Heavy halogen geochemistry of martian shergottite meteorites and implications for the halogen composition of the depleted shergottite mantle source

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ABSTRACT

Volatile elements (e.g., H, C, N) are essential to life on Earth. Dissolved salts, such as chlorides, perchlorates, and sulfates, that are present in aqueous fluids impact the physical (e.g., freezing point) and chemical (e.g., pH) properties of these fluids and therefore the ability of surface or subsurface liquid environments to host life. The heavy halogens (Cl, Br, and I) are important components of salts in aqueous fluids, such as recently described for subsurface cold brine environments (Orosei et al. 2018; Stamenković et al. 2018) on Mars. Therefore, characterizing the origin and distribution of the halogens in the terrestrial planets is important for a better understanding of planetary habitability.

The heavy halogens are highly incompatible and volatile elements, indicating that their general distribution should be influenced by partial melting processes, magmatic fractionation, and degassing (Aiuppa et al. 2009). Their hydrophilic behavior means that they are mobilized by, and track with, aqueous fluids.

INTRODUCTION

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