MAPPING INFLATED LAVA FLOWS IN CTX IMAGES NEAR ELYSIUM MONS, MARS. A.C. Venzke[1] and J.R. Zimbelman[2], [1]Beloit College Department of Geology, Beloit, Wisconsin 53511, venzkeac@beloit.edu [2]CEPS/NASM MRC 315, Smithsonian Institution, Washington, D.C. 20013-7012, zimbelmanj@si.edu.

Introduction: Inflation can occur in pahoehoe lava when it travels over a surface with a very shallow gradient. The inflation process starts when the exposed crust and sides of a lava flow begin to cool and harden. Lava, still hot and fluid, flows beneath a thin colder crust, which behaves as a thermal shield. This crust develops a sufficient strength to retain the incoming lava producing an increase in hydrostatic head at the flow front. By the continued injection of lava, the tensile stress increases in the cooled crust until the inflated front breaks and a new lava lobe forms. The repetition of this phenomenon creates a series of inflated lobes linked together to form a unique sheet inflated lava flow, which can expand to over 10m in height. [1, 2]. Inflated flows are typically much longer and wider than they are thick.

Whether inflated lava flows are commonplace on Mars has been in question for some time. A few groups have searched for examples, primarily in the Tharsis region, and these studies have reported diverse abundances [4]. Earlier studies used many THEMIS (Mars Odyssey Thermal Emission Imaging Spectrometer) visible images to locate candidate inflated flows but since then, CTX (Mars Reconnaissance Orbiter Context Camera) images have been studied more thoroughly and they provide a factor of 3 improvement in resolution over THEMIS VIS images. As images, methods, and spacecraft data analysis techniques become more refined, perhaps the inflated flows will become easier to spot and map using spacecraft images.

Methods: We searched for inflated lava flows in the Elysium region of Mars. The Tharsis region has been the focus of multiple searches for inflated lava flows previously but more inflated flows should be sought across the surface of Mars. This specific project focused on a large area west and northwest of the Elysium volcanic province. The data examined included images from the Mars Reconnaissance Orbiter Context Camera (CTX), which with 6 m/pixel resolution has an improvement in resolution over the THEMIS VIS images that were used in previous studies. The inflated lava flows were mapped using the publicly available program JMARS [3] which laid the CTX images over a MOLA (Mars Orbiter Laser Altimeter) shaded relief base map. Inflated lava flows were identified based on a number of different characteristics, the first being that such flows should have a flat, smooth top with little to no relief in the CTX images. Flows with irregular surfaces are assumed to be normal ‘a‘ā flows, or possibly pahoehoe flows that did not undergo inflation. Second, the candidate inflated flows should have irregular edges, for similar features with uniform edges may be either aqueous or glacial in origin [5, 6]. Third, the flows should be tabular, meaning that they are much wider and longer than they are thick. Fourth, the flows must be elevated above their surroundings [4].

CTX images were then rendered in JMARS (Java Mission-planning and Analysis for Remote Sensing) in order to obtain a more complete picture of each flow, before they were given a label for no inflated flows, possible inflated flows, and good inflated flows. The good inflated flows label, along with the longitude and latitude and brief description were entered onto a Google sheets spreadsheet, to keep track of the good flows being evaluated.

Results: A total of 18 CTX images contained what were classified as “good” inflated lava flows, out of a 168 total CTX images examined in the Elysium Mons region. This gives us an approximate number of 10.7% of CTX images in the Elysium region that contain “good” inflated lava flows. The inflated lava flows in figure 1 and 2 were both found in the middle cluster of CTX images shown in figure 3.

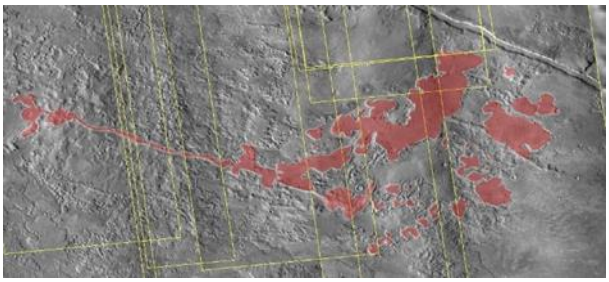

Figure 1. Location of a very good inflated flow near Elysium Mons. Image is centered on 139.803E, 38.154

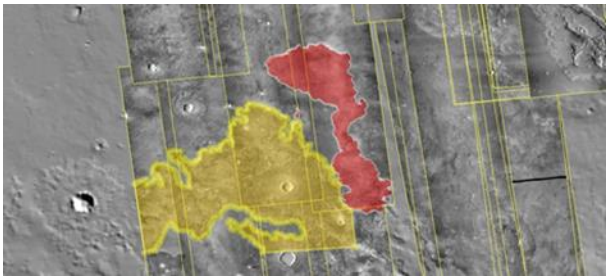

Figure 2. Two adjacent good inflated lava flows in the Elysium Mons region. Image is centered on 139.672E, 33.373.

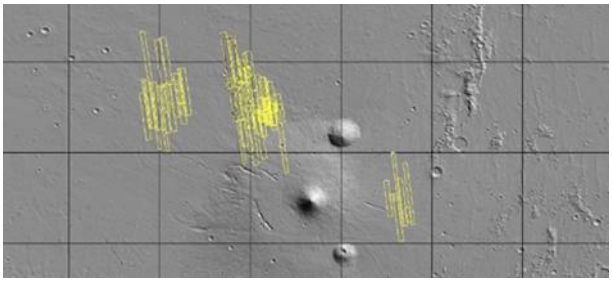

Figure 3. Locations of CTX images examined in the Elysium Mons region (Elysium Mons is the middle of the 3 volcanic mountains). Each yellow box is a CTX image footprint, overlain on a MOLA shaded relief image of the region of interest.

There were inflated flows discovered in the other two clusters, but due to time constraints available to this project, those areas were not investigated further, so more inflated flows may be present in those regions, something worthy of further investigation in the future.

References:

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