Mapping ejecta diversity of young lunar craters with thermal infrared imaging

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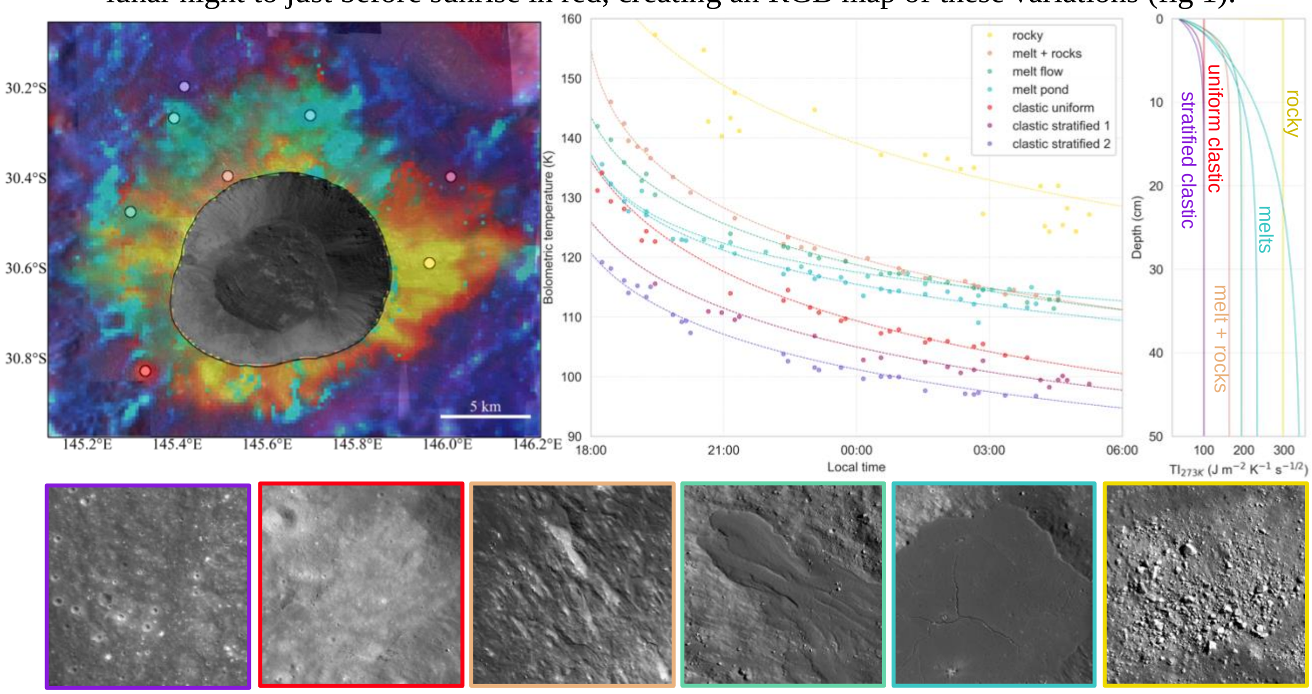
Abstract. The process of impact cratering creates a wide diversity of ejecta with different geological and physical properties, including fragmental/clastic debris, excavated rocks, and impact melt. Here we fit surface temperature data from the Diviner Lunar Radiometer instrument onboard the Lunar Reconnaissance Orbiter with a modified version of the lunar regolith thermal model from [1], in order to distinguish ejecta types by their variation in thermal inertia. Specifically, we account for densities beyond standard “regolith” values (~1100-1800 kg/m^3) in the new model, up to the density of basaltic rock (~2940 kg/m^3). By fitting two parameters (the model bottom density and the e-folding depth of density increase, or “H-parameter”[1]) to night-time bolometric temperatures[2] from the young lunar crater Tharp, many ejecta types are readily distinguishable, which correspond well to observable morphology. Rocks are uniformly warmer throughout the night than other ejecta types, while impact melts initially cool quickly due to a covering layer of regolith, but then maintain a steadier temperature. We map the best-fit model bottom density in green, the best-fit H-parameter in blue, and the difference in temperature from early in the lunar night to just before sunrise in red, creating an RGB map of these variations (fig 1).



[1] P.O. Hayne, J.L. Bandfield, M.A. Siegler, A.R. Vasavada, R.R. Ghent, J.-P. Williams, B.T. Greenhagen, O. Aharonson, C.M. Elder, P.G. Lucey, and D.A. Paige. *J. Geophys. Res.: Planets*, 122 (2017).
[2] J.-P. Williams, D.A. Paige, B.T. Greenhagen, E. Sefton-Nash. *Icarus*, 283 (2017).