Metal mobility in granite-related hydrothermal ore deposits: a synthetic fluid inclusion study

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With the development of LA-ICP-MS techniques it has become possible to analyze major, minor and trace element concentrations in fluid inclusions [1]. Thereby synthetic fluid inclusion studies have become the method of choice to study metal transport in hydrothermal fluids to provide key data necessary for the quantification of transport properties.

To analyze fluid inclusions by LA-ICP-MS we have implemented a new technique, which is based on the combination of a fs-laser with a heating-freezing cell and a sectorfield ICP-MS [2]. The inclusion remains frozen during ablation with a fs-laser, resulting in an excellent control of the opening of the inclusions and considerably longer signal analysis time. We are able to successfully analyze fluid inclusions in excess of 8 μm size up to a depth of ca. 50 μm in quartz with a success rate of ca. 90%. The analytical uncertainties are <20% for the investigated elements.

We conducted experiments in cold seal pressure vessels at T = 600-800°C and P = 200 MPa to unravel the parameters governing the transport of metals in granite related ore deposits. By combining two methods of host mineral pretreatment (thermal cracking [3] and HF etching [4]), we are able to synthesize fluid inclusions in quartz with a size in excess of 20 μm at T down to at least 400°C. Results for molybdenite (MoS_2), scheelite ($CaWO_4$), powellite ($CaMoO_4$) and gold solubility in fluids of varying composition obtained at 200 MPa and 600-800°C at different fO_2 and fS_2 will be presented. At 800°C Mo concentration in fluids in equilibrium with MoS_2 ranges from 200-3500 ppm for different buffer systems and is in good agreement with data from [5]. Mo concentrations in equilibrium with $CaMoO_4$ show slightly higher values (1800 ppm vs. 1300 ppm at Py-Po-Mag buffered conditions). In the investigated fO_2/fS_2 range gold concentration is ca. one magnitude lower (ca. 10 -400ppm). W concentration varies from ca. 1000-10000 ppm and is ca. 7000 ppm at Py-Po-Mag.

[1] Günther *et al* (1998), *J Anal Atom Spectrom* **13**, 263-270 [2] Albrecht *et al* (subm.), *JAAS*. [3] Sterner & Bodnar (1984), *Geochim Cosmochim Ac* **48**, 2659-2668 [4] Li & Audetat (2009), *Am Mineral* **94**, 367-371 [5] Zhang *et al* (2012) *Geochim Cosmochim Ac* **77**, 175-185.