Isotopic and trace element constraints on the source of the Late Cretaceous alkaline magmatism of the West Iberian Margin

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The onshore West Iberian Margin was the locus of important alkaline magmatic activity during the Late Cretaceous. This magmatism occurred in two pulses, the first one (94-88 Ma) took place during the opening of the Bay of Biscay and counterclockwise rotation of Iberia. The second pulse (75-72 Ma) is contemporaneous with the initial stages of the Alpine orogeny in Iberia.. This post-rift anorogenic magmatic activity has been considered as a precursor to the Cenozoic circum-Mediterranean anorogenic igneous province (Lustrino & Wilson, 2007) and includes three subvolcanic complexes, the volcanic complex of Lisbon and other minor intrusions, covering an area of 325 km^2.

Collected samples from the most primitive rocks on each of the major occurrences point towards a mantle source enriched in incompatible elements. However, Sr Nd isotopic data ($^{87}Sr/^{86}Sr_i$= 0.7030-0.7049; εNd_i= 3.1-5.8) indicate a time integrated isotopic depletion, suggesting the involvement of a sublithospheric source, such as the one identified in components for the European mantle, such as the Low Velocity Component (Hoernle et al., 1995) and the Common Mantle Reservoir (Lustrino & Wilson, 2007). The significantly more enriched character of sublithospheric mantle dredged in the nearby Iberian Abyssal Plain (Chazot *et al.*, 2005) excludes it as a source for this event. Superchondritic Th/La and K/Nb detected only in some of the more evolved samples support the minor role of crustal contamination on the generation of these rocks.

Magmas from the two pulses are distinguishable based on the behaviour of K. Occurrences from the second pulse show multielemental plots with K anomalies suggesting equilibration with K-rich phase(s), possibly as a result of interaction between the ascending magmas and the mantle lithosphere while this is not seen in rocks from the first pulse. It is suggested that such differences are due to changes in the lithospheric stress field.

Hydrous phase equilibria of the upper Martian mantle

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The melting behaviour of an undegassed Martian mantle is investigated to explore the potential influence of water on the mode of early planetary differentiation. Mars is particularly interesting as it accreted from a chondritic mix richer in volatile elements than other terrestrial bodies (Dreibus and Wänke, 1985), and because its size is equivalent to a proto-planet just before the giant impact stage (Lunine, 2003), suggesting that Mars might have escaped the formation of a magma ocean which would have largely obliterated the evidence of early accretion and differentiation.

Experimental phase relations from terrestrial studies predict storage of significant amounts of water deep inside the planetary interior in the form of hydrous Mg-silicates (talc, chlorite, antigorite; Schmidt and Poli, 1998; Komabayashi et al., 2004), and nominally anhydrous minerals such as stishovite, majorite or the high-pressure olivine polymorphs wadsleyite and ringwoodite. A majority of the experimental work however, is based on the simplified terrestrial mantle analog compositions (Litasov and Ohtani, 2007), and little is known about the effects of Fe, Al, Cr, P that are both important constituents of the Martian mantle and may significantly influence phase equilibria. For example, apatite and spinel will be stabilized to higher pressures in Mars than in Earth as a consequence of the higher mantle phosphorus and chromium contents. The reduced, Fe^{2+}-enriched and Al-deficient mantle of Mars will also restrict the stability of olivine to lower pressures, while hydrous Mg-silicates such as amphibole and chlorite will break down at considerably lower temperatures in the less magnesian Martian mantle.

Furthermore, the position of H_2O-saturated solidus relative to the stability fields of hydrous minerals has only been closely scrutinized at relatively low pressures below 3.0 GPa (Médard and Grove, 2007). The melting relations of dense hydrous silicates, and in turn the dominant phase regimes in deep mantle of early Mars depend on where, and to what extent, the slope of the wet high-pressure solidus reverses to positive dP/dT in deep Martian mantle. Recent results of experimentally determined hydrous phase equilibria and melting relations from wet Martian mantle above 3 GPa are shown and compared to the existing thermal models of planetary evolution (Senshu et al., 2002).