

JACK GEARY MURPHY

(he/him/his)

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ResearchGate | Jack Geary Murphy
Google Scholar | Jack Geary Murphy



EDUCATION

Princeton University, Princeton, NJ

PhD in Geosciences 2023

MA in Geosciences 2017

Thesis: Carbonate Archives of Seawater Lithium: Element & Isotope Ratios, Diagenesis,
and the History of Seawater Chemistry

Committee: John Higgins | Blair Schoene | Daniel Sigman | Peter Swart

Bates College, Lewiston, ME

B.Sci. in Physics, Philosophy minor 2008

Thesis: *Breaking the Black Box – An introduction to the fundamentals of climate modeling*

Agouon Institute and Penn State, State College, PA

Short course: *Mathematical Modeling of Earth's Dynamical Systems* 2016

EMPLOYMENT

Postdoctoral Researcher, Univ. of Penn Dept. of Earth & Env. Sci., Phila., PA 2023–

Senior Research Coordinator, Univ. of Penn Dept. of Earth & Env. Sci., Phila., PA 2022-2023

Assistant in Instruction, Princeton Univ. Dept of Geosciences, Princeton, NJ 2015-2022

Assistant in Research, Princeton Univ. Dept of Geosciences, Princeton, NJ 2015-2022

High School Science Teacher, Solebury School, New Hope, PA 2011-2015

Peace Corps Education Volunteer & Teacher Trainer, US Peace Corps, Lesotho 2008-2010

Physics Laboratory Instructor, Bates College, Lewiston, ME 2005-2008

RESEARCH INTERESTS

- ◇ Role of the cryosphere in global biogeochemical cycles (especially continental silicate weathering)
- ◇ Measurements of traditional (C, O, Sr, S) and new (Li, K, Mg, Ca, Si) isotopic systems to reconstruct the history of ocean chemistry, climate, & life
- ◇ Reconstructing the depositional and diagenetic histories of modern and ancient carbonate environments
- ◇ Modeling of Earth System biogeochemical dynamics in both modern and deep time, with an emphasis on the long-term geologic carbon cycle
- ◇ Direct U-Pb dating (geochronology) of carbonate rocks
- ◇ Utilization of novel methods for field-based geochemical analysis
- ◇ Toxic element cycling (e.g., mercury, lead, chromium, arsenic) in human and natural environments
- ◇ Carbon capture and storage by carbonate mineralization

HONORS & AWARDS

Departmental Teaching Award, Princeton Dept. of Geosciences	2021
Princeton Energy & Climate Scholar	2018 –2020
Mary and Randall Hack '69 Graduate Award (\$8,000), Princeton Env. Inst.	2019
Graduate Student Research Fund Award (\$4,000), Princeton Dept. of Geosciences	2018
National Science Foundation Grad Research Fellowship Program, Honorable Mention	2016
Graduate School Excellence Fellowship (\$53,000), Rutgers SEBS (<i>declined</i>)	2015
National Science Foundation Research Experience for Undergraduates (REU)	2006
Dean's List, Bates College	2005 - 2008

PUBLICATIONS

[7] Schell, EV, **Murphy, JG**, Hawkings, JR, Plante, AF, Allen, MG (2023) Degradable Mo-Based Phosphate Sensor for In-Soil Agricultural Monitoring, *2023 IEEE Sensors, Vienna, Austria*.

[6] **Murphy, JG**, Ahm, A-S, Swar, PK, Higgins JA (2022) Reconstructing the lithium isotopic composition ($\delta^7\text{Li}$) of seawater from shallow marine carbonate sediments, *Geochimica et cosmochimica acta*.

[5] Kalderon-Asael, B, Katchinoff, JAR, Planavsky, NJ, Hood, AS, Dellinger, M, Bellefroid EJ, Jones, DS, Hofmann, A, Ossa, FO, Macdonald, FA, Wang, C, Isson, TT, **Murphy, JG**, Higgins JA, West, AJ., Wallace, WM, Asael, D, and Pogge von Strandmann, PAE (2021) A lithium-isotope perspective on the evolution of carbon and silicon cycles, *Nature*.

[4] Maloney, KM, Halverson, GP, Schiffbauer, JD, Xiao, S, Gibson, TM, Lechte, MA, Cumming, VM, Millikin, AEG, **Murphy, JG**, Wallace, MW, Selby, D, and Laflamme, M (2021) New multicellular marine macroalgae from the early Tonian of northwest Canada, *Geology*.

[3] Stolarski, J, Coronado, I, **Murphy, JG**, Kitahara, MV, Janiszewska, K, Mazur, M, Gothmann, AM, Bouvier, AS, Marin-Carbonne, J, Taylor, ML, Quattrini, AM, McFadden, CS, Higgins, JA, Robinson, LF, and Meibom, A (2021) A modern scleractinian coral with a two-component calcite-aragonite skeleton, *Proceedings of the National Academy of Sciences*, v. 118, no. 3.

[2] Crockford, PW, Kunzmann, M, Blättler, CL, Kalderon-Asael, B, **Murphy, JG**, Ahm, A-S, Sharoni, S, Halverson, GP, Planavsky, NJ, Halevy, I, Higgins, JA (2020) Reconstructing Neoproterozoic seawater chemistry from early diagenetic dolomite. *Geology*.

[1] Santiago Ramos, D.P., Coogan, L.A., **Murphy, J.G.**, and Higgins, J.A. (2020) Low-temperature oceanic crust alteration and the isotopic budgets of potassium and magnesium in seawater. *Earth and Planetary Science Letters*, v. 541, p. 116290.

CURRENT PROJECTS IN THE PIPELINE (⊗ first author, ⊙ supervising, ○ coauthor)

- ⊗ A record of seawater Li isotopes in well-preserved fossil corals since the Mesozoic
- ⊗ The effects of meteoric diagenesis on lithium isotopic composition of shallow marine carbonates
- ⊗ Precise determination of lithium isotope ratios by Multi-Quadrupole ICP-MS
- ⊗ Aquatic geochemistry of the Schuylkill River, Pennsylvania
- ⊙ Lithium isotope fractionation during experimental leaching of lithium micas in various environmental acids
- ⊙ Improved analysis of trace metals in seawater by Multi-Quadrupole ICP-MS after preconcentration using InertSep ME-2 solid-phase extraction
- Diagenetic dolomite as an archive for paleo-seawater chemistry
- A record of seawater Li, Ca, & Mg isotopes since the Mesozoic in diagenetic dolomites
- Tracing sources of residential lead contamination using lead isotopes
- Reconstructing the secular evolution of lithium isotope composition of seawater from marine halite

- Mercury biogeochemical cycling and export from Greenland to the Arctic
- The influence of glacier transition from tidewater to land-based on marine biological production and biogeochemistry in the Arctic
- Linking microbial diversity and carbon cycling in subglacial ecosystems and during the subglacial-proglacial transition

CONFERENCE PROCEEDINGS

IEEE Sensors

Vienna, Austria | 2023

[23] Schell, E. V., **Murphy, J.G.**, Hawkings, J.R., Plante, A.F., Allen, M.G., *Degradable Mo-Based Phosphate Sensor for In-Soil Agricultural Monitoring*

Geological Society of America Annual Meeting

Pittsburgh, PA | 2023

[22] Weldeghebriel, M.F., **Murphy, J.G.**, Jurikova, H., Lowenstein, T.K., Rae, J.W.B., Niespolo, E.M., Higgins, J.A., *Reconstructing the secular evolution of lithium isotope composition of seawater from marine halite*

[21] Toupal, J., **Murphy, J.G.**, Hawkings, J., Geiré, R., *Lithium isotope fractionation during experimental leaching of lithium micas in various environmental acids*

Goldschmidt Geochemistry Conference

Lyon, France | 2023

[20] Weldeghebriel, M.F., **Murphy, J.G.**, Jurikova, H., Lowenstein, T.K., Rae, J.W.B., Niespolo, E.M., Higgins, J.A., *Reconstructing the secular evolution of lithium isotope composition of seawater from marine halite*

[19] Nadeau, M.D., **Murphy, J.G.**, Hagen, C., Wu, Z., Akhtar, A.A., Ahm, A-S, Stolper, D.A., Maloof, A.C., Higgins, J.A., *Secular change, early diagenesis, or both? A case study from Cretaceous Ocean Anoxic Event 1a*

Association of Canadian Universities for Northern Studies

Virtual | 2021

[18] Maloney, K.M., Halverson, G.P., Schiffbauer, J.D., Xiao S., Gibson, T.M., Lechte, M.A., Cumming, V.M., Millikin, A.E.G, **Murphy, J.G.**, Wallace, M.W., Selby, D., and Laflamme, M., *Ancient Macroalgae Fossils from Yukon Help Fill Evolutionary Gaps*

Geological Society of America Annual Meeting

Virtual | 2020

[17] Maloney, K.M., Halverson, G.P., Schiffbauer, J.D., Xiao S., Gibson, T.M., Lechte, M.A., Cumming, V.M., Millikin, A.E.G, **Murphy, J.G.**, Wallace, M.W., Selby, D., and Laflamme, M., *Possible multicellular green algae in early Tonian marine environments*

Goldschmidt Geochemistry Conference

Virtual | 2021

[16] Akhtar, A.A., Ahm, A-S, **Murphy, J.G.**, Maloof, A. C., Higgins, J.A., *Geochemical fingerprints of early diagenesis in Pleistocene shallow-water marine carbonates*

[15] Nadeau, M.D., **Murphy, J.G.**, Higgins, J.A., *Evaluating the suitability of diagenetic dolomite as an archive for paleo-seawater chemistry*

Northeast Geobiology Meeting

Hanover, New Hampshire | 2020

[14] Maloney, K.M., Halverson, G.P., Gibson, T.M., Lechte, M.A., Millikin, A.E.G, **Murphy, J.G.**, Wallace, M.W., Schiffbauer, J.D., and Laflamme, M., *Filamentous green macroalgae from Tonian Mackenzie Mountain Supergroup of the Wernecke Mountains, Yukon*

Advances in Earth Science Research Conference

Kingston, Ontario, Canada | 2020

[13] Maloney, K.M., Halverson, G.P., Gibson, T.M., Lechte, M.A., Millikin, A.E.G, **Murphy, J.G.**, Wallace, M.W., Schiffbauer, J.D., and Laflamme, M., *Filamentous green macroalgae from Tonian Mackenzie Mountain Supergroup of the Wernecke Mountains, Yukon*

Geobiology Gordon Research Conference

Galveston, Texas | 2020

[12] **Murphy, J.G.**, Gothmann, A.M., Stolarski, J., Bender, M.L., Higgins, J.A., *A record of seawater Li isotopes in well-preserved fossil corals since the Mesozoic*

American Geophysical Union Fall Meeting

San Francisco, California | 2019

[11] Stolarski, J., Coronado, I., Janiszewska, K., **Murphy, J.G.**, Higgins, J.A., Gothmann, A.M., Mazur, M., Meibom, A., *The modern analogue of Cretaceous coral with a calcite skeleton*

Geochemistry Conference

Barcelona, Spain | 2019

[10] **Murphy, J.G.**, Gothmann, A.M., Stolarski, J., Bender, M.L., Higgins, J.A., *A record of seawater Li isotopes in well-preserved fossil corals since the Mesozoic*

[9] Higgins, J.A., Blättler, C.L., Ahm, A-S, **Murphy, J.G.**, *A geochemists guide to stratigraphic variability in shallow-water carbonate sediments*

[8] **Murphy, J.G.**, Schoene, B., Higgins, J.A., *Solution-based U-Pb Dating of Carbonates by Single Quadrupole ICP-MS*, presented at the Advances in Laser Ablation U-Pb Carbonate Geochronology workshop

Geobiology Society Conference

Banff, Canada | 2019

[7] Maloney, K.M., Halverson, G.P., Gibson, T.M., Lechte, M.A., Millikin, A.E.G, **Murphy, J.G.**, Wallace, M.W., Schiffbauer, J.D., and Laflamme, M., *Macroalgae from the Tonian Dolores Creek Formation of the Wernecke Mountains, Yukon*

[6] Lechte, M., Halverson, G., Wallace, M., van Smeerdijk Hood, A., Planavsky, N., Gibson, T., Millikin, A., Maloney, K., **Murphy, J.G.**, *Ironstones of the Katherine Group, Yukon: evidence for low oxygen surface waters in the early Neoproterozoic*

GAC-MAC Annual Meeting

Québec, Canada | 2019

[5] Gibson, T.M., Halverson, G. P., Macdonald, F.A., Cumming, V.M., Kunzmann, M., Wörndle, S., Lechte, M.A., Maloney, K.M., Millikin, A.E.G., **Murphy, J.G.**, Wallace, M.A., *Tectono-stratigraphy and facies architecture of the Tonian Hematite Creek and Katherine groups, Wernecke Mountains*

[4] Maloney, K.M., Halverson, G.P., Gibson, T.M., Lechte, M.A., Millikin, A.E.G., **Murphy, J.G.**, Wallace, M.A., Schiffbauer, J., and Laflamme, M., *Macrofossils from the Tonian Dolores Creek Formation of the Wernecke Mountains, Yukon*

[3] Lechte, M.A., Halverson, G.P., Wallace, M.W., Hood, A.v.S, Gibson, T.M., Millikin, A.E.G., Maloney, K.G., **Murphy, J.G.** *Ironstones of the Katherine Group, Yukon: marine iron cycling in the early Neoproterozoic*

Northeast Geobiology Meeting

Amherst, Mass | 2019

[2] **Murphy, J.G.**, Higgins, J.A., Ahm, A-S. C., Swart, P.K., *Early marine diagenesis and mineralogical controls on the lithium isotopic composition ($\delta^7 Li$) of shallow marine carbonates* (Talk)

American Geophysical Union Fall Meeting

Washington, D.C. | 2018

[1] **Murphy, J.G.**, Higgins, J.A., Ahm, A-S. C., Swart, P.K., *Assessing the effects of early marine diagenesis on the lithium isotopic composition of shallow marine carbonates*, PP41E-1893 (poster)

RESEARCH TALKS

Carbonate Archives of Seawater Lithium

Department Seminar, UPenn Dept. of Earth & Env. Sci., Phila., PA

May 2023

Paleoclimate proxy record constraints on Earth System Models

Geophysical Fluid Dynamics Laboratory, Princeton, NJ

Apr 2021

Lead Isotopes in Tap Water: Identifying the Sources of Lead Contamination in Trenton, N.J., Homes

Hack Day Symposium, Princeton Environmental Institute

May 2020

What can lithium isotopic composition of seawater tell us about the global carbon cycle?

Graduate student seminar, Princeton University

Nov 2018

Earth history and the global carbon cycle

Princeton Energy & Climate Scholars, Princeton University

Nov 2018

Lithium separation by automated ion chromatography and isotope measurement by MC-ICP-MS

Student Seminar, Department of Geosciences, Princeton University

Oct 2016

Carbonate isotope geochemistry of Triple Goose Creek, Bahamas

Student Seminar, Department of Geosciences, Princeton University

May 2016

Breaking the Black Box: An introduction to the fundamentals of climate modeling

Department Seminar, Department of Physics, Bates College	Jun 2008
<i>Potential well trapping of excitons to achieve Bose-Einstein condensation</i>	
Department Seminar, Department of Physics, Bates College	Sep 2006
NSF REU Seminar, Department of Physics, University of Pittsburgh	Aug 2006

FIELD EXPERIENCE

Schulkill River, Pennsylvania <i>Aquatic biogeochemistry of the Schuylkill River, Pennsylvania</i>	weekly 2023-2024
Western Greenland <i>Subglacial methane production and transport</i>	3 week 2022
Northern New Mexico <i>Rio Grande Rift and Bandelier Tuff</i>	1 week 2019
Wernecke Mountains, Yukon, Canada <i>Tonian-Cryogenian mapping, stratigraphy, and geochemistry</i>	3 weeks 2018
Scotland <i>Princeton Dept. of Geosciences fieldtrip</i>	1 week 2018
Parashant & Gold Butte National Monuments, Arizona & Nevada <i>Far-field sedimentological and geochemical expressions of late Paleozoic glaciations</i>	3 weeks 2018
Iceland <i>Princeton Dept. of Geosciences fieldtrip</i>	1 week 2016
Andros Island, Bahamas <i>Geochemistry of a modern carbonate platform</i>	1 week 2016

TEACHING

University of Pennsylvania, Philadelphia, PA

Lecturer (cotaught w/ Dr. Jon Hawkings) – Introduction to Environmental Science	F 2023
Supervisor (w/ Dr. Jon Hawkings) – Independent Study: Stable Isotope Geochemistry	F 2023

Princeton University, Princeton, NJ

Assistant in Instruction – Fundamentals of Solid Earth Science	F 2021
Assistant in Instruction – Natural Disasters	W 2021
Assistant in Instruction – Geochemistry of the Human Environment	W 2017 - 2020
Assistant in Instruction – Climate: Past, Present, and Future	F 2019
Assistant in Instruction – Life in the Universe (Astrobiology)	F 2016

Solebury School , New Hope, PA	<i>(trimester schedule)</i>
AP Physics C: Mechanics	F 2014
AP Physics C: Electricity & Magnetism	W 2015
General Chemistry	2011 - 2015
Earth System Science	S 2014
Environmental Ethics	S 2013
Formal Logic	W 2013, 2014
Philosophy of Science	F 2012, 2013
Environmental Science	2011 - 2012

U.S. Peace Corps , Maseru, Lesotho	
Teacher Trainer	2009 - 2010
Secondary School Mathematics & Science Instructor	2008 - 2010

Bates College , Lewiston, ME	
Laboratory Instructor, Classical Mechanics	F 2005 - 2008
Laboratory Instructor, Modern Physics	W 2005 - 2008

ADVISING/MENTORING

Sandy Phuong, UPenn B'24 Senior Thesis	2023-present
Jonas Toupal, UPenn D'24 PhD Dissertation Chapter	2023-present
Emma Kocik, UPenn D'28* PhD Dissertation Chapter	2023-present
Amina Youssef, UPenn D'27* PhD Dissertation	2023-present
Neelavro Pal, UPenn M'24 Master's Capstone Project	2023-present
Leah Hopf, UPenn B'25 Lab/Field Research Assistant	2023
David McCabe, UPenn B'23 Senior Research	2023
Camille Do, Princeton Research Assistant	2022
Perrin Hagge, Princeton B'20 Senior Thesis	2020
Polly Hochman, Princeton B'20 Senior Thesis	2020
Sidney Swearingen, Davidson College B'21 Summer Research Assistant at Princeton	2019
Shoichi Hayashi, Princeton B'22 Princeton Environmental Institute (PEI) Summer Intern	2019
Marc Roberge-Pika, Univ. of Toronto B'21 Summer Research Assistant at Princeton	2019
Mary Szatkowski, Bates College B'18 Summer Research Assistant at Princeton	2017
Young Joo Choi, Princeton B'20 Princeton Environmental Institute (PEI) Summer Intern	2017
Hinako Kawabe, Princeton B'19 Princeton Environmental Institute (PEI) Summer Intern	2017
Elizabeth Stanley, Princeton B'18 Princeton Environmental Institute (PEI) Summer Intern	2017
10+ High School Students Solebury School	2011 - 2015

SERVICE

INSTITUTIONAL SERVICE

Physical Science Complex Planning - Workplace Committee	UPenn 2022 - present
Graduate student representative to Geosciences faculty	Princeton University 2019-2020
Graduate student coordinator, Geosciences faculty search	Princeton University 2019
Department representative, graduate student government	Princeton University 2016
Faculty salary review committee	Solebury School 2013-2015
Academic committee	Solebury School 2011-2015
Committee on Environmental Responsibility	Bates College 2007-2008

PEER REVIEWER

Nature Communications
Geochimica et Cosmochimica Acta
Chemical Geology

PROFESSIONAL SOCIETIES

American Geophysical Union
European Association of Geochemistry

POPULAR PRESS

From glacier ice, a wealth of scientific data

PennToday | February 15, 2023

<https://penntoday.upenn.edu/news/penn-earth-environment-glacier-ice-wealth-scientific-data>

Rare fossilized algae, discovered unexpectedly, fill in evolutionary gaps

BBC Science in Action | April 1, 2021

<https://www.bbc.co.uk/sounds/play/w3ct1l3f>

Combining science and service: Studying lead contamination in Trenton, N.J.

Princeton University Press Release | April 2, 2018

www.princeton.edu/news/2018/04/02/combining-science-and-service-studying-lead-contamination-trenton-nj

Taking Science into the Community

Princeton Alumni Weekly | June 7, 2017 | paw.princeton.edu/article/taking-science-community

Zeroing In: Creating a Sustainable Bates begins with taking stock of the College's green accomplishments

Bates News | December 23, 2007 | www.bates.edu/news/2007/12/23/zeroing-in/