

## CLARA S. CHAN

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### Education

- Ph. D. **University of California, Berkeley**  
Earth and Planetary Science, 2006  
Advisor: Jill Banfield
- M. S. **Stanford University**  
Civil and Environmental Engineering, 1998
- B. S. **Stanford University**  
Geological and Environmental Sciences, 1997

### Appointments

- Associate Professor** 2015-present  
Earth Sciences, with joint appointments in Biological Sciences, Civil and Environmental Engineering, and Marine Science and Policy, University of Delaware, Newark, DE
- Visiting Associate** Spring 2016  
Geological and Planetary Sciences, Caltech, Pasadena, CA
- Assistant Professor** 2009-2015  
Geological Sciences, joint appointment in School of Marine Science and Policy University of Delaware, Newark, DE
- Visiting Scientist** Fall 2008  
Life Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA
- Visiting Assistant Professor** 2007-2008  
Geology, Bowdoin College, Brunswick, ME
- Postdoctoral Fellow** 2006-2008  
Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, MA (2006-2008), Biological Sciences, University of Southern California (2008), Katrina Edwards, PI.
- Graduate Student Instructor** 2002-2003  
Earth and Planetary Science, University of California, Berkeley
- Research Assistant** 2000-2006  
Geomicrobiology Group, University of California, Berkeley (2001-2006), University of Wisconsin, Madison (2000-2001), Jill Banfield, PI.

<b>Geologist and Environmental Engineer</b> CDM (now CDM Smith), Walnut Creek, CA	1998-2000
<b>Teaching Assistant</b> Civil and Environmental Engineering, Geological and Environmental Sciences, Stanford University	1997-1998
<b>Physical Science Technician</b> United States Geological Survey, Menlo Park, CA	1997
<b>Laboratory Assistant</b> Molecular Organic Geochemistry Laboratory and Theoretical Geochemistry Laboratory, Stanford University (PIs M. Moldowan, D. Bird)	1994, 1996-1998

### Honors and Awards

Geological Society of America Geobiology & Geomicrobiology Post-Tenure Award	2019
Mineralogical Society of America Distinguished Lecturer	2017-2018
NSF CAREER Award	2012-2017
US National Academy of Sciences Kavli Fellow	2011, 2016
Excellence in Undergraduate Academic Advising and Mentoring Award nomination, University of Delaware	2011
National Science Foundation Ridge 2000 Postdoctoral Fellowship	2006-2008
Outstanding Graduate Student Instructor, for <i>Introduction to Oceans</i> , University of California, Berkeley	2004
National Defense Science and Engineering Graduate Fellowship	2001-2004
National Science Foundation Graduate Fellowship (declined)	2001
University Fellowship, University of Wisconsin	2000-2001
Field Studies Scholarship, Stanford University	1995

### Research and Scholarship

#### Publications

(\*Chan corresponding author, ^Chan lab student or postdoc)

For up-to-date citation metrics, please see [Google Scholar](#). As of December 2019, h-index=25, #citations=2572.

#### In review/preprint

1. McAllister, S. M.^, Polson, S. W., Butterfield, D. A., Glazer, B. T., Sylvan, J. B., **Chan, C. S.\***, Validating the Cyc2 Fe oxidation pathway using meta-omics of Zetaproteobacteria Fe mats at marine hydrothermal vents. (available on bioRxiv as doi:10.1101/722066), *in revision*.
2. **Chan, C. S.\***, McAllister, S. M.^, Garber, A.^, Hallahan, B. J.^, Rozovsky, S. Fe oxidation by a fused porin-cytochrome common to diverse Fe-oxidizing bacteria. (available on bioRxiv as doi:10.1101/228056), *in revision*
3. Garber, A. I., Nealson, K. H., Okamoto, A., McAllister, S. M.^, **Chan, C. S.**, Barco, R. A., Merino, N. FeGenie: a comprehensive tool for the identification of iron genes and iron gene neighborhoods in genomes and metagenome assemblies. (available on bioRxiv as doi:10.1101/777656), *in revision*.

**Published or in press**

1. Cooper, R. E., Wegner, C.-E., McAllister, S. M.<sup>^</sup>, Shevchenko, O., **Chan, C. S.**, Küsel, K. (2019) Draft genome sequence of *Sideroxydans* strain CL21, a Fe(II)-oxidizing bacterium, *Microbiol. Resour. Announc.*, in press
2. Cron, B., Macalady, J. L., Henri, P. A.<sup>^</sup>, **Chan, C. S.**, Cosmidis, J. (2019) Elemental sulfur formation by *Sulfuricurvum kujiense* is mediated by extracellular organic compounds. *Front. Microbiol.*, doi: 10.3389/fmicb.2019.02710
3. McAllister, S. M.<sup>^</sup>, Moore, R. M., Gartman, A., Luther, G. W., Emerson, D., **Chan, C. S.\*** (2019) Marine Fe-oxidizing Zetaproteobacteria: Historical, ecological, and genomic perspectives. *FEMS Microbiol. Ecol.*, 95, fiz015. doi:10.1093/femsec/fiz015 (highlighted as Editor's Choice)
4. Marnocha, C. L.<sup>^</sup>, Sabanayagam, C., Modla, S., Powell, D., Henri, P. A.<sup>^</sup>, Steele, A., Hanson, T. E., **Chan, C. S.\*** (2019) Insights into the mineralogy and surface chemistry of extracellular biogenic S<sup>0</sup> globules produced by *Chlorobaculum tepidum*. *Front. Microbiol.* 10:271. doi: 10.3389/fmicb.2019.00271
5. McAllister, S. M.<sup>^</sup>, Moore, R. M., **Chan, C. S.** (2018) ZetaHunter, a reproducible taxonomic classification tool for tracking the ecology of the *Zetaproteobacteria* and other poorly resolved taxa, *Microbiol. Resour. Announc.*, doi:10.1128/MRA.00932-18. (highlighted on ASM web page/blog as MRA of the month)
6. Beam, J., Scott, J. J., McAllister, S. M.<sup>^</sup>, **Chan, C. S.**, McManus, J., Meysman, F. and Emerson, D. (2018) Potential for biological rejuvenation of iron oxides in bioturbated marine sediments. *ISME J*, 12:1389-1394. doi:10.1038/s41396-017-0032-6.
7. Chiu, B. K.<sup>^</sup>, Kato, S.<sup>^</sup>, McAllister, S. M.<sup>^</sup>, Field, E. K.<sup>^</sup>, **Chan, C. S.\*** (2017) Novel pelagic iron-oxidizing Zetaproteobacteria from the Chesapeake Bay oxic-anoxic transition zone, *Front. Microbiol.*, 8:1280. doi:10.3389/fmicb.2017.01280.
8. Percak-Dennett, E., He, S., Converse, B., Konishi, H., Xu, H., Corcoran, A., Noguera, D. R., **Chan, C. S.**, Bhayyacharya, A., Borch, T., Boyd, E.S., Roden, E. (2017) Aerobic microbial pyrite oxidation at circumneutral pH, *Geobiology*, 15:690-703. doi:10.1111/gbi.12241.
9. **Chan, C. S.\***, Emerson, D., Luther, III, G. W. (2016) The role of microaerophilic Fe-oxidizing microorganisms in producing banded iron formations, *Geobiology*, 14:509-528. doi: 10.1111/gbi.12192.
10. Field, E. K.<sup>^</sup>, Kato, S.<sup>^</sup>, Findlay, A. J., MacDonald, D. J., Luther, III, G. W., **Chan, C. S.\*** (2016) Planktonic marine iron-oxidizers drive iron mineralization under low oxygen conditions, *Geobiology*, 14:499-508. doi:10.1111/gbi.12189.
11. **Chan, C. S.\***, McAllister, S. M.<sup>^</sup>, Leavitt, A. H., Glazer, B. T., Krepski, S. T.<sup>^</sup>, Emerson, D. (2016) The architecture of iron microbial mats reflects the adaptation of chemolithotrophic iron oxidation in freshwater and marine environments, *Front. Microbiol.* 7:796. doi:10.3389/fmicb.2016.00796.
12. Marnocha, C. L.<sup>^</sup>, Powell, D. H., Levy, A. T., Hanson, T. E., **Chan, C.S.\*** (2016) Mechanisms of extracellular S(0) globule production and degradation in *Chlorobaculum tepidum* via dynamic cell-globule interactions, *Microbiology*, 162:1125-1134. doi: 10.1099/mic.0.000294.

13. Hanson, T. E., Bonsu, E., Tuerk, A., Marnocha, C. L.<sup>^</sup>, **Chan, C.S.** (2016) *Chlorobaculum tepidum* growth on biogenic S(0) as the sole photosynthetic electron donor, *Env. Microbiol.*, doi: 10.1111/1462-2920.12995.
14. Kato, S.<sup>^</sup>, Ohkuma, M., Powell, D. H., Krepski, S. T.<sup>^</sup>, Oshima, K., Hattori, M., Shapiro, N., Woyke, T., **Chan, C. S.\*** (2015) Comparative genomic insights into ecophysiology of neutrophilic, microaerophilic iron oxidizing bacteria, *Front. Microbiol.*, 6:1265. doi: 10.3389/fmicb.2015.01265.
15. McAllister, S. M.<sup>^</sup>, Barnett, J. M.<sup>^</sup>, Heiss, J. W., Findlay, A. J., MacDonald, D. J., Dow, C. L., Luther, III, G. W., Michael, H. A., **Chan, C. S.\*** (2015) Dynamic hydrologic and biogeochemical processes drive microbially enhanced iron and sulfur cycling within the intertidal mixing zone of a beach aquifer, *Limnol. Oceanogr.* 60:329-345.
16. Ruocco, M. H. W., **Chan, C. S.**, Hanson, T. E., Church, T. M. (2014) Biotransformation and distribution of selenium in cultures of the marine yeast *Rhodotorula mucilaginosa*-13B, *Geomicrobiol. J.*, 31:769-778.
17. MacDonald, D. J., Findlay, A.J., McAllister, S. M.<sup>^</sup>, Barnett, J. M.<sup>^</sup>, Hredzak-Showalter, P., Krepski, S. T.<sup>^</sup>, Cone, S. G.<sup>^</sup>, Scott, J., Bennett, S. K., **Chan, C. S.**, Emerson, D., Luther, G. W. (2014) Using in situ voltammetry as a tool to search for iron oxidizing bacteria: from fresh water wetlands to hydrothermal vent sites, *Env. Sci. Process. Impact.* 16:2117-2126.
18. Sawyer, A. H., Lazareva, O., Kroeger, K., Crespo, K., Stieglitz, T., **Chan, C. S.**, Michael, H. A. (2014) Shallow stratigraphic controls on fluid and solute fluxes across the sediment-water interface of an estuary, *Limnol. Oceanogr.*, 59:997-1010.
19. Kato, S.<sup>^</sup>, Krepski, S. T.<sup>^</sup>, **Chan, C. S.**, Itoh, T., Ohkuma, M. (2014) *Ferriphaselus amnicola* gen. nov., sp. nov., a neutrophilic, stalk-forming, iron-oxidizing bacterium isolated from an iron-rich groundwater seep. *IJSEM*, 64:921-925.
20. Fleming, E. J., Cetinic, I., **Chan, C. S.**, King, D. W., Emerson, D. (2014) Ecological succession among Fe-oxidizing bacteria. *ISME J.*, 8:804-815.
21. Kato, S.<sup>^</sup>, **Chan, C. S.**, Itoh, T. Ohkuma, M. (2013) Functional gene analysis of freshwater iron-rich flocs at circumneutral pH and isolation of a stalk-forming microaerophilic iron-oxidizing bacterium. *Appl. Environ. Microbiol.*, 79:5283-5290.
22. Krepski, S. T.<sup>^</sup>, Emerson, D., Hredzak-Showalter, P. L., Luther, G. W. and **Chan, C. S.\*** (2013) Morphology of biogenic iron oxides records microbial physiology and environmental conditions: toward interpreting iron microfossils. *Geobiology*, 11:457-471.
23. Fleming, E. J., Davis, R., McAllister, S., **Chan, C. S.**, Moyer, C. L., Tebo, B., Emerson, D. (2013) Hidden in plain sight: discovery of sheath-forming, Fe-oxidizing Zetaproteobacteria at Loihi Seamount. *FEMS Microbiol. Ecol.*, 85: 116-127.
24. Saini, G.<sup>^</sup> and **Chan, C. S.\*** (2013) Near-neutral surface charge and hydrophilicity prevent mineral encrustation of Fe-oxidizing microorganisms. *Geobiology*, 11:191-200.
25. Krepski, S. T.<sup>^</sup>, Hanson, T. E., **Chan, C. S.\*** (2012) Isolation and characterization of a novel biomineral stalk-forming iron-oxidizing bacterium from a circumneutral groundwater seep, *Environ. Microbiol.*, 14(7):1671-1680.

26. Singer, E., Emerson, D., Webb, E.A., Kuenen, J. G., Nelson, W. C., Barco, R. A., **Chan, C. S.**, Comolli, L. R., Heidelberg, J. F., Ferriera, S., Johnson, J., Edwards, K. J. (2011) *Mariprofundus ferrooxydans* PV-1 The first genome of a marine Fe(II) oxidizing Zetaproteobacterium, *PLoS One*, 6(9): e25386.
27. Comolli, L. R., Luef, B, **Chan, C. S.\*** (2011) High resolution 2D and 3D cryo-TEM reveals structural adaptations of two stalk-forming bacteria to an Fe-oxidizing lifestyle, *Environ. Microbiol.*, 13(11): 2915-2929.
28. Yücel, M., Gartman, A., **Chan, C. S.**, Luther, III, G. W. (2011) Hydrothermal vents as a kinetically stable pyrite (FeS<sub>2</sub>) nanoparticle source to the ocean, *Nature Geoscience*, 4: 367-371.
29. Edwards, K. J., Glazer, B. T., Rouxel, O. J., Bach, W., Emerson, D., Davis, R. E., Toner, B. M., **Chan, C. S.**, Tebo, B. M., Staudigel, H., Moyer, C. L. (2011) Ultra-diffuse hydrothermal venting supports Fe-oxidizing bacteria and massive umber deposition at 5000m off Hawai'i. *ISME J.*, 5: 1748–1758.
30. **Chan, C. S.\***, Fakra, S. C., Emerson, D., Fleming, E. J., Edwards, K. J. (2011) Lithotrophic iron-oxidizing bacteria produce organic stalks to control iron mineral growth: Implications for biosignature formation, *ISME J.*, 5: 717-727.

#### **Prior to the University of Delaware**

31. **Chan, C. S.\***, Fakra, S., Edwards, D. C., Emerson, D. Banfield, J. F. (2009) Iron oxyhydroxide mineralization on microbial polysaccharides. *Geochim. Cosmochim. Acta*, **73**: 3807-3818.
32. Toner, B. M., Santelli, C. M., Marcus, M. A., Wirth, R., **Chan, C. S.**, McCollom, T., Bach, W., Edwards, K. J. (2009) Biogenic iron oxide formation at mid-ocean ridge hydrothermal vents: Juan de Fuca Ridge. *Geochim. Cosmochim. Acta*, 73: 388-403.
33. Singer, S. W., **Chan, C. S.**, Zemla, A., VerBerkmoes, N. C., Hwang, M. H., Hettich, R. L., Banfield, J. F., Thelen, M. P. (2008) Characterization of cytochrome 579, an unusual cytochrome isolated from an iron-oxidizing microbial community. *Appl. Environ. Microbiol.* 74: 4454-4462.
34. Jeans, C., Singer, S. W., **Chan, C. S.**, VerBerkmoes., N. C., Hettich, R. L., Banfield, J. F., Thelen, M. P. (2008) Cytochrome 572 is a conspicuous membrane protein with iron oxidation activity purified directly from a natural acidophilic microbial community. *ISME J.*, 2: 542-50.
35. Emerson, D., Rentz, J. A., Lilburn, T. G., Davis, R. E., Aldrich, H., **Chan, C.**, Moyer, C. L. (2007) A novel lineage of proteobacteria involved in formation of marine Fe-oxidizing microbial mat communities. *PLoS One*, 2: e667.
36. **Chan, C. S.**, de Stasio, G., Welch, S. A., Girasole, M., Frazer, B., Nesterova, M., Fakra, S. Banfield, J. F. (2004) Microbial polysaccharides template assembly of nanocrystal fibers. *Science*, 303: 1656-1658.
37. Banfield, J. F., Moreau, J. W., **Chan, C. S.**, Welch, S. A. Little, B. (2001) Mineralogical biosignatures and the search for life on Mars. *Astrobiology*, 1: 447-467.

#### **Research Funding and Support**

Total: \$3,827,720 to Chan Lab since 2009 at Univ. of Delaware

#### **Current projects**

1. Developing a functional marker gene for Fe oxidation  
PI Chan, with co-PI Shawn Polson and collaborators Denise Akob, Kirsten Küsel  
NSF Geobiology and Low Temperature Geochemistry, EAR-1833525  
2018-2021
2. Collaborative Research: Unravelling mechanisms of Fe oxidation using synthetic biology and biochemistry  
Lead PI Chan, with co-PI Sharon Rozovsky, collaborator Jeffrey Gralnick  
NSF Molecular and Cellular Biosciences – Systems and Synthetic Biology, BIO-1817651  
2018-2021
3. Life on clays: Evaluating Fe(II)-smectites as electron donors on the early Earth and on other planetary bodies  
co-PI Chan, with PI Jeffrey Catalano  
NASA Exobiology 80NSSC18K1292, WU-19-50  
2018-2021
4. Coupling metabolism to mineralogical scaffolding for understanding nano-material production in metal-oxidizing bacteria  
PI Chan  
ONR N00014-17-1-2640  
2017-2020
5. Impacts of rice cultivation practices on carbon and iron cycling: Unraveling functional microbial diversity in rice paddy rhizocompartments subject to silica-rich rice residue amendment  
co-PI Chan, with Angelia Seyffferth  
DOE JGI Community Sequencing Program, Small Scale Microbial/Metagenome  
2017-
6. Clash of cultures: Development of Fe(II)-oxidizing microbial activities upon intrusion of acid mine drainage into soil  
co-PI Chan, with Shagun Sharma and John Senko  
DOE JGI Community Science Program, New Investigator  
2019-

### **Projects completed at the University of Delaware**

1. CAREER: Rusting the Earth: the mechanisms and mineralogy of microbial Fe oxidation  
PI Chan  
NSF Geobiology and Low Temperature Geochemistry, #1151682  
2012-2018
2. Genome-enabled investigation of S<sup>0</sup> cycling in a subterranean microbial ecosystem  
Collaborative PI Chan, with Project PI J. Macalady  
NSF Geobiology and Low Temperature Geochemistry, #1251918  
2013-2017
3. S(0) globule metabolism in *Chlorobaculum tepidum*: interdisciplinary studies of a novel microbe mineral interaction  
Co-PI Chan, with PI T. Hanson  
NSF Molecular and Cellular Biosciences, #1244373  
2013-2017

4. Collaborative Research: Ecology of microbial mats at seamount associated Fe-rich hydrothermal vent systems  
Collaborative PI Chan, with Project PI D. Emerson and collaborative PI C. Moyer  
NSF Biological Oceanography, #1155290  
2012-2017
5. Development of biogenicity criteria and paleoenvironmental interpretations for iron microfossils based on the morphology, physiology and behavior of modern iron-oxidizing bacteria  
PI Chan with co-PIs G. Luther and D. Emerson  
NASA Exobiology, NNX12AG20G  
2012-2017
6. Christina River Basin CZO: a whole watershed approach to integrating feedbacks between water, mineral and carbon fluxes in human landscapes  
NSF Critical Zone Observatories, #1331856  
2014-2015
7. The effects of Fe- and S-oxidizing microorganisms on post-biostimulation permeability reduction and oxidative processes at the Rifle IFRC site  
PI Chan  
DOE Subsurface Biogeochemical Research, DE-DC0007116  
2011-2014
8. Sequencing a neutrophilic Fe-oxidizing, biomineral stalk-forming Gallionellales strain R-1  
PI Chan  
DOE JGI Community Sequencing Program, CSP760  
2011- 2014
9. Biogenic elemental sulfur: integrating nanoscale imaging and molecular microbiology to understand an environmentally and biotechnologically important mineral  
PI Chan with co-PI T. Hanson  
UDRF Strategic Initiatives, #12A00319  
2011-2013
10. Linking microbial Fe oxidation and hydrology of groundwater-surface water interfaces at the Christina River Basin Critical Zone Observatory  
Delaware NSF EPSCoR seed grant  
PI Chan with co-PI Holly Michael  
2012-2013
11. Mineral biosignatures of Fe-oxidizing bacteria: towards detecting and interpreting evidence of early life on Earth and other planets  
PI Chan with co-PI G. Luther  
Delaware NASA EPSCoR seed grant  
2011-2012
12. Surface characterization of an iron-oxidizing bacterium by atomic force microscopy  
PI with postdoc Gaurav Saini  
Delaware EPSCoR minigrant  
2010

**Prior to the University of Delaware**

1. Linking genetics and mineralization of iron-oxidizing microbes at midocean ridges

NSF Ridge 2000 postdoctoral fellowship  
2006-2008

2. Biomineralogy and ultrastructure of neutrophilic iron-oxidizing bacteria  
Environmental Molecular Sciences Laboratory, Pacific Northwest National Lab  
2006  
Cryoelectron and high resolution transmission electron microscope time (2 weeks)
3. Microbial polymer templation of iron oxide mineralization in biofilms and biomimetic synthesis: a STXM investigation  
Advanced Light Source beamtime  
2004

## **Presentations**

### ***Invited seminars***

1. University of Minnesota Dept. of Earth Sciences, January 24 and 25, 2019.
2. University of Tübingen Kappler Geomicrobiology Group, July 26, 2018.
3. Dartmouth College Dept. of Earth Sciences, April 27, 2018.
4. Princeton University Dept. of Geosciences, April 17, 2018.
5. Pennsylvania State University Environmental Chemistry and Microbiology Student Symposium keynote, April 13, 2018.
6. Mineralogical Society of America Distinguished Lecture tour
  - a. January 2018: University of New Mexico, New Mexico Tech.
  - b. March 2018: University of Delaware, Washington and Lee, Wofford College
  - c. April 2018: Washington University St. Louis, University of Missouri
7. University of Akron Dept. of Geosciences, April 13, 2017.
8. Massachusetts Institute of Technology Dept. of Geological and Planetary Sciences, September 28, 2016.
9. California Institute of Technology Dept. of Geological and Planetary Sciences, October 5, 2015.
10. University of Connecticut Dept. of Civil and Environmental Engineering, November 8, 2013.
11. Bigelow Laboratory for Ocean Sciences, July 11, 2013.
12. Louisiana State University Dept. of Geology and Geophysics, April 12, 2013.
13. Carnegie Institution of Washington Geophysical Laboratory, November 5, 2012.
14. Stroud Water Research Center, PA, June 5, 2012.
15. Smithsonian Museum of Natural History Dept. of Mineral Sciences, May 3, 2012.
16. Regional Microbiology Educators 8th Annual Student Research Symposium, Swarthmore College, keynote speaker July 21, 2011.



17. Franklin Medal symposium in honor of recipient Jill Banfield, Franklin Institute/Univ. of Pennsylvania, April 27, 2011.
18. Appalachian State University Depts. of Geology and Biology seminar, April 20, 2011.
19. Pennsylvania State University Dept. of Geosciences, October 5, 2010.
20. Rutgers University, Dept. of Environmental Sciences seminar, October 2, 2009.

***Invited seminars, prior to University of Delaware***

21. Woods Hole Oceanographic Institution Geochemistry seminar, June 10, 2008.
22. Johns Hopkins Dept. of Earth and Planetary Sciences, April 15, 2008.
23. Maine Geological Society annual meeting keynote speaker, April 11, 2008.
24. University of Delaware Dept. of Geological Sciences, March 13, 2008.
25. University of Minnesota Dept. of Geology and Geophysics, January 28, 2008.
26. University of Connecticut Center for Integrative Geosciences, October 9, 2007.
27. Pacific Northwest National Laboratory, November 17, 2006.
28. University of Vermont Department of Geology, October 16, 2006.

***Invited talks at meetings*** (^Chan lab member)

1. **Chan, C. S.**, How microbes make and break minerals, Geobiology Gordon Research Conference, Galveston, TX, January 2020.
2. **Chan, C. S.**, McAllister, S. M.^, Vandzura, R.^, Henri, P. A.^, Pavia, M.^, Polson, S. W., Macalady, J. L. How do microbes make minerals in the environment? Geological Society of America Annual Meeting, Phoenix, September 2019, *keynote/award talk*.
3. **Chan, C. S.**, McAllister, S. M.^, Vandzura, R.^, Henri, P. A.^, Pavia, M.^, Polson, S. W., Macalady, J. L. How do microbes make minerals in the environment? Tracking iron and sulfur biomineralization using meta-omics and microscopy. Goldschmidt Conference, Barcelona, August 2019, *keynote*.
4. **Chan, C. S.** How microbes make minerals: challenges and adaptations of biomineralization, Microbiology Summer School (Univ. Tübingen), Bad Urach, Germany, July 25, 2018.
5. **Chan, C. S.**, McAllister, S. M.^, Garber, A. K.^, Keffer, J.^, Rozovsky, S. How do microbes oxidize Fe? Insights from 'omics and biochemistry, Fe biogeochemistry workshop, Lech, Austria, 2018.
6. **Chan, C. S.**, McAllister, S. M.^, Garber, A. K.^, Currie, A.^ How microbes oxidize Fe(II), Goldschmidt Conference, Paris, 2017.
7. **Chan, C. S.**, McAllister, S. M.^, Chiu, B. K.^, Field, E. K.^, Kato, S.^, Polson, S. Fe(II) oxidation by Zetaproteobacteria and friends: mechanisms and influences on biogeochemical cycles, American Chemical Society, San Francisco, 2017.

8. **Chan, C. S.**, Henri, P. A.<sup>^</sup>, Marnocha, C. L.<sup>^</sup>, Levy, A. T., Hanson, T. E., Steele, A., Macalady, J. Elemental sulfur biomineralization by phototrophs and chemolithotrophs: model isolate and field studies, American Chemical Society, San Francisco, 2017.
9. **Chan, C. S.**, McAllister, S. M.<sup>^</sup> How do Fe-oxidizing microbes influence biogeochemical cycles? Perspectives from transcriptomics. Goldschmidt Conference, Yokohama, 2016.
10. **Chan, C. S.**, Kato, S.<sup>^</sup>, McAllister, S. M.<sup>^</sup>, Field, E. K.<sup>^</sup>, Gartman, A., Luther, III, G. W. Using modern Fe-oxidizing microbes to unravel the evolutionary and geologic history of Fe oxidation. Goldschmidt Conference, Prague, 2015.
11. **Chan, C. S.** Microbial Fe oxidation in modern and ancient environments. American Society for Microbiology 2015 meeting, New Orleans, *plenary talk*.
12. **Chan, C. S.**, McAllister, S.<sup>^</sup>, Leavitt, A., Emerson, D., Moyer, C. L., Glazer, B. T. Fe-oxidizing microbes are hydrothermal vent ecosystem engineers at the Loihi Seamount. American Geophysical Union Fall 2013 meeting, San Francisco.
13. **Chan, C. S.**, Krepski, S. T.<sup>^</sup>, Hredzak-Showalter, P., Luther, G. W, and Emerson, D. Combining microscopy and voltammetry to link Fe biomineralization with geochemical conditions, American Chemical Society, New Orleans, April 2013.
14. **Chan, C. S.** Microbial Fe oxidation and biomineralization: Visualizing at the nanomineral, pore, and biofilm scales, Soil Science Society of America Conference, Cincinnati, 2012.
15. **Chan, C. S.**, Hanson, T. E., Hiras, J., Cabaniss, K. A.<sup>^</sup> and Brodzinski, J.<sup>^</sup> Challenges of cell-mineral contact during mineral formation and dissolution by Fe and S-oxidizing bacteria, Goldschmidt Conference, Montreal, Canada, 2012.
16. **Chan, C. S.** Visualizing microbial roles in Fe mineral formation, Scandem Annual meeting of the Nordic microscopy society, Bergen, Norway, 2012.
17. **Chan, C. S.**, Saini, G.<sup>^</sup>, Krepski, S. T.<sup>^</sup>, Hredzak-Showalter, P., and Luther, G. W. Architects of rust: Mineral precipitation and evasion strategies of Fe-oxidizing microbes. Geological Society of America 2011 meeting.
18. **Chan, C. S.** Deciphering microbial roles in mineral formation: an interdisciplinary, microscopy-based approach, Goldschmidt Conference 2010, *keynote*.

***Invited talks at meetings, prior to University of Delaware***

19. **Chan, C. S.**, Thelen, M., Hwang, M., and Banfield, J. F. Characterization and localization of iron-oxidizing proteins in acid mine drainage biofilms. American Geophysical Union Fall 2005 meeting.
20. **Chan, C. S.**, Fakra, S., De Stasio, G., and Banfield, J. F. Molecular mechanisms of iron oxyhydroxide biomineralization. American Geophysical Union Fall 2003 meeting.
21. **Chan, C. S.**, Nesterova, M., Welch, S. A., De Stasio, G., and Banfield, J. F. Microbial polymer templation of iron oxyhydroxides. Stanford Synchrotron Radiation Laboratory users meeting 2003.

***On campus seminars and presentations***

1. UD Darwin Day, February 12, 2018

2. Caltech Micromorning, May 11, 2016
3. UD Astrobiology Club, January 18, 2013
4. UD Research Foundation trustees meeting, November 14, 2012
5. Dept. of Biological Sciences seminar, September 12, 2012
6. DENIN external advisory board presentation, March 21, 2012
7. Dept. of Plant and Soil Sciences seminar, February 27, 2009
8. Dept. of Civil and Environmental Engineering seminar, March 25, 2009
9. Biogeochemistry group seminar, April 8, 2009
10. UD chapter of the American Society for Biochemistry and Molecular Biology Undergraduate Affiliate Network, October 19, 2009

**Other presentations** (\*presenter, ^Chan lab member)

1. Michael, H. A.\*, Kim, K. H., Heiss, J., Guimond, J., Ullman, W. J., **Chan, C. S.**, McAllister, S.^ Dynamic hydrologic and biogeochemical hotspots along coastlines as potential targets for biogeophysical investigation. American Geophysical Union Fall meeting, San Francisco, December 2019, *talk*.
2. **Chan, C. S.\*** Coupling metabolism to mineralogical scaffolding for understanding nano-material production in metal-oxidizing bacteria, Office of Naval Research (ONR) Bioscience Program Review, November 2019, *talk*.
3. **Chan, C. S.\***, McAllister, S. M.^, Vandzura, R.^, Polson, S. W. Microbial niches and elemental cycling in hydrothermal vent Fe mats. Goldschmidt Conference, Barcelona, August 2019, *talk*.
4. Keffer, J. L.^\*, McAllister, S. M.^, Rozovsky, S., **Chan, C. S.** What is the iron oxidase in neutrophilic iron-oxidizing bacteria? American Society of Microbiology Microbe, San Francisco, June 2019, *poster*.
5. Vandzura, R.^\*, McAllister, S.^, Polson, S., **Chan, C. S.** Microbial and viral roles in hydrothermal vent Fe mat elemental cycling and ecology at the Loihi Seamount, American Society of Microbiology Microbe, San Francisco, June 2019, *poster*.
6. Hallenbeck, M.^\*, Zhou, N.^, Akob, D., Küsel, K., **Chan, C. S.** Comparative genomic analysis of *Thiomonas* isolates from acid mine drainage, AGU Fall Meeting, Washington, D. C., December 2018, *poster*.
7. McAllister, S. M.^\*, Polson, S., Sylvan, J., Glazer, B. T., **Chan, C. S.** Meta-omic approaches at mid-ocean hydrothermal vents reveal biogeochemical roles of the Zetaproteobacteria in Fe mineralizing ecosystems, AGU Fall Meeting, Washington, D. C., December 2018, *talk*.
8. Pavia, M. J.^\*, Henri, P. A.^, Polson, S., Macalady, J. L., **Chan, C. S.** Metagenomic and metatranscriptomic analysis of S(0) rich microbial community reveals genetic diversity and ecological success of the genus *Sulfurovum*, AGU Fall Meeting, Washington, D. C., December 2018, *poster*.
9. Vandzura, R.^\*, McAllister, S.^, Polson, S., **Chan, C. S.** Microbial and viral roles in hydrothermal vent Fe mat elemental cycling and ecology at the Loihi Seamount, AGU Fall Meeting, Washington, D. C., December 2018, *poster*.

10. Zhou, N.<sup>^\*</sup>, McAllister, S.<sup>^</sup>, Polson, S., **Chan, C. S.** Developing model neutrophilic iron-oxidizing microbes for exploring Fe oxidation pathways by transcriptomics, AGU Fall Meeting, Washington, D. C., December 2018, *poster*.
11. Garber, A.<sup>^\*</sup>, McAllister, S. M.<sup>^</sup>, Hallahan, B. J.<sup>^</sup>, Keffer, J.<sup>^</sup>, Rozovsky, S., **Chan, C. S.** Fe oxidation by a fused porin-cytochrome common to diverse Fe-oxidizing bacteria. Northeast Geobiology Symposium, Woods Hole, MA, April 2018, *talk*.
12. Vandzura, R.\*, McAllister, S., Polson, S., **Chan, C. S.** Bacteriophage in Hydrothermal Vent Iron Mats: a metagenomic analysis. Northeast Geobiology Symposium, Woods Hole, MA, April 2018, *poster*.
13. **Chan, C. S.\*** Coupling metabolism to mineralogical scaffolding for understanding nano-material production in metal-oxidizing bacteria, ONR Bioscience Program Review, March 2018, *talk*.
14. Dykes, G. E.<sup>^\*</sup>, **Chan, C. S.**, Seyfferth, A. L. Silicon addition to rice paddy soils impacts arsenic biogeochemical cycling: implications for global food security. Joint Genome Institute Genomics of Energy and Environment Meeting, March 2018, *poster*.
15. **Chan, C. S.\***, McAllister, S. M.<sup>^</sup>, Garber, A.<sup>^</sup>, Hallahan, B. J.<sup>^</sup>, Rozovsky, S. Fe oxidation by a fused porin-cytochrome common to diverse Fe-oxidizing bacteria. Geobiology Gordon Research Conference, January 2018, *poster*.
16. **Chan, C. S.\***, McAllister, S. M.<sup>^</sup>, Polson, S. W. Using marine Fe mat meta-omics to gain insights into Zetaproteobacteria functional diversity, ecological interactions, and biogeochemical roles, International Symposium on Chemosynthesis-Based Ecosystems, Woods Hole, August 2017, *talk*.
17. Henri, P. A.<sup>^\*</sup>, **Chan, C. S.**, Macalady, J., Webb, S., Steele, A., Elucidating the role of chemolithotrophic sulphide-oxidizers in the formation of S(0) deposits, Goldschmidt Conference, Paris, 2017, *poster*.
18. Field, E. K.<sup>^\*</sup>, Hoppes, K.<sup>^</sup>, Kim, K., Michael, H. A., Hanson, T. E., **Chan, C. S.**, Multi-talented microbes drive Fe, S, N, and C cycling in an intertidal coastal aquifer: a metagenomic study, Goldschmidt Conference, Paris, 2017, *talk*.
19. Marnocha, C. L.<sup>^\*</sup>, Henri, P. A.<sup>^</sup>, Sabanayagam, C., Modla, S., Powell, D., Hanson, T. E., Steele, A., **Chan, C. S.** What makes biogenic sulfur special? Insights into surface chemistry and mineralogy of sulfur globules, Goldschmidt Conference, Paris, 2017, *poster*.
20. Emerson D.\*, **Chan C. S.**, Barco R. Implications for extracellular iron-oxidation and production of biogenic iron oxides by Fe-oxidizing bacteria, Goldschmidt Conference, Paris, 2017, *talk*.
21. Levy, A. T.\*, Marnocha, C.<sup>^</sup>, **Chan, C. S.**, Lee, K., Hanson, T. New insights into the physical characteristics and (bio)chemical make-up of S<sup>0</sup> globules from *Chlorobaculum tepidum*. Applied and Environmental Microbiology Gordon Research Conference, 2017, *talk*.
22. McAllister, S. M.<sup>^\*</sup>, Sylvan, J., Polson, S., **Chan, C. S.** Meta-omics of hydrothermal Fe microbial mats reveal Zetaproteobacteria functional diversity and interactions within the mat microbial community, Applied and Environmental Microbiology Gordon Research Seminar, 2017, *poster*.

23. Pavia, M. J.<sup>^\*</sup>, Henri, P. A.<sup>^</sup>, Macalady, J. L., Polson, S., **Chan, C. S.** Colonization of sulfur oxidizing biofilms in the Frassasi Cave System, a Meta-omics approach. Astrobiology Graduate Conference, 2017, *poster*.
24. Garber, A.<sup>^\*</sup>, McAllister, S., Hallahan, B., Rozovsky, S., **Chan, C. S.** Cytochrome Cyc2: A putative Fe oxidase and possible marker for Fe-oxidizing bacteria. Astrobiology Graduate Conference, 2017, *poster*.
25. Chiu, B. K.<sup>^\*</sup>, Field, E. K.<sup>^</sup>, Kato, S.<sup>^</sup>, McAllister, S. M.<sup>^</sup>, Luther, III, G. W., **Chan, C. S.** Novel Fe-oxidizing Zetaproteobacteria floating in the Chesapeake: kinetics and genomic insights into microbial Fe cycling in a stratified marine water column, American Geophysical Union Fall 2016 meeting, *poster*.
26. **Chan, C. S.\*** Kinetics, transcriptomics and biochemical approaches to understanding neutrophilic Fe oxidation, Telluride Iron Biogeochemistry Workshop August 2016, *talk*.
27. McAllister, S. M.<sup>^\*</sup>, Polson, S., **Chan, C. S.** Metatranscriptomics of Zetaproteobacteria at marine hydrothermal vents: ecological and biogeochemical interactions, ISME Conference, Montreal, August 2016, *poster*.
28. Marnocha, C. L.<sup>^</sup>, Hanson, T. E., Powell, D. H., Sabanayagam, C. R., Tuerk, A. L., **Chan, C. S.\*** Elemental sulfur biomineralization and dissolution by the phototroph *Chlorobaculum tepidum*, ISME Conference, Montreal, August 2016, *poster*.
29. Field, E. K.<sup>^\*</sup>, Hoppes, K. L.<sup>^</sup>, Kim, K. H. K., Michael, H. A., Hanson, T. E., **Chan, C. S.** Just another Day at the Beach? The Microbial Role in Iron and Sulfur Cycling in a Beach Aquifer System, ISME Conference, Montreal, August 2016, *poster*.
30. McAllister, S. M.<sup>^\*</sup>, Polson, S., **Chan, C. S.** Metatranscriptomics of Zetaproteobacteria at marine hydrothermal vents: ecological and biogeochemical interactions, Southern California Geobiology Conference, May 2016, *poster*.
31. Chiu, B. K.<sup>^\*</sup>, Field, E. K.<sup>^</sup>, Kato, S.<sup>^</sup>, **Chan, C. S.** Using kinetics to demonstrate a novel iron-oxidizing bacteria's potential link to the deposition of banded iron formations Northeastern Geobiology Conference, April 2016, *poster*.
32. Marnocha, C. L.<sup>^</sup>, Hanson, T. E., Powell, D. H., Sabanayagam, C. R., Tuerk, A. L., **Chan, C. S.\*** Elemental sulfur biomineralization and dissolution by the phototroph *Chlorobaculum tepidum*, Kavli Frontiers in Science symposium, Potsdam Germany, March 2016, *poster*.
33. Marnocha, C. L.<sup>^</sup>, Hanson, T. E., Powell, D. H., Sabanayagam, C. R., Tuerk, A. L., **Chan, C. S.\*** Elemental sulfur biomineralization and dissolution by the phototroph *Chlorobaculum tepidum*, Geobiology Gordon Research Conference, Galveston, February 2016, *poster*.
34. McAllister, S. M.<sup>^</sup>, Polson, S. W., Glazer, B. T., **Chan, C. S.** Using metatranscriptomics to understand the roles of Fe(II)-oxidizing microbes in marine hydrothermal vents. American Geophysical Union Fall 2015 meeting, *poster*.
35. **Chan, C. S.**, McAllister, S. M.<sup>^</sup>, Leavitt, A. H., Glazer, B. T., and Emerson, D. Using intact iron microbial mats to gain insights into mat ecology and geochemical niche at the microbial scale. American Geophysical Union Fall 2015 meeting, *poster*.

36. **Chan, C. S.\***, Field, E. K., Kato, S., Gartman, A., Emerson, D., and Luther, III, G. W. The role of microaerophilic Fe-oxidizing microorganisms in producing banded iron formations, Geological Society of America conference, Baltimore, November 2015, *poster*.
37. Hoppes, K. A.^\*, **Chan, C. S.**, Cabaniss, K. A.^, Williams, K. H., Moore, M., Caplan, J., Michael, H. A., Caplan, J., Microbial iron oxidation and contribution to Fe oxide coatings in aquifer sediment, Geological Society of America conference, Baltimore, November 2015, *poster*.
38. Marnocha, C. L.^\*, Powell, D. H., Sabanayagam, C. R., Tuerk, A. L., Hanson, T. E., **Chan, C. S.** Spatial relationships and physical dynamics of *Chlorobaculum tepidum* and extracellular S(0) globules, Geological Society of America conference, Baltimore, November 2015, *talk*.
39. Marnocha, C. L.^\*, Hanson, T. E., Powell, D. H., Sabanayagam, C. R., **Chan, C. S.** *C. tepidum*-S<sup>0</sup> globule interactions: some attachment required, Goldschmidt conference, Prague, August 2015, *poster*.
40. Field, E. K.^\*, Kato, S., Findlay, A. J., MacDonald, D. J., Luther, III, G. W., **Chan, C. S.** Microaerophilic iron-oxidizing bacteria and oxygenic phototrophs in the Chesapeake Bay: implications for microbial roles in the production of ancient iron formations, Goldschmidt conference, Prague, August 2015, *talk*.
41. Kato, S.^\*, Moriya, O., **Chan, C. S.** Genetic markers for neutrophilic iron oxidation and biomineralization determined by comparative genomics, Applied and Environmental Microbiology Gordon Conference, July 2015.
42. McAllister, S. M.^\*, Sylvan, J. B., **Chan, C. S.** Comparative metatranscriptomics of marine Fe microbial mats: toward determining the mechanism(s) of neutrophilic Fe(II) oxidation and the activity of other biogeochemical cycles in marine Fe-rich habitats, Applied and Environmental Microbiology Gordon Conference, July 2015.
43. Field, E. K.^\*, Kato, S., Findlay, A. J., MacDonald, D. J., Luther, III, G. W., **Chan, C. S.** Microaerophilic iron-oxidizing bacteria and oxygenic phototrophs in the Chesapeake Bay: implications for microbial roles in the production of ancient iron formations, Astrobiology Science Conference, June 2015, *talk*.
44. McAllister, S. M.^\*, Leavitt, A. H., Kato, S.^, Sylvan, J. B., Emerson, D., **Chan, C. S.** Iron microbial mat morphological and genetic signatures: clues to the ecology and mechanisms of chemolithotrophic iron-oxidizers in freshwater and marine environments, Astrobiology Science Conference, June 2015, *talk*.
45. Marnocha, C. L.^\*, **Chan, C. S.**, Hanson, T. E. *C. tepidum*-S<sup>0</sup> globule interactions: some attachment required, Northeast Geobiology Symposium, February 2015, *poster*.
46. Field, E. K.^\*, Kato, S.^, Findlay, A. J., MacDonald, D. J., Luther, III, G. W., **Chan, C. S.** Microaerophilic Iron-Oxidizing Bacteria and oxygenic phototrophs in the Chesapeake Bay, an Ancient Ocean Analog, Northeast Geobiology Symposium, February 2015, *talk*.
47. McAllister, S. M.^\*, Barnett, J. M.^, Heiss, J. W., Findlay, A. J., MacDonald, D. J., Dow, C. L., Luther, III, G. W., Michael, H. A., and **Chan, C. S.\*** (2015) Dynamic hydrologic and biogeochemical processes drive microbially enhanced iron and sulfur cycling within the intertidal mixing zone of a beach aquifer, Northeast Geobiology Symposium, February 2015, *poster*.

48. Kato, S<sup>^\*</sup>, Chan, C. S., Ohkuma M. Genomic insights into ecophysiology of freshwater neutrophilic biomineral-producing iron-oxidizing bacteria, Northeast Geobiology Symposium, February 2015, *poster*.
49. **Chan, C. S.\***, Cabaniss, K. A.<sup>^</sup>, Williams, K. H., Moore, M., Michael, H. A., Caplan, J., Lin, C.<sup>^</sup>, Fe-oxidizing microorganisms in microscopic model aquifer systems: feedbacks between flow and biomineralization, Ninth International Symposium on Subsurface Microbiology, October 2014, *talk*.
50. McAllister, S. M.<sup>^</sup>, Barnett, J. M.<sup>^</sup>, Findlay, A., MacDonald, D., Luther G. W., Michael, H. A., and **Chan, C. S.\*** Interplay between Fe- and S-cycling microbial communities, geochemistry, and hydrology in the intertidal mixing zone of a beach aquifer, Ninth International Symposium on Subsurface Microbiology, October 2014, *poster*.
51. Percak-Dennett, E., Roden, E.\*, Xu, H., Konishi, H., **Chan, C.**, Bhattacharyya, A., Borch, T. Microbial chemolithoautotrophic oxidation of pyrite at neutral pH. Goldschmidt Conference, June 2014, *invited talk*.
52. Vander Roost, J.\*, **Chan, C.**, Pedersen, R. B., Steen, I. H., Thorseth, I., Dahle, H. Distribution of Iron Oxidizers in the Jan Mayen Vent Field, Biosignatures across space and time: Joint meeting of the Nordic Network of Astrobiology and the Centre of Geobiology, May 20-22, 2014.
53. McAllister, S. M.<sup>^\*</sup>, Barnett, J. M.<sup>^</sup>, Findlay, A., MacDonald, D., Luther G. W., Michael, H. A., and **Chan, C. S.** Interplay between iron- and sulfur- cycling microbial communities and geochemistry along ecosystem gradients in the intertidal mixing zone of a beach aquifer. Ocean Sciences meeting 2014, *talk*.
54. **Chan, C. S.\***, Lin, C., Kan, J., McAllister, S. M., Krepski, S. T., Lazareva, O. A novel Fe(II)-oxidizing Epsilonproteobacterium isolated from a streambank aquifer. American Geophysical Union Fall 2013 meeting, *poster*.
55. Sawyer, A. H.\*, Lazareva, O., **Chan, C. S.**, Crespo, K., Stieglitz, T. C., and Michael, H. A. Shallow stratigraphic controls on fluid and solute fluxes across the sediment-water interface of an estuary, American Geophysical Union Fall 2013 meeting, *invited poster*.
56. Cabaniss, K. A.<sup>^</sup>, **Chan, C. S.\***, Moore, M., Lin, C.<sup>^</sup>, Williams, K. H. Fe-oxidizing microorganisms in microscopic model aquifer systems: toward understanding post-biostimulation permeability reduction and oxidative processes at the Rifle IFRC site, DOE TES/SBR PI meeting, May 14, 2013, *poster*.
57. **Chan., C. S.\*** and Lin, C. Exploring the diversity and distribution of aerobic Fe-oxidizing microorganisms in groundwater-surface water transition zones. Monte Verità Conference on Iron Biogeochemistry 2013, *talk*.
58. Krepski, S. T.<sup>^</sup>, Hredzak-Showalter, P. L., Emerson, D., Luther, G. W., **Chan, C. S.\***, Fe-oxidizing microbial biosignatures record microaerobic environments, Geobiology Gordon Research Conference 2013, *poster*.
59. **Chan, C. S.\*** Microbial Fe oxidation and mineral formation in modern and ancient environments, Telluride Iron Biogeochemistry Workshop August 2012, *talk*.

60. Krepski, S. T.<sup>^\*</sup>, Hredzak-Showalter, P. L., Emerson, D., Luther, G. W., **Chan, C. S.**, Biogenicity of iron microfossils based on the morphology, physiology, and behavior of modern iron-depositing bacteria, Goldschmidt Conference June 2012, *poster*.
61. Hredzak-Showalter, P. L.<sup>\*</sup>, S. T. Krepski.<sup>^</sup>, G. W. Luther III, **C. S. Chan** and D. E. Emerson. The Coupling of Voltammetric Microelectrodes with Optical Microscopy: A Novel Combination as Applied to the Study of Neutrophilic Iron Oxidizers, Goldschmidt conference, Montreal, Canada, June 27, 2012, *talk*.
62. Hiras, J., Hess, D., **Chan, C. S.** and Hanson, T.E.<sup>\*</sup> Small molecules with big roles in phototrophic bacteria. BIOFUME: Biodiversity and functioning of marine ecosystems, 3rd Banuyls-Delaware Workshop. Observatoire Océanologique, Banyuls sur Mer, France, *talk*.
63. **Chan, C. S.**<sup>\*</sup>, Cabaniss, K. A.<sup>^</sup>, Lin, C.<sup>^</sup>, Williams, K. H. Isolation of Fe-oxidizing microorganisms from the Rifle IFRC site: toward understanding post-biostimulation permeability reduction and oxidative processes DOE SBR PI meeting, May 1, 2012, *poster*.
64. Luther, G. W.<sup>\*</sup>, A. Gartman, M. Yücel and **C. S. Chan**. Metal sulfide nanoparticles in the marine environment, meeting of the American Chemical Society, San Diego, CA, March 27, 2012, *invited talk*.
65. Gartman, A.<sup>\*</sup>, M. Yücel, **C. S. Chan** and G. W. Luther, III. Pyrite nanoparticles from hydrothermal vents are a potential source of iron to the ocean, 2012 Ocean Sciences Meeting, Salt Lake City, UT, February 23, 2012.
66. Krepski, S. T.<sup>^\*</sup>, Hredzak-Showalter, P. L., Luther, G. W., and **Chan, C. S.** Micro-scale morphology and texture of biogenic iron oxide mats provide a physical record of microbial physiology and oxygen conditions. American Geophysical Union Fall Meeting, December 2011, *poster*.
67. Saini, G.<sup>^</sup> and **Chan, C. S.**<sup>\*</sup> Cell surface characteristics enable encrustation-free survival of neutrophilic iron-oxidizing bacteria. American Geophysical Union Fall Meeting, December 2011, *poster*.
68. **Chan, C. S.**<sup>\*</sup>, Saini, G.<sup>^</sup>, Krepski, S. T.<sup>^</sup>, Hredzak-Showalter, P., and Luther, G. W. Architects of rust: Mineral precipitation and evasion strategies of Fe-oxidizing microbes. National Academies of Science Kavli Frontiers of Science meeting, Shenzhen, China, November 2011, *poster*.
69. **Chan, C. S.**<sup>\*</sup>, Krepski, S. T.<sup>^</sup>, and Saini, G. S.<sup>^</sup> A new Gallionellales isolate: a model system for comparative studies of Fe-oxidizer physiology and biomineralization, Goldschmidt Conference, Prague, August 2011, *talk*.
70. Gartman, A.<sup>\*</sup>, M. Yücel, **C. S. Chan** and G. W. Luther, III. Hydrothermal emissions of pyrite nanoparticles, presented at the 242nd ACS National Meeting that will be held in Denver, Colorado, August 28, 2011.
71. Krepski, S. T.<sup>^\*</sup> and **Chan, C. S.** Biomineralization by a newly-isolated stalk-forming Fe-oxidizing bacterium: towards interpretation of putative Fe microfossils, American Geophysical Union Fall Meeting, December 2010, *poster*.
72. **Chan, C. S.**<sup>\*</sup> Biomineralization by neutrophilic Fe-oxidizing microorganisms, Telluride Iron Biogeochemistry Workshop 2010, *talk*.



73. **Chan, C. S.\***, Comolli, L. R., Luef, B. and Krepski, S. T.^ Ultrastructure and reactivity of Fe-oxidizer microbial surfaces: Implications for controlling mineralization, ISME Conference 2010, *talk*.
74. **Chan, C. S.\*** and Comolli, L. R. Visualizing cell surfaces and biominerals in 3D: cryo-electron microscopy and tomography of iron-oxidizing bacteria, Goldschmidt Conference 2009, *talk*.

***Other presentations, prior to University of Delaware***

75. **Chan, C. S.\***, Fleming, E. J., Emerson, D., and Edwards, K. J. Linking microbial ultrastructure and physiology to iron depositional processes in deep sea hydrothermal environments. American Geophysical Union Fall 2008 meeting, *poster*.
76. **Chan, C. S.\***, Emerson, D., Fakra, S., and Edwards, K. J. Iron oxidation and biomineralization by *Mariprofundus ferrooxydans*, a deep-sea microaerophilic lithoautotroph. American Geophysical Union Fall 2007 meeting, *poster*.
77. **Chan, C. S.\***, Emerson, D., Fakra, S., and Edwards, K. J. Organic-mineral stalk formation by the marine iron-oxidizing bacterium *Mariprofundus ferrooxydans*. Interridge Theoretical Institute 2007, *talk and poster*.
78. **Chan, C. S.\***, Emerson, D., Fakra, S., and Edwards, K. J. Formation of biomineralized stalks by a marine iron-oxidizing bacterium. Goldschmidt Conference 2007, *poster*.
79. **Chan, C. S.\***, Emerson, D., and Edwards, K. J. Biomineralogy and morphology of the marine iron-oxidizing bacterium *Mariprofundus ferrooxydans*. American Geophysical Union Fall 2006 meeting, *talk*.
80. **Chan, C. S.\***, Fakra, S., and Banfield, J. F. Iron oxyhydroxide mineralization by microbes in terrestrial environments. American Geophysical Union Fall 2004 meeting, *poster*.
81. **Chan, C. S.\***, Nesterova, M., Welch, S. A., De Stasio, G., and Banfield, J. F. Microbial polymer templation of iron oxyhydroxides. Goldschmidt conference 2003, *talk*.
82. **Chan, C. S.\*** and Banfield, J. F. Roles of microbial communities and polymers in iron oxide mineralization. American Society for Microbiology 2003 General Meeting, *poster*.
83. **Chan, C. S.\*** and Banfield, J. F. Microbial communities associated with biogenic iron oxide mineralization in circumneutral pH environments. American Geophysical Union Fall 2002 meeting, *poster*.
84. **Chan, C. S.\***, Skatvold, A. M., Labrenz M., Welch S. A., and Banfield, J. F. Phylogenetic analysis of microbial populations associated with iron cycling in the Piquette Mine in Tennyson, Wisconsin. American Geophysical Union Fall 2001 meeting, *poster*.

**Other professional meetings and workshops attended**

National Center for Faculty Development and Diversity Coach Training for Faculty Success Program, October-November, 2019

Earth Science Womens Network workshop on Building Leadership and Management Skills for Success, June 10-12, 2013

NSF-NNIN Workshop on Nano-Enabled Sensing Microsystems for Geosciences, February 4-5, 2010

NAGT Early Career Geoscience Faculty workshop, June 14-18, 2009

The Institute for Genomic Research (TIGR) Prokaryotic genome annotation course, Oct. 10-12, 2006

Molecular Geomicrobiology, GS/MSA short course, Berkeley, CA, Dec. 2-4, 2006

Hawaii Astrobiology Winter School, University of Hawaii NASA Astrobiology Institute, Jan. 10-21, 2005

Preparing for an Academic Career in the Geosciences, NAGT/NSF Professional Development Workshop, Aug. 15-17, 2003

Applications of Synchrotron Radiation in Low-Temperature Geochemistry and Environmental Science, GS/MSA short course, Monterey, CA, Dec. 4-5, 2002

## **Cruises and Field Experience**

### **Cruises**

2013 August and 2014 August, Chesapeake Bay, R/V Sharp (5+6 days), chemocline sampling for Fe and S-oxidizing microbes (w/ E. Field and S. Kato in 2014)

2013 March, Loihi Seamount, Hawaii, R/V Thompson, Jason submersible ROV, and Sentry AUV (17 days), marine Fe microbial mat survey/sampling

2008 October, Loihi Seamount, Hawaii, R/V Thompson and Jason submersible ROV (11 days), FeMO (Fe Microbial Observatory), Fe mat and hydrothermal vent survey and sampling

2006 October-November, Loihi Seamount, Hawaii, R/V Melville and Jason submersible ROV (20 days), FeMO vent survey and sampling

*Other cruises with student participation:*

2017 March-April, East Pacific Rise, marine Fe oxidizer and endosymbiont sampling (B. Chiu)

2014 November-December, Eifuku and nearby seamounts, Marianas Arc, marine Fe microbial mat survey/sampling (S. McAllister)

2012 October-November, Mid-Atlantic Ridge Rainbow, Snake Pit, and TAG sites, R/V Knorr (24 days, S. McAllister)

2011 August, Chesapeake Bay, R/V Sharp (5 days, S. Krepski)

### **Other field experience**

2013 May-October, Cape Shores, Lewes, DE, intertidal zone groundwater microbiological and geochemical sampling

2012 July, Rifle aquifer, CO, groundwater microbiological and geochemical sampling

2011 August, 2016 July, Frasassi Cave system, Italy, sulfur microbial mat sampling

2009-2012 White Clay and Christina Creeks, DE and Boothbay, ME, Fe microbial mat sampling and geochemical profiling

2000-2005 Piquette Mine (Tennyson, WI) and Richmond Mine (Iron Mountain, near Redding, CA), Geochemical and microbiological sampling and field-based geochemical analyses

1998-2000 Groundwater well installation and monitoring, soil sampling and core logging, various sites in San Francisco and Los Angeles areas, CA

1994-1995 Summer field camps, geologic mapping, Snake Range, NV, Eastern Sierras and White-Inyo Range, CA

**Teaching and Advising****Courses Taught** (at Univ. of Delaware unless otherwise specified)

<u>Course</u>	<u>Units</u>	<u>Term</u>
GEOL 202 Earth Materials (co-taught with S. McGeary)	4	Fall 2012 Fall 2013
GEOL 300 Earth's Materials I: Minerals	4	Fall 2010
GEOL 367 Independent Study (Microbial Biosignatures)	2	Winter 2011
GEOL 401 Senior Seminar: Topics in Geoscience	3	Spring 2012
GEOL 467/667, now GEOL/MAST 445/645 Geomicrobiology	3	Fall 2009 Fall 2011 Fall 2013 Fall 2015 Fall 2017 Fall 2018
GEOL 601 Geological Sciences at Delaware	1	Fall 2019
GEOL 666 Independent Study (Advanced Mineralogy)	4	Fall 2012
GEOL 667 Methods in Geomicrobiology	3	Spring 2010 Fall 2012
GEOL 667, now GEOL 604 Writing in Geosciences	2-3	Spring 2011 Spring 2012 Spring 2013 Spring 2014 Spring 2015 Spring 2017 Spring 2019
GEOL 868 Special Problems (Advanced Mineralogy; O <sub>2</sub> in Earth history and microbial physiology)	2-4	Fall 2010
Mineralogy (Bowdoin)		Spring 2008
Investigating Earth (Introductory Geology, Bowdoin)		Fall 2007

**Advisement****Graduate students (^current students)**

Sean Krepski	M. S. 2011, Ph. D. Geological Sciences; technician in Chan lab 2012-2013 (currently a middle school Earth Science teacher in New York City)
Michelle Owens	M. S. Geological Sciences, 2010-2011
Kevin Cabaniss	M. S. Geological Sciences, 2011-2014 (currently a high school science teacher in Virginia)
Sean McAllister	Ph. D. 2019. Marine Biosciences, 2012-2019 (Delaware Space Grant graduate fellow 2012-2013, 2016-2017, UD Dissertation fellow 2017-2018;

	currently a postdoc in Chan Lab, starting a postdoc at University of Washington in December 2019)
Shane Cone	M. S. Geological Sciences, 2013-2014 (currently an Environmental Scientist, Delaware Department of Natural Resources and Env. Control)
Beverly Chiu	M. S. 2017, Geological Sciences, 2015-2017 (currently a research assistant/lab manager in Leavitt Lab at Dartmouth)
Gretchen Dykes <sup>^</sup>	Ph. D., Microbiology, 2015-present (Townsend Fellow, 2019-2020)
Michael Pavia	M. S. 2018, Biological Sciences, 2016-2018 (currently a Ph.D. student at Arizona State University)
Arkadiy Garber	M. S. 2018, Geological Sciences, 2016-2018 (currently a research scientist at Montana State University)
Nanqing Zhou <sup>^</sup>	Ph. D. Marine Biosciences, 2017-present
Rebecca Vandzura	M. S. 2019, Marine Biosciences, 2017-2019 (AGU Outstanding Presentation award 2019; currently a high school biology teacher, Ridley School District, PA)
Jordan Knuth <sup>^</sup>	Ph. D. Microbiology, 2018-present
Rene Hoover <sup>^</sup>	Ph. D. Microbiology, 2019-present
Rotation students:	Andrew Hydrusko, Fall 2010; Ronald McMillan, Summer 2018; Vadesse Noundou, Spring 2019 (all Biological Sciences)

#### **Postdoctoral researchers (<sup>^</sup>current postdocs)**

Gaurav Saini	June 2010-Aug. 2011 (currently Associate Professor, Sharda University, Uttar Pradesh, India)
Chaofeng Lin	Feb. 2012-Jan. 2013 (currently science writer/editor, Translation Studio eChoice, and environmental consultant, Qingdao Transcend Environtech, Shandong, China)
Cassandra Marnocha	January 2014-July 2016 (currently Assistant Professor, Niagara University)
Shingo Kato	April 2014-Aug 2015 (currently Research Scientist, RIKEN Japan Collection of Microorganisms)
Erin Field	May 2014-Nov 2015 (currently Assistant Professor, East Carolina University)
Pauline Henri	October 2015-September 2017
Jessica Keffer <sup>^</sup>	October 2017-present
Sean McAllister <sup>^</sup>	September 2019-present

#### **Undergraduate researchers (\*Senior thesis)**

(students in Biological Sciences, Chemistry, Environmental Sciences, and Geological Sciences)

Jeff Brodzinski	Spring 2009 (also a technician in Chan lab 2011-2012)
Emily Olson	Spring 2009-Spring 2010, DE Water Resource Center intern
Natalie Villa	Winter – Spring 2010
Santiago Suarez	Spring – Fall 2010, NSF EPSCoR summer scholar (\$3500 stipend+\$500 research funds)
Allison Gutsche	Summer 2010, UD summer undergraduate fellow (\$500 stipend)
Rachel Ibers	Winter – Spring 2012
Rebecca Gripp	Summer 2012-Spring 2013, NSF EPSCoR summer scholar (\$4000 stipend+\$500 research funds)
Joshua Barnett*	Winter 2013- Spring 2015, NSF EPSCoR summer scholar (\$4000 stipend+\$500 research funds), DENIN scholar (\$5500 stipend)
Kara Hoppes	November 2014-June 2016, NSF EPSCoR summer scholar (\$4000 stipend), DENIN scholar (\$6000 stipend)
Andrew Currie	September 2016-present, DENIN scholar (\$3000 stipend)
Michelle Hallenbeck*	January 2017-May 2019, NASA Delaware Space Grant Summer Intern (\$4000 stipend), DENIN Environmental Scholar (\$3000 stipend), NSF EPSCoR summer scholar (\$4000 stipend)
Annie Browne	Spring 2019

#### **High school researcher**

Nicholas Gardner Summer 2010

**Academic adviser** to 8 undergraduates

#### **Visitors**

Shingo Kato	Visiting postdoc from Japan Collection of Microorganisms, RIKEN BioResource Center, January-February 2013
Hakon Dahle	Visiting postdoc from University of Bergen, February 2014
Jan van der Roost	Visiting student from University of Bergen, February 2014
Rebecca Cooper	Visiting postdoc from Friedrich Schiller U. Jena, October 2018

#### **Graduate committees**

Maria Wilburn, M. S. 2011, Oceanography  
 Kiran Upreti, M. S., 2013, Plant and Soil Sciences  
 Laurel Kegel, Ph. D. 2013, Chemistry  
 Patricia Hrezdak-Showalter, Ph. D. Oceanography  
 Autumn Starcher, Ph. D. 2016, Plant and Soil Sciences  
 Mengyin Yao, Ph. D. 2016, Civil and Environmental Engineering  
 Jacob Hilzinger, Ph. D. 2017, Marine Biosciences  
 Katie Kalis, Ph. D. 2019, Marine Biosciences

LeAundra Jeffs, M. S. 2019, Marine Biosciences  
 Gretchen Dykes, Ph. D. Plant and Soil Sciences  
 Stefanie Becker, Ph. D. Geosciences, Univ. Tübingen  
 Tian Bai, Ph. D. Civil and Environmental Engineering  
 Vadesse Noundou, Ph. D. Biological Sciences

### **Senior thesis committee**

Joshua Barnett, B. S. Biological Sciences, 2015  
 Nicole Coffey, B. S. Marine Science/Chemistry, 2018  
 Michelle Hallenbeck, B. S. Biological Sciences, 2019

## **Service**

### **Professional service**

#### **Journal editorial position**

Associate editor, *Frontiers in Microbiological Chemistry and Geomicrobiology* (*Frontiers in Microbiology, Environmental Science, and Earth Science*), 2017-present

Review editor, *Frontiers in Microbiological Chemistry and Geomicrobiology*, 2011-2017

Review editor, *Frontiers in Extreme Microbiology* (*Frontiers in Microbiology*), 2011-present

Editorial Board, *Geobiology*, 2013-present

#### **Journal article reviews**

*Geochimica et Cosmochimica Acta*, *Environmental Science and Technology*, *Science*, *Geomicrobiology*, *Geology*, *Geobiology*, *Chemical Geology*, *Geochemical Transactions*, *American Mineralogist*, *Environmental Microbiology*, *Applied and Environmental Microbiology*, *Elements*, *PNAS*, *Scientific Reports*, *Nature Geoscience*, *Frontiers in Microbiology*, *ISME Journal*, *mSphere*, *FEMS*, *ACS Nano*

#### **Proposal reviews**

National Science Foundation (NSF) Biological Oceanography, NSF Geobiology and Low Temperature Geochemistry, NSF Integrative Organismal Systems, NSF MRI, NASA, Minnesota Environment and Natural Resources Trust, C-DEBI (NSF Center for Dark Energy Biosphere Investigations), NSERC (Natural Sciences and Engineering Research Council of Canada)

#### **Conference and session organization**

Goldschmidt Meeting 2020, Theme Chair for “Mineral, Melt, and Fluid Chemistry”

American Chemical Society Spring Meeting 2018 and 2020, “Microbially-Driven Geochemical Reactions: Kinetics and Communities”

Goldschmidt Meeting 2015, “The evolution of biomineralization: Using the modern to infer the past”  
 Geological Society of America Meeting 2015, “Geomicrobiology: Microbes as a geologic force on modern and ancient Earth”

American Geophysical Union Fall Meeting 2011, “Microbe-mineral interactions in modern and ancient environments”

American Geophysical Union Fall Meeting 2007, “Geomicrobiology and Biogeochemistry of Iron and Manganese”

#### **Workshop participant**

NSF workshop on Geomicrobiology and Microbial Geochemistry, 2013

### **University, College (CEOE), and Department service at Delaware (^current positions)**

^University Graduate College Council, 2019-present

^CEOE Awards Committee, 2018-present, Chair of committee 2019-present

^CEOE Diversity Committee, 2018-present

Geological Sciences Business Administrator search committee, 2018

^Microbiology Graduate Program Steering Committee, 2018-present

Graduate Program Director, Dept. of Geological Sciences/Earth Sciences, 2016-2019

Strategic Planning Initiative, Models for the New American Research University working group, 2014-2015

Faculty search committee, department chair, Dept. of Geological Sciences, 2013-2014

Chair, Safety committee, Dept. of Geological Sciences, 2012-2014

Faculty search committee, Geochemist, Dept. of Geological Sciences, 2012

Chair, Undergraduate curriculum committee during curriculum revision, Dept. of Geological Sciences; successfully applied for and hosted SERC Building Strong Geoscience Departments visiting workshop, 2010-2011

^Graduate Committee, Dept. of Geological Sciences/Earth Sciences, 2011-2012, 2016-present

Faculty search committees, Environmental Cluster hire, College of Earth, Ocean, and Environment, 2011 and 2012

Faculty search committee, Critical Zone Scientist, Dept. of Plant and Soil Sciences, 2010

Organizer, Dept. of Geological Sciences seminar, Fall 2009, Spring 2012, Spring 2015

### **Other activities**

Founder/organizer, Geological Sciences poster symposium, 2012-2013, 2015, 2017

Panelist, DENIN Scholar's winter retreat career panel, 2017

Co-organizer, Delaware Biotechnology Institute research symposium, 2011

Delaware Decision Days presenter, 2010

New Student Orientation advising, 2010

Co-led DE EPSCoR Grants workshop, reported results at annual DE EPSCoR meeting, June 10-11, 2009

Biogeochemistry and Microbiology interdisciplinary graduate programs planning

Interdisciplinary Science and Engineering Building core facilities planning and equipment purchasing

### **Outreach at Delaware**

Workshops at Serviam academy to introduce 5th-8th grade girls to geo/environmental microbiology using a combination of soil sampling, culturing, and microscopy activities, Summer camps 2014-2016, Fall semester 2019 weekly workshops

College of Earth, Ocean, and Environment's annual Coast Day, ongoing annually

Careers in Academia panelist, DENIN scholars retreat 2017

Science Café (informal presentation and Q&A open to public): "Ancient life: finding your microbial ancestors on Earth and beyond," UD Center for Science Ethics and Public Policy, Nov. 22, 2011

EPSCoR INBRE summer student scholars environmental careers panel 2010

Environmental Technology Week Teacher workshop (presentation and lab demo) and Charter School of Wilmington AP Environmental Science class 2010

UD Mineral Museum presentation to DE Natural History Society 2010