Synthetic fluid inclusions in opaque ore minerals as standards for NIR-light microthermometry experiments

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Fluid inclusions (FI) are an essential tool to study the formation of ore deposits. However, most studies are based on gangue minerals interpreted to be cogenetic. Near-infrared (NIR) microscopy of ore minerals can be used to study FIs hosted in opaque to the visible light, thus providing direct insights into ore-forming fluids. An earlier study on enargite-hosted FIs [1] pointed out important overestimation of fluid salinities and underestimation of homogenization temperatures owing to shifts in recorded phase transition temperatures as a function of the used light intensity. More recent work [2] did not notice drastic light intensity-dependant temperature shifts in pyrite-hosted FIs.

Here we report results of the first systematic study of synthetic FIs in a variety of NIR-transparent ore minerals in an attempt to create standards for NIR-microthermometry. The chosen analytical setting allowed fast fluid-mineral equilibration and ensured trapping of the same solution in both quartz and ore minerals. Natural enargite, pyrite, sphalerite, hematite and stibnite samples were selected on the basis of their transparency to NIR and paucity of FIs. Each sample was loaded together with fine-grained equivalents into a gold capsule, to which synthetic quartz and a 10wt% NaCl solution spiked with Cs was added. After heating and quenching, synthetic FIs (up to 70 μm in size) in enargite, pyrite, Fe-rich, and Fe-poor sphalerite were obtained.

Microthermometry performed under low light intensity yields similar apparent salinities for FIs trapped in quartz and NIR-transparent minerals from the same batch. With increasing light intensity, important shifts are recorded. In contrast to [1], they are not linearly correlated with the light intensity but correlation trends are exponential-like. For each mineral, there is a range of light settings for which no shift is noticeable.

Ongoing LA-ICP-MS analyses on FIs and their host aim to better characterize fluid-mineral equilibria during the experiments.

[1] Moritz (2006) *J. Geochem. Explor.***89**, 284-287 [2] Zhu *et al* (2013) *Chem. Geol.***351**, 1-14