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Inferring deglacial ventilation ages in Western Mediterranean waters using cold-water corals

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Mediterranean Outflow Water (MOW) acts as a net source of salt and heat into North Atlantic intermediate depths that ultimately contributes to the Atlantic Meridional Overturning Circulation. On this basis, it has been hypothesised that MOW variability might influence global climate. Although several studies have documented major glacial-interglacial changes in deep- and intermediate Mediterranean circulation patterns, little is known about associated impacts on MOW properties, in particular its residence time and geochemical signature. Using a set of cold-water coral samples from along the 'pre-MOW' and MOW path, i.e. from the Alboran Sea to the northern Galician Bank including the Strait of Gibraltar and the Gulf of Cadiz, we aim to identify changes in both the ventilation state of the water masses flowing out of the Mediterranean and the distribution of coral growth.With this purpose, paired Uranium-series and AMS radiocarbon ages have been obtained in the same coral samples allowing any potential change in the reservoir age to be inferred accurately, as well as allowing a spatio-temporal 'coral map' to be created. Furthermore, these results have been complemented by trace element measurements in benthic foraminifera from the Alboran coral mound sediment core.

Our results show a particular spatio-temporal coral distribution with glacial presence only at the deepest sites of the Gulf of Cadiz (~1000m), followed by ~300m Western Mediterranean (WMed) coral appearance across the deglaciation/mid Holocene (14-4 kyr), to end with a proliferation at the Strait of Gibraltar and Galicia Bank from ~6 kyr towards the present. We hypothesise 1) that ~300m WMed area might have been bathed in Atlantic waters inflow during the glacial due to sea-level drop, returning to LIW (Levantine Intermediate Water) influence over the deglaciation, and 2) that MOW reached deeper areas outside of the Mediterranean Sea in the Gulf of Cadiz during the glacial period. Regarding the reservoir age, little change at the WMed is observed at 150-450m

across the deglaciation as compared to the large ventilation excursion detected in the Iberian Margin at ~1000m. However, a ventilation age gradient of ~300 yr related to water depth is observed within WMed corals when appearing at the Bølling-Allerød, in synchrony with significant changes in hydrographical parameters inferred from foraminiferal trace element from the same area. Overall, our results suggest a water mass reorganization at the surface-intermediate layer of the WMed during the deglaciation and early Holocene, but the ultimate nature of these changes needs yet to be explored by further analysis of Nd isotopes as well as of trace elements beyond the deglaciation.