CHARACTERIZATION OF LIQUID BRINES UNDER MARS AMBIENT CONDITIONS. H. M. Elliott[1], N. O. Renno[1] and G. M. Martinez[1], [1]Department of Atmospheric, Oceanic, and Space Sciences (Ann Arbor, MI 48109, E-mail: helliott@umich.edu)

Objectives: We have been characterizing the properties of liquid brines under Mars ambient conditions to aid in the derivation of the baseline science requirements for future missions to Mars. Our aim is to develop instruments to search for brines in the shallow subsurface of Mars, both in situ and from orbit. This abstract is submitted in response to Challenge Area 1 of the Concepts and Approaches for Mars Exploration: *Instrumentation and Investigation Approaches.*

Motivation: The idea that liquid brines are present on Mars is exciting because many microorganisms thrive in terrestrial brines, and in particular brines found in subglacial environments. The discovery of sulfur and iron cycling microbial communities in the subglacial brine that episodically drains from Taylor Glacier in Antarctica's Dry Valleys is particularly relevant to the understanding of the habitability of Mars [1].

Water ice is known to exist on Mars, but the presence of pure liquid water is inhibited by the planet's low temperature and pressure [2]. However, the Phoenix Mars Lander discovered perchlorate salts [3,4] on Mars capable of depressing the freezing temperature and the water vapor pressure enough to form liquid brines [4-6]. Since the Phoenix Lander's findings, independent results suggesting the presence of liquid brines on Mars have been mounting [6-12].

Laboratory Apparatus: We have fabricated a Mars environmental chamber to develop sensors for brine detection and characterize the properties of liquid brines. This system consists of a vacuum chamber with internal thermal plates that can be cryogenically cooled with liquid nitrogen to simulate the diurnal and seasonal temperature cycles on Mars [13]. We are using this system to test Martian soil analogues mixed with salts and water ice to determine the conditions under which salts deliquesce and form liquid brines. During testing, the soil analogues are prepared in a dry anaerobic environment, placed in sample holders, and attached to the thermal plates. Using this system, we have the ability to test multiple samples at once or a single sample of up to 175 liters and each sample holder has its own instrument suite with an independent heater to provide additional thermal control. The chamber is then purged with carbon dioxide gas and pumped down to mars ambient pressure. When thermal cycling commences, the chamber's humidity is monitored using a chilled mirror hygrometer and controlled by throttling the carbon dioxide purge.

Our laboratory currently has the capability to detect brine formation in three ways: (1) shift in the sample's peak frequency of microwave resonance, (2) through use of an optical microscope, and (3) by multispectral imaging. Using this equipment, we are performing a characterization of the spectral reflectance, albedo, and electrical permittivity of liquid brines and brine-related rheological features. It should also be noted that our system makes it possible to change the illumination geometry of the samples so that multiple observational scenarios can be tested.

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