MULTISPECTRAL ASSESSMENT OF IMPACT MELT DEPOSITS WITHIN COMPLEX LUNAR CRATERS. B. Shankar[1], G. R. Osinski[1], and I. Antonenko[1], [1]Centre for Planetary Science and Exploration/Dept. of Earth Sciences, University of Western Ontario, London, ON, Canada (bshanka2@uwo.ca)

Introduction: The release of high resolution multispectral data (with improved spatial and spectral detail) from the Lunar Reconnaissance Orbiter (LRO) and Chandrayaan-1 missions provides new opportunities to assess the morphologies and spectral characteristics of impact melt deposits from lunar complex craters in greater detail. Impact melt deposits represent shock-melted target rocks that range in morphologies from crater fill deposits to melt veneers, melt sheets, and ponded deposits [1]. Models indicate that the amount of melt generated increases with the size of the impact event [2]. The modification phase of crater formation determines where much of the impact melts are concentrated [3, 4], as collapsing crater walls and central uplifts in the transient cavity can transport impact melt materials beyond the crater rim.

This study focuses on the characterization and distribution of impact melt deposits using multispectral satellite datasets around two well preserved complex craters with varying central uplift morphologies, located on the lunar farside.

Study Sites: 1) Olcott (22^{o}N, 117^{o}E) is an 81 km diameter complex crater situated on the edge of the degraded Lomonosov-Fleming basin [5, 6]. The crater morphology includes a sharp rim, crater walls with terraces, and a cluster of central peaks on the crater floor. 2) Kovalevskaya (30^{o}N, 129^{o}W) is a 113 km complex crater located north-west of Orientale basin [7]. The crater morphology includes a well preserved crater rim, terraced walls, a flat crater floor, and a central uplift with two peaks of variable heights.

Methods: Impact melt deposits were identified primarily based on their visible characteristics, smooth, low albedo deposits that show obvious contrast when compared to their immediate surroundings, and deposits that do not have a volcanic source of origin [1]. Monochrome 643 nm LRO Wide Angle Camera (WAC) global mosaics at 100m/pixel resolution [8, 9], and high resolution panchromatic images from the Narrow Angle Camera (0.5 m/pixel) instruments on the Lunar Reconnaissance Orbiter [8] were used to identify the extent of the deposits.

Characterization of impact melt deposits was conducted by the fusion of multiple lunar datasets – combining spatial, spectral, and topographic data. Multispectral reflectance data in the UV-VIS-NIR range were derived from the Chandrayaan-1 Moon Mineralogy Mapper (M^3) [10] to provide compositional detail. Topographic information was acquired from the LRO Lunar Orbiter Laser Altimeter instrument [11].

Results: From image data, impact melt deposits are identified both within and beyond the crater floor at each of the study sites (cf., [5, 7]). The deposits are typically smooth and have low albedo. They fill the crater floor, occur as thin veneers over central uplifts, or pooled on crater terraces and beyond the crater rim. The aerial extent of mapped melt deposits is greater in Kovalevskaya than at Olcott crater [12]. M^3 reflectance data reveals a great detail about the rock compositions present at each crater site. Sampled spectral profiles of the morphological units within each crater indicate the presence of both low and high-Ca pyroxenes and plagioclase feldspar [5, 7, 12]. The distribution of mafic material is not ubiquitous, which alludes to the complexity of the target subsurface.

Discussion and conclusions: The identification of impact melt deposits around these complex impact craters is challenging, and limited only to visible datasets. Multispectral datasets are, however, useful in broadly determining the compositional and surface textural details of impact melts and provide a complimentary tool in understanding the impact cratering process [e.g. 5, 7, 12]. Our work shows that the spectral characteristics of the exterior melt deposits are typically undistinguishable from spectral characteristics of the crater floor. This is an indication that the melts emplaced beyond the crater floor are the same materials as the crater floor melts, consistent with a multi-stage ejecta emplacement process [4]. Future work will integrate data from the LRO Diviner mission [13] to provide additional opportunities to constrain the compositional details of identified melt deposits, and will be further investigated.

References: [1] Hawke, B. R., and Head, J. W. (1977). *SPCM*, pp. 815–841. [2] Cintala, M. J., and Grieve, R. A. F. (1998). *Meteoritics and Planet. Sci*, *33*, 889–912. [3] Melosh, H.J. (1989). 245p. [4] Osinski, G. R. et al. (2011). *EPSL, 310*, 167–181. [5] Shankar, B. et al. (2012). *LPSC XLIII*, Abstract #1357. [6] Giguere, T. A. et al. (2003). *JGR, 108*, 5118. [7] Shankar, B. et al. (2013). *LPSC XLIV,* Abstract #2094. [8] Robinson, M. S. et al. (2010). *Space Sci. Rev*. *150*, 81–124. [9] Speyerer, E. J. et al. (2011). *LPSC XLII*, Abstract #2387. [10] Pieters, C. M. et al. (2009). *Current Sci., 96,* 500–505 [11] Smith, D. E. et al. (2010). *Space Sci. Rev*., *150*, 209–241. [12] Shankar, B. (2013). *Ph.D. Thesis,* http://ir.lib.uwo.ca/etd/1137 [13] Greenhagen, B. T. et al. (2010) *Science, 329*, 1507–1509.