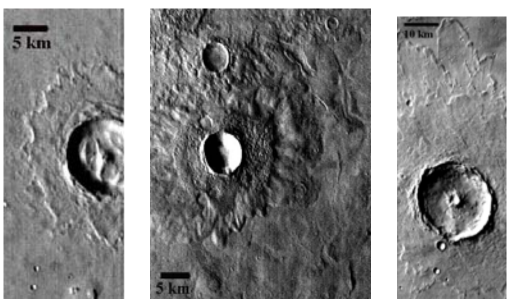
SINUOSITY OF MARTIAN LAYERED EJECTA BLANKETS A.E. Wintzer[1] and N. G. Barlow[2], [1]Dept. of Geology, University of Florida, Gainesville, FL 32611, awintzer@ufl.edu, [2]Dept. Physics and Astronomy, NAU Box 6010, Northern Arizona University, Flagstaff, AZ 86001-6010, Nadine.Barlow@nau.edu.

Introduction: Layered ejecta blankets are typically found surrounding fresh Martian impact craters. Two models have been proposed for the formation of layered ejecta: interaction of ejected material with the thin martian atmosphere [1], and incorporation of vaporized ice from the martian subsurface [2]. We are conducting a survey of craters with layered ejecta blankets on Mars to determine if their lobateness (a measure of sinuosity) varies with latitude, diameter, and ejecta type, and thus might provide constraints on the different formation models [3,4]. We report here our preliminary results for the northern equatorial region of Mars .

Background: Layered ejecta blankets on Mars are divided into single layered ejecta (SLE) (Fig 1a), double layered ejecta (DLE) (Fig 1b), and multiple layered ejecta (MLE) (Fig 1c), based on the number of ejecta layers present [5]



(a) (b) (c)

Figure 1. (a) 11.6-km-diameter (D) single layer ejecta **(**SLE) crater located at 23.6°N 101.7°E (THEMIS I02493005) (b) 6.4-km-D double layer ejecta **(**DLE) crater located at 40.4°N 98.6°E (THEMIS I11368011).(c) 17.7-km-D multiple layer ejecta **(**MLE) at 12.3°S 279.2°E (THEMIS I08903008).

Layered ejecta sinuosity and how it varies with latitude, crater diameter, and terrain may help constrain the ejecta formation mechanism. Sinuosity is quantified by a parameter called lobateness (Γ), which compares the ejecta blanket outer perimeter (P) to that expected for a circular blanket of the same area (A) [6]:

$$\Gamma = P/(4\pi A)^{1/2}$$

A 1994 Viking-based study found little to no correlation between crater diameter and Γ [3]. That study also found that MLE craters have a greater median Γ than DLE and SLE craters. The Viking analysis revealed that the outer layer of DLE craters has a greater Γ than the inner layer. This suggests differences in the fluidity of the ejecta deposits producing the two layers.

Current Study: The 1994 study was conducted using the Viking 1:2,000,000-scale photomosaics, which had resolutions between 130 m/pixel and 300 m/pixel. Higher resolution data are now available and we undertook this study to determine if resolution strongly affects lobateness results. We used THEMIS day IR images, which cover most of Mars at a resolution of 100 m/pixel. This study focused on craters in the northern hemisphere, mainly in the 0-30°N latitude zone (Fig. 2). Craters with layered ejecta blankets were identified from Barlow's revised *Catalog of Large Martian Impact Craters* [7]. Measurements of ejecta blanket area and perimeter were conducted using ArcMap software tools. The area and perimeter results were then used to calculate Γ values. The northern hemisphere was divided into 10° segments for the latitude-Γ correlation analysis.

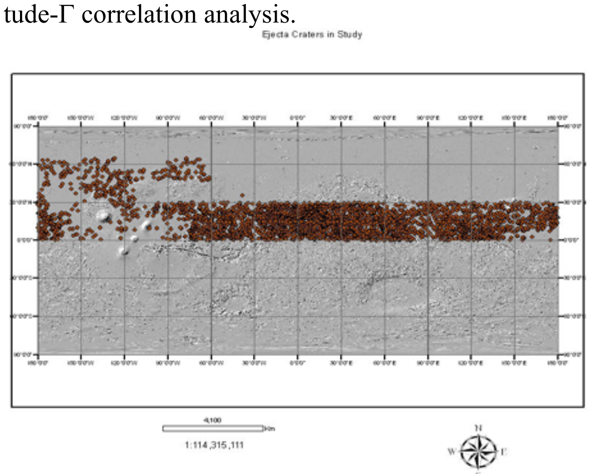


Figure 2. Distribution map of ejecta craters in this study

Results: This study computed Γ values for 3,409 layered ejecta craters in the northern hemisphere of Mars, of which 2246 (66%) were classified as SLE, 152 (4%) as DLE, and 1011 (30%) were MLE. This is consistent with previous studies which found that the SLE morphology is the most common ejecta morphology across the planet [8]. Both the outer and inner layers were measured and Γ calculated for DLE craters, whereas only the outermost layer was measured for SLE and MLE craters. Outer layers of both DLE and MLE have higher Γ values than SLE (Fig 3). The inner layer of DLE shows a lower Γ value than the outer layer. MLE craters have the highest median lobateness (1.23), while the far more numerous SLE craters have median Γ=1.16. The SLE median value is close to that for the DLE outer layer (1.17) and higher than that of the DLE inner layer (1.12).

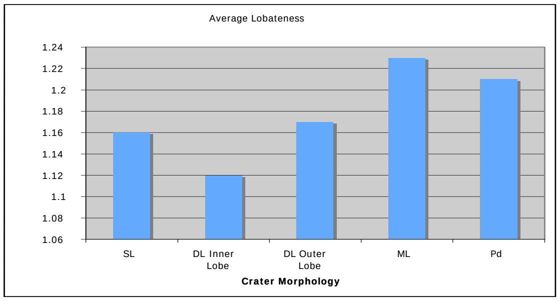
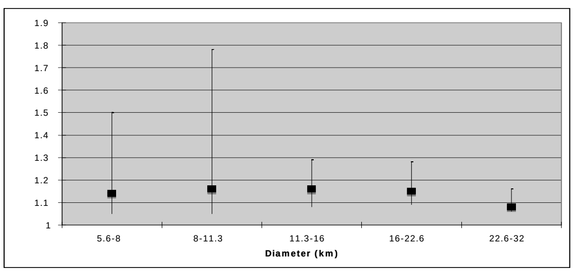
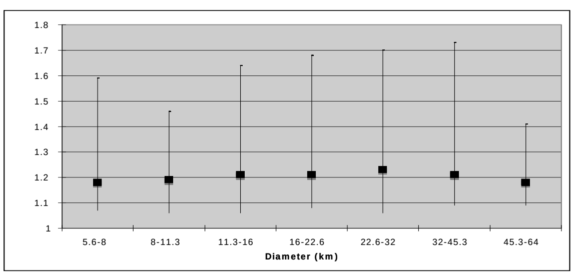


Figure 3. Average lobateness by crater ejecta type. Pd = pedestal craters, which are not discussed here.

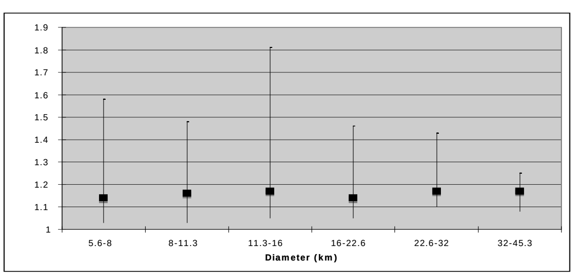
Correlations between diameter and Γ were studied using standard √2 diameter increments. No correlation between diameter and Γ is seen for any of the layered ejecta classes (Fig. 4). We also found no correlation between Γ and latitude within our limited range.



(a)



(b)



(c)

Figure 4. Comparison of diameter and lobateness for (a) SLE, (b) outer layer of DLE, and (c) MLE craters. Points are median Γ values for each diameter range; error bars are actual variation in Γ values.

Discussion and Future Work: This study is still in its preliminary stages and more work remains before we can determine if lobateness can be used to distinguish between the proposed formation models. However, we can begin to compare the results of this study with those of the 1994 Viking-based lobateness study [5]. The lack of latitude-lobateness and diameter-lobateness relationships are consistent with 1994 results. That study also found that the outer layers of DLE and MLE craters have higher Γ than SLE or the inner layer of DLE, consistent with our results. However, the actual lobateness values do show some variation from those reported in the Viking-based study. Lobateness values in this study are consistently higher than those reported in the 1994 study: 1.16 versus 1.09 for SLE, 1.12 versus 1.09 for inner layer of DLE, 1.17 versus 1.14 for outer layer of DLS, and 1.23 versus 1.18 for MLE. This suggests that resolution does influence calculated lobateness values, probably because finer details in ejecta perimeter sinuosity are more readily apparent. One major difference between the two studies is that we find the median lobateness of SLE craters is similar to that of the outer DLE layer rather than the inner layer as was found in the 1994 study. This suggests similar emplacement processes for SLE and the outer layer of DLE, but this needs to be investigated further since it is contrary to the conclusions of other studies [9].

Future work includes direct comparison of Γ calculated from Viking and THEMIS image data for each individual crater, as well as completion of the lobateness study for all layered ejecta craters on Mars. We also plan to use higher resolution imagery from THEMIS, HRSC, and CTX on selected craters to further characterize how lobateness varies with resolution

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