HE Junguo, ZHOU Yongzhang, WANG Shugong and ZHANG Yanlong, 2017. Hydrothermal solution and its related antimony mineralization in Shalagang mine of southern Tibet. *Acta Geologica Sinica* (English Edition), 91(supp. 1): 177-178.

Hydrothermal activities and related antimony mineralization in Shalagang mine of southern Tibet

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1 Introduction

Shalagang mine, the largest antimony deposit in southern Tibet, is located in the west of Longma Town, Jiangzi County, to the east is the anticlinorium of Jiangzi basin. The exposed strata in the mine area are the Upper Cretaceous Zongzhuo Formation (a set of sedimentary chaotic melange) and the Lower Cretaceous Duojiu Group which is widely spread in the study area and mainly consist of deep marine basin sedimentation (Zhang et al., 2011).The ore country rocks are siliceous rocks, carbonaceous slate as well as altered diabase. Siliceous rocks, with black and gray black colors, contain essentially aphanitic quartz (>80%), argilloid, carbon, and iron materials, and develop aphanitic, particulate, phyric crystal, massive and brecciated structures.

Due to the complex mineralization mechanism of the deposit and lack of further geological work, there exist several kinds of understanding the mineralization process of Shalagang antimony, such as, the mineralization of composite SEDEX deposit (Li, et al.,2001; Qi, et al., 2008), the low temperature hydrothermal mineralization (Sun, et al., 2014) and the magmatic hydrothermal mineralization related to the activity of alkaline granite (Nie et al., 2005). The author, in this study, argue that the hydrothermal activities play an important role in the mineralization process of antimony deposit based on the field investigation and the laboratory geochemistry analysis.

2 Hydrothermal activities and the antimony mineralization

2.1 Hydrothermal characteristics of siliceous rocks

Content of SiO_2 in the siliceous rock is 17.6% ~ 80.6%, major components Al_2O_3, Na_2O, K_2O and CaO vary greatly, with Na_2O about 7%. The main element ratios Fe_2O_3/FeO, SiO_2/ Al_2O_3, SiO_2/(Na_2O+K_2O), SiO_2/MgO, compared with siliceous rocks of Guangxi Dachang, Shaanxi Zhashui and Japan Noda Yuchuan, display the typical characteristics of hot water deposition (Zhou et al., 2004). The total amounts of rare earth is higher, ΣREE is 54.64×10^{-6}~523.99×10^{-6}, with obvious negative anomalies of europium and heavy rare earth characteristics, REE distribution pattern is consistent with that of western Guangdong hot water deposition and Tibetan Jiama penite-gritite rocks. The contents of As, Sb and Au are 10.9~208.1, 1~24.1 and 0.1~15.2, respectively, which is similar to the characteristics of typical hot water both home and abroad, and PY, Cr-Zr and U-Th discriminant diagrams also indicate the hydrothermal deposition origin.

2.2 Hot water field and the metallogenic mechanism

As we know, some metal elements such as Cu, Pb, Zn, Au and Ag are enriched in the recent submarine TAG, Galapagos area and the thermal brine of the red sea. Geothermal hot water is more likely to enrich Au, Ag, Sb and Cs metals（Robert, 1999). Since the Mesozoic, a series faulted basins were developed in the southern Tethys sedimentary belts due to the multi-stage extensions. Intruded by the frequently basic volcanic rocks, the old strata of the floor basement gradually became the high background layers enriched in metal elements. Since 65Ma, the Eurasian and Indian continental collision took place, the floor basement have undergone moderate and low degree of metamorphism. Till 25 Ma, after the collision period, the southern Tibet detachment were formed, and then produced a series of metamorphic complex dome structures, which consequently result in a large number of new generation of magmatic intrusions. In this way, the geothermal field around the metamorphic

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complexes were formed which drive the shallow hot water to circulate around the system. Heated by the high geothermal gradient of the deep magma, the atmospheric precipitation infiltrate along the detachment fractures and then were transformed into hot water (Fig.1).

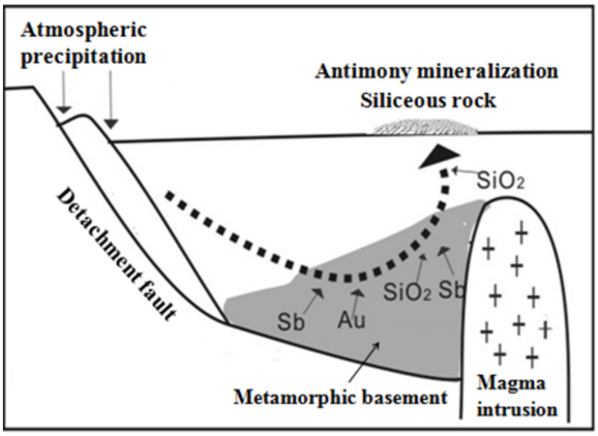

Fig. 1. Sketch of hydrothermal field and metallogenic model.

Heated and activated by the hydrothermal system, the components SiO_2 and H_2S which differentiated from the magma intrusions, were added and began to react with the old basement and the intermediate volcanic rocks. As a result of the collisions and metamorphisms, Sb, and other metal elements are easily extracted into the hydrothermal fluid, and migrated as the form of complex compound together with SiO_2 and HS^-. When the fluid migrates to the shallow layer of the basement, the temperature decreases sharply and the oxygen fugacity increase, acid gas such as H_2S was thus oxidized to cause the fluid solution acidify. In the appropriate ore structures, Sb and other mineral elements will precipitate with SiO_2, because of the changes of the thermodynamic states, hence, in this way forming the antimony ores associated with hydrothermal siliceous deposition. In addition, the hot water fluid can also metamorphic with the alteration surrounding rock, produce the disseminated mineralization.

Acknowledgements

This work was financially supported by the General Program of National Natural Science Foundation of China (No.40573019) and the Research Found for the Doctoral Program of Higher Education of China (No.20040558050).

References

Li Jingao, Wang Quanhai, Zheng Minghua, Zhou Zuyi, Hu Xiaoqiang, Yao Peng, Liu Hongfei and Yang Chengyu, 2001.The controls of the host basins on ore-forming elements from the sedex deposits in Tibet. *Sedimentary Geology and Tethyan Geology*, 21(4):11–20.

Nie Fengjun, Hu Peng, Jiang Sihong, Li Zhenqing, Liu Yan and Zhou Yongzhang, 2005. Type and temporal-spatial distribution of gold and antimony deposits (prospects) in SouthernTibet,China,*ActaGeologicaSinica*,79(3):373–385.

Qi Xue xiang, Li Tianfu and Yu Chunlin,2008. Rare earth element and trace element geochemistry of Shalagang antimony deposit in the southern Tibet and its tracing significance for the origin of metallogenic elements. *Geoscience*, 22(2):162–172.

Robert, R. L., and John, A. M., 1999. Gold solubility in supercritical hydrothermal brines. *Science*, 284(25): 2159–2163.

Sun Xiaoming，Mo Ruwei，Zhai Wei，Wei Huixiao，Zhou Feng，Liang Yeheng， Zhang Xiangguo and Yi Jianzhou, 2014. Infrared fluid inclusion microthemometry on stibnite from Shalagang antimony ore in southern Tibet，China. *Acta Petrologica Sinica*,30 (1): 189–198.

Zhang Gangyang，Zheng Youye，Zhang Jianfang，Zhang Sukun and Fan Zihui, 2011. Ore-control structural and geochronologic constrain in Shalagang antimony deposit in southern Tibet，China. *Acta Petrologica Sinica*，27(7): 2143–2149.

Zhou Yongzhang, He Junguo, Yang Zhijun, Fu Wei,Yang Xiaoqiang, Zhang Chengbo and Yang Haisheng, 2004. Hydrothermally sedimentary formations and related mineralization in south China, *Earth Science Frontiers*, 11(2): 373–377.