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Collapse of the Mediterranean Thermohaline Circulation during the Sapropel S1: New insights from Nd isotopes

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Sapropel events, organic-rich sedimentary layers that typically appear in the E-Mediterranean, have been often attributed to a combination of enhanced biological production in the surface ocean as well as a deficit in the renewal rate of deep basin waters leading to severe anoxic conditions that helped with the preservation of organic matter in the sediment. The sapropels are intrinsically linked to changes in the Mediterranean thermohaline circulation (MedTHC), but little is known on the drivers of these changes. For example, there are no evidences on how the main intermediate and deep convection cells in the E-Med responded during sapropels. Here we present a new reconstruction of the changes of the MedTHC circulation system during Sapropel 1 using Nd isotopes (εNd) in the Adriatic-North Ionian Sea region. Our study core site is located at the mixing line between the formation of Adriatic Deep Waters (ADW) and the arrival of E-Med Levantine Intermediate Water (LIW). Our newly measured Nd isotope ratios thus reflect changes in the mixing proportions of these two endmembers (ADW vs. LIW), and clearly show two distinctive collapse phases during the sapropel (S1a and S1b) as a result of reduced strength in the ADW convection cell and increased presence of LIW. The two sapropel phases where interrupted but a relatively short period where ADW resumed its convection into the north Ionian Sea. Further support to this interpretation comes from U/Mn ratios measured in foraminifera as well as benthic foraminiferal fauna supporting the idea that the changes in the intensity of deep water convection preceded both the establishment of anoxic conditions at depth and the increased organic matter export to the sediments. We conclude that the collapse of ADW convection cell led the deposition of the last sapropel layer and favoured the dominance of LIW at intermediate depths in the E-Med water column.