LROC WIDE ANGLE CAMERA ULTRAVIOLET–VISIBLE IMAGES OF THE MOON. Brett W. Denevi[1], Mark S. Robinson[2], Hiroyuki Sato[2], and Aaron K. Boyd[2]. [1]Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, USA (brett.denevi@jhuapl.edu), [2]School of Earth and Space Exploration, Arizona State University, Tempe, AZ 85251, USA.

The Lunar Reconnaissance Orbiter Camera (LROC) Wide Angle Camera (WAC) provides a global dataset to assess differences in ultraviolet (UV, 321 nm and 360 nm) through visible (415, 566, 604, 643, 689 nm) reflectance across the lunar surface. The WAC is a push-frame imager, with filter strips mounted on the CCD, and acquires near-global coverage each month [1]. This repeat coverage over a wide variation of illumination and viewing conditions allowed for the calculation of Hapke-based model parameters for 0.5°×0.5° tiles, providing detailed knowledge of photometric variations [2], and enabling the production of seamless, photometrically normalized mosaics [3]. WAC color mosaics were also produced by compiling many months of observations and taking each photometrically normalized reflectance value as the median of all observations at that point (typically >100), which greatly increases the signal-to-noise ratio of the mosaic and minimizes any residual errors in calibration or photometric normalization [3].

Composition has a strong control on reflectance at WAC UV–visible wavelengths, particularly the abundance of ilmenite, which is highly correlated to 321/415 nm ratio [4]. However, this result only holds for sub-mature to mature soils [5], as maturity has a strong effect on spectral slope in this wavelength region [6]. In contrast to ilmenite, silicate minerals typically have a steep spectral slope at wavelengths below ~450 nm due to strong absorptions shortward of 300 nm [7]. Spectra of laboratory samples suggest that space weathering decreases this slope [8]; LROC WAC observations of fresh craters generally confirm these results, with an important exception [6].

Changes in UV slope are explored with a ratio of 321/415 nm, where a low value is consistent with a steeper slope. Low ratio values are observed in association with the ejecta and rays of Copernican craters throughout the mare. However, in the highlands, the picture is more complicated. Instead of a simple relationship between maturity and 321/415 nm ratio as seen in the mare, fresh ejecta at highland craters has ratio values both lower (within ~one crater radius) and higher (distal ejecta and rays) than for mature soils. Laboratory spectra of powdered lunar rocks (no space weathering) and soils of varying degrees of space weathering (as measured by I_S/FeO [9]) show that for materials with less than ~5 wt% FeO, little change is observed in the 321/415 nm ratio except for an increase at the lowest levels of maturity (I_S/FeO <~ 20). However, relatively modest shock pressures result in the solid-state transformation of plagioclase to a diaplectic glass, maskelynite [10]. Rather than a minimal downturn toward short wavelengths at ~360 nm, maskelynite and low-iron glass has a strong downturn at ~415 nm, likely the result of broadening of the plagioclase UV absorption due to vitrification [6]. Thus the low 321/415 nm ratio values near to crater rims are likely due to the effects of shock [6].

Swirls are also found to be distinct in LROC WAC UV data [11], as well as at far-UV wavelengths observed by the Lyman Alpha Mapping Project (LAMP) instrument on LRO [12]. Similar to fresh craters, swirls have low 321/415 nm ratios and elevated reflectance, and this distinguishing characteristic allowed for the creation of a comprehensive map of their global distribution [11]. Swirls generally have high optical maturity (OMAT) parameter values, stronger 1-µm bands, and shallower normalized continuum slopes than their surroundings, consistent with a surface that has experienced less space weathering. However, some swirls cannot be discerned in OMAT or band-depth images. Areas of swirls with low 321/415 nm ratios but non-distinct visible–near-infrared properties could be related to the presence of fresh silicates or a glassy component that does not have a substantial abundance of embedded large submicroscopic iron grains (i.e., a difference in the agglutinate fraction of the soil). Swirl color properties vary with distance from Copernican and some Eratosthenian craters; their association with Eratostheninan craters suggests fresh material may be preserved longer in swirls than in non-swirl regions.

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