1 Introduction

Recently studies showed that Xiuwachu-Luoji Yanshanian epoch acid magma belt which ranges approximately N-S directions, is developed strong molybdenum polymetallic mineralization (Li et al., 2012, 2013; Yu et al., 2012, 2013). The rock belt is plunge southward, and it is possible to find concealed porphyry molybdenum polymetallic mine t in the south segment. It have made a new breakthrough in prospecting in Tongchanggou in 2010, and explored and control vein molybdenum and copper ore shoot represented by KT1 ore body, and as the medium content, then have drilling work at outcropped granodiorite porphyry apophysis in 2011, and revealed wholly mineralized, the industrial ore body was more than 400m in thickness. It revealed prephyry type molybdenum deposit in many drill holes like ZK0451 in 2012, and the industrial ore body were all more than 300m in thickness. The molybdenum metal resources quantity more than 500,000 tons in 2014, and as a superlarge molybdenum deposit with huge metallogenic prospective in the region.

Tongchanggou molybdenum polymetallic deposit is located one side of Yanyuan-Lijiang depression, western margin of Yangtze Block (Fig. 1 and Fig. 2). Permian Heinishao Formation and Triassic Beiya Formation Strata could be found in mining area, and it also develop faults and folds, they formed folds and faults system, which are mostly in direction from northwest, and secondly from northeast. Mafic-intermediate volcanic rocks and intermediate-acid, alkaline intrusive rocks are widely developed in mining area due to strong magmatic activity.

2 Features of Ore Bodies

There are three types of ore bodies in mining area: vein ore bodies which occurred in interlayer of wall rock nearby apophysis, different lithology and fault zone, prephyry type ore bodies which occurred in apophysis, and skarn type ore bodies which occurred in the contact belt. Ore bodies show that associated molybdenum, copper, lead, zinc and iron, and with significant mineralizing zonation: ore bodies are mainly of copper, lead, zinc on the ground surface;skarn type iron ore bodies occurred in some top part of apophysis; associated copper and molybdenum in shallow part; deep part is mainly of molybdenum, associated copper.

2.1 Major ore body features

Ore body of KT1, the main orebody in Bala mining area, which occurred in basalt of Heinishao Formation (P2h), limestone fault zone and skarn of first stage of Beiya Formation (T2b1), and small amount of it occurred in secondary structures at western of fault. The outcrop reaches the elevation of 2663m to 2850m, and the engineering control length of ore body up to 680m, depth of deviation control up to 640m. Ore bodies is stratoid, with general dipping steeply to NW and locally overturned to the dip SE, with the strike 35°, the dip 50 ° to 84°. Ore bodies show that associated copper and molybdenum,
copper and molybdenum have significant vertical zoning: copper associated lead and zinc on the ground surface; associated copper and molybdenum in shallow part; deep part is mainly of molybdenum. The ore body reaches 0.91 to 33.83m in thickness, with a mean of 4.69m. The copper grade is 0.11% to 7.32%, with a mean of 1.45%, and the molybdenum grade is 0.03% to 1.29%, with a mean of 0.17%.

The ore body of KT11, a main prephyry type molybdenum orebody in Bala mining area, which occurred in granodiorite porphyry (Fig. 2). It is a concealed orebody with dipping steeply to NW in the deep part (about 70°). The drill hole 0451 (ZK0451) controlled the apophysis reached 620m in thickness, the thickness that reached industrial grade is about 400m. The mean of molybdenum grade of whole rock in prephry is 0.04%, and The grade of molybdenum is more than 0.08% can be divided into upper member (more than 166m in thickness) and lower member (90m in thickness). Molybdenite is distribution as veinlet disseminated, and small amount of satellite disseminated, and with weakly chalcopyrite mineralization.

The orebody of KT1, a concealed orebody, which occurred in skarnization limestone and basalt of Beiya Formation (T2b1). Ore bodies is stratoid, with general dipping steeply to NW, and with the strike 35°, the dip 45° to 79°. The ore body is molybdenum orebody, and locally with weakly copper mineralization. The ore body is with a mean of 7.18m in thickness, and the molybdenum grade is 0.04% to 0.59%, with a mean of 0.17%.

2.2 Ore types and mineral composition

According to naked eye and analysis results of copper samples, the natural types of ore could be divided into oxidized ore, mixed ore and sulphide ore, in which the main ore is oxidized ore and sulphide ore, and with small amount of mixed ore.

The oxidized ore can reach the elevation of 2686m, with vertical depth more than 215m, its oxidation rate on ground surface is up to 97%, with a weighted mean of 83%. They are brownish yellow, and with strong limonitization, their structures are classified into soil-like, mottled, honeycomb. The main ore mineral are malachite azurite and molybdite. The main gangue minerals are feldspar and quartz.

Sulphide ore is distributed in the depth of mining area, under the elevation of 2686m, and its oxidation rate is 5.32% to 8.19%, with a weighted mean of 6.93%. The main ore mineral of hydrothermal gold vein and skarn type ore bodies are chalcopyrite, pyrite, and there is small amount of molybdenite, azurite, malachite, a little of molybdine, magnetite, limonite, tenorite and scheelite. The main gangue minerals are garnet, diopside, feldspar, epidote, actinolite, calcite, dolomite. The main ore mineral of prephyry type ore bodies chalcopyrite, pyrite, molybdenite, magnetite and scheelite. The main gangue minerals are plagioclase, potash feldspar, quartz, biotite, epidote and muscovite.

Copper of oxidized ore is mainly of malachite (Cu2CO3(OH)2), azurite (Cu3(CO3)2(OH)2), molybdite in the ores exists mainly as molybdite (MoO3). Copper in the mixed and sulphide ore exists mainly as chalcopyrite (CuFeS2), and molybdenum is mainly hosted in molybdite (MoS2).

2.3 Wall rock alteration

Prephyry type ore bodies is with biotite potash feldspathitization, sericite quartzification, chloritization and disseminated-veinule disseminated molybdenite mineralization.

Skarn is mainly located in interlayer of marl rock of Beiya Formation, it assume layered, lenticular and veinlike. The outcrop is 50~500 m long and 0.5~7m thick, rocks are mainly with (epidote) garnet skarn and (epidote) diopside skarn.

Acknowledgements

This research was supported by the China Geological Survey Research Foundation for Basic Research (grant no.12120113094600); the Science and Technology Leading Talent from Yunnan (grant no. 2013HA001).