Investigating the Microorganisms of Subsurface Mineral Environments

Matthew Joshua Medina¹, Michael N. Spilde², Stephen Smith³ and Diana E. Northup⁴

¹Department of Biology, University of New Mexico, mmedin03@unm.edu
²Institute of Meteoritics and Department of Earth and Planetary Sciences, University of New Mexico
³The National Speleological Society

The discovery of lava caves on Mars and lunar terrains has prompted the study of analogous environments on Earth to enhance our ability to detect life on extraterrestrial bodies. Such environments are lava caves that occur on Mauna Loa, Hawai‘i. Lava caves contain secondary mineral deposits that appear non-biological, but reveal diverse microbial communities upon DNA sequencing. We hypothesize that secondary mineral deposits in lava caves contain a considerable number of microbial communities that vary among different mineral types, and can be investigated for multiple biosignatures. The investigation of these mineral deposits involves scanning electron microscopy (SEM) and sequencing, targeting the 16S rRNA SSU gene. SEM analysis of mineral deposits resulted in images depicting putative microorganisms: filamentous, coccoid, and bacillus morphologies present in biofilms. SEM images also depict mineral substrates having features that could be associated with microbial destructive activities. Collectively, our samples contain putative methane and hydrogen oxidizing bacteria, acidophilic and chemoheterotrophic bacteria, based on closest relatives. Investigating these microbes that masquerade as minerals, and the biosignatures associated with them can help in life detection efforts on extraterrestrial bodies and expand our knowledge of the microbial communities of oligotrophic caves on Earth.

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