GEOLOGIC MAPPING OF THE MERIDIANI REGION OF MARS. B. M. Hynek[1,2] and G. Di Achille[3] [1]Laboratory for Atmospheric and Space Physics, [2]Department of Geological Sciences (392 UCB, Univ. of Colorado, Boulder, CO 80309), [3]now at Research and Scientific Support Department, ESA-ESTEC (Noordwijk, The Netherlands).

Introduction: The Mars Exploration Rover Opportunity observed an upper layer of a more than 600-m-thick sequence of light toned outcrops that characterize the Meridiani region of Mars. Results from the rover analyses have shown that the bedrock contains mineral and textural characteristics that require the interaction of, and possibly an overall formation by, water-related mechanisms in order to be explained [1]. Additionally, remote sensing studies of the region have suggested that the rocks sampled in places by the MER rover consist of many distinct layers extending over an area of more than 3×10^5 km^2 spanning 20º of longitude [2].

Geologic Mapping: To address the origin and history of these unique materials, we are completing a PG&G-funded geologic, stratigraphic, and thermophysical properties study of this widespread terrain. Specifically, we have drafted a geological map covering the full extent of these water-related deposits that will be ready for peer-review within a month. This task serves several purposes including gaining an understanding of the complex nature of these materials, their potential sources region(s), and the timing of their emplacement, as well as to place the observations by the Opportunity Rover in a broader context.

We have completed a detailed geologic mapping at 1:2M-scale in the Meridiani region. The study area is defined here as 5°S-15°N, 15°W eastward across the prime meridian to 15°E. This covers portions of the quadrangles MC-11, MC-12, MC-19, and MC-20. The numerous units in the study area were refined from recent works [2-4] and new data and analysis. Formal geological mapping used a 100-m-resolution THEMIS base map combined with MOLA gridded data. Additional data for mapping included MOC WA images, THEMIS daytime and nighttime IR data, some THEMIS visible data, HRSC mosaics and topography, MOLA topography, TES and THEMIS thermal inertia, MOC NA, and CTX and HiRISE images. We also mapped valley networks to understand their potential link to the layers. Additionally, we have identified and characterized all craters in the region down to 1.5 km diameter for age-dating.

Geologic History Determined from Mapping (Figure 1): From our mapping, the geologic history of the region can be ideally reconstructed as follows. The heavy bombardment period is still preserved in the uplifted crustal materials found around the rim of large impact craters, resulting in the formation of the *Nm* unit. Impacts continued during the remainder of the Noachian and accompanied the formation of the *Nc* and *Ncd* units (in analogy with the Npl2 and Npld units described in ref. 5). The *Ncd* shows evidence of erosional features and deposits produced by fluvio-lacustrine processes. The latter processes formed unit *Nv* in the southern part of the map area.

Etched terrains (see *Etch1*, *Etch2*, *Etch3*, and *Etchu* units) likely formed from the Middle-Late Noachian to the Early Hesperian. Several hypotheses have been put forth to explain the deposition of these sub-horizontal highly erodible materials including eolian, lacustrine, groundwater, ice-related, and/or volcanic depositional processes. The occurrence of many outliers of these materials throughout the central part of the map region suggests that the deposits could have had a larger and more contiguous extent. The *Ilcd* unit is found in craters surrounding the etched terrains, suggesting its correlation with the latter units. Subsequently the unit has been likely affected by intense eolian erosion. Crater statistics and stratigraphic relationships suggest that the hematite-rich *Hema* unit likely formed during the Early Hesperian. The unit is exclusively associated with the etched terrains and its outcrops represent smooth surfaces overlying the *Etch3* unit. *Hema* could have formed as a primary or alteration product from either water-related (e.g. precipitation from solutions or groundwater alteration) or volcanic processes. The occurrence of isolated patches around the main extensive outcrop suggests that the deposits could have had a larger and more contiguous extent over the region.

Almost contemporarily to the *Hema* unit, the *Hr* unit likely started to form around the Early Hesperian in the low-lying plains surrounding the central region of the map. The unit of almost certain multisource volcanic origin generally overlies all the units of the highlands group. Finally, the *Hct* unit is cropping out only in the southwestern portion of the map area as an eastern extension of the large chaotic complex of Iani Chaos located just west of the mapped region.

References: [1] Squyres, S. W., et al., *Science,* DOI: 10.1126/science.1170355, 2004. [2] B. M. Hynek and R. J. Phillips, *Earth and Plan. Sci. Lett*., 274, 214-220, 2008. [3] B. M. Hynek et al., *J. Geophys. Res.*, doi:10.1029/ 2002JE001891, 2002. [4] Edgett, K. S., *Mars,* doi:10.1555/ mars.2005.0002, 2005. [5] Scott D. H. and K. L. Tanaka, *U.S. Geol. Surv. Misc. Invest. Ser., Map I-1802-A,* 1986.

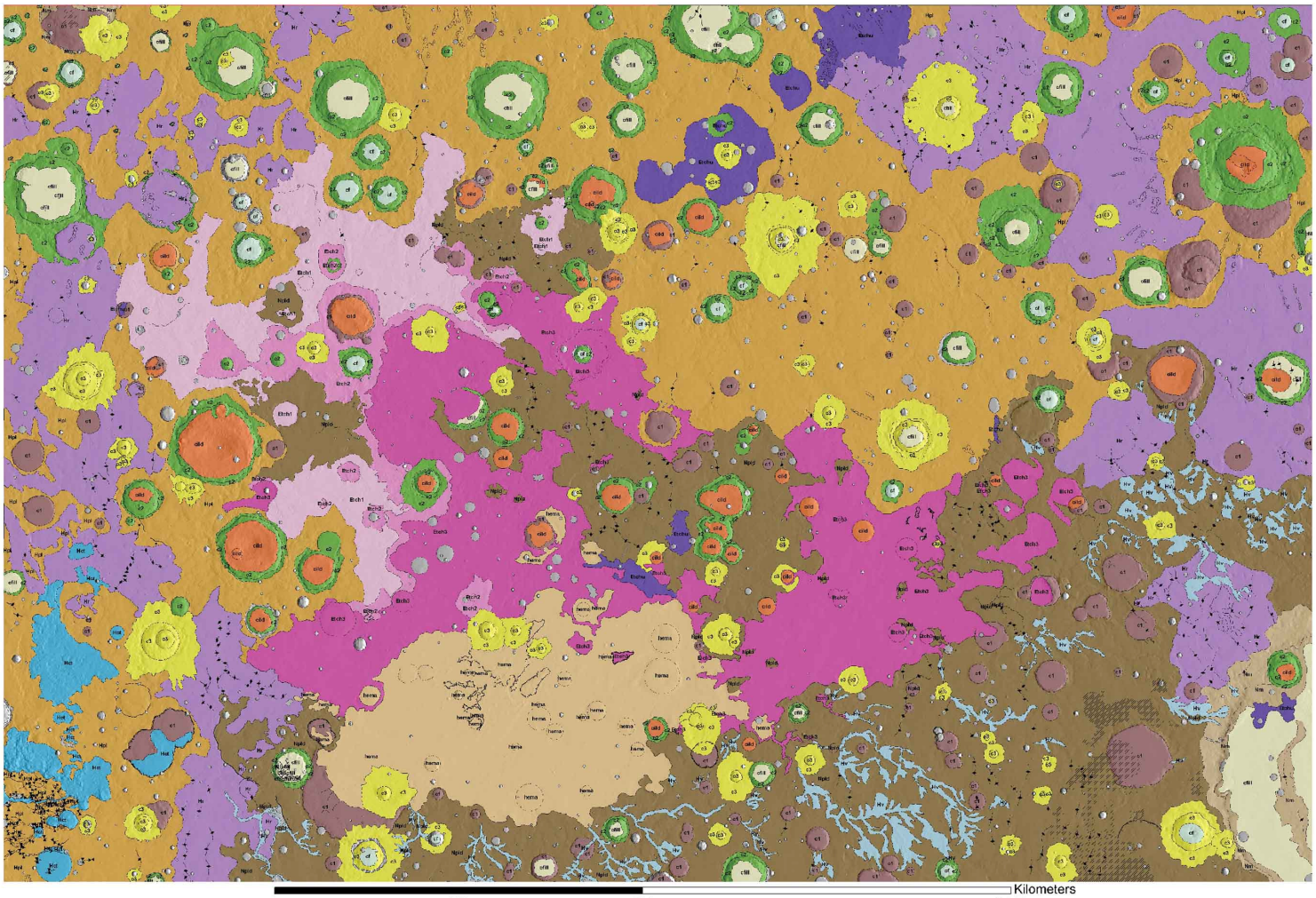

Figure 1. Draft version of updated geologic map of the Meridiani region, Mars. See text for details. Zoom in on map to see features.