

Public Abstract

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Graduation Term:SP 2015

Department:Geology

Degree:MS

Title:ATYPICAL MVT, ZN-CU-RICH MINERALIZATION IN THE LOWER PORTION OF THE BONNETERRE DOLOMITE, VIBURNUM TREND, SOUTHEAST MISSOURI, U.S.A.

Mississippi Valley-type (MVT) deposits of the Viburnum Trend are typically lead-dominant ($Pb:Zn > 5$) and occur mainly in the reef-grainstone facies of the upper Bonneterre Dolomite (Cambrian). Recent drilling has encountered economic Zn-Pb-Cu-(Ni-Co)-rich mineralization within the lower Bonneterre Dolomite and underlying Lamotte Sandstone, more than 30 m below the main ore-bearing horizon of the district. In one area of the Brushy Creek mine, a currently mined orebody of this mineralization comprises a resource of more than 250,000 tonnes containing $> 14\%$ Zn + Pb. This study investigates the relationship of the lower orebody at Brushy Creek mine to the typical, overlying MVT deposits of the Viburnum Trend through a combination of petrographic, cathodoluminescence, fluid inclusion, and stable isotope studies.

The lower orebody consists dominantly of distinctly zoned, early Ni-, Co-, Zn-, and Cu-bearing sulfides that were frequently brecciated and successively overprinted by later mineralization, including main stage Pb-Zn mineralization, indicating that the deposit represents in part an early, complex fault- and fracture-related system. Lower ore zone dolomite cements exhibit cathodoluminescent stratigraphies distinct from and pre-dating the regional, 4-zone CL stratigraphy. The complex vertical and temporal variations of stable isotope compositions indicate that the lower orebody at the Brushy Creek mine formed from multiple fluids with distinct and evolving sources. The fluid inclusion data of this thesis indicate complex mixing of multiple, geochemically unique fluids that varied spatially and temporally and traveled through different aquifers, including the Precambrian granitic basement. This study emphasizes the importance of fault and fracture systems as structural controls of MVT ore formation in the Viburnum Trend and southeast Missouri.