

Bradford J. Foley
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Education

2014 Ph. D., Geology and Geophysics, Yale University, New Haven, CT
2011 M. Phil., Geology and Geophysics, Yale University, New Haven, CT
2008 B.S., Geological Sciences, University of Southern California, Los Angeles, CA

Research and Professional Experience

2022-present Associate Professor, Department of Geosciences, Penn State University
2016-2022 Assistant Professor, Department of Geosciences, Penn State University
2014-2016 Postdoctoral Associate, Department of Terrestrial Magnetism, Carnegie Institution for Science
2008-2014 Graduate Student, Department of Geology and Geophysics, Yale University, advisor: David Bercovici
2007-2008 Undergraduate Researcher, University of Southern California, supervised by Thorsten Becker

Research Experience

My research uses theoretical models to study the dynamics of Earth's and other planetary mantles. I focus on the rheological mechanisms that allow for shear localization in the lithosphere, and hence the generation of plate-like mantle convection. I study the long-term evolution of tectonics on Earth, addressing what tectonic processes operated on the early Earth and generated the early crustal record. I also study the possibility of plate tectonics on other planets, and how tectonics influences climate and habitability in our solar system and beyond.

Selected Publications

Choi, H. and Foley, B. J. (2026) Establishment of subduction at early Earth continent margins by migration: Implications for interpreting geochemical observations. *Earth and Planetary Science Letters*, 683(1).

Brenner, A. R., Fu, R. R., Foley, B. J., Lourenço, D. L., Palma-Gomez, J., Gong, Z., Steele, S. C., Li, J., Flannery, D. T., Brown, A. J., Hodgins, E. B. (2026) Paleomagnetic detection of relative plate motions and an infrequently reversing core dynamo at 3.5 Ga, *Science*, 391(6791).

Stone, A. T., Foley, B. J., Tutolo, B. M., and Lau, K. V. (2025). Lithological Controls on Aqueous Phosphorus on Ocean-Covered Exoplanets. *The Planetary Science Journal*, 6(11), 258.

Foley, B. J. (2024). Generation of Archean TTGs via Sluggish Subduction. *Geology*.

Foley, B. J. (2024). Exoplanet Geology: What can we learn from current and future observations? *Reviews in Mineralogy and Geochemistry*, 90(1), 559-594.

Unterborn, C. T., Foley, B. J., Desch, S. J., Young, P. A., Vance, G., Chiffelle, L., & Kane, S. R. (2022). Mantle Degassing Lifetimes through Galactic Time and the Maximum Age Stagnant-lid Rocky Exoplanets Can Support Temperate Climates. *The Astrophysical Journal Letters*, 930(1).

Foley, B. J. (2020), Timescale of Short-Term Subduction Episodicity in Convection Models With Grain Damage: Applications to Archean Tectonics, *J. Geophys. Res. Solid Earth*, 125.

Bauer, A., J. Reimink, T. Chacko, B. J. Foley, S. Shirey, G. Pearson (2020) Hafnium isotopes in zircons document the gradual onset of mobile-lid tectonics, *Geochem. Prosp. Lett.* 14, 1-6

- Foley, B. J. and A. J. Smye (2018), Carbon cycling and habitability of Earth-size stagnant lid planets, *Astrobiology*, 18 (7), 873-896.
- Foley, B. J. and H. Rizo (2017), Long-term preservation of early-formed mantle heterogeneity by mobile lid convection: Importance of grainsize evolution, *Earth Planet. Sci. Lett.*, 475, 94-105.
- Foley, B. J. and P. E. Driscoll (2016), Whole planet coupling between climate, mantle, and core: Implications for rocky planet evolution, *Geochem. Geophys. Geosyst.*, 17, 1885–1914.
- Foley, B. J., D. Bercovici, and W. Landuyt (2012), The conditions for plate tectonics on super-Earths: Inferences from convection models with damage, *Earth Planet. Sci. Lett.*, 331-332, 281-290.

Awards

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| 2021-present | NSF CAREER Award |
| 2017-present | 6 research grants from NSF, NASA, Heising-Simons, RCSA |
| 2024-2025 | Computational Infrastructure for Geodynamics Distinguished Speaker |
| 2024 | Visiting Fellow Commoner of Trinity College, University of Cambridge |
| 2024 | ETH Zurich Department of Earth Sciences, Distinguished Visiting Professor |
| 2021-2023 | Scialog Fellow for workshop “Scialog: Signatures of Life in the Universe” |
| 2013 | Elias Loomis Prize excellence in studies of physics of the Earth, Yale University |
| 2011 | Estwing Hammer Prize outstanding geology graduate student, Yale University |

Professional and University Service and Leadership

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| 2024-present | Director, Planetary Systems Science Center |
| 2021-present | Professor in charge of the Astrobiology Dual Title PhD program |
| 2012-present | Reviewer for numerous journals, and proposals for NASA, NSF, Swiss NSF, German Research Foundation, ERC |
| 2017-present | Member of graduate admissions committee (2017-2018 & 2018-2019); search committee member (2017 & 2019-2020); graduate program committee (2018-2023); executive committee (2019-2020 & 2024-2025) |
| 2021-2023 | Member of Graduate Council Subcommittee on New and Revised Programs and Courses |
| 2020-2021 | Co-chair, graduate admissions committee |
| 2016-present | Session convener for AGU Meeting 2016, 2018, 2019, 2020, 2022, 2026 |
| 2018-2022 | Organizing committee member for 2022 CIDER program |

Outreach

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| 2023-present | Summer undergraduate short course on data visualization and modeling |
| 2017-2019 | Activity leader for Penn State Dept. of Geoscience’s “Shake, Rattle, Rocks” education outreach event |
| 2016 | Judge for Washington DC Middle and High School STEM fair |

Media Appearances or Coverage

- Interviewed for articles in BBC News (2016), Sky & Telescope Magazine (2017), Scientific American (2017), Quanta Magazine (2018)
- Media coverage of research papers: “Becoming Habitable in the Habitable Zone” EOS, 2016 (Based on Foley & Driscoll, 2016); “How to make a planet habitable” Geolog, EGU blogs, 2018 & “Plate Tectonics not needed to sustain life” Penn State News, 2018 (both based on Foley & Smye, 2018)