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Energy Yield of Potential Microbial Lithoautotrophic Metabolisms at Geothermal Sites of Mt. Erebus, Antarctica

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Mt. Erebus, Antarctica is the southern-most active volcano, hosts some of the most physically isolated geothermal environments on Earth, generates rare intermediate-silica high-alkali phonolite rock, and contains an unusual combination of volcanic gasses. Steam and gas from Tramway Ridge and Western Crater, two geothermal sites near the summit of Mt. Erebus, maintain hot localized sediments up to 65°C in an otherwise frozen environment. The steam both introduces moisture, a catalyst to life in the Antarctic desert, and contributes gaseous molecular oxides for redox reactions. Previous studies have demonstrated taxonomically novel, potentially endemic, microbes thriving in this unique geochemical setting [1,2]. In November, 2023, we embarked on the first subsurface microbiological culturing campaign at Tramway Ridge and Western Crater and collected both gas and rock samples from each site. Here, we present bioenergetic calculations of potential lithoautotrophic microbial metabolisms from a novel environment. These reactions incorporate the O_2 and elevated CO_2 present at each site combined with the dominant phonolite minerals including magnetite, olivine, pyrrhotite, and apatite. These findings underpin our ongoing *in situ* cultivation efforts at Mt. Erebus and reveal the unique combination of exergonic reactions.

[1] Herbold, C. W., Lee, C. K., McDonald, I. R., & Cary, S. C. (2014). Evidence of global-scale aeolian dispersal and endemism in isolated geothermal microbial communities of Antarctica. Nature Communications, 5(1), 3875.

[2] Noell, S. E., Baptista, M. S., Smith, E., McDonald, I. R., Lee, C. K., Stott, M. B., et al. (2022). Unique Geothermal Chemistry Shapes Microbial Communities on Mt. Erebus, Antarctica. Frontiers in Microbiology, 13.