Halogen geochemistry of lunar rocks

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The depletion of volatiles in the lunar interior, lost upon collision during a large-impact scenario between Earth and a Mars-sized body [1,2] has been called into question by recent SIMS studies of melt inclusions from lunar glass beads [3,4] and apatite in lunar rocks [5-7]. These studies suggest that the lunar mantle may contain water in similar abundances as the terrestrial upper mantle. Alternatively other studies [8], suggest that the lunar mantle should be anhydrous.

In this study we have measured halogen (Cl, Br and I) element concentrations in a wide range of major lunar lithologies to investigate the volatile budget of their source regions. Nine samples were selected to represent various sample types, landing sites, and chemistry; including two ferroan anorthosites, dunite sample 72415, four mare basalts (low-Ti and high-Ti types), and picritic pyroclastic glass from soil samples 74220 (orange glass) and 15427 (green glass).

Halogen abundances were determined from bulk chips and olivine mineral separates by neutron irradiation noble gas mass spectrometry (NI-NGMS) [9]. All samples are variably affected by the presence of trapped solar wind and cosmogenic-derived noble gases. A methodology for discerning and correcting for these different components is being developed. Results will be presented and discussed in the context of understanding the volatile budget and evolution of the lunar interior and effects of surface exposure [3-8].

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