Element partitioning at the magmatic-hydrothermal transition in a shallow plutonic system

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Quartz crystals from miarolitic cavities in the Torres del Paine igneous complex, Chile, contain inclusions that document the fluid-related processes during the complete late-stage magmatic-hydrothermal evolution of the pluton. Inclusion petrography and microthermometry combined with growth textures of Quartz crystals identified by variable pressure, secondary electron (VPSE) imaging and oxygen isotopic compositions are used to reconstruct the late magmatic-hydrothermal history of the pluton with focus on the partitioning behavior of elements between residual water-saturated melt and aqueous fluid. This stage is decisive for the mass transfer of elements between geological reservoirs and also central to ore deposit forming processes.

Coeval silicate melt inclusions and magmatic aqueous fluid inclusions were analyzed by individual inclusion LA-ICP-MS [1] to calculate partition coefficients for a set of 42 elements from Li to U.

This broad data set can be divided into groups of elements according to their fluid or melt affinity. Fluid mobile elements such as e.g. Zn, Ag, Pb, or Mn are characterized by fluid-melt partition coefficients (K_Ds) >50. These elements are likely to be enriched in magma-derived fluids and are therefore expected to be dominant in magmatic-hydrothermal ore deposits. Arsenic, Cs, Mo, and Sr are among a group of moderately fluid mobile elements with K_Ds in the range of 5-50, while the group of least mobile elements (e.g. Zr, Th, Nb, and Ce) exhibits K_Ds <0.1.

A first evaluation of the data set indicates a general agreement with previously published data [2], but we observed more extreme K_D values for some elements (e.g. Zn, Pb, Sn, and Zr, Nb), even though internal analytical variations are small. This observation might indicate a pressure effect on element partitioning, as the system studied here represents very shallow emplacement conditions.

[1] Pettke et al. (2012) *Ore Geol Rev* **44**, 10-38. [2] Zajacz et al. (2008) *Geochim Cosmochim Ac* 72, 2169-2197