).

Our data thus indicate a gradual hydrological evolution in the eastern central Sahara over the Holocene, controlled by insolation forcing, and argue against strong bio-geophysical feedback mechanisms. Site-specific local thresholds might exist in other regions, e.g., the Horn of Africa, leading to abrupt rainfall changes.