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Validation of spectral remote sensing algorithms using lunar soils

B. B. Wilcox, P. G. Lucey, and S. B. Sherman

Hawaii Institute of Geophysics and Planetology, University of Hawaii, 1680 East-West Road, Honolulu, HI 96822, U.S.A. (email: bbwilcox@higp.hawaii.edu)

An important goal of lunar remote sensing is the estimation of mineralogy and mineral chemistry of remote locations on the Moon. The increasing diversity of lunar spectral data sets provides the opportunity to carry out this kind of analysis, and methods are being developed to extract the desired information (e.g. Lucey, 2004; Shkuratov et al., 2005). However, validation data for mineral derivation is sparse. Petrographic analyses of modal mineral abundances often include classes of materials that have no direct meaning spectroscopically (e.g. “mare lithic fragment”). Recognizing this shortcoming, among the goals of the Lunar Soils Characterization Consortium (Taylor et al., 1996) is to use modern microprobe-based point counting techniques to derive quantitative abundances and spectra for both validation and development of spectral analysis tools. However, many of the soils analyzed by this consortium are quite mature, and the spectral signature of the minerals will be greatly weakened by space weathering. Our group has focused on the mineral analysis of immature locations using Clementine data, so we have embarked upon an effort to collect modal data and spectra for immature soils. Our approach is slightly different than that of the LSCC. We use existing grain mounts of 90-150 micron soils to avoid problems with extremely small grain sizes, and we have used both manual probe point counts and x-ray maps to classify grains into their mineral classes. Noting that the LSCC classifies glasses based on elemental criteria, instead we determine if a grain is a glass based on digital imaging in orthogonal polarizations to determine if it is isotropic. To date we have derived mineral and glass abundances for six soils and are in the process of analyzing three more. We are also obtaining spectra of the soils in Hawaii, and will send them to RELAB when our analysis is completed. We will then begin to test existing algorithms for their ability to derive quantitative mineral abundances and chemistries for lunar soils.