The Zhaxikang Pb-Zn-Sb-Ag polymetallic ore deposit is the first discovered large polymetallic deposit in the South Tibet Sb-Au metallogenic belt in recent years. In this deposit, sulfosalt minerals are well-developed, and the ore-forming elements are mainly Pb, Zn, Sb and Ag, which is different from the most other ore deposits in the South Tibet Sb-Au metallogenic belt, and indicates its ore-forming material sources may have some particularity.

According to the element geochemistry research on ore rocks, altered rocks and host strata, as well as S and Pb isotopic study of sulfide minerals in ore rocks from Zhaxikang ore deposit, we discussed the possible sources of the ore-forming materials.

2 Samples and Methodology

Ore bodies mainly take occurrence in calcium containing carbon slate and calcareous siltstone of the Lower Jurassic Ritang Formation within the Zhaxikang Pb-Zn-Sb-Ag polymetallic ore deposit. There are many mineral species in ore rocks, with metallic minerals are principally sphalerite, gelenite, stibnite, boulangerite, jamesonite, pyrite etc., while secondarily arsenopyrite, bournonite, tetrahedrite, brongniardite etc. We chose ore rocks, altered rocks and host strata, as well as S and Pb isotopic study of sulfide minerals in ore rocks from Zhaxikang ore deposit, we discussed the possible sources of the ore-forming materials.

3 Result and Discussion

3.1 Element geochemistry

The results of element geochemistry have shown that the main ore-forming elements of Sb, Pb, Zn, Ag etc. were performed using full spectrum direct reading plasma emission spectrometry (ICP-OES). As, Sb and Hg were tested by atomic fluorescence spectrometry (AFS).

S and Pb isotopic compositions were analysed in Beijing research institute of uranium geology. The S isotope was determined by MAT-251 mass spectrometer. The Pb isotope was analysed by isotope dilution thermal ionization mass spectrometer (ID-TIMS), with ISOPROBE-T as the instrument model.

4 Conclusion

The element geochemistry analysis of the ore formation (Ritang Formation) indicates there are four types of ore-forming elements in their stratigraphic unit, compared with the world's average shale which element content can represent that of the upper crust (Wedepohl, 1991). The first one includes Sb, As and Ag, the highly enriched elements, which average contents in all kinds of rocks are more than five times to that of the world's average shale. The second type contains Pb, Zn, and Mn, the weak
enrichment elements, whose contents in various rocks are one to two times to that of the world's average shale. The third type includes Cd and Au, which concentrations are equal to the world's average shale. The fourth one includes Cu and Ag, which contents are significantly lower than that of the world's average shale. As mineralization related elements, Zn and Pb, Au and Sb, As and Ag, as well as Cd and Zn represent good positive correlations, with correlation coefficients of 0.85, 0.85, 0.78 and 0.59 respectively. But the correlations between other mineralization related elements are poor, the absolute values of which correlation coefficients are less than 0.5. Moreover, the correlation between ore-forming elements of the host strata is totally different from that of the altered and ore rocks, indicating the enrichment of Sb, As, Ag and Pb in the host strata is not caused by the metallogenesis. It suggests that the host rocks in Zhaxikang deposit have the ability to provide ore-forming materials.

3.2 Sulfur and lead isotope

The $\delta^{34}S$ of gelenite, sphalerite and pyrite are all concentrated between 4.5‰ and 12‰, close to that of the host strata of Lower Jurassic Ritang Formation, which $\delta^{34}S$ are ranged from 4.93‰ to 11.49‰. It shows the ore-forming fluids extracted Sb, As, Ag and S from the strata in the fluid migration process and the Ritang Formation is the primary origin of sulfur.

The sulphides of ore rocks in Zhaxikang deposit have higher and larger range in lead isotope ratios of $^{206}\text{Pb}/^{204}\text{Pb}$, $^{207}\text{Pb}/^{204}\text{Pb}$ and $^{208}\text{Pb}/^{204}\text{Pb}$. The ages of these samples calculated by H-H single phase evolution model are negative except one, shows that much radiogenic lead had been brought (Faure and Mensing 2005). Most samples are located above the upper lithosphere line in the lead isotope diagram for discrimination of tectonic setting (Zartman and Doe 1981), and in the India Basement range set by Gariepy et al. (1985). As the North Himalayan metamorphic crystalline rock series have the ability to provide ore-forming materials such as Zn, Cd, Pb Mn and so on (after Liu et al., 2005), and the leucogranites formed from these metacrystalline partial melting have higher lead contents of 21.15 to 131 ppm (Guo and Wilson 2012; Huang et al., 2013), which important accessory mineral of garnet is rich in MnO (5.65%~10.56%) and Zn (152~321 ppm) (Gao et al., 2012) as well, the activation and migration of Pb, Zn and other ore-forming elements might happen when the metacrystalline partially melted to leucogranites, while the leucogranites itself could provide part Pb, Zn and Mn.

As a result, the ore-forming materials have multiple sources and the ore-forming fluids extracted them from all the geologic bodies around the deposit. The Ritang Formation probably is the main source region for Sb, Ag, As, and S, while the Laguigangri crystalline basement rocks and related leucogranites may provide Pb and Zn.

4 Conclusion

(1) Apart from ore-forming elements of Sb, Pb, Zn and Ag, the Zhaxikang Pb-Zn-Sb-Ag polymetallic ore deposit has also mineralization elements been enriched, such as Mn, Cu, As, Cd, Au etc. The host strata are enrichment in Sb, As and Ag too, but there are some distinct differences in element correlation compared to altered and ore rocks, indicating the enrichment of ore-forming elements in the host strata is not caused by the metallogenesis and the host rocks have the ability to provide ore-forming materials.

(2) Based on S and Pb isotopic compositions, the ore-forming fluids might have extracted Sb, As, Ag and S from the host strata in the fluid migration process as the Ritang Formation is the main provider of sulphur, while the metamorphic crystalline rock series and leucogranites provided much Pb and Zn for the metallogenesis in the Zhaxikang Pb-Zn-Sb-Ag polymetallic ore deposit.

Acknowledgements

This research was supported by the Geological and Mineral Surveying Project from the China Geological Survey (grant No. 12120113053000), the Research Fund for the Doctoral Program of Higher Education of China (grant No. 20125122120013), and the National Natural Science Foundation of China (grant Nos. 41302066, 41372093).

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