Deposit Geology

The Luoboling porphyry Cu-Mo deposit is located about 3km northeast to the Zijinshan Cu-Au mine. Cu and Mo mineralizations in the deposit are associated with a granodioritic complex composed of granodioritic porphyries, and an equi-granular granodioritic intrusion. Two main orebodies can be recognized, i.e. a Mo-rich orebody and a Cu-rich orebody (with cut off grades of 0.2% and 0.03% for Cu and Mo respectively). The Mo-rich orebody is characterized by disseminated molybdenite, chalcopyrite and abundant quartz-molybdenite vein, with average grades of 0.073% Mo, 0.14% Cu, and 0.30ppm Re. The Cu-rich orebody is typified by more disseminated chalcopyrite, pyrite and minor quartz-molybdenite vein, with average grades of Cu, Mo and Re of 0.38%, 0.026% and 0.17 ppm respectively. Rhenium is commonly concentrated in Cu-Mo sulfides and tends to be much more abundant in molybdenite than co-existing sulfides (McCandless et al., 1993). This study focuses on the spatial distribution of rhenium in the ores and molybdenite of the deposit.

Sampling and Analytical Methods

435 bulk ore samples were taken continuously from drilling core of 59 drilling holes, with sampling intervals between 10 to 40 meters. 9 molybdenite samples were taken from the drilling cores of 6 drilling holes. Molybdenite was hand-picked to produce a flaky powder.

The Re content of bulk ore samples was assayed using inductively coupled plasma mass spectrometry (ICP-MS) at Zijin Laboratories (Fujian Zijin Mining and Metallurgy Analytical Chemistry Co. Ltd.), with a detection limit of 0.002 ppm. The Re content of molybdenite samples was analyzed using ICP-MS at State Key Laboratory of Isotope Geochemistry (Guangzhou Institute of Geochemistry, Chinese Academy of Sciences), with a detection limit of 0.1 ppb.

Results and Discussion

Figure 1 illustrates the horizontal distribution of Re in ores (ore-body thickness*Re grade) and Mo in ores in the deposit, and it reflects that the Re concentration center coincides with the Mo concentration center and both tend to decrease toward the edges of the deposit. And the results of 9 molybdenite samples analyzed this time and other 17 analyzed molybdenite samples (Zhong et al., 2013, Liang et al., 2012) indicate Re content varies from a few tens to several hundreds of ppm.

In the vertical direction, Re grades in both ores and molybdenite tend to increase with the elevation.

Fig. 1. The horizontal distribution of Re in ores.
decreasing. Figure 2 reflects the close correlation of Re and Mo grade, and the Re grade decrease from Mo-rich orebody to Cu-rich orebody due to the drop of molybdenite content in ores. It has been accepted that there is a significant positive correlation between average Cu/Mo ration in ores and the Re in associated molybdenite (Berzina et al., 2005). Re content in molybdenites is affected by temperature, and alteration styles (Newberry, 1979), and there is an inverse correlation between the temperature of formation and Re content of molybdenite (Sutulov, 1978). In potassic alteration, molybdenite deposited in veins is relatively low due to the high temperature and high K⁺/Na⁺ ratio. With the decreasing of temperature and PH value, chlorite-sericite alteration telescoped on the potassic alteration, and large quantity of molybdenite was precipitated in quartz-molybdenite veins, along with the deposition of chalcopyrite and pyrite. The molybdenite deposited in the quartz-molybdenite veins (B veins) of this stage is characterized by high rhenium molybdenite (Newberry, 1979). In the Luoboling porphyry Cu-Mo deposit, however, the Re content in molybdenite of Mo-rich orebody, with lower Cu/Mo ratios range from 0.5 to 2, tends to be higher than that in molybdenite of Cu-rich orebody. This is probably due to late overprinting of low-pH phyllic alteration, which could result in partially or completely leaching of rhenium in molybdenite. The temperature of this alteration is high enough for the recrystallization of Re depleted molybdenite, so the molybdenite formed in this zone is relatively Rhenium-poor. And the intensity of phyllic alteration tend to decrease as the down-hole depth increasing towards the Mo-rich orebody, which explains that Re in molybdenite of the Cu-rich orebody is relatively lower than that of the Mo-rich orebody.

4 Conclusions

(1) There are two concentration centers of Re in the Luoboling porphyry Cu-Mo deposit, and Re grades decrease towards the periphery and increase with increasing down-hole depth.

(2) The grades of Re and Mo in ores is positively correlated in the Luoboling porphyry Cu-Mo deposit, therefore, a smaller quantity of molybdenite precipitated in Cu-rich orebody is the reason responsible for the lower Re grade in Cu-rich orebody compared with Mo-rich orebody. And it was the leaching and recrystallization of rhenium in Cu-rich orebody, caused by phyllic overprinting, that resulted in the low Re grade of some molybdenite samples in Cu-rich orebody.

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References


