

Rachel E. Breunig

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EDUCATION

University of Wisconsin-Madison	Ph.D. Geoscience Minor in Civil & Environmental Engineering Advisors: Dr. Ken Ferrier, Dr. Michael Cardiff	<i>Expected 2027</i> GPA: 4.00
University of Wisconsin-Madison	M.S. Geoscience Advisors: Dr. Ken Ferrier, Dr. Michael Cardiff	2022 GPA: 4.00
The University of Texas at Austin (UT), Jackson School of Geosciences (JSG)	B.S. Environmental Science, Geology with High Honors Advisor: Dr. Daniella Rempe	2020 GPA: 3.89

AWARDS & FELLOWSHIPS

Kenneth and Linda Ciriacks Wisconsin Distinguished Graduate Fellowship	2026
UW-Madison Thomas E. Berg Award for Excellence in Teaching	2022, 2026
American Geophysical Union Horton Research Grant	2025
American Geophysical Union Catchment Hydro. Subcommittee Contest winner	2025
Geological Society of America John T. and Carol G. McGill Research Award	2024
Jay C. Nania Research Assistantship	2024
American Geophysical Union Outstanding Student Presentation Award	2022
UW-Madison Weeks/ Senger Research Assistantship	2020-2021
JSG Professional Networking Contest winner	2020
Wayne Franklin Bowman Endowed Presidential Scholarship	2020
UT Green Fund Sustainability Grant	2018-2019
Sabina Elizabeth Endowed Presidential Scholarship in Quantitative Earth Sciences	2019
Bloomer Scholarship Fund for Motivated and Late Bloomer Students	2019
Robert H. Cuyler Endowed Presidential Scholarship	2019
F. W. Simonds Endowed Presidential Scholarship	2019
Vincent R. DeNino Endowed Scholarship	2019
University of Texas College Scholar, Jackson School of Geosciences	2018-2020
John H. and Luzja McCammon Endowed Scholarship	2019
Anne and Henry Hamman Scholarship in Geoscience	2019
Carroll C. Miller Endowed Presidential Scholarship	2018
Lee and Joe Jamail Endowed Presidential Scholarship	2017, 2018
Undergraduate Scholarship to Support Geoscience Students	2018
Greater Texas Foundation Endowed Scholarship in Geosciences	2018
University Honors, University of Texas at Austin	2016- 2020
Ben Garcia Memorial Purple Monkey Scholarship	2016
Girl Scouts of America Gold Award	2015

PUBLICATIONS

- Moreno-Yaeger, P., Singer, S.B., Jicha, B.R., Kurz, Edwards, B.R., M.D., Tremblay, M.M., Fustos-Toribio, I., Vera, F., Mixon, E.E, **Breunig, Rachel E.**, Flores, F., Hickey-Vargas, R., Licciardi, J.M., Townsend, M. *Rapid growth cone of Villarrica (Rukapillán) volcano during the Pleistocene to Recent*. Bulletin of Volcanology. [under review].
- (6) Hu, K., Ferrier, K.L., Aarons, S.M., Norris, E.D., Blankenship, R., Marcott, S., **Breunig, Rachel E.**, Ruetenik, G., Peters, I., Ceperley, E.G. 2026. *Sensitivity of soil chemical erosion rate to climate and dust along a 2.8-km elevation transect at San Jacinto Mountain, California*. Journal of Geophysical Research: Earth Surface.
- (5) Donaldson, A.M., Callahan, R.P., Hahm, W.J., Dralle, D.N., Noren, A., **Breunig, Rachel E.**, Hudson-Rasmussen, B.M., Krone, L.V., Brantley, S.L., West, A.J., Ma, L., Riebe, C.S., Zimmer, M., Dere, A., Rempe, D.M. 2026. *Drilling within the critical zone*. Hydrological Processes. DOI:10.1002/hyp.70463.
- (4) Singer, S.B., Moreno-Yaeger, P., Townsend, M., Huber, C., Cuzzzone, J., Edwards, B.R., Romero, M., Orellana-Salazar, Y., Marcott, S.A., **Breunig, Rachel E.**, Ferrier, K.L., Scholz, K., Coonin, A.N., Alloway, B.V., Tremblay, M.M., Stevens, S.M., Fustos-Toribio, I., Moreno, P.I., Vera, F., Amigo, A., 2024. *New perspectives on ice forcing in continental arc magma plumbing systems*. Journal of Volcanology and Geothermal Research. DOI: 10.1016/j.jvolgeores.2024.108187.
- (3) Moreno-Yaeger, P., Singer, S.B., Edwards, B.R., Jicha, B.R., Nachlas, W.O., **Breunig, Rachel E.**, Fustos-Toribio, I., Vásquez Antipán, D., Piegrossi, E., 2024. *Pleistocene to recent evolution of Mocho-Choshuenco volcano during growth and retreat of the Patagonian Ice Sheet*. Geological Society of America Bulletin. DOI: 10.1130/B37514.1.
- (2) **Breunig, Rachel E.**, 2022. *Shallow Critical Zone evolution under evolving topography*. University of Wisconsin- Madison thesis.
- (1) Pedrazas, M.A., Hahm, W.J., Huang, M-H., Dralle, D., Nelson, M.D., **Breunig, Rachel E.**, Fauria, K.E., Bryk, A.B., Dietrich, W.E., and D.M. Rempe, 2021. *The relationship between topography, bedrock weathering, and water storage across a sequence of ridges and valleys*. Journal of Geophysical Research: Earth Surface. DOI: 10.1029/2020JF005848.

CONFERENCE PRESENTATIONS

- (16) **Breunig, Rachel E.**, Ferrier, K.L., Cardiff, M.A., 2026, *Investigating Driftless Area hydrostratigraphy using hydrologic monitoring and geochemistry*. American Water Resources Association Conference- Wisconsin.
- (15) **Breunig, Rachel E.**, Ferrier, K.L., Cardiff, M.A., 2025, *Measuring loess's impacts on Critical Zone hydrology, geochemistry, and topography*. AGU Fall meeting.
- (14) **Breunig, Rachel E.**, Ferrier, K.L., Cardiff, M.A., 2025, *Revealing flow patterns through Driftless Area stratigraphy using End Member Mixing Analysis and catchment monitoring: Wyalusing State Park, WI*. American Water Resources Association Conference- Wisconsin.
- 13) Donaldson, A., **Breunig, Rachel E.**, Callahan, R.P., Rempe, D.M., Hahm, W.J., Dralle, D., Dere, A.L. D., Brantley, S.L., West, J.A., Ma, Lin, Riebe, C.S., Cantner, K., 2024, *An opportunity to identify and discuss best practices for critical zone scientific drilling across disciplines*. AGU Fall Meeting.
- (12) **Breunig, Rachel E.**, Cardiff, M.A., Ferrier, K.L., 2024, *From hillslope to stream: investigating the chemical evolution of the shallow Critical Zone in layered stratigraphy*. AGU Water Science Convention.

- (11) Moreno-Yaeger, P, Singer, B.S., Edwards, B.R., Jicha, B., Nachlas, W.O., **Breunig, Rachel E.**, Fustos-Toribio, I., Vásquez Antipán, D., Piegrossi, E., 2023, *Pleistocene to recent evolution of Mocho-Choshuenco volcano during growth and retreat of the Patagonian Ice Sheet*. AGU Fall Meeting.
- (10) Edwards, B.R., Piegrossi, E., Moreno-Yaeger, P, Cummings, M., Foote, M., Singer, B.S., **Breunig, Rachel E.**, Stevens, S.M., Vera, F., 2023, *Diverse jointing Types Record Emplacement Styles of Lavas at Mocho-Choshuenco Volcano, Chile*. AGU Fall Meeting.
- (9) **Breunig, Rachel E.**, Ferrier, K.L., Cardiff, M.A., Hu, K., Bares, V., Carson, E.C., 2022, *Variations in Regolith Thickness, Porosity, and Chemistry in Evolving Topography*. AGU Fall Meeting.
- (8) **Breunig, Rachel E.**, Igonin, N., Liberty, L.M., Ochoa, E., Moreno, D.E.M., Ferguson, J.F., 2022, *Anthropogenic Geomorphological Features Elucidated through Active Seismic Surveying: San Marcos Pueblo, Northern New Mexico*. AGU Fall Meeting.
- (7) Hu, K., Ferrier, K.L., Aarons, S.M., Norris, E., Blankenship, R., **Breunig, Rachel E.**, Ruetenik, G., Peters, I., Ceperley, E., 2022 *Soil chemical depletion and dust deposition rates along an altitudinal climate transect at San Jacinto Peak, southern California*. AGU Fall Meeting.
- (6) Hu, K., Ferrier, K.L., Aarons, S.M., Norris, E., Blankenship, R., **Breunig, Rachel E.**, Ruetenik, G., Peters, I., Ceperley, E., 2021, *Soil Chemical and Physical Erosion Rates and Dust Deposition Rates Along an Altitudinal Climate Transect at San Jacinto Peak, Southern California*. AGU Fall Meeting, EP041-1579.
- (5) **Breunig, Rachel E.**, Pedrazas, M.A., Fisher, C., and D.M. Rempe, 2020, *Evaluating chemical depletion as a weathering indicator in heterogeneous, sedimentary systems*. 2020 Jackson School Research Symposium.
- (4) **Breunig, Rachel E.**, Gardiner, K., Lad, B., Montoux, I., and E.G. Ortiz, 2020, *Growing Pains: Triumphs and Trials of Student Sustainability Initiatives*. Texas Regional Alliance for Campus Sustainability Summit. (*Conference cancelled for Covid-19*)
- (3) **Breunig, Rachel E.** and E. Ortiz, 2019, *Green Offices on Tap*. University of Texas Sustainability on Tap.
- (2) **Breunig, Rachel E.** and A.M.K. Lassmann, 2019, *Project: Waste Free LHB—Zero Waste success in collegiate marching band*. University of Texas Sustainability on Tap.
- (1) **Breunig, Rachel E.** and A.M.K. Lassmann, 2018, *Zero Waste in the Longhorn Band*. University of Texas Sustainability Showcase.

INVITED TALKS

UT EVS121 (2023, 2024, 2025) Invited panelist, “Recent alumni in higher education”

UW-Platteville (Sauk County)’s *Physical Geology* (2024) Guest lecturer, “Earth surface processes”

UW-Madison’s *Geosci320* (2024) Guest lecturer, “A tour of Driftless Area landscapes”

UW-Madison’s *Geosci627* (2023) Guest lecturer, “Site characterization to model predictions”

UW-Madison’s *VEC Seminar Series* (2023) “Integrating GIS for quantitative & qualitative investigation”

UW-Madison’s *Freshwater@UW* (2023) Invited panelist, “Graduate Student Panel on Research”

GRANTS

American Geophysical Union Horton Research Grant The impact of loess on Critical Zone hydrology, geochemistry, and topography Total award: \$10,500	2025-2026
UW-Madison Summer Research Grant The impact of lithologic heterogeneity on Critical Zone structure: linking point measurements to landscape-scale patterns with geophysical surveys Total award: \$3,000	2026
UW-Madison Summer Research Grant Hydraulic properties of layered stratigraphy: Wyalusing State Park Total award: \$2,000	2025
Geological Society of America John T. and Carol G. McGill Research Award Elucidating chemical evolution from hillslope to stream in layered stratigraphy Critical Zones Total award: \$2,500	2024
UW-Madison Summer Research Grant Elucidating chemical evolution from hillslope to stream in layered stratigraphy Critical Zones Total award: \$500	2024
UT-Austin Green Fund Project: Waste Free LHB Total award: \$5,683	2018-2019

UNIVERSITY TEACHING EXPERIENCE

† Denotes courses that included a field component

University of Wisconsin- Madison, Department of Geoscience

GEOSCI/ GLE 627: Hydrogeology Undergraduate/Graduate †

Course instructor Fall 2025; Co-Instructor: Dr. Athena Nghiem

Enrollment: 17 students; Instructor Evaluation Rating: 4.64/5; Course Evaluation Rating: 4.1/5
(Awarded Thomas E. Berg Award for Excellence in Teaching)

Teaching Assistant Fall 2023; Professors: Dr. Michael Cardiff & Dr. Christopher Zahasky;
Enrollment: 29 students; TA Evaluation Rating: 4.74/5

Teaching Assistant Fall 2021; Professor: Dr. Michael Cardiff;
Enrollment: 31 students; TA Evaluation Rating: 4.91/5

Grader Fall 2024; Professors: Dr. Christopher Zahasky & Dr. Athena Nghiem;
Enrollment: 24 students

GEOSCI/ GEOG 320: Geomorphology Undergraduate/ Graduate †

Teaching Assistant Spring 2022; Professor: Dr. Ken Ferrier; Enrollment: 20 students;
TA Evaluation Rating: 4.86/5
(Awarded Thomas E. Berg Award for Excellence in Teaching)

GEOSCI/ ASTRON 160: Life in the Universe

Reader/ Grader Spring 2021; Professors: Dr. Ann Bauer, Dr. Stephanie Napieralski, Dr. Andrew Vanderburg; Enrollment: 180 students

Universidad de la Frontera, Chile**Volcanoes and Ice Summer Program (Pucón, Cautín, CL) Undergraduate †**

Teaching Assistant January 2022; Instructors: Dr. Ivo Fustos Toribio, Dr. Brad Singer,
Dr. Shaun Marcott, Dr. Ben Edwards, Pablo Moreno-Yaeger, Matias Romero, Yasmeen Orellana
Salazar; Enrollment: ~20 students

RESEARCH MENTORSHIP

Nouqub Vang (UW- Milwaukee) – <i>Freshwater@UW Summer Research mentee</i>	2026
Project: Water-Landscape Interactions in Wisconsin's Driftless Area	
Mason Gourley (UW- Madison) – <i>UW LASER summer research mentee</i>	2026
Project: Evaluating AI-automated photogrammetry for topographic mapping	
Hannah Justice (UW-Madison) – <i>honors thesis/ Sophomore Research Fellow mentee</i>	2024-2026
Project: The impact of anthropogenic landscape change on water chemistry	
Ella Flattum (UW- Platteville) – <i>Freshwater@UW Summer Research mentee</i>	2025
Project: Investigating the impact of loess on hillslope hydrology	
Molly Egan (UW-Madison) – <i>undergraduate research mentee</i>	
Project: Landscape evolution of Calbuco Volcano, Lake District, Chile	2024
Mara Corum (UW-Madison) – <i>undergraduate research mentee</i>	2024
Project: Snowmelt-driven changes in water chemistry in Wyalusing State Park	
Valerie Bares (UW-Madison) – <i>undergraduate research mentee</i>	2021-2022
Project: Constraining erosion rates at Osorno Volcano, Lake District, Chile	

SERVICE & LEADERSHIP

Committee member, AGU Earth and Planetary Surface Processes Student Committee	2026-
Application Reviewer, Freshwater @UW Student Research Opportunity Program	2026
Faculty Liaison, UW-Madison Geoscience Graduate Student Assn.	2023-2026
Seminar Committee member, UW-Madison Very Early Career Seminar Series	2025-2026
Conference Volunteer, AWRA-Wisconsin Annual Meeting	2025
Seminar Chair, UW-Madison Very Early Career Seminar Series	2024-2025
Member, UW-Madison Geoscience Diversity, Equity, and Inclusion Committee	2023-2025
President, UW-Madison Geoscience Graduate Student Assn.	2022-2023
President, UW-Madison Association of Women Geoscientists	2021-2022
Founder, UW-Madison Annual Women in Geoscience Careers Panel	2021
Ombud, UW-Madison Geoscience Graduate Student Assn.	2021-2022
Section Leader, UT Longhorn Band	2017-2020

OUTREACH

UW Geology Museum	(Educator & Saturday Docent)	2021-Present
Skype a Scientist	(Volunteer Scientist & Presenter)	2021-Present
WaterCycling Team	(Community Educator)	2023-2024
Letters to a Pre-Scientist	(Scientist PenPal)	2021-2022

CERTIFICATIONS

Mental Health First Aid (National Council for Mental Wellbeing)	2025-Present
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RELEVANT PROFESSIONAL EXPERIENCE

GeoFORCE Texas	Austin, TX
Geoscience Instructor & Educational Coach	2022-2023
• Taught classroom and field-based modules introducing high school students to core concepts in geoscience, including sedimentary processes and landscape evolution of the Basin and Range and Colorado Plateau • Developed and implemented GeoFORCE curriculum informed by geoscience education literature and evidence-based practices in field learning • Mentored instructional staff and student researchers in formulating geological questions, conducting field observations, and applying the scientific method to geologic interpretation	
Geoscience Research Counselor	2020-2021
• Facilitated virtual field experiences introducing high school students to principles of geology and geologic interpretation • Guided students in geological observations, methods, and proposal development • Led programming for learning modules on Water Resources and Landscapes Through Time and assisted instructors on Engineering and Critical Mineral modules	
Critical Zone Laboratory, The University of Texas at Austin	Austin, TX
Undergraduate Researcher	2018-2020
• Conducted experiments investigating rock porosity and low-temperature geochemical processes for independent research and lab members • Collected physical and chemical data using laboratory and field instrumentation • Synthesized research findings in conference-style presentations and a thesis	
Office of Sustainability, The University of Texas at Austin	Austin, TX
Intern/ Green Offices Leader	2018-2020
• Evaluated sustainability practices across UT departments and offices, in partnership with the Green Labs program • Consulted with university staff to implement environmentally, socially, and economically sustainable workplace practices	
Longhorn Band Student Association	Austin, TX
Service and Sustainability Chair	2017-2019
• Led sustainability initiatives for the University of Texas's largest student organization • Wrote grant proposals, coordinated project budgets, and implemented service and sustainability programs • Directed the organization's first waste-free game initiative	

ADDITIONAL AFFILIATIONS

Association of Women Geoscientists	2021-Present
GeoPath Peer-to-Peer Mentorship program	2021-Present
Geoscience Graduate Student Association	2020-Present
The University of Texas Longhorn Alumni Band	2020-Present
Phi Kappa Phi Honor Society (UT Austin Chapter)	2019-2020
Undergraduate Geological Society (UT Austin)	2016-2020
Tau Beta Sigma	2017-2020
The University of Texas Longhorn Pep Band	2017-2020
The University of Texas Longhorn Band	2016-2020

FIELD EXPERIENCE & SHORT COURSES

Wyalusing State Park, WI (2021-Present)

Cumulative 18 weeks of field experience mapping, collecting cores via direct push methods, installing, collecting data from and maintaining vadose zone monitoring stations, sampling lysimeters, meteorological monitoring stations, and game cameras in a steeply incised catchment to probe properties of the unsaturated, sedimentary stratigraphy.

Andean Southern Volcanic Zone (2023 & 2025)

Cumulative 7 weeks of field experience in the Andean Southern Volcanic Zone conducting field study of Llaima Volcano, Villarrica Volcano, Mocho-Choshuenco Volcano, Osorno Volcano, Antillanca Volcanic Field, and Nahuel-Huapi National Park. Collected lava, tephra, and woody debris samples with a field team for He-3 dating, glass geochemistry, and C-14 dating to improve volcanic history reconstruction. Mapped erosional features including fluvially and glacially incised valleys and landslide scars.

UW-Madison Iceland Graduate Student Field Experience (2023)

10-day field experience traversing the southern coast of Iceland following an itinerary and field guide written by students in the course. This field experience was the culmination of a semester-long primary literature-based seminar course on the volcanology, tectonics, geology, hydrology, climatic history, and culture of Iceland.

UW-Madison Quantitative Geomorphology Field Experience (2022)

1-week field experience in California (USA) exploring the effects of tectonics, climate, and sediment supply on the surface processes that shape a variety of landscapes including the Sierra Nevada range, Yosemite Valley, Owens Valley, Death Valley, Eureka Dune, Convict Lake, Tioga Moraines, and the Mendocino Triple Junction. This field experience was the culmination of a primary literature review conducted by students and was followed by a semester of process-based analysis of these landscapes.

Geology of the Colorado Plateau—GeoFORCE Texas 10th grade academy (2022-2023)

10 cumulative days teaching the evolution of the Colorado Plateau (UT & AZ, USA) along with the scientific method, principles of physics, chemistry, stratigraphy, tectonics, and geochronology to outstanding 10th grade students. This included leading guided learning experiences for students at the Virgin River Canyon, Zion National Park, Bryce Canyon National Park, Glen Canyon Dam, the Grand Canyon.

Summer of Applied Geophysical Experience (2022)

2.5 weeks in Northern New Mexico (Jemez Mountains, Galisteo Basin, Valles Caldera National Preserve, San Marcos Pueblo, and Abiquiu) using active seismic, Electrical Resistivity Tomography (ERT), and Ground Penetrating Radar (GPR) surveying to probe the near-surface and passive (broadband and nodal) seismic, magnetotellurics, gravity, magnetic, and time-domain electromagnetic (TEM) surveying to probe the structure and composition of the shallow to mid crustal structure.

Work completed as part of this experience has contributed to mapping volcanic history associated with the Jemez Lineament, structure of the Valles Caldera, and mapping anthropogenically-driven changes in Northern New Mexico's water resources.

Ground Penetrating Radar-- Principles, Practice & Processing (2022)

Sensors and Software Inc. abbreviated 3-day course taught by Peter Annan in the Galisteo Basin. Theory and applications of ground penetrating radar using Sensors and Software's SmartCart system.

UT-Austin Ecohydrology Field Experience (2019)

3-day field experience in Rocksprings, Texas investigating shallow water resources and the woody plants that rely on them in Texas karst. Documented water levels in a well, measured plant photosynthesis rates on woody and non-woody species with a LiCOR Portable Photosynthesis System, measured leaf water potential with a water potential pressure chamber, and cored trees to date them based on tree rings.

Field and Stratigraphic Methods (2018)

Semester-long course with a cumulative 9 days in the field across central Texas practicing classic geologic mapping and stratigraphic interpretations to understand the geologic history of the region.

Field Seminar in Environmental Science (2017)

Semester-long course with a cumulative 12 days in the field from the Texas coast at Port Aransas to Central Texas. This course taught biological, geographical, and geologic field methods through hands-on practice. Methods employed included: woody vegetation transect surveying, freshwater invertebrate surveying, prescribed burn methods, post-wildfire evaluation, climate proxy analysis via speleothems, rock and mineral identification, bird identification, and grain size interpretation in coastal sedimentology.

PROFESSIONAL MEMBERSHIPS

Sigma Xi Scientific Research Honor Society	2025-Present
National Ground Water Association	2024-Present
American Geophysical Union	2023-Present
Geological Society of America	2020-Present