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Conference or Workshop Item

Colour Peak: An analogue environment for the waters of late Noachian Mars

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The surface of Mars cannot sustain liquid water today, but there is evidence water was present during the Noachian era. The transition of the martian climate from the wet Noachian to the dry Hesperian would have resulted in saline and sulfur rich surface waters . Terrestrial analogue environments that possess a chemistry like these proposed waters can be used to develop an understanding of organisms that could have persisted under such conditions. Here we present the chemistry and microbiome of the analogue environment Colour Peak, a sulfidic and saline spring system located within the Canadian High Arctic.

In this study, molecular and geochemical techniques were used to investigate the sediment of the Colour Peak springs. Nucleic acids were extracted from the microbes in the sediments and the microbiome was characterised by the amplification and sequencing of 16S rRNA gene amplicons. The elemental composition of the fluids and sediment was determined by ICP-OES and compared with brines determined from the chemistry of the "Rocknest" sand sample at Yellowknife Bay, Gale Crater (Mars) by thermochemical modelling. Gibbs energy values were calculated from this fluid chemistry to identify potentially viable metabolisms.

Analysis of the chemistries of the Colour Peak fluids confirmed a chemical composition like the thermochemically modelled fluid, with this justifying the classification of Colour Peak as an appropriate analogue environment to investigate the habitability of former martian aqueous environments. 16S rRNA gene profiling of the Colour Peak microbial community revealed it was dominated by bacteria associated with oxidation of reduced sulfur species and carbon dioxide fixation. Gibbs energy values calculated using the chemistry of the modelled martian fluid demonstrated that the oxidation of reduced sulfur species was also viable in this chemical environment under aerobic and anaerobic conditions. These results demonstrate that microbial sulfide oxidation is thermodynamically viable using both modelled and environmental proxies for former martian aqueous environments.

This study highlights that metabolisms utilising the oxidation of reduced sulfur species could have been thermodynamically viable in ancient martian aqueous environments. Further work is needed to assess this proposed viability and the potential for unambiguous biosignature formation.