Sulfide-silicate partitioning of moderately siderophile elements at high P-T

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Fundamental evidences of the conditions prevailing during core formation of the planetary bodies essentially come from siderophile element partitioning between core and mantle during metal segregation to the core. For example, the abundances of moderately siderophile elements (MSEs) in the Earth's mantle can be reconciled with metal-silicate equilibration at high pressures and temperatures. It has been proposed, that in addition to Fe-rich metal an immiscible sulfide melt may have been stabilized and segregated to the core. Removal of such sulfide liquid to the core will also have an effect on MSEs that are also chalcophile, for example Ni or Co. Therefore, we experimentally investigate the sulfide-silicate partitioning behavior of four MSEs (W, Mo, Ni and Co) at high pressure and high temperature. A molten peridotitic silicate was equilibrated with a FeS melt doped with the elements of interest (~1 wt.% each) at pressures between 7-16 GPa and temperatures of 2273-2623 K. Single crystal MgO capsules were used in multi-anvil experiments and the starting silicate powder was reduced at FMQ-2 for 24 hours. Quenched peridotite, sulfide and ferropericlase phases were analyzed for major element compositions by electron microprobe and for trace element concentrations using LA-ICPMS.

Reuslts confirm that Ni and Co behave chalcophile under the conditions investigated, while Mo and W are lithophile.Sulfide-silicate exchange coefficients ($K_D^{sulfide-silicate}$) for Co and Ni are fairly constant with increasing temperature and decrease with increasing pressure. The pressure effect is stronger for Co, consistent with previous experimental results.

Both $K_D^{sulfide-silicate}$(Mo) and $K_D^{sulfide-silicate}$(W) decrease with increasing *T* although to different extent: W decreases more strongly with increasing temperature relative to Mo. Both W and Mo only show a small pressure dependence. Overall, segregation of a sulfide melt to the core will have affected mantle abundances of Co and Ni and to a lesser extent Mo, while W will remain unaffected. Our experimental results will be used to model the effect of sulfide segregation on the abundances of these elements in Earth's mantle.