MAPPING AND STUDYING INFLATED LAVA FLOWS IN MARS' THARSIS REGION. B. F. Healy[1] and J. R. Zimbelman[2], [1]Boston University Department of Astronomy, Boston, MA 02215, bfh@bu.edu, [2]CEPS/NASM MRC 315, Smithsonian Institution, Washington, D.C. 20013-7012, zimbelmanj@si.edu.

Introduction: When basaltic pahoehoe lava travels across gentle slopes, the flow's outer layer begins to harden as additional lava collects underneath. The result is inflation, a process by which a centimeters-high flow can grow up to 20 meters by the continual ingress of lava [1, 2]. Inflated lava flows have been observed on Earth, Mars, and perhaps the Moon [3]. Using high-resolution images of the Martian surface, it is possible to map and study candidate inflated flows in unprecedented detail. Learning more about Mars' inflated flows would enable a comparison with terrestrial analogs and shed light on the Red Planet's volcanic history.

Procedure: All three inflated flows described here are located in Mars' Tharsis region. Their coordinates are (-3 – -1 N, 250 – 252 E), (-7 – -5 N, 245 – 247 E) and (-10 – -8 N, 244 – 246 E).

Instruments: Starting with THEMIS (Thermal Emission Imaging System) visible wavelength images containing inflated lava flows, the corresponding CTX (Context Camera) images were used for mapping. CTX images have a resolution of 6 meters per pixel, and they facilitate close inspection of flow boundaries and craters.

Mapping flows: The immediate and surrounding regions of each flow were mapped with Arizona State University's JMARS software. Dashed and dotted boundary markings indicated lower and least certainty, respectively. Where they appeared related to the flows in question, linear features such as tubes were also mapped.

Crater counting: For the primary flow of interest in each map, crater counting was performed in JMARS. The count ignored any flows that could not be verified as penecontemporaneous. The diameter of each crater and the area of the flow in question were input into Craterstats, a planetary surface aging program.

Results: The methods described above yielded both qualitative and quantitative insight into each flow.

Evidence of tube-fed flows. One of the mapped flows (Flow A, Figure 1), located southeast of Pavonis Mons, was connected to a tube that extended west of the flow for roughly 100 kilometers. The tube appeared to be the source of several small flows in addition to the main inflated flow. Figure 2 shows a close-up of the tube connecting to the flow by two routes. Another flow (Flow B, Figure 3) was not as clearly fed by a tube, but it was close to several linear features originating at higher elevations.

Gentle elevation gradients. Using Mars Orbiter Laser Altimeter (MOLA) numeric elevation data and a ground distance obtained in JMARS, an elevation gradient of 0.2° was calculated for Flow A starting at the lava tube's visible beginning and descending to the inflated flow. The gradient for Flow B was calculated to be 0.07°, starting at one of the prominent tubes and descending to the main flow. The third flow studied, Flow C, had a gradient of 0.06° from its highest to lowest points.

Young flow ages. Given the crater counting data from JMARS and a model of Martian impacts, the age of each flow was calculated using Craterstats (Table 1). Craters with a diameter below 40 meters were ignored to avoid resolution-limited selection bias.

Flow	Age
A	43 ± 5 Ma
B	28 ± 4 Ma
C	32 ± 3 Ma

Table 1. Ages of the three mapped flows.

Discussion: The age of each flow, on the order of tens of millions of years, is relatively young for the Martian surface. This result agrees with existing calculations for inflated flows [3].

The elevation gradient calculations of 0.2°, 0.07° and 0.06° fall within the < 1° expectation for regions with inflated flows [4]. These calculations support the idea that gentle slopes accommodate inflation.

The evidence showing that two of the three flows may be tube-fed is an unexpected result of the mapping. This result implies that the mechanism by which inflated flows form on Mars may be more similar to the terrestrial mechanism than previously thought [4]. Further study of a greater number of inflated flows will be necessary to reach a conclusion.

References: [1] Giacomini L. et al. (2009) *PSS, 57,* 556-570. [2] Garry W. B. et al. (2011) IAG Planetary Geomorphology Working Group, *Inflated Lava Flows on Earth and Mars.* [3] Garry W. B. et al. (2012) *JGR, 117, E00H31.* [4] Hon K. et al. (1994) *GSAB, 106,* 351-370.

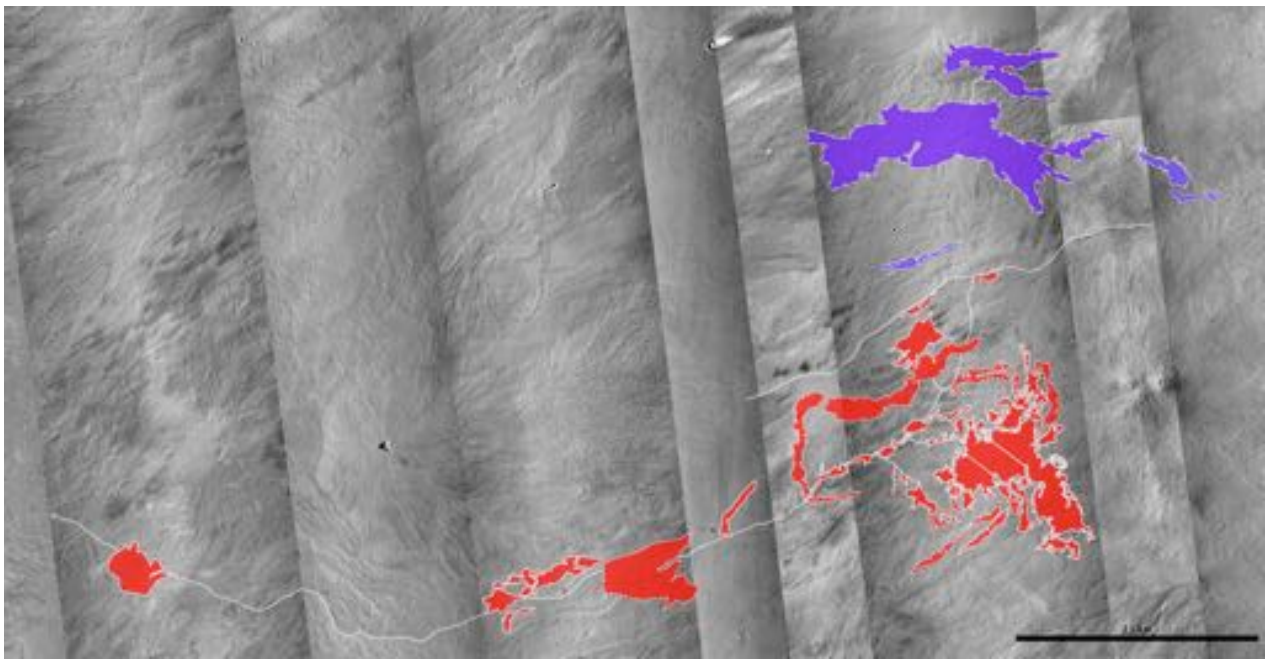

Figure 1. Map of Flow A (right side of image) and corresponding tubes. The scalebar in the lower right corner represents 25 km. Purple-colored flows are not related to the tube system.

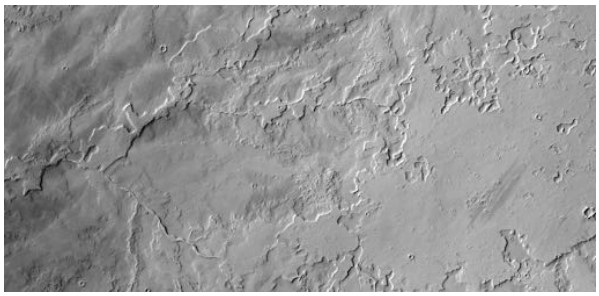

Figure 2. Detailed image of Flow A (right side) and corresponding tube (left). Lava appears to have traveled from the main tube to the flow through two narrow tubes in the middle of the image. The tubes appear to have "leaked" lava at some points along their path.

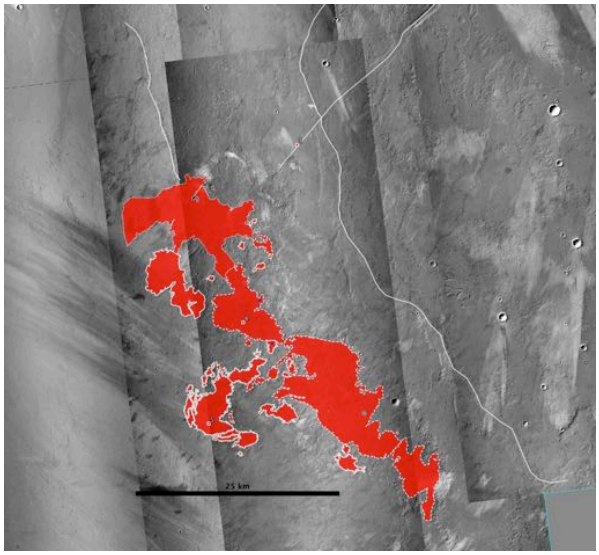

Figure 3. Map of Flow B and nearby tubes. The scalebar represents 25 km. A gradient of 0.07° was calculated starting at the tube in the upper right and descending to the lower left part of the flow.