Orebody Characteristics and Mineralization Stages of the Qiushuwan Cu-Mo Deposit in the Eastern Qinling, China

CHENG Yongsheng1,2,3* and QIN Zhen4

1 Key Laboratory of Metallogenic Prediction of Nonferrous Metals, Ministry of Education, Central South University, Changsha 410083, China
2 School of Geosciences and Info-Physics, Central South University, Changsha 410083, China
3 State Key Laboratory of Ore Deposit Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002, China
4 No. 3 Geological Party of Henan Non-ferrous Metals of Geology and Mineral Resources Bureau, Zhengzhou 450016, China

1 Regional Geology

The Qiushuwan copper-molybdenum deposit is located in southern Erlangping terrain in the eastern part of North Qinling tectonic belt. The area has undergone the very complex of tectonic movement and tectonic evolution, where the exposed strata are mainly the Qinling group which experienced complicate tectonism and metamorphism, mainly consisting of Guozhuang group (Pt1g) and Yanlinggou group (Pt1y), from the old to the new formation along the stratum from north to south.

Qiushuwan copper-molybdenum deposit situates in the southern of Sikeshu anticlinorium, with the NWW and NW structure and the late NNE faults in the consistent direction with the regional structure.

In Qiushuwan copper-molybdenum mine area, the fault structures are developed well, which can be divided into two groups, a group of longitudinal fracture (NW, NWW) paralleling to the formation, another group of transverse fracture in the direction of NE.

In Qiushuwan copper-molybdenum mine area, the exposed rocks are composed of biotite granite and vein rocks. In Yanshan period, the magmatic activities dominated by the acid intrusive rocks and the subvolcanic rocks, which are usually characterized by the small-scale. The significant alteration phenomena on both sides of the magmatite rock and dike rock suggest a close relationship with the regional mineralization.

2 Orebody Characteristics

The Qiushuwan copper-molybdenum mineralization can be divided into two types: the porphyry type and skarn type molybdenum ore, the Breccia type copper ore. Molybdenum ore bodies mainly occur in the Nanshan molybdenum deposit, located near the inside and outside contact zone between Qiushuwan rock and Yanlinggou group and their xenoliths. In the inside contact zone the porphyry ore formed, in the outside contact zone or near the xenoliths the skarn type ore formed. Copper ore body mainly occurs in Beishan ore section, hosted by the explosive pipe breccia in the middle of Beishan, northern of Qiushuwan rock.

According to the spatial distribution of ore bodies, there are two main types of molybdenum ore: one is porphyry molybdenum mineralization occurred in the biotite granite porphyry, another is the skarn Mo mineralization, which closely related to contact metamorphic pyroxene and garnet skarn, occurred in the contact zone between porphyry and wall rock.

Copper ore, shaped in stratoid and irregular lenticular, is characterized by an imbricate style and occurs in the lower part of the breccia pipe with small distance between the ore bodies. The expansion shrinkage branch composite phenomenon of ore body is more obvious, but with better continuity along the strike.

3 Ore Minerals

Metal mineral in the ore is mainly molybdenite, chalcopyrite, pyrrhotite, followed by magnetite, sphalerite, galena and pyrite, and the very small amounts of copper blue under a microscope. Non-metallic minerals consist of diopside, garnet, calcite, quartz, feldspar, biotite, chlorite and fluorite, etc.

Ore texture are mainly allotriomorphic granular texture,
euhedral to subhedral granular texture, poikilitic texture, emulsion texture, metasomatic erosion texture, metasomatic relict texture, border texture, etc. Ore structures are mainly composed of block structure, disseminated structure, followed by vein structure and fine vein structure.

Molybdenite is mainly shaped in scaly, subhedral to anhedral granular texture, yet euhedral leaf texture secondly. The veinlets, filling vein structure or scaly molybdenite aggregates filled along the fissure filling. The scaly and granular molybdenite occurs in fine quartz vein, potassium feldspar-quartz fine vein, generally constituting the fine vein.

Chalcopyrite in the ore is mainly in the style of allotriomorphic irregular aggregates, commonly chalcopyrite replacing sphalerite, pyrite and pyrrhotite, yet occasionally galena replacing chalcopyrite. A little chalcopyrite scatters in the gangue in the pattern of star point and punctuate, occasionally covellite at the edge of chalcopyrite.

4 Mineralization Stages

According to mineral paragenesis relationship, ore texture, wall rock alteration types, the interspersed between the main minerals and the ore vein, the following three metallogenic periods are discriminated.

(1) The early high temperature alteration skarn stage (1): without the large-scale mineral precipitation, but only a little of mineralization, such as pyrrhotite, magnetite, pyrite and molybdenite. Including four stages: ① stem skarn-K feldsparization, barren quartz stage (I1), ② the blasting breccia stage (I2), ③ the wet skarn stage (I3), and ④ the magnetite stage (I4).

(2) The medium for sulfide precipitation period(II): the main mineralization stage, including two parallel mineralization stages: porphyry copper (molybdenum) mineralization phase (II b) and quartz sulfide stage (II s). Because of the change of temperature, pressure and other conditions, in order to cater to the large-scale precipitation environment of sulfide, metasomatism and filling of the ore bearing fluid occurred along the contacting zone or crack, and cementation and replacement of the blasting breccia and tectonic breccia, forming porphyry mineralization, such as quartz-potassium feldspar-sulfide net vei, quartz-sulfide vein and quartz-sulphide-calcite vein, and disseminated or vein quartz-diopside (epidote, garnet)-sulfide mineralization. In this stage, molybdenite is shaped in euhedral flake, xenomorphic granular, characterized by deep gray and greasy luster.

(3) The late calcite-barite-quartz stage (III), occurs along the early cracks and holes. Mineralizations include mainly calcite, barite, quartz as well as some other sulfides such as pyrite, chalcopyrite and galena, etc. Calcite is mainly rhomb or granular, associating with quartz and barite.

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