18-14-P. On the UV Resistance of *Halococcus hamelinensis*, a Novel Archaeon Isolated from Stromatolites

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Stromatolites are laminated structures primarily built by microbial trapping and binding of sediment and/or precipitation of a framework of calcium carbonate. These structures can be found in the geological record as far back as 3.5 billion years and represent the oldest evidence of life on Earth. Studying adaptation to various stresses in microbial communities today can provide insights survival strategies on Early Earth. Shark Bay in Western Australia serves as an analogous marine environment to early Earth with respect to the physical conditions microbes had to deal with in early microbial systems. This study focused on a novel halophilic isolate from Shark Bay stromatolites, *Halococcus hamelinensis* sp. nov. Investigations of this strain include exposure to simulated early Earth UV conditions for up to two hours. The study indicated that *Hcc. hamelinensis* was able to survive high doses of UVC for two hours, with 2% of cells still viable following this exposure. In accordance to the decline in survival, the formation of thymine dimers increased with dosage. Although bacterioruberin does not absorb UV radiation, the amount of bacterioruberin present in the samples increased during the time of exposure with the maximum amount following 30 min of exposure. After 30 min, the amount decreased and was not measurable following 1 hour of exposure. These data suggest that bacterioruberin, although not directly absorbing UV radiation, plays a major role in the protection of the cell against damaging UV doses.


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Complex morphological features in biofilms and microbial mats are potential diagnoses of the behaviors and environments that control the relationships among morphology, behavior, and environment. The study of cyanobacterial mats in Shark Bay, Australia, is crucial to the study of the early evolution of microbial communities. In situ carbonate precipitation is one way these communities were preserved. Microbial mats sampled from Pavilion Lake, BC, are associated with carbonate precipitation both in situ and in the laboratory. Biofilms dominated by *Oscillatoria* sp. are grown in BG-11 artificial lake water medium and CaCO₃ precipitation is induced by increasing the concentration of CaCl₂ from 0.2 mM/L to 1–40 mM/L. Within 24 hours, precipitates form due to supersaturation of the media both in controls and within mats. Analysis of the mats with light microscopy shows 10–100 μm aggregates of amorphous or cryptocrystalline crystals less than 1 μm in diameter that dissolve with addition of HCl, indicating that the aggregates are CaCO₃. Aggregates are most common in dense regions of the mat where many cyanobacterial filaments cross each other. Precipitation usually occurs in gaps near filament intersection points. Mineral aggregates are mostly seen in direct contact with live cyanobacterial filaments, and they commonly are centered to the side of individual filaments and may partially envelop filaments. These relationships suggest that precipitation is not due to decay of abandoned sheaths. Rather, precipitates are nucleated where the local microenvironment is heavily influenced by cyanobacteria, probably by microbial carbon cycling. This system can be used to characterize the processes that lead to carbonate precipitation and the influence cyanobacteria have on precipitation and lithification of microbialites.

18-16-P. CaCO₃ Precipitation in Freshwater Laboratory Biofilms Dominated by *Oscillatoria* sp.

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Microbiomes dominate Earth’s fossil record, and understanding the processes that control the formation and preservation of microbialites is crucial to the study of the early evolution of microbial communities. In situ carbonate precipitation is one way these communities were preserved. Microbial mats sampled from Pavilion Lake, BC, are associated with carbonate precipitation both in situ and in the laboratory. Biofilms dominated by *Oscillatoria* sp. are grown in BG-11 artificial lake water medium and CaCO₃ precipitation is induced by increasing the concentration of CaCl₂ from 0.2 mM/L to 1–40 mM/L. Within 24 hours, precipitates form due to supersaturation of the media both in controls and within mats. Analysis of the mats with light microscopy shows 10–100 μm aggregates of amorphous or cryptocrystalline crystals less than 1 μm in diameter that dissolve with addition of HCl, indicating that the aggregates are CaCO₃. Aggregates are most common in dense regions of the mat where many cyanobacterial filaments cross each other. Precipitation usually occurs in gaps near filament intersection points. Mineral aggregates are mostly seen in direct contact with live cyanobacterial filaments, and they commonly are centered to the side of individual filaments and may partially envelop filaments. These relationships suggest that precipitation is not due to decay of abandoned sheaths. Rather, precipitates are nucleated where the local microenvironment is heavily influenced by cyanobacteria, probably by microbial carbon cycling. This system can be used to characterize the processes that lead to carbonate precipitation and the influence cyanobacteria have on precipitation and lithification of microbialites.

18-17-P. Microbial Diversity in Icelandic Hot Springs

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The study of extreme environments and the organisms that inhabit them, i.e., extremophiles has made the search for extinct and extant life in the ancient Earth as well as on other planets more plausible. Among terrestrial extreme environments, geothermal hot springs and the associated silica sinters are well known analogues for early Earth conditions and the phylogenetic characterization of microbial communities in such systems have been the focus of extensive research. However, the parameters controlling the abundance and diversity of microbial communities as well as the links between community diversity and geochemical/hydrodynamic regime prevalent in hot springs are still poorly understood. Here we present results from phylogenetic analyses of the microbial diversity in five geochemically diverse (T, pH, salinity, nutrients, sinter growth rate) Icelandic hot springs where silica precipitation leads to the preservation/fossilization of microbial biomarkers. Standard molecular techniques that targeted both bacterial and archaeal 16S rDNA were employed and ~220 bacterial clones were sequenced. Preliminary data show that the main factors controlling the microbial abundance and diversity are salinity, sinter growth rate, and temperature. Where high-salt, high growth rates (300 kg silica y⁻¹ m⁻²) and high-T (75°C) conditions dominate, neither bacterial nor archaeal strains were detected whereas in low-salt systems exhibiting low precipitation rates (1 kg y⁻¹ m⁻²) and lower T (66°C), the microbial abundance and diversity was characterized by the presence of both archaeal and bacterial strains. BLAST search of sequenced bacterial clones indicated close relationship to the phyla Deinococcus-Thermus, Proteobacteria, Aquificae, Candida division OP1, Nitrospirae, and Firmicutes strains. BLAST search of sequenced bacterial clones indicated close relationship to the phyla Deinococcus-Thermus, Proteobacteria, Aquificae, Candida division OP1, Nitrospirae, and Firmicutes.