Long-term response of African dust inputs to the tropical Atlantic to climate

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We have generated a 180-kyr down-core record of Pb, Sr and Nd isotopes in the detrital fraction of sediment core GeoB2910-1 (4°50'N, 21°03'W, 2703 m), located on the Sierra Leone Rise (SLR) in the eastern tropical Atlantic. This core is ideally situated to examine how dust emission from North African potential source areas (PSA) responded to glacial-interglacial cycles and long-term changes in the African monsoon. The most important PSA are located in Mauritania (PSA-2), Northern Mali (PSA-3) and the Bodélé Depression (Chad, PSA-5) [1].

The detrital fraction Pb isotope data in GeoB2910-1 agree with those for bulk sediment reported in [2]. Radiogenic isotope fingerprinting of PSA [3] [4] suggests eolian inputs at the SLR in roughly equal proportions from Mali and Bodélé sources, entirely consistent with dust emission modelling [5].

The most important feature of the time series is a shift to more radiogenic Pb during the last deglaciation (10 to 4 kyr) and at 101 kyr, corresponding to African Humid Periods (AHP) when the African monsoon penetrated much further north [6]. All three Pb isotope ratios correlate strongly with North African Humidity Index [6]. In contrast, Sr and Nd isotopic compositions show no clear-cut response.

A puzzling observation is that outside AHP, the detrital fraction isotopic compositions are tightly clustered and indistinguishable for glacial and interglacial periods. This implies that the Mali and Bodélé sources, and their relative proportions, remained nearly unaltered over 180 kyr, even though latitude shifts in the ITCZ are known to have taken place. Dust delivery to the SLR occurs, however, during the boreal winter, when the ITCZ is closest to the equator, and is blocked during the summer monsoon months as the ITCZ migrates northwards. The clear change in dust provenance during AHP likely reflects increased vegetation and filling of lakes (e.g. Lake Megachad in the Bodélé Depression) that are dry and prominent sources of dust today.

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