Sulphur solubility in andesitic to basatic melts: An example of Hekla volcano

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The magmatic gas phase plays a major role at active volcanoes and the interest in studying degassing processes has been continuously increasing in modern volcanology. However, the mechanisms of volatile release and partitioning between melt and fluid phase during eruptions of andesitic to basaltic volcanoes are not yet well-understood. In fact, mainly, information to model the distribution of complex volatiles between volcanic gases and natural silicate melts, especially for mafic systems, are limited to a few studies.

In this work, particular attention is given to the Hekla volcanic complex (one of the most active volcanoes in Iceland), which is well characterised, both for the petrology and degassing behaviour (Sigmarsson *et al*., 1992, Moune *et al*., 2006, Moune *et al*., 2007). The distribution of sulphur between silicate melts and coexisting gas phase has been determined experimentally at 300 MPa, 1050°C and FMQ oxygen buffer in the systems containing H-O-S-bearing fluids and basaltic to basaltic andesite melts.

Melt inclusions preserved in those melts allowed us to follow the volatile evolution during magmatic differentiation, showing that the saturation of sulphur in basaltic melts at Hekla is reached around 2500 ppm and that the solubility of sulphur decreases during fractional crystallisation between basalts and basaltic andesites (Moune *et al*., 2007). The first experimental results confirm a saturation of 2500 ppm S in basaltic melts of Hekla coexisting with pyrrhotite. Moreover, these experimental results show the evolution of the melt and the gas phase compositions during magmatic differentiation and during magma ascent. The comparison between experimental products and natural phases is used to interpret the variations in sulphur during volcanic eruptions as well as eruptive mechanisms.

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Further Helium isotopic evidence for a lower mantle contribution to the Cape Verde plume

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The origin of Cape Verde Islands has been intensely debated, and controversy still exists concerning the influence or not of a deep mantle plume beneath the archipelago. In order to better constrain the ultimate origin of the Cape Verde magmatism we will present and discuss He isotopic data, which has been considered one of the most powerful geochemical tools presently available to identify the contribution of the lower mantle to magmatism.

For Brava, one of the youngest Cape Verde islands, He isotopic signatures were performed on olivines, extracted from mafic silicate rocks, and on calcites and apatites occurring in sövitic carbonatites. While apatites are strongly radiogenic, owing to their high U and Th contents, calcites and olivines are usually characterized by $^4He/^3He$ values lower than the typical value of 90,000±10,000 reported for MORB, presenting values as low as 60,711 (11.9Ra) and 53,663 (13.4Ra), respectively. Low $^4He/^3He$ was obtained for silicate rocks of S. Nicolau (45,928; 15.73Ra) and S. Vicente (58,887; 12.27Ra) (Doucelance *et al*., 2003). R/Ra values as low as 46,414 (15.5Ra) were also obtained for S. Vicente carbonatites. Cape Verde islands define two alignments (Northern and Southern islands), presenting distinct elemental and isotopic signatures (e.g. Doucelance *et al*., 2003). Our helium isotopic data for Brava are clearly distinct from those reported for other Southern Islands where the lower $^4He/^3He$ values are MORB-type. These results show that for both Northern and Southern islands, silicate and carbonatitic magmas preserve signs of the contribution from a relatively undegassed/primitive reservoir, as compared with the upper mantle sampled by MORB. We consider this a compelling evidence for a lower mantle origin of the Cape Verde plume, thus supporting the tomographic data imaging the plume down to significantly below the 670 km discontinuity (Montelli *et al*., 2006).

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