SUBAQUEOUS MEGA-SLIDES ON THE FLOOR OF HELLAS. A. D. Howard[1], J. M. Moore[2]. [1]Dept. Environmental Sciences, University of Virginia, P.O. Box 400123, Charlottesville, VA, 22904-4123 (ah6p@virgina.edu), [2]NASA Ames Research Center, MS 245-3, Moffett Field, CA 94035-1000.

Introduction: The floor of the Hellas basin (Hellas Planitia) features unique landforms which have defied unambiguous interpretation [*1-5*]. We suggest that extensive subaqueous mass movements have been involved in the emplacement and deformation of the basin floor deposits, followed by intensive eolian erosion.

Topography, Landforms, and Previous Interpretations: Hellas Planitia is characterized by a rough central plateau (Alpheus Colles [AC] and Hellas Chaos [HC]) surrounded on the south, west, and north sides by lower terrain adjacent to the interior walls of Hellas Basin, including the lowest elevations on Mars (Fig. 1). The Hellas Basin probably hosted deep lakes during the Noachian and Hesperian [*2, 6*]

Honeycomb and reticulate deposits. In the north and western portions of this marginal depression occur eroded and highly deformed “honeycomb” sediments (unit *h* of [*2*], *AHh* of [*5*] and *Arr* of [*4*]). Recent CTX images indicate this unit is more widespread than previously mapped, including exposures within depressions in the AC. The unit has been interpreted to be the result of soft-sediment deformation possibly due to the weight of blocks of ice from remnants of an ice-covered lake [*2*]. Alternatively, deformation has been interpreted to have resulted from penetrative cellular convection in soft sediment (salt-doming) or crustal doming [*7*]. The deformation has a strong structural grain oriented parallel to the Hellas rim and to the northwestern margin of the higher AC plateau (Fig. 2), and individual “cells” have dimensions of 5-10 km. Because of the low crater density, freshness of exposures, and interpretations of superposition relationships in MOC images, this unit has been interpreted to be the youngest basin-floor deposit in Hellas [*2, 4, 5*]. . A similar, but topographically higher deformed “reticulate” unit (*r* of [*2*] and *Hr* of [*5*]) flanks the bottom of the western Hellas interior rim and likewise has a structural grain paralleling the rim.

Alpheus Colles and Hellas Chaos plateau. The materials forming the interior Hellas plateau have been interpreted as a stack of Hesperian sediments of possible eolian, volcanic, fluvial, or lacustrine origin [*1, 2, 4, 5*]. A variety of subunits have been mapped based largely on morphology, but we emphasize the general patterns. The largest features are a series of irregular or elongate ridges up to 1 km high spaced about 100-200 km apart separating broad depressions either smooth-floored or filled with clusters of knobs or multi-km plateaus or parallel ridges. The dominant topographic grain of both the large and small ridges is SW-NE (Figs. 1,2). The knobs and ridges are generally rounded or flat with rounded edges, and many exhibit complex patterns of linear depressions that may represent fracturing or exposure of deformed layers (Fig. 3). The ridges and knobs have a size and structural orientation similar to that of the adjacent honeycomb deposits. The basins are locally unconformably filled with younger deposits of probable Amazonian age. The complex topography of the AC and HC plateau has been suggested to have resulted from selective sublimation of ice-rich deposits [*2, 3*].

Interpretations: *Stratigraphy.* Our interpretation of the extensive coverage of CTX images suggests that the honeycomb unit stratigraphically underlies the Hesperian units of AC and HC, and is thus of Hesperian or older age and it is exposed through erosion of the AC deposits. We suggest that the AC deposits were structurally deformed concomitantly with deformation of the honeycomb terrain. Evidence for this is the complex fracturing or deformation of the AC deposits and the similar size and topographic orientation of the honeycomb cells and the AC knobs and ridges. The AC and HC deposits are presumably less deformable or more massive than the underlying honeycomb units.

Deformation. We suggest that a series of large mega-slides are responsible for the deformation of the AC and HC and possibly for emplacement of some of the Hesperian units by turbidity currents. The combination of large, aligned blocks separated by depressions together with smaller knobs and aligned ridges is similar (but at a larger scale) than the submarine landslide deposits of Hawaii (Fig. 4) and of a similar scale to the Norwegian Storegga slides. These large terrestrial mega-slides exhibit evidence of both multiple epidoes or phases of movement as well as different flow types or stages (e.g., slumps, debris flows, turbites, etc.). We speculate that the heterogeneous morphology of the Hellas floor deposits are analogously formed. The dominant NE-SW structural grain suggest emplacement either from the NW interior wall of Hellas (which exhibits basin-parallel fracturing, Fig. 2) or from the SE wall, possibly triggered by the accumulation of the extensive sedimentary and volcanic deposits in this region. The weak underlying honeycomb sediments may have acted as a dècollement. The intense structural deformation of these units would have been an obvious consequence. Many questions remain for future study, e.g.: 1) source direction; 2) triggering mechanisms; 3) number of events; and 4) slow (topographically-driven thrust faulting) to rapid (debris flow) emplacement.

Erosion: We suggest that the low annulus surrounding the N, W, and S sides of the AC and HC plateau is due to extensive erosion by katabatic winds from the Hellas walls. Extensive eolian stripping has also been suggested by [*1, 2*]. These have removed the later AC and HC deposits (except for a few high outliers) and exposed the underlying honeycomb units. A contrast in resistance between weak honeycomb and stronger AC-HC deposits can account for the abrupt edge of the AC-HC plateau, along with deceleration and hydraulic jumping in the katabatic winds.

References: [1] Moore, J. M., Edgett, K. S. (1993) *GRL.*, *20*, 1599-602; [2] Moore, J. M., Wilhelms, D. E. (2001) *Icarus, 154*, 258-76; [3] Tanaka, K. L., Leonard, G. J. (1995) *JGR, 100*, 5407-32; [4] Leonard, G. J., Tanaka, K. (2001) *USGS Geol. Inv.* I-2694; [5] Moore, J. M., Wilhelms, D. E. (2007) *USGS Geol. Inv.* I-2953; [6] Wilson, S. A. *et al.* (2007) *JGR., 112*, doi:10.1029/2006JE2380. [7] Mangold, N., Allemand, P. (2003) *6th Intern. Conf. Mars* Abstr. 3047.

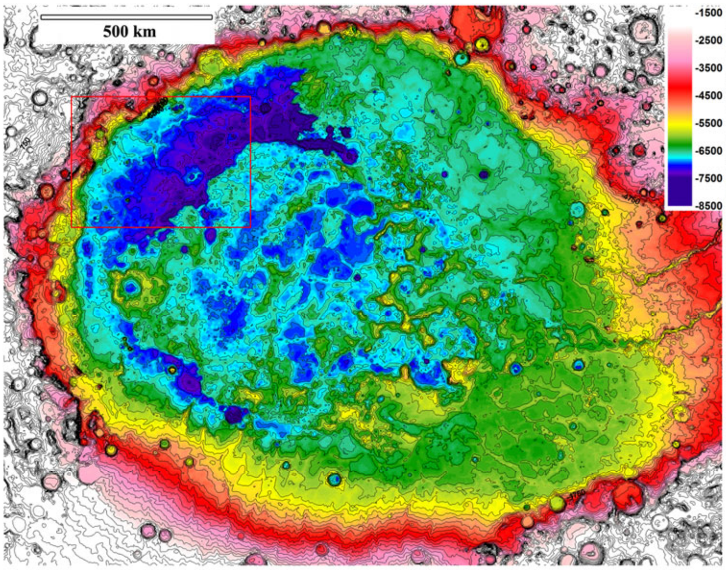

Figure 1. Color-coded contour map of the floor of the Hellas Basin. Red box shows location of Figure 2.

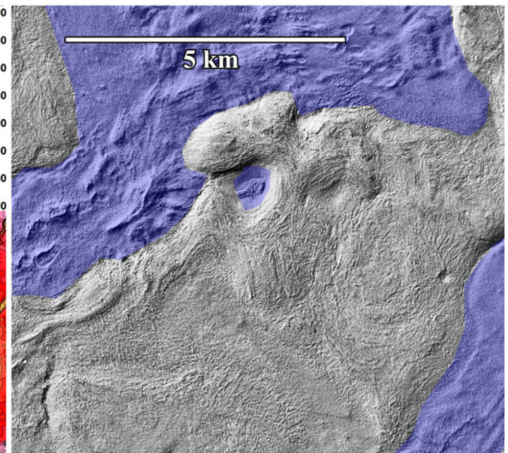

Figure 3. Detail of a ridge in the Alpheus Colle
plateau showing intricate pattern of grooving. Superimposed younger deposits in blue. Part of CTX P17_007675_1414.

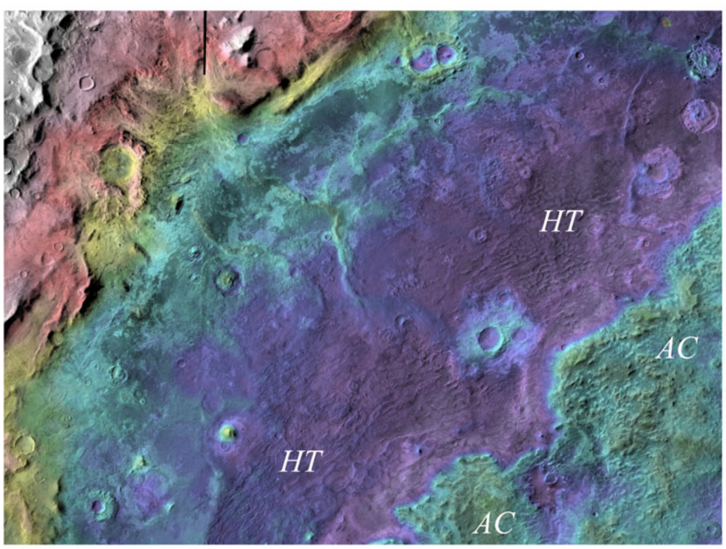

Figure 2. Colorized Themis IR map of the NW corner of the Hellas Basin. "*HT"* is honeycomb terrain, "*AC"* is the Alpheus Colles plateau.

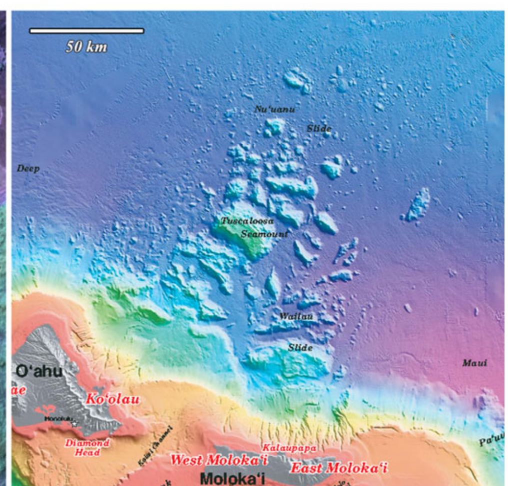

Figure 4. Bathymetry off the north shore of O'ahu and Moloka'i. From USGS Geol. Inv. Map I-2809.