SEG 2017 Conference

Magnetite and epidote textures at Chalcobamba Cu-skarn deposit, Las Bambas district, southern Peru

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Chalcobamba is a Cu-skarn deposit (338 Mt @ 0.55 % Cu) located in the centre of the Middle Eocene-Early Oligocene Las Bambas district, Andahuaylas-Yauri Belt, Southern Peru. At Chalcobamba, skarns formed when limestones of the Ferrobamba Formation were intruded by a Late Eocene quartz-diorite pluton. Skarn ores were then cut by a quartz monzodiorite porphyry stock, and swarms of monzogranitic and monzodiorite dikes.

Chalcobamba has spectacular outcrops of massive magnetite, massive epidote endoskarns, and coarse grained garnet. Magnetite and epidote display a wide range of textures linked with the evolution of alteration and mineralization in the deposit.

Distinctive magnetite textures formed during magmatic-hydrothermal activity in the intrusive rocks and in the prograde and retrograde skarn assemblages. The pluton, stocks and dikes typically have mafic minerals replaced by magnetite. Early banded magnetite and diopside skarn formed in limestone horizons that have some dolomitic content. Magnetite bands are typically thin and fine grained, but locally coarsen and increase in thickness. Magnetite associated with retrograde sulfide mineralization has replaced garnet and pyroxene in a continuous progression from magnetite patches to massive magnetite skarns. Hematite-epidote-calcite is a typical late-stage assemblage. In many cases, the hematite is partially to total pseudomorphed by magnetite, producing mushketovite. Some mushketovite crystals are up to 5 cm in diameter.

The typical epidote progression in intrusive rocks at Chalcobamba is from veinlets and disseminations in plutons, stocks and dikes, through endoskarn alteration patches, to tens of meter outcrops of massive epidote endoskarns. The monzogranitic swarm dike has a mappable gradient in disseminated epidote intensity. It is abundant near the skarn mineralization centre, and progressively weaker to the periphery of the system. The disseminated epidote consists of partial or total replacements of feldspars crystals. Epidote has also locally replaced prograde garnet, pyroxene and magnetite skarns. When epidote is associated with calcite and mushketovite, it typically displays coarse radial acicular textures.

Both magnetite and epidote have the capacity to record chemical anomalies via their stable isotopic or trace element compositions, potentially allowing inferences about the evolution and fertility of hydrothermal fluids to be made, provided that interpretations are made within the framework of the textural evolution of these key gangue minerals. Work is on-going to establish if any of the textural varieties of magnetite and/or epidote can be used to aid skarn exploration in the Andahuaylas-Yauri Belt, particularly as to whether mapping characteristic textures can provides insights into ore genesis and/or proximity to the center of mineralization.