Geophysical Research Abstracts
Vol. 19, EGU2017-15980, 2017
EGU General Assembly 2017

Benthic foraminiferal faunal and geochemical proxies as tracers for paleoenvironmental and paleoceanographic changes in the western Mediterranean over the last 24 ka

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Paleoenvironmental and paleoceanographic changes in the western Mediterranean are reconstructed for the last 24 ka using a combination of benthic foraminiferal assemblages and geochemical proxies measured on benthic foraminiferal shells (Mg/Ca-deep water temperatures and stable isotopes). The studied materials are sediment cores HER-GC-UB06 and MD95-2043recovered at 946 m and 1841 m, respectively, from the Alboran Sea. At present, both core sites are bathed by the Western Mediterranean Deep Water (WMDW), although UB06 core is close to the boundary with the overlying Levantine Intermediate Water (LIW). Therefore, past variability of both water masses can potentially be recorded by the benthic foraminiferal proxies from the studied sites. Benthic foraminiferal assemblages and geochemical data show fluctuations in bottom-water ventilation, organic matter accumulation and deep-water temperatures related to WMDW and LIW circulation. During the glacial interval, an alternation of events showing better ventilation (higher abundance of Cibicides pachyderma) with lower temperatures and events of warmer deep water temperatures with poorer ventilation (Nonionella iridea assemblage, lower abundance of C. pachyderma) are observed. This variability might reflect stronger WMDW formation during the Last Glacial Maximum (LGM) and Heinrich Stadial 1. During the Bølling-Allerød and Younger Dryas (YD) periods, cold temperatures and the lowest oxygenation rates are recorded coinciding with the highest abundance of deep infaunal taxa on both UB06 and MD95-2043 cores. This interval was coetaneous to the deposition of an Organic Rich Layer in the Alboran Sea. However, a re-ventilation trend started at the end of the YD in the shallower site (UB06 core) whereas low-oxygen conditions prevailed until the end of the early Holocene in the deep site (MD95-2043 core). During the early Holocene a significant deep water temperature increase occurred at the shallower site suggesting the replacement of WMDW by warmer water mass, likely LIW. In the middle Holocene, highly variable bottom-water oxygenation and temperatures are observed showing warmer deep waters with less oxygen content (higher deep and intermediate infaunal abundances). The late Holocene (last 4 ka) was characterized by slightly cooler deep water temperatures and enhanced oxygen levels supporting that WMDW became dominant at the shallower site. These observations reveal that Mediterranean thermohaline system has been highly variable during the studied period supporting its high sensitivity to changing climate conditions. These results open a new insight into the Mediterranean sensitivity to Holocene climate variability.