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Paleoriver discharge controlled by precession cycle in the North Africa over the past 240,000 years: relationship to sapropel formation

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The sedimentary sequence of the eastern Mediterranean is often marked by organic-rich layers called sapropels. Sapropel formation was mainly caused by excess freshwater input and the subsequent reduction of ventilation due to an enhanced African monsoon combined with deglacial water input. However, the paleoriver discharge from the North Africa under interglacial and glacial boundary conditions and its impact on the sapropel formation has not been fully clarified yet. We obtained an Nd isotopic composition (ϵ_{Nd}) record of the detrital fraction as well as a grain size indicator of a marine sediment core from the eastern side of the Gulf of Sirte to reconstruct the reactivation of Libyan fluvial fossil systems for the past 240,000 years. The ϵ_{Nd} record showed a systematic increase from a baseline of -12 to -9 to -8 for sapropels S1 to S9, including the glacial sapropel S6. This ϵ_{Nd} shift was synchronous with barium enrichment and depleted planktonic foraminiferal oxygen and carbon isotopic compositions that marked the sapropels. Based on a new ϵ_{Nd} map of source regions in North Africa, the higher ϵ_{Nd} values can be explained by preferential weathering of volcanic fields and soils and increased river discharge under both interglacial and glacial conditions. The grain size indicator showed an increase in fine river particles relative to coarse atmospheric dust when detrital ϵ_{Nd} was higher, supporting this interpretation. These observations are consistent with the available detrital ϵ_{Nd} records, suggesting that the higher isotopic signals during sapropel formation are a basin-wide feature in the Gulf of Sirte. The hydrological cycle in the study area was estimated to be more sensitive to precessional forcing than to high-latitude climate conditions, being consistent with previous modelling studies.