

# Carla E. Rosenfeld

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## Research Interests

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Trace element biogeochemistry, microbe-metal interactions, redox, biominerals, biological weathering, rhizosphere processes, plant-soil interactions, spectroscopy

## Education

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- 2013 Ph.D. **Pennsylvania State University**  
Ph.D. in Soil Science (focus soil chemistry) and Biogeochemistry
- 2007 M.E.M. **Duke University**  
Masters in Environmental Management, focus environmental chemistry and toxicology
- 2005 B.S. **McGill University**  
B.S. *with distinction*, major: Chemistry

## Professional Experience

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- 2017-present **Research Associate**, University of Minnesota
- 2015-2017 **NSF Postdoctoral Fellow**, University of Minnesota
- 2014-2015 **Smithsonian Postdoctoral Fellow**, National Museum of Natural History
- 2011-2013 **Graduate Fellow**, CarbonEARTH NSF GK-12 Graduate Fellowship, Pennsylvania State University
- 2008-2011 **Graduate Teaching Assistant**, Pennsylvania State University
- 2007-2008 **Ecological Risk Assessor and Environmental Consultant**, ARCADIS
- 2006-2007 **Research Assistant**, USGS
- 2006 **Research Fellow**, USEPA National Network for Environmental Management Studies Fellowship, USEPA

## Peer-Reviewed Publications

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- Rosenfeld, C.E.**, Chaney, R.L. and Martínez, C.E. (2018) Soil geochemical factors regulate Cd uptake by metal hyperaccumulator *Noccaea caerulea* (J. Presl & C. Presl) F.K. Mey in field-contaminated soils. *Science of the Total Environment* **616-617**:279-287 doi: [10.1016/j.scitotenv.2017.11.016](https://doi.org/10.1016/j.scitotenv.2017.11.016)
- Rosenfeld, C.E.**, Kenyon, J., James, B.R., Santelli, C.M. (2017) Selenium (IV, VI) reduction and tolerance by fungi in an oxic environment. *Geobiology*, 15(3): 441–452. doi:[10.1111/gbi.12224](https://doi.org/10.1111/gbi.12224).
- Rosenfeld, C.E.**, Chaney, R.L., Tappero, R.V. and Martínez, C.E. (2017) Micro-scale investigations on soil heterogeneity: Impacts on Zn retention and uptake in Zn contaminated soils. *Journal of Environmental Quality*, 46(2): 373-383 doi:[10.2134/jeq2016.05.0184](https://doi.org/10.2134/jeq2016.05.0184)

**Rosenfeld, C.E.** and Martínez, C.E. (2015) Dissolution of mixed amorphous-crystalline Cd-containing Fe coprecipitates in the presence of common organic ligands.

*Environmental Chemistry*. **12**(6): 739-747. <http://dx.doi.org/10.1071/EN14223>

**Rosenfeld, C.E.**, McCormack, M.L. and Martínez, C.E. (2014) A novel approach to study composition of *in situ* produced root- derived dissolved organic matter. *Soil Biology and Biochemistry* **76**:1-4 [doi:10.1016/j.soilbio.2014.04.026](https://doi.org/10.1016/j.soilbio.2014.04.026)

#### In Review & In Preparation

**Rosenfeld, C.E.** James, B.R., Santelli, C.M. Selenium in reclaimed mine soils alters fungal and bacterial community structure and diversity. **In Review** at *Applied and Environmental Microbiology*

Hinkle, M.A.G., **Rosenfeld, C.E.**, Post, J.A., and Santelli, C.M., Structural changes to mycogenic manganese oxides upon trace metal binding and incorporation. *In preparation*

**Rosenfeld, C.E.**, Hinkle, M.A.G., Santelli, C.M. Ascomycete fungi mediate multiple simultaneous redox transformations in oxic systems. *In preparation*

**Rosenfeld, C.E.**, James, B.R., Santelli, C.M. Fungal activity drives Se(IV), but not Se(VI), removal in model rhizosphere systems. *In preparation*

#### Grants & Fellowships

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|------|--|
| 2016 | <b>University of Minnesota Institute on the Environment Mini-grant, co-PI</b> <i>Early-career cross-disciplinary science communication group</i> (\$3,000)   |
| 2015 | <b>NSF EAR Postdoctoral Fellowship</b> <i>Linking geomicrobiology and geochemistry in seleniferous soils</i> (\$172,000)                                     |
| 2015 | <b>Smithsonian Institution Competitive “Pell” Grants for Science, co-PI</b> (primary author) <i>Geomicrobiology of Se-contaminated soils</i> (\$55,000)      |
| 2013 | <b>Smithsonian Institution Postdoctoral Fellowship</b> <i>Investigating the role of fungi in selenium biogeochemistry in natural environments</i> (\$95,000) |
| 2011 | <b>CarbonEARTH, NSF GK-12 Graduate Fellowship</b> , Pennsylvania State University (\$60,000)   |

#### National Laboratory Instrument Use

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|------|---|
| 2017 | <b>Argonne National Laboratory Advanced Photon Source Synchrotron Beamline 12-BM</b> <i>Effects of dual biomineralization processes on resulting biogenic mineral chemistry</i>                         |
| 2016 | <b>Argonne National Laboratory Advanced Photon Source Synchrotron Beamline 12-BM</b> <i>Microbial Impacts on Se biogeochemistry: Measuring solid-phase Se speciation in real and model soil systems</i> |
| 2012 | <b>Argonne National Laboratory Advanced Photon Source Synchrotron Beamline 13-ID</b> <i>Synchrotron microprobe studies of <i>Thlaspi caerulescens</i> grown in Cd contaminated rhizosphere</i>          |

#### Awards

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| 2012, 2013 | Student Travel Grant, Goldschmidt Conference                          |
| 2011       | Outstanding Student Paper Award, American Geophysical Union           |
| 2011       | Competitive Grant Award, College of Agriculture, PSU                  |
| 2011       | Outstanding Student Service, Department of Crop and Soil Science, PSU |

- 2010 Research Award, Center for Environmental Chemistry and Geochemistry, PSU
- 2006 EPA National Network for Environmental Management Studies (NNEMS) Fellow
- 2005 Duke Energy Climate Change Policy Partnership Fellow, Duke University

## **Teaching & Educational Outreach**

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### *Undergraduate Courses*

- 2016, 2017 Guest Lecturer, Geomicrobiology, UMN, ESCI 4801
- 2011 Guest Lecturer, Chemistry of the Environment, PSU, SOILS 397A
- 2009, 2010 Teaching Assistant, Introductory Soil Science, PSU, SOILS 101
- 2009, 2010 Instructor, Introductory Soil Science Laboratory, PSU, SOILS 101
- 2004 Instructor, Organic Chemistry Laboratory, McGill University, CHEM 212
- 2004 Tutor, Organic Chemistry, McGill University, CHEM 211

### *Public Outreach*

- 2018 Volunteer, Minneapolis Public Schools STEM Expo, Minneapolis, MN
- 2016 Presenter, STEAM camp, Bell Museum of Natural History, Minneapolis, MN
- 2015-2016 Curriculum development, STEAM (science, technology, engineering, art, and math) camp, Bell Museum of Natural History, Minneapolis, MN
- 2013-2015 Presenter, Q?rius science education center, NMNH, Washington, DC
- 2014 Panelist, Tri Region Science and Engineering Fair, Washington, DC
- 2013 Presenter, Science Night at the Alexandria Public Library, Alexandria, VA
- 2012-2013 Scientist in the Classroom, Philipsburg Osceola Junior High, Philipsburg, PA
- 2011-2012 Scientist in the Classroom, Rowland Middle School, Harrisburg, PA
- 2009-2012 Presenter, MathOptions program, Penn State DuBois, DuBois, PA
- 2011 Judge, PA Junior Academy of Sciences Competition, State College, PA
- 2009 Presenter, "Introduction to Soil Science" Jr. MANNRS (Minorities in Agriculture, Natural Resources and Related Sciences) workshop, PSU, State College, PA

## **Mentoring Experience**

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1 Ph.D. student, 4 undergraduate researchers (NSF REU, UMN Undergraduate Research Opportunities Program, UMN Undergraduate Honors Thesis)

## **Presentations**

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### *Invited Seminars*

- 2018 Microbes and metal(loid)s: Combining field and experimental systems to understand contaminant biogeochemistry. School of Earth and Environmental Sciences. CUNY Queens College, Queens, NY.
- 2017 Microbes and metal(loid)s: Combining field and experimental systems to understand contaminant biogeochemistry and improve environmental quality. Department of Soil and Water Sciences, University of Florida, Gainesville, FL
- 2017 Trace metal(loid) biogeochemistry: How microbes and minerals impact environmental quality. School of Earth, Environment, and Society, Bowling Green State University, Bowling Green, OH

- 2015 Selenium biogeochemistry: fungal and abiotic controls on Se redox and implications for contaminated soils. Department of Civil and Environmental Engineering, University of Wisconsin, Madison, WI
- 2015 Fungal and abiotic controls on selenium redox and implications for contaminated soils. Department of Soil Water and Climate, University of Minnesota, St. Paul, MN
- 2014 Contaminant biogeochemistry: Trace element dynamics at the plant-soil interface. Bromery Lecture, Johns Hopkins University, Baltimore, MD
- 2013 Bridging chemistry and ecology: Using advanced spectroscopic techniques to study ecological questions. China Ecological Forum. Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, China, 2013

*Conference Presentations (\*indicates invited presentation)*

**2018**

- Rosenfeld, C.E., Hinkle, M.A.G., and C.M. Santelli. Mycogenic biogeochemistry: Simultaneous manganese oxidation and selenium reduction in oxic systems. Goldschmidt, Boston, MA
- Santelli, C.M., Hinkle, M.A.G., Rosenfeld, C.E., Roepke, E, and D.L. Chaput, Biogenic Mn oxide influences on metal(loid) contaminants. Goldschmidt, Boston, MA
- Hinkle, M.A.G., Rosenfeld, C.E., Post, J.A., and C.M. Santelli, Mycogenic Manganese Oxide Structural Changes and Nickel Incorporation with Aging. Goldschmidt, Boston, MA
- Sabuda, M., Rosenfeld, C.E., Torgeson, J., and C.M. Santelli, Time-resolved biogeochemical insights to fungal redox transformations of selenium, the essential toxin. Goldschmidt, Boston, MA

**2017**

- Ng, G.-H. Crystal, O'Hara, P., Santelli, C.M., Rosenfeld, C.E., and A. Yourd, Evaluating the role of sulfur and hyporheic exchange in biogeochemical cycling in riparian wetlands. American Geophysical Union, New Orleans, LA
- \* Rosenfeld, C.E., MacDonald, E.A., James, B.R., and C.M. Santelli. Biogeochemistry of seleniferous mine soils: Metal(loid) impacts on microbial community ecology. Society of Environmental Toxicology and Chemistry, Minneapolis, MN
- \* Rosenfeld, C.E., Hinkle, M.A.G., James, B.R., and C.M. Santelli. Mycogenic minerals – Impacts of multi-metal systems on fungal mineral production and metal sequestration. Soil Science Society of America, Tampa, FL
- Hinkle, M.A.G., Rosenfeld, C.E., Santelli, C.M., Post, J.A. Changes in Ni binding to and uptake by mycogenic Mn oxides with aging. Soil Science Society of America, Tampa, FL
- MacDonald, E.A., Rosenfeld, C.E., and C.M. Santelli. Identification of 22 selenium-tolerant bacteria and 4 selenium-tolerant fungi. Midwest Geobiology, Indianapolis, IN
- Torgeson, J.M., Rosenfeld, C.E., and C.M. Santelli. Considerations for aerobic bioremediation of selenite and selenate. Midwest Geobiology, Indianapolis, IN
- Santelli, C.M., Rosenfeld, C.E., Torgeson, J.M. and L. Cousins. Fungi-mediated redox transformations of selenium. Goldschmidt Conference, Paris
- Rosenfeld, C.E., MacDonald, E.A., James, B.R., C.M. Santelli. Microbial ecology of seleniferous reclaimed mine soils. Goldschmidt Conference, Paris
- \*Rosenfeld, C.E., Hinkle, M.A.G., James, B.R., and C.M. Santelli. Fungal-selenium interactions in experimental and field systems. American Chemical Society, San Francisco, CA

**2016**

- Rosenfeld, C.E., James, B.R., and C.M. Santelli. Tracing biogeochemical Se cycling in seleniferous reclaimed mine soils. American Geophysical Union, San Francisco, CA. 2016
- Torgeson, J., Rosenfeld C.E., and C.M. Santelli. Considerations for aerobic bioremediation of selenite and selenate. *Frontiers in Mine Water Remediation*, UMN - Twin Cities, Minneapolis, MN
- \* Rosenfeld, C.E., James, B.R., and C.M. Santelli. Understanding Se biogeochemistry in seleniferous reclaimed mine soils American Chemical Society, San Diego, CA

**2015**

- \* Rosenfeld, C.E. and C.E. Martínez. Biological weathering in metal-contaminated soils: Influence of biologically derived dissolved organic compounds on mineral dissolution. Soil Science Society of America, Minneapolis, MN
- Rosenfeld, C.E., James, B.R., and C.M. Santelli. Fungal and abiotic controls on selenium redox and implications for remediation of contaminated soils. Soil Science Society of America, Minneapolis, MN
- Santelli, C.M., Rosenfeld, C.E., and B.R. James. Environmental impact of fungi-mediated redox transformations of selenium. Geological Society of America, Washington, DC

**2014**

- Kenyon, J.A., Rosenfeld, C.E., and C.M. Santelli. Investigating the effects of selenium on fungal growth and mineral production (poster). Goldschmidt Conference, Prague, CZ
- Rosenfeld, C.E., James, B.R. and C.M. Santelli. Selenium in the environment: Biotic and abiotic controls on Se redox. Goldschmidt Conference, Prague, CZ
- Rosenfeld, C.E., Kenyon, J.A., James, B.R. and C.M. Santelli. Environmental selenium transformations: Biotic factors influencing Se redox transformations (poster). American Geophysical Union, San Francisco, CA
- Kenyon, J.A., Rosenfeld, C.E., and C.M. Santelli. Investigating the effects of selenium on fungal growth and mineral production (poster). LSU Undergraduate Research Conference, Baton Rouge, LA
- \*Winner, 1<sup>st</sup> place Math and Physical Sciences division.*

**2013**

- Rosenfeld, C.E., Chaney, R.L., Lanzirrotti, A. and C.E. Martínez. Linking nutrient and contaminant dynamics in rhizospheres of hyperaccumulators (poster). Goldschmidt Conference, Florence, Italy

**2012**

- Rosenfeld, C.E. and C.E. Martínez. Identifying root exudates in field contaminated soil systems (poster). American Geophysical Union, San Francisco, CA
- Rosenfeld, C.E., Chaney, R.L., Lanzirrotti, A. and C.E. Martínez. Trace metals and soil solids: Effects of soil heterogeneity on Zn mobility. Goldschmidt Conference, Montreal, Canada
- Rosenfeld, C.E., Chaney, R.L., Lanzirrotti, A. and C.E. Martínez. Heavy metal contamination in soils: Role of soil solids on metal mobility. Environmental Chemistry Student Symposium, University Park, PA

**2011**

- Rosenfeld, C.E. and C.E. Martínez. Role of root exudates in dissolution of Cd containing iron oxides. American Geophysical Union, San Francisco, CA
- \*Winner, Outstanding Student Paper Award (OSPA), Biogeosciences Division*

Rosenfeld, C.E. and C.E.Martínez. Role of dissolved organic matter in Cd-goethite dissolution (poster). American Chemical Society, Anaheim, CA

### **Organized Symposia**

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- 2018 Redox transitions and impacts on biogeochemical cycling of carbon, nutrients, and contaminants, Goldschmidt Conference, Boston, MA
- 2017 Geomicrobiology, Biogeochemistry and Environmental Impact Studies of Trace Elements and Metals in Earth Surface Environments. Goldschmidt Conference, Paris, France
- 2013 Biogeochemical cycles in the rhizosphere: examining carbon, trace and heavy metal cycling at the plant-soil interface. Goldschmidt Conference, Florence, Italy
- 2012 Investigating ecosystem-scale metal dynamics using micro-scale techniques. Goldschmidt Conference, Montreal, Canada

### **Additional Training & Skills**

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#### *Workshops*

- 2016 Focused Discussion on Mine Water Bioremediation – Frontiers in Mine Water Remediation, UMN
- 2016 R Workshop for Microbial Ecologists – Pat Schloss, University of Michigan
- 2016 Active Learning in Life Sciences Classrooms– Department of Biological Teaching and Learning, UMN
- 2012 Course in College Teaching – Schreyer Institute for Teaching Excellence, PSU
- 2010 Advanced Techniques in Environmental Biogeochemistry –Tübingen, Germany

#### *Techniques*

##### **Chemistry**

Atomic Absorption Spectroscopy  
 CNS Elemental Analysis (solids)  
 Total Carbon Analysis (solutions)  
 Fourier Transform Infrared Spectroscopy  
 Gas Chromatography  
 ICP-Mass Spectrometry  
 ICP-Optical Emission Spectroscopy  
 Liquid Chromatography/Ion Chromatography  
 Nuclear magnetic resonance spectroscopy  
 Synchrotron-based spectroscopy  
 Synchrotron-based microprobe imaging  
 Scanning Electron Microscopy  
 Transmission Electron Microscopy  
 UV-Visible spectroscopy  
 X-ray Fluorescence  
 X-ray Diffraction

##### **Microbiology & Molecular Biology**

DNA extraction  
 Gel electrophoresis  
 Microbial isolation from environmental samples

Microbial cultivation (bacteria and fungi)  
 High-throughput DNA sequencing  
 PCR

### **Professional and Community Service**

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#### Manuscript Reviewer

Applied and Environmental Microbiology, ACS Earth and Space Chemistry, ACS Environmental Science and Technology, Environmental Engineering Science, Geochimica et Cosmochimica Acta, Journal of Environmental Quality, Plant and Soil, Science of the Total Environment, Soils, Tree Physiology, Vadose Zone Journal

#### Proposal Reviewer

Stanford Synchrotron Light Source Beamline Proposals, 2017-present

#### Organizer

2017- Graduate student presentation awards, Soil Science Society of America  
 2017 Early career writing workshop, University of Minnesota  
 2009-2011 Environmental Chemistry Student Symposium. PSU  
 2010, 2011 Undergrad Research Proposal Review Committee. College of Agricultural Sciences, PSU

#### Member/Participant

2012 Congressional Visit Day, Soil Science Society of America  
 2009-2012 Core Constituent Science Team, Soil Science Society of America  
 2010-2011 College of Agricultural Sciences Grad Student Advisory Council. PSU  
 2010-2012 Faculty, Staff and Student Affairs Committee, Crop and Soil Sciences. PSU

#### Professional Society Membership

American Chemical Society  
 American Geophysical Union  
 Geochemical Society  
 Soil Science Society of America