

MAPPING LUNAR SOIL MATURITY USING GROUND BASED CCD MULTISPECTRAL IMAGERY; S. M. Larson, J. R. Johnson and R. B. Singer, Planetary Image Research Laboratory, Lunar and Planetary Laboratory/ Department of Geosciences, University of Arizona, Tucson, Arizona 85721

One measure of lunar soil maturity is the relative proportion of agglutinates to crystalline pyroxene grains. The soil weathers, or "matures" as micrometeorite impacts rework the surface, increasing the agglutinate content and decreasing the optical contribution of crystalline pyroxene. Since Fe^{2+} crystal field transitions in pyroxene cause a strong absorption at 950 nm [1], the 950/560 nm reflectance ratio has been used to determine relative soil maturity of the lunar surface [2]. In such ratio images, the darker (less mature) regions are usually associated with more recent impact craters.

As part of our recent global CCD survey of the TiO_2 content in lunar maria [3,4], we constructed 950/560 nm image ratios to help estimate the regions where the Charette et al. [5] empirical TiO_2 abundance relation is considered valid. Johnson et al. [6] pointed out that 1050nm vidicon imaging data had systematically lower resolution than the shorter wavelength images. Since silicon becomes transparent at wavelengths longer than about 800 nm, and has a high index of refraction, internal scattering may be quite efficient, especially in the thick silicon targets of vidicon tubes. A first-order attempt to compensate for this was applied to the McCord data by subtracting a 10-15% "d.c." level to the 950 nm image (Pieters, personal communication, 1990). Comparing our ratios show lower contrast between highland and maria than those of [2,6], although there may be some intrinsic differences due to the different bandpass in [6]. We had noted a slight, but noticeable degradation of resolution in our 950 nm CCD images, so we investigated the scattering properties of the CCD. Comparison between lunar limb profiles at 560 and 950 nm showed only a slight difference as did laboratory tests with 3-bar targets. Deconvolution kernels based upon the measured (small) point spread function were used on the 950 nm image before ratioing. The resulting ratio was not noticeably different from the unconvolved ratio. Comparison of seven regions from our 950/560 nm images (calibrated to the absolute MS-2 value from [7]) show good agreement. We feel that the 1 nm thin, phosphor coated silicon CCD substrate causes negligible effect on the results and that CCDs are well suited for near-IR photometric imaging.

Our resulting 950/560 nm ratio images are dominated by the more recent impact craters and show very little highland/maria contrast. Areas covered by dark mantle materials appear brightest due to their lack of pyroxene grains.

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This work is supported by the NASA Space Engineering Research Center at the University of Arizona, under grant NAGW 1332 #3 and by NASA grant NAGW 247.