

Lunar halogen determinations using a noble gas approach

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Recent *in situ* SIMS studies of melt inclusions from lunar volcanic glass [1,2] and lunar apatite [3-5] suggest that the Moon's mantle may contain water abundances at levels similar to the terrestrial upper mantle. Other studies, however [e.g. 6], contend that the lunar mantle should be anhydrous as a result of volatile element depletion during the Moon-forming impact event. A useful complement to *in situ* measurements is bulk determinations of volatiles in diverse lunar materials from different landing sites.

Here, we present a method to determine bulk halogen (Cl, Br and I) concentrations, in a range of lunar lithologies, to establish the volatile budget of their source regions. Neutron-irradiated noble gas mass spectrometry (NI-NGMS) [7] enables low abundances of halogens to be measured in small samples (~1 mg). Complementing noble gas isotope determinations on unirradiated aliquots of companion samples enables correction of trapped and spallation-derived components. Nine samples, including two ferroan anorthosites, dunite sample 72415, four mare basalts (low-Ti and high-Ti types), and picritic pyroclastic glass from soils 74220 (orange glass) and 15427 (green glass) have been analyzed. We will discuss these results in the context of the evolution of the lunar interior and the effects of surface exposure on the measurements.

[1] Saal et al. (2008) *Nature* **254**, 192-195 [2] Hauri et al. (2011) *Science* **333**, 213-215 [3] Tartèse et al. (2013) *GCA* **122**, 58-74 [4] Barnes et al. (2014) *EPSL* **390**, 244-252 [5] McCubbin et al. (2010) *Am. Min.* **95**, 1141-1150 [6] Sharp et al. (2010) *Science* **329**, 1050-1053 [7] Ruziè-Hamilton et al. (2016) *Chem. Geol.* **437**, 77-87.