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The modern Mediterranean Sea neodymium isotopic budget: insight from core-top sediments and box model calculations

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Neodymium isotopic compositions ($^{143}Nd/^{144}Nd$ or ε_{Nd}) have been used as a tracer of water masse provenances in the modern and past oceans. Recently, a potential importance of benthic flux from abyssal seafloor has been proposed although its ubiquitous contribution is still a matter of debate. The Mediterranean Sea is ideal to study major Nd sources and factors affecting seawater isotopic distribution because the water circulation, seawater and detrital ε_{Nd} distribution are relatively well constrained. We analyzed ε_{Nd} of foraminiferal authigenic oxides and leachate (thereafter authigenic phases) and residual fraction of modern sediments along a zonal transect of Mediterranean Sea. The authigenic and residual ε_{Nd} ranged from -9.0 to -3.9 and from -12.0 to -4.4, respectively with the highest values in the easternmost Levantine and the Aegean Seas. The authigenic ε_{Nd} generally agree with deep-water signals except in the easternmost Levantine Sea where they are more radiogenic than corresponding seawater values. Our results combined with existing data revealed that the correlation between the authigenic and detrital ε_{Nd} is not significant on sub-basin scale. Compiled seawater ε_{Nd} co-vary with detrital signals at water depths 0-200m and the correlation becomes weaker at water depths deeper than 1000m. These results question general importance of benthic flux in the modern Mediterranean Sea. Sensitivity tests using a calibrated box model demonstrate that two major factors affecting seawater Nd isotopic distribution in the Mediterranean Sea are the flux of radiogenic Nd from possibly Nile river particles to easternmost basin and the Mediterranean circulation state.