

Stephanie Brown Krein

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Professional Experience

- Postdoctoral Associate, MIT, 2019 - present
- Software and Database Internal Consultant, Ab Initio, 2021 - present
- Research Associate, Linda T. Elkins-Tanton, Carnegie Institution for Science, June 2011 – Sept. 2012
- Research Intern, Enel S.p.A (Pisa, Italy), June 2007 – August 2007

Education: *Massachusetts Institute of Technology*

Ph.D., Geology, 2012 - 2019

Dissertation: Quantifying melting and chemical differentiation processes on Earth and the Moon

Principal Advisor: Timothy L. Grove, Committee: Mark D. Behn, Oliver Jagoutz, David McGee

S.M. Earth, Atmospheric, and Planetary Sciences, 2011

Principal Advisor: Linda T. Elkins-Tanton, Committee: Sang-Heon Shim, Benjamin P. Weiss

S.B. Earth, Atmospheric, and Planetary Sciences, 2010

S.B. Engineering as Recommended by the Department of Mechanical Engineering, 2010

Other Research and Field Experience: *MIT Dept. of Earth, Atmospheric, and Planetary Science*

- Scientist for R/V Armstrong Voyage #AR23-02, Mark D. Behn, October 2017
- Field Work: Cascades 2012, 2014, 2017
- Field Geology Assistant, Oliver Jagoutz, Indian Himalayas (Ladakh), August 2011
- Field Work: MIT field camp in southern Nevada, January 2010
- Research Assistant, Linda T. Elkins-Tanton, August 2007 – June 2010
- Research Assistant, Wesley A. Watters, January 2007 – May 2007

Honors & Awards

- Editor's Highlight, EOS Science News by AGU for Krein et al. (2021), 2021
- The Award for Excellence in Teaching, Massachusetts Institute of Technology, 2016
- The Award for Excellence in Teaching, Massachusetts Institute of Technology, 2014
- The Massachusetts Institute of Technology Presidential Fellowship, 2012-2013
- The W. O. Crosby Award for Sustained Excellence, Massachusetts Institute of Technology, 2010
- Paul E. Gray (1954) Endowed Fund for research, Massachusetts Institute of Technology, 2008
- 39th LPSC Stephen E. Dworkin Planetary Geoscience Award, Honorable Mention poster, 2008

Invited Talks

- Harvard University, Special Department Seminar (April 2020)
- Brown University, Planetary Lunch Seminar (May 2019)
- Woods Hole Oceanographic Institute, Geophysics and Geochemistry Seminar (January 2019)

- American Geophysical Union Annual Meeting (December 2018)
- Goldschmidt Conference (Geochemical Society) Keynote (August 2018)
- Harvard University, Geophysical Sciences Department Seminar (May 2018)
- University of Chicago, Geophysical Sciences Department Seminar (April 2018)

Teaching Experience: MIT Teaching Assistant

- Petrology 12.109, Timothy L. Grove, Spring 2016
- Structure of Earth Materials (Mineralogy) 12.108, Timothy L. Grove, Spring 2014
- Discovering Earth, Atmospheric, and Planetary Science, Yellowstone National Park, August 2008, 2009, 2010, 2016, 2017, 2018, 2019 Samuel Bowring and Timothy L. Grove
- Structure of Earth Materials 12.108, Spring 2009, Sang-Heon Shim
- Introduction to Geology 12.001, Spring 2008, Linda T. Elkins-Tanton

Publications in preparation

- **Krein, S. Brown.**, H. Brodsky, M. Guenther, T.L. Grove, Remelting the lunar magma ocean : hybridization is required (in prep)
- **Krein, S.B.**, M.D. Behn, and T.L. Grove, U-series disequilibria in MORBs generated by shallow spinel and plagioclase-field mantle melting (in prep)
- **Krein, S.B.**, M.D. Behn, and T.L. Grove, Measuring consistency in petrologic models: the effect of mantle source composition, mantle potential temperature, and plagioclase field melting on basalt variability at the slow and ultraslow 9-25°E Southwest Indian Ridge (in prep)
- Guenther, M.E., **Krein, S. Brown.**, T.L. Grove, The influence of variable oxygen fugacity on the source depths of lunar high-titanium ultramafic glasses (*submitted to Geochimica et Cosmochimica Acta*)

Published Software

2. **Krein, S. Brown**, Z.M. Molitar, and T.L. Grove, ReversePetrogen and ImportPlot, Harvard Dataverse, 2021, <https://doi.org/10.7910/DVN/VWYCMY>
1. **Krein, S. Brown**, M. D. Behn., T. L. Grove, Petrogen, Harvard Dataverse, 2020, <https://doi.org/10.7910/dvn/cxit95>

Publications

8. **Krein, S. Brown**, Z.M. Molitar, and T.L. Grove, ReversePetrogen: a Multiphase Dry Reverse Fractional Crystallization-Mantle Melting Thermobarometer applied to 13,589 Mid-Ocean Ridge Basalt Glasses, *Journal of Geophysical Research: Solid Earth*, 126, 1–20, 2021.
7. **Krein, S. Brown**, M. D. Behn., T. L. Grove, Origins of Major Element, Trace Element, and Isotope Garnet Signatures in Mid-Ocean Ridge Basalts, *Journal of Geophysical Research: Solid Earth*, 125, 1–33, 2020.
6. Shinevar, W.D., Mark, H., Clerc, F., Codillo, E., Gong, J., Olive, J.A., **Brown, S.M.**, Smalls, P., Le Roux, V., Behn, M.D., Causes of oceanic crustal thickness oscillations along a 100-Myr Mid-Atlantic Ridge flow line, *Geochemistry, Geophysics, Geosystems*, 20, 1–17, 2019.
5. Grove, T.L., and **Brown, S.**, Magmatic processes leading to compositional diversity in igneous rocks: Bowen (1928) revisited, *American Journal of Science*, 318, 000-000, 2018.
4. **Brown, S.**, and T.L. Grove, Origin of the Apollo 14, 15, and 17 yellow ultramafic glasses by mixing of deep cumulate remelts, *Geochimica et Cosmochimica Acta*, 171, 201-215, 2015.
3. **Brown, S.**, L.T. Elkins-Tanton, and R.J. Walker, Effects of magma ocean crystallization and overturn on the development of ¹⁴²Nd and ¹⁸²W isotopic heterogeneities in the primordial mantle, *Earth and Planetary Science Letters*, 408, 319-330, 2014.

2. Black, B.A., E.H. Hauri, L.T. Elkins-Tanton, and **S.M. Brown**, Sulfur isotopic evidence for sources of volatiles in Siberian Traps magmas, *Earth and Planetary Science Letters*, 394, 58-69, 2014.
1. **Brown, S.** and L.T. Elkins-Tanton, Composition of Mercury's oldest crust from magma ocean models, *Earth and Planetary Science Letters*, 286, 446-455, 2009.

Selected Conference Presentations

Talks

- Krein, S. Brown, M. Geunther, T.L. Grove, Source Regions of the Lunar Ultramafic Glasses, 52st LPSC, 2021.
- Brown, S.M. and T.L. Grove, Melting Conditions of Primary Lunar Ultramafic Glasses, 51st LPSC, 2020.
- Brodsky, H.F., S.M. Brown and T.L. Grove, Origin of the High-Titanium Lunar Glasses: Constraints from Cumulate Remelting Experiments, 50th LPSC, 2019.
- Guenther, M.E., S.M. Brown and T.L. Grove, Origin of the Apollo 14 Black Glasses: New Experimental Constraints on the Influence of Variable Oxygen Fugacity on the Depth of Multiple Saturation and Implications for Late-Stage Magma Ocean Cumulate Overturn, 50th LPSC, 2019.
- Brown, S.M., Olive, J.A., Behn, M.D., and T.L. Grove, Chaos at ultraslow and slow spreading ridges: effects of asymmetric thermal structures on basalt compositions, AGU, 2018.
- Brown, S.M., M.D. Behn, T.L. Grove, Addressing an old question with a new model: What are the sources of garnet signatures in MORB?, Goldschmidt, 2018.
- Brown, S.M., M.D. Behn, T.L. Grove, Major and trace element modeling of mid-ocean ridge mantle melting from the garnet to the plagioclase stability fields: generating local and global major and trace element compositional variability, AGU, 2017.
- Brown, S.M. and T.L. Grove, Mixing of Melts of Compositionally Distinct Source Regions Can Explain the Within- and Between-Suite Compositionally Variability of the Lunar Ultramafic Glasses: Experiments and Models, 48th LPSC, 2017.
- Brown, S.M. and T.L. Grove, Olivine-Melt Equilibria in Lunar Ultramafic Magmas: Insights into Melt Thermodynamic Properties, 46th LPSC, 2015.
- Brown, S.M. and T.L. Grove, Influence of variable fO_2 and TiO_2 on the high pressure phase equilibria of lunar ultramafic glasses, Goldschmidt, Sacramento, CA, 2014.
- Brown, S.M. and T.L. Grove, The origin of the Apollo 14, 15 and 17 yellow glasses, 44th LPSC, 2013.
- Brown, S.M. and L.T. Elkins-Tanton, The early dynamics and density structure of Mercury's mantle, 43th LPSC, 2012.
- Brown, S. and L.T. Elkins-Tanton, Thermal and solar weathering of Mercury's crust, EPSC-DPS Joint Meeting 2011.
- S. Brown and L.T. Elkins-Tanton, Hypotheses for compositions of Mercury's ancient crust and implications for surface spectra, The Surface Composition of Mercury from Ultraviolet-Visible-Infrared Spectroscopy: State of the Art and Future Strategies Conference, 2009.
- L.T. Elkins-Tanton and S. Brown, A mechanism for spreading non-silicate iron- titanium oxides on the Mercurian surface (Presented by S. Brown), The Surface Composition of Mercury from Ultraviolet-Visible-Infrared Spectroscopy: State of the Art and Future Strategies Conference, 2009.
- Brown S. and L.T. Elkins-Tanton, Earliest planetary crusts: Constraints on the formation of Mercury and implications for bodies of different sizes, 40th LPSC, 2009.

Posters

- Brown, S.M., M.D. Behn, T.L. Grove, U-series disequilibria in MORBs generated by shallow spinel and plagioclase field mantle melting, AGU, 2019.
- Brown, S.M., M.D. Behn, T.L. Grove, Modeling Major and Trace Element Magma Compositions at Slow and Ultra-Slow Spreading Mid-Ocean Ridges: Implications for Melting in the Garnet Field, AGU, 2016.
- Brown, S.M., L.T. Elkins-Tanton, R.J. Walker, Non-Chondritic ^{142}Nd and Archean ^{142}Nd and ^{182}W variability reconciled by magma ocean crystallization and overturn, Goldschmidt, Sacramento, CA, 2014.

- Brown, S. and L.T. Elkins-Tanton, Influence of variable fO_2 and TiO_2 on the high pressure phase equilibria of lunar ultramafic glasses, 45th LPSC, 2014.
- Brown, S., L.T. Elkins-Tanton, R.J. Walker, Linking early Earth magma ocean crystallization and overturn with observed large low shear velocity provinces (LLSVPs) and short lived radioisotopic measurements in Archean rocks, AGU, 2013.
- Brown, S. and L.T. Elkins-Tanton, An experimental approach to thermal and solar weathering of Mercury's surface, 42nd LPSC, 2011.
- Brown, S. and L.T. Elkins-Tanton, An experimental approach to thermal and solar weathering of Mercury's surface, AGU, 2010.
- Brown, S. and L.T. Elkins-Tanton, Ranges of likely earliest crustal compositions on rocky planets, DPS, Cornell University, 2008.
- Brown, S. and L.T. Elkins-Tanton, Predicting Mercury's ancient crustal composition, 39th LPSC, 2008.
- Brown, S. and L.T. Elkins-Tanton. Mercury's core fraction and ancient crustal composition: Predictions from planetary formation under extremely reducing conditions, AGU, 2007.

Grants

3. Grove, T.L., **Krein, S. Brown**, and Chatterjoe, N., Experimental investigations of major and trace element partitioning during melting of mantle lherzolite, *NSF - Petrology and Geochemistry*, in review.
2. Soderblom, J., **Brown, S.**, and Huang, Ya Huei, Material Mixing on the Moon from Impacts, *NASA*, 2020, Selected.
1. Grove, T.L. with help from **Brown, S.**, Generating mare magmas by lunar magma ocean cumulate remelting: Experiments and models, *NASA*, 2017, Selected.

Professional Activities

Reviewer

- Nature Communications
- Contributions to Mineralogy and Petrology
- Journal of Petrology
- Geochemistry, Geophysics, Geosystems
- Marine Geology
- Geochimica et Cosmochimica Acta

Panelist

NASA review panel (2018, 2021)

Affiliations

- Member, Geochemical Society, 2014 - present
- Member, Pi Tau Sigma (Mechanical Engineering honor society), 2010 - present
- Member, American Astronomical Society & Division of Planetary Science, 2008 - present
- Member, American Geophysical Union, 2007 - present

Last updated: October 2021