

Geology and genesis of the gold-copper skarn deposit in the Shwe Min Bon area, Kalaw Township, Southern Shan State, Myanmar

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The Shweminbon area lies within one of the largest gold-copper skarn zones in Myanmar. Skarn occurs in Plateau limestones and is spatially associated with two or more phases of intrusive rocks. Based on field observation and mineral assemblages, the skarn zone can be subdivided into three sub-zones of garnet-pyroxene, wollastonite-garnet and epidote-tremolite-wollastonite. Skarn-type alteration and mineralization occur along the contact parts between the post Mesozoic diorite intrusion and the Triassic-Jurassic Nagyan Chaung Formation or Shwe Min Bon Formation. This research will focus on gold mineralization during skarn formation.

The formation of endoskarn began with the replacement of plagioclase and hornblende by coarse-grained garnet and minor sulfide. Exoskarn is the principal skarn occurring mainly in marble and hornfelsic sandstone and siltstone. Metasomatism developed in both endoskarn and exoskarn, which is contemporaneous with or following recrystallization of limestone to marble. From north to south, skarn is zoned away from intrusive in the sequence: garnet, pyroxenoid to marble. Three mineralization stages have been identified in the deposit: prograde skarn (pre-ore stage), retrograde skarn and Cu-Fe-As-Bi sulfides (main ore stage) and Bi-Te minerals associated with calcite (late ore stage) in brecciated marble. In addition, another supergene stage marked by secondary Cu mineralization (malachite and azurite) is closely associated with oxidized zone. Prograde skarn is characterized by the development of garnet with pyroxene proximal and wollastonite-bearing assemblages distal, mostly along bedding-controlled replacement fronts. Retrograde skarn is characterized by the formation of chlorite, epidote and tremolite-actinolite in the later stage. The most intense retrograde skarn overprints the prograde skarn and is mainly composed of epidote, quartz, and chlorite. Gold mineralization is mainly associated with sulfide minerals such as chalcopyrite, bornite, tennantite and cosalite in the retrograde skarn stage and telluobismuthinite in later stage. High-grade gold ores occur in supergene zone with hematite and magnetite.

Fluid inclusion microthermometry was conducted in garnet, quartz and calcite. In the prograde skarn stage, fluid inclusions are composed of three-phase (liquid-vapor-halite) with an average homogenization temperature of 440 °C. The fluid inclusions in quartz from the main mineralization stage formed under two-phase conditions and liquid-rich fluid inclusions have homogenization temperatures of 240°-320°C. According to the integrated analysis of ore features, mineral associations, ore-forming environment and fluid evolutionary process, it can be reasonably concluded that the Shwe Min Bon deposit is a copper-gold skarn deposit.