Geophysical Research Abstracts,
Vol. 11, EGU2009-10880, 2009
EGU General Assembly 2009

Reconstructing paleoceanographic conditions in the westernmost Mediterranean during the last 4.000 yr: tracking rapid climate variability

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The westernmost Mediterranean (Alboran Sea basin) is a key location for paleoceanographic and paleoclimatic reconstructions since high sedimentation rates provide ultra high-resolution records at centennial and millennial scales. Here, we present a paleoenvironmental reconstruction for the last 4000 yr, which is based on a multi-proxy approach that includes major and trace element-content fluctuations and mineral composition of marine sediments. The investigated materials correspond to several gravity and box cores recovered in the Alboran Sea basin during different oceanographic cruises (TTR-14 and TTR-17), which have been sampled at very high resolution. Comparative analysis of these cores allows establishing climate oscillations at centennial to millennial scales. Although relatively more attention have been devoted to major climate changes during the last glacial cycle, such as the Last Glacial Maximun, deglaciation and abrupt cooling events (Heinrich and Younger Dryas), the late Holocene has also been punctuated by significant rapid climate variability including polar cooling, aridity and changes in the intensity of the atmospheric circulation. These climate oscillations coincide with significant fluctuations in chemical and mineral composition of marine sediments. Thus, bulk and clay mineralogy, REE composition and Rb/Al, Zr/Al, La/Lu ratios provide information on the sedimentary regime (eolian-fluvial input and source areas), Ba-based proxies on fluctuations in marine productivity and redox sensitive elements on oxygen conditions at time of deposition. A decrease in fluvial-derived elements/minerals (e.g., Rb, detrital mica) takes places during the so-called Late Bronze Age-Iron Age, Dark Age, and Little Ice Age Period. Meanwhile an increase is evidenced during the Medieval Warm Period and the Roman Humid Period. This last trend runs parallel to a decline of element/minerals of typical eolian source (Zr, kaolinite) with the exception of the Roman Humid Period where Zr/Al ratio increases. These climate oscillations (wet and dry periods) are also accompanied by changes in marine productivity rates, as suggested by the Ba/Al ratio. Additionally, anthropic contribution during the Industrial Period is also evidenced by a significant increase in Pb content in most recent sediments.

Acknowledges: Projects Marcal CGL2006-13327-C04-04, Sagas CTM2005-08071-C03-01, Ministerio MARM 200800050084447, RNM 0179, CSD2006-00041.