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 March 2020.

Lunning N. G., Bischoff A., Gross J., Patzek M., McCoy T. J., and Corrigan C. M. (*in press*) Insights into the formation of ancient silica-rich magmas from Rumuruti chondrite impact melts. *Meteorites & Planetary Science.* Accepted November 2019. DOI: 10.1111/maps.13430

McSween H. Y., Raymond C.A., Stolper E. M., Mittlefehldt D.W., Baker M., **Lunning N.G.**, Beck A.W., Hahn T.M. (*in press*) Differentiation and magmatic history of Vesta: Constraints from HED meteorites and Dawn spacecraft data. *Chemie der Erde — Geochemistry. doi.org/10.1016/j.chemer.2019.07.008*

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

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

- Studying 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 (Selected for 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 Dwornik 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