National Aeronautics and Space Administration

Analog Mars Sample Return Science (AMaSRS)

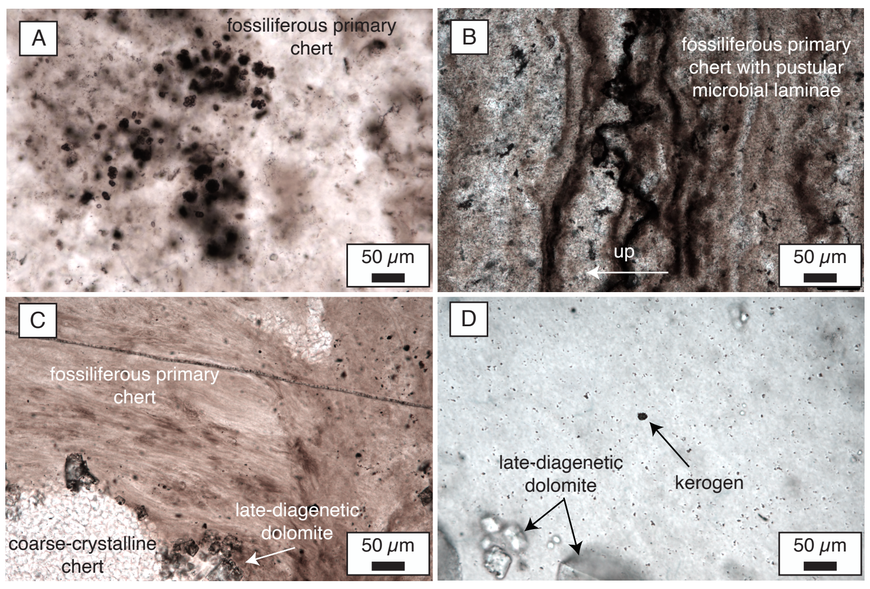
Principal Investigator: Michael Tuite (322); Co-Investigators: Kelsey Moore (322)

Program: FY22 R&TD Strategic Initiative
Strategic Focus Area: Enabling Mars Sample Return Science at JPL - Strategic Initiative Leader: Paul V Johnson

Objective

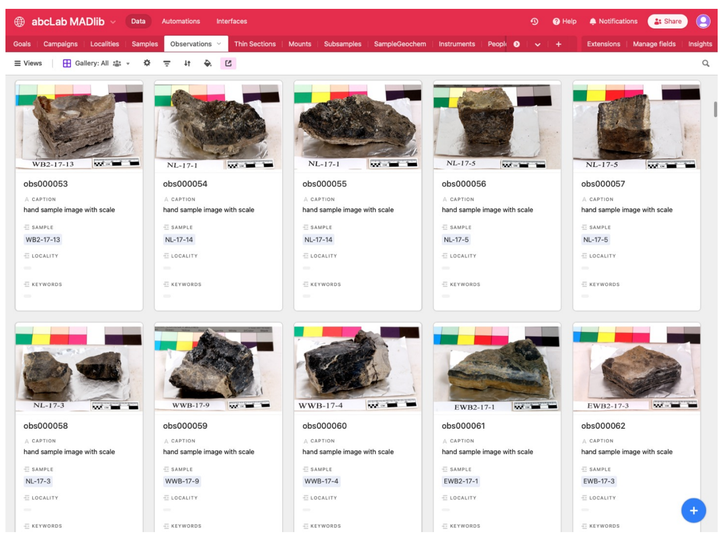
The objective of the Analog Mars Sample Return Science program is to collect, curate, and analyze Earth rocks that are analogs for lithologies anticipated or observed in and around Jezero Crater. Our focus is on the complex biosignatures that record the history of life and the environment on Earth with the goal of eventually applying that knowledge to returned Mars samples. Our methods include the use of an analog coring device and a workflow that mimics the experience of a returned sample. The broader motivation for this program is maintaining JPL's MSR leadership and participation in the final phase of the MSR program.

In the Lab



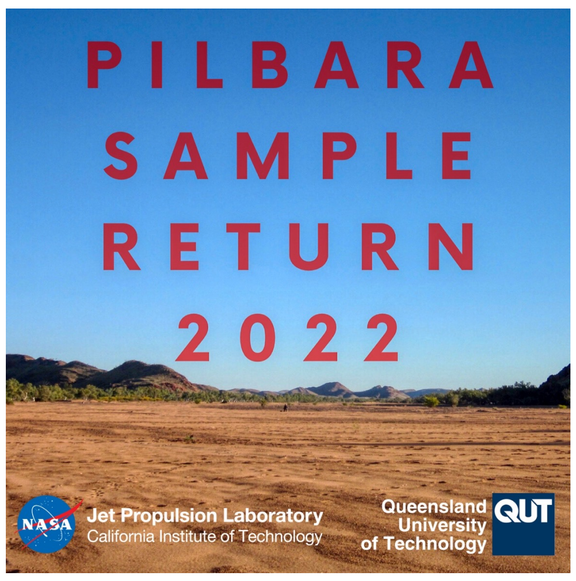
Transmitted light photomicrographs of thin sections from the Kotuikan Formation (A), Balbirini Dolomite (B), Debengda Formation (C), and Duck Creek Formation (D). Thin sections show examples of coccoidal microfossils with organic-rich walls (A and B), organic rich microbial lamination (B), filamentous microfossils (C), and kerogen clots (D) preserved in early diagenetic chert. All contain kerogen and variable amounts of late diagenetic chert and both early and late diagenetic carbonate are found across the four formations.

Data Management



The Mars Analog Digital Library (MADlib) currently contains records for 1,328 individual samples and continues to grow.

In the Field



- Successfully collected ~60 rock core and regolith samples.
- Conducted proximity science on 15 abrasions including imaging and Raman spectroscopy.
- Generated a detailed 3D terrain model of each sampling site.
- Currently preparing data and samples for analysis and distribution to collaborators.

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Publications:

Moore, K.R., Present, T.M, Pavia F., Grotzinger. J.P, Razzell Hollis,J., Sharma, S., Flannery, D., Bosak, T., **Tuite**, M.L., Knoll, A.H., Williford, K. (2022) Biosignature preservation aided by organic-cation interactions in Proterozoic tidal environments. Palaios 37, 9. https://doi.org/10.2110/palo.2022.017https://doi.org/10.2110/palo.2022.017

Hickman-Lewis K, **Moore** KR, Hollis JJR, **Tuite** ML, Beegle LW, Bhartia R, Grotzinger JP, Brown AJ, Shkolyar S, Cavalazzi B, Smith CL. (2022); Identification of Paleoarchean Biosignatures Using Colocated Perseverance Rover Analyses: Perspectives for Mars Science and Sample Return. Astrobiology. 2022 Sep;22(9) 1143-1163. doi:10.1089/ast.2022.0018.

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