Stanford

Ayla Pamukcu

Assistant Professor of Earth and Planetary Sciences and, by courtesy, of Geophysics

Earth & Planetary Sciences

Bio

BIO

Ayla joined the Earth and Planetary Sciences department as an Assistant Professor in Fall 2019. In 2006, she received her B.S. in Geophysical Sciences and a minor in Near Eastern Languages and Civilizations at the University of Chicago. She then spent a year in Turkey as a Fulbright Scholar studying geoarchaeology and then as a research assistant continuing her undergraduate research on supereruptions at the University of Chicago. From 2008-2014, she attended graduate school in the Department of Earth and Environmental Sciences at Vanderbilt University, where she studied the evolution and eruption of supereruptive magmas. She was awarded her M.S. and Ph.D. degrees in 2010 and 2014, respectively. She then held several postdoc positions, expanding her research into new areas as a postdoctoral scholar at Brown University, studying magmas using high-temperature and high-pressure experiments, as a Harry Hess Postdoctoral Fellow at Princeton University, studying links between extrusive and intrusive magmas using zircon geochronology, and as a postdoctoral investigator at the Woods Hole Oceanograhic Institution, studying ascent rates of Antarctic basanites using diffusive water loss from olivine-hosted melt inclusions.

ACADEMIC APPOINTMENTS

- Assistant Professor, Earth & Planetary Sciences
- Assistant Professor (By courtesy), Geophysics

HONORS AND AWARDS

- Harry Hess Postdoctoral Fellowship, Princeton University (2015-2017)
- Teaching Certificate, Vanderbilt University Center for Teaching (2010)
- Teaching-As-Research (TAR) Fellowship, Vanderbilt University Center for Teaching (2009)
- Fulbright Scholar (Turkey), Fulbright (2006)
- REU, American Museum of Natural History (2005)
- Foreign Language Acquisition Grant, University of Chicago (2004)

PROFESSIONAL EDUCATION

- Ph.D., Vanderbilt University , Environmental Engineering (Earth and Environmental Sciences option) (2014)
- M.S., Vanderbilt University , Earth and Environmental Sciences (2010)
- B.S., University of Chicago , Geophysical Sciences (2006)
- Minor, University of Chicago , Near Eastern Languages and Civilizations (2006)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

I have long been fascinated by magmas and volcanic eruptions, for reasons ranging from purely academic (trying to understand the magmatic construction of Earth's crust) to purely practical (developing effective monitoring and mitigation strategies for volcanic eruptions). Consequently, my research revolves around understanding how, when, where, and why magmas are stored, evolve, and ultimately do (or do not!) erupt.

Within this context, I focus on two main themes: (1) the temporal, chemical, and physical, evolution of magmas, and (2) the interplay between magma storage conditions in the crust and magmatic processes. I employ a multi-faceted approach to explore these topics, integrating data from multiple scales and perspectives; my studies capitalize on information contained in field relations, crystal and melt inclusion textures (sizes, shapes, positions), crystal and volcanic glass geochemistry, geochronology, phase-equilibria and numerical modeling, and experiments. As a function of this approach, I am also engaged in the development of novel methods to address petrologic problems in new, better, and more refined ways than is currently possible.

A major focus of my research has been on supereruptions – gigantic explosive eruptions the likes of which we have never seen in recorded human history – but I am continually exploring other kinds of magmatic systems. I am currently particularly interested in the links (or lack thereof) between extrusive (i.e., erupted) and intrusive (i.e., unerupted) magmas, similarities/differences between large- and small-volume eruptions, and similarities/differences between magmas generated at different levels of the crust. I have also had a longstanding interest in the interactions and relationships between humans and their geologic surroundings (particularly volcanoes).

Teaching

COURSES

2026-27

- Chemistry of the Earth and Planets: EARTHSYS 2, EPS 2 (Aut)
- Departmental Seminar in Earth & Planetary Sciences: EPS 290 (Win)
- Magmatic and Eruptive Processes: EPS 180, EPS 280 (Aut)
- Physical Volcanology: GEOPHYS 385R (Aut, Win, Spr)

2025-26

- Chemistry of the Earth and Planets: EARTHSYS 2, EPS 2 (Aut)
- Departmental Seminar in Earth & Planetary Sciences: EPS 290 (Win)
- Geochemical Instrumentation and Analysis: so you've collected a sample, now what?: EPS 131, EPS 231 (Aut)
- Physical Volcanology: GEOPHYS 385R (Aut, Win, Spr)

2024-25

- Chemistry of the Earth and Planets: EARTHSYS 2, EPS 2 (Aut)
- Departmental Seminar in Earth & Planetary Sciences: EPS 290 (Win)
- Magmatic and Eruptive Processes: EPS 180, EPS 280 (Aut)
- Physical Volcanology: GEOPHYS 385R (Aut, Win, Spr, Sum)

2023-24

- Chemistry of the Earth and Planets: EARTHSYS 2, EPS 2 (Aut)
- Departmental Seminar in Earth & Planetary Sciences: EPS 290 (Win)

- Geochemical Instrumentation and Analysis: so you've collected a sample, now what?: EPS 131, EPS 231 (Aut)
- Physical Volcanology: GEOPHYS 385R (Aut, Win, Spr)

STANFORD ADVISEES

Caroline Dee

Doctoral Dissertation Advisor (AC)

Anna Ruefer

Doctoral (Program)

Keiji Hammond, Anna Ruefer

Publications

PUBLICATIONS

- **PICTURE-PERFECT PETROGRAPHY II: AFFORDABLE, AUTOMATED THIN-SECTION SCANNING** *CANADIAN JOURNAL OF MINERALOGY AND PETROLOGY*
  Lleung, D. D. V., Ruefer, A. C., Mcdonald, A. M., Pamukcu, A. S.
  2026; 64 (4): 297-304
- **Hydrogen isotope fractionation in olivine-hosted melt inclusions during passive degassing, CO₂ flushing, and magma ascent** *CONTRIBUTIONS TO MINERALOGY AND PETROLOGY*
  Pamukcu, A. S., Gaetani, G. A.
  2026; 181 (5)
- **Reliability of quartz-hosted melt inclusions and discrete rhyolite reservoirs revealed by H isotopes, trace elements, and volatiles.** *Science advances*
  Hickernell, S. M., Pamukçu, A. S., Monteleone, B. D.
  2026; 12 (11): eadw1667
- **Geology constrains the diffusivity of Ti in quartz and crystallization timescales of high-silica magmas in the Searchlight Magmatic System (NV, USA)** *EARTH AND PLANETARY SCIENCE LETTERS*
  Pamukcu, A. S., Hickernell, S. M., Eddy, M. P., Schoene, B., Steiner-Leach, T.
  2025; 666
- **Experimental investigation of hydrogen isotope fractionation during hydration of olivine-hosted melt inclusions: Implications for D/H in Baffin Island picrites** *EARTH AND PLANETARY SCIENCE LETTERS*
  Zhang, Y., Gaetani, G., Pamukcu, A., Monteleone, B., Saper, L.
  2024; 647
- **Deciphering Clues Regarding Magma Composition Encoded in Quartz-Hosted Embayments and Melt Inclusions Through Direct Numerical Simulations** *JOURNAL OF GEOPHYSICAL RESEARCH-SOLID EARTH*
  Wei, Z., Ruefer, A. C., Pamukcu, A. S., Suckale, J.
  2024; 129 (4)
- **Extensive H2O degassing in deeply erupted submarine glasses inferred from Samoan melt inclusions: The EM2 mantle source is damp, not dry** *CHEMICAL GEOLOGY*
  Anderson, O. E., Jackson, M. G., Pamukcu, A. S., Rose-Koga, E. F., Le Roux, V., Klein, F., Koga, K. T., Gaetani, G. A., Price, A. A.
  2024; 651
- **Laser heating effect on Raman analysis of CO₂ co-existing as liquid and vapor in olivine-hosted melt inclusion bubbles** *VOLCANICA*
  DeVitre, C. L., Dayton, K., Gazel, E., Pamukcu, A., Gaetani, G., Wieser, P. E.
  2023; 6 (2): 201-219
- **Volcano-pluton connections at the Lake City magmatic center (Colorado, USA)** *GEOSPHERE*
  Pamukcu, A. S., Schoene, B., Deering, C. D., Keller, C., Eddy, M. P.

2022

- **Constraints on the timescales and processes that led to high-SiO2 rhyolite production in the Searchlight pluton, Nevada, USA** *GEOSPHERE*
  Eddy, M. P., Pamukcu, A., Schoene, B., Steinerleach, T., Bell, E. A.
  2022; 18 (3): 1000-1019

- **Rhyolite-MELTS and the storage and extraction of large-volume crystal-poor rhyolitic melts at the Taupo Volcanic Center: a reply to Wilson et al. (2021)** *CONTRIBUTIONS TO MINERALOGY AND PETROLOGY*
  Pamukcu, A. S., Gualda, G. A. R., Gravley, D. M.
  2021; 176 (10)

- **New Ti-in-quartz diffusivities reconcile natural Ti zoning with time scales and temperatures of upper crustal magma reservoirs** *GEOLOGY*
  Gualda, G. A. R., Pamukcu, A. S.
  2020; 48 (12): E513

- **Memorial to Alfred T. Anderson** *JOURNAL OF GEOLOGY*
  Rowley, D. B., Gualda, G., Pamukcu, A., Wallace, P.
  2020; 128 (4): 319–23

- **Magma residence and eruption at the Taupo Volcanic Center (Taupo Volcanic Zone, New Zealand): insights from rhyolite-MELTS geobarometry, diffusion chronometry, and crystal textures** *CONTRIBUTIONS TO MINERALOGY AND PETROLOGY*
  Pamukcu, A. S., Wright, K. A., Gualda, G. A. R., Gravley, D.
  2020; 175 (5)

- **Rhyolite-MELTS vs. DERP – Newer Does Not Make it Better: a Comment on "The Effect of Anorthite Content and Water on Quartz–Feldspar Cotectic Compositions in the Rhyolitic System and Implications for Geobarometry" by Wilke et al. (2017; Journal of Petrology, 58, No. 4, 789–818)** *JOURNAL OF PETROLOGY*
  Gualda, G. R., Begue, F., Pamukcu, A. S., Ghiorso, M. S.
  2019

- **Climbing the crustal ladder: Magma storage-depth evolution during a volcanic flare-up** *SCIENCE ADVANCES*
  Gualda, G. A. R., Grayley, D. M., Connor, M., Hollmann, B., Pamukcu, A. S., Begue, F., Ghiorso, M. S., Deering, C. D.
  2018; 4 (10): eaap7567

- **High-Ti, bright-CL rims in volcanic quartz: a result of very rapid growth** *CONTRIBUTIONS TO MINERALOGY AND PETROLOGY*
  Pamukcu, A. S., Ghiorso, M. S., Gualda, G. A. R.
  2016; 171 (12)

- **Melt inclusion shapes: Timekeepers of short-lived giant magma bodies** *GEOLOGY*
  Pamukcu, A. S., Gualda, G. A. R., Begue, F., Gravley, D. M.
  2015; 43 (11): 947–50

- **Phase-equilibrium geobarometers for silicic rocks based on rhyolite-MELTS-Part 3: Application to the Peach Spring Tuff (Arizona-California-Nevada, USA)** *CONTRIBUTIONS TO MINERALOGY AND PETROLOGY*
  Pamukcu, A. S., Gualda, G. A. R., Ghiorso, M. S., Miller, C. F., McCracken, R. G.
  2015; 169 (3)

- **Phase-equilibrium geobarometers for silicic rocks based on rhyolite-MELTS. Part 2: application to Taupo Volcanic Zone rhyolites** *CONTRIBUTIONS TO MINERALOGY AND PETROLOGY*
  Begue, F., Gualda, G. A. R., Ghiorso, M. S., Pamukcu, A. S., Kennedy, B. M., Gravley, D. M., Deering, C. D., Chambefort, I.
  2014; 168 (5)

- **Quantitative 3D petrography using X-ray tomography 4: Assessing glass inclusion textures with propagation phase-contrast tomography** *GEOSPHERE*
  Pamukcu, A. S., Gualda, G. A. R., Rivers, M. L.
  2013; 9 (6): 1704–13

- **The Evolution of the Peach Spring Giant Magma Body: Evidence from Accessory Mineral Textures and Compositions, Bulk Pumice and Glass Geochemistry, and Rhyolite-MELTS Modeling** *JOURNAL OF PETROLOGY*
  Pamukcu, A. S., Carley, T. L., Gualda, G. A. R., Miller, C. F., Ferguson, C. A.

2013; 54 (6): 1109–48

- **Timescales of Quartz Crystallization and the Longevity of the Bishop Giant Magma Body** *PLOS ONE*
  Gualda, G. A. R., Pamukcu, A. S., Ghiorso, M. S., Anderson, A. T., Sutton, S. R., Rivers, M. L.
  2012; 7 (5): e37492
- **Crystallization Stages of the Bishop Tuff Magma Body Recorded in Crystal Textures in Pumice Clasts** *JOURNAL OF PETROLOGY*
  Pamukcu, A. S., Gualda, G. A. R., Anderson, A. T.
  2012; 53 (3): 589–609
- **Quantitative 3D petrography using X-ray tomography 2: Combining information at various resolutions** *GEOSPHERE*
  Pamukcu, A. S., Gualda, G. A. R.
  2010; 6 (6): 775–81
- **Quantitative 3D petrography using X-ray tomography 3: Documenting accessory phases with differential absorption tomography** *GEOSPHERE*
  Gualda, G. A. R., Pamukcu, A. S., Claiborne, L. L., Rivers, M. L.
  2010; 6 (6): 782–92