GEOLOGIC MAPPING OF VOLCANIC REGIONS ON MARS: INVESTIGATIONS OF SOUTHERN THARSIS LAVA FLOW FIELDS AND THE ALBA MONS SUMMIT. David. A. Crown, Daniel C. Berman, Frank C. Chuang, and Thomas Platz, Planetary Science Institute, 1700 E. Fort Lowell Road, Suite 106, Tucson, AZ 85719, crown@psi.edu.

Introduction: This research examines styles of volcanism and the geologic histories in two parts of the Tharsis volcanic province on Mars. Geologic mapping southwest of Arsia Mons and in Daedalia Planum [1-10] allows reconstruction of complex volcanic surfaces, including delineation of individual flow lobes and superposition relationships within a large expanse of the southern Tharsis flow fields. Geologic mapping of Alba Mons' summit region was recently initiated [11] to examine eruptive activity, tectonism, and degradation in the caldera region and on the surrounding flanks.

Mapping Approach and Datasets: In this study, we utilize a combination of imaging and topographic datasets. These include Thermal Emission Imaging System (THEMIS), High Resolution Stereo Camera (HRSC), and ConTeXt Camera (CTX) images and HRSC and Mars Orbiter Laser Altimeter (MOLA) DTMs. High Resolution Imaging Science Experiment (HiRISE) images, where available, are used to document the small-scale surface characteristics of the mapped geologic units. This project uses Geographic Information Systems (GIS) software and analysis tools for the production of both hard copy and digital map products. Populations of small, superposed impact craters are used along with stratigraphic and cross-cutting relationships to derive relative and absolute age constraints.

Geologic Mapping of Southern Tharsis: Two formal USGS map publications are being produced: 1) six MTM quadrangles (-30137, -30132, -30127, -35137, -35132, and -35127) in central and southern Daedalia Planum at 1:1M scale, and 2) two MTM quadrangles (-25127 and -25122) in SW Arsia Mons/NE Daedalia Planum at 1:500K scale. The six quadrangle area covers the rayed crater Zumba, the surrounding lava flow fields, smooth and ridged plains, and the highlands of Terra Sirenum to the south. The two quadrangle area covers a complex of elongate and broad flow lobes extending from the southwestern flanks of Arsia Mons across Daedalia Planum.

A geologic map of MTM -35137 quadrangle has been completed using THEMIS IR and CTX images in order to establish mapping techniques for the 1:1M-scale Daedalia Planum area; these are now being extended to the full map area [5-7]. The geologic history includes an early episode of volcanism (volcanic plains) that embayed the highlands in the Early Hesperian (~3-3.5 Gy) and recent volcanism emplacing vast sheet flows during the Middle Amazonian Epoch (0.5-1 Gy). Chuang et al. [12-13] published a detailed analysis of the extensive rays and secondary field of Zumba crater that extend across various lava flow units.

Geologic mapping of MTM -25127 and -25122 quadrangles has been completed [1-4, 8-9], and a manuscript is in review documenting the morphologic and thermophysical properties of lava flows in the SW Arsia Mons/NE Daedalia Planum region [10]. Mapping and related analyses characterize flow types and emplacement styles, describe flow interactions and flow field stratigraphy, document evidence for flow inflation, examine thermal data that are consistent with basaltic lava compositions, and attribute diurnal temperature changes to the the combined effects of rugged lava outcrops, aeolian mantling, and dust exposed at flow surfaces. Crater size-frequency distributions for a series of elongate flow lobes south of Arsia Mons indicate ages of ~100 My in the Late Amazonian Epoch.

Geologic Mapping of Alba Mons: A 1:1M-scale USGS geologic map of the Alba Mons summit region is being produced [11]. The map area is 245-255°E, 32.5-47.5°N and includes six 1:500,000-scale MTM quadrangles (45112, 45107, 40112, 40107, 35112, and 35107). The map region is centered on the summit caldera complex and includes the main Alba Mons edifice, most of the circumferential grabens encircling the volcano (Alba, Ceraunius, and Tantalus Fossae), and parts of the mid-flank and lower flank regions containing lava flows and dendritic valley networks.

Initial mapping is being done on the caldera region to develop a preliminary unit and symbol scheme, focusing on the intra-caldera flows and flows on the upper flanks of the volcano extending from the caldera complex. Geologic features along the rim and on the floor of a ~65 km across collapse depression have been mapped using THEMIS and CTX images (**Figure 1**). Based on cross-cutting relationships, this depression represents the last stage of caldera collapse. The depression rim shows diverse morphologic expression. Scalloped, steep-walled areas to the south presumably represent discrete, late-stage collapse events. Graben and scarps aligned with the eastern and western margins show the larger extent of deformation in summit materials related to this depression. Analysis

of the morphology and topography of the depression floor indicate: a) the most recent eruptive activity formed small constructs to SE; b) flows extended from SE to NW across the depression floor; c) floor materials are obscured by mid-latitude mantling deposits and aeolian activity.

References: [1] Crown, D.A. et al. (2009), LPSC XL, abstract 2252. [2] Crown, D.A. et al. (2010), LPSC XLI, abstract 2225. [3] Ramsey, M.S. and D.A. Crown (2010), LPSC XLI, abstract 1111. [4] Crown, D.A. et al. (2011), LPSC XLII, abstract 2352. [5] Crown, D.A. et al. (2012), LPSC XLIII, abstract 2138. [6] Crown, D.A. and D.C. Berman (2012) LPSC XLIII, abstract 2055. [7] Crown, D.A. et al. (2013), LPSC XLIV, abstract 2499. [8] Crown, D.A. et al. (2014) AGU 2014, abstract P41B-3906. [9] Crown, D.A. et al. (2015), LPSC XLVI, abstract 1439. [10] Crown, D.A. and M.S. Ramsey (2016), JVGR, in review. [11] Crown, D.A. et al. (2016), LPSC XLVII, abstract 2383. [12] Chuang, F.C. et al. (2015), LPSC XLVI, abstract 2488. [13] Chuang, F.C. et al. (2016), Icarus 269, doi:10.1016/j.icarus.2016.01.005.

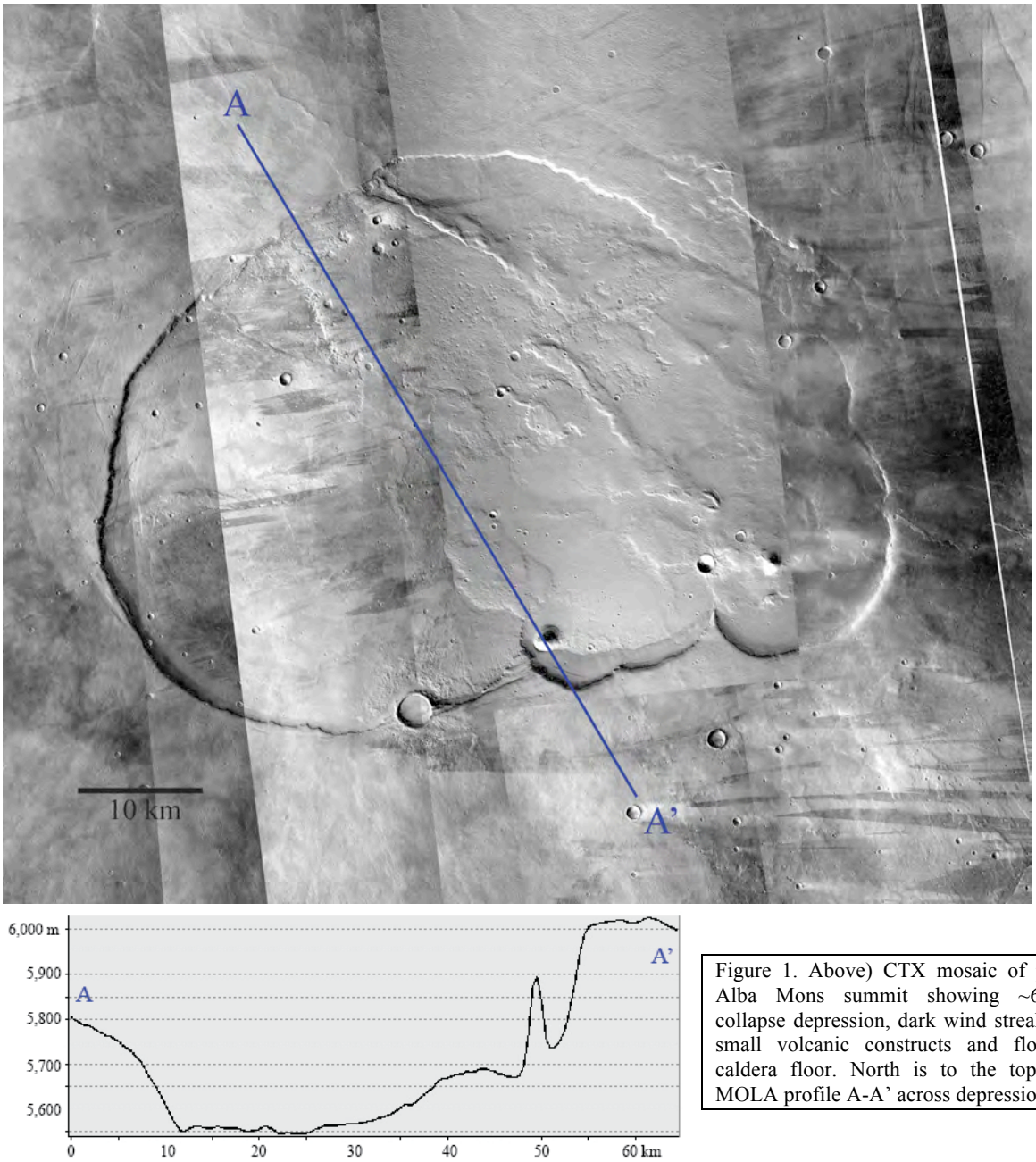

Figure 1. Above) CTX mosaic of part of Alba Mons summit showing ~65 km collapse depression, dark wind streaks, and small volcanic constructs and flows on caldera floor. North is to the top. Left) MOLA profile A-A' across depression.