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13.000 years of multicentennial variability in Nile discharge: The link between solar activity, Indian monsoon, and Sapropel S1 formation

Rick Hennekam (1), Tom Jilbert (1), Bernhard Schnetger (2), and Gert J. De Lange (1)

(1) Utrecht University, Faculty of Geosciences, Budapestlaan 4, 3508 TA, Utrecht, The Netherlands (*correspondence: f.m.hennnekam@uu.nl), (2) Institute of Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky-University Oldenburg, P.O. Box 2503, D-26111 Oldenburg, Germany.

Sediments in the southeast Mediterranean are characterized by high accumulation rates, being influenced by suspended matter from the Nile plume. Therefore, the sediments from this area offer an invaluable high-resolution climate archive. Earlier work has shown that Nile River outflow has influenced water chemistry in this region throughout the entire Holocene, being well recorded in the oxygen isotopic ratio of the planktic foraminifer Globigerinoides ruber (δ18Oruber). The deposition of organic-rich layers (sapropels) during precession minima is often linked to Nile discharge. Here we present a multi-proxy study of a well-dated sediment core from the southeast Mediterranean basin to study in high-resolution the variability in Nile discharge during the early- to mid-Holocene. High sedimentation rates and sample resolution allow for recognition of (multi-)centennial variability in Nile discharge as recorded by δ18Oruber. Moreover, we measured bulk sediment Ba/Al (representing export-productivity), V/Al (representing redox conditions), and total organic carbon (Corg) during deposition of sapropel S1 ($\sim$6-10 kyr BP). Nile discharge is influenced by moisture transport from both the Atlantic and Indian Oceans, being presently dominated by Atlantic moisture. We show that Nile discharge during the early- to mid-Holocene was dominated by Indian Ocean moisture transport. This is supported by the maximum in Nile discharge at $\sim$9.5 cal. kyr BP, similar to the maximum intensity of Indian Ocean-influenced southwest Indian summer monsoon. Moreover, the strong solar activity signal observed in multi-centennial oscillations in Nile discharge during this time interval concords with those recorded in contemporaneous Indian Ocean-derived monsoon records, but not with those from the Atlantic Ocean. Solar-induced variability in Nile discharge also influenced the conditions relating to Sapropel S1 formation. During its deposition, similar multi-centennial variability is found in bulk sediment Ba/Al, V/Al, and Corg, indicating that nutrient availability and shallow water column ventilation in the eastern Mediterranean were sensitive to Nile discharge.