

RHIANNA MOORE

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RESEARCH INTERESTS

Surface processes of planetary bodies, and how surface deposits are influenced by aqueous and volcanic processes, including: how aqueous processes transform landscapes and alter rock over time; how water and volcanic systems interact in surface environments; applied planetology and terrestrial analogs; and mission data analysis to map and interpret areas of geological interest.

EDUCATION

Ph.D. in Geology **Dec 2022**

The University of Tennessee, TN

Dissertation: *“Geochemical and climatic controls on the sulfur cycle in volcanic settings: Implications for the origin of S-rich deposits investigated by the Spirit and Opportunity rovers on Mars.”*

B.S. in Planetary Science **Dec 2017**

Purdue University, IN

Thesis: *“Using remote sensing data to understand the geomorphology of a glaciated volcanic Mars analog”*

Study Abroad Exchange Program **Jul - Nov 2015**

University of Canterbury, Christchurch, New Zealand

RESEARCH EXPERIENCE

Postdoctoral Fellow **Jul 2023 - present**

Dept. of Earth and Planetary Sciences; The University of Texas at Austin; Austin, TX

Advisor: *Dr. Timothy Goudge*

- Investigate deposition of globally-distributed clay deposits on Mars to better constrain the nature of the Noachian surface environment.
- Develop stereo-derived DEMs (from HiRISE data) for integration with spectroscopic and image data (e.g., CRISM, CTX) for analysis of martian clay stratigraphies.
- Use physical, sedimentological, and structural characteristics of clay-bearing strata to identify depositional environment and timing.
- Perform collaborative and independent research regarding planetary surface processes.

Planetary Science Summer School Participant **May 2024 - Aug 2024**

Jet Propulsion Laboratory – California Institute for Technology; Pasadena, CA

Mentors: *Drs. James Tuttle Keane & Alfred Nash*

- Developed a hypothesis-driven robotic space mission to Ceres motivated by Decadal-level science in response to a New Frontiers 5 announcement of opportunity.
- Learned in-depth about mission design, life cycle, cost, scheduling, and trade-offs involved in mission architecture.
- Acted as a Ceres surface science Objective Lead to develop requirements on science traceability, instrumentation suites, and data sufficiency. Also acted as the spacecraft mechanical/configuration engineer.
- Presented with team the final mission concept design to NASA expert review board.

Doctoral Researcher **Aug 2018 - Dec 2022**

Dept. of Earth and Planetary Sciences; The University of Tennessee; Knoxville, TN

Advisor: *Dr. Anna Szyrkiewicz*

- Investigated sulfur mineralogy on Earth and Mars, including volcanic/hydrothermal origins, oxidation mechanisms, and implications for paleoclimate.
- Conducted field work to collect sediment and water samples from analog sites.

- Performed independent geochemical laboratory analyses on hydrothermal S minerals.
- Quantified sulfate fluxes in river catchments of Mars analogs (Hawaii, Iceland) using GIS mapping techniques and geochemical and hydrological data.
- Interpreted and used spectral and geomorphic data obtained from MER and MRO missions.
- Wrote reports for publication and presented dissertation findings at conferences and meetings.

NASA Intern

Jan 2018 - May 2018

Planetary Geology Laboratory; NASA Goddard Space Flight Center; Greenbelt, MD

Mentors: Drs. Jacob Bleacher & Jacob Richardson

- Mapped lava flow channels within Tharsis volcanic province on Mars using CTX/HiRISE imagery in ArcMap.
- Evaluated geomorphology of lava channels, pits, and vents to assess emplacement style, lava viscosity, etc., of small volcanic eruptions on Mars.
- Conducted team field work in the Potrillo volcanic field (NM) to study terrestrial lava flow morphology and test field instruments (i.e., LIBS, LIDAR).

NASA Intern

May 2017 - Aug 2017

Meteoroid Environment Office; NASA Marshall Space Flight Center; Huntsville, AL

Mentor: Dr. Bill Cooke

- Identified new small-scale impact features on the Moon from telescope imagery and georeferenced their locations using ArcMap and Python scripts.
- Calculated crater diameters based on angle and energy of source meteoroids.
- Created and maintained a working database of all impact data.

Undergraduate Researcher

Aug 2016 - May 2017

Earth, Atmospheric, and Planetary Science Dept.; Purdue University; West Lafayette, IN

Advisor: Dr. Briony Horgan

- Investigated glacial weathering in the Cascades as an analog to Mars.
- Developed a high-res (10 m) digital elevation model (DEM) from LIDAR data of the glaciated volcanic complex and mapped glacial morphologies using ENVI and ArcMap.

PUBLICATIONS

Journal Publications

Moore, R. D. and Szykiewicz, A. (2023) Aqueous sulfate contributions in terrestrial basaltic catchments: Implications for understanding sulfate sources and transport in Meridiani Planum, Mars: *Icarus*, v.391, 115342.

Moore, R. D. and Szykiewicz, A. (2022) Controls on S mineral formation and preservation in hydrothermal sediments: Implications for the volcanic, aqueous, and climatic history of Gusev crater, Mars: *Icarus*, v.376, 114880.

Under Review

Klidaras, A., Navarre, R., Horgan, B., Farrand, W., Broz, A., Goudge, T.A., **Moore, R.** (*in review*) Topography and mineralogy of clay deposits signify and epoch of warm and humid climate on early Mars: *Geology*.

Thomson, B., Basu, U., Harris, C., Ettenborough, I., Lewis, M., **Moore, R.**, Skjetne, H., & Tuggle, J. (*in review*) Geology of the Gale Crater landing site: *Oxford Research Encyclopedia*.

CONFERENCE ABSTRACTS

Oral Presentations

Moore, R. D., Goudge, T. A., Klidas, A., Horgan, B., & Farrand, W. (2024) Global scale physical landscape constraints on the formation of Noachian clay sequences on Mars: *55th Lunar and Planetary Science Conference, Abstract # 2263*.

Moore, R. D. (2023) "Sulfur from Source to Sink on Mars," *Canadian Institute for Advanced Research Meeting*.

Moore, R. D. and Szykiewicz, A. (2022) Aqueous sulfate fluxes in basaltic catchments: An analog investigation of sulfate deposition in Meridiani Planum, Mars: *53rd Lunar and Planetary Science Conference*.

Moore, R. D. and Szykiewicz, A. (2021) Geochemical and environmental controls on S mineral formation and preservation in hydrothermal sediments: Implications for the volcanic and aqueous history of Gusev crater, Mars: *Geological Society of America Meeting*.

Moore, R. D., Bleacher, J., & Richardson, J. (2018) A survey of the Tharsis volcanic plains: Mapping lava tubes and channels on Mars: *Geological Society of America Meeting*, Abstract #318913.

Poster Presentations

Mishra, I., Banerjee, S., Coumarbatch, K., Economon, S., Fifer, L., Gwizd, S., Gamage, S., Hinshaw, R., Kareta, T., Levine, W.G., Leeming, A., McConville, C., **Moore, R. D.**, Plattner, T., Sanchez, A., Sikka, A., Wroblewski, F., Keane, J.T., Nash, A.E. (2024) A concept for a New Frontiers class Ceres Lander: *American Geophysical Union Meeting*.

Moore, R. D., Goudge, T. A., Klidas, A., Horgan, B., & Farrand, W. (2024) Global scale formation constraints for martian clay stratigraphies: *10th International Conference on Mars*.

Moore, R. D. (2023) A 4D look into sulfate cycling in basaltic catchments with application to Meridiani Planum, Mars: *Canadian Institute for Advanced Research Meeting*.

Moore, R. D. (2023) MER Revisited: How sulfur deposits can inform about hydrothermal, aqueous, and climatic processes on Mars: *Texas Area Planetary Science Conference*.

Moore, R. D. and Szykiewicz, A. (2020) The Signature of Sulfur: Geochemical characterization of hydrothermal S-rich deposits in terrestrial Mars analogs: *American Geophysical Union Meeting*.

Moore, R. D., Szykiewicz, A., Ende, J., & Burt, P. (2019) Characterization of hydrothermal sulfur on Earth as a geochemical analog for Mars: *Ninth International Conference on Mars*.

Moore, R. D., Bleacher, J., & Richardson, J. (2018) A survey of the Tharsis volcanic plains: Mapping lava tubes and channels on Mars: *NASA GSFC Intern Poster Session*.

Moore, R. D. and Horgan, B. (2017) Using remote sensing data and digital elevation models of a glaciated volcanic complex as an analog to martian environments: *Purdue University Undergraduate Poster Symposium*.

Moore, R. D., Moser, D., & Suggs, R. (2017) Locating New Meteoroid Impacts on the Lunar Surface: *NASA MSFC Intern Poster Session*.

TEACHING & MENTORING EXPERIENCE

Graduate Teaching Assistant - Lab Instructor

Aug 2018 - May 2022

Dept. of Earth and Planetary Sciences; University of Tennessee; Knoxville, TN

- Taught 2-3 lab components of introductory geology courses per semester (over five semesters) covering physical geology, Earth history, and environmental geology.
- Developed syllabi, quizzes, and labs, and administered all lab grades.
- Collaborated with instructors on lab preparation, topics, and course development.
- Proctored exams and held office hours (2 hrs per week) for face-to-face time with students.

Graduate Mentor

May 2019 - Jul 2021

Dept. of Earth and Planetary Sciences; University of Tennessee; Knoxville, TN

- Instructed four undergraduate research assistants on lab protocol, experiment design, data collection and analysis, GIS mapping, and script writing with respect to doctoral research.
- Guided mentees in preparation and presentation of research findings and provided guidance on career building.

Museum and Outreach Guide

- Participated in UT Austin's STEM Girl Day to teach K-8 students about earth and planetary science.
- Volunteered for guided tours and outreach events of the McClung Museum (UTK) geology exhibit.
- Taught students about science and geology during STEM events at local elementary schools.
- Headed an earth and planetary science booth at the Indianapolis Children's Museum for Purdue outreach events.

OTHER EXPERIENCE

Meteor Crater EVA Science Operations Participant

Sept 2023

EVA Exercise at Meteor Crater; LPI-JSC Center for Lunar Science and Exploration

- Served in a virtual Science Operations Center with 10 early-career participants to simulate EVA communication with an "astronaut" in Meteor Crater (AZ) as training for the Artemis missions.
- Learned to maximize scientific return of the EVA mission, and how to address issues that may affect lunar astronauts.

Senior Scientist

Jan 2023

NSF Small Business Innovation Research Grant

- Collaborated with a small business to submit an NSF grant for novel lunar mining research.
- Provided the team with geologic knowledge of lunar surface conditions and mineralogy and used scientific expertise for materials and instrument testing.

Participating Scientist

Jun 2020

NASA HeroX "Honey, I shrunk the NASA payload" Competition

- Participated in a competition for developing a small (10x10x5) lunar rover capable of analyzing the lunar geology and resources to assist with the Artemis missions.
- Assisted a team as the geologic investigator, providing background on regolith characteristics like mineralogy, grain size, thickness, etc.

Science Team Leader

Aug 2017 - Dec 2017

Purdue University Mission Design Challenge

- Participated in a team-based mission design course focused on analyzing SpaceX's plan for a martian colony, with consideration of Buzz Aldrin's Cyclor concept.
- Determined mission feasibility in the areas of site geology, colony establishment and growth, science research, and resource management.

SCIENTIFIC & LANGUAGE SKILLS

Spatial & spectral analysis: ArcGIS (feature mapping, georeferencing, topographic analysis), ENVI (spectral mapping, mineral identification, analysis of remote sensing data (i.e., ASTER, LIDAR)).

Field work: Sediment and water sample collection (filtering, solute precipitation, trenching), in situ data collection (temperature, dissolved oxygen, pH), GPS tracking, stratigraphic mapping.

Laboratory: Isotope-ratio mass spectrometry (IRMS), elemental analyzer (EA), ion chromatography (IC), sulfur sequential extraction (i.e., acid digestion), gas chromatography (GC), petrographic microscopy, inductively coupled plasma optical emission spectrometry (ICP-OES).

Programming & data analysis: Python, R, Microsoft, and Adobe Suites

Language: English (native), French (proficient)

ACADEMIC SERVICE

Reviewer; NASA MDAP 2023 Proposal Panel	2024
Travel Coordinator; Center for Planetary Systems Habitability	2024
Treasurer; UT Earth and Planetary Sciences Student Association	2020 - 2022

PROFESSIONAL & ACADEMIC AFFILIATIONS

UT Austin Center for Planetary Systems Habitability (CPSH)	current
Graduate Women in Science (GWS)	current
Geological Society of America (GSA)	2018 - 2023
UTK Earth and Planetary Sciences Student Association	2018 - 2022
UTK Association for Women Geoscientists (AWG)	2019 - 2020
Purdue University Planetary Science club (PUPS)	2016 - 2017
Purdue Women in Science Program (WISP)	2016 - 2017

HONORS & AWARDS

UTK Volunteer of Distinction: Extraordinary Professional Promise Award	2022
UTK Earth and Planetary Science Department Graduate Fellowship	2018 - 2022
Undergraduate Scholars Award for Academic Excellence	2017
Purdue Moves Study Abroad Scholarship	2015
Purdue University Presidential Scholarship	2012 - 2016

PROFESSIONAL REFERENCES

Dr. Tim Goudge, Assistant Professor, Earth and Planetary Sciences, University of Texas at Austin
Email: tgoudge@jsg.utexas.edu; Phone: 512.471.4770

Dr. Anna Szykiewicz, Associate Professor, Earth and Planetary Sciences, University of Tennessee
Email: aszynkie@utk.edu; Phone: 865.974.6006

Dr. Linda Kah, Professor, Earth and Planetary Sciences, University of Tennessee
Email: lckah@utk.edu; Phone: 865.974.6399

Dr. Bradley Thomson, Assistant Professor, Earth and Planetary Sciences, University of Tennessee
Email: bthom@utk.edu; Phone: 865.974.2699