# Magmatic Degassing of Trace Elements in Martian Meteorites

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The higher abundances of Li, Cl, S, Zn and Ge in Martian soils than in rocks are due to accumulation of volcanic exhalations [1], but their volatilities are not well known. Terrestrial volcanic aerosols have been used as proxies for martian soil enrichments [2]. No Martian volcanic aerosols are available, but outgassing would leave a distinct depletion of volatile trace elements in Martian igneous meteorites. In this study, we analyzed B, Zn, Ga, Ge, As, Cd and ~ 50 other elements in olivine, pyroxene, plagioclase and bulk rocks of 31 igneous Martian meteorites using LA-ICP-MS [3]. Germanium was outgassed from shergottites but not from nakhlites and chassignites, but Zn does not show any measurable loss due to degassing [4]. Here, we report that Cd contents are lower in shergottites than in nakhlites (except NWA 8694) and chassignites, and correlate with Ge in the most degassed shergottites. Although B and As are both more volatile than Ge in terrestrial magmas [2], our data show that B, As and Ga correlate with a refractory incompatible element in all studied Martian meteorites and thus do not show evidence of volcanic degassing. Thus, only Ge and Cd appear to be significantly outgassed during Martian volcanism, whereas other elements known to be outgassed in terrestrial volcanoes (B, Zn, Ga, As) behave in a refractory manner. Such differences in volatility are due to differences in complexing with Cl, S, etc. [5], the concentrations of which are not always known in Martian magmas. In conjunction with future experimental determination of elemental volatilities, these findings would help constrain the complexing species of Martian magmas.

**Reference:** [1] Berger J. A. et al. (2017), *JGR: Planets* 122, 1747–1772. [2] Zelenski et al. (2013), Chem. Geol. 357, 95-116. [3] Yang et al. (2015), *MAPS 50,* 691-714. [4] Yang S. et al. (2019) *LPS L,* Abstract #1908. [5] Rogaski et al. (2019) *LPS L,* Abstract #2864.