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H-O-S-Pb Isotopic Components of Chagele Pb-Zn Polymetallic Deposit, Tibet, China: Implications for the Genesis and Comparison with Those of Typical Pb-Zn Polymetallic Deposits in the Mid-East Nyainqentanglha Metallogenic Belt

Yongchao Zhang,[1,*] Youye Zheng,[2] Shunbao Gao,[1] and Junsheng Jiang[2]

[1]China University of Geosciences (Wuhan), Institute of Geological Survey, Wuhan, Hubei, China
[2]China University of Geosciences (Wuhan), Faculty of Earth Resources, Wuhan, Hubei, China

*Corresponding author: e-mail, dzzhych@163.com

The Chagele Pb-Zn deposit (0.38 Mt Pb, 2.08%; 0.60 Mt Zn, 3.29%; 110.1 t Ag, 6.07 g/t), located in the Central Lhasa terrane, is the only confirmed large Pb-Zn polymetallic deposit discovered in recent years in the western part of the Nyainqentanglha metallogenic belt. The deposit contains three orebody types: the porphyry (Cu)-Mo type, showing as thin veins, is hosted by the granite porphyry; the skarn (Cu)-Pb-Zn type, characterized by the vein type or lenticular type, mainly occurs in orebodies in the external contact zone and interstratified crack zone; and the hydrothermal vein Pb-Zn type, controlled by the NNE-striking faults, is situated at the structural fractured zone and the upper wall of the fault zone. Ore minerals of the (Cu)-Pb-Zn orebodies are dominated by galena, sphalerite, chalcopyrite, pyrite, and malachite; the ores primarily show automorphic granular, hypautomorphic to allotriomorphic granular and metasomatic-relict textures, and mainly involve veined, banded, disseminated, and massive structures. Hydrothermal alteration includes skarnization, silicification, and limonitization. Both chalcopyrite and molybdenite are the dominant ore minerals of the (Cu)-Mo orebodies, and there is minor pyrite. The ore minerals of (Cu)-Mo orebodies are characterized by scaly texture and veinlet and massive structures.

This study includes detailed field work, petrology, microscopic mineralography on hand specimens, systematic research on H, O, S, and Pb isotopes of the Chagele deposit, and comparison with other four deposits in the Mid-East Nyainqentanglha metallogenic belt in an attempt to identify the genesis of the deposit. Isotopic geochemistry analyses show that the δD values of fluid inclusions of quartz range from –189‰ to –157‰, and $\delta^{18}O$ for fluids calculated from $\delta^{18}O_{V\text{-}SMOW}$ values of fluid inclusions range from +2.6‰ to +5.9‰ for quartz minerals, indicating that the fluids may be a mixture between magmatic water and meteoric water. The $\delta^{34}S$ values of sulfides range from –5.6‰ to +1.9‰ (average –3.5‰), and the $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, $^{208}Pb/^{204}Pb$ values of sulfides range from 18.614 to 18.688, 15.657 to 15.747, and 38.988 to 39.269; the $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ values of granite porphyry range from 18.663 to 19.058, 15.643 to 15.664, and 39.002 to 39.559, exhibiting traits of magmatic origin in the upper crust, and are similar to values from deposits in the Mid-East Nyainqentanglha metallogenic belt. To conclude, Chagele deposit is a typical porphyry-type Mo deposit + skarn-hydrothermal vein type of Pb-Zn deposit controlled by magma and tectonism. We also believe that the mineralization is not confined to the Mid-East Nyainqentanglha metallogenic belt, and the western part of the belt, with similar tectonic magmatism, also has high potential for similar deposits.