SEG 2017 Conference

Characteristics of pyrite in the Tiegelongnan copper (gold) deposit, Duolong district, Tibet

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The Tiegelongnan copper (gold) deposit is the first porphyry-epithermal deposit identified in Tibet. Many metallic minerals formed in the Tiegelongnan deposit and pyrite is the largest one. Four types of pyrite are identified in the Tiegelongnan deposit described here in chronological order. Pyrite 1 is granular and occurs as euhedral-subhedral grains. The crystal form of the euhedral pyrite is mainly tetrahedron and the surface of it is compact. Quartz, alunite, dickite, and kaolinite always develop inside the subhedral pyrite. This type of pyrite has no relationship with the copper mineralization and is disseminated within the deposit. Pyrite 2 also occurs as disseminated grains in the deposit. It is always replaced by the enargite, tennantite, digenite, covellite, and bornite. It appears as subhedral grains, and cavities and micro-fractures can be seen inside the pyrite 2. Some fine-grained digenite and covellite develop near pyrite 2. This type of pyrite is closely related with the copper mineralization. Pyrite 3 occurs as veins always present with quartz veins, alunite, dickite, and kaolinite. Some pyrite 3 occurs along both sides of quartz veins and in the center of the quartz veins. Enargite, tennantite, digenite, covellite, and bornite always replace pyrite 3 and occur as granular grains or veinlets in the pyrite 3 veins. Pyrite 4 always is present in veins of variable width that cut pyrite 3. Some pyrite 4 often occurs solely as pyrite veins and other pyrite 4 occurs as veinlets along the margins of or within quartz, alunite, and dickite veins . Pyrite 4 has no relationship with copper mineralization. The chemical analyses of these pyrites show: (1) the content of Au, Ag, Cu, Pb, Zn, and Bi in pyrite 1 is lowest among the four types of pyrite and the content of Au, Ag, Cu, Pb, Zn, As, Sb, and B in pyrite 3 is highest; (2) Au, As, Pb, Zn, and Bi in pyrite 4 is higher than in pyrite 2; (3) Ag and Cu, Pb and Zn, Cu and Pb, and Ag and Pb in pyrite 3 show positive relationships, but they don’t show any relationships in pyrite 4; (4) Cu and Ni in pyrite 3 shows no relationship, but they show a negative relationship in pyrite 4; and (5) Cu and Ni, As and Se, and Zn and Se show an inverse relationship in pyrite 3 and pyrite 4. Therefore, Cu-Ni, As-Se, and Zn-Se relationships can be used to identify pyrite 3 and pyrite 4 in the Tiegelongnan deposit.