Aqueous geochemistry and substrate utilization by microorganisms at active sites of serpentinization, Tablelands Ophiolite, Newfoundland

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The Tablelands in Gros Morne National Park, Newfoundland, is an ophiolite thought to have been obducted during the closing of the Iapetus Ocean, several hundred million years ago. This site is barren due to its lack in usual nutrients, low in calcium, high in magnesium and toxic amounts of heavy metals. It contains the extreme environment of active serpentinization, low-temperature oxidization and hydrolization of ultramafic rocks into serpentine, with its anoxic conditions that include elevated pH and low redox potential (Eh) values. Serpentinization provides an environment amendable to abiogenic and biogenic production of methane. Serpentinization is suspected on Mars and more prevalent on early Earth, which is why this site is a Mars and early Earth analog site, supported by the Canadian Space Agency.

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The geochemistry of the water will be analysed at various sites within the ophiolite. Concentrations of anions such as sulfate, phosphate and nitrate along with organic acids such as propionate, acetate, valerate and formate will be determined. Total organic nitrogen, total inorganic nitrogen, dissolved organic carbon and dissolved inorganic carbon will all be examined. These compounds will help determine possible substrate sources for microbes at these sites, along with understanding the overall community within the high pH, low Eh groundwater produced by serpentinization.

Microcosms, simplified ecosystems that are used to simulate and predict the behaviour of natural ecosystems under controlled conditions, have been sampled. The microcosms of this study have ^{13}C labeled organic acids and bicarbonate added to determine carbon source in methanogenic microbial pathways. Measuring $d^{13}C$ of methane and carbon dioxide, after microcosm experiment is complete, will determine if labeled substrate was metabolized for methanogenesis. Examining the results between the live bottles and the killed controls will help determine if the methane was produced abiotically or biotically.

Examining possible life in Tablelands serpentinization sites and their energy source will help better understand the carbon cycling in serpentinization environments. As well as, this information can be used to compare to possible Martian communities and/or physical reactions occurring on Mars.