LATE HOLOCENE CLIMATE VARIABILITY RECORDED BY MARINE-SEDIMENT COMPOSITION IN THE WESTERNMOST MEDITERRANEAN.

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Abstract

Rapid climate variability in the Western Mediterranean for the last 4000 years is reconstructed using high resolution marine sediments. Fluctuations in chemical and mineralogical sediment composition are linked to fluvial-eolian input and redox conditions coinciding with wet (Roman Humid Period, Medieval Warm Period) and dry (Little Ice Age, Late Bronze Age-Iron Age) periods. Such oscillations support the coupling of the Mediterranean climate with the North Atlantic climate system.

Keywords: Western Mediterranean, Alboran Sea, Paleoceanography, Geochemistry, River Input

Introduction

Although relatively more attention has been traditionally devoted to major climate changes during the last glacial cycle, the Holocene has also been punctuated by significant rapid climate variability including polar cooling, aridity and changes in the intensity of the atmospheric circulation [1]. During the Late Holocene (last 4000 years), the Medieval Warm Period (650-1150 cal. BP) and the Little Ice Age (150-650 cal. BP) have been the best identified climate fluctuations worldwide[2]. Previous work has revealed that Western Mediterranean is a highly sensitive area to abrupt forcing at millennial scales during the last glacial cycle ([3], [4]), supporting its link with the North Atlantic ocean-atmosphere system. The aim of this work is to reconstruct the paleoenvironment of the last 4000 yrs based on a multi-proxy approach that includes major and trace element-content and mineral composition of marine sediment records.

Material and methods

Two gravity-cores (305G, 306G) recovered during the Training Through Research Cruise 14, Leg 2, in the East Alboran Sea basin in 2004 have been selected. Both cores were sampled at 1 cm thick slices, to obtain a high resolution record of the last 4000 years. Samples were air-dried and homogenized to carry out mineralogical and geochemical analyses: X-Ray Diffraction, Transmission and Scanning Electron Microscopy, Atomic Absorption and Inductive Coupled Plasma-Mass Spectrometry. Grain size was also determined as a cumulative mass percentage using Sedigraph. The age-depth model has been based on six 14C-AMS dates performed on planktonic foraminifera (*Globigerina Bulloides*) extracted from the >125 μm fraction. Redundancy analyses of the datasets were carried out using the R software.

Results and discussion

Fluctuations of chemical and mineral composition of marine sediments coincide with significant Late Holocene climate oscillations. A decrease in fluvial-derived elements/minerals (e.g., Rb, detrital mica) occurred during the so-called Late Bronze Age-Iron Age and the Little Ice Age Period, while an increase is recognized during the Medieval Warm Period and the Roman Humid Period. This last trend is parallel to a decline of element/minerals of typical eolian source (Zr, kaolinite) with the exception of the Roman Humid Period when the Zr/Al ratio increases. Although barium has been proposed and used as a paleoproductivity proxy in the Mediterranean Sea at time of sapropel deposition, geochemical and statistical analyses show that during the Late Holocene, instead it provides information on detrital input, being associated with alumino-silicates. Furthermore, during this period, productivity reached low levels in relation to previous productive episodes (e.g. sapropels, Heinrich events). In fact, biogenic barite has not been detected in the studied cores. In the most recent sediments, an anthropic contribution is evidenced by a significant increase in the Pb content.

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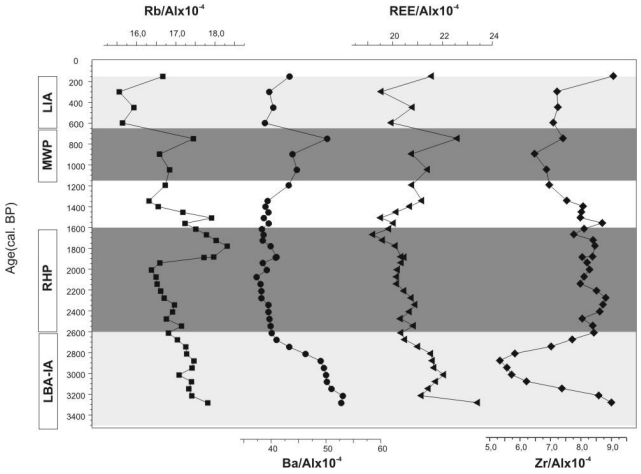

Fig. 1. **Detrital proxies from core 305G. Light grey bars indicate dry periods (LIA= Little Ice Age, LBA-IA= Late Bronze Age-Iron Age) and dark grey bars indicate humid periods (MWP= Medieval Warm Period, RHP= Roman Humid Period).**

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