Monsoon-driven paleoproductivity changes in the central Red Sea during MIS 4 - MIS 6

Lóránd Silye[1,2*], Michael Siccha[2] and Michal Kučera[2]

[1] Department of Geology, Babeș-Bolyai University, Romania, lsilye@marum.de

[2] MARUM, University of Bremen, Germany

The Red Sea is an elongated and desert-enclosed basin with very limited connections to the global ocean. As a consequence the effects of atmospheric forcing on its marine environment are amplified. Previous studies of planktonic microfossil assemblages suggested that paleoproductivity in the Red Sea was elevated during boreal winter insolation maxima[1], reflecting enhanced Indian NE monsoon-driven exchange with the Indian Ocean. However, the plankton-based reconstructions are overprinted by nuisance variables in the surface waters and cannot be applied to glacial times. To assess how Red Sea productivity changed on glacial-interglacial timescales and test the monsoon driver hypothesis, we generated an independent and continuous record of paleoproductivity based on the accumulation of benthic foraminifera.

Specifically, we investigated deep-sea benthic foraminifera assemblages (size fraction >63 μm) from piston core GEO TÜ KL09 (19°57.6'N, 38°8.3'E, 814 m water depth) from the central Red Sea across the MIS5 interglacial and its surrounding glacials (MIS 4 and 6). We found that the observed flux of benthic foraminifera allows robust reconstruction of organic matter delivery to the sea floor, even during glacial lowstands and associated hypersalinity in the basin. Contrary to previous hypothesis, our record reveals that productivity in the central Red Sea followed a semi-precessional cyclicity across MIS 5, with peak productivity occurring during summer low-latitude insolation maxima on both hemisphere. We suggest the pattern results from alternate enhancement of the Indian SW summer and Indian NE winter Monsoons over the Red Sea. The enhancement of each monsoon mode leads to elevated productivity at the studied site, but in each case for a different reason. This example provides a mechanistic explanation on how semi-precession can be a dominant forcing in the northermost part of the intertropical belt.

References

Trommer G., et al. Sensitivity of Red Sea circulation to sea level and insolation forcing during the last interglacial. Clim Past, 7, 941-955 (2011).