HIGH PRESSURE, TEMPERATURE EXPERIMENTAL CONSTRAINTS ON VOLATILE, SIDEROPHILE ELEMENT DEPLETIONS (Cd, In) IN MANTLES.

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**Introduction:** The Earth and other differentiated bodies are depleted in volatile elements [1]. This is commonly attributed to condensation processes, whereby these bodies accrete from materials that were already depleted. Although this may be true in general, a complete understanding remains elusive for many elements [2,3]. Additionally, many of the volatile elements are also siderophile at low pressure conditions [4], demonstrating that a specific mantle concentration could be caused by volatility or core formation. Experimental studies in the last decade have shown that the concentrations of many siderophile elements in the Earth’s mantle can be explained by high pressure and temperature core formation processes [5], but little is known about many of the volatile siderophile elements. As a result, studies of Cd and In are being initiated to determine if these elements are lithophile or siderophile at conditions proposed for early magma oceans on Earth and other bodies.

**Experiments and analyses:** Experiments have been carried out at 1 GPa and 1650 °C, using a piston cylinder apparatus. Basaltic starting material containing wt% levels of CdO and In was encapsulated in MgO with Fe metal. Equilibration of the metal-silicate mixture results in liquid silicate and liquid metal, which upon quench were analyzed at NASA-JSC.

**Results:** Silicate liquids are MgO-rich (~20 wt%) and FeO-bearing (~8 wt%), similar to that expected for a magma ocean. Metallic liquids are Fe-rich (~80 wt%) with smaller amounts of Cd, In, P, and Pd. Metal-silicate partition coefficients, D(M/S) (where D = wt% element in metal / wt% element in silicate), measured were: D(Cd) = 1.9; D(In) = 1.7; and D(P) = 6.3.

**Discussion:** A recent study has highlighted an In depletion for the terrestrial mantle that is smaller than expected based on other elements (such as Cd) along the volatility trend as originally defined [2]. However, the new experimental results reported here do not reveal a major difference between D(In) and D(Cd) at high PT conditions. Instead the difference in depletion may be due to two aspects of the behavior of Cd and In: a) In is mildly compatible in clinopyroxene [2] and some high pressure silicates [6], b) In is lithophile in metal-silicate systems at high PT conditions. Whether In and Cd depletions are due to volatility, late veneer additions, or high PT core formation will be evaluated with more experimental data. However, high PT core formation is an alternative to origin from a late veneer (e.g., [7, 8]), and consistent with two other volatile siderophile elements – Ga and Sb [9,10].