Melodie French

Department of Earth, Environmental, and Planetary Sciences
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EDUCATION

Texas A&M University	Geophysics	PhD	2014
University of Wisconsin, Madison	Geology	MS	2009
Oberlin College	Physics with honors in Geology	BA	2006

APPOINTMENTS

1/2017 – present	Assistant Professor, Rice University
1/2015 – 1/2017	NSF Earth Sciences Postdoctoral Fellow, University of Maryland, College Park
10/2014–1/2015	Postdoctoral Scientist, University of Maryland, College Park

SUBMITTED PUBLICATIONS

† Rice Student, ‡ Rice Postdoc, ˆRice Lab Visiting Student/Data

‡Condit,C., **M. E. French**, J. A. Hayles, L. Y. Yeung, and C. A. Lee, Fluid and stress state at the base of the subduction seismogenic zone, *in revision.*

PUBLICATIONS

(since 2016)

M. E. French and J. K. Morgan (2020), Pore fluid pressures and strength contrasts maintain frontal fault activity, northern Hikurangi margin, New Zealand, *Geophys. Res. Lett.*, *47*, (21), doi:10.1029/2020GL089209.

‡Condit, C., V. E. Guevara, ‡J. R. Delph, and **M. E. French** (2020), Slab dehydration in warm subduction zones at depths of episodic slip and tremor, Earth Planet. Sci. Lett., 552, doi: 10.1016/j.epsl.2020.11660.

ˆPhillips, N., †B. Belzer, **M. E. French**, C. Rowe, and K. Ujiie (2020), Frictional strengths of subduction thrust rocks in the region of shallow slow earthquakes, *J. Geophys. Res. Solid Earth*, *125*, doi: 10.1029/2019JB018888.

French, M. E. and ‡C. Condit (2019), Slip partitioning along an idealized subduction plate boundary at deep slow slip conditions, Earth Planet. Sci. Lett., 528, doi: 10.1016/j.epsl.2019.115828.

Xing, T., W. Zhu, **M. E. French**, and †B. Belzer (2019), Stabilizing Effect of High Pore Fluid Pressure on Slip Behaviors of Gouge-Bearing Faults, J. Geophys. Res. Solid Earth, 124, doi: 10.1029/2019JB018002.

French, M. E., G. Hirth, and K. Okazaki (2019), Fracture-induced pore fluid pressure weakening and dehydration in serpentinite, Tectonophysics, doi: 10.1016/j.tecto.2019.228168.

French, M. E. and J. S. Chester (2018), Localized slip and associated fluidized structures record seismic slip in clay-rich fault gouge, *J. Geophys. Res. Solid Earth*, *123*, doi.org/10.1029/2018JB016053.

French, M. E. and W. Zhu (2017), Slow fault propagation in serpentinite under conditions of high pore fluid pressure, *Earth Planet. Sci. Lett.*, *473*, (131–140), doi: 10.1016/j.epsl.2017.06.009.

French, M. E., F. M. Chester, J. S. Chester, and J. E. Wilson (2016), Stress-dependent transport properties of fractured arkosic sandstone, *16*(3), *Geofluids*, doi:0.1111/gfl.12174.

French, M. E., W. Zhu, and J. Banker (2016), Fault slip controlled by stress path and fluid pressurization rate, *Geophys. Res. Lett.*, *43*, (4330–4339), doi:10.1002/2016GL068893.

(prior to 2016)
French, M. E., F. M. Chester, and J. S. Chester (2015), Micromechanisms of creep in clay-rich gouge from the Central Deforming Zone of the San Andreas Fault, *J. Geophys. Res. Solid Earth*, *120*(827-849), doi:10.1002/2014JB011496.

Coble, C. G, **M. E. French**, F. M. Chester, J. S. Chester, and H. Kitajima (2014), In situ frictional properties of San Andreas Fault gouge at SAFOD, *Geophys. J. Int.*, *199*(2), doi: 10.1093/gji/ggu306.

French, M. E., H. Kitajima, J. S. Chester, F. M. Chester, and T. Hirose (2014), Displacement and dynamic weakening processes in smectite-rich gouge from the Central Deforming Zone of the San Andreas Fault, *J. Geophys. Res. Solid Earth*, *119*, doi:10.1002/2013JB010757.

French, M. E.., D. F. Boutt, and L. B. Goodwin (2012), Sample dilation and fracture in response to high pore fluid pressure and strain rate in quartz-rich sandstone and siltstone, *J. Geophys. Res.*, *117*, B03215, doi:10.1029/2011JB008707.

Other Products:

(since 2016)
Huntington, K.W., and Klepeis, K.A., with 66 community contributors (including **French, M. E.**) (2018), Challenges and opportunities for research in tectonics: Understanding deformation and the processes that link Earth systems, from geologic time to human time. *A community vision document submitted to the U.S. National Science Foundation.* University of Washington, 84 pp., $https://doi.org/10.6069/H52R3PQ5$.

McGuire, J., and Plank, T. , with 16 writing committee members (including **French, M. E.**) (2017), The SZ4D Initiative, Understanding the Processes that Underlie Subduction Zone Hazards in 4D, *A vision document submitted to the National Science Foundation*, 63 pp., $https://www.iris.edu/hq/files/workshops/2016/09/szo_16/sz4d.pdf$.

FUNDING

(since July 2016)
NSF Geophysics/Tectonics/Marine G&G (#1945264), CAREER: Path Dependent Slip of the Shallow Subduction Megathrust, 2020-2025, PI, $601,711

NSF EAR-IF (#1921517), Upgrade of a Triaxial Rock Deformation Apparatus to Measure the Rheology of Subduction Megathrusts, 2019-2021, PI, $102,379.

NSF Geophysics (# 1759127), Controls of Pore Fluid Pressure on Fault Slip Weakening and Fracture Energy, 2018-2021, PI, $264,839.

American Chemical Society PRF-DNI (# 59440), Frequency-Dependent Attenuation of Elastic Waves in Fault Zones, 2018-2021, PI, $110,000.

(prior to July 2016)
NSF EAR–PF (# 1452339), *An Experimental Study on the Role of Pore Fluid Pressure During Slow Slip in Subduction Zones*, 2/2015 - 12/2016, PI, $174,000.

(other)
NSF GeoPRISMS Synthesis Workshop (recommended), The Geological Fingerprints of Slow Earthquakes, 2021, Senior Personnel (PI: David Schmidt), $38,152

Penrose Conference funding (2021), The Geological Fingerprints of Slow Earthquakes, Co-Organizer, $20,000

Southern California Earthquake Center (#19133), Workshop Support to Explore the Geological Fingerprints of Slow Slip and Tremor, 2019-2021, Co-PI (PI: John Platt), $12,000

NSF EAR (#1828096), RCN: A Research Coordination Network for the SZ4D Initiative, Senior Personnel (PI: Harold Tobin), $499,900

AWARDS AND HONORS

- Editor's Citation for Excellence in Refereeing, JGR – Solid Earth, 2018
- EarthScope Distinguished Speaker Series 2015–2016
- NSF EAR Postdoctoral Fellowship 2015-2017
- John and Frances Handin Fellowship, Center for Tectonophysics, Texas A&M University, 2014
- Bailey Outstanding Student Paper Award, Department of Geoscience, University of Wisconsin, Madison, 2012
- Chevron Fellow, The Berg-Hughes Center for Petroleum Research, Texas A&M University, 2010–2012
- Outstanding Student Paper Award, Rock and Mineral Physics Focus Group, AGU fall meeting, 2008

SEMINAR PRESENTATIONS

(since July 2016)
University of Louisiana, Lafayette, *upcoming*, March 2021
WHOI, 14 Oct. 2020
Houston Geological Society, 8, Apr., 2019
University of Houston Departmental Seminar, 6, Apr., 2018
Industry-Rice Earth Science Symposium (IRESS), Houston, TX, 23, Feb., 2018
Cooperative Institute for Dynamic Earth Research (CIDER), Berkeley, CA, 18, July, 2017
Gordon Conference on Rock Deformation, Andover, NH, 25, Aug., 2016
(prior to July 2016)
University of Pennsylvania: Dept of Earth and Environmental Sciences Seminar, 15 Apr., 2016
Brown University: Geophysics Lunch Bunch Seminar, 22 Mar., 2016
University of Minnesota: Dept of Earth Sciences Seminar, 10 Mar., 2016
West Virginia University: Dept of Geology and Geography Seminar, 8 Mar., 2016
Rice University: Dept of Earth Science Seminar, 11 Feb., 2016
University of Colorado: Dept of Geological Sciences Seminar, 3 Feb., 2016
University of Michigan: Dept of Earth and Environmental Sciences Seminar, 20 Nov., 2015
Oberlin College: Dept of Geology Seminar, 6 Oct., 2015
Marshall University: Dept of Geology Seminar, 12 Nov., 2015
Marshall University: General Audience Seminar, 12 Nov., 2015
University of Maryland: Dept of Geology Seminar, 11 Sept., 2015
Institut de Physique du Globe de Paris: Geophysics Seminar, 3 June, 2014
University of Wisconsin: Department of Geoscience Seminar, 26 Nov., 2013
University of Wisconsin: Department of Civil Engineering Seminar, 25 Nov. 2013

CONFERENCE ABSTRACTS (since July 2016)

∗: invited, †: student, ‡: postdoc, ¡: data from Rice lab

*‡Condit, C., V. E. Guevara, J. R. Delph, **French, M. E.**, and A. F. Holt (2020). Forarc dehydration in warm subduction zones provides ample fluids at the depths of episodic slip and tremor, V041-01 presented at annual Fall Meeting, AGU, virtual, 1-17 Dec.

†Fliedner, C. and **M. E. French** (2020). Microphysical controls on the elastic wave speeds of an exhumed greenschist and implications for the interpretation of conditions along the subduction interface., T053-0006 presented at annual Fall Meeting, AGU, virtual, 1-17 Dec.

*‡Condit, C., V. E. Guevara, J. R. Delph, and **M. E. French** (2020). Metamorphic dehydration from oceanic crust provides fluid sources for deep slow slip and tremor in subduction zones, 109-4 presented at 2020 Annual GSA Meeting , virtual, 26-30 Oct

*†Belzer, B. and **M. E. French** (2020). Path-dependent strength and deformation behavior of shallow subduction fault rock, 109-1 presented at 2020 Annual GSA Meeting, virtual, 26-30 Oct.

‡Condit, C., , V. E. Guevara, J. R. Delph, and **M. E. French** (2020). Thermal controls on oceanic lithosphere dehydration and fluid flux to the mantle during subduction, presented at the 2020 Goldschmidt conference, online, 21-26 June.

Zhu, W., T. Xing, K. Takamasa, Z. Zega, and **M. E. French** (2020). Mechanisms for pore fluid stabilization of fault propagation and slip, EGU2020-11918 presented at the 2020 EGU General Assembly, online, 4-8 May.

French, M. E. and J. K. Morgan (2019). The strength and consolidation state of sediments from Hikurangi Expedition 375 and implications for plate boundary mechanics, T51F-0351 presented at 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.

†Belzer, B. and **M. E. French** (2019). Effects of evolving fluid pressure and consolidation state on shallow megathrust deformation, T51F-0345 presented at 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.

†Fliedner, C. and **M. E. French** (2019). Anelasticity of the Orocopia schist under different effective pressures and temperatures, MR23C-0116 presented at 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.

¡Nyblade, L., K. Nootenboom, P. Lindquist, S. Titus, and **M. E. French** (2019). Deformation experiments on the Etchegoin sandstone, MR23G-0181 presented at 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.

French, M. E. and ‡C. Condit (2019). Deformation partitioning along an idealized subduction interface at deep slow slip conditions, 84-11 presented at The Geological Society of America Annual Meeting, Phoenix, AZ, 22-25 Sept.

†Belzer, B. and **M. E. French** (2019). Constitutive behavior of chlorite-rich fault gouge under hydrothermal conditions, A-37 presented at the GeoPRISMS Synthesis & Integration Theoretical and Experimental Institute, San Antonio, TX, 27 Feb. - 1 Mar.

†Fliedner, C. and **M. E. French** (2019). Seismic wave propagation in Orocopia schist, A-50 presented at the GeoPRISMS Synthesis & Integration Theoretical and Experimental Institute, San Antonio, TX, 27 Feb. - 1 Mar.

∗‡Condit, C., **M. E. French**, K. H. Mahan, C.-T. Lee, J. Hayles, and L. Yeung (2018). Fluid infiltration promotes both ductile and brittle deformation within the deep crust: Examples from Southwestern Montana and the Central Alps, T32B-06 presented at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec. (oral)

French, M. E. and ‡C. Condit (2018). Rheology and strain partitioning at the base of the subduction seismogenic zone: A case study from the Alps, MR31B-0077 presented at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

†Belzer, B. and **M. E. French** (2018). Frictional behavior of chlorite at in-situ conditions along shallow plate boundary faults, T11E-0202 presented at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

†Fliedner, C. and **M. E. French** (2018). Pressure, temperature, and frequency dependent wave propagation in Orocopia schist, MR31B-0088 presented at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

Xing, T., W. Zhu, **M. E. French**, and †B. Belzer (2018). Strengthening effect of high pore pressure on the frictional behavior of serpentine gouge, T11E-0194 presented at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

¡Phillips, N. J., C. D. Rowe, K. Ujiie, **M. E. French**, M. Motohashi, and †B. Belzer (2018). Stressed Out at the Border: Geological Observations and Models of Elevated Stresses along the Boundaries of Strong Lithologies in Shallow and Deep Melanges, T13D-0251 presented at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec.

French, M. E., G. Hirth, and K. Okazaki (2018). Fracture-Induced Pore Fluid Pressure Weakening and Dehydration of Serpentinite, # 23 presented at 2018 Gordon Conference on Rock Deformation, Andover, NH, 19-24 Aug.

‡Condit, C., **M. E. French**, L. Yeung, J. Hayles, and C.-T Lee (2018). Fluid Sources and Stress State at the Base of the Subduction Seismogenic Zone, # 23 presented at 2018 Gordon Conference on Rock Deformation, Andover, NH, 19-24 Aug.

¡Phillips, N. J., C. D. Rowe, K. Ujiie, **M. E. French**, and †B. Belzer (2018). Seismicity Along the Shallow Subduction Interface: Mapping, Experiments, and Models Exploring the Role of Heterogeneous Stress Distributions, # 22 presented at 2018 Gordon Conference on Rock Deformation, Andover, NH, 19-24 Aug.

∗**French, M. E.**, W. Zhu, and G. Hirth (2017). Pore fluid pressure and the seismic cycle, MR32A-02 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec. (oral)

French, M. E., G. Hirth, and K. Okazaki (2017). The constitutive behavior of antigorite gouge under fluid-saturated undrained conditions, MR21B-0449 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.

Xing, T., W. Zhu, **M. E. French**, and †B. Belzer (2017). Change in frictional behavior during olivine serpentinization, V34A-02 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.

Bletery, Q. and nine others including **M. E. French** (2017). Hunting for shallow slow-slip events at Cascadia, T51E-0531 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.

†Grabiec, J. G., S. C. Penniston-Dorland, R. J. Walker, and **M. E. French** (2017). Insights into the

formation of the Cottonwood Canyon fault in the Catalina Schist, 254-9 presented at The Geological Society of America Annual Meeting, Seattle, WA, 22-25 Oct.

[¡]Lindquist, P., **M. E. French**, and S. Titus (2017). Experimentally produced deformation bands in the Etchegoin Sandstone: Implications for inferring stress directions in central California, 288-2 presented at The Geological Society of America Annual Meeting, Seattle, WA, 22-25 Oct.

Zhu, W. and **M. E. French** (2017). Controls of Stress Regime and Injection Rate on Slip Events, EGU2017-4709 presented at 2017 annual EGU meeting, Vienna, Austria, 23-28 Apr.

∗**French, M. E.** and W. Zhu (2016). Slow fault propagation under conditions of high pore fluid pressure, MR32A-02 presented at 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec. (oral)

[†]Belzer, B., **M. E. French**, and W. Zhu (2016). Constitutive relations for antigorite-rich fault gouge under conditions of high pore fluid pressure, MR41A-2690 presented at 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.

∗**French, M. E.** (2016). Rheology and dynamics of the plate boundary, presented at the Subduction Zone Observatory Planning Workshop, Boise, ID, 29 Sept. - 1 Oct. (oral)

∗**French, M. E.** and W. Zhu (2016). Slow fault rupture propagation in serpentinite, 201-4 presented at The Geological Society of America Annual Meeting, Denver, CO, 25-28 Sept. (oral)

PROFESSIONAL SERVICE

National and International

- 2021 Penrose Conference Co-Organizer
- Associate Editor, Geophysical Research Letters (2017 – present)
- Steering Committee member for *SZ4D* (Subduction zones in 4-D) community initiative (2017–present) (funding for RCN support through NSF)
- Steering committee member, Physical Properties of Earth Materials (2018–present)
- Discussion Leader, Gorgon Research Conference on Rock Deformation (2018)
- Funding agency panelist: NSF (2018, 2019, 2020) and USGS (2015, 2016, 2017)
- Co-organizer of NSF funded workshop on Experimental Studies of Subduction Zone Processes (June 4-6 2018)
- Contributor to the Future of Tectonics whitepaper submitted to NSF (2017)
- Writing committee member for NSF report on the Subduction Zone Observatory (now SZ4D) Workshop (2016-2017)
- Session convener at American Geophysical Union fall meeting (2015, 2018, 2019, 2020)
- Reviewer for Geophysical Research Letters, Journal of Geophysical Research-Solid Earth, Earth and Planetary Science Letters, Journal of Structural Geology, Science Advances, Journal of Seismology, Terra Nova, NSF-Geophysics, NSF-Marine Geology and Geophysics, NSF-EarthScope, ACS-Petroleum Research Fund
- Panelist for co-sponsored Early Career Networking Event at the American Geophysical Union fall meeting (2015)

Institutional

- Board Member, Shared Equipment Authority (2018 – present)
- Natural Sciences Laboratory Committee (2020)

Departmental Committees

- Graduate (2020 – present)
- Weiss Postdoctoral Fellowship (2017 – present)
- Graduate Admissions (2017 – present)
- Departmental Seminar Speaker (2017 – present)
- Laboratories and Safety (2017 – present)
- Student Awards (2017 – present)

TEACHING

(Fall 2020) Natural Disasters (ESCI 108, 65 enrolled)

(Fall 2019) The Brittle-Ductile Transition (ESCI 524, 6 enrolled)

(Spring 2019) Earth Structure and Deformation (ESCI 323, 7 enrolled) (1/2 load), Introduction to the Earth (ESCI 115, 9 enrolled) (1/4 load)

(Fall 2018) Faults and Earthquakes (ESCI 524, 6 enrolled)

(Spring 2018) Earth Structure and Deformation (ESCI 323, 7 enrolled), Seminar: Advanced Topics in Earth Structure (ESCI 501, 5 enrolled)

(Fall 2017) Rock Deformation and Rheology (ESCI 566, 9 enrolled)

ADVISING

Postdoctoral

Cailey Condit, Rice University Weiss Postdoctoral Fellow, 2017-2018
now faculty at the University of Washington

PhD

Stewart Williams, Rice University, 2019-present
Celine Fliedner, Rice University, 2017-present
Benjamin Belzer, Rice University, 2017-present

VISITING STUDENTS

Noah Phillips, PhD candidate, McGill University, 2018
Lena Nyblade, undergraduate, Carleton College, 2019 & 2020
Peter Lindquist, undergraduate, Carleton College, 2017 & 2018
Kate Nootenboom, undergraduate, Carleton College, 2018 & 2019

STUDENT COMMITTEES

PhD

David Blank, 2017-present
Proteek Chowdhury, 2017-present
Maria Furtney, 2018-present
Kevin Gaastra, 2019-present
Hope Jasperson, 2018-present
Patrick Phelps, 2019-present
Xiaoyu Wang, 2017-present
Pengfei Dong (Chemical Engineering), PhD, 2018
Ruichao Ye PhD, 2018

M.S.

William Farrell, 2017-present

Jacob Proctor, MS 2018