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The importance of sulfur as a lignad to the highly siderophile elements

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Previous studies have shown that HSE dissolve as oxides species in silicate melts (i.e. associated with O^{2-} as a ligand). However, little is known about the possible role of S^{2-} as a ligand to the HSE, even though the HSE are known to be chalcophile.

In order to investigate the role of S^{2-} as a ligand, the effect of S on the solubility of the HSE in silicate melts was studied experimentally. For that purpose a natural picrite was equilibrated with Ru or Pd metal at 1300°C in a 1 atm gas mixing furnace under controlled fS_2 and fO_2.

The solubility of Ru in the picrite is enhanced more than one order of magnitude in sulfur-bearing experiments relative to S-free melts at identical fO_2. Our results indicate that Ru bonds with S^{2-} anions dissolved in the silicate melt. Quantifying the oxygen available to associate with Ru using the Fe^{3+}/Fe^{2+} ratio of the silicate melt, the preference of Ru to associate with S^{2-} is calculated to be ~800 times larger than with O^{2-}. This simple estimate clearly shows that sulfur has the major control on Ru solubility in silicate melts, and possibly on the solubilities of other HSE as well.

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