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Conference Abstract

Characterizing biofilms and their associated biosignatures in an Arctic hypersaline cold spring Mars analog

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Abstract

The last surface-level aqueous environments on Mars were likely sulfurous brines that formed as the climate cooled and large bodies of water receded during the transition from the wet Noachian to the dry Hesperian (4.1 – 3.0 Gya). To understand the diversity of microorganisms that could have inhabited such environments and their associated biosignatures, we turn to analogous environments on Earth. Here we investigated biofilm communities and their associated biosignatures at Gypsum Hill, (GH), a perennial cold spring system located at nearly 80°N on Axel Heiberg Island in the Canadian high Arctic. The biofilms develop during the summer months alongside the oligotrophic and sulphur rich GH brines and spread out along the flood plains formed by meltwater and spring run-off. Our objective was to link the microbial community structure of the biofilms to geochemical changes across the GH site as an analog to the micro-niches that could have formed during the recession of an ancient Martian Ocean. We collected 14 morphologically distinct biofilms over two field season and found that minor variations in chemistry between proximal sites impacted community structure. 16S amplicon sequencing revealed that biofilms closest to outflow channels were dominated by sulfur oxidizing bacteria, suggesting that primary production may be driven by chemolithoautotrophy. The community structure shifted towards more heterotrophic and phototrophic populations the

further the biofilms appeared from a spring source. Microbial eukaryotes at the GH site were investigated for the first time through 18S sequencing with diatoms and photoautotrophic algae dominating all biofilms. Lastly, we linked the biofilm communities to potential biosignatures by examining lipid profiles to help guide the search and identification of potential remnants of hypothetical ancient Martian life.

Keywords

Astrobiology, Mars Analogue, Microbial Diversity, Polar Microbiology

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Ethics and security

N/A

Conflicts of interest

The authors have declared that no competing interests exist.