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Survivability and Growth Kinetics of Methanogenic Archaea at various pHs and Pressures: Implications for Deep Subsurface Life on Mars

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Life as we know it requires liquid water and sufficient liquid water is highly unlikely on the surface of present-day Mars. However, according to thermal models there is a possibility of liquid water in the deep subsurface of Mars. Thus, the martian subsurface, where the pressure and temperature is higher, could potentially provide a hospitable environment for a biosphere. Also, methane has been detected in the Mars' atmosphere. Analogous to Earth's atmospheric methane, martian methane could also be biological in origin. The carbon and energy sources for methanogenesis in the subsurface of Mars could be available by downwelling of atmospheric CO_2 into the regolith and water-rock reactions such as serpentinization, respectively. Corresponding analogs of the martian subsurface on Earth might be the active sites of serpentinization at depths where methanogenic thermophilic archaea are the dominant species. Methanogens residing in Earth's hydrothermal environments are usually exposed to a variety of physiological stresses including a wide range of pressures, temperatures, and pHs. Martian geochemical models imply that the pH of probable groundwater varies from 4.96 to 9.13. In this work, we used the thermophilic methanogen, Methanothermobacter wolfeii, which grows optimally at 55^{o}C. Therefore, a temperature of 55^{o}C was chosen for these experiments, possibly simulating Mars' subsurface

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