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Origin of high-Ag fahlores from the Galena Mine, Wallace, Idaho, U.S.A.

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ABSTRACT

Tetrahedrite fahlores from the Galena Mine of the Coeur d'Alene Mining District (Wallace, Idaho) have been found to be enriched in Ag by the Ag-Cu exchange reaction:

$$^{1}/_{10}\,Cu_{10}(Zn,Fe)_2Sb_4S_{13} + AgSbS_2 + PbS = CuPbSbS_3 + {}^{1}/_{10}\,Ag_{10}(Zn,Fe)_2Sb_4S_{13}$$

Cu-fahlore — in galena — galena — bournonite — Ag-fahlore

which occurred during cooling following fahlore mineralization. This solid-state reaction produced a distinct population of high-Ag fahlores found in galena-rich samples, quantitatively removed Ag (in an $AgSbS_2$ component) from galena, and accounts for all of the bournonite mineralization. This reaction has produced the most argentian fahlore yet found [molar Ag/(Ag + Cu) = 0.443] in the district, and forms a secondary overprint on any primary fahlore zoning that may have existed. The results obtained here indicate that the galena and fahlore-siderite stages of mineralization were virtually synchronous, as this reaction has produced the same result despite the opposite relative age relationships of these mineralization stages exhibited in two of the mines studied. Multiple lines of evidence suggest a temperature between 320 and 350 °C for this "stage." Based on the Ag/(Ag + Cu) of fahlores and Fe-Zn partitioning between fahlore and sphalerite, we estimate that fahlore compositions were frozen in by about 235 °C, roughly 40 °C above corresponding temperatures obtained for the Gold Hunter vein of the Lucky Friday Mine. This result and the absence of readily detectable diaphorite ($\sim Pb_2Ag_3Sb_3S_8$) in the Galena Mine sample containing the highest Ag fahlore indicate a faster cooling rate for the terrane in the vicinity of the Galena Mine.