

# SEG 2024 Conference: Sustainable Mineral Exploration and Development

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## Timing and Characteristics of Skarn-Hosted Cu-Au Mineralization at Blue Copper, Montana, USA

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The Blue Copper Cu-Au prospect, located in the Ophir District on the northern border of the Boulder Batholith in Montana, USA, hosts several mineralized skarn zones. These zones are developed along the contact between the Blackfoot City granodiorite intrusion and carbonate rocks of the Mississippian Madison Group, Devonian Jefferson Formation, and the Cambrian Meagher and Pilgrim Formations. Here we present preliminary results of geological mapping, petrography and geochronology of skarn Cu-Au mineralization at Blue Copper. Outcropping skarn zones vary from 2 to 15 m in thickness and can be traced along several hundreds of meters of strike length. Their vertical extent is yet to be constrained.

Proximal prograde exoskarn comprises mainly dark red garnet overprinting local pyroxene skarn. Distal/intermediate skarn is characterized by green garnet, green pyroxene, and vesuvianite. Prograde skarn varieties are cross-cut by retrograde epidote-calcite-quartz veins. Endoskarn is subordinate, instead most of the intrusion in contact with skarn is overprinted by propylitic alteration. Locally, magnesian skarn alteration with abundant magnetite and serpentine is recognized, which shows elevated gold concentrations compared to calcic skarn. Copper-gold mineralization is intimately associated with skarn alteration. Hypogene sulfides are completely weathered to secondary copper minerals.

Four samples of garnet across the district were dated by LA-ICP-MS U-Pb geochronology, yielding ages ranging from  $82 \pm 3$  Ma to  $85 \pm 2$  Ma. The ages indicate that skarn alteration at Blue Copper is the oldest yet recognized hydrothermal mineralization event within the Boulder Batholith. We are planning to carry out zircon U-Pb geochronology of samples from the Blackfoot City granodiorite and place our age data in the regional context to update the metallogenetic understanding of the area.