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Tracing riverine and atmospheric supply variability over the Holocene Mediterranean Sea: A basin-wide perspective

JIAWANG WU[1], SHENGNAN YAO[1], YAN ZHANG[1], ZHIFEI LIU[2], YULONG ZHAO[2], AMALIA FILIPPIDI[3] AND GERT J. DE LANGE[3]

[1]Sun Yat-Sen University
[2]Tongji University
[3]Utrecht University

Presenting Author: jwwu@tongji.edu.cn

The Mediterranean Sea is located at the interface between the African monsoon and the European temperate climate zones. As a semi-enclosed basin, it receives various riverine and eolian inputs from surrounding continents characterized by different rock compositions and climate regimes. These features make the Mediterranean Sea an ideal area to study changes in the Earth' surface hydrological cycle.

Previous works mostly focused on the Saharan dust and Nile discharge, but the supplies from other sources – like the fossil river/wadi systems from the wider North-African margin – may have been underestimated. Besides, how the various terrigenous inputs changed through time remains unclear. Focusing on the Holocene sapropel S1 layer deposited during the African Humid Period, the samples from a suite of cores throughout the eastern Mediterranean Sea and one diagnostic core from the western Mediterranean Sea were analyzed for elemental geochemistry. Comparing between the key time-slices having different hydroclimate backgrounds, this study permits a basin-wide, detailed investigation of the terrigenous detrital inputs to the Mediterranean Sea over the Holocene. Particularly, we aim to geochemically characterize the various dust and riverine contributions and track their variations, with implications for hydroclimate changes.

The ratios of Ti/Al and Zr/Al show longitude and latitude gradients, making them reliable proxies of Saharan dust. The differences among these detrital elements likely reflect changes in the dust sources and delivery from North Africa. Consistent north–south pattern in the various dust proxies suggests an interacting boundary of 36°N between the subtropical high-pressure belt and the temperate westerlies, which appears persistent in the Holocene. In contrast to dust proxies, the riverine indicators (e.g. K/Al, Mg/Al) are not only significantly higher in value for the African Humid Period, but also show distinct differences in geographical patterns. This indicates complex mixings between the various river-borne material. Taken together, the riverine inputs should have largely increased during the early Holocene, while the delivery extents differ between the river systems, affected by specific hydroclimate mechanisms and the transport of the surface currents.