

## Melody R. Lindsay, Ph.D. - Curriculum Vitae

### Research Scientist

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[Google Scholar](#), [Research Gate](#)

**Research Interests:** My research interests in **geomicrobiology** are focused on how environments influence microbial community diversity, function, and evolution, and how microbial communities can in turn shape their environments. I primarily do this through analyzing the biology, geochemistry, and geology of unique, often "extreme" environments. My work currently focuses on methods to measure respiration of single cells in the **deep biosphere**, tracking **microbial activity** and revealing unique **genomic information**.

**Keywords:** geomicrobiology, deep biosphere, chemosynthetic metabolisms, anaerobic microbiology, astrobiology, early Earth metabolisms, single cell genomics, active respiration

### Professional Experience:

2023 – current      *Research Scientist*, Bigelow Laboratory for Ocean Sciences  
2022 – current      *Diversity, Equity, and Inclusivity Liaison*, Bigelow Laboratory for Ocean Sciences  
2019 – 2022        *Postdoctoral Scientist*, Bigelow Laboratory for Ocean Sciences  
                          Advisors: Dr. Beth Orcutt & Dr. Dave Emerson  
2013 – 2019        *Graduate Research Assistant*, Montana State University  
                          *NASA Earth and Space Science Fellow*; Advisor: Dr. Eric S. Boyd  
2011 – 2013        *Undergraduate Researcher*, Princeton University; Advisor: Dr. Tullis C. Onstott  
2010                *REU*, NASA Astrobiology Institute at the University of Hawaii  
2009 – 2010        *Undergraduate Researcher*, Princeton University/Bermuda Institute of Ocean Sciences

### Education:

2013 – 2019        Ph.D., Microbiology, Montana State University, Bozeman, MT  
                          *Thesis: "Geomicrobiology of Hydrogen in Yellowstone Hot Springs"*  
2009 – 2013        A.B., Ecology and Evolutionary Biology; Certificate in Musical Performance;  
Princeton University, Princeton, NJ  
                          *Thesis: "The Microbes of Moria: Characterization of active microbial members in the subsurface environment of the Witwatersrand Basin"*

### Publications:

#### *In Review:*

- (22) **M.R. Lindsay\***, T. D'Angelo, J.H. Munson-McGee, A. Saidi-Mehrabad, M. Devlin, J. McGonigle, E. Goodell, M. Herring, L. Lubelczyk, C. Mascena, J. Brown, G. Gavelis, J. Liu, D.J. Yousavich, S.D. Hamilton-Brehm, B.P. Hedlund, S. Lang, T. Treude, N.J. Poulton, R. Stepanauskas, D.P. Moser, D. Emerson, B.N. Orcutt. Species-resolved, single-cell respiration rates reveal dominance of sulfate reduction in a deep continental subsurface ecosystem. *In Review*. \*Corresponding Author.
- (21) K. Sims, B. Carr, S. Scott, A. Parsekian, **M.R. Lindsay**, D. Colman, C. Messa, J. Lowenstern, E. Shock, R. McCleskey, M. Charette, H. Heasler, C. Jaworowoski, A. Role, T. Moloney, W. Holbrook, S. Pasquet, E. Boyd. A Tale of Two Pools: The Impact of Phase Separation on the Geohydrobiology of the Yellowstone Hydrothermal System. *In Review*.

#### *In Press/Published:*

20. T. D'Angelo, J. Goordial, **M.R. Lindsay**, J. McGonigle, A. Booker, D. Moser, R. Stepanauskas, B.N. Orcutt. Replicated life-history patterns and subsurface origins of the bacterial sister-phyla Nitrospirota and Nitrospinota. (2023) *The ISME Journal*. <https://www.nature.com/articles/s41396-023-01397-x>.
19. J.H. Munson-McGee\*, **M.R. Lindsay\***, E. Sintes, J.M. Brown, T. D'Angelo, J. Brown, L.C. Lubelczyk, P. Tomko, D. Emerson, B.N. Orcutt, N.J. Poulton, G.J. Herndl, R. Stepanauskas. Decoupling respiration

- rates and abundance in marine prokaryoplankton. (2022) *Nature*. \*These authors contributed equally to this project and should be considered co-first authors. <https://www.nature.com/articles/s41586-022-05505-3>.
18. K.M. Fecteau, E.S. Boyd, **M.R. Lindsay**, M.J. Amenabar, K.J. Robinson, R.V. Debes II, E.L. Shock. Cyanobacteria and Algae Meet at the Limits of the Habitat Ranges in Moderately Acidic Hot Springs. (2021) *JGR Biogeosciences*. <https://doi.org/10.1029/2021JG006446>
  17. D.R. Colman, **M.R. Lindsay**, A. Harnish, E.M. Bilbrey, M.J. Selensky, M.J. Amenabar, K.M. Fecteau, R.V. Debes II, M.B. Stott, E.L. Shock, E.S. Boyd. (2021) Seasonal hydrologic and geologic forcing drive hot spring geochemistry and microbial biodiversity. *Environmental Microbiology*. <https://doi.org/10.1111/1462-2920.15617>
  16. M. Kanik, M. Munro-Ehrlich, M. Fernandes-Martins, D. Payne, K. Gianoulas, L. Keller, A. Kubacki, **M.R. Lindsay**, B. Baxter, M. Vanden Berg, D. Colman, E. Boyd. (2020) Unexpected abundance and diversity of phototrophs in mats from morphologically diverse microbialites in Great Salt Lake, Utah. *Applied and Environmental Microbiology*. [doi:10.1128/AEM.00165-20](https://doi.org/10.1128/AEM.00165-20)
  15. **M.R. Lindsay**, E.C. Dunham, and E.S. Boyd. Microbialites of Great Salt Lake. (2020). In Great Salt Lake: Biology of a terminal lake in the age of change. B.K. Baxter and J.K. Butler, Editors. Springer-Verlag. [Link](#).
  14. D.R. Colman, **M.R. Lindsay**, M.J. Amenabar, M.C. Fernandes Martins\*, E.R. Roden, E.S. Boyd. (2020). Phylogenomic analysis of novel Diaforarchaea is consistent with sulfite but not sulfate reduction in volcanic environments on early Earth. *The ISME Journal*. \*Mentored undergraduate student. [doi:10.1038/s41396-020-0611-9](https://doi.org/10.1038/s41396-020-0611-9).
  13. E.C. Dunham, E.M. Fones, **M.R. Lindsay**, C. Steuer, N. Fox, M. Willis, A. Walsh, D.R. Colman, B.K. Baxter, D. Mogk, D. Bowen, D. Lageson, E.S. Boyd. (2019). An Ecological Perspective on Dolomite Formation in Great Salt Lake, Utah. *Frontiers in Earth Science*. [doi: 10.3389/feart.2020.00024](https://doi.org/10.3389/feart.2020.00024).
  12. D.R. Colman, **M.R. Lindsay**, M.J. Amenabar, E.S. Boyd (2019). The Intersection of Geology, Geochemistry, and Microbiology in Continental Hydrothermal Systems. *Astrobiology*. [doi: 10.1089/ast.2018.2016](https://doi.org/10.1089/ast.2018.2016).
  11. D. Payne, E.C. Dunham, E. Mohr, I. Miller, A. Arnold, R. Erickson, E.M. Fones, **M.R. Lindsay**, D.R. Colman, E.S. Boyd. (2019). Geologic legacy spanning >90 years explains unique Yellowstone hot spring geochemistry and biodiversity. *Environmental Microbiology*. [doi: 10.1111/1462-2920.14775](https://doi.org/10.1111/1462-2920.14775).
  10. **M.R. Lindsay**, D.R. Colman, M.J. Amenabar, K.E. Fristad, K.M. Fecteau, R.V. Debes, J.R. Spear, E.L. Shock, T.M. Hoehler, E.S. Boyd. (2019). Probing the Geological Source and Biological Fate of Hydrogen in Yellowstone Hot Springs. *Environmental Microbiology*. [doi:10.1111/1462-2920.14730](https://doi.org/10.1111/1462-2920.14730).
  9. D.R. Colman, **M.R. Lindsay**, E.S. Boyd. (2019). Mixing of end-member fluids supports hyperdiverse chemosynthetic hydrothermal communities. *Nature Communications*. [doi:10.1038/s41467-019-08499-1](https://doi.org/10.1038/s41467-019-08499-1).
  8. **M.R. Lindsay**, R.E. Johnston\*, B.K. Baxter, E.S. Boyd. (2019). Effects of Salinity on Microbialite-Associated Production in Great Salt Lake, Utah. *Ecology*. 100(3):1-14. [doi: 10.1002/ecy.2611](https://doi.org/10.1002/ecy.2611). \*Mentored undergraduate student.
  7. **M.R. Lindsay**, M.J. Amenabar, K.M. Fecteau, R.V. Debes, M.C. Fernandes-Martins\*, K.E. Fristad, H. Xu, T.M. Hoehler, E.L. Shock, and E.S. Boyd. (2018). Subsurface Processes Influence Oxidant Availability and Chemoautotrophic Hydrogen Metabolism in Yellowstone Hot Springs. *Geobiology*. 16:674-692. [doi:10.1111/gbi.12308](https://doi.org/10.1111/gbi.12308). \*Mentored undergraduate student.
  6. S. Poudel, E. Dunham, **M.R. Lindsay**, M. Amenabar, E. Fones, D. Colman, E.S. Boyd. (2018). Origin and Evolution of Flavin-Based Electron Bifurcating Enzymes. *Frontiers of Microbiology*. [doi: 10.3389/fmicb.2018.01762](https://doi.org/10.3389/fmicb.2018.01762).
  5. R.S. Hindshaw, **M.R. Lindsay**, and E.S. Boyd. (2017). Diversity and abundances of microbial eukaryotes in stream sediments from Svalbard. *Polar Biology*. [doi:10.1007/s00300-017-2106-3](https://doi.org/10.1007/s00300-017-2106-3).
  4. **M.R. Lindsay**, C. Anderson, N. Fox, G. Scofield, J. Allen, E. Anderson, L. Bueter, S. Poudel, K. Sutherland, J. H. Munson-McGee, J. van Norstrand, J. Zhou, J.R. Spear, B.K. Baxter, D. Lageson, and

- E.S. Boyd. (2017). Microbialite response to an anthropogenic salinity gradient in Great Salt Lake, Utah. *Geobiology*. 15(1):131-145. Chosen for cover image. DOI: [10.1111/gbi.12201](https://doi.org/10.1111/gbi.12201).
3. M.C.Y. Lau, T.L. Kieft, K. Olukayode, B. Linage-Alvarez, E. van Heerden, **M.R. Lindsay**, C. Magnabosco, W. Wang, J.B. Wiggins, L. Guo, D.H. Perlman, S. Kyin, H.H. Shwe, R.L. Harris, Y. Oh, M.J. Yi, R. Purtschert, G.F. Slater, S. Ono, S. Wei, L. Li, B. Sherwood Lollar, T.C. Onstott. (2016). An oligotrophic deep-subsurface community dependent on syntrophy is dominated by sulfur-driven autotrophic denitrifiers. *Proceedings of the National Academy of Sciences*. 113(49): E7927-E7936. DOI: [10.1073/pnas.16122244113](https://doi.org/10.1073/pnas.16122244113).
  2. R.S. Hindshaw, S.Q. Land, **M.R. Lindsay**, and E.S. Boyd. (2016). Origin and temporal variability of unusually low  $\delta^{13}\text{C}$ -DOC values in two high Arctic catchments. *Journal of Geophysical Research: Biogeosciences*. 121: 1073-1085. DOI: [10.1002/2015JG003303](https://doi.org/10.1002/2015JG003303).
  1. R.S. Hindshaw, T.H.E. Hinton, E.S. Boyd, **M.R. Lindsay**, and E.T. Tipper. (2015). Influence of glaciation on mechanisms of mineral weathering in two high Arctic catchments. *Chemical Geology*, 420: 37-50. DOI: [10.1016/j.chemgeo.2015.11.004](https://doi.org/10.1016/j.chemgeo.2015.11.004).

#### **Other Publications/Products:**

- M.R. Lindsay**, R.E. Johnston, B.K. Baxter, E.S. Boyd. Effects of salinity on microbialite-associated production in Great Salt Lake, Utah: Photo Gallery. *Bulletin of the Ecological Society of America*. April 2019.
- M.R. Lindsay**. "Great Salt Lake: Productive on Many Levels". *Friends of Great Salt Lake Newsletter*. Summer 2017, volume 25. URL: <https://fogsl.org/news-and-archives/newsletter-archive>.
- "Living Rock from the Great Salt Lake". Part of permanent exhibit at the Natural History Museum of Utah. Salt Lake City, July 2016 to present.

#### **Funded Research:**

##### *Current Awards:*

- \*2024-2026 NSF GEOPATHs. **Co-I: GP-IN: Communities of Aquatic Sciences in Teaching and Learning (COASTAL) Research Partnerships for Equity**. \$399,932; \$49,081 to Bigelow. PI: Karis Jones, Co-I's: Nadia Harvieux, Amy Sheldon. \*Pending FY24 budget.
- 2023-2025 NASA Exobiology (80NSSC23K1355). **PI: Pilot Study: Active-Life Detection Technologies and Lineage-Resolved Microbial Process Rates in an Ocean World Analog Subsurface Ecosystem**. \$551,254 award. Co-Is: Ramunas Stepanauskas, Nicole Poulton, Beth Orcutt.
- 2023 US Science Support Program for IODP Expedition 395 (subaward from NSF OCE-1450528). **PI: Expedition participation funds for Melody Lindsay**. \$46,488 subaward.
- 2022-2023 US Science Support Program for IODP Expedition 395C/384 (subaward from NSF OCE-1450528). **PI: Post expedition award for Melody Lindsay**. \$17,956 subaward.
- 2022-2023 JGI Community Sciences Program, DOE. **Co-PI: Ecology and adaptation of microorganisms immured in the West Antarctic Ice Sheet: Sequencing of single cell genomes, library preparation**. ~\$25,000 in-kind value. PI: Alex Michaud.

##### *Past Awards:*

- 2020-2021 US Science Support Program for IODP (subaward from NSF OCE-1450528). **PI: Participation of Melody Lindsay as science party member on IODP Expedition 395C** (deferred 2020 but completed Summer 2021). \$15,035 subaward.

- 2016-2019 NASA Earth and Space Sciences Graduate Fellowship: Planetary Sciences. **Co-PI/Graduate Student: Linking hydrogen metabolism with primary production in early Earth analogue mineral-supported ecosystems.** \$120,000 total. PI: Eric Boyd.
- 2018 JGI Community Sciences Program, DOE. **Co-PI: Linking subsurface geologic processes and microbial diversification: sequencing of 12 metagenomes, library preparation.** ~\$5,000 in-kind value. PI: Daniel Colman.

***Fellowships, Scholarships and Awards Received:***

- 2023 Siyuan-Ocean Emerging Leader - International Center for Deep Life Investigation
- 2021 Rodney L. White Postdoctoral Fellowship - Bigelow Laboratory for Ocean Sciences
- 2020 Travel Grant - Europa and Ocean World *In Situ* Science Workshop
- 2020 Travel Grant - Demystifying the IODP proposal process for early career scientists
- 2016-2019 NASA Earth and Space Science Fellowship – Planetary Science Research
- 2018 Student Travel Grant – ACA Astrobiology Grand Tour 2018
- 2017-2018 Doyle W. Stephens Award – Friends of Great Salt Lake
- 2017 International Society for Subsurface Microbiology Travel Grant
- 2016-2017 Beverly Ferguson Graduate Student Award – MBI Department
- 2016 Funding for the 2016 NASA/ESA Astrobiology Summer School
- 2015 SETI Institute Student Travel Grant (AbSciCon 2015)
- 2015 Thermal Biology Institute Turner Foundation Student Award
- 2012-2013 Princeton University ODOC Senior Thesis Award
- 2012 American Geophysical Union Travel Grant
- 2012 Princeton University Ecology/Evolutionary Biology Research Grant
- 2009 Davidson Fellow Laureate Scholarship Award

***Research Experience/Cruises:***

- 2023 Science Party Member - Inorganic geochemist/microbiologist - Research Cruise IODP Exp. 395, on JOIDES Resolution
- 2023 Co-Chief Scientist in Training, Remote Participation - TN-421, on R/V Thompson  
Chief Scientist: Dr. Beth Orcutt
- 2021\* Science Party - Research Cruise IODP Exp. 395C, on JOIDES Resolution  
\*Deferred to 2021 from 2020, then carried out remotely
- 2019 Research Cruise AT42-11, on R/V Atlantis with ROV Jason II  
Chief Scientist: Dr. Beth Orcutt
- 2013-2019 Numerous research trips to Yellowstone National Park hot springs
- 2017 Field work in New Zealand hot springs
- 2016 Research on/in Alaskan backcountry mud volcanoes
- 2014-2018 Numerous research trips to Great Salt Lake, Utah
- 2012 Research in Witwatersrand Basin gold and diamond mines, South Africa

***Service & Synergistic activities:***

Recent reviewer for the following journals:

*Applied and Environmental Microbiology, The ISME Journal, Frontiers in Microbiology, Geobiology, mSystems, Geomicrobiology, Ecosphere, Plant Systematics and Evolution.*

Recent reviewer for NASA (various PSD panels as panel group chief, panelist, and external reviewer) and NSF (as external reviewer) proposals.

**Committee Service:**

Steering Committee Representative (for Dr. Beth Orcutt), NfoLD: NASA's Network for Life Detection

Bigelow Education committee member - Postdoctoral/Research Scientist/DEI Liaison Representative (2021 to current)

Session Convener for:

- 2023 AGU: OS019 - Multidisciplinary Approaches in Scientific Ocean Drilling to Investigate Interactions Within the Earth System.
- 2022 Astrobiology Science Conference (AbSciCon): Life Detection in Deep Biosphere Earth Analog Environments (Chair).
- 2019 Astrobiology Science Conference (AbSciCon): Anaerobic Biospheres: Past and Present.

**Teaching Experience:**

- 2021-2022 Laboratory Teaching Instructor for CH385B: Ocean Biogeochemistry on a Changing Planet, Colby College. Sea Semester 2021 and 2022.
- 2018 Co-instructor for BIOM494: Senior Capstone class in Microbiology, Montana State University.
- 2017 Teaching assistant for BIOM494: Senior Capstone class in Microbiology, Montana State University.
- 2015 Head Teaching Assistant for BIOM360: General Microbiology. Department of Microbiology and Immunology, Montana State University – Overall Instructor Rating: 4.95/5.00.
- 2014 Co-Teaching Assistant for BIOM360: General Microbiology. Department of Microbiology and Immunology, Montana State University – Overall Instructor Rating: 4.88/5.00.
- 2014-2016 MAP (Montana Apprenticeship Program). Mentored Native American High School Students in a summer immersion program which aims to increase underrepresented high school students entering STEM fields.

**Students Mentored:**

- 2022 Amy Doiron  
B.A. student at Southern Maine Community College  
Project \*co-advised: *Examining how iron cycling microbes affect phosphorus availability in the Arctic.*
- 2022 Melissa Herring  
B.A. student at Northeastern College, Co-op student.  
Project: *Utilization of a fluorogenic probe to detect and measure microbial life in a deep subsurface aquifer.*
- 2021-2022 Elizabeth Baker  
B.A. student at Bowdoin College, Bigelow REU.  
Project: *Patterns in deep biomass associated with sediment in the Reykjanes Ridge-Plume System*
- 2021 Eliza Goodell  
B.A. student at Oberlin College  
Project: *Establishing methods to quantify microbial activity across diverse environments*
- 2021 Anne Sternberg  
B.A. student at Colby College  
Project: *Quantifying microbial activity in Maine Coastal Sediments*
- 2018-2019 Maria Michelotti  
B.S. student at Montana State University

- 2017-2018 Project: *Culturing active H<sub>2</sub> oxidizers from Yellowstone hot springs*  
Rachel Johnston  
B.S. student at Montana State University  
Project: *Effects of Salinity on Microbialite-Associated Production in Great Salt Lake*
- 2017-2018 Evan Billbrey  
B.S. student at Montana State University  
Project: *Quantifying use of geochemical electron acceptors*
- 2016-2018 Maria Clara Fernandes Martins  
B.S. student at Montana State University  
Currently a Ph.D. student at MSU  
Project: *Growing chemosynthetic microbes from Yellowstone hot springs*
- 2014-2016 C. Andrew Dyson  
B.S. student at Montana State University  
Project: *Cultivation-based approach to quantifying H<sub>2</sub> metabolizing organisms in Smoke Jumper Hot Springs, Yellowstone*
- 2015 Kevin Glover  
B.S. student at Whitworth University  
Project: *Subglacial microbial iron utilization, Robertson Glacier*
- 2015 Marjorie Shinn  
B.S. student at Montana State University  
Project: *Cultivation-based approach to quantifying H<sub>2</sub> metabolizing organisms in Roadside Hot Springs, Yellowstone*
- 2014-2015 Cade Comstock  
B.S. student at Montana State University
- 2014 Zorah Maserati  
Masters student from Germany
- 2014 Joshua Thiel  
B.S. student at Westminster College  
Project: *Mercury methylating microbes in Lake Powell*
- 2014 Heather Rosler  
High School Student from Flathead Reservation
- 2013-2015 Jayme Feyhl-Buska  
Presidential Scholar at Montana State University  
Currently a Ph.D. student at USC.

***Selected Presentations:*** (\* indicates invited talk or seminar)

- 2023 \*Invited abstract at AGU, San Francisco, CA.
- 2022 \*Invited talk at Gordon Research Conference - Geobiology, Ventura, CA
- 2022 International Society for Microbial Ecology, Lausanne, Switzerland
- 2022 Astrobiology Science Conference, Atlanta, GA
- 2022 Association for the Sciences of Limnology and Oceanography, Virtual
- 2022 \*Rutgers University Marine Sciences Seminar, New Brunswick, NJ
- 2021 \*Center for Dark Energy Biosphere Investigations Meeting, Marina, CA
- 2021 \*NFoLD Steering Committee Meeting, Virtual
- 2021 \*Great Salt Lake Institute Salty Science Series, Virtual
- 2020 Bigelow Laboratory Science Seminar Series, East Boothbay, ME
- 2020 IODP Expedition 395 Summer Workshop, Virtual
- 2019 Center for Dark Energy Biosphere Investigations Meeting, Marina, CA
- 2019 EPSCoR National Conference, Columbia, SC

2018 \*Lake Bonneville Geologic Conference, Salt Lake City, UT  
2018 \*Great Salt Lake Issues Forum Meeting, Salt Lake City, UT  
2018 \*Gordon Research Seminar on Geobiology, Galveston, TX  
2018 Gordon Research Conference on Geobiology, Galveston, TX  
2017 International Society for Subsurface Microbiology, Rotorua, New Zealand  
2017 Astrobiology Science Conference, Mesa, AZ  
2016 \*Great Salt Lake Issues Forum, Salt Lake City, UT  
2015 Astrobiology Science Conference, Chicago, IL  
2012 American Geophysical Union Meeting, San Francisco, CA