

Public Abstract

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Title:GEOCHEMISTRY AND ORIGINS OF MISSISSIPPI VALLEY TYPE MINERALIZING FLUIDS OF THE OZARK PLATEAU

Mississippi Valley-type (MVT) ore deposits represent some of the greatest enrichments of lead and zinc in the Earth's crust. Determining the factors responsible for creating such large metal enrichments has been an ongoing scientific endeavor spanning over a century. One of the most important factors, which has been difficult to determine until recently, is the composition of the fluids responsible for ore precipitation. This study used microanalytical techniques to determine the composition of the fluids responsible for forming the Ozark Plateau MVT deposits.

Two basic Ozark MVT mineralizing fluid composition types were identified. One of the fluids, the ore fluid, had high lead and zinc concentrations and low sulfur concentrations whereas the other fluid had low lead and zinc concentrations and high sulfur concentrations. The composition of the Ozark MVT mineralizing fluids were used to develop a hydrogeochemical conceptual model and reaction path and mixing models. The hydrogeochemical conceptual model incorporated all of the fluid inclusion compositions and demonstrated that: (1) Ozark MVT ore fluids had limited contact with limestone along their flow paths, (2) the ore deposits formed when a lead- and zinc-rich fluid reacted with sulfur to precipitate the lead and zinc sulfide minerals galena and sphalerite, and (3) the largest Ozark MVT deposits are associated with organic-rich carbonate rocks. The reaction path and mixing models were used to identify the possible origins of the Ozark MVT fluids. These models demonstrated that the fluids were likely the result of mixing between evaporatively concentrated seawater and meteoric water. This fluid mixture was also likely modified by reaction with the rocks with which it was in contact prior to ore precipitation.

The results of this study demonstrate Ozark MVT ore fluids can be anomalously elevated in lead and zinc and that fluid mixing and organic rich carbonate rocks are key requirements for developing some deposits. In addition, fluids responsible for forming the Ozark MVT deposits are mixtures of multiple fluids that have likely had significant interaction with granitic rocks prior to precipitating ore. Collectively, these findings have advanced our understanding of the factors required to form MVT deposits worldwide and may aid in the development of new exploration techniques to locate new lead and zinc metal resources.