HIRISE DIGITAL TERRAIN MODELS OF VOLCANIC FEATURES ON MARS. Daniel C. Berman, David A. Crown, Frank C. Chuang, and James W. Rice, Planetary Science Institute, 1700 E. Ft. Lowell Rd., Suite 106, Tucson, AZ 85719; bermandc@psi.edu.

Introduction: We are currently producing a series of HiRISE Digital Terrain Models (DTMs) for volcanic features on Mars to facilitate detailed morphologic and topographic analyses. Study sites include: a) the Columbia Hills/MER Spirit region to examine Home Plate and similar features, lava flow margins, and other associated volcanic features; b) the eroded flanks of Apollinaris Mons; c) lava flows in Daedalia Planum characteristic of the vast volcanic plains of southern Tharsis; and d) valleys, graben, and lava flows associated with Alba Mons. Morphologic and topographic analyses are being used to provide integrated characterizations of small-scale volcanic features, to assess the styles and diversity of volcanic processes on Mars, and to evaluate degradation of volcanic surfaces of various types and ages [2-4].

Data and Methods: DTM production was completed using the methodology described by [1] with BAE Systems' SOCET SET 5.6 software and stereo pairs of MRO HiRISE images. Individual raw HiRISE EDR RED and IR band images were downloaded from the University of Arizona Planetary Image Research Laboratory (PIRL) servers and imported into USGS ISIS 3.4.3 software, evaluated for jitter and dejittered through the HiRISE dejitter pipeline, radiometrically calibrated, and mosaicked before being imported into SOCET SET. Tie points were then created on the stereo pairs and each pair was solved for relative and absolute orientations horizontally and vertically. Each pair was controlled to the gridded MOLA DEM (~462 m/pixel) for vertical alignment with the geoid and with MOLA track points for horizontal alignment. The final DTMs were generated from the controlled pairs using both NGATE and ATE processes in SOCET SET. Manual editing was performed to correct for errors in the automatically generated DTM, utilizing tools such as the area editor, geomorphic editor, and Triangulated Irregular Network (TIN) editor.

Post-DTM Production and Results: After completion of the DTMs, RED orthophotos were generated for each HiRISE image at the 1 m/pixel and 25 cm/pixel scales. DTM and orthophotos were then exported to an ISIS raw format. ESRI ArcGIS Desktop 10.4 software was used to produce slope maps, elevation contours, and topographic profiles from the DTMs. The DTMs generated in this investigation allow for measurements of elevations, layer and flow thicknesses, and scarp heights to the nearest ~0.2 m.

Three study site DTMs have been complete thus far (Figs. 1-3): Columbia Hills/MER Spirit region, Apollinaris Mons, and Daedalia Planum.

References: [1] Kirk R.L. (2008) JGR 113. [2] Rice J.W. et al. (2016) LPSC 47 #2904. [3] Chuang F.C. et al. (2017) LPSC 48 this issue. [4] Crown D.A. et al. (2013) LPSC 44 #2499.

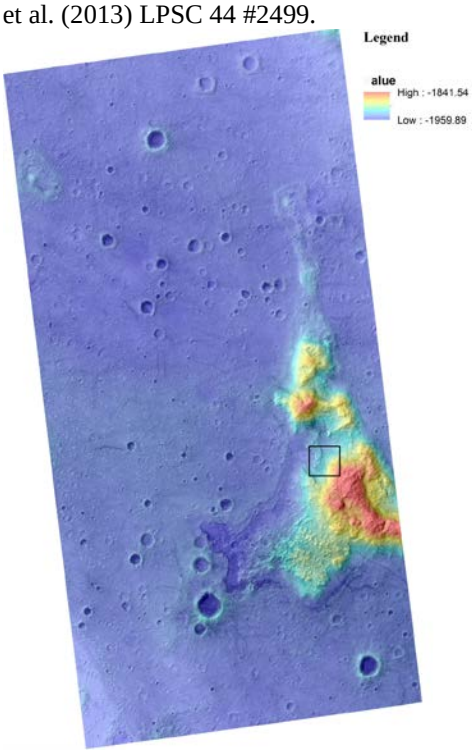

Figure 1a. DTM covering the Columbia Hills region from HiRISE stereo images PSP_001513_1655 and PSP_001777_1650. Box shows location of Fig. 1b.

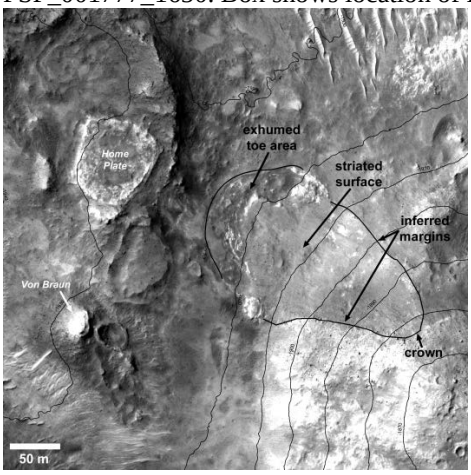

Figure 1b. Columbia Hills region, HiRISE image PSP_001513_1655. Landslide extending toward Home Plate, with 10 m contours from DTM.

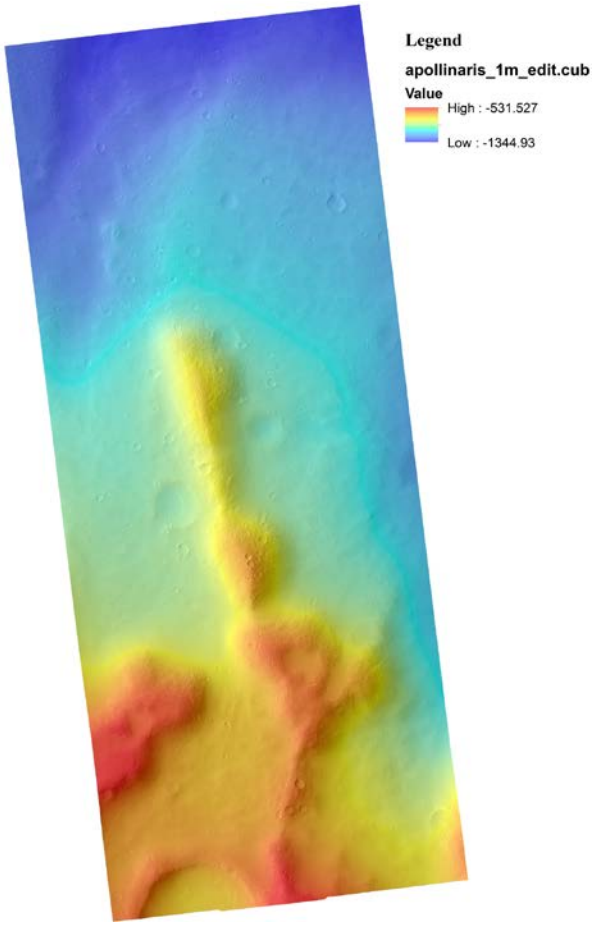

Figure 2a. DTM of NE flanks of Apollinaris Mons created from HiRISE stereo images PSP_001645_1725 and PSP_002634_1725.

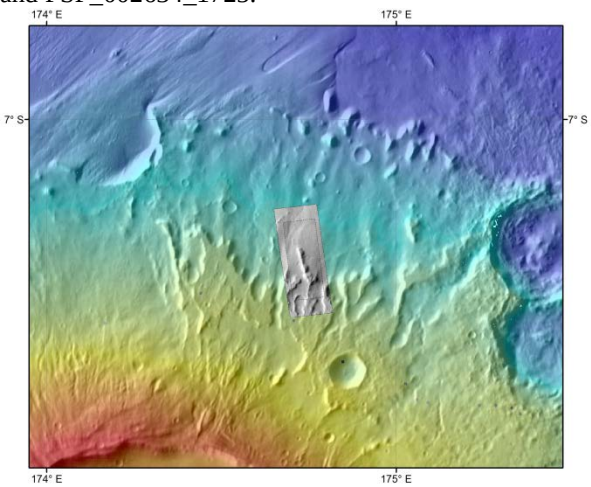

Figure 2b. Context image for HiRISE stereo pair in Apollinaris Mons study region.

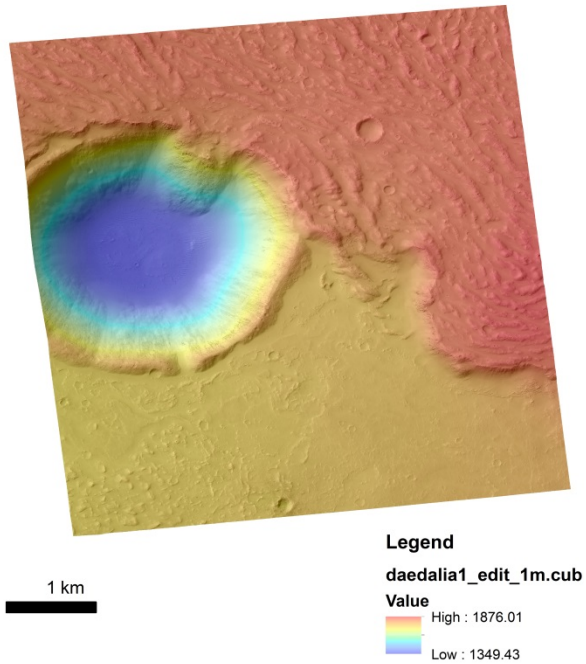

Figure 3a. DTM in Daedalia Planum produced from HiRISE stereo images ESP_024877_1465 and ESP_024587_1465.

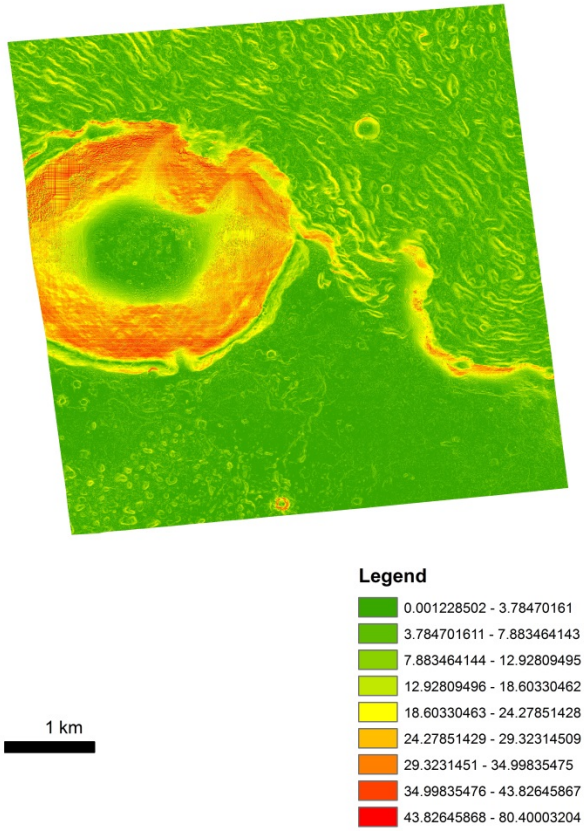

Figure 3b. Slope map derived from DTM in Daedalia Planum showing ridged lava flow surrounding crater.