

TRINITY L. HAMILTON
 Assistant Professor
 Department of Plant and Microbial Biology
 BioTechnology Institute, Microbial and Plant Genomics Institute
 University of Minnesota
 218 Cargill Building, Saint Paul, MN 55108
 tel: (612) 625-6372, email: trinityh@umn.edu, website: The-Fringe-Lab.com

PROFESSIONAL PREPARATION

Montana State University	Ph.D.	Chemistry & Biochemistry	2012
Montana State University	B.S.	Chemistry & Biochemistry	2006
Montana State University	B.S.	Biology	2003

APPOINTMENTS

UNIVERSITY OF MINNESOTA Assistant Professor Department of Plant and Microbial Biology	2017 - present
UNIVERSITY OF CINCINNATI Assistant Professor Department of Biological Sciences	2015 - 2017
THE PENNSYLVANIA STATE UNIVERSITY NASA Astrobiology Institute Postdoctoral Fellow Department of Geosciences	2012 - 2014
MAX PLANCK INSTITUTE FOR MARINE MICROBIOLOGY Visiting Scientist, Microsensor Group	2013
MONTANA STATE UNIVERSITY PhD Research Assistantship Department of Chemistry and Biochemistry <i>Defining the ecological interactions that drove the evolution of biological nitrogen fixation</i>	2006 - 2012

PUBLICATIONS

‡ Denotes graduate student author. * Denotes undergraduate student author. # Corresponding author.

2019

Havig, J.R., **Hamilton, T.L.** (2019) Snow algae drive productivity and weathering at volcanic rock-hosted glaciers. *Geochimica et Cosmochimica Acta*. *In press*. (doi: 10.1016/j.gca.2018.12.024)

2018

Mitchell, M.E., **Hamilton, T.L.**, Uebel, C., Hopfensperger, K., Buffam I. Nitrogen cycling players and processes in green (vegetated) roof ecosystems in the Midwestern United States. *Applied Soil Ecology*. *In press*. (doi: 10.1016/j.apsoil.2018.08.007)

Rutledge, A.M., Horgan, B., Havig, J.R., Rampe, E.B., Scudder, N.A., **Hamilton, T.L.** (2018) Silica Dissolution and Precipitation in Glaciated Volcanic Environments and Implications for Mars. *Geophysical Research Letters*. 45: 15. (doi: 10.1029/2018GL078105)

Haas, S., de Beer, D., Fink, A., Klatt, J.M., McCauley, R.M., **Hamilton, T.L.**, Meyer, V., Kakuk, B., Macalady, J.L. (2018) Low-light Anoxygenic Photosynthesis and Fe-S-Biogeochemistry in a Microbial Mat. *Frontiers in Microbiology*. 9: 858. (doi: 0.3389/fmicb.2018.00858)

Hamilton#, T.L., Havig, J.R. (2018) Inorganic carbon stimulates snow algae primary productivity. *The ISME Journal*. In press. (doi: 0.1038/s41396-018-0048-6)

Hamilton#, T.L., Klatt, J., de Beer, D., Macalady J.L. (2018) Cyanobacterial photosynthesis under sulfidic conditions - Insights from the isolate *Leptolyngbya* sp. strain hensonii. *The ISME Journal* 12, 568–584 (doi:10.1038/ismej.2017.193)

Havig, J.R., **Hamilton, T.L.**, McCormick, M.L., *McClure, B., Sowers, T., Wegter, B., Kump, L.R. (2018) Water column and sediment carbon isotope geochemistry of permanently redox-stratified Fayetteville Green Lake, New York, USA: Carbon cycling and implications for the Paleoproterozoic ocean. *Limnology and Oceanography*. 63, 570-587. (doi: 10.1002/lno.10649)

Colman, D.R., Poudel, S., **Hamilton T.L.**, Havig, J.R., Selensky, M., Shock, E.L., Boyd, E.S. (2018) Geobiological feedbacks and the evolution of thermoacidophiles. *The ISME Journal*. 12, 225-236. (doi: 10.1038/ismej.2017.162)

2017

*Schuler C., Havig, J.R., **Hamilton#**, T.L. (2017) Carbon fixation across geochemical gradients in the Greater Obsidian Pool Area. *Frontiers in Earth Science*. 5:97. (doi: 10.3389/feart.2017.00097)

Hamilton#, T.L., Welander, P., Albrecht, H.L., Fulton, J.M., Schaperdoth, I., Bird, L., Summons, R., Freeman, K.H., Macalady, J.L. (2017) Microbial communities and organic biomarkers in a Proterozoic-analog sinkhole environment. *Geobiology*. 15: 784-797. (doi: 10.1111/gbi.12252)

Havig, J.R., **Hamilton, T.L.**, Bachan, A., Kump, L.R. (2017) Sulfur and carbon isotopic evidence for metabolic pathway evolution and a four-stepped Earth system progression across the Archean and Paleoproterozoic. *Earth-Science Reviews*. 174: 1-21. (doi: 10.1016/j.earscirev.2017.06.014)

Hamilton#, T.L., Havig, J.R. (2017) Supraglacial primary productivity in glaciers on stratovolcanoes of the Pacific Northwest. *Geobiology*. 15: 280-295. (doi:10.1111/gbi.12219)

Havig, J.R., Grettenberger, C., **Hamilton#**, T.L. (2017) Geochemistry and microbial community composition across a range of acid mine drainage impact and implications for the Neoproterozoic-Paleoproterozoic transition. *Journal of Geophysical Research: Biogeosciences*. 122: 1404–1422. (doi:10.1002/2016JG003594) **Cover feature**

‡Hotaling, S., Hood, E., **Hamilton#**, T.L. (2017) Microbial ecology of the alpine cryosphere: glaciers, subglacial environments, and meltwater streams. *Environmental Microbiology*. 19: 2935-2948. (doi: 10.1111/1462-2920.13766) *Invited Review*

de Beer, D., Weber, M., Chennu, A., **Hamilton, T.L.**, Lott, C., Macalady, J.L., Klatt, J. (2017) Oxygenic and anoxygenic photosynthesis in a microbial mat from an anoxic spring, Little Salt Spring. *Environmental Microbiology*. 19: 1251–1265. (doi: 10.1111/1462-2920.13654)

Therien, J.B., Artz, J.H., Poudel, S., **Hamilton, T.L.**, Liu, Z., Noone, S.M., Adams, M.W.W., King, P.W., Bryant, D.A., Boyd, E.S., Peters, J.W. (2017) The physiological functions and structural determinants of

catalytic bias in the [FeFe]-hydrogenases of *Clostridium pasteurianum* strain W5. *Frontiers in Microbiology, Microbial Physiology and Metabolism*. **8**:1305. (doi: 10.3389/fmicb.2017.01305)

2016

Boyd, E.S., Yu, R.-Q., Barkay, T., **Hamilton, T.L.**, Baxter, B.K., Naftz, D.L., Marvin-DiPasquale, M. (2016) Effect of Salinity on Mercury Methylating Benthic Microbes and Their Activities in Great Salt Lake, Utah. *Science of the Total Environment*. 581-582: 495-506. (<http://dx.doi.org/10.1016/j.scitotenv.2016.12.157>)

Urschel, M.R., **Hamilton, T.L.**, Roden, E.R., Boyd, E.S. (2016) Substrate Preference, Uptake Kinetics, and Bioenergetics in a Facultatively Autotrophic, Thermoacidophilic Crenarchaeote. *FEMS Microbiology Ecology*. (doi: <http://dx.doi.org/10.1093/femsec/fiw069>)

Hamilton#, T.L., Bovee R.J., Sattin S.R., Mohr, W., Gilhooly III, W.P., Lyons, Pearson, A., Macalady, J.L. (2016) Carbon and sulfur cycling below the chemocline in a meromictic lake and the identification of a novel taxonomic lineage in the FCB superphylum, *Candidatus Aegiribacteria*. **7**:00598. *Frontiers in Microbiology*. (doi: 10.3389/fmicb.2016.00598)

Hamilton#, T.L., Bryant, D.A., Macalady, J.L. (2016) The role of biology in planetary evolution: Cyanobacterial primary production in low oxygen Proterozoic oceans. *Environmental Microbiology*. **18**: 325–340. (doi: 10.1111/1462-2920.13118) *Invited Review*

2015

Harrold, Z.R., Skidmore, M., **Hamilton, T.L.**, Desch, L., Amada, K., van Gelder, W., Roden, E., Boyd, E.S. (2015) Aerobic and anaerobic thiosulfate oxidation by a cold-adapted, subglacial chemoautotroph. *Applied and Environmental Microbiology*. **82**:1486-1495. (doi: 10.1128/AEM.03398-15)

Telling, J., Boyd, E.S., Bone, N., Jones, E., Tranter, M., J.L., MacFarlane, Martin, P., Wadham, J., LaMarche-Gagnon, G., Skidmore, M.L., **Hamilton, T.L.**, Hill, E., Jackson, M., Hodgson, D.A. (2015) Rock comminution as a source of hydrogen for subglacial ecosystems. *Nature Geoscience*. **8**, 851–855. (doi: 10.1038/ngeo2533)

Mansor, M., **Hamilton, T.L.**, Fantle, M., Macalady, J.L. (2015) Metabolic diversity and ecological niches of *Achromatium* populations revealed with single-cell genomic sequencing. *Frontiers in Microbiology* **6**:822. (doi: 10.3389/fmicb.2015.00822)

Havig, J., McCormick, M.L., **Hamilton, T.L.**, Kump, L.R. (2015) The behavior of biologically important trace elements across the oxic/euxinic transition of meromictic Fayetteville Green Lake, New York, USA. *Geochimica et Cosmochimica Acta*. **165**:389-406. (doi: 10.1016/j.gca.2015.06.024)

Hamilton#, T.L., Jones, D.S., Schaperdoth, I., Macalady, J.L. (2015) Metagenomic insights into S(0) precipitation in a terrestrial subsurface lithoautotrophic ecosystem. *Frontiers in Microbiology* **5**:756. (doi: 10.3389/fmicb.2014.00756)

Boyd, E.S., Garcia Costas, A.M., **Hamilton, T.L.**, Mus, F., Peters, J.W. (2015) Evolution of molybdenum nitrogenase during the transition from anaerobic to aerobic metabolism. *Journal of Bacteriology*. (doi: 10.1128/JB.02611-14)

2014

Boyd, E.S., **Hamilton T.L.**, Swanson, K.D., Howells, A.E., Baxter, B.K., Meuser, J.E., Posewitz, M.C., Peters, J.W. (2014). [FeFe]-Hydrogenase abundance and diversity along a vertical redox gradient in Great Salt Lake, USA. *International Journal of Molecular Sciences* **15**:21947-21966. (doi: 10.3390/ijms150x000x)

Boyd, E.S., **Hamilton, T.L.**, Havig, J.R., Skidmore, M., Shock, E.S. (2014) Chemolithotrophic primary production in a subglacial ecosystem. *Applied and Environmental Microbiology*. 80: 6146-6132. (doi: 10.1128/AEM.01956-14)

Hamilton[#], T.L., Bovee, R.J., Thiel, V., Sattin, S.R., Mohr, W., Schaperdoth, I., Vogl K., Gilhooly III, W.P., Lyons, T.W., Tomsho, L.P., Schuster, S.C., Overmann, J., Bryant, D.A., Pearson, A., Macalady, J.L. (2014) Coupled reductive and oxidative sulfur cycling in the phototrophic plate of a meromictic lake. *Geobiology*. 12: 451-468. (doi: 10.1111/gbi.12092)

Hamilton, T.L., Koonce, E., Howells, A., Havig, J.R., Jewell, T., de la Torre, J., Peters, J.W., Boyd, E.S. (2014) Competition for ammonia influences the structure of chemotrophic communities in geothermal springs. *Applied and Environmental Microbiology* 80: 653-661. (doi: 10.1128/AEM.02577-13)

2013

Macalady, J.L., **Hamilton, T.L.**, Grettenberger, C.L., Jones, D.S., Tsao, L.E., Burgos, W.D. (2013) Energy, ecology and the distribution of microbial life. *Philosophical Transactions of the Royal Society B* 368: 1622. (doi: 10.1098/rstb.2012.0383)

Boyd, E.S., **Hamilton, T.L.**, Wang, J., He, L., Zhang, C.L. (2013) The role of tetraether lipid composition in the adaptation of thermophilic archaea to acidity. *Frontiers in Terrestrial Microbiology* 4: 62. (doi: 10.3389/fmicb.2013.00062)

Hamilton, T.L., Peters, J.W., Skidmore, M.L., Boyd, E.S. (2013) Molecular evidence for an active endogenous microbiome beneath glacial ice. *The ISME Journal* 7: 1402-1412. (doi: 10.1038/ismej.2013.31)

2012

Duffus, B.R., **Hamilton, T.L.**, Shepard, E., Boyd, E.S., Peters, J.W., Broderick, J. B. (2012) Radical Ado-Met Enzymes in Complex Inorganic Metal Cluster Biosynthesis. *Biochimica et Biophysica Acta (BBA)-Proteins and Proteomics* 1824: 1254-1263. (doi: 10.1016/j.bbapap.2012.01.002)

Hamilton, T.L., Vogl, K., Bryant, D.A., Boyd, E.S., Peters, J.W. (2011) Environmental constraints define the distribution, composition, and evolution of chlorophototrophs in thermal features of Yellowstone National Park. *Geobiology* 10: 236-249. (doi: 10.1111/j.1472-4669.2011.00296.x)

2011

Peters, J.W., Boyd, E.S., **Hamilton, T.L.**, Rubio, L. (2011) Chapter 4: Biochemistry of Mo-Nitrogenase. In *Nitrogen Cycling in Bacteria: Molecular Analysis*. Ed. J.W.B. Moir. Norfolk: Caister Academic Press. (ISBN: hisb978-1-904455-86-8)

Boyd, E.S., **Hamilton, T. L.**, Peters, J.W. (2011) An alternative path for the evolution of biological nitrogen fixation. *Frontiers in Microbiology* 2: 205. (doi: 10.3389/fmicb.2011.00205)

Hamilton, T.L., Jacobson, M., Ludwig, M., Boyd, E.S., Bryant, D.A., Dean, D.R., Peters, J.W. (2011) Differential accumulation of *nif* structural gene mRNA in *Azotobacter vinelandii*. *Journal of Bacteriology* 193: 4534-4536. (doi: 10.1128/JB.05100-11)

Hamilton, T.L., Ludwig, M., Dixon, R., Boyd, E.S., Dos Santos, P., Setubal, J.C., Bryant, D.A., Dean, D.R., Peters, J.W. (2011) Transcriptional profiling of nitrogen fixation in *Azotobacter vinelandii*. *Journal of Bacteriology* 193: 4477-4486. (doi: 10.1128/JB.05099-11) ****Journal Highlight, Microbe, October, 2011****

Boyd, E.S., Lange, R.K., Mitchell, A.C., Havig, J.R., **Hamilton, T.L.**, Lafrenière, M.J., Shock, E.L., Peters, J.W., Skidmore, M. (2011). Diversity, abundance, and potential activity of nitrifying and denitrifying microbial assemblages in a subglacial ecosystem. *Applied and Environmental Microbiology* 77: 4778-4787. (doi: 10.1128/AEM.00376-11)

Hamilton, T.L., Boyd, E.S., Lange, R.K., Peters, J.W. (2011) Biological nitrogen fixation in acidic high temperature geothermal springs in Yellowstone National Park, Wyoming. *Environmental Microbiology* 13: 2204-2215. (doi: 10.1111/j.1462-2920.2011.02475.x)

Hamilton, T.L., Boyd, E.S., Peters, J.W. (2011) Environmental constraints underpin the phylogenetic diversity of *nifH* in the Yellowstone Geothermal Complex. *Microbial Ecology* 61: 860-870. (doi: 10.1007/s00248-011-9824-9)

Boyd, E.S., Anbar, A.D., Miller, S., **Hamilton, T.L.**, Lavin, M., Peters, J.W. (2011) A late methanogen origin for molybdenum-dependent nitrogenase. *Geobiology* 9: 221-232. (doi: 10.1111/j.1472-4669.2011.00278.x)

Boyd, J.M., Endrizzi, J.A., **Hamilton, T.L.**, Downs, D.M., Peters, J.W. (2011) FAD binding by ApbE protein from *Salmonella enterica*: a new class of FAD binding proteins. *Journal of Bacteriology* 193: 887-895. (doi: 10.1128/JB.00730-10)

2010

Boyd, E.S., **Hamilton, T.L.**, Spear, J.R., Lavin, M., Peters, J.W. (2010) [FeFe]-hydrogenase In Yellowstone National Park: Evidence for dispersal limitation and phylogenetic niche conservation. *The ISME Journal* 4: 887-895. (doi: 10.1038/ismej.2010.76)

2008

Sarma, R, Barney, B.M., **Hamilton, T.L.**, Jones, A., Seefeldt, L.C., Peters, J.W. (2008) Crystal structure of the L protein of *Rhodobacter sphaeroides* light-independent protochlorophyllide reductase with MgADP bound: a homologue of the nitrogenase Fe protein. *Biochemistry* 47: 13004-13015. (doi: 10.1021/bi801058r)

2007

Taylor, R.M., Maaty, W.S., Lord, C.I., **Hamilton, T.**, Burritt, J.B., Bothner, B., Jesaitis, A.J. (2007) Cloning, sequence analysis and confirmation of derived gene sequences for three epitope-mapped monoclonal antibodies against human phagocyte flavocytochrome b. *Molecular Immunology* 44: 625-637. (doi: 10.1016/j.molimm.2005.10.022)

GENOME ANNOUNCEMENTS

Thiel T., Tank, M., Tomsho, L.P., Burhans, R., Gay, S.E., **Hamilton, T.L.**, Schuster, S.C., Bryant, D.A. (2017) Draft genome sequence of *Anoxybacillus ayderensis* strain MT-Cab (Firmicutes). *Genome Announc* **5**: e00547-17. (doi: 10.1128/genomeA.00547-17)

Lincoln, S.A., **Hamilton, T.L.**, Juárez, A.G.V, Schedlerb, M., Macalady, J.L., Müller, R., Freeman, K.H. (2015) Draft genome sequence of the piezotolerant, crude oil-degrading bacterium *Rhodococcus qingshengii* strain TUHH-12. *Genome Announc* **3**: e00268-15. (doi: 10.1128/genomeA.00268-15)

Thiel T., **Hamilton, T.L.**, Tomsho, L.P., Burhans, R., Gay, S.E., Ramaley, R.F., Schuster, S.C., Steinke, L.A., Bryant, D.A. (2014) Draft genome sequence of the moderately thermophilic bacterium *Schleiferia thermophila* strain Yellowstone (*Bacteroidetes*). *Genome Announc* **2**: e00860-14. (doi: 10.1128/genomeA.00860-14)

Thiel T., **Hamilton, T.L.**, Tomsho, L.P., Burhans, R., Gay, S.E., Schuster, S.C., Ward, D.M., Bryant, D.A. (2014) Draft genome sequence of the filamentous anoxygenic phototrophic bacterium *Chloroflexus* sp. strain MS-G (*Chloroflexi*). *Genome Announc* **2**: e00872-14.. (doi: 10.1128/genomeA.00872-14)

PROCEEDINGS

Miller, J.M., Frisbee, M.D., **Hamilton, T.L.** (2018) Does meltwater from alpine glaciers provide mountain-block recharge? A discussion of evolving conceptual models and methodological challenges. (SIMFAI-2018).

INVITED ABSTRACTS AND PRESENTATIONS (Last 2 years, see Archive at end of CV for full list)

* student advisee presenting author

2018: Cyanobacterial photosynthesis under sulfidic conditions. 5th International Symposium on Microbial Sulfur Metabolism (ISMSM-5). Vienna, Austria.

2017: Cyanobacterial photosynthesis under sulfidic conditions in a Proterozoic-analog sinkhole. 1st Geobiology Society Conference. Banff, Alberta, Canada.

2017: Living on the edge: Model photoautotrophs from a Proterozoic ocean analog. 253rd American Chemical Society National Meeting and Exposition. San Francisco, CA.

CONFERENCE PRESENTATIONS (Last 2 years, see Archive at end of CV for full list)

* student advisee presenting author

2018: Hamilton, T.L., Havig, J.R. Inorganic carbon addition stimulates snow algae primary productivity. Snow Algae Meeting 2018, Potsdam, Germany.

2018: Hamilton, T.L., Havig, J.R. Supraglacial phototrophic productivity and implications for Early earth and mars. Astrobiology Australasia Meeting. Rotorua, New Zealand.

2018: Lentz, D., Hamilton, T.L., Dunning, N., Scarborough, V. Lowland Maya Agriculture, Arboriculture and Other Production Systems: Applications of Paleoethnobotanical, Isotopic and Molecular Techniques. Society for Economic Botany/Society of Ethnobiology Annual Meeting. Florence, Italy.

2018: Rutledge, A.M., Horgan, B.H.N., Havig, J.R., Rampe, E.B., Scudder, N., Hamilton, T.L. Glacial Alteration as a Source of Amorphous Silica on Amazonian Mars. Mars Workshop on Amazonian and Present Day Climate. Lakewood, CO.

2018: Berberich, M.E., Beauliea, J.J., Hamilton, T.L., Buffam, I. Spatial variability of methane production and methanogen communities within a eutrophic reservoir: evaluating the importance of organic matter source and quantity. ASLO 2018 Summer Meeting. Victoria, B.C., Canada.

- 2018: Havig, J.R., Hamilton, T.L. Potential Effect of Eutrophication-Induced Cyanobacterial Blooms and Invasive Mussel Species on Carbon Cycling and Burial in the Great Lakes Region Lakes and Reservoirs. 2018 GSA North-Central Annual Meeting, Ames, Iowa.
- 2017: Schuler*, C.G., Havig, J.R., Hamilton, T.L. Relating Microbial Community Composition and Function to Morphology: Implications for Interpreting the Rock Record. Astrobiology Science Conference. Mesa, AZ.
- 2017: Colman, D.R., Poudel, S., Hamilton, T.L., Havig, J.R., Selensky, M.J., Shock, E.L., Boyd, E.S. Oxygen and the Evolution of Thermoacidophiles. Astrobiology Science Conference, Mesa, AZ.
- 2017: Skidmore M.L., Mitchell, R., Steigmeyer, A., van Gelder, W., Dunham, E., Lindsay, M., Hamilton T.L., Boyd, E.S. Mineral Dependent Chemolithotrophy in Subglacial Systems. Astrobiology Science Conference, Mesa, AZ.
- 2017: Havig, J.R., Hamilton, T.L. Cryptic photosynthesis: A possible analog for early Earth and Mars. Astrobiology Science Conference, Mesa, AZ.
- 2017: Sublett*, H., Hamilton, T.L., Lentz, D. DNA Analyses of Reservoirs and Watersheds of the Ancient Maya City of Tikal. Undergraduate Research Conference. Cincinnati, OH.
- 2017: Schuler*, C.G., Havig, J.R., Hamilton, T.L. Carbon fixation across geochemical gradients in the Greater Obsidian Pool Area. Undergraduate Research Conference. Cincinnati, OH.
- 2017: Bretland*, K.A., Havig, J., Hamilton, T.L. Life at the fringe: in situ characterization of the upper temperature limit of photosynthesis. Undergraduate Research Conference. Cincinnati, OH.
- 2017: Boucher, J., Havig, J.R., Hamilton, T.L., Antonopoulos, D.A., Koval, J., McCormick, M. mapping microbial community composition and geochemical gradients at high spatial resolution in a meromictic lake (Green Lake, Fayetteville, New York. 2017 NE/NC GSA Joint Section Meeting, Pittsburgh, PA.
- 2017: Havig, J.R., Hamilton, T.L., McCormick, M., McClure, B., Sowers, T., Wegter, B., Kump, L.R. Water Column and Sediment Carbon Isotope Geochemistry of Permanently Redox-Stratified Fayetteville Green Lake, New York, USA. 2017 NE/NC GSA Joint Section Meeting, Pittsburgh, PA.
- 2017: Hamilton T.L., Klatt, J., Weber, M., Lott, C., Clark, C., de Beer, D., Macalady, J.L. Model Photoautotrophs Isolated from a Proterozoic Ocean Analog. 2017 NE/NC GSA Joint Section Meeting, Pittsburgh, PA.

PUBLISHED ABSTRACTS (Last 2 years, see Archive at end of CV for full list)

* student advisee presenting author

- 2018: Miller, J.M., Frisbee, M.D., Hamilton, T.L. Identifying alpine glacier melt influenced springs in Mt. Hood National Forest and Glacier National Park using stable isotopes of water. Presented at the 2018 GSA Annual Meeting, Indianapolis, IN.
- 2018: Bennett*, A.C., Murugapiran, S., Havig, J.R., Hamilton, T.L. Phototrophic community distribution and morphology along a geothermal stream: Insights into both modern and ancient microbial ecology. Presented at the 2018 GSA Annual Meeting, Indianapolis, IN.
- 2018: Hamilton, T.L., Murugapiran, S., Havig, J. Anoxygenic photosynthesis across temperature and pH space. Goldschmidt Abstracts, 2018. Presented at Goldschmidt, Boston, MA.
- 2018: Havig, J.R., Hamilton, T.L. Cryptic Oxygen Oases: Hypolithoic oxygenic photosynthesis in hydrothermal areas as a model for continental oxidation before the GOE.. Goldschmidt Abstracts, 2018. Presented at Goldschmidt, Boston, MA.
- 2017: Hamilton, T.L., Havig, J.R. Inorganic carbon addition stimulates snow algae primary productivity. Abstract #B13K-05, presented at 2017 Fall Meeting, AGU, New Orleans, LA.
- 2017: Havig, J.R., Hamilton, T.L. Cryptic oxygen oases: Hypolithoic photosynthesis in hydrothermal areas and implications for Archean surface oxidation. Abstract #V24A-02, presented at 2017 Fall Meeting, AGU, New Orleans, LA.

- 2017: Rutledge, A.M., Horgan, B.H.N., Havig, J.R., Rampe, E.B., Scudder, N., Hamilton, T.L. Glacial Chemical Alteration of Mars-Like Bedrock. Abstract #P35H-05, presented at 2017 Fall Meeting, AGU, New Orleans, LA.
- 2017: Rutledge, A.M., Horgan, B., Havig, J.R., Rampe, E.B., Scudder, N.A., Hamilton, T.L. Glacial Melt water as a Source of Amorphous Silica on Early Mars. Fourth International Conference on Early Mars: Geologic, Hydrologic, and Climatic Evolution and the Implications for Life. Abstract #1964, presented at the Lunar and Planetary Science Conference, The Woodlands, TX.

INVITED SEMINARS

MIT, December 2018
 Wright State University, March 2017
 University of Minnesota, Plant and Microbial Biology, February 2017
 Miami University, Department of Microbiology, November 2016
 University of Kentucky, Department of Biology, November 2015
 The Pennsylvania State University, Ecology Program, April 2015
 University of Cincinnati, Department of Biological Sciences, February 2014
 Colorado School of Mines, Department of Chemistry and Geochemistry, December 2013

RESEARCH GRANTS

External Pending Awards

Ecophysiology of Cyanobacteria at the Upper Temperature Limit of Photosynthesis. NSF - Geobiology and Low-Temperature Geochemistry. Role: PI. \$423K. 10/01/2018 to 9/30/2021.

Bioreactor Microbiomes and Their Impact on Drainage Water and Nitrate Removal. USDA. Role: Co-PI (PI: R. McDaniel). \$227K to UMN. 10-01-2018 to 9/30/2022.

Collaborative Research: Chemistry and biology under low flow hydrologic conditions beneath the Greenland Ice Sheet revealed through naturally emerging overwinter records. NSF. Role: Co-PI (PI: J. Graly). \$138K to UMN. 01/01/2019 to 12/31/2020.

Collaborative Research: Quantifying the contribution of alpine glacier meltwater to mountain-block recharge using microbiological markers and environmental isotopes. NSF. Role: Co-PI (M. Frisbee). \$191K to UMN. 05/01/2019 to 12/31/2022.

Current Awards

Microbe-Mineral Interactions in Glaciated Basaltic Terrains. NASA Exobiology and Evolutionary Biology. Role: Co-I (PI: M. Skidmore). \$466K. 06/01/2016 to 05/31/2019.

Some Liked it Hot: Searching for Early Life in Terrestrial Hot Springs. Royal Society Te Apārangi Marsden Fund. Role: Invited Collaborator (PI: K. Campbell). \$958K NZD. 01-10-2018 to 12-31-2020.

Past Awards

Characterizing the Link Between Algal Bloom Biomass and Methane Production in Ohio Reservoirs. Ohio WRC (USGS 104(b)). Role: Co-I (PI: I. Buffam). \$79K. 03-01-2017 to 02-28-2018.

Contaminated Water and the Collapse of the Ancient Maya: Microbiome and Geochemical Analyses of Reservoir Sediments from Tikal. NSF-Archaeology. Role: Co-I (PI: D. Lentz). \$35K. 07-01-2016 to 06-30-2017.

Proposal to the 2017 BTI Shared Equipment Grant (Gas chromatograph mass spectrometer (GCMS)).
Role: Co-I (PI: S. Ishii). \$35K. Awarded January 2018.

Life on ice - The role of microbiota in glacier ice worm adaptation and biogeography. University of Cincinnati - University Research Council. Role: PI. \$6K. 03/01/2016 - 02/28/2017.

Primary Productivity in Supraglacial Ecosystems. UC LEAF. Role: PI: \$3K. 09/01/2015 - 08/31/2016.

The Role of Biology in Planetary Evolution: Microbial Primary Production in Proterozoic Oceans. NASA Astrobiology Institute Postdoctoral Fellowship. 2013-2015.

HONORS AND SERVICE

2018 - 2020	Treasurer, Geobiology & Geomicrobiology Division of GSA
2017 - 2019	Executive Board, Geobiology Society
2016	National Academy of Education Fellow in the Life Sciences
2015	Guest Associate Editor, Frontiers in Microbiological Chemistry and Geomicrobiology, Special Topic: Origin and Evolution of Photosynthesis
2013	NASA Astrobiology Institute Postdoctoral Fellow
2013	ASM Career Development Grant for Postdoctoral Women
2012	Women in Science and Engineering Travel Grant
2012	Montana Institute on Ecosystems Graduate Fellow-Spring
2011	Poster award winner, Thermophiles
2010	Timothy Swager Travel Grant
2008 - 2010	NSF IGERT Fellowship
2008	MT INBRE Travel Award
2005	MT INBRE Summer Undergraduate Award
2004	MT INBRE Undergraduate Research Program

PROFESSIONAL ASSOCIATIONS

American Chemical Society (ACS)
 American Geophysical Union (AGU)
 American Society for Microbiology (ASM)
 Geological Society of America (GSA)
 International Society for Microbial Ecology (ISME)
 Sigma Xi

TEACHING

University of Minnesota
 Molecular Biology and Society - BIOL 3020 (Fall 2018)

University of Cincinnati
 Microbiome - BIOL8053001
 Molecular Biology - BIOL8003001
 Research Progress in Biology - BIOL9004002
 Seminar - BIOL9003001

Penn State University
 Geosc 598 - Metagenomics Seminar
 Geosc 021 - Earth & Life
 Abiol 590 - Astrobiology Seminar

SYNERGISTIC ACTIVITIES

Session co-convener - Goldschmidt 2019 "Co-evolving life and environments through deep time"

Treasurer - Geobiology & Geomicrobiology Division of GSA, 2018 - 2020
 Editorial Board - *Geobiology*
 Review Editor - *Frontiers in Extreme Microbiology*
 Guest Associate Editor - *Frontiers in Microbiological Chemistry and Geomicrobiology*
 Session co-convener - Goldschmidt 2018 "Biological Approaches and Modern Analogues for Reconstructing the Co-evolution of Early Life and its Environment"
 Session co-convener - Goldschmidt 2017 "The importance of being enzymatic: microbial metabolic and isotopic processes"
 Midwest Geobiology Symposium co-organizer - October, 2016
 Session co-convener - AbSciCon 2015 "Phototrophic Life and Earth's Redox Evolution"
 Session co-convener - Goldschmidt 2014 "From Genes to Geochemistry"
 Workshop panel speaker - Goldschmidt 2014 "Integrating Microbiology and Geochemistry"
 Session co-convener - Goldschmidt 2013 "Phototrophic Life and Earth's Redox Evolution"
 AbGradCon 2011 co-organizer

EDUCATION AND PUBLIC OUTREACH

University of Cincinnati - Greater Cincinnati Water Works Board Member
 University of Cincinnati - Water quality monitoring with the Great Miami River Volunteer Water Quality Monitoring, the Mill Creek Water Quality Monitoring and Greenacres Saturday Stream Snapshot
 Pennsylvania State University - Shake, Rattle, and Rocks
 Montana State University - MSU Science Zone
 Montana State University - Women in Science

PEER REVIEW

Journal Manuscript Reviews

Nature Geosciences, Nature Communications, Scientific Reports, PNAS, Applied and Environmental Microbiology, PeerJ, PLOS ONE, Frontiers in Microbiology, Chemical Geology, Geochimica et Cosmochimica Acta, FEMS Microbiology, Journal of Applied Microbiology, Marine Environmental Research, Astrobiology, Microbial Ecology, International Journal of Astrobiology, BioScience, Geomicrobiology Journal, Geobiology, Environmental Microbiology, Environmental Research Letters

Grant Reviews

NSF Geobiology, NSF EPSCoR, NSF-GRFP, NASA Exobiology and Evolutionary Biology Program, Ohio Water Resources, NASA Earth and Space Science, NASA Planetary Protection, NASA PSTAR, NASA Habitable Worlds

POSTDOCTORAL RESEARCHERS SUPERVISED/MENTORED

Senthil Murugapiran University of Minnesota, 2018-present

GRADUATE STUDENTS SUPERVISED/MENTORED

Anna Bennett (current)	PhD student at the University of Minnesota
Jonathan Popovici (past)	PhD student at the University of Cincinnati
Rupal Jain (past)	Masters student at the University of Cincinnati
Randall Marshall (past)	PhD student at the University of Cincinnati
Sam Klassen (past)	Masters student at the University of Cincinnati

UNDERGRADUATE AND HIGH SCHOOL STUDENTS SUPERVISED/MENTORED

Amanda Borowski	University of Minnesota
Reed Grumann	University of Minnesota
Jenna Hovind	University of Minnesota
Garner Kohrell	University of Minnesota
Katie Quinn	University of Minnesota

Blake Everett (past)	University of Minnesota
Isabel Voigt (past)	University of Minnesota
Madeline Cammack (past)	University of Minnesota
Katie Bretland (past)	University of Cincinnati
Caleb Schuler (past)	University of Cincinnati
Richard Renko (past)	University of Cincinnati
Courtney Motley (past)	University of Cincinnati
Enna Selmanovic (past)	University of Cincinnati
Ian Huffer (past)	University of Cincinnati
Taiwo Oyadiran (past)	University of Cincinnati
Rahul Patel (past)	High school student at Walnut Hills High School
Elizabeth Johnson (past)	High school student at Cincinnati Day School

ADVISING COMMITTEE

UMN

Megan Smith, MICaB (PhD expected Spring 2021)

Lisa Fazzino, MICaB (PhD expected Spring 2020)

External

Amanda Labrado (Geological Sciences, University of Texas at El Paso, PhD expected Spring 2021)

Andrew Gangidine (Biological Sciences, University of Cincinnati, PhD expected Spring 2021)

Alex Golden (Biological Sciences, University of Cincinnati, PhD expected Spring 2021)

Elise Szuter (Biological Sciences, University of Cincinnati, PhD expected Spring 2019)

Sara Handlon (Biological Sciences, University of Cincinnati, Masters expected Fall 2018)

Jordyn Miller (Earth, Atmospheric, and Planetary Sciences, Purdue University, PhD expected Spring 2019)

Chris Holmes (Biological Sciences, University of Cincinnati, PhD expected Spring 2020)

Megan Berberich (Biological Sciences, University of Cincinnati, Masters, defended Fall 2017)

Khaled Gazi (Department of Biological Sciences, University of Cincinnati, Masters, defended, Fall 2017)

RESEARCH FIELD SITES

Yellowstone National Park, WY, USA

Green Lake, Fayetteville, NY, USA

Little Salt Spring, North Port, FL

Cascade Range, Pacific Northwest, USA

Beartooth Pass, MT, USA

Daniel Boone National Forest, KY, USA

Great Lakes Basin, Ohio, US

Iron Springs Bog, MN

Geothermal Areas near Rotorua, New Zealand

ARCHIVE**INVITED ABSTRACTS AND PRESENTATIONS**

* student advisee presenting author

- 2018: Cyanobacterial photosynthesis under sulfidic conditions. 5th International Symposium on Microbial Sulfur Metabolism (ISMSM-5). Vienna, Austria.
- 2017: Cyanobacterial photosynthesis under sulfidic conditions in a Proterozoic-analog sinkhole. 1st Geobiology Society Conference. Banff, Alberta, Canada.
- 2017: Living on the edge: Model photoautotrophs from a Proterozoic ocean analog. 253rd American Chemical Society National Meeting and Exposition. San Francisco, CA.
- 2016: Model photoautotrophs isolated from a Proterozoic ocean analog - aerobic life under anoxic conditions. American Geophysical Union Fall Meeting. San Francisco, CA.
- 2015: Microbes in a bottle: Where model organisms and analog systems meet. American Geophysical Union. American Geophysical Union Fall Meeting. San Francisco, CA.
- 2015: Light-dependent primary productivity in a Proterozoic ocean analog. Goldschmidt. Prague, Czech Republic.
- 2014: A Metabolically Versatile Cyanobacterium and the Low- Oxygen Proterozoic World. Goldschmidt. Sacramento, CA.
- 2013: Molecular evidence for an active endogenous microbiome beneath glacial ice. Polar & Alpine Microbiology. Big Sy, MT..
- 2013: 2-Methyl Hopanoid Production and Anoxygenic Photosynthesis: A Model Early Earth Cyanobacteria Isolated from a Proterozoic Ocean Analog. Florence, Italy. August 2013.
- 2011: Biological Nitrogen Fixation in the Yellowstone Geothermal Complex. Bioinorganic Chemistry Gordon Research Seminar. Ventura, CA.

CONFERENCE PRESENTATIONS

- 2018: Hamilton, T.L., Havig, J.R. Inorganic carbon addition stimulates snow algae primary productivity. Snow Algae Meeting 2018, Potsdam, Germany.
- 2018: Havig, J.R., Hamilton, T.L. Potential effects of eutrophication-induced cyanobacterial blooms and invasive mussel species on carbon cycling and sequestration in Great Lakes Region lakes and reservoirs. GSA North-Central - 52nd Annual Meeting. Ames, Iowa.
- 2017: Schuler*, C.G., Havig, J.R., Hamilton, T.L. Relating Microbial Community Composition and Function to Morphology: Implications for Interpreting the Rock Record. Astrobiology Science Conference. Mesa, AZ.
- 2017: Colman, D.R., Poudel, S., Hamilton, T.L., Havig, J.R., Selensky, M.J., Shock, E.L., Boyd, E.S. Oxygen and the Evolution of Thermoacidophiles. Astrobiology Science Conference, Mesa, AZ.
- 2017: Skidmore M.L., Mitchell, R., Steigmeyer, A., van Gelder, W., Dunham, E., Lindsay, M., Hamilton T.L., Boyd, E.S. Mineral Dependent Chemolithotrophy in Subglacial Systems. Astrobiology Science Conference, Mesa, AZ.
- 2017: Havig, J.R., Hamilton, T.L. Cryptic photosynthesis: A possible analog for early Earth and Mars. Astrobiology Science Conference, Mesa, AZ.
- 2017: Sublett*, H., Hamilton, T.L., Lentz, D. DNA Analyses of Reservoirs and Watersheds of the Ancient Maya City of Tikal. Undergraduate Research Conference. Cincinnati, OH.
- 2017: Schuler*, C.G., Havig, J.R., Hamilton, T.L. Carbon fixation across geochemical gradients in the Greater Obsidian Pool Area. Undergraduate Research Conference. Cincinnati, OH.
- 2017: Bretland*, K.A., Havig, J., Hamilton, T.L. Life at the fringe: in situ characterization of the upper temperature limit of photosynthesis. Undergraduate Research Conference. Cincinnati, OH.

- 2017: Boucher, J., Havig, J.R., Hamilton, T.L., Antonopoulos, D.A., Koval, J., McCormick, M. mapping microbial community composition and geochemical gradients at high spatial resolution in a meromictic lake (Green Lake, Fayetteville, New York. 2017 NE/NC GSA Joint Section Meeting, Pittsburgh, PA.
- 2017: Havig, J.R., Hamilton, T.L., McCormick, M., McClure, B., Sowers, T., Wegter, B., Kump, L.R. Water Column and Sediment Carbon Isotope Geochemistry of Permanently Redox-Stratified Fayetteville Green Lake, New York, USA. 2017 NE/NC GSA Joint Section Meeting, Pittsburgh, PA.
- 2017: Hamilton T.L., Klatt, J., Weber, M., Lott, C., Clark, C., de Beer, D., Macalady, J.L. Model Photoautotrophs Isolated from a Proterozoic Ocean Analog. 2017 NE/NC GSA Joint Section Meeting, Pittsburgh, PA.
- 2016: Havig, J.R., Grettenberger, C.L., Hamilton, T.L. Zombie Mines and Brain Biofilms: Acid Mine Drainage Impact and Implications for the Archean-Paleoproterozoic transition. GSA Annual Meeting, Denver, CO.
- 2016: Oyadiran*, T., Hamilton T.L. Trace Metal Availability and the Evolution of Biological Nitrogen Fixation. Undergraduate Research Conference. Cincinnati, OH.
- 2016: Huffer*, I., Hamilton, T.L. Effect of Various Nitrogen Sources on Growth of *Microcystis aeruginosa* Strains. Undergraduate Research Conference. Cincinnati, OH.
- 2015: Hamilton, T.L., Weber, M., Lott, C., Clark, C., de Beer, D., Dron, A., Macalady, J.L. Light-dependent primary productivity in a Proterozoic ocean analog. Astrobiology Science Conference, Chicago, IL.
- 2015: Hamilton, T.L., Jones, D.S., Tsao, L., Schaperdoth, I., Macalady, J.L. Metagenomic insights into S(0) precipitation in a terrestrial subsurface lithoautotrophic ecosystem. Hamilton T.L., Astrobiology Science Conference, Chicago, IL.

PUBLISHED ABSTRACTS

* student advisee presenting author

- 2018: Hamilton, T.L., Murugapiran, S., Havig, J.R. Anoxygenic photosynthesis across temperature and pH space. Presented at Goldschmidt 2018, Boston, MA.
- 2018: Havig, J.R., Hamilton, T.L. Cryptic Oxygen Oases: Hypolithic Oxygenic Photosynthesis in Hydrothermal Areas as a Model for Continental Oxidation Before the GOE. Presented at Goldschmidt 2018, Boston, MA.
- 2017: Hamilton, T.L., Havig, J.R. Inorganic carbon addition stimulates snow algae primary productivity. Abstract #B13K-05, presented at 2017 Fall Meeting, AGU, New Orleans, LA.
- 2017: Havig, J.R., Hamilton, T.L. Cryptic oxygen oases: Hypolithic photosynthesis in hydrothermal areas and implications for Archean surface oxidation. Abstract #V24A-02, presented at 2017 Fall Meeting, AGU, New Orleans, LA.
- 2017: Rutledge, A.M., Horgan, B.H.N., Havig, J.R., Rampe, E.B., Scudder, N., Hamilton, T.L. Glacial Chemical Alteration of Mars-Like Bedrock. Abstract #P35H-05, presented at 2017 Fall Meeting, AGU, New Orleans, LA.
- 2017: Rutledge, A.M., Horgan, B., Havig, J.R., Rampe, E.B., Scudder, N.A., Hamilton, T.L. Glacial Melt water as a Source of Amorphous Silica on Early Mars. Fourth International Conference on Early Mars: Geologic, Hydrologic, and Climatic Evolution and the Implications for Life. Abstract #1964, presented at the Lunar and Planetary Science Conference, The Woodlands, TX.
- 2016: Scudder, N.A., Horgan, B., Havig, J.R., Rutledge, A.M., Rampe, E.B., Scudder, N.A., Hamilton, T.L. Differentiating Hydrothermal, Pedogenic, and Glacial Weathering in a Cold Volcanic Mars-Analog Environment. Abstract #2973 presented at Lunar and Planetary Science Conference, The Woodlands, TX.
- 2016: Hamilton, T.L., de Beer, D., Klatt, J., Weber, M., Lott, C., Chennu, A. Model photoautotrophs isolated from a Proterozoic ocean analog - aerobic life under anoxic conditions. Abstract #B43F-04, presented at 2016 Fall Meeting, AGU, San Francisco, CA.

- 2016: Hamilton, T.L., Havig, J.R. Primary productivity of supraglacial snow algae communities on stratovolcanoes of the Pacific Northwest. Abstract #B44B-08, presented at 2016 Fall Meeting, AGU, San Francisco, CA.
- 2016: Berberich, M.B., Buffam, I.D., Beaulieu, J.J., Hamilton, T.L., Waldo, S., Li, X. Effects of Algal-Derived Carbon on Sediment Methane Production in a Eutrophic Ohio Reservoir. Abstract #B23B-0576, presented at 2016 Fall Meeting, AGU, San Francisco, CA.
- 2015: Hamilton, T., Weber, M., Lott, C., Clark, C., Bird, L., de Beer, D., Dron, A., Freeman, K., Macalady, J. Light-Dependent Primary Productivity in a Proterozoic Ocean Analog. Goldschmidt Abstracts, 2015 1156. Presented at Goldschmidt, Prague, Czech Republic.
- 2015: Gilhooly III, W., Werne, J.P., O'Beirne, M., Harris IV, J.H., Fouskas, F., Havig, J.R., Hamilton, T.L., McCormick, M. Diurnal sulfur isotope patterns in a stratified euxinic lake. Abstract #B21A-0411, presented at 2016 Fall Meeting, AGU, San Francisco, CA.
- 2015: Microbes in a bottle: Where model organisms and analog systems meet. Hamilton, T.L., Weber, M., Lott, C., Havig, J.R., Clark, C., Bird, L.R., de Beer, D., Dron, A., Freeman, K.H., Macalady, J.L. Abstract #B24A-01, presented at 2015 Fall Meeting, AGU, San Francisco, CA.
- 2014: Hamilton, T.L., Klatt, J., Bird, L., Freeman, K., de Beer, D., Macalady, J. A Metabolically Versatile Cyanobacterium and the Low-Oxygen Proterozoic World. Goldschmidt Abstracts, 2014 902. Presented at Goldschmidt, Sacramento, CA.
- 2014: Havig, J., Hamilton, T., Bachan, A. Interpreting the Ancient Sulfur-Isotopic Signal from a Metabolic Pathway Perspective. Goldschmidt Abstracts, 2014 933. Presented at Goldschmidt, Sacramento, CA.
- 2014: Hamilton, T.L., Jewell, T.N.M., de la Torre, J.R., Boyd, E.S. The Co-Distribution of Nitrifying Archaea and Diazotrophic Bacteria in Geothermal Springs. Abstract #B23D-0231, presented at 2014 Fall Meeting, AGU, San Francisco, CA.
- 2013: Hamilton, T.L., Bird, L., Freeman, K., Macalady, J. 2-Methyl Hopanoid Production and Anoxygenic Photosynthesis: A Model Cyanobacteria Isolated from a Proterozoic Ocean Analog. Mineralogical Magazine, 77(5) 1249. Presented at Goldschmidt 2013, Florence, Italy.
- 2013: Boyd, E., Hamilton, T., Spots, T., Dore, J., Canovas, P., Havig, J., Peters, J., Shock, E., Skidmore, M. Seasonal Variation in Biological Methane Production in a Subglacial Ecosystem. Mineralogical Magazine, 77(5) 758. Presented at Goldschmidt 2013, Florence, Italy.
- 2013: McClure, B.E., Havig, J.R., Sowers, T.A., Hamilton, T.L., McCormick, M., Kump, L.R. Dynamics of the methane profile through the water column of meromictic Fayetteville Green Lake, N.Y. Abstract #B13E-0553, presented at 2013 Fall Meeting, AGU, San Francisco, CA.
- 2013: Boyd, E.S., Hamilton, T.L., Havig, J.R., Lange, R., Murter, E., Skidmore, M.L., Shock, E. Coupling autotrophic sulfide mineral weathering with dolomite dissolution in a subglacial ecosystem. Abstract #OS53A-1685, presented at 2015 Fall Meeting, AGU, San Francisco, CA.
- 2012: Hamilton, T.L., Peters, J., Boyd, E.S. Competition for Ammonia Structures the Composition of a Hydrothermal Microbial Community. Abstract #B44B-04, presented at 2012 Fall Meeting, AGU, San Francisco, CA.
- 2012: Boyd, E.S., Hamilton, T.L., Skidmore, M.L., Peters, J.W. Comparing and Contrasting the Active Component of Subglacial and Supraglacial Microbial Communities Through Transcriptional Analyses. Abstract #C23E-08, presented at 2012 Fall Meeting, AGU, San Francisco, CA.
- 2012: Havig, J.R., Hamilton, T.L., Boyd, E.S., Meyer-Dombard, D.R., Shock, E. Geochemical and physical drivers of microbial community structure in hot spring ecosystems. Abstract #B51D-0590, presented at 2012 Fall Meeting, AGU, San Francisco, CA.
- 2012: Peters, J., Boyd, E.S., Hamilton, T.L. The Role of Oxygen in the Evolution of Molybdenum Nitrogenase. Abstract #B43A-0387, presented at 2012 Fall Meeting, AGU, San Francisco, CA.

- 2011: Hamilton, T.L., Havig, J.R., Boyd, E.S., Meyer-Dombard, D.R., Shock, E., Peters, J. A shift in microbial community composition as a result of a natural temporal change in in a hot spring ecosystem. Abstract #B31K-02, presented at 2011 Fall Meeting, AGU, San Francisco, CA.
- 2011: Skidmore, M.L., Boyd, E.S., Lange, R.K., Mitchell, A.C., Havig, J.R., Hamilton, T.L., Lafreniere, M.J., Shock, E., Peters, J. Diversity, Abundance, and Potential Activity of Nitrifying and Nitrate-Reducing Microbial Assemblages in a Subglacial Ecosystem. Abstract #B22A-02, presented at 2011 Fall Meeting, AGU, San Francisco, CA.
- 2011: Havig, J.R., Hamilton, T.L., Boyd, E.S., Meyer-Dombard, D.R., Shock, E. Effects of geochemical changes on microbial community structure in a hot spring ecosystem. Abstract #B31K-01, presented at 2011 Fall Meeting, AGU, San Francisco, CA.
- 2011: Boyd, E.S., Hamilton, T.L., He, L., Wang, J., Peters, J., Zhang, C. Quantitative Mapping of Archaeal Biodiversity on the Geochemical Landscape in Yellowstone National Park, Wyoming. Abstract #B51G-0497, presented at 2011 Fall Meeting, AGU, San Francisco, CA.
- 2011: Peters, J., Boyd, E.S., Hamilton, T.L. Probing the evolution of biological nitrogen fixation by examining phylogenetic relationships of nitrogen fixation genes related by gene duplication. Abstract #B41B-0217, presented at 2011 Fall Meeting, AGU, San Francisco, CA.
- 2010: Boyd, E.S., Hamilton, T.L., Peters, J.W. Environmental Constraints on the Distribution, Diversity, and Activity of Biological Nitrogen Fixation in the Yellowstone Geothermal Complex. Abstract #B41L-06, presented at 2010 Fall Meeting, AGU, San Francisco, CA.
- 2009: Boyd, E.S., Miller, S., Hamilton, T.L., Lavin, M., Peters, J. A Methanogenic Origin for Molybdenum-Nitrogenase. Abstract #B12A-04, presented at 2010 Fall Meeting, AGU, San Francisco, CA.