Cecilia M. Howard
Postdoctoral Researcher, Environmental Sciences, University of Toledo
cecilia.howard@utoledo.edu | Personal Website | LinkedIn | ORCID

1 EDUCATION

2025 **PhD; Earth and Environmental Sciences**
University of Michigan, Rackham Graduate School
Dissertation title: "Unraveling Records of Time and Environment in Microbial Ecosystems from the Archean to Today"
Advisor: Nathan Sheldon
Rackham Predoctoral Fellow (2024) and Rackham Merit Fellow (2020)

2020 **Bachelor of Science; Molecular and Cellular Biology; Earth and Planetary Sciences**
Johns Hopkins University (with honors)

2019 **SEA Semester; Marine Biodiversity and Conservation**
Sea Education Association (Spring semester study away program)

2 PROFESSIONAL POSITIONS

2025–Present **Postdoctoral Research Associate**
Department of Environmental Sciences, University of Toledo

3 PUBLICATIONS

Howard, C.M., Sheldon, N.D., Loveall, Z., Keating, K.A., Hong, J., Smith, S.Y., and Passey, B.H. (Submitted to *Sedimentology*) Disentangling Morphological and Chemical Records of Climate, Hydrology, and Diagenesis in Microbialites from the Eocene Green River Basin, WY, USA.

Howard, C.M., and Sheldon, N.D. (2025) Microbialite niches across the Archean and Paleoproterozoic. *Geophysical Research Letters.* DOI: 10.1029/2025GL117354

Sheldon, N.D., **Howard, C.M.,** Dzombak, R., and Velazquez, D. (2025) Ephemeral subaerial environments, paleosols, and life on land: consequences for early continental weathering and global biogeochemistry. In *The Archean Earth* (2nd ed.), Eds. Homann, M., et al. Elsevier Science.

Howard, C.M., Sheldon, N.D., Smith, S.Y., and Noffke, N. (2024) Interpreting an Archaean paleoenvironment through 3D imagery of microbialites. *Geobiology*. DOI: 10.1111/gbi.12601

4 DATASETS

Howard, C. (2023) Interpreting an Archaean paleoenvironment through 3D images of microbialites (µCT scans). MorphoSource. Collection includes the following DOIs:
Sample 1 µCT Scan: 10.17602/M2/M572597; Sample 2 µCT Scan: 10.17602/M2/M572614; Sample 1 Meshes: 10.17602/M2/M572640, 10.17602/M2/M572617, 10.17602/M2/M572604, 10.17602/M2/M572601; Sample 2 Meshes: 10.17602/M2/M572622, 10.17602/M2/M572653, 10.17602/M2/M572662, 10.17602/M2/M572638, 10.17602/M2/M572659, 10.17602/M2/M572656.

Howard, C.M., Sheldon, N.D., Loveall, Z., Keating, K.A., Hong, J., Smith, S.Y., and Passey, B.H. (2025). Early Eocene Green River Basin Microbialite Morphological and Geochemical Data [Data set]. University of Michigan - Deep Blue Data. DOI: 10.7302/mtgm-xb86

Howard, C.M., and Sheldon, N. D. (2025). Microbialite Occurrence Data for the Archean and Paleoproterozoic [Data set]. University of Michigan - Deep Blue Data. DOI: 10.7302/2r9t-8810

Howard, C.M., Velazquez, D., Rico, K.I., and Sheldon, N.D. (2025). Sediment Carbon and Nitrogen and Environmental Data, Middle Island Sinkhole, 2007–2021 [Data set]. University of Michigan - Deep Blue Data. DOI: 10.7302/atpb-7k16

5 In Prep

Howard, C.M., Velazquez, D., Rico, K.I., and Sheldon, N.D. Climate-driven changes in sediment carbon and nitrogen of an anoxic Lake Huron sinkhole.

6 Abstracts and Presentations

[UG] – undergraduate mentee presenting author

Howard, C. (2025). Records of life and environment in microbial ecosystems from the Archean to today. UGA Department of Marine Sciences (Invited talk).

Howard, C. and Sheldon, N. (2024). Changing landscapes and life: Linking depositional environment to microbialite abundance across the Archean and Paleoproterozoic. AGU Fall Meeting, EP53A-1447. Poster.

Loveall, Z.[UG], **Howard, C.**, and Sheldon, N. (2024). Lacustrine stromatolites record environmentally-driven microbial mat growth and biogeochemical cycling in Paleolake Gosiute (52–50 Ma ago). AGU Fall Meeting, PP31C-0514. Poster.

Howard, C., and Sheldon, N. (2024). Reframing the search for Archean life. NAPC. DOI: 10.7302/23169. Presentation.

Howard, C., and Sheldon, N. (2024). Archean terrestrialization of the biosphere and impacts on marine ecosystems. MGU. Poster.

Loveall, Z.[UG], **Howard, C.,** and Sheldon, N. (2024) Differences in the mineralogy and morphology of Eocene Green River Basin stromatolites across paleolake stages. MGU. Presentation.

Howard, C., and Sheldon, N. (2023). Tracing impacts of climate variation on anoxic microbial communities and carbon sequestration. IGCB Open House. Poster.

Howard, C., Loveall, Z., and Sheldon, N. (2023). Variations in microbialite morphology and preservation in the Eocene Green River Basin. GSA Connects 2023. DOI: 10.1130/abs/2023AM-394006. Presentation.

Keating, K., **Howard, C.,** and Sheldon, N. (2023). Paleoenvironments and carbon cycling in the Paleogene Hoback Basin, WY. GSA Connects 2023. DOI: 10.1130/abs/2023AM-394473. Poster.

Velazquez, D., Kharbush, J., Sheldon, N., Hren, M., Junium, C., **Howard, C.,** and McKay, C. (2023). Investigating controls on carbon and nitrogen cycling in a modern anoxic lake environment. GSA North-Central Section Meeting. DOI: 10.1130/abs/2023NC-387052. Presentation.

Howard, C., Sheldon, N., Rico, K., Hren, M., and Velazquez, D. (2023) Muddy signals: Records of climate in C and N chemistry of an anoxic system. MGU. DOI: 10.7302/7054. Poster.

Loveall, Z.[UG], **Howard, C.,** Sheldon, N., and Smith, S. (2023) 3-D imaging of Ordovician fossils from the Chambersburg limestone using μCT scanning. MGU. DOI: 10.7302/7054. Poster.

Velazquez, D., Kharbush, J., Sheldon, N., Hren, M., Junium, C., and **Howard, C.** (2023) Carbon and Nitrogen Source to Sink Dynamics in a Modern Hypoxic Lake System. MGU. DOI: 10.7302/7054. Poster.

Velazquez, D., Sheldon, N., Kharbush, J., Hren, M., and **Howard, C.** (2022) Nitrogen isotope signatures in Lake Huron's Middle Island Sinkhole Sediments. AGU Fall Meeting, H32P-113. Poster.

Howard, C., Sheldon, N., Rico, K., Hren, M., and Velazquez, D. (2022) Climate-driven shifts in C and N burial in an anoxic lake sinkhole. AGU Fall Meeting, PP55C-0478. Poster.

Howard, C. and Sheldon, N. (2022) Understanding biogenicity of microbial structures through 3D imaging. MGU. DOI: 10.7302/4224. Presentation.

Rivera, S., Levin, N.E., Curley, A., **Howard, C.**, Kelson, J., Cook, M.K., Friedman, M., Sheldon, N.D., Smith, S.Y., and Johnson, J.E. (2021) URGE Outcomes From University of Michigan's Earth & Environmental Sciences. AGU Fall Meeting, U35A-2264.

Howard, C., Sheldon, N., Smith, S.Y., and Noffke, N. (2021) Life in 3D: Examining putative 3.2 Ga microbial mats with microCT imaging. GSA Connects 2021. Presentation.

Howard, C., and Gomes, M. (2021) Biological and environmental influences on stable isotopes of carbonates in microbial mats. MGU. DOI: 10.7302/879. Poster.

Gomes, M., **Howard, C.,** Trower, E.J., Sibert, E.C., Present, T.M., and Lingappa, U. (2020) Carbon isotope signatures in microbial mat carbonates – how do different carbonate components record information about local versus global carbon cycling? GSA 2020 Connects Online. Presentation.

Trower, L., Mahseredjian, T., Overeem, I., Gomes, M., **Howard, C.,** Lingappa, U.F., Present, T., and Sibert, E.C. (2019). Grain-Trapping by Microbial Mats—A Key Mechanism of Sediment Accumulation in Mangroves? AGU Fall Meeting, EP23B-03. Presentation.

Howard, C., and Measham, A. (2019) Bringing remote ocean regions home: Lessons on and from a semester on the High Seas. In "Traditions, tools, and technologies for advancing ecosystem-based management for the global ocean," panel organized by IUCN and DOSA. UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea. (Invited)

Howard, C. and Ahlman, S. (2019) Encouraging ocean literacy through picture books. Ned Cabot Marine Biodiversity and Conservation Symposium. Presentation.

Howard, C., Johnson, G., Reilinger, A. (2019) Holopelagic *Sargassum* diversity in the Sargasso Sea. Ned Cabot Marine Biodiversity and Conservation Symposium. Poster.

7 MEDIA

Sinkhole science in the Sanctuary. The Alpena News by Hinkley, Darby. Published June 8, 2024.

Lake Huron sinkhole resembles Earth two billion years ago. Interview with WCMU Public Media by Abarca, Zipporah. Published August 8, 2023.

8 TEACHING

F24 **Guest Lab for EARTH 313: Geobiology**
Designed and taught a lab about microbialite morphology.

F22–W24 **EARTH Graduate Student Mentor**
Lead GSM for 2023–2024 academic year; part of a three-person team. Responsible for training and supporting graduate student instructors in the Earth and Environmental Sciences Department, including developing and running three-day orientations, leading teaching workshops, and conducting mid-semester teaching observations to provide feedback to instructors.

W21, F22 **EARTH 442: Earth Surface Processes**
Taught lab sections, created introductory presentations, organized and lead field trips to collect and analyze soil samples.

Sp/Su 22 **EARTH 450: Ecosystem Science in the Rockies (Field Course)**

Part of a four-person teaching team. Assisted in developing, teaching, and supervising a field course curriculum and sampling procedures focused on the impacts of wildfires on ecosystems, including water quality, plant communities, soils, and natural hazards. Responsible for course logistics, risk management and safety, and scouting field locations.

9 AWARDS AND FELLOWSHIPS

2024 **Rackham Predoctoral Fellow**
University of Michigan Rackham Graduate School

2024 **Best Visuals (Poster)**
Michigan Geophysical Union

2023 **IGCB Graduate Fellow**
University of Michigan Institute for Global Change Biology

2023 **Outstanding GSI**
GeoClub, University of Michigan Dept. of Earth and Environmental Sciences

2022 **Audience Choice Award: Best Talk**
Michigan Geophysical Union

2021 **1st Place, Asynchronous Talks**
Michigan Geophysical Union

2020 **Rackham Merit Fellow**
University of Michigan Rackham Graduate School

10 GRANTS

2024 **Turner Grant**
"Climate, hydrology, or diagenesis? Microbialites as records of an ancient lake"
University of Michigan Dept. of Earth and Environmental Sciences

2023 **Turner Grant**
"(Elemental) mapping of variations in microbialite morphology and geochemistry in the Eocene Green River Basin"
University of Michigan Dept. of Earth and Environmental Sciences
Golden Star Award for best proposal

2023 **GSA Graduate Student Research Grant**
"Tracing the impact of anoxia on lacustrine microbial communities and biomarkers"
Geological Society of America

2023 **IGCB Small Research Grant**
"Tracing impacts of climate variation on anoxic lacustrine microbial communities and carbon sequestration"
University of Michigan Institute for Global Change Biology

2022 **Turner Grant**
"Tracing the impact of anoxia on lacustrine microbial communities and biomarkers"
University of Michigan Dept. of Earth and Environmental Sciences

2022, 2023 **Rackham Conference Travel Grant**
University of Michigan Rackham Graduate School

2021 **Turner Grant**
"Linking morphology and geochemistry in Eocene microbialites"

University of Michigan Dept. of Earth and Environmental Sciences

2021 **Rackham Graduate Student Research Grant**
"Understanding the middle age of Earth through modern lacustrine proxies"
University of Michigan Rackham Graduate School

2019 **Arts and Sciences Projects, Investigations, and Research Endeavors Grant**
"Records of carbon isotopes in microbial mats"
Johns Hopkins University Krieger School of Arts and Sciences

11 Field Research Experience

2024 **Green River Basin/Hoback Basin Geology, WY**
Planned and organized geological field work with one other graduate student, including stratigraphic logging with a Jacob's staff and Brunton and sample collection in remote areas. Trained an undergraduate field assistant in geological field methods. 4 weeks.

2023 **Green River Basin/Hoback Basin Geology, WY**
Planned and organized geological field work with one other graduate student, including stratigraphic logging and sample collection in remote areas. 2 weeks.

2021–2024 **Middle Island Sinkhole, Alpena, MI**
Organized shipboard sampling day trips with NOAA Thunder Bay National Marine Sanctuary and other collaborators 1–3 times per year, including as lead scientist on the ground. Collected sediment cores and water, deployed sensors, and deployed and retrieved a McLane Parflux 78H sediment trap.

2019 **Little Ambergris Cay, Turks and Caicos**
Participated in sampling modern tidal microbial mats, porewaters, and sediments. 2 weeks.

2019 **Sea Education Association (SEA) Semester**
Shipboard field work, including regular CTD deployment, water sampling, and net tows. 6 weeks.

12 Leadership and Service

2024–2025 **Peer Reviewer for *Lethaia***

2024–2025 **Grievance Committee Chair**
Graduate Employees' Organization; AFT Local 3550

2024 **Conference Logistical Support Volunteer**
North American Paleontological Convention

2023–2025 **Grievance Committee Member**
Graduate Employees' Organization; AFT Local 3550

2023 **Undergraduate Research Experience Program Development**
University of Michigan, Department of Earth and Environmental Sciences

2022–2023 **GeoClub DEI Coordinator**
University of Michigan, Department of Earth and Environmental Sciences

2021– **Undergraduate Research Mentor**
Mentor for three undergraduate students in the GRiTS Lab, University of Michigan Department of Earth and Environmental Sciences (Amelia Jelic (2021–2022), Kelsey Jones (2021), and Zachary Loveall (2022–Present))

13 CERTIFICATIONS

2024 **ESRI Cartography Massive Open Online Course (MOOC) Certificate**
Completed the ESRI Cartography MOOC, covering basic mapping skills in ArcGIS

2017–2026 **Wilderness First Responder**
Certified through NOLS, valid through January 2026. Includes adult, child, and infant CPR and epinephrine auto-injector certifications

14 ANALYTICAL AND COMPUTATIONAL SKILLSETS

Elemental analysis: ECS (organic and inorganic carbon and nitrogen; including training and maintenance experience with a Costech ECS 4010)
Stable and clumped isotopes: Aerodyne TILDAS (dual CH_4 isotopes; set up new instrument); CM-CRDS (organic and inorganic carbon; including training and maintenance experience with a Picarro G2201-*i* CM-CRDS); IRMS (clumped carbon and oxygen isotopes on a Nu Perspective IRMS)
DNA: Sediment DNA extraction and quantification, 16S community analysis
µCT Scanning: Nikon XT H 225 ST industrial µCT scanner (full user), Inspect-X, CT Pro 3D, Dragonfly ORS (3D image analysis and segmentation)
Imaging and microscopy: Optical microscopy, experience working with data from XRD, WDS
GIS and mapping: Experience with ArcGIS Pro, QGIS, and R
R: Proficient in base R, R Studio, R Markdown, Tidyverse
Vector drawing and image editing software: Adobe Illustrator, Inkscape