VISIBLE AND THERMOPHYSICAL CHARACTERISTICS OF THE BEST-PRESERVED MARTIAN CRATERS, PART 2: THERMOPHYSICAL MAPPING OF RESEN AND NOORD. J. L. Piatek[1], L. L. Tornabene[2], N. G. Barlow[3], G. R. Osinski[2,4], and S. J. Robbins[5], [1]Dept. of Geological Sciences, Central Connecticut State Univ., New Britain, CT (piatekjel@ccsu.edu) [2]Centre for Planetary Science & Exploration (CPSX) and Dept. of Earth Sciences, Western University, London, ON, [3]Dept. Physics and Astronomy, Northern Arizona Univ., Flagstaff, AZ, [4]Dept. of Physics & Astronomy, Western University, London, ON, [5]Southwest Research Institute, Boulder, CO.

Introduction: This work is part of an ongoing study to identify the characteristics associated with the best-preserved craters on Mars. A list of the candidate craters for this study were identified using criteria discussed by [1]. Craters were prioritized by size; those of around the upper portion of simple-to-complex transition diameter (7-10 km) were selected for initial study, as smaller craters have less detail in lower resolution data, while larger craters would introduce additional complications such as variations in underlying target materials. The goal of our study is to define the morphological and thermophysical characteristics of the best-preserved craters on Mars as a baseline for additional studies [see 1,2]. Thermophysical results are discussed here; corresponding morphologic maps are presented at this conference by [3].

Thermophysical Mapping: Thermal inertia (TI) images for thermophysical mapping were generated using THEMIS nighttime IR data. Appropriate stamps were identified in JMars and processed via THMPROC [4]. Nighttime temperature mosaics were created in ENVI using routines written to process THEMIS data. The mosaics are used to align the temperature images, which often have a few pixel offsets. Temperature images are then used with model-derived lookup tables [5], along with elevation and albedo data, to generate images. In most cases, overlapping images have differing TI values due to the effects of atmospheric dust (reducing incident sunlight and/or insulating the surface). The value of tau (optical depth of dust) used in TI image generation is adjusted so overlapping images have similar TI values. This process is repeated for all images so the final mosaic appears color balanced with minimal blending of images.

Initial maps were completed using TI mosaics. Although the goal of the project is to synthesize the results of thermal and visible analyses, the initial thermophysical maps are made without utilizing information from visible images. Crater floor materials and wall units were outlined based on relative TI: wall units appear bright in THEMIS images due to the presence of large blocks and potential bedrock outcrops. Ejecta deposits were mapped based on distance from crater and its distinctive appearance. Continuous ejecta units are proximal to the crater and have distinct thermophysical boundaries, which have been previously interpreted to represent the "ramparts" of the layered portion(s) of the ejecta [6]. If the outer margin of the continuous ejecta is not distinct in thermal images, it may be classified into multiple units during our initial mapping. Discontinuous ejecta units are defined based on the appearance of thermophysically contrasted material consistent with either ballistic emplacement of ejecta (typically lower TI material forming secondary crater rays radial to the primary), and target material affected by airblast (typically higher TI). The inner boundary of the discontinuous units is assumed to be the continuous ejecta, while the outer boundary is the furthest extent that modification of the target is visible as a thermophysical contrast and obviously correlated with the crater. Craters within ejecta are defined as an additional unit so their associated deposits are not included in quantitative analyses of the resulting maps.

Once initial units are defined, the resulting map units are converted to image masks so detailed variations in TI values within each unit can be appropriately stretched and examined. The results of these analyses can be used to further refine unit boundaries (particularly where the boundary of the continuous ejecta is indistinct) and eventually compared to results from the morphologic mapping [see 3].

Initial Results: Portions of TI mosaics for Resen and Noord, with TI maps of crater units, are shown in Figures 1 and 2. Significant variations are present in the floors of both craters (Figs 1a,2a insets), which appear to correlate with features noted in visible morphology maps [3]. Although there may be dust deposits contributing to some of the low TI areas, the clusters of higher TI may represent deposits of larger blocks from the walls overlying lower inertia floor deposits.

In both craters, the continuous ejecta units (Figs 1b, 2b) have higher TI than the lower inertia portions of the discontinuous ejecta, but overall they have similar TI values to the discontinuous ejecta. The major difference in appearance is the lack of a radial pattern suggesting ballistic emplacement: the continuous ejecta deposits. In initial thermophysical maps, there is no discernible pattern to TI values in the continuous ejecta deposits: detailed morphologic mapping is necessary to identify correlation with surface features [3].

Per unit definition, the discontinuous ejecta deposits (Figs. 1b, 2b) exhibit radial patterns. The pattern of thermophysical contrasts, however, is different in the two craters. The discontinuous ejecta at Resen is higher TI than the background, with a slight asymmetry, which may be consistent with an oblique impact (radial ejecta east and west of the crater, less radial ejecta to the north and south). These radial deposits consist of moderate TI material with cores of higher TI, possibly due to secondary craters. Portions of these deposits have TI values over 500 MKS units, suggesting large blocks rather than fine grained material [7].

At Noord, the discontinuous ejecta is distinctly asymmetric, due at least in part to the underlying topography. Material to the southwest of the crater forms low TI rays suggesting deposition of very fine material (dust/fine sand), while radial ejecta to the northeast appears to be more coarse material deposited over a higher TI background. At Noord, this background material is still relatively low in TI (200-300 MKS units), consistent with a sandy surface layer [7].

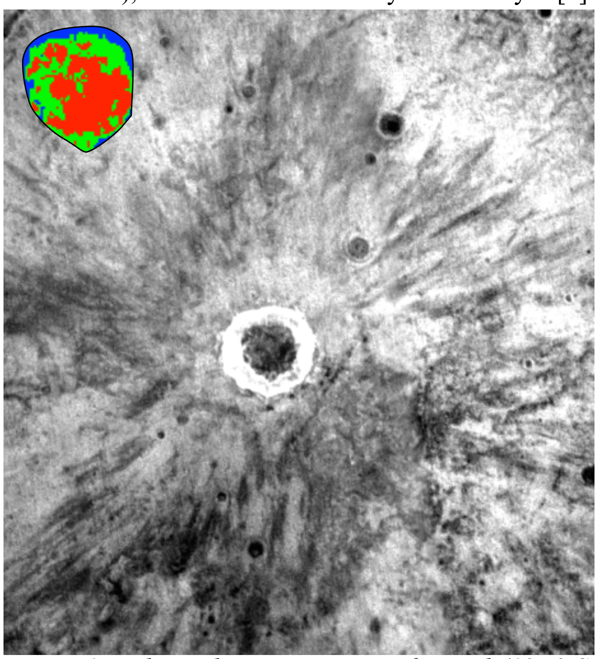

Figure 1a: Thermal inertia mosaic of Noord (19.5° S, 11.3° W, D=7.8 km). Inset: thermal variations of crater floor (red='low', green='moderate', blue='high').

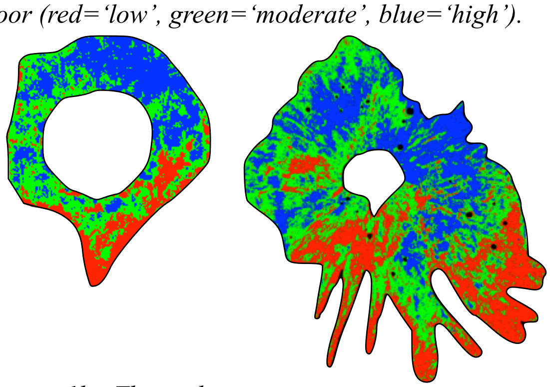

Figure 1b: Thermal inertia variations in continuous (left) and discontinuous ejecta (right) units for Noord. The continuous unit fits inside the discontinuous; crater walls and floor inside the continuous unit (red='low', green='moderate', blue='high').

The discontinuous ejecta at Noord may not form a single coherent unit, as pre-existing topography or later modification appears to interrupt the outer portions of this unit: further correlation with visible and elevation datasets will be used to continue to refine these results.

References: [1] Tornabene, L.L. et al., 2015. *LPSC* 46, #2531. [2] Piatek, J.L. et al., 2015. *LPSC* 46, #2654. [3] Tornabene, L.L. et al., this conf. [4] http://thmproc.mars.asu.edu [5] Putzig, N. and M. Mellon, *Icarus* 191, 68-94. [6] Piatek, J.L. et al., 2014. *LPSC* 45, #2813. [7] Pelkey, S.M. et al., 2001. *JGR* 106, 23909-23920.

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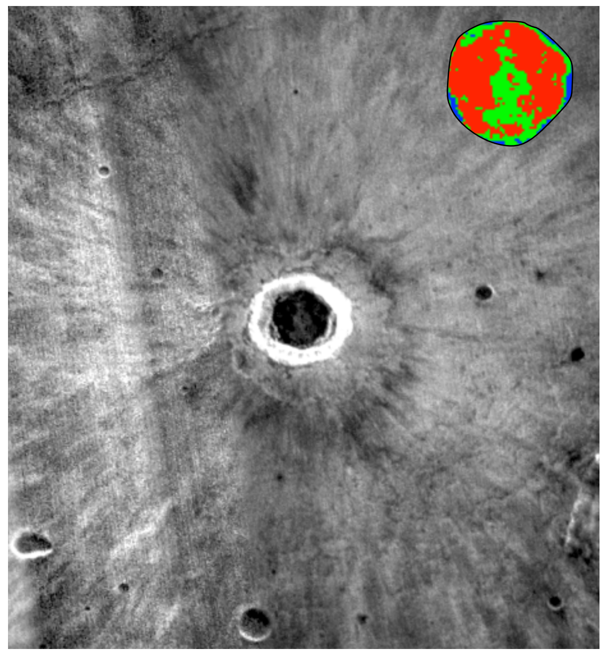

Figure 2a: Thermal inertia mosaic of Resen (28.2° S, 251.3° W, D=7.4). Inset: thermal variations o crater floor (red='low', green='moderate', blue='high').

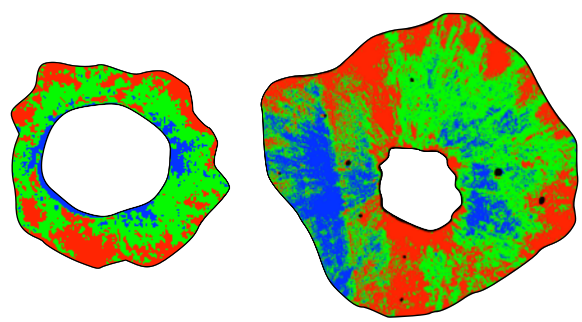

Figure 2b: Thermal inertia variations in continuous (left) and discontinuous ejecta (right) units for Resen. The continuous unit fits inside the discontinuous; crater walls and floor are inside the continuous unit (red='low', green='moderate', blue='high').