

## Fluid inclusion LA-ICPMS analysis of ore fluids from the Pampalo orogenic gold deposit, Eastern Finland

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The late Archean Hattu schist belt, Eastern Finland, is composed of metamorphosed epiclastic and felsic volcanic rocks, intruded by tonalites and granodiorites. The schist belt hosts structurally controlled orogenic-type gold deposits, including the actively mined Pampalo deposit and many smaller prospects. The mineralization at Pampalo is characterized by gold disseminations in a felsic porphyry dike and intermediate pyroclastic rock as well as gold bearing quartz veins. Quartz occurs as euhedral crystals in boudin necks within the ore zone together with biotite, K-feldspar and calcite; as massive veins recording ductile deformation, and as tabular euhedral crystals in later vein sets related to brittle deformation. Based on structural and petrographic features, a clear time framework of different quartz veins and generations could be established. We have quantitatively determined the composition of fluid inclusions along this time sequence, combining microthermometry, quantitative Raman spectroscopy and LA-ICPMS analysis of individual fluid inclusions. This yielded the most complete multi-element dataset of fluid compositions from orogenic gold deposits worldwide.

Low salinity aqueous-carbonic fluids predominate in quartz associated with earlier boudin neck infills and veins recording ductile deformation, while the later tabular quartz crystals contain only aqueous fluids of similarly low salinities. The LA-ICPMS data reveal significant compositional differences between fluids hosted in the different quartz generations. Alkaline and alkaline earth metals as well as Sb show distinctly higher concentrations in the youngest fluids, whereas high S concentrations up to 3000  $\mu\text{g/g}$  occur only in the oldest fluid types. These also contain Au in the range of up to 0.5  $\mu\text{g/g}$ , in line with recent considerations about reliable Au concentration levels in orogenic gold ore fluids (Pettke and Diamond, 2015), and well above Au concentrations in typical regional-metamorphic fluids. The early Au-bearing fluid therefore bears all the hallmarks of an ore forming fluid, while the later fluid types record the subsequent evolution of the Pampalo hydrothermal system. This provides a firm basis for reconstructing the P-T evolution and thermodynamically modelling the key factors that control formation of orogenic gold deposit.

### References:

Pettke, T. and Diamond, L.W., 2015. Fluid Inclusion Gold Concentrations: From Analysis to Implications for Hydrothermal Ore Formation. ECROFI XXIII Extended Abstracts, p. 29.