NASA Astrobiology Early Career Collaboration Award Report

Characterizing organic matter in opaline silica sinters from Chile utilizing Raman spectroscopy with relevance to the search for biosignatures on Mars

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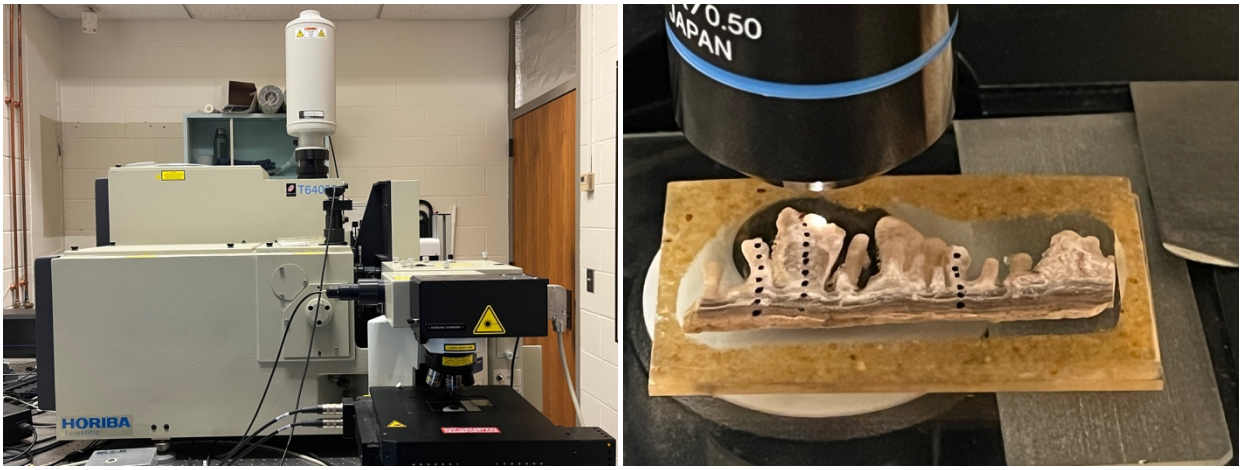
In collaboration with Prof. Andy Czaja (University of Cincinnati)

In March 2026, NASA Astrobiology Early Career Collaboration Award (ECCA) supported my 10-day trip to Prof. Andy Czaja's lab at University of Cincinnati for collecting Raman spectra of organic matter preserved in silica sinter samples using the deep-UV excitation laser.

Siliceous deposits in terrestrial hot spring environments, also known as silica sinters, are favorable materials for preserving microbial textures and biogenic organic matter (OM). The ongoing exciting discoveries from the UV Raman instrument onboard the Mars 2020 Perseverance rover urge systematic investigations of terrestrial Mars analog materials that involve biosignature preservation and characterization. However, there is a lack of Raman spectra of opaline silica sinters using UV excitation lasers. The objective of this collaboration project is to conduct a systematically investigation of OM in opaline silica sinters from El Tatio, Chile, an excellent analog site for Mars.

Before the trip, I selected sinters from different lithofacies in the terrestrial hydrothermal setting and with distinct textures. I prepared both un-processed and polished samples of each sinter for Raman spectra collection. At the University of Cincinnati, Prof. Czaja demonstrated the use of the UV excitation laser with the Raman microscope, which differs from conventional visible or infrared excitation wavelengths commonly used in Raman spectroscopy. Over the following days, I successfully collected Raman spectra from silica sinter samples using both the 257 nm deep-UV and the 514 nm green excitation lasers.

Throughout the 10 days laboratory work at Prof. Czaja's lab, all objectives of this award were achieved. This project resulted in the successful collection of Raman spectra from opaline silica sinters. The work also strengthened my cross-institutional collaboration and supported my broader research goal of contributing to the search for life on Mars through the application of Raman spectroscopy techniques.



Left: HORIBA T64000 Raman microscope. | Right: A geyserite sample under the microscope.