NEW VIEWS OF LUNAR SURFACE MATURITY USING LRO DATA FROM UV TO RADAR. A. M. Stickle[1], J. T. S. Cahill[1], J. A. Grier[2], B. Greenhagen[1], G. W. Patterson[1], [1]Johns Hopkins University Applied Physics Laboratory, Laurel, MD, 20723, USA (angela.stickle@jhuapl.edu),[2]Planetary Science Institute, Tuscon AZ USA.

Background: The physical evolution of the lunar surface with exposure to the space environment (particularly impacts) is termed "maturation", can take place over relatively short timescales, and has been attributed to the amount of glass and agglutinate content within the lunar soil [e.g., 1-8], the amount of trapped solar wind nitrogen [9], solar wind sputtering and vapor deposition [10-11], and/or the amount of sub-microscopic iron (SMFe) in the material. Studies show that the abundance of these glasses and agglutinates increases with age of the soil and can account for large portions of a given mature soil [e.g., 2,4,9]. Changes in physical properties of the lunar soil are quantified in terms of specific maturity indices (e.g., Optical maturity (OMAT) [13]), and thus soils are generally classified on the basis of one or more of these specific indices [3]. Though sampling maturity effects from different processes and on different time- and depth-scales, comparisons indicate that maturity of the soil can be tracked across wavelengths, which is a powerful tool when examining the surface evolution of the Moon. New data from the LRO and Kaguya missions (coupled with Clemetine OMAT) provide important new ways to examine lunar surface maturity.

Observations of Crater Age Across Wavelengths: There are a number of methods for representing maturity: e.g., OMAT, LROC, Diviner, Mini-RF. Using OMAT, [13] classify Byrgius A as "young", Dufay B as "intermediate" and Golitsyn J as "old". Here, we survey how these ages are manifested across wavelengths to examine if correlations exist for maturity indices as a function of wavelength.

Comparisons of observations from UV to radar for these three craters (e.g., Fig. 1) indicate that maturity of the soil can be tracked across wavelengths. These comparisons suggest that specific "maturity parameters" manifest differently at different wavelengths. Further, more detailed comparisons are underway, and they are necessary to more fully understand when these maturity trends can be correlated and how to quantify the correlation. If trends can be correlated, this will provide a powerful tool when examining the surface evolution of the Moon and determining relative ages between features.

References: [1] Adams, J.B. and T.B. McCord (1971) *Science*, 171, 567-571; [2]McKay, D.S., et al. (1974) *Proc. Lunar. Sci Conf 5^{th}*, p. 887-906; [3]Adams, J.B., and M.P. Charette (1975) *The Moon, 13*, 293-299; [4]Charette, M.P., et al. (1976) *Proc. Lunar Sci. Conf. 7^{th}*, p. 2579-2592; [5]Wells, E., and B. Hapke (1977) *Science*, 195, 977-979; [6] Pieters, C. M. et al (1993) *J. Geophys. Res. Planet. 98*(E11), 20817-20824; [7] Britt, D.T., and C.M. Pieters (1994) *Geochim. Cosmochim. Acta 58*, 3905-3919; [8] Lucey, P. G., & Riner, M. A. (2011) *Icarus*, *212*(2), 451-462; [9] Charette, M.P., and J.B. Adams (1975), *Proc. Lunar Sci. Conf. 6^{th},* 2281-2289; [10] Gold, T., et al. (1976) *Proc. Lunar Sci. Conf. 7^{th}*, p. 901-911; [11] Hapke, B., et al (1975) *Moon*, 13, 339-354; [12] McKay, D.S., et al. (1972) *Proc. Lunar Sci. Con;f. 3^{rd},* p. 983-994; [13] Grier *et al.* (2001) *J. Geophys. Res. 106*(E12), 32847-32862 [15] Stickle et al. (2016) *Proc. Lunar Sci. Conf.*, Abstract #2928.

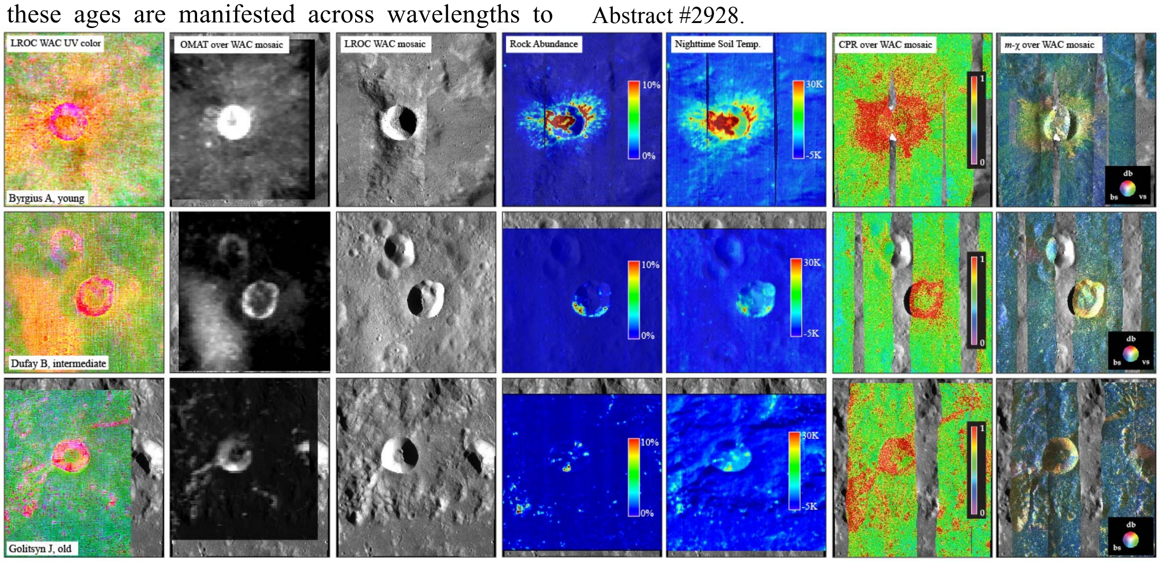

Figure 1. (top) Byrgius A (19.7 km, 24.6°S, 63.5°W), a young highlands crater, (middle) Dufay B (19.8 km, 8.3°N,171°E), an "intermediate" aged highlands crater, (bottom) Golitsyn J (19.5 km, 27.9°S, 102.9°W), an "old" highlands crater. The columns show the appearance of the crater across wavelengths, from UV (WAC UV, left) to radar (Mini-RF radar,right).