

Emmy Bronwyn Hughes
PhD Candidate at Georgia Institute of Technology
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Education

PhD Georgia Institute of Technology, Expected May 2026

Major Field of Study: Earth and Atmospheric Sciences – Planetary Geology. *GPA:* 4.0

PhD Advisor: Dr. James Wray

Relevant Coursework: Geomorphology, Environmental Geochemistry, Physics of Planets, Instruments for Life Detection, Geodynamics, Seminal Papers in Astrobiology, Astrobiology Seminar; Surface Processes Seminar; Advanced Environmental Data Analysis; Biogeochemical Cycles

B.A. Wesleyan University, May 2020

Majors: Earth and Environmental Science; English. *GPA:* 3.80.

Senior Thesis: “Experimental Evaporation and Spectral Analysis of Martian Analogue Brines”

Senior Thesis Advisor: Dr. Martha Gilmore

Relevant Coursework: Global Climate Change, Geochemistry, Sedimentology and Stratigraphy, Earth Materials, Introductory Physics, Elementary Statistics, Applied Data Analysis, Remote Sensing, Structural Geology, Field Geology, Geospatial Analysis, Geologic Field Mapping, Senior Thesis Tutorial (Thesis awarded High Honors)

Research Interests

Martian mineralogy and geochemistry, particularly that of salts, as related to planetary habitability and environmental reconstruction.

Mission Experience

Collaborator, Mars Curiosity Rover: August 2022 – Present

- ChemCam instrument science operations downlink lead

Research Experience

Researcher, Georgia Institute of Technology: August 2021 – Present

- PhD Candidate researching salts as paleoclimate indicators for Mars
- Integrating analogue studies, laboratory work, modeling and remote sensing

Research Assistant, Louisiana State University: August 2020 – July 2021

- Modeling global martian mineralogy with the aim of completing a manuscript
- Running the Planetary Reading Marathon journal club

Nasa SUPPR Intern, Louisiana State University: May 2020 – August 2020

- Using Gamma Ray Spectroscopy data to derive and map global martian MgO concentrations
- Synthesizing Thermal Emission Spectrometer data with Gamma Ray Spectroscopy data to interpret global martian mineralogy
- Contributed to two white papers for the 2023 – 2032 decadal survey including science writing and editing

Research Assistant, Wesleyan University: February 2019 – May 2020

- Worked with Professor of Geology Martha Gilmore to develop and study Martian analogue brines

- Designed and implementing technical work on a Mars analogue chamber
- Compared resulting experimental data to data received from the Mars Reconnaissance Orbiter (MRO)
- Synthesized into 240-page senior thesis, awarded high honors in Earth and Environmental Sciences

Planetary Science Intern, Smithsonian Air and Space Museum: May 2018 - August 2018

- Studied over 500 images of Martian surface, identified dominant and unique morphologies of Transverse Aeolian Ridges (TARs)
- Organized major outreach program “Mars Day” for thousands of museum visitors to learn about Mars
- Research culminated in a poster presented at Lunar and Planetary Science Conference, March, 2019

Researcher, Dr. Mary Droser’s Ongoing Paleontological work, South Australia: 2014 - Present

- Worked on the oldest evidence of animal life from the Ediacaran Period, 560-million years ago
- Research includes cataloging fossils, taking measurements and assisting in writing papers
- Worked during summers of 2014, 2015, 2016, 2017, 2019, and 2021

Teaching Experience

Teaching Assistant, Georgia Institute of Technology, Earth Processes: January 2022 – May 2022

- Running two lab sections covering principles of geology and earth science with 24 students each
- Responsible for pre-lab lecture materials and lectures, lab set-up, overseeing and answering questions
- Grading lab assignments weekly

Teaching Assistant, Georgia Institute of Technology, Habitable Planet: August 2021 – December 2021

- Responsible for material ranging from planetary interiors to spectroscopy to exoplanet detection
- Ran a lab section with ~24 students; prepared pre-lab lectures; oversaw experiments
- Graded lab assignments weekly

Teaching Assistant, Wesleyan University, Planetary Geology: January 2020 - May 2020

- Held TA sessions and answered questions for about 60 students in Intro to Planetary Geology course
- Helped implement teaching exercises including cratering simulation

Teaching Assistant, Wesleyan University, Introductory Statistics: January 2019 - May 2019

- Graded statistics problem sets, culminating in 5-6 hours of work a week
- Lead TA sessions, helping students understand statistical concepts and complete problem sets

Publications

Hughes, E. B., Wray, J., Karunatilake, S., Fanson, G., Harrington, E., & Hood, D. R. (2024). Water-Limited Hydrothermalism and Volcanic Resurfacing of Eridania Basin, Mars. *Journal of Geophysical Research: Planets*, 129(7), e2024JE008461. <https://doi.org/10.1029/2024JE008461>

Surprenant, R. L., Gehling, J. G., **Hughes, E. B.,** & Droser, M. L. (2023). Biostratinomy of the enigmatic tubular organism *Aulozoon soliorum*, the Rawnsley Quartzite, South Australia. *Gondwana Research*.

Hughes, E.B., Gilmore, M., Martin, P.E. and Eleazer, M. (2023). “Visible to near-infrared reflectance and Raman spectra of evaporites from sulfate-chloride Mars analogue brines.” *Icarus*, p.115597
<https://doi.org/10.1016/j.icarus.2023.115597>

Droser, M. L., Evans, S. D., Tarhan, L. G., Surprenant, R. L., Hughes, I. V., **Hughes, E. B.,** & Gehling, J. G. (2022). What Happens Between Depositional Events, Stays Between Depositional Events: The Significance of Organic Mat Surfaces in the Capture of Ediacara Communities and the Sedimentary Rocks That Preserve Them. *Frontiers in Earth Science*, 10(February), 1–17.
<https://doi.org/10.3389/feart.2022.826353>

Droser, M., Evans, S., Dzaugis, P., **Hughes, E. B.,** Gehling, J., 2020, “*Attenborites janeae*, A new enigmatic organism from the Ediacara Member (Rawnsley Quartzite), South Australia.” *Australian Journal of Earth Sciences*, 67, 915-921.

Droser, M., Gehling, J., Tarhan, I., Evans, S., Hall, C., Hughes, I., **Hughes, E. B.** [...] 2017, “Piecing together the puzzle of the Ediacara Biota: Excavation and reconstruction at the Ediacara National Heritage site Nilpena (Australia).” *Palaeogeo, Palaeoclim., Palaeoec.* 513, 132-145.

White Papers

- Skok, J. R., Karunatillake, S., Zacny, K., **Hughes, E. B.**, Blank, J., Gaskin, J., Williams, A., Cannon, K., Edmunson, J., Parente, M. (2021). “SPRING Mission: Exploring the past and enabling the future of Mars. Planetary Science and Astrobiology Decadal Survey 2023-2032.” white paper e-id. 360; Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 360
- Karunatillake, S., Bramson, A.; Zacny, K., Dundas, C., Ojha, L., Aharonson, O., Vos, E., Hood, D. R., Rogers, D., Levy, J., Doran, P., Mandt, K., Wilson, J., **Hughes, E. B.** [...] (2021). “GANGOTRI mission concept on the glacial key to the Amazonian climate of Mars.” Planetary Science and Astrobiology Decadal Survey 2023-2032 white paper e-id. 357; Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 357

First-Authored Conference Talks and Abstracts

- Hughes, E. B.**, Buffo, J., Wray, J., & Rivera-Hernandez, F. (2024, May). Spectral Diversity of Sulfate Minerals in Canadian Lakes as Analogues for Early Mars. In 2024 Astrobiology Science Conference. AGU.
- Hughes, E. B.**, F. Rivera-Hernández, W. Rapin, J. R. Johnson, P. Gasda, D. Das, E. Sklute, O. Gasnault, N. Lanza, L. C. Kah, B. Tutolo, P.Y. Meslin, E. Dehouck, R. Y. Sheppard. “Hydrated Na-Mg-Sulfate Suggests Warmer Concentrated Fluids Infiltrated the Sulfate Unite, Gale Crater, Mars” (2024). Talk presented at 55th Lunar and Planetary Science Conference.
- Hughes, E. B.**, J. J. Wray, F. Rivera-Hernández, P. Dharmapriya, S. Karunatillake, G. Kodikara, A. Sarbadhikari, V. M. Nair, Y. Srivastava, A. Rani, and the 2023 Expedition Team. “Raman and VNIR Spectra of Sri Lanka Serpentine Zone Minerals With Relevance to Nili Fossae and Jezero Crater, Mars” (2024). Poster presented at 55th Lunar and Planetary Science Conference.
- Hughes, E. B.**, J. J. Buffo, F. Rivera Hernández, K. L. Lynch, J. J. Wray. “Season Changes in VNIR Spectra of Salts from Canadian Hypersaline Lakes with Relevance to Mars” (2023). Talk presented at Ancient and Future Brines conference.
- Hughes, E. B.**, J. Wray, S. Karunatillake. “Amorphous Silica Deposits Suggest Aeolian and Glacial Conditions in Eridania Basin, Mars” (2022). Poster presented at 53rd Lunar and Planetary Science Conference.
- Hughes, E. B.**, J. Wray, S. Karunatillake, D. R. Hood. “Modeled Bulk Mineralogy Suggests Limited Alteration in Eridania Basin, Mars” (2021). Poster Presented at AGU, 2021.
- Hughes, E.B.**, M. S. Gilmore, M. “Eleazer Experimental Evaporation of Multicomponent Brines Demonstrates Variability in Salt Identification” (2021). Talk presented at Modern Brines Conference.
- Hughes, E.B.**, M.S. Gilmore, M. Eleazer “VNIR and Raman Spectral Characterization of Martian Analogue Chloride and Sulfate Brines” (2021). Talk given for the 52nd Lunar and Planetary Science Conference.
- Hughes, E.B.**, Karunatillake, S., Hood, D. R. “Global and Regional Martian Regolith Compositions Derived from GRS and TES Data” (2021). Poster presented for 52nd Lunar and Planetary Science Conference.
- Hughes, E. B.**, Karunatillake, Suniti, Hood, Donald. “Global Magnesium Mapping for Mars: Insights from Methodology Driven Variability” (2020). Poster presented at the 2020 Geologic Society of America (GSA) Conference.
- Hughes, E. B.**, Gilmore, Martha S., Martin, Peter E. “Experimental Evaporation and Spectral Analysis of Martian Analogue Brines” (2020). Poster presented at 2020 American Geophysical Union (AGU) Conference.
- Hughes, E. B.**, Gilmore, Martha S. “Characterization of Martian Salts through Experimental Evaporation and Spectral Analysis of Analogue Brines” (2020). Abstract accepted to the 2020 Lunar and Planetary Science Conference (LPSC).
- Hughes, E. B.**, Zimbelman, James R. “Preliminary Observations of Transverse Aeolian Ridges in Digital

Terrain Models” (2019). Poster presented at 2019 Lunar and Planetary Science Conference (LPSC).
Hughes, E. B. “Relationships between Crater Size, Depth, and Degradation State” (2017). Poster presented at the 2017 Wesleyan Quantitative Analysis Center’s Poster Session.

Invited Talks

- University of Peradeniya: “Evidence Against Hydrothermalism in Eridania Basin, Mars.” June, 2023.
- LSU Astrophysics Lunch Seminar: “The Global Regolith Mineralogy of Mars in Geologic and Geochemical Context.” April, 2021
- Wabash College: “Global Mineralogical Mapping for Mars.” December, 2020.
- University of Dhaka, “Global Mineralogical Mapping for Mars.” December, 2020.

Academic Awards and Honors

- ARCS Foundation Atlanta Scholar
- 2023 EAS Graduate Student Service Award
- GEAS Symposium 2nd Place Best Talk
- **NSF GRFP Fellow (Fall 2022 – Spring 2025)**
- Astrobiology Fellow (2022 – 2023)
- High Honors Senior Thesis: “Experimental Evaporation and Spectral Analysis of Martian Analogue Brines.” April 2020.
- 2020 Recipient of Peirce Prize for Excellence in Chemistry, Biology, or Geology
- 2019 Earth and Environmental Science Department McKenna Fellow
- Spring 2017, Spring 2019, Fall 2019, Spring 2020 Dean’s List

Workshops, Summer Schools and Training Courses Attended

- 2024 Jet Propulsion Laboratory Planetary Science Summer School (PSSS) participant
- 2023 NASA Mars Ideation Factory Participant

Awarded Grants

- **Co-I: Planetary Society STEP Grant for “Multiscale Characterization of Brine-Rich Planetary Analog Environments” (\$49,284)**
- 2023 Center for Promoting Inclusion and Equity in the Sciences Summer Research Experience Award (\$1500)
- 2022 National Science Foundation Graduate Research Fellowship Program (NSF GRFP)
- 2022 Astrobiology Fellowship (\$4000)
- 2022 Astrobiology Early Career Collaboration Award (\$4530)
- 2019 NASA Connecticut Space Grant for Student Research (\$5000)

Volunteer and Outreach Experience

Letters to a Pre-Scientist: January 2024 – April 2024

- Exchanging letters with a middle schooler from an underserved community about scientific exploration and education

Atlanta Science Festival: March, 2023, 2024

- Prepared material for students to learn about spectroscopy and remote sensing at Georgia Tech
- Helped run a booth teaching K-12 students about Mars, astrobiology, and the scale of the universe

Wikipedia Editor: August 2021 – Present

- Significantly expanded the Wikipedia page for [Goldich Dissolution Series](#)
- Significantly expanded the “Habitability Requirements” section of the [Terraforming](#) Wikipedia page

Sunrise Movement Worcester: December 2020 – June 2020

- Member of Political and Trainings Teams
- Created a “Climate Change Training” to teach members of the public the science of climate change
- Generated criteria for endorsing candidates for local city council elections; interviewed candidates for endorsement

IN-Reach Coordinator: May 2019 – August 2019

- Mentored a local high school student in remote sensing for Mars
- Program benefited minority and low-income Connecticut high school students

Software and Coding Skills

- Skilled in ENVI, MatLab, Excel, ArcMap, and ArcGIS Pro
- Proficient in Rstudio, Command Line, JMARS

Instrument Techniques

- Laser Induced Breakdown Spectroscopy (LIBS), X-Ray Florescence Spectroscopy (XRF); Visible to Near Infrared Spectroscopy (VNIR); X-Ray Diffraction Spectroscopy (XRD); Raman Spectroscopy; Scanning Electron Microscopy with Electron Dispersion Spectroscopy (SEM/EDS)

Field Experience

Sri Lanka Serpentine Zones

- LIBS, XRF, VNIR field data from Sri Lanka serpentine zones across 5 field sites
- Geologic mapping and sample analyses

Cariboo Plateau, British Columbia

- Using VNIR and XRF spectral analysis on salts in hypersaline lakes in the Cariboo Plateau
- Aided in collection and preparation of brine samples for ion analysis and cell counts

Flinders Ranges, South Australia

- High familiarity with Ediacaran period type fossils from Rawnsley Quartzite member of the Wilpena Group, South Australia
- Experience in excavation of fossil beds, fossil identification, categorization, measurement, preservation, taphonomic analysis, relationship with trace fossils, energy regimes and ripple wavelength relationship, cross-section analysis

Marble Mountains, San Bernardino County, California

- Familiarity with the Marble Mountains paleozoic sedimentary geology
- Studied preservation, energy regimes, structural relationships between units, trilobite identification

Tapeats Sandstone Formation, Arizona

- Identified trace fossils (burrows) in Tapeats Sandstone

Kona and Hilo, Hawaii

- Managed a project on microplastics distribution based on particle size and shoreline distance across Hawaiian beaches

Gillette Castle State Park, Connecticut

- Categorized geologic relationships, stratigraphy and structural geology, geologic mapping
- Categorized metamorphic grade and regime