Core-mantle partitioning of volatile elements and the origin of volatile elements in Earth and Moon

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Depletions of volatile siderophile elements (VSE; Ga, Ge, In, As, Sb, Sn, Bi, Zn, Cu, Cd) in mantles of Earth and Moon, help to constrain the origin of volatile elements in these bodies, and the overall depletion of volatile elements in Moon relative to Earth, but a satisfactory explanation has remained elusive [1,2]. We examine the depletions of VSE in Earth and Moon and quantify the amount of depletion due to core formation and volatility of potential building blocks.

We calculate the composition of the Earth's PUM during continuous accretion scenarios with constant and variable fO_2. Results suggest that the VSE can be explained by a rather simple scenario of continuous accretion coupled with high PT metal-silicate equilibrium that establishes the siderophile element content of Earth's PUM near the end of accretion [3]. Core formation models for the Moon explain most VSE, but calculated contents of In, Sn, and Zn (all with $T_c < 750$ K) are all still too high after core formation, and must therefore require an additional process to explain the depletions in the lunar mantle. We discuss possible processes including magmatic degassing, evaporation, condensation, and vapor-liquid fractionation in the lunar disk.

[1] Ringwood and Kesson (1977) *The Moon* **16**, 425-464. [2] Delano and Ringwood (1978) *Moon and the Planets* **18**, 385-425. [3] Righter (2011) *EPSL* **304**, 158-167.