A UNIQUE YOUNG FLOW SOUTHWEST OF CERBERUS FOSSAE, MARS. P. J. Mouginis-Mark, Hawaii Institute Geophysics Planetology, University of Hawaii, Honolulu, HI 96822 (pmm@hawaii.edu).

Introduction: CTX and HiRISE images have revealed a fresh lobate flow with unique morphologic characteristics (Fig. 1). The flow is ~34 km long, 0.5 - 2.0 km wide, falls ~50 m along its length, and has a broad distal fan ~6 x 9 km in size. The flow originates from within the ejecta blanket (at 0° 35'N, 155° 17'E) of a 10 km diameter impact crater to the southeast, but appears to associated with a partially buried remnant of a large yardang formed within the lower unit of the Medusae Fossae Formation [1].

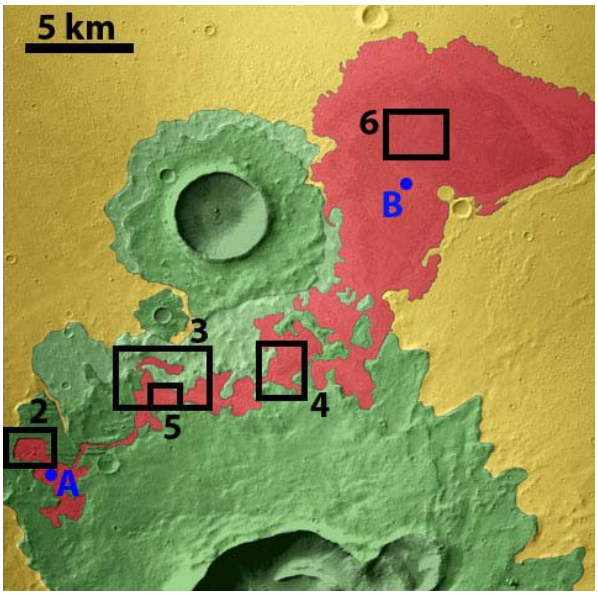

Fig. 1: The new flow (red) identified here. Direction of flow motion was from left to right. MOLA data show that the change in elevation between points "A" and "B" is 46 m. Location of Figures 2 to 6 are identified. Part of CTX image P20_008700_1787.

The source area of the flow (Fig. 2) is a 1.2 x 1.5 km depression that appears to be eroded into the yardang material. A CTX-derived digital elevation model reveals that this depression is ~20 m deep. Multiple phases of upwelling can be identified in the source area, where multiple concentric ridges associated with flows can be seen. Absent from the source area is any landform comparable to the vent structures typically seen at martian calderas or volcanic vents [2, 3].

Flow Morphology: The flow has many unusual characteristics that indicate that it is not a lava flow: (a) the source area has multiple concentric ridges (Fig. 2), suggestive of multiple cycles of flow emplacement; (b) MOLA data indicate that the flow is very thin, between 2 – 4 m thick; (c) super-elevated margins of the flow appear to have over-ridden local topographic obstacles and then slumped back to the base-level (Fig. 3), sometimes trapping segments of the flow in local depressions; (d) in places the flow bifurcated and then re-coallesced around pre-existing obstacles (Fig. 4) that caused down-stream disruptions to the flow surface; and (e) the flow displays several types of lineations that are both parallel and transverse to the direction of flow (Fig. 5). These lineations define rectangles on the surface with an almost constant size of 45 – 60 m along the length of the flow.

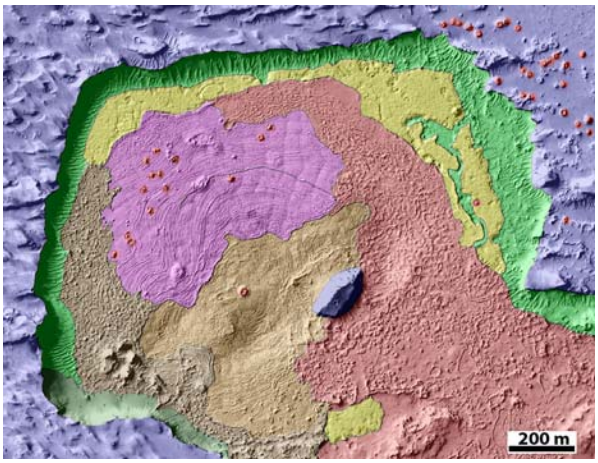

Fig. 2: Source area of flow. Purple, tan and red units are successive phases of the flow. Blue denotes pre-flow yardang surface, and green denotes recently emplaced eolian materials. Note remnant block of pre-existing material preserved near center of source area. HiRISE frame ESP_025697_1805.

Possible Mode of Formation and Broader Implications: While the flow may be comprised of lava that had a very low viscosity during emplacement, a more likely mode of formation for the flow appears to be that it is a large mud flow. It is proposed that this flow may have been produced by water reaching the surface within the yardang and fluidizing this material. Based upon the uniform morphology and apparent constant thickness of the flow along its length, the viscosity of the flow does not appear to have changed from the earliest phase of its eruption until the distal portion of the flow (Fig. 6) was reached. This distal portion of the flow bears a close similarity to the fresh flows in Cerberus Fossae that have previously been interpreted as potentially ice-rafted flows [4] or once highly fluid lava flows [5, 6].

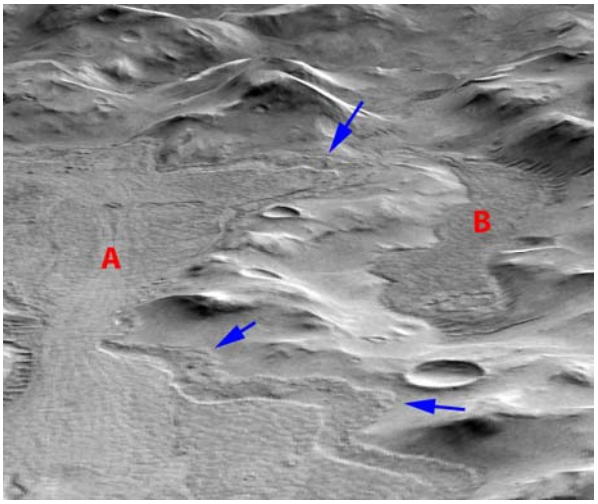

Fig. 3: Oblique view of middle portion of flow, looking west. "A" is the main flow, "B" marks a spill-over lobe in a local depression, and the blue arrows identify high-stands and subsequent drain-back from topographic highs. Direction of flow from top to bottom of image. Peak at top center of image is ~50 m high. CTX image draped over DEM derived from CTX frames G19_025486_1805 and P20_008700_1787.

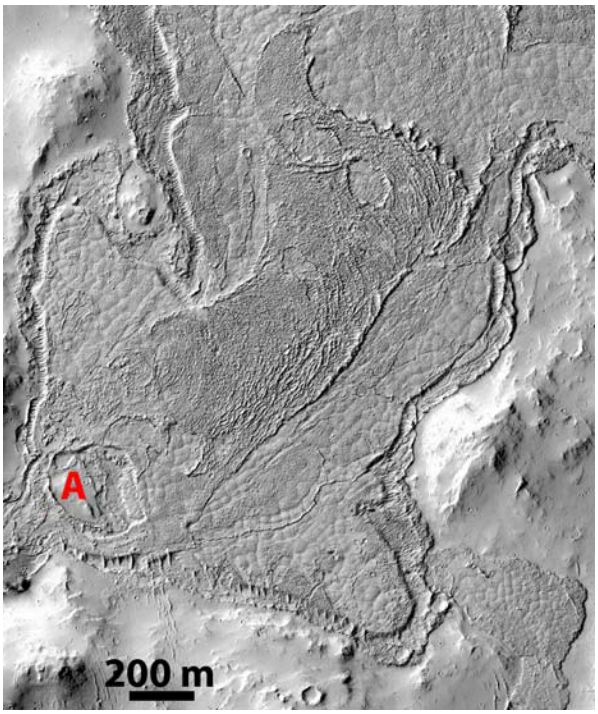

Fig. 4: Example of the complex morphology of the flow. "A" is a pre-existing obstacle that produced a shear zone with rougher textured material down-flow. Direction of flow was from lower left to top right. HiRISE frame ESP_026264_1805.

The morphology of the distal portion of this new enigmatic flow raises the possibility that the other flows within the Cerberus Fossae region are not lava flows, but may instead be mud flows. Additional mapping of the entire length of the flows using HiRISE data would help resolve the origin of these Cerberus flows, and show if the flow identified here is unique on Mars.

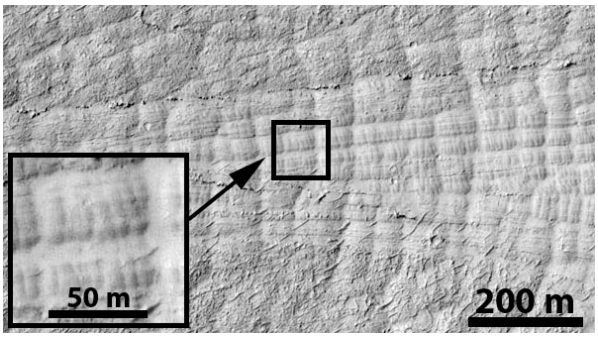

Fig. 5: The surface of flow is characterized by both large (main image) and small (insert) transverse and longitudinal ridges, interpreted to be products of flow transport. Direction of flow from left to right. HiRISE image ESP_026264_1805.

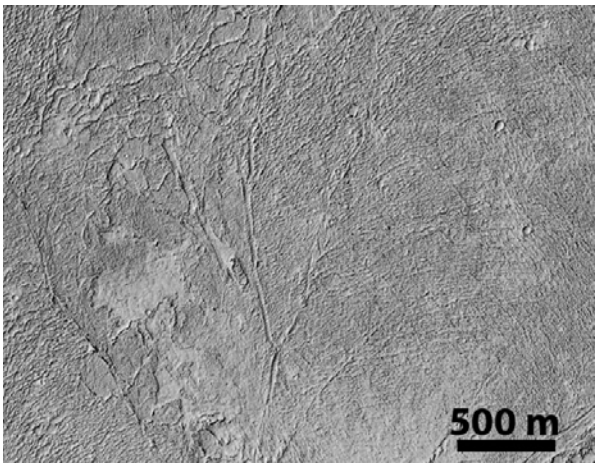

Fig. 6: Distal portions of the flow show a remarkable similarity to textures interpreted to be lava flows [5, 6]. Direction of flow is towards top of image. HiRISE image ESP_028097_1805.

References: [1] Zimbelman J.R. and L.J. Griffin (2010) *Icarus 205*, 198 - 210. [2] Mouginis-Mark P.J. and S.K. Rowland (2001), *Geomorphology 37*, 201 - 223. [3] Mouginis-Mark P.J. and P.R. Christensen (2005) *JGR 110 (E10)* doi: 10.1029/2005JE002421. [4] Murray J.B. *et al*. (2005*) Nature 434* (7021), 352 – 356. [5] Vaucher J. *et al*. (2010) *Icarus 200*, 39 – 51. [6] Jaeger W. L. *et al*. (2010) *Icarus 205*, 230 – 243.