

Kirsten L. Siebach, Ph.D.

Assistant Professor at Rice University

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EDUCATION

Ph.D. in Geology, California Institute of Technology, June 2016, Advisor: John Grotzinger, Thesis: Formation and Diagenesis of Sedimentary Rocks in Gale Crater, Mars.

B. A. in Earth & Planetary Science and Chemistry, Washington University in St. Louis, minor in English Literature, *summa cum laude*, May 2011, Advisor: Raymond Arvidson.

PROFESSIONAL EXPERIENCE

Assistant Professor <i>Dept of Earth, Environmental, and Planetary Sci., Rice University</i>	2018 – present
Mars Science Laboratory Science and Operations Team Collaborator <i>NASA JPL</i>	2011 – present
Mars Exploration Rover Science and Operations Team Collaborator <i>NASA JPL</i>	2010, 2012 – present
Postdoctoral Associate <i>Department of Geosciences, Stony Brook University</i>	2016 – 2017
Graduate Research Assistant <i>Division of Geological and Planetary Sci., Caltech</i>	2011 – 2016
NASA Student Airborne Research Program Intern <i>NASA Airborne Science Program</i>	2011
Undergraduate Research Assistant <i>Washington University in St. Louis</i>	2007 – 2011
Undergraduate Research Intern <i>Smithsonian Air and Space Museum</i>	2010
Mars Phoenix Lander Science and Operations Team Collaborator <i>University of Arizona</i>	2008
Science and Engineering Apprenticeship Program Intern <i>Naval Research Laboratory</i>	2006 – 2007

ACHIEVEMENTS AND HONORS

- NASA Group Achievement Award: MSL Extended Mission-1 Science and Operations Team (2017)
- NASA Group Achievement Award: MSL Prime Mission Science and Operations Team (2015)
- ExxonMobil/GSA Student Science Award (2014)
- NASA Group Achievement Award: MER Science Development and Operations Team (2014)
- NASA Group Achievement Award: MSL Science Development and Operations Team (2013)
- National Science Foundation Graduate Research Fellowship Honorable Mention (2013)
- Washington University “Outstanding Graduate” recognition (Fall 2011)
- Courtney A. Werner Memorial Prize for outstanding academic achievement in the Earth and Planetary Sciences at Washington University in St. Louis (Fall 2011)
- NASA Group Achievement Award: Phoenix Mission Team (2008)
- Washington University Dean’s list 5 semesters (2007-2011)
- Deans Honorary Scholarship at Washington University (2007-2011)
- Fossett Fellowship: annual funding for research activities (2008-2011)

TEACHING EXPERIENCE

- **Instructor of Record** *Exploring Mars*, NASA Endeavor Online Teaching Program, Spring 2018
- **Instructor of Record** *Eyes on Earth*, NASA Endeavor Online Teaching Program, Summer 2017
- **Geology Teacher** *Schooling for Life American Frontiers Trip*, 2 weeks, Summer 2016
- **Field and Teaching Assistant** *Ireland Geological Field Course*, James Madison University, 2 weeks, Summer 2015
- **Teaching Assistant** *Remote Sensing*, Caltech Graduate Course, Spring 2013 and Spring 2015

- **Martian Explorations** Institute for Educational Advancement, developed and taught 8 week after-school classes for gifted elementary students in Spring 2014, Fall 2014, and Winter 2015
- **Teaching and Lab Assistant** *Intro to Geology*, Caltech Undergraduate Course, Fall 2014
- **Teaching and Lab Assistant** *Land Dynamics*, Washington University in St. Louis, Spring 2008, Spring 2009, and Spring 2010

PEER-REVIEWED PUBLICATIONS

20. Stein, N., and 24 coauthors, incl. K. L. Siebach, (in review) Desiccation Cracks Provide Evidence of Lake Drying on Mars, Middle Murray Formation, Gale Crater., *Geology*, submitted 31 May 2017.
19. Watkins, J., J. Grotzinger, N. Stein, S. Banham, S. Gupta, D. Rubin, K. Stack Morgan, K. Edgett, J. Frydenvang, K. Siebach, M. Lamb, D. Sumner, and K. Lewis, (in review) Geometry and significance of an erosional unconformity on Mars, base Stimson formation, Gale crater., *J. Geophys. Res.*, submitted 11 Feb 2017.
18. Ehlmann, B. L. and 38 coauthors, incl. K. L. Siebach, (2017) Chemistry, Mineralogy, and Grain Properties at Namib and High Dunes, Bagnold Dune Field, Gale Crater, Mars: A Synthesis of Curiosity Rover Observations., *J. Geophys. Res.*, online 7 Dec 2017, DOI:10.1002/2017JE005267.
17. Rampe, E., and 32 coauthors, incl. K. L. Siebach, (2017) Mineralogy of an ancient lacustrine mudstone succession from the Murray formation, Gale crater, Mars., *EPSL.*, 471, pp.172-185 DOI: 10.1016/j.epsl.2017.04.021.
16. Hurowitz, J., and 22 coauthors, incl. K. L. Siebach, (2017) Redox stratification of an ancient lake in Gale Crater, Mars. *Science*, 356, 6341, DOI: 10.1126/science.aah6849.
15. Bristow, T. F., R. M. Haberle, D. F. Blake, D. Des Marais, J. L. Eigenbrode, A. G. Fairen, J. P. Grotzinger, K. M. Stack, M. A. Mischna, E. B. Rampe, K. L. Siebach, B. Sutter, D. T. Vaniman, A. R. Vasavada, (2017) Low Hesperian P_{CO2} constrained from in situ mineralogical analysis at Gale crater, Mars., *PNAS.*, online 17 Feb 2017, DOI: 10.1073/pnas.1616649114.
14. Siebach, K. L., M. B. Baker, J. P. Grotzinger, S. M. McLennan, R. Gellert, L. Thompson, J. A. Hurowitz (2017) Sorting out Compositional Trends in Sedimentary Rocks of the Bradbury Group (Aeolis Palus), Gale Crater, Mars., *J. Geophys. Res.*, online 2 Feb 2017, DOI: 10.1002/2016JE005195.
13. Rice, M., S. Gupta, A. H. Treiman, K. M. Stack, F. Calef, L. A. Edgar, J. Grotzinger, N. Lanza, L. Le Deit, J. Lasue, K. L. Siebach, A. Vasavada, R. C. Weins, and J. Williams, (2017) Geologic Overview of the Mars Science Laboratory Rover Mission at The Kimberley, Gale Crater, Mars., *J. Geophys. Res.*, online 28 Jan 2017, DOI: 10.1002/2016JE005200.
12. Mangold, N., and 32 coauthors, incl. K. L. Siebach, (2016) Composition of conglomerates analyzed by the Curiosity rover: Implications for Gale crater crust and sediment sources. *J. Geophys. Res.*, online 15 Apr 2016, DOI: 10.1002/2015JE004977.
11. Grotzinger, J. P., S. Gupta, M. C. Malin, D. M. Rubin, J. Schieber, K. L. Siebach, and 41 additional coauthors, (2015) Deposition, exhumation, and paleoclimate of an ancient lake deposit, Gale Crater, Mars. *Science*, 350, 6257, DOI: 10.1126/science.aac7575.
10. Leveille, R. J. and 20 coauthors, incl. K. L. Siebach, (2014) Chemistry of fracture-filling raised ridges in Yellowknife Bay, Gale Crater: Window into past aqueous activity and habitability on Mars. *J. Geophys. Res.*, online 26 Nov 2014, DOI: 10.1002/2014JE004620.
9. Stack, K. M. and 18 coauthors, incl. K. L. Siebach, (2014) Diagenetic origin of nodules in the Sheepbed member, Yellowknife Bay formation, Gale crater, Mars. *J. Geophys. Res.*, online 22 Jul 2014, DOI: 10.1002/2014JE004617.
8. Siebach, K. L., J. P. Grotzinger, L. C. Kah, K. M. Stack, M. Malin, R. Leveille, and D. Y. Sumner. (2014) Subaqueous Shrinkage Cracks in the Sheepbed Mudstone: Implications for Early Fluid

- Diagenesis, Gale Crater, Mars. *J. Geophys. Res.*, online 17 Jul 2014, DOI: 10.1002/2014JE004623.
7. Siebach, K. L., and J. P. Grotzinger. (2014) Volumetric Estimates of Ancient Water on Mount Sharp Based on Boxwork Deposits, Gale Crater, Mars. *J. Geophys. Res.*, online 28 Jan 2014, DOI: 10.1002/2013JE004508.
 6. Grotzinger, J. P., and 71 coauthors, incl. K. L. Siebach, (2014) A Habitable Fluvio-Lacustrine Environment at Yellowknife Bay, Gale Crater, Mars. *Science*, 343, 6169, DOI: 10.1126/science.1242777.
 5. Grant, J., R. P. Irwin III, S. A. Wilson, D. Buczkowski, and K. Siebach (2011) A Lake in Uzboi Vallis and Implications for Late Noachian-Early Hesperian Climate on Mars. *Icarus*, 212, 1, 110.
 4. Arvidson, R. E., and 36 coauthors, incl. K. L. Siebach, (2010), Spirit Mars Rover Mission: Overview and selected results from the northern Home Plate Winter Haven to the side of Scamander crater. *J. Geophys. Res.*, 115, E00F03, DOI:10.1029/2010JE003633.
 3. Morris, R. V., S.W. Ruff, R. Gellert, D.W. Ming, R.E. Arvidson, B.C. Clark, D.C. Golden, K. Siebach, G. Klingelhöfer, C. Schröder, I. Fleischer, A.S. Yen, S.W. Squyres. (2010) Identification of Carbonate-Rich Outcrops on Mars by the Spirit Rover. *Science*, 329, 421-424, DOI: 10.1126/science.1189667.
 2. Arvidson, R. E., and 21 coauthors, incl. K. L. Siebach, (2009), Results from the Mars Phoenix Lander Robotic Arm experiment. *J. Geophys. Res.*, 114, E00E02, DOI:10.1029/2009JE003408.
 1. Imam, M. A., A. W. Fliflet, K. L. Siebach, A. David, R. W. Bruce, S. B. Qadri, and S. H. Gold. (2009). Continuous Microwave-driven Polyol Process for Synthesizing Ytterbium-doped Yttria Powder. *Processing and Properties of Advanced Ceramics and Composites: Ceramic Transactions*, 3, DOI: 10.1002/9780470522189.ch1.

OUTREACH EFFORTS

- Houston Geological Society “Rice Night” Keynote Speaker, 2018
- Astronomical Society of Long Island and Amateur Observers Society of NY keynotes, 2017
- Spark Talk and assemblies at Gulf Coast Exploreum Science Center, Mobile, AL, 2017
- Presented in multiple assemblies at GEMS Modern School, Dubai, UAE as a prize for winning the Lego/Atlab Space Challenge Competition, 2017
- Geology Open Night at Stony Brook University, 2017
- Various outreach talks to public and school groups *in addition to those listed below*; over 50 talks reaching over 2000 people, and volunteer at 7 NASA booth events
- Finalist in 3 Minute Thesis Competition, Caltech, 2016
- Keynote Speaker at Global Education Supplies & Solutions Conference in Dubai, UAE, 2016
- *Science Sunday* Public Lecture at Caltech, “Road Trips on Mars”, 2016
- Invited Lecture for LEGO Education Conference, Singapore 2015
- *Reel Science* Caltech Outreach Program Talks, each to ~500 attendees 9-15 years old: 2013 – Rock my World: the Power of Volcanoes, 2014 – Trial by Fire, 2015 – Ultimate Mars Challenge
- Invited Lecture for NASA Student Airborne Research Program 2012, 2013, 2014, 2015, 2016
- Expert Reader for National Geographic Kids book, “Mars”, Fall 2014 and Summer 2016
- Developed and ran a one-day seminar for gifted elementary students on William Smith and Geologic Mapping at the Huntington Gardens in Pasadena, November 2014
- Invited Lecture for Siemen’s Competition Regional Finals held at Caltech, 2014
- Judge for American Geophysical Institute Award at Intel International Science Fair, 2014
- Organized and staffed Caltech “Exploration Station” booth at the 2013 AGU conference meeting
- High School Teacher Training Talk on Applications of Spectroscopy, DNP Conference 2012

- Caltech Classroom Connection Volunteer (2011-12); aid with school farm soil testing
- Invited Lecture at Central Methodist University Math and Science Competition, 2008

FIRST-AUTHOR CONFERENCE ABSTRACTS

- Siebach, K. L., M. B. Baker, J. P. Grotzinger, S. M. McLennan, R. Gellert, L. M. Thompson, and J. A. Hurowitz. (2017) Mineral Fractionation during Sediment Comminution and Transport in Fluvio-Deltaic and Lacustrine Rocks of the Bradbury Group, Gale Crater, Mars. *AGU 98*, Fall Meeting, Abstract EP12B-05. (Invited Talk)
- Siebach M. B. Baker, J. P. Grotzinger, S. M. McLennan, R. Gellert, L. M. Thompson, J. A. Hurowitz. (2017) Untangling Provenance Signals in Fluvio-Deltaic-Lacustrine Facies, Gale Crater, Mars. *SEPM Research Conference: Propagation of Environmental Signals within Source-to-Sink Stratigraphy*.
- Siebach, K. L., S. M. McLennan, and C. M. Fedo. (2017) Geochemistry of the Stimson Sandstone, Gale Crater, Mars. *LPSC 48*, Abstract 2499.
- Siebach, K. L., S. M. McLennan, J. P. Grotzinger, R. Gellert, J. A. Hurowitz, and W. W. Fischer. (2016) Causes of Geochemical Diversity in Three Gale Crater Sedimentary Rock Formations. *GSA Annual Meeting 2016*, Paper no. 20-12.
- Siebach, K. L., J. P. Grotzinger, J. A. Hurowitz, S. M. McLennan, W. W. Fischer, and R. Gellert. (2016) Sedimentary Petrology of the Murray Mudstone, Gale Crater, Mars. *Goldschmidt 2016*.
- Siebach, K. L., J. P. Grotzinger, S. M. McLennan, M. B. Baker, R. Gellert, J. A. Hurowitz, and D. L. Blaney. (2015) Sorting out APXS Compositional Variations in Gale Crater Sedimentary Rocks, Mars. *GSA Annual Meeting 2015*, Paper no. 94-2.
- Siebach, K. L., J. P. Grotzinger, S. M. McLennan, J. A. Hurowitz, D. W. Ming, D. T. Vaniman, E. B. Rampe, D. L. Blaney, L. C. Kah, and the MSL Science Team. (2015) Constraining the Texture and Composition of Pore-Filling Cements at Gale Crater, Mars. *LPSC 46*, Abstract 2234.
- Siebach, K. L., J. P. Grotzinger, S. M. McLennan, J. A. Hurowitz, L. C. Kah, K. S. Edgett, R. M. E. Williams, R. C. Wiens, and J. Schieber. (2014) Sandstone Diagenesis at Gale Crater, Mars, As Observed by *Curiosity*. *AGU 95*, Fall Meeting, Abstract P42C-07.
- Siebach, K. L., and J. P. Grotzinger. (2014) Characterizing Sandstone Porosity using MAHLI Imagery along *Curiosity's* Traverse. *8th International Conference on Mars*, Abstract 1466.
- Siebach, K. L., J. P. Grotzinger, L. C. Kah, K. Stack, R. J. Leveille, D. Y. Sumner, L. A. Edgar, and the MSL Science Team. (2013) Raised Ridges in the Sheepbed Member as Evidence for Early Subaqueous Diagenesis at Yellowknife Bay, Gale Crater, Mars. *AGU 94*, Fall Meeting, Abstract P13D-07.
- Siebach, K. L. and J. P. Grotzinger. (2013) Formation of Boxwork Structures on Mount Sharp, Gale Crater, Mars. *LPSC 44*, Abstract 1719.
- Siebach, K. L. and J. P. Grotzinger. (2012) Boxwork Structures and Groundwater Volume Estimates on Mount Sharp, Mars. *GSA Annual Meeting 2012*, Paper no. 69-7. (Invited Talk)
- Siebach, K. L., S. Kefauver, and S. Ustin. (2011) Monitoring evapotranspiration of almond orchards using a METRIC model with MASTER imagery. *NASA booth at the AGU Fall Meeting 92*.
- Siebach, K. L., R. E. Arvidson, J. Boettger, S. Bova, P. Murrey, M. Rudd, S. Spera, T. Stein, and M. Witchger. (2010) Testing Planetary Radiative Transfer Models via Remote Sensing of Gypsum Sands in White Sands National Monument. *AGU 91*, Fall Meet. Suppl., Abstract P53A-1491.
- Siebach K., R. Arvidson, N. Cabrol, and Athena Science Team. (2010) Recent Spirit Results: Microscopic Imager Analysis of Particle Properties in Scamander Crater, West of Home Plate. *LPSC 41*, Abstract 2548.
- Siebach, K., R. E. Arvidson, R.V. Morris, R. Gellert, and A. Wang. (2009) Recent Spirit Rover Results: Morphological and Textural Analysis of Sulfate-Rich Soils to the West of Home Plate *AGU, 90(52)*, Fall Meet. Suppl., Abstract P13A-1250.

ACADEMIC TALKS

- Keynote in Opening Ceremony of AAPG-SEG ICE 2017, London, UK, October 2017: *Sedimentary Records from Another World: Exploring Gale Crater Basin with the Curiosity Rover*.
- SGT-MGG seminar at Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, October 2017: *Formation and Diagenesis of Sedimentary Rocks in Gale Crater, Mars*.
- Department Seminar at Rice University, Houston, TX, March 2017: *Formation and Diagenesis of Sedimentary Rocks in Gale Crater, Mars*.
- Rice University Department Seminar (2017) *Formation and Diagenesis of Sedimentary Rocks in Gale Crater, Mars*. Houston, TX, March 2017.
- Keynote at IRESS (2017) *Sedimentary Records from Another World: Exploring Gale Crater Basin with the Curiosity Rover*. Houston, TX, February 2017.
- Department Colloquium at Stony Brook University (2016) *Formation and Diagenesis of Sedimentary Rocks in Gale Crater, Mars*. Stony Brook, NY, October 2016.
- Mars Science Laboratory Team Meeting (2016) *APXS Geochemical Trends in the Mount Sharp Rocks: Overview*. Pasadena, CA, April 2016.
- Mars Science Laboratory Team Meeting (2015) *Distinguishing Provenance, Sorting, and Diagenetic Effects in Sedimentary Rocks along Curiosity's Traverse*. Paris, France, June 2015.
- Rector's Tea at Yale-National University of Singapore (2015) *Exploring Mars with the Curiosity Rover*. Singapore, September 2015.
- Mars Science Laboratory Team Meeting (2015) *Correlations between Rock Chemistry, Texture, and Stratigraphic Position*. Pasadena, CA, February 2015.
- Mars Science Laboratory Team Meeting (2014) *Introduction to Cements at Gale*. Pasadena, CA, September 2014.
- Caltech GPS Division "Geoclub" Seminar Series (2014) *Diagenesis of Martian Sediments in Gale Crater*. Pasadena, CA, September 2014.
- Mars Science Laboratory Team Meeting (2014) *Sandstone Porosity along Curiosity's Traverse*. Pasadena, CA, April 2014.
- Caltech Kliegel Lectures in Planetary Science (2013) *Formation of Boxwork Structures on Mount Sharp, Gale Crater, Mars*. Pasadena, CA, April 2013.

SCIENCE TEAM AND PROFESSIONAL MEMBERSHIPS

Mars Science Laboratory Science and Operations Team
 Mars Exploration Rover Science and Operations Team
 Phoenix Lander Geology Science and Operations Team
 American Geophysical Union
 Geological Society of America
 American Association of Petroleum Geologists

FIELD EXPERIENCE

Ainsa Basin, Spanish Pyrenees, SEPM Source-to-Sink Conference	5 days, 6/2017
Maine Bedrock, New England Intercollegiate Geological Conference	2 days, 9/2016
WY-MT-CO-SD, American Frontiers Trip, Schooling for Life (teacher)	2 weeks, 8/2016
Ireland Geological Field Camp, James Madison University (TA)	2 weeks, 6/2015
Mojave Desert, CA, Ge157 Remote Sensing Field Trip (TA)	2 days, 5/2015
Guadalupe Mountains, NM, ExxonMobil Geoscience Trip	7 days, 4/2015
Iceland, Geophysics and Planetary Surfaces Enrichment Trip, Caltech	2 weeks, 8/2014
Turks and Caicos, Ge110 Sedimentology Field Course, Caltech	10 days, 2/2014

Mojave Desert, CA, Ge151 Planetary Surfaces Field Trip, Caltech	2 days, 11/2013
Utah Sedimentology and Diagenesis GSA Field Trip, U. Nebraska	4 days, 10/2013
Greece, Geophysics Enrichment Course, Caltech	3 weeks, 9/2013
Belt Basin, MT, Agouon Field Course	10 days, 7/2013
Mojave Desert, CA, Ge157 Remote Sensing Field Trip (TA)	2 days, 5/2013
California Coast, CA, Ge136 Field Course, Caltech	3 days, 11/2012
Death Valley, CA, Ge110 Geomorphology Field Course, Caltech	9 days, 3/2012
Guadalupe Mountains, NM, Ge110 Sedimentology Field Course, Caltech	7 days, 3/2012
Baja Peninsula, Mexico, Ge136 Field Course, Caltech	3 days, 11/2011
Death Valley, CA, Ge112 Sedimentology, Caltech	3 days, 11/2011
White Sands NM, Pathfinder Program, Wash. U. St. Louis	7 days, 8/2010
The Big Island, HI, Volcano Seismology Field Camp, New Mexico Tech	2 weeks, 7/2010
Ireland Geological Field Camp, James Madison University	6 weeks, 5/2010
The Big Island, HI, Pathfinder Program, Wash. U. St. Louis	9 days, 1/2010
Ozarks, MO, Pathfinder Program, Wash. U. St. Louis	2 days, 10/2009
American Southwest, Survey Geological Trip, Wash. U. St. Louis	9 days, 5/2009
The Big Island, HI, Pathfinder Program, Wash. U. St. Louis	9 days, 1/2009
Mojave Desert, CA, Pathfinder Program, Wash. U. St. Louis	9 days, 3/2008

TECHNICAL SKILLS

Computer Programs: ArcGIS, ENVI, Matlab, Microsoft Office, NASA-MSLICE, NASA-MAESTRO, Adobe Lightroom

Programming Languages: Matlab, IDL, Java