Defining the Surficial Geochemical Footprint of Buried Cu-Mo Porphyry Mineralization at the Highland Valley Copper Deposits, South-Central British Columbia

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Introduction

This project is part of the Canadian Mining Innovation Council (CMIC) and Natural Sciences and Engineering Research Council's (NSERC) 'Footprints' Project's Porphyry Cu Subproject. The Porphyry Cu Subproject aims to quantify and identify the distal footprint of porphyry Cu(Mo) mineralization at the Highland Valley Copper operations (HVC) in south-central British Columbia, through a multi-disciplinary, collaborative and integrated approach. The deposits at HVC comprise five main known clusters of porphyry-style mineralization, which vary in production state from active to undeveloped. The J.A. and Highmont South targets comprise two mineralized areas within these clusters that are both undeveloped and buried under cover of glacial and pre-glacial origin. Surficial geochemical studies at these two buried targets aim to fully characterize mineralogical and chemical changes manifested in the surficial environment after glacial dispersal and soil development over mineralized bedrock. This robust, multi-parameter investigation aims to develop surficial geochemical exploration models to apply in the search for other buried Cu porphyry mineralization.

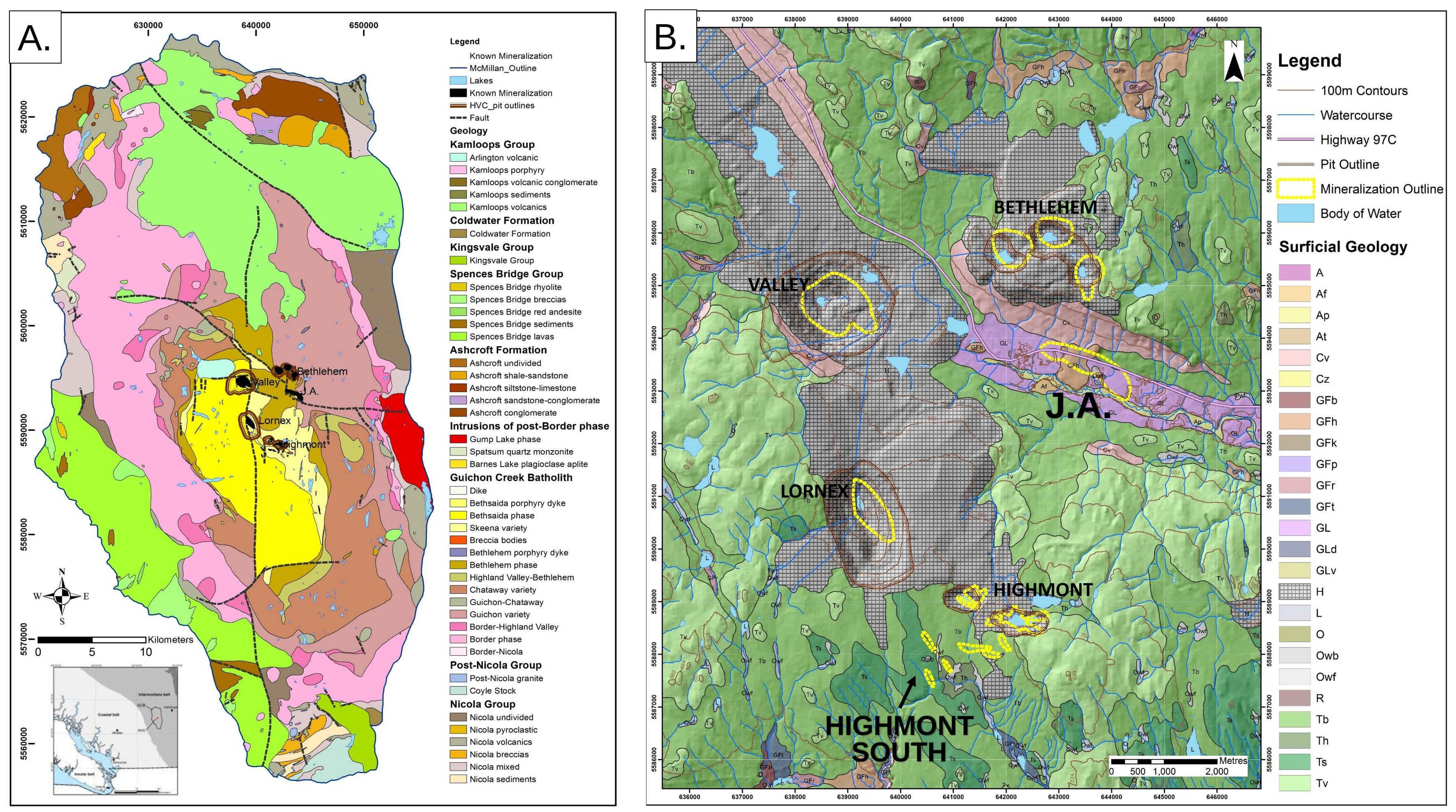

Figure 1. **A**. Geologic map of the GCB region modified after McMillan et al., 2009. **B**. Surficial geology at HVC, adapted from Plouffe & Ferbey, 2015.

Research Questions

- What is the surficial response from the presence of buried mineralization at Highmont South?
- Will the same techniques used to detect a response at Highmont South identify a surficial response from the presence of much more deeply buried mineralization at J.A.?
- Is there a distinction between a surficial signal from vertical metal transfer from bedrock mineralization and geochemical signals from mineralized fragments in the transported glacial cover?
- Is there a distinction between a surficial signal from buried mineralization and a 'false' signal introduced from anthropogenic inputs?
- What is the geochemical influence of the alteration halo in the surficial materials surrounding the centres of known mineralization?
- What is the spatial limit of the alteration halo expressed in surficial materials?
- Will the evaluation of various exploration methods, including novel techniques, develop a future framework for surficial geochemical exploration of buried porphyry Cu deposits in glaciated and till-covered terrains?

Work Completed

- Surficial mapping of unnatural features that would influence sample site selection, such as exploration trenches, drill pads, agricultural ruins, zones of mechanical reforestation, etc.
- A total of 6 soil sampling transects (2 at Highmont South, 4 at J.A.) were planned to perpendicularly cross known mineralization and extend out into background
- A total of 93 soil samples were collected at the Highmont South and 85 soil samples were collected at J.A. (totals do not include duplicates or CRMs)
- The soil sampling process included detailed descriptions and in-situ measurements for each horizon identified in each hole. The upper 10cm of the B horizon was targeted for the soil sample itself and subsequent soil slurry tests.
- In-situ measurements using field-portable probes in each horizon identified were completed for electrical conductivity (EC), soil moisture and pH
- Soil samples were collected for multi-element, microbial, and soil gas hydrocarbon analyses
- Slurry tests using the sampled medium and deionized water in a 1:1 ratio were conducted for oxidation-reduction potential (ORP), EC, pH, acidified pH (to test the soil's buffering capacity), and chlorine content
- A total of 187 GORE-SORBER™ hydrocarbon collectors were inserted at the bottom of each sampled hole, including duplicate holes, for approximately 40 days. The sample modules are currently being analyzed by Amplified Geochemical Imaging LLC (AGI) for volatile organic and inorganic compounds.
- Quality assurance was completed on the data obtained from multi-element soil analysis at a commercial facility which used both deionized leach and aqua regia digests

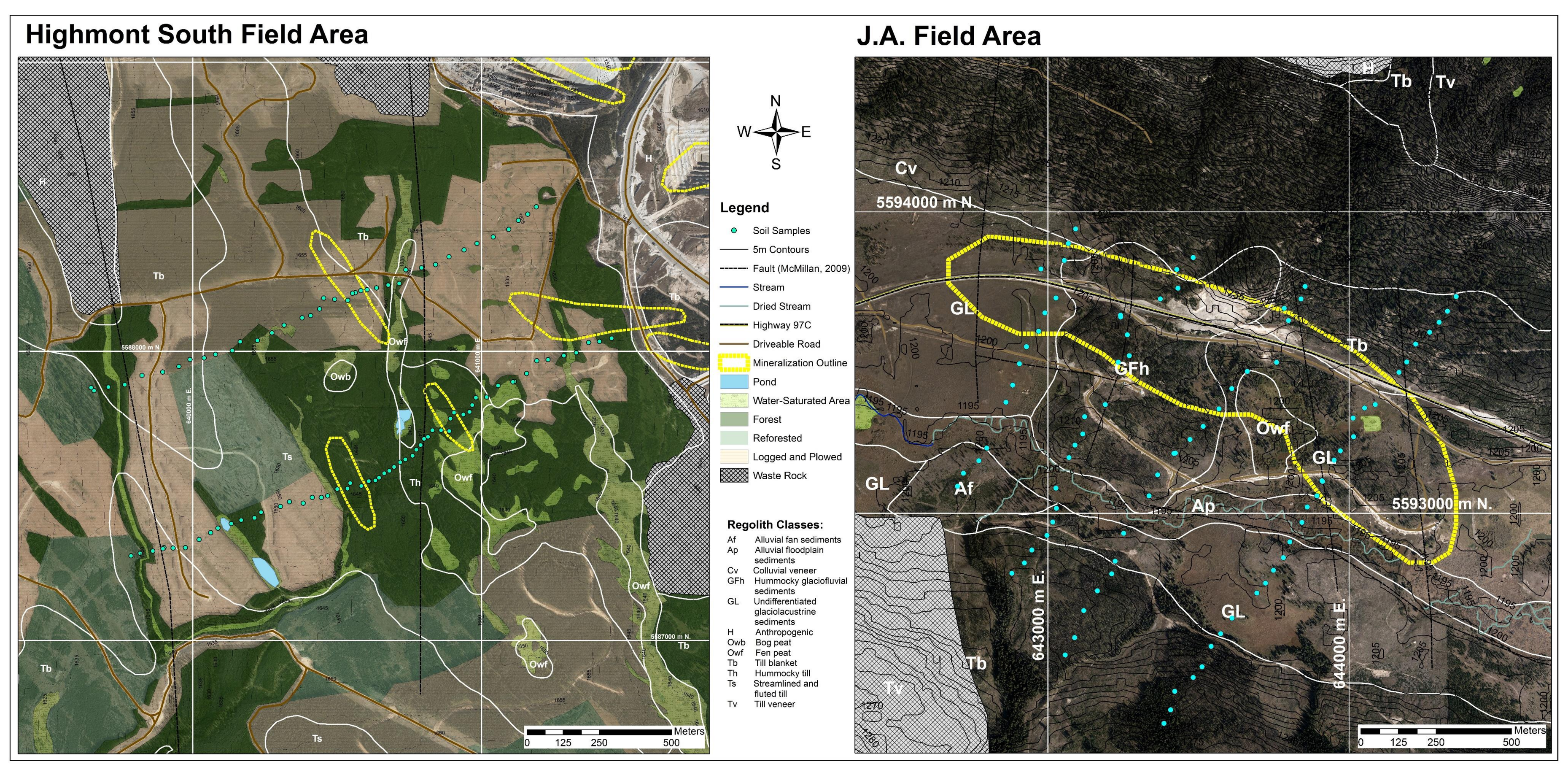

Figure 2. Field area maps of the two buried targets of interest at HVC. Two transects were planned to perpendicularly cross mineralized targets at Highmont South, with 25m spacing close to and over top of the targets and 50m spacing out into the background. Four transects were planned to perpendicularly cross the mineralized J.A. target, all with 50m spacing between samples within a transect and approximately 200-300m spacing between transects. The sampling transects on J.A. could only extend to the southwest in order to collect background material due to a steep valley wall that restricted sampling access to the northeast. The 2015 sampling program yielded 178 samples in total (does not include duplicates and CRMs).

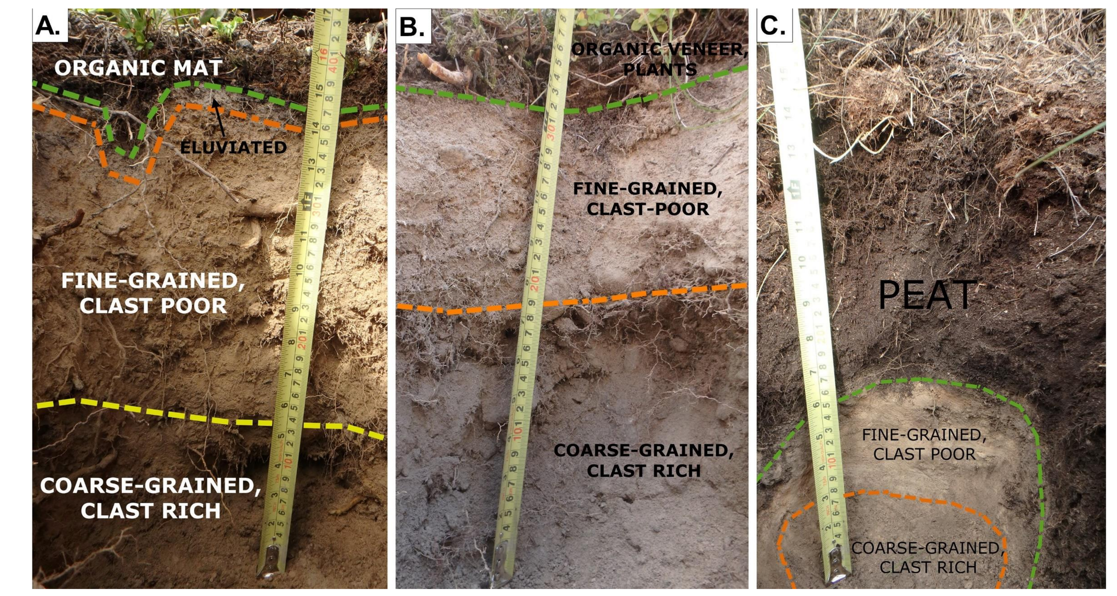

Figure 3. **A**. An example of a typical soil sampling hole in Highmont South. **B**. An example of a typical soil sampling hole in J.A. **C**. An example of a soil sampling hole in the bottom of Witches Brook valley in J.A. which contains a dense, organic peat mat.

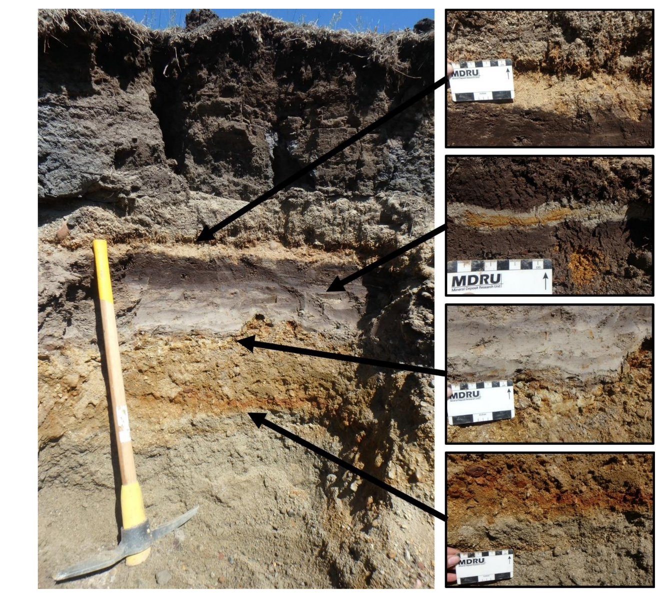

Figure 4. A surficial profile from Witches Brook valley in J.A. which shows alternating fine and coarse horizons under a thick layer of peat.

Future Work

- The multi-element data acquired from soil sample analysis at a commercial facility will be subjected to various statistical techniques to identify the surficial response to the presence of buried mineralization
- Based on this initial analysis, samples will be selected and submitted for Cu isotopic studies as well as sequential leach for Cu
- Soil samples will be analyzed for total element concentrations by an Olympus Innov-X FP-XRF instrument
- Field work next season will involve further soil sampling at selected anomalous and background locations, as well as soil profile sampling to assess the influence of anthropogenic inputs. Detailed regolith and vegetation zone mapping will be completed over the field area. Groundwater sampling, tree core sampling and a geophysical self potential (SP) survey are also being planned.

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