**OCEAN SEDIMENTS IN THE NORTHERN PLAINS.** T. J. Parker[1] and D. C. Barker[2], [1]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, timothy.j.parker@jpl.nasa.gov, [2]University of Houston (University of Houston Geosciences, 4800 Calhoun Road, 77004).

Based on the highest-resolution image data available during the 1980s and 1990s, Parker et al. [1,2] hypothesized that the best explanation for the geomorphic features and contacts seen along the highland margin was erosion and deposition of material onto pre-existing terrain at a series of shorelines around the planet's northern lowland plains. These shorelines were inferred to indicate paleoclimate conditions that allowed liquid water to remain stable at the surface long enough for wind-driven waves to produce the features through wave refraction and longshore sediment transport. While the Arabia Level [3] does exhibit terracing in the modern very high-resolution images that is reminiscent of strandlines in terrestrial paleolakes, most of the other mapped levels do not. Instead, boundary morphology at the prominent, Deuteronilus Level [3] often exhibits lobate flow fronts and textures that resemble low-viscosity lava or debris flows. However, the MOLA topography does verify that the contacts are elevated by hundreds of meters to kilometers with respect to the northern plains interior to them, which does suggest that millions of cubic kilometers of volume was lost after emplacement of the marginal landforms.

Parker et al. [1] inferred marine conditions in a cooling climate based on the following observations: Starting at the Arabia Level and working plainward, plains textures transition from "smooth plains" between the Arabia and Ismenius Levels; to small-scale polygonally-patterned ground between the Ismenius and Deuteronilus Levels; to Thumbprint terrain (with bright conical hills interpreted as pingos) between the Deuteronilus and Acidalia Levels; to Mottled plains below the Acidalia Level. The reasoning was that: Smooth plains could indicate cold climate conditions hadn't ensued until the shoreline had receded and plains had been desiccated; small-scale polygons indicate ice-wedge polygons that formed by thermal cycling in a cold climate with water or ice present in the permafrost; closed-system pingos formed in a permanently cold climate after shoreline recession as near-surface groundwater water froze and concentrated remaining groundwater into lenses.

Additional landforms and plains morphologies identified recently [4] need also be considered in formulating a testable hypothesis commensurate with the newer, very-high resolution image data [e.g., 5]. We infer that an ocean would have been covered by debris and ice at least by Hesperian time (Arabia Level), and that it gradually receded due to loss via sublimation and redistribution elsewhere on Mars. The ice cover would have been frozen to the substrate at the shorelines, but floating as the bottom topography declined toward the plains interior. Fluvial rills identified at the Ismenius Level [1,4] could have formed via catastrophic disruption of this ice cover – perhaps due to an impact or landslide into the ocean. Similarly, when the ocean had receded to about the Deuteronilus Level, floods into the northern plains triggered a minor transgression to produce the lobate flow fronts as debris and ice was pushed upslope at the shoreline. Following cessation of the floods, the disrupted cover re-froze, this time producing pingos (and thumbprint terrain) as the debris/ice cover froze.

**References:** [1] Parker T. J., et al. (1989) *Icarus,* 82, 111-145. [2] Parker T. J. et al. (1993) *JGR*, 98, 11061-11078. [3] Clifford and Parker (2001) Icarus 154, 40-79. [4] Parker (2009) LPS XXXX [5] Barker and Bhattacharya (2010) LPS XXXX.

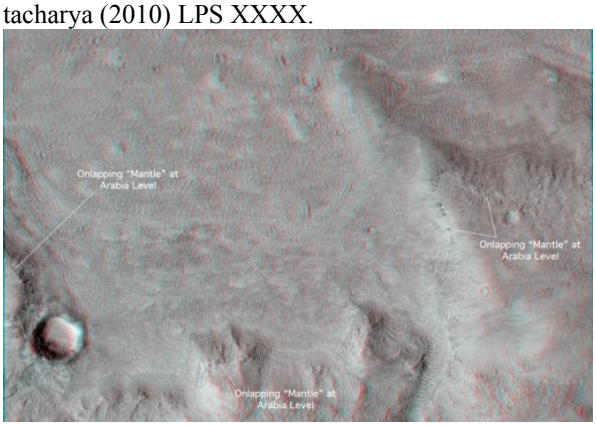


Figure 1: a. HiRISE anaglyph of mantle on sloping highland margin at Arabia Level in east Cydonia/NW Arabia. b: Detail of mantle at right of frame. PSP_001414_2165_PSP_001968_2165_RED.