

Tirzah Abbott, M.S.

NUANCE Center SEM Facility Manager

PhD Candidate - Earth and Planetary Sciences

Northwestern University

2145 Sheridan Rd, Tech Institute AB A173

Evanston, IL 60202

Email: Tirzah.abbott@northwestern.edu

[Website](#) - [LinkedIn](#)

Education

Doctor of Philosophy - Student: Earth and Planetary Sciences (2022 – *expected fall 2026*)

Northwestern University – Evanston, Illinois

Advisor: Professor Steve Jacobsen

Master of Science: Geology, 2016

Northern Illinois University - Dekalb, Illinois

Geology M.S. Thesis Title: Oxygen and Silicon Isotope Variations in Diatom Silica from a Pliocene Antarctic Marine Sediment Core

Advisor: Dr. Justin Dodd

Bachelor of Science: Geology, 2012

Beloit College - Beloit, Wisconsin

Geology Honors Thesis Title: Fresh Water Diatoms as Bioindicators of Pollution in Selden Cove, Connecticut River

Relevant Work Experience

Electron Probe Instrumentation Center - SEM Facility Manager, 3/2022 to present.

NUANCE Center at Northwestern University – Evanston, IL

- Manage team of SEM facility staff to assist and train users on microscopes and associated equipment.
- Develop strategic plan and set goals for the center's future growth and development and write annual reports.
- Apply for internal and external funding to support new equipment.
- Work with research faculty to develop advanced electron microscopy tools and techniques.
- Hosts and plans educational workshops, seminars, trainings, and demonstrations.
- Networks with key decision makers in the research community and works with faculty to determine the needs of the research community.
- Aids in data analysis, interpretation, and methods.
- Provides consultations and service work for academic and industrial researchers.
- Training on advanced EM equipment (EBSD, FIB, eBL, in-situ Heating)
- Manage scientific programs (REU and RET programs through SHyNE Resource)

Electron Probe Instrumentation Center - SEM Laboratory Manager, 11/2019 to 3/2022

NUANCE Center at Northwestern University – Evanston, IL

- Oversee operations for open access electron microscopy laboratory serving 300 users annually.
- Determine strategic goals in coordination with university administration and 35+ faculty users.

- Management of scientists in lab, teaches lab courses, develop curriculum, coordinate with Teaching Assistants
- Lead User Experience and Training Task Force to optimize methods to teach users and contribute to their knowledge and expertise.
- Supervise EPIC lab staff members in support of lab training and operations goals.
- Write internal and federal proposals to fund new upgrades to research instrumentation.
- Collaborate with faculty research groups from diverse scientific and engineering fields.
- Develop methods on new tools and equipment and teaching tools for lab users.
- Maintain lab equipment and coordinate vendor service calls.
- Coordinate and oversee major instrumentation installation, facilities, and moves.
- Run the SHyNE REU summer program with the IIN and NNCI

Senior Electron Microscopy and Imaging Specialist, 04/2017 to 11/2019

NUANCE Center at Northwestern University – Evanston, IL

- Training and assisting internal and external users of the SEM facility.
- Teaching and maintaining safety and laboratory use protocols.
- Writing and updating standard operating procedures (SOPs).
- Training users of SEM equipment.
- Performing SEM imaging and analysis for funded projects.
- Assisting in advanced SEM capabilities: EDS, EBSD, WDS, eBeam lithography
- Highly experienced in Focused Ion Beam (FIB) - TEM and APT, slice and view imaging, 3D EBSD, and Transmission Kikuchi Diffraction (TKD)

Graduate Research Assistant, 08/2014 to 12/2016

Northern Illinois University Stable Isotope Geochemistry Laboratory – Dekalb, Illinois

- Calibrated and troubleshoot laboratory instruments.
- Chemical cleaning and preparation for isotope analyses
- Maintained laboratory instruments and developed new laboratory equipment.
- Laser Fluorination method for oxygen and silicon isotope analyses.
- Thermo Finnigan MAT-253 Dual inlet Mass Spectrometer.
- Scanning Electron Microscope (JEOL JSM-S610LV)
- X-ray Diffraction (XRD), Fourier transform infrared spectroscopy (FTIR)

Graduate Teaching Assistant, 01/2015 to 06/2015

Northern Illinois University – Dekalb, Illinois

- Prepared lectures on topics related to geology and science.
- Prepared and taught lab exercises
- Wrote and administered examinations.

Paleontological Geodatabase Technician, 05/2013 to 08/2013

United States Forest Service, Nebraska National Forest and Grassland – Chadron, Nebraska

- Designed and maintained USFS Paleontology ArcGIS geodatabase.
- Researched and organized geospatial data.
- Assisted fellow USFS employees with ArcGIS related questions and issues.

Freelance Cartographer, 06/2013 to 09/2013

Joan Turley Cartographics – Plymouth, NH

- Geographic and geospatial analysis for major organizations (academic and professional).
- Produced and designed maps for reports and displays.

Undergraduate Teaching Assistant, 01/2011 to 06/2012

Beloit College – Beloit, Wisconsin

- Invertebrate Paleontology and Introductory Geology.
- Instructed groups of students in basic and complex geological concepts.
- Prepared and instructed laboratory exercises and field work.

Publications and Presentations

1. ***Invited Talk*** – Minnesota Microscopy Society Meeting – May 1, 2026. Title: Revealing multiple pathways of ringwoodite and wadsleyite formation in the Catherwood L6 shocked meteorite using transmission Kikuchi diffraction
2. ***Invited Talk*** - New England Microscopy Society Spring Meeting – April 10, 2026. Title: Revealing multiple pathways of ringwoodite and wadsleyite formation in the Catherwood L6 shocked meteorite using transmission Kikuchi diffraction
3. **Abbott, T.M.**, Akins, C., Barsoum, M.L., Gardner, L.L., Hjelmstad, M., Hu, X., Farha, O.K., Winkelmann, A., Heck, P.R., Sharp, T., Dravid, V.P., Jacobsen, S.D., **2026**. Revealing multiple ringwoodite and wadsleyite transformation mechanisms in a shock-melt vein using transmission Kikuchi diffraction. *American Mineralogist*. <https://doi.org/10.2138/am-2026-10241>
4. Hassan, Z.A., Isheim, D., Buchholz, D.B., **Abbott, T.M.**, Chung, Y.W., **2026**. Tribocatalytic NiCrMo Superlattice Nanolayer Coatings for Wear Protection of Steel under Boundary Lubrication. *Research Square Pre-print*. <https://doi.org/10.21203/rs.3.rs-9180491/v1>
5. Barsoum, M.L., **Abbott, T.M.**, Jacobsen, S.D., Farha, O.K., Dravid, V.P., **2025**. Crystal Orientation and Defect Mapping in Electron Beam-sensitive Zeolites with Near-Axis Transmission Kikuchi Diffraction. *ACS NanoLetters*. <https://doi.org/10.1021/acs.nanolett.5c05800>
6. Jacobsen, S.D., Bausch, H., Townsend, J.P., Davis, J.P., Duwal, S., Seagle, C.T., **Abbott, T.M.**, Clark, A.N., **2025**. Shock-ramp compression of MgO up to 400 GPa on the Z machine. *American Geophysical Union Conference Presentation*
7. Gogola, N., Villalon, K.V., **Abbott, T.A.**, **2025**. Evaluating the Effectiveness of BEX-EDS SEM for Rapid Forensic Sand Analysis. *Microscopy and Microanalysis*, 31(Suppliment_1)
8. ***Invited Talk*** - **Abbott, T.M.**, Ribet, S.M., Bustillo, K.C., Hjelmsted, M., Ophus, C., dos Reis, R., Dravid, V.P. and Jacobsen, S.D., **2025**. Phase Transformation Mechanisms and Plastic Deformation in Shocked High-Pressure Minerals Using Near-Axis TKD and 4D-STEM. *Microscopy and Microanalysis*, 31
9. **Abbott, T.M.**, Gardner, L.L., Koube, K., Svaldi, V., Nguyen, T., Edmunson, J., Dravid, V.P. and Jacobsen, S.D., **2025**. EBSD Crystallographic and Microstructure Characterization of Laser 3D-Printed Lunar Regolith Simulants for Off-World Construction. *Microscopy and Microanalysis*, 31(Supplement_1)
10. Du, F., Yuk, S.A., Qian, Y., Mbaye, E.H.A., Vincent, M.P., Bobbala, S., **Abbott, T.M.**, Kim, H., Li, Y., Li, H., Yi, S., Qiao, B. and Scott, E.A., **2025**. A biomimetic multi-component subunit vaccine via ratiometric loading of hierarchical hydrogels. *Nature Communications*, 16, 5443. <https://doi.org/10.1038/s41467-025-60416-x>
11. **Abbott, T.M.**, Ribet, S., Bausch, H., Gardner, L., Bustillo, K., Ophus, C., Dravid, V.P., dos Reis, R. and Jacobsen, S.D., **2024**. Phase Transformation Characterization of High-Pressure Olivine Polymorphs in Shocked Meteorites using STEM-EDS and 4D-STEM.

12. Liu, R., Janicki, T.D., Marks, S.D., Gyan, D.S., Zuo, P., Savage, D.E., Zhou, T., Cai, Z., Holt, M., Butun, S., Lu, S., Basit, N., Hu, X., **Abbott, T.M.**, Kabat, N., Li, W., Li, Q., Kelley, K., Vasudevan, R.K., Schmidt, J.R., Babcock, S.E., Evans, P.G., **2024**. Optical and electronic functionality arising from controlled defect formation in nanoscale complex oxide lateral epitaxy. *Science Advances*, 10(30), p.eadk5509
13. Marquez, R., Charlier, B., **Abbott, T.**, Smeets, P., Heck, P., Tissot, F.L.H., Search for the Carriers of P-process Anomalies in Early Solar System Condensates, Goldschmidt **2022**
14. Clinkscales, E., **Abbott, T.**, Rougvie, J, Interface-coupled dissolution-precipitation mechanism in K Feldspar replacements produced by low T K-metasomatism: Creede Co. Geological Society of America Conference, **2021**
15. **Abbott, T.A.**, Ribet, S.M., Kabat, N., Smeets, P.J., Reis, R., and Dravid, V.P., **2021**, Exploring the inner space of outer space: multi-length scale, multimodal characterization of Muonionalusta IVA iron meteorite. Microscopy and Microanalysis **2021** Conference
16. Jongkamonwiwat, N., Ramirez, M.A., Edassery, S., Wong, A.C.Y., Yu, J., **Abbott, T.A.**, Pak, K., Ryan, A.F., Savas, J.N., **2020**, Noise exposures causing hearing loss generate proteotoxic stress and activate the proteostasis network. Cell Reports, 33
17. Ribet, S., Nandwana, V., dos Reis, R., **Abbott, T.A.**, Roth, E., Dravid, V.P., **2020**, Multimodal Characterization of the Oleophilic Hydrophobic Magnetic (OHM) Sponge: A Nanocomposite Material for Oil Spill Remediation. Microscopy and Microanalysis.
18. **Abbott, T.**, Dodd, J.P., Gibbons, J., Scherer, R., Frank, T., Powell, R., *in prep.*, Cryogenic brine formation in the Pliocene Ross Embayment, Antarctica. Paleoceanography and Paleoclimatology.
19. Dodd, J.P., **Abbott, T.**, and Gibbons, J.A., **2017**, A Pliocene marine diatom $\delta^{18}\text{O}$ record of terrestrial-marine feedbacks and orbitally-paced cryogenic brine formation in the McMurdo Dry Valleys. American Geophysical Union Fall Meeting, New Orleans, LA
20. Dodd, J.P., Abbott, T., Gibbons, J.A., **2017**, A Pliocene marine diatom $\delta^{18}\text{O}$ record of terrestrial-marine feedbacks and orbitally-paced cryogenic brine formation in the McMurdo Dry Valleys, American Geophysical Union, Fall Meeting **2017**, abstract #PP33C-1341
21. **Abbott, T.**, Dodd, J.P., Findley, M. and Scherer, R.P., **2016**, Cryogenic brine formation in the Ross Sea Recorded by diatom silica oxygen isotope values from a Pliocene marine sediment core. Geological Society of America Annual Meeting, Denver, CO, Paper No. 43-5.
22. **Abbott, T.**, Dodd, J.P., Hackett, H. and Scherer, R.P., **2016**, A First Look at Oxygen and Silicon Isotope Variations in Diatom Silica from a Pliocene Antarctic Marine Sediment Core. American Geophysical Union Ocean Sciences Meeting 2016; PC54A-2214.

Teaching and Education Experience

- **Teach Assistant – Earth and Planetary Materials** – Earth 300 course in the Earth and Planetary Sciences Department at Northwestern University. Coordinated laboratory work and assignment, graded assignments and test, assisted students through the course
- **Futures Unlimited – December 2024** - EPIC SEM Facility Manager Tirzah Abbott volunteered at Oakton Community College's annual Futures Unlimited program, a STEM outreach event for middle and high school female and gender-expansive students. She presented MicroWorlds Unveiled: Exploring Natural and Engineered Materials with Electron Microscopy and, with support from Hitachi High-Tech, provided hands-on electron microscopy experience using a tabletop SEM.
- **SHyNE Photos from the Future series: [Little Rock Candy Mountains](#)** – Learn how Scanning Electron Microscopes produce extraordinary images of the microscopic world. SHyNE/NUANCE SEM Facility Manager, Tirzah Abbott talks about her award-winning image, the Little Rock Candy Mountains.
- **NUANCE Center Tech Talk Presentations**
 1. **Introducing the New Hitachi SU8700 SEM and Remote Data Analysis** ([May, 2025](#))
 2. **Introduction to the Wavelength Dispersive X-ray Spectroscopy (WDS) in the SEM** ([November, 2022](#))
 3. **In-Situ Heating and Cooling Experiments in the SEM** ([September, 2021](#))
 4. **The Future is Bright (FIB): A Brand-New Dual-Beam FIB/SEM in EPIC with new Capabilities and Applications** ([November, 2020](#))
 5. **Introduction to the JEOL 7900F FEG SEM** ([March, 2020](#))
 6. **Interpreting SEM and EDS Results** ([June 2019](#))
 7. **SEM Match Maker: Selecting the right SEM for imaging your samples** ([September 2018](#))
- **Educational Content Creation**
 1. **Interactive Introduction to [Scanning Electron Microscopy module](#)** – soon to be available on Northwestern's MyHR learn portal for certification.
 2. **Training Video for [Quanta 650F SEM](#)**
 3. **Interactive introduction/overview [of JEOL 7900F SEM](#)**
- **Intro to Scanning Electron Microscopy [Video for Science in Society](#)** – Video created during pandemic for the boys and girls club of Evanston to learn about SEM and provided foldscopes to learn microscopy. Students then spoke with my SEM staff over Zoom about being a scientist.
- **Hitachi SEM STEM Imaging and EDS Workshop** – 2 Day workshop with Hitachi High Technologies and Oxford instruments for users to learn about STEM in SEM and EDS Layerprobe over Zoom, then schedule 1-on-1 time with specialists from both companies at the microscope.
- **NUANCE Center Training Taskforce Leader**- Create instrument manual templates and expectations, teach staff how to create educational content, develop learning objectives for SEM, TEM, and FIB trainings.
- **Instrument Training at NUANCE Center** –SEM imaging, EBSD, EDS, eBL, FIB sample preparation, FIB 3D tomography, 3D EBSD, Sample preparation techniques, metal evaporation, data storage and recovery
- **SHyNE Resource REU Mentor 2021** – Interface-coupled Dissolution-precipitation Mechanisms in K Feldspar Replacements Produced by Low T K-Metasomatism: Creede, CO with
- **MSE190 and MSE360 Course TA** – Help to write labs for SEM courses and work with lab TA to teach the microscope, create samples, and with student final projects.
- **MSE316 EDS Labs** – Run EDS experiments with and for the MSE316 course on CuAl alloys made in class.

Professional Experience

- **Manager Foundations Course** – Northwestern University Fall Cohort 2021
- **Leadership and Management in Core Facilities Certificate** – Northwestern University, June 2021
- **Quantitative X-ray Microanalysis: Problem Solving using EDS and WDS Techniques** – Lehigh University, Bethlehem, PA. June 2019.
- **Oxford Instrument Wavelength Dispersive X-ray Spectroscopy Training** course – Oxford Instrument, Pleasanton, CA, September 2018.
- **Executive secretary on NASA Exobiology Grant Review Panel** with Dr. Jill Mikucki (University of Tennessee, Knoxville) - February 2018.
- **Scanning Electron Microscopy and Microanalysis Course** - Lehigh University, Bethlehem, PA. June 2017
- **LacCore Drilling and Coring Summer Institute** – University of Minnesota, Minneapolis. Aug 2016
- **United States Forest Service Passport in Time Paleontological Dig Co-leader** – Thunder Basin National Grassland, Wyoming. July 2013.
- **Geological Society of America's GeoCorps** Position with Nebraska National Forest and Grassland – Chadron, NE. May-Aug 2013.
- **Yellowstone Bighorn Research Association Geology Field School** – University of Houston. Red Lodge, Montana. July-Aug 2011.
- **Keck Geology Consortium REU Program** (Research and Conference) – Wesleyan University, Middletown, CT. June-July 2011.

Outreach Activities and Committees

- **GEAR UP 7th Grade Program – April 2026** - GEAR UP (Gaining Early Awareness and Readiness for Undergraduate Programs) demonstration on the SEM
- **All Scouts Nano-Day – April 2026** - welcoming five groups of scouts for hands-on demonstrations using [scanning and transmission electron microscopy](#) (SEM and TEM). Led by Tirzah Abbott, Michael Barsoum, and Christopher Sharpe, students explored samples ranging from insects and hair to lunar regolith—gaining a firsthand look at how scientists study materials at the nanoscale.
- **Women in Microscopy Conference 2026** - brought together more than 200 attendees. The program featured a keynote address by Dr. Berit Goodge, Minerva Group Leader at MPI-CPfs and incoming Assistant Professor at Cornell University School of Applied and Engineering Physics
- **Broad Ion Beam Milling with the Hitachi IM4000-II Workshop** - a technical workshop on Broad Ion Beam milling using the Hitachi IM4000-II Ion Mill. The event brought together researchers, students, and microscopy specialists to learn about advanced sample preparation techniques and explore practical applications of ion milling for materials characterization.
- **Hitachi and Oxford Instruments Workshop May 2025 – [Advances in TKD and FE-SEM Technologies 2025](#)** - NUANCE Center, Hitachi High-Tech, and Oxford Instruments, jointly hosted a workshop spotlighting the latest techniques and tools enhancing microstructure analysis at the nanoscale.
- **SHyNE Resource REU Mentor 2025** – Mentored student researching high pressure minerals in shocked meteorites.
- **SHyNE Resource REU and RET Technical Director 2020 – 2025** – Review REU and RET applications and match them with SHyNE Facilities and faculty groups for summer research projects. Plan assignments, teach scientific writing and presentation. Teachers build nanotechnology curriculum for high school or community college courses.

- **Women in Microscopy – 2025** - Close to 500 people from over 35 countries registered for this year's event, which featured an impressive lineup of speakers spanning biological and physical sciences. The keynote speaker, Dr. Michelle Thompson, an Associate Professor in Purdue University's Department of Earth, Atmospheric, and Planetary Sciences, captivated attendees with her talk, From Atomic Sales to Asteroid Surfaces: Analyzing Samples Returned from across the Solar System with Electron Microscopy.
- **The Ultimate SEM Experience: High-Throughput Oxford NanoAnalysis with the Hitachi SU8700 Workshop September 2024** - a workshop in partnership with Hitachi High-Tech and Oxford Instruments highlighting the capabilities of the new Hitachi SU8700 field-emission SEM. The event featured expert presentations on advanced SEM imaging, EDS, EBSD, and the Oxford Unity BEX detector, along with hands-on demonstrations that showcased the instrument's high-resolution imaging and microanalysis capabilities for the Northwestern research community.
- **Women in Microscopy – 2024** - The 4th annual Women in Microscopy conference attracted over 200 attendees from all around the world for the 4th year in a row, all in celebration of International Women's Day. Keynote from Dr. Eva Nogales entitled "Cryo-EM in mechanistic studies of human gene regulation"
- **NUANCE Center and Oxford Instruments Workshop (October 2023)** – Highlighting WDS/EDS and EBSD with guest speakers Jennifer Mitchell from U of Minnesota and Dr. Ben Britton from U of British Columbia. Demos at microscope with Oxford applications specialist
- **National Nanotechnology Initiative (NNI) Women's History Month Skype with a Scientist** - virtual session and SEM demo in celebration of Women's History Month with Ms. Medinah Eatman and 2nd-6th graders at Healing Roots Online School.
- **Electron Microscopy Diffraction Workshop 2021** – [Introduction to Electron Backscatter Diffraction](#)
- **All Scouts Nano-Day 2017-2026** – Nanoscouts SEM demonstration for regional all scout troops.
- **Women in Microscopy Conference 2023** – Over 500 registrants in 2023 and 280 attendees from 30 different countries. Keynote speaker: Dr. Grace Burke, Oak Ridge National Lab Corporate Fellow
- **Hitachi Table-top Microscope STEM program in Chicago Public Schools 2023**– Coordinated with Hitachi High Technologies to have tabletop SEM placed at 3 Chicago Public schools during the Spring of 2023
- **Women in Microscopy Conference 2022** – Over 300 Registrants and 180 attendees from 19 different countries. Coordinated and planned meetings with committee from the MSA Student Council. Keynote speaker: Prof. Frances Ross from MIT
- **SHyNE Resource REU Mentor 2021** – Interface-coupled Dissolution-precipitation Mechanisms in K Feldspar Replacements Produced by Low T K-Metasomatism: Creede, CO with
- **Electron Microscopy Diffraction Workshop 2021**– A one day workshop on diffraction techniques in SEM and TEM in collaboration with Oxford Instruments and Gatan Ametek. Presented EBSD basics and co-chaired the event.
- **Microscopy Society of America Diversity, Equity, and Inclusion Committee member** – Work with team to develop ways to foster diversity in science, make conferences more inclusive for people with disabilities, provide opportunities and safe space for conversations on DEI issues. Keynote speaker: Dr. Ilke Arslan – direct of the Center for Nanoscale Materials at Argonne National Laboratory
- **Women in Microscopy Conference Co-Chair 2021**– Co-founder of half day conference featuring women in microscopy with keynote speaker, post-doc presentations, and career discussion panels with vendors, facility managers, and academics/national labs.
- **SHyNE - NNCI Diversity, Equity, and Inclusion Co-representative**
- **NNCI REU Program Technical Manager** – Organize REU projects, select students, develop summer program.

- **Nano Scouts at Northwestern University** – Boy and girl scouts education activities on the SEMs
- **Science in Society** – Demos for middle school students in the community on nanotechnology, microscopy, and engineering
- **Science Club Evanston** – judge of middle school science club projects
- **Splash Northwestern** – educational opportunity for high school students in low-income areas in non-traditional high school topics (scanning electron microscopy, dinosaurs, facts and fakes in Jurassic Park)
- **Member of the Sigma Gamma Epsilon the National Honor Society** for the Earth Sciences

Awards, Grants, and Honors

- Oxford Instruments Insight Awards – 2025 Image contest winner in the category of Materials Science
- Spring 2024 NU Core Facilities Equipment Grant - Microsoft Azure Virtual Machines for Remote Microanalysis Post-Processing - \$33,870 Awarded
- Fall 2024 NU Core Facilities Equipment Grant - Ion Mill System for High-Quality EBSD Sample Preparation and Analysis - \$97,500.00 Awarded
- NSF MRI 2023 – Equipment Acquisition: A State-of-the-Art Plasma Focused Ion Beam-Scanning Electron Microscope (FIB-SEM) – Awarded
- Spring 2022 NU Core Facilities Equipment Grant - Refurbishment of Wavelength Dispersive Spectrometer for Quantitative Trace Element Analysis on Modern SEM - \$35,523.00 Awarded
- Spring 2021 NU Core Facilities Equipment Grant – SEM EBSD and EDS upgrade for Quanta 650F SEM – Funded
- Fall 2020 NU Core Facilities Equipment Grant – Gatan Murano Heating Stage for SEM -Funded
- 2019 National Nanotechnology Coordinated Infrastructure (NNCI) Outstanding Staff award – User Assistance
- 2015 Geological Society of America Research Grant Recipient
- 2015 Goldich Fund Student Research Grant from Department of Geology Northern Illinois University
- Sarah Wallbank Memorial Prize in Geology - Beloit College: Awarded to a student showing academic excellence, dedication, and remarkable enthusiasm.