

Buchanan Kerswell

Curriculum Vitae: Aug 26 2026

✉ b.kerswell@liverpool.ac.uk



I study how Earth's mantle and tectonic plates move using fieldwork, petrography, numerical geodynamic modeling, applied statistics, and analytical techniques in laboratories. My work focuses on rock formation and deformation at a small scales, and how these processes affect larger systems. I work in remote mountains, use electron beams in labs, and run simulations on large computer clusters with my colleagues and students. I also teach, create learning materials, and explore how AI can improve geoscience.

EDUCATION

May 2022 : Aug 2015 **PhD Geosciences** Boise State University

Supervisor: Dr. Matthew Kohn

Dissertation: Computational Approaches to Understanding Subduction Zone Geodynamics, Surface Heat Flow, and the Metamorphic Rock Record

Jul 2015 : Aug 2011 **BSc Earth Science** Utah Valley University (NSF Fellow)

Supervisor: Dr. Steven Fellows

Thesis: Geochemical Analysis Of Tourmaline as a Tool for Determining the Location and Characteristics of the Main Central Thrust, Central Nepal

PROFESSIONAL APPOINTMENTS

present : Nov 2024 **Postdoc** University of Liverpool

Investigated phase transformations in mantle flow models under non-hydrostatic stress conditions

Oct 2024 : May 2023 **Postdoc** Géosciences Montpellier

Applied machine learning (ML) and artificial intelligence (AI) techniques to geochemical and thermodynamic datasets to increase the efficiency of predicting rock properties in numerical geodynamic simulations

May 2023 : Aug 2022 **Visiting Assistant Professor** Miami University

Adapted, updated, delivered, and graded course materials, mentored independent undergraduate research on high-pressure metamorphic rocks within the AUGITE program, taught graduate/undergraduate seminars on scientific communication including technical writing workshops and student-led public presentations and discussions, completed a New Faculty Teaching Enhancement Program with Miami's Center for Teaching and Learning, participated in cross-disciplinary events across campus

- May 2019 : Jan 2019 **Instructor** Boise State University
Adapted, updated, delivered, and graded course materials, transitioned a field-based course to online-learning, produced a virtual field trip during the early COVID-19 pandemic
- Aug 2018 : Jun 2018 **Visiting Student** Sorbonne Université
Supervisor: Dr. Philippe Agard
Studied rheologic theory and application, implemented metamorphic-rheologic processes into numerical geodynamic models
- Dec 2017 : Sep 2017 **Visiting Student** ETH-Zürich
Supervisor: Dr. Taras Gerya
Studied computational fluid dynamic theory and application, practiced high performance computing, and developed finite-difference numerical geodynamic models of subduction
- May 2022 : Aug 2015 **Graduate Research Associate** Boise State University
Supervisor: Dr. Matthew Kohn
Studied petrologic theory and application, practiced chemistry- and physics-based analytical techniques, sampled various rock types and tectonic structures from exhumed HP terranes (Catalina Island, W Alps, NW India, Greece), led seminars on tectonic theory and application
- May 2021 : Aug 2015 **Graduate Research Associate** Boise State University
Adapted, updated, delivered, and graded course materials, organized, ran, and graded up to one field exercise per week, developed web pages and inclusive formats to enhance online-learning experiences
- May 2021 : Aug 2015 **Guest Lecturer** Boise State University
Introduced finite-difference numerical modeling approaches, led students through live coding tutorials (a student's code featured in [this peer-reviewed publication](#)), presented selected material on subduction zone metamorphism and geodynamics

PEER-REVIEWED PUBLICATIONS

BOOK CHAPTERS

- [1] **B. Kerswell** (2026). Methods in Tectonics: From Big Data to Machine Learning. *Geoscience in Practice: Geological Society of London*. [In Review]

JOURNAL ARTICLES

- [9] **B. Kerswell**, M. Kohn (2026). Along-Strike Heat Flow Continuity Near Subduction Zones Is Mostly Ambiguous, Not Globally Uniform. *JGR: SE*. [In Review] [repo](#)

- [8] **B. Kerswell**, J. Wheeler, R. Gassmöller, J. Huw Davies, I. Papanagnou, S. Cottaar, D. P. Dobson (2026). Beyond Equilibrium II: Ringwoodite Decomposition Kinetics Amplify 660 km Discontinuity Depressions and Offer an Independent Control on Slab Stagnation. *JGR: SE*. [In Review] [repo](#)
- [7] **B. Kerswell**, J. Wheeler, R. Gassmöller, J. Huw Davies, I. Papanagnou, S. Cottaar (2026). Beyond Equilibrium: Kinetic Thresholds and Rheological Feedbacks Create a Potentially Complex 410 in Slab Regions. *JGR: SE*. doi: 10.1029/2026JB033781 [online](#) [pdf](#) [repo](#) [google](#)
- [6] **B. Kerswell**, N. Cerpa, A. Tommasi, M. Godard, J. Alberto Padrón-Navarta (2024). RocMLMs: Predicting Rock Properties through Machine Learning Models. *JGR: MLC*. doi: 10.1029/2024JH000264 [online](#) [pdf](#) [repo](#) [google](#)
- [5] **B. Kerswell**, M. Kohn, T. Gerya (2023). Computing Rates and Distributions of Rock Recovery in Subduction Zones. *Geochemistry, Geophysics, Geosystems*. doi: 10.1029/2022GC010834 [online](#) [pdf](#) [repo](#) [google](#)
- [4] M. Klöcking, L. Wyborn, K. Lehnert, B. Ware, A. Prent, L. Profeta, F. Kohlmann, W. Noble, I. Bruno, S. Lambart, H. Ananuer, N. Barber, H. Becker, M. Brodbeck, H. Deng, K. Deng, K. Elger, G. de Souza Franco, Y. Gao, K. Ghasera, D. Hezel, J. Huang, **B. Kerswell**, J. Kim, H. Koch, A. Lanati, G. ter Maat, N. Martínez-Villegas, L. Nana Yobo, N. Randazzo, A. Redaa, W. Schäfer, M. R. Swing, R. Taylor, M. Traun, J. Whelan, T. Zhou (2023). Community Recommendations for Geochemical Data, Services and Analytical Capabilities in the 21st Century. *Geochimica et Cosmochimica Acta*. doi: 10.1016/j.gca.2023.04.024 [online](#) [pdf](#) [google](#)
- [3] **B. Kerswell**, M. Kohn, T. Gerya (2021). Backarc Lithospheric Thickness and Serpentine Stability Control Slab-Mantle Coupling Depths in Subduction Zones. *Geochemistry, Geophysics, Geosystems*. doi: 10.1029/2020GC009304 [online](#) [pdf](#) [repo](#) [google](#)
- [2] S. Long, M. Kohn, **B. Kerswell**, J. Starnes, K. Larson, N. Blackford, E. Soignard (2020). Thermometry and Microstructural Analysis Imply Protracted Extensional Exhumation of the Tso Moriri UHP Nappe, Northwestern Himalaya: Implications for Models of UHP Exhumation. *Tectonics*. doi: 10.1029/2020TC006482 [online](#) [pdf](#) [repo](#) [google](#)
- [1] M. Kohn, A. Castro, **B. Kerswell**, C. Ranero, F. Spear (2018). Shear Heating Reconciles Thermal Models with the Metamorphic Rock Record of Subduction. *Proceedings of the National Academy of Sciences*. doi: 10.1073/pnas.1809962115 [online](#) [pdf](#) [google](#)

CONFERENCE PROCEEDINGS

- [12] **B. Kerswell**, J. Wheeler, R. Gassmöller, J. Huw Davies, I. Papanagnou, S. Cottaar (2026). ***Invited** Beyond Equilibrium: Kinetic Thresholds and Rheological Feedbacks Create a Potentially Complex 410 in Slab Regions. *European Geosciences Union 2026, Vienna Austria*. doi: 10.5194/egusphere-egu26-6886 [abstract](#) [slides](#)
- [11] **B. Kerswell**, N. Cerpa, A. Tommasi, M. Godard, J. Alberto Padrón-Navarta (2024). ***Invited** RocMLMs: Predicting Rock Properties through Machine Learning Models. *American Geophysical Union 2024, Washington D.C.* [abstract](#) [slides](#) [video](#)

- [10] **B. Kerswell**, N. Cerpa, A. Tommasi, M. Godard, J. Alberto Padrón-Navarta (2024). RocMLMs: Predicting Rock Properties through Machine Learning Models. *European Geosciences Union 2024, Vienna Austria*. doi: 10.5194/egusphere-egu24-8578 [abstract](#) [slides](#)
- [9] **B. Kerswell**, M. Kohn (2023). A Comparison of Surface Heat Flow Interpolations Near Subduction Zones. *Goldschmidt 2023, Lyon France*. [slides](#)
- [8] D. Sims, **B. Kerswell** (2023). Deformation of Dry High-Pressure Eclogites During Tectonic Slicing of Subducted Oceanic Lithosphere: a Case Study from the Monviso Ophiolite, Italy. *Geological Society of America North-Central 2023, Grand Rapids*. doi: 10.1130/abs/2023NC-386862 [abstract](#)
- [7] C. Morrison, **B. Kerswell** (2023). Comparing PT Paths of Metamorphic Rocks Determined by Quantitative and Semi-Quantitative Approaches: a Case Study from the Monviso Ophiolite, Italy. *Geological Society of America North-Central 2023, Grand Rapids*. doi: 10.1130/abs/2023NC-386686 [abstract](#)
- [6] **B. Kerswell**, M. Kohn (2022). A Comparison of Surface Heat Flow Interpolations Near Subduction Zones. *American Geophysical Union 2022, Chicago*. [abstract](#) [slides](#) [video](#)
- [5] **B. Kerswell**, M. Kohn, T. Gerya (2022). Computing Rates and Distributions of Rock Recovery in Subduction Zones. *Geological Society of America 2022, Denver*. [abstract](#) [slides](#)
- [4] **B. Kerswell**, M. Kohn, T. Gerya (2022). Computing Rates and Distributions of Rock Recovery in Subduction Zones. *Goldschmidt 2022, Honolulu USA*. [abstract](#) [slides](#) [video](#)
- [3] **B. Kerswell**, M. Kohn, T. Gerya (2018). A Physical Mechanism Explaining the Common Depth of Slab-Mantle Coupling and Formation of a Rheologic Backstop at ~80 km Depth. *Goldschmidt 2018, Boston USA*. [abstract](#)
- [2] **B. Kerswell**, M. Kohn, T. Gerya (2018). Backarc Lithospheric Thickness and Serpentine Stability Control Slab-Mantle Coupling Depths in Subduction Zones. *50 Years of Plate Tectonics: Then, Now, and Beyond, Collège de France, Paris France*.
- [1] **B. Kerswell**, S. Fellows, S. Emerman, S. Panday, S. Adhikari (2014). Geochemical Analysis Of Tourmaline as a Tool for Determining the Location and Characteristics of the Main Central Thrust, Central Nepal. *Geological Society of America 2014, Vancouver Canada*. [abstract](#) [slides](#)

INVITED TALKS

- [6] **B. Kerswell**, J. Wheeler, R. Gassmöller, J. Huw Davies, I. Papanagnou, S. Cottaar (2026). Beyond Equilibrium: Kinetic Thresholds and Rheological Feedbacks Create a Potentially Complex 410 in Slab Regions. *European Geosciences Union 2026, Vienna Austria*. [slides](#)
- [5] **B. Kerswell** (2026). Beyond Equilibrium: Reaction Kinetics in Geodynamic Models. *ASPECT User Meeting 2026*. [slides](#)
- [4] **B. Kerswell**, J. Wheeler, R. Gassmöller (2025). Displaced and Faded: how thermodynamics and kinetics collude to complicate seismic structures in Earth's mantle. *University of Liverpool, Earth Science Research Group*. [slides](#) [video](#)

- [3] **B. Kerswell**, N. Cerpa, A. Tommasi, M. Godard, J. Alberto Padrón-Navarta (2024). RocMLMs: Predicting Rock Properties through Machine Learning Models. *American Geophysical Union 2024, Washington D.C.* [slides](#) [video](#)
- [2] **B. Kerswell** (2022). Evaluating Distributions of High-Pressure Rock Recovery in Subduction Zones with Large Empirical Datasets and Numerical Simulations. *University of Minnesota.* [slides](#)
- [1] **B. Kerswell** (2022). Evaluating Aspects of Geodynamic Uniformity Among Subduction Zones with Large Empirical Datasets and Numerical Simulations. *University of Southern California.* [slides](#) [video](#)

SOFTWARE

LEAD DEVELOPER

- [4] **RxnDB**  Python (MIT License)
A mineral reaction database toolkit
- [3] **RocMLM**  Python (MIT License) doi: 10.17605/OSF.IO/K23TB
A toolkit for predicting rock properties through machine learning models
- [2] **Peakfit Explorer**  R (MIT License) doi: 10.17605/OSF.IO/2BU3C
An app for performing Gaussian Mixture Modeling on 1D data
- [1] **Light Slides**  Website (MIT License)
A set of thin sections sampled from Matt Kohn's personal library

CONTRIBUTOR

- [2] **Candi**  bash (LGPL-3.0 License)
Downloads, configures, builds and installs deal.II
- [1] **ASPECT**  c++ (GPLv2 License)
A finite element code to simulate convection in both 2D and 3D models

PROFESSIONAL DEVELOPMENT

WORKSHOPS

- Jul 2026 **ASPECT Hackathon** Liensfeld, Germany
Implemented a new reaction kinetics framework in ASPECT that enables sequences of phase transformations governed by kinetic models
- Jun 2025 **ASPECT Hackathon** Garden City, Utah, USA
Implemented a new material model in ASPECT that governs phase transformation kinetics via non-equilibrium thermodynamics

- Apr 2025 **Research Integrity Training** University of Liverpool
Evaluated my own research practice in terms of research integrity and ethics.
Lead by Dr. Roberto Ferrero.
- Jul 2020 **Preparing for an Academic Career** Earth Educators Rendezvous
Discussed career paths, prepared and reviewed job application materials
- Feb 2016 **SIMS Student Workshop** UCLA EPSS
Engaged in a 5-day workshop focused on principles and practice of secondary-ion mass spectrometry (SIMS)

SYMPOSIA

- Jun 2026 **Ada Lovelace** Séc, Czechia
Presented research and engaged in networking and scientific discussions focusing on numerical geodynamic modeling
- Apr 2025 **Metamorphic Studies Group** Liverpool, United Kingdom
Presented research and engaged in networking and scientific discussions focusing on metamorphic petrology
- Apr 2025 **Imaging Planetary Solid Dynamics** Cambridge, United Kingdom
Presented research and engaged in networking and scientific discussions focusing on seismology and geodynamics
- Sep 2024 **Ada Lovelace** Sète, France
Presented research and engaged in networking and scientific discussions focusing on numerical geodynamic modeling
- Jul 2024 **ERC RhEoVOLUTION** Montpellier, France
Presented research and engaged in networking and scientific discussions focusing on deformation in the solid Earth
- Jul 2024 **French Network on Subduction Zones (FrenSZ)** Barcelonnette, France
Presented research and engaged in networking and scientific discussions focusing on subduction zone dynamics
- Jan 2024 **ERC RhEoVOLUTION** Villard-de-Lans, France
Presented research and engaged in networking and scientific discussions focusing on deformation in the solid Earth
- May 2023 **Réseau Numérique en Terre Solide (NuTS)** Université Lyon 1
Presented research and engaged in networking and scientific discussions focusing on current capabilities and new directions for scientific computing in the geosciences
- Jul 2022 **Earth Science Meets Data Science** Goldschmidt Conference Honolulu
Explored scientific challenges in geochemistry, showcased examples of existing data solutions/infrastructures/services, discussed recommendations, best practices, and essential features of a globally standardised geochemical data framework

- Feb 2019 **GeoPRISMS Synthesis & Integration TEI** Hotel Menger, San Antonio TX
Engaged in community efforts to synthesize the successful achievements of the MARGINS and GeoPRISMS programs, participated in an Early-Career Investigator symposium to identify outstanding questions in subduction zone research
- Aug 2018 **GeoPRISMS EFIRE** Boston College, MA
Engaged in community building, initiated strategic sharing and storage protocols for EFIRE samples, presented research on subduction zone mechanics, planned a field institute for 2019
- Dec 2016 **GeoPRISMS EFIRE** Marin Headlands Hostel, CA
Engaged in community building, discussed past research to identify future targets for subduction zone investigations, planned a field institute for 2017

TEACHING & LEARNING

- Aug 2022 **New Faculty Teaching Enhancement Program** Miami University CTE
Engaged in numerous activities on improving scholarly teaching
- Aug 2020 **Exploration in Pedagogy** Boise State University CTL
Engaged in numerous activities on pedagogy and inclusive teaching
- Aug 2020 **Identity Formation Through Teaching** Boise State University CTL
Planned K-12 lessons with Education majors based on next generation science standards

AWARDS & HONORS

COLLABORATIVE GRANTS

- Mar 2022 **Postdoc** £2.8M NERC NE/V018477/1
Feedbacks between mineral reactions and mantle convection
- Nov 2020 **Postdoc** €2.5M ERC 882450
RhEoVOLUTION: Micro-scale dependent, time- and space-evolving rheologies
- Jun 2016 **PhD Student** \$4.0M NSF 1545903
ExTerra Field Institute

FELLOWSHIPS

- Sep 2026 **PI** £2.18M Royal Society University Research Fellowship [Pending]
AI-Driven Critical Mineral Exploration: From Grain-Scale Analysis to Crustal-Scale Deposit Formation

- Jun 2026 **PI** £1.58M NERC Independent Research Fellowship [Pending]
AI-Driven Critical Mineral Exploration: From Grain-Scale Analysis to Crustal-Scale Deposit Formation
- Apr 2026 **PI** £350k UKRI AI Metascience Early Career Fellowship [Not funded]
AI-Assisted Microscopy in Geoscience: A Practical Metascientific Investigation of Changing Research Practices, Skills, and Human Roles
- Nov 2024 **PI** €89k Humboldt Foundation Fellowship [Not funded]
Interplay between Metamorphic Reactions and Fluid-Mediated Strain Localization: A Comparative Study of Mélange-Type and Coherent-Type Ophiolites in the Cycladic Archipelago and Western Alps
- Feb 2024 **PI** €196k Marie Curie Fellowship (score: 85.6/100) [Not funded]
SMARTGEOS: Supervised Machine learning for Accurate and Rapid Thermodynamics in GEodynamic Simulation
- Aug 2011 **PI** \$40k NSF Undergraduate STEM Fellowship
Engaged in interdisciplinary activities with faculty mentors and undergraduates from STEM fields

MINOR AWARDS

- Jun 2019 **Research Grant** \$3,500 GeoPRISMS: EFIRE
Sampling mafic eclogites from Monviso, Italy
- Feb 2016 **Research Grant** \$1,500 Geological Society of America
Zr-in-Rutile EPMA analysis

HONORS

- May 2021 **Outstanding Graduate Teaching Assistant** Boise State University
Voted best Teaching Assistant by the Department of Geosciences student body
- May 2015 **Outstanding Undergraduate Contributions** Utah Valley University
Engaged in community building, organized field trips, and served as president of the Geology Club

PROFESSIONAL SERVICE

I regularly serve as an expert reviewer for top-tier international journals, including *Earth and Planetary Science Letters*, *Journal of Geophysical Research*, *Geophysical Journal International*, *Geophysics*, *Geochemistry Geosystems*, *Journal of Metamorphic Geology*, *Scientific Reports*, and *iScience*. I frequently review research proposals via major international funding agencies, including the National Science Foundation (NSF) and the German Research Foundation (DFG). I also contribute to academic governance by co-organizing and chairing conference sessions and symposia for international organizations, as well as volunteer judging of student presentations for major societies such as the American Geophysical Union (AGU).

- Apr 2025 **Organizing Committee** MinSoc Metamorphic Studies Group
50+ participants
Co-organized and hosted meeting and workshop on behalf of the Mineralogical Society
- May 2023 **Faculty Judge** Road Test Pitch Competition 2023
100+ undergraduates
Heard undergraduates pitch early-stage business ideas that they developed at Miami University's Farmers Business School
- Mar 2023 **Faculty Mentor** Social Innovation Weekend 2023
100+ undergraduates
Engaged with student teams at Miami University's Farmers Business School as they proposed innovative new technologies regarding climate change and its impacts on our society

PROFESSIONAL AFFILIATIONS

I maintain an active, long-standing membership in leading international professional societies within the geosciences, including the American Geophysical Union (AGU), European Geosciences Union (EGU), Geological Society of America (GSA), Mineralogical Society of America (MSA), and International Association for Mathematical Geosciences (IAMG).

MENTORING

year	name	role	thesis
2023 : 2022	C. Morrison	Undergraduate	<u>Comparing PT paths: Monviso Ophiolite</u>
2023 : 2022	D. Sims	Undergraduate	<u>Strain localization: Monviso Ophiolite</u>

TEACHING

The table below shows my comparative scores versus the departmental average for the following prompt given to students at the end of term: "Upon reflection, this instructor is an effective teacher" (out of 4 = "strongly agree").

term	course	title	format	role	size	score	dpt
S23	GLG 556	Environmental & Economic Mineralogy	Seminar	Instructor	7	3.9/4	3.4/4
S23	GLG 456	Environmental & Economic Mineralogy	Seminar	Instructor	30	3.9/4	3.4/4
S23	GLG 111	Dynamic Earth	Lecture/Lab	Instructor	342	3.6/4	3.4/4
F22	GLG 211	Chemistry of Earth Systems	Lecture/Lab	Instructor	27	3.4/4	3.4/4
F22	GLG 121	Environmental Geology	Lecture/Lab	Instructor	196	3.7/4	3.5/4

term	course	title	format	role	size	score	dpt
S21	GEOS 345	Igneous & Metamorphic Petrology	Lecture/Lab	TA	23	—	—
F20	GEOS 471	Field Methods	Field Lab	TA	8	—	—
F20	GEOS 315	Sedimentology & Stratigraphy	Lecture/Lab	TA	21	—	—
S20	GOES 314	Structural Geology	Lecture/Lab	Instructor	20	—	—
S19	GEOS 645	Physics & Chemistry of Mountain Building	Seminar	Guest lecturer	12	—	—
S18	GEOS 597	Subduction Zone Processes	Seminar	Co-instructor	15	—	—
S16	GEOS 300	Earth Materials	Lecture/Lab	TA & guest lecturer	23	—	—
F15	GEOS 101	Introductory Geology	Lecture/Lab	TA	48	—	—