AMAZONIAN GROUNDWATER SPRINGLINE AT PEACE VALLIS FAN, GALE CRATER; IMPLICATIONS FOR A LATE PERIOD OF SURFACE HABITABILITY. L. A. Scuderi[1], Z. E. Gallegos[1], H. E. Newsom[1], R. C. Wiens[1]. [1]Earth and Planetary Science Dept., Institute of Meteoritics, Univ. of New Mexico, Albuquerque, NM, U.S.A. (tree@unm.edu; zeg@unm.edu)

Introduction: Groundwater sourced materials are a likely environment to look for extant life on Mars. Analysis of Mars orbital and Curiosity rover surface imagery and high-resolution digital elevation models of Gale Crater's Peace Vallis fan reveals two large drainage features with cross-sectional forms, stepped downslope profiles, erosional scarps and locations analogous to groundwater seepage and springline features found on terrestrial fans [1]. Crater counting statistics indicate that these findings have implications for the latest surface conditions that might have been habitable to terrestrial-like life.

RMI observations: The Peace Vallis campaign of the Mars Science Laboratory rover captured a texturally distinct feature ~11.5 km away during the ChemCam RMI 20x1 raster CCAM04981 sequence [2]. Figure 1 shows the channel feature with white arrows showing the eastern scarp. The west scarp is obscured by an inverted channel ridge beside the feature. Additional processing of this image adjusted brightness, contrast, and corrected vignetting artifacts from the imaging system.

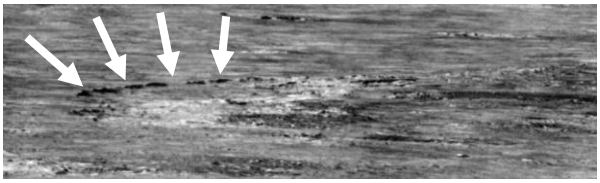

Figure 1. ChemCam RMI image of a groundwater sapping channel on the Peace Vallis fan (Figure 2 Box A). The white arrows indicate the eastern scarp of the channel.

Orbital data: HiRISE DTM data (1m/pxl) of the fan illuminate features of the channels which are not apparent in imagery. Cross-sections across and down the channels reveal a repeating, self-similar morphology characterized by flat bottoms, steep parabolic sides, and an amphitheater-like headwall from continued backwasting. These groundwater springline channels were determined to all reside at the -4435 elevation contour which represents a similar morphologic boundary to springlines observed on terrestrial fans.

Discussion: Topographic superposition of these features, relative to a fluvially deposited thin and younger fan unit dated by crater counting to <2 Ga [3], indicates that these erosional features formed shortly after surface flow and fluvial deposition of this mid-Amazonian fan unit. Persistent groundwater flow, likely active over several hundred years, produced headward erosion that removed portions of this thin, upper-fan unit.

Physical mechanism. Environmental conditions late in Mars history producing both surface and groundwater flow were initiated by short-term climatic events, possibly the result of a large impact or obliquity variations late in the Amazonian.

Extinct/extant life? The Peace Vallis fan is a future target for the investigation of recent life on Mars. It exhibits a long history of water interaction from the Hesperian to this latest Amazonian activity. The pressure/temperature regime of the atmosphere at the time was suitable for sustained water flow indicating potential habitability. Subsurface life could potentially still persist at these sites as any current groundwater system in the Peace Vallis watershed would still ultimately drain through the fan. This may only be answered through drill core analysis of fan material.

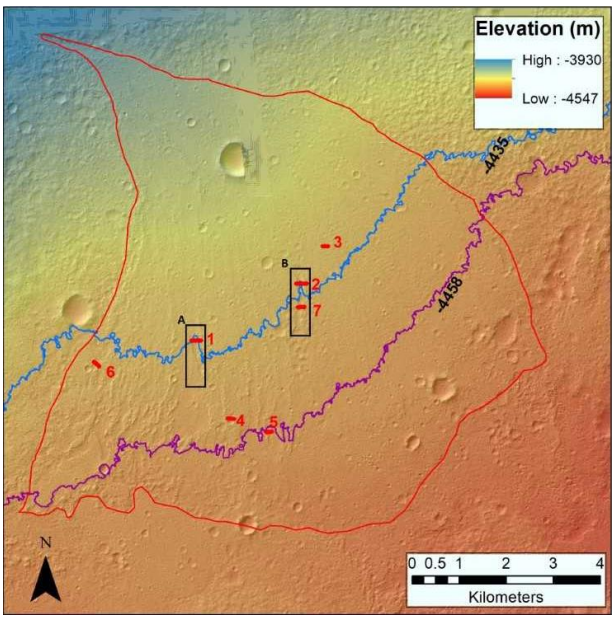

Figure 2. Orbital HiRISE DTM representation showing the Peace Vallis fan outlined in RED. The -4435 elevation contour is shown in BLUE. The groundwater sapping channel in Figure 1 is confined in box A, the other major channel is in box B.

References: [1] Scuderi L. A. et al. (2018) *Science*, in submission. [2] Gallegos Z. G. et al. (2018) *LPSC XLIX*, Abstract #2965. [3] Grant J. A. and S. A. Wilson (2018)) *LPSC XLIX*, Abstract #2012