

Mapping Organic-Mineral Associations in Jezero crater

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The search for potential signs of life on Mars, a primary aim of the Mars 2020 mission, is greatly informed by the detection of organic matter¹. The presence of organic matter also provides key information about the habitability and biological potential of the planet throughout its history. The *Perseverance* rover was designed for *in situ* science with the ability to collect a suite of promising samples for eventual return to Earth. One of its instruments, Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals (SHERLOC), is a deep ultraviolet (DUV) Raman and fluorescence spectrometer designed to map the distribution of organic molecules and minerals on rock surfaces at a resolution of 100 μm^2 . With its unique spectral mapping capabilities, SHERLOC enables a novel understanding of organic-mineral relationships on Mars to better determine their formation, deposition, and preservation mechanisms.

The rover's landing site within Jezero crater combines a high potential for past habitability as the site of an ancient lake basin with a diverse set of minerals, including carbonates and clays, that may preserve organic materials and potential biosignatures. The Jezero crater floor includes three formations (fm); two of these, Mááz and Séítah, were explored as part of the mission's first campaign. Here, we report the detection of multiple species of aromatic organic molecules using Raman and fluorescence spectroscopy across ten targets in the two formations. This is the first evidence of organic molecules in Martian materials obtained using Raman spectroscopy, and among the first using fluorescence spectroscopy, beyond Earth³. We report specific spatial patterns and classes of organic molecules in these compositionally distinct formations, potentially indicating different fates of carbon in these environments. Our findings indicate that there is a diversity of aromatic molecules prevalent on the Martian surface and these materials persist despite exposure to surface conditions. These organic molecules are largely found within minerals linked to aqueous processes, suggesting that these processes may have had a key role in organic synthesis, transport from their point of origin, or preservation.

References

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