BIOGEOCHEMICAL INTERFACES IN SERPENTIZING SYSTEMS: A CASE STUDY FROM THE COAST RANGE OPHIOLITE MICROBIAL OBSERVATORY. M.C. Sabuda[1], M.D. Kubo[2], T.M. Hoehler[3], D. Cardace[4], L.I. Williams[1], M.O. Schrenk[1]. [1]Michigan State University, 288 Farm Ln, Rm 144, East Lansing, MI 48824; sabudama@msu.edu, [2] SETI Institute & NASA Ames Research Center, Building 239 Room 327, Moffett Field, CA 94035; michael.d.kubo@nasa.gov, [3]NASA Ames Research Center, Mail Stop 239-4, Moffett Field, CA, 94035; tori.m.hoehler@nasa.gov, [4]University of Rhode Island, 317 Woodward Hall, 9 East Alumni Avenue, Kingston, RI 02881; cardace@uri.edu.

Terrestrial and marine serpentinizing systems on Earth are considered to be analogues for processes occurring in locations such as Mars, Europa, and Enceladus. The volatiles and reduced carbon compounds mobilized via serpentinization reactions can be used as sources of nutrients and energy by subsurface microbial communities. In addition, these serpentinite-associated fluids have minimal dissolved oxygen present to support growth. Understanding the unique geomicrobiology of systems such as the serpentinite mélange of the Coast Range Ophiolite Microbial Observatory (CROMO) in northern California can yield insight into the potential for finding life coexisting in the extreme conditions present in geologically-similar extraterrestrial environments. To address this idea, a detailed investigation of the serpentinite groundwater geomicrobiology was performed in the standing water column occupying a purpose-drilled borehole at CROMO, CSW1,1.

In this study, 16S rRNA sequence diversity of microbial communities were analyzed in parallel to a suite of aqueous chemical parameters in order to understand how redox and microbiological gradients develop with decreasing oxygen concentrations in the wells. Ion chromatography (SO_4^{2-}, Cl^-, NO_2^-, NO_3^-, F^-, PO_4^{3-}), colorimetric methods (sulfide, ferrous and total iron), high-performance liquid chromatography (organic acids), hydrocarbon gas chromatography (CH_4), and isotope ratio mass spectrometry (methane stable isotopes) were used to create a comprehensive database of biogeochemical information. Samples were collected from the top of the well when the ultra-sensitive dissolved oxygen probe reached predetermined oxygen concentrations equal to 100%, 50%, 15%, and 0% of air saturation. A peristaltic pump and sterile tubing were used to extract fluid samples from the well, and a depth to water meter was used to identify sample extraction location with respect to the top of the well casing. In addition, the same samples were collected from the well bottom using a pre-installed bladder pump.

Preliminary data indicate a chemical interface at about 4 mg/L DO (50% air saturation), where microbial cell densities slightly decrease in an otherwise positive relationship with increasing oxygen concentration. At the 4 mg/L DO interface, total iron, ferrous iron, and sulfate concentrations peak, and sulfide concentrations begin to increase as DO decreases. Because microbes often work in tandem with other species (e.g. biofilms) to obtain enough energy for survival in the high pH, low-oxygen fluids, it is important to understand how these communities shift in response to chemical variances. The results presented here will help elucidate the intriguing relationship between community structures and the complex serpentinite-hosted water chemistry. Understanding the distribution and activities of microorganisms in the context of environmental gradients at CROMO may guide our efforts to detect life in astrobiologically relevant serpentinizing systems.