

SWIR Spectroscopy Reliability in Mixed Mineral Assemblages: Implications for Orogenic Gold Deposits Exploration

Lidbert Alarcón^{1,2}, Georges Beaudoin^{1,2}, Bertrand Rottier^{1,2}, Tim Baker³, Jacques Simoneau³

¹Université Laval, Quebec,, Canada, ²Centre de Recherche sur la Géologie et L'ingénierie de Ressources Minérales (E4m), Quebec,, Canada, ³Eldorado Gold Corporation, Vancouver,, Canada

Short-wave infrared (SWIR) spectroscopy has been used in mineral exploration to define alteration patterns in several mineral deposit types, demonstrating its rapid, cost-effective delivery of mineralogical and compositional information. However, the mineralogy and mineral chemistry reliability based of SWIR in orogenic gold deposits on mixed mineral assemblages remains unclear and requires detail evaluation. Here, we validate SWIR absorption signatures in pure and mixed mineral samples collected in the Val-d'Or vein field, Abitibi greenstone belt, Canada. The SWIR data were acquired with an ASD TerraSpec 4, and the chemical composition and mineralogy was validated with electron microprobe analysis. Chlorite and white mica are detectable at ~5% modal abundance in mixed minerals assemblages, epidote at ~15% and amphibole, biotite at ~25%, reflecting matrix-controlled spectral dominance. Carbonate is generally not detected, and when it occurs in high abundance it is obscured by the Fe-Mg-OH absorption bands of other minerals. Correlation between position of absorption bands and chemical composition of the minerals have been tested for chlorite, white mica, epidote, biotite, amphibole and tourmaline. For chlorite, a good correlation is observed between the 2240-2265 nm absorption wavelength and Mg# and Alvi content. Mg# correlation may be enhanced by the presence of biotite, as both minerals show a similar band shift at ~2250 nm. For white mica, a relatively good correlation between the 2185-2225 nm absorption wavelength and Al and Mg content, but only when Na₂O is <2%. Similarly, correlation between the position of the typical absorption wavelength for epidote, biotite, amphibole and tourmaline with their chemical composition is generally weak or absent in most of the samples, due to interference of other SWIR active minerals. Our results demonstrate the reliability of SWIR measurement to detect accurately the presence and chemical composition of chlorite and white mica for use in volcanic-intrusive rock-hosted orogenic gold exploration.