

Source vs. contamination in Martian shergottites: noble gas and halogen insights

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Terrestrial alteration and the associated contamination of Martian geochemical signatures are a significant issue in the study of Martian meteorites [1]. Weathering in Antarctic meteorites for example is thought to be caused by thin films of water/brine that can exist even below the freezing point of pure water [2].

Halogen ratios of terrestrial surface endmembers are well constrained. However, low concentrations of halogens in Martian meteorite minerals, together with the lack of available techniques for their low level detection, means that reliable abundance data are relatively sparse compared to other volatile elements.

Here, we present a method to determine bulk halogen (Cl, Br and I) concentrations in shergottites to establish the volatile budget of their source regions, but also to assess the extent of external contamination. Neutron-irradiated noble gas mass spectrometry (NI-NGMS) [3] enables low abundances of halogens to be measured in small samples (~1 mg). We have complemented these measurements with noble gas isotope (Ar, Kr, Xe) determinations on unirradiated aliquots of companion samples, this enables correction of trapped and spallation-derived components. Both sets of data were obtained on noble gases extracted by step heating using a CO₂ laser and analysed using a ThermoFisher Scientific ARGUS VI mass spectrometer.

We will present and discuss these results in the context of the evolution of the Mars interior and the effects of external contamination.

[1] Schwenzer et al. (2013) *Meteoritics & Planetary Science* **48**, 929-954; [2] Gooding J. L. (1986), International workshop on Antarctic meteorites. LPI Contribution. Houston, Texas: Lunar and Planetary Institute, 48-54; [3] Ruzié-Hamilton et al. (2016) *Chem. Geol.* **437**, 77-87.