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

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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.
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 Emeishan 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.

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