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Deglacial-Holocene Pulses of Old Carbon-Enriched Mediterranean Water Masses: Implications for Aragonite Mounds Growth and Global Carbon Cycle

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Major changes in the Mediterranean Thermohaline Circulation (MedTHC) related to deglaciation and monsoon dynamics have been documented, while in turn, Mediterranean waters have been proposed to play a role back in global climate variability, ocean circulation and carbon cycle budgets, for instance via changes in water mass residence times. The ^{14}C offset between coeval planktonic and benthic foraminifera over time is a very useful tool to infer variations in the water column ventilation (with no biological interference) that becomes more accurate when combined with local paired ^{14}C-U/Th analyses in cold-water corals (CWC). Here, we present a multi-proxy-archive study (i.e., estimates of reservoir ages, εNd, $[CO_3^{2-}]$, O_2 and current speed) carried out on the on-mound sediment core MD13-3452 (305 m, West Melilla, Alboran Sea, Western Mediterranean), which investigates potential deglacial changes and triggers in deep reservoir ages, as well as possible impacts on CWC aragonite mound growth and on global carbon cycle.

Our combined foraminifera-CWC radioactive isotopes results show: 1) the arrival of two pulses of aged waters at intermediate depth corresponding to the Younger Dryas (YD) and to the end of the last sapropel (S1), when low CWC mound growth rates dominated, and 2) a very well-ventilated water mass between those two events, parallel to a CWC mound flourishing stage. In combination with the other proxies, poorer ventilated water pulses seem to have had a different origin, but common higher content in respired carbon. Our results allow, for the first time, changes in ventilation rates to be shown, quantified, and timed in association with a periodical MedTHC weakening, as well as suggesting significant aragonite dissolution as a cause of decreased mound growth rate when higher CO_2 episodes. Our findings may have implications for past hydrographic interconnexions between Mediterranean basins and for global marine carbon storage and alkalinity budget in particular.