

## 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*

- Charlotte Connop 2024– Petrochronology of a Mesozoic subduction complex, Baja California, Mexico.
- David Hernández-Urbe 2020–2022 (now Assistant Professor at University of Illinois Chicago): theoretical modeling of subduction metamorphism, intermediate-depth earthquakes, and slab melting.

##### *Graduate students, primary advisor*

- Sam Neumann, MS student 2024– : Subduction metamorphism in Baja California, Mexico
- Hannah Schroeder, PhD student 2022– : Archean metamorphism and tectonics in the English River Subprovince, Ontario, Canada
- Yiruo Xu, PhD student 2021– : Archean metamorphism and tectonics in the Quetico Subprovince, Ontario, Canada
- Julisan Street, MS student 2021– : Paleoproterozoic granulite metamorphism and crustal melting in the southwest USA

##### *Graduate students, academic mentor*

- Chloe Marks, PhD student 2023–

##### *Graduate students, committee member*

- Anisha Ghosh 2024–
- David Aguilar, PhD student (School of Public Health) 2024–
- Jiaqi Li, PhD student 2024–
- Allyson Murray, PhD student 2023–
- Bobo Bai, PhD student 2023–
- Lucas Gomes, PhD student 2022–
- Dongyuan Zhou, PhD student 2022–

- Andrés Felipe González Duran, PhD student 2022–
- Mackenzie Taylor, PhD student 2022–
- Bryanne Gordon, PhD student 2022–
- Justin Casaus, PhD student 2021–2023
- Daniel Blakemore, PhD student 2020–2024
- María Alejandra Rodríguez Mustafa, PhD student 2021–2022

#### ***Undergraduate students***

- Benjamin Woodmansee, 2024–
- Hannah Bartlett, 2023–2024
- Tyler Bush, 2023–2024
- Anna Sheck, 2024
- Benjamin Bos, 2024

#### **University of California, Santa Barbara**

##### ***Undergraduate students***

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

#### **Teaching** (course numbers in parentheses)

##### UM Instructor

- Structural geology (351): 2023
- Magmatism, metamorphism, & plate tectonics (412 / 352): 2021, 2022
- Geology field course (440): 2021–2024
- Geochronology (485): 2021, 2023, 2025
- Graduate seminar: Mineralogy, Petrology, & Geochemistry (535): 2020–2023
- Graduate seminar: The evolution of the Precambrian Earth (596): 2024

##### 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**

- Packard Fellowship UM 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. 9/1/2022–8/31/2025. \$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-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
- M-LEEd (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, 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

- 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
  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
- Editorial Board member for *Geology*. 2022–2024
- 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*. 44 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 indie film *Unconformity*, by director Jonathan DiMaio, 2019

### Visiting Lectures/Seminars

13. Earth's hottest crust in Earth's largest continental collision. Date TBD, Winter 2024. University of Kansas
12. Earth's hottest crust in Earth's largest continental collision. Date TBD, Fall 2024. Wayne State University
11. Invited to speak at Curtin University, Perth, Western Australia. August 9, 2023. Trip canceled
10. Metamorphism and the evolution of plate tectonics. Virtual talk for Queens University, Kingston, Ontario. September 9, 2021
9. Metamorphism and the evolution of plate tectonics. Virtual talk for Western Washington University. May 18, 2021

8. Metamorphism and the evolution of plate tectonics. Virtual talk for the Smithsonian Museum of Natural History, Washington DC. April 29, 2020
7. Metamorphism and the evolution of plate tectonics. University of British Columbia, Vancouver. October 10, 2019
6. Metamorphism and the evolution of plate tectonics. University of Maryland. April 26, 2019
5. 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

**bold = works led by me or my UM research group**

H-index = 15 i10-index = 18 citations = 899 (Google Scholar, 09/04/2024)

31. **Holder RM, Horton F, Swindle C, Rakotondrazafy AFM (in press)** 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
30. Kaare-Rasmussen J, Horton F, Holder RM, Kylander-Clark A, Bouvier A-S, Müntener O, Rakotondrazafy AFM (in press) Protracted mantle heat conduction after lithospheric foundering beneath the Malagasy Orogen. *Geology*
29. **Holder RM, Viete DR (2024)** The metamorphic rock record through Earth's history. In: *Treatise on Geochemistry*, 3<sup>rd</sup> Edition. doi:10.1016/B978-0-323-99762-1.00002-4
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). <https://doi.org/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, Moyen 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, Holder RM, Condit CB (2022)** Fluid-induced fault reactivation due to brucite + antigorite dehydration triggered the  $M_w$ 7.1 September 19<sup>th</sup> 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, Yakymchuck 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 **bold = works led by me or my UM research group**

68. Pramanik S, Hernández-Urbe 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](https://github.com/rmholdergeo/batchRCLC)