EXAMINING LUNAR REGOLITH MATURATION AT A DEEPER LEVEL. J. T. S. Cahill[1], D. J. Lawrence[1], O. Delen[1], A.M. Stickle[1], R.K. Raney[2], G.W. Patterson[1], and B.T. Greenhagen[1]. [1]The Johns Hopkins University Applied Physics Laboratory (Joshua.Cahill@jhuapl.edu), [2]Unaffiliated.

Introduction: Lunar surface maturity is consistently examined using the NIR optical maturity parameter (OMAT) [1]. However, the NIR only provides a perspective of the upper microns of the lunar surface. Recent studies of Lunar Prospector (LP) and Lunar Reconnaissance Orbiter data sets are now demonstrating additional measures of maturity with sensitivities to greater depths (~2 m) in the regolith. These include thermal infrared, S-band radar, and epithermal neutron data sets [2-4].

Previous Work: Interestingly, each of these data sets measured parameters or abundances is directly comparable to OMAT despite each measuring different aspects of the regolith. This is demonstrated by *Lawrence et al.* [3] where LP-measured non-polar highlands epithermal neutrons trend well with albedo, OMAT, and the Christensen Feature (CF). *Lawrence et al.* [3] used these data to derive and map highlands hydrogen (H) which is dominantly a function of H-implantation. With this in mind, areas of enriched-H are mature, while areas of depleted H are immature.

Lunar Maturation from Additional Perspectives: Surface roughness measured by S-band radar [4], also provides a measure of maturity. In this case, the circular polarization ratio (CPR) is high when rough and immature, and low when smooth and mature. Knowing this, one can recognize areas in the non-polar lunar highlands that show contradictory measures of maturity. For example, while many lunar localities show consistently immature albedo, OMAT, CF, CPR, and H concentrations (e.g., Tycho), others do not. Orientale basin is the most prominent example, shown to have immature CPR, CF, and H concentrations despite a relatively mature albedo and OMAT values as well as an old age determination (~3.8 Ga; **Figure 1**).

Summary: To better understand how the lunar regolith is weathering in the upper 1-2 m of regolith with time we examine the Orientale basin relative to other non-polar highlands regions (~35 localities).

References: [1] Lucey P.G. et al. (2000) JGR-Planets, 105, 20377-20386. [2] Lucey P.G. et al. (2013) Lunar and Planetary Science Conference, XXXXIV, 2890. [3] Lawrence D.J. et al. (2015) Icarus, j.icarus.2015.01.005. [4] Neish C.D. et al. (2013) Journal of Geophysical Research-Planets, 118, 2247-2261.

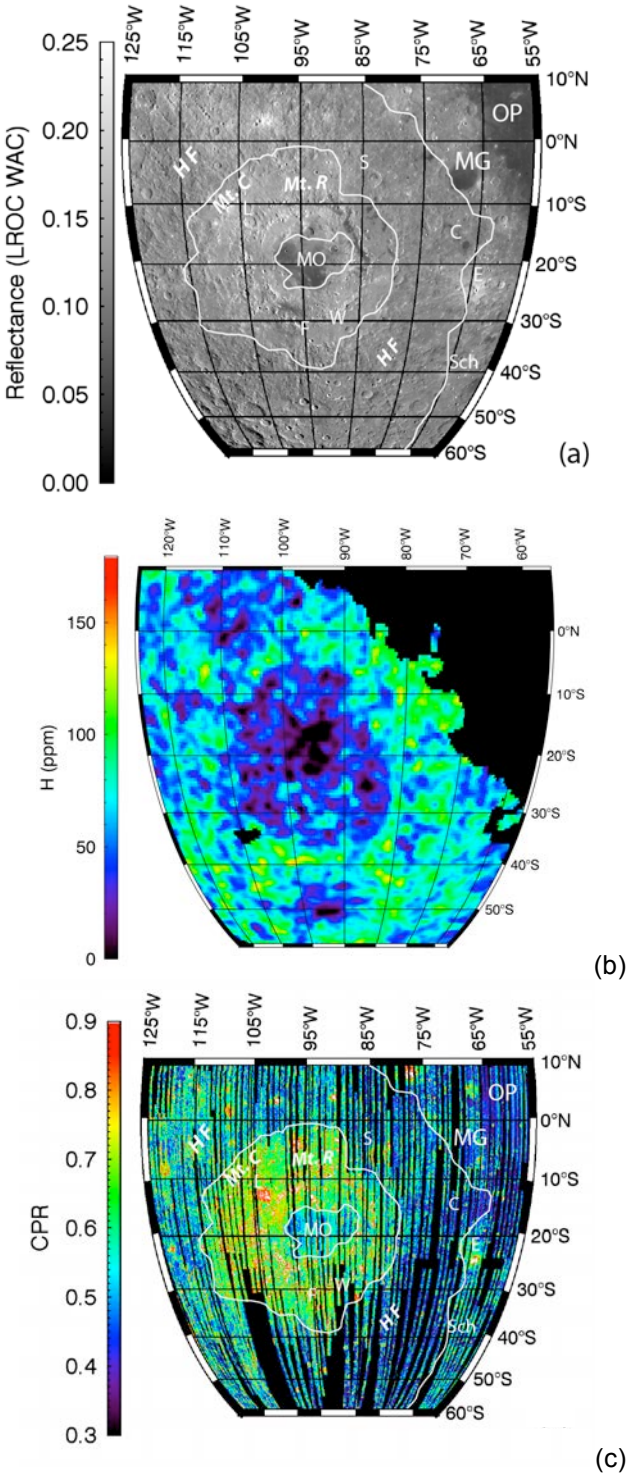

Figure 1*: Orientale impact basin in (a) LROC WAC monochrome, (b) Lunar Prospector derived Hydrogen, and (c) Mini-RF derived CPR maps at 2 ppd.*