ENVIRONMENTAL MAGNETISM OF SEDIMENTS FROM THE RED SEA: UNDERPINNING THE CHRONOLOGY OF SEA LEVEL CHANGE THROUGH MARINE ISOTOPE STAGE 3

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Magnetic properties of marine sediments often provide detailed paleoclimate records. When deciphered, sedimentary magnetic signals can provide powerful insights into environmental processes and evaluation of climate signals. The Red Sea is an enclosed marginal basin with no significant riverine input; the deposited sediments are therefore mainly carbonates and eolian dust. It has been shown that the oxygen isotope signal in this basin is controlled by sea level variation. The depth to the sill at the only connection to the global Ocean, the Bab el Mandab Strait, has a similar depth as the maximum glacial sea level excursion. Flow through this connection becomes choked during glacial stages, which drives major evaporative salinity changes in the Red Sea. Salinity changes therefore control the oxygen isotope signal, which can be used, in conjunction with a model of hydraulic exchange through Bab el Mandab, to derive records of relative sea level change. There has been considerable debate about sea level during marine isotope stage (MIS) 3 and whether its variations follow Greenland- or Antarctic-style climate rhythms. We use co-registered records of oxygen isotopic, elemental abundance and magnetic property variations (at 1-cm spacing) from a central Red Sea sediment core to test the synchronization of the sea level record. Red Sea records of sea level variability have been synchronized to Antarctic climate proxy records because of the clear similarity in these signals. In contrast, recent studies argue that MIS 3 sea level followed Greenland-style climate variability. We show that down-core variations in magnetic susceptibility, hematite contents, elemental variations in Fe and Ti are well correlated. This correlation indicates that the environmental magnetic data provide a good proxy for variations in eolian dust input to the central Red Sea. Variation in our Red Sea eolian dust record is consistent with Arabian Sea monsoon variations, which followed a Greenland-style rhythm of climate change during MIS 3, with marked Dansgaard-Oeschger-style variations. Our sea level and eolian dust records unambiguously reveal different phasing of these co-registered signals. Our analysis supports the conclusion that large amplitude sea level changes during MIS 3 were synchronous with Antarctic-style climate variations.

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