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Formation of an Iron - Copper - Gold (Uranium) Metallogenic System in the Luzong Volcanic Basin, Central Anhui

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1 Introduction

Iron oxide copper gold (IOCG) deposits, which was first formally defined by Hitzman et al. (1992), comprise a broad and ill-defined clan of mineralization styles. IOCG deposits contain abundant (>10%) iron oxides (magnetite and/or hematite) and economic grade of copper and/or gold (Sillitoe, 2003; Williams et al., 2005). Besides the copper and by-product gold, IOCG deposits may also contain appreciable amounts of cobalt, zinc, molybdenum, silver, rare earth elements, uranium and other elements. In fact, the iron - copper - gold - uranium deposits in the Luzong volcanic basin, central Anhui have some close relationships. For example, the porphyrites have close relationships to the formation of copper (gold), which are mainly in the Shaxi diorite porphyrite; the iron deposits are closely related to the syenites, such as the Nine iron deposit and Dabaozhuang iron deposit; and the uranium mineralization is closely related to the A-type granite in the contact zone of Mesozoic sedimentary layers, such as the Huangmeijian uranium deposit. In this paper, we present a case study of the IOCG mineralization system in the Luzong volcanic basin, central Anhui Province.

2 Regional Geological Background

The Lower Yangtze River Belt (LYRB) is economically one of the most important metallogenic belts in China, with more than 200 polymetallic (Cu–Fe–Au, Mo, Zn, Pb, Ag) deposits (Chang et al., 1991). The Luzong volcanic basin in the north of the Yangtze River, located at the south margin of Yangtze and North China Craton boundary, is a famous ore-cluster field. The volcanic and intrusive plutons occur widely in Luzong Basin, including four groups of volcanic rocks such as, Longmenyuan Formation, Zhuanqiao Formation, Shuangmiao Formation and Fushan Formation and dozens of intrusive plutons. From verge to center, zircon U-Pb ages of these igneous rocks vary from 134.8 ± 1.8Ma ~ 127.1 ± 1.2Ma (Yang et al., 2007; Zhou et al., 2008). Large-scale Fe-Cu-Au (U) mineralization in the Luzong Basin is associated with these igneous series (Ren et al., 1991; Yang et al., 2011), for example, Longqiao-Luohe-Nihe Fe deposits, Shaxi porphyry Cu (Au) deposits, and Huangmeijian U deposit. The Shaxi porphyry Cu (Au) deposit, as a super large poly-sulfide deposit, is located 10 km northeast of Luzong volcanic basin (Yang, 1996). In the Luzong volcanic basin, several diorite intrusions occurred accompanying with a lot of hydrothermal copper deposits on a small scale.

3 Characteristics of an IOCG Mineralization System in the Luzong Volcanic Basin

The Luzong volcanic basin contain abundant Fe - Cu - Au - U ore deposits, and have close relationship with deep and surrounding intrusive rocks. For a rather long time, the igneous rock intrusions and related metallogenic system have been confused and argued between Chinese geologists. Currently the debate mainly focused on the following aspects: (1) the magma origin and formation; (2) the tectonic setting; (3) metallogenic system; (4) the lithospheric thinning in Yanshan period. The crucial scientific topic is the relationship between magmatism and mineralization.

The Luzong Mesozoic volcanic basin is an important iron, copper, gold, sulfur, alunite mineral resource base, in recent years, uranium deposits have been discovered on the edge of the basin, and they are located in the contact

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zone between A-type granite intrusion (in Huangmeijian Mt.) and Mesozoic red sedimentary layers. Although these mineralization types are different from each other, their distributions and formation have certain internal relations (Ren et al., 1991), especially those of iron, copper, gold and uranium deposits, constituting major metal mineralization system in this Mesozoic volcanic basin. These deposits present the long-term settlement of basal internal and external related to shoshonite series of metallogenic series, thus we define it as an iron-copper-gold (uranium) metallogenic system.

Hitzman (1992) proposed details on wall rock alteration in IOCG deposits, which is usually very intense, depending on the nature of the surrounding rock types and the depth of the mineralization. In general, in the depth, it is with the sodic alteration while in the shallow level, with the combination of potassic alteration, and at the superficial level, with sericitization and silicide alteration. These kinds of alteration also occurred in the iron-copper-gold-(uranium) metallogenic system in the Luzong volcanic basin (Yang et al., 2011; Fan et al., 2012). As to genesis of the formation of this IOCG mineralization system, the current domestic point of view focuses on intracontinental delamination, which is the response for the crustal lithosphere delamination in the Cretaceous (such as Mao et al., 2008).

This study proposed details on magmatic rocks, petrological and geochemical study in order to understand formation of intrusions and volcanic rocks as well as this iron-copper-gold-uranium metallogenic system. Research results show that origin of volcanic rocks and intrusion in the Luzong basin has the nature implying the subduction of oceanic crust to east China continent (e.g., Deng et al., 2012), thus the formation of the iron oxide copper gold (uranium) deposits have related to the subduction of Pacific plate in the Yanshanian period (e.g., Sun et al., 2007; Ling et al., 2009).

4 Conclusion

The Luzong ore-cluster field keeps several aspects in common with IOCG deposits, such as mineralization, associated complexes, alteration, hydrothermal type and tectonic settings. We suggest that the Luzong ore-cluster field can be regarded as an IOCG (-U) mineralization system.

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