GEOLOGY OF MTM QUADRANGLES -40277, -45277, AND -45272, EASTERN HELLAS PLANITIA, MARS. Leslie F. Bleamaster III, and David A. Crown, Planetary Science Institute, 1700 E. Ft. Lowell Rd., Suite 106, Tucson, AZ 85719, lbleamas@psi.edu.

Introduction. Geologic mapping studies at the 1:1M scale, coupled with geomorphic analyses, are being used to characterize geologic processes that have shaped the highlands surrounding the Hellas impact basin and, in particular, to evaluate landforms and deposits resulting from modification of highland terrains by volatile-driven degradation. Specific research objectives for geologic mapping of MTM quadrangles -40277, -45277, and -45272 (Figure 1) in eastern Hellas Planitia include: a) to reconstruct fluvial systems that dissect the Hellas rim; b) to characterize the extensions of Dao and Harmakhis Valles onto the basin floor and to identify, if present, sediments contributed to Hellas Planitia; c) to investigate the nature of the boundary between the east rim and Hellas Planitia in order to infer its mode of origin, age, and history of modification; and d) to use small-scale surface morphology and small crater populations to examine finely layered deposits, local erosion, and burial/mantling/exhumation of surfaces. This new mapping study builds on previous mapping in eastern Hellas [1-10] and facilitates comparisons between the geologic history of the east rim and Hellas Planitia.

Background. The map area includes Dao and Harmakhis Valles and their floor deposits, possible remnants of rugged basin rim materials, dissected channeled plains, and the basin floor deposits. To first order, the materials in MTM quads -40277, -45277, and -45272 have been divided into one of two major geologic assemblages (the Hellas rim assemblage or the Hellas Planitia assemblage [3]); the contact between these assemblages occurs near the -5800 meter topographic contour. Materials above -5800 m have been mapped, at 1:5M scale, as the Hesperian/Noachian dissected unit, member 1 (unit HNd_1); below -5800 m, is the Hesperian smooth interior unit (unit His) [3]. Mapping at 1:1M scale by Price [8], subdivided unit HNd_1 into Hesperian smooth plains material (unit Hps) and Hesperian/ Noachian hummocky plains material (unit HNh).

Geology. *Hellas rim assemblage:* Above -5800 m, the two areally expansive units (units HNh and Hps) surround the distal portions of Dao and Harmakhis Valles. Using THEMIS IR (Figure 2) and VIS data, we have evaluated the contacts of units Hps (S) and HNh (H) and extended these units throughout the new mapping region. The hummocky plains (unit HNh) display 10s to 100s of meters of relief and appear to be exposed by the removal of the upper smooth plains surface (by either down cutting from channels, scarp retreat and aeolian erosion, and/or collapse from loss of volatiles).

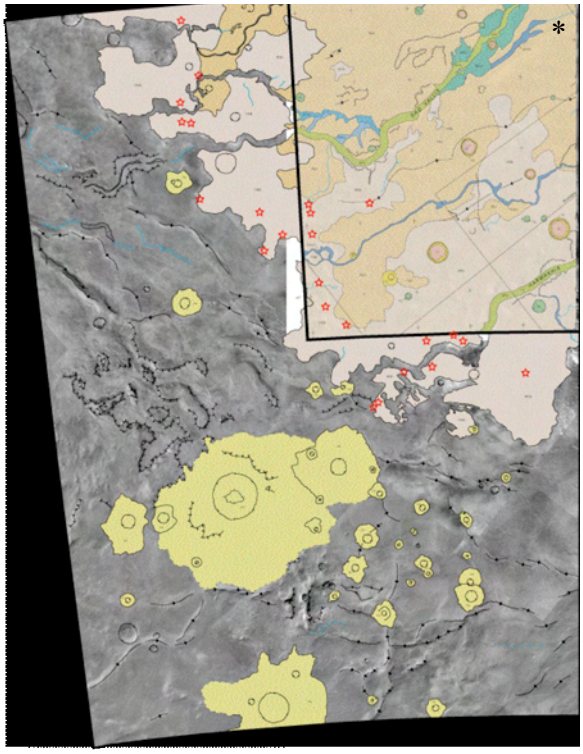

Figure 1. MTM quads, counterclockwise from upper left, -40277, -45277, -45272, and (–40272[3]) with preliminary mapping work. Red stars represent locations of finely layered outcrops, exposed in the hummocky plains (unit HNh), as identified in MOC images (see Figure 3).*

The smooth plains (unit Hps) are correlated with locations of small-scale surface channels, which may be the initiation of hummocky plains exposure. It is unclear at this time if 1) the channels are responsible for emplacing the smooth plains (i.e., bank-full deposits) or 2) the channels cut the smooth plains and are only preserved within them. Larger, more mature, canyon systems (namely Dao and Harmakhis Valles) also dissect the rim assemblage. Where canyons are wide enough, Amazonian/Hesperian valley fill superposes their floors.

High-resolution MOC images allowed the identification of finely layered outcrops (Figure 3), which are concentrated along the scarp that defines the eastern edge of the basin. Outcrops are exposed in locally high standing mesas, knobs, and surfaces near -5700 m within the hummocky plains material. Elevation levels and spatial association with contacts

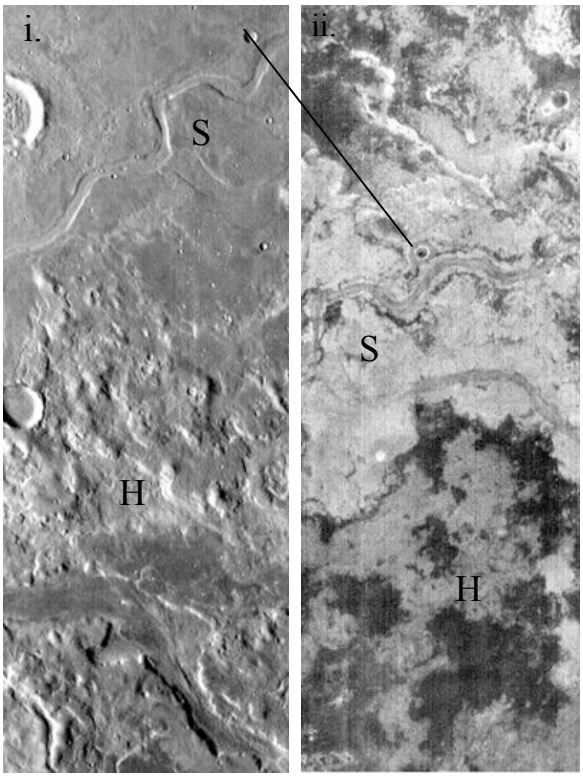

Figure 2. Parts of THEMIS i) daytime IR (I07937005) and ii) nighttime IR (I08018008) images illustrate the morphologic and thermophysical variability between the smooth (S) and hummocky (H) plains units (line shows common crater, image widths ≈ 30.5km).

of the layered deposits suggest that it was once a lateral continuation of the upper smooth plains deposit and may have been part of a more widespread depositional shelf [11].

Hellas Planitia assemblage: Below -5800 m, Hellas floor materials are moderately to heavily cratered, deformed by wrinkle ridges, and are locally dissected by the farthest extensions of Dao and Harmakhis Valles. With the exception of the major assemblage contact near -5800 m, there is a general lack of distinct depositional margins/contacts near the mouths of Dao and Harmakhis Valles. This could indicate that the eastern Hellas floor materials are 1) far reaching deposits from Dao and Harmakhis Valles, or that 2) both the floors of the Valles and Hellas have undergone significant Amazonian resurfacing (mass movements and aeolian infill), which has masked any original genetic and/or temporal relationships between the Valles and Hellas floor materials.

Considering the variable preservation state of some Hellas floor craters (pristine to buried) and the presence of inverted channel topography, it is likely that the floor of Hellas has undergone a long lived history of burial and exhumation, which has served to complicate the determination of relative timing through embayment and cross-cutting relationships alone. Because cumulative crater counts by various workers for the Hellas rim assemblage and units therein have yielded variable and inconsistent ages [1, 3, 8], we will re-evaluate crater counts (including counts of small craters, ~250 m) in the context of burial and exhumation processes.

References. [1] Crown D.A. et al. (1992) *Icarus, 100*, 1-25. [2] Mest S.C. and Crown D.A. (2001) *Icarus, 153*, 89-110. [3] Leonard G.J. and Tanaka K.L. (2001) *USGS Geol. Invest. Ser. Map I-2694*. [4] Tanaka K.L. and Leonard G.J. (1995) *JGR, 100*, 5407-5432. [5] Greeley R. and Guest J.E. (1987) *USGS Geol. Invest. Ser. Map I-1802B*. [6] Mest S.C. and Crown, D.A. (2002) *USGS Geol. Invest. Ser. Map I-2730*. [7] Mest S.C. and Crown, D.A. (2003) *USGS Geol. Invest. Ser. Map I-2763*. [8] Price K.H. (1998) *USGS Geol. Invest. Ser. Map I-2557*. [9] Mest S.C. and Crown, D.A. (2005 in press) *USGS*. [10] Crown D.A. and Greeley R (2005 in review), *USGS*. [11] Crown D.A. et al. (2005) *JGR, 110,* E12S22.

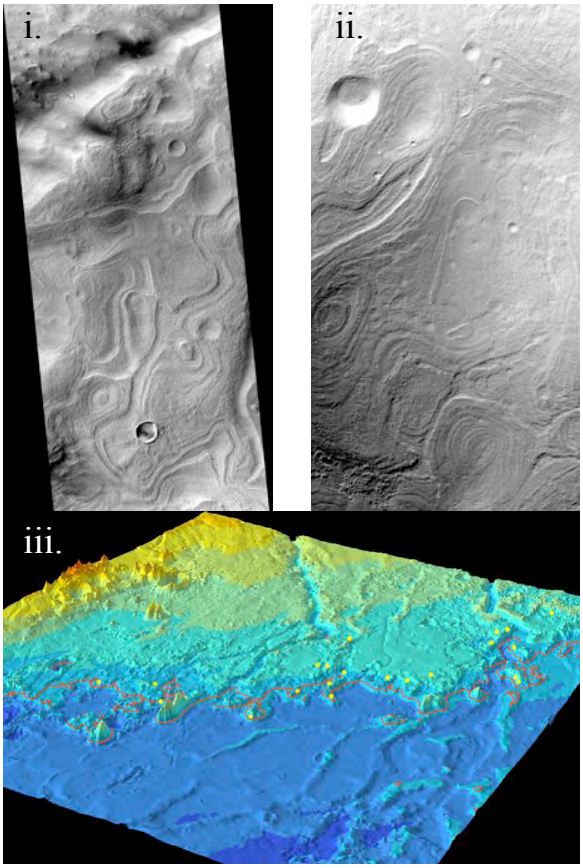

Figure 3. Parts of MOC images i) E2000151 and ii) E2200427 show intricate curvilinear patterns in finely layered deposits that are concentrated in the hummocky plains unit (image widths≈3km). iii) Perspective MOLA DEM with locations of layered outcrops (yellow dots) and -5800 m contour (red line). View to NE; width ≈ 300km.