**EAST OF EDEN: A RETURN TO THE MERIDIANI REGION.** B. M. Hynek, Laboratory for Atmospheric and Space Physics, University of Colorado. hynek@lasp.colorado.edu

**Introduction:** The Opportunity Rover has revealed a fascinating ancient history of Mars that is still not well understood. Several models exist to explain the observations including evaporite/groundwater, volcanic, and impact processes [1-3, respectively]. This is in part because of the limited stratigraphic section examined (~7 m) and instrument limitations. Both of these constraints can be removed by sending Mars Science Laboratory (MSL) to eastern Meridiani. In this region, many layers at the heart of the thick, sulfate-bearing, stratigraphic sequence can be scrutinized with capable instruments. Understanding the detailed history of this area has great potential for addressing the key mission goal of determining if a specific environment was ever habitable.

**Motivation:** Many questions remain for any model to explain the Meridiani deposits including: how much water was required, at what temperature, and for how long? These questions are paramount to assessing the biological potential and climate history of Mars. MSL has the ability to answer these critical issues. For example, detailed mineralogy and chemistry data from the CheMin instrument, coupled with other instruments' observations, will reveal the aqueous geochemical history of the area.

**Ample Opportunity for Safe, Amazing Science:** ~600 km east-northeast of the Opportunity Rover lies a terrain on Mars unlike any other. Stratigraphically and topographically below the hematite plain is a finely layered sequence of diverse layered bedrocks (Fig. 1) that in total cover >3 × $10^5$ $km^2$ spanning 20º of longitude [4]. These layers range from very light to dark toned, have differences in thermal inertia of up to 200 SI units over a couple kilometers(!), and have a range of sulfate minerals as seen from OMEGA on Mars Express [5]. Thus, distinct lithology can be characterized for a large number of exposed layered units within the proposed landing ellipse (profile in Fig. 1). A number of these layers show potential evidence of fluid flow/precipitation in large joints (Fig. 1). An extensive stratigraphic study is underway to help constrain the timing and nature of these layers and results show that most are coherent over 100s kms and have shallow dips to the NW that is consistent with the topographic response of a preexisting Tharsis load [6]. Best of all, the site and its surroundings are very safe and trafficable. In fact, a substantial number of safe 20 km ellipses can be placed on this terrain. Even though many layers are exposed, the area has very little topography and resultant slopes at all scales (max slopes: 5km=0.9º; 2km=1.7º; with MOLA shot-to-shot average of ~1º). Rock abundance from IRTM data is ~8%. Thermal inertia values of over 500 SI units, and MOC NA, imply a "clean" and drivable surface with large bedrock exposures. Studying a high albedo and high thermal inertia region on Mars will reveal a novel surface type to be placed in the global context of TES and IRTM data.

**Summary:** Examining an extensive, thick, water altered stack of stratigraphy will help accomplish MSL's primary question of determining the biologic potential of Mars. The Opportunity Rover examined a very limited section of bedrocks and profoundly changed our view of Mars. The capable MSL's has the potential to decipher the history of complex layered materials in eastern Meridiani. Precision mineralogy, chemistry, and imagery will characterize the paleoenvironment; particularly the nature, degree, and duration of water. These results can be extrapolated to understanding the formation and habitability of layered sulfate-rich deposits all over Mars.

**References:** [1] Squyres S. and Knoll A. (2005) *EPSL* 240, 1-10. [2] McCollom T. and Hynek B. (2005) *Nature 438,* 1129-1131. [3] Knauth L. et al. (2005) *Nature 438,* 1123-1128. [4] Hynek B. (2004) *Nature*, *431*, 156-159. [5] Gendrin E., et al. (2005) *Science, 307*, 1587-1591. [6] Phillips R. and B. Hynek (2005) *EOS Trans. AGU, 86, 2566.*

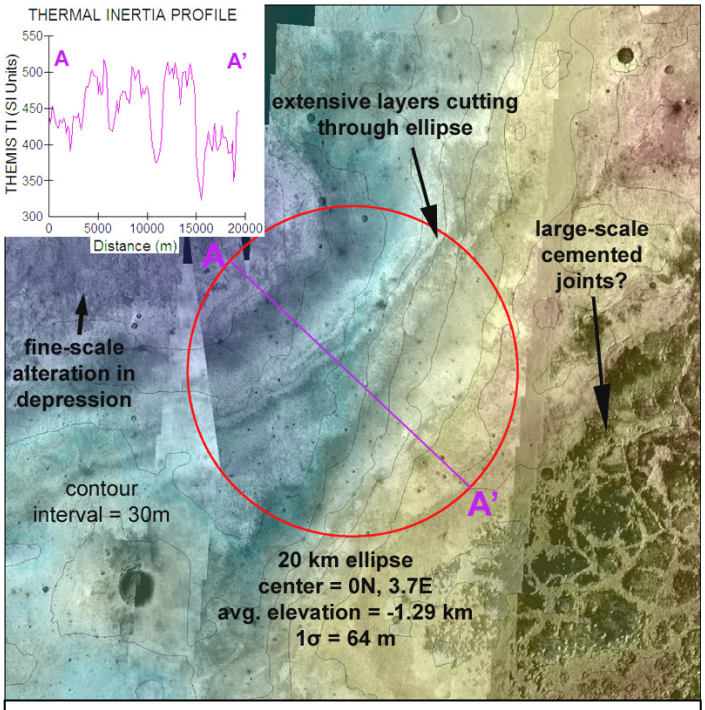


**Figure 1 (zoomable).** Candidate ellipse in east Meridiani. Colors are MOLA topography over THEMIS VIS and MOC NA images. Interesting features include over a dozen layers in the ellipse with diverse thermal properties implying varied composition, aqueous alteration in the surroundings, and numerous craters excavating the subsurface. The entire figure, and well beyond, contain sulfate-bearing minerals.