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Atmospheric patterns driving Holocene productivity in the Alboran Sea (Western Mediterranean): a multiproxy approach.

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Abstract

This study is aimed to reconstruct productivity during the Holocene in the Western Mediterranean as well as to investigate what processes account for its short-term variability. Fossil coccolithophore assemblages have been studied along with Mg/Ca and Uk'37-estimated Sea Surface Temperature (SST) and other paleoenvironmental proxies. The study site is located in a semi-permanent area of upwelling in the Alboran Sea. This productive cell is of special interest since is closely related to local hydrological dynamics driven by the entering Atlantic Jet (AJ). The onset of this productive cell is suggested at 7.7 ka cal. B.P. and linked to the establishment of the anticyclonic gyres. From 7.7 ka cal. BP to present, the N ratio and accumulation rate of Florisphaera profunda show successive upwelling and stratification events. This alternation is simultaneous to changes in the Western Mediterranean Deep Water (WMDW) formation rate in the Gulf of Lions [Frigola et al., 2007], along with changes in Mg/Ca-estimated SST, relative abundance of reworked nannoliths, pollen grains record [Fletcher et al., 2012] and n-hexacosan-1-ol index. Two scenarios are proposed to explain short-term climatic and oceanographic variability: [1] Wetter climate and weaker north-westerlies blowing over the Gulf of Lions trigger a slackening of the WMDW formation. Consequently, a minor AJ inflows the Alboran Sea leading to less vertical mixing and a deepening of the nutricline and hence, long-term stratification events. [2] Arid climate and stronger north-westerlies enable WMDW reinforcement. In turn, increased AJ triggers vertical mixing and nutricline shoaling, and therefore, productive periods. Finally, changes in atmospheric patterns (e.g. the winter North Atlantic Oscillation; [Olsen et al., 2012]) prove to be useful in explaining the WMDW formation in the Gulf of Lions and associated short-term productivity variations in the Alboran Sea.

References

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