

Spectral Analysis of Sillimanite Mineralization

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This study aims at analyzing the spectral profiles of the sillimanite mineral to map the sillimanite mineralized zones in the Hafafit area which is located in the southern Eastern Desert of Egypt. Minerals spectral reflectance depends mainly on purity and grain size. We used the reference spectra of the sillimanite mineral from the USGS and Jet Propulsion Laboratory (JPL) digital spectral libraries. The JPL spectral library has three spectra of sillimanite mineral at three different particle sizes coarse, medium, and fine (125-500, 45-125, and <45 μm), respectively. The USGS has only one reference spectra of sillimanite. The X-ray diffraction (XRD) analysis indicated that there are no significant changes in composition of the USGS and JPL samples. The JPL spectra were measured by Beckman UV5240 spectrometer and the USGS spectra were measured by Beckman UV5270 spectrometer. The position, depth, and full-width-half-maximum (FWHM) of the absorption features were calculated for all of the continuum-removed spectra. The results show that the USGS and JPL spectra have absorption features at 1.38, 1.40, 1.91, and 2.20 μm . The reflectance increases as the particle size decreases, there are also reduction in the depth and FWHM with decreasing the particle size. Supervised classifications of ASTER image using Spectral Angel Mapper (SAM) and Spectral Information Divergence (SID) indicated that the sillimanite mineralized zones are better identified using the medium size particle sillimanite JPL spectrum. The classifications accuracy was evaluated using 120 ground truth sample that were collected from the study area. The results demonstrated that particle size and type of spectrometer influence the reflectance, the depth, and the FWHM of the absorption features, but they do not affect the position of the absorption features. The results of this study recommend that for the mineral spectral libraries to include spectra of various grain sizes for each mineral.