EROSIONAL MODIFICATION OF APOLLINARIS MONS, MARS. N.P. Lang[1], E. DeFazio[1], R. Schneider[1], [1]Department of Geology, Mercyhurst College, Erie, PA 16546, nlang@mercyhurst.edu.

Introduction: Apollinaris Mons is an ~3.7 Ga Martian volcano [1-2] interpreted to have formed through a series of explosive eruptions that temporally transitioned into effusive activity [3]. Most work on Apollinaris has focused on the processes that contributed to, both, edifice construction and evolution of its summit caldera complex [e.g., 3-5]. Here we take a different approach by addressing how the volcano has eroded. By examining the erosive processes that have operated on Apollinaris, additional insight into the early evolution of this volcano can be gleaned.

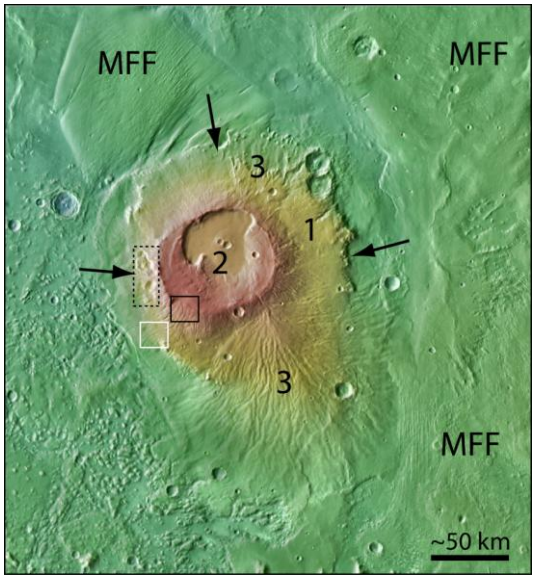

Figure 1: THEMIS daytime IR image overlain by MOLA colorized shaded relief image highlighting the physical characteristics of Apollinaris Mons. 1 = main edifice; 2 = summit caldera complex; 3 = fan materials; black arrows = mass wasting scars; black box = fig. 2; white box = fig. 3; dashed box = fig. 4; MFF = Medussa Fossae Formation. Image centered at 8.5 S, 176 E.

Apollinaris Overview: Apollinaris is a singular, isolated volcano with an E-W diameter of ~160 km and that is located near the boundary between the northern lowlands and the southern highlands at ~8.5˚S, 174˚E. It can be divided into three major morphologic features [e.g., 3] (Fig. 1): 1) the main edifice, 2) the summit caldera complex, and 3) fan materials. In this contribution we focus on erosion that has shaped the main edifice.

Much of the main edifice consists of amorphous fine-grained materials that appear to lack large-scale internal structuring such as layering and mechanical strength, though the upper-most few meters of these deposits seem to be mechanically stronger than the underlying materials. CTX imagery reveals the presence of aeolian deposits (possible longitudinal dunes or even yardangs?) on some edifice materials (Fig. 2). These deposits show a predominant northeast-trend and appear texturally similar to material that comprises the MFF [e.g., 5].

Cutting through the edifice's deposits are channels that are straight on the upper most slopes near the summit caldera complex, but either dissipate or meander at shallower slopes. The channels lack distributaries [5], but channels do have minor tributaries near the summit. At the termini of a few channels on the western flank, leveed materials appear to have emerged (Fig. 3); the presence of levees in these materials indicates that the material has some mechanical strength, which would be consistent with them being either lava flows or perhaps even debris flows [e.g., 5]. Although these deposits have travelled through these channels, it is not clear if these are the materials that carved the channels. No materials can be observed to have emerged from other Apollinaris channels.

The edifice has also been characterized by at least three mass wasting events. The first event is the scarp located around Apollinaris' base. With the exception of the southwest part of Apollinaris, there is an absence of eroded materials from around much of the scarp. Materials around the southwest side may have undergone possible sliding away from the base. In additionn, topographic profiles around the basal scarp indicates that it does not occur at the same elevation around Apollinaris. A second scarp occurs on the southwest corner of Apollinaris (to the lower right of the white box in Figure 1) that also lacks associated eroded materials. The third mass wasting event is the occurrence of localized slumping (also) on the western side (Fig. 4), which has a slightly steeper slope than the eastern side of the volcano (slope = 4.5° to 5° on the western side vs. ~3° on the eastern side).

Discussion: Erosion has modified Apollinaris via at least two distinct processes: 1) channel formaton and 2) mass wasting. Both processes show evidence of having occurred when this volcanic system was still active. However the driving cause(s) of the erosion is unclear, but may have been enhanced by the fact that materials comprising the main part of the edifice appear to be weak and poorly consolidated. In such a case, building the volcano on a weak substrate such as the MFF [e.g., 5] may have facilitated gravitational

spreading of the edifice. Further, channels could easily have been formed in weak materials by either lavas, debris flows, water, or pyroclastic flows. The presence of aeolian deposits on the main edifice indicates that aeolian processes also likely play a dominant role in the shaping of Apollinaris. Wind may be burying Apollinaris in MFF-related deposits [5] at the present time, but it may have also set the stage for some of the mass wasting that has occrrued here. Specifically, local slumping occurs only on Apollinaris' western side, which may be steeper due to the southwesterly winds transporting materials to the northeast; the steepening of the slopes on the west side may have made slumping more likely. Ultimately, the erosional modification of Apollinaris appears to be a longterm, interrelated process that has been amplified the by the presence of a fine-grained, mechanically weak main edifice.

References: [1] Greeley, R. et al. (2005), *JGR*, 110, E05008, doi:10.1029/2005JE002401. [2] Robbins, S.J., et al. (2011) *Icarus*, 211, 2, 1179-1203. [3] Robinson M., et al. (1993) *Icarus*, 104, 2, 301-323. [4] Farrell, A.K., and Lang, N.P. (2011), *42nd LPSC*, Abstract 2072. [5] Gregg, T.K.P., and Krysak, D.J. (2011), *42nd LPSC*, Abstract 1922.

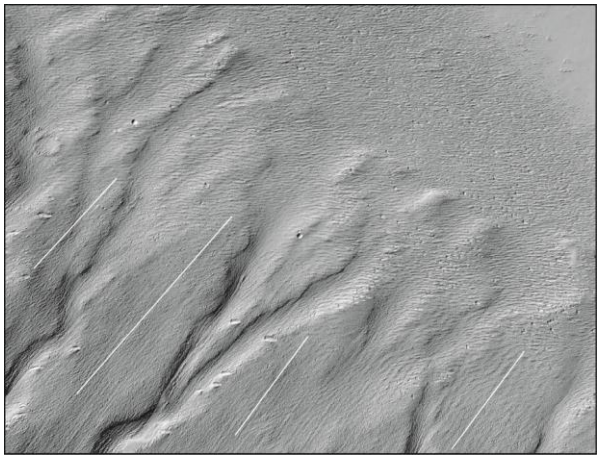

Figure 2: CTX image of Apollinaris highlighting yardangs that occur on the main edifice. Yardang trends are highlighted by white lines; yardang material appears similar to that of the MFF [e.g., 5]. Figure is ~10 km across.

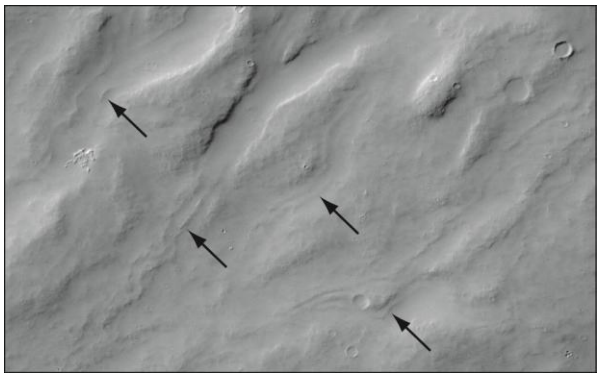

Figure 3: CTX image of Apollinaris highlighting leveed material (black arrows) that has travelled through channels on the edifices western flank. The presence of levees indicates that this material has some mechanical strength. Image is ~10 km across.

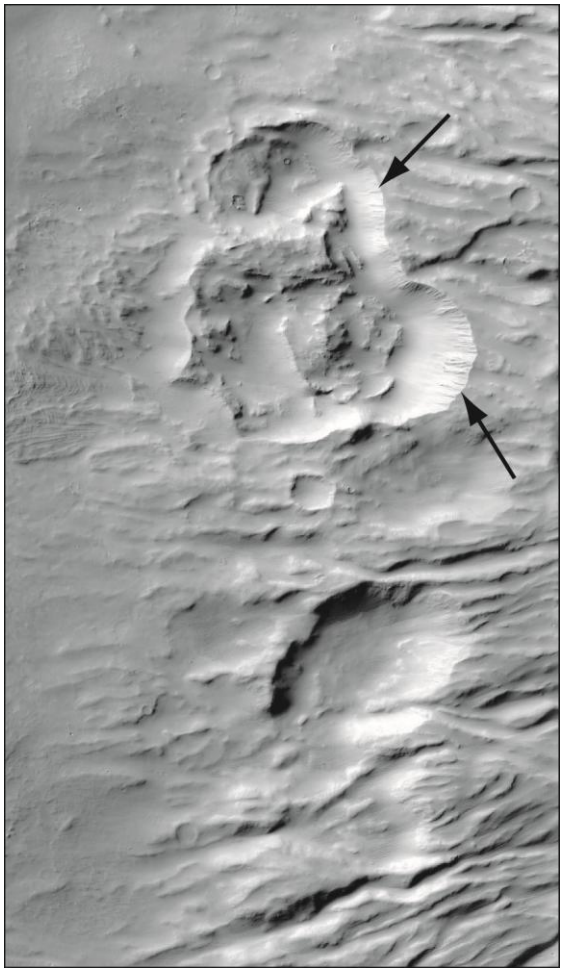

Figure 4: CTX image highlighting slumping (black arrows) that has occurred on Apollinaris' western flank. Slumping has occurred only on the edifice's western side, which is steeper than the eastern side. Image is ~15 km across.