THRESHOLDS OF DETECTABILITY FOR HABITABLE ENVIRONMENTS IN THE ALTIPLANO OF CHILE, WITH IMPLICATIONS FOR MARS EXPLORATION. M. S. Phillips[1], J. E. Moersch[1], N. A. Cabrol[2,3], and the SETI Institute NAI Team, [1]Planetary Geosciences Institute, Department of Geological Sciences, University of Tennessee, Knoxville, Tennessee 37996-1410, USA, (mphill58@vols.utk.edu), [2]SETI Institute Carl Sagan Center, [3]NASA Ames, Space Science Division.

Introduction: Much of Mars exploration has been motivated by the search for life both past and present [1]. However, much of the focus has been on the broad habitability of environments rather than on potential, specific, Martian habitats [1]. Describing habitats on Earth that are plausible analogs for potential Martian habitats can guide hypotheses about what habitats could exist on Mars; and defining the thresholds of detectability in remote observations of such habitats is an important first step in defining what data are necessary to detect them.

In this study, we determine the threshold of detectability for gypsum structures, a habitat found in some salars in the Chilean Altiplano [2], using photogeologic data gathered by a UAV. Threshold of detectability is defined in the context of this work as the spatial resolution required to resolve and identify a diagnostic set of features of a habitat. Consequently, each type of habitat has a unique threshold of detectability. Gypsum structures are evaporite features and an endolithic habitat; they form in an environment analogous in some ways to Hesperian Mars when Mars transitioned from relatively wet to dry [2, 3].

Regional Setting: The Altiplano of Chile lies east of the Cordillera de Domeyko, (28° S and 18° S). Of interest in the Altiplano are the continental, Miocene, salt-encrusted playas, or salars [4]. Characteristics of this environment that are analogous to Hesperian Mars are its extreme and continued dryness and high UV flux [5]. In addition to resembling certain characteristics of Hesperian Mars, endolithic salt habitats within salars, such as gypsum structures, require water to form and their crystal matrices are conducive to preservation of organic molecules [2]. In this report we describe our preliminary results in determining the threshold of detectability for gypsum structures at Salar de Pajonales.

Data and Methods: A UAV was used to gather visible images of the salar surface. Ground sampling distance (GSD) of the images ranged from 0.009 - 0.026 m/pixel. Flights were conducted in the morning with solar elevations between 27.6° and 67.2°. The following set of features, taken collectively, is considered diagnostic of gypsum structures: positive topographic relief; meter-wide decameter-long interconnected network of sinuous ridges; or, meter-scale light-toned isolated domes; leeward talus of dark material intermixed with light material. This diagnostic set of features was used to determine the threshold of detectability for gypsum structures via visual inspection. Aerial images were resized to simulate different spatial resolutions using a bicubic interpolation.

Results and Discussion: Results are shown in figure 1. We preliminarily determine gypsum structures to have a threshold of detectability between 1 m/pixel and 0.25 m/pixel. The interconnected network of gypsum forming positive relief sinuous ridges is first recognizable at ~2 m/pixel, however, the full set of diagnostic features does not become recognizable until ~0.25 m/pixel. These preliminary results indicate that if similar gypsum structures exist on Mars they could be identifiable with HiRISE, although fine-scale structures relevant at the microbial habitat level require much higher resolution. The lack of detection of gypsum structures on Mars potentially indicates that either they are not present, or the have not yet been recognized. At the conference we intend to elaborate on fine-scale components of the gypsum structures.

References: [1] Ehlmann, B.L., et al., (2016), *JGR,* **121**(2): p.1927-1961 [2] Rasuk, M., et al., (2014) *MicbioEco*. **68**(3): p. 483-494 [3] Bibring, J.P., et al., (2006) *Sci*. **312**(5772):p. 400. [4] Artieda, O., et al., (2015) *ESP&L*. **40**(14):p.1939-1950. [5] Grosjean M., (1994) *PaleoClim.* **109**(1)**:p.**89-100.

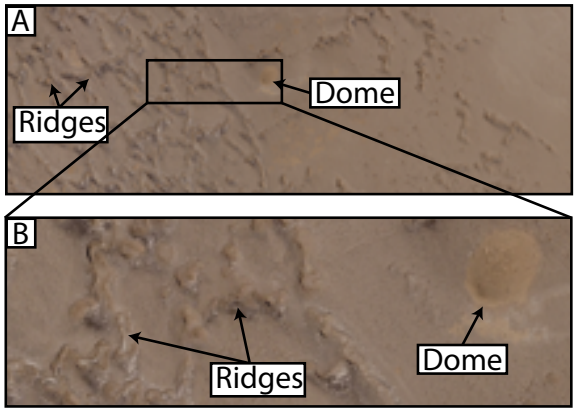

Figure 1: Salar de Pajonales (A) Gypsum structures at 1 m/pixel. Both sinuous rille (left) and domical (middle) morphologies are shown. Most characteristics in the diagnostic set of features are recognizeable, with exception of leeward talus material (B) Gypsum structures at 0.25 m/pixel. This figure shows the approximate GSD of HiRISE. Positive topographic relief, meter-wide decameter-long sinuous ridges, meter-scale light-toned domical morphology, interconnected network of sinuous ridges, isolated domes, and leeward talus of dark material intermixed with light material are identifiable at this resolution.