INFLATED LAVA FLOWS WEST OF MARS' THARSIS MONTES. C. A. Wishard[1], J. R. Zimbelman[2] and L. A. Hennig[3], [1]Thomas Jefferson High School for Science and Technology Astronomy and Astrophysics Senior Research Laboratory, 6560 Braddock Road, Alexandria, VA 22312-2297, 2013cwishard@tjhsst.edu; [2]CEPS/NASM MRC 315, Smithsonian Institution, Washington, D.C. 20013-7012, zimbelmanj@si.edu.

Introduction: An inflated lava flow starts out as a large expanse of basaltic pahoehoe lava. Irregular cooling causes the surface of the sheet to harden and solidify while the inside of the lava remains molten and hot. The hot lava presses out on the crust, overtaking it and inflating the sheet from a few centimeters high to almost 20 meters tall [1]. A recent study shows that inflated lava flows are relatively abundant on the eastern side of the Tharsis Region; this study recorded a 12.8 percentage rate for "good candidates" for inflated flows in the studied region [2]. A study conducted in the western region of the Tharsis Montes of Mars will expand upon the results of the previous study, using comparable satellite images.

Procedures: Three areas on the western side of the Tharsis Montes region were studied. The coordinates were (10N – 20N, 245E – 255E), (5S – 5N, 235E – 245E) and (10S – 25S, 220E – 240E).

Identifying inflated flows via satellite images: To be considered a candidate for an inflated lava flow, an image must contain key features indicative of a flow. In an image, an inflated lava flow should be large and relatively smooth looking [1]. No major texture should be visible on the surface of the candidate lava flow. An inflated lava flow should have an irregular margin and cover a large area of the Martian surface in moderate spatial resolution images. Finally, an inflated flow should be clearly raised to a relatively uniform height in relation to the land around it [2]. In a grayscale image, it can be difficult to determine whether an area is raised or depressed. Impact craters in an image help to determine the angle of the incident sunlight, based on the orientation of a depressed feature's shadow. Knowledge about the angle of the sun helps to determine the elevation or depression of unknown features.

Instrument: This study was conducted using the THEMIS (Thermal Emission Imaging System) onboard the Mars Odyssey spacecraft [3]. All of the images examined here were taken in the visible spectrum; these images all have a resolution of about 17 to 18 meters per pixel [3].

Classification System: As the THEMIS images were analyzed, a spreadsheet was kept, recording the frame identification number and the status of the image. Images were evaluated using the requirements stated above. Images with no possible inflated flows in the frame were marked with the notation "nothing". These images showed flat terrain with no elevation or intensely textured terrain. Images with possible inflated flows were marked "possible" and images with probable inflated flows were marked "yes". The flows marked "possible" and "yes" were reevaluated after the initial evaluation to make sure that they contained a good candidate for an inflated flow.

Results: After reviewing 1062 THEMIS images, it was determined that about 3.6% of the images contained candidates for inflated lava flows. Figures 1, 2 and 3 show example images of the best candidates found for inflated lava flows.

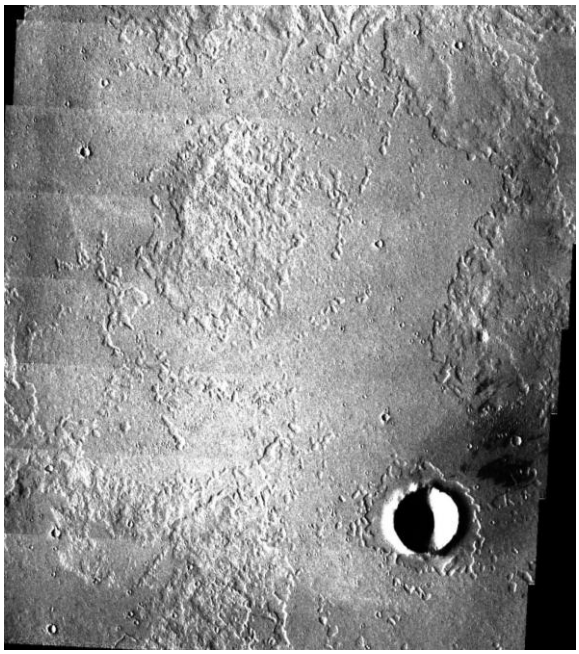

Figure 1: THEMIS image V26675047 shows a moat around the crater at the bottom right. This is most likely where the flow ran into the ejecta from the impact crater before it inflated. This candidate is near (19.6 N, 253.6 E).

Figure 2: THEMIS image V26962023 features a good candidate for an inflated lava flow below the same impact crater shown in Figure 1. This candidate is near (18.9 N, 253.6 E).

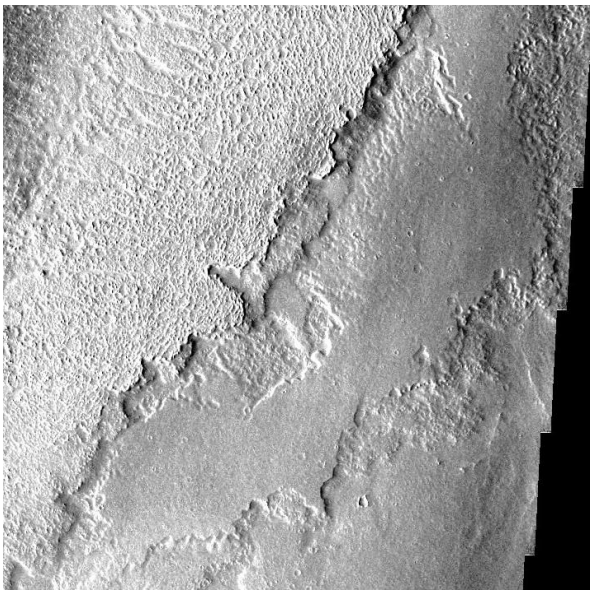

Figure 3: THEMIS image V39552007 is a good candidate for an inflated lava flow. This candidate is near (13.0 N, 247.7 E).

These candidates were widely dispersed throughout the three regions examined and there was no apparent pattern to the placement of the flows.

Discussion: While it is possible that, of the 1062 images, a small number were overlooked or mislabeled, we believe that a 3.6% candidate rate is a good estimate of the true percentage of inflated lava flows in the western Tharsis region. This percentage is notably less than the 12.8 percentage found in the previous study conducted in the eastern Tharsis region [2]. A percentage rate of 3.6 demonstrates that detection of inflated flows in the Tharsis Region of Mars is more variable spatially than previously thought. A reason for this discrepancy could be the angle of the slope that the lava traveled down. A more gradual slope will increase the possibility of inflated flows, due to the mechanics by which an inflated flow forms. A steeper slope will decrease the possibility of flows, because the surface of the lava will have less time to cool and form a crust before the inside of the flow catches up to it. Inflated flows, therefore, can be readily found in areas that contain a very gradual elevation slope. These areas also need to contain large amounts of lava. While this investigation was conducted in an attempt to expand and improve upon the findings of McCarthy and Zimbelman [2], this study found spatial variability within the Tharsis region that should add to our understanding of the mechanics of inflated lava flows on Mars.

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References:

[1] Garry B. W. et al. (2011) IAG Planetary Geomorphology Working Group, *Inflated Lava Flows on Earth and Mars.* http://www.psi.edu/pgwg/images/Oct11Image.html.
[2] McCarthy, M.L., & Zimbelman, J. R. (2013). *Inflated lava flows east of Mars' Tharsis Montes,* LPS XIIV, Abstract 1153.
[3] http://themis.asu.edu/about