Circulation changes in eastern Mediterranean Sea over the past 23,000 years inferred from Nd isotopic ratios

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The Mediterranean Sea circulation is sensitive to climate forcing as exemplified by the occurrence of organic-rich layers "sapropels". For the most recent sapropel S1 deposited during the Holocene, a leading role of slower eastern Mediterranean thermohaline circulation has been proposed in relation to enhanced water column stratification due to excess fresh water inputs. However, the timing of ventilation changes and circulation patterns since the last glacial maximum (LGM) are still elusive.

Based on well dated marine sediment cores, we reconstructed the past 23-kyr deep and intermediate water Nd isotopic ratios (ε_{Nd}) using ferromanganese coatings of foraminiferal tests and nondecarbonated sediment leachates from the Levantine Sea (1780 mbsl) and the Siculo-Tunisian Strait (771 mbsl). For the whole studied period, the εNd values from the Levantine Sea varied from -5 to -3 whereas the Siculo-Tunisian Strait record presented a larger amplitude (-7 to -3). The LGM ε_{Nd} were higher than the core-top values at both sites, suggesting less contribution of Atlantic water. A marked positive shift at 15-13 ka in the Siculo-Tunisian Strait can be interpreted as enhanced contribution of high ε_{Nd} Nile River waters to the intermediate water mass. Over the African Humid Period (AHP), elevated ε_{Nd} values were maintained for the two records except for sharp negative peaks centred at 8 ka. Around 7 ka, the Nd isotopic compositions started to decrease towards the modern water values. We suggest that the past Eastern Mediterranean Sea circulation was significantly different from the present state with reduced water mass exchange between the eastern and the western basins during the LGM and the AHP. The formation of intermediate water continued for the whole period although the contribution to the western basin was estimated to be small since Alboran Sea showed little ε_{Nd} variability. The events around 8ka can be explained either by a stronger convection and/or a shift in the convection zone.