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Hydrographic changes in the central Gulf of Cadiz (NE Atlantic) during Marine Isotope Stages 5 and 6 – The IODP Site U1390 record

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During Integrated Ocean Drilling Program (IODP) Expedition 339 – Mediterranean Outflow IODP Site U1390 (36°19.11′N, 7°43.08′W, 992 m water depth) was drilled into sediments of the central middle slope of the Gulf of Cadiz. While its open water location allows to monitor changes in the subtropical surface waters advected into the Gulf of Cadiz by the Azores Current, bottom conditions are dominated by the presence –as nowadays– or absence of the Mediterranean Outflow Water (MOW). IODP Site U1390 exhibits extremely high sedimentation rates of 75 cm/ky during the late Pleistocene and we are making use of this to generate centennial-scale climate records for surface and intermediate-depth water conditions during Marine Isotope Stage (MIS) 4 to MIS 6. Here we focus on the interval from to 190 to 85 ky, encompassing penultimate glacial MIS 6 and interglacial MIS 5e (Eemian). Surface-water conditions are reconstructed using the stable isotope records of planktonic foraminifer species G. bulloides and during MIS 5e also G. ruber white, whereas conditions in the intermediate depth water column, i.e. in the MOW level, are reflected in the benthic foraminifer stable isotope data. In addition, the mean grain size of the bulk fraction <63μm, the weight percent of the sand fraction >63μm and the XRF-derived ln(Zr/Al) data reveal variations in bottom current strength with maxima in all three proxy records indicating a stronger current, namely the MOW, and the formation of a contourite layer.
The planktonic foraminifer stable isotope records show high-frequency oscillations throughout the whole interval, in particular during MIS 6. During MIS 5, the G. bulloides oxygen isotope record clearly reflects marine impressions of Greenland interstadials 25 to 21. During the interglacial period, the current strength related proxy records indicate a sluggish bottom flow – a phenomenon that is linked to the formation of sapropel 5 in the Mediterranean Sea and subsequent changes in the outflow. The very negative benthic carbon isotope values, contemporary with the low current speed, point to Antarctic Intermediate Water replacing MOW during this period in the intermediate depth of the central Gulf of Cadiz. On the other hand, maxima in bottom flow strength, together with relative high benthic carbon isotope values, indicating the presence of the MOW, are associated with the terminal cold event of the MIS 6/ MIS 5 transition, during Greenland stadial periods and frequently during MIS 6. The Site U1390 records therefore reflect millennial-to-centennial scale hydrographic changes in the surface to intermediate depth waters in the Gulf of Cadiz and extend the strong linkages between NE Atlantic subtropical gyre surface conditions and Greenland stadial/interstadial oscillations back to MIS 5.