

Nicole G. Lunning
Curriculum Vitae

Research Interests

The goal of my research is to contribute to understanding how rocky bodies formed and evolved in the Solar System. As a petrologist, I investigate the geochemical evolution of Solar System bodies by conducting experiments and by studying extraterrestrial samples.

Education

Ph.D. Geology, University of Tennessee, Knoxville, GPA 4.0, August 2015. Dissertation Title: Insights into planetesimal evolution: Petrological investigations of regolithic howardites and carbonaceous chondrite impact melts. Advisor: H. Y. McSween, Jr.

M.S. Geology, University of California, Davis, GPA 3.78, June 2009. Thesis Title: Wind erosion in the Sacramento-San Joaquin Delta recorded by phytolith concentrations. Advisor: K. L. Verosub.

B.S. Geophysical Sciences, University of Chicago, GPA 3.45, June 2005. Honors in the College and Honors in the Geophysical Sciences, Deans' List 2002-2005.

Awards

- University of Tennessee Chancellor's Citation for Professional Promise (2015)
- Wiley-Blackwell Award for an Outstanding Student Presentation (2014)
- Best Professional Presentation from the East Tennessee Geological Society (2014)
- McKay Award for Best Student Oral Presentation at the Meteoritical Society Meeting (2013)
- Excellence in Geology Award from the Knoxville Gem and Mineral Society (2013)
- Smithsonian National Museum of Natural History Peer Recognition Award (2011)

Grants and Fellowships

- Workshop on Catastrophic Disruption in the Solar System Travel Grant (2018)
- Peter Buck Smithsonian Institution Postdoctoral Fellowship (2015-2017)
- Meteoritical Society Early Career Scientist Travel Grant (2017)
- University of Tennessee Chancellor's Fellowship (2012-2015)
- Meteoritical Society Student Travel Grants (2013, 2014, and 2015)
- University of Tennessee Graduate Student Senate Travel Grants (2013 and two in 2014)
- University of California Davis Durrell Grant for Graduate Research (2006-2007)
- University of Chicago Richter Grant for Undergraduate Research (2004-2005)

Peer-Reviewed Publications

- Lunning N. G.** and Gross J. (*in prep*) Petrology of the lunar feldspathic regolith breccia Northwest Africa 11303. *Meteorites & Planetary Science*. Anticipated Submission May 2020.
- Lunning N. G.**, Bischoff A., Gross J., Patzek M., McCoy T. J., and Corrigan C. M. (2020) Insights into the formation of ancient silica-rich magmas from Rumuruti chondrite impact melts. *Meteorites & Planetary Science*. 55:130-148.
- McSween H. Y., Raymond C.A., Stolper E. M., Mittlefehldt D.W., Baker M., **Lunning N.G.**, Beck A.W., Hahn T.M. (2019) Differentiation and magmatic history of Vesta: Constraints from HED meteorites and Dawn spacecraft data. *Chemie der Erde — Geochemistry*. 79:125526.
- Lunning N. G.**, McCoy T. J., Schrader D. L., Nagashima K., Corrigan C. M., Gross J., and Kracher, A. (2019) Lewis Cliff 86211 and 86498: Metal-sulfide liquid segregates from a carbonaceous chondrite impact melt. *Geochimica et Cosmochimica Acta* 259: 253-269.
- Crossley S. D., **Lunning N. G.**, Mayne R. G., McCoy T. J., Yang S., Humayun M., Ash R. D., Sunshine J. M., Greenwood R. C., and Franchi I. A. (2018) Experimental insights into Stannern-trend eucrite petrogenesis. *Meteorites & Planetary Science* 53: 2212-2137.
- Hahn T. M., **Lunning N. G.**, McSween H. Y., Bodnar R. J., and Taylor L. A. (2018) Mg-rich harzburgites from Vesta: Mantle residua or cumulates from planetary differentiation? *Meteorites & Planetary Science* 53: 514-546
- Lunning N. G.**, Gardner-Vandy K. G., Sosa E. S., McCoy T. J., Bullock E. S., and Corrigan C. M. (2017) Partial melting of oxidized planetesimals: An experimental study to test the formation of oligoclase-rich achondrites Graves Nunataks 06128 and 06129. *Geochimica et Cosmochimica Acta* 214: 73-85.
- Hahn T. M., **Lunning N. G.**, McSween H. Y., Bodnar R. J., and Taylor L. A. (2017) Dacite formation on Vesta: Partial melting of the eucritic crust. *Meteorites & Planetary Science*. 52:1173-1196.
- Lunning N. G.**, Corrigan C. M., McSween H. Y., Tenner T. J., Kita N. T., and Bodnar R. J. (2016) CV and CM chondrite impact melts. *Geochimica et Cosmochimica Acta* 189: 338-358.
- Lunning N. G.**, Welten K. C., McSween H. Y., Caffee M. W., and Beck A. W. (2016) Regolithic howardites found in the Grosvenor Mountains, Antarctica. *Meteorites & Planetary Science* 51: 167-194.
- Lunning N. G.**, McSween H. Y., Tenner T. J., Kita N. T., and Bodnar R. J. (2015) Olivine and pyroxene from the mantle of asteroid 4 Vesta. *Earth and Planetary Science Letters* 418: 126-135.
- Udry A., **Lunning N. G.**, McSween H. Y., and Bodnar, R. J. (2014) Petrogenesis of a vitrophyre in the martian meteorite breccia NWA 7034. *Geochimica et Cosmochimica Acta* 141: 281-293.

Experience

Carbonaceous Chondrite Curator, Astromaterials Research and Exploration Science (ARES), NASA Johnson Space Center. March 2020-Present

- Meteorite curation and research

Postdoctoral Researcher, Department of Earth and Planetary Sciences, Rutgers University, September 2018-March 2020

- Studied the petrology and geochemistry of lunar meteorite breccias, Rumuruti chondrites, and iron meteorites
- Instructor for Planet Mars, a planetary geology course for non-majors

Peter Buck Postdoctoral Fellow, National Museum of Natural History, Smithsonian Institution, September 2015-September 2018

- Performed melting experiments using a 1-bar gas mixing furnace, a vertical furnace with a molybdenum-alloy pressure vessel at high temperatures and moderate pressures (e.g., 1100 °C and 500 bars), and a horizontal cold seal furnace at moderate temperatures and pressures (e.g., 700 °C and 400 bars)
- Characterized experimental charges and meteorites with petrographic microscope
- Analyzed experimental charges and meteorites with scanning electron microscope and electron microprobes (JEOL 8900, JEOL 8530F at the Smithsonian Institution)
- Outreach including meteorite vault tours and public programs
- Mentor to graduate and undergraduate students

Graduate Researcher, Lecturer, and Teaching Assistant, University of Tennessee, Knoxville, August 2012-August 2015

- Researched meteorite petrology and geochemistry
- Used the following instruments: electron microprobe, secondary ion mass spectrometer, laser ablation-inductively coupled-mass spectrometer, Raman microprobe, scanning electron microprobe, petrographic microscope
- Taught, as a lecturer, introductory physical geology
- Guest lectured in mineralogy and planetary geology
- Led and designed lab activities for mineralogy, petrology, and planetary geology

Meteorite Technician/Contractor, National Museum of Natural History, Smithsonian Institution, September 2010-August 2012

- Performed support and classification work for the Antarctic Meteorite Collection
- Assisted curators and summer interns with research projects: surveyed potential research samples, cut/subsampled meteorites, made thin sections, documented meteorite subsampling, analyzed samples with the scanning electron microscope and electron microprobe, extracted/processed data, drafted figures, replied to reviewer comments regarding figures, and other support activities
- Evaluated and responded to potential meteorites from members of the public

Volunteer Math Teacher, Academy of Hope in Washington, D.C., January 2011-July 2012

- Taught basic arithmetic to adults preparing to take the GED

Adjunct Instructor, University of St. Thomas in St. Paul Minnesota, January 2010-July 2010

- Taught and prepared laboratory activities
- Guest lectured in introductory-level Physical Geology and Natural Disasters courses
- Led field trips for introductory students

Field Assistant, Villanova University, May 2009-August 2009

- Measured carbon dioxide gas emissions for a carbon sequestration study

Graduate Researcher and Teaching Assistant, University of California, Davis, September 2005-May 2009

- Set-up a laboratory space and implemented a procedure for phytolith extraction
- Taught geology discussion sessions and guest lectured to classes of up to 100 students
- Supervised and taught students at field camp mapping

Research Assistant, USGS California Water Science Center, June 2006-September 2006

- Assisted with sediment core processing

NSF-REU Intern, University of Minnesota, Twin Cities, June 2004-September 2004

- Assisted in the collection and analysis of sediment and groundwater

Synergistic Activities

- U.S. Antarctic Search for Meteorites Field Team Member (2019-2020 season)
- Reviewer for *Geochimica et Cosmochimica Acta*, *Journal of Geophysical Research-Planets, Meteoritics & Planetary Science*, *Nature Astronomy*, *Proceedings of the National Academy of Sciences*, and *Process in Earth and Planetary Sciences*
- Served on eight NASA proposal review panels (2015-2019)
- Session chair at the Lunar and Planetary Science Conference (2018) and the Meteoritical Society Annual Meeting (2016, 2017, & 2019)
- Led tours of the Smithsonian National Meteorite Collection (2015-2018)
- Thesis Committee Member/Adjunct Faculty Member at Texas Christian University (2017-8)
- Mentor in the Geological Society of America's On To the Future (OTF) program aimed at increasing diversity in the geosciences (2015-2016)
- Organized seminar series for the UT Planetary Geosciences Institute (2014-2015)
- Meteorite-related public outreach (2010-2019)

Select Recent Conference Presentations

- Lunning N. G.**, Gross J. (2019) Texturally zoned silicon-bearing iron-nickel metal inclusions in the lunar feldspathic regolith breccia Northwest Africa 11303. 82th Annual Meteoritical Society Meeting #6076
- Mayne R. G., Funderburg R. L., **Lunning N.G.** (2019) Reevaluating the unbrecciated eucrites for evidence of metasomatism. 82th Annual Meteoritical Society Meeting #6193
- Lunning N. G.**, Gross J. (2019) Lunar feldspathic regolith breccia with magnesium-rich components: Northwest Africa 11303. 50th Lunar and Planetary Science Conference #2407
- Lunning N. G.**, McCoy T. J., Schrader D. L., Nagashima K., Corrigan C. M., Gross J., and Kracher A. (2019) Metal-sulfide segregates from a carbonaceous chondrite impact melt: The ungrouped irons Lewis Cliff 86211 and 86498. 50th Lunar and Planetary Science Conference #2763
- McSween H. Y., Stolper E. M., Baker M. B., **Lunning N. G.**, Raymond C. A. (2019) Distinguishing intrusive and extrusive magmatism on Vesta. 50th Lunar and Planetary Science Conference #1220
- Dunn T. L., **Lunning N. G.**, Robak K. N., Gross J. (2019) Initial description of an impact melt clast in LL3 chondrite Northwest Africa 10598. 50th Lunar and Planetary Science Conference #1570
- Lunning N. G.**, Bischoff A., Gross J., Patzek M., McCoy T. J., Corrigan C. M. (2018) Disequilibrium crystallization of Rumuruti chondrite impact melts [P42C-08] presented at 2018 Fall Meeting, AGU, Washington, D.C., 10-14 Dec.
- McCoy T. J., **Lunning N. G. (presenter)**, Corrigan C. M. (2018) Experimental investigation of core formation in the CV-CK chondrite parent body. [P52B-06] presented at 2018 Fall Meeting, AGU, Washington, D.C., 10-14 Dec.
- Andrews B. J., Befus K. S., **Lunning N. G.** Disequilibrium nucleation and growth of plagioclase: A numerical model. [V53A-07] presented at 2018 Fall Meeting, AGU, Washington, D.C., 10-14 Dec.
- R. L. Funderburg, R. G. Mayne, **N. G. Lunning**, S. Singletary (2018) Metasomatic features in eucrites. 49th Lunar and Planetary Science Conference #2585
- Lunning N. G.**, Waters L. E., McCoy T. J. (2017) Amphibole and phlogopite formation on the R chondrite parent body: An experimental investigation. 80th Annual Meteoritical Society Meeting #6373
- Lunning N. G.**, Waters L. E., McCoy T. J., Corrigan C. M. (2017) Size influences core composition of oxidized planetesimals. 80th Annual Meteoritical Society Meeting #6366
- *Sosa E. S., **Lunning N. G.**, McCoy T. J., Bullock E. S., Corrigan C. M., Gardner-Vandy, K. G. (2017) Constraining the petrogenesis of the paired achondrites GRA 06128/9 through partial melting of an oxidized chondrite. 48th LPSC #2356
- *Winner of the 2017 Dworkin Award for Best Undergraduate Poster Presentation

Non-Technical Publications

- Lunning N. G.** and Corrigan C. M. (2017) Carbonaceous chondrite impact melts. *Elements* 13: 68-69.

Invited Talks

- University of Hawaii, Hawaii Institute for Geophysics and Planetology, Manoa, HI. October 2019. Exploration of the Solar System Using Samples from the Moon and Asteroids
- Johnson Space Center, Astromaterials Research and Exploration Science, Houston, TX. August 2019. Melting on Carbonaceous Chondrite Parent Bodies
- Sonoma State University, John and Mary Louise Riley Geology Seminar Series, Rohnert Park, CA. April 2019. Investigating Asteroids Using Meteorites
- University of Georgia, Department of Geology, Athens GA, March 2019. From Crusts to Cores: Investigating Asteroids Using Meteorites
- American Museum of Natural History, New York, NY February 2019. From Crusts to Cores: Investigating Asteroids Using Meteorites and Experiments
- Jet Propulsion Laboratory, Astrophysics, Planetary Science, Earth Science Colloquium, Pasadena, CA. November 2018. Modification of Asteroid Surfaces: Insights from Meteorites
- Rutgers University, Department of Earth and Planetary Sciences Seminar, Piscataway, NJ, October 2018. Crusts & Regoliths: Petrological Studies of Asteroid Surface Materials
- Ninth Catastrophic Disruption in the Solar System Workshop (CD9), Kobe, Japan, May 2018. Impact Melts in CV and CM chondrites
- Carnegie Institution for Science, Department of Terrestrial Magnetism, Washington DC, May 2018. Melting on Oxidized Asteroids and Planetesimals
- California Lutheran University, Department of Geology, Thousand Oaks CA, April 2018. Investigating Asteroids Using Meteorites
- University of Missouri, Department of Geological Sciences, Columbia MO, February 2018. From Crusts to Cores: Investigating Asteroids Using Meteorites
- Harvard University, Solid Earth Seminar, Cambridge MA, November 2017. From Crusts to Cores: Investigating Asteroids Using Meteorites
- Purdue University, Department of Earth, Atmospheric, and Planetary Sciences, West Lafayette IN, April 2017. A Petrologist's View of Asteroids
- Geological Society of Washington, Cosmos Club Washington DC, November 2016. Carbonaceous Chondrite Impact Melts
- Colby College, Geology Department, Waterville ME, October 2016. Melting Meteorites to Investigate the First Magmas Generated in Our Solar System
- National Museum of National History, Senate of Scientists, Washington DC, April 2016. Making Pocket-sized Planetesimals: Petrological Experiments on Meteorites
- University of Maryland, Geochemistry Group, College Park MD, February 2016. Investigating Asteroid 4 Vesta from Mantle to Regolith Using Meteorite Analogs
- University of West Georgia, Department of Geosciences, Carrollton GA, February 2016. Investigating Asteroid 4 Vesta from Mantle to Regolith Using Meteorite Analogs