Microbial ecology and resultant taphonomy as a function of hydro-geological history in a terrestrial analog of Martian, fault-controlled spring system.

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On Mars, recent observations suggest that groundwater heated and controlled by geologic events represents a likely late-stage reservoir available for biological activity. Photo-geological observations of the Martian surface support geologically, relatively young groundwater discharge via sapping and/or fault-controlled springs. Investigation into these reservoirs is crucial to our understanding of the biological potential of the planet. Connections in terrestrial springs among hydro-geological variables, nutrient availability for microbial metabolism, and differences in extant community structure, as

well as taphonomic preservation of biosignatures, must be further explored to provide contextual information for remote sensing or ground-based experiments on Mars. This research investigates a fault-driven, mesophilic, sulfur spring system in Hayward, California, possibly analogous to a hypothetical Martian system. We suggest that aqueous geochemical variations among springs will affect the respective structures of microbial communities and, subsequently, the mineral and/or organic biosignatures preserved in older mineralized springs at the Hayward site. Initial biological results indicate that sulfide oxidation by *Epsilon-proteobacteria* is a significant process occurring in each of two studied springs, while iron-oxidation by *Beta-proteobacteria* seems to be present only in one spring. Also, preliminary chemical analysis of the Calcite associated with the mineralized springs indicates abundant organic carbon, and thus, suggests a possible record of prior microbial ecosystems. The geologic history, aqueous geochemistry, and microbial ecology of this site provide an attractive model for study of similar Martian sites and their ability to either currently, or historically, sustain biological systems.