Mineralogical and Geochemical Vectoring Techniques in Advanced Argillic-Altered Rocks of British Columbia

Farhad Bouzari[1], Robert G. Lee[1], Craig J. Hart[1], Bram I. van Straaten[2]
1. MDRU-Mineral Deposit Research Unit, The University of British Columbia, Vancouver, BC, Canada, 2. British Columbia Geological Survey, Vancouver, BC, Canada

Zones of advanced argillic-alteration occur in the upper parts of porphyry systems, and where preserved may create the largest near-surface footprint of the hydrothermal system. Mineral exploration within advanced argillic zones is difficult because of their large size, the intense nature of the alteration, and the subtle mineralogical changes that can be challenging to identify.

This study characterizes alteration-mineral assemblages and compositions across zones of advanced argillic-alteration in three British Columbia properties: Tanzilla, Alunite Ridge, and Kemess North. A total of 230 rock samples were characterized by field observations, hyperspectral shortwave infrared, petrography, cathodoluminescence, scanning-electron microscope, and whole-rock lithogeochemistry.

Aluminum-rich minerals such as andalusite, corundum, diaspore, and topaz occur within zones of intense alteration and silicification with pyrophyllite and/or muscovite-clay assemblages. The muscovite color changes laterally, with respect to the main up-flow zone, to pale-green and green, in conjunction with a change to phengitic composition. A new K-Mg-Al molar diagram is introduced to map white muscovite-clay-(aluminum-rich minerals), pale-green muscovite, green muscovite-chlorite, and chlorite-dominated alteration assemblages. A K/Rb-Al diagram distinguishes the aluminum-rich phases from those of the muscovite-clay assemblages. Cathodoluminescence study indicates that quartz within more central parts of advanced argillic alteration displays red luminescence and typically occurs with blue luminescent pyrophyllite and clays.

Two trace element indices, MPIx (MDRU Porphyry Index) and MPIx-Lateral, are used to map the mineralization footprints vertically and laterally, respectfully. These indices provide tools to compare prospects in a district, identify size potential and level of exposure, and help target deep drilling. A Na-Ca depletion index maps the intensity of muscovite and advanced argillic-alteration, adding more new tools to define vectors for mineralization.

These research advances provide a toolset that can aid rapid and cost-effective exploration vectoring for porphyry copper and related epithermal mineralization within and around regions with advanced argillic-altered rocks.