

# Daniel R Hummer

Assistant Professor  
Department of Geology  
Southern Illinois University  
Carbondale, IL 62901  
(814) 321-8859 dhummer@geo.siu.edu

*Areas of expertise: Mineralogy, Petrology, High-T Geochemistry*

## Education

### Doctor of Philosophy in Geoscience, May 2010

The Pennsylvania State University, University Park, PA

Thesis: *Mechanisms of Aqueous Crystallization and Phase Transformation in Titanium Oxide Minerals*

### Bachelor of Science in Geology, with Distinction, May 2004

Iowa State University of Science and Technology, Ames, IA

*Minors: Physics, Mathematics, Spanish*

### Bachelor of Science in Chemistry, with Distinction, May 2004

Iowa State University of Science and Technology, Ames, IA

## Peer-Reviewed Scientific Publications

**Hummer, DR.** (2016) Ionic moduli: A new semi-empirical model for the compression of crystalline ionic compounds. *Science*, in final preparation.

**Hummer, DR;** Manning, CE; Kavner, A; Kono, Y; Park, C; Kenney-Benson, C. (2016) Structure of carbonated silicate liquids at upper mantle conditions using X-ray diffuse scattering. *Nature*, in final preparation.

**Hummer, DR;** Noll, B; Hazen, RM; Downs, RT. (2016) Crystal structure of abelsonite, the only known crystalline geoporphyrin. *American Mineralogist*, submitted.

Bower, DM; Steele, A; **Hummer, DR.** (2016) The taphonomy of cyanobacterial mats in siliciclastic sediments: implications for life detection strategies. *Palaios*, in review.

Hazen, RM; Hystad, G; Golden, JJ; **Hummer, DR;** Liu, C; Downs, RT; Morrison, SM; Grew, ES. (2016) Cobalt mineral ecology. *American Mineralogist*, in press.

- Hazen, R; **Hummer, DR**; Hystad, G; Downs, R; Golden, JJ. (2016) Carbon mineral ecology: predicting the undiscovered minerals of carbon. *American Mineralogist* 101, 889-906.
- Bower, DM; **Hummer, DR**; Steele, A; Kyono, A. (2015) The co-evolution of Fe-oxides, Ti-oxides, and other microbially induced mineral precipitates in sandy sediments: Understanding the role of cyanobacteria in weathering and early diagenesis. *Journal of Sedimentary Research* 85, 1213-1227.
- Hummer, DR**; Heaney, PJ. (2015) MinKin: A kinetic modeling program for the precipitation, dissolution, and phase transformation of minerals in aqueous solution. *Chemical Geology* 405, 112-122.
- Kono, Y; Kenney-Benson, C; **Hummer, DR**; Ohfuji, H; Park, C; Shen, G; Wang, Y; Kavner, A; Manning, CE. (2014) Ultralow viscosity of carbonate melts at high pressures. *Nature Communications* 5:5091 doi: 10.1038/ncomms6091.
- Hummer, DR**; Kubicki, JD; Kent, PRC; Heaney, PJ. (2013) Single-site and monolayer surface hydration energy of anatase and rutile nanoparticles using density functional theory. *Journal of Physical Chemistry C* 117, 26084-26090.
- Seagle, CT; Cottrell, E; Fei, Y; **Hummer, DR**; Prakapenka, VB. (2013) Electrical and thermal transport properties of iron and iron-silicon alloy at high pressure. *Geophysical Research Letters* 40, 5377-5381.
- Lee, N; **Hummer, DR**; Sverjinsky, DA; Rajh, T; Hazen, RM; Steele, A; Cody, GD. (2012) Speciation of L-DOPA on nanorutile as a function of pH and surface coverage using surface-enhanced Raman spectroscopy (SERS). *Langmuir* 28(50), 17322-17330.
- Hummer, DR**; Heaney, PJ; Post, JE. (2012) In situ observations of particle size evolution during hydrothermal crystallization of TiO<sub>2</sub>: A time-resolved synchrotron SAXS and WAXS study. *Journal of Crystal Growth* 344(1), 51-58.
- Hummer, DR**; Fei, Y. (2012) Synthesis and crystal chemistry of Fe<sup>3+</sup>-bearing (Mg,Fe<sup>3+</sup>)(Si,Fe<sup>3+</sup>)O<sub>3</sub> perovskite. *American Mineralogist* 97, 1915-1921.
- Hummer, DR**; Kubicki, JD; Kent, PRC; Post, JE; Heaney, PJ. (2009) The origin of nanoscale stability reversals in titanium oxide polymorphs. *Journal of Physical Chemistry C* 113(11), 4240-4245.
- Heaney, PJ; Post, JE; Fischer, TB; **Hummer, DR**; Lopano, CL; Wall, AJ. (2008) Applications of time-resolved synchrotron X-ray diffraction to cation exchange, crystal growth and biomineralization reactions. *Mineralogical Magazine* 72(1), 179-184.

**Hummer, DR;** Heaney, PJ; Post, JE. (2007) Thermal expansion of anatase and rutile between 300 and 575 K using synchrotron powder X-ray diffraction. *Powder Diffraction* 22(4), 352-357.

## Proposals

Barry, P; de Moor, JM; Giovannelli, D; **Hummer, DR;** Lloyd, K; Lopez, T; Pratt, K. (2015) Biology meets subduction: A collaborative and multi-disciplinary deep carbon field initiative. *Sloan Foundation*, Deep Carbon Observatory (\$464,129), awaiting decision.

**Hummer, DR.** (2015) The carbon mineral challenge. *Sloan Foundation*, Deep Carbon Observatory (\$67,500), funded.

## Other Publications

**Hummer, DR.** (2016) What the heck is a diamond anvil cell? *DCOECS15 Open Science Blog* [posted 2016 Mar 23]. <https://dcoecs15.wordpress.com/2016/03/23/what-the-heck-is-a-diamond-anvil-cell/>.

Eiblum, D; Lee, EC; Forman, M; Abendroth, E; Celino, A; Chu, M; DeFonce, E; **Hummer, DR;** Kosh, A; Rho, R; Wang, H; Zheng, D. (2013) *SAT Math Prep 800: Challenge Yourself to a Perfect Score*. CreateSpace Independent Publishing Platform. ISBN-10: 1490444807

**Hummer, DR.** Review of *Fabric of the Cosmos*, by Brian Greene. (2009) *Science* 324, 1268.

## Research Experience

### **Assistant Professor, Department of Geology**

Southern Illinois University, Carbondale, IL 2016-present

- Working on projects involving composition and evolution of minerals across geologic time, crystal chemistry of minerals at variable P-T conditions, and modeling interactions between minerals and fluids

### **Postdoctoral Scholar, Geophysical Laboratory**

Carnegie Institution of Washington, Washington, DC 2015-2016

- Working with Dr. Robert Hazen on the evolution of redox sensitive minerals
- Working with Dr. Robert Hazen on the ecology of carbon-bearing minerals

### **Postdoctoral Scholar, Department of Earth, Planetary and Space Sciences**

University of California, Los Angeles, CA 2012-2015

- Worked with Dr. Craig Manning and Dr. Abby Kavner on the local atomic structure and behavior of carbonate-silicate melts

- Working with Dr. Craig Manning on solubility of carbonate minerals at high pressure and temperature

### **Postdoctoral Fellow, Geophysical Laboratory**

Carnegie Institution of Washington, Washington, DC 2010-2012

- Worked with Dr. Yingwei Fei on the crystal chemistry of Fe<sup>3+</sup>-bearing bridgmanite and implications for lower mantle structure
- Worked with Dr. Namhey Lee, Dr. Dimitri Sverjinsky, Dr. George Cody, and Dr. Robert Hazen on amino acid adsorption on the surface of TiO<sub>2</sub> nanoparticles
- Worked with Dr. Dina Bower and Dr. Andrew Steele to examine mineral biosignatures in Archean rocks using Raman spectroscopy
- Worked independently on a theoretical model quantifying the compression of ionic materials as a function of the compression of their individual ions

### **Research Assistant, Department of Geoscience**

The Pennsylvania State University, University Park, PA 2004-2010

- Worked with Dr. Peter Heaney and Dr. James Kubicki on the crystallization of titanium oxides from hydrothermal solutions using time-resolved synchrotron X-ray diffraction, quantum calculations, and small angle X-ray scattering

### **Research Assistant, Department of Chemistry**

Iowa State University, Ames, IA 2003

- Investigated the crystal chemistry of a Gd-(Sn,Si) solid solution series using single crystal and powder X-ray diffraction

### **Research Assistant, Department of Geological and Atmospheric Sciences**

Iowa State University, Ames, IA 2003-2004

- Assisted in solution design and preparation for a road degradation study in collaboration with the Iowa Department of Transportation
- Investigated fractal geometry of carbonate tidal streams on Andros Island, Bahamas

### **Research Assistant, Ames Laboratories**

Ames, IA 1999-2000

- Designed automated dry chemical Hg analysis method for industrial flue gases

## **Teaching Experience**

### **Assistant Professor, Department of Geology**

Southern Illinois University, Carbondale, IL 2016-present

- Teaching GEOL 310: Mineralogy for undergraduate geology majors
- Teaching GEOL 419: Ore Deposits for undergraduate geology majors and graduate students

**Tutor, TutorPro Co.**

Washington, DC

2010-2012

- Tutored high school and college students in chemistry, physics, algebra, geometry, and calculus

**Teaching Assistant, Department of Geoscience**

The Pennsylvania State University, University Park, PA 2004, 2008

- Assisted in teaching environmental geology for non-majors
- Taught introductory geology lab for non-majors

**Teaching Assistant, Department of Chemistry**

Iowa State University, Ames, IA

2000-2004

- Taught general chemistry recitations for chemistry and biochemistry majors, as well as non-majors
- Prepared, taught and supervised 3 hour general chemistry laboratory classes for chemistry and biochemistry majors, as well as non-majors
- Served as substitute lecturer for general chemistry large lecture courses

**Teaching Assistant, Department of Geological and Atmospheric Sciences**

Iowa State University, Ames, IA

2002-2004

- Taught 2 hour introductory geology lab class for non-majors
- Taught and supervised optical petrology laboratory class for geology majors

**Tutor, Health Careers Opportunity Program**

Des Moines Area Community College, Ankeny, IA

2002

- Tutored underprivileged Des Moines area high school students in biology, chemistry, and math during a summer program

## Other Work and Leadership Experience

**Organizing Committee Member, DCO Field Focus Site**

2016-present

- Collaborating with a team of early career researchers within the Deep Carbon Observatory to propose, design, and implement a cross-disciplinary field sampling campaign to characterize the flux of carbon-bearing species and other volatiles through an active subduction zone.

**Principal Investigator, The Carbon Mineral Challenge**

2015-present

- Leading a worldwide effort with mineralogists and collectors to discover new carbon-bearing minerals

**Organizing Committee Member,****Second DCO Early Career Scientist Workshop**

2014-2015

- Worked with 6 other committee members to arrange logistics, create budget, attract corporate sponsors, review participant applications, and organize scientific program for the Second Early Career Scientist Workshop of the Deep

Carbon Observatory at the University of the Azores, Ponta Delgada, Azores, Portugal, Aug. 31-Sept. 5, 2015.

**Associate Editor, American Mineralogist**

2012-present

- Handling editing and peer review for general submissions
- Handling editing and peer review for the special section *Chemistry and Mineralogy of Earth's Mantle* with co-AE Katherine Crispin

## Professional Affiliations

- Geological Society of America
- American Geophysical Union
- American Chemical Society
- Mineralogical Society of America
- European Association of Geochemistry
- American Association for the Advancement of Science

## Conference Presentations and Seminars

**Hummer, DR**; Hazen, RM; Ma, X; Golden, JJ; Downs, RT; Liu, C; Morrison, SM; Meyer, M. (2016) Quantifying and visualizing Earth's mineral chemistry through geologic time. *Geological Society of America Programs and Abstracts*, session T129, Sep. 2016.

Liu, C; Hazen, RM; Hystad, G; Golden, JJ; **Hummer, DR**; Downs, RT, Morrison, SM; Ralph, J. (2016) Chromium and vanadium mineral ecology. *Geological Society of America Programs and Abstracts*, session T129, Sep. 2016.

Ma, X; **Hummer, DR**; Hazen, RM; Golden, JJ; Fox, P; Meyer, M. (2016) Showing co-relationships between elements and minerals in a three-dimensional matrix. *Geological Society of America Programs and Abstracts*, session T129, Sep. 2016.

Meyer, M; Downs, RT; Falkowski, PG; Fox, P; Hazen, RM; Knoll, AH; Sverjensky, DA; Golden, JJ; Hao, J; Hystad, G; **Hummer, DR**; Jelen, B; Kolankowski, S; Liu, C; Ma, X; Moore, EK; Morrison, SM; Muscentie, AD; Pires, AJ; Zednick, S; Zhong, H. (2016) The co-evolution of the geo- and biospheres: An integrated program for data-driven, abductive discovery in the Earth sciences. *Geological Society of America Programs and Abstracts*, session T129, Sep. 2016.

Morrison, SM; Downs, RT; Golden, JJ; Pires, AJ; Fox, P; Ma, X; Zednick, S; Eleish, A; Kolankowski, S; Liu, C; **Hummer, DR**; Meyer, M; Ralph, J; Hystad, G; Hazen, RM. (2016) Mineral ecology: Social network analysis and sociograms of mineral connections, distributions, and segmentation. *Geological Society of America Programs and Abstracts*, session T129, Sep. 2016.

- Morrison, SM; Downs, RT; Golden, JJ; Pires, AJ; Fox, P; Ma, X; Zednick, S; Eleish, A; Kolankowski, S; **Hummer, DR**; Liu, C; Meyer, M; Ralph, J; Hystad, G; Hazen, RM. (2016) Social network of copper minerals: A mineral ecology study. *Geological Society of America Programs and Abstracts*, session T129, Sep. 2016.
- Hummer, DR**; Hazen, RM; Ma, X; Golden, JJ; Downs, RT. (2016) Constraints on the mineral evolution of planetary crusts using statistical correlations and anti-correlations among the mineral-forming elements. *Goldschmidt Programs and Abstracts*, session 6f, June 2016.
- Hazen, RM; **Hummer, DR**; Liu, C; Hystad, G; Downs, RT; Golden, JJ; Morrison, SM. (2016) Mineral ecology and evolution of first-row transition elements. *Goldschmidt Programs and Abstracts*, session 3g, June 2016.
- Hummer, DR**; Hazen, RM; LaFuente, B. (2015) The Carbon Mineral Challenge: A worldwide hunt for new carbon minerals. *Press Workshop, American Geophysical Union*, Dec. 2015.
- Hummer, DR**; Manning, CE; Kavner, A; Kono, Y; Park, C; Kenney-Benson, C. (2015) Structure and viscosity of carbonate-silicate melts using in situ techniques. *AGU Programs and Abstracts*, session V14C (**invited**), Dec. 2015.
- Hummer, DR**, Hazen, RM; Golden, J; Downs, RT. (2015) Constraints on the mineral evolution of terrestrial planets using statistical correlations among the mineral-forming elements. *AGU Programs and Abstracts*, session V51C, Dec. 2015.
- Hazen, RM; **Hummer, DR**; Downs, RT; Hystad, G; Golden, J. (2015) Carbon mineral ecology: Predicting the undiscovered minerals of carbon. *AGU Programs and Abstracts*, session V51C, Dec. 2015.
- Hummer, DR**; Hazen, RM; Hystad, G; Golden, J; Downs, RT. (2015) Mineral ecology and evolution of manganese: Using redox sensitive minerals to probe Earth's history. *Geological Society of America Programs and Abstracts*, session T133, Nov. 2015.
- Hummer, DR**; Manning, CE; Kavner, A; Kono, Y; Park, C; Kenney-Benson, C. (2015) Viscosity of carbonate-silicate melts using ultra-high resolution falling sphere viscometry. *Second Early Career Scientist Workshop, Deep Carbon Observatory*, Sep. 2015.
- Hummer, DR**; Heaney, PJ. (2015) MinKin: A new computational tool for modeling the kinetics of multi-component geochemical systems. *Goldschmidt Programs and Abstracts*, session 14d, Aug. 2015.

- Giovanelli, D; Cox, A; **Hummer, DR**; Pratt, K; Sheik, C; Thomas, D; Viveiros, F. (2015) Second DCO Early Career Workshop. *Deep Carbon Observatory Second International Science Meeting*, Mar. 2015.
- Hummer, DR**; Manning, CE; Kavner, A; Kono, Y; Park, C; Kenney-Benson, C. (2015) Viscosity of carbonate-silicate melts using ultra-high resolution falling sphere viscometry. *Deep Carbon Observatory Second International Science Meeting*, Mar. 2015.
- Hummer, DR**; Kavner, A, Manning, CE; Kono, Y; Park, C; Kenney-Benson, C. (2014) Viscosity of carbonate-silicate melts using ultra-high resolution falling sphere viscometry. *AGU Programs and Abstracts*, session DI-13A, Dec. 2014.
- Hummer, DR**; Manning, CE; Kavner, A; Park, C; Kono, Y; Kenney-Benson, C. (2014) Structure and viscosity of carbonate-silicate melts using in situ X-ray scattering. *Extreme Physics and Chemistry Workshop, Deep Carbon Observatory, UCLA (invited)*, Oct. 2014.
- Hummer, DR.** (2014) Ionic moduli: A new semi-empirical model describing the compression of crystalline ionic compounds. *Goldschmidt Programs and Abstracts*, session 26a, June 2014.
- Hummer, DR**; Kavner, A; Manning, CE; Park, C; Kono, Y; Kenney-Benson, C. (2014) The effect of composition and pressure on the structure of carbonate-silicate melts using in situ X-ray diffuse scattering. *Goldschmidt Programs and Abstracts*, session 4a (**invited**), June 2014.
- Hummer, DR**; Kavner, A; Manning, CE. (2014) The effect of composition and pressure on the structure of carbonate-silicate melts using in situ X-ray diffuse scattering. *Early Career Scientists Workshop, Deep Carbon Observatory, San Jose, Costa Rica (invited)*, Feb. 2014.
- Hummer, DR**; Kavner, A; Manning, CE. (2013) The effect of composition and pressure on the structure of carbonate-silicate melts using in situ X-ray diffuse scattering. *AGU Programs and Abstracts*, session MR-32A, Dec 2013.
- Hummer, DR**; Kavner, A; Manning, CE. (2013) Structure of carbonate-silicate melts at high P-T conditions using in situ X-ray diffuse scattering. *Goldschmidt Programs and Abstracts*, session 21b, Aug 2013.
- Bower, D; **Hummer, DR**; Kyono, A; Steele, A; Armstrong, J. (2013) The co-evolution of Fe-, Ti-oxides and other microbially induced mineral precipitates during the diagenesis of sandy sediments. *Goldschmidt Programs and Abstracts*, session 9e, Aug 2013.



Kubicki, J; Sung-Yup, K; van Duin, A; Ridley, M; Machesky, M; **Hummer, DR**; Kent, PRC. (2013) Modeling of TiO<sub>2</sub> nanoparticles interactions with water and ions. *Goldschmidt Programs and Abstracts*, session 10e, Aug 2013.

**Hummer, DR**; Kavner, A; Manning, CE. (2013) Structure of carbonate-silicate melts at high P-T conditions using in situ X-ray diffuse scattering. *COMPRES Annual Meeting*, Jun 2013.

**Hummer, DR**; Kavner, A; Manning, CE. (2013) Structure of carbonate-silicate melts at high P-T conditions using in situ X-ray diffuse scattering. *Paris Edinburgh Cell Workshop, Argonne National Laboratory*, May 2013.

**Hummer, DR**; Kavner, A; Manning, CE. (2013) Structure of carbonate-silicate melts at high P-T conditions using in situ X-ray diffuse scattering. *Gordon Research Conference: Interior of the Earth*, May 2013.

**Hummer, DR**. (2013) The surprising effects of ferric iron on MgSiO<sub>3</sub> perovskite in Earth's lower mantle. *Geology Club Seminar, California Institute of Technology*, (invited) Jan 2013.

**Hummer, DR**; Kavner, A; Manning, CE. (2012) Structure of CaCO<sub>3</sub>-CaSiO<sub>3</sub> melts at high P-T conditions using in situ X-ray diffuse scattering in a Paris-Edinburgh press. *AGU Programs and Abstracts*, session V-53D, Dec 2012.

**Hummer, DR**; Fei, Y; Seagle, CT. (2011) Thermal equation of state of Fe(III) and Al-bearing magnesium silicate perovskite. *AGU Programs and Abstracts*, session MR-43A, Dec 2011.

Bower, DM; **Hummer, DR**; Kyono, A; Steele, A; Armstrong, JT. (2011) The co-evolution of Fe,Ti-oxides and other microbially induced mineral precipitates in sandy sediments: Understanding the role of microbes in diagenesis. *AGU Programs and Abstracts*, session B-51I, Dec 2011.

Seagle, CT; Cottrell, E; Fei, Y; **Hummer, DR**; Prakapenka, V. (2011) Electrical and thermal conductivity of iron and iron-silicon alloy at high pressures. *AGU Programs and Abstracts*, session MR54A, (invited) Dec 2011.

Bower, DM; **Hummer, DR**; Kyono, A; Steele, A. (2011) The co-evolution of Fe-,Ti-oxides and microbial fossilization during early diagenesis in sandy sediments: establishing potential mineral biosignatures. *Geological Society of America Programs and Abstracts*, 129-5, Oct 2011.

**Hummer, DR**. (2011) From atoms to crystals: Tracking phase stability reversal in TiO<sub>2</sub> minerals at the onset of crystallization. *Geochemistry Seminar, University of Maryland*, (invited) Sep 2011.

**Hummer, DR;** Fei, Y. (2011) Crystal chemistry of Fe<sup>3+</sup> in (Mg,Fe)SiO<sub>3</sub> perovskite and implications for lower mantle properties. *Goldschmidt Programs and Abstracts*, session 3f, Aug 2011.

**Hummer, DR;** Fei, Y. (2010) Crystal chemistry of Fe(III)-bearing magnesium silicate perovskite. *AGU Programs and Abstracts*, session MR-41B, Dec 2010.

**Hummer, DR;** Heaney, PJ; Post, JE. (2010) Probing the aqueous nucleation and growth of TiO<sub>2</sub> with high time-resolution small-angle and wide-angle X-ray scattering. *Goldschmidt Programs and Abstracts*, session 17c, June 2010.

**Hummer, DR;** Heaney, PJ; Kubicki, JD; Kent, PRC; Post, JE. (2008) Nanoscale phase stability reversal during the nucleation and growth of titanium oxide minerals. *AGU Programs and Abstracts*, session V-23F, Dec 2008.

**Hummer, DR;** Heaney, PJ; Kubicki, JD; Kent, PRC; Post, JE. (2008) The origin of nanoscale stability reversals in titanium oxide minerals. *Geological Society of America Abstracts with Programs*, session T93, Oct 2008.

**Hummer, DR;** Heaney, PJ; Kubicki, JD; Kent, PRC. (2008) Nanoscale stability reversal in titanium oxide polymorphs. *Center for Nanophase Materials Science User Conference, Oak Ridge National Laboratory, (invited)* Sep 2008.

**Hummer, DR;** Heaney, PJ; Post, JE; Kubicki, JD. (2007) Nucleation, growth, and phase transformation of titanium oxides in hydrothermal solution. *Goldschmidt Programs and Abstracts*, session S97, Aug 2007.

**Hummer, DR;** Heaney, PJ; Post, JE. (2006) Aqueous nucleation and growth of titanium oxides using time-resolved synchrotron X-ray diffraction. *AGU Joint Assembly Programs and Abstracts*, section V06, May 2006.

## Conference Sessions Chaired

Grew, ES; Ross, NL; **Hummer, DR.** (2016) Mineralogical evidence for the co-evolution of the geosphere and biosphere: In honor of Robert M. Hazen, 2016 Roebling medalist. *GSA Fall Meeting 2016*, oral and poster session T129.

**Hummer, DR** and Millot, M. (2014) Carbon chemistry in the deep Earth. *AGU Fall Meeting 2014*, poster session DI-13A.

**Hummer, DR** and Crispin, K. (2012) Impact of minor elements on lower mantle mineralogy I. *AGU Fall Meeting 2012*, oral session DI-23B.

## **Skills**

- Thorough background in mineralogy, crystallography, petrology, aqueous chemistry, and solid state chemistry
- Experience with multi-anvil, piston cylinder, and diamond-anvil high pressure synthesis techniques
- Extensive experience with X-ray scattering techniques (especially XRD) and synchrotron work, including beamlines at NSLS, APS, and SSRL
- Experience with optical microscopy, electron microprobe, Raman and Mössbauer spectroscopy, SEM, TEM, SAXS, XRF, and ICP-MS
- Experience with field-based, handle sample, and mapping work
- Programming experience in Basic, Matlab, and Fortran
- Have worked at and collaborated with scientists at Pacific Northwest National Laboratory, Oak Ridge National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Stanford Linear Accelerator Center, the Carnegie Institution for Science, and the Smithsonian Institution
- Experience doing multidisciplinary research with scientists from a variety of backgrounds through the DOE's Center for Environmental Kinetics Analysis, and the Deep Carbon Observatory
- Extensive teaching and tutoring experience in geoscience, chemistry, physics, and mathematics from the middle school to college levels
- Extensive public outreach experience including lectures, classroom demonstrations, hands-on activities, exhibitions, and mineral shows
- Semi-fluent in Spanish

## **Honors and Awards**

- Carnegie Institution Postdoctoral Fellowship (\$100,000), Geophysical Laboratory, 2010-2012
- Muan Graduate Fellowship (\$3000), College of Earth and Mineral Sciences, Penn State University, Fall 2008
- Peter Deines lectureship, Dept. of Geoscience, Penn State University, Spring 2008
- Kraus Award for Crystallographic Research (\$5000), Mineralogical Society of America, Fall 2007
- Ohmoto Scholarship, Department of Geoscience, Penn State University, Fall 2006
- 2<sup>nd</sup> place, Physical Sciences and Mathematics division, Graduate poster exhibition, Penn State University, Spring 2005
- Excellence in Teaching Award, Iowa State University, Spring 2003

- Undergraduate academic achievement award, Department of Chemistry, Iowa State University, Spring 1999, 2000, 2001, 2002
- Outstanding undergraduate award, Department of Geological and Atmospheric Sciences, Iowa State University, Spring 2000, 2001, 2003
- Rodney G. Gardner Memorial Scholarship, Iowa State University, Spring 2002
- Levine Alumni Scholarship, Iowa State University, Spring 2002
- Golden Key Honor Society, Fall 2002
- Phi Beta Kappa, Spring 2001
- Peter Johnson Memorial Scholarship, Department of Geological and Atmospheric Sciences, Iowa State University, Spring 2001
- Top 2% of College of Liberal Arts and Sciences undergraduates, Iowa State University, Spring 1999, 2000
- Clifford C. Hach Memorial four-year scholarship (\$24,000), Department of Chemistry, Iowa State University, Spring 1999