ARAGONITE-CALCITE VEIN MINERALIZATIONS FROM THE „ERZBERG“ IRON-ORE MINE: RADIOMETRIC DATING, HYDROGEOCHEMICAL & NEOTECTONIC CONSTRAINTS

BOCH, Ronny* (1); WANG, Xianfeng (2); KURZ, Walter (3); KLUGE, Tobias (4); LIN, Ke (2); PLUCH, Hannes (5); LEIS, Albrecht (6); MITTERMAYR, Florian (7); DIETZEL, Martin (1)

1: Graz University of Technology, Institute of Applied Geosciences; 2: Earth Observatory of Singapore, Nanyang Technological University; 3: Karl-Franzens-University of Graz, Institute of Earth Sciences; 4: University of Heidelberg, Inst. of Environmental Physics; 5: VA Erzberg GmbH; 6: Joanneum Research, Resources – Inst. f. Water, Energy & Sustainability; 7: Graz University of Technology, Institute of Technology and Testing of Building Materials

ronny.boch@tugraz.at

vein carbonate, U-Th dating, neotectonics, water-rock interaction, Erzberg

The Erzberg is the world’s largest siderite deposit and one of Austria’s most prominent geological sites due to its historic and economic value. Within ore-bearing Devonian carbonates aragonite-calcite precipitates occur in vertical fractures that are referred to as “erzbergite” in museums and mineral collections.

In order to better understand the formation conditions of these mineral precipitates we collected samples in-situ, i. e. from veins currently accessible and being cm to dm in horizontal and tenths of meters in vertical extension. Several fractures also contain fragments of coarse siderite/ankerite host-rock components embedded in a fine-grained matrix partially cemented by secondary carbonate. Microstructural inspection shows that these fragments are of cataclastic origin. In addition, slickenside striations are present at most sample sites and indicate sinistral strike-slip along the near vertical faults – today entirely filled (healed) with aragonite/calcite. 238U-234U-230Th dating using multi-collector ICP-MS allowed to constrain inception and ending of carbonate precipitation. All samples dated so far (n=20) are from the Late Pleistocene and most are younger than the last glacial maximum. A 10 cm thick laminated aragonite-calcite sequence recovered in-situ revealed an age of 14.7 ±0.3 kyr BP near its base (approx. initial precipitation on one fault plane) and 13.1 ±0.2 kyr near top (end of growth at second wall). Another 4 cm thick erzbergite sample composed of solely aragonite filling a tenths of meters extending fault yielded 10.4 ±0.2 kyr (base) and 1.03 ±0.04 kyr (top). A 25 cm sample from our university collections covers 14.2 ±0.2 to 5.0 ±0.2 kyr. In essence, the precipitates support geologically young and relatively short time intervals of fracture infilling and we consider it unlikely that the voids themselves are much older, i.e. open for hundred-thousands or even millions of years and being filled with carbonate instantaneously.

Regarding the particular erzbergite formation conditions carbonate δ13C values, clumped isotopes, frequent iron-oxyhydroxide inclusions and elevated sulfate concentrations measured in modern local waters support cool meteoric waters in connection with sulfide oxidation and sulfuric acid evolution as an efficient mechanism of host-rock dissolution, mobilization and often rapid vein mineralization. Fresh reaction surfaces in fractures resulting from (seismo)tectonic activity would enhance such fluid-rock interaction.