

CARA M. SANTELLI

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EDUCATION

Ph.D. Massachusetts Institute of Technology/Woods Hole Oceanographic Institution, 2007

MIT/WHOI Joint Program in Oceanography, Marine Geomicrobiology

Dissertation Advisors: Dr. Katrina J. Edwards and Dr. Wolfgang Bach

Geomicrobiology of the ocean crust: the phylogenetic diversity, abundance, and distribution of microbial communities inhabiting basalt and implication for rock alteration processes

B.S. University of Wisconsin, Madison, 2000

B.S., Department of Geology and Geophysics

Senior Thesis Advisors: Dr. Jillian F. Banfield and Dr. Susan A. Welch

The effect of Fe-oxidizing bacteria on Fe-silicate mineral dissolution

RESEARCH EXPERIENCE

Postdoctoral Research Fellow, Harvard University, Dr. Colleen Hansel Laboratory, 2007-present

- Investigation of the role and mechanisms of Mn(II)-oxidation employed by fungi using physiological assays, enzyme assays, and protein purification methods
- Examination of the microbial communities associated with remediation of Mn in coal mine drainage and metal-contaminated freshwater environments using culture-dependent and -independent (phylogenetic analysis) approaches
- Analysis of biogenic Mn (III/IV) oxide minerals produced by fungi using electron microscopy and synchrotron-based X-ray diffraction and X-ray absorption spectroscopy

Graduate Research Assistant, MIT/WHOI Joint Program in Oceanography, 2000-2007

- Investigation of basaltic ocean-crust alteration, hydrothermal sulfide weathering, and iron biomineralization using synchrotron-based X-ray diffraction, μ X-ray fluorescence, and μ X-ray absorption spectroscopy techniques
- Examination and quantification of microbial communities inhabiting ocean crust and low-temperature hydrothermal systems using molecular methods (phylogenetic analysis, in-situ hybridization, and quantitative-PCR)
- Exploration of deep-subsurface microbial communities using molecular-biological methods

Undergraduate Research Assistant, University of Wisconsin, Madison, 1998-2000

- Investigation of microbiologically-induced silicate mineral weathering using mineralogical, aqueous geochemical, and microscopic analysis
- Identification of minerals using conventional X-ray diffraction

XRD Lab Technician, University of Wisconsin, Madison, 1999-2000

- Maintenance of the x-ray diffraction laboratory in the Department of Geology and Geophysics
- Training of new users of the facility

RESEARCH CRUISE & FIELD EXPERIENCE

Field research participant, Central Pennsylvania, October 2007

Examination of microbial communities in passive remediation systems for acid mine runoff

Field research leader, Cape Cod, Massachusetts, Summer 2007

Microbiological isolation and description of manganese oxidizing microorganisms

Research cruise participant, East Pacific Rise, 9°N, R/V Atlantis, AT11-20, November 2004

Geomicrobiological investigations of basalt and sulfide alteration

Research cruise participant, East Pacific Rise, 9°N, R/V Atlantis, AT11-7, February 2004

Geomicrobiological investigations of basalt alteration

Research cruise participant, Costa Rica Margin, Ocean Drilling Program Leg 205, September 2002

Fluid flow and subduction fluxes across the Costa Rica Convergent Margin

Geological Summer Field Assistant, Montana and Idaho, Summer 1998

Rock collection/identification for graduate student studying the source and alteration of the Idaho batholith

RESEARCH INTERESTS

- Microbiologically mediated metal redox transformations
- Fungal biogeochemistry
- Biologically induced mineral precipitation and dissolution
- Bioremediation of metal-contaminated environments

SYNERGISTIC ACTIVITIES/TEACHING EXPERIENCE

Laboratory Mentor, Hansel Lab in Microbial Geochemistry, Harvard, 2007-present

Supervision and instruction of micro- and molecular biological laboratory techniques to undergraduate (Joao Campos Jr., Greta Friar, and Dana Lazarus) and graduate students (Kiana Frank, Arven Saunders, Lu Sun, Adiar Vazquez-Rodriguez)

Gender Climate at Sea Committee, Student representative, WHOI, 2006

Investigation of gender-related issues on research vessels, reviewed current gender equity and harassment training, and recommended training procedures.

Laboratory Mentor, Edwards Geomicrobiology Laboratory, WHOI, 2004-2007

Instruction of molecular biological laboratory techniques and phylogenetic analysis tools to undergraduate students, graduate students, and post-doctoral investigators

Falmouth Schools Science Outreach Program, Falmouth, MA, 2005

Design and improvement of science curriculum

High School Geology Teacher, Swiss Semester, Zermatt, Switzerland, Fall Semester, 2001

Teaching of a classroom and lab-based geology class at an American boarding school

K-12 Outreach Engagements, University of Wisconsin, Madison, 1997-1999

Demonstration of basic science experiments a civil engineering city planning outreach kit

AWARDS, FUNDING & TRAINING

Molecular Geomicrobiology Short Course, Mineralogical Society of America, 2005

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NASA Astrobiology Institute Travel Award, to attend the MSA Molecular Geomicrobiology Short Course, 2005
Troodos Ophiolite Field School, Ridge2000, Cyprus, 2005
Schlanger Ocean Drilling Fellowship, 2003
Student Travel Grant, to attend the American Society for Microbiology Conference, 2003
Outstanding Senior Award, Department of Geology and Geophysics, University of Wisconsin-Madison, 2000
Wasatch-Uinta Field Camp, Geological Field Methods course, Utah, Summer 1999

PROFESSIONAL SOCIETIES

Member of the American Geophysical Union, the Geochemical Society, the Mineralogical Society of America, the American Society for Microbiology, and the American Chemical Society

PUBLICATIONS & MANUSCRIPTS

Santelli, C.M., Banerjee, N.R., Bach, W., Edwards, K.J. The deep ocean biosphere: Evidence for low biomass in old ocean crust. *Submitted, Geomicrobiology Journal*.

Brandy M. Toner, Sirine C. Fakra, Steven J. Manganini, **Santelli, C.M.**, Matthew A. Marcus, James W. Moffett, Olivier Rouxel, Christopher R. German, and Katrina J. Edwards, 2009. Deep-sea Hydrothermal Iron(II) is Stable in Association with Organic Carbon in Plume Particulates. *Nature Geoscience*, vol. 2, pp. 197-201.

Brandy M. Toner, **Santelli, C.M.**, Matthew A. Marcus, Richard Wirth, Clara S. Chan, Thomas McCollom, Wolfgang Bach, and Katrina J. Edwards, 2009. Biogenic Iron Oxide Formation at Mid-Ocean Ridge Hydrothermal Vents: Juan de Fuca Ridge. *Geochimica et Cosmochimica Acta*, vol. 73, no. 2, pp. 388-403.

Santelli, C.M., Edgcomb, V., Bach, W., Edwards, K.J., 2009. The diversity and abundance of bacteria inhabiting seafloor lavas positively correlate with rock alteration. *Environmental Microbiology*, vol. 11, no. 1, pp. 86-98.

Santelli, C.M., Orcutt, B.N., Banning, E., Bach, W., Moyer, C.L., Sogin, M.L., Staudigel, H., Edwards, K.J., 2008. Abundance and diversity of microbial life in ocean crust. *Nature*, vol. 453, pp. 643-657.

Rogers, D.R., **Santelli, C.M.**, Edwards, K.J., 2003. Geomicrobiology of deep-sea deposits: Estimating community diversity from low-temperature seafloor rocks and minerals. *Geobiology Journal*, vol. 1, pp. 109-117.

Santelli, C.M., Welch, S.A., Westrich, H.R., Banfield, J.F., 2001. The effect of Fe-oxidizing bacteria on Fe-silicate mineral dissolution. *Chemical Geology*, vol. 180, no. 1-4, pp. 99-115.

Welch, S.A., **Santelli, C.M.**, Banfield, J.F., 2000. An experimental study of fayalite alteration by an iron oxidizing microorganism, *Thiobacillus ferrooxidans*. *Midwest Microscopy* 27, 3, pp. 6-7.

ABSTRACTS OF PRESENTATIONS

Santelli, C.M., Lazarus, D., Burgos, W., Hansel, C.M., 2008. Diverse Mn(II)-oxidizing fungi contribute to the passive remediation of acid mine drainage in Western Pennsylvania. American Chemical Society, Philadelphia, Pennsylvania. *Oral Presentation*.

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Santelli, C.M., Lazarus, D., Burgos, W., Hansel, C.M., 2008. Manganese(II)-oxidizing Fungi are Prevalent in Acid Mine Drainage Passive Treatment Systems of Western Pennsylvania. American Society for Microbiology, Boston, Massachusetts. *Poster Presentation*.

Santelli, C.M., Moyer, C.M., Bach, W., Edwards, K.J., 2007. Biofilms in Ocean Crust: Processes and Interactions with Rock. Bioastronomy Meeting, San Juan, Puerto Rico. *Invited Oral Presentation*.

Santelli, C.M., Bach, W., Edwards, K.J., 2006. Microorganisms and the weathering of ocean crust at the seafloor. V.M. Goldschmidt Conference 2007, Melbourne, Australia. *Oral Presentation*.

Santelli, C.M., Toner, B., Bach, W., Edwards, K.J., 2006. Low-temperature alteration of basaltic glass: results of μ XRF and μ EXAFS studies. Gordon Research Conference: Environmental Bio-inorganic Chemistry, Andover, NH. *Poster Presentation*.

Santelli, C.M., Edgcomb, V., Bach, W., Edwards, K.J., 2005. Bacterial Diversity of Young Seafloor Basalts: A potential role for microorganisms in ocean crust weathering. AGU Fall Meeting, San Francisco, CA. *Poster Presentation*.

Santelli, C.M., Banerjee, N.R., Bach, W., Edwards, K.J., 2005. The deep ocean crust biosphere: Young and dynamic, old and dormant? The Joint International Symposia for Subsurface Microbiology (ISSM 2005) and Environmental Biogeochemistry (ISEB XVII), Jackson Hole, WY. *Poster Presentation*.

Santelli, C.M., Bach, W., Edwards, K.J., 2005. Bacterial diversity of young ocean crust at the East Pacific Rise, 9°N. Ridge 2K Troodos Ophiolite Field School, Troodos, Cyprus. *Poster Presentation*.

Santelli, C.M., Bach, W., Rogers, D.R., Edwards, K.J., 2004. Phylogenetic Diversity of Young Ocean Crust at the East Pacific Rise 9°N. AGU Fall Meeting, San Francisco, CA. *Poster Presentation*.

Santelli, C.M., Edwards, K.J., 2003. The Role of Crystallography and Electrostatic Forces in the Adhesion of *Thiobacillus ferrooxidans* to Pyrite Surfaces. ASM Conference, Washington D.C. *Poster Presentation*.

Santelli, C.M., Welch, S.A., Banfield, J.F., 1999. Lithotrophic growth of *T. ferrooxidans* on Fe^{2+} from silicate mineral dissolution. Geological Society of America Meeting, Denver, CO. *Poster Presentation*.

SELECT CO-AUTHORED PRESENTATIONS

Edwards, K.J., Marcus, M.A., Toner, B., **Santelli, C.M.**, 2007. Evaluation of oxidation state and potential for bio-signatures in Fe-bearing minerals in deep-sea minerals using spectroscopic approaches. *Geochimica et Cosmochimica Acta*, vol. 71, no. 15, pp. A249-A249, Suppl. S

Toner, B., **Santelli, C.M.**, Rouxel, J.J., Edwards, K.J., 2006. Seafloor weathering of hydrothermal chimney sulfide minerals from the East Pacific Rise, 9°N: an X-ray absorption spectroscopic study. *Geochimica et Cosmochimica Acta*, vol. 70, no. 18, pp. A255-A555, Suppl. S.

Banfield, J.F., Welch, S.A., Taunton, A.E., **Santelli, C.M.**, Barker, W.W., 1999. Exploring microbial controls on mineral weathering. Proceedings of the 5th International Symposium on the Geochemistry of the Earth's Surface, Reykjavik Iceland, 16-20, August, 1999: 353-356.

Welch, S.A., Taunton, A.E., **Santelli, C.M.**, Fournelle, J., Banfield, J.F., 1998. The role of microorganisms in biotite weathering. Geological Society of America, Abstracts with Programs, vol. 30, no. 7, pp. 305. *Poster Presentation*.