

David Chas Bolton

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Education:

The Pennsylvania State University, University Park, PA June 2016-August 2021

- Ph.D. Geoscience | GPA: 3.98/4.0 | Advisor-Chris Marone
- Dissertation: Characterizing the evolution of acoustic emission signals throughout the laboratory seismic cycle: Insights on seismic precursors

University of Texas at Arlington, Arlington, TX August 2010-December 2015

- Bachelor of Science in Geology | GPA: 3.67/4.0
- Minor in Chemistry

WORK EXPERIENCE:

NSF Postdoctoral Fellow, University of Texas Institute for Geophysics, Austin, TX
September 2021-

Geophysics Intern, Diamondback Energy, Midland, TX
May-August 2021

Research Assistant, Penn State Rock and Sediment Mechanics Lab, University Park, PA
June 2016-May 2021

Graduate Intern, Non-linear Geophysics (EES-17) Los Alamos National Laboratory, Los Alamos, NM
Summer 2017; Summer 2018

Undergraduate Research Assistant, Geomechanics Lab University of Texas at Arlington, Arlington, TX
August 2015-December 2015

PUBLICATIONS

Published

1. Shreedharan, S., **Bolton, D. C.**, Rivière, J., & Marone, C. (2021). Machine learning predicts the timing and shear stress evolution of lab earthquakes using active seismic monitoring of fault zone processes. *Journal of Geophysical Research: Solid Earth*, 126, e2020JB021588. <https://doi.org/10.1029/2020JB021588>
2. Shreedharan, S., **Bolton, D. C.**, Rivière, J., & Marone, C. (2021). Competition between preslip and deviatoric stress modulates precursors for laboratory earthquakes. *Earth and Planetary Science Letters*, 553, 116623.
3. Trugman, D. T., McBrearty, I. W., **Bolton, D. C.**, Guyer, R. A., Marone, C., & Johnson, P. A. (2020). The Spatio-temporal Evolution of Granular Microslip Precursors to Laboratory Earthquakes. *Geophysical Research Letters*, e2020GL088404.
4. **Bolton, D. C.**, Shreedharan, S., Rivière, J., & Marone, C. (2020). Acoustic Energy Release During the Laboratory Seismic Cycle: Insights on Laboratory Earthquake Precursors and

- Prediction. *Journal of Geophysical Research: Solid Earth*, 125, e2019JB018975. <https://doi.org/10.1029/2019JB018975>
5. Shreedharan, S., **Bolton, D. C.**, Rivière, J., & Marone, C. (2020). Preseismic fault creep and elastic wave amplitude precursors scale with lab earthquake magnitude for the continuum of tectonic failure modes. *Geophysical Research Letters*, 46. <https://doi.org/10.1029/2020GL086986>
 6. **Bolton, D. C.**, Shokouhi, P., Rouet-Leduc, B., Hulbert, C., Rivière, J., Marone, C., & Johnson, P. A. (2019). Characterizing acoustic signals and searching for precursors during the laboratory seismic cycle using unsupervised machine learning. *Seismological Research Letters*, 90(3), 1088-1098.
 7. Hulbert, C., Rouet-Leduc, B., Johnson, P. A., Ren, C. X., Rivière, J., **Bolton, D. C.**, & Marone, C. (2019). Similarity of fast and slow earthquakes illuminated by machine learning. *Nature Geoscience*, 12(1), 69-74.
 8. Lubbers, N., **Bolton, D. C.**, Mohd-Yusof, J., Marone, C., Barros, K., & Johnson, P. A. (2018). Earthquake catalog-based machine learning identification of laboratory fault states and the effects of magnitude of completeness. *Geophysical Research Letters*, 45(24), 13-269.
 9. Wu, Y., Lin, Y., Zhou, Z., **Bolton, D. C.**, Liu, J., & Johnson, P. (2018). DeepDetect: A cascaded region-based densely connected network for seismic event detection. *IEEE Transactions on Geoscience and Remote Sensing*, 57(1), 62-75.
 10. Rouet-Leduc, B., Hulbert, C., **Bolton, D. C.**, Ren, C. X., Riviere, J., Marone, C., ... & Johnson, P. A. (2018). Estimating fault friction from seismic signals in the laboratory. *Geophysical Research Letters*, 45(3), 1321-1329.

In Review

1. **Bolton, D. C.**, Shreedharan, S., Rivière, J., & Marone, C. (2021). "Frequency-magnitude statistics vary with shear velocity, fault slip rate, and shear stress". In review with *Journal of Geophysical Research: Solid Earth*.
2. Jaspersen, H., **Bolton, D.C.**, Johnson, P., Guyer, R., Marone, C., V. de Hoop, M. (2021) "Attention network forecasts time-to-failure in laboratory shear experiments". In review with *Journal of Geophysical Research: Solid Earth*.

AWARDS & SCHOLARSHIPS:

Paul D. Krynine Scholarship	2017-2020
Shell Geoscience Energy Research Facilitation Award	2017-2019
Charles E. Knopf, Sr., Memorial Scholarship	2017

Invited Talks:

1. Machine Learning in Solid Earth Geoscience, Santa Fe, NM February 2018 & March 2019
2. American Geophysical Union, Fall Meeting 2017, New Orleans, LA December 2017

SKILLS:

Programming	Oil & Gas Software	Experimental / Geomechanics
Python	ProMax	Biaxial Deformation Apparatus
MATLAB		Split Hopkinson Pressure Bar
		3D Scanning Vibrometer

OUTREACH:

Shake, Rattle and Rocks

2017-2019

- Taught basic principles of seismology and earthquake physics to a group of elementary school students

Earth and Mineral Science Exposition

2017-2019

- Informed undergraduate students of the opportunities that are available in the Geosciences Program at The Pennsylvania State University, and more specifically, the type of research conducted in the Geomechanics Lab

Teaching:

Teaching Assistant: GEOSC 040 The Sea Around Us (oceanography)

Spring 2019

Teaching Assistant: GEOSC 001 Introduction to Physical Geology

Spring 2018

Service:

Reviewer for Geophysical Research Letters, Seismological Research Letters, US Department of Energy, Artificial Intelligence in Geosciences

Presentations & Abstracts:

- **Bolton, D.C.**, Shreedharan, S, Rivière, J, Marone, C. The influence of fault slip rate on temporal variations in frequency-magnitude statistics of acoustic emissions throughout the laboratory seismic cycle. *AGU Fall Meeting 2020, San Francisco*. (Talk)
- Jasperson, H., **Bolton, D.C.**, Johnson, P.A., Marone, C., & de Hoop, M. Fault time-to-failure forecasting using LSTM and Unsupervised Classification. *AGU Fall Meeting 2020, San Francisco*. (Talk)
- Shreedharan, S, **Bolton, D.C.**, Rivière, J, Marone, C. On the Pre-, Co-, and Post-seismic Evolution of Elastic Wave Properties for Slow and Fast Laboratory Earthquakes. *AGU Fall Meeting 2020*. (Invited Talk)
- Shreedharan, S, **Bolton, D.C.**, Rivière, J, Marone, C. Pre-seismic Fault Creep and the Evolution of Elastic Wave Properties for Slow and Fast Laboratory Earthquakes. *GSA Annual Meeting 2020*. (Invited Talk)
- Shreedharan, S, **Bolton, D.C.**, Rivière, J, Marone, C. (2019). The Physics of Elastic Precursors to Laboratory Earthquakes. *AGU Fall Meeting 2019, San Francisco*. (Talk)
- Jasperson, H., **Bolton, D.C.**, Johnson, P.A., Marone, C., & de Hoop, M. Unsupervised classification of acoustic emissions from catalogs and fault time-to-failure prediction. *AGU Fall Meeting 2019, San Francisco*. (Poster)
- **Bolton, D.C.**, Shreedharan, S, Shokouhi, P, Rivière, J, Marone, C. (2019). Frequency content of lab earthquakes for the spectrum of failure modes, from slow slip to elastodynamic rupture. *AGU Fall Meeting 2019, San Francisco*. (Poster)
- McBrearty, I., **Bolton, D.C.**, Guyer, R., Marone, C., & Johnson, P. A. (2019). Locations and Evolution of Micro-Seismicity in Laboratory Earthquake Experiments. *Machine Learning in Solid Earth Geoscience, Santa Fe, NM*. (Talk)
- **Bolton, D. C.**, Shokouhi, P., Rouet-Leduc, B., Hulbert, C., Rivière, J., Marone, C., & Johnson, P. A. (2019). Using unsupervised machine learning to probe laboratory precursors. *Machine Learning in Solid Earth Geoscience, Santa Fe, NM*. (Talk)

- Jasperson, H., **Bolton, D.C.**, Johnson, P.A., Marone, C., & de Hoop, M. Towards laboratory earthquake prediction using unsupervised classification of acoustic emissions. *AGU Fall Meeting 2018, Washington, D.C.* (Poster)
- **Bolton, D. C.**, Rouet-Leduc, B., Hulbert, C., Marone, C., & Johnson, P. A. (2018). Probing slow and fast slip events in the laboratory using machine learning. *AGU Fall Meeting 2018, Washington, D.C.* (Poster)
- **Bolton, D. C.**, Hulbert, C., Rouet-Leduc, B., Marone, C., Guyer, R., & Johnson, P. A. (2018). Probing slow and fast slip events in the laboratory using machine learning. *Gordon Research Conference on Rock Deformation 2018.* (Poster)
- Hulbert, C., Rouet-Leduc, B., Johnson, P. A., Ren, C. X., Rivière, J., **Bolton, D. C.**, & Marone, C. (2018). Estimating the Physical State of a Slow Slipping Fault from Seismic Signals. *Machine Learning in Solid Earth Geoscience, Santa Fe, NM.* (Talk)
- Rouet-Leduc, B., Hulbert, C., **Bolton, D. C.**, Ren, C. X., Rivière, J., Marone, C., ... & Johnson, P. A. (2018). Estimating the state of faults from continuous seismic data. *Machine Learning in Solid Earth Geoscience, Santa Fe, NM.* (Talk)
- Lubbers, N., **Bolton, D. C.**, Mohd-Yusof, J., Marone, C., Barros, K., & Johnson, P. A. (2018). Machine Learning for laboratory earthquakes using catalogues of varying fidelity. *Machine Learning in Solid Earth Geoscience, Santa Fe, NM.* (Talk)
- **Bolton, D. C.**, Shokouhi, P., Rouet-Leduc, B., Hulbert, C., Rivière, J., Marone, C., & Johnson, P. A. (2018). Characterizing precursory phenomena in laboratory stick-slip failure events using unsupervised machine learning. *Machine Learning in Solid Earth Geoscience, Santa Fe, NM.* (Talk)
- **Bolton, D.C.**, Rivière, J., Marone, C., & Johnson, P. A. (2017). The evolution of the Gutenberg-Richter, b-value, throughout periodic and aperiodic stick-slip cycles. *AGU Fall Meeting 2017, New Orleans.* (Talk)
- Hulbert, C., Rouet-Leduc, B., **Bolton, D. C.**, Ren, C. X., Marone, C., Johnson, P. A. (2017). Characterizing Slow Slip Applying Machine Learning. *AGU Fall Meeting 2017, New Orleans.* (Poster)
- Rouet-Leduc, B., Hulbert, C., Ren, C. X., **Bolton, D. C.**, Marone, C., & Johnson, P. A. (2017, December). Friction Laws Derived From the Acoustic Emissions of a Laboratory Fault by Machine Learning. *AGU Fall Meeting 2017, New Orleans.* (Talk)
- Shreedharan, S., Rivière, J., **Bolton, C.**, Zheng, L., Johnson, P., Marone, C. (2017). Characterization of Acoustic Emissions From Laboratory Stick-Slip Events in Simulated Fault Gouge. ARMA Symposium-51th US Rock Mechanics Symposium, Houston. (Talk)
- **Bolton, D.C.**, Zheng, L., Rivière, J., & Marone, C. (2017). An Experimental Investigation of Gutenberg-Richter Statistics from Acoustic Emissions in Simulated Fault Gouge. *Seismology Student Workshop, Lamont-Doherty Earth Observatory.* (Poster)