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Coincident Fold-Fault-Vein Geometric Patterns at Galore Creek and Sulphurets Cu-Au Districts: Reflections of Cryptic Basin Architecture and Transcrustal Magma Conduits

Gayle Febbo[1], Lori Kennedy[2], JoAnne Nelson[3], Bram I. van Straaten[3]
1. Kingfisher Metals Corp., Terrace, BC, Canada, 2. University of British Columbia, Vancouver, BC, Canada, 3. British Columbia Geological Survey, Victoria, BC, Canada

The Galore Creek and Sulphurets Cu-Au porphyry-epithermal districts are host to combined measured and indicated resources of 9.2 Moz Au with 11.4 Blbs Cu and 95.0 Moz Au with 13.1 Blbs Cu, respectively. The districts are part of a protracted Late Triassic-Early Jurassic Cu-Au metallogenic epoch related to island-arc magmatism in Stikinia, British Columbia. Structural regimes in the study areas include 1) pre-212 Ma extension along N- and E-striking faults at Galore Creek (preporphyry); 2) a 212 (?)-208 Ma fold-and-thrust deformation event expressed as dextral transpression at Galore Creek (pre-/synporphyry; NE-SW-oriented σ_1) and as a significant angular unconformity between Stuhini and Hazelton groups at Sulphurets; 3) latest Triassic-early Jurassic dextral transtension and basin formation at Sulphurets (pre-/synporphyry); and 4) the Skeena fold-and-thrust belt (120-110 Ma) at Sulphurets (postporphyry; early NW-SE-oriented σ_1; late E-W-oriented σ_1).

The latest Triassic Galore Creek deposits cut and emplace to the east of a >2-km-wide, N-striking high--strain zone and folded corridor (~212-208 Ma), which includes a crenulated, prehigh-strain zone, N-striking, 40° W-dipping dextral-normal mylonite. Sheeted and stockwork K-feldspar-rich veins (1-5 vol %) in the district were emplaced along structural corridors of various orientations, including subparallel to a S-dipping normal fault segment in the footwall of a district-bounding, E-striking, S-dipping thrust fault. The >4-km-long Central-West Fork magmatic-hydrothermal trend parallels a N-striking, 45° W-dipping fault array that is defined by normal offset of stratigraphy across hydrothermally healed paleostructures and by spatially coincident, N-trending fold culminations. Both brittle-ductile deformation zone trends and hydrothermal-magmatic healed paleostructures parallel cryptic predeformation and preporphyry N- and E-striking basin architecture at Galore Creek.

The Early Jurassic Sulphurets district includes the Kerr, Sulphurets, Mitchell and Iron Cap (KSM), Snowfield, and Brucejack deposits. It is bounded to the north by the E-striking Johnstone fault and to the east by the N-striking Brucejack fault. Early Jurassic units thicken into the district across both faults, indicating that a coeval basin structural framework provided the E- and N-striking magmatic-hydrothermal pathways for metal deposition. Mid-Cretaceous deformation inverted the Early Jurassic basin, resulting in N- to NW-plunging isoclinal folds of porphyry veins at Kerr deposit, and W-plunging open to isoclinal folds of veins at Mitchell and Snowfield deposits. These fold arrays are parallel to sheeted quartz vein corridors (20-90 vol %) within the Kerr, Mitchell, and Brucejack deposits.

The spatio-geometric correlation of late Triassic and mid-Cretaceous fold patterns with hydrothermally healed paleostructures at Galore Creek and Sulphurets, due in part to basin inversion, can potentially be used to constrain the geometry and strike length of ore-focusing structures. The long-lived nature of these recurring patterns hints at the geometry of transcrustal magma conduits during the formation of porphyry clusters in Stikinia.