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Genesis of the stratiform Pb-Zn ore bodies in Qingchengzi in the North China Craton: Rb-Sr and C-O-S-Pb isotope constraints

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Isotopes (Rb-Sr, C, O, S, and Pb) were investigated from the Zhenzigou Pb-Zn deposit in the Qingchengzi mineral field (QMF) of the North China Craton as an aid to determine the genesis of stratiform Pb-Zn deposits in the Liao-Ji Rift. A step-dissolution Rb-Sr age of 1798 ± 8 Ma with $^{206}Pb/^{204}Pb$ ratios of 17.7477–17.8527 were obtained from sphalerite. Sulfur isotopic ratios for pyrite (5–14.4‰), sphalerite (2.4–8.6‰), and galena (-0.3–8.6‰) from Zhenzigou have a narrower range than those from the host Paleoproterozoic Dashiqiao Formation, and granite in the area. Calcite and limestone from ore and wallrocks at the deposit have similar C and O isotope compositions, with $\delta^{13}C_{PDB}$ ranging from -6.0 to -2.3‰ and $\delta^{18}O_{SMOW}$ from 9.8 to 13.7‰, which are similar to those of carbonatite and the mantle.

Comprehensive analysis of the Pb isotopic composition of the sulfide from the Zhenzigou deposit and Pb-Zn deposits in adjacent area show that the Pb originated from the upper crust and mixed with Pb from the mantle. Sulfur isotopes from Zhenzigou deposit indicate that the mineralization has a volcanic eruption source. The $\delta^{13}C_{PDB}$ and $\delta^{18}O_{SMOW}$ values indicate that the CO_2 originated from a mixed mantle, marine carbonate and organic source.

Combined with the study of regional metallogenic background, this paper proposes that deposition of stratiform Pb-Zn mineralization in the QMF began ca. 2052 Ma during development of the Liaoji Rift. The mineralization extended to ca. 1798 Ma prior to deformation associated with the Lvliang Movement, which dismembered the stratiform Pb-Zn mineralization. The veined mineralization in the region cross-cuts the stratiform deposits and represents remobilized and redeposited deposits associated with the emplacement of Triassic plutons such as the Xinling and Shuangdinggou granites.