RACHEL Y. SHEPPARD

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CURRENT PROFESSIONAL APPOINTMENTS

Institut d'Astrophysique Spatiale (IAS), Université Paris-Saclay — Orsay, France
Marie Curie Postdoctoral Fellow — *June 2023 - present*

Planetary Science Institute — Tucson, Arizona
Research Scientist — *2022 - present*

PAST PROFESSIONAL APPOINTMENTS

Jet Propulsion Laboratory, Caltech — Pasadena, California
Postdoctoral Fellow — *2020 - 2022*

Gemological Institute of America (GIA) — New York, New York
Research Laboratory Technician, Diamond Color Origin Group — *2013 - 2015*

EDUCATION

Brown University, Providence, RI

◇ **2020 Ph.D.**, Earth, Environmental & Planetary Sciences
Spatial and temporal variations in the chemistry and mineralogy of mafic lacustrine systems on Earth and Mars. Advisor: Ralph Milliken

◇ **2017 M.Sc.**, Earth, Environmental & Planetary Sciences
Spectroscopic analysis of iron cycling in a terrestrial ultramafic lake and its implications for martian sedimentary systems. Advisor: Ralph Milliken

Columbia University, New York, NY

◇ **2013 B.A.**, Earth Science
Extractable organic molecules are an effective thermometer of both naturally and artificially heated fault rocks. Advisors: Pratigya Polissar & Heather Savage

PEER-REVIEWED PUBLICATIONS (†STUDENT)

P. Gasda, E. Kite, L. Thompson, C. Mondro, W. Dietrich, C. Weitz, B. Tutolo, W. Farrand, E. Hausrath, A. Cowart, N. Lanza, K. Lewis, S. Gupta, A. Roberts, W. Goetz, H. E. Newsom, L. Crossey, J. Lightholder, C. Hardgrove, J. Schieber, S. Schwenzer, S. VanBommel S. Schroder, C. O'Connell-Cooper, D. Das, D. Rubin, W. Rapin, T. Bristow, E. Rampe, D. Archer, C. Seeger†, G. Caravaca, J. Johnson, S. Le Mouelic, J. Grant, J. Davis, J. Lasue, A. Yingst, A. Bryk, M. Lamb, W, Fischer, C. House, E. Dehouck, A. Essunfeld, R. Milliken, **R. Sheppard**, M. Minitti, D. Ming, S. Simpson, J. Frydenvang, R. Williams, R. Arvidson, R. Gellert, O. Gasnault, S. Clegg, D. M. Delapp, A. Vasasvada, A. Fraeman. Amapari Marker Band metal-enrichments: Potential mechanisms and implications for surface and subsurface water and weathering in Gale crater. Under review, *Journal of Geophysical Research: Planets.*

R. Y. Sheppard, J. M. Weber, L. E. Rodriguez, C. Trejo†, E. M. Hausrath, L. M. Barge. The effect of clay minerals on Li in martian groundwater simulant. Under review, *Icarus.*

A. R. Trussell†, J. F. Bell III, W. H. Farrand, L. C. Kah, E. B. Hughes, C. D. O'Connell-Cooper, L. M. Thompson, **R. Y. Sheppard**, H. Manelski†, G. Paar, B. S. Douglass, A. M. Eng†, J. R. Johnson. Dark-toned veins above the Marker Band record a drying environment in Gale Crater. Under review, *Journal of Geophysical Research: Planets*.

J. M. Weber, E. M. Martinez†, **R. Y. Sheppard**, L. E. Rodriguez, A. Celestian, B. L. Teece, L. M. Barge. Mars mineral weathering experiments in a continuous-flow reactor. Under review, *Geofluids*.

2025 E. M. Martinez†, E. Flores†, D. Valadez†, J. M. Weber, D. VanderVelde, **R. Y. Sheppard**, R. P. Hodyss, J. Castillo-Rogez†, M. Melwani Daswani, B. Henderson†, L. M. Barge. Organic adsorption onto iron sulfide and hydroxide minerals: Implications for Ceres sample return analysis. In press, *ACS Earth & Space Chemistry*. doi:10.1021/acsearthspacechem.4c00372

2025 R. Y. Sheppard, D. Loizeau, A. A. Fraeman, E. B. Rampe, C. Pilorget, J.-P. Bibring. Mg sulfate can spectrally obscure siderite: Implications for martian surface carbonates. *Frontiers in Astronomy and Space Sciences* special issue, "Remote Sensing and Modelling of Planetary and Moon Surfaces," 12:1549242. doi:10.3389/fspas.2025.1549242

2025 J. Ando†, **R. Y. Sheppard**, A. B. Bryk, V. Sun, C. H. Seeger†, A. A. Fraeman, A. M. Eng†, L. Kah, A. N. Rudolph. Diagenetic features reveal the influence of the Greenheugh Pediment on the alteration history of Gale crater, Mars. *Journal of Geophysical Research: Planets*, 130, e2024JE008891. doi:10.1029/2024JE008891.

2025 A. B. Bryk, W. E. Dietrich, K. A. Bennett, V. K. Fox, C. M. Fedo, M. P. Lamb, E. S. Kite, Lucy M. Thompson, S. G. Banham, J. Schieber, J. A. Grant, A. R. Vasavada, A. A. Fraeman, Patrick J. Gasda, R. C. Wiens, O. Gasnault, J. P. Grotzinger, K. Stack-Morgan, R. E. Arvidson, S. Le Mouelic, S. Gupta, R. M. E. Williams, **R. Y. Sheppard**, K. W. Lewis, D. M. Rubin, W. Rapin, M. N. Hughes, M. Turner, S. A. Wilson, J. M. Davis, R. E. Kronyak, L. Le Deit, L. C. Kah, J. Frydenvang, R. J. Sullivan, C. C. Bedford, E. Dehouck, H. E. Newsom, M. C. Malin. Pediment formation and subsequent erosion in Gale crater: clues to climate history of Mars. *Icarus*, 430, 116445.

2024 N. A. Carman†, E. M. Hausrath, A. Celestian, J. Chavez†, N. Hermis, D. E. LaRowe, A. Fraeman, **R. Y. Sheppard**, C. T. Adcock, O. Tschauner, E. B. Rampe, R. Price, L. M. Barge. Simulated Fe/Mg-silicate chimneys as analogs to saponite-rich hydrothermal systems on early Earth and Mars. *ACS Earth & Space Chemistry*, 8(10), 1982–1996. doi:10.1021/acsearthspacechem.4c00109

2024 A. Rudolph, B. Horgan, K. Bennett, C. Weitz, **R. Y. Sheppard**, L. Scuderi, A. Bryk, K. Lewis, A. Roberts†. An orbital comparison of a late mantling unit on Aeolis Mons with other erosion-resistant strata explored by MSL in Gale crater, Mars. *Journal of Geophysical Research: Planets*. 129, e2023JE008242. doi:10.1029/2023JE008242

2024 T. Marlin†, J. M. Weber, **R. Y. Sheppard**, S. Perl, D. Diener, M. Baum, L. M. Barge. Chemical gardens as analogs for prebiotic chemistry on ocean worlds. *Chemistry*. doi:10.1016/j.chempr.2024.08.012

2024 M. J. Meyer†, R. E. Milliken, K. M. Stack Morgan, L. A. Edgar, E. B. Rampe, M. L. Turner, K. W. Lewis, E. S. Kite, G. Caravaca, A. R. Vasavada, W. E. Dietrich, A. B. Bryk, O. Gasnault, S. Le Mouelic, C. H. Seeger, **R. Y. Sheppard**. The geological context and significance of the clay-sulfate transition region in Mount Sharp, Gale crater, Mars: An integrated assessment based on orbiter and rover data. *GSA Bulletin*, doi:10.1130/B37355.1

2024 A. M. Eng†, M. S. Rice, W. H. Farrand, J. R. Johnson, S. Jacob, E. B. Rampe, L. M. Thompson, D. Applin, J. Bishop, E. Cloutis, M. Gabbert, K. Lapo, A. Rudolph, C. Seeger, **R. Sheppard**. A

Mastcam multispectral investigation of rock variability in Gale crater, Mars: Implications for alteration in the clay-sulfate transition of Mount Sharp. *Journal of Geophysical Research: Planets*. 129, 2.

2023 E. M. Martinez†, L. E. Rodriguez, **R. Y. Sheppard**, Z. Yi†, C. Cid, A. Khodayari, L. M. Barge. Nitrate reactivity in iron (oxy)hydroxide systems: Effect of pH, iron redox state, and phosphate. *Earth & Space Chemistry*. 7, 11.

2023 H. T. Manelski†, **R. Y. Sheppard**, A. A. Fraeman, R. Wiens, J. Johnson, J. Frydenvang, N. Lanza, O. Gasnault. Compositional Variations in Sedimentary Deposits in Gale Crater as seen by ChemCam Passive and Active Spectra. *Journal of Geophysical Research: Planets*. 128, 3.

2022 R. Y. Sheppard, R. E. Milliken, K. M. Robertson. Presence of clay minerals can obscure spectral evidence of Mg sulfates: Implications for orbital observations of Mars. *Icarus*. 383, 115083.

2022 R. S. Vachula, **R. Y. Sheppard**, A. H. Cheung†. Preservation biases are pervasive in Holocene paleofire records. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 602, 111165.

2022 C. Lee, J. M. Weber, L. E. Rodriguez, **R. Y. Sheppard**, L. M. Barge, E. L. Berger, A. S. Burton. Chirality in organic and mineral systems: A review of reactivity and alteration processes relevant to prebiotic chemistry and life detection missions. *Symmetry* special issue, "Chirality, Prebiotic Chemistry, and the Origins of Life." 14(3), 460.

2022 M. Prakash†, J. M. Weber, L. E. Rodriguez, **R. Y. Sheppard**, L. M. Barge. Database on carbon reduction: Implications for future research. *International Journal of Astrobiology*, 21(6), 423-440.

2021 R. Y. Sheppard, M. T. Thorpe, A. A. Fraeman, V. K. Fox, R. E. Milliken. Merging perspectives on secondary minerals on Mars: A review of ancient water-rock interactions in Gale crater inferred from orbital and in situ observations. *Minerals* special issue, "Expanding Views of Clays, Oxides, and Evaporites on Aquaplanets in the Solar System," 11(986).

2021 R. Y. Sheppard, R. E. Milliken, J. M. Russell, M. D. Dyar, E. Sklute, H. Vogel, M. Melles, S. Bijaksana, A. K. M. Hasberg, M. A. Morlock. Iron mineralogy and sediment color in a 100 m drill core from Lake Towuti, Indonesia reflect catchment and diagenetic conditions. *Geochemistry, Geophysics, Geosystems*. 22, e2020GC009582.

2020 R. Y. Sheppard, R. E. Milliken, Y. Itoh, M. Parente. Updated perspectives and hypotheses on the mineralogy of Lower Mt. Sharp, Mars, as seen from orbit. *Journal of Geophysical Research: Planets*. 26.

2020 J. Russell, H. Vogel, S. Bijaksana, M. Melles, A. Deino, A. Hafidz, A. Hasberg, M. Morlock, T. von Rintelen, **R. Y. Sheppard**, B. Stelbrink, J. Stevenson. The Late Quaternary tectonic, biogeochemical, and environmental evolution of ferruginous Lake Towuti, Indonesia. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 556, 109905.

2019 R. Y. Sheppard, R. E. Milliken, J. M. Russell, M. D. Dyar, E. Sklute, H. Vogel, M. Melles, S. Bijaksana, A. K. M. Hasberg, M. A. Morlock. Characterization of iron in Lake Towuti sediment. *Chemical Geology*. 512, 11-30.

2017 B. C. Johnson, **R. Y. Sheppard**, A. C. Pascuzzo, E. A. Fisher, S. E. Wiggins. Porosity and salt content determine if subduction can occur in Europa's ice shell. *Journal of Geophysical Research: Planets*. 122.

2015 R. E. Sheppard, P. J. Polissar, H. M. Savage. Organic thermal maturity as a proxy for frictional fault heating: experimental constraints on methylphenanthrene kinetics at earthquake timescales. *Geochimica et Cosmochimica Acta.* 151, 103-116.

2014 H. M. Savage, P. J. Polissar, **R. Sheppard**, C. D. Rowe, E. E. Brodsky. Biomarkers heat up during earthquakes: New evidence of seismic slip in the rock record. *Geology.* 42(2), 99-102.

2015 R. E. Sheppard, W. Wang, T. Moses. Analysis of melee diamonds using FTIR spectroscopy. *Gems & Gemology.* 51(1).

2015 R. E. Sheppard, U. D'Haenens-Johansson, K. S. Moe, W. Wang. HPHT synthetic diamond melee in high-quality mounted jewelry piece. *Gems & Gemology.* 51(1).

2014 W. Wang, M. Altobelli, C. Dieck, **R. E. Sheppard.** Screening of small yellow melee for treatment and synthetics. *Gems & Gemology.* 50(4).

OTHER PUBLICATIONS

2025 R. Y. Sheppard, J. Cuadros. Chapter "Lithologic and textural context of clays inferred from remote sensing" within the book *Clay on Mars.* Editor: Javier Cuadros. Elsevier, Developments in Clay Science. *(In press.)*

2021 Revolutionizing Access to the Mars Surface. Editors: C. J. Culbert, B. L. Ehlmann, A. A. Fraeman, editors. Final Workshop Report for the W. M. Keck Institute for Space Studies (KISS), Pasadena, CA.

RESEARCH GRANTS

2025-2028 Mars Science Laboratory Participating Scientist Program Augmentation (MSL-PSE25), NASA ROSES. **PI**. "Identifying primary and secondary hydrous minerals in upper strata of Mt. Sharp." ($50,000.)

2023-2026 Mars Data Analysis Program (MDAP), NASA ROSES. **Co-I**. "Analyses of sulfates in chaos regions on Mars." ($540,000.)

2023-2026 Marie Skłodowska-Curie Actions research fellowship, European Commission (MSCA-EF). **PI**. "Spectral diversity within Ryugu." (€210,000.)

2022-2025 Mars Science Laboratory Participating Scientist Program (MSL-PSP), NASA ROSES. **PI**. "Understanding Mg-sulfate distribution, hydration state, and crystallinity in Mt. Sharp." ($300,000.)

2022 Spontaneous Research and Technology Development Program, Jet Propulsion Laboratory. **Co-I**. "Novel reaction design to test martian weathering." ($40,000.)

2022 Data Science Working Group, Jet Propulsion Laboratory. **Co-I**. "Developing machine learning models to facilitate the untargeted identification and classification of organics in complex mixtures via tandem mass spectrometry." ($50,000.)

2020-2022 Strategic Research and Technology Development Program, Jet Propulsion Laboratory. **Science PI**. "Experimental constraints on groundwater driven redox gradients on Mars." ($300,000.)

MISSION INVOLVEMENT

OSIRIS-REx September 2023 - present
MicrOmega Team

Hayabusa2 June 2023 - present
MicrOmega Team

Mars Science Laboratory (MSL) May 2016 - present
CheMin Team Member *2025-present*
Participating Scientist *2022-present*
Science Team Collaborator *2016-2022*

AWARDS & FELLOWSHIPS

2022 Seal of Excellence, European Commission, Marie Skłodowska-Curie Actions.

2019 Dissertation Fellowship, Brown University (6 mo.).

2017, 2015 NASA Group Achievement Award, MSL Science and Operations Team.

2015-2018 Presidential Fellowship, Brown University (3 yr.).

2013 Walter C. Pitman III Award, Columbia University Dept. Earth & Environmental Sciences.

CONFERENCE PRESENTATIONS (LAST 5 YEARS ONLY, *ORAL PRESENTATIONS)

2025 R. Y. Sheppard*, D. Loizeau, A. A. Fraeman, E. B. Rampe, C. Pilorget, J.-P. Bibring. Presence of Mg-sulfate can obscure spectral evidence of carbonate: MicrOmega observations with implications for Mars. Lunar and Planetary Science Conference, The Woodlands, TX.

2025 R. Y. Sheppard, J. Ando, A. B. Bryk, V. Sun, C. H. Seeger, A. A. Fraeman, A. M. Eng, L. Kah, A. N. Rudolph. Effects of geologic features including Greenheugh Pediment on the morphology, size, and distribution of diagenetic features within Mt. Sharp, Gale crater. Lunar and Planetary Science Conference, The Woodlands, TX.

2024 R. Y. Sheppard, D. Loizeau, E. B. Rampe, A. A. Fraeman. The presence of Mg sulfate can obscure spectral evidence of siderite. The 10th International Conference on Mars, Pasadena, CA.

2023 R. Y. Sheppard*, J. M. Weber, L. E. Rodriguez, E. M. Hausrath, L. M. Barge. The effect of clay minerals on Li in a simulated martian groundwater environment. Goldschmidt, Lyon, France.

2023 R. Y. Sheppard*, W. Rapin, V. Tu, L. Lim, T. Gabriel, M. Hughes, A. Fraeman, D. Vaniman. Updated orbital perspective of the Mt. Sharp upper sulfates in preparation for in situ exploration. European Geophysical Union, Vienna, Austria.

2023 R. Y. Sheppard, W. Rapin, V. Tu, L. Lim, T. Gabriel, M. Hughes, A. Fraeman, D. Vaniman. Updated orbital perspective of the Mt. Sharp upper sulfates in preparation for in situ exploration. Lunar and Planetary Science Conference, The Woodlands, TX.

2022 R. Y. Sheppard, A. A. Fraeman, L. M. Barge, J. M. Weber, L. Rodriguez, E. Martinez. Laboratory sediment columns to explore habitability of the martian subsurface under different groundwater conditions. AbSciCon, Atlanta, GA.

2022 R. Y. Sheppard*, A. A. Fraeman, L. M. Barge, J. M. Weber, L. Rodriguez, E. Martinez. Laboratory sediment column simulations of chemical and redox gradients in the martian groundwater environment. Lunar and Planetary Science Conference, The Woodlands, TX.

2021 R. Y. Sheppard*, L. Barge, A. A. Fraeman, J. M. Weber, L. Rodriguez, E. Flores, E. Martinez. Laboratory sediment column simulations of chemical and redox gradients in the martian groundwater environment. American Geophysical Union Fall Meeting, New Orleans, LA.

2021 R. Y. Sheppard, R. E. Milliken, J. M. Russell, M. D. Dyar, E. C. Sklute, S. Bijaksana, M. Melles, H. Vogel. Mineral and chemical changes in a 100 m long sediment core from Lake Towuti, Indonesia and implications for mafic lacustrine sediments in Gale crater, Mars. American Geophysical Union Fall Meeting, New Orleans, LA.

2021 R. Y. Sheppard*, R. E. Milliken, K. M. Robertson. Presence of clay minerals can obscure spectral evidence of Mg sulfates: Implications for orbital observations of Mars. Lunar and Planetary Science Conference, The Woodlands, TX.

2020 R. Y. Sheppard, R. E. Milliken, K. M. Robertson. Reflectance measurements of clays and sulfates under Mars-like temperature and relative humidity cycles and implications for clay-sulfate assemblages in Gale crater. Lunar and Planetary Science Conference, The Woodlands, TX. *(Canceled due to Covid-19.)*

2020 R. Y. Sheppard, R. E. Milliken, J. M. Russell, M. D. Dyar, E. C. Sklute, S. Bijaksana, M. Melles, H. Vogel. Mineral and chemical changes in a 100 m long sediment core from Lake Towuti, Indonesia and implications for mafic lacustrine sediments in Gale crater, Mars. Lunar and Planetary Science Conference, The Woodlands, TX. *(Canceled due to Covid-19.)*

PRESENTATIONS: CONTRIBUTING AUTHOR (LAST 5 YEARS ONLY, †STUDENT)

2025 C. Pilorget, T. Okada, J.-P. Bibring, D. Loizeau, K. Hatakeda, L. Nardelli, L. Riu, **R. Y. Sheppard**, T. Jiang, M. Mahlke, R. Brunetto, R. Fukai, M. Abe, A. Aleon-Toppani, D. Baklouti, Y. Enokido, V. Hamm, S. Kawasaki, C. Lantz, A. Miyazaki, A. Moussi-Soffys, M. Nishimura, F. Poulet, R. Tahara, T. Usui, T. Yada, K. Yogata. Characterization of the Bennu samples in their pristine state with the NIR hyperspectral microscope MicrOmega at JAXA Curation Center adn preliminary comparison with Ryugu samples. MetSoc, Perth, Australia.

2025 C. Pilorget, T. Okada, J.-P. Bibring, D. Loizeau, K. Hatakeda, L. Nardelli, L. Riu, **R. Y. Sheppard**, M. Mahlke, R. Brunetto, R. Fukai, M. Abe, D. Baklouti, Y. Enokido, V. Hamm, T. Jiang, S. Kawasaki, C. Lantz, A. Miyazaki, A. Moussi-Soffys, M. Nishimura, F. Poulet, R. Tahara, T. Usui, T. Yada, K. Yogata. Non-destructive analysis and curation of Bennu samples without atmospheric exposure. Japan Geoscience Union Meeting, Chiba, Japan.

2025 C. Weitz, **R. Sheppard**, J. Bishop, S. Cartwright, F. Seelos. Analyses of sulfate deposits in the martian equatorial chaos regions. EGU, Vienna, Austria.

2025 T. Jiang, C. Pilorget, D. Baklouti, D. Loizeau, K. Hatakeda, M. Abe, J.-P. Bibring, Y. Enokido, R. Fukai, S. Kawasaki, C. Lantz, A. Miyazaki, L. Nardelli, M. Nishimura, T. Okada, L. Riu, **R. Y. Sheppard**, R. Tahara, T. Usui, T. Yada, K. Yogata. Detection of NH-rich compounds in Bennu pristine samples via IR characterization at JAXA Curation Center and comparison with Ryugu. EGU, Vienna, Austria.

2025 C. Pilorget, T. Okada, J.-P. Bibring, D. Loizeau, K. Hatakeda, L. Nardelli, L. Riu, **R. Y. Sheppard**, M. Mahlke, R. Brunetto, R. Fukai, M. Abe, D. Baklouti, Y. Enokido, V. Hamm, T. Jiang, S. Kawasaki, C. Lantz, A. Miyazaki, A. Moussi-Soffys, M. Nishimura, F. Poulet, R. Tahara, T. Usui, T. Yada, K. Yogata. Characterization of the Bennu samples in their pristine state with the NIR hyperspectral microscope MicrOmega at JAXA Curation Center and preliminary comparison with Ryugu samples. LPSC, The Woodlands, TX.

2025 R. Fukai, Y. Enokido, M. Nishimura, K. Yumoto, Y. Cho, Y. Shimizu, M. Matsuoka, E. Tatsumi, S. Furukawa, T. Yada, K. Hatakeda, K. Yogata, R. Tahara, A. Miyazaki, S. Kawasaki, S. Sugita, S. Mori, S. Nakahara, Y. Aikyo, H. Miyamoto, C. Pilorget, D. Loizeau, L. Nardelli, **R. Sheppard**, C. Lantz, L. Riu, J.-P. Bibring, R. Brunetto, T. Okada, M. Abe, T. Usui. Non-destructive observation of Bennu samples in JAXA without atmospheric exposure. LPSC, The Woodlands, TX.

2025 L. Nardelli, R. Brunetto, C. Pilorget, K. Hatakeda, **R. Sheppard**, J.-P. Bibring, T. Okada, R. Fukai, M. Abe, Y. Enokido, T. Jiang, S. Kawasaki, C. Lantz, D. Loizeau, M. Mahlke, A. Miyazaki, M. Nishimura, L. Riu, , R. Tahara, T. Usui, T. Yada, K. Yogata. Investigating alteration processes recorded in the phyllosilicates present in Bennu samples with a combination of NIR hyperspectral microscopy and MIR micro-spectrometry. LPSC, The Woodlands, TX.

2025 C. Weitz, **R. Y. Sheppard**, J. L. Bishop, S. Cartwright, F. P. Seelos. Finding order in the martian chaos through analyses of sulfates. LPSC, The Woodlands, TX.

2025 A. R. Trussell, J. F. Bell III, W. H. Farrand, L. C. Kah, E. B. Hughes, C. D. O'Connell-Cooper, B. S. Douglass, J. R. Johnson, A. M. Eng, H. Manelski, **R. Y. Sheppard**. Dark-toned halite veins as a record of a drying environment in Gale crater. LPSC, The Woodlands, TX.

2025 A. Pandey, E. B. Rampe, D. Vaniman, S. Chipera, R.V. Morris, T. Bristow, D. Blake, J. Meusburger, T. Peretyazhko, D. Ming, P. Craig, N. Castle, R. T. Downs, S. Morrison, R. Hazen, A. H. Treiman, A. Yen, B. Tutolo, E. Hausrath, S. Simpson, M. Thorpe, V. Tu, D. J. Des Marais, **R. Y. Sheppard**. Insights into the Mineralogy of the Sulfate-bearing Unit, Gale Crater, Mars. LPSC, The Woodlands, TX.

2025 J. V. Clark, B. Sutter, A. McAdam, P. D. Archer, J. Lewis, H. Franz, L. Chou, C. Knudson, D. Burtt, J. Eigenbrode, J. Stern, P. Casbeer, S. Simpson, J. Berger, V. Tu, B. Tutolo, C. Malespin, P. Mahaffy, D. P. Glavin, C. House, R. Milliken, E. Rampe, **R. Y. Sheppard**. A record of arid surface conditions and aqueous alteration in the layered sulfate-bearing unit and Marker Band Valley as revealed by the Sample Analysis at Mars Evolved Gas Analyzer instrument. LPSC, The Woodlands, TX.

2025 V. E. Concepcion†, C. Hardgrove, S. Czarnecki, **R. Y. Sheppard**. Using the Dynamic Albedo of Neutrons instrument to correlate hydration with elemental variability and mineralogy in the clay-sulfate transition. LPSC, The Woodlands, TX.

2025 L. F. Lim, W. Rapin, O. Gasnault, S. Connell, R. C. Wiens, E. Dehouck, P.-Y. Meslin, S. Schröder, **R. Sheppard**. Hydration in the sulfate-bearing units, Gale crater, Mars. LPSC, The Woodlands, TX.

2025 S. N. Lamm, **R. Y. Sheppard**, A. Yanchillinia, C. P. Marshall, A. J. Celestian, B. Lacroix, P. Sobron, L. M. Barge, L. E. Rodriguez. Machine Learning Strategies to Distinguish Iron Sulfide, Oxide, and (Oxy)hydroxide Minerals using Raman and LIBS Spectroscopy. LPSC, The Woodlands, TX.

2024 C. Pilorget, T. Okada, J.-P. Bibring, D. Loizeau, K. Hatakeda, L. Riu, **R. Sheppard**, L. Nardelli, T. Yada, K. Yogata, M. Nishimura, T. Usui, V. Hamm, A. Moussi-Soffys, M. Abe, A. Aléon-Toppani, D. Baklouti, R. Brunetto, J. Carter, Y. Enokido, Y. Hitomi, T. Jiang, S. Kawasaki, K. Kumagai, Y. Langevin, C. Lantz, M. Mahlke, A. Miyazaki, K. Nagashima, A. Nakano, A. Nakata, T. Ojima, F. Poulet, K. Sakamoto, R. Tahara, K. Tamanoi. First characterizations of Bennu samples by the NIR hyperspectral microscope MicrOmega at the ISAS Curation Center and comparison with Ryugu samples. Hayabusa2 Symposium, Sagamihara, Japan.

2024 A. L. Roberts†, S. Gupta, A. Cowart, L. Edgar, W. Rapin, W. E. Dietrich, E. S. Kite, S. G. Banham, J. M. Davis, C. A. Mondro, W. Farrand, A. B. Bryk, T. Kubacki, N. Moore, **R. Y. Sheppard**, L. C. Kah, G. Caravaca, A. Fraeman, A. R. Vasavada. What depositional processes and

paleoenvironments formed the layered sulphate unit in Gale crater, Mars?: Insights from Marker Band Valley. Geofutures Planetary Geoscience Conference.

2024 W. H. Farrand, B. Horgan, **R. Y. Sheppard**, A. Klidaras, A. Broz. Carbonate detections in the SWIR to MWIR amidst masking phases in stratigraphy clay deposits on Mars. AGU, Washington, D.C.

2024 O. Barraud, J. Carter, M. Vincendon, A. Stcherbinine, **R. Sheppard**. Spectral variability in the south polar region of Mars. EPSC, Berlin, Germany.

2024 W. Rapin, G. Dromart, J. Schieber, B.C. Clark, P. Beck, L. Kah, D. Rubin, S. Gupta, A. Roberts†, G. Caravaca, L. Edgar, **R. Y. Sheppard**, E. Dehouck, S. Le Mouelic, A. Bryk, W.E. Dietrich, P. Gasda, O. Gasnault, N. Lanza. Sulfate-bearing strata sequence extends early Mars environments conducive to prebiotic evolution. The 10th International Conference on Mars, Pasadena, CA.

2024 A. A. Fraeman, R. E. Arvidson, M. N. Hughes, **R. Y. Sheppard**, J. Berger, J. Frydenvang, C. Seeger, A. Eng, M. J. Meyer, E. Rampe, K. M. Stack. Mt. Sharp's clay-sulfate transition: A regional perspective from orbital spectral and geomorphic datasets. The 10th International Conference on Mars, Pasadena, CA.

2024 A. L. Roberts†, S. Gupta, A. Cowart, L. A. Edgar, W. E. Dietrich, W. Rapin, E. Kite, S. G. Banham, J. M. Davis, C. Mondro, B. Farrand, A. B. Bryk, T. Kubacki, N. Moore, G. Caravaca, A. Fraeman, A. Vasavada. **R. Y. Sheppard**. Depositional processes and environments of the Layered Sulfate unit, Gale crater, Mars. The 10th International Conference on Mars, Pasadena, CA.

2024 V. M. Tu, D. F. Blake, E. B. Rampe, **R. Y. Sheppard**. Mineralogy and habitability during the Hesperian age in Gale crater, Mars. The 10th International Conference on Mars, Pasadena, CA.

2024 S. L. Simpson, E. B. Rampe, C. A. Achilles, A. Pandey, T. F. Bristow, D. F. Blake, S. J. Chipera, D. T. Vaniman, R. T. Downs, J. M. Meusburger, D. W. Ming, R. V. Morris, S. M. Morrison, V. M. Tu, M. T. Thorpe, B. Tutolo, A. S. Yen, D. J. Des Marais, G. Downs, J. P. Grotzinger, R. M. Hazen, A. H. Treiman, S. Van Bommel, N. Castle, P. I. Craig, R. Gellert, E. M. Hausrath, T. S. Peretyazhko, L. M. Thompson, J. A. Berger, **R. Y. Sheppard**. The composition and abundance of X-ray amorphous material in smectite and Mg-sulfate-bearing regions in Gale crater, Mars. The 10th International Conference on Mars, Pasadena, CA.

2024 E. Harris†, J. M. Davis, S. Gupta, W. E. Dietrich, S. Banham, A. L. Roberts†, W. Rapin, O. Gasnault, A. Cowart, **R. Sheppard**. The sedimentology and stratigraphy of Texoli Butte: Curiosity's investigation into the Upper Sulfate-bearing Unit of Mt. Sharp, Gale crater, Mars. The 10th International Conference on Mars, Pasadena, CA.

2024 E. B. Hughes, F. Rivera-Hernandez, 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 unit, Gale crater, Mars. LPSC, The Woodlands, TX.

2024 A. B. Bryk, W. E. Dietrich, C. M. Fedo, G. Caravaca, J. M. Davis, M. P. Lamb, J. A. Grant, R. C. Wiens, O. Gasnault, J. P. Grotzinger, A. R. Vasavada, K. Stack-Morgan, R. E. Arvidson, S. Le Mouelic, V. K. Fox, K. A. Bennett, S. Gupta, R. M. E. Williams, **R. Y. Sheppard**, K. W. Lewis, D. M. Rubin, W. Rapin, A. A. Fraeman, S. Banham, M. N. Hughes, M. Turner, S. W. Purdy, and E. S. Kite. In situ investigation of the Gediz Vallis Ridge: A remnant late-stage debris flow dominated fan deposit in Gale crater. LPSC, The Woodlands, TX.

2024 W. H. Farrand, A. R. Trussell, J. R. Johnson, J. F. Bell, A. Eng, E. B. Rampe, **R. Y. Sheppard**, O. Gasnault. Mastcam multispectral and ChemCam passive reflectance examination of dark-toned

rocks from the Stimson to Upper Gediz Valis Ridge in Gale crater, Mars. LPSC, The Woodlands, TX.

2024 E. Harris†, J. Davis, W. E. Dietrich, S. Banham, A. L. Roberts†, **R. Y. Sheppard**. Sedimentology and stratigraphy of the Texoli butte: MSL Curiosity rover analysis of the upper sulphate-bearing unit in Gale crater. UK Planetary Forum Early Careers meeting, London, UK.

2024 N. A. Carman, E. M. Hausrath, A. Celestian, J. Chavez, N. Hermis, D. E. LaRowe, A. Fraeman, **R. Y. Sheppard**, C. T. Adcock, O. Tschauner, R. Price, L. M. Barge. Understanding the geochemical conditions of simulated hydrothermal vents as analogs to saponite-rich hydrothermal environments on early Earth and Mars. AbSciCon, Providence, RI.

2023 W. Rapin, G. Dromart, A. L. Roberts†, J. Schieber, E. S. Kite, D. Rubin, L. A. Edgar, G. Caravaca, S. G. Banham, **R. Y. Sheppard**, A. Cowart, A. B. Bryk, W. E. Dietrich, T. Kubacki, O. Gasnault, N. Lanza, A. Fraeman, A. Vasavada. Aridification sequence and formation of sulfates in Aeolis Mons, Gale crater. ESA Fairplay workshop, Noordwijk, Netherlands.

2023 A. A. Fraeman, R. E. Arvidson, M. J. Meyer, M. N. Hughes, **R. Y. Sheppard**, J. Berger, S. Czarnecki, C. Hardgrove, J. Johnson, J. Lightholder, J. Frydenvang. Mt. Sharp's clay-sulfate transition: the view from orbit and the ground. AGU, San Francisco, CA.

2023 T. C. Marlin†, J. M. Weber, **R. Y. Sheppard**, S. M. Perl, L. M. Barge. Chemical gardens as analogs for prebiotic chemistry on ocean worlds. European Astrobiology Network Association Conference, Madrid, Spain.

2023 W. Rapin, G. Dromart, J. Schieber, B.C. Clark, L. Kah, D. Rubin, S. Gupta, A. Roberts†, G. Caravaca, **R. Y. Sheppard**, E. Dehouck, S. Le Mouelic, A. Bryk, B. Dietrich, P. Gasda, J. Frydenvang, O. Gasnault, N. Lanza. An aridification sequence in the clay-sulfate transition at Gale crater. LPSC, The Woodlands, TX.

2023 C. M. Weitz, K. M. Lewis, E. S. Kite, W. E. Dietrich, L. M. Thompson, C. D. O'Connell-Cooper, J. Schrieber, D. Rubin, P. Gasda, C. Mondro, W. Rapin, S. Gupta, A. Roberts†, J. Frydenvang, J. Berger, H. Newsom, A. Bryk, M. P. Lamb, J. Grotzinger, W. W. Fischer, A. Cowart, J. Davis, J. Grant, A. Yingst, W. Farrand, T. Parker, A. Vasavada, A. Fraeman, R. Milliken, **R. Sheppard**, D. Ming, S. Simpson, E. Rampe, D. Fey, R. Arvidson. The marker band in Gale crater: A synthesis of orbital and ground observations. LPSC, The Woodlands, TX.

2023 A. A. Fraeman, R. E. Arvidson, K. M. Stack, J. Christian, **R. Y. Sheppard**. Mt. Sharp's clay-sulfate transition: a regional perspective from orbital spectral and geomorphic datasets. LPSC, The Woodlands, TX.

2023 H. T. Manelski, **R. Y. Sheppard**, A. A. Fraeman, R. C. Wiens, J. R. Johnson, E. B. Rampe, J. Frydenvang, N. L. Lanza, O. Gasnault. Variability in Mt. Sharp group bedrock as seen by ChemCam passive and active spectra. LPSC, The Woodlands, TX.

2023 R. S. Vachula, **R. Y. Sheppard**, A. H. Cheung. Preservation biases affect charcoal-based paleofire interpretations. INQUA, Rome, Italy.

2022 R. S. Vachula, **R. Y. Sheppard**, A. H. Cheung. Preservation biases affect charcoal-based paleofire interpretations. GSA Annual Meeting, Denver, CO.

2022 W. Rapin, **R. Y. Sheppard**, G. Dromart, J. Schieber, B. C. Clark, L. Kah, D. Rubin, B. L. Ehlmann, S. Gupta, G. Caravaca, N. Mangold, E. Dehouck, S. Le Mouelic, O. Gasnault, J. V. Clark, A. Bryk, B. Dietrich, R. C. Wiens. The Curiosity rover investigates an aridification sequence in the layered sulfate-bearing unit. Europlanet Science Conference, Granada, Spain.

2022 J. M. Weber, L. E. Rodriguez, **R. Y. Sheppard**, E. Martinez†, L. M. Barge. Understanding habitability and prebiotic chemistry with continuous-flow terrestrial analogs. *Invited.* AbSciCon, Atlanta,

GA.

2022 T. C. Marlin†, J. M. Weber, **R. Y. Sheppard**, S. M. Perl, L. M. Barge. Chemical gardens as analogs for prebiotic chemistry on ocean worlds. AbSciCon, Atlanta, GA.

2022 D. Valadez†, E. Flores†, E. Martinez†, **R. Y. Sheppard**, R. P. Hodyss, J. M. Weber, J. Castillo†, B. Henderson, L. M. Barge. Sorption of prebiotic organics on iron sulfide minerals in ocean world analog systems. AbSciCon, Atlanta, GA.

2022 E. Martinez†, E. Flores†, D. Valadez†, J. M. Weber, T. C. Marlin†, **R. Y. Sheppard**, L. M. Barge. Organic acid adsorption onto iron (oxy)hydroxides under ocean world analog conditions. AbSciCon, Atlanta, GA.

2022 J. M. Weber, E. Martinez†, **R. Y. Sheppard**, L. E. Rodriguez, L. M. Barge. Mars weathering experiments: development and use of continuous-flow packed bed for geologic exploration. LPSC, The Woodlands, TX.

2022 H. T. Manelski†, **R. Y. Sheppard**, A. A. Fraeman, J. R. Johnson, R. Wiens, N. Lanza, J. Frydenvang. Classification of ChemCam passive spectral targets in Gale crater. LPSC, The Woodlands, TX.

2022 J. K. Ando†, **R. Y. Sheppard**, A. A. Fraeman, V. Sun. Locations and multispectral features of distinct classes of diagenetic features within the Murray formation, Gale crater, Mars. LPSC, The Woodlands, TX. *(Received the LPSC Dwornik Award.)*

2022 W. Rapin, **R. Y. Sheppard**, G. Dromart, J. Schieber, B. Clark, L. Kah, D. Rubin, B. L. Ehlmann, S. Gupta, G. Caravaca, N. Mangold, E. Dehouck, S. Le Mouelic, O. Gasnault, J. V. Clark, A. Bryk, B. Dietrich, R. C. Wiens. The Curiosity rover is exploring a key sulfate-bearing orbital facies. LPSC, The Woodlands, TX.

2022 E. Martinez†, E. Flores†, T. C. Marlin†, D. Valadez†, J. M. Weber, **R. Y. Sheppard**, R. P. Hodyss, L. M. Barge. Organic acid adsorption on iron (oxy)hydroxides under ocean world analog conditions. Origins of Life Gordon Research Conference, Oxnard, CA. *(Canceled due to Covid-19)*

2021 T. F. Bristow, E. B. Rampe, **R. Sheppard**, R. Milliken. In situ mineralogy of a clay-sulfate transition in Gale crater. AGU Fall Meeting, New Orleans, LA.

2021 A. A. Fraeman, M. Hughes, C. Seeger, J. Ando†, S. Jacob, J. Johnson, **R. Sheppard**, R. Arvidson, M. Rice, J. Bell. Spectral properties of diagenetic features near the clay-sulfate transition in Mt. Sharp. AGU Fall Meeting, New Orleans, LA.

2021 S. N. Lamm†, L. E. Rodriguez, **R. Y. Sheppard**, S. M. Perl, A. J. Celestian, L. M. Barge. Classification of iron (oxy)hydroxides and sulfides using mission-ready spectroscopic techniques and machine learning. GSA Annual Meeting, Portland, OR.

2020 R. E. Milliken, J. P. Grotzinger, **R. Sheppard**, R. Wiens, R. Gellert, L. M. Thompson, A. Vasavada, T. Bristow, & N. Mangold. The chemistry and mineralogy of an ancient lacustrine sequence on Mars: observations, interpretations, and future prospects. LPSC, The Woodlands, TX. *(Canceled due to Covid-19)*

TEACHING EXPERIENCE

2024 Lecturer, Planetary Surfaces Summer School, University of Glasgow.

2024 Co-Instructor, summer course *Climate Change, Economics, and the Wine Industry*, Rice University Global Paris Center, Paris, France.

2018 Instructor, summer course *(Our Solar System Up Close)*, Brown University.

2018 Teaching Assistant, *Planetary Geology* (GEOL0810), Brown University.

2017 Teaching Assistant, summer course *(Our Solar System Up Close)*, Brown University.

MENTORING EXPERIENCE

2024-2025 Undergraduate students advised at the University of Paris-Saclay:
◇ Maëlys Boubet (8 weeks)
◇ Talia Druon (8 weeks)

2024 Maître de stage, Stage de 3e (1 student, 1 week), Institut d'Astrophysique Spatiale.

2024 Maître de stage, Stage de 3e (1 student, 1 week), Institut d'Astrophysique Spatiale.

2023 Maître de stage, Stage de 3e (12 students, 1 day), Institut d'Astrophysique Spatiale.

2021 Undergraduate advisees hosted by Caltech/JPL:
◇ Jordan Ando – *LPSC Dwornik Award 2022. Now a PhD student at the University of Hawaii*
◇ Henry Manelski – *Now a PhD student at Purdue University*

2016-2020 Undergraduate advisees hosted by Brown University:
◇ Ana Colón – *Now a PhD student at the University of Oregon*
◇ Christopher Yen – *LPSC Dwornik Award Honorable Mention 2019. Continued on to earn a PhD (2024) at WashU*
◇ Grant Rutherford – *Now a PhD student at MIT*
◇ Catherine Miranda
◇ Sarah Martinez

2018 Leadership Alliance Summer Program Coordinator, Brown University.

SERVICE & OUTREACH (LAST 5 YEARS ONLY)

Recent journal referee work: *Nature Geoscience, Journal of Geophysical Research: Planets, Journal of Geophysical Research: Biogeosciences, Icarus, Advances in Space Research, Astrobiology.*

2025 Panelist, NASA review panel.

2024 Panelist, NASA review panel.

2024 Session Chair, The 10th International Conference on Mars, *"Carbonates and the Jezero Margin Unit."*

2024 Proposal reviewer, Deutsche Forschungsgemeinschaft (DFG).

2023 Panelist, NASA review panel.

2023 Panelist, NASA review panel.

2023 Judge, Mission Design Challenge, Womanium Global Astrobiology Program.

2022 Session Convener and Chair, AbSciCon, *"Diagenesis and subsurface habitable environments."*

2021 Reviewer, Graduate Women In Science (GWIS) National Fellowship Program.

2020 Panelist, NASA review panel.

2019-2023 Participant, semiannual Skype a Scientist outreach program for K-12 students and incarcerated adults across the world.

FIELD WORK

2018 Naukluft Mountains, Namibia, 12 days in the field, Agouron Institute Advanced Geobiology Field School, Caltech.

2016 Guadalupe Mountains, TX, 5 days in the field, Brown University.

2013 San Gabriel Mountains, CA, 3 days in the field, Columbia University.

2012 Catskill Mountains, NY, 12 days in the field, Columbia University.

2011 Adirondack Mountains, VT, 2 days in the field, Columbia University.