

Differentiating Magmatic-hydrothermal Sericite From Other White Micas Based on Grain Size Using Airborne Hyperspectral Data, Battle Mountain Mining District, Nevada

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We demonstrate the utility of using airborne imaging spectroscopy data (hyperspectral data) to differentiate magmatic-hydrothermal sericite from other white micas based on grain size, in a case study of the Battle Mountain mining district in Humboldt and Lander Counties, Nevada. White micas, defined here as muscovite, sericite, and illite, are common hydrothermal alteration products associated with certain ore deposits. The Battle Mountain mining district contains porphyry, skarn, and distal disseminated deposits that formed in magmatic-hydrothermal systems, as well as sedimentary rock-hosted gold deposits of less certain origin. Using a reference spectral library and the U.S. Geological Survey's Material Identification and Classification Algorithm (MICA) spectral feature comparison algorithm, we generated surface mineral maps from airborne AVIRIS-Classic and SpecTIR® FENIX 1K hyperspectral data to examine the spatial distribution of spectrally dominant minerals such as kaolinite, montmorillonite, and white micas. Using MICA, we also created maps of the wavelength position and width of the 2200 nm feature in the spectra of pixels that matched white mica reference spectra. These feature parameters relate to the composition and grain size of white micas, enabling us to differentiate igneous muscovite from magmatic-hydrothermal sericite. Previous studies have determined that positive aeromagnetic anomalies in the Battle Mountain district are associated with batholiths at depth. By integrating our spectral-based maps with geologic mapping, airborne aeromagnetic data, and prior geological studies, we determined that finer grained, higher Al white mica spatially correlated with the footprints of known magmatic-hydrothermal systems and is interpreted as forming from magmatic-hydrothermal alteration. Coarser grained, lower Al muscovites are distal from known magmatic-hydrothermal systems and are interpreted as being igneous derived siliciclastic sediments that became constituents of the host sedimentary rocks. Techniques described in this contribution can be applied to any appropriate hyperspectral data, regardless of sensor type used to collect the data.