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Rapid response of the Adriatic convection cell during the Sapropel S1: New insights from Nd isotopes

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The Sapropel events are intrinsically linked to changes in the Mediterranean thermohaline circulation (MedTHC). These organic-rich sedimentary layers that typically appear in the E-Mediterranean, have been often attributed to the combination of enhanced biological production in the surface ocean and to a deficit in the renewal rate of deep waters leading to severe anoxic conditions that helped preserving organic matter in the sediment. There is a general lack of knowledge on how the main intermediate and deep convection cells in the E-Med responded during sapropels. In this work 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. The study site is located at the convergence and mixing between the outflow of Adriatic Deep Waters (ADW) and the arrival of E-Med Levantine Intermediate Water (LIW). New results using Nd isotope ratios illustrate changes in the mixing proportions of these two endmembers (ADW vs. LIW), and clearly show two distinctive collapse intervals 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 intervals where rapidly interrupted but a relatively short period where ADW resumed its convection and outflow into the north Ionian Sea. Further support to this interpretation comes from U/Mn ratios measured in foraminifera, gran size measurements 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. By using a stochastic box model of the Mediterranean Sea enabled for isotopic tracers in seawater following a Monte-Carlo approach we demonstrate that the Nd isotope results measured in the north Ionian Sea are consistent with a complete shutdown of the ADW outflow during the Sapropel events. The collapse of ADW convection cell led the deposition of the last sapropel layer and favored the dominance of LIW at intermediate depths in the E-Med water column.