

**THE PILOT VALLEY BASIN, UTAH: A MODEL SYSTEM FOR EXTANT LIFE IN THE MARTIAN SUBSURFACE.** K. L. Lynch<sup>1,2</sup>, Kevin A. Rey<sup>3</sup>, Robin J. Bond<sup>4</sup>, W. Andrew Jackson<sup>5</sup>, Frank Rosenzweig<sup>2</sup>, Jennifer F. Biddle<sup>6</sup>. <sup>1</sup>Lunar and Planetary Institute, <sup>2</sup>Georgia Institute of Technology, <sup>3</sup>Brigham Young University, <sup>4</sup>The Evergreen State College, <sup>5</sup>Texas Tech University, <sup>6</sup>University of Delaware. (klynch@lpi.usra.edu)

**Introduction:** One of the key recommendations from the recent National Academies study on the state of astrobiology science is that “NASA’s programs and missions should reflect a dedicated focus on research and exploration of subsurface habitability...” and in particular the focused study of saline/hypersaline subsurface habitats. On Earth, one such environment that could serve as an excellent model for study of extant life in Martian subsurface environments is the Pilot Valley Basin in Northwest Utah.

Pilot Valley is a closed basin paleolake that consists of hypersaline fluvial and lacustrine deposits. It hosts a shallow brine aquifer that encompasses the upper 6 m of basin fill and is maintained through subsurface groundwater flow by mountain-front recharge from the adjacent Silver Island Mountain Range (Figure 1). The only loss mechanism from the basin is capillary wicking and evaporation from the playa surface. Pilot Valley is being studied as a geochemical and mineralogical Mars analog environment due to the presence of aqueous minerals similar to those found in multiple Martian paleolake basins; it can also serve as a sedimentological analog to Martian paleolake environments as it contains the full sequences of 28 lake cycles going back over 800,000 years [1].



Figure 1. Pilot Valley Basin, Utah. *Image Credit: NASA Land Processes Distributed Active Archive Center (LP DAAC). ASTER LIB. USGS/Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. 2000*

Pilot Valley is also being studied as a habitability analog for both ancient and modern Martian habitable zones due to the presence of an extensive microbial ecology throughout the 6 m expanse of the basin shallow aquifer.

**Microbial Ecology:** Continuing research shows that the ecosystem present in Pilot Valley is organized into three distinct community groups. This discrete assembly is most likely influenced by grain size among other lithological factors. Because lithology is a factor that seems to influence community structure, this variable could impact how, where, and what type of biosignatures get preserved within this type of subsurface environment [2].

**Perchlorate-influenced Ecosystem:** Recent experimental results show that perchlorate reducing bacteria co-exist with the naturally-occurring perchlorate (NOP) present in the basin. Research results also indicate strong evidence of active microbial reduction of the NOP throughout the basin. This is the first potential finding of in situ perchlorate metabolism in a Mars analog environment and could serve as a model for possible extant ecosystems in the Martian subsurface [3].

**References:** [1] Lynch, K.L et al. (2015), *JGR Planets*, [2] Lynch, KL et al. (2016), *LPI Contributions 1912*, [3] Lynch, K. L. et al (2018), *Astrobiology, In Press*.