Geochemistry of ultrabasic reducing waters at a continental site of present-day serpentinization in the Tablelands, Gros Morne National Park, Newfoundland

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Abiogenic hydrocarbons (produced geologically by the reduction of oxidized forms of carbon) have been hypothesized to be possible precursor compounds from which life originated. Apart from being geologically synthesized hydrocarbons can also form through microbial processes or by thermally induced decomposition of once living organic matter. These hydrocarbons are known as biogenic hydrocarbons. Understanding the reaction pathways by which abiogenic hydrocarbons form on Earth and differentiating between abiogenic and biogenic hydrocarbons can help better understand the processes that are responsible for past and present life.

Serpentinization – a reaction between water and ultramafic rock (derived from the mantle) – is suspected to be a source of hydrocarbons on early Earth and potentially on other ultramafic planetary bodies. Through the hydration of ultramafic rock, this reaction produces hydrogen gas (H_2) and reducing conditions necessary for abiogenic hydrocarbon synthesis, while also producing conditions amendable for the production of methane through microbial chemoautotrophic pathways.

Today, exposed rocks from the Earth's mantle can be found in few rare continental locations that exhibit present-day serpentinization. One such location is found in the Tablelands Ophiolite, in Gros Morne National Park, Newfoundland. Present-day serpentinization at the Tablelands is evidenced by fluid seeps characterized by their high alkalinity (~pH 11–12), highly reducing conditions (as low as –820 mV), high Ca^{2+}/Mg^{2+} ratios, and the presence of dissolved methane and other lower molecular weight hydrocarbon gases. These fluids contain high concentrations of Ca^{2+} (~5.00×10^4 ppb) compared to freshwater inputs (~ 1.00×10^3 ppb) and react at the surface with atmospheric CO_2 producing travertine deposits (as $CaCO_3$ precipitate), which is also characteristic of serpentinization localities. Isotopic and geochemical analysis of the fluids, dissolved hydrocarbon gases, and carbonates will be discussed to help understand how methane and other low molecular weight hydrocarbons are produced in the serpentinized fluid seeps at the Tablelands Ophiolite; and how the information can be useful in our understanding of the past and present carbon cycle, prebiotic chemistry, and the evolution of chemolithotrophy on early earth and other ultramafic planetary bodies.

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