TRANSVERSE AEOLIAN RIDGES OBSERVED AT PRESSURE EXTREMES WITHIN THE MARTIAN ATMOSPHERE.

C. D. Dressing[1], J. L. Andros[1], H. E. Kashdan[1], J. R. Zimbelman[2], and L. A. Hennig[1], [1]Thomas Jefferson High School for Science and Technology, Astronomy Research Lab, 6560 Braddock Rd, Alexandria, VA 22312, [2]CEPS/NASM, Smithsonian Institution, Washington, D.C. 20013-7012 (zimbelmanj@si.edu).

Introduction: We carried out a preliminary investigation of Mars Orbiter Camera (MOC) narrow angle (NA) images of two locations that represent the pressure extremes currently present on Mars. The study areas are the summit of Ascraeus Mons volcano (11N, 255E) and the lowest part of the Hellas impact basin (~33S, 62E). MOLA topographic data [1, 2] indicate elevations for these areas of ~18.2 km (A.M.) and –8.2 km (Hellas), which for an atmospheric scale height of 10 km [3] indicates atmospheric pressures of ~1 mb (A.M.) and ~14 mb (Hellas). We searched MOC NA images of both areas looking for transverse aeolian ridges (TARs) [4], in order to assess whether atmospheric pressure correlates with observable attributes of the TARs (as part of MDAP grant NNG04GN88G).

Methodology: We studied images from the Mars Orbiter Camera (MOC) aboard Mars Global Surveyor to search for TARs in both areas. For Ascraeus Mons, all images from September 1997 (time period AB01) to March 2005 (time period S04) were analyzed. Hellas Basin has been analyzed from September 1997 (time period AB01) to March 2000 (time period M12). Our observations of each image were recorded in a spreadsheet to allow us to search by latitude, longitude, season, and other parameters.

Results: We now present the preliminary results from our search of MOC NA images at the two locations with atmospheric pressure extremes.

Summit of Ascreaus Mons. We analyzed all images within the outer caldera rim (10 to 13°N, 254 to 257°E). TARs were only detected in areas that were topographically lower than the surrounding terrain. These depressions may facilitate dune formation by acting as a wind tunnel to concentrate the air stream so that particulates could be transported. TARs were always observed to be perpendicular to the walls of the local depressions (Figure 1). Of the 47 images observed, 15 (approximately 32%) showed TARs.

Floor of Hellas Basin. We analyzed all images within the parabola-shaped lowest contour roughly parallel to the nearby curve of the basin rim, from 45 to 60°E and 30 to 47.5ºS. TARs within Hellas (Figure 2) apparently do not require the aerodynamic concentration of depressions to form, in contrast to the summit of Ascraeus Mons. This observation may reflect the influence of the atmospheric pressure being ~14 times greater on the basin floor than at the top of the volcano, or it may be related to proximity and volume of sources of particulates in both locations. TARs typically were observed at multiple locations within a single image. Dust devil tracks often are correlated with TAR locations, possibly because the local winds are particularly strong in these regions. Of the 22 images observed, 2 (approximately 9%) showed TARs but investigations in Hellas are ongoing. Furthermore, as the target region within Hellas is very large, the potential locations of TARs are much more spread out.

Discussion: Although all publicly available Ascraeus Mons caldera images have been analyzed, only a fraction of the Hellas Basin floor images have been studied to date. Because Hellas is such a large region, we have chosen to focus on the area with the lowest elevation, but TARs could potentially be located in numerous regions within the large area of the basin. Other limitations to the search include periodic dust storms, which prevent clear observations of the surface in images obtained during the dusty periods, and possibly the resolution of the MOC NA images (as wonderful as it is) may not be sufficient to reveal the smallest landforms. Further research could include examination of all available Hellas images across the entire basin floor, as well as all newly released Ascraeus Mons caldera images. Analyses of Mars Express, Mars Odyssey, and Mars Reconnaissance Orbiter images would also provide more data on these areas, but it is likely that a resolution at least as good as MOC NA may be required to show most TARs. We also in the process of making wavelength measurements to document any systematic changes in TAR dimensions at both locations.

Conclusions: TARs located at Ascraeus Mons are always observed to be perpendicular to the linear or arcuate depression walls in which they are located. It appears that these features can only form within the bounds of a depression; this may be an artifact of the extremely low atmospheric pressure found at the 18 km elevation of the summit. Winds outside of the depressions may be too weak and unfocused to facilitate particulate transportation. The 13 mb difference in air pressure at the two regions may contribute to the different appearances of features at the two sites, but other factors (e.g. particulate source proximity and abundance) also likely contribute to the observations reported here. Hellas TARs do not appear to require nearby walls or cliffs to form, and they can be located outside of any observable depression; we hypothesize that the enhanced atmospheric pressure at this low elevation is at least a significant (if not the dominant) factor in this lack of TAR localization within Hellas.

References: [1] Smith D.E. et al. (2001) *JGR, 106*, 23689-23722. [2] U.S.G.S. (2003) *Map I-2782*, scale 1:25,000,000. [3] Leovy C.B. (1979) *Ann. Rev. Astron. Astrophys.*, *17*, 387-413. [4] Wilson S.A. and Zimbelman J.R. (2004) *JGR, 109*, E10003, 10.1029/2004JE002247.

Figure 1. TARs in Ascraeus Mons (from image M08-05021). Image dimensions: 1660 m x 1540 m. North towards top of image. NASA/JPL/MSSS.

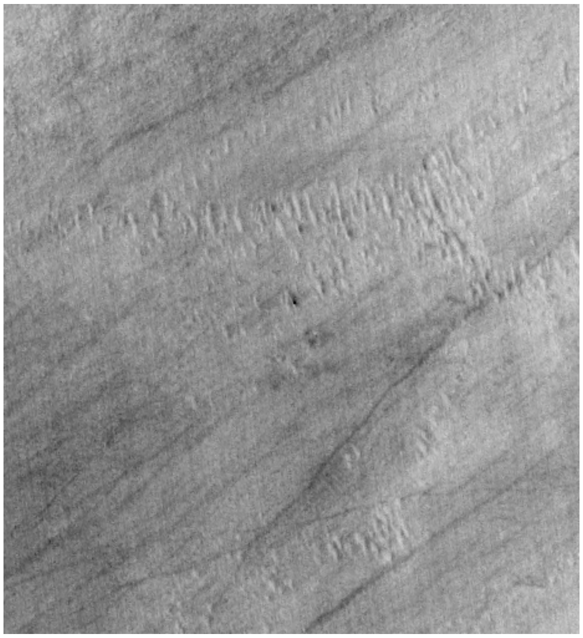

Figure 2. Dunes in Hellas Basin (Section from image M10-03003). Image dimensions: 1930 m x 1420 m. North towards top of image. NASA/JPL/MSSS.