

Allan H. Treiman
Lunar and Planetary Institute
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Curriculum Vitæ: July, 2019

Associate Director and Senior Staff Scientist, Lunar and Planetary Institute.

Research – >100 Peer-Reviewed Publications

Recent: Petrology / geochemistry of Mars, Moon, & Venus. Emphases on volatiles and terrestrial analogs.

Past: Achondrite and chondrite meteorites; carbonatites; Mars geology.

External Funding: Multiple active grants, ~50% salary plus post-docs, continuous funding since 1996. Proposals submitted and in preparation.

Spacecraft Mission Participation. Co-I on MSL, CheMin instrument. Long-term Planner on MSL. Co-I on PIXL instrument for Mars 2020 Rover. Several mission proposals.

Teaching / Mentoring. Graduate and undergraduate research; college teaching petrology, mineralogy, phase equilibria; K-12 teacher training.

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EMPLOYMENT

Associate Director, Lunar and Planetary Institute, 2016-present.
Principal Staff Scientist, Lunar and Planetary Institute, 2016-present.
Senior Staff Scientist, Lunar and Planetary Institute, 1998-2016.
Associate Director for Science, Lunar and Planetary Institute, 2007-2012.
Staff Scientist, Lunar and Planetary Institute, 1993-1998.
Principal Scientist, Lockheed Engineering and Sciences Co., 1993.
N.R.C. Senior Research Associate, NASA-Johnson Space Center, 1991-1992.
Crystal Synthesis Contractor, ALEM Associates, 1990 (half-time).
Engineering Geologist, Stone Products Consultants Inc. 1990 (half-time).
Assistant Professor of Geology, 1985-1990, Boston University.
Research Associate, 1983-1985, University of Arizona.
Research Assistant, 1981-1982, University of Michigan.
Field Geologist, 1974, Buttes Gas & Oil Co., Oakland, CA.

GRANTS RECEIVED (* = active)

- *“Radar Emissivity and Dielectric Permittivity of the Venus Surface Beneath Crater Parabolas.” NASA Solar System Workings 2017; P.I. is Dr. M. Gilmore, Wesleyan Univ. 7% FTE for three years.
- *“Rock Weathering on Venus: Experimental Constraints on Products and Kinetics of Basalt-Atmosphere Interactions.” NASA Solar Systems Workings 2016. Treiman is PI, @ 20% FTE. Three year.
- *“Planetary Instrument for X-Ray Lithochemistry (PIXL),” arm instrument selected for Mars 2020 rover mission. Funded for phase A/B. Treiman to receive funding starting 2019, Phase C – 10%-30% FTE.
- *“Support for the CheMin Mineralogical Instrument During the Mars Science Laboratory,” MSL mission, Phase E. 2011-2017, ~40% salary during active mission.
- *“Inner Solar System Impact Processes: An integrated analysis using extraterrestrial samples, astronomical observations, and modeling.” To NASA SSERVI CAN, funded 2014-2019. PI is David Kring. Treiman is Co-I for ~5% FTE.
- *“Student Support for Attending the 80th to 82nd Annual Meetings (2017 - 2019) of the Meteoritical Society.” NASA TWSC. Treiman is nominal PI for this vehicle to allow NASA SMD to fund U.S. student participation through the LPI. No salary or other compensation for Treiman..
- “Noble gas fractionation during aqueous alteration of minerals on Mars”. To NASA Mars Fundamental Research, Funded 2014-2017. PI: Mark A. Bullock. Co-P.I., Susanne P. Schwenzer; Co-I, Allan Treiman. 6% Salary for Treiman.
- “STEP: Creating a Sustainable Trainer Engagement Program for Earth and Space Science.” NASA Education. Christine Shupla is P.I. Treiman is co-I @~\$10,000/year.
- “Spinel-rich lithologies in the lunar highland crust: Linking lunar samples, crystallization experiments and remote sensing.” J. Gross is PI, Treiman is Co-I at 10% salary for 3 years. NASA Cosmochemistry program, 2013-2016.
- “Volatiles in the moon's highlands crust: Apatite, nominally volatile-free minerals, and cordierite.” Treiman is PI at 20% salary for 3 years, plus support for post-docs. NASA Cosmochemistry Program, Funded 2012-2015 at ~\$175,00 per year.
- “Experimental Study of Oxygen-Isotope Exchange in Melilite during Hydrothermal Alteration.” NASA Cosmochemistry, funded through 2015; Treiman is acting PI in the absence of the proposer, Dr. M. Ito. ~5% FTE for Treiman.
- “Student Support for Attending the 78th Annual Meeting (2015) of the Meteoritical Society.” NASA TWSC. Treiman is nominal PI for this vehicle to allow NASA

- SMD to fund student participation through the LPI. No salary or other compensation for Treiman.
- “Student Support for Attending the 79th Annual Meeting (2016) of the Meteoritical Society.” NASA TWSC. Treiman is nominal PI for this vehicle to allow NASA to fund student participation through the LPI. No salary or other compensation for Treiman.
- “Student Support for Attending the 77th Annual Meeting (2014) of the Meteoritical Society.” NASA Meetings. Treiman is nominal PI for this vehicle to allow NASA SMD to fund student participation through the LPI. No salary or other compensation for Treiman. NCE through Oct. 2015
- “Impact Processes in the Origin and Evolution of the Moon: New Sample-driven Perspectives,” NLSI Institute Proposal from LPI/USRA. Funded 2009-2013. P.I. is D. Kring. Treiman was co-I at ~10% salary.
- “Linking Our Origins to Our Future.” NASA/Ames node of NASA Astrobiology Institute (NAI). Funded 2009-20013. P.I. is D. DesMarais of NASA Ames; Treiman was a Co-I. @ \$40,000/year.
- “Acid Fog on Mars II.” Treiman is P.I., from NASA Mars Fundamental Research Program. Funded 2009-2012 at ~\$150,000 per year.
- “Antarctic Mars Analogue Svalbard Expedition (AMASE)” NASA Astrobiology Science and Technology for Exploring Planets (ASTEP) Program, 2006-2012. P.I. is Dr. Andrew Steele of the Carnegie Institution of Washington, Treiman was a co-I, funded at ~\$25,000/year.
- “Petrology of the Lunar Highlands: Lithic Clasts in Lunar Meteorites.” NASA Cosmochemistry, funded 2008-2011. Treiman is P.I., \$100,000/year for three years, mostly for post-docs.
- “CheMin: An X-ray Diffraction/X-ray Fluorescence (XRD/XRF) instrument for definitive mineralogical analysis in the Analytical Laboratory of MSL.” P.I. is D. Blake of NASA Ames; Treiman was a Co-I. 2005-2011. \$12,000/year in Phase C/D.
- “SAGE: Venus Surface and Atmosphere Geochemistry Lander” (New Frontiers Mission). P.I. is Larry Esposito (LASP / Colorado); Treiman is a co-I. July 2009. Phase A study, but not selected for flight.
- “Linking Our Origins to Our Future.” NASA/Ames node of NASA Astrobiology Institute (NAI). Funded 2003-2009. P.I. is D. DesMarais of NASA Ames; Treiman was a Co-I. @ \$50,000/year.
- “Acid Fog on Mars.” Treiman is P.I., from NASA Mars Fundamental Research Program. Funded 2006-2009 at ~\$100,000 per year.
- “Enhancing LPI Field/Lab Workshops for Professional Development.” NASA Code S education supplement to “Tracking Water In Martian Magmas – Light Lithophile Elements,” (NASA Mars Fundamental Research Program). \$15,000 /yr, six years, start 2003.
- “Tracking Water In Martian Magmas – Light Lithophile Elements.” Treiman is P.I., from NASA Mars Fundamental Research Program. Funded 2003-2006 at \$80,000 - \$110,000 per year.
- “Water And Light Lithophile Elements In Martian Magmas.” Treiman is P.I. From NASA Cosmochemistry. Funded 2003-2006 at \$30,000 per year.
- “CheMin: An X-ray Diffraction/X-ray Fluorescence (XRD/XRF) instrument for definitive mineralogical analysis in the Analytical Laboratory of MSL.” P.I. is D. Blake of NASA Ames; Treiman was a Co-I. @ \$12,000/year in Phase A/B.
- “Meteorite Mineralogy by *in situ* Synchrotron X-ray Diffraction.” Allocation of Synchrotron X-ray beam time at the NSLS, Brookhaven National Laboratory. Twenty four days beam time over three years. Fall 2002 – Fall 2004.
- “Biomarkers in Astromaterials.” Funded 1998-2003, NASA/JSC node of NASA Astrobiology Institute. P.I. was D. McKay; Treiman was a Co-I. \$8,000/year.

- “A Broker/Facilitator Team for Space Sciences Education and Outreach in the South Central Region.” Treiman participation 1997-2003. NASA Office of Space Sciences. P.I. was S. Shipp of the L.P.I.; Treiman was a Co-I. Renewed 2001.
- “Minerals and Submicrometer forms as Biomarkers.” Funded 1999-2003 by NASA. D. Blake was PI, Treiman was a Co-I at \$15,000/year
- “Water on Mars: Views from the Martian Meteorites.” Treiman is P.I. From NASA Planetary Materials and Geochemistry. Funded 1996-2002 by NASA, effective ~\$45,000 per year.
- “Microbes in Silicate Rocks on Earth: Analogues of Extant and Fossil Microbial Habitats on Other Planetary Bodies.” Funded 2000-2001 by NASA. M. Fisk was P.I., Treiman was a Co-I at ~\$10,000/year.
- “An Evaluation of Biogenicity in ALH 84001.” 1997-1998 by NASA Ancient Martian Meteorite Research Program. P.I. was D. Blake of NASA Ames; \$8,500 per year.
- “Technology-based Education Project: Reflection Spectrometer Kit – Engineering and Pre-production.” Treiman was P.I. Funded 1996 by NASA, \$18,470.
- “Water-Rock Interactions on Mars: STEM Study of Volatile-rich Alterations in the SNC Meteorites.” Two years salary and expenses as Senior Associate from National Research Council, 1991-1993.
- “Kinetics of Thermochemical Gas-Solid Reactions Important in the Venus Atmospheric Sulfur Cycle”, Dr. B. Fegley Jr. was P.I.; Treiman was Co-I. Funded by NASA, \$30,000 for 1991.
- “Experimental Investigation of the Solubilities of Lithophile Elements in Pt: A Potential Oxygen Cosmobarometer for the Early Solar Nebula”, J.H. Jones was P.I., Treiman was Co-I. Funded by N.A.S.A., \$35,000 for 1991.
- “Computer-Aided, Quantitative Analysis of the Textures of Igneous Rocks: A Feasibility Study.” Funded 1988 by Boston Univ., \$1,995.
- “Meteoritic Basalts: Experimental Petrology of the Nakhilite and Angras dos Reis Meteorites.” Funded 1988 by N.A.S.A., \$20,000.
- “Meteoritic Basalts: The Nakhilites, their Parental Magmas, Cooling Rates, and Equivalents on Earth.” Funded 1986-1987 by N.A.S.A., ~\$27,500.
- “Physical and Chemical Conditions during Crystallization of Alkalic Magmas: The Monteregian Hills, Quebec.” Funded 1980 by N.S.F., \$9,200.
- N.S.F. Graduate Fellowship, Stanford University, 1975-1977.

GRANTS Submitted 2018-2019

- “A Desktop Scanning Electron Microscope with Energy Dispersive Capability at the Lunar and Planetary Institute (Universities Space Research Association.)” To NASA Planetary Major Equipment. P.I. is Dr. **A.H. Treiman**, LPI/USRA.
- “SIMPLEx spacecraft mission proposal for a Venus NIR emissivity imager, multiple fly-bys.” P.I. is Robbie Herrick (U. Alaska) .

RESEARCH SUPERVISION

Graduate and Post-Doctoral

- Post-Doctoral Fellow: Dr. Julia Semprich. Planetary Petrology & Geochemistry, Graham Ryder Post-Doctoral Fellow, LPI. July, 2018 – present.
- Post-Doctoral Fellow: Dr. Nicholas Castle. Planetary Petrology & Mineralogy, LPI, October 2017 – present.
- Post-Doctoral Fellow: Dr. Patricia Craig. Planetary Petrology, LPI, June 2015 – August 2017.

- Post-Doctoral Fellow: Dr. Yann Sonzogni. Planetary Petrology, LPI, February 2012 – April, 2015.
- Ph.D. Student. Dr. Yolanda Cedillo-Flores, of the Universidad Nacional Autonoma de Mexico. Visiting scientist post at LPI, to complete dissertation manuscripts on Martian gullies. Apr.-June, 2011.
- Post-Doctoral Fellow: Dr. Celeste Mercer. Planetary Petrology, LPI, August 2010 - 2011.
- Post-Doctoral Fellow: Dr. Juliane Gross. “Lunar Highland Granulites: Petrology and Geochemistry,” LPI, May 2009 - 2011.
- Post-Doctoral Fellow: Dr. Justin Filiberto. “Acid Fog on Mars: Experimental Constraints,” LPI / Rice University, Sept. 2006 to 2011.
- Research Technician. K. Robinson, “Basalts in Lunar Highland Meteorites.” LPI. 2009-2010.
- M.S.: Heather Berglund. “Lunar ferroan anorthosites: Geochemical Constraints”, University of Houston, Sept. 2006 - 2009.
- M.S.: Amy Maloy. “Geochemistry and Petrology of Granulites in the Lunar Meteorites”, Rice University, 2004 - 2007.
- M.S.: Heather Sartain. “Sizes, Structures and Origins of “Blueberries,” Meridiani Planum, Mars,” U. Houston, 2004 - 2006.
- Post-Doctoral Fellow: Dr. Don Musselwhite. “Tracking Water In Martian Magmas – Light Lithophile Elements,” LPI / Johnson Space Center, 2003 - 2005.
- Post-Doctoral Fellow: Dr. Chistopher D.K. Herd. “Partitioning of Li and B during Evolution of Martian Basalts,” LPI / Johnson Space Center, 2001 - 2003.
- Visiting Graduate Fellow: Karly Pitman. “Petrologic Setting of Amphibole in the Zagami Martian meteorite,” Louisiana State Univ., Sept. 2003.
- Ph.D.: Laurel Kirkland. “Near- and Mid-IR Spectrometry of Mars,” Rice Univ., 1994-1999.
- M.A.: “Mafic Enclaves in the Eastern White Mountain Batholith, New Hampshire.” L. Fluk. Boston Univ., 1989.
- M.A.: “Petrogenesis of a Niobium-rich Carbonatite Dike, Oka, Quebec.” E. Diaz. Boston Univ., 1988.

Undergraduate

- Summer Internship, 2018: Frank Wroblewski, “Anomalous Radar Properties at Venus’ Mountaintops: Refined Spatial Resolution from SAR Backscatter and Stereo Altimetry.” Lunar and Planetary Institute.
- Summer Internship, 2017: “Origin of Radar-Dark Streak, Nissaba Corona, Venus.” Sabrina Martinez, University of Houston, TX. Lunar and Planetary Institute. With W. Kiefer
- Summer Internship, 2015: “Lunar Meteorite NWA 5000: Petrologic Characterization of a Metal-rich Anorthosite-Norite Breccia.” A. Nagurney, Lafayette College, PA. Lunar and Planetary Institute. With P. Spudis.
- Summer Internship, 2014: “Anomalous Radar Emissivity from Venus’ Mountaintops: Refined Spatial Resolution from SAR Reflectivity and Stereo Altimetry.” E. Harrington, Simon Fraser University, BC. Lunar and Planetary Institute. With V. Sharpton.
- Summer Internship, 2013: “Kaersutite in melt inclusions in Martian meteorite basalts.” Kelsey Williams, Brown University, RI. Lunar and Planetary Institute. With Y. Sonzogni.
- Summer Internship, 2010: “Mineral chemistry and origin of spinel bearing rock types in lunar highland meteorites.” T. Engle, Sam Houston State Univ., TX. Lunar and Planetary Institute.
- Summer Internship, 2009: “Mineral Chemistry of Basalt from Lunar Highland Meteorites.” K. Robinson, University of Chicago. Lunar and Planetary Institute.

- Summer Internship, 2008: “Granulites in lunar meteorites: Bulk composition and origin.” K. Rahilly, Smith College. Lunar and Planetary Institute.
- Summer Internship, 2005: “Geology of Gullies on Mars.” R. Morgan, Chadron State College, NE. Lunar and Planetary Institute.
- High-School Mentorship, 2004: “Parallax of the Moon.” Kelly Lee, senior at Clear Creek High School, TX.
- Summer Internship, 2003: “Granulites in the Lunar Meteorite ALHA81005: The Origin of a Ferroan Gabbro.” A. Maloy, Miami University (Ohio). Lunar and Planetary Institute.
- Summer Internship, 2002: “Shock Metamorphism of Diogenite Meteorites.” E. McLeish, University College London. Lunar and Planetary Institute.
- Summer Internship, 2001: “Stratigraphy of Ganges Mensa.” M. Higbee, Skidmore College, Lunar and Planetary Institute.
- Summer Internship, 2001: “The Serra de Magé Cumulate Eucrite.” K. Goldman, Eastern Illinois U. Lunar and Planetary Institute.
- Summer Internship, 1999: “Sedimentary deposits in Ganges Chasma, Mars: Stereo and Geomorphologic Analysis.” J. Waggoner, South Dakota School of Mines. Lunar and Planetary Institute.
- High-School Mentorship, 1999: “Meteor Showers on Mars.” Summer Rolin, junior at Clear Brook High School, TX.
- Senior Thesis, 1999: “Subsurface structures on Mars as exposed in impact craters.” J. Cohen, Rice University. Lunar and Planetary Institute, 1998-1999.
- Summer Internship, 1998: “Geochemical modeling of low-temperature weathering of Martian rocks.” A. Wallendahl, U. Montana. Lunar and Planetary Institute.
- Summer Internship, 1996: “Geology of the Reull Vallis Region, Mars.” P. Leth, Pomona College. Lunar and Planetary Institute.
- Summer Internship, 1995: “Fault-continuation Ridges in the Valles Marineris, Mars.” K. Spiker, N.M. School of Mines. Lunar and Planetary Institute.
- Summer Internship, 1994: “Layering in the Walls of Valles Marineris, Mars.” K. Fuks, U. Georgia. Lunar and Planetary Institute.
- Senior Research, 1989: “The olivine-fassaite liquidus: experiments and implications for the angrite achondrites and Ca-Al chondrules,” S. Sherman Bean. Boston Univ.

ADMINISTRATION/SERVICE

Advisory/Assessment Panels

- Co-Lead, VEXAG ‘Goals, Objectives, Investigations’ revision, 2018-2019.
- Lead, LPI Summer Intern Program, 2018.
- Venus Exploration Analysis Group (VEXAG). Member of Steering Committee, 2008 – 2011, 2017-present.
- Member, Lunar Allocations Subcommittee of CAPTEM, Dec. 2017 to Nov. 2018
- Chair of Lunar Allocations Subcommittee of CAPTEM, Jan. 1, 2015 to Nov. 2017.
- Mars 2020 Rover Science Definition Team, January through July, 2013.
- NRC Decadal Survey of Planetary Science, Inner Planets Panel. Member, May 2009 – October 2010.
- CAPTEM (Curation and Analysis Planning Team for Extraterrestrial Materials), Member, 1997-2002, 2007-2012, 2015-present.
- Lunar Sample Acquisition and Curation Review Team, Member Nov. 2008 – Aug. 2010.
- Venus Science and Technology Definition Team (VSTDT), chair of Geochemistry Sub-group. Major effort to define parameters for a flagship mission to Venus in 2020 timeframe. 2008-2009.

MSL'09 Sample Cache Science Definition Group (SC-SDG). Member, June-Oct., 2007.

Mars Sample Return Roundtable. Science policy and planning for "Ground truth from Mars" workshop. Participant. (Dr. C. Shearer, organizer) 2007.

VEXAG (Venus exploration analysis group). Member, 2005-present.

LPI-JSC Liaison for Cooperative Efforts, 2003-2005.

Writing Group "Mars Sample Handling Protocol Workshops," May, 2001.

Participant: 1st, 3rd, & 4th "Mars Sample Handling Protocol Workshops" March 2000, March 2001, June 2001.

Mars 2003 Science and Instrument Definition Team, 2000.

LIFARS Advisory Committee on Laboratory Instrumentation, 2000.

Mars Surveyor 2001 Science Opportunities Team, JPL, 1998.

COMPLEX "Assesment of NASA's Mars Exploration Architecture," National Academy of Sciences, 1998. Invited participant.

Antarctic Meteorite Working Group (NASA), 1994-1997.

Proposal Review Panels – many – participation is now considered proprietary information.

Workshop Organization

Conference Co-Organizer and co-Convener. "Differentiation." May 7-10, 2018, Pasadena CA.

Conference Organizer and co-Convener. "Accretion." August 15-18, 2017, Houston.

Workshop "Venus Science Priorities for Laboratory Measurements and Instrument Definition," led by Tibor Kremic. Organizing Committee, and lead of Surface breakout group. April 7-8, 2015.

Workshop "Workshop on Mars Interior Volatiles," led by Justin Filiberto, Nov. 2-5, 2014." Organizing Committee. LPI.

Workshop "Second Conference on Lunar Highlands Crust". Planner and organizer. LPI, July, 2012. Bozeman MT.

Workshop "Venus Geochemistry: Progress, Prospects, and Future Missions." Planner and organizer. LPI, February, 2009.

Workshop "Ground Truth from Mars: Science Payoff from a Sample Return Mission," April 2008. Organizing Committee Member.

Workshop "Martian Gullies: Theories and Tests". Initiator, planner, and organizer. LPI, February, 2008.

Workshop "Sulfates as Recorders of Atmospheric-Fluid-Rock Interactions," October 2006. Organizing Committee Member. Dr. J.J. Papike, organizer.

CheMin Instrument Team meeting, Logistics Organizer. LPI, January, 2007.

Organizer, LPI Teacher Training Workshop, 2003. Responsible for all logistics and scientific content.

Co-convenor, Conference on Early Mars, at Lunar and Planetary Institute, April 24-27, 1997.

Co-convenor, Workshop on Evolution of Martian Volatiles; Lunar and Planetary Institute, 1996.

Co-convenor, Planetary Surface Instrument Workshop, at Lunar and Planetary Institute, May, 1995.

Public and Education

Presenter: "The New 'Wet' Moon." Invited presentations (two) to Astronomy Days at Rayleigh-Durham (North Carolina) Science Museum. Jan 26-27, 2019.

Presenter: "Accretion: Building New Worlds." Invited presentation to American Association of Physics Teachers national conference, Houston, Jan. 14, 2019.

Presenter: "Light-n-Up: Use a New Multichannel Reflectance Spectrometer, ..."
Teacher training workshop presented to Richmond VA public Schools, July 24-25, 2000

Presenter at "Liftoff 2000: " Teacher Training Workshop, sponsored by L.P.I. and Texas Spacegrant Consortium. July 17-21, 2000.

Mentor and Participant, Mars Millenium Project, 1999.

Co-Teacher "Kids and Chemistry." for Ed White Elementary School, El Lago, TX. 1997-1999.

Presenter at "Liftoff 1998: " Teacher Training Workshop, sponsored by L.P.I. and Texas Spacegrant Consortium.

Presenter at "Liftoff 1997: " Teacher Training Workshop, sponsored by L.P.I. and Texas Spacegrant Consortium.

Science Advisory Committee for Oregon Public Broadcasting program "Mission to Mars." 1995-1996.

Consultant for National Museum of Natural History (Smithsonian Institution) on text, science, specimens, and layout for new meteorite hall. One month in residence, 1995.

Featured in Smithsonian Air & Space, October 1995, in article on meteorites from Mars.

Co-teaching and planning "Exploring the Solar System," gifted and talented student program for 5th grade, local school district, 1993-present.

Participated in Alvin (TX) middle school classes on microscopy and rock identification, 1995.

Participated in NASA-sponsored workshop for secondary science teachers, 1995.

Participated in planning and presentation of "Liftoff '94: Roving the Red Planet:"
NASA Space Grant training workshop for secondary science teachers, 1994

Liaison for meteorite identification and verification between SN/NASA and the public; 1991-1993.

Consultant on optical materials to Boston University Chemistry Dept. 1990-1992.

Consultant on granites of Mt. McKinley, for Boston Science Museum, 1989.

Reviewed student award proposals, Mineralogy/Petrology Research Grant Committee, Mineralogical Society of America, 1986.

Others

Associate Editor, *Meteoritics and Planetary Sciences*, 2002-2010.

Program Committee for Lunar and Planetary Science Conference, 1994-1996, 1998, 2000, 2008, 2009.

Administrator, LPI Summer Intern Program. Responsible for all planning and logistics,. 2003-2004.

Associate Editor, *Journal of Geophysical Research – Planets*. 1997-2002.

Manager, invited seminar series: L.P.I. (1994-1996); Solar System Exploration Division, Johnson Space Center (1991-1993).

Lead, consortium study of Martian meteorite LEW88516, 1991-1994. Integrated individual needs for proposal, coordinated distribution of meteorite samples, wrote and integrated text and conclusions for manuscript.

Alternate Lead, Science/Payloads Design Team for NASA/JSC effort in support of First Lunar Outpost planning. 1992.

Lead, Consortium study of non-meteorite LEW88446, 1991.

Manager, International Short Course in Remote Sensing, Center for Remote Sensing, Boston Univ., Summer, 1989. Organized, prepared, scheduled, and managed the lectures, laboratory exercises, and field trips.

Organizer, public demonstration of lunar and meteorite samples, 1987. Planned, organized, and implemented university-wide display of lunar samples and related space materials.

EDUCATION / TEACHING

Teacher Training Workshops

- Organizer / Presenter / Field Leader. "The Heat Within: Volcanology." Eugene OR. July, 2009.
- Presenter / Field Leader. "Earth's Extremophiles: Implications for Life in the Solar System" Yellowstone National Park & Bozeman, MT., July 2007.
- Organizer/Presenter. "The Heat Within: Volcanology." Eugene OR. July, 2006.
- Organizer/Presenter. "Life at the Limits: Earth, Mars, and Beyond." Reno NV. July, 2005.
- Organizer/Presenter. "Floods and Flows: Exploring Mars Geology on Earth." Billings, MT. July, 2004.
- Organizer/Presenter. "The Great Desert: Geology and Life on Mars and in the Southwest." Albuquerque NM. July, 2003.
- Presenter. "Extremities: Geology and Life in Yellowstone, and Implications for Other Worlds." Bozeman, MT. July-August, 2002.
- Presenter. "Planetary Volcanism: A Science Workshop for Middle and High School Educators." Seattle, WA. July, 2001.
- Presenter. "Mars Geology: A Planetary Science Workshop for Educators." Seattle, WA. July, 2000.

University Teaching

- Advanced Petrology - Graduate/Undergraduate
- Igneous and Metamorphic Rocks (including new lab sequence with field/regional focus) - Advanced Undergraduate
- Optical Mineralogy - Advanced Undergraduate
- Phase Equilibria - Graduate/Undergraduate
- Geology of North America - Advanced Undergraduate
- Physical Geology - Introductory
- Environmental Geology - Introductory
- Remote Sensing - Introductory Lectures
- Geology of Granites - Independent Study
- Carbonatites - Independent Study
- Undergraduate Research: Experimental Petrology
- Chemistry - Introductory, through Core Science Curriculum.
- Field Methods/Field Camp – Camp Davis, U. Michigan.

Curriculum Deveopment

- "ALTA Reflectance Spectrometer: Introduction and Classroom Exercises." Curriculum about light and vision based on a hand-held reflectance spectrometer – grades 8-college, 2001.
- "Exploring the Solar System", continuing development of L.P.I.'s gifted and talented course for 5th grade students, offered through local school district. Eight terms, 1993-2001.
- "Exploring Meteorite Mysteries": Team member in planning, development, writing, and testing of a multi-disciplinary, hands-on and heads-on science curriculum targeted for 8th grade science, with options for use in 4th through 12th grades. 1997.
- "Liftoff '94: Roving the Red Planet": Space Grant-sponsored teacher training workshop. Team member in planning of materials, presentations and activities. Presented talks on Mars Geology, Rocks on Mars, and Life on Mars. Participated in Mars Rover exercises.
- Science Core Program. Team member representing geology and chemistry in preparing structure, syllabus, and logistics for integrated 'core' science curriculum for freshman level. Boston University, 1988-89.

College geology curriculum review, 1988-1989. Team member in a successful effort to increase enrollments and provide better job preparation through revision of departmental curriculum and degree requirements.

Teaching K-12

“Rocks from Space!” Mini-course on meteorites for GT students, grades 6-8, Webster Intermediate School. 2003.

“Exploring the Solar System,” participant teacher in the L.P.I.'s gifted and talented course for 5th grade students, offered through local school district. Sixteen terms, 1993-2002.

“ALH 84001: Evidence for Life.” Presented talk to K-12 teachers at the 1996 Arizona State University K-12 Teachers Workshop: “Blast off to Mars.” August 24, 1996.

“Chemistry and Kids”, assisted presentation of these American Chemical Society hands-on lab exercises to the grade students, Ed White (TX) Elementary School, 1995.

Invited Speaker, Seabrook (TX) Intermediate School, presentation "Life on Mars," 1994.

Meteorites, planetary geology, science careers: volunteer and invited guest to elementary and junior-high classes, 1988-present.

Academic Client Services

Academic Conduct Committee, 1989-1990, Boston University. Experience as Chairman.

Departmental Recruitment, 1987-1981. More than doubled number of concentrators (10 to 25) by recruitment and retention.

Department Undergraduate Advisor, Boston University, 1988-1989. Geology and Environmental Geology Concentrations. Planetary and Space Sciences Concentration (with Astronomy).

College Undergraduate Advisor, Boston University, 1986-1990.

Invited Presentations

“The Curiosity Rover on Mars: Moving Towards the Mountain.” Cosmic Explorations Series, evening public presentation. June 2, 2016..

“Climate Change on Mars” Cosmic Explorations Series, evening public presentation, November 2010.

“Alteration of crustal rocks under Venus surface conditions. *International Venus Conference, Aussois 2010*, 05-02. August, 2010.

“Report on Workshop: “Martian Gullies: Theories and Tests’.” To the MEPAG committee, JPL, February 2008.

“Volatiles in melt inclusions: The example of kaersutite versus rhönite.” *Workshop on Water in Planetary Basalts*. August, 2007.

“Mineralogy of HED meteorites in the context of Dawn”. Dawn Mission Science Symposium, July 2007, Cocoa Beach FL.

“Compositions of igneous rocks on Venus.” Session on Planetary Compositions at 2007 AGU Joint Assembly Meeting, Acapulco, MX.

“Report to MEPAG on ‘Workshop on Martian Sulfates as Recorders of Atmospheric-Fluid-Rock Interactions. 16th MEPAG Meeting, Jan. 2007, Washington DC.

“ALH84001: A Synthesis of What Happened, Current Thinking Relative to Life on Mars, and What We (Should) Have Learned.” National Research Council’s Committee on the Origins and Evolution of Life. Jan., 2006.

“Volatile Elements on Mars: Mineralogical Evidence.” *Jahrestagung der Deutschen Mineralogischen Gesellschaft (DMG)* September, 2005.

“Martian Gullies: Geology and Origin.” Carnegie Institution Washington, April 2005.

“Water on Mars, Fact and Fancy.” Inaugural lecture of Johnson-Youngquist endowed lecture series, Gustavus Adolphus College, St. Peter, MN. April, 2003.

- "Geochemistry of Martian Meteorites." Gustavus Adolphus College, St. Peter, MN.
April, 2003
- "Martian Gullies: Geology and Origin." Houston Astronomical Society, Houston TX,
March 2003.
- "Martian Gullies: Geology and Origin." LASP, U. Colorado, Feb. 2003.
- "A hypothesis for the abiotic and non-Martian origins of putative signs of ancient
Martian life in ALH84001." Arizona State University, Tempe. February, 2001
- "Groundwater on Mars." Carnegie Institution, Washington, January, 2001
- Mars Sample Handling Protocol Workshop. "The current state of controversy about
traces of ancient martian life in meteorites ALH84001: Instrumentation Issues."
March 20, 2000.
- Sixth Bioastronomy Conference "*Bioastronomy 99: A New Era in Bioastronomy*",
Kona, HI. "Getting a Life: Some Implications of the ALH84001 Controversy to
Mars Sample Return." August, 1999.
- Fifth International Mars Conference, Pasadena CA. "Biomarkers in ALH84001??"
July, 1999.
- Lunar and Planetary Institute, *Workshop on the Issue Martian Meteorites: Where Are
We Now, Where Are We Going?* "Ancient martian life in ALH 84001? Status of
some current controversies (invited)". November, 1998.
- Rutgers University, Geology Department 30th Anniversary Celebration: "ALH 84001:
To Bug or not to Bug?" 1998.
- Microscopy Society of America, Microscopy & Microanalysis '97 meeting:
"Meteorites from Mars: A Tale of Two Planets." 1997.
- Committee for Planetary and Lunar Exploration, of Space Studies Board of National
Research Council, Washington DC, 1996, "Mars Sample Return Science:
Geology."
- Mars 2005 Sample Return Workshop, Ames Research Center, NASA, 1996, "The
Martian Regolith."
- Mineral Sciences, Smithsonian Institution, 1995, "ALH84001 and Valles Marineris:
Two views of the martian highlands."
- American Geophysical Union, 1994, "Martian oxidative alterations in the Martian
meteorites."
- Argonne National Laboratory, Chemical Technology Div., 1993, "Martian hydrology:
Aqueous alteration of the SNC Meteorites."
- Lunar and Planetary Institute, 1993, "Martian hydrology: Aqueous alteration of the
SNC Meteorites."
- M.I.T., 1989, "The SNC meteorites and Mars Sample Return."
- Boston University Astronomy Department, 1989, "Geology of Triton and other
Moons", in connection with Voyager Neptune flyby.
- American Geophysical Union, 1989, "Mineralogy of the SNC meteorites: Primary and
secondary."
- Prometheus Society of Boston U., 1989, "Lunar Resources."
- American Geophysical Union, 1988, "Mafic-to-felsic enclaves in a syenite ring-dike,
White Mountains, N.H.: Magma mixing and mingling."
- Rutgers University, 1988, "Martian meteorites and geology."
- G.A.C./M.A.C. Annual Meeting, 1986, "Carbonatite magmas: properties and
processes."
- University of Utah, 1985, "Meteorites from Mars."
- M.S.A. Symposium on Alkaline Rocks, 1983, "The Oka carbonatite complex: Tests of
liquid immiscibility."

OTHERS

Education

Ph.D., Igneous Petrology, University of Michigan, 1982. Dissertation: "The Oka Carbonatite Complex, Quebec: Aspects of Carbonatite Petrogenesis". Advisor: Dr. E. J. Essene.

M.S., Metamorphic Geology, Stanford University, 1977. Thesis: "Precambrian Geology of the Ojo Caliente Quadrangle, Rio Arriba and Taos Counties, New Mexico". Advisor: Dr. R. H. Jahns.

B.A. *magna cum laude*, Physical Chemistry, Pomona College, 1974.

Awards

NASA Group Achievement Award for MSL Prime Mission Team, 2015.

NASA Group Achievement Award for the MSL CheMin Instrument Development and Science Team, 2013.

Fellow of the Meteoritical Society. August, 2002.

Patent: "Manually Portable Reflectance Spectrometer," U.S. Patent No. 6,043,893. Hand-held, classroom device to help teach about light, reflectance, and reflectance spectroscopy. Co-Inventor T. Shelfer.

Professional Affiliations

American Geophysical Union

Meteoritical Society

Mineralogical Society of America

Geological Society of America

Personal

Married, two adult children. Excellent health.

PUBLICATIONS (Reverse chronological order)

Peer Reviewed

- Castle N., **Treiman A.H.**, Achilles C.N., Blake D.F., Bristow T.F., Chipera S.J., Craig P.I., Downs G.W., Downs R.T., Hazen R.M., Ming D.W., Morrison S.M., Morookian J.M., Rampe E.B., Tu V., Vaniman D.T., Walroth R., and Wilson M. (in revision) Detection and quantification of minor phases in CheMin X-ray diffraction results from Mars. To *ACS Earth and Space Chemistry*.
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