Introduction

Jiama and Qulong deposits, which are located along the Gangdese metallogenic belt 15 km apart, have yielded super-large degrees of ore after several years of prospecting. Studies show that the type of the two deposits is porphyry–skarn–hydrothermal related to Miocene magmatic activity (Rui et al., 2003; Li et al., 2005; Yang et al., 2008; Xiao, 2011; Ying, 2011; Tang et al., 2010). However, significant differences are present. The main difference between these deposits and their genetic mechanics is the focus of the present study. This work can provide further understanding of the metallogenic regularity of the eastern Gangdese metallogenic belt and provide a necessary reference for regional deposit prospecting.

2 Geological Features of Ore Body

Skarn, porphyry, and hornfels serve as main ore hosts in the Jiama deposit. Copper polymetallic ore bodies are developed in the skarn and are distributed in the expansion space between the Late Jurassic Duodigou and Early Cretaceous Linbuzong formations within the folds of an overthrust nappe. They appear in stratiform-like, layered, and lenticular forms with disseminated, massive, and network-vein ore structures. Associated minerals include chalcopyrite, bornite, chalcocite, teraherahedrite, molybdenite, galena, and sphalerite. Molybdenum (copper) ore bodies are developed mainly in a granite porphyry, which is distributed in prospecting line 12-32 in lenticular form, with network-vein ore structure; chalcopyrite and molybdenite are useful minerals.

A granitic complex body appearing in the anticline of an overthrust nappe and a skarn within the flanks of synclines 2–3 km to the south serves as the main ore host in the Qulong deposit (Zhong et al., 2013). Copper (molybdenum) ore bodies are developed in a complex body composed of monzonitic granite porphyry with adamellite and granodiorite appearing outward (Yang et al., 2008) in cylinder-shaped form with disseminated, veinlet disseminated, and network-vein ore’s structures and chalcopyrite and molybdenite are the useful minerals. Copper ore bodies are developed in skarn along the interface between tuff and marble and in structural fracture zones in stratiform-like and lenticular forms with disseminated, massive, and network-vein ore structures and chalcopyrite, bornite, galena, and sphalerite are the useful minerals (Xiao Bo, 2011).

3 Main Differences

The two deposits differ significantly in the following two aspects:

(1) Their mineral resource composition differs. The number of ore bodies in the skarn and hornfels constitute 65% and 30% of the total Jiama deposit, respectively. However, the number of porphyry ore bodies is more than 90% of the total Qulong deposit.

(2) Their useful elements series differ. The main useful elements in the Jiama deposit are molybdenum, gold, silver, lead, and zinc, all of which are large-scale. In
addition, they exhibit notable vertical zoning characteristics from the center outward in a trend of Mo (Cu) → Cu + Mo → Cu (Mo) → Cu (Pb + Zn + Au + Ag) → Cu + Pb + Zn (Au + Ag) (Zheng et al., 2010). The main useful element in the Qulong deposit is copper with a small amount of molybdenum. Although skarn ore bodies yield small amounts of lead and zinc, their mineralizations show no obvious zoning characteristics.

4 Genesis

The two deposits are close spatially and have the same degree of regional denudation. According to the recent prospecting results, the Qulong porphyry ore bodies occur at altitudes between 4.2 km and 5.3 km, whereas the Jiama porphyry ore bodies appear between 4.2 km and 4.9 km. Therefore, the emplacement depth of the ore-forming porphyry in the Jiama deposit is relatively deeper than that in the Qulong deposit.

In a Cenozoic thrust nappe that formed from south to north in the southern margin of the Gangdese belt, a series of folds occur along with an expansion space between the Late Jurassic Duodigou and Early Cretaceous Linbuzong formations. This expansion space facilitated fluid mass migration and accumulation, water–rock reaction, and gigantic skarn-type ore body formation. In most of the polymetallic porphyry deposits, hydrothermal molybdenum–copper ore bodies are distributed more often in the center, whereas lead, zinc, gold, and silver ore bodies occur in the periphery (Sillitoe, 2010). In the expansion space between the two groups, large-scale stratiform skarn-type ore bodies occur, in addition to multimetal zonation from the center outward with the trend of Mo (Cu) → Cu + Mo → Cu (Mo) → Cu (Pb + Zn + Au + Ag) → Cu + Pb + Zn (Au + Ag). Late-stage fluid migration in the overlying strata also provided space for the vein-type ore body formation in the hornfels. The two types of ore bodies yield the aforementioned metals, which were conserved during the Tibet Plateau uplift and denudation so far.

The ore-forming porphyry occurs in the core of the anticline in a shallower fold system of the Qulong deposit. Such placement was helpful for fluid accumulation, water–rock reaction, and gigantic porphyry ore body formation. Vein-type ore bodies may have formed in the overlying strata because vein-type ore in tuff appears in the deposit at the river’s midstream point. Moreover, the copper–molybdenum ore body appears on the surface, which implies that the vein-type ore body may have been eroded during the uplifting of the Tibetan Plateau. The skarn-type ore body is related to the interface between the tuff and marble in addition to the structural fracture zone in the syncline flanks. Thus, the fluid reaction time was shorter and occurs to a lesser extent in the rock interface and fault fracture. Moreover, the skarn body is relatively smaller than that in the Jiama deposit and shows no significant elemental zoning characteristics.

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