Geologic Mapping of the Martian Impact Crater Tooting. Peter Mouginis-Mark and Joseph M. Boyce, HIGP/SOEST, University of Hawaii, Honolulu, HI 96822. <pmm@higp.hawaii.edu> and <jboyce@higp.hawaii.edu>

Introduction: Tooting crater is ~29 km in diameter, is located at 23.4°N, 207.5°E, and is classified as a multi-layered ejecta crater [1]. Tooting crater is a very young crater, with an estimated age of 700,000 to 2M years [2]. The crater formed on virtually flat lava flows within Amazonis Planitia where there appears to have been no major topographic features prior to the impact, so that we can measure ejecta thickness and cavity volume [2]. In the past 12 months, we have: (1) Published our first detailed analysis of the geometry of the crater cavity and the distribution of the ejecta layers [2]; (2) Refined the geologic map of the interior of Tooting crater through mapping of the cavity at a scale of 1:100K (Figure 1); and (3) Continued the analysis of an increasing number of high resolution images obtained by the CTX and HiRISE instruments [3].

Science Questions: We are trying to resolve several science issues that have been identified during this mapping, including:

1) <u>What is the origin of the lobate flows on the NW and SW rims of the crater?</u> We have produced a digital elevation model from a stereo pair of HiRISE images of the western rim of the crater that has enabled us to determine the slope and thickness of a prominent lobe on the outer SW wall. These measurements support the idea that these flows are sediment flows (potentially similar to terrestrial lahars) rather than being flows of impact melt or lava.

2) <u>How did the ejecta curtain break apart during the formation of the crater, and how uniform was the emplacement process for the ejecta layers?</u> We have identified three different types of ejecta layers: (1) layers that have massive, circumferential ridges on the surface; (2) smoother ejecta layers with faint radial striations; and (3) crenulated terrain close to the maximum radial extent of the ejecta layer, but closer to the primary than the distal rampart. This subdivision of the ejecta layers may have particular importance for the formation of individual ejecta layers at Tooting, and also has importance for the formation of ejecta layers at other, older, Martian multi-layered craters [1, 4-6]. This emplacement process appears to be quite different from the mode of emplacement of ejecta at double-layered craters [7] and our hope is that our mapping at scales of 1:50K or 1:100K may help us better understand the process at Tooting.

3) <u>Can we infer physical characteristics about the ejecta?</u> CTX and HiRISE images have revealed that there are a large number of pits, often aligned as chains of many dozen individual craters, within the ejecta layers. These pits seem to be preferentially concentrated at the crest of the distal ramparts, or as long (5 – 10 km) chains of craters that form on the outermost layer of ejecta. In several instances, we also see chains of craters extending beyond the visible outer boundary of the ejecta. We also find a few (<10) places where the ejecta ramparts appear to have been remobilized, suggesting that the fluidization process continued even after the ejecta came to rest for the first time. We

continue to study these higher resolution data sets in order to better define the number of sub-units that define the flow properties of the ejecta.

Plans for Year 3:

a) Complete a draft geologic map of Tooting crater and submit this map to the U.S. Geological Survey for preliminary review.

b) Publish a second research paper (either in *JGR-Planets* or *Meteoritics and Planetary Science*) on the detailed geology of the crater cavity, and the distribution of the flows on the crater rim.

c) Complete the accompanying map text.

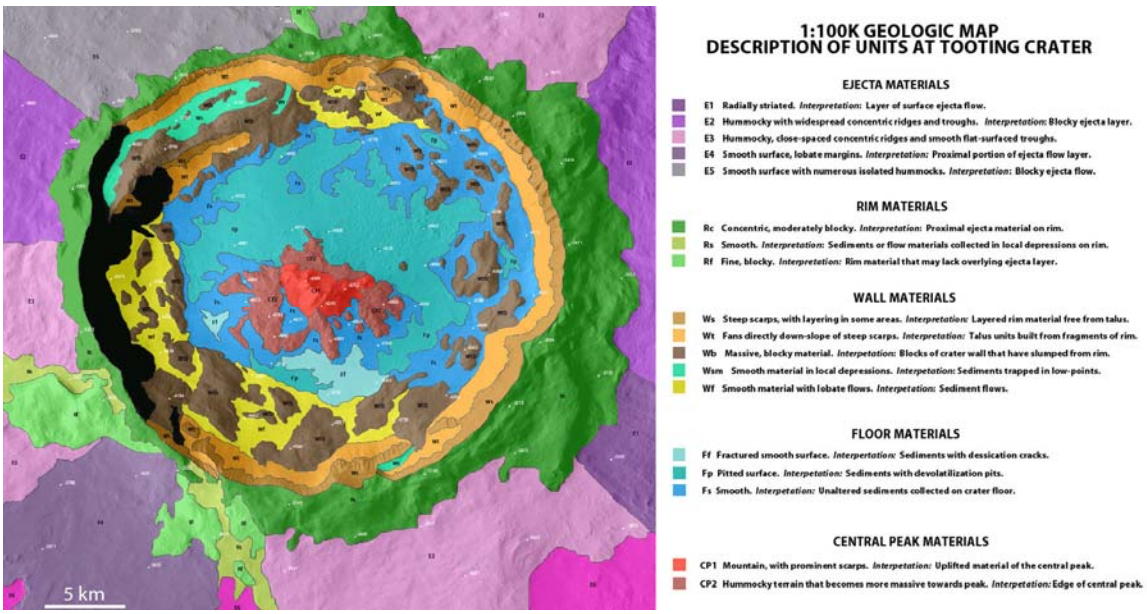

Figure 1: Revised draft of the geology of the cavity of Tooting crater, produced from analysis of THEMIS VIS and HiRISE images. The white labels give the elevation of the crater and ejecta relative to the MOLA datum for Mars.

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