

RITA PARAI

Department of Earth and Planetary Sciences
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EDUCATION

Ph.D., Earth and Planetary Sciences, Harvard University, Cambridge, MA, May 2014
Volatiles in the Earth and Moon: Constraints on planetary formation and evolution
Advisors: Sujoy Mukhopadhyay and Stein B. Jacobsen
A.M., Earth and Planetary Sciences, Harvard University, Cambridge, MA, March 2012
A.B., cum laude in Earth and Planetary Sciences, Harvard University, Cambridge, MA,
May 2007

PROFESSIONAL EXPERIENCE

Assistant Professor, Washington University in St. Louis, St. Louis, MO, 2016 – present
Carnegie Post-doctoral Fellow, Department of Terrestrial Magnetism, Carnegie
Institution for Science, Washington, D.C., 2014 – 2016
Post-doctoral Fellow, Harvard University, Cambridge, MA, 2014
Graduate Student Fellow, Harvard University, Cambridge, MA, 2008 – 2014

RESEARCH INTERESTS

Origin of volatiles in terrestrial planets; early Earth environments; timing and mechanism of lunar formation; origin and evolution of Earth's atmosphere; chemical cycling between deep Earth and surface reservoirs; nature of mantle heterogeneities; chemical constraints on geodynamics; core-mantle interaction. Numerical modeling techniques; laboratory measurements by thermal ionization and inductively-coupled plasma mass spectrometry; development of next-generation high-precision multi-collector noble gas mass spectrometry techniques for terrestrial and planetary materials.

AWARDS AND HONORS

Carnegie Post-doctoral Fellowship, 2014-2016
NSF Graduate Research Fellowship, 2009-2013
Harvard University Graduate Merit Fellowship, 2013
Stephen E. Dworkin Planetary Geoscience Student Paper Award, Geological Society of America, 2013
AGU Volcanology, Geochemistry, Petrology Outstanding Student Paper Award (Oral Presentation), 2010
Shaler Teaching Award, Harvard Department of Earth and Planetary Sciences, 2010
Harvard University Certificate of Distinction in Teaching, 2009, 2010
National Merit Scholarship Winner, 2003
Robert C. Byrd Honors Scholarship, 2003

PROFESSIONAL MEMBERSHIPS

American Geophysical Union; Geochemical Society

PUBLICATIONS – IN PROGRESS

1. R. Parai (**in prep**). Accretion of a volatile-poor plume mantle from noble gas isotopes (to be submitted to *Nature*)
2. J. Rodriguez, S. J. Turner, M. Barickman, D.A. Fike, C. Jones, R. Parai (**in prep**). Boron isotopic variations in mid-ocean ridge basalts. (to be submitted to *Geochem. Perspect. Lett.*)
3. M. Barickman, S. J. Turner, J. Rodriguez, D.A. Fike, C. Jones, R. Parai (**in prep**). Boron isotopic constraints on slab contributions to mantle sources of Nicaraguan volcanics. (to be submitted to *Geochem. Geophys. Geosys.*)
4. R. Parai, S. Mukhopadhyay (**in revision**). Noble gas signatures of the North Atlantic Popping Rock: Implications for upper mantle heterogeneity. *Geochim. Cosmochim. Acta.*
5. S. J. Lock, K.R. Bermingham, R. Parai, and M. Boyet (**in revision**). Geochemical constraints on the origin of the Moon and preservation of ancient terrestrial heterogeneities. *Space Science Reviews.*

PUBLICATIONS

6. R. Parai, **2020**. Primordial nitrogen variations in the mantle (News & Views). *Nature* 580, 324-325.
7. R. Parai, S. Mukhopadhyay, J.M. Tucker, M.K. Peto, **2019**. The emerging portrait of an ancient, heterogeneous and continuously evolving mantle plume source. *Lithos* 346-347, 105153.
8. S. Mukhopadhyay and R. Parai, **2019**. Noble Gases: A record of Earth's Evolution and Mantle Dynamics. *Ann. Rev. Earth Planet. Sci.* (47) 389-419.
9. R. Parai and S. Mukhopadhyay, **2018**. Xenon isotopic constraints on the history of volatile recycling. *Nature* 560 (7717): 223-227.
10. R. Parai and S. Mukhopadhyay, **2015**. The evolution of MORB and plume mantle volatile budgets: Constraints from fission Xe isotopes in Southwest Indian Ridge basalts. *Geochem. Geophys. Geosys.*, 16, 719-735.
11. R. Parai, S. Mukhopadhyay and J.J. Standish, **2012**. Heterogeneous upper mantle Ne, Ar and Xe isotopic compositions and a possible Dupal noble gas signature recorded in basalts from the Southwest Indian Ridge. *Earth Planet. Sci. Lett.*, 359-360, 227-239.
12. R. Parai, S. Mukhopadhyay, **2012**. How large is the subducted water flux? New constraints on mantle regassing rates. *Earth Planet. Sci. Lett.*, 317-318, 396-406.
13. R. Parai, S. Mukhopadhyay, J.C. Lassiter, **2009**. New constraints on the HIMU mantle from neon and helium isotopic compositions of basalts from the Cook-Austral Islands. *Earth Planet. Sci. Lett.* 277, 253-261.
14. S.P. Patel, R. Parai, R. Parai, D.L. Campbell, **2004**. Regulation of Kv4.3 voltage-dependent gating kinetics by KChIP2 isoforms. *J. Physiol.* 557, 19-41.

INVITED TALKS AND SEMINARS

- 2019 American Geophysical Union Fall Meeting
- 2019 Les Treilles, Seminar: Planetary Atmospheres
- 2019 University of Chicago, Department Colloquium
- 2019 Yale University, Department Colloquium
- 2019 UCLA, Department Colloquium

- 2018 American Geophysical Union Fall Meeting
- 2018 ISSI Workshop, Early Solar System, Bern, Switzerland
- 2018 Northwestern University, Department Colloquium
- 2018 Cooperative Institute for Dynamic Earth Research, Lecturer
- 2017 American Geophysical Union Fall Meeting
- 2017 V. M. Goldschmidt Conference
- 2017 Gordon Research Conference: Interior of the Earth
- 2017 McGill University, Department Colloquium
- 2016 American Geophysical Union Fall Meeting
- 2016 V. M. Goldschmidt Conference
- 2016 Johns Hopkins University, Department Colloquium
- 2015 American Geophysical Union Fall Meeting
- 2015 Brown University, Department Colloquium
- 2015 Princeton University, Solid Earth Seminar
- 2015 Washington University in St. Louis, Department Colloquium
- 2015 University of Maryland, Department Colloquium
- 2014 MIT, Chemical Oceanography and Biogeochemistry Seminar
- 2013 American Geophysical Union Fall Meeting
- 2013 Brown University, Lunch Bunch Seminar
- 2012 Boston University, Solid Earth Seminar
- 2012 V. M. Goldschmidt Conference

EXTERNAL FUNDING

National Science Foundation, Petrology and Geochemistry (1939080). EAGER:
Collaborative Research: Development and application of Sr stable isotopes as a novel tracer of carbonate through subduction (Submitted June 2019). **Selected for funding**, \$111,276 over 2 years to S. J. Turner and R. Parai (start date September 2019).

Department of Energy, National Nuclear Security Administration, (SSAA) FOA DE-FOA-0001831. Seeing through the fission: Multi-modal analyses of actinides and noble gas isotopes in geological samples (submitted March 2018). **Selected for funding**, \$750,000 over 3 years to R. Parai and D. Fike (start date April 2019).

ACADEMIC SERVICE

Reviewer for Science, Nature, Proceedings of the National Academy of Sciences, Earth and Planetary Science Letters, Geochemistry Geophysics Geosystems, Nature Communications, Geochimica et Cosmochimica Acta, Chemical Geology, Philosophical Transactions of the Royal Society A.

ADVISING

Mattison H. Barickman (PhD advisor)
Savannah M. Rodriguez (Honors Thesis advisor)
Dr. Stephen J. Turner (Postdoctoral advisor)
Dr. David Bekaert (Dissertation Committee)
Dr. Josiah Lewis (Dissertation Committee)

FIELD EXPERIENCE

Shipboard Scientist aboard *R/V Knorr*, 2012

Dredging, core sampling and geophysical investigation of the Mid-Atlantic Ridge between the Kane and Atlantis Fracture Zones

São Miguel, Azores, 2012

Collection of basalt samples to investigate chemical zoning of the Azores plume

Iceland, 2010

Collection of subglacially-erupted olivine-phyric basalt glass samples to investigate host phase of primordial noble gas signatures

SELECTED CONFERENCE PROCEEDINGS

- R. Parai. Injection of Atmospheric Xenon into the Deep Earth. Les Treilles Seminar: Origins and evolutions of planetary atmospheres: Venus, Earth, Mars (invited talk).
- R. Parai. Noble gas constraints on Earth formation and early evolution including magma oceans. ISSI Workshop: Reading Terrestrial Planet Evolution in Isotopes and Element Measurements (invited talk).
- R. Parai and S. Mukhopadhyay. Terrestrial upper mantle I-Pu-Xe and the age of the Moon. V.M. Goldschmidt Conference 2017 (invited talk).
- R. Parai. Ancient and relatively modern mantle heterogeneities from xenon isotopes in mantle rocks. Gordon Research Conference: Interior of the Earth 2017 (invited talk).
- R. Parai and S. Mukhopadhyay. Xenon isotopic constraints on deep volatile cycling over Earth history. AGU Fall Meeting 2016 (invited talk).
- R. Parai and C. R. M. Jackson. Recycled and primordial noble gas components in the upper mantle. V. M. Goldschmidt Conference 2016 (invited talk).
- R. Parai and S. Mukhopadhyay. Xenon isotopic constraints on the timing of atmospheric volatile recycling. AGU Fall Meeting 2015 (invited talk).
- R. Parai and S. Mukhopadhyay. Constraints on the timing of the Moon-forming giant impact from MORB Xe isotopes. AGU Fall Meeting 2014 (talk).
- S. Mukhopadhyay, S.T. Stewart, S.J. Lock, R. Parai, J.M. Tucker. Late Impacts and the Origins of the Atmospheres on the Terrestrial Planets. AGU Fall Meeting 2014.
- R. Parai, M.K. Petó, J.M. Tucker and S. Mukhopadhyay. The emerging portrait of an ancient, heterogeneous and continuously evolving plume source. AGU Fall Meeting 2013 (invited talk).
- R. Parai, S.B. Jacobsen and S. Huang. Strontium isotopic constraints on early Solar System Chronology. 44th Lunar and Planetary Science Conference 2013 (poster).
- S. Mukhopadhyay, R. Parai, M.K. Petó, J.M. Tucker. The recycling efficiency of water and noble gases to the mantle. American Geophysical Union, Fall Meeting 2012.
- S. Mukhopadhyay, M.K. Petó, R. Parai (speaker) and J.M. Tucker. Early planetary differentiation and volatile accretion recorded in deep mantle neon and xenon. SEDI 2012 (talk).
- R. Parai and S. Mukhopadhyay. How large is the subducted water flux? New constraints on mantle regassing rates. Goldschmidt Conference 2012 (invited talk).
- R. Parai, S. Huang and S.B. Jacobsen. Precise Determination of Calcium Isotope Variations in Meteoritic and Planetary Materials. Lunar and Planetary Science Conference 2012 (poster).

- R. Parai, S. Mukhopadhyay and J.J. Standish. A Spatial Gradient in Helium, Neon, and Argon Isotopes Along the Southwest Indian Ridge. American Geophysical Union, Fall Meeting 2011 (poster).
- R. Parai and S. Mukhopadhyay. Global Flux Balance in the Terrestrial H₂O Cycle: Reconsidering the Post-Arc Subducted H₂O Flux. American Geophysical Union, Fall Meeting 2010 (talk).