

## Alteration of sulfide minerals in the Ardakan barite - chalcopyrite ore deposits

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**Abstract:** In the Ardakan barite ore deposits, two groups of copper ore minerals have been identified in the barite veins. The hypogene ore minerals consist of chalcopyrite and chalcocite, which are associated with pyrite. The Supergene ore minerals are mainly composed of secondary Cu-sulfides (such as covellite, yarrowite and anilite), Cu-carbonates (malachite and azurite) and Cu-oxides (cuprite). Chalcopyrite is the most important hypogene Cu-mineral which has been altered to Cu-supergene minerals. Chalcopyrite tarnishing were developed along the joints, fractures and grain boundaries as films and veinlets. The tarnish color on the chalcopyrite varies from deep blue, pale blue, pink, yellow and dark gray. The tarnish phases in the chalcopyrite were studied using SEM - EDXA. Sequences of the chalcopyrite alterations by the continued oxidation are as following: chalcopyrite ( $\text{CuFeS}_2$ ), covellite ( $\text{CuS}$ ), yarrowite ( $\text{Cu}_9\text{S}_8$ ), spionkopite ( $\text{Cu}_{39}\text{S}_{28}$ ), geerite ( $\text{Cu}_{1.6}\text{S}$ ) and anilite ( $\text{Cu}_{1.75}\text{S}$ ). Alteration and oxidation caused a series of changes from chalcopyrite to anilite. These changes include general fluctuations in the Cu/Fe and Cu/S ratio, so that some new minerals form by Fe and S depletion and Cu enrichment. Weathering of chalcopyrite to covellite results in a decrease in iron content with simultaneous increase in copper. Subsequent weathering of covellite to anilite caused an increase in the Cu/S ratio from 0.9 in covellite, to 1.12 in yarrowite, 1.45 in spionkopite, 1.64 in geerite, and to 1.77 in anilite. Supergene weathering in the chalcopyrite of the Arakan barite is mainly due to galvanic reactions.

**Keywords:** *Galvanic reactions, Chalcopyrite alteration, Supergene minerals, Barite, Ardakan.*