TERRESTRIAL MEGAFANS AS AN ANALOG FOR RIDGED UNIT OF SW ARABIA TERRA, MARS: CURRENT OBSERVATIONS AND FUTURE ANALYSIS. M. R. Salvatore[1], M. J. Wilkinson[2], C. C. Allen[3], and D. Z. Oehler[3], [1]Department of Geography, Penn State University, 302 Walker Building, University Park, PA 16802, mrs5002@psu.edu, [2]Jacobs Engineering, PO Box 58447, Houston, TX 77258, [3]NASA Johnson Space Center, Houston, TX 77058.

Introduction: Terrestrial megafans are quickly receiving more attention in the geologic community as features that dominate large landscapes [1]. While Indian and South American megafans have been widely studied [2, 3], recent observations have uncovered over 150 megafans on all continents except Antarctica. The ridged unit of southwest Arabia Terra, Mars, appears to be the remains of one or several megafans [1, 4, 5]. The ridges, interpreted as inverted stream channels and levee systems, show evidence of cross-cutting and braiding, both characteristics of megafan environments.

Terrestrial Megafans: Megafans are partial cones of sediment with low slopes (< 1°) that develop just downstream of where a river exits an erosional environment (valley) and enters a depositional environment (basin) [4]. The low slopes enable stream channels to braid and meander across the landscape. Channels within megafans are not confined by valleys, but instead deposit sediment in levees, making them the highest features on the landscape.

Environmental events (floods, etc.) can trigger streams to leave their channels and develop new ones. As a result, over time, the entire landscape becomes dominated with stream channels, both active and abandoned. These channels commonly cross-cut and interact with one another as they make their way downstream.

SW Arabia Terra, Mars: Southwest Arabia Terra, Mars (10°N - 2°S, 10°W - 8°E), is just north of the hematite-bearing plains being explored by *Opportunity*. This region was home to seven potential Mars Science Laboratory landing sites prior to the Second MSL Landing Site Workshop. A detailed geologic map of this region was created to further explore the geologic significance of this region. This map revealed the expanse of the ridged unit (Figure 1). The ridges of this unit have been hypothesized to be inverted fracture fill amongst many other hypotheses [6, 7, 8]. However, current evidence suggests that these ridges are fluvial in origin.

Microscale Observations (Figure 2). MOC and HiRISE imagery show extensive layering and preferential erosion within the ridges. In addition, studies have shown that ridge heights vary little across the landscape [7]. These observations are consistent with those seen in terrestrial megafans; it is common for numerous sedimentary deposits to be superimposed on each other, while topography varies little across the megafan.

Mesoscale Observations (Figure 3). THEMIS imagery effectively shows the ridged unit on a regional scale. Braiding and cross-cutting relationships can be seen in the ridges in addition to ridges ranging from highly sinuous to almost completely straight. Similar patterns are commonly seen in terrestrial megafans.

Macroscale Observations. Southwest Arabia Terra is uniquely located on the transition between the southern highlands and the northern lowlands. Additionally, channels mapped by Michael Carr seem to end abruptly at the start of the ridged unit [9]. The topographic dichotomy and the presence of channels are identical to the environments that produce megafans on Earth.

Future Studies: Future studies of southwest Arabia Terra are necessary in order to bolster the megafan hypothesis. Quantitative studies such as ridge orientations, lengths, and widths should be conducted and compared to similar studies of terrestrial megafans. In addition, analyses of the channels upstream of the ridged unit can provide information about the amount of water present as well as the amount of material that must have been transported downstream.

Conclusions: One or more megafans likely dominated the landscape of southwest Arabia Terra, Mars, at some point in the past. This implies the presence of long-duration fluvial activity in the Martian past. The amount of water present and the duration of fluvial activity can be estimated by future quantitative studies.

References: [1] Wilkinson, M. J. et al. (2007) *Eos Trans. AGU, 88(52), Fall Meet. Suppl.*, Abstract P12C-03. [2] Geddes A. (1960) *Trans., Inst. Brit. Geographers, 28*, 253–276. [3] Iriondo M. H. (1984) *Quaternary of South America 2*, 51–78. [4] Wilkinson, M. J. et al. (2008) *LPS XXXIX*. [5] Salvatore, M. R. et al. (2007) *Eos Trans. AGU, 88(52), Fall Meet. Suppl.*, Abstract P13B-1293. [6] Edgett K. S. (2005) *Mars, 1*, 5–58. [7] Arvidson R. E. et al. (2003) *JGR, 108(E12)*, 8073-8092. [8] Ormö J. et al. (2004) *Icarus 171*, 295–316. [9] Carr M. H. (2006) *The Surface of Mars*, CUP, 307 pp.

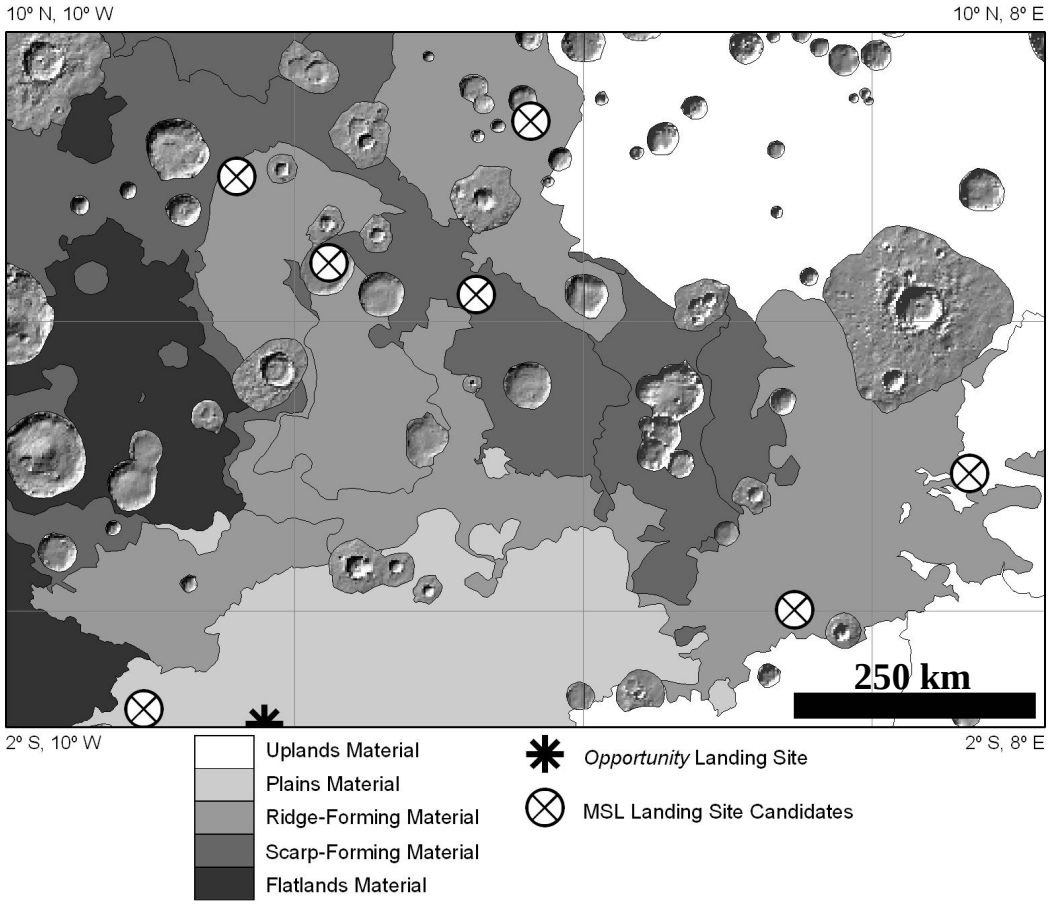

Figure 1: A geologic map of southwest Arabia Terra, Mars. The ridged unit is shown in the intermediate grey color that spans from the southeast corner of the map to the northwest corner.

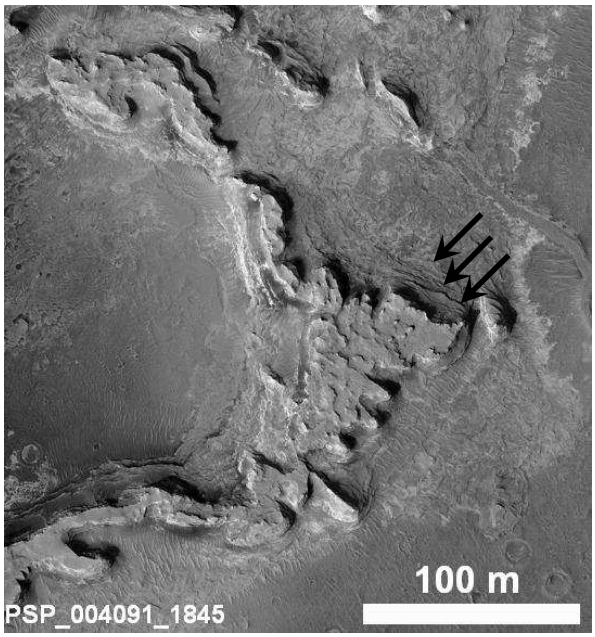

Figure 2: A HiRISE image showing sedimentary layers within a ridge of the ridged unit. Individual layers are indicated by black arrows. (4.7°N, 1.2°W)

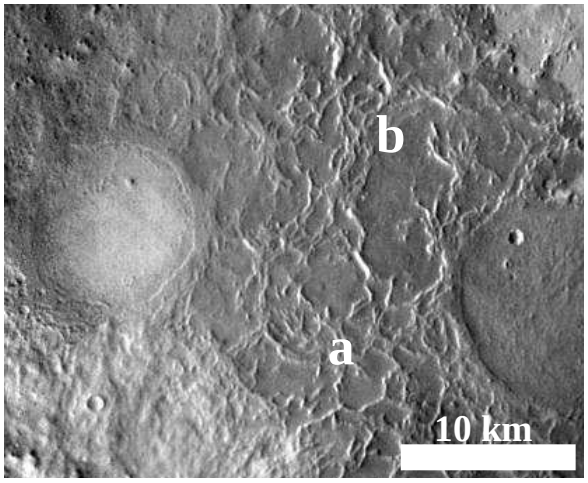

Figure 3: A THEMIS daytime IR mosaic showing cross-cutting (a), braiding (b), and a variety of ridge types in southwest Arabia Terra, Mars. Part of image E2200884f.