

LAURA KERBER
Jet Propulsion Laboratory
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Education

- September 2006-May 2011 Brown University, Providence, RI
PhD, Geological Sciences (May 2011)
MS, Engineering, Fluid Mechanics (May 2011)
MS, Geological Sciences (May 2008)
- August 2002-May 2006 Pomona College, Claremont, CA
Major: Planetary Geology/Space Science
Minor: Mathematics
- May 2002 Graduated Cherry Creek High School, Greenwood Village, Colorado, highest honors

Research Experience and Roles

- September 2014- Present Jet Propulsion Laboratory, Research Scientist
- PI of Discovery Mission Concept Moon Diver
 - Deputy Project Scientist, 2001 Mars Odyssey
 - Yardang formation and distribution on Mars and Earth
 - Ongoing development of end-to-end Martian sulfur cycle model, including microphysical processes, photochemistry, and interaction with the surface
 - Measurement of wind over complex surfaces
 - Microscale wind and erosion processes in cold polar deserts
 - Science liaison to the Mars Program Office, Next Mars Orbiter (NeMO)
 - Member of 2015 NeMO SAG
 - Member of 2015 ICE-WG (In-situ resource utilization and civil engineering HEOMD working group)
 - Science lead on several internal formulation studies, including a “Many MERs to Mars” concept study; “RSL Exploration with the Axel Extreme Terrain Robot” strategic initiative; “Autonomous Recognition of Signs of Life” spontaneous RTD; Moon Diver Instrument Trade Study; etc.
 - Lead of Citizen Scientist “Planet Four: Ridges” initiative on “Zooniverse”
 - President of the New Researchers’ Support Group (2016-2017); Vice President (2015-2016); Founder of NRSRG “Navigators” initiative
- May 2013-September 2014 SETI Institute, Principal Investigator
- Development of Martian sulfur model, including radiative transfer, sulfate and elemental sulfur aerosols, and CO₂ ice clouds.
 - Geomorphological analyses on aeolian features on Mars
 - Geological mapping of fine-grained deposits on Mars
 - Collaborator creating aeolian science objectives for proposed 2020 Rover boundary layer wind measurement instrument (MARBLL)
- September 2011-January 2014 Laboratoire de Météorologie Dynamique, Centre Nationale de la Recherche Scientifique, Post Doctoral Fellow
- Modeling the radiative effects of SO₂ and H₂S gases and H₂SO₄ and S₈ aerosols on the early Martian atmosphere, with implications for climate and habitability during the late Noachian
 - Development of generic aerosol scheme for GCM
 - Mapping and characterizing pyroclastic deposits on Mercury
- August 2006-May 2011 Brown University, Graduate Researcher
- Modeled explosive volcanic eruptions into the Martian atmosphere using GCM-generated winds, compared results to geological units
 - Modeled pyroclastic eruptions on Mercury in concert with the Mercury MESSENGER team

- Conducted field experiments in the McMurdo Dry Valleys, Antarctica, on boundary layer flow over obstacles and sediment transport
 - Conducted stratigraphic and photogeologic assessments of Martian sand dunes and fine-grained deposits
- July 2006-August 2006 RCOM Summer Student, Universität Bremen, Paid Internship: Mathematical modeling of coccolithophore populations near West Africa
- June 2005-July 2005 Keck Geology Consortium, Paid Internship: U-Pb isotope analysis of detrital zircons in paleoproterozoic shales.

Field Work

- Jan 2017 Field work in the Danakil Depression, Ethiopia
- Oct 2016 Field work on yardangs in the Lut Desert, Iran
- Oct-Dec 2014-2015 Universidad de Salta Volcano field school, San Antonio de los Cobres; Field work on yardangs and tafoni weathering, Catamarca, Argentina; Yardangs near Dunhuang, China; Yardangs in the Mojave (Edwards Air Force Base; Coyote Lake), Yardangs in White Sands National Monument.
- Nov-Dec 2009 Field work conducted in the McMurdo Dry Valleys of Antarctica, working on projects including spectroscopic measurements of rock weathering regimes, hydrologic analysis of gully systems, analysis of boundary layer roughness conditions over polygonal terrain, and morphological and sedimentological analysis of coarse-grained aeolian ripples.
- July-August 2008 NASA Planetary Volcanology Field Workshop, Hawaii
- July 2008 IAVCEI Askja Silicic Explosive Volcanism Short Course, Iceland
- July-Aug 2005 KECK Geology Consortium field work collecting magnetically oriented samples from outcrops around Minnesota.

Teaching Experience

- August 2006-December 2006 Brown University Geological Sciences Department, Teaching Assistant
Mars, the Moon, and the Earth (Introductory Planetary Geology)
- August 2005-December 2005 and
August 2004-December 2004 Pomona College Physics Department, Lab Teaching Assistant
Introductory Physics (Classical Mechanics)

Peer-Reviewed Publications

Whelley, P.L., **Kerber, L.**, de Silva, S. (2017) Introduction to Special Issue: Remotely Sensed Observations of Volcanic Deposits and Their Implications for Surface Processes. *Journal of Volcanology and Geothermal Research*

Kerber, L., Dickson, J.L., Head, J.W., Grosfils, E.B. (2017) Polygonal Ridge Networks on Mars: Diversity of Morphologies and the Special Case of the Eastern Medusae Fossae Formation. *Icarus* 281, 200-219. doi: <https://doi.org/10.1016/j.icarus.2016.08.020>.

Ehlmann, B.L., Anderson, F.S., Andrews-Hanna, J., (...) **Kerber, L.** (...), Yung, Y.L., Zahnle, K.J. (2016) The sustainability of habitability on terrestrial planets: Insights, questions, and needed measurements from Mars for understanding the evolution of Earth-like worlds. *Journal of Geophysical Research: Planets*.

Weider, S.Z., Nittler, L.R., Murchie, S.L., Peplowski, P.N., McCoy, T.J., **Kerber, L.**, Klimczak, C., Ernst, C.M., Goudge, T.A., Starr, R.D., Izenberg, N.R., Klima, R.L., Solomon, S.C. (2016) Evidence from MESSENGER for sulfur- and carbon-driven explosive volcanism on Mercury. *GRL*. Doi: 10.1002/2016GL068325.

Kerber, L., Forget, F., Wordsworth, R. (2015) Sulfur in the early martian atmosphere revisited: Experiments with a 3-D global climate model. *Icarus* 261, 133-148.

Wordsworth, R.D., **Kerber, L.**, Pierrehumbert, R.T., Forget, F., Head, J.W. (2015) Comparison of “warm and wet” and “cold and icy” scenarios for early Mars in a 3-D climate model. *Journal of Geophysical Research: Planets* 120 (6), 1201-1219.

Goudge, T.A., Head, J.W., **Kerber, L.**, Blewett, D.T., Denevi, B.W., Domingue, D.L., Gillis-Davis, J.J., Gwinner, K., Helbert, J., Holsclaw, G.M., Izenberg, N.R., Klima, R.L., McClintock, W.E., Murchie, S.L., Neumann, G.A., Smith, D.E., Strom, R.G., Xiao, Z., Zuber, M.T., Solomon, S.C. (2014) Global inventory and characterization of pyroclastic deposits on Mercury: New insights into pyroclastic activity from MESSENGER orbital data. *Journal of Geophysical Research: Planets* 119 (3), 635-658.

Rothery, D.A., Thomas, R., **Kerber, L.** (2014) Prolonged eruptive history of a compound volcano on Mercury: volcanic and tectonic implications. *Earth and Planetary Science Letters, Icarus* 385, 59-67.

Craddock, J.P., Rainbird, R.H., Davis, W.J., Davidson, C., Vervoort, J., Konstantinou, A., Boerboom, T., **Kerber, L.**, Kerber, L., Lundquist, R. (2013) Detrital zircon geochronology and provenance of the Paleoproterozoic Huron (~2.4-2.2 Ga) and Animikie (~2.2-1.8 Ga) Basins, Southern Superior Province. *The Journal of Geology* 121 (6), 623-644.

Kerber, L., Forget, F., Madeleine, J.-B., Wordsworth, R., Head, J.W., Wilson, L. (2013) The effect of atmospheric pressure on the dispersal of pyroclasts from Martian volcanoes. *Icarus* 223, 149-156.

Forget, F., Wordsworth, R., Millour, E., Madeleine, J.B., **Kerber, L.**, Leconte, J., Marcq, E., Haberle, R.M. (2013) 3D modeling of the early Martian climate under a dense CO₂ atmosphere: Temperatures and CO₂ ice clouds. *Icarus* 222, 81-99.

Kerber, L., Head, J.W., Madeleine, J.-B., Forget, F., Wilson, L. (2012) The dispersal of pyroclasts from ancient explosive volcanoes on Mars: Implications for the friable layered deposits. *Icarus* 219, 358-381.

Kerber, L. and Head, J.W. (2012) A progression of induration in Medusae Fossae Formation transverse aeolian ridges: evidence for ancient aeolian bedforms and extensive reworking. *Earth Surface Processes and Landforms*, 37 422-433.

Kerber, L., Head, J.W., Madeleine, J.-B., Forget, F., Wilson, L. (2011) The dispersal of pyroclasts from Apollinaris Patera, Mars: Implications for the origin of the Medusae Fossae Formation. *Icarus* 216, 212-220.

Head, J.W., Chapman, C.R., Strom, R.G., Fassett, C.I., Denevi, B.W., Blewett, D.T., Ernst, C.M., Watters, T.R., Solomon, S.C., Murchie, S.L., Prockter, L.M., Chabot, N.L., Gillis-Davis, J.J., Whitten, J.L., Goudge, T.A., Baker, D.M.H., Hurwitz, D.M., Ostrach, L.R., Xiao, Z., Merline, W.J., **Kerber, L.**, Dickson, J. (2011) Flood Volcanism in the Northern High Latitudes of Mercury Revealed by MESSENGER. *Science* 333, 1853-1856.

Kerber, L., Head, J.W., Blewett, D.T., Solomon, S.C., Wilson, L., Murchie, S.L., Robinson, M.S., Denevi, B.W., Domingue, D.L. (2010) The Global Distribution of Pyroclastic Deposits on Mercury: The View from MESSENGER Flybys 1-3. *Planetary and Space Science* 59, 1895-1909.

Kerber, L., Head, J.W. (2010) The Age of the Medusae Fossae Formation: Evidence of Hesperian Emplacement from Crater Morphology, Stratigraphy, and Ancient Lava Contacts. *Icarus* 206, 669-684.

Kerber, L., Head, J.W., Solomon, S.C., Blewett, D.T., Wilson, L., Murchie, S.L. (2009) Explosive Volcanic Eruptions on Mercury: Eruption Conditions, Magma Volatile Content, and Implications for Mantle Volatile Abundances. *Earth and Planetary Science Letters* 285, 263-271 (**featured in Nature 459, Iss. 7248, Research Highlights**).

Head, J.W., Murchie, S.L., Prockter, L.M., Solomon, S.C., Chapman, C.R., Strom, R.G., Watters, T.R., Blewett, D.T., Gillis-Davis, J.J., Fassett, C.I., Dickson, J.L., Morgan, G.A., **Kerber, L.** (2009) Volcanism on Mercury: Evidence from the first MESSENGER flyby for extrusive and explosive activity and the volcanic origin of plains. *Earth and Planetary Science Letters* 285, 227-242.

Penprase, B.E., Berger, E., Fox, D.B., Kulkarni, S.R., Kadish, S., **Kerber, L.**, Ofek, E., Kasliwal, M., Hill, G., Schaefer, B., Reed, M. (2006) Spectroscopy of GRB 051111 at z=1.54948: Kinematics and Elemental Abundances of the GRB Environment and Host Galaxy. *The Astrophysical Journal*, Vol. 646 Iss. 1 pg 35.

Invited Talks

Descending into a Moon Cave to Better Understand the Solar System's Largest Volcanic Eruptions. Caltech University KECK Institute for Space Science, April 2, 2018

Explosive Volcanic Eruptions on Early Mars: Using a Global Circulation Model to Assess Effects on the Climate and the Geologic Record. Brown University, Providence, Rhode Island, March 10, 2016

Explosive Volcanic Eruptions on Early Mars: Using a Global Circulation Model to Assess Effects on the Climate and the Geologic Record. Georgia Tech, Atlanta, Georgia, April 19, 2016

Yardangs: Ghost Cities of the Past, Scientific Enigmas of the Present, Refuges of the Future. Caltech, Pasadena, January 19, 2016

Explosive Volcanism on Mars: Sources, Characteristics, and Applications to Human Exploration. Pomona College, California, November 10, 2015

A Landing Site at Apollinaris Sulci: Life Inside a Yardang, University of Austin, Texas, October 11, 2015

Volcanisme Explosif dans le Système Solaire: du fond de la mer au vide de l'espace. Caltech, Pasadena, June 1, 2015

Wind Flow Over Complex Surfaces on Mars: Lessons from a Field Season in Antarctica. The Astronomical Observatory of Naples, Italy, May 28, 2013.

The Effect of Sulfur on the Early Martian Climate: Experiments with a 3-D Global Climate Model. NASA Goddard Space Flight Center, USA, March 13, 2013.

Explosive Volcanism on Mercury. The Open University, UK, January 24, 2013.

The Geology of Mercury as Seen by the MESSENGER Mission. SIMBIO-SYS Instrument Team, Bepi-Colombo Mission, Italy, January 18, 2013.

Explosive Volcanism in the Solar System: From Beneath the Sea to the Vacuum of Space, University of Padua, Italy, January 17, 2013.

Explosive Volcanism in the Solar System: From Beneath the Sea to the Vacuum of Space, University of Münster, Germany, December 14, 2012.

The Dispersal of Pyroclasts from Ancient Explosive Volcanoes on Mars: Implications for the Friable Layered Deposits. European Geosciences Union, Austria, April 27, 2012.

The Dispersal of Pyroclastic Ash on Mercury and Mars. University of Nantes, France, April 12, 2012.

Modeling Explosive Volcanic Eruptions into the Martian Atmosphere. NASA Goddard, USA, January 19, 2011.

Selected First-Authored Abstracts

Kerber, L., Nesnas, I., Keszthelyi, L., Head, J.W., Denevi, B., Hayne, P.O., Mitchell, K., Ashley, J.W., Whitten, J.L., Stickle, A.M., Paton, M., Donaldson-Hanna, K., Anderson, R.C., Needham, D., Isaacson, P., Jozwiak, L. (2018) Moon Diver: A Discovery Mission Concept for Understanding the History of the Mare Basalts Through the Exploration of a Lunar Mare Pit. The European Lunar Symposium, Abs. 37.

Kerber, L., Schwamb, M.E., Aye, K.-M., Portyankina, G., Hansen, C.J. (2018). Global Polygonal Ridge Networks: Evidence for Pervasive Noachian Crustal Groundwater Circulation. LPSC, Abs. 2972.

Kerber, L., Nesnas, I., Keszthelyi, L., Head, J.W., Denevi, B., Hayne, P.O., Mitchell, K., Ashley, J.W., Whitten, J.L., Stickle, A.M., Paton, M., Donaldson-Hanna, K., Anderson, R.C., Needham, D., Isaacson, P., Jozwiak, L. (2018) Moon Diver: A Discovery Mission Concept for Understanding the History of the Mare Basalts Through the Exploration of a Lunar Mare Pit. LPSC 49, Abs. 1956.

Kerber, L. (2017) The Mysteries and Curiosities of Mars: A Tour of Unusual and Unexplained Terrains. American Geophysical Union Fall Meeting. Abs. 234058.

- Kerber, L., J. Radebaugh (2017) Terrestrial Analogs for Martian Yardangs: The Argentinian Altiplano and the Lut Desert of Iran. GSA Cordilleran Section, 113th Annual Meeting. Paper No. 38-1.
- Kerber, L. (2017) Controls on the Morphology of Yardangs. 5th International Planetary Dune Workshop, Abs. 3022.
- Kerber, L., Radebaugh, J. (2017) The Role of Water and Wind in Yardang Formation in Iran and on Mars. 48th Lunar and Planetary Science Conference (March), Abs. 2571.
- Kerber, L. (2016) Controls on the Morphology of Yardangs on the Earth and Mars. 47th Lunar and Planetary Science Conference (March), Abs. 2708.
- Kerber, L. (2016) A Concept for Exploring the History of Lunar Mare Deposits with the Axel Extreme Terrain Rover. 47th Lunar and Planetary Science Conference (March), Abs. 2969.
- Kerber, L., Mueller, R.P., Sibille, L., Abbud-Madrid, A., Bertrand, T., Stack, K.M., Nicholas, A.K., Parcheta, C.E., Piqueux, S., Daubar, I.J., Malaska, M.J., Ashley, J.W., Diniega, S., Dickson, J.L., Fassett, C.I. (2015) First Landing Site/Exploration Zone Workshop for Human Missions to the Surface of Mars (October), Abs. 1043.
- Kerber, L., Hamilton, C.W., Scheidt, S.P. (2015) The Aerodynamic Roughness of Mars-like Surfaces. 4th International Planetary Dunes Workshop (May), Abs. 8033.
- Kerber, L., Dickson, J.L., Grosfils, E.B., Head, J.W. (2015) Global Inventory of Rectilinear and Polygonal Ridge Networks on Mars. 46th Lunar and Planetary Science Conference (March), Abs. 2148.
- Kerber, L., Forget, F., Wordsworth, R. (2015) The Marginal Case for Sulfur-Driven Warming in the Early Martian Atmosphere. 46th Lunar and Planetary Science Conference (March), Abs. 2666.
- Kerber, L., Besse, S., Head, J.W., Blewett, D.T., Goudge, T.A. (2014) The Global Distribution of Pyroclastic Deposits on Mercury. Lunar and Planetary Science Conference 45, Abs. 2862.
- Kerber, L. (2014) The Distribution and Diversity of Layering within the Medusae Fossae Formation. Lunar and Planetary Science Conference 45, Abs. 2672.
- Kerber, L. (2013) Small-scale features of the Medusae Fossae Formation: Do they support a volcanic origin? AGU Fall Meet., San Francisco, Calif., 9-13 Dec. Abs. V51G-08.
- Kerber, L., Forget, F., Wordsworth, R. (2013) Sulfur in the Early Martian Atmosphere Revisited: Experiments with a 3-D Global Climate Model. Lunar and Planetary Science Conference 44, Abs. 2296.
- Kerber, L., Head, J.W., Forget, F. (2012) Aeolian features in the Medusae Fossae Formation: A HiRISE Survey. Third International Planetary Dunes Workshop. Abs. 7016.
- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2012) Explosive Volcanic Eruptions into the Early Martian Atmosphere: Implications for Fine-Grained Material on Mars. Third Conference on Early Mars. Abs. 7049.
- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2012) The Dispersal of Pyroclasts from Ancient Explosive Volcanoes on Mars: Implications for the Friable Layered Deposits. European Geosciences Union, Abs. EGU2012-7846.
- Kerber, L., Forget, F., Madeleine, J.B., Wordsworth, R., Head, J.W., Wilson, L. (2012) The Effect of Atmospheric Pressure on the Dispersal of Pyroclasts from Martian Volcanoes. Lunar and Planetary Science Conference 43, Abs. 1295.
- Kerber, L., Head, J.W. (2011) A Progression of Induration in Transverse Aeolian Ridges: Evidence for Ancient Aeolian Bedforms and Extensive Reworking in the Medusae Fossae Formation. Lunar and Planetary Science Conference 42. Abs. 1628.
- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2011) Explosive Volcanic Eruptions into the Martian Atmosphere: Tracking Ash and Water Ice. Lunar and Planetary Science Conference 42, Abs. 2015.

- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2011) Explosive eruptions into the Martian Atmosphere. Mars Atmosphere Workshop: Modeling and Observations.
- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2010) Pyroclastic Eruptions on Mars in a Mars Climate Model: The Effects of Grain Size, Plume Height, Density, Geographical Location, and Season on Ash Distribution. Eos Trans. AGU 89(53), Fall Meet. Suppl., Abstract P11B-1337.
- Kerber, L., Head, J.W. (2010) A Progression of Induration in Medusae Fossae Formation Dunes. Second International Planetary Dunes Workshop, Abs. 2027.
- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2010) The Distribution of Ash from Ancient Explosive Volcanoes on Mars. Lunar and Planetary Science Conference 41, Abs. 1006.
- Kerber, L., Head, J.W. (2009) The Age of the Medusae Fossae Formation: Reassessment Using Lava Flow Cast and Mold Contacts. Lunar and Planetary Science Conference 40, Abs. 2235.
- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2009) The Dispersal of Pyroclasts from Apollinaris Patera, Mars. Lunar and Planetary Science Conference 40, Abs. 2176.
- Kerber, L., Head, J.W., Solomon, S.C., Murchie, S.L., Blewett, D.T., Wilson, L. (2009) Evidence for Pyroclastic Eruptions on Mercury and Implications for Volatiles. 49th Brown-Vernadsky Symposium.
- Kerber, L., Head, J.W., Solomon, S.C., Murchie, S.L., Blewett, D.T., Wilson, L. (2008) Explosive volcanic eruptions on Mercury: Eruption conditions, magma volatile content, and implications for mantle volatile abundances. Eos Trans. AGU 89(53), Fall Meet. Suppl., Abstract U21A-0022.
- Kerber, L., Head, J.W., Madeleine, J.B., Forget, F., Wilson, L. (2008) The Dispersal of Pyroclasts in the Martian Atmosphere. Mars Atmosphere: Modeling and Observations Workshop, Abstract 9020.
- Kerber, L., Head, J.W. (2008) Dispersal of Tephra from Ancient Volcanic Centers on Mars: The Effects of Seasonality, Eruption Strength, and Vent Size. IAVCEI General Assembly, Abstract 2-n P19.
- Kerber, L., Head, J.W. (2008) Modeling Ash Dispersal from Apollinaris Patera: Implications for the Medusae Fossae Formation. LPSC 39, Abstract 1881.

Awards and Fellowships

JPL Voyager Award (2017), Mars Exploration Science and Support Team Award (2016), NASA Graduate Student Research Program Fellowship (2009, 2010), Planetary Dunes Conference JPL Travel Award (2010), RCOM Summer Student Internship (2006), Mason L. Hill Memorial Award in Geology (2006), KECK Geology Consortium Internship (2005), Moncrief Astronomy Prize (2003)

Professional Associations and Service

AGU Member, Reviewer for *Icarus*, *Geomorphology*, *Geology*, *Journal of Geophysical Research*, *Aeolian Research*, *Geophysical Research Letters*, and *Science*. NASA review panel member, Mars Data Analysis Program, NASA Facilities. Guest Editor, *Journal of Volcanological and Geothermal Research*. Session convener, AGU 2013 (Pattern to Process: Remotely Sensed Observations of Volcanic Deposits and Their Implications for Surface Processes) and AGU 2017 (Nature and Evolution of Climate and water on Early Mars). Graduate Student Council Representative (2007-2009).

Activities/Skills

- Experienced with UNIX and Linux; Fortran, and similar programming languages; ArcGIS, GrADS, and ENVI, Microsoft Excel, Word, Powerpoint, Illustrator, Photoshop, and InDesign
- Experienced with Flash, Dreamweaver, Python, and Matlab
- Experienced with ICP-MS, anisotropy of magnetic susceptibility measurements, rock saws, crushers, and polishers, thin-section-making, forklifting
- Professionally fluent in French; basic familiarity with written and spoken Spanish and German
- PADI Scuba Certified