# Influence of deep water circulation on Saharan vegetation and human migration patterns in North Africa

Isla S. Castaneda[1], Stefan Mulitza[2], Enno Schefuss[2], Raquel A. Lopes dos Santos[1], Jaap S. Sinninghe Damste[1], Stefan Schouten[1]

[1]NIOZ Royal Netherlands Institute for Sea Research, Department of Marine Organic Biogeochemistry, PO Box 59, 1790 AB Den Burg (Texel), The Netherlands
[2]MARUM – Center for Marine Environmental Sciences, University of Bremen, Leobener Strasse, D-28359 Bremen, Germany

The Sahara desert is known to have undergone major, and sometimes abrupt, hydrological fluctuations and was vegetated at times in the past (Kuper and Kropelin, 2006; deMenocal et al., 2000). Understanding its vegetation history is of particular interest because this region may have provided an episodic dispersal path for anatomically modern humans out of sub-Saharan Africa (Osborne et al., 2008; Stringer, 2000). However, only a few long-term and continuous vegetation records presently exist for the Sahara/Sahel region. Here, we use carbon isotope (d13C) measurements of individual plant leaf waxes (n-alkanes) from a site situated beneath the plume of Sahara-derived dust (Guinea margin) to examine variability in the distribution of C3 (trees) and C4 (warm season grasses) vegetation of the Sahara/Sahel region during the past ~200,000 years. The large scale distribution of C3 versus C4 vegetation in tropical Africa is strongly dependent on precipitation (Schefuss et al., 2003) and thus changes in African continental hydrology can be inferred from the n-alkane d13C record. Our data show that variability in strength of Atlantic deep water circulation, which influences both the position of the monsoonal rainbelt over N Africa (Chiang et al., 2008) and the intensity of the African Easterly Jet (AEJ) (Mulitza et al., 2008), is a main control on vegetation distribution in the central Sahara/Sahel region. For the majority of the past 192 ka, central N Africa was dominated by C4 vegetation, indicating arid conditions similar to or even more severe than at present. However, substantial expansions of C3 vegetation, indicating wetter conditions, occurred within Marine Isotope Stage (MIS) 3 (~51-45 ka) and during MIS 5 (125-117 ka), coinciding in time with the two major human migration events out of sub-Saharan Africa (e.g. Mellars, 2006; Forster et al., 2001; Stringer, 2000). Our results thus suggest that changes in deep water circulation influenced North African climate and, at times, contributed to amenable conditions in the central Sahara/Sahel, which allowed humans to cross this otherwise inhospitable region.