Paper ID: 16599
oral
student

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 2 (3B)

Author: Mr. Jun Huang
China University of Geosciences,Wuhan, China, jhuang.cug@gmail.com

Dr. Michael Kraft
United States, mdkraft@asu.edu
Prof. Philip Christensen
United States, phil.christensen@asu.edu
Prof. Long Xiao
China, longxiao@cug.edu.cn

NEW EVIDENCE FOR EARLY EXPLOSIVE VOLCANISM ON MARS

Abstract

There has been a debate over the dominate style of volcanism (effusive or explosive) in early martian history, which are the fundamental processes forming the crust of Mars. We identify and characterize knobby terrains on the slopes of Noachian volcanoes in the Thaumasia Highlands and we interpret them to be eroded remnants of pyroclastic flows to support explosive volcanism. We used imaging data from THEMIS global mosaic (100 m/pix) and gridded topographic data of MOLA (128 ppd) to show the overall regional context. Then we showed local and detailed geomorphology using data of CTX (6 m/pix) and HiRISE (30 cm/pix). Using THEMIS nighttime IR data converted to thermal inertia we derived the thermophysical nature of the materials in these terrains. The knobby terrains we observed occur on the southern slope of a heavily modified ancient volcano (6000 m above datum). The volcano has a crater retention age of 3.94 Ga and stands 1500-2000 m above the surrounding area. The slopes of the volcano are incised by channels. Knobby terrains occur in the areas between channels and they have a rough and blocky appearance. They are curved near their bases as in a style of erosion. Individual knobs are separated by topographically low lineations. The lineations generally trend NW or ENE and most likely are joints occur-ring in bedrock. Knobs occur in clusters with knobs of similar size(cluster 1: 30-40 m in diameter and 10-20 m high; cluster 2: 5-15 m in diameter and 5-10 m in height). The knobby materials have a sharp appearance and maintain steep slopes, indicating the material is well consolidated. The knobby terrains are relatively dark-toned and dust-free (Dust Cover Index > 0.97); however, the thermal inertia of the knobby terrains is surprisingly low (190-210 Jm-2K-1s-1/2). These properties could be consistent with bedrock covered by dark, fine-grained material, such as volcanic ash. It is also plausible that the knobs themselves are consolidated fine-grained material, such as a volcanic tuff. We expect to add to these initial results with further work to: 1) investigate the distribution of these unique knobby terrains; 2) determine the composition of the knobs; and 3) further analyze morphology and assess possible erosion mechanisms. Discussion with C. Edwards is appreciated. JMARS (http://jmars.asu.edu/) was used in data process. We thank R. Fergason for providing the thermal inertia products.