Geophysical Research Abstracts
Vol. 15, EGU2013-3329-2, 2013
EGU General Assembly 2013

Geochemical and isotopic constraints on the significance of the Bodélé Depression as source for global dust emission

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The Bodélé Depression, located in Chad in the Southern Sahara, is one of the most prominent dust emission regions. Despite evidence of large dust storms emanating from the Bodélé region, geochemical tracer studies have not been able to identify unambiguously the signature of dust emitted from this region. This is partly due to the lack of isotope data on samples collected directly from the Bodélé Depression.

Here, we present a major and trace element dataset as well as Pb, Nd and Sr isotope data for samples collected from the Bodélé Depression and dust deposits from various locations (Chad, Niger) along the Harmattan wind trajectory. The dataset provides the first isotope characterization of dust derived from a key emission source in the Sahara and allows investigating the postulated fertilization of the Amazon Basin by African dusts and the significance of the Bodélé dust source for short and long range transport of African dusts.

The results reveal the presence of contrasting signatures in the dry lake bed sediments and the mixed diatomites and surrounding sand material. This finding implies that the Bodélé Depression material is not “pre-mixed” at the source to provide a homogeneous source of dust. There appears to be no detectable contribution from Bodélé or other African dust sources to the Amazon Basin surface sediments investigated. These have isotope signatures that reflect an origin from in-situ weathering products from local Amazonian sources. Dust emitted from the Bodélé source region may, however, be significant in the overall global budget of dusts mobilized by the Harmattan low-level jet during the winter. To this extent, our results bear on the understanding of present-day African dust sources and transport patterns and will be useful to interpret the marine sedimentary record of dust transport and deposition downwind from the Saharan plume.