DEVELOPMENT OF A SMALL RAYED CRATER DATABASE FOR MARS: INITIAL RESULTS. F. J. Calef III[1], R. Herrick[2] and V. L. Sharpton[1,2], [1]Department of Geology and Geophysics, University of Alaska, Fairbanks, AK, 99739, fred@gi.alaska.edu, [2]Geophysical Institute, University of Alaska, Fairbanks, AK, 99739, buck.sharpton@alaska.edu, rherrick@gi.alaska.edu.

Introduction: Subkilometer in diameter rayed craters result from both primary [1, 2] and secondary [3, 4] cratering on Mars. Previous research [5] has identified over 200 images, from a global context, that contain rayed craters in this size range. The goal is to compile a comprehensive and global assessment of their spatial distribution, geomorphology, and target attributes.

This abstract presents the initial results from a data collection of small rayed craters (hereafter, SRC) on Mars, which builds upon previous [5, 6] and [7] current efforts.

Methodology: Using the 227 Mars Orbiter Camera Narrow Angle (MOCNA) images identified with SRC [5], several geometric and geomorphic parameters were extracted from each SRC found. Each imaged was transformed into a Mercator projection centered at the MOCNA centroid to reduce geometric distortion. Linear contrast stretches were calculated on every image to emphasize ejecta patterns.

SRC were selected based upon 1) the existence of ejecta with a contrast distinct from the background (i.e. 'bright' or 'dark'), 2) a diameter less than one kilometer, 3) contained some form of ejecta extended from the primary ejecta blanket, and 4) a crater diameter could be measured that was at minimum five pixels wide. Some SRC were rejected whose ejecta were ambiguous (e.g. rays or ejecta indiscernible), possibly wind modified only (e.g. crater tails), or could be resultant of natural background contrast variation (i.e. all craters have some 'dark' or 'bright' areas around their rims). All measurements are in meters and rounded to the nearest meter or within one pixel width. Crater diameters are measured rim to rim. Minimum and maximum primary ejecta blanket radius was measured from the crater centroid to discern blanket asymmetries. The longest ray of the SRC was estimated. Floor and rim characteristics (e.g. shallow floor or circular rim) were noted. Where ejecta blanket asymmetry indicated low angle impacts, trajectory azimuth was measured in degrees clockwise from North.

Results: From the base set of 227 images, 89 have been processed and 290 SRC found (Figure 1). Crater diameters ranged from 15m to 725m with an average of 71m. Ray lengths fluctuated from 0.2 to 13.4 crater diameters (CD) averaging 3.7. Difference between minimum and maximum primary ejecta blanket widths ranged from nearly circular (0.1 CD) to asymmetric (2.8 CD). Most rayed ejecta was either 'dark' or 'bright' relative to the background surface, though some SRC have bimodal (a 'dark' and 'bright' annulus) and eight had 'neutral' ejecta (i.e. same contrast as the background). Resolution effects limited the recording of floor and rim characteristics to half of the current database. Where observable, craters floors were predominately bowl shaped or shallow with infill, while eleven had irregular floors and three contained central pits. Rims were near equal in ratio between circular and irregular, though ten had discernable elliptical shapes (the primary axis was recorded as the diameter).

Discussion: While the initial SRC measurements and observations are rudimentary, some useful information can be gleaned from the data that is of use to modelers. For example, looking at a bivariate plot of ray length and crater diameter, most SRC are well below 100m in diameter and the majority of rays are only four to six crater diameters in length regardless of the crater diameter (top of Figure 2). If we break out these parameters by ejecta contrast, we begin to see differences. 'Dark' SRC drop off in ray length as their diameter increases (Figure 2, 2nd from top); perhaps these larger, older (?) craters have had their more distal rays removed. 'Bright' SRC are somewhat limited in diameter (~<=75m) and ray length (~<=6 CD) (Figure 2, 3rd from top). 'Bimodal' SRC are also <100m in general, but have a larger range in ray length (Figure 2, bottom).

On Mars, it appears that 'dark' single layered targets have no influence on ray length, while 'bright' single layered targets limit ray length, regardless of crater diameter, from 2 to 6 CD. 'Bimodal', assumed dual-layer, targets may somewhat promote longer rays. Overall, most SRC rays remain below 6 CD.

Future Work: Further examination into the target (e.g. 'dark' basaltic versus 'bright' sulfate/siliceous?) attributes versus ray length and crater diameter may provide limits to modeled impacts in this size range, on Mars. Future work on the database and its parameters could separate secondary and primary impacts yielding limits on both low and high velocity impact events.

References: [1] Malin et al. (2006) *Science*, *314*, 1573-1577. [2] Tornabene et al. (2006) *JGR*, *111*, 2005JE002600. [3] McEwen et al. (2005) *Icarus*, 176, 351–381. [4] Preblich et al. (2007) *JGR*, 112, 2006JE002817. [5] Calef et al. (2007) *LPSC 38*, #1483. [6]

Calef et al. (2004) *AGU*, abstract #P41A-0890. [7] Calef et al. (2007) Ejecta retention ages on Mars, *in prep*.

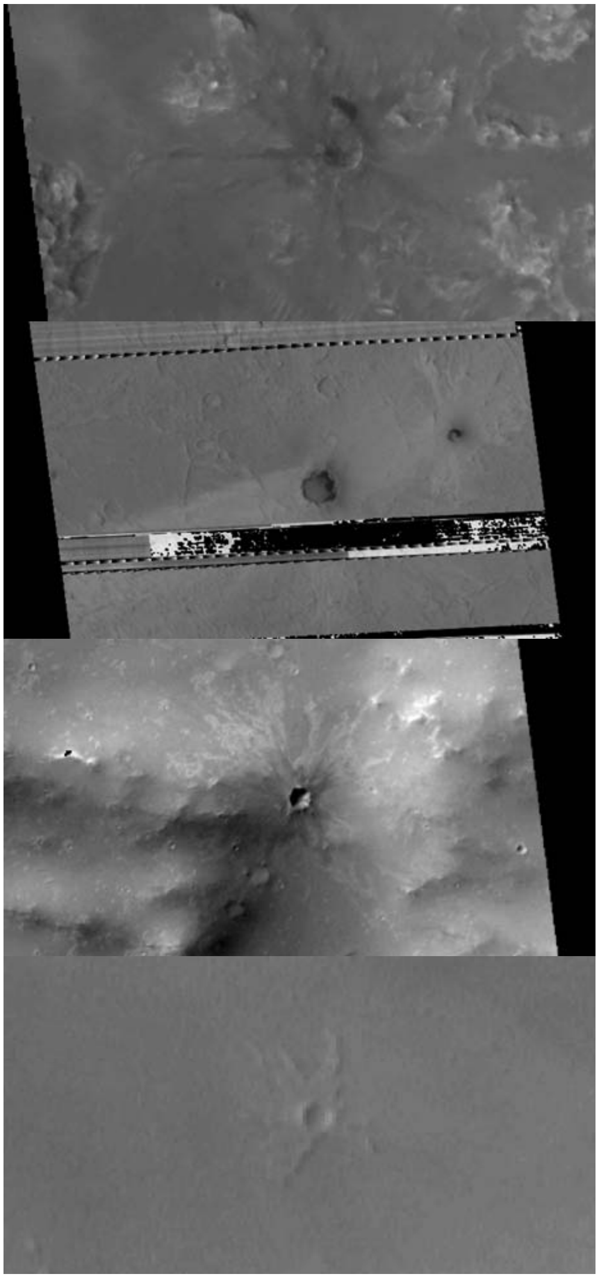

Figure 1: Example of small rayed craters from top to bottom: E110251 (‘dark’ ejecta, crater diam. 46m), E18001385 (‘bright’ ejecta, left: crater diam. 242m and right: 97m, with some wind modification), E0201549 (‘bimodal’ ejecta, crater diam. 152m), and E0400083 (‘neutral’ ejecta, crater diam. 33m). Note rayed ejecta blanket and contrast differences. Top image has evidence of possible impactor from crater, just north of crater rim.

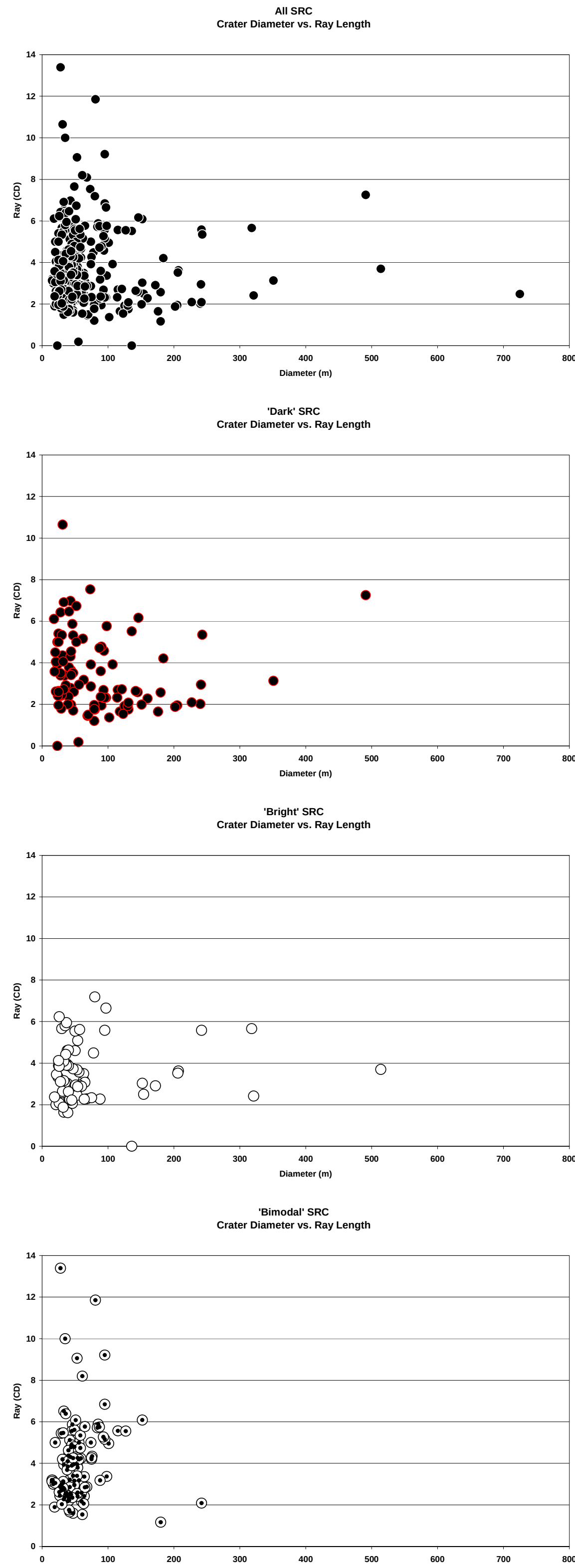

Figure 2: Crater diameter (in meters, x-axis) versus ray length (in crater diameters, CD, y-axis). Ejecta contrast broken out for all, dark, bright, and bimodal SRC, respectively.