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**TITLE:** Deglaciation and the Evolution of Planetary Lake Habitability

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**ABSTRACT BODY:** The goal of the Planetary Lake Lander project (PLL) is to deploy an adaptive robotic lake lander in the Central Andes of Chile, where ice is melting at an accelerated rate. Deglaciation subjects lakes to interannual variability, raising questions about its impact on metabolic activity and biogeochemical cycles, lake habitat, ecosystem, and biodiversity. Documenting these questions contributes to a better understanding of the changes affecting Earth's glacial lake ecosystems, and may shed light on how life adapted during past deglaciations. From an astrobiological perspective, it brings new insights into the evolution of Mars habitability during comparable geological periods. Further, the robotic exploration of glacial lakes confronts us with challenges analogous to those that will be faced by future planetary missions to Titan's planetary seas. PLL, thus, bridges planets along an intertwined pathway where the study of one planet informs on the evolution of others and on the technological challenges associated with their exploration. During our field field campaign In November 2011, we characterized the physical, geological, and biological environment of Laguna Negra (33.65S -70.13W) a 6-km large, 300 m deep glacial lake, and generated an environmental database to baseline the adaptive system that will be used in the future by the lake lander to autonomously monitor the lake.Time series show changes in precipitation over the past decades, and in temperature and relative humidity. Meteorological stations and a stream gauge are tracking daily and seasonal changes at high resolution. Data are correlated to daily vertical profiles performed by the lake lander to monitor physico-chemical changes. Bathymetric maps reveal the bottom topography, and isolated habitats. Most dominant spectral units have been defined in ASTER near- and thermal infrared. They were sampled from spectra and hand specimens in the field and are now being characterized for mineralogic compositions in the lab. Three 24-hour time-lapse thermal videos show changing surface temperature conditions around the lake, which can be controlled by solar radiation, surface moisture content, grain size, slope, and/or geology. Changes in archea and bacteria populations are observed from 0-20 m. The archaeal community is represented by only one hand with similar electrophoresis mobility in the DGGE profile of most samples. Water column and sediment samples were collected and analyzed by sandwich microarray immunoassays, and by cloning and sequencing bacterial and archaeal 16SrRNA gene. Biomarker and microbial profiles were obtained by using a Life Detector Chip (LDChip450), which contains 450 antibodies raised against whole microbial cells (archea and bacteria), extracellular polymers, exopolysaccharides, universal biomarkers like DNA, amino acids, and other biomolecules. We prototyped and tested an underwater microscopic imager for long-term in situ study of copepod behavior

that will use algorithms to automatically detect and track copepods in images. PLL uses an Exploration Ground Data Systems (xGDS) developed at NASA Ames to handle science data. Correlations between different datasets are visualized through a single interface. Users interact with xGDS through a web browser, making the repository available to an international science team with minimal overhead for software installation and maintenance.

**KEYWORDS:** [5200] PLANETARY SCIENCES: ASTROBIOLOGY, [1605] GLOBAL CHANGE / Abrupt/rapid climate change.
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**Additional Details**
**Previously Presented Material:** These are new results

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