MAPPING HESPERIA PLANUM, MARS. Tracy K.P. Gregg[1] and David A. Crown[2], [1]Department of Geology, 876 Natural Sciences Complex, University at Buffalo, Buffalo, NY 14260, tgregg@geology.buffalo.edu; [2]Planetary Science Institute, 1700 E. Ft. Lowell Rd., Suite 106, Tucson, AZ 85719, crown@psi.edu.

Introduction: Hesperia Planum, characterized by a high concentration of mare-type wrinkle ridges and ridge rings [1-4], encompasses > 2 million km^2 in the southern highlands of Mars (Fig. 1). The most common interpretation is that the plains were emplaced as “flood” lavas with total thicknesses of <3 km [4-10]. The wrinkle ridges on its surface make Hesperia Planum the type locale for “Hesperian-aged ridged plains” on Mars [e.g., 9], and recent investigations reveal that wrinkle-ridge formation occurred in more than one episode [4]. Hesperia Planum’s stratigraphic position and crater-retention age [e.g., 9, 11-12] define the base of the Hesperian System. However, preliminary results of geologic mapping reveal that the whole of Hesperia Planum is unlikely to be composed of the same materials, emplaced at the same geologic time. To unravel these complexities, we are generating a 1:1.5M-scale geologic map of Hesperia Planum and its surroundings (Fig. 1). To date, we have identified 4 distinct plains units within Hesperia Planum and are attempting to determine the nature and relative ages of these materials (Fig. 2) [13-15].

Hesperia Planum Plains Materials: Geologic units within Hesperia Planum can be broadly classified as those associated with Tyrrhena Patera, and those that are not (Fig. 2). Crown and others [14] discuss the characteristics and relative ages of the Tyrrhena Patera materials [see also 16-20]. The plains materials to the south and southeast of Tyrrhena Patera are heavily affected by fluvial, ice, and possibly lacustrine processes [16, 21, 22], making interpretations of the original nature of the materials difficult. Here, we discuss previously unidentified plains units within eastern Hesperia Planum and the adjacent highlands.

The region of Hesperia Planum located to the east of Tyrrhena Patera (Fig. 2) is the typical “Hesperian ridged plains” [7, 9]. Aside from Tyrrhena Patera, no obvious volcanic vents have been found within Hesperia Planum [cf. 4, 12, 17, 19-21]. Lava flows can be seen at available image resolutions in the Tyrrhena Patera lava flow field [17] that post-dates the ridged plains, but they are not readily apparent within the ridged plains. In eastern Hesperia Planum, we have identified the following plains units: *highland knobby plains*, *smooth plains*, *highland smooth plains*, and *knobby plains*. MOLA data reveal that the east and west boundaries of the continuous topographic basin that defines Hesperia Planum closely follow the 2-km contour, and most of what has been geologically defined as Hesperia Planum [cf. 1, 7] is contained within that contour line. In contrast, highland plains occur in isolated outcrops surrounded by highlands material (Fig. 3). Units with the descriptor “highlands” are found at elevations above 2 km [15]. Jones and others [15] discuss the potential for these basins to have been sites of temporary lakes, fed by highland valley networks.

Highlands Materials: As part of her M.S. thesis, Jones [23] identified 3 distinct units within the highlands subregion located in the extreme northwest corner of the map area. These units are characterized primarily on the basis of erosional morphology: the density and size of gullies and channels; the crispness of topographic crests and troughs; the degree of outcrop isolation (an individual massif surrounded by plains deposits versus a part of a broader highlands region). It is not yet clear whether these are appropriate distinguishing characteristics for highlands geologic map units; however, their spatial distributions may reveal significant information about the erosional history of the region.

Mapping Progress: Units have been identified and are being mapped across the region. Preliminary crater size-frequency distributions have been calculated using Barlow’s crater database for craters ≥5 km in diameter. The plains-forming materials are mapped; we are currently working on mapping the highlands materials and comparing our results with those found in published 1:500K-scale maps of the region.

References: [1] Scott, D.A. and M. Carr (1978) *USGS Misc. Series I-1083*. [2] Chicarro, A.F., P.H. Schultz and P. Masson (1985) *Icarus 63*:153. [3] Watters, T. and D.J. Chadwick (1989) *NASA Tech. Rpt. 89-06*:68. [4] Goudy, C., R.A. Schultz and T.K.P. Gregg, *J. Geophys. Res. 110*: E10005 10.1029/2004JE002293. [5] Potter, D.B. (1976) *USGS Misc. Series I-941*. [6] King, E.A. (1978) *USGS Misc. Series I-910*. [7] Greeley, R. and P. Spudis (1981) *Rev. Geophys. 19*:13. [8] Scott, D.A. and K. Tanaka (1986) *USGS Misc. Series I-1802A*. [9] Greeley, R. and J. Guest (1987) *USGS Misc. Series I-1802B*. [10] Leonard, J.G. and K. Tanaka (2001) *USGS Misc. Map Series I-2694*. [11] Tanaka, K.L. (1986) Proc. LPSC 17th, JGR Suppl. 91, E139-E158. [12] Tanaka, K. (1992) in *Mars*, U. Arizona Press, p. 345. [13] Gregg, T.K.P. and D.A. Crown

(2007) *Lun. Planet. Sci. Conf. 38th*, Abstract #1190. [14] Crown, D.A., D.C. Berman and T.K.P. Gregg (2007) *Lun. Planet. Sci. Conf. 38th*, Abstract #1169. [15] Jones, T.K., T.K.P. Gregg and D.A. Crown (2007) *Lun. Planet. Sci. Conf. 38th*, Abstract #2156. [16] Mest, S. and D.A. Crown (2001) *Icarus 153*:89. [17] Greeley, R. and D.A. Crown (1990) *J. Geophys. Res. 95*:7133. [18] Gregg, T.K.P., D.A. Crown and R. Greeley (1998) *USGS Misc. Series I-2556*. [19] Gregg, T.K.P. and M.A. Farley (2006) *J. Volcanol. Geophys. Res. 151*:81-91. [20] Farley, M.A., T.K.P. Gregg and D.A. Crown (2004) *USGS Open File Rpt. 2004-1100*. [21] Ivanov, MA et al. (2005) JGR 110, E12S21. [22] Crown, D.A., L.F. Bleamaster III and S.C. Mest (2005) *J. Geophys. Res. 110, E12S22*, doi:10.1029/2005JE002496. [23] Jones-Krueger, T. (2007) *M.S. Thesis*, University at Buffalo, Buffalo, NY, 94 pp.

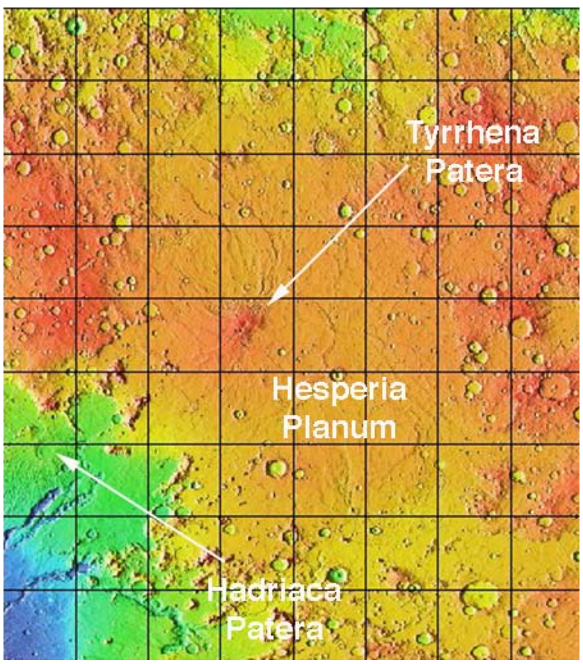

Figure 1. Gridded MOLA data (128 pixels/degree) of the area being mapped at 1:1.5 million. Reds are topographic highs (Tyrrhena Patera summit is ~3 km above mean planetary radius) and blues are lows.

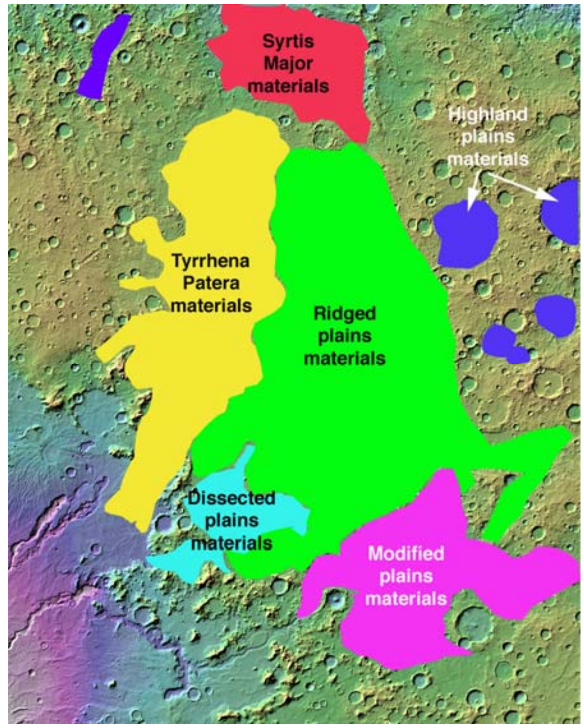

Figure 2. Rough boundaries of identified plains materials within Hesperia Planum. Portions of these materials were originally mapped as "Hesperian-aged ridged plains" at 1:15 million [9].

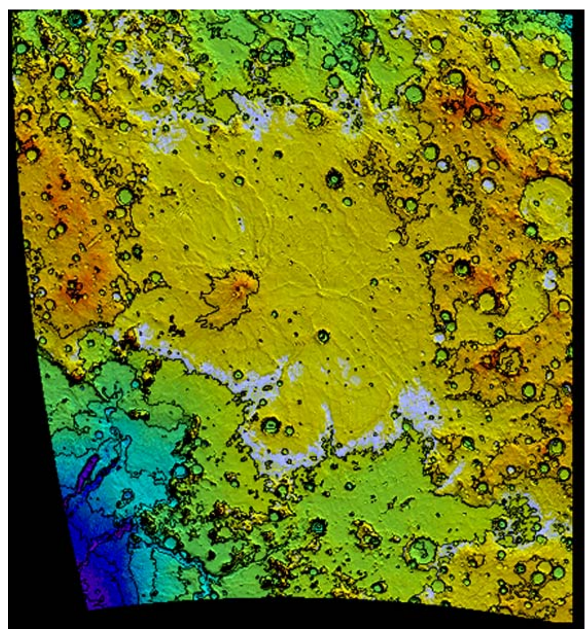
Figure 3. Hesperia Planum with 1-km-interval contour lines. The boundary of Hesperia Planum [9] roughly corresponds with the 2-km elevation line [21].