Michael J. Krawczynski

Contact Information

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Research Interests

The study of dynamic igneous processes, and the evolution of magma in rocky planet interiors, using an experimental approach to determine: kinetic time scales, isotopic and trace element partitioning, and thermodynamic variables.

Positions Held

Washington University in St. Louis, St. Louis, MO USA
Dept. of Earth and Planetary Sciences
Assistant Professor Aug 2014-present

Case Western Reserve University, Cleveland, Ohio USA
Dept. of Earth, Environmental, and Planetary Sciences
Postdoctoral Scholar Nov 2011- Jul 2014

- Research Topics: Equilibrium and kinetic fractionation of stable Fe-isotopes in lunar basalts and Fe-meteorites
- Advisor: James Van Orman

Education

MIT/WHOI Joint Program, Cambridge, Massachusetts USA
Department of Marine Geology & Geophysics
Ph.D., Geochemistry, September 2005 – September 2011

- Dissertation Title: "Experimental Studies of Melting and Crystallization Processes in Planetary Interiors"
- Advisor: Timothy L. Grove

Brown University, Providence, Rhode Island USA
Department of Geological Sciences
Sc.B., Geochemistry and Archaeology, June, 2005
Phi Beta Kappa, Magna Cum Laude

- Thesis Topic: "Hydrous Synthesis of Al-Bearing Silicate Perovskite: implications for hydrogen storage in the lower mantle"
- Advisors: Malcolm Rutherford and Yingwei Fei

Honors and Awards

EAPS award for excellence in teaching, 2010
for outstanding service as a TA in the MIT EAPS department
NASA Earth and Space Science Graduate Fellowship, 2009-11
GSA Dwornik award, 2009
for best student presentation at the 40th LPSC meeting
Honorable mention: NSF MARGINS student presentation award, 2008
for best student presentation at the AGU fall mtg
AGU Outstanding Student Paper Award, Cryosphere division, 2007
MIT Presidential Fellowship, 2005-2006
Brown University Geology Department Senior Award, 2005
Royce Fellowship (Brown University), 2003

for study of magma storage conditions on Nevis Island (advisor MJ Rutherford)

Academic Experience

Washington University in St. Louis, St. Louis, MO USA
Courses taught: **2014-present**

- EPSc 441 Introduction to Geochemistry

Advanced Photon Source, Argonne National Lab, Argonne, IL USA
Beamline user **4 beamline visits 2008-2013**
XANES and EXAFS analysis on the GSECARS beamline for x-ray fluorescence measurements. NRIXS measurements on the sector 3 beamline.

MIT, Cambridge, MA USA
Teaching Assistant **2008-10**
Responsible for lab work and shared responsibility for lectures, exams, homework assignments, and grades.

- 12.108 Mineralogy, Spring 2008.
- 12.109 Petrology, Fall 2009.
- 12.490 Advanced Igneous Petrology, Spring 2009.
- 12.480 Thermodynamics for Geoscientists, Fall 2010.

Carnegie Institute of Washington, Washington, DC USA
Summer Student Fellow **June - August, 2004**
Student research project utilizing multi-anvil press synthesis experiments and ion microprobe-SIMS analysis. Yingwei Fei and Erik Hauri as project advisors.

Brown University, Providence, RI USA
Teaching Assistant **2004-2005**
Duties at various times have included office hours and leading weekly lab exercises.

- GEO 22 Physical Processes Geology, Fall 2004.
- GEO 23 Geochemistry, Spring 2004, 2005.

Service

Referee
Contributions to Mineralogy and Petrology, Nature, Geochimica et Cosmochimica Acta, Meteoritics and Planetary Science, Journal of Petrology, NSF, NASA

Publications

Krawczynski, M.J. and T.L. Grove; (*in prep*) Fractional crystallization of primitive H_2O-rich magmas derived from heterogeneous mantle and slab sources beneath Mt. Shasta, CA. *Contributions to Mineralogy and Petrology.*

Van Orman, J.A. and **M.J. Krawczynski** (*submitted*) Theoretical constraints on the isotope effect for diffusion in minerals. *Geochimica et Cosmochimica Acta.*

Grove,T.L., E.S. Holbig, J.A. Barr, C.B. Till, **M.J. Krawczynski** (2013) Melts of garnet lherzolite: experiments, models and comparison to melts of pyroxenite and carbonated lherzolite, *Contributions to Mineralogy and Petrology, 166.* p. 887-910. DOI: 10.1007/s00410-013-0899-9.

Krawczynski, M.J., T.L. Grove (2012) Amphibole stability in primitive arc magmas: effects of temperature, H_2O content, and oxygen fugacity, *Contributions to Mineralogy and Petrology, 164.* p. 317-319. DOI: 10.1007/s00410-012-0740-x.

Till, C.B., T.L. Grove, and **M.J. Krawczynski** (2012) A melting model for variably depleted and enriched lherzolite in the plagioclase and spinel stability fields, *Journal of Geophysical Research–Solid Earth, 117* DOI:10.1029/2011JB009044.

Grove, T.L., C.B. Till, and **M.J. Krawczynski** (2012) The Role of H_2O in Subduction Zone Magmatism, *Annual Review of Earth and Planetary Sciences, 40.* DOI: 10.1146/annurev-earth-042711-105310.

Krawczynski, M.J. and T.L. Grove (2012), Experimental investigation of the influence of oxygen fugacity on the source depths for high titanium lunar ultramafic magmas, *Geochimica et Cosmochimica Acta, 79*, p. 1-19. DOI: 10.1016/j.gca.2011.10.043

Krawczynski, M.J., M.D. Behn, S.B. Das, and I. Joughin (2009), Constraints on the lake volume required for hydro-fracture through ice sheets, *Geophysical Research Letters, 36*, L10501, doi: 10.1029/2008GL036765.

Grove, T. L. and **M. J. Krawczynski**, (2009), Lunar mare volcanism: Where did the magmas come from? *Elements, 5*, 1. p. 29-34.

Hirschmann, M.M., M.S. Ghiorso, F.A. Davis, S.M. Gordon, S. Mukherjee, T.L. Grove, **M. Krawczynski**, E. Medard, and C.B. Till (2008) Library of Experimental Phase Relations (LEPR): A database and Web portal for experimental magmatic phase equilibria data. *Geochemistry Geophysics Geosystems, 9*, Q03011, DOI:10.1029/2007GC001894.

Papers in preparation

Krawczynski, M.J., and J-A.L. Olive; A new fitting algorithm for petrological mass-balance problems. (for submission in G^3)

Krawczynski, M.J., S.R. Sutton, T.L. Grove; Ti-XANES study of titanium oxidation state in pristine lunar ultramafic glasses and analogue experiments.

Invited Seminars

Geogia Tech University, February 2013
Washington University in St. Louis, February 2013
University of Chicago, November 2012
Denison University, April 2012
Case Western Reserve University, March 2012
Carnegie Institution of Washington, April 2011

Conference Presentations

Abstracts presented: (*=presenter)

*Krawczynski MJ, TL Grove (2014, **keynote**) Evidence for a greater abundance of H_2O-saturated melts at arcs. Goldschmidt Conference (Sacramento).

*Van Orman JA, Krawczynski MJ (2014, **invited**) Theoretical constraints on the mass dependence of isotope diffusion in minerals. Goldschmidt Conference (Sacramento).

*Krawczynski MJ, JA Van Orman, N Dauphas, EE Alp, M Hu (2014) Equilibrium Fe-isotope fractionation applied to cooling rates of iron meteorites. Goldschmidt Conference (Sacramento).

*Krawczynski MJ, JA Van Orman, N Dauphas, EE Alp, M Hu (2014) Iron isotope fractionation between metal and troilite: a new cooling speedometer. 45th Lunar and Planetary Science Conference.

*Till CB, Grove TL, Krawczynski MJ (2011) A new melting model for variably metasomatized mantle and its implications for the generation of intraplate basalts in Oregon's High Lava Plains and the Modoc Plateau. AGU Fall Meeting.

*Grove TL, Krawczynski MJ (2011) Enclaves in Mt. Shasta, CA lavas preserve evidence for fractionation of primitive water-rich magmas through a 35 km deep magmatic conduit. AGU Fall Meeting

*Krawczynski MJ, Grove TL (2011) Petrogenesis of Lunar High-Titanium Liquids: The Importance of f_{O_2} on the Depth of Origin and Melt Structure. 42nd Lunar and Planetary Science Conference.

*Grove TL, Till CB, Barr JA, Krawczynski MJ (2010). Melting of metasomatized subcontinental mantle: New experiments and a new predictive model for plagioclase, spinel, and garnet lherzolite melting. AGU fall meeting

*Krawczynski MJ, Grove TL, (2008). Magma processing in the lower crust as recorded in mafic inclusions from Mt. Shasta, CA. AGU fall meeting.

*Krawczynski MJ, Elkins-Tanton LT, Grove TL, (2008). Petrology of Olivine-Diogenite MIL03443,9: Constraints on Eucrite Parent Body Bulk Composition and Magmatic Processes, 39th Lunar and Planetary Science Conference.

*Krawczynski MJ, Grove TL, (2007). A Common Depth of Origin for Lunar High Titanium Glasses, 38th Lunar and Planetary Science Conference.

*Krawczynski MJ, Grove TL, Medard E, Barr JA, Till CB, Behrens H, (2006). The Fate of Wet Mantle Melts: Fractionation Crystallization Processes Preserved in Magmatic Inclusions, Mt. Shasta CA. AGU fall meeting.

Posters presented:

*Krawczynski MJ, Millet MA, Dauphas N, Van Orman JA (2013) The mare basalt Fe-isotope dichotomy: a preliminary exploration into the role of ilmenite fractionation. 44th Lunar and Planetary Science Conference.

*McCanta MC, Krawczynski MJ, Grove TL, and Seaman SJ (2013) Hydrogen speciation in low f_{O_2} lunar melts. 44th Lunar and Planetary Science Conference.

*Krawczynski MJ, Olive J-AL (2011) A new fitting algorithm for petrological mass-balance problems. AGU Fall Meeting.

*Krawczynski MJ, Sutton SR, Barr JA, Grove TL (2010) Titanium valence in lunar ultramafic glasses and olivine-diogenites. 41st Lunar and Planetary Science Conference.

*Krawczynski MJ, Barr JA, Till CB, Grove TL (2009) How much of the range in mantle potential temperatures is natural? AGU Fall Meeting.

*Krawczynski MJ, Sutton SR, Grove TL, Newville M (2009) Titanium oxidation state and coordination in the lunar high-titanium glass source mantle. 40th Lunar and Planetary Science Conference.

*Krawczynski MJ, Grove TL (2008) Experimental investigations of f_{O_2} Control on Apollo 17 Orange Glass Phase Equilibria. 39th Lunar and Planetary Science Conference.

*Elkins-Tanton LT, Maroon E, Krawczynski MJ, Grove TL (2008) Magma Ocean Solidification Processes on Vesta. 39th Lunar and Planetary Science Conference.

*Krawczynski MJ, Behn MD, Das SB, Joughin I (2007) Constraints on melt-water flux through the West Greenland ice-sheet: modeling of hydro-fracture drainage of supraglacial lakes. AGU fall meeting.

*Krawczynski MJ, Grove TL, Medard E (2007) Experimental investigation of the Depth of Origin for the Apollo 15 Red Glass: Evidence for an fO2 control on olv-opx multiple saturation. 38th Lunar and Planetary Science Conference.

*Watson HC, Krawczynski MJ, Fei Y (2005) Hydrogen Solubility in Al-bearing Perovskite. AGU fall meeting.

*Krawczynski MJ, Fei Y, Hauri E (2004) Hydrous synthesis of aluminum bearing silicate perovskite: implications for hydrogen storage in the lower mantle. AGU fall meeting.