

Jeffrey Joseph McGuire  
Associate Scientist, Department of Geology and Geophysics  
Woods Hole Oceanographic Institution

### **Contact Information**

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### **Education**

Ph.D. 2000 MIT (Seismology).  
B.A. 1994 Washington University, cum laude (Geophysics and Physics)

### **Professional History**

2014-present member Board of Directors, Incorporated Research Institutions for Seismology  
2009-present Associate Scientist with Tenure, Woods Hole Oceanographic Institution  
2005-2009 Associate Scientist, Woods Hole Oceanographic Institution  
2008 Visiting Associate Professor, The Institute of Statistical Mathematics, Tokyo Japan.  
2006 Visiting Associate Professor, The Earthquake Research Institute, Univ. of Tokyo  
2002-2005 Assistant Scientist, Woods Hole Oceanographic Institution.  
2004 Visiting Assistant Professor in Geophysics, California Institute of Technology  
2000-2001: NSF Earth Sciences Post-Doctoral Fellow, Stanford University;  
1995-2000: Graduate Research Assistant, Massachusetts Institute of Technology;  
1991-1995: Research Assistant, Washington University

### **Honors and Awards**

2001 National Science Foundation Earth Sciences Post-Doctoral Fellowship

### **Professional Affiliations**

Member American Geophysical Union, Seismological Society of America

### **Research Interests and Expertise**

My research utilizes recordings of the ground motion produced by earthquakes to constrain the basic physical properties occurring within fault-zones during earthquake rupture. I utilize both the dynamic wavefield (seismology) radiated by ruptures and the permanent deformation left behind after the shaking subsides (geodesy). The majority of my contributions have focused on the seismicity and deformation of two types of plate boundaries, oceanic transform faults and subduction zones. I developed new analytical techniques in both seismology and geodesy including the ability to resolve the “fault-plane ambiguity” that traditionally prevented seismologists from identifying the orientation of earthquake rupture surfaces from the radiated wave field. I have also developed algorithms for detecting strain transients in continuous geodetic data. My research program at WHOI is actively pursuing the connection between rock mechanics processes, fault-zone geology/structure, and individual earthquake ruptures in both

transform fault and subduction zone settings. Our group demonstrated that East Pacific Rise transform fault earthquakes have the highest degrees of both short and long-term predictability owing to their relatively simple geometrical and geological structure and the preponderance of aseismic fault slip on these faults. We have developed and deployed the first U.S. instrumentation for recording large earthquakes on the seafloor, including geodetic systems. We are also heavily involved in studying the seismicity of the Salton Sea Geothermal field, where the East Pacific Rise comes onshore and interacts with a large geothermal power generation operation to produce abundant seismicity and aseismic fault slip. Another major area of focus is the Cascadia subduction zone where we are involved in numerical modeling studies of megathrust rupture, ocean bottom seismometer deployments to understand the structure of the seismogenic zone, and seafloor geodesy deployments to understand the build up of strain in the offshore locked zone. The seafloor geodetic observatory will be telemetered in real-time and possibly incorporated into earthquake early warning systems. Most recently we have used high-rate GPS data and novel inversion algorithms to study the aseismic slip before the 2011 M9 Tohoku earthquake as well as supraglacial lake drainage events within the Greenland Ice Sheet.

### **Field Experience**

1. R/V Kilo Moana, October 2005 cruise to deploy acoustic extensometers on the Hilina Slump feature associated with the collapse of the Kilauea volcano.
2. R/V Kilo Moana, June 2006 cruise to recover acoustic extensometers from the Hilina Slump.
3. R/V Thomas Thompson, Dec 2007-Jan 2008, Chief Scientist, cruise to deploy 40 Ocean bottom seismometers and seafloor geodesy equipment at the Quebrada, Discovery, and Gofar transform faults of the East Pacific Rise.
4. R/V Marcus Langseth, April-May 2008, Chief Scientist, active source seismic refraction experiment to study the Quebrada and Gofar transform faults of the East Pacific Rise.
5. R/V Atlantis, January-February 2009, Chief Scientist, recovery of ocean bottom seismometers and geodesy equipment from the Quebrada, Discovery, and Gofar Transform Faults.
6. Obsidian Creep active source seismic experiment in the Salton Trough CA, March 2010. Co-PI, joint with USGS-Menlo Park, and Cornell Univ., Multiple reflection/refraction lines collected in the Salton Trough to better understand the material properties that lead to creep events.
7. R/V Wecoma, July 2010, Chief Scientist, deployment of ocean bottom seismometers offshore of Vancouver Island to study the Cascadia Subduction zone.
8. R/V Wecoma, June 2011, Chief Scientist, recovery of ocean bottom seismometers offshore of Vancouver Island to study the Cascadia Subduction zone.
9. R/V Connecticut, July 2012, WHOI-USGS deployment of ocean bottom seismometers to study submarine landslides on the continental shelf of the east coast U.S.
10. R/V Oceanus, September 2012, Co-Chief Scientist, deployment of ocean bottom seismometers off of northern California as part of the NSF Cascadia Initiative.

11. R/V Oceanus, September 2013, Chief Scientist, deployment of ocean bottom seismometers off of northern California as part of the NSF Cascadia Initiative.

**Invited talks**

**2014**

McGill University, GEOPRISMS Distinguished Lecturer  
Appalachian State University, GEOPRISMS Distinguished Lecturer

**2013**

USGS-Menlo Park  
IRIS OBS workshop  
Univ. of Wisconsin, GEOPRISMS Distinguished Lecturer  
Carleton College, GEOPRISMS Distinguished Lecturer

**2012**

Columbia University  
Stanford University  
Lawrence Livermore National Lab

**2011**

NSF GeoPRISMS workshop  
European Science Foundation, LFUI Conference on Continuing Challenges in Earthquake Dynamics, Austria  
Harvard University

**2010**

Hokudan Symposium, Kobe Japan,

**2008**

Kyoto Univ., Disaster Prevention Research Institute,  
Univ. of Tokyo, Earthquake Research Institute,  
Brown Univ., Department of Geological Sciences,  
The Carnegie Institution of Washington, Department of Terrestrial Magnetism,  
Pennsylvania State Univ., Department of Geosciences  
Canadian Geological Survey, Pacific Geosciences Centre,  
United States Japan Natural Resources Panel

**2007**

Seismological Society of America, Annual Meeting,

**2006**

Univ. of Southern California, Department of Earth Sciences  
Univ. of Tokyo, Department of Earth and Planetary Sciences  
Univ. of Tokyo, Earthquake Research Institute  
JAMSTEC, Institute for Frontier Research on Earth Evolution

**2005**

Harvard University, Division of Applied Mechanics  
Princeton University, Department of Geosciences

**2004**

Univ. of Southern California, Dept. of Earth Sciences  
UCLA, Dept of Earth and Space Sciences  
Johns Hopkins Univ  
Lamont Doherty Earth Observatory

American Geophysical Union, Fall Meeting

**2003**

University of California, Berkley, Geology Department  
California Institute of Technology, Seismological Laboratory

**2002**

Lamont Doherty Earth Observatory  
Massachusetts Institute of Technology, Dept. of Earth, Atmospheric, and Planetary Sci.  
Univ. of Rhode Island

**2001**

Univ. of California, Berkeley, Seismological Laboratory  
Univ. of North Carolina  
North Carolina State Univ  
Woods Hole Oceanographic Institution, Dept. of Geology and Geophysics

**2000**

Univ. of Hawaii, Hawaii Institute of Geophysics  
Univ. of Southern California, Dept. of Earth Sciences  
Woods Hole Oceanographic Institution, Dept. of Geology and Geophysics  
Georgia Institute of Technology

**1999**

California Institute of Technology, Seismological Laboratory

### **Education Program**

#### **Students/Post-docs**

Post-doctoral Advisor for Rowena Lohman (now Associate Professor at Cornell Univ.),  
Matt Wei (current), Yoshi Kaneko (now on staff at GNS New Zealand), and  
Hongfeng Yang (now at Georgia Tech), Xiaowei Chen (current)

Doctoral Advisor for: Margaret Boettcher, PhD 2005 (joint w/ J. G. Hirth and T. H. Jordan; now Assistant Professor at UNH); Andrea Llenos PhD 2010 (now USGS Mendenhall Post-doc), and Emily Roland PhD 2012 (now USGS Mendenhall Post-doc).

#### **Teaching Experience:**

Fall 2002, 2005: MIT-WHOI joint program upper-level graduate course (12.755)  
“Mechanics of Earthquakes and Faulting”. This course covers the processes involved  
in brittle deformation and the constraints placed on them by rock mechanics,  
seismology, and geodesy.

Spring 2003: Co-organizer of the WHOI geodynamics seminar on “Catastrophes and  
Instabilities in solid earth systems”. This course, which has a long history as a core  
component of the MIT-WHOI joint graduate program, involves students discussing  
papers and talks from a number of outside speakers organized around a particular  
theme followed by a ~2 week field trip to examine in detail a relevant site. We  
focused on earth system instabilities, such as earthquakes, land-slides, and mass  
extinctions, and the historical physics theories that are attempting to explain the  
common features among the different systems. The field trip was to various  
earthquake and volcano related sites in the Pacific Northwest.

Fall 2003: 2007; 2009; 2011; MIT-WHOI joint program upper-level graduate reading seminar “Oceanic Faulting and Earthquakes”. This reading seminar focused on evaluating the current state of knowledge of how faults form, rupture, and evolve over time in the oceanic lithosphere from its creation at spreading ridges to the deepest earthquakes in subduction zones. Papers from rock mechanics, localization theory, marine geology, and earthquake seismology were discussed.

Spring 2004: Caltech-Ge169: “Slow Earthquakes”. This reading seminar covers the wide variety of aseismic slip events that have been observed by geodetic instrumentation in the last ten years, the analysis techniques used to interpret this data, and the rheological models proposed to explain these phenomena.

Spring 2006. MIT-WHOI joint program upper-level graduate class “Advanced Seismology” focused on inversion of seismic and geodetic data for understanding earthquake source processes.

### **Service And Committees (general)**

Associate Editor, Journal of Geophysical Research., 2005-2011  
Incorporated Research Institutions for Seismology (IRIS) Standing Committee for the Global Seismic Network 2008-2010,  
USGS National Earthquake Hazards Reduction Program (NEHRP) proposal panel 2008,2009, 2012, 2014  
Science Plan writing committee for NSF-MARGINS SEIZE initiative, 2008  
NSF Amphibious Array Steering Committee, 2010-2012  
NSF Cascadia Initiative Workshop Organizing Committee, chair, 2010.  
Cascadia Initiative Expedition Team 2010-present  
IODP Detailed Planning Group for the JFAST Expedition, 2011  
USGS- National Earthquake Prediction Evaluation Council subcommittee on Potential Earthquake Forewarning Scenarios in the Pacific Northwest, 2012  
IRIS President/CEO Search Committee 2013-2014  
IRIS Board of Directors 2014-  
IRIS Coordinating Committee 2014-  
IRIS Grand Challenge Science Committee 2014-  
GEOPRISMS Distinguished Lecturer 2013-2014

### **Service and Committees (WHOI)**

Marine Hydrogeology Search Committee (2008)  
Submarine GeoHazards Search Committee (2008)  
Benefits Task Force (2006)  
DOEI Proposal Review Committee (2004)  
Green Proposal Review Committee (2007)  
G+G Postdoc Advisory Committee (2009-2013)  
G+G department chair search committee (2012)  
OBSIP management committee (2012-present)

### **Peer Reviewed Publications**

1) Wiens, D. A., J. J. McGuire, and P. J. Shore, Evidence for Transformational Faulting from Deep Double Seismic Zone in Tonga, *Nature*, **364**, 790-793., 1993.

- 2) Wiens, D. A., J. J. McGuire, P. J. Shore, M. G. Bevis, K. Draunidalo, G. Prasad, and S. P. Helu, A Deep Earthquake Aftershock Sequence and Implications for the Rupture Mechanism of Deep Earthquakes, *Nature*, **372**, 540-543, 1994.
- 3) Wiens, D. A., and J. J. McGuire, The 1994 Bolivia and Tonga events: Fundamentally different types of deep earthquakes?, *Geophys. Res. Lett.*, **22**, 2245-2248, 1995.
- 4) McGuire, J. J. and D. Wiens, A Double Seismic Zone in New Britain and the Morphology of the Downgoing Plate, *Geophys. Res. Lett.*, **22**, 1965-1968, 1995.
- 5) McGuire, J. J., P. F. Ihmlé, and T. H. Jordan, Time-Domain Observations of a Slow Precursor to the 1994 Romanche Transform Earthquake, *Science*, **274**, 82-85, 1996.
- 6) McGuire, J. J., D. A. Wiens, P. J. Shore, and M. G. Bevis, The March 9th, 1994 Deep Tonga Earthquake: Rupture Outside the Seismically Active Slab. *J. Geophys. Res.*, **102**, 1997.
- 7) Wiens, D. A. and J. J. McGuire, Aftershocks of the March 9, 1994 Tonga earthquake: The strongest known deep aftershock sequence, *J. Geophys. Res.*, **105**, 19067-19083, 2000.
- 8) McGuire, J. J. and T. H. Jordan, Further Evidence for the Compound Nature of Slow Earthquakes: The Prince Edward Island Earthquake of April 28, 1997, *J. Geophys. Res.* **105**, 7819-7828, 2000.
- 9) McGuire, J. J., L. Zhao, and T. H. Jordan, Rupture Dimensions of the 1998 Antarctic Earthquake from Low-Frequency Waves, *Geophys. Res. Lett.*, **27**, 2305-2308, 2000.
- 10) McGuire, J. J., L. Zhao, and T. H. Jordan, Teleseismic inversion for the 2nd-degree moments of earthquake space-time distributions, *Geophys. J. Intl.*, **145**, 661-678, 2001.
- 11) McGuire, J. J., T. H. Jordan, and J. Lin, Complexities of Transform Boundaries in the Oceans, in “*Plate Boundary Zones*”, ed Stein and Freymueller, AGU, Washington D.C. 2002.
- 12) McGuire, J. J., L. Zhao, and T. H. Jordan, Predominance of Unilateral Rupture for a Global Catalog of Large Earthquakes, *Bull. Seism. Soc. Am.*, **92**, 3309-3317, 2002.
- 13) Perez-Campos, X., J. J. McGuire, and G. C. Beroza, Resolution of the Slow Earthquake/Apparent Stress Paradox for Oceanic Transform Fault Earthquakes, *J. Geophys. Res.*, **108**, doi:10.1029/2002JB002312, 2003.
- 14) Miyazaki, S. J. J. McGuire, and P. Segall, A Transient Subduction Zone Slip Episode in Southwest Japan Observed by the Nationwide GPS Array, *J. Geophys. Res.*, **108**, 10.1029/2001JB000456, 2003.
- 15) McGuire, J. J. Immediate Foreshock Sequences of Oceanic Transform Earthquakes on the East Pacific Rise, *Bull. Seism. Soc. Am.*, **93**(2) 948-952, 2003.
- 16) McGuire, J. J., and P. Segall, Imaging of Aseismic Slip Transients recorded by continuous GPS arrays, *Geophys. J. Intl.*, **155**, doi.10.1111/j.1365-246X.2003.02022.x., 2003.
- 17) McGuire, J. J., Estimating the finite source properties of small earthquake ruptures, *Bull. Seismol. Soc. Am.*, **94**, 377-393, 2004.

- 18) Ide, S., G. C. Beroza, and J. J. McGuire, Imaging Earthquake Source Complexity, in “Seismic Earth: Array Analysis of Broadband Seismograms”, *Geophysical Monograph Series*, **157**, 280p, 2005.
- 19) McGuire, J. J., M. Boettcher, and T. H. Jordan, Foreshock Sequences and Earthquake Predictability on East Pacific Rise Transform Faults, *Nature*, **434**, 457-461, 2005.
- 20) McGuire, J. J. and Y. Ben-Zion, High-resolution imaging of the Bear Valley section of the San Andreas Fault at seismogenic depths with fault zone head waves and relocated seismicity, *Geophys. J. Intl.*, **163**, 152-164, 2005.
- 21) Miyazaki, S., P. Segall, J. McGuire, T. Kato, and Y. Hatanaka, Spatial and Temporal evolution of Stress and Slip-rate during the 2000 Tokai Slow earthquake, *J. Geophys. Res.*, **111**, doi:10.1029/2004JB003426, 2006.
- 22) Lewis, M., Y. Ben-Zion, and J. J. McGuire, Imaging the deep structure of the San Andreas Fault south of Hollister with joint analysis of fault-zone head and direct P wave arrivals, *Geophys. J. Intl.*, **169**, 1028-1042, doi:10.1111/j.1365-246X.2006.03319.x, 2007.
- 23) \*Lohman, R. and J. J. McGuire, Earthquake swarms driven by aseismic creep in the Salton Trough, *J. Geophys. Res.* **112**, B04405, doi:10.1029/2006JB004596, 2007.
- 24) \*Llenos, A. L. and J. J. McGuire, Influence of forearc structure on the extent of great subduction zone earthquakes, *J. Geophys. Res.* **112**, B09301, doi:10.1029/2007JB004944, 2007.
- 25) McGuire, J. J., Seismic Cycles and Earthquake Predictability on East Pacific Rise Transform Faults, *Bull. Seism. Soc. Am.* **98**, 1067-1084, 2008.
- 26) Brooks, B. A., J. H. Foster, J. J. McGuire, and M. Behn, Submarine Landslides and Slow Earthquakes: Monitoring Motion with GPS and Seafloor Geodesy, submitted to Springer Complexity Encyclopedia on Complexity in Earthquakes, Tsunamis, and Volcanoes, and Forecasting and Early Warning of their Hazards (<http://refworks.springer.com/complexity>), 2008.
- 27) McGuire, J. J., F. J. Simons, and J. A. Collins, Analysis of Seafloor Seismograms of the 2003 Tokachi-Oki Earthquake Sequence for Earthquake Early Warning, *Geophys. Res. Lett.* **35**, L14310, doi:10.1029/2008GL033986, 2008.
- 28) \*Llenos, A. L., J. J. McGuire, and Y. Ogata, Modeling Seismic Swarms Triggered by Aseismic Transients, *Earth and Planetary Science Letters*, 281, 59-69, 2009.
- 29) \*Roland, E. and J. J. McGuire, Earthquake Swarms on Transform Faults, *Geophysical Journal International.*, **178**, 1677-1690, 2009.
- 30) Boettcher, M. S. and J. J. McGuire, Scaling Relations for Seismic Cycles on Mid-Ocean Ridge Transform Faults, *Geophys. Res. Lett.*, **36**, L21301, doi:10.1029/2009GL040115 2009.
- 31) Ohtani, R., J. J. McGuire, and P. Segall, The Network Strain Filter – A New Tool for Monitoring and Detecting Transient Deformation Signals in GPS Arrays, *J. Geophys. Res.*, **115**, B12418, doi:10.1029/2010JB007442, 2010.
- 32) \*Llenos, A. L., and J. J. McGuire, Detecting Aseismic Strain Transients From Seismicity Data, *J. Geophys. Res.*, **116**, B06305, doi:10.1029/2010JB007537, 2011.
- 33) H. Yao, P. Gouedard, J. J. McGuire, J. A. Collins, R. D. van der Hilst, Structure of young East Pacific Rise lithosphere from ambient noise correlation analysis of

- fundamental- and higher-mode Rayleigh waves, *Comptes Rendus Geoscience*, **343**, 571-583, 2011.
- 34) Miyazaki, S., J. J. McGuire, and P. Segall, Seismic and Aseismic Fault Slip Before and During the 2011 Tohoku Earthquake, *Earth, Planets, Space*, **63**, 637-642, 2011.
- 35) McGuire, J.J., J. A. Collins, P. Gouedard, E. Roland\*, D. Lizarralde, M. S. Boettcher, M. D. Behn, R. D. van der Hilst, Capturing the End of a Seismic Cycle on the Gofar Transform Fault, *Nature Geoscience*, 5(5), 336-341, DOI:10.1038/NNGEO1454, 2012
- 36) Liu, Y., J. J. McGuire, and M. D. Behn, Frictional behavior of oceanic transform faults and its influence on earthquake characteristics, *J. Geophys. Res.*, **117**, B04315, 2012
- 37) Collins, J. A., J. J. McGuire, D. K. Smith, Seismicity of the Atlantis Massif detachment fault, 30 N at the Mid-Atlantic Ridge, *Geochem Geophys. Geosys.*, doi:10.1029/2012GC004210, 2012.
- 38) \*Roland, E., Lizarralde, D., J. A. Collins, and J. J. McGuire, Constraints on the material properties that control earthquake behavior from seismic velocity structure at the Quebrada-Discovery-Gofar transform faults, East Pacific Rise, *J. Geophys. Res.*, **117**, doi:10.1029/2012JB009422 2012.
- 39) McGuire, J. J. and G. C. Beroza, A Rogue Earthquake off Sumatra, *Science*, **336**, 1118-1119, 2012.
- 40) \*Wei, M., J. J. McGuire, and E. Richardson, A slow slip event in the south central Alaska Subduction Zone and related seismicity anomaly, *Geophysical Research Letters*, **39**, 15, doi:10.1029/2012GL052351, 2012.
- 41) \*Wei, M., Y. Kaneko, Y. Liu, and J. J. McGuire, Episodic fault creep events in California controlled by shallow frictional heterogeneity, *Nature Geoscience*, doi:10.1038/ngeo1835, 2013.
- 42) McGuire, J. J., and J. A. Collins, Millimeter-Level Precision in a Seafloor Geodesy Experiment at the Discovery Transform Fault, East Pacific Rise, *Geochem Geophys. Geosys.*, doi:10.1002/ggge.20225, 2013.
- 43) Gouedard, P., T. Seher, J. J. McGuire, J. A. Collins, and R. D. van der Hilst, Correction of OBS instrumental clock errors using ambient seismic noise, *Bull. Seism. Soc. Am.*, **104**, p. 1276-1288, doi:10.1785/0120130157 2014.
- 44) Douglas R. Toomey, Richard M. Allen, Andrew H. Barclay, Samuel W. Bell, Peter D. Bromirski, Richard L. Carlson, Xiaowei Chen, John A. Collins, Robert P. Dziak, Brent Evers, Donald W. Forsyth, Peter Gerstoft, Emilie E. E. Hooft, Dean Livelybrooks, Jessica A. Lodewyk, Douglas S. Luther, Jeffrey J. McGuire, Susan Y. Schwartz, Maya Tolstoy, Anne M. Tréhu, Michelle Weirathmueller, William S. D. Wilcock, The Cascadia Initiative: A Sea Change in Seismological Studies of Subduction Zones, *Oceanography* **27**(2):138–150, <http://dx.doi.org/10.5670/oceanog.2014.49>, 2014.
- 45) Froment, B., J. J. McGuire, P. Gouedard, E. C. Roland, H. Zhang, J. A. Collins, and R. D. van der Hilst,, Imaging along-strike variations in mechanical properties of the Gofar transform fault, East Pacific Rise, *J. Geophys. Res.*, **119**, DOI:10.1002/2014JB011270, 2014.



- 46) Wofson-Schwehr, M., M. S. Boettcher, J. J. McGuire, and J. A. Collins, The Relationship Between Seismicity and Fault Structure on the Discovery Transform Fault, East Pacific Rise, *Geochemistry, Geophysics, Geosystems*, doi:10.1002/2014GC005445, 2014.
- 47) \*Wei, M. and J. J. McGuire, Coseismic and Post-seismic slip from the 2010 offshore Northern California earthquake recorded by the Plate Boundary Observatory GPS network, *Geophys. Res. Lett.*, **41**, doi:10.1002/2014GL061043, 2014
- 48) McGuire, J. J., R. B. Lohman, R. D. Catchings, M. J. Rymer, and M. R. Goldman, Relationships between seismic velocity, metamorphism, seismic and aseismic fault slip in the Salton Sea Geothermal Field region, submitted to *J. Geophys. Res.*, 2014.

\* denotes students and post-docs advised by McGuire

#### Other Publications

- 1) McGuire, J., D. Toomey, C. Goldfinger, S. Schwartz, R. Allen, and K. Wang, Cascadia Initiative Workshop Update, GEOPRISMS Newsletter No 26, Spring 2011.
- 2) Scherwath, M. George Spence, Koichiro Obana, Shuichi Kodaira, Kelin Wang, Michael Riedel, Jeffrey McGuire, and John Collins, Monitoring Earthquakes in Northern Cascadia With a Japan-Canada-US Seafloor Seismometer Array, EOS, 2011.
- 3) Cascadia Initiative Expedition Team, Status of the Ocean Bottom Seismology Component of the Cascadia Initiative, GEOPRISMS Newsletter, 2011.