

COMPOSITION OF FLUID INCLUSIONS FROM THE CAVE-IN-ROCK BEDDED-REPLACEMENT  
FLUORITE DEPOSITS IN THE ILLINOIS-KENTUCKY DISTRICT

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Abstract

The stable mid-continent platform of North America hosts some of the greatest known concentrations of Mississippi Valley-type (MVT) mineralization in the world. Most of the mineralization occurs between two major physiographic regions, the Ozark Plateau and the Interior Low Plateau. The Illinois-Kentucky district is one of three principal MVT districts in the Interior Low Plateau and is distinct from other North American mid-continent MVT deposits in that its ore mineral assemblage is dominated by fluorite instead of sulfide minerals or barite. However, like these other MVT deposits, the Illinois-Kentucky deposits were probably precipitated from northward flowing sedimentary brines set in motion by topographic gradients created by the Alleghanian-Ouachita orogeny during the Late Paleozoic. The primary objective of the current study was to quantify the chemical composition of the mineralizing fluids through in situ fluid inclusion analysis using microthermometry, laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS), and laser Raman spectroscopy in order to try to gain insights into the ore formation process.

Results show that the fluids that formed the Illinois-Kentucky district are chemically distinct from the fluids that formed MVT deposits in the Ozark Plateau. These differences can be attributed to interaction of the mineralizing sedimentary brines with ultramafic, rift-related igneous rocks present in the Illinois-Kentucky district but not in any of the Ozark Plateau districts. Fluid inclusion homogenization temperature and salinity relationships suggest that MVT mineralization in the Illinois-Kentucky district was produced from a mixture of at least three brines, two of which had relatively high salinities and temperatures and the third of which was cooler and more dilute. Mixing among at least three fluids is supported by the elemental concentration data, which tend not to correlate with one another or with the microthermometry data, but rather plot as two-dimensional arrays. The compositions of the end member fluids could not be pinpointed from the available data, however it appears that at least one of the fluids had elevated concentrations of the ore metals, Pb, Zn, Cu, and Fe as high as on the order of 1000's of ppm.