MINERALOGY OF IMPACT MELT AT COPERNICUS CRATER: INSIGHTS INTO MELT EVOLUTION AND DIVERSITY Deepak Dhingra and Carle M. Pieters, Geological Sciences, Brown University, 324, Brook Street, Providence, RI 02912 (deepak_dhingra@brown.edu)

Introduction: Impact melt deposits occurring on planetary surfaces could be considered as a tertiary crust formed due to recycling of pre-existing (primary or secondary origin) material. Melt produced at large impact craters could crystallize to form igneous-like rocks or may cool with significant glassy component. Either form can be intimately mixed with clasts of host material. Mineralogy of impact melt has been extensively studied both in terrestrial and extra-terrestrial samples [e.g. 1, 2]. However, remote mineralogical assessment of impact melt in the context of local geology has been less common. On Earth, erosion and vegetation often obscures exposures but geologically young craters on other planetary surfaces provide an excellent opportunity to analyze and evaluate melt mineralogy in great detail. We present a remote sensing perspective of impact melt mineralogy highlighting its spatial diversity as it exists at the geologically young complex crater Copernicus on the Moon, utilizing high spectral and spatial resolution data from recent missions.

Geologic Setting: Copernicus is a 96 Km diameter complex crater with terraced walls and a cluster of central peaks, located on the Earth facing side of the Moon. The crater has an extensive ray system and defines the youngest stratigraphic unit in the lunar time scale. The original target has been suggested [3] to be (from top to bottom): i) Mare Basalts ii) Imbrium Ejecta iii) Megaregolith iv) lower crust containing norites and probably some olivine [e.g. 4]. Copernicus overall composition highlights the originally heterogeneous target with a generally feldspathic northern part and more mafic southern part.

Impact Melt Distribution and Diversity: Subsequent to crater formation impact melt is emplaced in variety of morphological forms such as flows, ponds and spherules. Impact melt at Copernicus spans from the floor (where it occurs extensively) to the walls (occurring as ponds and flows) and beyond the crater rim. Several morphological forms are observed with a different melt to mega-clast ratio and thereby different cooling history. We are mapping this diversity at Copernicus with the objective of understanding impact melt composition, its variation and relationship with the morphological form as well as pre-impact target lithology. Our recent remote sensing analysis at Copernicus [5] has led to the discovery of a large scale mineralogical heterogeneity in the impact melt, likely related to the diverse lithology of the original target.

New Results: Melt mineralogy on the floor of Copernicus shows variability in the crystallinity with the NW quadrant (relatively free of large clasts) displaying relatively stronger spectral signatures as compared to the SW and NE quadrants (densely populated by mega-clasts) which usually display weaker bands. Isolated large boulders at times display detectable absorptions.

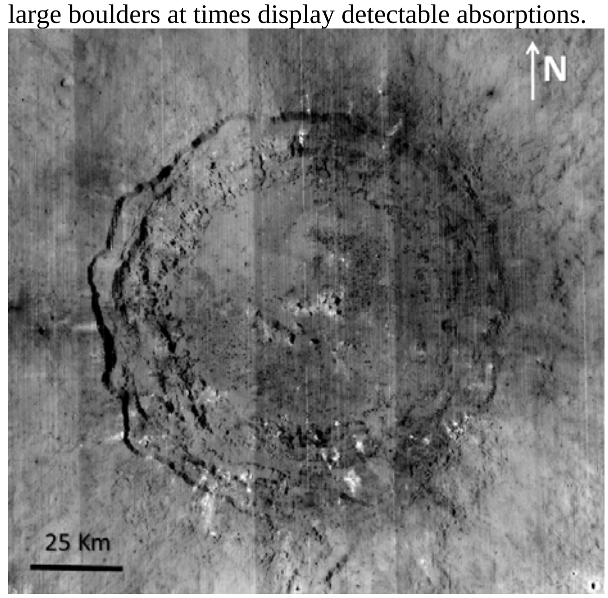

Fig. 1 Moon Mineralogy Mapper (M^3) Near IR ratio mosaic of Copernicus Crater designed to highlight quenched glass and olivine/pyroxene-rich deposits (brightest regions are more abundant)

Morphological mapping suggests that the mega-clasts may be coated by thin-veneer of impact melt which might have cooled faster as compared to the clast-free impact melt in the NW quadrant. As compared to the mega-clast rich NE and SW quadrants, collapse pits on the crater floor (which expose material below the surface) show detectable absorptions suggesting that there is a spectrally neutral coating at the top with more crystalline layers beneath. Impact melt glass displaying spectral bands (referred as quenched glass in spectroscopic studies) has been reported for the NW crater floor, walls and part of the rim from telescopic and spacecraft observations [6,7], and we are also characterizing this component.

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