MVT deposits in an extensional setting: structural control on fluid flow and its importance for trace element mineral chemistry in the Wiesloch deposit, Germany

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Most Mississippi Valley Type (MVT) deposits are attributed to occur in compressional regimes and therefore, are related to orogenically and topographically driven fluid flow. In contrast, the carbonate-hosted MVT Ag-Pb-Zn deposit in Wiesloch (near Heidelberg), SW Germany, is associated to graben related faults of the Upper Rhine Graben in an extensional setting.

The mineralization is developed in the Middle Triassic Upper Muschelkalk (mu1) and subordinate in the Lower Muschelkalk. The mineralized area is divided into different mining districts (e.g. Gänsberg, Segen Gottes, etc.) by various step faults, parallel to subparallel to the Upper Rhine Graben, and consists of mainly calcite, dolomite, sphalerite (mainly as banded sphalerite), galena, pyrite, and subordinate sulfosalts and barite.

Carbonates, sphalerite, galena, and pyrite were investigated by microscopy, electron microprobe, and stable isotopes (O, and C). Interestingly, each horst shows a different, characteristic mineral chemistry with varying amounts of trace elements such as Tl, Cd, As, Sb and Ag. Some trace elements are homogenous within one mining district, but varies between different ones, particularly As and Sb in galena and As and Cd in sphalerite. Surprisingly, silver contents are very low and found not only in galena, but also in sphalerite, which shows also high contents of Cl, which is, however, not correlated to Ag. Strong correlation of trace elements in rim-core profiles of sphalerite crystals and in transition-profiles from sphalerite crystals to banded sphalerite are observed. This means, in rim-core profiles, the elements Cd, Sb, As decrease, whereas As, Sb, and Cl contents increase in transition profiles from sphalerite crystals to banded sphalerite.

Interestingly, stable isotopes do not show significant differences between the different mining districts, but rather form a consistent trend, which implies an involvement of basinal brines, sedimentary formation waters and hydrocarbons. We will discuss the reasons for trace element differences in the framework of tectonic and isotopic arguments.

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