Lithium and Boron concentrations and isotopes of the lunar volcanic glasses

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Most of the geochemical inferences about the deepest section of the Moon have been based on studies of the most primitive melts recovered by the Apollo mission, the lunar volcanic glasses. Here, we report new in-situ SIMS measurements of Boron and Lithium (B, Li) abundances and isotopic compositions on ~50 individual beads (25 very low-Ti, 8 low-Ti and 17 high-Ti) of lunar volcanic glasses from the Apollo 15 (sample 15426/27) and 17 (sample 74220) landing sites. We performed spot analyses and depth profiles to unravel not only the primitive B, Li isotopic composition of the Moon's interior, but also the processes that affected the B, Li isotopes and contents during and after eruption.

The new data indicate that the cores of lunar volcanic glass bead have $\delta^{11}B$ -6 ± 2‰, similar to the average MORB (-7 ± 1‰ [1]) and a surface component with a $\delta^{11}B$ as low as -14‰. The $\delta^{7}Li$ of the glass cores ranges from values similar to those in MORB (+3.5 ± 1‰ [1]) to values as heavier as + 10‰, with a surface component with $\delta^{7}Li$ as low as -20‰ and Li concentrations 3 to 8 times higher than the glass interior. In general Li and B concentrations seem to correlate with F and S contents among the major compositional groups, consistent with their moderately volatile behavior. The best correlation with highly volatile element is exemplified by the low-Ti glasses where H, C, Cl, F, S concentrations positively correlate Li and B contents and inversely correlate with $\delta^{7}Li$.

The Li and B concentrations and isotopic variations in the bead cores and surface component of the lunar volcanic glasses, suggest that the Moon's interior has isotopic compositions similar to those of the Earth's upper mantle and that Li and B were partially mobilized as volatile elements, forming part of the gas phase during the processes that generated the lunar glasses.

[1] Marschall *et al*. (2017) *Geochim. Cosmochim. Acta* **207**, 102-53.