Ore Genesis of the Taoyuan Pb-Zn Deposit, Liaoning Province: Evidence from Characteristics of S and Pb Isotopic Compositions

LIN Chenggui\(^1\), YAO Xiaofeng\(^1\), and LI Shenghui\(^1\)

1 Development and Research Center, China Geological Survey, Beijing 100037, China
2 Technical Guidance Center for Mineral Resources Exploration, Ministry of Natural Resources, Beijing 100083, China
3 103 Brigade of Non-ferrous Geological Bureau of Liaoning Province, Dandong 118008, Liaoning, China

Abstract: Qingchengzi Pb-Zn-Au-Ag ore concentration area located in the eastern of Liaoning province, there are a large number of Pb-Zn deposits, gold deposits, silver deposits in it (Ma et al., 2016). There have been dispute on the ore genesis in Qingchengzi ore concentration area, three controversial views are (a) Metamorphic hydrothermal mineralization (Duan et al., 2014) (b) Magmatic hydrothermal mineralization (Yu et al., 2009; Duan et al., 2017), (c) polygenetic mineralization (Liu et al., 2019). Taoyuan Pb-Zn deposit is located in the middle of Qingchengzi ore concentration area. There are two kinds of lithology in it. One ismarble from Dashiqiao formation, and the other is schist from Gaixian formation. The host strata of orebodies is the third paragraph of Dashiqiao formation thick dolomite marble. There are some granite-porphry and lamprophyre dykes in it. Structure is more development, the NE-trending of Erdaogou fault controlled the distribution of most of the Pb-Zn deposit. Near the Taoyuan Pb-Zn deposit, it is tend to EW-trending extends to Jianshanzi fault. The most favourable metallogenic space is the transitionsite of structure. The metallogenic materials come from the mixed source area of crust and mantle which inform to relate to hydrothermal metasomatic rock or other mixture. Thus it can be seen that S isotopic in the Taoyuan Pb-Zn deposit mainly comes from the Indosinian intrusive, may be mixed with a small amount of strata sulfur from Liaohe group.

The sulfide from Taoyuan Pb-Zn deposit give the lead isotopic ratios of 17.969~18.309 for \(^{206}\text{Pb}/^{204}\text{Pb}\), with an average of 18.076; 15.572~15.669 for \(^{207}\text{Pb}/^{204}\text{Pb}\), with an average of 15.617; and 38.222~38.371 for \(^{208}\text{Pb}/^{204}\text{Pb}\), with an average of 38.312. The \(\mu\) values range from 9.46 to 9.61 (average at 9.55), and the \(\mu\) values in Qingchengzi Pb-Zn-Au-Ag deposit and the Indosinian intrusive is relatively close, the main change in 9.38~9.66 (average 9.52), which suggest that Pb isotopic has the characteristics of crust-mantle mixed source, and the mineralization is related to magmatism. On the drawing of Pb isotopic structure pattern diagram, the Pb isotopic values in Qingchengzi Pb-Zn-Au-Ag deposit and Indosinian intrusive cut the three growth curve of Pb source area. Most of the samples between upper crust and orogenic belts, which is close to the evolution of orogenic belt line. It suggests that they may have the same source or evolution process, and the apparent linear trend is usually considered that the Pb has the characteristics of mixed sources.

On the Pb isotopic genetic classification diagram, Pb isotopic of the ore in Taoyuan Pb-Zn deposit and Qingchengzi Pb-Zn-Au-Ag ore concentration area, the pyrite in Indosinian intrusive landed on the subduction-zone type lead ranges in which the upper crust and mantle are mixed, which inform to relate to magmatism closely. This indicates that the Taoyuan Pb-Zn deposit was formed in the same tectonic environment as the nearby Qingchengzi Pb-Zn-Au-Ag ore and the Indosinian intrusive. The sources of Pb-Zn ore and Au-Ag ore in Qingchengzi are may be derived from deep magmatic fluid. They constitute a set of Pb-Zn-Au-Ag mineralization system. The metallogenic materials come from the mixed source area of crust -mantle, not from the stratum. Therefore, the Pb-Zn-Au-Ag deposit in Qingchengzi ore concentration area is magmatic hydrothermal deposit, not the “strata-bound” deposit as the predecessors said.

Key words: S and Pb isotopic, source of ore-forming materials, Taoyuan Pb-Zn deposit, Qingchengzi ore concentration area, Liaodong

Acknowledgments: This work is granted by the National Key Research and Development Program (Grant No.

* Corresponding author. E-mail: linchenggui1991@163.com

© 2019 Geological Society of China
2018YFC0603806) and the Geological Surveying Project of China Geological Survey (Grant No. DD20160052).

References

About the first author (also corresponding author)
LIN Chenggui, male, born in 1990 in Ganzhou City, Jiangxi Province; master; graduated from China University of Geosciences (Beijing); Engineer of Development and Research Center, China Geological Survey. He is now interested in the study on mineral deposits, and deep prospecting prediction. Email: linchenggui1991@163.com; phone: 010-62066030, 15712981526.