THE EUROPLANET TNA ACTIVITY REPORT

TITLE PROJECT: Provenance of wind-blown dust and river-derived muds in marine sediment cores offshore NW Afrika
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Purpose of the visit

In order to improve our predictions of future climate, a better understanding of the coupled continent-ocean dynamics and their role in global heat and moisture transport is essential. Deep-sea sediments from regions off the major desert areas, like the Saharan desert, show distinct fingerprints of land-sea connections and offer excellent opportunities to study continental climate change. It has been shown that on geological time scales there have been large climate changes causing the present-day hyperarid Sahara to have been lush and green and even covered by dense vegetation. It is of vital importance to understand how and why this part of Africa responded to climate change but especially the spatial and temporal distribution of environmental change in this region remains unclear.

Description of the work carried out during the visit

In order to characterize the precise provenance of the aeolian and the fluvial fraction offshore the North-West African coast, 22 sediment samples from three time slices in the geological past of relatively well-known environmental conditions (present-day; dry and warm / 6kyr BP; wet and warm/ 12yr BP; dry and cold) split into fluvial mud and wind-blown dust based on their size, were analysed for their $^{143}Nd/^{144}Nd$ and $^{87}Sr/^{86}Sr$ isotope ratios.
Sample preparations for the isotopic analysis were carried out in a "class-100" ultraclean laboratory at the VU University Amsterdam. For Sr and Nd analyses sediment samples were dissolved with a HF-HNO_3-HCl mixture. Two international standards were also included in the analysis procedure. $^{87}Sr/^{86}Sr$ isotope ratios were determined using a MAT 262 Thermal Ionisation Mass Spectrometer (TIMS). Samples were loaded onto single rhenium filaments and measured in static mode. $^{143}Nd/^{144}Nd$ isotope ratios isotopes were analysed on a ThermoFinnigan Neptune multiple-collector inductively-coupled-plasma magnetic-sector mass-spectrometer (MC-ICP-MS). Daily performance of the Neptune is monitored using an internal standard CIGO. Additionaly, trace elements were analysed by inductively coupled plasma mass spectrometry (ICP-MS).

Description of the main results obtained

Changes in the isotopic ratio between $^{87}Sr/^{86}Sr$ can be used to identify changes in the intensity of chemical weathering processes. Furthermore, the isotopic ratio between $^{143}Nd/^{144}Nd$ provides information about the source area of the sediment. The combined analysis enables the distinction and quantification of the contribution of different aeolian and fluvial source areas as well as to reconstruct the regional weathering regimes within NW Africa during the Holocene. Isotope ratios of both, $^{143}Nd/^{144}Nd$ and $^{87}Sr/^{86}Sr$, seem to be of very good quality and show clear evidence that the African humid period was significantly wetter than today. The results of the project are being used as

the main part of a manuscript currently under preparation that will be submitted before the end of the year.

Inka Meyer, Gareth Davies, and Jan-Berend Stuut
Grain size control to (Necessity of size separation in) Sr-Nd-isotope provenance studies and impact on paleoclimate reconstructions off NW-Africa. For submission to Earth & Planetary Science Letters.