Sulfide-silicate partitioning of the HSEs and S-solubility in peridotite melt at high *P* and *T*

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The abundances of the highly siderophile elements (HSEs – Os, Ir, Ru, Rh, Pt, Pd, Re, Au) in the Earth's mantle are thought to have been established by the addition of a chondritic late veneer after core formation ceased. However, the observed HSE mantle abundances, especially the Pd/Ir and Ru/Ir ratios, cannot be reproduced by any known meteorite group, questioning how the HSE abundances were established. Here, the possible stabilization of a core-forming sulfide melt is not taken into account. Segregation of this so-called "hadean matte" [1] would have a strong effect on the behaviour of the HSEs during core formation.

In order to investigate the role of sulfide melt for the partitioning of the HSEs during core formation, we have studied S-solubility and sulfide-silicate partitioning of Pt, Pd, Ru and Ir under high P-T conditions. A molten peridotite was equilibrated with FeS-melt doped with two of the HSEs at a time (10 wt. % each). All experiments were performed in a multianvil-apparatus at 2100-2400 °C and 7-21 GPa using single crystal MgO capsules. Quenched silicate and sulfide were analyzed by electron microprobe for their major element concentrations while HSE and S abundances in the silicates were determined using LA-ICP-MS.

Results show S-solubility in peridotite melt decreases strongly with increasing pressure, consistent with previous studies [2] The solubility limit for S in peridotite melt is slightly higher than in basaltic and chondritic (CV3) melt compositions due to the strong effect of melt composition (esp. FeO) [3]. Our experiments indicate that $D_{HSE}^{sulfide\text{-}silicate}$ of Pt increases with pressure, whereas those of Ru and Pd decrease and $D_{Ir}^{sulfide\text{-}silicate}$ remains constant. Moreover, $D_{HSE}^{sulfide\text{-}silicate}$ of Pt and Pd increase with increasing temperature, whereas $D_{Ru}^{sulfide\text{-}silicate}$ decreases. Modelling the behaviour of S and the HSEs in a combined accretion and core formation model [4] demonstrates that HSE abundances in the Earth's mantle and Pd/Ir and Ru/Ir ratios can only be reproduced if segregation of an immiscible sulfide melt is taken into account.

[1] O'Neill (1991) *GCA* **55**, 1159-1172. [2] Mavrogenes & O'Neill (1999) *GCA* **63**, 1173-1180. [3] O'Neill & Mavrogenes (2002) *JPet* **43**, 1049-1087. [4] Rubie et al. (2015), this meeting