

Identifying past and present life at a terrestrial site of serpentinization: the Tablelands, western Newfoundland, Canada

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Serpentinization, the hydration of ultramafic minerals, is hypothesized to occur on Mars as well as other planetary bodies including Jupiter's moon Europa, and Saturn's moons Titan and Enceladus. Serpentinization also occurs in terrestrial settings in ophiolites that can be considered analogues for these less accessible sites. The Tablelands is an example of a terrestrial analogue. The serpentinization process results in the production of highly reducing, ultra-basic fluids that cause a characteristic travertine deposit when these fluids emerge. The fluids at sites of serpentinization are rich in methane and hydrogen gas. The methane can be produced biotically or abiotically; therefore, its detection alone is insufficient evidence to indicate the presence of life. Affinity calculations were performed to identify other likely biochemical reactions that could be occurring at these sites to identify alternative products indicative of present life at active sites of serpentinization. The results from these predictive calculations indicated the oxidation of methane should be favoured at the Tablelands. This hypothesis was tested through a series of laboratory experiments using sediment and fluids containing native microbial communities from a spring at the Tablelands.

A microbial observatory was also created in 2017 by drilling three holes and inserting incubators into the subsurface. These incubators were left for a year to collect microbial communities that are representative of life in the subsurface. Extractions will be performed on these incubators to identify lipids that can be used to indicate the presence of life at these springs. Experiments will also be performed to better understand how these lipids degrade over time and how they are preserved. Together, these techniques will help identify biosignatures that could indicate present and past life at sites of serpentinization.