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1 Elemental Partitioning in Boiling Processes: Imaging Single Fluid Inclusions with Synchrotron Radiation μ-X-Ray Fluorescence

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A standardless quantification procedure dedicated to single fluid inclusions analysis has recently been established using Synchrotron Radiation μ-X-ray Fluorescence (SR-XRF). This was achieved in combining fluorescence and transmission techniques.

We focused on boiling processes and the related elemental partitioning between the two fluid phases generated: a brine and a vapour-like fluid. This is of great interest for a comprehensive understanding of ore generation linked with these processes. New studies suggested that Cu and Au could preferentially partitionate in the vapour phase, which would have profound consequences on current ore generation models. We applied our SR-XRF method to samples from a Cu-Au deposit with preserved inclusions from the two distinct fluid phases generated by a boiling process linked with the ore.

Punctual SR-XRF (1D), mapping (2D) and μ-fluorescence tomography (3D) analyses were performed on these samples. This provided data with good statistics and valuable information on the elemental spatial distribution. This study is the first to look for partitioning evidences with a in-situ, non-destructive method. Our results confirm previous studies suggesting a preferential partitioning of Cu in the vapour phase. Moreover, the initially homogeneous phases evolved in complex multi-phases systems and some elements, like Cu and As, concentrate in the liquid phase of the brine inclusions and in daughter crystals in the vapour ones.