SPECTRAL UNMIXING APPLIED TO ARCTIC ENVIRONMENTS FOR MINERAL MAPPING

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Over the last decade, spectral unmixing techniques have been developed together with endmember selection procedures to successfully map minerals under sparse vegetation cover such as in arid and semi-arid regions of interest using hyperspectral data. A particular challenge for mineral mapping is the application of these techniques to areas with increased vegetation condition. The objective of this research is to validate the use of spectral unmixing techniques for creating mineral abundance maps of the exposed Proterozoic and Paleozoic sedimentary rocks of the Borden Basin (latitude 73ºN) in the Canadian Arctic. Bedrock in this region ranges from almost completely barren to heavily encrusted with lichens. Therefore, this surface vegetation complicates the extraction of spectra for the underlying rock and the production of mineral maps.128-band Probe-1 data was acquired between 440 and 2500 nm during late July of 1999. The data is extensively pre-processed including calculation of new calibration coefficients using ground-based reflectance spectra, removal of atmospheric effects, and correction of band-to-band errors due atmospheric modeling. Subsequently, an automatic endmember selection procedure is applied to the full band set in combination with a constrained linear spectral unmixing technique to map the minerals. The paper describes in detail the aforementioned processing steps together with the extracted results. Special emphasis is given to the lichen-mineral characteristics for mapping purposes. A quantitative analysis is presented showing the influence of endmembers extracted from the hyperspectral data cube versus those retrieved from ground-based reflectance measurements on the unmixing results.