**Kelsey R. Moore, Ph.D.**
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## Education

Massachusetts Institute of Technology — Cambridge, MA
Ph.D. Geobiology — May 2020
Praecis Presidential Graduate Fellow

Smith College — Northampton, MA
B.A. in Geosciences, *cum laude*, GPA 3.88 — May 2015
Senior Thesis in Paleontology with Highest Honors

## Awards and Honors

- MIT EAPS Award for Excellence in Teaching — 2019
- JPL Strategic University Research Partnership grant — 2017 and 2018
- Lewis and Clark Fund in Astrobiology Field Scholar — 2017
- MIT Graduate Women of Excellence Award — 2017
- NSF GRFP Honorable Mention — 2017
- Member of Sigma Xi — 2013-present
- Member of Phi Beta Kappa — 2015-present
- Praecis Presidential Graduate Fellow — 2015-2016
- Dean's List, Smith College — 2011-2013
- First Group Scholar, Smith College — 2012
- Benjamin A. Gilman Scholar — 2013
- Recipient of an International Experience Grant, Smith College — 2013
- Summer Undergraduate Research Fellow, Smith College — 2013 and 2014

## Research Experience

Organic matter preservation in Proterozoic chert and carbonate — 2020-present

- *Investigating organic matter preserved in Proterozoic and Archean chert*
- *Identified and analyzed organic matter preserved in chert and carbonate to understand the biological and abiotic processes that contribute to biosignature preservation*
- *Integrating multiple spatially resolved analytical techniques to study organic-rich domains with the dual purpose of studying the ancient biosphere on Earth and creating a framework that will be used to study samples collected by the NASA Mars2020 mission and returned by the NASA Mars Sample Return Mission*

Participation in the NASA Mars2020 mission — 2020-present

- *Member of the Mars2020 science team*
- *Contribute to mission operations and planning*
- *Serve as a member of the SHERLOC and PIXL instrument teams for the Perseverance rover*

Preservation of Cyanobacteria — 2017-present

- *Investigated the preservation of cyanobacterial analogs to ancient fossils preserved by silicification*
- *Conducted taphonomy experiments to silicify cyanobacteria and analyze the biological and abiotic factors that may have driven silicification during the Proterozoic*
- *Research includes the design of a microfluidic bioreactor for taphonomy experiments, microbial fossilization experiments, analysis of modern and fossil samples using SEM/EDS, XRD, Raman spectroscopy and FT-IR spectroscopy, and NanoSIMS. Published one manuscript in* Geology *with a second paper in revision for* Geobiology

Fossil Preservation During the Neoproterozoic 2015-present

- *Investigated the Neoproterozoic fossil record with a focus on fossil and organic matter preservation through chemical and mineralogical analyses*
- *Carried out XRD and SEM/EDS chemical and mineralogical analyses. Published one manuscript in* Geobiology *and a second in* Palaios
- *Continued research through a JPL SURP collaboration to further analyze organic matter preserved in fossils using NanoSIMS*

Evolution of Cyanobacteria 2016-2020

- *Investigated the evolution of cyanobacteria through phylogenetic tree reconstructions*
- *Research included critical analysis of the fossil record of cyanobacteria to identify fossil calibrations for molecular clocks, application of bioinformatics and phylogenetic techniques, and culturing of cyanobacteria to be sequenced and used in phylogenetic trees. Published one paper in* Frontiers in Microbiology

Senior Undergraduate Thesis on Neoproterozoic Microfossils 2013-2015

- *Examined the fossil record of the post-Sturtian warming period*
- *Research included maceration and analysis of rock residues, production of petrographic thin sections, and analysis with SEM/EDS, XRD, and Raman spectroscopy*
- *Analyzed results and developed conclusions from experiments, lab work, and analyses*
- *Collaborated with a research advisor throughout the 2-year project culminating in a senior thesis and two publications (see above research on fossil preservation during the Neoproterozoic)*

Special Study Course on Carbonate Sedimentology of the Bahamas Spring 2013

- *Carried out research on the sedimentary record and processes of Exuma Island, Bahamas, including collection and analysis of field samples*
- *Produced and analyzed petrographic thin sections from samples collected in the field.*
- *Collaborated with one professor and seven research students*

Geology Field Camp in the Central Andes Summer 2013

- *Participated in field camp in the San Juan Province and Central Andes of Argentina through Cornell University and the University of Buenos Aires and learned to identify geological structures and rock types in the field, make stratigraphic sections, and carry out geologic mapping*

## Teaching and Mentoring Experience

Mentor for four undergraduate interns in the Bosak Lab at MIT 2018-2020

- *Trained and mentored undergraduates in basic microbiology and geology including laboratory techniques*
- *Guided students in the design of experiments, and oversaw students as they carry out experiments, analyze data, and interpret results*
- *Guided one student through writing and defending a senior undergraduate thesis. This thesis is in prep for publication in* Geobiology

Teaching Assistant for Geobiology and Geobiology in the Field at MIT 2018-2020

- *Assisted with course planning and design*
- *Ran lab sections and activities*
- *Held review sessions and office hours to assist students outside of class*
- *Wrote and grade problem sets and quizzes*
- *Professors: Tanja Bosak and Gregory Fournier*

Graduate Resident Tutor at MIT 2017-2020

- *Live in tutor and mentor for undergraduate students at Massachusetts Institute of Technology*

- *Assisted with advising of students and organization of small- and large-scale events*

MIT WiXII President 2015-2020

- *Co-founder and president of the Women in Course XII (WiXII) group at MIT*
- *Organized and facilitated events and conversations to promote women in science and academia*

Tutor for MIT/Wellesley Upward Bound Program 2015-2016

- *Tutored and mentored high school students in the Cambridge area in science and math*
- *Assisted with college applications and career mentoring*

Lab Manager for Pruss Lab 2014-2015

- *Managed lab personnel*
- *Trained first- and second-year students in lab techniques*
- *Ordered supplies, fixed equipment, managed miscellaneous lab tasks*

Teaching Assistant for Invertebrate Paleontology and the History of Life Fall 2014

- *Assisted in laboratory exercises and class discussions relating to Invertebrate Paleontology and evolution of life on Earth*
- *Graded labs and led review sessions*
- *Professor: Sara Pruss*

## Publications

**Moore, K.R**., Gong, J., Pajusalu, M., Skoog, E.J., Xu, M., Feliz Soto, T., Sojo, V., Matreux, T., Braun, D., Williford, K., Bosak, T., *in revision*, A new model for silicification of cyanobacteria in Proterozoic tidal flats. *Geobiology.*

Skoog, E.J., **Moore, K.R**., Momper, L., Bosak, T., *in prep*, Microbial cycling of sulfated polysaccharides in peritidal pustular mats in Shark Bay, Australia. *ISME*

Morgenstein, K., **Moore, K.R.**, Bosak, T., *in prep,* Exploring the Silicification of Microbes and Understanding their Role in the Fossil Record. *Frontiers in Earth Science.*

Bosak, T., **Moore, K.R.**, Grotzinger, J.P., *in review*, Exploring the record of early life in sedimentary rocks on Earth and Mars. *Nature Earth and Environment*.

Fournier, G.P., **Moore, K.R.**, Rangel, L.T., Payette, J., Momper, L., Bosak, T., *in review*, The Archean origin of oxygenic photosynthesis and extant cyanobacterial lineages. *PNAS.*

Masiero, J.R., Davidsson, B.J.R., Liu, Y., **Moore, K.**, Tuite, M., *submitted*, Volatility of sodium in carbonaceous chondrites at temperatures consistent with low-perihelia Asteroids. *The Planetary Science Journal*

**Moore, K.R.**, Pajusalu, M., Gong, J., Sojo, V., Matreux, T., Braun, D., Bosak, T., (2020) Biologically mediated silicification of benthic cyanobacteria and implications for the Proterozoic fossil record. *Geology*.

**Moore, K.R.**, Magnabosco, C., Momper, L., Gold, D.A., Bosak, T., Fournier, G.P., 2019 An expanded phylogeny of Cyanobacteria supports deep placement of plastids. *Frontiers in Microbiology*. v.12.

Momper, L., Hu, E., **Moore, K.R.**, Skoog, E.J., Tyler, M., Evans, A.J., Bosak., T. 2019 Metabolic versatility in a modern lineage of cyanobacteria from terrestrial hot springs. Free Radical Biology and Medicine. https://doi.org/10.1016/j.freeradbiomed.2019.05.036

Magnabosco, C., **Moore, K.R.**, Wolfe, J.M., Fournier, G.P., 2018, Dating phototrophic microbial lineages with reticulate gene histories. *Geobiology.* v. 16, p 179-189.

**Moore, K.R.**, Bosak, T., Macdonald, F.A., Du, K., Newman, S.A., Lahr, D.J.G., Pruss, S.B., 2017, Pyritized Cryogenian cyanobacterial fossils from Arctic Alaska. *Palaios.* v. 32, n. 12, p. 769-778.

**Moore, K.R.**, Bosak, T., Macdonald, F.A., Lahr, D.J.G., Newman, S., Settens, C., Pruss, S.B., 2017, Biologically agglutinated microfossil from Cryogenian cap carbonates. *Geobiology*. v. 15, p 499-515.

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## Invited Talks

*Cyanobacterial evolution and interactions with the Proterozoic world*, 2020, Invited Talk, COG3 Seminar, MIT Dept. Earth, Atmospheric and Planetary Sciences

*The evolution and fossilization of cyanobacteria on early Earth*, 2020, Invited Talk, Parsons Lecture Series, MIT Dept. Biology

*Cyanobacterial evolution and interactions with the Proterozoic world*, 2020, Invited Talk, Planetary Science Seminar, NASA/Caltech Jet Propulsion Laboratory

*Ancient life on Earth and the search for past life on Mars*, 2020, Guest Lecture for Hands-On Astronomy: Observing Stars and Planets, Course 12.409, MIT Dept. Earth, Atmospheric and Planetary Sciences

*The ancient evolution of Cyanobacteria and plastids*, 2019, Invited Talk, NAPC Conference

*Search for past life on Mars*, 2019, Guest Lecture for Hands-On Astronomy: Observing Stars and Planets, Course 12.409, MIT Dept. Earth, Atmospheric and Planetary Sciences

*Search for past life on Mars*, 2018, Guest Lecture for Hands-On Astronomy: Observing Stars and Planets, Course 12.409, MIT Dept. Earth, Atmospheric and Planetary Sciences

*Preservation of cyanobacteria in the Precambrian*, 2018, Invited Speaker, Geosciences Seminar, Smith College Dept. Geosciences

## Professional Talks and Posters

**Moore, K.R.**, Gong, J., Pajusalu, M., Skoog, E.J., T., Sojo, V., Matreux, T., Braun, D., Williford, K., Bosak, T., Active silicification by benthic marine cyanobacteria. Gordon Research Conference (2020)

**Moore, K.R**., Pajusalu, M., Gong, J., Williford, K., Bosak, T., Investigating the preservation of the oldest cyanobacterial fossils. Geobiology Society Conference (2019)

**Moore, K.R.**, Magnabosco, C., Momper, L., Gold, D.A., Bosak, T., Fournier, G.P., Expanding phylogenetic trees and constraining the divergence of Cyanobacteria. Goldschmidt Conference (2017), Geobiology Society Conference (2017), Gordon Research Conference (2018).

**Moore, K.R.**, Magnabosco, C., Wolfe, J.M., Fournier, G., Photosystem evolution is constrained by relative divergence times of phototrophic lineages. Astrobiology Graduate Student Conference (2016).

**Moore, K.R.**, Bosak, T., Macdonald, F. A., Newman, S., Lahr, D. J. G., and Pruss, S. B., Microfossil assemblages in the Cryogenian non-glacial interlude (~660-640 Ma) of Namibia, Zambia, Mongolia and Arctic Alaska, Geological Society of America conference (2015), Gordon Research Conference (2016)

Pruss, S. B., Bosak, T., Dalton, L. A., Macdonald, F. A., Sawdy, M., **Moore, K.R**., and Lahr, D.J.G., Evidence for a post-Sturtian eukaryotic biosphere from cap carbonates of northern Namibia and Zambia. Geological Society of America Conference (2013)

**Moore, K.R.**, Bosak, T., Macdonald, F. A., Newman, S., Lahr, D. J. G., and Pruss, S. B., Microfossil assemblages in Cryogenian cap carbonates of Namibia, Zambia, and Mongolia. Geological Society of America Conference (2014)

**Moore, K.R.**, Pruss, S. B., 2014, Possible agglutinated testate amoebae in post-Sturtian cap carbonates from Zambia and Namibia. Northeastern Geobiology Symposium (2014)

**Moore, K.R.**, Pruss, S. B., Possible agglutinated testate amoebae in post-Sturtian cap carbonates from Zambia and Namibia. STEP Funded Geobiology Workshop (2014).

**Moore, K**.R., Pruss, S. B., Possible agglutinated testate amoebae in post-Sturtian cap carbonates from Zambia and Namibia. Smith College Celebrating Collaborations (2014).

**Moore, K.R.**, Aluia, V., Camboulives, S., Collier, N., Gomez, K., Glumac, B., Lawson, S., Leman, J., Stephen, S., Petrology of Holocene carbonate deposits from Exuma, Bahamas. Smith College Celebrating Collaborations (2013).

## Skills

- Expertise in imaging and chemical analyses using a Scanning Electron Microscope (SEM) and Energy Dispersive X-Ray Spectroscopy (EDS) and data processing with AZtec software
- Expertise in Raman spectroscopy and Fourier-transform infrared (FT-IR) spectroscopy
- Expertise in X-ray diffraction (XRD) analysis and data processing
- Experience in Nano-Secondary Ion Mass Spectrometry (NanoSIMS)
- Expertise in culturing and maintenance of microbial samples, including cyanobacteria
- Expertise in extraction, isolation and analysis of microfossil samples
- Expertise in production and analysis of petrographic thin sections
- Experience in bioinformatics techniques including BLAST, sequence alignment using MUSCLE, phylogenetic tree reconstruction using RAxML and PhyloBayes, and molecular clock modeling using PhyloBayes
- Expertise in basic geological field skills including the identification of rock types, structures, and fossils, as well as collection, labeling, and organization of samples
- Expertise in basic geologic field mapping
- Proficient in Adobe Indesign, Adobe Photoshop, and Adobe Illustrator
- Conversational Spanish speaker, proficient in reading Spanish

## Professional Membership

- NASA Mars2020 Science Team
- Geological Society of America
- American Philosophical Society
- Sigma Xi, Smith College Chapter
- Phi Beta Kappa, Smith College Chapter