HIGH RESOLUTION NEODYMIUM CHARACTERIZATION ALONG THE MEDITERRANEAN MARGINS AND MODELING OF ND DISTRIBUTION IN THE MEDITERRANEAN BASINS.

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Abstract
An extensive compilation of published neodymium (Nd) concentrations and isotopic compositions (Nd IC) was realized in order to establish a new database and a map (using a high resolution geological map of the area) of the distribution of these parameters for all the Mediterranean margins. The use of a high resolution regional oceanic model (1/12° of horizontal resolution) allows to realistically simulate for the first time the epsilonNd distribution in the Mediterranean Sea. This modelling set-up provides the opportunity to study in more the role of the BE on the distribution of Nd IC parameters in the marine environment.

Keywords: Circulation models, Paleoceanography, Continental margin, Geochemical cycles, Mediterranean Sea

Neodymium is a Rare Earth Element (REE) with seven naturally occurring isotopes, all stable. At the continent surface, the eNd of a given material is a function of the Sm/Nd ratio characterizing this material, which is primarily a function of its age and lithology. As a consequence, the εNd of the continents presents a heterogeneous distribution (Goldstein and Hemming, 2003 ; Jeandel et al. 2007).
In this study, we developed a new modelling platform for simulating Nd isotopic composition at high resolution in the Mediterranean basin.
First, the results of a dense compilation of the concentrations and isotopic compositions of the different materials that constitute the Mediterranean margins and are expected to interact with the water masses are presented. This high resolution mapping was also established using a detailed geological map, providing the most realistic representation of the Mediterranean geology existing so far (Fig.1).

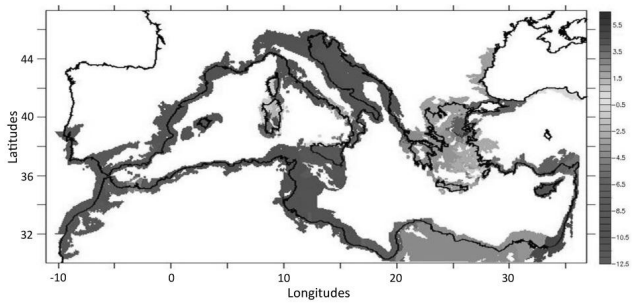

Fig. 1. Map of the Nd margin used in the model, done by interpolation of existing data on a geological map of the Mediterranean basin.

The quality of this interpolated map allows using it as a continuous source of eNd to make a link between an ocean circulation model and the tracer inputs from the margins .The eNd distribution was simulated using a high-resolution regional model (Beuvier et al., 2012) at 1/12° of horizontal resolution (6–8 km).
As a first test, Boundary Exchange (BE, Jeandel et al. 2007) is the only source term of eNd (Arsouze et al., 2007) taken into account. Results reinforce the preceding conclusions at global scale on "BE" as an important process in the Nd oceanic cycle. Nevertheless the present approach simulates a slightly too radiogenic value in the Med Sea (Fig.2). This bias will likely be corrected once the dust and river inputs will be included in the model.

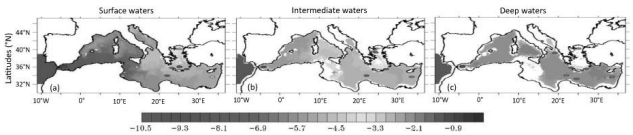

Fig. 2. Modeled eNd distribution in the surface intermediate and deep waters with data superimposed (colored dots).

This work highlights that a significant interannual variability of Nd IC distribution in seawater could occur. In particular, important hydrological events such as the Eastern Mediterranean Transient (EMT), associated with deep water formed in the Aegean sub-basin, could induce a shift in Nd IC at deep/intermediate depths that could be noticeable in the Eastern part of the basin. This confirms that Nd IC could represent an appropriate proxy to improve our knowledge on the long term trend in the Med Sea circulation, especially to explore if EMT-type events occurred in the past. New Nd-paleo-data or recent Nd observations collected on corals or foraminifera in the context of the the PaleoMeX (Paleo Mediterranean Experiment) program should give the opportunity to address this question.
Our next step was therefore to use a fully prognostic coupled dynamical/biogeochemical model with an explicit representation of all Nd sources and sinks to simulate the Nd oceanic cycle in another dedicated study.

References
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