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Last deglacial reorganization of the western Mediterranean thermohaline circulation: evidences from sedimentological and Nd isotopes proxies

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Last glacial/interglacial transition involved significant changes in western Mediterranean (Med) thermohaline circulation that culminated with the formation of an organic rich layer (ORL) in the Alboran Sea from 14.5 to 9 ka BP. This event pre-dated the eastern Med stagnation associated with the Last Sapropel (S1: 10.8-7.1 kyr BP). Here we aim to gain in the understanding that those two events had in the oceanography of the westernmost Med and ultimately its impact on the Med outflow waters (MOW). Our approach combines sedimentological indicators (grain-size and XRF-core scanner data) with Nd isotopes measured in foraminifera diagenetic coatings as a proxy of water mass source. The studied material includes a set of cores covering a depth range from the Alboran Sea (from 300 to 1800 m) combined with a core from the Balearic Basin and another from the Gulf of Cadiz.

Grain-size measurements confirm that major changes in current intensity happened within Heinrich stadial 1. While deepest currents (2400 m) in the vicinity of the Gulf of Lion convection cell became weaker, records from the Alboran Sea show a reinforcement at deep and intermediate levels (1800-600 m) that surprisingly maintained during the whole ORL. During the Younger Dryas Nd isotope values converge along the whole water column, supporting the arrival of more radiogenic waters at the intermediate layer (900-300 m), which are further exported into the Gulf of Cadiz. This event coincides with maximum current speeds above 900 m in the Alboran Sea but also in the Gulf of Cadiz, in agreement with a reinforcement in the arrival of Eastern Med Source Waters (EMSW). In contrast, with the formation of S1 in the E-Med, Nd values between intermediate and deep waters diverge, confirming the reduced influence of more radiogenic EMSW during this period, a signal further exported into the MOW, whose currents reached minimum intensities. These data indicate that during the studied period E and W-Med convection cells changed their operation way compared to the present day and presented a heterogeneous response to deglacial-Holocene climate forcings.