MORPHOMETRY OF RADIAL GROOVE ON THE INNER EJECTA LAYER OF MARTIAN DOUBLE LAYERED EJECTA CRATERS.

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Introduction: A variety of linear features are observed on the layered ejecta blankets of fresh Martian impact craters [1 - 7], and are presumed to form during ejecta emplacement. Here, we focus on the radial grooves formed on the inner ejecta layers of double layered ejecta (DLE) craters [7], that are thought to be either produced by blast surge, high-speed convective granular flow [8], or low-speed flow like that common to landslides.

Data Collection: CTX images were used as a base to measure the length, width and location (relative to the crater rim) of radial grooves on the inner ejecta layers of 10 Martian DLE craters (Table 1). These data were

Location/Name	Dia. (km)	Area (km^2)
45S, 25E	9.9	20
Steinheim	11.1	17.1
41S 197E	13.2	17
33N 84E	14.5	41.3
41N 98E	15	20
36N 88E	16.8	47.8
38N 99E	18.9	26.9
Bacolor	20.6	48.2
Arandas	24.5	62.6
Gamboa	30	76.7

Table 1: DLE Test Craters

collected in rectangular sample areas that extend from the rims of each crater outward for at least 1 crater radius (R) and were subdivided into sample areas of 0.5 R increments. While groove area can be calculated, groove volume could not be because of the lack of high-resolution topographic data. In addition, azimuth data were not included because nearly all grooves are within ~ 5° of radial to the craters centers.

Average groove length shown in Fig. 1 was measured from where the grooves start nearest the rim to their maximum radial extent, even if a groove extends across sample area boundaries. The grooves that start in one sample area and extend across the sample area boundaries are recorded as belonging to the sample area nearest the rim where they start. Groove width is the average width along the length of each groove, while individual grooves typically widen only modestly outward.

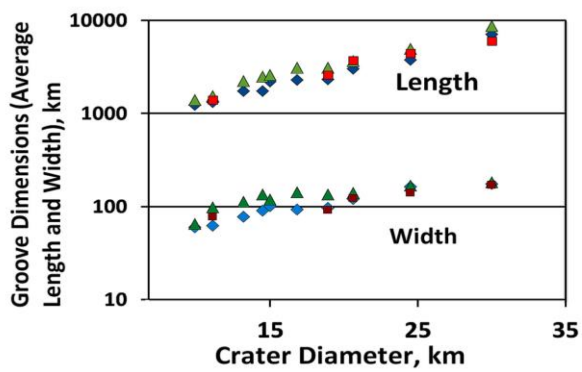

Fig. 1. Average length and width of grooves on the inner ejecta layers of DLE craters. Blue diamonds are for grooves from the rim to 0.5 R, green triangles are for grooves from 0.5 to 1.0 R, and red squares are for grooves from 1.0 to 1.5 R.

The number of grooves/km^2 in each sample area is shown in Fig. 2. In addition, Fig. 3

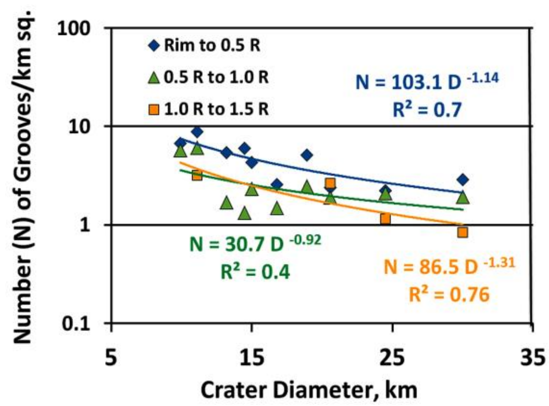

Fig. 2. Relative number of grooves (per km^2) on the inner ejecta layer of Martian DLE craters.

shows the surface area of grooves (where length is measured only within the sample area) in each sample area extrapolated to the entire ejecta deposit (i.e., in increments of 0.5 R outward) for each crater.

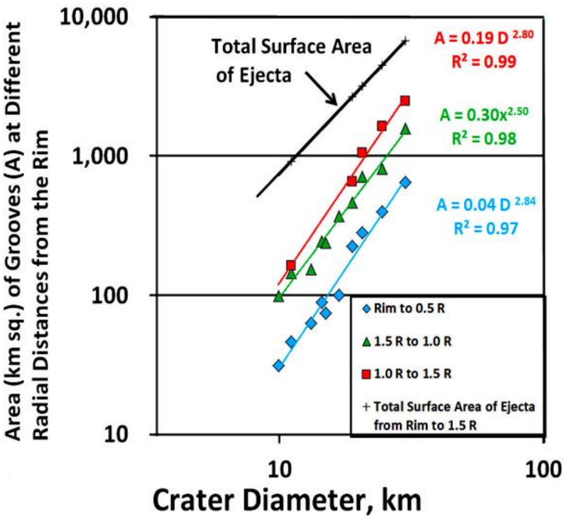

Fig. 3. Area occupied by grooves on the inner ejecta layer of DLE craters in increments of 0.5 R outward from the rim. For comparison, the black line shows the surface area of the inner ejecta layers from the rim to 1.5 R

Results: These data show that the average width and length of grooves on the inner ejecta layer increases with crater diameter. The average dimensions of the features are comparatively smaller closest to the crater rim (Fig. 1). Further from the rim their average dimensions are larger, and remain nearly constant. This appears to be the result of a relatively greater abundance of short, narrow grooves near the crater rim that commonly coalesce with other small grooves to form larger grooves, or disappear altogether away from the crater (Fig. 2). However, some relatively large grooves occur near the rim and extend to the outer edge of the ejecta layer, while other large grooves develop abruptly further out from the rim on the ejecta layer (Fig. 4). For each crater, the area of grooves on the inner ejecta layer also increases with both crater's size, and distance from the rim (Fig. 3).

Conclusions: These data indicate that fewer, but larger, grooves are produced on the inner ejecta layer outward from the rims of DLE resulting in a progressive increase in total groove area with radial distance. There is a disappearance of smaller grooves, replaced outward by fewer, but larger new grooves (instead of widening of individual grooves) as the ejecta spreads radially. This characteristic provides constraints to models of groove formation [1, 2, 7, 8], and tends to discount low-speed granular flow as being responsible for formation of the grooves.

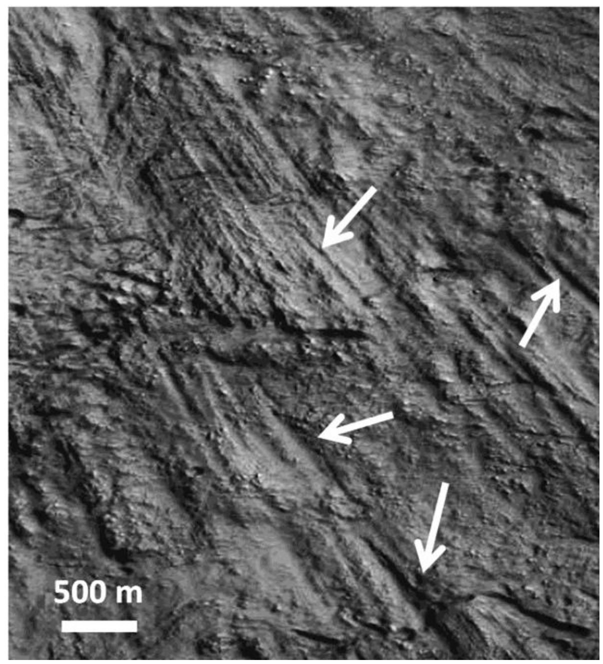

Fig. 4. CTX image (D02_028025_2205) of SE portion of inner ejecta layer of Gamboa Crater (40°N, 216°E). Most small grooves occur towards the crater rim (top left), and an abrupt formation of large grooves (arrows) at greater radial distances.

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