**EAST ACIDALIA SHORELINE MORPHOLOGY AT MRO CTX IMAGE SCALES.** T. J. Parker, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, timothy.j.parker@jpl.nasa.gov.

**Introduction:**

This paper will describe recent and ongoing work to revisit sites along the lowland/upland boundary where landforms interpreted to be shorelines were identified. For this effort, it was decided to use ArcMap software to generate an image map of the planet's northern hemisphere based primarily on CTX images georeferenced to the MOLA gridded topography base map provided by Trent Hare of the USGS.

Initial work by this author on the identification and mapping of potential ancient shorelines on Mars was based on Viking Orbiter image data [1,2] which at best provided regional coverage at several tens of meters/pixel, and very poorly controlled topography. Mapping of shorelines on Earth requires both very high resolution aerial photos or satellite images and good topographic information.

Significant improvements over Viking data have been realized from MGS MOC, MOLA, Odyssey THEMIS IR and VIS, and MRO CTX and HiRISE. Of these, the MOC, THEMIS VIS, CTX and HiRISE images provide the highest resolution views which, combined with the MOLA gridded topography, enable the compilation of global maps of proposed shorelines. That's the good news. The bad news is that these data make for truly gigantic map files! This paper will focus on the west Deuteronilus Mensae region first described by [1].

**West Deuteronilus Mensae "Shorelines":**

Parker et al. [1] identified 7 contacts or topographic benches in the Mamers Valles region (fig1). Based on the appearance of these features at Viking image scales, and their inferred topographic and age relationships, they were interpreted to be most comparable to wave-eroded shorelines in terrestrial paleolakes (lacking oceanic tides).

But at very large scales (THEMIS VIS, MOC, CTX, and HiRISE), many of the better-preserved, lowest-elevation of these features exhibit lobate flow-front morphology suggestive of low-viscosity lava or debris flows advancing up the highland margin from the northern plains. Contacts at higher elevation – notably "Contact 1" (Arabia Level) do tend to exhibit morphologies reminiscent of terrestrial paleolake strandlines, however. And all of these contacts or benches are elevated with respect to the northern plains interior, still requiring withdrawal of vast amounts of water (or lava) from the northern basin.

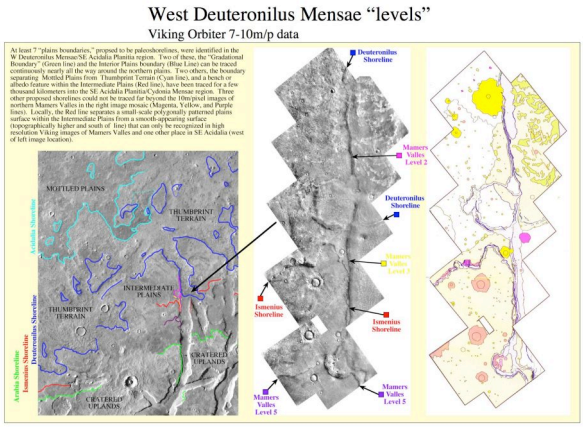


Figure 1: Terraces and plains contacts identified based on Viking Orbiter images and interpreted to be shorelines. Labeled with type locality names used in this text.

**Arabia Level:** Of the seven proposed shorelines in this region, the Arabia Level (Contact 1) most resembles terrestrial paleolakeshores (fig 2). Typically, where this feature has been identified in CTX images, it is expressed as one or more narrow terraces that appear level over great distances around elevated topography, such as crater rims. The plains interior to these terraces are often polygonally fractured, like a desiccated sedimentary deposit or cooled lava lake surface.

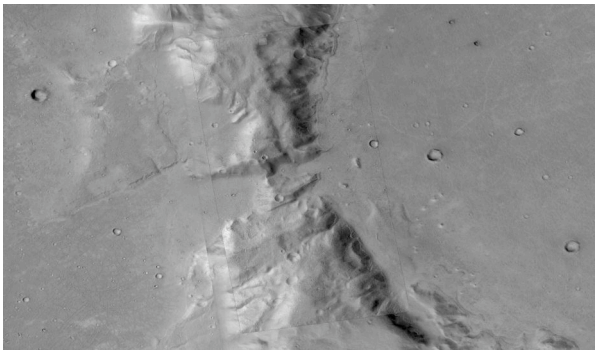

Figure 2: Multiple terraces in CTX and HiRISE images of west wall of crater, at the Arabia Level in SE Cydonia (36N, 350E).

**Ismenius Level:** Perhaps the most intriguing of the regional contacts in this area, the Ismenius level is defined by a narrow band of fluvial rills that terminate at an elevation of about -3700m locally. They are only found at elevations above -3700m – they never cut terrain at lower elevations, even when in direct proximity. These rills are neither tributary or distributary systems that most resemble swash rills on a beach, but at a grand scale. The plains surface

interior to the Ismenius Level is similar to that above it in visible light images. But in THEMIS daytime IR, there is a pronounced contrast between the two surfaces at the Ismenius Level, suggesting the higher plains surface has a higher thermal inertia than the lower one.

**Deuteronilus Level:** This level (Contat 2 in [1]) exhibits lobate flow fronts with relief at the margins, though locally it is sometimes expressed as a topographic bench (in Mamers Valles where it was first identified). The lobate fronts suggegst a flow direction from the plains interior and up the flanks of the highlands, to about an elevation of -3900m locally. The plains interior to the Deuteronilus Level is the classic "Thumbprint Terrain" identified in Viking Orbiter images over 30 years ago.

**Acidalia Level:** This level is very similar in expression to the Deuteronilus Level, though the flow fronts and terraces are typically more subtle in this region (but may be more pronounced to the west in Cydonia Mensae). In west Deuteronilus, the Acidalia Level is at an elevation of -3950 to -4000m. The plains interior to the Acidalia Level is the classic "Mottled Plains" identified in Viking Orbiter images.

**Unusual dark streaks between the Deuteronilus and Ismenius Levels:** In several places in west Deuteronilius Mensae, a number of dark streads extend eastward from many of the knobs on these plains. At Viking image scales, they most resembled wind streaks, though their local expression was somewhat puzzling at the time. Now, with very high resolution regional coverage from CTX, they are revealed to not be wind related at all, but more similar to rents in the well-known platy flow crusts in the southern Elysium region where topographic features have torn the crust as it moved past them. The streaks in the west Deuteronilus examples never occur below the Deuteronilus Level, and fade out before reaching the Ismenius Level (fig 3). It is proposed that these represent tears in a debris-rich ice cover over at the margin of a northern ocean as the crust was pushed past the immovable knobs. The rills above the Ismenius Level may be temporally related, perhaps indicating a tsunami associated with either an impact or a landslide into the ocean when it was at the Ismenius level.

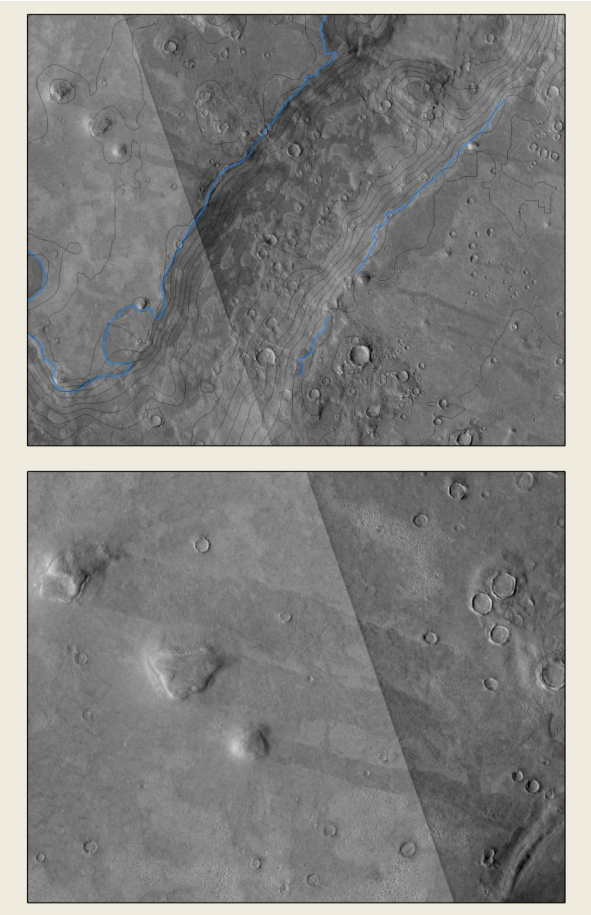

Figure 3, top: Portion of Shoreline Map in west Deuteronilus Mensae (near center of fig 1), showing dark streaks associated with knobs between the Deuteronilus and Ismenius Levels in elevation. Note they are not straight and terminate abruptly at the Deuteronilus Level (bottom right of lower view). Plains surface here resembles tears in a crust and breakup of that crust into plates, similar to the south Elysium platy flow material.

**References:** [1] Parker T. J., et al. (1989) *Icarus,* 82, 111-145. [2] Parker T. J. et al. (1993) *JGR*, 98, 11061-11078.