

Bryce Kenneth Belanger, PhD

Laboratory of Tree-Ring Research

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1. EDUCATION

Vanderbilt University, Nashville, TN

2025 Ph.D., Earth and Environmental Sciences

Primary Advisor: Dr. Jessica Oster

Dissertation: *A multifaceted approach to speleothem paleoclimate reconstruction during the Holocene and MIS 5: Construction of traditional proxy records and experimental novel proxy development*

Vanderbilt University, Nashville, TN

2022 M.S., Earth and Environmental Sciences

Thesis: *Modern climate change recorded in a Rocky Mountain speleothem: Assembling a late-Holocene climate record for Titan Cave, WY.*

Middlebury College, Middlebury, VT

2019 B.A., Geology (*magna cum laude*)

Thesis: *Modelling climate constraints on the formation of pluvial Lake Bonneville in the Great Basin, United States.* Published in *Journal of Quaternary Science*.

Foreign study at the University of Canterbury (Christchurch, New Zealand) through *Frontiers Abroad Geologic Field Camp and Semester Abroad*

2. PROFESSIONAL EXPERIENCE

University of Arizona, Tucson, AZ

11/2025 – Present Postdoctoral Scholar – National Science Foundation, Division of Atmospheric Geospace Sciences - Postdoctoral Research Fellowship
Mentor: Kevin Anchukaitis

Vanderbilt University, Nashville, TN

05/2023 – 09/2024 Graduate Lab Manager, Department of Earth and Environmental Sciences

01/2021 – 10/2025 Teaching Assistant, Department of Earth and Environmental Sciences

Frontiers Abroad Geologic Field Camp, Christchurch, New Zealand

01/2020 – 03/2020 Geology Teaching Assistant

Mammoth Cave National Park, Mammoth Cave, KY

09/2019 – 12/2019 Natural Resource Management Assistant, Science and Resource Management Office

Middlebury College, Middlebury, VT

09/2018 – 05/2019 Teaching Assistant, Geology Department

01/2017 – 05/2019 Research Assistant, Geology Department

Colgate University, Hamilton, NY

06/2016 – 08/2016 Research Assistant, Geology Department

01/2015 – 06/2015 Research Assistant, Biology Department

3. PUBLICATIONS

A. Peer Reviewed Articles

Published and In press/Accepted

6. **Belanger, B.**, Sharp, W., Kinsley, C., Cai, Y., de Wet, C., and Oster, J. (2025). Coeval Holocene stalagmites record multi-centennial climate variability and drought in the northern Rocky Mountains, USA, *Geophysical Research Letters*. doi: 10.1029/2025GL115747
5. Custado, M., Gagnon, C., **Belanger, B.**, Sekhon, N., Bernstein-Schalet, J., Kinsley, C., Sharp, W., Oster, J., and Ibarra, D. (2025). Constraining the modern hydrological balance of Bear Lake, Utah-Idaho: Insights from stable isotopes (^{18}O and 2H), *Water Resources Research*. doi: 10.1029/2024WR038264
4. **Belanger, B.**, de Wet, C., McKenzie, B., and Oster, J. (2024). Modern cave monitoring informs interpretations of past climate change: Applications to Titan Cave, Wyoming, *Reviewed Conference Proceedings for USGS Karst Interest Group*. doi: 10.3133/ofr20241067
3. de Wet, C., Ibarra, D., **Belanger, B.** and Oster, J. (2023). North American hydroclimate during past warm states: A proxy compilation-model comparison for the Last Interglacial and the mid-Holocene, *Paleoceanography and Paleoclimatology*, 38(6). doi: 10.1029/2022PA004528
2. **Belanger, B.**, Amidon, W., Laabs, B., Munroe, J. Quirk, B. (2022). Modelling climate constraints on the formation of pluvial Lake Bonneville in the Great Basin, USA, *Journal of Quaternary Science*, 37(3), 478-488. doi: 10.1002/jqs.3394
1. Zier, J., **Belanger, B.**, Trahan, G. and Watkins, J.E., (2015). Ecophysiology of four co-occurring lycophyte species: an investigation of functional convergence, *AoB Plants*, 7, p.plv137. doi: 10.1093/aobpla/plv137

Forthcoming

Belanger, B., Sharp, W., Kinsley, C., and Oster, J., *In prep*, Multi-proxy stalagmite records from the western US document precipitation shifts during the Last Interglacial period, for *Quaternary Science Reviews*.

Belanger, B., Hopker, S., Ibarra, D., Hartland, A. and Oster, J., *In prep*, Evaluation of stable ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$), triple oxygen ($\Delta^{17}\text{O}$), and clumped (Δ_{47} , Δ_{48}) isotope compositions in speleothems grown under cave analog conditions, for *Geochemistry, Geophysics, Geosystems*.

Bolden, I., Timmerman, A., Clark, D., **Belanger, B.**, Oster, J., Salas-Saavedra, M., Niespolo, E., *Submitted*, Monitoring coral reef metabolism under changing ocean conditions – Novel insights from seawater stable carbon isotopes, for *Global Biogeochemical Cycles*

Tingle, K., Anderson, R., Schiffbauer, J., Czaja, A., **Belanger, B.**, Manning-Berg, A., Oster, J., Darroch, S., *Submitted*, Buried alive: extracellular polymeric substances promote clay templating of live eukaryotic algae, for *PNAS*

Custado, M., Waldeck, A., **Belanger, B.**, Wang, X., Rugenstein, J., Cobb, K., Oster, J., and Ibarra, D., *Submitted*, Differing sensitivity of $\delta^{18}\text{O}$ - $\delta^2\text{H}$ versus $\delta^{18}\text{O}$ - $\delta^{17}\text{O}$ systematics in a balance-filled lake, for *Geochemical Perspectives Letters*

Treble, P., Zang, Y., Kaushal, N., Baker, A., Hartmann, A., **Belanger, B.**, et al. *In Prep*, SISAL cave monitoring: a global database of cave drip and precipitation water isotopes, for *Earth System Science Data*

B. Other publications

Sekhon, N., Kong-Johnson, C., **Belanger, B.**, Tabujara, S., Gatluda, J., Geraldles, M., Gao, A., Custado, M., Geronia, M., David, C.P., Ibarra, D. (2024). Tracking hydroclimate extremes from deep in the tropics. *Past Global Changes Horizons* 3, 13-19.

C. Invited Seminars

2024: Colgate University, Department of Earth & Environmental Geosciences, Cooper Lecture Series

4. RESEARCH GRANTS AND SUPPORT

External Funding as a PI

National Science Foundation – Postdoctoral Research Fellowship from the Division of Atmospheric and Geospace Sciences, *Atmospheric Moisture Variability in the Western United States Reconstructed from Tree-Ring Oxygen Isotopes*, begins 11/1/2025, \$202,000 total

External funding as Vanderbilt graduate student

John W. Hess Research Grant in Karst Studies - GSA Graduate Student Research Grant, *Evaluation of stable ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$) and triple oxygen ($\Delta^{17}\text{O}$) isotope compositions in speleothems grown under cave analog conditions*, 2024, \$3475 total

GSA Awards for Geochronology Student Research Grant, *Dating climatic shifts during past warm periods: Building a U-series chronology for a Last Interglacial speleothem*, 2021, \$6840 total

Charles A. & June R.P. Ross Research Grant – GSA Graduate Student Research Grant, *Reconstructing mid-Holocene hydroclimate conditions in the Rocky Mountains, USA*, 2021, \$3013 total

Cave Research Foundation Graduate Research Grant for Cave and Karst Research, *Reconstructing mid-Holocene hydroclimate conditions in the Rocky Mountains, USA: Implications for seasonality and monsoon influence*, 2021, \$2750 total

National Science Foundation Graduate Research Fellowship Program, *Western United States hydroclimate during past warm periods: Comparing stalagmite records and isotope-enabled climate model output from the Last Interglacial*, 2022, Honorable Mention

Internal funding from Vanderbilt University

Vanderbilt Award for Doctoral Discovery, *Evaluation of stable ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$) and triple oxygen ($\Delta^{17}\text{O}$) isotope compositions in speleothems grown under cave analog conditions*, 2024, \$4810 total

Alberstadt-Reesman-Stearns Fund, *Exploratory cave field research in northern Utah, USA*, 2023, \$1704 total

Graduate Leadership Institute Spring 2023 Dissertation Enhancement Grant, *Experimental evaluation of triple oxygen isotopes in speleothems*, 2022, \$1765 total

5. SERVICE

Departmental and University Service

Vanderbilt EES Graduate Student Officer: President (2023-2024), Academic Chair (2021-2022, 2022-2023), Vice President (2024-2025)

Vanderbilt EES URGE (Unlearning Racism in the Geosciences), Pod Member, 2020-2021

Vanderbilt Association for Women Geoscientists, Member, 2020-present

Professional Service

Manuscript Reviewer, including the following journals: Geophysical Research Letters (2); Quaternary Research (1); Geochemistry, Geophysics, Geosystems (1); Cave and Karst Science (1); Hydrology and Earth System Sciences (1); Quaternary Science Reviews (3)

Session co-chair, AGU Fall Meeting 2023 & AGU Fall Meeting 2024: Climate Reconstruction from the Pacific Region: Insights into Past Oceanic and Atmospheric Conditions

Manuscript Reviewer for Young Scientist Journal for high school students (2023-present)

OSPA Reviewer at AGU Fall Meeting 2023 (n=2) & AGU Fall Meeting 2024 (n=1)

SISAL (Speleothem Isotopes Synthesis and AnaLysis) group member and team leader (Modern Carbonates working group) (2023-present)

Grant reviewer for *Kye's Climate Action Fund (KCAF)* Climate Science and Technology awards

Community Service and Outreach

Caving outreach trips with local Nashville elementary and middle school classes (2021-present)

6. TEACHING AND MENTORING

Vanderbilt University Graduate Teaching Assistant

Dynamic Earth, EES 1510, Fall 2022 (two lab sections totaling 35 Undergraduates)

Global Climate Change, EES 3310, Spring 2022 (one lab section totaling 23 Undergraduates)

Dynamic Earth, EES 1510, Spring 2021 (two lab sections totaling 43 Undergraduates)

Environmental Geochemistry, EES 3280, Fall 2023 (Lab Assistant duties as part of Graduate Lab Manager role)

Frontiers Abroad Geologic Field Camp Teaching Assistant

Field Research in Geology, Spring 2020 (6-week geologic field course, 22 Undergraduates)

Middlebury College Undergraduate Teaching Assistant

Geology of Climate Change, GEOL 221, Spring 2019

Igneous and Metamorphic Petrology, GEOL 300, Fall 2018

Invited Class Lectures

Earth's climate system, Dynamic Earth (EES 1510), Vanderbilt University, Fall 2024

Analytical techniques in environmental geochemistry, Environmental Geochemistry (EES 3280), Vanderbilt University, Fall 2023

Stable water isotopes in the environment, Environmental Geochemistry (EES 3280), Vanderbilt University, Fall 2023

Reconstructing past climate change using modeling approaches, Glacial Geology (EES 4440), Vanderbilt University, Fall 2021

Advising and Mentorship

Mentor to Devon Reilly, high school student from the School for Science and Math at Vanderbilt (Fall 2023 – present)

Mentor and advisor to Carolina Rocha Lima, Vanderbilt EES Undergraduate student (as part of EES Graduate Lab Manager role)

Informal mentor to junior graduate students in Oster Lab group (Aida Zyba, Erica Scarpitti, Bethan Lodge, Lily Pendergrass)

7. SHORT COURSES AND TRAINING

ELEVATE Leadership Training (Spring, 2024): 12-week Vanderbilt Graduate Leadership Institute program

PaleoCAMP (Summer, 2022): 2-week summer school for graduate students in paleoclimatology

8. SELECTED CONFERENCE ABSTRACTS

Belanger, B., Sharp, W., Kinsley, C., Cai, Y., de Wet, C., and Oster, J. (December, 2024). Coeval Holocene stalagmites record linkages between ENSO and Rocky Mountain hydroclimate on multi-centennial timescales. 2024 AGU Annual Meeting, Washington, D.C.

Oster, J., **Belanger, B.**, Maxey, M., Kinsley, C., Sharp, W., Chen, C., Ibarra, D. (December, 2024). Lake Manix carbonate stable isotope record documents climate change in the Mojave across four glacial terminations. 2024 AGU Annual Meeting, Washington, D.C.

Kong Johnson, C., Sekhon, N., Gerald Vega, M., **Belanger, B.**, Jalandoni, S., Santos Dela Cruz, N., David, CP, Geronia, M., Cobb, K., Oster, J., McGee, D., Ibarra, D. (December, 2024). A tale of two Philippines speleothem records: The relationship between Southeast Asian Summer Monsoon and Winter Monsoon systems during the Late Holocene. 2024 AGU Annual Meeting, Washington, D.C.

Clark, D., **Belanger, B.**, Oster, J., Boden, I. (December, 2024). Southern Caribbean records of post-industrial sea surface temperature and hydrology from the Massive Starlet Coral (*Siderastrea siderea*). 2024 AGU Annual Meeting, Washington, D.C.

Gerald Vega, M., Sekhon, N., Kong Johnson, C., **Belanger, B.**, Jalandoni, S., Santos Dela Cruz, N., David, CP, Geronia, M., Cobb, K., Oster, J., McGee, D., Ibarra, D. (December, 2024). Late Pleistocene, high resolution speleothem record from the Philippines provides insight into Southeast Asian Monsoon dynamics at orbital and decadal timescales. 2024 AGU Annual Meeting, Washington, D.C.

Reilly, D., **Belanger, B.**, Zyba, A., Oster, J. (December, 2024). The effect of vegetation and soil depth on the soil geochemistry above Titan Cave, Wyoming. 2024 AGU Annual Meeting, Washington, D.C.

Oster, J., **Belanger, B.**, Zyba, A., de Wet, C., et al. (September, 2024). Understanding climate teleconnections and the impact of fire on soil and drip water chemistry through stalagmite records and cave monitoring in northern Wyoming. 2024 GSA Fall Meeting, Anaheim, CA.

Ibarra, D., Miller, S., Custado, M., Kinsley, C., **Belanger, B.**, Sekhon, N., Gagnon, C., Sharp, W., Oster, J. (September, 2024). Investigating late Pleistocene stable isotope systematics of lakes in the western United States. 2024 GSA Fall Meeting, Anaheim, CA.

Tingle, K., Anderson, R., Manning-Berg, A., **Belanger, B.**, Oster, J., and Darroch, S. (May, 2024). Extracellular polymeric substances promote clay templating of live eukaryotic algae. Astrobiology Science Conference 2024.

Belanger, B., Hopker, S., Ibarra, D., Hartland, A. and Oster, J. (December, 2023). Evaluation of traditional stable ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$), triple oxygen ($\Delta^{17}\text{O}$), and clumped (Δ_{47} , Δ_{48}) isotope compositions in calcite grown under cave analog conditions. 2023 AGU Fall Meeting, San Francisco, CA.

Sekhon, N., Kong Johnson, C., Gao, A., **Belanger, B.**, Custado, M.J., Gerald Vega, M., McGee, D., Mallick, S., David, C.P., Geronia, M., Jalandoni, S., Gatdula, J., Santos Dela Cruz, N., Oster, J., and Ibarra, D. (December, 2023). What it takes to develop speleothem records: Developing an understanding of modern and past hydroclimate variability impacts on tropical island nations: a case study from the Philippines. 2023 AGU Fall Meeting, San Francisco, CA.

Miller, S., Gagnon, C., Kinsley, C., **Belanger, B.**, Chen, C., Sharp, W., Oster, J., and Ibarra, D. (December, 2023). Identifying drivers of hydroclimate change during Marine Isotope Stage 5 in Owens Valley, CA using carbonate clumped isotopes. 2023 AGU Fall Meeting, San Francisco, CA.

Sekhon, N., Gao, A., **Belanger, B.**, David, C.P., Geronia, M., Jalandoni, S., Gatdula, J., Santos Dela Cruz, N., Gerald Vega, M., and Ibarra, D. (October, 2023). What it takes to develop speleothem records: A deep-dive into transfer functions between climate and geochemistry in tropical cave systems from the Philippines. 2023 GSA Fall Meeting, Pittsburgh, PA.

Custado, M.J., Miller, S., Chang, N., Prausnitz-Weinbaum, M., Gagnon, C., **Belanger, B.**, de Wet, C., Kinsley, C., Sharp, W., Oster, J., and Ibarra, D. (May, 2023). Hydrological balance in the Bear Lake watershed, Utah and Idaho using major-ion and stable isotope analysis. GSA Rocky Mountain Section 2023.

Belanger, B., de Wet, C., Sharp, W., Kinsley, C., Cai, Y., and Oster, J. (April, 2023). Coeval stalagmite records from the Rocky Mountains record Holocene climate change. EGU General Assembly 2023, Vienna, Austria. <https://doi.org/10.5194/egusphere-egu23-4539>.

de Wet, C., Ibarra, D., **Belanger, B.** and Oster, J. (February, 2023). Western US precipitation patterns during past warm states: A proxy compilation-model comparison for the mid-Holocene and Last Interglacial. 2023 Pacific Climate Conference.

Belanger, B., de Wet, C., Sharp, W., Cai, Y., and Oster, J. (October, 2022). Holocene climate change recorded in a Rocky Mountain speleothem: Assessing shifting drought dynamics in the western US from 5.7 ka to present. 2022 GSA Fall Meeting, Denver, CO. <https://doi.org/10.1130/abs/2022AM-379690>.

Belanger, B., de Wet, C., Cai, Y., Sharp, W. and Oster, J. (December, 2021). Modern climate change recorded in a Rocky Mountain Speleothem: Assembling a late-Holocene climate record for Titan Cave, Wyoming. 2021 AGU Fall Meeting, New Orleans, LA.

de Wet, C., Oster, J., Ibarra, D., **Belanger, B.** (April, 2021). North American rainfall patterns during past warm states: A proxy network-model comparison for the Last Interglacial and mid-Holocene. EGU General Assembly 2021.

<https://ui.adsabs.harvard.edu/abs/2021EGUGA..23.6574D/abstract>

Belanger, B., de Wet, C., Cai, Y. and Oster, J. (January, 2021). Assembling a late-Holocene climate record for Titan Cave, Wyoming. 2021 Climate Change: The Karst Record IX (KROnline) Meeting.

Walcott, C., Munroe, J., Amidon, W., **Belanger, B.**, Laabs, B., (April, 2019). A late-Pleistocene – early-Holocene luminescence-based chronology of pluvial Lake Clover, Nevada, USA. 2019 EGU General Assembly, Vienna, Austria.

Belanger, B., Amidon, W., Laabs, B., Munroe, J. (March, 2019). Modelling climate constraints on the formation of pluvial Lake Bonneville in the Great Basin, USA. 2019 Northeast Geological Society of America Meeting, Portland, ME.

Belanger, B. and Hampton, S. (November, 2018). Geochemical analysis of near and far field tsunami deposits, Little Pigeon Bay, New Zealand. 2018 GSA Annual Meeting, Indianapolis, IN.