**ASTROGEOBIOLOGY SAMPLE RETURN AND IN-SITU SCIENCE IN ANTARCTICA: UNDERSTANDING TRADES BETWEEN SCIENCE OBJECTIVES AND OPERATIONS ACROSS SCIENTIFIC DISCIPLINES.** Joseph S. Levy[1] [1]Portland State University, Department of Geology, Portland, OR, 97201, USA. jlevy@pdx.edu

**Introduction:** The McMurdo Dry Valleys of Antarctica represent one of the most Mars-like environments on Earth [1-3]. Accordingly, astrobiological field research into the structure, functioning, and preservation of extreme Antarctic ecosystems provides a testbed for planning sample-return-based science in remote planetary settings.

Although terrestrial analog research does not provide a precise duplication of planetary conditions, it does provide a valuable case study in addressing questions that are of primary concern to sample return mission planners: 1) What is the best approach to selecting samples for competing scientific constituencies with different research goals and different sample-handling requirements? 2) How can in-situ measurements be used to select representative and/or high-priority samples for return to home labs while still conducting meaningful field science? 3) How can humans and/or robots rapidly characterize surface and subsurface (and relict) ecosystems under strict time constraints?

**Antarctic Site and Research Team.** The McMurdo Dry Valleys Long Term Ecological Research program (www.mcmlter.org) is a multi-investigator, ecosystem functioning and characterization research project focused on analysis of the physical environment, biological community, and relict ecosystems present in Taylor Valley, Antarctica (77.7°S, 162.8°E). Taylor Valley contains examples of permafrost, cold-based glaciers, ephemeral streams, and ice-covered lakes [4]—a cold desert landscape that supports a nematode-dominated community based on algal primary production [5]. The MCMLTER supports an integrative science program with researchers representing a wide range of disciplines, including limnology, microbiology, hydrology, geology, glaciology, genetics, remote sensing, geophysics, meteorology, and geochemistry. Accordingly, the MCMLTER represents a microcosm of the scientific community most interested in sample return from planetary environments.

Interdisciplinary research projects, for example, analysis of the ecological effects of water-regolith interactions [6] require multiple researchers to make use of the same limited sample—for example, rock, soil, or ice that has been collected during a short summer field season, or during an even more abbreviated day trip to a remote field location. Analyzing splits of the same sample ensures that all disciplines have access to a sample that is minimally heterogeneous (large changes in ice content, salinity, chemical composition, and organic carbon content occur at meter-scales in Antarctic environments [5]. As a result, the selection and curation of these samples needs careful planning to ensure that the sample preservation requirements of each discipline is met.

**Sample Return Insight From Antarctica.** Several key lessons relevant to planetary sample return can be learned from Antarctic planetary analog research.

1) *There is no single, ideal sample that will address every scientific constituency.* Different disciplines have different material interests. Selecting samples that characterize the diversity of a science site (soils, ices, stream water, biological matter) requires a diversity of sample acquisition and handling devices.

2) *High quality in-situ science is essential for selecting representative and anomalous samples.*. Field measurements (e.g., soil conductivity, reflectance spectra, etc.) provide a quantitative assessment of the research site. They are necessary to select samples that represent the diversity of materials at the site. High-quality in-situ measurements also reduce risk by ensuring science return in the event that samples are compromised in transit.

3) *Sample curation for multiple disciplines requires meeting each researcher's needs through a sequential curation plan.* Samples often require different temperature, humidity, chemical storage conditions. Sequential splitting of samples to ensure that no discipline's sample is compromised by the curation techniques of another discipline requires prior planning and tactical oversight.

4) *The effective selection of sample return targets requires both strategic and tactical input from all scientific discipline groups*. Interdisciplinary science groups—whether working in Antarctica or Mars—are often complementary by design. When programmatic constraints reduce resources available for science, research groups can become competitive. Strategic prioritization of sample collection and curation (conducted with a transparent end-goal, for example, of maximizing diversity in the return sample) provides a framework for making fair and scientifically justified scoping decisions.

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