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RAMAN SPECTROSCOPY OF MICROBIALLY-PRECIPITATED MG-CARBONATES: RELEVANCE TO JEZERO CRATER, MARS.

Abstract

The landing site of the Perseverance rover - Jezero crater - contains several units with evidence of Mg-rich carbonates which provides a unique opportunity to investigate carbonates with a possible fluvio-lacustrine origin, and the potential to preserve and enable detection of microbialites. This study is designed to advance our abilities to detect and characterize magnesium-rich carbonates on Mars and within Jezero crater. Atlin playas and surrounding bedrock mine samples, in addition to Clinton Creek, Lake Salda and Lake Alchichica are analogue sites forming microbialites, microbial mats and various microbial precipitates that will advance our understanding of Mg-carbonate formation and precipitation with microbial interactions in mafic lacustrine environments. Raman spectra of whole rock, unsorted and ¡45-micron powders were acquired using a 532 nm laser. Reflectance and X-ray diffraction (XRD) spectra indicate the presence of magnesite, hydromagnesite and aragonite. Knowing the minerology of the samples aids in interpretation of the Raman data and the related peaks with the appropriate mineralogy. The Atlin bedrock Pictu and Anna mine samples indicate characteristic peaks associated with magnesite at 200, 320 and 1094cm-1. The Anna mine ¡45-micron powder sample exhibited additional magnesite-related Raman shift peaks at 1450 and 1750 cm-1. Additionally, Raman of all the bedrock samples indicated the presence of quartz at 460 cm-1 and the Anna mine sample exhibited a quartz peak at 1160 cm-1. The Atlin playa samples ATM unsorted powder and all ATP samples exhibited weaker peaks at 1080 cm-1 from which the presence of aragonite can be confirmed, in conjunction with its identification n the XRD of the respective samples. Lake Salda presents one weak peak from the unsorted powder at 1115 cm-1 associated with hydromagnesite, while Clinton Creek did not exhibit any related peaks in the Raman spectra. The LALC sample from Lake Alchichica exhibited clear and definite cyanobacteria/carotenoids peaks at 1150 and 1510 cm-1 on the whole rock sample. Due to the modern lacustrine nature the origin of the organic related peaks is uncertain. The Raman spectra alone were able to detect the variety of carbonate present along with any inclusions such as quartz. The Raman laboratory data indicate the possibility of identifying multiple mineral peaks within the Mg-carbonate deposits on Mars. The capabilities of Raman spectroscopy to detect biosignatures within mafic terrain microbial precipitates will be further examined with the identification of “hot spots” through SEM mapping to locate region of higher potential for organic materials.