

## Owen W. Duckworth

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### EXPERIENCE

2013-Pres. Associate Professor of Soil Biogeochemistry  
2007-2013 Assistant Professor of Soil Biogeochemistry  
Department of Soil Science  
North Carolina State University, Raleigh, North Carolina  
  
2010 (Oct.-Nov.) Visiting Professor  
Department of Environmental Geosciences  
University of Vienna, Vienna, Austria  
  
2003-2007 Postdoctoral Scholar  
Division of Ecosystem Sciences  
University of California, Berkeley, California  
Advisor: Garrison Sposito

### EDUCATION

**Ph.D.** *Engineering and Applied Sciences, 2003*  
Harvard University, Cambridge, Massachusetts  
Dissertation Title: “*Macroscopic and Microscopic Perspectives on the Dissolution of Carbonate Minerals*”  
Advisor: Scot T. Martin  
  
**M.S.** *Environmental Sciences and Engineering, 2000*  
University of North Carolina, Chapel Hill, North Carolina  
Master’s Thesis Title: “*Ligand-Promoted Dissolution of Hematite: Relationships between Surface Complexation Structures and Dissolution Rate Constants*”  
Advisor: Scot T. Martin  
  
**B.S.** *Chemistry and Geology, cum laude, 1997*  
College of William and Mary, Williamsburg, Virginia  
High-Honors Thesis Title: “*The Environmental History of the Upper Lake Matoaka Delta Drainage Basin*”  
Advisors: Gary W. Rice and Gerald H. Johnson

### PEER-REVIEWED RESEARCH PUBLICATIONS (37)

1. Droz, B., Dumas, N., **Duckworth, O.W.** and Peña, J., (2015) Structure and sorption reactivity of biogenic MnO<sub>2</sub> precipitated by bacterial and fungal cultures, *Environmental Science and Technology*, **49**, 4200-4208.
2. Gillispie, E., Sowers, T.D., **Duckworth, O.W.**, and Polizzotto, M.L. (2015) Soil Pollution Due to Irrigation with Arsenic-Contaminated Groundwater: Current State of Science, *Current Pollution Reports*, **1**, 1-12.

3. Harrington, J.M., **Duckworth, O.W.**, and Haselwandter, K. (2015) The Fate of Siderophores: Antagonistic Environmental Interactions in Exudate-Mediated Micronutrient Uptake, *Biometals*, **28**, 461-472.
4. Rivera, N.A., Kaur, N., Hesterberg, D., Ward, C.R., Austin, R.E. and **Duckworth, O.W.** (2015) Chemical composition, speciation, and elemental associations in coal fly ash samples related to the Kingston ash spill, *Energy and Fuels*, **29**, 954-967.
5. Kraemer, S.M., **Duckworth, O.W.**, Harrington, J.M., and Schenkeveld, W. D. C. (2015) Metallophores and trace metals biogeochemistry, *Aquatic Geochemistry*, **21**, 159-195.
6. Kang, J., Heitman, J.L., Amoozegar, A., **Duckworth, O.W.**, and McLaughlin, R.A. (2015) Transport of dissolved polyacrylamide in a clay loam soil, *Geoderma*, 243-244, 108-114.
7. Akafia, M.M., Harrington, J.M., Bargar, J.R., and **Duckworth, O.W.** (2014) Metal hydroxide dissolution as promoted by structurally diverse siderophores and Oxalate, *Geochimica et Cosmochimica Acta*, **141**, 258-269.
8. **Duckworth, O.W.**, Akafia, M.M., Andrews, M.Y., and Bargar, J.R. (2014) Siderophore-promoted dissolution of chromium from hydroxide minerals, *Environmental Science: Processes and Impacts*, **16**, 1348-1359.
9. Kang, J., McLaughlin, R.A., Sowers, T.D., **Duckworth, O.W.**, Amoozegar, A., and Heitman, J.L. (2013) Turbidimetric determination of anionic polyacrylamide in soil extracts. *Journal of Environmental Quality*, **42**, 1902–1907.
10. Kruff, B.I., Harrington, J.M., **Duckworth, O.W.**, Jarzecki, A.A. (2013) Quantum mechanical investigation of aqueous desferrioxamine B metal complexes: Trends in structure, binding, and spectroscopy. *Journal of Inorganic Biochemistry*, **129**, 150–161.
11. Abit, S.M., Vepraskas, M.J., **Duckworth, O.W.**, and Amoozegar A. (2013) Dissolution of Phosphorus into Pore-Water Flowing through an Organic Soil. *Geoderma*, **197–198**, 51-58.
12. Wu, L., Osmond, D.L., Graves, A.K., Burchell, M.R., and **Duckworth, O.W.** (2012) Relationships between Nitrogen Transformation Rates and Gene Abundance in Riparian Buffer Soils. *Environmental Management*, **50**, 861-874.
13. Park, M., Kim, H.-J., Kim, K. **Duckworth, O.W.**, and Komarneni, S. (2012) Hydronium-Promoted Equilibrium Mechanism for the Alkali Metal Cation Exchange Reaction in Na-4-Mica. *Journal of Physical Chemistry C*, **116**, 18678–18683.
14. Harrington, J.M., Parker, D.L., Bargar, J.R., Jarzecki, A.A., Tebo, B.M., Sposito, G. and **Duckworth, O.W.** (2012) Structural Dependence of Mn Complexation by Siderophores: Donor Group Dependence on Complex Stability and Reactivity. *Geochimica et Cosmochimica Acta*, **88**, 106–119.
15. Harrington, J.M., Bargar, J.R., Jarzecki, A.A., Roberts, J.G., Sombers, L.A. and **Duckworth, O.W.** (2012) Trace Metal Complexation by the Triscatecholate Siderophore Protochelin: Structure and Stability. *Biometals*, **25**, 393-412.
16. Saal, L.B., and **Duckworth, O.W.** (2010) Synergistic Dissolution of Manganese Oxides as Promoted by Siderophores and Small Organic Acids. *Soil Science Society of America Journal*, **74**, 2021-2031.

17. Bi, Y., Hesterberg, D. L., and **Duckworth, O.W.** (2010) Siderophore-Promoted Dissolution of Cobalt from Hydroxide Minerals. *Geochimica et Cosmochimica Acta*, **74**, 2915-2925.
18. Kim, D., **Duckworth, O.W.**, and Strathmann, T.J. (2010) Reactions of Aqueous Iron-DFOB (Desferrioxamine B) Complexes with Flavin Mononucleotide in the Absence of Strong Iron(II) Chelators, *Geochimica et Cosmochimica Acta*, **74**, 1513-1529.
19. Smits, M.M., Herrmann, A. M., Duane, M., **Duckworth, O.W.**, Bonneville, S., Benning, L., and Lundström, U. (2009) The Fungal-Mineral Interface: Challenges and Considerations of Micro-Analytical Developments. *Fungal Biology Reviews*, **23**, 122-131.
20. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. (2009) Coupled Biogeochemical Cycling of Iron and Manganese as Mediated by Microbial Siderophores. *BioMetals*, **22**, 605-613.
21. **Duckworth, O.W.**, Bargar, J.R., Jarzecki, A.A., Oyerendi, O. Spiro, T.G., and Sposito, G. (2009) An Exceptionally Stable Cobalt(III)–Desferrioxamine B Complex. *Marine Chemistry*, **113**, 114-122.
22. Kim, D., **Duckworth, O.W.**, and Strathmann, T.J. (2009) Hydroxamate Siderophore-Promoted Reduction of Nitroaromatic Contaminants by Iron(II). *Geochimica et Cosmochimica Acta*, **73**, 1297-1311.
23. **Duckworth, O.W.**, Holmström, S.J.M., Peña, J., and Sposito, G. (2009) Biogeochemistry of Iron Oxidation in a Circumneutral Freshwater Habitat. *Chemical Geology*, **260**, 149-158.
24. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. (2009) Quantitative-Structure Activity Relationships for Aqueous Metal-Siderophore Complexes. *Environmental Science and Technology*, **43**, 343–349.
25. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. (2008) Sorption of Ferric Iron from Ferrioxamine B to Synthetic and Biogenic Layer Type Manganese Oxides. *Geochimica et Cosmochimica Acta*, **72**, 3371-3380.
26. Peña, J., **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. (2007) Dissolution of Hausmannite in the Presence of the Trihydroxamate Siderophore Desferrioxamine B. *Geochimica et Cosmochimica Acta*, **71**, 5661-5671.
27. **Duckworth, O.W.** and Sposito, G. (2007) Siderophore-Promoted Dissolution of Synthetic and Biogenic Layer Type Mn Oxides. *Chemical Geology*, **242**, 500-511.
28. **Duckworth, O.W.**, and Sposito, G. (2005) Siderophore-Manganese(III) Interactions I. Air-Oxidation of Manganese(II) Promoted by Desferrioxamine B. *Environmental Science and Technology*, **39**, 6037-6044.
29. **Duckworth, O.W.**, and Sposito, G. (2005) Siderophore-Manganese(III) Interactions II. Manganite Dissolution Promoted by Desferrioxamine B. *Environmental Science and Technology*, **39**, 6045-6051.
30. Perry, T.D., **Duckworth, O.W.**, Kendall, T.K., Martin, S.T., and Mitchell, R. (2005) Chelating Ligand Alters the Microscopic Mechanism of Mineral Dissolution. *Journal of the American Chemical Society*, **127**, 5744-5745.

31. Perry, T.D., **Duckworth, O.W.**, McNamara, C.J., Martin, S.T., and Mitchell, R. (2004) The Effects of the Biologically Produced Polymer Alginic Acid on Macroscopic and Microscopic Calcite Dissolution Rates. *Environmental Science and Technology*, **38**, 3040-3046.
32. **Duckworth, O.W.**, Cygan, R.T., and Martin, S.T. (2004) Linear Free Energy Relationships between Dissolution Rates and Molecular Modeling Energies of Rhombohedral Carbonates. *Langmuir*, **20**, 2938-2946.
33. **Duckworth, O.W.**, and Martin, S.T. (2004) Dissolution Rates and Pit Morphologies of Rhombohedral Carbonate Minerals. *American Mineralogist*, **89**, 554-563.
34. **Duckworth, O.W.**, and Martin, S.T. (2004) Role of Molecular Oxygen in the Dissolution of Siderite and Rhodochrosite. *Geochimica et Cosmochimica Acta*, **68**, 607-621.
35. **Duckworth, O.W.**, and Martin, S.T. (2003) Connections between Surface Complexation and Geometric Models of Mineral Dissolution Investigated for Rhodochrosite. *Geochimica et Cosmochimica Acta*, **67**, 1787-1801.
36. **Duckworth, O.W.**, and Martin, S.T. (2001) Surface Complexation and Dissolution of Hematite by C<sub>1</sub>-C<sub>6</sub> Dicarboxylic Acids at pH = 5.0. *Geochimica et Cosmochimica Acta*, **65**, 4289-4301.
37. Martin, S.T., Schlenker, J.C., Chelf, J.H., and **Duckworth, O.W.** (2001) Structure-Activity Relationships of Mineral Dusts as Heterogeneous Nuclei for Ammonium Sulfate Crystallization from Supersaturated Aqueous Solutions. *Environmental Science and Technology*, **35**, 1624-1629.

#### **INVITED PRESENTATIONS (33)**

1. **Duckworth, O.W.**, Akafia, M., Harrington, J.M., Andrews, M.Y, Jarzecki, A. A., Bargar, J.R., *New Roles for Siderophores in the Biogeochemical Cycling of Contaminant Metals*, presented at US Army Corps of Engineers-Engineer Research and Development Center, Vicksburg, Mississippi, September 17, 2014.
2. **Duckworth, O.W.** *Strategies to prevent soil from pollution and degradation*, presented at 20<sup>th</sup> World Congress of Soil Science, Jeju, Korea, June 8-13, 2014.
3. **Duckworth, O.W.**, Akafia, M., Harrington, J.M., Andrews, M.Y, Jarzecki, A. A., Bargar, J.R., *New Roles for Siderophores in the Biogeochemical Cycling of Contaminant Metals*, presented at Monte Verita Conference on Iron Biogeochemistry- From Molecular Processes to Global Cycles, Ascona, Switzerland, March 3-8, 2013.
4. **Duckworth, O.W.**, Harrington, J.M., Akafia, M., Bargar, J.R., Jarzecki, A. A., Sombers, L.A. and Roberts, J.G. *Trace metal complexation and dissolution by the triscatecholate siderophore protochelin*, presented at the Goldschmidt Annual Meeting, Montreal, Canada, June 24-29, 2012.
5. **Duckworth, O.W.**, Akafia, M., Harrington, J.M., Jarzecki, A. A., Bargar, J.R., and Parker, D.L. *New Roles for Siderophores In the Biogeochemical Cycling of Contaminant Metals*, presented at the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America Annual Meeting, San Antonio, Texas, October 16-19, 2011. (keynote)
6. Kaur, N., Hesterberg, D.L., **Duckworth, O.W.**, and Buchwalter, D. *Predicting Mobilization and Bioaccumulation of Trace Elements from Coal Fly Ash using Speciation Analysis*, presented

at the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America Annual Meeting, San Antonio, Texas, October 16-19, 2011.

7. **Duckworth, O.W.**, Akafia, M., Harrington, J.M., Jarzecki, A. A., Bargar, J.R., and Parker, D.L. *New Roles for Siderophores in the Biogeochemical Cycling of Transition Metals*, presented at the Biogeochemical Processes and Chemical Speciation in Soils Symposium at Umeå University, SE, September 28, 2011.

8. Kaur, N., Hesterberg, D.L., **Duckworth, O.W.**, and Buchwalter, D. *Predicting Mobilization and Bioaccumulation of Trace Elements from Coal Fly Ash using Speciation Analysis*, presented at the TVA Fly Ash Release Environmental Research Symposium, Harriman, Tennessee, August 2-3, 2011.

9. **Duckworth, O.W.**, Bi, Y., Harrington, J., Saal, L.B., Jarzecki, A. A., and Bargar, J.R. *New Roles for Siderophores in the Biogeochemical Cycling of Transition Metals*, presented at the Department of Environmental Geosciences, University of Vienna, November 9, 2010.

10. **Duckworth, O.W.**, Bi, Y., Harrington, J., Saal, L.B., Jarzecki, A. A., and Bargar, J.R. *New Roles for Siderophores in the Biogeochemical Cycling of Transition Metals*, presented at the Department of Biology, Appalachian State University, September 1, 2010.

11. **Duckworth, O.W.**, Bi, Y., Jarzecki, A. A., and Bargar, J.R. *The structure and reactivity of cobalt-siderophore complexes*, presented at the Goldschmidt Annual Meeting, June 13-19, 2010.

12. **Duckworth, O.W.** *The Biogeochemistry of Natural and Anthropogenic Nanoparticles*, presented at the Nanotechnology Integration Forum, North Carolina State University, March 23, 2010.

13. **Duckworth, O.W.**, Bargar, J.R., Bi, Y., Peña, J., Saal, L.B., and Sposito, G. *Effects of Rhizosphere Exudates on Trace Metal Biogeochemistry*, presented at the Department of Crop Science, North Carolina State University, October 29, 2009.

14. **Duckworth, O.W.**, Bargar, J.R., Bi, Y., Peña, J., Saal, L.B., and Sposito, G. *New Roles for Siderophores in Metal Speciation and Transport*, presented at the Department of Geography and Environmental Engineering, Johns Hopkins University, October 13, 2009.

15. **Duckworth, O.W.**, Bargar, J.R., Peña, J., Saal, L.B., and Sposito, G. *The Reactivity of Siderophores at Manganese Oxide Surfaces*, presented at the American Chemical Society National Meeting, presented at Salt Lake City, Utah, March 22-26, 2009.

16. **Duckworth, O.W.**, Peña, J., Bargar, J.R., Jarzecki, A.A., Spiro, T.G., and Sposito, G. *Siderophore-Mediated Biogeochemical Cycling of Transition Metals*, presented at the Department of Environmental Engineering and Earth Sciences, Clemson University, September 26, 2008.

17. **Duckworth, O.W.**, Peña, J., Bargar, J.R., Martin, S.T., and Sposito, G. *Environmental Science at the Earth's Surface: the Dirt on Soil Biogeochemistry*, presented at the Department of Geology at the College of William and Mary, September 17, 2008

18. **Duckworth, O.W.**, Peña, J., Bargar, J.R., Jarzecki, A.A., Spiro, T.G., and Sposito, G. *Siderophore-Mediated Biogeochemical Cycling of Transition Metals*, presented at the Department of Environmental Sciences and Engineering, California Institute of Technology, March 5, 2008.

19. **Duckworth, O.W.** *Bioavailability and Bioremediation of Contaminant Metals*, presented at the Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 22-23, 2008.
20. **Duckworth, O.W.**, Holmström, S.J.M., Peña, J., Zacharias, E.H. and Sposito, G. *Biogeochemistry of Iron Oxidation in a Circumneutral Freshwater Habitat*, presented at the American Geophysical Union National Meeting, San Francisco, California, December 10-14, 2007.
21. **Duckworth, O.W.**, and Sposito, G. *Nature's Own Nanoparticles: Bacteriogenic Manganese Oxides as Agents of Biogeochemical Change*. presented at the 2007 Geological Society of America National Meeting, Denver, Colorado, October 28-31, 2007.
22. **Duckworth, O.W.**, Peña, J., Bargar, J.R., Jarzecki, A.A., Spiro, T.G., and Sposito, G. *The Role of Siderophores in the Biogeochemical Cycling of Transition Metals*. presented at the Department of Plant and Soil Sciences, University of Delaware, September 27, 2007.
23. **Duckworth, O.W.** *Molecular and Nanoscale Approaches to Soil Biogeochemical Processes*. presented at the Department of Soil Science, North Carolina State University, November 30, 2006.
24. **Duckworth, O.W.**, and Sposito, G. *The Effects of the Adsorption of Biogenic Ligands on the Dissolution of Manganese Oxides*. presented at the 2006 Geological Society of America National Meeting, Philadelphia, Pennsylvania, October 22-25, 2006.
25. **Duckworth, O.W.**, and Sposito, G. *Mn(III)-Siderophore Complexes: Formation, Stability, and Reactivity*. presented at the 2006 Gordon Research Conference on Environmental Bioinorganic Chemistry, Andover, New Hampshire, June 18-23, 2006.
26. **Duckworth, O.W.** *Novel Approaches to Environmental Mineral Surface Chemistry*. presented at the Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, April 11, 2006.
27. **Duckworth, O.W.** *Interfacial Environmental Chemistry of Reactive Minerals*. presented at the Department of Chemical and Environmental Engineering, University of California-Riverside, Riverside, California, March 1, 2006.
28. **Duckworth, O.W.** *Scratching the Surface: Dissolution of Reactive Mineral Phases*. presented at the Department of Chemistry, Physics, and Geology, Winthrop University, February 13, 2006.
29. **Duckworth, O.W.**, and Sposito, G. *Formation of Manganese-Desferrioxamine B Complexes by Dissolution of Manganese Oxides*. presented at the annual Goldschmidt Conference, Moscow, Idaho, May 20-25, 2005.
30. **Duckworth, O.W.**, Cygan, R.T., and Martin, S.T. *Relationships between Molecular Modeling Energies and Dissolution Rates of Rhombohedral Carbonates*. presented at the Telluride Workshop: Chemical Reactivity of Aqueous Species at Mineral Surfaces, Telluride, Colorado, June 24-27, 2003.

31. **Duckworth, O.W.**, Cygan, R.T., and Martin, S.T. *Physical and Chemical Perspectives on Carbonate Dissolution*. presented at the Geochemistry Department, Sandia National Laboratories, Albuquerque, New Mexico, May 20, 2003.

32. **Duckworth, O.W.**, Cygan, R.T., and Martin, S.T. *Physical and Chemical Perspectives on Carbonate Dissolution*. presented at the Department of Geosciences, The State University of New York, Stony Brook, New York, March 13, 2003.

33. **Duckworth, O.W.**, and Martin, S.T. *Ligand-Promoted Dissolution of Hematite: Relationship between Surface Complexation Structures and Dissolution Rate Constants*. presented at the Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, October 2, 2000.

#### **CONTRIBUTED PRESENTATIONS AND CONFERENCE PROCEEDINGS (64)**

1. Roper, W.R., Grossman, J.M., Israel, D.W. and **Duckworth, O.W.** *Rhizobium leguminosarum strain combination effects on nodulation and biological nitrogen fixation in cover crop Vicia villosa*, presented at the Soil Science Society of North Carolina, January 20-21, 2015. (Poster)

2. Sowers, T.D., Andrews, M.Y., Whitaker, A.H., and **Duckworth, O.W.** *Probing the formation, structure, and reactivity of biogenic iron oxides compared to those lab-synthesized*, presented at the Soil Science Society of North Carolina, January 20-21, 2015. (Poster)

3. Andrews, M.Y., Holmström, S.J.M., Santelli, C.M., and **Duckworth, O.W.** *Siderophore production by Mn-oxidizing fungi*, presented at the Soil Science Society of America, Long Beach, CA, November 2-5, 2014.

4. Roper, W.R., Grossman, J.M., Israel, D.W. and **Duckworth, O.W.** *Rhizobium leguminosarum strain combination effects on nodulation and biological nitrogen fixation in cover crop Vicia villosa*, presented at the Soil Science Society of America Annual Meeting, Long Beach, California, November 2-5, 2014. (Poster)

5. Heitman, J.L., **Duckworth, O.W.**, Graves, A.K., Polizzotto, M.L., and Vepraskas, M.J. *Basic and Environmental Soil Science Training (BESST)*, presented at the Soil Science Society of America Annual Meeting, Long Beach, California, November 2-5, 2014. (Poster)

6. Gardner, T.G.G, Andrews, M.Y., Chaput, D.L., Droz, B., Peña, J., Polizzotto, M.L., Polizzotto, M.P., Rivera, N.A., Santelli, C.M. and **Duckworth, O.W.** *The geobiology of manganese oxide formation in an environmental remediation system*, presented at the Soil Science Society of America Annual Meeting, Long Beach, California, November 2-5, 2014. (Poster)

7. Gillispie, E.C., Austin, R., Rivera, N., Abraham, J., Wang, S., Bolich, R., Bradley, P., Amoozegar, A., **Duckworth, O.W.**, and Hesterberg, D., and Polizzotto, M.L., *Manganese near-surface repartitioning and delivery to groundwater in North Carolina*, presented at Goldschmidt2014, Sacramento, CA, June 8-13, 2014.

8. Akafia, M.M., Harrington, J.M., Andrews, M.Y., Bargar, J.R., and **Duckworth, O.W.**, *Mobilization and complexation of first-row transition metals by structurally diverse siderophores*, scheduled for presentation at Biometals2014, Durham, NC, July 13-18, 2014. (Poster)

9. Gardner, T.G, Andrews, M.Y., Chaput, D.L., Droz, B., Peña, J., Polizzotto, M.L., Rivera, N.A., Santelli, C.M. and **Duckworth, O.W.** *The geobiology of manganese oxide formation in an environmental remediation system*, scheduled for presentation at Biometals2014, Durham, NC, July 13-18, 2014. (Poster and Talk)
10. Kim, K.S., Kang, Y.J., Kim, M.-T., Ryu, J.-H., Choi, J.-S., Kim, J.-S., Lee, C.-W., Park, K.D., Kang, H.-W., **Duckworth, O.W.** and Park, M. *Ethylenediamine-zeolite hybrid for a new approach to phytoremediation*, presented at 20<sup>th</sup> World Congress of Soil Science, Jeju, Korea, June 8-13, 2014. (Poster)
11. **Duckworth, O.W.** and Andrews, M.Y. *Detection of Siderophores in Natural Environments*, presented at 20<sup>th</sup> World Congress of Soil Science, Jeju, Korea, June 8-13, 2014. (Poster)
12. Polizzotto, M., Gillispie, E., Austin, R., Rivera, N., Abraham, J., Wang, S., Bolich, R., Bradley, P., **Duckworth, O.W.**, Amoozegar, A. and Hesterberg, D. *Manganese near-surface repartitioning and delivery to groundwater in North Carolina*, presented at Goldschmidt2014, Sacramento, CA, June 8-13, 2014.
13. Andrews, M.Y, Holmstrom, S.J.M., Santelli, C.M., and **Duckworth, O.W.** *Siderophore production by Mn-oxidizing fungi*, presented at Goldschmidt2014, Sacramento, CA, June 8-13, 2014.
14. Rivera, N.A., **Duckworth, O.W.**, Buchwalter, D.B., Shiebener, S., and Hesterberg, D.L., *Mobilization and bioaccumulation of trace elements from coal fly ash*, presented at Goldschmidt2014, Sacramento, CA, June 8-13, 2014.
15. Droz, B., Dumas, N., Gardner, T.G., Rivera, N.A., **Duckworth, O.W.**, and Pena, J. *Impact of Microbial Surfaces on Nickel Sorption by Bacteriogenic and Mycogenic Birnessite*, presented at the Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 21-21, 2014. (Poster)
16. Akafia, M.M., Andrews, M.Y., and **Duckworth, O.W.** *Siderophore-Promoted Mobilization of Chromium from Hydroxide Minerals*, presented at the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America Annual Meeting, Tampa, Florida, November 3-6, 2013.
17. Gardner, T.G., Santelli, C.M., Andrews, M.Y., Polizzotto, M.L. and **Duckworth, O.W.** *Microbially Mediated Formation of Manganese Oxides at a Superfund Site Remediation System*, presented at the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America Annual Meeting, Tampa, Florida, November 3-6, 2013. (Poster)
18. Gillispie, E.C., Austin, R.E., Bolich, R., Bradley, P., Amoozegar, A., **Duckworth, O.W.**, Hesterberg, D.L., and Polizzotto, M.L. *Characterizing the Sources and Variability of Manganese in Well Water of the North Carolina Piedmont* presented at the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America Annual Meeting, Tampa, Florida, November 3-6, 2013. (Poster)
19. Gillispie, E.C., Austin, R.E., Bolich, R., Bradley, P., Amoozegar, A., **Duckworth, O.W.**, Hesterberg, D.L., and Polizzotto, M.L. *Characterizing the Sources and Variability of Manganese in Well Water of the North Carolina Piedmont* presented at the 12th International Conference on the Biogeochemistry of Trace Elements, Athens, GA, June 16-20, 2013. (Poster)

20. Sowers, T.D., McLaughlin, R.A., Andrews, M.Y., Kang, J., and **Duckworth, O.W.** *Developing Field Portable Methods for Polyacrylamide Determination*, presented at the International Erosion Control Meeting, San Diego, California, February 10-13, 2013. (Poster)
21. Sowers, T.D., McLaughlin, R.A., Andrews, M.Y., Kang, J., and **Duckworth, O.W.** *Developing Field Portable Methods for Polyacrylamide Determination*, presented at the Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 22-23, 2013. (Poster)
22. Nowak, B.T., Hesterberg, D.L., **Duckworth, O.W.**, and Buchwalter, D.B. *Dissolution of trace elements from coal fly ash as affected by citrate*, presented at the Soil Science Society of America Annual Meeting, October 21-24, 2012.
23. Kaur, N., Hesterberg, D.L., **Duckworth, O.W.**, and Buchwalter, D.B., and Ward, C.R., *Solubilization of trace elements from coal fly ash in relation to chemical speciation*, presented at the Goldschmidt Annual Meeting, June 24-29, 2012.
24. Krufft, B.I., Yam, R., Harrington, J.M., **Duckworth, O.W.**, and Jarzecki, A.A. *Quantum Mechanical Investigation of Aqueous Desferrioxamine B Metal Complexes: Trends in Structure, Binding and Spectroscopy*, presented at Bioinorganic Chemistry Gordon Conference, Ventura, California January 26-29, 2012. (Poster)
25. Kaur, N. Hesterberg, D.L., Ward, C.R., Austin, R.E. and **Duckworth, O.W.** *Chemistry and Potential Environmental Impacts of Fly Ash*, presented at Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 17-18, 2012.
26. Akafia, M., Harrington, J.M., and **Duckworth, O.W.** *Kinetics and Mechanism of Dissolution of Metal Hydroxides Promoted by Structurally Diverse Siderophores*, presented at Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 17-18, 2012. (Poster)
27. Kulbok, K.E. and **Duckworth, O.W.** *Elucidating the Effect of Biomolecule Structure on Calcium Carbonate Crystal Formation*, presented at the American Geophysical Union National Meeting, San Francisco, California, December 4-9, 2011. (Poster)
28. Akafia, M.M., Harrington, J.M., and **Duckworth, O.W.** *Kinetics and Mechanism of Dissolution of Metal Hydroxides Promoted by Structurally Diverse Siderophores*, presented at the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America Annual Meeting, San Antonio, Texas, October 6-19, 2011. (Poster)
29. Harrington, J.M., Roberts, J.G., Jarzecki, A. A., Sombers, L.M., Bargar, J.R., and **Duckworth, O.W.** *Trace Metal Chelation Properties of the Catecholate Siderophore Protochelin: Implications for the Cycling of Iron and Manganese*, presented at the American Chemical Society National Meeting, Denver, Colorado, August 28-September 1, 2011.
30. Kulbok, K.E. and **Duckworth, O.W.** *Elucidating the Effect of Biomolecule Structure on Calcium Carbonate Crystal Formation*, presented at the Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 18, 2011. (Poster)
31. Wu, L., Osmond, D.L., Graves, A.K., Burchell, M.R., and **Duckworth, O.W.** *Denitrification and Molecular Detection in Riparian Buffer Soils*, presented at the Society of Wetland Scientist Meeting, Salt Lake City, Utah, June 27- July 2, 2010. (Poster)

32. Wu, L., Osmond, D.L., Graves, A.K., Burchell, M.R., and **Duckworth, O.W.** *Denitrification and Molecular Detection in Riparian Buffer Soils*, presented at the Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 19-20, 2010. (Poster)
33. D. Kim, **Duckworth, O.W.**, and Strathmann, T.J. *Reactions of Aqueous Iron-DFOB (Desferrioxamine B) Complexes with Flavin Mononucleotide in the Absence of Strong Iron(II) Chelators*, presented at the American Chemical Society National Meeting, San Francisco, CA, March 21-25, 2010.
34. **Duckworth, O.W.** and Saal, L.B. *Synergistic Effects of Siderophores and Small Organics at Manganese Oxide Surfaces*, presented at Goldschmidt Annual Meeting, Davos, SUI, June 21-26, 2009.
35. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. *Sorption of Iron from Siderophore Complexes by Mn Oxides*, presented at the at the Joint Meeting of the Geological Society of America, American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, Gulf Coast Association of Geological Societies, Houston, Texas, 5-9 October, 2008.
36. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. *Sorption of Iron from Siderophore Complexes by Mn Oxides*, presented at the American Chemical Society National Meeting, Philadelphia, Pennsylvania, August 17-21, 2008.
37. Bi, Y. and **Duckworth, O.W.** *Siderophore-mediated dissolution of Co-substituted goethite*, presented at the American Chemical Society National Meeting, Salt Lake City, Utah, March 22-26, 2009. (Poster)
38. Bi, Y. and **Duckworth, O.W.** *Siderophore-promoted dissolution of Co-bearing minerals*, presented at the Annual Soil Science Society of North Carolina Meeting, Raleigh, North Carolina, January 19-20, 2009. (Poster)
39. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. *Sorption of Iron from Siderophore Complexes by Mn Oxides*. Presented at annual Goldschmidt Conference, Vancouver, British Columbia, July 13-18, 2008.
40. D. Kim, **Duckworth, O.W.**, and Strathmann. T.J. *Abiotic Reduction of Organic Contaminants by Iron(II)- Siderophore Complexes*. presented at the American Chemical Society National Meeting, New Orleans, LA, April 6-10, 2008.
41. **Duckworth, O.W.**, Holmström, S.J.M., Peña, J., Zacharias, E.H. and Sposito, G. *Biogeochemistry of Iron Oxidation in a Circumneutral Freshwater Habitat*. presented at the 2007 Geological Society of America National Meeting, Denver, Colorado, October 28-31, 2007.
42. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. *Sorption of Ferric Iron from Ferrioxamine B to Synthetic and Biogenic Layer Type Manganese Oxides*. presented at the American Geophysical Union National Meeting, San Francisco, California, December 11-15, 2006.
43. **Duckworth, O.W.**, Bargar, J.R., Jarzecki, A.A., Spiro, T.G., and Sposito, G. *Structure and Stability of Metal-Siderophore Complexes*. presented at the American Chemical Society National Meeting, San Francisco, California, September 10-14, 2006. (also presented at Sci-Mix session as Poster)

44. **Duckworth, O.W.**, Peña, J. and Sposito, G. *Siderophore-Promoted Dissolution of Mn(II,III,IV) oxides*. presented at the American Chemical Society National Meeting, San Francisco, California, September 10-14, 2006. (Poster)
45. **Duckworth, O.W.**, Bargar, J.R., and Sposito, G. *Sorption of Ferrioxamine B to Synthetic and Biogenic Layer Type Mn Oxides*. presented at the American Geophysical Union National Meeting, San Francisco, California, December 5-9, 2005. (Poster)
46. Martin, S.T., Jun, Y.S., Kendall, T.A., and **Duckworth, O.W.** *Nucleation and growth of manganese oxide films*. presented at the annual Goldschmidt Conference, Moscow, Idaho, May 20-25, 2005.
47. Oyerinde O.F., Balakrishnan G., **Duckworth O.W.**, Villalobos M., Sposito G., Spiro T.G. *Raman spectroscopic studies of manganese oxides: Structure and reactivity*. presented at the American Chemical Society National Meeting, San Diego, California, March 17-21, 2005.
48. **Duckworth, O.W.**, and Sposito, G. *Formation and Stability of Manganese-Desferrioxamine B Complexes*. presented at the American Geophysical Union National Meeting, San Francisco, California, December 13-17, 2004. (Poster)
49. Martin, S.T. and **Duckworth, O.W.** *Role of molecular oxygen in the dissolution of siderite and rhodochrosite*. presented at 11<sup>th</sup> International Symposium on Water-Rock Interaction. Saratoga Springs, NY, June 27- July 4, 2004.
50. Perry, T.D., **Duckworth, O.W.**, McNamara, C.J., Martin, S.T., Breuker, M., and Mitchell, R. *Biologically produced polymers affect calcite dissolution*. presented at 11<sup>th</sup> International Symposium on Water-Rock Interaction. Saratoga Springs, NY, June 27- July 4, 2004.
51. **Duckworth, O.W.**, and Sposito, G. *Desferrioxamine B-Promoted Dissolution of Manganite*. presented at the American Chemical Society National Meeting, Anaheim, California, March 28-April 1, 2004.
52. Martin, S.T. and **Duckworth, O.W.** *Role of molecular oxygen in the dissolution of siderite and rhodochrosite*. presented at the American Chemical Society National Meeting, Anaheim, California, March 28-April 1, 2004.
53. Perry, T.D., **Duckworth, O.W.**, McNamara, C.J., Martin, S.T., and Mitchell, R. *Alginic Acid Accelerates Calcite Dissolution*. presented at the American Geophysical Union National Meeting, San Francisco, California, December 8-12, 2003. (Poster)
54. **Duckworth, O.W.**, and Martin, S.T. *The Effect of Oxygen on Siderite and Rhodochrosite Dissolution*. presented at the American Geophysical Union National Meeting, San Francisco, California, December 8-12, 2003. (Poster)
55. **Duckworth, O.W.**, and Martin, S.T. *The Effect of Oxygen on Siderite and Rhodochrosite Dissolution*. presented at the American Chemical Society National Meeting, New York, New York, September 7-11, 2003.
56. Perry, T.D., **Duckworth, O.W.**, McNamara, C.J., Martin, S.T., and Mitchell, R. *Alginic Acid Accelerates Calcite Dissolution*. presented at the American Chemical Society National Meeting, New York, New York, September 7-11, 2003.
57. **Duckworth, O.W.**, and Martin, S.T. *Rhodochrosite Dissolution Investigated Simultaneously by Flow-Through Reactor and Atomic Force Microscopy: Quantitatively Linking Surface*

*Complexation Modeling to AFM Observations*. presented at the 2002 Gordon Research Conference on Environmental Science: Water, Plymouth, New Hampshire, June 23-28, 2002. (Poster)

58. **Duckworth, O.W.**, and Martin, S.T. *Dissolution and Oxidation of Rhodochrosite and Siderite Investigated by Macroscopic and Microscopic Methods*. presented at the American Chemical Society National Meeting, Orlando, Florida, April 7-11, 2002.

59. **Duckworth, O.W.**, and Martin, S.T. *Dissolution Rates and Mechanisms of Calcite and Smithsonite Investigated by Macroscopic and Microscopic Methods*. presented at the 2001 USEPA STAR Fellowship Conference, Washington, District of Columbia, August 20-24, 2001. (Poster)

60. **Duckworth, O.W.**, and Martin, S.T. *Relationship between Rates of Ligand-Promoted Dissolution of Hematite and the Iron-Ligand Surface Structures of C<sub>1</sub>-C<sub>6</sub> Dicarboxylic Acids*. presented at the American Chemical Society National Meeting, Washington, District of Columbia, August 20-24, 2000. (Poster)

61. Martin, S.T. and **Duckworth, O.W.** *Dicarboxylate ligands adsorbed to hematite: Surface complexation structures inferred from ATR IR spectra*. presented at the American Chemical Society National Meeting, Washington, District of Columbia, August 20-24, 2000.

62. **Duckworth, O.W.**, and Martin, S.T. *Ligand-Promoted Dissolution of Hematite: Relationship between Surface Complexation Structures and Dissolution Rate Constants*. presented at the USEPA STAR Fellowship Conference, Washington, District of Columbia, July 9-12, 2000. (Poster)

63. **Duckworth, O.W.**, and Martin, S.T. *Ligand-Assisted Dissolution of Hematite*. presented at the USEPA STAR Fellowship Conference, Washington, District of Columbia, July 17-20, 1999. (Poster)

64. Bishop, J.W. and **Duckworth, O.W.** *Ammonium affinity of sediments in ENCORE microatolls*. presented at 8th International Coral Reef Symposium, Panama City, Panama, June 24 -29, 1996.

#### **TEACHING AND CURRICULUM DEVELOPMENT**

Developed and taught new undergraduate course: Soil and Environmental Biogeochemistry (SSC 495/442), Spring 2009, 2010, 2012, 2013, 2014, 2015

Developed and taught new graduate Current Topics in Soil Science (SSC 620), Spring 2014

Taught graduate Soil Chemistry (SSC 521), Spring 2008

Guest lecturer in Professional Development in Soil Science SSC (609/809), Advanced Soil Chemistry (SSC 722), and Duke University's Introduction on Environmental Engineering (CE24)

Conducted workshops for middle and high school teachers in 2010, 2012

#### **PEER-REVIEWED EDUCATIONAL PUBLICATIONS (4)**

1. **Duckworth, O.W.**, Franzluebbers, A.J., and Gardner, T.G. (2014) Biogeochemical Processes Underpin Ecosystem Services in *Soil Ecosystem Services*, Stromberger, M.E., Lindbo, DL., Comerford, N.B. (eds.), accepted.

2. **Duckworth, O.W.**, Heitman, J.L., and Polizzotto, M.L. (2014) Soil water: From molecular structure to behavior, *Nature Education Knowledge*, **5(8)**, 1.
3. Harrington, J.M., Gardner, T.G., Amoozegar, A., Andrews M.Y., Rivera, N.A., and **Duckworth, O.W.** (2013) A workshop to facilitate the development of learning modules for 6-12 grade science classes based on biogeochemical research, *Natural Sciences Education*, **42**, 75-84.
4. **Duckworth, O.W.**, and Harrington, J.M. (2012) Student Presentations of Case Studies to Illustrate Core Concepts in Soil Biogeochemistry, *Journal of Natural Resources and Life Science Education*, **41**, 35-43.

#### **AWARDS/HONORS**

- |            |  |
|------------|--|
| 2014       | Profiled as an Emerging Investigator by <i>Environmental Science: Processes and Impacts</i>  |
| 2013       | National Science Foundation Early Career Award   |
| 2011       | Opponent for Anna Simanova, Ph.D. student, Umeå University   |
| 2008, 2011 | NCSU Faculty Research and Professional Development Award   |
| 2001-2003  | Sandia National Laboratories Campus Executive Fellow   |
| 2000       | Student Poster Prize, Environmental Division, ACS Fall National Meeting  |
| 1998-2001  | USEPA STAR Fellow  |
| 1997       | University of North Carolina B.B. Parker Fellow  |
| 1997-1998  | North Carolina Board of Governors' Fellow  |
| 1997       | High-Honors Bachelor's Thesis<br>College of William and Mary Department of Geology Alumni Prize<br>Baldwin- Speece Environmental Award |
| 1996       | William and Mary Parents' Association Scholarship for Domestic Research  |
| 1993-1997  | Monroe Scholar<br>Dow Chemical Scholar   |

#### **AWARDS WON BY GROUP MEMBERS**

**Reina Diaz:** 2015 NCSU Undergraduate Research Fellowship

**Mac Jones:** 2015 NCSU Undergraduate Research Fellowship

**Wayne Roper:** 2015 Hugh Hammond Bennett Award

**Tyler Sowers:** 2015 Outstanding Poster Prize (grand prize) at the Soil Science Society of North Carolina Meeting

2014 Hubert J. Byrd Scholarship from the Soil Science Society of America

2014 J. Fielding Reed Scholarship from the American Society of Agronomy

2013 ACCIAC Undergraduate Research Fellowship

2013 Outstanding Student Poster Prize (first place) at the Soil Science Society of North Carolina Meeting

2013 Outstanding Student Poster Contest (second place) at the International Erosion Control Association Conference

**Andrew Whitaker:** 2014 Graduate Recruitment Fellowship

**Boris Droz:** 2014 Outstanding Student Poster Prize (second place) at the Soil Science Society of North Carolina Meeting

**Wayne Roper:** 2013 Deans Graduate Research Assistantship

**Terrence Gardner:** 2012 CALS Dean's Postdoctoral Fellowship

**Martin Akafia:** 2010 Graduate Recruitment Fellowship

**Lin Wu:** 2009 Society of Wetland Scientists Student Grant

**Yuqiang Bi:** 2009 American Chemical Society Graduate Student Award in Environmental Chemistry

2009 Outstanding Student Poster Prize (second place) at the Soil Science Society of North Carolina Meeting

2008 Stevens Graduate Student Fellowship

### **PROFESSIONAL ACTIVITIES**

Associate editor for *Geochimica et Cosmochimica Acta* and review editor for *Frontiers in Environmental Science*

*Incoming Chair-Elect of the Soil Chemistry Division of the Soil Science Society of America*

National Club Poster Presentation Contest Committee Member and Soil Chemistry Student Presentation Contest Judge for the Soil Science Society of America, 2013

Chair of the Soil Science Society of America Soils and Environmental Quality (S-11) Student Awards Committee, 2012

Reviewer for 28 different journals (American Journal of Science, American Mineralogist, Applied Geochemistry, Biogeosciences, Canadian Journal of Soil Science, Chemical Geology, Colloids and Surfaces B, Crystal Growth & Design, *Current Medicinal Chemistry*, Energy & Fuels, Environmental Chemistry, Environmental Microbiology and Environmental Microbiology Reports, Environmental Science and Technology, Environmental Science & Technology Letters, Frontiers in Microbiological Chemistry, Geobiology, Geochemical Transactions, *Geochimica et Cosmochimica Acta*, *Geoderma*, *Geomicrobiology Journal*, Journal of Colloid and Interface Science, Journal of Environmental Quality, Langmuir, Microbial Ecology, Pedosphere, Plant and Soil, Soil Science Society of America Journal, and Water Research), three book chapters, and a book proposal

Proposal review panel member for two federal funding agencies (including two NSF programs) and two federal user facility; reviewer for four national funding agencies (including four NSF programs), a state funding agency, four private foundations, two national user facilities, 27 peer-reviewed journals, three book chapters, and a book proposal

Symposium Organization:

*Organic molecule interactions with mineral surfaces as key regulators of soil processes* (Co-organizer: Peter Nico, Alan Stone, Aaron Thompson) at the Soil Science Society of America Meeting in Long beach, CA, Nov 2-5, 2014.

*Mobilization of Essential Micronutrients by Exudates* (Co-organizer Sara Holmström) at the World Congress of Soil Science in Jeju, Korea June 8-13, 2014.

*Geochemistry and re-use of petroleum, coal combustion, and gasification products* (Co-organizers James C. Hower, Hamed Sanei, Owen Duckworth, Dean Hesterberg, Mark Chappell) at the Goldschmidt Annual Meeting in Montreal, CA June 24-29, 2012.

*Nanogeology: How Nanoparticle Structure and Composition Lead to Function and Reactivity* (Co-organizers: Patricia Maurice, Andrew Quicksall, Chongzheng Na, Treavor Kendall) at the Goldschmidt Annual Meeting in Knoxville, TN June 13-19, 2010.

*Structure and Reactivity of Organic Species at Mineral Surfaces* (Co-organizers: S. M. Kraemer and Alan Stone) at the Goldschmidt Annual Meeting in Davos, CH June 21-26, 2009.

*Roles of Speciation and Molecular Structure in Soil Processes* (Co-organizer: Alan Stone) at the Joint Meeting of the GSA and the Tri-Societies, Houston, TX October 5-9, 2008.

Invited Discussion Leader: *Separate and combined contributions of fungi and bacteria to weathering*, Geomycology workshop, Uppsala, Sweden, May 7-9, 2008.

Member of the American Chemical Society, American Geophysical Union, Soil Science Society of America, Soil Science Society of North Carolina, and the Geochemical Society.