Li and B contents in silicate melts as tracers of volcanic degassing

R. SPALLANZANI[1], S.B. CICHY[1,2], M. WILKE[1], M. OELZE[2], K. KOGA[3], D. LAPORTE[3]

[1]Institute for Geosciences, University of Potsdam, Germany (spallanzani@uni-potsdam.de)
[2] GFZ German Research Centre for Geosciences, Potsdam, Germany
[3] Laboratoire Magmas et Volcans, Université Clermont Auvergne, France

Understanding degassing processes of magmatic systems is crucial for the prediction and risk assessment of volcanic eruptions. Lithium and boron are light elements, moderately incompatible to silicate minerals, and both have two stable isotopes. Over the past two decades, Li and B have been widely used to detect subduction-related processes, but they may also be considered as volcanic geospeedometers.

During magmatic decompression, the solubility of volatile phases (mainly H_2O and CO_2) decreases, causing volatile exsolution and bubble formation. As Li and B are fluid-mobile elements, their abundance and distribution in the melt will be strongly affected by magma degassing.

Therefore, we have measured the concentrations of the two elements in erupted matrix glasses and olivine-bearing melt inclusions of several natural samples; namely the 1944 and AD 79 eruptions of Mt. Vesuvius (Italy), the 2007 eruption and other historic lavas from Piton de la Fournaise (La Réunion), the Minoan eruption of Santorini (Greece), and the 1902 eruption of Mt. Pelée (Martinique). Major elements have been measured by electron microprobe, while Li and B elemental concentrations were analyzed by LA-ICP-MS.

Natural melt inclusions show very low Li and B values (average contents are 12.3 ppm and 7.6 ppm, respectively). While the naturally erupted and degassed matrix glasses have Li and B contents in the range of 20-60 ppm.

Additionally, sets of decompression and diffusion-couple experiments on synthetic water-bearing rhyolitic glasses are currently being performed in an internally heated pressure vessel at elevated pressures and temperatures. This will allow us to compare the results of our natural samples to the experimental data, finding potential correlations between the decompression rate and the Li and B elemental and isotopic behaviour. Preliminary results of element mapping and profile measurements emphasize the fluid mobilty of Li and B during experimental magma degassing.

Acknowledgement: *We thank A. DiMuro (IPGP, OVPF) and S. Vogel (Uni Potsdam) for generously providing some of the natural samples.*