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Geology, Fluid Inclusions, and Isotope Geochemistry of the Jinman Sediment-hosted Copper Deposit in the Lanping Basin, China

ZHANG Jinrang[1, *], WEN Hanjie[2], QIU Yuzhuo[2, 3], ZOU Zhichao[4]

1 *Chengdu Institute of Geology and Mineral Resources, China Geological Survey, Chengdu, 610081, China;*
2 *State Key Laboratory of Ore Deposit Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002, China;*
3 *Key Laboratory for Metallogenic, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China;*
4 *Chengdu University of Technology, Chengdu 610059, China*

1 Introduction

The Jinman Cu polymetallic deposit (with a reserve of 7.75 million tons ore grading at 2.58 % Cu) is mainly hosted by sandstones and slates of the Jurassic Huakaizuo Formation in the Lanping basin, Southwest China (Li and Fu, 2000; Hou et al., 2008). The orebodies mainly occur as lenses and stratiform, and are hosted in Middle Jurassic Huakaizuo Formation mottled clastic rocks. No igneous rocks have been found nearby.

The deposit is apparently different from the sediment-hosted base metal deposits in other parts of the world, and genetically it remain poorly understood (Li and Fu, 2000; He et al., 2009). Most of previous geochemical studies indicated that metallogenic materials and ore fluids were mainly derived from sedimentary rocks of the basin (Xiao et al., 1994; Li and Fu, 2000; Liu et al., 2000, 2001; Wu et al., 2003), whereas some studies argued that the ore-forming components mainly derived from the mantle through deep structures (Ji and Li, 1998; Chi and Xue, 2011).

In this paper, we present the results of the systematical investigation on the geology, fluid inclusion, and isotopic geochemistry of the Jinman deposit. Furthermore, we discussed the sources of the ore-forming fluids and materials, as well as the mechanism of ore precipitation. All these studies suggested new constraints on the ore genesis, for this deposit, as well as for most of the sediment-hosted Cu deposits in the western Lanping basin.

2 Results and Discussion

A detailed study of fluid inclusions from the Jinman deposit distinguishes three types of fluid inclusions, including aqueous water (type-A), CO_2–H_2O (type-B), and pure CO_2 inclusions (type-C). The CO_2–H_2O inclusions have homogenization temperatures of the CO_2 phase from 23.4°C to 29.8°C, and the clathrate melting temperatures range from 7.6°C to 9.8°C, with corresponding salinities from 0.4 to 4.6 wt.% NaCl equivalent. The homogenization temperatures of CO_2–H_2O inclusions range from 224° C to 320° C. The homogenization temperatures of the aqueous fluid inclusions mainly range from 140°C to 256°C, with salinities from 3.1 to 22.8 wt.% NaCl equivalent. These characteristics of fluid inclusions in the Jinman deposit are significantly different from those of basinal mineralization systems, but comparable to those of orogenic or magmatic mineralization systems.

The $^3He/^4He$ ratios of inclusions in chalcopyrite and syn-ore pyrite range from 0.01 to 0.07 Ra, all significantly lower than the mantle values, but extremely consistent with typical crustal values (0.01~0.05). The measured $^{40}Ar/^{36}Ar$ values range from 305 to 1142, greatly higher than the atmospheric value of 295.5, which indicates the presence of a significant proportion of ^{40}Ar of mantle or crustal origin. He and Ar isotope studies indicate that the mineralization was dominated by crustal fluid, mixed with meteoric water. The H, O isotope studies of inclusions in quartz also suggest that the ore-bearing fluid is derived from both magmatic water and atmospheric water. The $\delta^{34}S$ values are widely variable between −17.9‰ and 16.3‰, with a tower-shaped distribution around zero, which may be interpreted by the variation in physical-chemical conditions of the ore-forming fluids or by a diverse source of the sulfur. The Pb isotope compositions

* Corresponding author. E-mail: zhangjinrang123@163.com

mostly fall within the range of the sedimentary lead, suggesting that the metal is mostly derived from the sedimentary rocks of the basin. Probably, the mixing of an extra-basinal, deeply sourced CO_2-rich fluid with basinal brine derived from meteoric water was the key mechanism responsible for the mineralization of the Jinman deposit.

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References

Chi, G.X., Xue, C.J., 2011. Abundance of CO_2-rich fluid inclusions in a sedimentary basin-hosted Cu deposit at Jinman, Yunnan, China: implications for mineralization environment and classification of the deposit. Mineralium Deposita , 46 (4): 365–380.

He, L.Q., Song, Y.C., Chen, K.X., Hou, Z.Q., Yu, F.M., Yang, Z.S., Wei, J.Q., Li, Z., Liu, Y.C., 2009. Thrust-controlled, sediment-hosted, Himalayan Zn-Pb-Cu-Ag deposits in the Lanping foreland fold belt, eastern margin of Tibetan Plateau. Ore Geology Reviews, 36 (1–3), 106–132.

Hou, Z. Q., Song, Y. C., Li, Z., Wang, Z.L., Yang, Z.M., Yang, Z.S., Liu, Y.C., Tian, S.H., He, L.Q., Chen, K.X., Wang, F.C., Zhao, C.X., Xue, W.W., Lu, H.F., 2008. Thrust-controlled, sediments-hosted Pb-Zn-Ag-Cu deposits in eastern and northern margins of Tibetan orogenic belt: Geological features and tectonic model. Mineral Deposits, 27 (2), 123–144 (in Chinese with English abstract).

Ji, H.B., Li, C.Y., 1998. Geochemical characteristics and source of ore-forming fluid for Jinman copper deposit in western Yunnan Province, China. Acta Mineralogica Sinica, 18 (1), 28–37 (in Chinese with English abstract).

Li, F., Fu, W.M., 2000. Geology of Red Bed Copper Deposits in Western Yunnan. Yunnan University Press, Kunming, 1~133 (in Chinese with English abstract).

Liu, J.J., Li, C.Y., Pan, J.Y., Liu, X.F., Liu, Y.P., 2000. Metallogenic mechanism of copper deposits from sandstone to shale in Lanping–Simao basin, western Yunnan. Geology and Mineral Resources Research, 15 (3): 216–223 (in Chinese with English abstract).

Liu, J.J., Li, C.Y., Zhang, Q., Pan, J.Y., Liu, Y.P., Liu, X.F., Liu, S.R., Yang, W.G., 2001. Wood textures in the Jinman Cu deposit in western Yunnan and their significance for ore genesis. Science in China (Series D), 31 (2): 89–95 (in Chinese with English abstract).

Wu, N.P., Jiang, S.Y., Liao, Q.L., Pan, J.Y., Dai, B.Z., 2003. Lead and sulfur isotope geochemistry and the ore sources of the vein-type copper deposit in Lanping-Simao Basin, Yunan province. Acta Petrologica Sinica, 19 (4), 799–807 (in Chinese with English abstract).

Xiao, R.G., Chen, H.Q., Shuai, K.Y., Yang, Z.F., 1994. Mineralization of the Jinman copper deposit in Mesozoic sedimentary rocks in Lanping, Yunnan Province. Geoscience, 8 (4), 490–496 (in Chinese with English abstract).