IBERIAN MARGIN DEEP WATER DYNAMICS: THE ROLE OF THE MEDITERRANEAN OUTFLOW WATER

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Background and Aims: Previous studies have shown that the Mediterranean Outflow Water (MOW) became denser and settled deeper in the water column during the last glacial (Schönfeld and Zahn, 2000) and that its flow strength varied on millennial time scales in synchrony with Greenland temperature oscillations (e.g., Voelker et al., 2006). Hardly anything is known about the MOW's history beyond the last glacial/ interglacial cycle.
Objective: Proxy records of core MD03-2699 (39° 2.2'N; 10° 39.6'W; 1896 m) are used to trace depth variations in the MOW/ North Atlantic Deep Water (NADW) interface under varying climate conditions, i.e. during the glacial/ interglacial cycles between 300 and 580 ka (Marine Isotope Stage (MIS) 9-15).
Methods: Benthic foraminifer derived stable isotope and trace element ratio and mean grain size <63µm data is used to reconstruct deep-water properties such as deep-water temperature (DWT) and bottom current intensity.
Results: All proxy records reveal changes on orbital to millennial time scales. Mean grain size shows clear maxima during glacial stages 14, 12 and 10 and periodic increases during the glacial inceptions. All grain size maxima coincided with warmer DWT related to MOW replacing NADW as the prevailing water mass. Thus MOW settled deeper in the water column during the glacial periods and during the cold periods of the glacial inceptions (stadials) when the Atlantic meridional overturning circulation (AMOC) was reduced. During interglacial MIS 11c and 9e current intensity and DWT similar to today reveal the presence of NADW. During the colder interglacial MIS 13, however, DWT were mostly warmer than today indicating either a strong admixing of MOW into the NADW or even the lower edge of the MOW.
Conclusions: Deep-water dynamics on the western Iberian margin were highly variable during the past. During glacial and stadial periods when the MOW settled at depths greater than 1900 m it exported significant amounts of heat and salt into water depths nowadays occupied by upper NADW. Forthcoming results from IODP Expedition 399 will help to trace the MOW's impact on the AMOC and potentially on the deep-sea biota further back in time.

References:

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