Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 20/1	Graz 2014
PANGEO AUSTRIA 2014	Graz, 14. September 2014 – 19. September 2014		

Vortrag zur Verleihung des Otto-Ampferer-Preises

The transport of copper in hydrothermal ore deposits: how does it really work?

LERCHBAUMER, L.

OMV AG, Trabrennstraße 6-8, 1020 Vienna, Austria

The analysis of element concentrations in natural vapor and brine fluid inclusions from porphyry copper deposits all around the world suggested that the vapor phase was the main transporting agent of Cu and thus played the crucial role in the formation of these deposits. But so far no experimental study was able to reproduce this phenomenon. Furthermore, recent investigations demonstrated that quartz-hosted fluid inclusions can diffusively loose or gain Cu after their formation. In order to account for such a possible change in element concentrations, in this study co-existing vapor and brine inclusions were first synthesized and then re- equilibrated in a second step. After each step element concentrations of some of the inclusions were analyzed by LA-ICP-MS. Already after a few days of re-equilibration, vapor inclusions experienced a dramatic increase in their Cu content from 0.3 ± 0.03 to 5.7 ± 3.3 wt% while brine inclusions remained largely unmodified. Subsequent experiments showed that the requirements for the diffusional gain of Cu in fluid inclusions are a change in fluid pH from ≤ 1 to a more basic value in the surrounding fluid, and the presence of significant amounts of sulfur in the inclusions. The former provides the impulse for the migration of Cu: H+ diffuses out of the inclusion due to a concentration gradient between the inner and outer fluid, and the resulting charge disequilibrium is balanced by Cu+ diffusing into the inclusion. The sulfur serves as the bonding agent to retain the copper as sulfides in the vapor inclusion. Both of these requirements are commonly fulfilled in nature during the ascent and cooling of sulfur-rich hydrothermal fluids. Consequently, the brines carried more Cu to the site of ore deposition than the vapor-type fluids and high Cu-concentrations in natural quartz-hosted vapor inclusions are an artifact.