Lesage G, Byrne K, Lypaczewski P, Lee RG, Hart CJR, 2016, Characterising the structure and signature of district-scale alteration surrounding a large porphyry Cu system: The case of Highland Valley Copper, British Columbia, Abstract, GAC-MAC

The Highland Valley Copper (HVC) district near Kamloops, British Columbia, is a porphyry copper district hosted in the Late Triassic Guichon Creek batholith. The HVC site was chosen to study what controls the extent and shape of porphyry deposit footprints, and to determine what is the footprint signature to distances up to 13 km away from the mineralized centers. The Guichon Creek batholith is ideal for this study because its geology is well known and shows minor lateral variability: only six major granitoid units are mapped across the batholith. The main alteration assemblages observed at the district scale include potassic (K-feldspar-biotite), sodic-calcic (albite-actinolite-diopside-garnet-chlorite-epidote), muscovitic (muscovite±quartz), and intermediate argillic characterized by either illite-chlorite-prehnite or kaolinite-dickite-smectite alteration. K-feldspar veins extend to a distance of up to 4.5 km. Sodic-calcic alteration overprints potassic alteration, covers a larger area than potassic alteration, and follows northeast- and northwest-oriented structures related to regional stresses at the time of hydrothermal activity. Muscovitic alteration, interpreted to be the main copper introduction event, post-dates sodic-calcic alteration, is primarily observed within and very close to the mineralized centers, and is locally present at district showings. Intermediate argillic alteration is interpreted to post-date muscovitic alteration. Illite-chlorite-prehnite alteration is widespread in the district, whereas kaolinite-dickite-smectite alteration is almost exclusively observed within the mineralized centers. Hydrothermal alteration associated with copper introduction (i.e., potassic and muscovitic alteration) typically shows elevated concentrations of Mo, W, Ag, Se, Te, Bi, As, Tl, Hg, Cs, Au, and Rb to distances up to 4 km from mineralized centers. White micas (i.e., muscovite, illite, phengite, and paragonite), which are abundant throughout the HVC district, can be used as an exploration tool for porphyry deposits because their chemical composition is partly determined by the hydrothermal fluid temperature and pH. White micas are typically muscovitic to paragonitic within and proximal to the ore zones due to high temperature and low pH fluids, whereas distal white micas are phengitic due to lower temperature and rock-buffered fluids. The Al-OH absorption feature wavelength (2200 nm) of white mica measured by short-wave infrared (SWIR) is a proxy for their chemical composition. SWIR measurements in the HVC district show an increase in the Al-OH feature wavelength from an average of 2197.2 nm at distances <1 km from the Valley or the Lornex mineralized center to an average of 2202.3 nm at distances >10 km, consistent with muscovitic proximal white micas and more phengitic distal white micas.

NSERC-CMIC Mineral Exploration Footprints Project Contribution 092.