ARSIA MONS FLANK PIT CRATERS AND VALLEYS: MODIFICATION BY DOWNSLOPE MOVEMENT PROCESSES. J. L. Dickson[1], J. W. Head[1], R. L. Parsons[1], G. Neukum[2] and the HRSC Co-Investigator Team. [1]Department of Geological Sciences, Brown University, Providence RI 02912 (james_dickson@brown.edu). [2]Freie Universitaet Berlin, Berlin, D-12249, Germany.

Summary: Pit craters and linear valleys at the southern margin and flank of the summit of Arsia Mons formed in association with volcanic activity related to lateral emplacement of magma from a reservoir beneath the summit and emplacement of a fan of lava flows along the edifice flank [1,2]. We use new HRSC image data to document a range of features associated with modification processes of the pits and linear valleys. We find evidence for several candidate modification processes (e.g., mass wasting, slumping, gelifluction, solifluction, and glaciation),

Introduction: The summit of Arsia Mons is capped by a large caldera and flanking rift zones which feed huge lava fans [1]. Sources for these lava fans are interpreted to be dikes emplaced laterally from magma reservoirs at neutral buoyancy zones within the edifice [2]. Repeated extrusions of lava have formed volcanic collapse pits and linear valleys along the upper parts of the lava fans near the summit (Fig. 1a-b). Here we report on modification processes associated with these source region topographic features in order to assess their history and to infer the potential role of climatic processes (e.g., presence of water and ice aiding and assisting in gravity driven modificational processes) in their emplacement.

New High Resolution Stereo Camera data obtained during the ESA Mars Express Mission has provided important new insight into geological processes on Mars. We use these data to analyze modificational processes of these volcanic and volcano-tectonic landforms (Fig. 1c-h).

Morphology: Examination of the HRSC data shows evidence for several different types of deposits which exhibit the following characteristics:

Shape: 1) Lobate: Tend to extend out from the base and sometimes to change direction (down-valley) with slope (Fig. 1c-d). 2) Parallel: Tend to extend parallel to slope (Fig. 1e-g). 3) Cuspate: Tend to be on crater interiors and appear similar to the lunar crater Dawes-type wall slumps (Fig. 1h).

Associated features: 1) Distal ridges: these are generally symmetric ridges at the outer edge of the deposit (Fig. 1c-f). 2) Internal ridges: these occur in several deposits and can be both concentric and radial with concentric dominating in abundance (Fig. 1e-f). 3) Marginal ridges: these are generally symmetric ridges at the flanks of the deposit (Fig. 1c,f). 4) Distal/Marginal ridges: these are generally symmetric ridges at the outer edge of the deposit that also extend along the sides (marginal). The marginal ridges strongly resemble lateral moraines in some cases (Fig. 1c, top). 5) Cuspate ridges: These usually occur internal to the deposit and can be multiple, and usually are convex outward (Fig. 1g). 6) Internal lobes: These emerge from the base of the talus and extend into and onto the deposit; they appear to be relatively late-stage lobes (Fig. 1f-g). 7) Hummocks: These are several hundred meters wide and can be equidimensional or elongated (Fig. 1c-d). 8) Cones and sheets: These occur upslope from the deposits and are often superposed on them (Fig. 1d-f). These resemble talus cones, sheets and aprons. 9) Outcrops: These occur at the top of the section and are the source of the talus aprons (Fig. 1c-g).

General Configuration and Age: These features occur along the base of walls in exposures of the southern Arsia flanking rift zone and occur primarily on south, west and southwest facing slopes. This orientation suggests that there may be insolation-related factors (e.g., heating, water vapor accumulation and diffusion) in their location and emplacement. The features are too small to date reliably with crater counts, but superposition relationships suggest that they are largely Amazoinan in age (e.g., they modify walls of graben and pit craters and are superposed on valley floors of Hesperian and Amazonian age [3]). Superposed 1) impact craters, and 2) talus aprons suggest that the larger deposits have not formed recently.

Discussion and Summary: A range of possible origins can be considered for these features: 1) Mass wasting and talus aprons: Clearly the major features themselves (Fig. 1) have been modified since their formation by mass wasting from downslope movement of debris. 2) Landslides/slumps: This is the most obvious possibility. Steep slopes, lobate deposits at the base, some radial texture, larger than normal ampitheaters at the head, all suggest that this porcess has occurred. It is also clear that some of the craters have the Dawes-like imbricate scarps in the interior and these are very similar to wall slumps particularly where cuspate deviations in the circular crater rim are associated. 3) Rock glaciers: The marginal/lateral ridges, the ampitheater association, and the migration of ridges up slope on the margins all could be related to ice-assisted debris flow or to debris covered glaciers [e.g., 4]. The preferential orientation may favor certain geometries for local ice and snow accumulation and preservation that could be related to Amazonian glaciation on Arsia Mons. Also associated with these the presence of ice could be gelifluction lobes, potentially supported by the lobate nature of these features and the multiple, often imbricate-looking lobes.

References: [1] L. Crumpler and J. Aubele (1978) *Icarus*, 34, 496. [2] L. Wilson and J. Head (1994) *RGSP*, 32, 221. [3} D. Scott and K. Tanaka (1986) *USGS Map I-1802-A*; [4] G. Neukum et al. (2004) *Nature*, 432, 971. [5] J. Head and D. Marchant (2003) *Geology*, 31, 641.

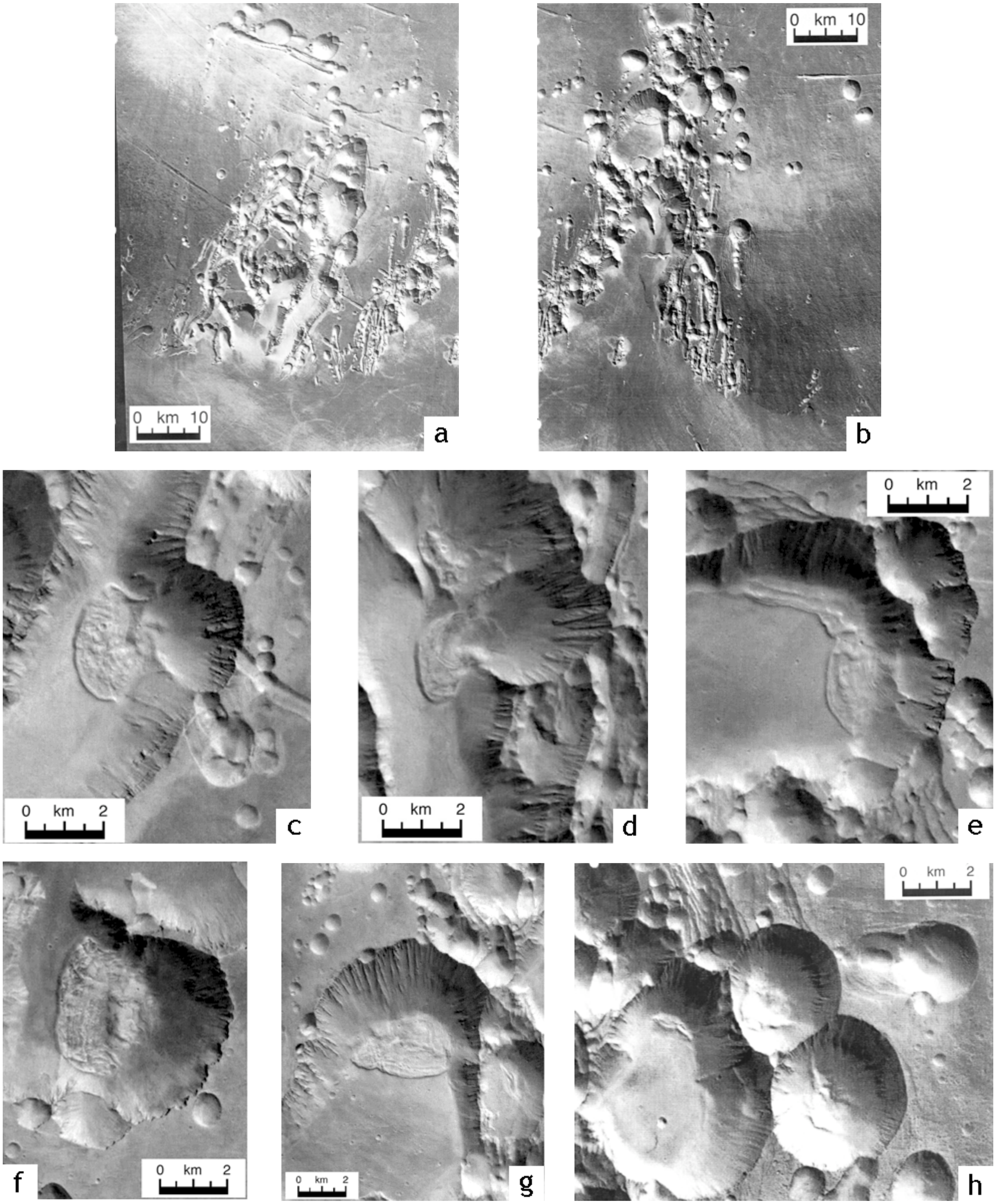

Figure 1. HRSC images of the southern rim of Arsia Mons summit showing individual features modifying pit craters and linear troughs Context (a, b) and individual occurrences (c-h). HRSC orbit 263.