

Patrick A. Rafter

Curriculum Vitae

Assistant Project Scientist
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Twitter: @OceanAndClimate

Podcast: Oceanography Is Fun (first episodes available in March)

EDUCATION / APPOINTMENTS / EMPLOYMENT

- Assistant Project Scientist (a research position). **UC Irvine**, Irvine, CA. Apr 2014-present
- Associate Research Scholar. **Princeton University**, Princeton, NJ. Oct 2013-Mar 2014
- Postdoctoral Research Associate. **Princeton University**, Princeton, NJ. (With Danny Sigman and Gerald Haug) Oct 2009-Sept 2013
- Ph.D. in Oceanography. **Scripps Institution of Oceanography**, La Jolla, CA. (With Chris Charles) Sept 2002-Sept 2009
- Owner. Scientific Coatings House Painting, Wilmington, NC. 2001-2002
- Manager. Quality Painting, Stone Harbor, NJ. Jun 2000-Sept 2002
- B.S. in Environmental Science and B.S. in Marine Environmental Studies **Florida Institute of Technology**, Melbourne, FL. Jun 2000

PUBLICATIONS

- | | |
|-----------|---|
| In Review | Rafter , P.A., J-C. Herguera, J. Carriquiry, E. A. Solomon, and J. R. Southon (In Review at <i>PNAS</i>) Linking seafloor volcanism to rising carbon dioxide after the last ice age. |
| In Review | Smart, S., H. Ren, S.E. Fawcett, R. Schiebel, M. Conte, P.A. Rafter , D. Sigman, G. Haug (In Review) Ground-truthing the planktic foraminifer-bound nitrogen isotope paleo-proxy in the Sargasso Sea. <i>Geochimica et Cosmochimica Acta</i> . |
| 2018 | Lehmann, N., J. Granger, and P. A. Rafter , et al (Accepted) Nitrate Isotope Evidence of the Origin of Subsurface Nitrate in the Western Equatorial Pacific. <i>JGR-Oceans</i> . |
| 2017 | Marconi, D., P.A. Rafter, et al. (2017) Nitrate isotopic gradients in the North Atlantic Ocean and the nitrogen isotopic composition of sinking organic matter. <i>Global Biogeochemical Cycles</i> . |
| 2017 | Rafter , P.A., D.M. Sigman, K.R.M. Mackey (2017) New production requires recycled iron in the eastern equatorial Pacific. <i>Nature Communications</i> . |
| 2017 | Rafter , P.A., S.C. Sanchez, J. Southon and others. (2017) Eastern tropical North Pacific coral radiocarbon reveals North Pacific Gyre Oscillation variability. <i>Quaternary Science Reviews</i> . |
| 2017 | Marconi, D., S. Kopf, P.A. Rafter , and D.M. Sigman (2017) Aerobic respiration along isopycnals leads to overestimation of the isotope effect of denitrification in the ocean water column. <i>Geochimica et Cosmochimica Acta</i> . |

- 2016 **Rafter**, P.A. and D.M. Sigman (2016) The spatial and temporal variation of upper equatorial Pacific nitrate utilization. *Limnology and Oceanography*.
- 2015 Marconi, D., D.M. Sigman, P.A. **Rafter** and others (2015) Nitrate isotope distributions on the US GEOTRACES North Atlantic cross-basin section. *Marine Chemistry*.
- 2014 Fripiat, F., D.M. Sigman, S.E Fawcett, P.A. **Rafter**, and J.L. Tison (2014) Sea Ice nitrogen biogeochemical dynamic from an isotopic perspective. *Global Biogeochemical Cycles*.
- 2013 **Rafter**, P. A., P.J. DiFiore, and D. M. Sigman (2013) Coupled nitrate nitrogen and oxygen isotopes and organic matter remineralization in the Southern and Pacific Oceans. *JGR-Oceans*.
- 2013 DeVries, T., C. Deutsch, P. A. **Rafter**, and F. Primeau (2013), Marine denitrification rates determined from a global 3-dimensional inverse model. *Biogeosciences*.
- 2012 **Rafter**, P.A. and C.D. Charles, (2012) Pleistocene equatorial Pacific dynamics inferred from zonal gradients in nitrogen isotopes. *Paleoceanography*.
- 2012 **Rafter**, P.A., C.D. Charles, D.M. Sigman, G.H. Haug and J. Kaiser, (2012) Subsurface tropical Pacific nitrogen isotopic composition of nitrate: biogeochemical signals and their transport. *Global Biogeochemical Cycles*.
- 2011 **Rafter**, P.A., S.L. Jaccard, E.D. Galbraith, T. Kiefer, and M. Kienast, (2011) The nitrogen cycle in the ocean, past and present: 2nd NICOPP meeting report. *PAGES Newsletter*.

MANUSCRIPTS IN PREPARATION

- **Rafter**, P.A., A. Bagnell, D. Marconi, T. DeVries. A global inventory and analysis of ocean nitrate (ms available; to be submitted to *Progress in Oceanography*).
- Robinson, R. S., P.A. **Rafter**, et al. Contraction of the eastern equatorial Pacific high productivity zone across the Mid-Pleistocene Transition (ms available; to be submitted to *Nature Geoscience*).
- **Rafter**, P.A. and D.M. Sigman. Recycled iron and Southern Ocean nitrate consumption from the last glacial period to today (to be submitted to *Science*).
- **Rafter**, P.A., H. Graven, E. Druffel, J. Carriquiry, J. Southon. Coral radiocarbon points to strong influence of North Pacific Gyre Oscillation on Gulf of California upwelling.
- **Rafter**, P.A. J. Southon, et al. Placing an upper bound on seafloor hydrothermal carbon flux since the last glacial maximum.
- Carriquiry, J. and P.A. **Rafter**. Northeast Pacific denitrification and nitrate consumption since the last glacial maximum.

GRANTS / HONORS / AWARDS / INVITATIONS

- 2018 Grant. National Geographic Society. First radiocarbon measurements of Gulf of California dissolved inorganic carbon (DIC). \$49,000 (pending)
- 2017 Grant. Comer Science and Education Foundation. Searching for enhanced seafloor volcanism and carbon flux during the last deglaciation. \$17,470 (current)
- 2017 Workshop. Memory in the Ocean (NAS-sponsored)
- 2017 Award. AGU Outstanding Reviewer for *GBC* and *GRL* (1 of 4 total awardees)
- 2016 Grant. NSF Marine Geology and Geophysics. Targeted equatorial Pacific foraminifera-bound N isotope measurements: implications for a rare record of nutrient dynamics and the El Niño-Southern Oscillation. \$99,000 (current)

2014 Workshop. Expert Witness Training Academy (NSF-sponsored)
 2013 Workshop. Marine Geoscience Leadership Symposium (NSF-sponsored)
 2011 Workshop. Ocean Leadership Early Career Workshop (NSF-sponsored)
 2006 Fellowship. Ocean Drilling Program-Schlanger Fellowship (NSF-sponsored)
 2004 Fellowship. California Space Institute Fellowship (UC-sponsored)

INVITED PRESENTATIONS

2018 **University of Southern California.** *Iron recycling is critical for new primary production in all nitrate-rich, iron-limited ocean regions*
 2018 **California State University-Bakersfield.** *Was there increased carbon from seafloor volcanism after the last ice age?*
 2018 **UC Santa Barbara.** *Iron recycling is critical for new primary production in all nitrate-rich, iron-limited ocean regions*
 2018 **Oregon State University.** *Iron recycling is critical for new primary production in all nitrate-rich, iron-limited ocean regions*
 2017 **Changelings / Comer Climate Conference.** *A song of Ice and Fire and CO₂: linking seafloor volcanism and CO₂ efflux during the deglaciation*
 2017 **Gordon Chemical Oceanography.** *Iron recycling fuels nitrate consumption, new primary production, and the biological pump in most HNLC regions*
 2017 **Rutgers University.** *A song of Ice and Fire and CO₂: linking seafloor volcanism and CO₂ efflux during the deglaciation*
 2017 **Pomona College.** *A song of Ice and Fire and CO₂: linking seafloor volcanism and CO₂ efflux during the deglaciation*
 2017 **CICESE (Centro de Investigación Científica y Educación Superior de Ensenada)** *A song of Ice and Fire and CO₂: linking seafloor volcanism and CO₂ efflux during the deglaciation*
 2017 **UCSD-Scripps Institution of Oceanography.** *Iron recycling drives New Production in HNLC region.*
 2016 **UC Riverside.** *The future of ENSO from Plio-Pleistocene sediments.*
 2016 **California Institute of Technology.** *Iron recycling drives New Production in HNLC region.*
 2015 **Stanford University.** *How to survive a High Nutrient-Low Chlorophyll region: insight to the internal cycling of iron and nitrogen.*
 2015 **UC Santa Barbara.** *Building a new view of the Plio-Pleistocene tropical climate.*
 2015 **University of Southern California.** *Building a new view of the Plio-Pleistocene tropical climate.*
 2014 **Richard Stockton State University of NJ.** *The past and future of El Niño.*
 2014 **UCSD-Scripps Institution of Oceanography.** *South Pacific respiration and the dual isotopic composition of nitrate*
 2014 **California Institute of Technology.** *3-Myr history of equatorial Pacific upwelling and Permanent El Niño.*
 2014 **UC Irvine.** *3-Myr history of equatorial Pacific upwelling and Permanent El Niño.*
 2014 **Ocean Sciences.** *A 3-Myr history of equatorial Pacific upwelling, Permanent El Niño, and a summary of the session's results.*
 2014 **Columbia University-Lamont Doherty Earth Observatory.** *3-Myr history of equatorial Pacific upwelling and Permanent El Niño.*
 2013 **Yale University.** *3-Myr history of eq. Pacific upwelling and Permanent El Niño.*

- 2013 **Woods Hole Oceanographic Institution.** *South Pacific respiration and the dual isotopic composition of nitrate.*
- 2013 **Goldschmidt Conference.** Florence, Italy. *South Pacific respiration and the dual isotopic composition of nitrate*
- 2013 **Woods Hole Oceanographic Institution.** Nitrate isotopes as a pseudo-sediment trap.
- 2013 **Middle Township High School.** *Science is NOT boring: isotopes and the ice ages.*
- 2013 **UNC-Wilmington.** *Science from the Sea Surface through the Seafloor.*
- 2013 **Coastal Carolina University.** *Science from the Sea Surface through the Seafloor.*
- 2011 **Dalhousie University.** Nitrogen Cycle in the Ocean, Past and Present Workshop.
- 2010 **Rutgers University.** *Tropical reign? A 1.2 million year record of nutrient dynamics in the eastern equatorial Pacific.*
- 2010 **CICESE (Centro de Investigación Científica y Educación Superior de Ensenada)** (Ensenada, Mexico). *A 1.2-Myr record of eastern equatorial Pacific thermocline depth from sediment nitrogen isotopes.*
- 2009 **UCLA.** *New insight to tropical Pacific circulation using isotopic tracers*
- 2008 **University of Southern California.** *Tropical Pacific nutrient dynamics of the past 1-Myr*

TEACHING / MENTOR EXPERIENCE

- 2018 Guest Lecture for J. Ferguson at UCI: “The Ocean and Atmosphere”.
- 2017 Mentor: Alyssa Mariah de la Rosa. Undergraduate research.
- 2017 Mentor: Juan Manuel Troncoso. Undergraduate research.
- 2015-2016 Mentor: Diana Nguyen. Undergraduate research and UCI Senior Thesis.
- 2015-2016 Mentor: Abigail Ambriz. UCI undergraduate research experience.
- 2015-2016 Mentor: Stephanie Silva. UCI undergraduate research experience.
- 2015 Guest Lectures for Kathleen Johnson at UCI: “Introduction to Paleoclimatology”
- 2015 Mentor: Annalysha Lafferty. UCI undergraduate research experience.
- 2015 Mentor: Mina Nada. UCI undergraduate research experience.
- 2015 Mentor: Philip Andre Nazareta. UCI undergraduate research experience.
- 2015 Mentor: Franloie Cruz. UCI undergraduate research experience.
- 2015 Mentor: Ian Kamus. UCI undergraduate research experience.
- 2014-2015 Mentor: Gabriella Lee. Undergraduate research and UCI Senior Thesis.
- 2014-2015 Mentor: Araceli Serrano. UCI undergraduate research experience.
- 2014 Mentor: Rachel Coons. UCI undergraduate research experience.
- 2014 Mentor: Johann Lopez. UCI undergraduate research experience.
- 2012 Guest Lecture for Jorge Sarmiento at Princeton University: “Ocean Biogeochemistry”
- 2012 Mentor: Tyler Tamasi Princeton University, summer internship
- 2012 Mentor: Samantha Csik Northeastern University, summer internship
- 2011 Mentor (w/Daniel Sigman): Lydia Rudnick Princeton University, junior thesis
- 2010 Mentor (w/Daniel Sigman): Jacob Kim Princeton University, summer internship
- 2008 Mentor (w/Lihini Aluwihare): Ulisses Barraza (SD Ocean Discovery Institute)
- 2008 Teaching Assistant for Chris Charles, Intro. Environmental Systems, SIO, UCSD
- 2007 Teaching Assistant, Lihini Aluwihare, CA Coastal Oceanography, SIO, UCSD
- 2007 Teaching Assistant, Chris Charles, Intro. to Environmental Systems, SIO, UCSD
- 2006 Teaching Assistant, Lynne Talley, Intro. to Environmental Systems, SIO, UCSD
- 2005 Teaching Assistant, Gabi Laske, EARTH/SIO 10: Natural Disasters, SIO, UCSD
- 2004 Teaching Assistant, Gabi Laske, EARTH/SIO 10: The Earth, SIO, UCSD
- 2003 Teaching Assistant, Sam Iacobellis, The Atmosphere, SIO, UCSD

RESEARCH FIELD EXPERIENCE (Select)

2013	Project director. Sargasso Sea. CTD, plankton tows, <i>in-situ</i> filtering and more (November BATS cruise). 7 days on <i>RV Atlantic Explorer</i> .
2013	Project director. Sargasso Sea. CTD, plankton tows, <i>in-situ</i> filtering and more (April BATS cruise). 7 days on <i>RV Atlantic Explorer</i> .
2012	Project director. Sargasso Sea. CTD, plankton tows, <i>in-situ</i> filtering and more (November BATS cruise). 5 days on <i>RV Atlantic Explorer</i> .
2012	Project director. Sargasso Sea. CTD, plankton tows, <i>in-situ</i> filtering and more (July BATS cruise). 5 days on <i>RV Atlantic Explorer</i> .
2012	Project director. Sargasso Sea. CTD, plankton tows, <i>in-situ</i> filtering and more (April Bermuda Atlantics Time Series (BATS) cruise). 5 days on <i>RV Atlantic Explorer</i> .
2008	Multi-coring, box-coring, seawater sampling in the Santa Barbara Basin. 5 days on the <i>RV Sproul</i> .
2007	Gravity-coring, dredge recovery, seawater sampling in the Arabian Sea. 21 days on the <i>RV Roger Revelle</i> .
2006	Lake. Lacustrine sediment freeze-coring on Swamp Lake, Yosemite National Park. 4 days remote field-work.
2005	CTD technician, seawater sampling in the eastern tropical Pacific. 40 days on the <i>RV Ka'imimoana</i> .
2002	Sediment pore-water and seawater preparation. 8 days on the <i>RV Atlantis</i> .

TEACHING & INCLUSIVE EXCELLENCE TRAINING

- Improving Student Learning Outcomes Assessment: Diversity, Efficiency, and Effectiveness. Workshop Participant. 2018
- Inclusive Teaching for Non-Native English Speakers and International Students. Workshop Participant. 2017.
- Helping Promote Academic Success for First Generation Undocumented Students. Workshop Participant. 2017.
- UC Irvine First Generation Faculty Initiative. Member. 2017.
- UCSD Center for Teaching Development Training. Participant 2003.

PROFESSIONAL SERVICE

- Chair: Ocean Sciences 2018: *Building biogeochemical bonds: Identifying the influence of macro and micro-nutrient cycling on marine carbon and nitrogen*
- Chair: AGU 2017: *Linking the fluid and solid Earth: The role of terrestrial and submarine volcanism in the Plio-Pleistocene ice ages*
- Chair: Goldschmidt 2016: Goldschmidt Geochemistry: *Marine Biogeochemistry at a Range of Scales: The Global Ocean and Polar Atmosphere-Sea Ice-Ocean Systems*.
- Chair: Ocean Sciences 2016: *Mode and Intermediate Waters: Their Contributions to Physical, Biological, Chemical, and Climate Processes*.
- Session Chair: Goldschmidt 2013 (17c: Changing ocean oxygen: Past, present, future)
- Reviewer: AGU-Geophysical Research Letters (11), AGU-Global Biogeochemical Cycles (9), AGU-Journal of Geophysical Research-Oceans (2), AGU-Paleoceanography (7), Deep Sea Research (2), Earth and Planetary Science Letters (2), EGU-Biogeosciences (2), Limnology and Oceanography (2), Marine Chemistry (2), National Geographic Society (1),

National Research Foundation-South Africa (2), Nature Geoscience (1), NSF OCE-Marine Geology and Geochemistry (7), NSF OCE-Chemical Oceanography (4), NSF-International Ocean Discovery Program (2), Philosophical Transactions of the Royal Society A (1).