Surface ocean δ^{11}B-pH reconstructions and insights into the ocean-atmosphere carbon exchange during the last deglaciation

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There is a long-standing debate about the causes of the glacial-interglacial fluctuations in atmospheric CO_2 concentrations (pCO_2). One of the most established hypotheses involves the "storage" of CO_2 in the deep ocean during glacial periods, and the subsequent re-communication of this deep carbon reservoir with the surface ocean and atmosphere during deglaciations (mainly via upwelling in the Southern Ocean), thereby causing atmospheric pCO_2 to increase [1-3]. Yet direct evidence for carbon leakage from the ocean into the atmosphere during deglaciations is currently lacking.

Boron isotopes (δ^{11}B) in planktic foraminifera are a proven proxy for past surface oceanic pH [4,5], which has provided valuable insights into past changes in the ocean carbonate system, and ultimately into past atmospheric pCO_2. Here we will present new planktic foraminifera δ^{11}B results from sediment cores retrieved from the Eastern Equatorial Pacific and Subantarctic Atlantic Ocean that yield novel insights into the causes and mechanisms of pCO_2 rise during the last deglaciation.

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Elemental ratios as proxies for paleoclimate reconstruction in the western Mediterranean

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The western Mediterranean region has provided excellent marine archives for paleoclimate reconstructions. In particular, the Alboran sea basin where exceptional high sedimentation rates allowed high-resolution analyses for reconstructing past climate variability. Elemental ratios have revealed as reliable proxies for such reconstruction and have served to characterize arid/wet fluctuations, intensity of atmospheric fluxes and dust deposition, as well as bottom-water oxygen conditions. Over the past 20,000 cal yr BP, ratios mirroring eolian input (Zr/Al, Ti/Al and Si/Al) evidenced a major input of dust from the offset of the Last Glacial Maximum to the Oldest Dryas. Mg/Al, K/Al and Rb/Al ratios have provided information on fluvial contribution, and record humid conditions during the subsequent Bolling-Allerod warm period, further supported by the decrease of Zr/Al ratio. These ratios have also allowed a detailed reconstruction of paleoclimate conditions during the Younger Dryas and the Holocene. Ratios of redox sensitive elements such as U/Th, Zn/Al, Cu/Al, and V/Al ratios have also supported fluctuations in oxygen conditions at time of deposition, although these elements are particularly susceptible to diagenetic remobilization that could alter the original records. Regarding productivity fluctuations, reconstructions based on Ba proxies, including Ba/Al ratios, have shown a significant increase in the Ba/Al ratio during cold periods, i.e., H1 and Younger Dryas (derived from authigenic marine barite) evidencing enhanced marine productivity. In contrast, during the early Holocene the Ba/Al ratio indicate decreasing productivity. However, the biogeochemistry of Ba is not yet fully understood and mechanisms for barite precipitation in the water column still require further investigation.

DOI:10.1180/minmag.2013.077.5.13