

The Source of Metals in the Qilinchang Zn-Pb Deposit, Northeastern Yunnan, China: Pb-Sr Isotope Constraints

CHAOXIAN ZHOU,[†]

Ore Deposits Geochemistry Laboratory, Institute of Geochemistry, Chinese Academy of Sciences, P. O. Box 91, Guiyang 550002, P. R. China

CHUNSHENG WEI,

Department of Earth and Space Sciences, University of Science and Technology of China, Jinzhai Rd., Hefei 230026, P. R. China

JIYUN GUO,

Shandong Build Material Vocational School, Liaocheng, Shandong 252000, P. R. China

AND CHAOYANG LI

Ore Deposits Geochemistry Laboratory, Institute of Geochemistry, Chinese Academy of Sciences, P. O. Box 91, Guiyang 550002, P. R. China

Abstract

Qilinchang, a Mississippi Valley-type Zn-Pb deposit, has essentially homogeneous lead isotope compositions as follows: $^{206}\text{Pb}/^{204}\text{Pb} = 18.432$ to 18.487 (i.e., $18.460 \pm 0.15\%$), $^{207}\text{Pb}/^{204}\text{Pb} = 15.664$ to 15.720 (i.e., $15.697 \pm 0.18\%$), and $^{208}\text{Pb}/^{204}\text{Pb} = 38.729$ to 38.874 (i.e., $38.833 \pm 0.19\%$). Strontium isotope compositions at the time of mineralization were relatively heterogeneous: $^{87}\text{Sr}/^{86}\text{Sr} = 0.7170$ for pyrite, 0.7138 to 0.7180 for sphalerite, 0.7109 to 0.7143 for galena, and about 0.7158 to 0.7168 for calcite.

The mineralizing metals of the Qilinchang ore deposit, Pb and Zn, have only one source rock.

The Pb isotope compositions of sulfides of the deposit are essentially the same as those of the Upper Proterozoic (i.e., lower Sinian) igneous rock suite, if the preferential migration of Pb isotopes during the leaching and the in situ radiogenic Pb back correction are taken into account. The $^{207}\text{Pb}/^{206}\text{Pb}$ ratios of sulfides in the deposit are notably high (0.850 – 0.851), which suggests that this ore deposit contains material with very old signatures.

On the basis of kinetic and thermodynamic calculations of water/rock interaction, we obtain a value of about 0.745 of source rock $^{87}\text{Sr}/^{86}\text{Sr}$ for the mineralizing metals. This value is similar to that of the lower Sinian igneous rock suite at the time of mineralization.

That the lower Sinian igneous rock suite served as the source is also favored by its characteristic of leachability and its content of metals in this and other geologic bodies.