GEOLOGY OF ALBA MONS, MARS: RESULTS FROM 1:1M-SCALE GEOLOGIC MAPPING. David A. Crown[1], Daniel C. Berman[1], Stephen P. Scheidt[1], and Ernst Hauber[3], [1]Planetary Science Institute, 1700 E. Ft. Lowell Rd., Suite 106, Tucson, Arizona 85719 (crown@psi.edu); [2]Institute of Planetary Research, German Aerospace Center, Berlin, Germany.

Introduction: Imaging and topographic datasets are being used to produce two 1:1M-scale geologic maps of Alba Mons in order to document the volcanic evolution and geologic history of the northernmost volcano in the Tharsis region. We utilize geologic mapping of Alba Mons' summit region (245-255°E, 32.5-47.5°N) and western flank (230-245°E, 37.5-47.5°N) to characterize volcanic, tectonic, and erosional processes and derive age constraints from cross-cutting relationships and crater size-frequency distributions.

Mapping Methodology and Datasets: Geologic mapping uses THEMIS, HRSC, CTX, and HiRISE images supported by HRSC and MOLA topography. GIS software and analysis tools are being used for the production of digital and hard copy USGS map products. The map region includes 12 1:500,000-scale Mars Transverse Mercator (MTM) quadrangles.

Background: Alba Mons is a large, low-relief volcano (1015 × 1150 km in planform; ~6 km relief) with low flank slopes (~1°) [e.g., 1-5]. Viking Orbiter studies described the summit caldera complex, extensive lava flow fields that exhibit different flow morphologies, and prominent sets of circumferential graben [6-15]. Dendritic valley networks characterize Alba Mons' northern flank [8, 16-19].

Geologic Mapping: Research to-date using THEMIS IR and CTX data includes [20-27]: 1) Preliminary mapping and analysis of geologic features in the summit region; 2) Systematic mapping of valleys (of likely fluvial origin) across both map areas; and 3) Systematic mapping of geologic features (volcanic, fluvial, tectonic, and impact) throughout the western flank map area. MOLA topographic datasets (DEM, slope maps with various baselines, and derived curvature statistics) have been integrated into mapping to enhance topographic aspects of geologic features (e.g., lava tubes, valleys) whose primary morphologic characteristics may be obscured by surface degradation or discontinuously defined.

Geologic mapping results for Alba Mons from digitial map layers that show the distribution of and interactions between volcanic, tectonic, erosional, and impact features (Figure 1) include the following:

1) Mapping of erosional valleys indicates extensive degradration of the northern and western flanks of Alba Mons [22, 27]. Elongate drainage systems (with lengths of 300+ km) have dendritic to parallel morphologies. The correlation between valley distribution and local slope, and the occurrence of dendritic networks on the highest local slopes, suggest control by topography rather than variations in substrate properties.

2) Alba Mons' western flank is dominated by lava flows and lava tube systems [24-26]. Their distribution is consistent with the broad shape of the volcano and local slopes (i.e., at 50 km scale), although some lava flow paths have been deflected by local obstacles, including pre-existing craters and volcanic flows. Although local relationships are complex, lava flows generally seem to post-date adjacent lava tube systems.

3) Individual lava flows are typically elongate with relatively constant widths. Width variations, branching, and broader lobes are also observed. No clear source vents have been identified within the western flank, presumably due to burial or because flows extend from the summit region. Central channels within flow lobes are not typically observed, due to lack of formation during emplacement and/or degradation and mantling of flow surfaces. Typical flow widths are ~2-10 km and numerous flow lobes extend for 100+ km in length.

4) Lava tube systems, which can extend for 100s of km, are delineated by discontinuous, sinuous chains of elongate depressions, which in many cases are located along the crests of prominent sinuous ridges [26]. Lava tube systems occur as both these ridged forms with lateral flow textures and more subtle features denoted by a central distributary feature within the flat-lying flow field surface. Most lava tubes follow the current regional slopes [26].

5) Cross-cutting relationships indicate that tectonic deformation post-dates volcanic and fluvial activity in the map area. Fluvial valleys dissect volcanic flank materials, including lava flow lobe surfaces, and frequently follow flow margins. Limited examples of lava flows embaying drainage systems are also evident. Mapped ejecta blankets superpose lava flows in some locations, and craters are observed to both truncate and be dissected by valley segments.

6) Preliminary age constraints from crater size-frequency distributions indicate a large pulse of volcanic activity across the western flank of Alba Mons between ~1.1 and 1.5 Ga. Our database of 12,000+ impact craters with diameters between 250 m and 18.3 km will be used for deriving relative and absolute ages of volcanic sequences.

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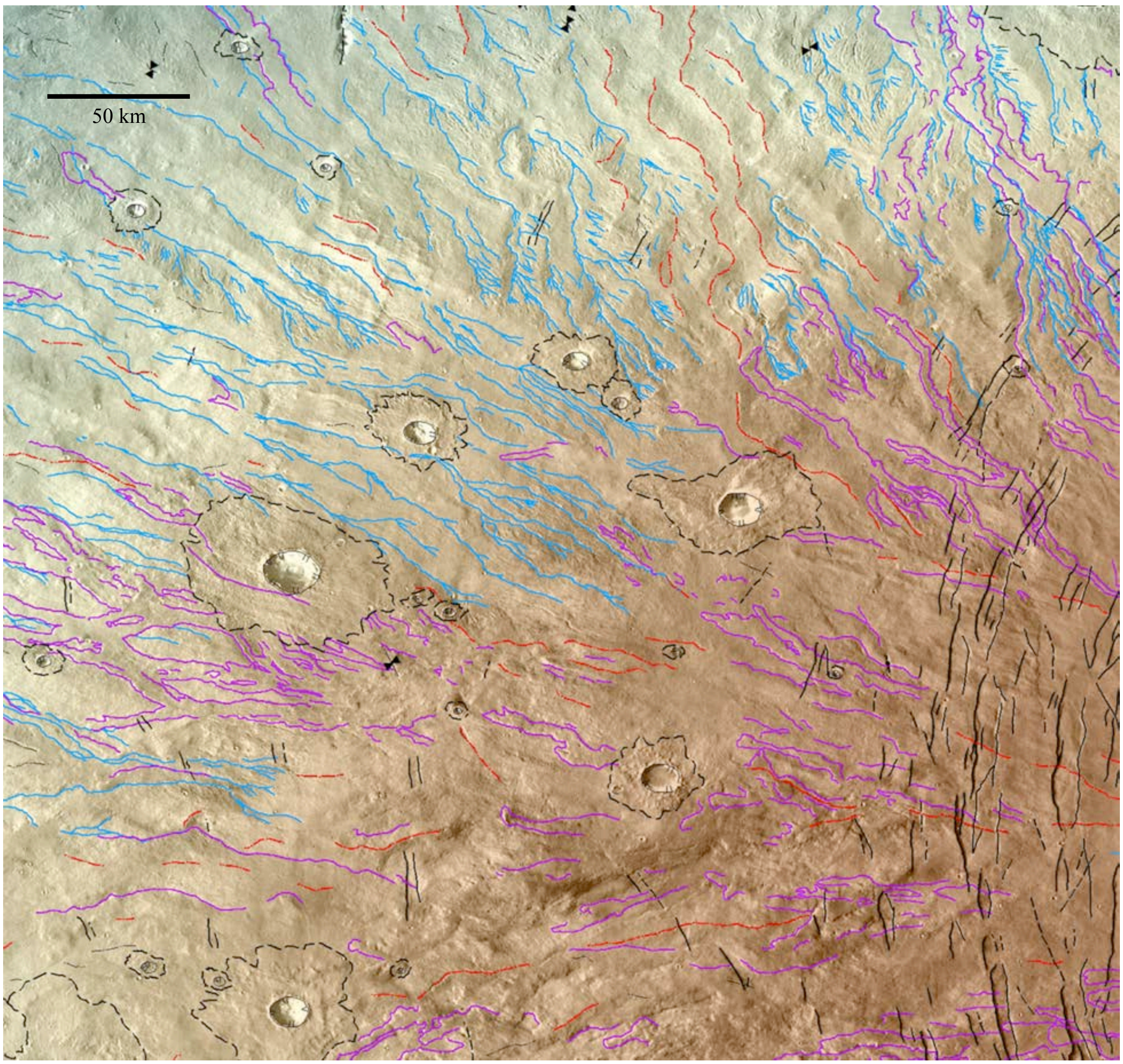

Figure 1. Geologic features from part of geologic map of western flank of Alba Mons shown over THEMIS IR daytime mosaic (100 m/pixel) merged with MOLA DEM (463 m/pixel) in simple cylindrical projection. Blue = fluvial valleys, purple = lava flow margins, red = lava tubes (denoted by circular to elongate depressions), and black = various structural features. Impact crater materials outlined by dashed black lines.