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Lead isotopic compositions in Miocene marine phosphates

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The early-middle Miocene cooling is marked by an excursion in the marine δ^{13}C record whose origin is still debated. The Monterey hypothesis calls upon carbon fluctuations induced by changes in upwelling with increase in organic carbon production and burial (Vincent and Berger, 1985). The alternative explanation (Hodell and Woodruff, 1994; Raymo, 1994) suggests that increased silicate weathering related to mountain building led to a CO_2 draw-down. In this scenario, the increase in organic carbon burial might have resulted from elevated nutrient supply by rivers.

Stille (1992) and Stille et al. (1994; 1996) have contributed to the running debate about the possible links between climate, the phosphorus cycle and the carbon cycle. They have shown that Nd isotopic signatures of marine phosphates deposited in pericontinental environments and for which Sr stratigrahic ages are available can be used to reconstruct past oceanic circulation. In particular, Nd isotopes in marine phosphates appear to monitor the breakdown of the circum-equatorial circulation patterns of the world oceans due to plate tectonics.

Very little is known about the potential of lead isotopes in marine phosphates as tracer of paleocean circulation, although Pb has a strong affinity for calcium fluoroapatite (Koschinsky et al., 2002). Previous Pb isotopic studies have been focused on Fe-Mn nodules and crusts whose compositions and variations throughout the oceans have been shown to reflect those of ambient seawater (e.g. Abouchami and Goldstein, 1995; Abouchami et al., 1999; Vlastélic et al., 2001).

Our aim is to first, evaluate the potential of Pb isotopes in marine phosphates for trac-

ing past seawater isotopic compositions, and second, use this information to constrain the cause of the Miocene cooling event. Indeed, changes in upwelling or increased silicate weathering would be expected to produce a shift in the seawater isotopic composition. Pb isotope data on Miocene phosphates from Malta and North Carolina for which Sr stratigraphic ages and Nd isotopes are already available (Stille et al., 1996) will be presented.

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