

The Deformation of Sulfides in the Tectonically Reworked Porphyry Cu-Mo Deposits: An Example from the Kalaxiangular Porphyry Copper Ore Belt (NW China)

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The Kalaxiangular porphyry copper (KPC) ore belt, situated in northern Xinjiang, is tectonically located in the middle of the Central Asian metallogenic domain, between the Siberian craton and the Kazakhstan-Junggar block. The Kalaxiangular porphyry copper ore belt originated from the consumption of the early Paleozoic Irtysh-Zaysan Ocean, a branch of the Paleo-Asia Ocean. Therefore, the Kalaxiangular porphyry copper ore belt documents different textural and geochemical variations of presubduction, synsubduction, and postsubduction environments, which can be divided into premylonite, mylonite, ultramylonite, and postmylonite stages, together with accompanying metallogenic processes. In addition, new geochemical data documenting variations of sulfide compositions from different mineralization stages provide a better understanding of the deformation and movement behavior of sulfides.

In this contribution, we report new morphological (BSE) and EPMA data of sulfides from various stages. Our new results reveal that (1) Fe does not correlate closely with Cu and S in pyrite from the undeformed stage (premylonite and postmylonite); however, a negative correlation, which is accompanied by growth zoning, between Fe and Cu, and a positive correlation between Fe and S evolved during the mylonite to ultramylonite stages; (2) from the mylonite to the ultramylonite stage, the correlation of Fe and Cu in molybdenite changes from negative to positive, while there is no correlation during the undeformed stage; (3) significant variations occur in chalcopyrite: during the premylonite, mylonite, and ultramylonite stages, Mo and Co correlate positively with S, while the correlation is negative during the postmylonite stage. However, the correlation between Sb and Co changes from negative during the premylonite stage to positive during the subsequent stage.

Combining EPMA geochemical profile data across zoned pyrites, molybdenites, and chalcopyrites, we suggest that the deformation of the ore-bearing porphyries during the tectonic evolution between the Sawuer Island arc and Altay terrane is responsible for the redistribution of copper, iron, molybdenum, cobalt, and other trace elements. The copper and Mo can move as inclusions or structure atoms in the pyrite. The Fe and Cu contents are gradually reduced toward the shearing direction of the molybdenite, indicating that the deformation process is responsible for the migration of Fe and Cu.