

# Dr. Joshua M. Garber

305 Deike Building, Dept. of Geosciences, Penn State  
University Park, PA 16802  
www.jmgarber.com; jmgarber@psu.edu

## Professional Preparation

### **E-FIRE Postdoctoral Scholar (02/2018–07/2021) -- Penn State University**

*Focus:* Petrology/geochemistry/geochronology of subducted metabasalts and metasediments in W. Alps/Corsica  
(Supervisors: M. Feineman, A. Smye; Collaborators: A. Vitale-Brovarone, P. Agard, M. Alvaro)

### **Ph.D., Geology (01/2018) -- University of California, Santa Barbara**

*Dissertation:* Multivariate Statistical Methods and Applications in Petrochronology and Geochemistry  
(Committee: B. Hacker [advisor], J. Cottle, M. Jackson)

### **M.S., Geology (09/2012) -- University of California, Davis**

*Thesis:* Early Devonian shortening, exhumation, and strain localization in a collisional orogen: the Bajo Pequeño Shear Zone, NW Argentina (Advisor: S. Roeske)

### **B.S., Geology; Departmental and University Honors (05/2008) – UT Austin**

*Thesis:* Impact of fluid evolution on garnet growth in pelitic rocks (Advisor: W. Carlson)

## Appointments (references available upon request)

- 07/2021 – present **Assistant Research Professor:** Pennsylvania State University  
07/2020 – present **LA-ICPMS Laboratory Manager:** Pennsylvania State University  
02/2018 – 07/2021 **Postdoctoral Scholar:** Pennsylvania State University  
09/2012 – 12/2017 **Graduate Researcher, Instructor, TA:** UC Santa Barbara  
06/2015 – 08/2015 **Intern:** Chevron Energy Technology Company (ETC), Houston, TX  
06/2012 – 08/2012 **Intern:** Lunar and Planetary Institute, Houston, TX  
09/2009 – 09/2012 **Graduate Researcher, TA:** University of California, Davis  
05/2009 – 08/2009 **Intern:** NASA-Johnson Space Center, Houston, TX  
08/2006 – 03/2009 **Research Assistant:** University of Texas at Austin  
05/2008 – 09/2008 **Intern:** United States Geological Survey (USGS), Eastern Mass.  
05/2006 – 09/2006 **Intern:** Lunar and Planetary Institute/NASA-Johnson Space Center  
05–08/2004, 2005 **Research Assistant:** Rice University, Houston, TX

## Peer-Reviewed Publications (+54 first- or co-authored conference abstracts)

- Liu, H., **Garber, J.M.**, Smye, A.J., Stockli, D.F., Collops, C.L., Stockli, L., Lee, C.-T., Chen, W., Cole, D., Planavsky, N.J., and McKenzie, N.R., Statistical assessment of zircon trace elements tracks tectonic regime changes and continental crust evolution for ~4.4 billion years, *in prep*
- Rioux, M., **Garber, J.M.**, Searle, M.P., Crowley, J.L., Stevens, S., Schmitz, M., Kylander-Clark, A.R.C., Leal, K., Ambrose, T., Smye, A.J., The temporal evolution of subduction initiation in the Samail ophiolite: High-precision U-Pb zircon petrochronology of the metamorphic sole, *in review at J. Met. Geo.*
- Cipar, J.H., Smye, A.J., **Garber, J.M.**, Reimink, J.R., Kylander-Clark, A.R.C., Attenuation of Laramide continental lower crust and mantle lithosphere: a zircon depth-profiling petrochronologic study, *in prep for Tectonics*
21. Searle, M.P., Rioux, M., **Garber, J.M.**, One Line on the Map: Geological history of the Semail Thrust, Oman-UAE Mountains, *Journal of Structural Geology*, 158, doi:10.1016/j.jsg.2022.104594
20. Wyatt, D.M., Smye, A.J., **Garber, J.M.**, Hacker, B.R. (2022) Assembly and tectonic evolution of continental lower crust: Monazite petrochronology of the Ivrea-Verbano Zone (Val Strona di Omegna), *Tectonics*, 41(3), doi:10.1029/2021TC006841
19. Moser, A.C., Hacker, B.R., Gehrels, G.E., Seward, G.G.E., Kylander-Clark, A.R.C., **Garber, J.M.** (2022) Linking Titanite U-Pb Dates to Coupled Deformation and Dissolution-Reprecipitation, *Contributions to Mineralogy and Petrology*, 177(42), doi:10.1007/s00410-022-01906-9
18. **Garber, J.M.**, Rioux, M., Searle, M.P., Kylander-Clark, A.R.C., Hacker, B.R., Vervoort, J.D., Warren, C., Smye, A.J. (2021) Dating continental subduction beneath the Samail Ophiolite: garnet, zircon, and rutile petrochronology of the As Sifah eclogites, NE Oman, *JGR: Solid Earth*, 126, doi:10.1029/2021JB022715 [**AGU Eos Highlight: "Radiometric Dating Sheds Light on Tectonic Debate,"** <https://bit.ly/33F3Vx5>]
17. Rioux, M., **Garber, J.M.**, Searle, M.P., Kelemen, P., Miyashita, S., Adachi, Y., Bowring, S. (2021) High-precision U-Pb zircon dating of late magmatism in the Samail ophiolite: A record of subduction initiation, *JGR: Solid Earth*, 126(5), doi:10.1029/2020JB020758

16. Rioux, M., Amri, I., Benoit, M., Ceuleneer, G., **Garber, J.M.**, Searle, M.P. (2021) The origin of felsic intrusions in the mantle section of the Semail ophiolite: Melting of underthrust amphibolite and metasediment and differentiation of mantle derived magmas, *JGR: Solid Earth*, 126(5), doi:10.1029/2020JB020760
15. **Garber, J.M.**, Rioux, M., Kylander-Clark, A.R.C., Hacker, B.R., Vervoort, J., Searle, M.P. (2020) Multi-phase petrochronology of Wadi Tayin metamorphic sole metasediment, with implications for the thermal and tectonic evolution of the young Semail subduction zone, *Tectonics*, 39, doi:10.1029/2020TC006135
14. Cipar, J.H., **Garber, J.M.**, Kylander-Clark, A.R.C., Smye, A.J. (2020) Active crustal differentiation beneath the Rio Grande Rift, *Nature Geoscience*, 13, doi:10.1038/s41561-020-0640-z
13. Rutte, D., **Garber, J.M.**, Kylander-Clark, A.R.C., Renne, P.R. (2020) An exhumation pulse from the nascent Franciscan subduction zone (California, USA), *Tectonics*, 39, doi:10.1029/2020TC006305
12. Bralower, T., Cosmidis, J., ..., **Garber, J.**, ..., Tikoo, S. (2020) The habitat of the nascent Chicxulub crater, *AGU Advances*, 3, doi:10.1029/2020AV000208
11. **Garber, J.M.**, Smye, A.J., Feineman, M.D., Kylander-Clark, A.R.C., Matthews, S. (2020) Decoupling of zircon U-Pb and trace-element systematics driven by U diffusion in eclogite-facies zircon (Monviso meta-ophiolite, W. Alps), *Contributions to Mineralogy and Petrology*, 175, doi:10.1007/s00410-020-01692-2
10. Searle, M.P., **Garber, J.M.**, Hacker, B.R., Htun, K., Gardiner, N.J., Waters, D.J., Robb, L.J. (2020), Timing of syenite-charnockite magmatism and ruby- and sapphire metamorphism in the Mogok valley region, Myanmar, *Tectonics*, 39, doi:10.1029/2019TC005998
9. Aulbach, S., Massuyeau, M., **Garber, J.M.**, Gerdes, A., Heaman, L.M., Viljoen, K.S. (2020), Ultramafic melt- and auto-metasomatism in mantle eclogites: Compositional effects and geophysical consequences, *G-cubed*, 21, doi:10.1029/2019GC008774
8. Smye, A.J., Marsh, J.J., Vermeesch, P., **Garber, J.M.**, Stockli, D.F. (2018), Applications and Limitations of U-Pb Thermochronology to Middle and Lower Crustal Thermal Histories, *Chemical Geology*, doi:10.1016/j.chemgeo.2018.07.003
7. **Garber, J.M.**, Maurya, S., Hernandez, J.-A., Duncan, M.S., Zeng, L., Zhang, H.L., Faul, U., McCammon, C., Montagner, J.-P., Moresi, L., Romanowicz, B.A., Rudnick, R.L., Stixrude, L. (2018), Multidisciplinary constraints on the abundance of diamond and eclogite in the cratonic lithosphere, *G-cubed*, 19, doi: 10.1029/2018GC007534 [**Altmetric: #1 in press attention of any G-cubed paper; ACS "Reactions" Video: Are We Standing on a Quadrillion Tons of Diamonds? <https://bit.ly/3DAEh8U>**]
6. **Garber, J.M.**, Hacker, B.R., Kylander-Clark, A.R.C., Stearns, M., Seward, G. (2017), Controls on trace-element uptake in metamorphic titanite: implications for petrochronology, *Journal of Petrology*, 58, 1031–1057, doi:10.1093/petrology/egx046
5. Rioux, M., **Garber, J.M.**, Bauer, A., Bowring, S., Searle, M., Kelemen, P., Hacker, B. (2016), Synchronous formation of the metamorphic sole and igneous crust of the Semail ophiolite: New constraints on the tectonic evolution during ophiolite formation from high-precision U-Pb zircon geochronology, *EPSL*, 451, 185–195, doi:10.1016/j.epsl.2016.06.051
4. Searle, M.P., Waters, D.J., **Garber, J.M.**, Rioux, M., Cherry, A.G., Ambrose, T.K. (2015), Structure and metamorphism beneath the obducting Oman ophiolite: evidence from the Bani Hamid granulites, northern Oman Mountains, *Geosphere*, 11(6), doi:10.1130/GES01199.1
3. Carlson, W.D., Hixon, J., **Garber, J.M.**, Bodnar, R.J. (2014), Controls on metamorphic equilibration: the importance of intergranular solubilities mediated by fluid composition, *JMG*, 32, doi:10.1111/jmg.12113
2. **Garber, J.M.**, Roeske, S.M., Warren, J., Mulcahy, S.R., McClelland, W.C., Austin, L.J., Renne, P.R., Vujovich, G.I. (2014), Crustal Shortening, Exhumation, and Strain Localization in a Collisional Orogen: The Bajo Pequeño Shear Zone, Sierra de Pie de Palo, Argentina, *Tectonics* 33, doi:10.1002/2013TC003477
1. Fong, T., Bualat, M., Deans, M., ..., **Garber, J.**, ..., Kobayashi, L. (2011), Robotic Follow-up for Human Exploration, AIAA 2010 Conference & Exposition, AIAA SPACE Forum, doi:10.2514/6.2010-8605.

## Other Publications

- Garber, J.M.** (2012). Chapter 1: Precambrian Rocks of the Grand Canyon: UC Davis Ecogeomorphology Field Guide to the Grand Canyon [<https://bit.ly/3robWyd>]
- Barnes, J., French, R., **Garber, J.**, Poole, W., Smith, P., Tian, Y. (2012), Science concept 2: The structure and composition of the lunar interior provide fundamental information on the evolution of a differentiated planetary body, *in*: Kring, D., and Durda, D., eds., A Global Lunar Landing Site Study to Provide the Scientific Context for Exploration of the Moon, LPI Contribution No. 1694, Houston, TX: LPI, pp. 47–131
- Garber, J.M.** (2011) Chapter 1: Tectonic History of British Columbia: Historical and Current Influences on the Chilko-Chilcotin-Fraser River System, in Chilko-Chilcotin River Network: A Lakes and Rivers Ecosystem [*field guide*], eds. J. Mount and P. Moyle
- Righter, K., **Garber, J.M.** (2011), HED [Howardite-Eucrite-Diogenite] Compendium. [<https://go.nasa.gov/3nytS8l>]

## Research Interests

**broadly:** plate tectonics, major- and trace-element geochemistry, geochronology, igneous and metamorphic petrology, statistical methods

**specifically:** long-term tectonic and chemical evolution of continents; initiation and evolution of subduction; “petrochronology” – marrying petrology, geochronology, and geochemistry

## Summary of Relevant Skills

- ♦ Broad research/lab experience, including (LA-)ICPMS, SEM/CL/EBSD, EPMA, optical microscopy, Raman spectroscopy, wet chemistry, and fluid-inclusion work
- ♦ Well-rounded teaching experience – 4 quarters as lead instructor and 14 quarters as a TA
- ♦ Excellent scientific communication skills, to both technical and non-technical audiences
- ♦ Statistical proficiency in geologic data reduction, processing, and interpretation
- ♦ Extensive and diverse field experience, including geological field mapping (at multiple scales), various sampling strategies, stratigraphy/measured sections
- ♦ Hard-working, professional, diplomatic, and productive, both independently and in groups
- ♦ Experience in Adobe Suite, Iolite, MATLAB, THERMOCALC/Perple\_X, ArcGIS/ENVI, StraboSpot (*in progress: Python*)

## Courses Taught

**as Instructor of Record:** Physical Geology (2014, 2016), Structural Geology (2015, 2017)  
*average student rating = 4.57/5.00*

**as TA:** Field Camp (2010, 2011, 2014), Earth Mat. (2009, 2011, 2013), Met. Petr. (2010, 2011), Ig. Petr. (2010), Struct. Geology (2011), Field Geology (2012, 2014), Intro. Geology (2012, 2014)  
*average 2013-2014 student rating = 4.91/5.00*

## Students Mentored

**2021–present:** Abigail Mensch (Penn State undergraduate, summer REU): LASS U-Pb and trace-element analyses of apatite from the Molopo Farms intrusive complex (S. Africa)

**2021–present:** Alexander Nikitin (Penn State undergraduate, senior thesis + RA): LASS U-Pb and trace-element analyses of detrital zircons from the Samail Ophiolite (Oman/UAE)

**2021–2022:** Kathryn Cordeiro (UCSB undergraduate, senior thesis, co-supervised with M. Rioux): Thermodynamic modelling of the metamorphic sole of the Samail Ophiolite (Oman/UAE)

**2019–2020:** Nancy Weinheimer (Penn State undergraduate, summer REU): whole-rock major-element, trace-element, and Sr isotopic work on subducted metabasalts from Corsica

**2018–2019:** Yihua Li (Penn State undergraduate, senior thesis): LASS U-Pb + trace-element analyses of W. Alps titanite

+ *informal mentoring of other graduate and undergraduate students*

## Grants and Fellowships

**2021:** NSF Grant EAR-2120931, “Determining the rates and conditions of subduction initiation beneath the Samail Ophiolite”, 08/01/2021-08/01/2023, \$199,802 (**PI:** Garber, **co-I:** Smye)

**2018:** E-FIRE European Training Funds Grant (\$4000)

**2016:** NSF CIDER Research Grant (\$4500 to collaborative group)

UCSB Earth Research Institute Fellowship (\$1500)

UCSB Tanya Atwater Field Studies Grant (\$3000 between 5 co-authors)

**2014:** ExxonMobil/Geological Society of America Graduate Research Grant (\$7500)

GSA Mineralogy, Geochemistry, Petrology, and Volcanology (MGPV) Research Grant (\$2000)

Graduate Opportunity Research Grant (UCSB) (\$3000)

**2012-2014:** University of California Regents Special Fellowship (\$53000)

**2011:** Geological Society of America Graduate Research Grant (\$4000)

**2010-2011:** UC-Davis Cordell Durrell Fund Grant (\$1000 in 2010, \$2800 in 2011)

**2009-2010:** NSF S-STEM Fellowship (through UC-Davis) (\$10000)

**2007:** University Co-op (UT) Undergraduate Research Fellowship (\$1000)

## Selected Awards and Honors

Penn State Earth and Mineral Sciences Postdoctoral Excellence in Research Award (2021)  
1<sup>st</sup> Judges Prize + 1<sup>st</sup> Audience Prize, Lightning Talk, Penn State Postdoc Research Exhibition (2020)  
UCSB Earth Science Alumni Graduate Award for Research Excellence (2016, 2017)  
UCSB Earth Science “Most Helpful Graduate Student” (2016, 2017)  
UCSB Earth Science Undergraduates “Lifetime Achievement Award” (2017)  
UCSB George Tunnell Award (2015)  
UCSB Earth Science Award for Commitment to Excellence in Undergraduate Education (2014)  
LPI Career Development Award (2011)                      USGS/Dept. of Interior Star Award (2008)  
UT/JSG Estwing Hammer Award (2008)              UT/JSG Dept. Honors, Senior Thesis (2008)  
UT Folk/McBride Petrography Award (2006)           Ozarka Earth Science Scholarship (2005)  
National Merit Scholarship (Finalist) (2004)           Chevron-Texaco REACH Scholarship (2004-08)

## Invited Talks/Field Trips

**2022:** Department of Geological Sciences, University of Texas at Austin, USA  
Department of Geosciences, Penn State University, USA  
**2021:** Department of Earth and Environmental Sciences, University of Michigan, USA  
Office of Postdoctoral Affairs, Penn State University, USA (“How to give a lightning talk”)  
Department of Geosciences, Boise State University, USA  
Department of Earth and Space Sciences, University of Washington, USA  
**2020:** Department of Chemistry, Penn State University, USA (“How to present to a general audience”)  
Department of Geosciences, Penn State University, USA  
Department of Geosciences, University of Arizona, USA  
**2019:** Department of Earth and Environmental Sciences, University of Michigan, USA  
Office of Postdoctoral Affairs, Penn State University, “Science Café” Seminar, USA  
Department of Earth and Planetary Science, Johns Hopkins University, USA  
**2018:** Institut des Sciences de la Terre de Paris, Paris, France  
Department of Geosciences, Penn State University, USA  
Institute for Geosciences, Johannes Gutenberg Universität, Mainz, Germany  
**2017:** Santa Barbara Museum of Natural History, Field Trip Leader (Santa Ynez Mountains, CA, USA)  
Santa Barbara Museum of Natural History, Field Trip Co-Leader (Owens Valley, CA, USA)  
Santa Barbara Museum of Natural History “Science Pub” Seminar  
Santa Barbara Museum of Natural History, Field Trip Co-Leader (Joshua Tree N.P., USA)  
Santa Barbara Astronomical Unit, Monthly Meeting  
**2016:** Department of Geology, Pomona College, USA

## Membership in Professional Societies

American Geophysical Union (AGU), European Association of Geochemistry (EAG), Geological Society of America (GSA), Mineralogical Society of America (MSA), National Association of Geoscience Teachers (NAGT), Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)

## Outreach and Service

**Journal Peer Reviewer:** American Mineralogist, EPSL, European Journal of Mineralogy, GSA Bulletin, Geology, Geoscience Frontiers, Journal of Metamorphic Geology, JGR: Solid Earth, JPet, Lithos, Lithosphere, PNAS, Springer Nature Applied Sciences ( $n=23$ )

**Proposal Reviewer:** National Science Foundation ( $n=2$ ), Deutsche Forschungsgemeinschaft ( $n=1$ )

### **Session Convener:**

Co-convener: “Secular changes in magmatism, metamorphism, and tectonics” (*planned 2022 Goldschmidt*)

Co-convener: “The Metamorphic Kitchen Sink” (2021 AGU)

Co-convener: “Advances and Applications of In-situ Petrochronology and Thermochronology” (2021 AGU)

Lead Convener: “Multidisciplinary insights into tectonic and metamorphic processes at convergent margins (2020 AGU)

Co-convener: “Multidisciplinary insights into subduction zone processes” (2018 Goldschmidt)

## Outreach and Service (cont.)

Postdoc Representative on the Assessment of the Living, Learning, and Working Environment (ALLWE) Implementation Steering Committee for the College of EMS, Penn State (2019-20)  
Search and Rescue Technician Level II Certification (NASAR) (2019-)  
Penn State Postdoc Society (PSPS) Hiking Coordinator (2018-2019), Council Member (2018-2021)  
Penn State Postdoctoral Virtual Research Exhibition Co-Organizer (2020)  
Frequent judge for student research presentations (e.g., Department, College, and University-Level Graduate Research Exhibitions)  
Weekly Volunteer Docent at Santa Barbara Museum of Natural History (2014-2017)  
Member of UCSB Earth Science Graduate Program Committee (2015-2016)  
Co-Organizer for UCSB Earth Science Graduate Alumni Career Panel (2014-2015)  
Geology Representative for the UC-Davis Graduate Student Assembly (2009-2010)  
UT Senate of College Councils Jackson School of Geosciences Representative (2006-2007)  
UT Undergraduate Geological Society President (2006-2007) and Secretary (2005-2006)

## Field Experience

**San Salvador Island, Bahamas** (1 week, 2005; carbonate sedimentology)  
**UT Austin Field Camp, western US** (6 weeks, 2007; mapping, stratigraphy, volcanology, structural geology, met. petrology)  
**Harpwell Neck, Maine, US** (1 week, 2007; metamorphic petrology)  
**Puna-Altiplano, Chile** (1 week, 2008; structural geology, volcanology)  
**Sierra Madre Oriental, Mexico** (3 months, 2008–2009; carbonate stratigraphy and mapping)  
**Otis Air Force Base, MA, US** (3 months, 2009; hydrogeology)  
**Sierra de Pie de Palo, Argentina** (6 weeks, 2010; metamorphic petrology, structural geology)  
**Death Valley, CA, US** (1 week, 2010/1 week, 2011; carbonate stratigraphy, structure/tectonics)  
**Meteor Crater, AZ, US** (1 week, 2010/1 week, 2011; impact crater structure)  
**UC-Davis Field Camp, Owens Valley, CA, US** (3 weeks, 2011/3 weeks, 2012; carbonate strat., structure, mapping, volcanology)  
**Chilko-Chilcotin-Fraser River, BC, Canada** (10 days, 2011; ecogeomorphology)  
**Grand Canyon, AZ, US** (3 weeks, 2012; ecogeomorphology)  
**Semail Ophiolite, Oman/UAE** (3 months total in 2013, 2017–2018; ig/met petrology, geodynamics)  
**Western Gneiss Region, Norway** (1 month, 2013; ig/met petrology, structural geology, tectonics)  
**Myanmar** (1 month, 2014; structural geology, metamorphic petrology, tectonics)  
**UCSB Field Camp, E. Nevada, USA** (3 weeks, 2014; strat., struct. geology, volcanology, tectonics)  
**various metamorphic core complexes, western US** (1 week, 2014; volcanology, met. petrology, structure, tectonics)  
**Bohemian Massif, Austria/Czech Republic** (2 weeks, 2017; metamorphic petrology, tectonics)  
**Western Alps, France/Italy** (3.5 weeks total in 2017–2019; metamorphic petrology, tectonics, geochemistry)  
**Schistes Lustrés, Corsica, France** (2.5 weeks total in 2017–2018; metamorphic petrology, geochemistry, tectonics)  
**Ivrea-Verbano Zone, Italy** (4 weeks total in 2018-19; ig/met petrology, geochemistry, tectonics)  
**Central Alps, Switzerland/Italy** (3 days, 2019; tectonics, metamorphic petrology, geochemistry)  
**Syros, Greece** (1 week, 2019; metamorphic petrology, geochemistry, tectonics)  
**Trois Seigneurs Massif, French Pyrenees** (1 week, 2019; metamorphic petrology, geochemistry, tectonics)  
+ numerous other single- to multi-day field trips around US and internationally