Anna R. Waldeck, Ph.D.

Pennsylvania State University | Department of Geosciences
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Research Interests

Low-temperature stable isotope geochemistry; geobiology; paleoclimate; novel isotope proxies

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Education

Ph.D. in Earth & Planetary Sciences, Harvard University 2021 Thesis: *Stable oxygen isotopes in sulfate: Implications for Phanerozoic pO_2,* Advisor: David T. Johnston

B.S. Chemistry with General Honors, University of Chicago 2014 B.S. Geophysical Sciences with Honors, University of Chicago 2014 Thesis: *Analysis of phosphate oxygen isotopes in microfossils from the Cambrian Period,* Advisor: Albert S. Colman

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Research appointments

Postdoctoral Research Fellow, Penn State University 2025–*present* Advisors: Matthew Fantle, Sandra Kirtland Turner

Agouron Postdoctoral Research Fellow, Penn State University 2024–*present* Advisors: Miquela Ingalls, Andrew D. Jacobson

Research Associate, Brown University 2023–2024 Advisor: Kim M. Cobb

Ubben Postdoctoral Research Fellow, Northwestern University 2021–2023 Advisors: Andrew D. Jacobson, Brad B. Sageman, Matt T. Hurtgen

Graduate Student Research Fellow, Harvard University 2015–2021

Undergraduate Researcher, University of Chicago 2011–2015

Awards

Agouron Geobiology Postdoctoral Fellowship Finalist 2023
NSF EAR Postdoctoral Fellowship Finalist 2023
Harvard University Distinction in Teaching Award 2020
NSF Graduate Research Fellowship Semi-Finalist 2016
University of Chicago Dean's List 2011-2013

Proposals and Funding

National Science Foundation – Postdoctoral Fellowship: EAR-PF [$180,000] EAR 2305613 "Testing the calcium isotope proxy in foraminifera microfossils from the Cretaceous hothouse"

Awarded to Anna Waldeck, however it was declined to accept the AGI Fellowship

Agouron Institute – Postdoctoral Fellowship in Geobiology [$167,000] Sept. 2023-Aug. 2025 AI-F-GB75.24.2 "A new look at an ancient analogue – pairing stable strontium, stable calcium, and dual-clumped isotope measurements in carbonates from Green Lake, NY" Awarded to Anna Waldeck

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Peer-Reviewed Publications (n=4 first-author)

13. Chen, J., Jacobson, A.D., Huber, B.T., Macleod, K.G., Wan, C., **Waldeck, A.R.**, Balestra, B., Sageman, B.B. (2026). Calcium isotopes link ocean acidification to Aptian-Albian foraminiferal extinctions. *Science*, *393*(6810), 527-531.

12. Crockford, P. W., **Waldeck, A. R.**, Bekker, A., Kunzmann, M., Ghosh, R., Ghosh, P., Sergeeva, N., Michurin, S., Halevy, I. & Johnston, D. T. (2025). Depositional controls on∆′ 17O signatures of sedimentary sulfate. *Geophysical Research Letters*, *52*(12), e2024GL114184.

11. Waldeck, A. R.*, Olson, H. C.*, Crockford, P. W., Couture, A. M., Cowie, B. R., Hodgin, E. B., Bergmann, K. D., Dewing, K., Grasby, S. E., Clark, R. J., Macdonald, F. A. & Johnston, D. T. (2025). Marine sulphate captures a Paleozoic transition to a modern terrestrial weathering environment. *Nature communications*, *16*(1), 2087.

10. Cetiner, J. E., Berelson, W. M., Rollins, N. E., Liu, X., Pavia, F. J., **Waldeck, A. R.**, Dong, S., Fleger, K., Barnhart, H. A., Quinan, M., Wani, R. P., Rafter, P. A., Jacobson, A. D., Byrne, R. H. & Adkins, J. F. (2025). Carbonate dissolution fluxes in deep-sea sediments as determined from in situ porewater profiles in a transect across the saturation horizon. *Geochimica et Cosmochimica Acta*, *390*, 145-159.

9. Hughes, E. R., **Waldeck, A. R.**, Moriarty, S. N., Jamieson, J. W., Martin, A. J., Scheuermann, P. P., Syverson, D. D., Seyfried, W. E., Reeves, E. P. & Johnston, D. T. (2023). The influence of submarine hydrothermal systems on seawater sulfate. *Geochimica et Cosmochimica Acta*, *344*, 73-89.

8. Bloom, B. P., **Waldeck, A. R.**, & Waldeck, D. H. "Homochirality and chiral-induced spin selectivity: A new spin on the origin of life." *Proceedings of the National Academy of Sciences* 119, no. 34 (2022): e2210505119.

7. Waldeck, A. R., Hemingway, J.D., Yao, W., Paytan, A., and Johnston, D.T. "The triple oxygen isotope composition of marine sulfate and 130 million years of microbial control." *Proceedings of the National Academy of Sciences* 119, no. 31 (2022): e2202018119.

6. Waldeck, A. R.*, Olson, H. C.*, Weiqi, Y., Blättler, C., Paytan, A., Hodell, D., & Johnston, D.T. "Calibrating the triple oxygen isotope composition of evaporite minerals as a proxy for marine sulfate." *Earth and Planetary Science Letters*, 578 (2022): 117320.

5. Laakso, T., **Waldeck, A. R.**, Johnston, D.T., & Macdonald, F. "Volcanic controls on seawater sulfate over the last 120 Ma." *PNAS* 117, no. 35 (2020): 21118-21124.

4. Bertran, E., **Waldeck, A.R.**, Wing, B.A., Halevy, I., Leavitt, W.D., Bradley, A.S., & Johnston, D.T. "Oxygen isotope effects during microbial sulfate reduction: applications to sediment cell abundances." *The ISME Journal* 14 (2020): 1508–1519.

3. Waldeck, A. R., Cowie, B. R., Bertran, E., Wing, B. A., Halevy, I., & Johnston, D. T. "Deciphering the atmospheric signal in marine sulfate oxygen isotope composition." *Earth and Planetary Science Letters* 522 (2019): 12-19.

2. B. W. Stamps, Nunn, H. S., Petryshyn V. A., Oremland R. S., Miller L. G., Rosen M. R., Bauer K. W., Thompson K. J., Tookmanian E. M., **Waldeck A. R.**, et al. "Metabolic capability and phylogenetic diversity of Mono Lake during a bloom of the eukaryotic phototroph Picocystis sp. strain ML." *Applied and environmental microbiology* 84 no.21 (2018): e01171-18.

1. Mine, A. H., **Waldeck, A.,** Olack, G., Hoerner, M. E., Alex, S. & Colman, A. S. "Microprecipitation and δ18O analysis of phosphate for paleoclimate and biogeochemistry research." *Chemical Geology* 460 (2017): 1-14.

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TALKS AND SEMINARS

Selected Conference Presentations

Waldeck, A.R., Fantle, M.S., Kirtland Turner, S. “Spatial controls on marine sedimentary carbonate preservation across the PETM.” Goldschmidt Conference (2026). Talk.

Waldeck, A.R. “Triple oxygen isotopes in marine sulphate lend insights into atmospheric oxygen levels and terrestrial weathering.” Geobiology Society Conference (2025). Invited Talk.

Waldeck, A.R., Jacobson, A.D., Sageman, B.B., Linzmeier, B.J., Kitch, G.D., Sarvian, N.L, Wan, C., & Hurtgen, M.T. “Radiogenic Sr isotope ratios spanning Cretaceous OAE2 record hydrothermal activity and ocean mixing.” Goldschmidt Conference (2024). Talk.

Waldeck, A.R., Jacobson, A.D., Sageman, B.B., & Hurtgen, M.T. “Ca and Sr isotopes in a Southern Mexico carbonate platform during Ocean Anoxic Event 2.” AGU (2022). Talk.

Waldeck, A.R. & Johnston, D.T. “The triple oxygen isotope record of Phanerozoic marine sulfate captures the rise of land plants.” Gordon Research Seminar – Geobiology (2022). Invited Talk.

Waldeck, A.R., Hemingway, J., Yao, W., Paytan, A., & Johnston, D.T. "Microbial control on the triple oxygen isotope (Δ’17O) composition of Cenozoic marine sulfate." Goldschmidt Conference (2022). Invited talk.

Waldeck, A.R., Yao, W., Hemingway, J.D., Paytan, A., & Johnston, D.T. "The Cenozoic-Cretaceous marine sulfate triple oxygen isotope (Δ’17O) record as a proxy for climate." Northeast Geobiology Conference (2021). Talk.

Waldeck, A.R., Yao, W., Hemingway, J., Paytan, A., & Johnston, D.T. "Rethinking the sulfate triple oxygen isotope (Δ’17O) proxy in the Cenozoic-Cretaceous." Geological Society Conference: Sulfur in the Earth System (2020). Talk.

Waldeck, A. R., Paytan, A., Laakso, T., Macdonald, F., & Johnston, D. T. "Using triple oxygen isotopes to test Cretaceous/Cenozoic LIP activity as a driver of the marine sulfur cycle." AGU 2019 (2019): V24A-07. Talk.

University/Institute Research Seminars

Stony Brook University, Department of Geosciences
Isotope Geochemistry Seminar, April 2024

Pennsylvania State University, Department of Geosciences
Geochemistry Forum Seminar, April 2024

Brown University, Department of Earth, Environmental, and Planetary Sciences
Climate and Environment Seminar, September 2023

Woods Hole Oceanographic Institution, Department of Marine Chemistry & Geochemistry
Department Seminar, August 2023

Western Michigan University, Department of Geological and Environmental Sciences
Department Seminar, April 2023

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Northwestern University, Department of Earth and Planetary Sciences
Department Seminar, January 2022

TEACHING AND MENTORING

Pennsylvania State University, instructor for the *International Geobiology Course 2024*, co-leader of field activities and lectures during a five week long summer course for graduate students. Mentor for the Association of Women Geoscientists (AWG) Mentor-Mentee Program.

Brown University, trained and supervised postdocs, graduate students, and undergraduates in carbonate & water stable isotope measurements and data interpretation.

Northwestern University, mentor for two undergraduates in the *Summer Undergraduate Research Grant* program, Summer 2022. Students presented at *GLSP* (*Great Lakes Student Paleoconference*) and *AGU* Fall 2022

Harvard University, teaching fellow for two classes (E-PSCI 53: Marine Geochemistry and E-PSCI 56: Geobiology and the History of Life)

TECHNICAL SKILLS

Isotope ratio mass spectrometry Continuous flow isotope ratio mass spectrometers (IRMS; Delta V, Delta V Plus) with High Temperature Conversion Elemental Analyzer (TC/EA), Elemental Analyzer (EA), and Gas Bench II; Dual Inlet IRMS (MAT 253 Plus) with Kiel II Device and Custom Fluorination line; Isodat Software

Thermal ionization mass spectrometry Triton Series Multicollector Thermal Ionization Mass Spectrometer (TIMS) with adjustable faraday cups; Tune Software

Cavity ringdown mass spectroscopy Picarro L2140-i isotopic water analyzer with Autosampler, Vaporizer, and Micro-Combustion Module; Picarro Software; d18O, d17O, and d2H of rainwater, groundwater and seawater

Elemental analysis Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES; Thermo iCAP 7600 ICP-OES with radial & axial modes and QTEGRA Software); Scanning Electron Microscope with Energy Dispersive Spectroscopy (SEM-EDS; Hitachi S-3400N-II with Back-scattered Electron Detector)

Analytical techniques MATLAB, isotope and elemental data correction methods, fluorination line for O_2 extraction, wet chemistry sample prep, X-ray Diffraction

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FIELD EXPERIENCE

Field work in *Green Lakes State Park, New York* (March-Sept 2024)
International Agouron Geobiology Course (co-instructor), *Italy* (Jun-July 2024)
E-PSCI 182: Stratigraphy and Sedimentology, *Northeast Spain* (April 2017)
E-PSCI 274: Field Geology, *Silurian Hills, California* (Jan 2017)
International Agouron Geobiology Course, *Southern California* (Jun-July 2016)

E-PSCI 74: Field Geology, *Kingston Range, California* (Jan 2015)
Field Work in *Pioche-Caliente region, Nevada* (April 2015)
GEOS 29002: Field Course in Modern and Ancient Environments, *Bahamas* (Jan 2013)
Melville RV Scientific Cruise, *Southern California Coast* (Sept 2012)

LEADERSHIP AND SERVICE

Reviewer for *ACS Earth & Space Chemistry*, *Earth and Planetary Science Letters*, *Geobiology, Geochimica et Cosmochimica Acta, Journal of the Geological Society, Nature Communications, Nature Geoscience, NSF EAR, & Science*
Geobiology Journal Club Co-organizer, 2019-2021
Graduate Student Mental Health Survey Committee, 2017-2021
EPS Diversity Committee on Graduate Student Recruitment and Retention, 2020
Harvard Graduate Women in Science Executive Board, 2018-2020
Graduate Field Trip Co-Organizer 2019; Graduate Field Trip Cook, 2017
Graduate Student Lunch Seminar Series Organizer, 2016-2017