The Pilot Valley Basin, Utah: A Modern Habitability and Preservation Model for Groundwater-fed Martian Paleolake Basins. K. L. Lynch[1], J. F. Biddle[2], R. J. Schneider[3], K. A. Rey[4], J. J. Wray[5], and R. F. Rosenzweig[1,5], [1]University of Montana, Missoula, MT (kennda.lynch@mso.umt.edu), [2]University of Delaware, Newark, DE. [3]St. John's University, New York, NY, [4]Brigham Young University, Provo, UT, [5]Georgia Institute of Technology, Atlanta, GA.

Introduction: Martian paleolake basins are prime exploration targets for future surface missions [1, 2]. The majority of terrestrial paleolakes transitioned to modern day evaporite basins with clay, sulfate and chloride compositions similar to the aqueous minerals identified across the martian surface. Paleolakes harbor a diverse array of microbial life and enhance the preservation of organic matter and fossils. As such, these terrestrial systems are considered excellent analogs for habitability studies that can be used to identify and explore paleolake systems on Mars [3].

We investigated the microbial ecology of a terrestrial groundwater-fed paleolake basin along mineralogical and geochemical gradients; our goals were to: 1) Characterize microbial diversity in this understudied environment 2) Assess the correlation between microbial diversity and mineralogical and geochemical variation. 3) Assess the influence of this relationship on biosignature preservation in order to better model groundwater-fed paleolake systems on the red planet such as Columbus Crater.

Field Site: The Great Salt Lake Desert (GSLD) and the Great Salt Lake are remnants of ancient Lake Bonneville, the largest of several North American paleolakes from the Pleistocene Epoch. Of the three main sub-basins of the GSLD, only the isolated Pilot Valley has remained relatively untouched, and thus is the focus of this investigation.

Pilot Valley is a closed basin system with a subsurface hydrology comprised of three distinct aquifers: an alluvial fan aquifer, a deep basin-fill aquifer at a depth of ~30 meters, and a shallow brine aquifer that encompasses the upper ~6 meters of the basin sediment fill. The shallow-brine aquifer is maintained by ground water flow from mountain front recharge of the alluvial aquifer flanking the Silver Island Range [4]. The only loss mechanism from the Pilot Valley basin is capillary wicking and evaporation from the playa surface [5].

Methods: Sediment core samples down to depths of 2 meters were taken along geochemical and mineralogical gradients in the Pilot Valley basin. Mineralogy of the sediments was determined by X-Ray Diffraction (XRD), automated scanning electron microscopy (QEMSCAN), and visible-near-infrared spectroscopy (VNIR). DNA was extracted from each sample and subjected to 454 pyrosequencing of the 16S rRNA gene. The resulting data were processed using the Qiime workflow software and analyzed using ecological statistic packages in Qiime, PAST and R.

Summary: Results show that the ecosystem present in Pilot Valley is organized into three distinct community groups (Figure 1). This discrete assembly is most likely influenced by grain size among other factors. Because grain size seems to influence community structure, this variable could impact which biosignatures get preserved within the basin. Pilot Valley can therefore serve as a model to gain insight into preservation processes possible in martian paleolake sediments.

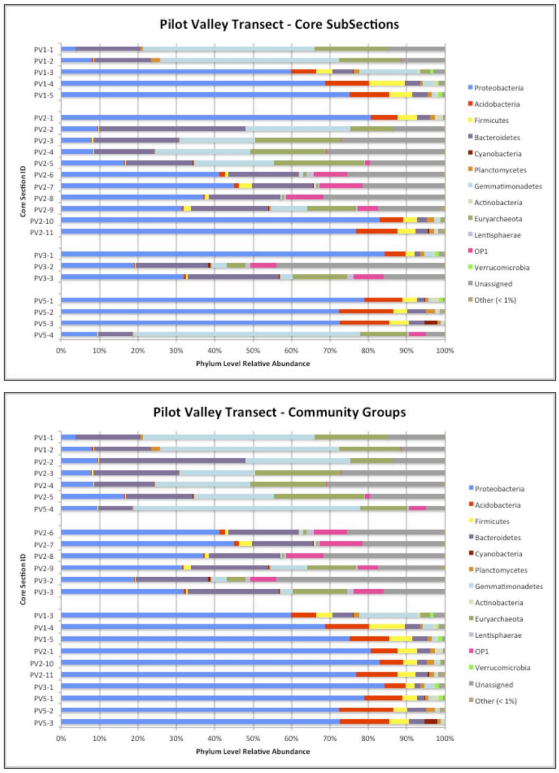

Figure 1. Phylum level relative abundances for Vertical Transect Study. a) Core sub-sections b) Community groups

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