

KARALEE K. BRUGMAN

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RESEARCH INTERESTS

Experimental petrology, magma genesis on exoplanets, Earth, and solar system bodies, diffusion chronometry, geothermometry, volcano science and hazards, high-silica magmatic systems

EDUCATION

- 2021-curr. Postdoctoral Fellow, Carnegie Institution for Science
Earth & Planets Laboratory (EPL)
- 2020 Ph.D., Arizona State University (ASU)
Geological Sciences, School of Earth and Space Exploration (SESE)
- Dissertation: *Timescales and Characteristics of Magma Generation in Earth and Exoplanets*
Advisor: Christy Till
Committee: Maitrayee Bose, Steven Desch, Richard Hervig, Everett Shock
- 2014 B.A., University of Colorado, Boulder (CU) – *summa cum laude* and *with distinction*
Geological Sciences, minor: Astrophysical and Planetary Sciences
- Honors thesis: *Understanding the History of Arabia Terra, Mars Through Crater-Based Tests*
Advisor: Brian Hynek
Committee: Fran Bagenal, Stephen Mojzsis, Charles Stern
- 2003 B.S., Northwestern University
Communications: Radio/TV/Film History, Theory, and Production

PUBLICATIONS

// PEER-REVIEWED

- Brugman, K.K., Phillips, M.G., Till, C.B. (*in press*). Experimental Determination of Mantle Solidi and Melt Compositions for Two Likely Rocky Exoplanet Compositions. *Journal of Geophysical Research: Planets*, special issue *Exoplanets: The Nexus of Astronomy and Geoscience*, EarthArXiv:10.31223/X5WG7Z.
- Brugman, K.K. and Till, C.B. (2019). A low-aluminum clinopyroxene-liquid geothermometer for high-silica magmatic systems. *American Mineralogist*, 104(7), 996–1004, doi:10.2138/am-2019-6842.

Hynek, B.M., T.M. McCollum, E.C. Marcucci, **K.K. Brugman**, K.L. Rogers (2013). Assessment of environmental controls on acid-sulfate alteration at active volcanoes in Nicaragua: Applications to relic hydrothermal systems on Mars, *Journal of Geophysical Research—Planets*, Special Issue: Early Mars, 118, 2083–2104, doi:10.1002/jgre.20140.

// OTHER PUBLICATIONS

Kohler, E., C. He, S.H. Shim, **K.K. Brugman**, A.C. Johnson, P.C. Vergeli, M.A. Thomson, H. Graham, M.S. Gudipati, B. Fleury, B.L. Henderson (2020) The Importance of Prioritizing Exoplanet Experimental Facilities, *Planetary Science and Astrobiology Decadal Survey 2023–2032*, arXiv:2007.13924.

Marley, M.S., S. Harman, H.B. Hammel, P.K. Byrne, J. Fortney, A. Accomazzi, S.E. Moran, M.J. Way, J.L. Christiansen, N.R. Izenberg, T. Holt, S. Vahidinia, E. Kohler, **K.K. Brugman** (2020) Enabling Effective Exoplanet/Planetary Collaborative Science, *Planetary Science and Astrobiology Decadal Survey 2023–2032*, arXiv:2007.10549.

Till, C.B., M.E. Pritchard, C.A. Miller, **K.K. Brugman**, J. Ryan-Davis (2018). Super-volcanic Investigations. *Nature Geoscience*, 11(4). doi:10.1038/s41561-018-0100-1.

// IN PROGRESS

Brugman, K.K., Bose, M., Till, C.B. Diffusion Chronometry Using a Proxy to the Growth-Then-Diffusion Initial Condition. To be submitted to *Contributions to Mineralogy and Petrology*.

FELLOWSHIPS & GRANTS

2021	Carnegie Institution for Science Postdoctoral Fellowship	\$147,000
2020	NASA Exoplanets Science Institute Travel Grant	\$1,100
2019	ASU Graduate College Completion Fellowship	\$18,200
2019	Geochemical Society Planetary Science Grant	\$1,000
2019	ASU Graduate & Professional Student Association Individual Travel Grant	\$950
2016, '18, '19	ASU Graduate Education Travel Grant (total)	\$1,440
2014	NSF Graduate Research Fellowship	\$102,000

HONORS

2021	Carnegie Institution for Science Postdoctoral Fellowship
2016, '17, '20	ASU College of Liberal Arts and Sciences Graduate Excellence Award
2019	ASU Graduate College Completion Fellowship
2016	AGU Outstanding Student Paper Award
2014	NSF Graduate Research Fellowship
2014	Rocky Mountain Association of Geologists Outstanding Student
2014	CU Boulder Bruce F. Curtis Scholarship
2013, 2014	CU Arts and Sciences Dean's Scholars' Award
2013	CU Boulder T. Keith Marks Award for Outstanding Geological Sciences Majors

CONFERENCE PRESENTATIONS

**invited †talk*

- *†Brugman, K. K., Phillips, M. G., & Till, C. B. (2021).** Using Experimental Petrology to Explore Exoplanet Melts and Solidi: Preliminary Implications for Habitability. Goldschmidt, Lyon, France.
- †Brugman, K.K., Phillips, M.G., and Till, C.B. (2021).** Petrological Experiments on Rocky Exoplanet Compositions Reveal Clues to Habitability. Lunar and Planetary Sciences Conference Abstract 1967, The Woodlands, TX.
- †Brugman, K.K., Phillips, M.G., and Till, C.B. (2020).** Exoplanet Crust Compositions as Determined by Petrological Experiments. Exoplanets in Our Backyard, Houston, TX.
- Brugman, K.K., Phillips, M.G., and Till, C.B. (2019).** Experimental Determination of Rocky Exoplanet Crust Compositions. EOS AGU Fall Meeting Abstract P51G-3437, San Francisco, CA.
- †Brugman, K.K. and Till, C.B. (2019).** New clinopyroxene-liquid geothermometer indicates a broad crystallization interval for low-Al clinopyroxene in high-silica magmatic systems. GSA Annual Meeting Abstract 337075, Phoenix, AZ.
- *†Brugman, K.K., Phillips, M.G., and Till, C.B. (2019).** Stars to Planets: Experimental Determination of Exoplanet Mantle Solidi and Crust Compositions. Goldschmidt, Barcelona, Spain.
- Brugman, K.K., C.B. Till (2018).** Clinopyroxene-Liquid Thermometry Hints at Cold Storage for High-Silica Systems. IAVCEI Commission on Collapse Calderas: VII International Workshop on Collapse Calderas, Toba Caldera, Sumatra, Indonesia.
- Brugman, K.K., C.B. Till (2018).** A Revised Low-Al Clinopyroxene-Liquid Geothermometer for High-Silica Igneous Systems. EOS AGU Chapman: Merging Geophysical, Petrochronologic, and Modeling Perspectives of Large Silicic Magma Systems Abstract P-28, Quinamávida, Maule Region, Chile.
- *†Brugman, K.K., C.B. Till (2017).** Taking Yellowstone's Temperature: A New Clinopyroxene Geothermometer to Improve Timescales of Pre-Eruptive Events. EOS AGU Fall Meeting Abstract U13B-03, New Orleans, LA.
- Brugman, K.K., C.B. Till (2017).** A Revised Clinopyroxene-Liquid Geothermometer for Silicic Igneous Systems with Applications to Diffusion Chronometry of the Scaup Lake Rhyolite, Yellowstone Caldera, WY. EOS AGU Fall Meeting Abstract V11C-0365, New Orleans, LA.
- Brugman, K.K., C.B. Till (2017).** Investigation of the Applicability of Clinopyroxene Geothermometers to Silicic Igneous Systems. IAVCEI Scientific Assembly Abstract ME43C-044, Portland, OR.
- †Brugman, K.K., C.B. Till, M. Bose (2016).** Clinopyroxene Diffusion Chronometry of the Scaup Lake Rhyolite, Yellowstone Caldera, WY. EOS AGU Fall Meeting Abstract V13F-02, San Francisco, CA.

Brugman, K.K., C.B. Till, M. Bose and R. Hervig (2015). Development of Clinopyroxene as an Igneous Geospeedometer Using NanoSIMS. EOS AGU Fall Meeting Abstract V31B-3030, San Francisco, CA.

Brugman, K.K., B.M. Hynek, S.J. Robbins (2015). Crater-based tests unlock the mystery of the origin and evolution of Arabia Terra, Mars. Lunar and Planetary Science Conference, The Woodlands, TX.

CURRENT PROJECTS

Determination of exoplanet melting curves, crust compositions, and volatile solubility (2015–current)

- Piston-cylinder experiments to identify location of the dry solidus in mantles of exotic composition
- Piston-cylinder experiments to measure the solubility of volatiles in primitive silicate mantles

Diffusion chronometry using Fe-rich clinopyroxene from Yellowstone post-caldera rhyolites to determine rejuvenation-eruption timescales of high-silica systems (2014–current)

- Developed new diffusion modeling method to use a slow-diffusing elemental profile as a proxy to the initial condition of a fast-diffusing elemental profile
- Analyses via LA-ICPMS, EPMA, SIMS, NanoSIMS (also operated)
- Finite differences diffusion model programmed in Python

INVITED TALKS & COLLOQUIA

2021	Goldschmidt Conference, Lyon
2021	Ruhr-University of Bochum, Institute of Geology, Mineralogy and Geophysics Colloquium
2021	Smithsonian National Museum of Natural History, Department of Mineral Sciences Seminar
2021	International Volcanology Seminar
2021	Stanford University, Geological Sciences Seminar
2021	The University of Chicago, Geophysical Sciences Seminar
2020	California Institute of Technology, Geoclub
2020	NASA Goddard, Exoplanet Seminar
2020	Harvard & Smithsonian Center for Astrophysics, Exoplanet Presentation Lounge
2019	Arizona State University, School of Earth & Space Exploration Colloquium
2019	Goldschmidt Conference, Barcelona
2018	Hot Life in the Desert Meeting, Arizona
2017	American Geophysical Union Fall Meeting, San Francisco

TEACHING EXPERIENCE

2019	Geochemistry, Invited lecturer “Crystal Chemistry”	ASU
2019	Geochemistry, Teaching Assistant	ASU
2016	Introduction to Geology, Laboratory Instructor	ASU
2013–2014	Introduction to Geology, Learning Assistant	CU

RESEARCH EXPERIENCE

- 2020–curr. Postdoctoral researcher, EPL, Carnegie: end-loaded piston-cylinder (PC), multi-anvil, NMR, FTIR, EPMA, Python
- 2014–2020 Graduate researcher, ASU Experimental Petrology and Igneous Processes Center (EPIC): PC, 1 atm vertical furnace, SIMS, NanoSIMS, EPMA, Python, C
- 2018 Visiting researcher, Earth Observatory of Singapore
- 2017 Visiting researcher, MIT Experimental Petrology lab: cold-seal pressure vessel
- 2011–2014 Undergraduate researcher, Laboratory for Atmospheric and Space Physics/CU Boulder: XRD/XRF, ArcGIS

FIELD EXPERIENCE

- 2017 Sample collection, Medicine Lake Volcano and Mt. Shasta, CA
- 2015 Sample collection, Yellowstone National Park, WY
- 2014 Tephra stratigraphy and mapping, Iceland
- 2012 Mapping, Front Range, CO

SERVICE & CONTRIBUTIONS TO DIVERSITY

// DIVERSITY, EQUITY, AND INCLUSION

- 2021–curr. Member, Carnegie Institution URGE Pod
- 2021–curr. Member, Carnegie EPL Anti-Racist Reading Group
- 2019–curr. Pen pal, Letters to a Pre-Scientist
- 2015–2018 Co-chair, ASU SESE Women in Science Program
- 2014–2017 Peer mentor, ASU SESE Women in Science Program
- 2015 Peer mentor, AGU Fall Meeting

// SESSION CONVENER

- 2019 “Volatile Elements in Magmatic and Planetary Processes: Budgets, Fluxes, and Behavior”, AGU Fall Meeting
- 2017 “Microscale archives of macroscale igneous processes”, AGU Fall Meeting

// LEADERSHIP

- 2021–curr. Representative, Carnegie Institution Postdoctoral Association (*elected*)
- 2016–2020 Student representative, AGU Volcanology, Geochemistry, and Petrology section
- 2016–2018 Graduate student representative, ASU Technology Advisory Board
- 2015–2018 Co-chair, ASU SESE Women in Science Program
- 2017 AGU Student & Early Career Scientist Conference Planning Committee
- 2014–2017 ASU SESE Graduate Council delegate (*elected*)
- 2012–2013 GSA 125th Annual Meeting Student Planning Committee

// MENTORING

- 2019–curr. Pen pal, Letters to a Pre-Scientist
- 2014–2017 Peer mentor, ASU SESE Women in Science Program
- 2015 Peer mentor, AGU Fall Meeting

// OUTREACH

- 2014–2020 ASU Open Door (annual campus-wide public lab visit and outreach event)
- 2014–2020 ASU SESE Earth and Space Exploration Day (annual department outreach event)
- 2019–2020 Judge for FutureEngineers.org’s “Name The Rover” contest for the Mars 2020 rover
- 2015 Article for the Space Exploration Network (SEN.com) about the ASU-NExSS project, “The next steps in our search for life”
- 2014–2018 ASU SESE Open House (monthly department outreach event)

// WORKSHOP PARTICIPATION

- 2021 NExSS/AAS Habitable Worlds Workshop
- 2020 NExSS Quantitative Habitability Workshop (NASA Earths in Other Solar Systems)
- 2020 Melts, Glasses, Magmas (LMU Munich)
- 2020 Exoplanets in Our Backyard (LPI)
- 2019 CONVERSE Volcanic Sampling and Eruption Dynamics Workshop (AGU Fall Meeting)
- 2019 CONVERSE Petrology, Geochemistry, Experimental, Communication and Sampling Communities Workshop (GSA Annual Meeting)
- 2015, '16, '19 Workshop on Secondary Ion Mass Spectrometry (ASU)
- 2018 IAVCEI VII International Workshop on Collapse Calderas (Toba Caldera, Indonesia)
- 2017 ENKI Datathon (ASU)
- 2016 How to Have a Successful Congressional District Visit (AGU)
- 2016 Working with Diverse Students on Societally Relevant Geoscience Issues (InTeGrate)
- 2014 alphaMELTS Workshop (Caltech)
- 2014 Global Seminar: Quaternary Geology and Volcanology (Iceland)

// PEER REVIEWER

- NSF Division of Earth Sciences (EAR)
- Contributions to Mineralogy and Petrology

PROFESSIONAL SOCIETIES

- Geochemical Society – since 2019
- International Association of Volcanology and Chemistry of the Earth’s Interior – since 2018
- Association for Women in Science – since 2016
- American Geophysical Union – since 2013
- Association for Women Geoscientists – since 2012
- The Geological Society of America – since 2012