

Tin transport in ore fluids - in-situ insight from cassiterite dissolution experiments

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Formation of hydrothermal ore deposits requires a fluid capable to transport and deposit metals. Because sources and physicochemical characteristics of hydrothermal fluids vary widely, complexation and speciation of metals in the fluid and precipitation mechanisms of ore minerals are still matter of controversial debates. For the formation of cassiterite (SnO₂), the most abundant tin ore mineral, it has been suggested that Sn in ore-forming fluids is predominantly transported as Sn(II) chloride complexes [e.g., 1-3]. This assumption stems mainly from data on cassiterite solubility at controlled oxygen fugacity (*f*O₂) from quench experiments using double capsule techniques [e.g., 4-5]. However, data interpretations have intrinsic uncertainties mainly due to the overlooked or neglected effect of alloying of Sn with the sample capsule and potentially present quench artifact for the Sn-content in the fluid [6].

One way to obtain in-situ data is using X-ray absorption spectroscopy (XAS) in a hydrothermal autoclave [7] at a synchrotron X-ray source. This experimental approach enables the determination of cassiterite solubility in H₂O-NaCl-HCl solutions and simultaneously establish the Sn(II)/Sn(IV) ratio - to which XAS is sensitive - in the fluid as function of oxygen fugacity at temperatures and pressures relevant for hydrothermal tin ore deposit formation. The relatively large sample chamber of the autoclave allows addition of solid buffers to the sample (e.g., Re-ReO₂, Fe₂O₃-Fe₃O₄, Co-CoO) and thus, enables experiments at various *f*O₂ conditions.

Here, we will present in-situ XAS results on cassiterite dissolution experiments in various fluids at 350 °C and 400 bar. In particular, we will focus on experiments using the Re-ReO₂ buffer and discuss benefits and limitations of this experimental approach.

References:

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