COMPOSITION AND FORMATION CONDITIONS OF TETRAEDRITE–TENNANTITE IN THE DEVONIAN SCHWAZ-DOLOMITE, N-TYROL, AUSTRIA

ARLT, T. & DIAMOND, L.W.

Mineralogisch-petrographisches Institut, Universität Bern, Baltzerstrasse 1, CH-3012 Bern, Switzerland

The fahlore deposits of the Schwaz-Brixlegg area are located at the western margin of the eastalpine Greywacke Zone and have been mined for copper and silver over many centuries. The mining district comprises approximately 20 deposits spread along a 20 km belt, in which ore occurs as stratabound, vein, and various breccia bodies.

Previous workers have inferred compositional trends in the fahlores along the belt, based on bulk wet chemical analyses. In this study, electron microprobe analyses were made on 25 fahlore samples collected from the Grosskogel Mine, Brixlegg and the Rotenstein Mine, Schwaz, both in the Schwaz Dolomite. In addition, analyses were made on 25 samples from museum collections in which the specimen labels implied high Hg contents („Schwazite" or „Mercury-fahlore, Schwaz"). The 1000 measurements on 50 samples (20 spots per sample) show that most of the fahlores lie within the middle of the tetrahedrite-tennantite solution series (total range = 35–100% tetrahedrite endmember), and that Hg-bearing ores are very rare. Only two of the museum samples were found to bear mercury in a significant amount (2 to 8 w%).

Mine	Grosskogel	Grosskogel	Grosskogel	Rotenstein	Rotenstein	"Schwaz"
Ore-type	fahlore-baryte-enargite-breccia			concordant	discordant	"unknown"
Mineral	tenn/tetr I	tetrah. II	enargite	tenn/tetr	tetrah.	Hg-tetrah.
No. of samples	6	3	3	2	2	1
No. of points	120	60	20	50	50	20
Cu	10.35	10.33	3.08	10.33	10.44	10.24
Ag	0.07	0.18	0.00	0.08	0.05	0.14
Sb	1.93	3.32	0.30	1.95	2.65	2.63
As	2.06	0.72	0.72	2.05	1.34	1.50
Fe	0.68	1.38	0.01	0.34	0.79	0.13
Zn	1.03	0.30	0.03	1.44	1.00	1.14
Mn	0.02	0.02	0.00	0.06	0.00	0.01
Hg	0.06	0.04	0.01	0.05	0.07	0.73
S	13.00	13.00	4.00	13.00	13.00	13.00
Total	29.37	29.28	8.15	29.29	29.36	29.52

Table:
Microprobe analyses of ore minerals. Tetrahedrite-tennantite normalized to 13 S atoms. Enargite normalized to 4 S atoms.

The data show that there is no regional trend in fahlore compositions as proposed earlier. Rather, individual deposits display the same range in composition as that seen through the entire ore district. In the Grosskogel Mine a second generation of silver-rich tetrahedrite was found and all investigated samples contain enargite or luzonite in significant amounts (10–30 vol%). In the Rotenstein Mine, fahlores in the stratabound bodies are clearly Zn-richer and Sb-poorer than fahlores in the discordant veins. Typical compositions of the investigated ores and of the very atypical Hg-tetrahedrite are given in the table.

Fluid inclusions in quartz from the tetrahedrite-barite-enargite breccia ores of the Grosskogel Mine were analysed by microthermometry. While most of the quartz is earlier than the tetrahedrite-tennantite, the last generation of quartz was found to be younger (Figure). Therefore the properties of the fluid inclusions directly reflect the properties of the ore-bearing fluid. Primary and secondary inclusions in quartz are identical and contain aqueous liquid and vapour at room temperature. Eutectic melting temperatures as low as -30°C indicate the presence of $CaCl_2$, in accordance with the hydrothermal mineralogy. Final ice melting temperatures indicate bulk salinities between 17 and 22 wt% NaCl equivalent. No microthermometric evidence was found for any gas components, although the mineralogy requires at least some CO_2. Homogenisation occurs to the liquid phase between approximately 130–150°C. Since the phase ratios of the fluid inclusion assemblages indicate homogeneous entrapment throughout, the homogenisation temperatures represent minimum precipitation temperatures. Published crystallinity and composition data on illites in underlying rock units suggest maximum lithostatic pressures of approximately 2 kb. This constraint combined with isochore calculations limits the precipitation temperature of the fahlores to less than 210°C.

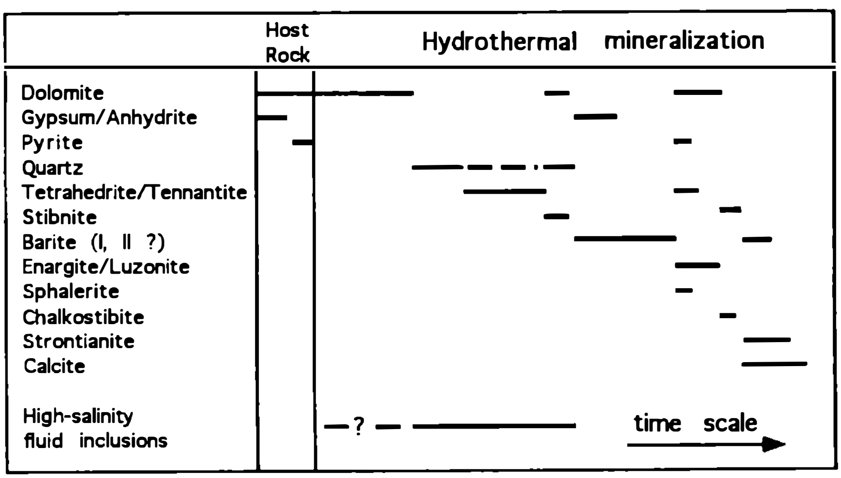

Figure:
Schematic paragenetic sequence in mineralized breccias of the Grosskogel Mine.