Martin A. Harris

Experimental Petrology • Lava Rheology • Mineralogy & Petrology • Solid Earth Processes

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RESEARCH INTERESTS

I investigate solid Earth processes by integrating experimental petrology, melt rheology, mineral physics, field observations, and numerical modeling. My research focuses on how the physical and chemical properties of multiphase silicate melts evolve as crystallinity, vesicularity, temperature, and redox conditions change, and how these evolving properties control lava-flow emplacement, morphology, and dynamics.

These rheological insights also inform the behavior of gravity-driven multiphase currents, including lahars, debris flows, and landslides, where mixtures of solids, liquids, and gases undergo rheological transitions governed by physical principles analogous to those in crystal- and bubble-bearing silicate melts. Through numerical simulations, I examine how suspension rheology, yield strength, and phase interactions regulate the transport of Earth materials across volcanic and geomorphic environments.

By combining high-temperature experiments, microanalytical characterization, custom-built field instruments, and computational models, my work aims to develop a unified understanding of how multiphase Earth materials deform, flow, and evolve from the magmatic interior to the surface.

EDUCATION

2022 – 2025 **University at Buffalo, USA**
Ph.D. in Geological Sciences, Department of Earth Sciences
Dissertation: *The Multiphase Rheology of Natural Lava.* Advisors: Dr. Stephan Kolzenburg; Dr. Oryaelle Chevrel (Université Clermont Auvergne).

2019 – 2021 **University of British Columbia, Canada**
M.Sc. in Geological Sciences, Department of Earth, Ocean, and Atmospheric Sciences,
Thesis: *Physical and Chemical Evolution of Cracked Mountain Glaciovolcano, SW British Columbia*. Advisor: Dr. Kelly Russell.

2013 – 2017 **University of Oregon, USA**
B.S. (Honors) in Geological Sciences, Department of Earth Sciences,
Thesis: *Late Miocene to Early Pleistocene Volcanism in the Parker Mountain Quadrangle, Southern Oregon.* Advisors: Dr. Paul Wallace; Dr. Jad D'Allura (Emeritus-Southern Oregon University).

2016 **School for International Training**
Study Abroad: Geoscience in the Himalaya, Nepal (Field Camp)

RESEARCH GRANTS

2024 – 2027	NSF EAR Standard Grant, "Tackling Multiphase Lava Rheology at its Origins" (Proposal #2420723; Budget: $490,302) — Role: PhD Graduate Research Assistant & Postdoctoral Research Associate, contributing as co-researcher.
2022 – 2024	NSF EAR RAPID Grant, "RAPID: Deployment of a Field Rheometer Prototype" (Award #2241489; Budget: $52,582) — Role: PhD Graduate Research Assistant, co-research contributor.
2024	Jack Kleinman Memorial Grant for Volcano Research (Budget: $5,000) — Role: PhD Research Recipient.

FELLOWSHIPS AND AWARDS (~US $71,000 TOTAL)

2022 – 2025	Presidential Fellowship, University at Buffalo ($30,000)
2025	Student Academic Excellence Showcase, University at Buffalo
2024, 2025	Solène Pouget Memorial Award for Scientific Contributions to Society, Department of Earth Science, University at Buffalo ($2,000)
2023	Center for Geological & Climate Hazards Award ($2,500)
2019 – 2021	Natural Resources Canada, Research Affiliate Program Bursary ($30,000)
2016	Walter Youngquist Fellowship Award, University of Oregon ($700)
2016	Friends of Cascade Siskiyou National Monument Grant for "Jenny Creek Summer Research" ($800)

APPOINTMENTS AND POSITIONS

2026 –	Postdoctoral Research Associate, Ruhr University Bochum, Germany
2025 – 2026	Postdoctoral Research Associate, University at Buffalo, USA
2024	Invited Graduate Student Researcher, Hawaiian Volcano Observatory, USA
2024	Invited Graduate Student Researcher, Observatoire Volcanologique du Piton de la Fournaise, La Reunion
2023 – 2025	Served as Graduate Research Assistant, Department of Earth Sciences, University at Buffalo, USA
2023 – 2025	Served as Graduate Teaching Assistant, Department of Earth Sciences, University at Buffalo, USA
2019– 2021	Served as Graduate Teaching Assistant, Department of Earth, Ocean, and Atmospheric Sciences, University of British Columbia, Canada
2019– 2021	Served as GIS & Field Research Assistant, Natural Resources Canada, Canada
2019	Served as Research Assistant, Department of Earth Science, Dartmouth College, USA

PEER-REVIEWED PUBLICATIONS

Published

[1] Kolzenburg, S., **Harris, M.A.**, Chevrel, M.O, & Lynn, K.J. (2026). Comprehensive characterization of Mauna Loa basalt rheology based on the 2022 eruption. *Earth and Planetary Science Letters*, https://doi.org/10.1016/j.epsl.2026.120205.

[2] Saucier, É., **Harris, M.A.,** & Kolzenburg, S. (2025). Permeability Heterogeneity in Enclave Bearing Dome Lavas: A Mechanism for Cyclic Explosive Gas Venting. *Geophysical Research Letters*, 52(20), https://doi.org/10.1029/2025GL117606

[3] **Harris, M.A.,** Kolzenburg, S., & Chevrel, M.O. (2025). The viscosity of multiphase lava: New insights from integrating laboratory and field measurements. *Earth and Planetary Science Letters*, 671, https://doi.org/10.1016/j.epsl.2025.119642

[4] **Harris, M.A.,** Chevrel, M.O., Parsons, J.T., Latchimy, T., Thordarson, T., Höskuldsson, A., Moreland, W.M., Payet–Clerc, M., & Kolzenburg, S. (2024). Real-time, in situ viscosity mapping of active lava. *Geology*, 53(2), 181–185. https://doi.org/10.1130/G52558.1

[5] ****Harris, M.A.,** Kolzenburg, S., Sonder, I., & Chevrel, M.O. (2024). A new portable penetrometer for measuring the viscosity of active lava. *Review of Scientific Instruments*. https://doi.org/10.1063/5.0206776

[6] Chevrel, M.O., Latchimy, T., Batier, L., Delpoux, R., **Harris, M.A.,** & Kolzenburg, S. (2023). A new portable field rotational viscometer for high-temperature melts. *Review of Scientific Instruments*, 94. https://doi.org/10.1063/5.0160247

[7] **Harris, M.A.,** Russell, J.K., Wilson, A., & Jicha, B. (2023). A 500 ka record of volcanism and paleoenvironment in the northern Garibaldi Volcanic Belt, British Columbia. *Canadian Journal of Earth Sciences*, 60(4), 401–421. https://doi.org/10.1139/cjes-2022-0101

[8] **Harris, M.A.,** & Russell, J.K. (2022). Polymagmatic glaciovolcanism: Cracked Mountain Tuya, Canadian Cascades. *Frontiers in Earth Science*, 10. https://doi.org/10.3389/feart.2022.859794

[9] **Harris, M.A.,** Russell, J.K., Barendregt, R., Porritt, L.A., & Wilson, A. (2022). Explosive glaciovolcanism at Cracked Mountain Volcano, Garibaldi Volcanic Belt, Canada. *Journal of Volcanology and Geothermal Research*, 423.10.1016/j.jvolgeores.2022.107477

**Editor's pick in Review of Scientific Instruments

OTHER PUBLICATIONS

[1] Wilson, A.M., Russell, J.K., & **Harris, M.A.** (2024). Glaciovolcanism in the Garibaldi volcanic belt: Nine geological maps from southwestern British Columbia, Canada. British Columbia Ministry of Mining and Critical Minerals, *British Columbia Geological Survey* Open File 2024-10, 64 p.

[2] **Harris, M.A.,** Russell, J.K., Muhammad, M., & Williams-Jones, G. (2022). Mount Meager volcanic complex, Garibaldi Volcanic Belt, British Columbia: Expanded bedrock map including Cracked Mountain, north Lillooet Ridge, and west Mount Meager. *Geological Survey of Canada*, Open File 8881, 1 Sheet. https://doi.org/10.4095/329886

[3] **Harris, M.A.,** & Russell, J.K. (2021). Bedrock mapping results for the Mount Meager geothermal research initiative. *Geoscience BC*, 7–34.

[4] **Harris, M.A.,** Muhammad, M., Williams-Jones, G., & Russell, J.K. (2020). Bedrock mapping for Mount Meager Geothermal Research Initiative, Garibaldi Geothermal Energy Project, Mount Meager 2019 - Field Report. *Geoscience BC*, 2, 1–29.

CONFERENCE ABSTRACTS, POSTERS, PRESENTATIONS

[1] ***Harris, M.A.,** Kolzenburg, S., Chevrel, M.O. (2025). TM7: New Advancements in Techniques for Investigating Lava Rheology. Session: Techniques and Methods: Rheometry, Tribometry, Spectroscopy and Microscopy, *Society of Rheology*. ***(***Invited Keynote Speaker***)**

[2] Kolzenburg, S., **Harris, M.A.,** Chevrel, M.O. (2025). A new generation of field rheometers and their potential for improving near real-time lava flow monitoring and hazard assessment. *Volcanology in Practice, University of Niigata, Japan*.

[3] Chevrel, M.O., **Harris, M.A.,** Kolzenburg, S., Cartographie in situ de la viscosité d'une coulée de lave. *Rencontre Scientifique Volcanologique* 2025; 25-27 June 2025, Le Bourget du Lac (France)

[4] **Harris, M.A.,** Chevrel, M.O., Kolzenburg, S. (2024). In-situ parameterization of the pāhoehoe-ʻāʻā transition of the 2023 Litli Hrútur lavas, Iceland. *AGU Fall Meeting* Abstracts, V51C-309. Poster

[5] Saucier, E., Kolzenburg, S., **Harris, M.A**. (2024). Permeability anisotropy of dome lavas constrained by in-situ field measurements. *AGU Fall Meeting* Abstracts, V13E-3309. Poster

[6] Kolzenburg, S., **Harris, M.A.,** Chevrel, M.O. (2024). The effect of oxygen fugacity on the rheology and texture of basaltic melts at thermal equilibrium. *AGU Fall Meeting* Abstracts, V51C-3096. Poster

[7] Chevrel, M.O., Latchimy, T., Batier, L., Delpoux, R., Kolzenburg, S., **Harris, M.A,** Parsons, T., Sonder, I., Berlie-Caillat, C., In-situ viscosity measurements of active lava., *Groupe Français de Rhéologie* Meeting 2024, France. Invited Talk

[8] **Harris, M.A.,** Kolzenburg, S., Chevrel, M.O., Parsons, J.T., Sonder, I. (2023). A new portable penetrometer for measuring the viscosity of active lava. *Geological Society of America* Abstracts with Programs, Vol. 55. Talk

[9] Chevrel O., T. Latchimy, S. Kolzenburg S, **M.A., Harris,** I. Sonder, T. Parsons, C. Berlie-Caillat, L. Batier, R. Delpoux. Measuring the viscosity of lava using a portable rotational field rheometer, *IAVCEI* 2023, Rotorua, New Zealand. Talk

[10] **Harris, M.A,** Russell, K., Wilson, A., Jicha, B. (2022). A 500 ka record of glaciovolcanism in the Mount Meager volcanic complex, northern Garibaldi Volcanic Belt, Canada. *AGU Fall Meeting* Abstracts, A15H-1328. Poster

[11] **Harris, M.A.,** Russell, J.K. (2021). The magmatic origins for Cracked Mountain, SW British Columbia: Evidence for cryptic tapping of two magma chambers during a monogenetic eruption. *AGU Fall Meeting*, V31A-05. Talk

[12] **Harris, M.A.,** Russell, J.K., Barendregt, R., Porritt, L.A., Wilson, A.M. (2021). Explosive glaciovolcanism at Cracked Mountain Volcano, Canada. *Geological Association of Canada*, Special Session 19: Volcanism. Talk

[13] D'Allura, J., and **Harris, M.A.,** Volcanic rocks of the High and Western Cascade Volcanic Series, Southeastern portion of the Cascade-Siskiyou National Monument, Southwest Oregon: Proceedings of the *American Association for the Advancement of Science*, Pacific Division meeting, Big Island, Hawai'i, Programs with abstr. vol. 36, Part I, p.93. June 2017. Talk

[14] **Harris, M.A**., Late-Miocene to Early-Pleistocene Volcanism in the 7.5' Parker Mountain Quadrangle of Southern Oregon, *Oregon Academy of Science* Proceedings, Volume LXXVI, February 2017. Talk

INVITED TALKS (NON-CONFERENCE)

2025 United States Geological Survey (Hawaiian, Cascades, Alaska, Yellowstone, and California Volcano Observatories) — Delivered a lightning talk on techniques for measuring active lava viscosity during the annual Kleinman Seminar (**virtual**).

2024 University of Hawai‘i at Hilo, Hawai‘i — Presented techniques for measuring active lava viscosity during an undergraduate volcanology course lecture and laboratory session, followed by a hands-on demonstration of axial viscometer assembly and use **(in-person).**

2024 United States Geological Survey, Hawaiian Volcano Observatory, Hawai‘i — Presented techniques for measuring active lava viscosity during the weekly volcano update meeting with observatory research staff, followed by a hands-on demonstration of axial viscometer assembly and use **(in-person).**

2024 Earth Education Seminar, University at Buffalo, NY — Presented techniques for measuring active lava viscosity to local secondary school science teachers interested in ongoing Earth Science research (**in-person).**

2024 Observatoire Volcanologique du Piton de la Fournaise, La Réunion — Presented a new axial viscometer for measuring active lava viscosity during the weekly volcano update meeting with observatory research staff, followed by a hands-on demonstration of viscometer assembly and use (**in-person).**

PROFESSIONAL MEMBERSHIP

2023 International Association of Volcanology and Chemistry of the Earth's Interior

2022 Geological Society of America

2021 American Geophysical Union

2021 Geological and Mineralogical Association of Canada; GAC/MAC

2019 Vancouver Volcanic Studies Group (2019)

2016 University of Oregon Geology Club (President)

SERVICE.

- Reviewer for *Nature Communications, Journal of Petrology, Chemical Geology,* and *Journal of Volcanology and Geothermal Research*.
- Developed and disseminated accessible rheometric instruments to four international volcano research centers, expanding global capacity for Earth-material measurement.
- Provided hands-on and virtual training to diverse research teams, emphasizing safe, inclusive, and accessible field and laboratory practices.
- Committed to inclusive mentorship and instruction, supporting students from diverse backgrounds in field, laboratory, and computational environments.

RESEARCH EXPERIENCE

2022 – **Experimental Volcanology & Petrology Laboratory (LAVAPUB)**, University at Buffalo

- Conducted experimental studies on silicate melt rheology, crystallization kinetics, and melt–mineral interactions.
- Designed and calibrated microcontroller-based rheometers for high-temperature Earth-material measurements.
- Synthesized volcanic glass, prepared thin sections, and performed petrographic and microanalytical characterization.
- Applied numerical models of lava flow emplacement, including PyFlowGo simulations of effusion rates, heat loss, crystallization trajectories, and flow advance over paleo-topography.

- Integrated Lava2D simulations to estimate inundation timescales and flow dynamics for hazard assessment.

2019 – 2022 **Volcanology & Petrology Laboratory**, University of British Columbia

- Conducted petrographic, mineralogical, and geochemical analyses of volcanic and subvolcanic rocks.
- Led field campaigns producing regional bedrock maps and lithologic interpretations.
- Integrated geochronology, paleomagnetism, and geochemistry to reconstruct magmatic evolution.

2019 **Radiogenic Isotope Geochemistry Lab**, Dartmouth College

- Prepared samples and standards for TIMS analysis; gained experience with isotope geochemistry workflows relevant to solid Earth processes.

2016 – 2017 **Geological Mapping Field Assistant and Researcher**, Ashland, OR

- Assisted in field mapping of volcanic rocks in the Southern Cascades
- Collected hand samples, cut and polished rocks for thin sections
- Generated geological maps and compiled textural and geochemical data for scientific research reports

TEACHING EXPERIENCE

2024 University at Buffalo, Department of Earth Sciences, **Guest Lecturer**

- Delivered lectures on the rheology, mineralogy, and petrology of Earth materials for *Earth Materials (GLY 205)*, emphasizing phase equilibria, crystallization behavior, and mineral–melt interactions.

2022 – 2023 University at Buffalo, Department of Earth Sciences, **Part-Time Teaching Assistant (20-hr/week)**

- *Earth Materials (GLY 205)*: Led mineral identification labs, thin-section petrography sessions, and mineral chemistry exercises; prepared teaching materials and graded assignments.
- *Geology for Engineers (GLY 103)*: Designed problem sets and quizzes, managed course platforms, and supported student learning.

2019 – 2021 University of British Columbia, Department of Earth, Ocean, and Atmospheric Sciences, **Teaching Assistant (20-hr/week)**

- *Structural Geology (EOSC 323)*: Taught structural analysis, deformation mechanisms, and mineral-scale fabric interpretation.
- *Introduction to Field Methods (EOSC 223)*: Supervised field mapping labs, emphasizing lithologic identification, mineralogical observations, and stratigraphic documentation.

2017 – 2018 Petpittayakom School (Secondary), Phetchabun, Thailand, **Full-time Instructor (40-hr/week)**

- Taught English conversation and Earth, Environmental, Biological, and Health sciences to grades 6–12
- Created lesson plans, weekly assignments, quizzes, exams, and graded all coursework

MENTORSHIP

2024-2025 Technological Support for Graduate Researchers, Department of Earth Sciences, University at Buffalo. I provided feedback and guidance on custom-built electronics, including single-board microcontrollers, Linux-based communication and coding, and sensor troubleshooting.

2024 Teaching Assistant Support for Graduate Student Instructors, Department of Earth Sciences, University at Buffalo. I provided source materials, feedback, and guidance on presenting laboratory content, facilitating assignments, and constructing grading schemes for GLY 205 and GLY 103.

FIELD CAMPAIGNS FOR RESEARCH

2023 **In-situ Permeability Measurements of Dome Lavas, Lassen National Park**
Field assistant for a two-week campaign measuring dome lavas in Lassen National Park, including Lassen Peak and the Chaos Crags. Responsibilities included transportation to sites, hiking, sampling, and using a TinyPerm™ to measure in-situ permeability of exposed lava dome surfaces.

2023 **In-situ Viscosity Measurements of Active Lava, Iceland**
Co-organizer of a two-week field campaign during the 2023 Litli-Hrútur eruption. Responsible for operating newly developed field viscometers to collect real-time viscosity data along the lava transect, measuring in-situ temperatures with K-type thermocouples, and collecting molten samples for quenching. This campaign provided the primary data and samples for my doctoral dissertation.

2021 **Cheakamus Basalt Mapping, British Columbia**
Field assistant for primitive mapping in the southwest Coast Mountains of British Columbia. Duties included gear transport, wilderness camping, and lava sampling.

2020 **Cracked Mountain Mapping, British Columbia**
Co-organizer of a five-week mapping campaign of the glaciovolcanic tuya, Cracked Mountain. The project was helicopter-supported with remote camping. Tasks included mapping, sampling, and volcanic stratigraphy for my Master's thesis on glaciovolcanic deposits in the MMCV. Also assisted with paleomagnetic drilling and sample orientation for relative age determinations.

2019 **Mount Meager Volcanic Complex Mapping, British Columbia**
Co-organizer of a seven-week bedrock and volcanic mapping campaign around Mount Meager Volcano (MMVC). The work was helicopter-supported with primitive camping. Mapping supported both the Geological Survey of Canada's geothermal initiative and my Master's research on glaciovolcanic deposits in the MMCV.

2019 **Chaos Crags, Lassen National Park**
Field assistant for a research campaign focused on sampling and taking structural measurements of exposed lava domes at Chaos Crags. Duties included transport, hiking, sampling, and assisting with field structural measurements.

2016 **Field Mapping in the Cascade-Siskiyou National Monument and Southern Oregon Cascades**
Field assistant and co-mapper for the summer, identifying bedrock units and collecting samples for textural and geochemical analyses used in my undergraduate honors thesis at the University of Oregon.

2016 **Field Mapping of the Palung Granite, Nepal**
Co-organizer of an independent mapping project as part of the School for International Training's Geoscience in the Himalaya final project. Involved three weeks of mapping, sampling, petrographic analysis, and report writing.

FIELD SKILLS

- Advanced geological mapping of volcanic, plutonic, and metamorphic terrains; lithologic identification and mineralogical documentation.
- In situ measurements of Earth-material physical properties (viscosity, permeability, temperature).
- Structural measurements, stratigraphic profiling, and sampling for petrographic and geochemical analysis.
- Extensive experience with helicopter-supported campaigns, remote field safety, and inclusive field practices.

NUMERICAL MODELING OF EARTH-SURFACE PROCESSES

- PyFlowGo modeling of lava flow advance, effusion rates, crystallization trajectories, and heat-loss dynamics using paleo-DEM reconstructions.
- Lava2D simulations of inundation timescales, flow routing, and hazard scenarios for gravity-driven currents.
- GIS-based preprocessing of DEMs, terrain smoothing, and flowline extraction for model stability and accuracy.
- Integration of experimental rheology, field measurements, and model outputs to constrain realistic viscosity–temperature paths and emplacement conditions.
- Experience with modeling frameworks applicable to lahars, landslides, and other gravity-driven surface flows, including parameterization of yield strength, density contrasts, and slope-driven acceleration.

TECHNOLOGICAL EXPERIENCE

2025 Design, construction, and calibration of a new, lightweight, microcontroller-based field rotational viscometer prototype with modifications made from lessons learned from field usage of existing field viscometers during the 2023 Litli-Hrútur eruption.

2022 – 2025 Design, construction, and deployment of two new high-accuracy, lightweight, microcontroller-based field rheometer prototypes (one penetrometer and one rotational rheometer). These were deployed to the 2023 Litli-Hrútur eruption in Iceland, resulting in nearly doubling the total number of viscosity measurements ever made of actively flowing lava.

MEDIA COVERAGE AND OUTREACH

2024

- Featured in American Geophysical Union magazine EOS article on field rheology titled “How Liquid Is That Lava? A new device helps scientists measure lava viscosity during active flows.” Published July 12th 2024 https://eos.org/articles/how-liquid-is-that-lava
- Article was chosen as Editor’s pick and highlighted on the cover page of the Review of Scientific Instruments journal for the article “A new portable penetrometer for measuring the viscosity of active lava” June 4th 2024.
- Presented techniques for measuring active lava viscosity to secondary school science teachers at the Earth Education Seminar (University at Buffalo, NY), including a hands-on viscometry demonstration and a laboratory tour of the Laboratory for Experimental Volcanology and Petrology at UB.

2023

- Featured research for UBNow on current research activity on lava flows and their monitoring / modeling titled: “UB volcano expert monitors lava flow around the world.” Published July 31, 2023 https://www.buffalo.edu/ubnow/stories/2023/07/kolzenburg-lava.html,

LABORATORY SKILLS

- High-temperature melting experiments, glass synthesis, and controlled crystallization studies.
- Thin-section preparation, mineral identification, petrographic microscopy, vesicle and crystal textural analysis.
- SEM and electron microprobe operation for mineral chemistry and phase characterization.
- TIMS sample preparation, geochemical workflows, and isotope geochemistry fundamentals.
- Microcontroller and sensor integration for Earth-material instrumentation.

SOFTWARE SKILLS

- ArcGIS: Geological mapping and spatial interpolation
- MATLAB: Figure creation, statistical and petrochemical modeling
- Python (including CircuitPython): Data analysis, visualization, microcontroller programming
- ImageJ: Textural and image analyses
- Microsoft Office: Word, Excel, PowerPoint for data management and presentations
- Adobe Creative Suite: Illustrator, Photoshop for figure production and visual communication
- HTML: Website Design, Build, and Maintenance