

ALEXANDER B. MICHAUD
Postdoctoral Research Scientist
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EDUCATION

Montana State University, Bozeman, MT	Ecology	Ph.D., 2016
Coe College, Cedar Rapids, IA	Biology	B.A. <i>Cum Laude</i> , 2009

RESEARCH AND PROFESSIONAL EXPERIENCE

May 2019 – Current Postdoctoral Research Scientist
Bigelow Laboratory for Ocean Sciences, East Boothbay, ME, USA
Advisor: David Emerson

2016 – 2019 Postdoctoral Research Scientist
Center for Geomicrobiology, Aarhus University, Aarhus, Denmark
Advisors: Bo Barker Jørgensen, Laura M. Wehrmann

2009 – 2016 Graduate Research Assistant
Department of Land Resources and Environmental Science, Montana State University, Bozeman, MT, USA
Advisor: John C. Prisco

Summer 2008 NSF Research Experience for Undergraduates
Desert Research Institute, Las Vegas, NV, USA
Advisor: Duane P. Moser

GRANTS, AWARDS, AND FELLOWSHIPS

6. US National Science Foundation – Earth Sciences Postdoctoral Fellowship, PI, (award #1625158) – 2017 – 2019 (\$184,000)
5. Alfred Wegener Institute-Institute Paul Emile Victor Arctic Research Station Access Grant, Co-PI: “Biogeochemistry of carbon, iron and sulfur cycles of West-Svalbard fjords” (Funding for 20 days lodging for 14 scientists at AWI-IPEV station - 2017, Ny Ålesund, Svalbard; ~140,000NOK)
4. US National Science Foundation – Center for Dark Energy Biosphere Investigations Graduate Fellowship – 2014 – 2016 (\$64,000)
3. Deep Carbon Observatory – Census of Deep Life, Co-PI, funding for sequencing of 3 metagenomes (2014)
2. NASA Montana Space Grant Consortium Fellowship, Montana State University – 2012 (6 months) (\$7,500)
1. US National Science Foundation – Integrative Graduate Education and Research Traineeship, Montana State University – 2009 – 2011 (\$75,000)

PENDING GRANTS

2. SLEDGE: Subglacial Lake Exploration – Diversity, Geochemistry, Ecology
Agency: National Environmental Research Council of the United Kingdom
Role: Project Partner
Funding: \$2500 to ABM for laboratory work at Aberystwyth University
Status: Under Review
1. Are There Perennial and Light-Independent Microbial Processes on Supraglacial Ecosystems?

Agency: National Environmental Research Council of the United Kingdom

Role: Project Partner

Funding: \$6500 to ABM for Svalbard field work and laboratory work at Aberystwyth University

Status: Under Review

PEER REVIEWED JOURNAL ARTICLES

23. Jørgensen, BB, K Laufer, **AB Michaud**, LM Wehrmann. Biogeochemistry and microbiology of high Arctic marine sediment ecosystems – case study Svalbard fjords. *Limnology and Oceanography*. (in press) doi: 10.1002/lno.11551
22. **Michaud, AB**, TJ Vick-Majors, AM Achberger, ML Skidmore, BC Christner, M Tranter, JC Priscu. Environmentally clean access to three Antarctic subglacial aquatic environments. *Antarctic Science*. (in press) doi: 10.1017/S0954102020000231
21. **Michaud, AB**, K Laufer, A Findlay, A Pellerin, G Antler, AV Turchyn, H Røy, LM Wehrmann, BB Jørgensen. Glacial influences on the iron and sulfur cycles in Arctic fjord sediments (Svalbard). *Geochimica et Cosmochimica Acta*. 280: 423-440. doi:10.1016/j.gca.2019.12.033
20. Vick-Majors, TJ, **AB Michaud**, ML Skidmore, C Turetta, C Barbante, BC Christner, JE Dore, K Christianson, AC Mitchell, AM Achberger, JA Mikucki, JC Priscu. 2020. Biogeochemical connectivity between freshwater ecosystems beneath the West Antarctic Ice Sheet and the sub-ice marine coastal environment. *Global Biogeochemical Cycles*. 34: e2019GB006446 doi:10.1029/2019GB006446
19. Laufer, K, **AB Michaud**, H Røy, BB Jørgensen. 2020. Reactivity of iron minerals in the seabed towards microbial reduction – a comparison of different extraction techniques. *Geomicrobiology Journal*. 37:170-189. doi:10.1080/01490451.2019.1679291
18. Herbert, LC, N Riedinger, **AB Michaud**, K Laufer, H Røy, BB Jørgensen, C Heilbrun, RC Aller, JK Cochran, LM Wehrmann. 2020. Glacial controls on redox-sensitive trace element cycling in Arctic fjord sediments (Spitsbergen, Svalbard). *Geochimica et Cosmochimica Acta*. 271:33-60. doi:10.1016/j.gca.2019.12.005
17. Buongiorno, J, LC Herbert, LM Wehrmann, **AB Michaud**, K Laufer, H Røy, BB Jørgensen, A Szykiewicz, A Faiia, KM Yeager, K Schindler, KG Lloyd. 2019. Complex Microbial Communities Drive Iron and Sulfur Cycling in Arctic Fjords Sediments. *Applied and Environmental Microbiology*. 85:e00949-19.
16. Santibáñez, PA, **AB Michaud**, TJ Vick-Majors, J D'Andrilli, A Chiuchiolo, KP Hand, JC Priscu. 2019. Differential incorporation of bacteria, organic matter, and inorganic ions into lake ice during ice formation. *Journal of Geophysical Research: Biogeosciences*. 124:585-600. doi:10.1029/2018JG004825.
15. Liu, Y, JC Priscu, T Yao, TJ Vick-Majors, **AB Michaud**, L Sheng. 2019. Culturable bacteria isolated from seven high altitude Tibetan ice cores. *Journal of Glaciology*. 65:29-38. doi:10.1017/jog.2018.86.
14. **Michaud, AB**, JE Dore, AM Achberger, BC Christner, AC Mitchell, ML Skidmore, TJ Vick-Majors, and JC Priscu. 2017. Microbial oxidation as a methane sink beneath the West Antarctic Ice Sheet. *Nature Geoscience*. 10:582. doi:10.1038/ngeo2992
13. Vick-Majors, TJ, AC Mitchell, AM Achberger, BC Christner, JE Dore, **AB Michaud**, JA Mikucki, AM Purcell, ML Skidmore, JC Priscu. 2016. Physiological ecology of microorganisms in Subglacial Lake Whillans. *Frontiers in Microbiology*. 7:1705. doi:10.3389/fmicb.2016.01705.
12. Achberger, AM, BC Christner, **AB Michaud**, JC Priscu, ML Skidmore, TJ Vick-Majors, the WISSARD Science Team. 2016. Microbial community structure of Subglacial Lake Whillans, West Antarctica. *Frontiers in Microbiology*. 7:1457. doi:10.3389/fmicb.2016.01457.
11. **Michaud, AB**, ML Skidmore, AC Michell, TJ Vick-Majors, JC Priscu, C Barbante, C Turetta, W VanGelder. 2016. Solute sources and geochemical processes in Subglacial Lake Whillans, West Antarctica. *Geology*. 44:347. doi:10.1130/G37639.1.
10. Liu, Y, JC Priscu, T Yao, TJ Vick-Majors, B Xu, N Jiao, P Santibáñez, S Huang, N Wang, M Greenwood, **AB Michaud**, S Kang, J Wang, Y Yang. 2015. Bacterial responses to environmental change in the Tibetan Plateau over the past half century. *Environmental*

- Microbiology*. 18:1930. doi:10.1111/1462-2920.13115
9. Vick-Majors, TJ, AM Achberger, P Santibáñez, JE Dore, T Hodson, **AB Michaud**, BC Christner, J Mikucki, ML Skidmore, R Powell, WP Adkins, C Barbante, A Mitchell, R Scherer, JC Priscu. 2015. Microbial diversity and biogeochemistry of the marine cavity beneath the McMurdo Ice Shelf, Antarctica. *Limnology and Oceanography*. 61:572. doi:10.1002/lno.10234
 8. Lever, MA, A Torti, P Eickenbusch, **AB Michaud**, T Šanti-Temkiv, BB Jørgensen. 2015. A modular method for the extraction of DNA and RNA, and the separation of DNA pools from diverse environmental sample types. *Frontiers in Microbiology*, 6:476. doi:10.3389/fmicb.2015.00476
 7. Matheus-Carnevali, P, M Rohrsen, MR Williams, **AB Michaud**, H Adams, D Berisford, GD Love, JC Priscu, KP Hand, AE Murray. 2015. Methane sources in Arctic thermokarst lake sediments on the North Slope of Alaska. *Geobiology*, 13:181. doi:10.1111/gbi.12124
 6. Purcel, AM, JA Mikucki, AM Achberger, IA Alekhina, C Barbante, BC Christner, D Ghosh, **AB Michaud**, AC Mitchell, R Scherer, JC Priscu, ML Skidmore, TJ Vick-Majors and the WISSARD Science Team. 2014. Microbial sulfur transformations in sediments from Subglacial Lake Whillans. *Frontiers in Microbiology*, 5:594. doi:10.3389/fmicb.2014.00594
 5. **Michaud, AB**, JE Dore, D Leslie, WB Lyons, DC Sands, JC Priscu. 2014. Biological ice nucleation initiates hailstone formation. *Journal of Geophysical Research: Atmospheres*, 119:12,186. doi:10.1002/2014JD022004
 4. Christner, BC, JC Priscu, AM Achberger, C Barbante, SP Carter, K Christianson, **AB Michaud**, JA Mikucki, AC Mitchell, ML Skidmore, TJ Vick-Majors and the WISSARD Science Team. 2014. A microbial ecosystem beneath the West Antarctic Ice Sheet. *Nature*, 512:310. doi:10.1038/nature13667
 3. Liu, Y, T Yao, JC Priscu, TJ Vick-Majors, **AB Michaud**, N Jiao, J Hou, L Tian, A Hu, Z-Q Chen. 2014. A comparison of pelagic, littoral, and riverine bacterial assemblages in Lake Bangongco, Tibetan Plateau. *FEMS Microbiology Ecology*, 89:211. doi:10.1111/1574-6941.12278
 2. Priscu, JC, AM Achberger, JE Cahoon, BC Christner, RL Edwards, WL Jones, **AB Michaud**, MR Siegfried, ML Skidmore, RH Spigel, GW Switzer, S Tulaczyk, TJ Vick-Majors. 2013. A microbiologically clean strategy for access to the Whillans Ice Stream subglacial environment. *Antarctic Science*, 25:637. doi:10.1017/S0954102013000035.
 1. **Michaud, AB**, M Šabacka, JC Priscu. 2012. Cyanobacterial diversity across landscape units in a polar desert: Taylor Valley, Antarctica. *FEMS Microbiology Ecology*. 82:268. doi:10.1111/j.1574-6941.2012.01297.x

BOOK CHAPTERS

2. Vick-Majors, TJ, AM Achberger, **AB Michaud**, JC Priscu. Metabolic and taxonomic diversity in Antarctic subglacial environments. in *Life in Extreme Environments: Insights in Biological Capability*. (ed. G diPrisco, HGM Edwards, J Elster, AHL Huiskes) Cambridge University Press. (in press)
1. Achberger, AM, **AB Michaud**, TJ Vick-Majors, BC Christner, ML Skidmore, JC Priscu, and M Tranter. 2017. Microbiology of Subglacial Environments. in *Psychrophiles: From Biodiversity to Biotechnology*. (Ed. R Margesin) Springer.

MANUSCRIPTS IN PREPARATION

7. **AB Michaud** and S Apollonio. Redox-dependent regeneration of silicate throughout winter in an Arctic lake (Immerk Lake, Devon Island, Canada). *Biogeochemistry*. (In Review).
6. Laufer, K, **AB Michaud**, M Maisch, JM Byrne, A Kappler, MO Patterson, H Røy, and BB Jørgensen. Bioavailable iron produced through benthic cycling in glaciated Arctic fjords (Svalbard). *Nature Communications*. (In Review).
5. Herbert, LC, Q Zhu, **AB Michaud**, K Laufer, CK Jones, N Riedinger, ZS Stooksbury, I Klingensmith, RC Aller, BB Jørgensen, and LM Wehrmann. Benthic iron flux influenced by climate-sensitive interplay between organic carbon availability and diagenetic mineral formation in Arctic fjords. *Limnology and Oceanography*. (In Review).

4. Herbert, LC, **AB Michaud**, K Laufer, C Hoppe, Q Zhu, RC Aller, BB Jørgensen, and LM Wehrmann. Seasonal carbon export drives changes in coupled Fe-S cycling dynamics in an Arctic fjord (Kongsfjorden, Svalbard). Prepared for *Estuarine, Coastal and Shelf Science*. (Draft with coauthors).
3. Hudson, JM, **AB Michaud**, D Emerson, and Y-P Chin. High-resolution spatial distribution of redox-active species in Arctic porewaters. Prepared for *Aquatic Microbial Ecology*. (Draft with coauthors).
2. **AB Michaud**, JC Priscu, and the SALSA Science Team. Sediment oxygen consumption in Antarctic subglacial environments. Prepared for *Limnology and Oceanography: Letters*. (Draft with coauthors).
1. Rosenheim, BE, J Broda, A Gagnon, **AB Michaud**, A Leventer, R Venturelli, MO Patterson, T Campbell, JE Dore, M Tranter, ML Skidmore. Sediment coring operations during clean access of Mercer Subglacial Lake, Antarctica. Prepared for *Journal of Marine Science and Engineering*. (Draft with coauthors).

TEACHING EXPERIENCE

Instructor of Record

Environmental Microbiology (Bio535) – Coe College Wilderness Field Station (Summer 2012)
Developed, taught, led field work, and evaluated the class

Lectures

Prospects for Planet Earth (ENS101) – Stony Brook University (2017)
Microbial Diversity, Ecology and Evolution (BIOM415) – Montana State University (2016)
Topics in Earth Sciences: Cool Life! (ERTH102) – Montana State University (2016)
Principles of Living Systems (BIOB 160) – Montana State University (2015)
Introduction to Land Resources and Environmental Sciences (ENSC110) – Montana State University (2015)
Introduction to Biotechnology (BIOB106) – Montana State University (2013, 2014)

STUDENTS MENTORED

9. Madeline Michaud – Bachelors student, Wheaton College (Nov. 2019 – current)
8. Rémi Massé – Bachelors student, University of Michigan, NSF Research Experience for Undergraduates (Summer 2019 and 2020)
7. Kim Roush – Masters Student, Montana State University, Bozeman, MT (Completed 2018)
6. Tyler Subatsch – MSU American Indian Research Opportunity Advisee (Summer 2013)
5. Stephin Littleshield – MSU American Indian Research Opportunity Advisee (Summer 2012)
4. Paloma Lopez – Bachelors student at University of California, Santa Cruz, MARC Fellow (Summer 2012)
3. Chase Jordan – Chief Joseph Middle School, Bozeman, MT (Fall 2011)
2. Chase Jordan and Hans Swenson – Chief Joseph Middle School, Bozeman, MT (Fall 2010)
1. Fritz Kalakay – Chief Joseph Middle School, Bozeman, MT (Fall 2009)

PROFESSIONAL SERVICE AND DEVELOPMENT

- Co-convener, Limnology of ice-covered lakes, ASLO-SFS, Madison, WI, USA (2020) – Cancelled due to COVID-19
- Competitively selected for Next Generation Polar Researcher Symposium, Catalina Island, CA (2019)
- Lead session convener, Session 9C: *Biogeochemical cycling in changing glacial habitats and downstream ecosystems*, Goldschmidt, Barcelona, Spain (2019)
- Reviewer (See Publons reviewer profile: 1327589):
Nature Climate Change, FEMS Microbiology Ecology, Scientific Reports, Biogeosciences Discussions, Geomicrobiology Journal, Extremophiles, Journal of Marine Systems, Biology

Letters, Chilean Antarctic Research Program, US-National Science Foundation, Earth and Planetary Science Letters, Science of the Total Environment, Frontiers in Earth Science

- Montana State University LRES Graduate Student Organization, Social Chair. 2010 – 2012
- Coe College Student Body Vice President. 2008

FIELD WORK EXPERIENCE

15. Toolik Lake Field Station, North Slope Borough, Alaska, USA (Summer 2019 – 6 weeks)
14. Subglacial Antarctic Lakes Scientific Access (SALSA) Project, Mercer Ice Stream, Mercer Subglacial Lake, West Antarctica (Dec 2018-Jan 2019)
13. Dicksonfjorden, Czech Research Station, Longyearbyen, Svalbard (Week of 5 Aug 2018)
*Expedition coordinator and leader (3 participants from Aarhus University)
12. Kongsfjorden, Svalbard, AWIPEV Research Station, Ny-Ålesund, Svalbard (April 2017, 2 weeks).
*Expedition coordinator and leader (6 participants, 3 Institutions, 3 countries represented)
11. Western fjords of Spitsbergen, Svalbard, AWIPEV Research Station, Ny-Ålesund, Svalbard (Jul 2017, 2 weeks).
*Expedition coordinator (13 participants, 6 Institutions, 5 countries represented)
10. Western fjords of Spitsbergen, Svalbard, AWIPEV Research Station, Ny-Ålesund, Svalbard (Aug 2016, 3 weeks).
*Expedition coordinator (13 participants, 7 Institutions, 5 countries represented)
9. Bornholm Basin Cruise, Baltic Sea, R/V Aurora (Week of 6 June 2016)
8. Beartooth Mountains, Alpine lake limnology and glacier runoff biogeochemistry, Carbon County, MT, USA (Week of 16 Aug 2015)
7. Whillans Ice Stream Subglacial Access Research Drilling (WISSARD) Project, Whillans Ice Stream Grounding Zone, Antarctica (Dec 2014 – Feb 2015)
6. NASA Icy Worlds Project, Thermokarst Lakes near Barrow, AK (week of 27 Oct 2013)
5. Whillans Ice Stream Subglacial Access Research Drilling (WISSARD) Project, Subglacial Lake Whillans, Antarctica (Nov 2012 – Feb 2013)
4. Robertson Glacier – Alberta, Canada (week of 21 Aug 2011)
3. American Dipper (*Cinclus mexicanus*) survey, Gallatin Gateway, MT, USA (week of 14 May, 2010, 2012)
2. McMurdo Long Term Ecological Research Site – Limnology Team, McMurdo Dry Valleys, Antarctica (Oct 2009 – Jan 2010)
1. Keane Wonder Spring, Death Valley National Park, CA, USA (Aug 2008, Jan 2009)

CONFERENCE ABSTRACTS AND INVITED LECTURES

(*Talk, >50 total conference abstracts, only showing presenting author abstracts)

- Michaud, AB, K Laufer, H Røy, BB Jørgensen. (2019) Glacial influences on the iron and sulfur cycle in Arctic fjord sediments (Svalbard). Goldschmidt. Barcelona, Spain.
- *Michaud, AB, K Laufer, H Røy, BB Jørgensen. (2019) Glaciological influences on competition between iron and sulfate reducing microorganisms. 8th International Polar and Alpine Microbiology Conference. Auckland, New Zealand.
- Michaud, AB, K Laufer, H Røy, BB Jørgensen. (2018) Microbial competition in glacially-influenced Arctic fjord sediments. International Society for Microbial Ecology Conference. Leipzig, Germany.
- *Michaud, AB, K Laufer, H Røy, BB Jørgensen. (2017) Glaciological controls on iron and sulfate reduction in Arctic fjords. 7th International Polar and Alpine Microbiology Conference. Nuuk, Greenland.
- *Michaud, AB, AC Mitchell, TJ Vick-Majors, AM Achberger, C Barbante, BC Christner, JE Dore, JA Mikucki, JC Priscu, AM Purcell, ML Skidmore, C Turreta. (2017) Linking biogeochemistry, energetics and microbial community function in an Antarctic subglacial ecosystem. Goldschmidt. Paris, France. (Invited)
- *Michaud, AB. (2015) Where penguins don't roam: Biogeochemistry of Subglacial Lake Whillans, West

Antarctica. Montana Tech, Butte, MT. Chemistry and Biochemistry Seminar Series.

- *Michaud, AB. (2015) Relict marine influences on contemporary microbial processes in Subglacial Lake Whillans, West Antarctica. Scripps Institute of Oceanography, San Diego, CA. Polar Seminar Series.
- Michaud, AB, JE Dore, AM Achberger, BC Christner, ML Skidmore, TJ Vick-Majors, JC Priscu. (2015) Microbial methane cycling beneath the West Antarctic Ice Sheet. Center for Dark Energy Biosphere Investigations Annual Meeting 2015, Marina, CA, USA.
- Michaud, AB, JE Dore, AM Achberger, BC Christner, ML Skidmore, TJ Vick-Majors, JC Priscu. (2015) Microbial methane cycling beneath the West Antarctic Ice Sheet. Microenergy Workshop 2015, Sandbjerg, DK.
- *Michaud, AB, AM Achberger, BC Christner, ML Skidmore, TJ Vick-Majors, JC Priscu. (2013) Geomicrobiology of Subglacial Lake Whillans Sediments. 5th International Polar and Alpine Microbiology Conference. Big Sky, MT.
- Michaud, AB, P Sañtibáñez, TJ Vick-Majors, AC Chiuchiolo, JA Dandrilli, JC Priscu. (2013) Biogeochemical partitioning between the liquid water and ice phases during freeze-down in Antarctic and Arctic lakes. 5th International Polar and Alpine Microbiology Conference. Big Sky, MT.
- *Michaud, AB. (2013) Exposing an ecosystem below the West Antarctic Ice Sheet. Coe College Research Symposium, Plenary Lecture. (Invited)
- *Michaud, AB. (2012) Microbial ecology of Subglacial Lake Whillans, West Antarctica. Coe College Biology Department Seminar Series.
- Michaud, AB, M Šabacka, JC Priscu. (2010) A comparative method for elucidating Cyanobacterial diversity in Taylor Valley, Antarctica. NSF-LTER McMurdo Dry Valleys Meeting. Ft. Collins, CO.
- *Michaud, AB, JE Dore, D Leslie, WB Lyons, DC Sands, JC Priscu. (2011) The Role of Ice Nucleation Active Bacteria in Hailstone Formation. American Society for Microbiology – General Meeting. New Orleans, LA.
- Michaud, AB, ML Leonardo, DP Moser. (2009) *Shewanella* sp. diversity and abundance in Keane Wonder Spring, Death Valley National Park, Inyo CA. American Society for Microbiology, General Meeting, Philadelphia, PA.

PUBLIC EDUCATION AND OUTREACH

- Michaud, AB, “The Life of Ice.” Art Exhibition Opening Talk for 0°C, -3°C at The 410 Project, Mankato, MN, April 2019.
- Michaud, AB, Arctic and Antarctic Polar Explorers, Solbjergskolen, Solbjerg, Denmark. (~125 students) April 2019.
- Michaud AB, Arctic and Antarctic Day, Pinewood Community School, Eagan, MN. 5 – 2nd grade class, 1 – 5th grade enhanced learning program. (~125 students) Jan 2018.
- Priscu Research Group, Antarctic Science Day at the Montana State University Sub-Zero Research Facility. Bozeman Montessori School. April 2015.
- Michaud, AB and J Patriarche, Frozen at the Bottom of Earth: The Life of Antarctic Ice. Colorado Springs Science Festival, Public Lecture, Fall 2014
- Michaud, AB and TJ Vick-Majors. Where penguins don't roam: Discovering life in a lake beneath the West Antarctic Ice Sheet. Colorado Springs Science Festival, Public Lecture, Fall 2013
- Colorado Spring Science Festival, Colorado Springs, CO. Four K-12 classroom presentations and activities focused on Earth's albedo and Antarctic microorganisms. (~230 students). 2014.
- Colorado Spring Science Festival, Colorado Springs, CO. Three K-12 classroom presentations and activities focused on glacial ice dynamics. (~150 students). 2013.
- Crow Nation Science Education Partnership, Crow Agency, MT. Classroom presentations and activities focused on polar biology (~100 students per year). 2010-2014
- Science for Kids Night, Coe College, Cedar Rapids, IA. (~1000 K-12 students each year). 2005-2009