Remote sensing of Carhuarazo volcanic complex. Using ASTER imagery in Southern Peru to detect alteration zones and volcanic structures – a combined approach of image processing in ENVI and ArcGIS/ArcScene

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A combined approach to detect hydrothermal alteration zones and their mineral distribution is proposed for a relatively remote area (2,222 km2) around the Carhuarazo volcanic complex in southern Peru encompassing. In this region Tertiary volcanic structures associated with hydrothermal alteration are known to host epithermal ore deposits. We make an attempt to detect and to quantify alteration minerals based on spectral analysis using ASTER reflectance data provided by LP-DAAC. Besides commonly used ratio images, mineral indices (MI) and relative band depth images (RBD) we also extracted endmember spectra using Pixel-Purity-Processing preceded by Minimum Noise Fraction transformation. These spectra represent the spectrally purest pixel of the image and show the typical absorption features of the main constituants. Based on this assumption we used different spectral analysis methods in order to extract the most important alteration minerals for these volcanic regions. The resulting mineral spectra were then used for matched filter processing in areas showing high values in MIs and RBDs.

Using this method we mapped argillic alteration and variations in the distribution of important minerals such as alunite, kaolinite or nacrite. There were no indications for the presence of propilitization at ASTER spatial resolution. Our method can be easily applied to any ASTER scene and provides information about the intensity of alteration and the character of alteration zones. The detected intensitiy is highest in the center of the Carhuarazo volcanic complex where it is mostly argillic with a high content of alunite, dickite and other clay minerals.

Results were incorporated in an ArcMap project and 3-D animations were created in ArcScene in order to better visualize the distribution of alteration minerals. In the GIS project this data was combined with geochemical and geological data to generate a better understanding of the spatial distribution and structural control of alteration features.