

# Short Wavelength Infrared Spectral Characteristics of the HW Horizon: Implications for Exploration in the Myra Falls Volcanic-Hosted Massive Sulfide Camp, Vancouver Island, British Columbia, Canada

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## Abstract

Short wavelength infrared (SWIR) spectrometry has been used to identify previously unmapped hydrothermal alteration zones around volcanic-hosted massive sulfide (VHMS) orebodies at Myra Falls, Vancouver Island, British Columbia. Hydrothermal alteration assemblages are uniformly dominated by fine-grained white mica, with poor development of mineralogical zonation. SWIR spectrometry is an ideal exploration tool for characterizing this fine-grained hydrothermal alteration. At Myra Falls, SWIR spectrometry has identified subtle shifts in the wavelengths of the AlOH absorption feature of white mica, corresponding to compositional changes in altered rhyolite distal and proximal to ore. AlOH absorption occurs at shorter wavelengths (<2,198 nm) and corresponds to lower Fe, Fe + Mg, and Si/Al and higher Na/(Na + K) in strongly altered samples proximal to ore (slightly sodic muscovites). AlOH absorption occurs at longer wavelengths (>2,206 nm) and corresponds to higher Fe, Fe + Mg, and Si/Al and lower Na/(Na + K) in samples distal to ore (nonsodic slightly phengitic muscovites). White mica in siltstone within a meter of VHMS ore has higher Zn, V, Fe, and Mg contents than white mica distal to these altered samples. Chlorite compositions, identified by SWIR, also show systematic changes with intensity of alteration and distance from ore. The average wavelength of the FeOH absorption feature for chlorite in rhyolitic samples proximal to ore is 2,241 nm (intermediate Mg chlorite), whereas wavelengths in background samples average 2,247 nm (intermediate Fe chlorite). Similar changes are observed in footwall and hanging-wall andesites, with samples near the Battle mine containing muscovite to phengitic muscovite (average wavelength of the AlOH absorption feature of 2,200 nm) and Mg-rich chlorite (average wavelength of the FeOH absorption feature of 2,245 nm) to regional andesite samples with phengitic muscovite (average wavelengths of the AlOH absorption feature of 2,209 nm) and Fe-rich chlorite (average wavelength of the FeOH absorption feature of 2,249 nm). In weakly altered rocks white mica compositions also vary with host lithology. The AlOH absorption feature occurs at longer wavelengths in white mica in dacite and andesite compared to adjacent rhyolitic rocks, suggesting that higher Fe and Mg in the host lithology affects the composition of white mica.

Two zones of intense hydrothermal alteration above the Battle and HW orebodies have distinctive SWIR spectral characteristics, with the AlOH and FeOH features occurring at shorter wavelengths (<2,197 and <2,240 nm, respectively). Small anomalous zones of alteration were also identified in the Thelwood Valley area, where minor mineralized zones are present. As broad zones of fine-grained white mica (sericite) alteration are ubiquitous throughout the Myra Falls property, alteration proximal to ore cannot be identified simply by visual logging of drill core. Alteration zonation may be determined by subtle shifts in white mica spectral characteristics. This study indicates that SWIR analysis may be an effective field-based exploration tool for quantifying the intensity of alteration associated with VHMS orebodies, and that trends in mineral compositions, even in very fine grained rocks, can be used as mine-scale vectors to ore.

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