Hydrothermal flows: a direct approach

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The improvement of fundamental knowledge on metallogenic models implies proposals and validations of new methods to study chemical fluxes related to mineralization. In the field of hydrothermal deposit, we propose to analyze the crystal growth band to estimate the direction and velocities of the local flow [1]. This inverse method is based on local flow modeling. However, no experience validates the approach. This study presents experiments on the crystal growth of a halite for a variable flow solution. The ratio of the upstream to downstream growth rate increases with the flow velocity as predicted by the numerical model. The experiments are carried out in laminar flow and are reproducible. They validate the use of the growth band ratio observed in the fossil hydrothermal system to deduce flow velocities. Such a method is the first to give local hydrodynamic information derived from field observations. In a previous study, we measure the growth band in tourmaline associated with variscan Sn deposits to describe the hydrodynamics of paleo-hydrothermal systems. The deduced flow velocities are higher than those calculated in conventional numerical models based on Darcy's law (10^{-4} m^{-1} vs. 10^{-6} m^{-1}). The comparison between field data and the numerical model is fundamental to understanding the local and temporal variations in hydrothermal systems. The possibility of proposing a controlled method for tracking chemical fluxes in the mineralized hydrothermal system through direct observations is one possible way to improve our understanding of metallogenic processes.

[1] Sizaret et al., (2009) EPSL 280, 71-82