

Understanding lunar highly siderophile element distributions

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Abstract. Highly siderophile elements (HSE: Re, Os, Ir, Ru, Pt, Rh, Au and Pd), are important geochemical tracers for understanding the formation and accretion of planetary bodies. Although the present estimates of the HSE in the lunar mantle are >20 times less than for Earth's primitive mantle, they are still overabundant when compared with models for HSE abundances in the lunar interior using low-pressure partition coefficients for these elements and assuming core formation^{1,2,3} (Fig. 1). Contrary to the moderately siderophile elements (e.g., Ni, Co), high temperature and high-pressure metal segregation cannot explain the elevated and chondritic relative abundances of the HSE in the lunar mantle⁴. Among various models evoked to explain this overabundance, late accretion contributions to the lunar interior emerges as the most promising hypothesis.

Late accretion, however, still requires explanation as the existing HSE data seemingly requires different amounts after considering gravitational focusing between Earth and the Moon. Furthermore, timing of the late accretionary flux is not well understood⁵. Unlike for Earth, lack of *bonafide* mantle samples of the Moon also means mantle HSE estimates are obtained from derivative melts¹. Here, we argue that, in the absence of mantle samples from the Moon, there is continued need to analyze lunar Apollo samples and meteorites to understand both the distribution and variability of the HSE in lunar mantle-derived melts and, ultimately, in the lunar mantle.

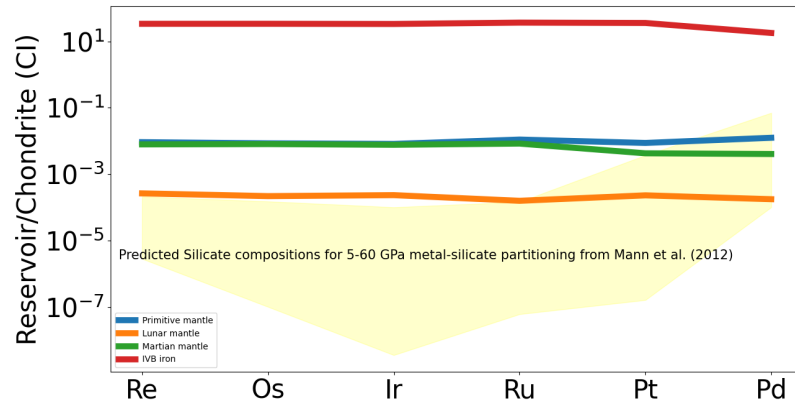


Fig. 1. Baseline distributions of HSEs in the Earth, Moon, Mars and IVB magmatic iron. The pattern does not match with the model prediction of silicate composition after core formation^{2,3}.

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