

WANG Ziyong, HAN Runsheng and REN Tao, 2017. Geochemical Characteristics and Ore-Forming Environment in the Qujiashan Manganese Deposit, Shaanxi. *Acta Geologica Sinica* (English Edition), 91(supp. 1):237 -238.

## Geochemical Characteristics and Ore-Forming Environment in the Qujiashan Manganese Deposit, Shaanxi

WANG Ziyong<sup>1</sup>, HAN Runsheng<sup>1,\*</sup> and REN Tao<sup>1</sup>

*Kunming University of Science and Technology, Kunming, Yunnan 650093*

### 1 Introduction

The Qujiashan manganese deposit is located in the northeastern margin of the Yangtze Block. It is an important part of Qinba area, which is one of the nine manganese ore prospecting area (Luo, 2002). Much achievements about the Qujiashan manganese deposit have been made in the geological characteristics and metallogenic conditions (Zhang, 1986; Wang, 2008), and important insights in ore deposit geology, mineral compositions and ore-forming structure have achieved. But analysis on the sources of ore-forming materials is not clear. In this paper, on the basis of previous data, we analyzed the geochemical characteristics of major elements of ore and surrounding rock, and traced the sources of ore-forming materials and discussed the genesis type of the deposit through systematic sampling from the mine tunnel and the drilling for the next research and exploration.

### 2 Deposit Geology

The Qujiashan manganese deposit distributes in the middle area of the Dabashan depression fold belt, belonging to the middle part of Bashan manganese ore belt, which is located in the south part of the Dabashan fault. The exposed strata of the mining area is only Sinian Dengying Formation, which is composed the manganese-bearing mudstone series, mainly consisted of gray-green and magenta striped shale, calcium-magnesite silty shale and mud-limestone clay manganese oxide-manganese carbonate layer (Zhang, 1986). Songshuba – zihuang anticline is an important structure in the region, which is an overturned anticline with a northwest-trending and southeast dip. The Qujiashan manganese deposit occurs within the north east wing of the anticline, and the orebodies mainly

occurs as layered. The orebodies have the same occurrence with the surrounding rock. Influenced by the structure, the ore bodies are enriched and thickened at the end of the fold.

### 3 Geochemical Characteristics of Major Elements in Mn – Bearing Rock Series

The major elements of the 15 samples of the Mn-bearing rock system in Qujiashan manganese deposit analysis was undertaken at the ALS Minerals-ALS Chemex of Guangzhou by using the ICP-AES (Leeman). Combined the previous data (Hou, et al., 1997), we may conclude that the concentration of  $Mn_3O_4$  in the Mn-bearing rock series changes largely from 9.37% to 49.29%;  $Fe_2O_3$  is in 0.84% ~ 4.91%;  $P_2O_5$  ranges from 0.05% to 0.30%;  $SiO_2$  changes largely from 4.93% to 57.3%, with an average of 40.7%;  $Al_2O_3$  ranges from 0.38% to 14.8%, with an average of 8.72%; CaO ranges from 1.89% to 50.2%, with an average of 8.62%; MgO ranges from 1.6% to 17.8%, with an average of 7.42%. The concentration of  $SiO_2$  in the ore is in 19.6% ~ 31.4%, with an average of 26.4%;  $Al_2O_3$  ranges from 2.04% to 7.13%, with an average of 5.04%; CaO ranges from 1.89% to 12.2%, with an average of 5.73%; MgO ranges from 2.13% to 7.95%, with an average of 4.69%. The main element shows that the main oxide composition of the Mn-bearing series varies widely, and in the ore is relatively stable, which is a low-phosphorus high-quality manganese ore.

### 4 Discussion

The value of  $SiO_2 / Al_2O_3$  is an important sign of distinguishing the source of sedimentary rocks (Taylor, et al., 1985). The value of  $SiO_2 / Al_2O_3$  in the continental crust is 3.6, the rock closed to the value of the rock which is mainly in the land source. The values that exceed the limit are mainly resulted from biological or hot water

\* Corresponding author. E-mail: 554670042@qq.com

effect. The value in manganese ore and surrounding rock ranges from 4.30 to 5.00, then it should be a result of involvement and supplement of hot water effect. Jewell et al. (1991) stated that the source should be terrigenous when the value of  $Al / (Al + Fe + Mn)$  in sedimentary rocks is greater than 0.5, and hot water is injected when this ratio is less than 0.35. The value in the Mn-bearing rock series range from 0.42 to 0.72, with an average of 0.65, the value in the ore ranges from 0.04 to 0.58, with an average of 0.33. The ratio of  $SiO_2 / Al_2O_3$  and  $Al / (Al + Fe + Mn)$  indicates that the top and bottom of the Mn-bearing rock is normal seawater deposition, and the manganese ore is distinguished with the characteristics of hot water effect and biological effect. At the same time, the ratio of Mn / Fe in the Mn-bearing series is higher, which shows that the sedimentary environment of the deposit may be weakly oxidized (Glasby, et al., 2000), and it is easy to form high-quality manganese-rich deposit.

## 5 Conclusion

By analyzing the geochemical characteristics of the major elements in the Mn-bearing rock system and the ore, It is believed that the Qujiashan manganese ore is formed in the weak oxidative environment, the source of the ore-forming material is mainly terrestrial source, the top and bottom of the Mn-bearing rock is normal seawater deposition, and the manganese ore bodies

formed in the superposition of hot water and biological effects, the manganese deposit should be classified to carbonate-hosted sedimentary type.

## References

- Glasby, G.P., Iizasa, K., Yuasa, M., and Usui, A., 2000. Submarine hydrothermal mineralization on the Iiu Bonin Arc, south of Japan: An Overview. *Mar Georesour Geotechnol*, 18(2): 141–176.
- Jewell, P.W. and Stallard, R.F., 1991. Geochemistry and paleoceanographic setting of central, Nevada bedded barites. *The Jour of Geology*, 99: 151–170.
- Taylor, R. and Mclenan, S.M., 1985. The Continental Crust: Its Composition and Evolution. *London: Black Well*, 57–72.
- Hou Zonglin, Xue Youzhi, Huang Jinshui, Lin Youhuan, et al., 1997. *The Manganese Ore around Yantze Platform [M]*. Beijing: Metallurgical Industry Publishing House, 1–364 (in Chinese).
- Luo Huabao, 2002. *The Direction of Prospecting for High Quality Manganese Ore Resources in China[J]*. *Geology and Prospecting*. 38(4): 8–11 (in Chinese).
- Wang Shijing and Yan Weijun, 2008. *Prediction of Distribution and Resource Potential of High Quality Manganese Ore in the Bashan Manganese Ore Zong of Shannxi[M]*. *West-China Exploration Engineering*. (11): 142–144 (in Chinese).
- Zhang Gongqin, 1986. *The Characteristics of Geology and Metallogenic Conditions of Marine Sedimentary Manganese Ore Deposits in the Late Sinian of Daba Mountains*. *Geology and Prospecting*, 7: 10–17 (in Chinese).