**Dr. Joshua M. Garber**

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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: A. Smye, M. Feineman; 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

06/2020 – 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 (+44 first- or co-authored conference abstracts)

Wyatt, D.M., Smye, A.J., **Garber, J.M.**, and Hacker, B.R. (202x) Assembly and tectonic evolution of continental lower crust: Monazite petrochronology of the Ivrea-Verbano Zone (Val Strona di Omegna), *in review at Tectonics*

**Garber, J.M.**, Rioux, M., Searle, M.P., Kylander-Clark, A.R.C., Hacker, B.R., Vervoort, J.D., and Warren, C. (202x) Dating continental subduction beneath the Samail Ophiolite: garnet, zircon, and rutile petrochronology of the As Sifah eclogites, NE Oman, *in prep*

**Garber, J.M.,** Holder, R.H., Smye, A.J., Reimink, J.R., and Feineman, M.D. (202x) The time-resolved compositional trajectory of igneous rocks and the punctuated continuum of plate tectonics, *in prep*

17. Rioux, M., **Garber, J.M.**, Searle, M.P., Kelemen, P., Miyashita, S., Adachi, Y., and 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.**, and 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., and 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., and 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., and 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.**, …, and 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., and 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., and 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., and 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.**, and 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., and 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 paper published in G-cubed***]

6. **Garber, J.M.,** Hacker, B.R., Kylander-Clark, A.R.C., Stearns, M., and 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., and 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., and 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.**, and 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., and 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.,** …, and 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. Part of UC Davis Ecogeomorphology Field Guide to the Grand Canyon, available online at [https://watershed.ucdavis.edu/education/classes/files/content/page/Ch1\_BigHistory.pdf]

Barnes, J., French, R., **Garber, J.**, Poole, W., Smith, P., and 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: Lunar and Planetary Institute, 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., and **Garber, J.M.** (2011), The HED [Howardite-Eucrite-Diogenite] Compendium. Published online at [http://curator.jsc.nasa.gov/antmet/hed/index.cfm]

Research Interests

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

**specifically:** long-term thermochemical 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, ion-exchange chromatography, heating/freezing stage (fluid inclusions), experimental petrology (minor)
* Well-rounded teaching experience – 14 quarters as a TA and 4 quarters as lead instructor
* Excellent scientific communication skills, to both technical and non-technical audiences
* Extensive and diverse field experience, including geological field mapping (at multiple scales), various sampling strategies, stratigraphy/measured sections
* Statistical proficiency in geologic data reduction, processing, and interpretation
* 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

**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

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**)

1st Judges Prize + 1st 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

**2021:** 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

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

**Reviewer**: American Mineralogist, EPSL, European Journal of Mineralogy, Geology, Geoscience Frontiers, Journal of Metamorphic Geology, JGR: Solid Earth, JPet, Lithos, Lithosphere, Springer Nature Applied Sciences (n=19)

**Reviewer**: National Science Foundation EAR (n=1)

**Session Convener**:

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

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

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 Postdoctoral Society (PSPS) Hiking Coordinator (**2018-2019**), Council Member (**2018-**)

Postdoctoral 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 UCD Graduate Student Assembly (**2009-2010**)

UT Senate of College Councils Representative from Jackson School of Geosciences (**2006-2007**)

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*)

**Harpswell 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 2–3 day field trips around US and internationally