

Robert McCarley Holder

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Education

2018: **PhD** in Earth Science, University of California, Santa Barbara (UCSB)
2014: **MS** in Earth Science, UCSB
2012: **BA *summa cum laude*** double major in Geology and Scandinavian Studies, Gustavus Adolphus College (GAC), Minnesota

Employment

2020– : **Assistant Professor**, University of Michigan (UM), Ann Arbor, MI
2018–2020: **Postdoctoral Fellow**, Johns Hopkins University (JHU), Baltimore, MD
2012–2018: **Teaching Assistant** and **Graduate Student Researcher** as MS and PhD student, UCSB
2016: **Instructor of Record**, UCSB
2009–2012: **Teaching Assistant** as BA student, GAC
2010: **ICP-MS student technician**, GAC
2009: **Field Technician**, Great Basin Unified Air Pollution Control District, Inyo County, CA

Mentoring

University of Michigan

Postdoctoral researchers

2. Charlotte Connop 2024–2025 (Assistant Professor at Bates College, Maine), Postdoctoral Researcher: Petrochronology of a Mesozoic subduction complex, Baja California, Mexico
1. David Hernández-Urbe 2020–2022 (Assistant Professor at University of Illinois, Chicago), Postdoctoral Researcher: Theoretical modeling of subduction metamorphism, intermediate-depth earthquakes, and slab melting

Graduate students, primary advisor

5. Sam Neumann, PhD student 2026– : The distribution of radioactive, heat-producing elements in continental crust
4. Hannah Schroeder, PhD student 2022–2027 (anticipated): Archean metamorphism and tectonics in the English River Subprovince, Ontario, Canada
3. Sam Neumann, MS student 2024–2026: Intrinsic Challenges in the Interpretation of Zirconium-in-Titanite Thermometry and Quartz-in-Garnet Barometry of an Ancient Subduction Zone; Cedros Island, Baja California, Mexico
2. Yiruo Xu, PhD student 2021–2026: The Temporal Footprint of Tectonics: Deciphering Metamorphic Timescales via Diffusion Chronometry
1. Julisan Street, MS student 2021–2024: Low-pressure granulite metamorphism in the Ivanpah and Southern McCullough Mountains: A case study on partial melting drivers

Graduate students, academic mentor

5. Amanda Holmes, MS student 2025—
4. Annie Lammes, MS student 2025—
3. Anaé Lamaire, PhD student 2024—

2. Madeline Huising, MS student 2024–
1. Chloe Marks, PhD student 2023–

Graduate students, committee member (PhD) or reader (MS)

18. Rory Sweedler, PhD student 2026–
17. Amanda Flores, PhD student 2025–
16. Ziqi Yang, PhD student 2025–
15. David Aguilar, PhD student (School of Public Health) 2024–
14. Jiaqi Li, PhD student 2024–
13. Bobo Bai, PhD student 2023–
12. Mackenzie Taylor, PhD student 2022–
11. Bryanne Gordon, PhD student 2022–

10. Benjamin Colding, MS student 2024–2026
9. Lucas Gomes, PhD student 2022–2026
8. Andrés Felipe González Duran, PhD student 2022–2026
7. Anisha Ghosh, MS student 2024–2025
6. Evan Hirsch, MS student 2024–2025
5. Allyson Murray, PhD student 2023–2025
4. Dongyuan Zhou, MS student 2022–2024
3. Daniel Blakemore, PhD student 2020–2024
2. Justin Casaus, PhD student 2021–2023
1. María Alejandra Rodríguez Mustafa, PhD student 2021–2022

Undergraduate student honors thesis

1. Benjamin Woodmansee, 2024–2026

Undergraduate student research mentor

8. Kendal Boyce, 2026–
7. Tess Gillum, 2026–
6. Benjamin Woodmansee, 2024–2026
5. Astrid Olsson, 2024–2025
4. Hannah Bartlett, 2023–2024
3. Tyler Bush, 2023–2024
2. Anna Sheck, 2024
1. Benjamin Bos, 2024

University of California, Santa Barbara

Undergraduate students

3. Carl Swindle 2017–2018 (senior thesis, UCSB)
2. Adam Kershner 2016–2017 (research credits toward major, UCSB)
1. Alex Guzman 2016–2017 (research, UCSB)

Teaching (course numbers in parentheses)

UM Instructor

- GeoClub's 2026 Best Instructor Award
- Structural geology (351): 2023
 - Collaborator in curricular re-design in 2024 with M. Clark (lead) and N. Niemi
- Magmatism, metamorphism, & plate tectonics (412 / 352): 2021, 2022, 2026
 - Lecture re-design in 2020 with R. Lange, lab and homework re-designs in 2022 and 2026
- Geology field course (440): 2021–2026

Yearly modifications with co-instructor N. Niemi, including updating existing projects and project sites, the introduction of digital field mapping and GIS, and complete one-year re-design for teaching at alternate location during camp renovations in 2026

- Geochronology (485): 2021, 2023, 2025
Created course in 2021, addition of Upper Level Writing Requirement (ULWR) designation in 2023 and 2025
- Graduate seminar: Mineralogy, Petrology, & Geochemistry (535): 2020–2026 (lead)
- Graduate seminar: Geophysics, Tectonics, Structural Geology (534): 2020–2026 (participant)
- Graduate seminar: The evolution of the Precambrian Earth (596): 2024 (co-lead, with J. Johnson)

UCSB Instructor

- Antarctica (10): 2016

UCSB Teaching Assistant

- Geomaterials (114): 2013
- Analytical methods (115): 2014
- Spring geology field camp (104b): 2013, 2014, 2015, 2016, 2017
- Summer geology field camp (118): 2014
- Introductory field geology for non-majors (6): 2013, 2015, 2017
- Metamorphic petrology (102c): 2012, 2014, 2016

Awards, Grants, & Honors

University of Michigan — PI

- NSF-MRI (planned, 2026). MRI: Track 2 Acquisition of a multi-collector inductively coupled plasma mass spectrometer for petrochronology and isotope geochemistry. Estimated \$1.5M
- NSF-EAR CESEV (submitted — pending). Collaborative Research: Does partial melting of metasedimentary rocks lead to net differentiation of heat-producing elements in continental crust? Proposed award period 12/1/2025–11/30/2028. \$431,108
- UM Center for Habitable Planetary Systems. Secular change in redox-sensitive ore deposits as a record of global biogeochemical evolution. \$15,000
- Invited lead author for book chapter in the Treatise on Geochemistry, 3rd edition, 2025. Chapter Topic: The metamorphic rock record through Earth's history.
- Sloan Fellowship nominee 2024. When did plate tectonics begin? Unraveling the fundamental framework of our planet
- Packard Fellowship nominee 2023. When did plate tectonics begin? Unraveling the fundamental framework of our planet
- UM Provost Early Tenure Track Faculty Research Support Initiative. 4/21/2023. \$3000.
- NSF-EAR Tectonics 2127195. Collaborative Research: Do subduction zone metamorphic rocks record evolving subduction-zone thermal structure or anomalous tectonic activity? Baja California. 9/1/2022–8/31/2026. \$340,466
- NSF-EAR Tectonics 2022746. Collaborative Research: Did Mantle Magma Cause Ultrahigh-Temperature Metamorphism (UHTM) in Southern Madagascar? 9/1/2020–8/31/2024. \$259,405

University of Michigan — named collaborations

- NSF-DEB Systematics & Biodiversity Science (submitted). Collaborative Research: Origin of the marsupial-placental dichotomy: did reproductive innovations steer early mammalian evolution? Collaborative project with lead PI, Dr Lucas Weaver (UM Earth & Environmental Sciences). Proposed award period 1/1/2026–12/31/2028. \$890,596
- NSF-EAR Petrology & Geochemistry 2233425. Collaborative Research: Testing endmember hypotheses for the source of mineralizing fluid(s) in iron oxide - copper - gold (IOCG) deposits. Collaborative project with lead PI, Dr Adam Simon (UM Earth & Environmental Sciences). 8/15/2023–7/31/2026. \$444,296

- NSF-EAR Petrology & Geochemistry 2214119. Reconstructing the magmatic and hydrothermal evolution of the Au-rich, Cu-poor Dorado porphyry deposit, Chile: Implications for Cu/Au ratios in porphyry deposits worldwide. Collaborative project with lead PI, Dr Adam Simon (UM Earth & Environmental Sciences). 7/1/2022–6/30/2025. \$357,603
- M-LEEdD (Michigan Center on Lifestage Environmental Exposures and Disease) pilot project: Integrated Spatial Metals and Transcriptomics Analysis to Understand Triple Negative Breast Cancer Disparities. Collaborative project with lead PI, Dr Justin Colacino (UM School of Public Health). 4/1/2023–3/31/2024. \$29,937

Johns Hopkins University — named senior personnel

- NSF-EAR Instrumentation and Facilities 1831766. Acquisition of a laser-based system for trace-element mapping and large-*N* geochronology by inductively coupled plasma mass spectrometry (ICP-MS). (Lead PI: Daniel Viete, JHU)

University of California, Santa Barbara

- Most Helpful Graduate Student (awarded by vote of Earth Science graduate students at UCSB), 2018
- UCSB Doctoral Student Travel Grant 2017
- EGU Outstanding Student Poster Award 2017
- UCSB Alumni Graduate Award in Research Excellence 2017
- UCSB Earth Science Graduate Student Opportunity Award 2017
- UCSB Earth Research Institute Summer Research Fellowship 2017
- UCSB Tanya Atwater Global Field Travel Fund 2016
- UCSB George Tunell Memorial Fellowship 2016
- Microanalysis Society Early Career Scholar Award 2016
- United States Antarctic Service Medal 2015
- UCSB Lloyd & Mary Edwards Field Studies Fellowship 2015
- UCSB Tanya Atwater Global Field Travel Fund 2015
- PSAAPG Imperial Barrel Award Competition, UCSB team 2014
- UCSB Earth Science Graduate Award for Research Excellence 2014
- Sigma Xi Scientific Research Society 2012
- Undergraduate Speaker, Phi Beta Kappa Annual Meeting, GAC 2012
- Phi Beta Kappa Academic Honor Society 2011
- GAC Chester O. Johnson Geology Scholarship 2010

Research Fieldwork

- United States, CA 2025. Franciscan accretionary complex & mélanges. 2 days
- United States, NV & CA 2024. Granulites & granites in the McCullough & Ivanpah Ranges. 1 week
- Mexico, Baja Cal. Sur 2023. Subduction complexes of Cedros Island & Vizcaíno Peninsula. 3 weeks
- Canada, NW Ontario 2022. Archean gneisses of the English River subprovince. 2 weeks
- United States, N. Michigan 2022. Metamorphic isograd sequences of the Penokean orogeny. 2 weeks
- United States, NV & CA 2022. Granulites in the McCullough Range & Mtn Pass REE deposit. 1 week
- United States, N. Michigan & Wisconsin 2019. The Paleoproterozoic Pembine ophiolite. 2 weeks
- United States, Upper Midwest 2019. Archean gneisses of the Minnesota River Valley. 2 weeks
- United States, Maryland 2019. Baltimore Mafic Complex & felsic plutons near Baltimore. ~12 daytrips
- United States, California 2019. Neoproterozoic dolomites in the Death Valley region. 1 week
- Scotland 2018. Shetland Ophiolite and mafic-ultramafic bodies in the Portsoy Shear Zone. 2 weeks
- United States, Nevada 2018. Paleoproterozoic granulites in the McCullough Range. 1 week
- Austria & Czech Rep. 2017. UHP & UHT rocks of the Bohemian Massif, Variscan Orogen. 2 weeks
- Antarctica 2015. High-K magma suites of the McMurdo Dry Valleys. 7 weeks
- Madagascar 2014. UHT metamorphism and magmatism in the East-African–Kuunga Orogen. 4 weeks
- Norway 2013. UHP metamorphism in the Western Gneiss Complex, Caledonian Orogen. 3 weeks

- Canada, Ontario 2010. Stromatolites in the Gunflint Formation. 1 week
- United States, Minnesota, 2010. Sediment provenance in the Le Sueur River watershed. 1 week
- United States, California, 2009. Mapping modern aeolian sediments, Keeler Dunes. 3 weeks

Contributions to Professional Community

- Editorial contributor for *Geology*. 2022–2027
- Strabospot workshop for developing digital tools for modern field-geology teaching. University of Kansas. March 2024
- Goldschmidt Conference 2024 chair for Theme 03: Crustal Processes and Evolution.
- Conference sessions convened/chaired
 7. GSA Penrose Conference - International Eclogites Conference 2025 session *The Franciscan and HP-UHP Rocks of the Circum-Pacific Realm* with S. Baldwin.
 7. GSA connects 2024 session *State of the Art and Future Directions in Petrology and Petrochronology: A session in Honor of Chris Yakymchuk, University of Waterloo, GSA MGPV Early Geological Career Awardee for 2024* with M. Brown, J. Kendrick, and D. Pattison.
 6. GSA connects 2024 session *Subduction Zones and their Volcanic Arcs: Initiation and Evolution, Structure, Metamorphism, Magmatism* with P. Kapp, D. Hernández-Uribe, and J. Wang
 5. GSA connects 2023 session *Unravelling timescales of magmatism, metamorphism, and crustal evolution* with C. Connop and M. Caddick
 4. NC-GSA meeting 2023 session *Reading the Record of Tectonic Processes through Diverse Investigations of Igneous and Metamorphic Rocks* with H. Blatchford
 3. Goldschmidt meeting 2022 session *Secular evolution in magmatism, metamorphism, geochemistry, and geodynamics across the evolution of plate tectonics* with J. Garber, J. Liebermann, & H. Moreira
 2. GSA Annual Meeting 2019 session *Metamorphic Petrology Past, Present and Future: Preparing for the next 100 years with the Mineralogical Society of America* with S. Penniston-Dorland and M. Caddick
 1. AGU Fall Meeting 2017 session *Petrochronology and microstructural geochronology (V022)* with D. Moser, K. Tait, and J. Darling
- Virtual short course for early career faculty and graduate students on the use of Theriak-Domino phase-equilibrium modeling software. Led with D. Hernández-Uribe. 2022
- Annual proposal reviewer for the American Philosophical Society Lewis and Clark Fund for Exploration and Field Research
- Book reviewer for *Reviews in Mineralogy and Petrology, Volume 83, Petrochronology: Methods and Applications*, eds. Matthew J. Kohn, Martin Engi, and Pierre Lanari. *American Mineralogist*
- Manuscript reviewer for: *American Mineralogist, Computers and Geosciences, Contributions to Mineralogy and Petrology, Earth and Planetary Science Letters, Episodes, Geology, Geoscience Frontiers, Journal of Metamorphic Geology, Lithos, Nature Communications, Precambrian Research, and Mineralogy & Petrology*. 45 manuscripts reviewed since 2017
- NSF-EAR Tectonics, Petrology & Geochemistry, Instrumentation & Facilities *ad hoc* proposal reviewer
- External thesis reviewer for Curtin University (1 MS student) and Adelaide University (2 PhD students)
- Geology field consultant for independent film *Unconformity*, by director Jonathan DiMaio, 2019

Visiting Lectures/Seminars

15. The evolution of plate tectonics: the metamorphic rock record. October 15, 2025. Wayne State University
14. The evolution of plate tectonics: the metamorphic rock record. October 8, 2025. Yale University
13. Invited to speak at Curtin University, Perth, Western Australia. August 9, 2023. Trip canceled
12. Metamorphism and the evolution of plate tectonics. Virtual talk for Queens University, Kingston, Ontario. September 9, 2021

11. Metamorphism and the evolution of plate tectonics. Virtual talk for Western Washington University. May 18, 2021
10. Metamorphism and the evolution of plate tectonics. Virtual talk for the Smithsonian Museum of Natural History, Washington DC. April 29, 2020
9. Metamorphism and the evolution of plate tectonics. University of British Columbia, Vancouver. October 10, 2019
8. Metamorphism and the evolution of plate tectonics. University of Maryland. April 26, 2019
7. Metamorphism and the evolution of plate tectonics. Pennsylvania State University. April 5, 2019
6. Reevaluating old paradigms and exploring new frontiers in U–Pb dating of titanite and calcite. Cornell University (faculty-position interview). February 12, 2019
5. Metamorphism and the evolution of plate tectonics. Cornell University (faculty-position interview). February 11, 2019
4. Petrochronology Part 1: Titanite, thermo- or petrochronometer? | Part 2: Carbonate petrochronology, a new frontier. University of Florida (faculty-position interview). February 5, 2019
3. Ultrahigh-temperature metamorphism: The hottest rocks in the crust and how they form. Amherst College (faculty-position interview). December 3, 2018
2. The progressive emergence of modern plate tectonics: A metamorphic perspective from the Archean to today. University of Michigan (faculty-position interview). November 9, 2018
1. Petrochronology Part 1: Titanite, thermo- or petrochronometer? | Part 2: Carbonate petrochronology, a new frontier. University of Michigan (faculty-position interview). November 8, 2018

Publications H-index = 17 i10-index = 24 citations = 1289 (Google Scholar, 05/04/2026)

**** works by student from my group ^^works by postdocs from my group *corresponding author**

37. González-Durán AF, Simon AC, **Holder RM**, Thompson JFH, Wade D, Ryan C, Mathur R (2026) Tracing the Origin and Hydrothermal Overprint of Magnetite-Apatite Mineralization in the New Afton Cu-Au ± PGE Alkalic Porphyry Deposit: Insights from Magnetite Textures and Chemistry. *Economic Geology*
36. Wang JW, Kapp P, **Holder RM**, He JJY, Hernández-Uribe D, Worthington J (2026) Polycyclic metamorphism and exhumation of subduction complex rocks, Cedros Island, Baja California. *GSA Bulletin*. doi:10.1029/2025TC009340
35. Roy S, **Holder RM**, Ramezani J, Brenner DC, Nelson LL, Viete DR (2025) Mantle heating drove short-duration Barrovian-type regional metamorphism during the Paleoproterozoic Penokean Orogeny, Michigan (USA). *GSA Bulletin*. doi:10.1130/B38653.1
34. Su X, Zhang Y, Liu Y, **Holder RM** (2025) Cooling History and Evolution Dynamics of Green Glass Beads During Lunar Fire-Fountain Eruptions: Insights from Na, K, and Cu Distributions. *JGR Planets*. doi:10.1029/2025JE009027
- **33. Xu Y, **Holder RM**, Viete DR (2025) Contrasting cooling histories within the Archean Minnesota River Valley Subprovince and re-examination of secular change of metamorphic timescales. *GSA Bulletin*. doi:10.1130/B37639.1
32. Hammerli J, Kemp AIS, Bouvier A-S, Rudnick R, Boivin P, **Holder RM**, Chacko T, Blake K (2025) The role of scapolite-bearing granulites in sequestering and releasing sulfur: implications for S isotope signatures of crustal fluids during the exhumation of the lower crust. *Geochimica et Cosmochimica Acta*. doi:10.1016/j.gca.2025.01.010
- *31. **Holder RM**, Viete DR (2025) The metamorphic rock record through Earth's history. In: Weis D and Anbar A (eds) *Treatise on Geochemistry 3e*, Vol 2, pp 621-645, Elsevier. doi:10.1016/B978-0-323-99762-1.00002-4
- *30. **Holder RM**, Horton F, Swindle C, Rakotondrazafy AFM (2025) The monazite record of (ultra)high-temperature metamorphism in southern Madagascar: Gondwana terrane correlations and structural trapping of hot middle crust. *Journal of the Geological Society*. doi:10.1144/jgs2024-065

29. Kaare-Rasmussen J, Horton F, **Holder RM**, Kylander-Clark A, Bouvier A-S, Müntener O, Rakotondrazafy AFM (2024) Protracted mantle heat conduction after lithospheric foundering beneath the Malagasy Orogen. *Geology*. doi:10.1130/G52316.1
28. Ben-Israel M, **Holder RM**, Nelson L, Smith E, Kylander-Clark ARC, Ryb U (2024) Late Paleozoic Oxygenation of Marine Environments Supported by Dolomite U-Pb Dating. *Nature Communications*. doi:10.1038/s41467-024-46660-7
- *27. **Holder RM**, Viete DR (2024) A compilation of metamorphic isograd sequences and their ages, Version 1.0. Interdisciplinary Earth Data Alliance (IEDA). doi:10.26022/IEDA/112748.
26. Weaver LN, Kelson JR, **Holder RM**, Niemi NA, Badgley C (2024) On the role of tectonics in stimulating the Cretaceous diversification of mammals. *Earth Science Reviews*. doi:10.1016/j.earscirev.2023.104630
25. Guice GL, Viete DR, **Holder RM**, Roy S (2023) c. 1900 Ma Tethyan-type ophiolite in the Paleoproterozoic Penokean Orogen, Pembine, Wisconsin (USA): Insights from the volcanic stratigraphy. *Precambrian Research*. doi:10.1016/j.precamres.2023.107223
24. Yakymchuk Y, **Holder RM**, Kendrick J, Moyon J-F (2023) Europium anomalies in zircon: a false signal of crustal depth? *Earth & Planetary Science Letters*. doi:10.1016/j.epsl.2023.118405
23. Rodriguez-Mustafa MA, Simon AC, **Holder RM**, Stein H, Kylander-Clark ARC, Jicha BR, Blakemore D, Machado ELB (2023) Integrated Re–Os, Ar/Ar, and U–Pb geochronology directly dates the timing of mineralization at the Mina Justa and Marcona Deposits, Peru. *GSA Bulletin*. doi: 10.1130/B36904.1
- ^^22. Hernández-Uribe D, **Holder RM** (2023) Eclogite thermobarometry: the consistency between conventional thermobarometry and phase-equilibrium modeling. *Journal of Metamorphic Geology*. doi:10.1111/jmg.12747
21. Su X, Zhang Y, Liu Y, **Holder RM** (2022) Outgassing and in-gassing of Na and Cu in Lunar 74220 Orange Glass Beads. *Earth and Planetary Science Letters*. doi:10.1016/j.epsl.2022.117924
- ^^20. Gutiérrez-Aguilar F, Hernández-Uribe D [*postdoc, corresponding author*], **Holder RM**, Condit CB (2022) Fluid-induced fault reactivation due to brucite + antigorite dehydration triggered the M_w 7.1 September 19th Puebla-Morelos (Mexico) intermediate-depth earthquake. *Geophysical Research Letters*. doi:10.1029/2022GL100814
- *19. Horton F, **Holder RM** [*corresponding author*], Swindle C (2022) An extensive record of orogenesis recorded in a Madagascar granulite. *Journal of Metamorphic Geology*. doi:10.1111/jmg.12628
18. Brenner DC, Passey BH, **Holder RM**, Viete DR (2021) Clumped-isotope geothermometry and carbonate U-Pb geochronology of the Alta stock metamorphic aureole, Utah, USA: Insights on the kinetics of metamorphism in carbonates. *Geochemistry, Geophysics, Geosystems*. doi: 10.1029/2020GC009238
17. Guice GL, Ackerson MR, George FR, **Holder RM**, Burgess JL, Browning-Hanson JF, Foustoukos DI, Becker N, Viete DR (2021). The Baltimore mafic complex, Maryland: Ophiolite fragments in the Southern Appalachian Orogen. *Geosphere*. doi:10.1130/GES02289.1
16. Závada P, Štípská P, Hasalová P, Racek M, Jeřábek P, Schulmann K, Kylander-Clark A, **Holder RM** (2020) Monazite geochronology in melt-percolated UHP meta-granitoids: An example from the Erzgebirge continental subduction wedge, Bohemian Massif. *Chemical Geology*. doi:10.1016/j.chemgeo.2020.119919
15. **Holder RM**, Yakymchuk C, Viete DR (2020) Accessory Mineral Eu Anomalies in Suprasolidus Rocks: Beyond Feldspar. *Geochemistry, Geophysics, Geosystems*. doi:10.1029/2020GC009052
14. Štípská P, Schulman K, Racek M, Lardeaux JM, Hacker BR, Kylander-Clark ARC, **Holder RM**, Košuličová M (2019) Finite pattern of Barrovian metamorphic zones: interplay between thermal reequilibration and post-peak deformation during continental collision—insights from the Svratka dome (Bohemian Massif). *International Journal of Earth Sciences*. doi:10.1007/s00531-019-01788-6
13. **Holder RM**, Viete DR, Brown M, Johnson TE (2019) Metamorphism and the evolution of plate tectonics. *Nature*. doi: 10.1038/s41586-019-1462-2

12. **Holder RM**, Hacker BR, Seward GGE, Kylander-Clark ARC (2019) Interpreting titanite U–Pb dates and Zr thermobarometry in high-grade rocks: empirical constraints on elemental diffusivities of Pb, Al, Fe, Zr, Nb, and Ce. *Contributions to Mineralogy and Petrology*. doi:10.1007/s00410-019-1578-2
11. Hacker BR, Kylander-Clark ARC, **Holder RM** (2019) REE partitioning between monazite and garnet: Implications for petrochronology. *Journal of Metamorphic Geology*. doi:10.1111/jmg.12458
10. **Holder RM**, Hacker BR (2019) Fluid-driven resetting of titanite following ultrahigh-temperature metamorphism in southern Madagascar. *Chemical Geology*. doi:10.1016/j.chemgeo.2018.11.017
9. **Holder RM**, Sharp ZD, Hacker BR (2018) LinT, a simplified approach to oxygen-isotope thermometry and speedometry of high-grade rocks: An example from ultrahigh-temperature gneisses of southern Madagascar. *Geology*. doi:10.1130/G40207.1
8. **Holder RM**, Hacker BR, Horton F, Rakotondrazafy AFM (2018) Ultrahigh-temperature osumilite gneisses in southern Madagascar record combined heat advection and high rates of radiogenic heat production in a long-lived high-temperature orogen. *Journal of Metamorphic Geology*. doi:10.1111/jmg.12316
7. Peřestý V, Lexa O, **Holder RM**, Jerabek P, Racek M, Štípská P, Schulmann K, Hacker B (2016) Metamorphic inheritance of Rheic passive margin evolution and its early Variscan overprint in the Teplá-Barrandian Unit, Bohemian Massif. *Journal of Metamorphic Geology*. doi:10.1111/jmg.12234
6. Štípská P, Powell R, Hacker BR, **Holder RM**, Kylander-Clark ARC (2016) Uncoupled U/Pb and REE response in zircon during the transformation of eclogite to mafic and intermediate granulite (Blanský les, Bohemian Massif). *Journal of Metamorphic Geology*. doi:10.1111/jmg.12193
5. Horton F, Hacker BR, Kylander-Clark ARC, **Holder RM**, Jöns N (2016) Focused radiogenic heating of middle crust caused ultrahigh temperatures in southern Madagascar. *Tectonics*. doi:10.1002/2015TC004040
4. **Holder RM**, Hacker BR, Kylander-Clark ARC, Cottle JM (2015) Monazite trace-element and isotopic signatures of (ultra)high-pressure metamorphism: examples from the Western Gneiss Region, Norway. *Chemical Geology*. doi:10.1016/j.chemgeo.2015.04.021
3. Hacker BR, Kylander-Clark ARC, **Holder RM**, Andersen T, Peterman E, Walsh E, Munnikhuis J (2015) Monazite response to ultrahigh-pressure subduction from U–Pb dating by laser-ablation split-stream ICP–MS. *Chemical Geology*. doi:10.1016/j.chemgeo.2015.05.008
2. Štípská P, Hacker BR, Racek M, **Holder RM**, Kylander-Clark ARC, Schulmann K, Hasalová P (2015) Monazite Dating of Prograde and Retrograde P–T–d paths in the Barrovian Terrane of the Thaya Window, Bohemian Massif. *Journal of Petrology*. doi:10.1093/petrology/egv026
1. Broussolle A, Štípská P, Lehmann J, Schulmann K, Hacker BR, **Holder RM**, Kylander-Clark ARC, Hanžl P, Racek M, Hasalová P, Lexa O, Hrdličková K, Buriánek D (2015) P–T–t–D record of crustal-scale horizontal flow and magma assisted doming in the SW Mongolian Altai. *Journal of Metamorphic Petrology*. doi:10.1111/jmg.12124

Invited Conference Abstracts

7. Holder RM, Viete DR, Brown M, Johnson TE (2021) Paired metamorphism and the evolution of plate tectonics. *GSA Connects*
6. Holder RM, Hacker BR, Seward GGE, Kylander-Clark ARC (2021) Interpreting titanite U–Pb dates and Zr thermometry in high-grade rocks: Empirical estimates of elemental diffusivities. 17th International Conference on ThermoChronology
5. Holder RM, Hacker BR (2021) Fluid-driven resetting of titanite following (ultra)high-temperature metamorphism. *Goldschmidt Conference*
4. Holder RM, Yakymchuk C (2019) Monazite Eu anomalies beyond feldspar: Constraining the timescales of deep crustal heat and mass transfer. *AGU Fall Meeting*
3. Holder RM, Yakymchuk C (2019) Monazite Eu anomalies: Beyond feldspar. *EGU General Assembly*

2. Holder RM, Hacker BR, Ryb U (2018) Linking high- and low-temperature processes in the crust with U–Pb dating of carbonate rocks and minerals. Goldschmidt Conference
1. Holder RM, Hacker BR, Kylander-Clark ARC, Nuriel P, Roberts N (2017) Directly dating deformation by U–Pb carbonate LA-ICP-MS. Goldschmidt Conference

Other Conference Abstracts

** presentations given by students from my group ^^ presentations given by postdocs from my group
*presenting author

79. Aguilar Jr, D, **Holder RM**, Zhao P, Zhou X, Erdei E, Colacino JA (2026) Uranium, Lead and Other Toxic Metals Mapped in New Mexican Women’s Triple-Negative Breast Cancer Samples. Society of Toxicology
78. Gordon B, Lange R, **Holder RM** (2025) The age of the Benton Range, CA high-SiO₂ rhyolite dike swarm from U–Pb zircon geochronology: tectonic implications. AGU
- **77. Neumann S, **Holder RM**, Connop C (2025) Understanding the Subduction Mélange Rocks of Cedros Island, Baja California, Mexico Using U-Pb Dating, ZIR, and QUG. AGU
- **76. Xu Y, **Holder RM**, Neumann S, Connop C (2025) Rapid exhumation of the subduction mélange of Cedros Island, Baja California, Mexico from compositional zoning of garnet. AGU
- *75. **Holder RM**, Xu Y, Hames W (2025) Rapid cooling of the Neoproterozoic Quetico metamorphic belt challenges the paradigm of long-lived, slow-cooling Archean metamorphism. GSA
- ^^74. Connop CH, **Holder RM**, Neumann SR, Xu Y, Hernández-Uribe D, Wang JW, Kapp P, He JJY, Worthington J (2025) Early Metamorphism of High-Grade Blocks from the Subduction Mélange of Cedros Island, Baja California, Mexico: Insights from Garnet Lu-Hf Geochronology. GSA
73. Roy S, **Holder RM**, Ramezani J, Hames WE, Webb LE, Guice GL, George FR, Stokes MR, Brenner DC, Nelson LL, Viete DR (2025) Barrovian metamorphic episodes in the Lake Superior Area, Michigan (USA): Insights into Paleoproterozoic mid-crustal thermal evolution. GSA
72. Hernández-Uribe D, Pramanik S, **Holder RM**, Kapp P, Wang JW, He JJY, Worthington J (2025) Tectonothermal constraints of high-grade blocks in the Puerto Nuevo subduction mélange. GSA Penrose Conference - International Eclogites Conference
- *71. **Holder RM**, Hernández-Uribe D, Wang JW, Connop CH, Neumann SR, Xu Y, Kapp P, He JJY, Worthington J (2025) Empirical constraints on the long-term evolution of subduction-zone thermal structure: P–T–t estimates from the Cedros Island subduction complex, Baja California. GSA Penrose Conference - International Eclogites Conference
- ^^70. Connop CH, **Holder RM**, Neumann SR, Xu Y, Hernández-Uribe D, Wang JW, Kapp P, He JJY, Worthington J (2025) The age of enigmatic high-grade blocks in subduction mélange of Cedros Island and their relationship to the tectonic evolution of the North American Cordillera: Garnet Lu-Hf and Sm-Nd geochronology. GSA Penrose Conference - International Eclogites Conference
- **69. Xu Y, **Holder RM** (2024) Did Metamorphic Terranes Cool Slower In the Past? Investigating Cooling Rates from Garnet Diffusion Chronometry on the Neoproterozoic Quetico Subprovince, Canada. AGU Fall Meeting
68. Pramanik S, Hernández-Uribe D, **Holder RM** (2024) Pressure–Temperature evolution of high-pressure blocks of the Puerto Nuevo mélange complex (Baja California Sur, Mexico). GSA Connects
- **67. Schroeder HY, **Holder RM** (2024) Analysis of tectonic activity from modern thermobarometry during the late Archean in the English River Subprovince, Ontario Canada. Granulites & Granulites
- **66. Xu Y, Holder RM (2024) Did Archean Metamorphic Terranes Cool Slower? Garnet Diffusion Study of the Quetico Subprovince, Canada. Granulites & Granulites
- *65. **Holder RM** (2024) Tracking partial melting with LREE content of monazite. Granulites & Granulites
- **64. Street JD, Holder RM (2024) The behaviour of Uranium, Thorium and Potassium during melting: Insights from the Palaeoproterozoic Metapelites of the Mojave Crustal Province. Goldschmidt Conference

63. Kaare-Rasmussen J, Horton F, **Holder RM**, Kylander-Clark A, Bouvier A-S, Müntener O, Rakotondrazafy AFM (2024) Elevated mantle heat flow after lithospheric foundering causes differentiation and metamorphism during orogenesis. Goldschmidt Conference
62. Ryb U, Ben-Israel M, **Holder RM**, Nelson LL, Smith EF, Kylander-Clark ARC (2024) Late Paleozoic Oxygenation of Marine Environments constrained by Dolomite U-Pb Dating. Goldschmidt Conference
- **61. Xu Y, **Holder RM** (2024) Cooling of an Archean metamorphic terrane: garnet diffusion study of the Quetico Subprovince, Canada. Institute on Lake Superior Geology
60. Gonzalez-Duran AF, Simon AC, **Holder RM**, Thompson JFH, Wade D, Ryan C (2024) Overlapping Alkalic Porphyry Cu-Au and Magnetite-Apatite mineralization in the Iron Mask Batholith, British Columbia, Canada. International Geological Congress
59. Weaver L, Kelson JR, **Holder RM**, Niemi NA, Badgley C (2024) On the role of tectonics in stimulating the Cretaceous diversification of mammals. North American Paleontological Convention
58. Kaare-Rasmussen J, Horton F, **Holder RM**, Kylander-Clark ARC, Bouvier A-S, Müntener O, Rakotondrazafy M, Paquette J-L (2023) Mantle heat advection not responsible for ultrahigh-temperature metamorphism in Madagascar. AGU Fall Meeting
57. Horton F, **Holder RM**, Rakotondrazafy AFM (2023) Petrochronologic 4D reconstruction of the Malagasy orogen. AGU Fall Meeting
- **56. Street JD, **Holder RM** (2023) Low-pressure granulite metamorphism in the Ivanpah and southern McCullough Mountains. GSA Connects
55. Roy S, **Holder RM**, Viete DR (2023) Heat sources for Barrovian-type metamorphism: What cooked the rocks of the Paleoproterozoic Penokean Orogen, Michigan (USA)? GSA Connects
- *54. **Holder RM**, Viete DR (2023) Secular change in global tectonics since the Neoproterozoic: A New Perspective from Metamorphic Isograd Sequences. GSA Connects
- *53. **Holder RM**, Horton F, Swindle C (2023) Structurally Trapped ultrahigh-temperature metamorphism in the core of the East-African Orogeny, Southern Madagascar. GSA Connects
52. Cerling T, Huth T, Marchetti D, Passey B, Ellwein A, Mahan S, Bard E, Rostek F, Tuna T, Blum T, **Holder R** (2023) Sub-millennial scale reconstruction of late Quaternary critical zones in Utah, USA using laminated soil carbonate rinds. Goldschmidt 2023
- **51. Street JD, **Holder RM** (2023) High-temperature granulite metamorphism in the Ivanpah and southern McCullough mountains ranges. NC-GSA
- **50. Schroeder H, **Holder RM**, Roy S (2023) Analysis of tectonic activity during the late Archean in the English River Subprovince, Ontario Canada. NC-GSA
- **49. Xu Y, **Holder RM**, Viete DR (2023) Interrogating the record of Archean tectonics from the metamorphic record of the Minnesota River Valley, USA. NC-GSA
- *48. **Holder RM**, Viete DR (2023) The metamorphic rock record through Earth's history. NC-GSA
47. Huth T, Marchetti D, Passey B, Cerling T, Ellwein A, Mahan S, Bard E, Rostek F, Tuna T, Blum T, **Holder R** (2023) Sub-millennial scale reconstruction of late Quaternary critical zones in Utah, USA using laminated soil carbonate rinds. INQUA 2023
46. Huth T, Marchetti D, Passey B, Cerling T, Ellwein A, Mahan S, Bard E, Rostek F, Tuna T, Blum T, **Holder R** (2022) High-resolution analytical techniques in the development of a novel paleoclimate archive; Laminated soil carbonate rinds as a tool for investigating late Quaternary climate-vegetation links. AGU Fall Meeting
- **45. Xu Y, **Holder RM**, Viete DR (2022) Interrogating the record of Archean tectonics from the metamorphic record of the Minnesota River Valley, USA. AGU Fall Meeting
44. Myers ML, Condit C, Warren J, **Holder RM**, Cooperdock EHG, Guevara V, Rader E, Bauer A, Mixon E (2022). Petronet: A petrology and high-temperature geochemistry community build with an antiracist and inclusive framework. AGU Fall Meeting
- **43. Street JD, **Holder RM** (2022) High-Temperature Granulite Metamorphism in the Ivanpah and Southern McCullough Mountain Ranges. AGU Fall Meeting

42. Su X, Zhang Y, Liu Y, **Holder RM** (2022) In-gassing of Na, K and Cu in Lunar 15366 Green Glass Beads. AGU Fall Meeting
41. Condit C, Myers ML, Warren J, **Holder RM**, Cooperdock EHG, Guevara V, Rader E, Bauer A, Mixon E (2022). Petronet: A petrology and high-temperature geochemistry community build with an antiracist and inclusive framework. GSA Connects
40. Guice G, **Holder RM**, Viete DR (2022) A Paleoproterozoic record of modern-style subduction initiation? Evidence from the 1.9 Ga Pembine Ophiolite, Wisconsin (USA). GSA Connects
- ^39. Hernández-Uribe D, **Holder RM** (2022) Eclogite thermobarometry: a comparison between conventional thermobarometry and phase equilibrium modeling. International Eclogite Conference
38. Su X, Zhang Y, Liu Y, **Holder R** (2022) Cooling Time Scales of Lunar 74220 Orange Glass Beads from Na and Cu Profiles. Michigan Geophysical Union
37. Su X, Zhang Y, Liu Y, **Holder R** (2022) Cooling Time Scales of Lunar 74220 Orange Glass Beads from Na and Cu Profiles. Goldschmidt Conference
36. Viete D, Becker N, Burgess J, Junkin W, George F, **Holder RM** (2022) The Baltimore Mafic Complex: Key record of earliest convergence in the central Appalachians. NEGSA section meeting
35. Ben-Israel M, Ryb U, **Holder RM**, Kylander-Clark A (2021) U–Pb dating constraints on dolomite formation environments. AGU Fall Meeting
34. Rodríguez-Mustafa MA, Blakemore D, Simon AC, **Holder RM**, del Real I, Barra F, Reich M, Thompson JFH, Hames WE (2021) Magnetite, apatite, titanite, and actinolite geochronology of the Candelaria iron oxide-copper-gold (IOCG) deposit, Chile. GSA Connects
- ^33. Hernández-Uribe D, **Holder RM** (2021) Slab vs crustal melting: implications for the Sr/Y signature in arc magmas. GSA Connects
32. Viete DR, **Holder RM**, Guice GL, George FR (2021) Metamorphic scales illuminate past tectonic processes. GSA Connects
31. Rodríguez-Mustafa MA, Blakemore D, **Holder RM**, Simon AC (2021) The timing of mineralization in the Mina Justa IOCG system, Peru: Insights from in situ U-Pb MC-ICP-MS ages for apatite, magnetite and titanite. SEG Annual Meeting
30. Blakemore D, Rodríguez Mustafa MA, Simon AC, **Holder RM**, Del Real I, Reich M, Barra F, Thompson JFH, Hames WE (2021) The Temporal Evolution of the Candelaria Iron Oxide - Copper - Gold (IOCG) System, Chile: Insights from in situ U-Pb LA-MC-ICP-MS of Apatite, Magnetite, Titanite and Ar-Ar of Actinolite. SEG Annual Meeting
29. Ben-Israel M, Ryb U, **Holder RM**, Kylander-Clark ARC (2021) U-Pb dating and clumped isotopes constraints on massive-dolomite formation environments. Goldschmidt Conference
28. Gutiérrez-Aguilar F, Hernández-Uribe D, **Holder RM**, Condit C (2021) The Mw7.1 September 19th Puebla-Morelos (Mexico) earthquake triggered by brucite and antigorite dewatering. EGU General Assembly
- *27. **Holder RM**, Viete DR, Brown M, Johnson T (2020) Metamorphism and the evolution of plate tectonics. AGU Fall Meeting
26. Garber JM, **Holder RM**, Smye A, Reimink JR, Feineman MD (2020) The punctuated continuum of plate tectonics revealed by global igneous rocks. AGU Fall Meeting
25. Becker NA, Browning-Hanson JF, **Holder RM**, Nelson WR, Burgess JL, Viete DR (2020) Geochemical progression in lavas and shallow intrusives of the Appalachian–Caledonian Leka Ophiolite Complex, Norway. GSA Annual Meeting
24. Guice GL, Ackerson MR, **Holder RM**, George FR, Browning-Hanson JF, Burgess JL, Foustoukos DI, Becker NA, Nelson WR, Viete DR (2020) The Baltimore Mafic Complex, Maryland: ophiolite fragments in the southern Appalachian Orogen? GSA Annual Meeting
23. Viete DR, **Holder RM** (2020) Accretionary orogenesis in the Lake Superior region, USA: modern-like tectonics during the Paleoproterozoic. EGU General Assembly
22. Burgess J, Becker NA, **Holder RM**, Piccoli PM, Viete DR (2020) Geochemical and thermobarometric constraints on the Perry Hall and tectonically associated gneisses from the

- Baltimore area piedmont, Maryland. Joint NE–SEGSA section meeting CANCELED due to pandemic
- *21. **Holder RM**, Hacker BR, Kylander-Clark ARC, Cottle JM (2020) Dating continental subduction and exhumation with monazite in the Western Gneiss Region, Norway. Joint NE–SE GSA section meeting CANCELED due to pandemic
 20. Becker NA, Browning-Hanson J, **Holder RM**, Nelson WR, Burgess JL, Viete DR (2020) Geochemical progression in lavas and shallow intrusives of the Appalachian–Caledonian Leka ophiolite complex, Norway. Joint NE–SE GSA section meeting CANCELED due to pandemic
 19. Viete DR, **Holder RM** (2019) Modern-style metamorphism in the Paleoproterozoic: A product of stochasticity in ‘time to subduction initiation’ within ocean basins? GSA Annual Meeting
 - *18. **Holder RM**, Hacker BR, Kylander-Clark ARC, Seward GGE (2019) Interpreting titanite U–Pb dates and Zr temperatures in high-grade rocks: Empirical constraints on elemental diffusivities. GSA Annual Meeting
 - *17. **Holder RM**, Hacker BR (2018) Prolonged fluid-driven resetting of titanite following ultrahigh-temperature metamorphism in southern Madagascar. AGU Fall Meeting
 16. Swindle C, **Holder RM** (2018) Mechanisms of granulite formation in an archetypal accretion-to-collision orogen: pseudosections and monazite petrochronology from southern Madagascar. AGU Fall Meeting
 15. Viete DR, **Holder RM** (2018) Geodynamics of (U)HT granulite metamorphism: a view from ‘accessory’ terranes. Granulites and Granulites Conference
 - *14. **Holder RM**, Hacker BR (2018) Interpreting titanite U–Pb dates and Zr temperatures in granulites: Empirical estimates of elemental diffusivities. Granulites and Granulites
 - *13. **Holder RM**, Hacker BR (2017) Titanite chronology, thermometry, and speedometry of ultrahigh-temperature (UHT) calc-silicates from south Madagascar: U–Pb dates, Zr temperatures, and lengthscales of trace-element diffusion. AGU Fall Meeting
 - *12. **Holder RM**, Hacker BR (2017) Titanite petrochronology of ultrahigh-temperature (UHT) calc-silicates from southern Madagascar: laser-ablation split-stream ICP-MS spot analyses, depth profiles, and quantified trace-element x-ray maps. EGU General Assembly
 - *11. **Holder RM**, Hacker BR (2016) The importance of intracrustal magmatic heat advection in large hot orogens: the Ediacaran-Cambrian ultrahigh-temperature domain of southern Madagascar. AGU Fall Meeting
 10. Hacker BR, Kylander-Clark ARC, **Holder RM**, Nuriel P (2016) U–Pb dating of Calcite by LA-ICPMS. AGU Fall Meeting
 - *9. **Holder RM**, Hacker BR, Kylander-Clark ARC, Everson A (2016) Development of calcite reference materials for *in-situ* U–Pb dating and trace-element analysis. GSA Annual Meeting
 - *8. **Holder RM**, Hacker BR (2016) Intracrustal magmatic heat advection in the Ediacaran UHT domain of Madagascar. GSA Annual Meeting
 - *7. **Holder RM**, Hacker BR, Horton F (2015) Protracted high-grade metamorphism in southern Madagascar: P–T–t paths of the Anosyen, Androyen, and Ikalamavony domains. Granulites and Granulites Conference
 - *6. **Holder RM**, Hacker BR, Kylander-Clark ARC, Cottle JM (2014) Monazite trace-element and isotopic signatures of high-pressure metamorphism: examples from the Western Gneiss Region, Norway. AGU Fall Meeting
 5. Perestý V, **Holder RM**, Lexa O, Racek M, Jerábek P (2014) Petrochronological and structural arguments for upper plate thickening and relamination of the lower plate buoyant material in the Variscan Bohemian Massif. EGU General Assembly
 - *4. **Holder RM**, Hacker BR, Kylander-Clark ARC (2013) Monazite Petrochronology from the UHP Western Gneiss Region, Norway. AGU Fall Meeting
 - *3. **Holder RM**, Hacker BR, Kylander-Clark ARC (2013) Monazite Petrochronology from the UHP Western Gneiss Region, Norway. GSA Annual Meeting

2. Perestý V, **Holder RM**, Lexa O, Racek M, Hacker BR (2013) Polyphase tectonometamorphic evolution of the Teplá Crystalline Complex: New structural, petrological, and geochronological data. GeoPilsen Conference
1. Hacker BR, Kylander-Clark ARC, Horton F, **Holder RM** (2013) Applying U/Th-Pb and trace-element LASS petrochronology to understanding high-temperature metamorphism. GSA Annual Meeting

Community dataset

Holder RM and Viete DR (2024) A Compilation of Metamorphic Isograd Sequences and Their Ages, Version 1.0. Interdisciplinary Earth Data Alliance (IEDA). doi.org/10.26022/IEDA/112748

Software and code

Python code for Al-in-orthopyroxene thermobarometry corrected for retrograde Fe–Mg diffusion (after method of Pattison et al., 2003). github.com/rmholdergeo/batchRCLC