CHARACTERIZING SUBSURFACE MICROBIAL IRON REDUCTION IN A MARTIAN ANALOG SERPENTINIZING SYSTEM: ZAMBALES OPHIOLITE, PHILIPPINES. C. Casar[1], D. R. Meyer-Dombard[2], D. Cardace[3], A. Simon[4], [1]University of Illinois at Chicago, ccasar2@uic.edu, [2]University of Illinois at Chicago, drmd@uic.edu, [3]University of Rhode Island, cardace@uri.edu, [4]University of Illinois at Chicago, asimon22@uic.edu.

Introduction: The detection of serpentine deposits on Mars suggests distinctive geochemical conditions that offer an exciting possibility for Martian habitability [1]. Serpentine deposits form via hydrothermal alteration of olivine-bearing rocks. Chemical reactions associated with serpentinization generate reducing, high pH fluids and hyrdrogen and methane gas, which can support chemosynthetic microorganisms [2]. Due to the nature of the Martian surface [3,4], it is likely that it is currently inhospitable to life. The protection of the subsurface may provide conditions more conducive to life; therefore, this study focuses on the potential for life in the subsurface, centered on characterizing an Earth-based serpentinizing system as an analog environment.

The Zambales region of the Philippines is tectonically active and receives seasonally heavy rainfall, which has contributed to the deformation and hydrothermal alteration of the Zambales ophiolite complex. The landscape is stippled with serpentinite outcrops and springs fed by serpentinizing fluid, and geochemical data from these springs has confirmed the presence of hydrogen and methane gas. From this geochemical data, predictions were made about the potential for chemosynthetic metabolisms, suggesting iron reduction as an energetically favorable metabolism that could be supported by serpentinization reactions in the subsurface [5,6].

This study seeks to first confirm the presence of microbial iron reduction in a subsurface serpentininzing system based on geochemical predictions, then observe the interaction of that microbial life with mineral surfaces and potential subsequent alteration of minerals in the system.

Confirming Microbial Iron-Reduction: The predicted metabolism in the subsurface was verified through culturing techniques employing ferric iron. Sediments collected from a serpentinizing spring were incubated under H_2:CO_2 headspace in a pH 11 yeast peptone growth media enriched with iron (III) hydroxide, along with a duplicate set of sterilized controls, and a set without yeast and peptone. Growth rate and cell morphology were documented via fluorescence microscopy, and extracted DNA from these incubations will be sequenced to identify iron-metabolizing organisms. The oxidation state of the iron used in the enrichment cultures will be identified via XPS before and after incubation.

Microbe-mineral Associations: Microbial associations with mineral surfaces of rocks collected from the study site will be examined through microcosm experiments. A rock core drilled from a site proximal to a serpentinizing spring was found to be comprised mainly of lizardite and olivine through XRD and XEDS techniques. Microbes cultured from the iron enrichment growth media will be suspended in fluid collected from the spring and incubated with sliced and pulverized samples from the rock core. Sterilized duplicates of these microcosms will serve as controls for interpreting abiotic processes. After two and four weeks, the pulverized rock mineralogy will be identified via XRD, and the slices of rock will be fixed, gold-coated, and examined via SEM/XEDS. Signs of pitting and etching or microbial attachment to mineral surfaces of the rock slices will be documented, and these minerals will be identified.

Implications: Metabolic predictions made from spring fluid geochemistry will be tested in this study, and the findings will help determine if geochemistry is a good indicator of metabolic functioning in a serpentininzing system.

Documentation of microbe-mineral associations in a serpentinizing system may provide insight to the biological interpretation of serpentine rocks. For example, microbes may preferentially attach to or pit certain minerals, or differences in mineralogy between microcosms and their sterilized controls may be observed. These findings could be useful in interpreting potential traces of life in extraterrestrial rocks

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