

## Research progress of the basalt-type copper ore in Guizhou, China

Tao Cui

College of Resources and Environmental Engineering, Guizhou Institute of Technology, Guiyang,  
550003, China  
cuitao1203@163.com

**Keywords:** Emeishan Basalt, Copper Ores, Metallogenic Mechanism

**Abstract:** After a comprehensive analysis of previous research, it is discovered that Emeishan basalt copper ores have been studied relatively intensively that their metallogenic epoch and provenance are generally not controversial. It is still unclear if there are large and medium-sized deposits in Emeishan basalt copper deposits, so it is more or less meaningful to strengthen the research on metallogenic mechanism of sedimentary copper ores.

### Introduction

Emeishan basalt is the sole large igneous province recognized by the international academic circle [1]. Large areas of Emeishan basalt are distributed in south China, including southern Sichuan Province, northeastern Yunnan Province, northwestern Guizhou Province and west Guangxi. The basalt is rich in mineral resources such as iron and copper. Many experts and scholars have explored the mineral resources of the basalt[2-9]. In this paper, the copper ores of the Emeishan basalt are summarized. Besides, metallogenic mechanism and research interest of copper ores on the Emeishan basalt are discussed.

### Geologic Background

Emeishan basalt originally referred to the basalt of the Maokou Formation in mountainous areas of Emeishan in southwestern Sichuan Province. Later, it is generally known as trap extensively distributed in three provinces of southwestern China, particularly represented by late Permian basalt (Fig 1), and widely used by a formal lithostratigraphic unit of the Upper Permian[10]. Huang Kainian have investigated the Emeishan basalt since the 1980s[11]. Up till now, plenty of scholars have examined Emeishan basalt from the perspective of the distribution features, formation time, petrology, geochemistry and isotopes, achieving considerable outcomes[12-14].

Emeishan basalt has formed through multistage eruption, by which extremely thick basalt has come into being. After subsequent denudation, the genesis of current metal mineral resources such as ancient basaltic weathering crust, copper and iron has been discovered to be related to the weathering crust.

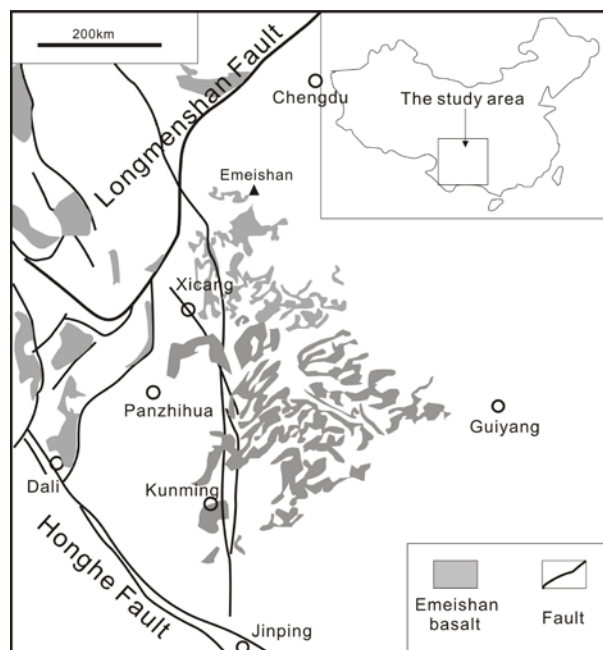


Fig.1 Distribution range of the Emeishan basalt(Modified from[15])

### Basaltic Copper Ores

Basaltic copper ores refer to sedimentary copper deposits reserving inside or on Emeishan basalt, closely connected with Emeishan basalt in terms of their genesis. These ores have been discovered in eastern Yunnan Province, southern Sichuan Province and western Guizhou Province. With tremendous changes to grade of copper ores, the deposits are mostly small or merely mineralized[16].

### Advances in Research

Emeishan basaltic copper ores are reserved in Emeishan basalt and their metallogenic age is generally not controversial. Wang (2006) and Qian (2006, 2007) considered that basalt was the material source of copper ores in the northeastern Yunnan Province after an analysis of trace elements and isotopic tracing. Emeishan basalt is the major provenance of basaltic copper ores in western Guizhou Province as well[5-8,19,20]. As a whole, Emeishan basalt is relatively rich in Cu. Multistage eruption, weathering and denudation are favorable for the genesis of copper ores. In addition, geochemical features of copper ores are consistent with those of Emeishan basalt. Therefore, it is basically uncontroversial that Emeishan basalt is the main provenance of Emeishan basaltic copper ores. However, it doesn't mean no other provenance provides metallogenic materials for the genesis of Emeishan basaltic copper ores.

There are multiple explanations of types of basaltic copper deposits, mainly including hydrothermal [21-22], volcanic hydrothermal [5] and sedimentary[16,19] deposits. Whatever the causes of the genesis of basaltic copper ores, many scholars acknowledge the decisive roles of Emei mantle plume in Emeishan basalt and its impacts upon the genesis of various minerals[2,6]. Although numerous experts and scholars have studied the metallogenic mechanism, no large copper deposits have been discovered by now. The author considers that the genesis of basaltic copper ores isn't attributed to a single action, basic materials are provide by volcanic eruption, hydrothermal reworking and re-deposition after weathering/transport are major metallogenic actions in the later period. Moreover, these two metallogenic actions may be superimposed. Large-scale iron ores deposit over again after weathering and transport in northwestern Guizhou Province, while copper ores can coexist with iron ores. Provided that the paleogeographic conditions are appropriate, sedimentary copper ores possibly develop into large and medium-sized deposits. Therefore,

technical instructions may be provided for exploring basaltic copper ores in the future by strengthening the research on the genetic mechanism of these copper ores.

## Conclusion

In general, the genesis of Emeishan basaltic copper ores is thought to be closely connected with Emei mantle plume activities, and Emeishan basalt is the provenance of copper ores. There would be relatively large sedimentary copper deposits in areas where Emeishan basalt is distributed, so it is necessary to enhance the research on the genetic mechanism of sedimentary copper ores.

## Acknowledgement

This work was supported by the initializing fund projects of Guizhou institute of technology (No.XJGC20131204; No.XJGC20140702; ), Guiyang, 550003, China, the provincial project of characteristics of REE and its transferring disciplinarian in mineralizing process of the bauxite in northern Guizhou, China (No.LH[2014]7358), and the Key support disciplines of Mineral prospecting and Exploration from Guizhou Province(ZDXK[2014]20).

## References

- [1]. Courtillot V. Evolution catastrophes: The science of mass extinctions. Cambridge:Cambridge university press,1-237.
- [2]. Hu Ruizhong, Tao yan, Zhong hong, Huang Zhilong, Zhang Zhengwei. Mineralization system of a mantle plume: A case study from the Emeishan igneous province, southwest China. *Earth science frontiers*, 2005,12(1):42-54.
- [3]. Qian Zhuangzhi, Xu Cuiling, Zhang Zhengjun, Jiang Changyi, Hou Shuguang, Tang Dongmei. Ore-formation source of copper deposits in Emeishan basalt area in northeast Yunnan province. *Journal of mineralogy and Petrology*, 2007,27(1):78-82.
- [4]. Zhu Jiang, Zhang Zhaochong, Hou Tong, Kang Jianli. La-ICP-MS zircon U-Pb geochronology of the tuffs on the uppermost of the Emeishan basalt succession in Panxian County, Guizhou Province: Constrains on genetic link between Emeishan large igneous province and the mass extinction. *Acta Petrologica Sinica*, 27(9):2743-2751.
- [5]. Nie Aiguo, Qin Dexian, Guan Daiyun, Huang Zhiyong, Zhang Zhuru. A research on regional metallogenic contribution to gushing Emeishan basalt magma in western of Guizhou province . *Geology and prospecting*, 2007,43(2):50-54.
- [6]. Nie Aiguo, Kang geng. Research on the Metallogenic difference of Emeishan basalt in Guizhou. Guizhou technology press, 2014, 86-87.
- [7]. Meng Changzhong, Chen Yang, Zhang Yinghua, Wu Hui, Lin Wenli. Unconfig of Emeishan LIP:-factor of polymetallic deposit: isotope constraint of U-Pb of zircon. *Science China*, Vol. 45(2015) No.10, p.1469-1480.
- [8]. Li Songtao. Geological and Geochemical characteristics of iron-copper deposits in Lushan area, Weining, Northwest Guizhou( Doctor, Chendu university of technology,(2014), p.57-80.
- [9]. Wang Fudong, Zhu Xiaochun, Han Tao, Wang Zhonggang. An experimental study on genesis of Emeishan basalt-related native copper deposit in the Siuchuan-Yunnan-Guizhou area. *Acta mineralogica sinica*, 2011,31(1):322-327.
- [10]. Sichuan Geology bureau. Sichuan Regional geological records.Geology press, Beijing, 1991,1310-1312.
- [11]. Huang Kainian, Yang Ruiying, Wang Xiaochun et al.. A preliminary study on trace element geochemistry of Emeishan basalts from SW China. *Acta petrologica sinica*, 1988,21(4):49-60.
- [12]. Zhang Zhaochong, Wang Fusheng. Sr, Nd and Pb isotopic characteristics of Emeishan basalt province and discussion on their source region. *Earth science- Journal of China university of geosciences*, 2003,28(4):431-438.
- [13]. Song Xieyan, Hou Zengqian, Wang Yunliang et al.. The mantle plume features of Emeishan

- basalts. *Journal of mineralogy and Petrology*, 2002,22(4):27-32.
- [14]. Xu Yigang. Mantles plumes, large igneous provinces and their geologic consequences. *Earth science frontiers*,2002,9(4):341-353.
- [15]. Xu Yigang, Luo Zhengyun, Huan Xiaolong, He Bin et al.. Zircon U-Pb and Hf isotope constraints on crustal melting associated with the Emeishan mantle plume. *Geochim cosmochim Acta*,2008,72:3084-3104.
- [16]. Wang Xiaogang, Li Rong, Cai Lipeng et al.. Geological features, Ore-forming conditions and prospecting potential of the Emeishan basalt-hosted Cu deposits in the Sichuan-Yunnan-Guizhou border region. *Acta Geologica Sinica*, 2010,30(2):174-182.
- [17]. Wang Juli, Guo Jian, Liu Zhongkui, Zhang Yunfeng, Zhang Rong et al.. Sedimentary copper deposit in Emeishan basalt, northeastern Yunnan Province. *Mineral deposits*,2006,25(6):663-671.
- [18]. Qian Zhuangzhi, Zhang Zhengjun, Jiang Changyi, Hou Shuguang, Tang Dongmei. Tracer for ore-forming material sources of copper deposits in Emeishan basalt area of northeast Yunnan. *Mineral deposits*, 2006,25(13):91-94.
- [19]. Liao Zhenwen. Comparison of geological characteristics of the copper and gold deposits related to Emeishan basalt in the borders area between Yunnan and Guizhou. *Journal of Jilin university(Earth Science Edition)*.2010,40(4):821-827.
- [20]. Xiao Qingxiang, Cai Dawei, Nie Aiguo. Metallogenic conditions of copper deposits associated with the Emeishan basalt in Tongchanghe, Weining, Guizhou. *Journal of Guizhou university(natural science)*,2014,31(2):28-35.
- [21]. Liu Yuanhui, Li Jin, Deng Keyong. Geological conditions of copper deposits associated with the Emeishan basalt in the Panxian area, Guizhou. *Geological bulletin of China*, 2003,22(9):713-717.
- [22]. Zhang Qian, Zhu Xiaoqing, Zhang Zhengwei, Wang Dapeng. Discussion on the ore-formation prospecting of the Emeishan basalt-type native copper- chalcocite deposits in the Weining district of Guizhou Province, China. 2007,27(3);379-383.