Tracking late Quaternary sediment provenance and rain belt shifts across the Red Sea from εNd and element abundances in dust and marine cores

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The Red Sea is an elongated, semi enclosed oligotrophic water body surrounded by hyper-arid deserts. As such, it receives negligible direct input of water and fluvial material from its margins, while being exposed to significant dust fluxes originating from the nearby Sahara-Arabian desert belt.

We present new results describing the history of the Red Sea since the last interglacial from a series of downcore records spanning >2000 km between the Gulf of Aden in the south and the Gulf of Aqaba in the north. In each core we report major and trace element concentrations of the bulk and terrigenous fractions, together with the organic carbon content and $\delta^{13}C$, and the detrital εNd composition.

The results show that the two recent glacial cycles (Marine Isotopes Stages (MIS) 6 and 2) are characterized by εNd values associated with Sahara dust (~-10), while Mg/Ca ratios suggest that significant fractions of Arabian dust are delivered during late MIS2.

By contrast, MIS5e sediments are characterized by an abrupt, basin wide shift of εNd values towards the local Arabian Nubian Shield end member (~ -2) surrounding the Red Sea. This shift stems from intense fluvial events whose impact reached as far north as the north Red Sea. These are coeval with the appearance of cave deposits across the Arabian Peninsula, development of wetlands in East Sahara, and an abrupt fluvial event in the Dead Sea, all pointing to an extensive northward shift of precipitation from the tropics during MIS5e, most likely driven by the African monsoon or tropical plumes.

Although general circulation models indicate corresponding northward migration of the African monsoon during MIS5e, the evidence suggests that they considerably under-estimate the intensity and possibly spatial extent of precipitation in the northern Red Sea. We find little evidence supporting similar climate system migration patterns during the Holocene.