THE EBERSWALDE DELTAIC COMPLEX AS A HIGH SCIENCE-RETURN TARGET FOR THE 2009 MARS SCIENCE LABORATORY. Juergen Schieber[1],Ken Edgett[2] and Michelle Minitti[3], [1]Department of Geological Sciences, Indiana University, Bloomington, IN 47405, [2]Malin Space Sci. Sys., P.O. Box 910148, San Diego, CA 92191-0148, [3]Center for Meteorite Studies, Arizona State University, Tempe, AZ, 85287-1404.

Introduction: Assessment of past and present habitability is the core objective of the Mars Science Laboratory (MSL) mission. Layered rocks on Mars contain a record of past environmental conditions via textural, mineralogical, and geochemical features, and constitute the best prospect for uncovering crucial evidence of past habitability. Layered rocks of sedimentary origin are especially valuable because they may also contain preserved biomolecules. Landing at a site with sedimentary rocks of variable composition and from different environments virtually assures enhancement of MSL's prospects for meeting its habitability objectives.

Eberswalde Delta: Located near 24.0°S, 33.7°W, the Eberswalde deltaic complex exposes approximately 200 m of layered rocks that fill a portion of the provisionally named Eberswalde Crater. The crater floor is at MOLA elevations of -1.2 to -1.5 km, and flat terrain to the north and west of the crater is at elevations of approximately -0.8 and -0.4 km, respectively. Eolian erosion has exposed, and in some cases inverted meandering channels, channel belts, distributary channel systems, and multiple delta lobes, features that strongly suggest deposition from water flowing into a crater lake [1]. Comparison with meandering channels on Earth suggests that the banks of the Eberswalde channels consisted of cohesive materials [2], possibly today preserved as mudstones. Narrow angle MOC images of areas adjacent to the Eberswalde delta complex show additional exposures of layered rocks, most likely also of sedimentary origin.

EDL and Trafficability: The terrain of the delta complex itself (Fig. 1) is too rugged to make a suitable landing site. Several potential landing sites in the vicinity, however, show relatively smooth topography (Fig. 1). The rover's planned "go to" capability should allow it to explore the edges of the delta complex with excellent exposures of sedimentary strata. MOC narrow angle images show various possible routes from each potential landing site (Fig. 1), which could include the study of other layered rocks between landing site and delta complex. Landing in Eberswalde (ellipse 2 in Fig. 1) might be the most challenging, as topography appears quite rugged at MOC narrow angle image scale.

The Site and Science: Delta slope deposits of the Eberswalde Delta show shallow slope angles [3]. This suggests deposition of fine-grained and muddy sediments and is consistent with cohesive and muddy bank materials for meandering channels. Consideration of flow and sediment transport suggests that short lived (100's of years) sedimentation pulses alternated with evaporative intervals and water level drop. [3]. Delta lobe stacking suggests a sediment buildup that lasted from several thousand to ten thousands of years and comparatively high rates of sediment deposition [2,3,4]. Analogous to Earth, rapid mudstone deposition would imply limited degradation of buried organic matter and the potential to find preserved biomarker molecules with the SAM investigation. These sediments would also afford an opportunity to test whether (a) the soft weathering (eolian eroded) rocks are indeed clay bearing and comparable to mudstones on Earth, (b) the exposed strata contain point bar sequences and shoaling upwards successions, and (c) the sedimentary features in deltaic and lacustrine sediments are comparable to Earth.

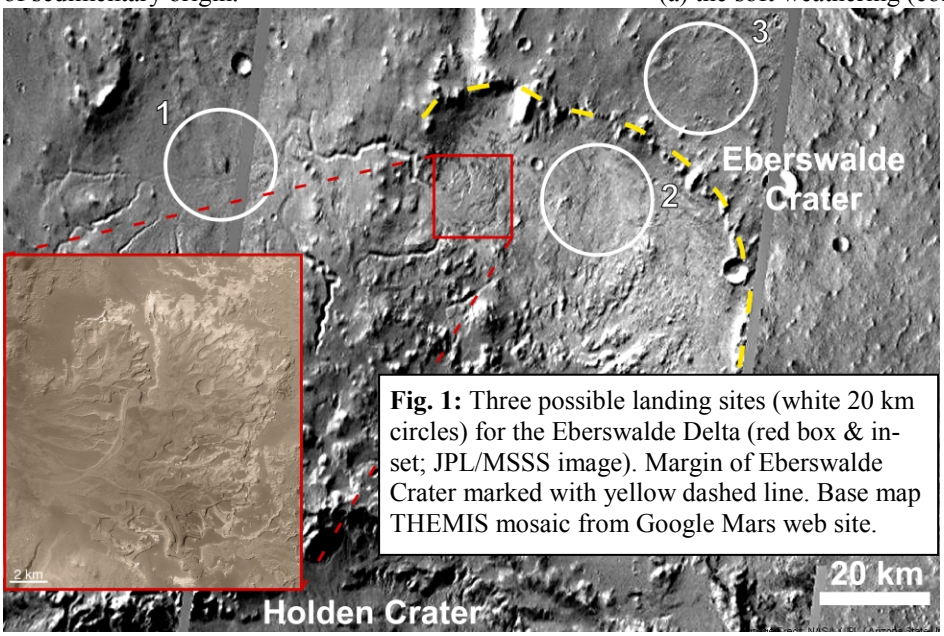

Fig. 1: Three possible landing sites (white 20 km circles) for the Eberswalde Delta (red box & inset; JPL/MSSS image). Margin of Eberswalde Crater marked with yellow dashed line. Base map THEMIS mosaic from Google Mars web site.

References: [1] Malin & Edgett (2003) Science, 302, 1931. [2] Moore et al. (2003) Geoph. Res. Let., 30, 2292. [3] Lewis and Aharonson (2006) J. Geoph. Res., in press. [4] Bhattacharya et al. (2005) Geoph. Res. Let., 32, L10201.