

# Emily C. First

Postdoctoral research associate

Department of Earth, Environmental and Planetary Sciences (DEEPS)  
Brown University, Providence, RI 02912

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## Education

- 2017      PhD in Geology & Geophysics, University of Hawai‘i at Mānoa (UH)  
            **TITLE:** Magmatic environments and timescales: Experimental studies on  
            martian basalt and terrestrial dacite. **COMMITTEE:** Julia Hammer (chair),  
            Bruce Houghton, Jeff Taylor, Thomas Shea, John Allen
- 2015      M.S.-en-route in Geology & Geophysics, UH
- 2011      B.A. in French, University of Georgia (UGA)  
            B.S. in Geology, UGA  
            — *summa cum laude* with highest honors
- 2010      Exchange semester at Institut d’études politiques de Paris (SciencesPo)

## Research Interests

My research focuses on phase relationships in silicate melts, including the texture and chemical composition of laboratory-grown minerals, to constrain the magmatic and extrusive histories of volcanic materials. I have used dynamic crystallization experiments to determine the eruptive context of a martian meteorite, and phase equilibrium experiments to pinpoint pre-eruptive storage conditions at Quizapu, Chile. I am particularly intrigued by the kinetics of mineral re-equilibration and reaction, including Fe-Ti oxide exsolution, amphibole rim formation, and diffusive exchange in plagioclase. My current project involves static experiments on synthetic lunar samples, with the aim of investigating the origin of the silicic “red spots” and the effect of H<sub>2</sub>O and pressure on silicate liquid immiscibility.

## Laboratory and Analytical Experience

- 2018-present      Postdoctoral research associate, Brown University DEEPS, *M. Rutherford*  
                            — experimental lab work: TZM, capsule welding, thin section prep  
                            — analytical work: EDS and WDS spot analyses and imaging (EPMA),  
                            SIMS volatile analyses, MATLAB coding
- 2011-2018      Research Assistant, UH Geology & Geophysics, *J. Hammer*  
                            — experimental lab work: 1-atm gas-mixing furnace (CO<sub>2</sub>+H<sub>2</sub>), water-  
                            medium cold-seal pressure line, thin section preparation, capsule welding  
                            — analytical work: EDS and WDS spot analyses and maps (on SEM and  
                            EPMA), electron backscatter diffraction, MATLAB coding

2008-2009            Lab Assistant, UGA Geology, *J. Wright*  
— zircon sample prep: jaw crusher, disk mill pulverizer, Gemini table

## Field and Sea Experience

2017                    3-day research cruise aboard R.V. Kilo Moana, mapping and dredging the sea floor east of the island of Molokai

2016                    Mapping a recent explosive deposit on the rim of Halema'uma'u Crater, Kilauea Volcano

2016                    Field campaign in Maule region of Chile, to sample dacite lava flows of Volcán Quizapu, along with geology of nearby mafic volcanic centers

2014                    Participant in Goldschmidt conference field trip around Yosemite National Park – pluton emplacement, recrystallization features, megacryst formation

2011-2014            Volcanology/petrology activities and classwork research in Hawaii – Ko'olau, Wai'anae, Kilauea, West Maui, Haleakala; and New Zealand – Ruapehu, Ngauruhoe, Tongariro, Taupo, White Island

2009                    UGA Field School student participant  
— Six-week field camp for geology majors, based in Cañon City, CO with trips to Utah and southern Colorado; four mapping projects; GIS short course; other field work in the Uinta and Paradise basins, Great Sand Dunes NP, Summitville Mine Superfund site, Valles caldera

2008                    UGA Honors Interdisciplinary Field Program student participant  
— Summer program of coursework in geology, anthropology, and ecology while camping across the country; locations include Sapelo Island, Mesa Verde, Crater Lake, Mount St. Helens, Yellowstone, Grand Tetons, Denver ice core lab; activities include geologic mapping, soil coring, assessment of stream remediation, research papers

## Teaching Activities

2018                    Completed Certificate I course through Sheridan Center at Brown University  
— semester-long; prepares early career academics for college teaching

2017                    Co-leader of GSA Cordilleran section field trip to Kilauea Volcano (historical and active flows, explosive deposits, caldera history)

2017                    Guest lectured for Geology101 class

- 2015 Taught mini-workshop on using the MELTS and alphaMELTS programs, open to all in the UH Geology & Geophysics department
- 2012 Guest lectured, plus designed and taught an in-class lab on viscosity for Volcanology undergraduate course
- 2011 TA, Dynamic Earth Laboratory (UH)  
— introductory/general level geology lab course; 2 sections
- 2011 TA & Bookkeeper, UGA Field School  
— senior-level Geology major capstone course; 6 weeks
- 2011, 2010 TA (2011) & Aide/Driver (2010), UGA Interdisciplinary Field Program  
— all levels; Geology, Anthropology, & Ecology; taught 4 out of 8 week

## Honors and Awards

- 2016 ARCS Honolulu Scholar - Toby Lee award in Geology & Geophysics
- 2015 UH Geology & Geophysics achievement award
- 2013 ARCS Honolulu Scholar
- 2011-present Member of Phi Beta Kappa
- 2011-2013 Fred M. Bullard Graduate Fellowship, UH Geology & Geophysics
- 2011 UGA First Honor Graduate, a distinction for graduates with a 4.00 GPA
- 2011 UGA Honors Program Joy P. Williams Science Award
- 2011 Undergraduate Student of the Year, UGA Geology
- 2010 Vernon Hurst Undergraduate Research Award, UGA Geology
- 2009 Field School Student of the Year, UGA Geology
- 2007-2011 Honors Program student at UGA
- 2007-2011 HOPE scholarship, a state of Georgia merit-based scholarship
- 2007-2011 National Merit Scholarship

## Peer-Reviewed Articles

\* indicates undergraduate mentee of E. First

**First, E.**, Hammer, J. (2016) Igneous cooling history of olivine-phyric shergottite Yamato 980459 constrained by dynamic crystallization experiments. *Meteoritics and Planetary Science*, 51, 1233-1255.

Brachfeld, S., Shah, D., **First, E.**, Hammer, J., Bowles, J. (2015) Influence of redox conditions on the intensity of Mars crustal magnetic anomalies. *Meteoritics and Planetary Science*, 50, 1703-1717.

Shea, T., Hammer, J., **First, E.** (2013) Magma balloons or bombs? *Nature Geoscience*, 6, 802–803.

In review:

**First, E.**, Leonhardi, T.\*, Hammer, J. (2019) Effects of superheating magnitude on olivine composition and growth morphology. *Contributions to Mineralogy and Petrology*, in review.

Shea, T., Hammer, J., Hellebrand, E., Mourey, A., Costa, F., **First, E.**, Lynn, K. (2019) Phosphorous and aluminum zoning in olivine: Contrasting behavior of two nominally incompatible trace elements. *Contributions to Mineralogy and Petrology*, in review.

## Manuscripts in Preparation for Submission

**First, E.**, Hammer, J., Ruprecht, P. (2019 expected) Experimental constraints on dacite magma storage beneath Volcán Quizapu, Chile. *Journal of Petrology*, in prep.

**First, E.**, Hammer, J. Re-equilibration of Fe-Ti oxides: Textural and compositional effects of low  $fO_2$ . *American Mineralogist*, in prep.

Brachfeld, S., **First, E.**, Hammer, J., Stewart, S., Hankin M., Spaulding, D., Strauss, B., Withers, A., Bowles, J., Feinberg, J. (2019 expected) Synthetic Mars Gusev Crater Basalts I: Implications for Crustal Anomaly Generation and Magnetic Properties of the Mars Crust. *Journal of Geophysical Research: Planets*, in prep.

## Ongoing Research Projects for Future Submission

**First, E.**, Rutherford, M., Welsch, B., McCanta, M., Saal, A.  
Hidden gems of the Apollo 17 orange glass magma – new petrology and geochemistry studies

**First, E.**, Rutherford, M.  
Conditions and consequences of silicate liquid immiscibility in moderately evolved lunar magmas

**First, E.**, Hammer, J., Shea, T., Hellebrand, E., Tachera, D.\*  
Magnesium diffusion in labradorite at hydrous magmatic conditions

## Conference Abstracts

**First, E.**, Rutherford, M. (2019) Immiscibility in evolved lunar magmas. *LPSC 2019*, abstract#2117. TALK.

**First, E.**, Rutherford, M. (2018) Phase equilibria and conditions of silicate liquid immiscibility in silicic lunar magmas at mid-lower crustal pressures and various H<sub>2</sub>O contents. *AGU 2018*, abstract#P23E-3494. POSTER.

**First, E.**, Hammer, J., Shea, T., Hellebrand, E., Tachera, D.\* (2018) Magnesium diffusion in labradorite at hydrous magmatic conditions. *Goldschmidt 2018*, abstract#2018003038. TALK.

Hammer, J., **First, E.**, Shea, T., Leonhardi, T.\*, Brachfeld, S. (2018) Nucleation: an existential problem in an extreme environment. *Goldschmidt 2018*, abstract. TALK.

Shea, T., Hammer, J., Hellebrand, E., Mourey, A., **First, E.**, Lynn, K., Costa, F. (2018) Phosphorous and aluminum partitioning during olivine growth: both sides of the story. *Goldschmidt 2018*, abstract. POSTER.

**First, E.**, Hammer, J., Ruprecht, P. (2017) Experimental constraints on dacite magma storage beneath Volcán Quizapu, Chile. *IAVCEI Scientific Assembly 2017*, abstract #917. TALK.

Brachfeld, S., **First, E.**, Hammer, J., Stewart, S., Hankin, M., Spaulding, D., Bowles, J., Strauss, E., Withers, A., Feinberg, J. (2016) Magnetic properties of synthetic Gusev Crater basalts: Implications for remanence acquisition and impact demagnetization of the martian crust. *AGU 2016*, abstract# GP13A-04. TALK.

Leonhardi, T., Hammer, J., **First, E.** (2015) Effect of superheating on olivine nucleation and growth in a silica-undersaturated melt: An experimental study. *AGU 2015*, abstract #V41B-3071. POSTER.

**First, E.**, Hammer, J. (2014) Extrusive history of martian meteorite Yamato 980459: An experimental study. *Goldschmidt 2014*, abstract #698. POSTER.

**First, E.**, Hammer, J., Welsch, B. (2013) Thermal history of Yamato 980459- Constraints from mineralogy, crystal morphology, and dynamic cooling experiments. *LPSC XLIV*, abstract #2943. TALK.

**First, E.**, Hammer, J. (2012) Laboratory studies of crystallization kinetics in magma-Elucidating the crystallization history of a martian meteorite. *10<sup>th</sup> International Symposium on Crystallization in Glasses and Liquids*. POSTER.

**First, E.**, Summerlin, E.S., Patiño Douce, A., Roden, M.F. (2011) Mineral probes of magmatic processes at Valles caldera, northern New Mexico. *GSA Southeastern Section 60<sup>th</sup> Annual Meeting*, abstract #184984. POSTER.

## Seminars and Invited Talks

- 2018 GMP Lunch Bunch Talk (Brown): *Silicate liquid immiscibility in evolved lunar magmas: Preliminary experimental findings and relevance to red spots*
- 2017 ARCS Foundation public pau hana (Honolulu, HI): *Cooking magma: Research in the experimental petrology lab and beyond*

- 2017 REU Seminar Series (U. Hawaii): *Between a rock and a hot place: Phase equilibrium experiments on a dacite magma from the southern Andes*
- 2013 HIGP Seminar (U. Hawaii): *Methods in the Madness* (experimental/methodological conundrums and study of martian meteorite Y-980459)
- 2013 TGIF Bullard Fellowship Talk (U. Hawaii): *Petrology of martian meteorite Yamato 980459: Mineralogy, crystal morphology, and laboratory experiments*

## Funding

- 2019 proposed *pending review* PI of NASA proposed research entitled “Apollo 17 Picritic Magmas: New Perspectives on Crystallization and Ascent Processes”
- 2019 awarded Co-I of NSF proposed research entitled “Experimental Study of Clinopyroxene Growth and Sector Zoning” (PI Benoit Welsch - \$379,864)
- 2017 awarded Lipman Research Award from the GSA (\$2650)
- 2017 awarded GSA MGPV Division Student Award (\$2000)
- 2017 awarded UH Graduate Student Organization Travel Grant (\$732.40)

## Synergistic Activities

- 2019 Dwornik Award judge for LPSC
- 2018-19 DEEPS STEP coordinator– designing, implementing lessons for K-12 science
- 2018 OSPA judge for AGU Fall Meeting
- 2018 Proposal reviewer for NSF EAR division
- 2018 Skype-a-Scientist participant for New Jersey 4<sup>th</sup> grade class
- 2017,-15, -13, -11 2-day Open House explosive eruptions demonstration
- 2012-2016 Ran a weekly reading group for VGP group of UH Geology & Geophysics
- 2016, 2012 Head of new graduate student welcoming committee
- 2014-2016 Reviewer of mini-grant proposals for K-12 teachers
- 2015 Attended MELTS workshop at CalTech
- 2014-2015 Traveling seismic lab activity at local middle schools
- 2014 Day of mineralogy experiments with local 6<sup>th</sup> graders
- 2014 Think Tech Hawaii “Petrological Puzzles” interview hour
- 2014, 2013 Middle School Research Conference at UH
- 2013 Hawaii Ocean Science Bowl volunteer
- 2012 Ocean and Earth Science Day at UH
- 2012 Ocean Science Career Night at Kailua Intermediate School
- 2010-2011 Outreach Coordinator for Geology Club at UGA
- 2008-2009 Homework Helpers program volunteer, Clarke County (GA) Libraries
- 2007-2008 Clarke County (GA) Mentor Program mentor for middle school

## **Professional Society Memberships**

2013-present	American Geophysical Union (AGU)
2013-present	Geological Society of America (GSA)
2013-present	Mineralogical Society of America (MSA)
2017-present	Internat'l Assoc. of Volcanology and Chem. of the Earth's Interior (IAVCEI)

## **Additional Skills**

MATLAB  
R (basics)  
Adobe Photoshop  
Adobe Illustrator  
ImageJ  
French (proficient reading, writing, and oral communication)