

# PATRICK A. RAFTER

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Department of Earth System Science  
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## EDUCATION / APPOINTMENTS

Assistant Professor. University of South Florida College of Marine Science. Dec. 2023-  
Assistant Researcher. UC Irvine. July 2022-December 2023  
Assistant Project Scientist. Keck Carbon Cycle Laboratory, UC Irvine. Apr 2014-July 2022  
Postdoctoral Research Associate & Associate Research Scholar. Princeton University. 2009-2014  
PhD in Oceanography. Scripps Institution of Oceanography. Sept 2002-Sept 2009  
Double BS in Environmental Science + Marine Env. Studies. Florida Inst. of Technology 2000

## PUBLICATIONS (\*student-led publication)

- \*Green, R., M.P. Hain, P.A. Rafter (*In Review*) Deglacial Pulse of Neutralized Carbon from the Pacific Seafloor: Constraints from the Radiocarbon Budget
- Umling, N.E., E. Sikes, P.A. Rafter, N. Goodkin (*IN REVIEW*) Deglacial carbon escape from the northern rim of the Southern Ocean.
- Asencio, M.D., J-C, Herguera, F.G. Romero, P.A. Rafter (*IN REVIEW*) Sediment accumulation rates and carbonate fluxes of deep-sea sediments in the southern Gulf of Mexico. *Marine Geology*.
- Cruz, A.P.S., C. Basak, P.A. Rafter, R.D.C. Portilho-Ramos, A.E. Rathburn, C.F. Barbosa. (*IN REVIEW*) Neodymium Isotope Response to Hydrologic and Water Masses Changes in the Tropical-Subtropical Western Atlantic During the Last 40-kyr. *Earth and Planetary Science Letters*
32. Prabhakar, M., K. Thirumalai, T.M. Cronin, L. Gemery, E.K. Thomas, P.A. Rafter (2023) Morphotypical and geochemical variations of planktic foraminiferal species in Siberian and central Arctic Ocean core tops. *Journal of Foraminiferal Research*.
31. Seltzer, A.M., D.P. Nicholson, W.M. Smethie, R.L. Tyne, E.L. Roy, R.H.R. Stanley, M. Stute, P.H. Barry, K. McPaul, P.W. Davidson, B.X. Chang, P.A. Rafter, P. Lethaby, R. J. Johnson, S. P. Khatiwala, W. J. Jenkins (2023) Dissolved gases track deep ocean ventilation processes in the deep North Atlantic. *Proceedings of the National Academy of Sciences*. DOI 10.1073/pnas.2217946120.
30. Rafter, P.A., W.R. Gray, S.K.V. Hines, A. Burke, K.M. Costa, J. Gottschalk, M.P. Hain, J.W.B. Rae, J.R. Southon, M.H. Walczak, J. Yu, J.F. Adkins, T. DeVries (2022) Global reorganization of deep-sea circulation and carbon storage after the last ice age. *Science Advances*. DOI: 10.1126/sciadv.abq5434
29. White, M.E., P.A. Rafter, B.M. Stephens, M.R. Mazloff, S.D. Wankel, L.I. Aluwihare. (2022) Stable isotopes of nitrate reveal the effects of ENSO on nitrogen cycling in the surface waters of the southern California Current System. *Limnology & Oceanography*. doi.org/10.1002/lno.12194
28. Fripiat, F., A. Martínez-García, D. Marconi, S.E. Fawcett, S.H. Kopf, V.H. Luu, P.A. Rafter, R. Zhang, D.M. Sigman, G.H. Haug. (2021) Nitrogen isotopic constraints on nutrient transport to the upper ocean. *Nature Geoscience*. doi.org/10.1038/s41561-021-00836-8
27. Horner, T.J. and GEOTRACES–PAGES Biological Productivity Working Group Members. (2021) Bioactive trace metals and their isotopes as paleoproductivity proxies: An assessment using GEOTRACES-era data. *Global Biogeochemical Cycles*.

- doi.org/10.1029/2020GB006814
26. Farmer, J.R., J.E. Hertzberg, D. Cardinal, S. Fietz, K. Hendry, S.L. Jaccard, A. Paytan, P.A. Rafter, H. Ren, C.J. Somes, J.N. Sutton. (2021) Major element isotope tracers associated to past ocean productivity. *Global Biogeochemical Cycles*. doi.org/10.1029/2020GB006775.
  25. Gajurel, A.P., M.S. Hubbard, B. Giri, A.C. Elmore, S. Maka, P.A. Rafter, A.E. Putnam, S. Elvin, A. Tait, P.A. Mayewski. (2021) Climatic and Tectonic Significance of Taboche Lake, Khumbu Region, Nepal. *iScience*. doi.org/10.1016/j.isci.2021.102418
  24. Dai, Y., J. Yu, and P.A. Rafter. (2021) Deglacial ventilation changes in the deep southwest Pacific. *Paleoceanography*. doi.org/10.1029/2020PA004172
  23. Rae, J., W.R. Gray, R.C.J. Wills, I. Eisenman, B. Fitzhugh, M. Fotheringham, E.F.M. Littley, P.A. Rafter, R. Rees-Owen, A. Ridgwell, B. Taylor, A. Burke. (2020) Overturning circulation, nutrient limitation, and warming in the Glacial North Pacific. *Science Advances*. doi.org/10.1126/sciadv.abd1654
  22. Díaz-Asencio, M., J-C. Herguera, P.T. Schwing, R.A. Larson, G.R. Brooks, J. Southon, P.A. Rafter. (2020) Sediment accumulation rates and vertical mixing of deep-sea sediments derived from  $^{14}\text{C}$  and  $^{210}\text{Pb}$  in the southern Gulf of Mexico. *Marine Geology*. doi.org/10.1016/j.margeo.2020.106288
  21. Robinson, R.S., C.A. Jones, R.P. Kelly, A. Love, I. Closset, P.A. Rafter, M. Brzezinski. (2020) A Test of the Diatom-Bound Paleoproxy: Tracing the Isotopic Composition of Nutrient-Nitrogen Into Southern Ocean Particles and Sediments. *Global Biogeochemical Cycles*. doi.org/10.1029/2019GB006508
  20. Saito, M., M.R. McIlvin, D.M. Moran, A.E. Santoro, C.L. Dupont, P.A. Rafter, J.K. Saunders, D. Kaul, C.H. Lamborg, M. Westley, F. Valois, J.B. Waterbury. (2020) Abundant nitrite oxidoreductase metalloenzyme in the mesopelagic metaproteome of Pacific OMZ extremities. *Nature Geoscience*. doi.org/10.1038/s41561-020-0565-6
  19. Rafter, P.A. J.D. Carriquiry, J-C. Herguera, M.P. Hain, E.A. Solomon, J.R. Southon. (2019) Anomalous >2000 year old surface ocean reservoir age as evidence for deglacial geologic carbon release. *Geophysical Research Letters*. doi.org/10.1029/2019GL085102
  18. White, M., P.A. Rafter, B.M. Stephens, S.D. Wankel, L.I. Aluwihare. (2019) Recent increases in water column denitrification in the seasonally suboxic bottom waters of the Santa Barbara Basin. *Geophysical Research Letters*. doi.org/10.1029/2019GL082075
  17. Rafter, P.A., A. Bagnell, D. Marconi, T. DeVries. (2019) Global trends in marine nitrate N isotopes from observations and a neural network-based climatology. *Biogeosciences*. doi.org/10.5194/bg-16-2617-2019
  16. Robinson, R.S., C.A. Jones, R.P. Kelly, P.A. Rafter, J. Etourneau, P. Martinez. (2019) Contraction of the eastern equatorial Pacific high productivity zone across the Mid-Pleistocene Transition. *Geophysical Research Letters*. doi.org/10.1029/2018GL081315
  15. Lund, D.C., F.J. Pavia, E.I. Seeley, S.E. McCart, P.A. Rafter, K.A. Farley, P.D. Asimow, R.F. Anderson. (2019) Hydrothermal scavenging of  $^{230}\text{Th}$  on the Southern East Pacific Rise during the last deglaciation. *Earth and Planetary Sciences Letters*. doi.org/10.1016/j.epsl.2018.12.037
  14. Smart, S., R. Haojia, S.E. Fawcett, R. Schiebel, M. Conte, P.A. Rafter, K.K. Ellis, M.A. Weigand, S. Oleynik, G.H. Haug, D. Sigman. (2018) Ground-truthing the planktic foraminifer-bound nitrogen isotope paleo-proxy in the Sargasso Sea. *Geochimica et Cosmochimica Acta*. doi.org/10.1016/j.gca.2018.05.023
  13. Rafter, P.A., J-C. Herguera, J. R. Southon. (2018) Extreme deglacial  $^{14}\text{C}$  depletion observed in epifaunal and infaunal benthic foraminifera. *Climate of the Past*. doi.org/10.5194/cp-14-1977-2018.
  12. Lehmann, N., J. Granger, M. Kienast, K.S. Brown, P.A. Rafter, G. Martínez-Méndez, M. Mohtadi. (2018) Isotopic evidence for the evolution of subsurface nitrate in the Western Equatorial Pacific. *JGR-Oceans*. doi.org/10.1002/2017JC013527

11. Rafter, P.A., D.M. Sigman, K.R.M. Mackey. (2017) New production requires recycled iron in the eastern equatorial Pacific. *Nature Communications*. doi.org/10.1038/s41467-017-01219-7
10. Rafter, P.A., S.C. Sanchez, J. Ferguson, J.D. Carriquiry, E.R.M. Druffel, J.A. Villaescusa, J. Southon. (2017) Eastern tropical North Pacific coral radiocarbon reveals North Pacific Gyre Oscillation variability. *Quaternary Science Reviews*. doi.org/10.1016/j.quascirev.2017.02.002
09. Marconi, D., D.M. Sigman, K.L. Casciotti, E.C. Campbell, M.A. Weigand, S.E. Fawcett, A.N. Knapp, P.A. Rafter, B.B. Ward, G.H. Haug. (2017) Tropical Dominance of N<sub>2</sub> Fixation in the North Atlantic Ocean. *Global Biogeochemical Cycles*. doi.org/10.1002/2016GB005613
08. 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. *Geochimica et Cosmochimica Acta*. doi.org/10.1016/j.gca.2016.10.012
07. Rafter, P.A. and D.M. Sigman. (2016) The spatial and temporal variation of upper equatorial Pacific nitrate utilization. *Limnology and Oceanography*. doi.org/10.1002/lno.10152
06. Marconi, D., M.A. Weigand, P.A. Rafter, M.R. McIlvin, M. Forbes, K.L. Casciotti, D.M. Sigman. (2015) Nitrate isotope distributions on the US GEOTRACES North Atlantic cross-basin section. *Marine Chemistry*. doi.org/10.1016/j.marchem.2015.06.007
05. Fripiat, F., D.M. Sigman, S.E. Fawcett, P.A. Rafter, M.A. Weigand, J.L. Tison. (2014) Sea Ice nitrogen biogeochemical dynamic from an isotopic perspective. *Global Biogeochemical Cycles*. doi:10.1002/2013GB004729
04. 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*. doi.org/10.1002/jgrc.20316
03. DeVries, T., C. Deutsch, P.A. Rafter, and F. Primeau. (2013) Marine denitrification rates determined from a global 3-dimensional inverse model. *Biogeosciences*. doi.org/10.5194/bg-10-2481-2013
02. Rafter, P.A. and C.D. Charles. (2012) Pleistocene equatorial Pacific dynamics inferred from zonal gradients in nitrogen isotopes. *Paleoceanography*. doi.org/10.1029/2012PA002367
01. Rafter, P.A., C.D. Charles, D.M. Sigman, J. Kaiser, G.H. Haug. (2012) Subsurface tropical Pacific nitrogen isotopic composition of nitrate: biogeochemical signals and their transport. *Global Biogeochemical Cycles*. doi.org/10.1029/2010GB003979
00. Rafter, P.A., S.L. Jaccard, E.D. Galbraith, T. Kiefer, and M. Kienast. (2011) The nitrogen cycle in the ocean, past and present: 2<sup>nd</sup> NICOPP meeting report. *PAGES Newsletter*. doi.org/10.22498/pages.20.1.48

#### MANUSCRIPTS IN PREPARATION AND AVAILABLE UPON REQUEST

- Rafter, P.A., N.A. Wiseman, A. Martiny, and J.K. Moore. Flexible nutrition and upper ocean retention drives global marine nutrient limitation patterns and the biological pump. (available upon request)
- Rafter, P.A. et al. An eastern equatorial Pacific nutrient tongue during the warm Pliocene (available upon request)

#### GRANTS/FELLOWSHIPS: \$1,289,978 total

- NSF P4Climate. Collaborative Research: Characterizing Northern Hemisphere Atmospheric Variability from Central American Wind Gap-Induced Upwelling. \$490,996. **Rafter Lead PI. 2023-CURRENT.**
- Ocean Carbon Biogeochemistry (OCB) Program. Funding for Workshop and Working Group on identifying key knowledge gaps in “Measurement, Reporting, and Verification” of marine carbon dioxide removal. \$67,356. **Rafter Co-PI. CURRENT.**

Ocean Memory Seed Grant (Art / Science Collaboration). An analog analysis of the ocean and climate: Exploring Ocean Memory and the materiality of historic data. \$10,000. **Rafter Lead PI.** 2020.

NSF MG&G 20132340. Collaborative Research with Mathis Hain (UCSC). *Uncovering marine carbon chemistry dynamics during the deglaciation with boron isotopes and radiocarbon.* \$222,510. **Rafter Lead PI.** 2020-**CURRENT.**

NSF OCE 2015647 *Eastern Pacific carbon chemistry after the ice age: gaining insight to a persistent mystery* \$326,148. **Rafter Lead PI.** 2019-**CURRENT.**

UCI Undergraduate Research Opportunities Program with Ryan Owings \$400. 2020. Current.

UCI Undergraduate Research Opportunities Program with Megan Ngo \$400. 2020. Current.

UCI Undergraduate Research Opportunities Program with Alan Yue \$400. 2020. Current.

UCI Undergraduate Research Opportunities Program with Jazmin Sanchez. \$500. 2019.

UC-MEXUS. Is the Gulf of California a source of the greenhouse gas carbon dioxide to the atmosphere? \$1,000. 2018. **CURRENT.**

GEOTRACES / PAGES. Trace element and isotope proxies in paleoceanography: \$3,000. 2018.

NSF MG&G Research Experience for Undergrads. **Rafter Lead PI.** \$15,000. 2018.

UCI UNDERGRADUATE RESEARCH OPPORTUNITIES PROGRAM with Chassidy Manlapid and Matthew Chan. \$500. 2018.

NSF OCE-16-36005. Analytical and modeling training program for paleo-pCO<sub>2</sub> reconstructions. \$1,500. 2018.

COMER Science and Education Foundation. Searching for enhanced seafloor volcanism and carbon flux during the last deglaciation. \$14,000. **Rafter Lead PI.** 2017.

NSF MG&G (1635610). Targeted equatorial Pacific foraminifera-bound N isotope measurements: implications for a rare record of nutrient dynamics and the El Niño-Southern Oscillation. \$99,000. **Rafter Lead PI.** 2016-2019.

UCI Undergraduate Research Opportunities Program with Diana Nguyen. \$468. 2016.

UCI Undergraduate Research Opportunities Program with Gabrielle Lee. \$500. 2015.

UCI Undergraduate Research Opportunities Program with Johann Lopez. \$1,200. 2015.

Ocean Drilling Program Schlanger Fellowship (NSF-sponsored). \$30,000. 2005.

California Space Institute Fellowship (UC-sponsored). \$5,000. 2004.

#### **PENDING GRANTS (Total: \$2,246,861)**

California Climate Action Grant. Mitigating Severe Floods for Underserved Communities: A Natural or Social Disaster? Rafter Co-PI (\$1,846,421).

NSF EAR: Equipment Upgrade: Continued support for carbon and nitrogen elemental and stable isotope analyses at UC Irvine's KCCAMS User Facility. **Rafter Lead PI** (\$400,440)

#### **UNFUNDED (BUT STILL USEFUL TO KNOW) PROPOSALS**

NOAA mCDR: Testing for durability, efficacy, and detectability of Ocean Alkalinity Enhancement in the California Current System. **Rafter Lead PI** (\$1,888,037)

NSF MG&G Carbon storage and release from the deep, glacial Indian Ocean. **Rafter Lead PI** (\$596,481)

#### **SCIENTIFIC COMMUNITY / OUTREACH**

Organizer for marine Carbon Dioxide Removal (CDR) Session at OCB Meeting (2023)

Steering Committee for Marine Carbon Dioxide Removal Workshop / Working Group (2021-2023)

Member of marine Carbon Dioxide Removal (CDR) Measurement, Reporting, and Verification Working Group (2022)

Organizer for marine Carbon Dioxide Removal (CDR) Workshop on Measurement, Reporting, and Verification (2022)

Organizer for OCB Meeting: Marine Carbon Dioxide Removal (2020-2022)  
First-Generation BEES (Becoming an Environmental & Earth Scientist) (2020-present). Founder.  
So Cal BOOM (Biogeochemical Ocean Observations & Models)—symposium for graduate students (2020-present). Founder.  
UCI Inclusive Excellence Committee. 2020-Current.  
Ocean Carbon Biogeochemistry Scientific Steering Committee (2020-2023)  
The Ocean Memory Project (National Academies sponsored art-science collaboration) (2018-present). Founding member.

## HONORS, AWARDS, ETC.

Plenary Speaker for International Conference on Paleoceanography. Bergen, Norway. 2022.  
UROP Faculty Mentor of the Month February 2019.  
Plenary speaker for GEOTRACES/PAGES synthesis workshop. Aix, France. 2018.  
US CLIVAR Tropical Pacific Observing System 2020 workshop. Boulder, CO. 2018  
AGU Outstanding Reviewer for *GBC* and *GRL*. 2017.  
NSF Expert Witness Training Academy. 2014.  
NSF Marine Geoscience Leadership Symposium. 2013.  
NSF Ocean Leadership Early Career Geoscience Symposium. 2011.  
Ocean Drilling Program Schlanger Fellowship. 2005.  
EPA National Network of Environmental Management Studies Fellowship. 2000.  
Florida Institute of Technology Outstanding Senior in Environmental Science. 2000.  
Florida Institute of Technology Outstanding Junior in Environmental Science. 1999.

## TEACHING EXPERIENCE

UCI ESS15: Introduction to Global Climate Change. SU 2020; SU 2021; SU 2022.  
Guest Lecture for K. Johnson at UCI: “Isotope Geochemistry”. 2018.  
Guest Lecture for J. Ferguson at UCI: “The Ocean and Atmosphere”. 2018.  
Guest Lectures for Kathleen Johnson at UCI: “Introduction to Paleoclimatology”. 2015.  
Guest Lecture for Jorge Sarmiento at Princeton University: “Ocean Biogeochemistry”. 2012.  
Teaching Assistant for Chris Charles, Intro. Environmental Systems, SIO, UCSD. 2008.  
Teaching Assistant, Lihini Aluwihare, CA Coastal Oceanography, SIO, UCSD. 2007.  
Teaching Assistant, Chris Charles, Intro. to Environmental Systems, SIO, UCSD. 2007.  
Teaching Assistant, Lynne Talley, Intro. to Environmental Systems, SIO, UCSD. 2006.  
Teaching Assistant, Gabi Laske, EARTH/SIO 10: Natural Disasters, SIO, UCSD. 2005.  
Teaching Assistant, Gabi Laske, EARTH/SIO 10: The Earth, SIO, UCSD. 2004.  
Teaching Assistant, Sam Iacobellis, The Atmosphere, SIO, UCSD. 2003.  
Training at the UCSD Center for Teaching Development (CTD). 2003.

## MENTORING EXPERIENCE (plus outcomes)

54. Ty Tassinari UCI Undergraduate Research. 2022-CURRENT.  
53. Tim Kacius UCI Undergraduate Research. 2022-CURRENT.  
52. Naina Rao UCI Undergraduate Research. 2022-CURRENT.  
51. Brianna Enriquez UCI Undergraduate Research. 2022-CURRENT.  
50. Abigail Ruth Kirubakaran UCI Undergraduate Research. 2022-CURRENT.  
49. Melody Shi UCI Undergraduate Research. 2022-CURRENT. BS in Earth System Science.  
48. Boyu Jiang UCI Undergraduate Research. 2022-CURRENT.  
47. Rohan Vaswani UCI Undergraduate Research. 2022-CURRENT.  
46. Corina Tostado UCI Undergraduate Research. 2022-CURRENT.  
45. Olivia Cox UCI Undergraduate Research. 2022-CURRENT.  
44. Brianna Chizhevsky UCI Undergraduate Research. 2022-CURRENT.

43. Jilan Hamden UCI Undergraduate Research. 2022-CURRENT
42. Wynne Young Corona Del Mar High School Research. 2022-CURRENT.
41. Lingyu Wang UCI Undergraduate Research. 2021-CURRENT.
40. Victoria Yu UCI Undergraduate Research. 2021-CURRENT. BS in Earth System Science.
39. Jonathan Lambert. Columbia University. **PhD thesis committee member.** 2022.
38. Ryan Green. UC Santa Cruz. **PhD thesis committee member.** 2021-CURRENT.
37. Irene Lilley. Undergraduate Research. 2021-2022. BS in Earth System Science.
36. Janiece Luu UCI Undergraduate Research. 2020-2022. BS in Earth System Science. **Pursuing a Masters in Environmental Science and Management Program at UCSB.**
35. Haoyang Liu UCI Undergraduate Research. 2020-2021. BS in Earth System Science. **Pursuing a Masters in Environmental & Water Resources.**
34. Ely Khatib UCI Undergraduate Research. 2020-2022. BS in Earth System Science.
33. Kathy Legaspi UCI Undergraduate Research. 2020-2022. **Pursuing a Masters in Business from SDSU.**
32. Yéssica Vanessa Contreras Pacheco. Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Baja California. **PhD thesis committee member. CURRENT**
31. Anthony Meza UCI Undergraduate research. 2019-2020. BS in Earth System Science. **Currently pursuing a PhD at MIT.**
30. Ryan Wong Owings UCI Undergraduate research. 2019-2020. BS in Earth System Science. **Pursuing a PhD in Geology at UCSB.**
29. Lucas Verde UCI Undergraduate research. 2019-2020. BS in Earth System Science.
28. Franklin Duffy summer research volunteer from CSU Boulder. 2019. Unknown.
27. Megan Lynn Ngo **UCI Senior Thesis.** 2019-2021. BS in Earth System Science. **Currently pursuing a Masters in Environmental Science.**
26. Claire Socorro Weeks UCI Undergraduate research. 2019. Unknown.
25. Alan Yue **UCI Senior Thesis.** 2019-2020. BS in Earth System Science. Laboratory Assistant at IDEXX Laboratories Limited.
24. Megha Rudresh UCI Undergraduate research. 2017-2019. BS in Earth System Science. Obtained a Masters in Geography at UGA. **Currently pursuing a PhD at University of Hawaii.**
23. April Naomi Castillo UCI Undergraduate research. 2019. BA in Environmental Science.
22. Jazmin Amanda Sanchez UCI Undergraduate research & **UCI Senior Thesis.** 2018-2019. BS in Earth System Science.
21. Chassidy Manlapid UCI Undergraduate research. 2018. BA in Environmental Science and Policy. **Currently pursuing a Masters student in Sustainability Solutions at Arizona State U.**
20. Matthew Chan UCI Undergraduate research. 2017-2018. BS in Earth System Science.
19. Alyssa Mariah de la Rosa UCI Undergraduate research. 2017-2018. BS in Earth System Science.
18. Juan Manuel Troncoso UCI Undergraduate research. 2017. BS in Earth System Science and BA in Spanish. Now Conservation Manager for The Escondido Creek Conservancy.
17. Diana Nguyen UCI Undergraduate research & **UCI Senior Thesis.** 2016. BS in Earth System Science.
16. Abigail Ambriz UCI undergraduate research experience. 2015-2016. BS in Environmental Science, Minor in Global Sustainability.
15. Stephanie Silva UCI undergraduate research experience. 2015-2016. BS in Earth System Science.
14. Annalysha Lafferty UCI undergraduate research experience. 2015. BS in Earth System Science.
13. Mina Nada UCI undergraduate research experience. 2015. BS in Earth System Science. Obtained a **Masters degree in Geography from CSULB.** Currently GIS Technician at Southern California Coastal Water Research Project.
12. Philip Andre Nazareta UCI undergraduate research experience. 2015. Unknown.
11. Franloie Cruz UCI undergraduate research experience. 2015. Unknown.
10. Ian Kamus UCI undergraduate research experience. 2015. BS in Earth System Science. Community Organizer at Pilipino Workers Center.

9. Gabrielle Lee Undergraduate research and **UCI Senior Thesis**. 2014-2015. BS in Earth System Science. Obtained a **Masters in Nuclear Engineering**.
8. Araceli Serrano UCI undergraduate research experience. 2014-2015. BS in Earth System Science. **Currently pursuing a PhD candidate at UCSC**.
7. Rachel Coons UCI undergraduate research experience. 2014. BS in Earth System Science. Now Technical Program Manager at Nvidia, Inc.
6. Johann Lopez UCI undergraduate research experience. 2014. BS in Earth System Science. Obtained a Masters degree in Earth System Science at UCI.
5. Tyler Tamasi Princeton University, summer internship. 2012. BS in Chemistry. **Currently working on a PhD at MIT**.
4. Samantha Csik Northeastern University, summer internship at Princeton University. 2012. **Obtained a Masters degree in Ecology, Evolution, and Marine Biology at UCSB**.
3. Lydia Rudnick Princeton University, junior thesis. 2011. BS in Geosciences. **Obtained a Masters degree in Environmental Science and Management**.
2. Jacob Kim Princeton University, summer internship. 2010. **Masters degree from University of Pennsylvania**.
1. Ulisses Barraza High School Student (SD Ocean Discovery Institute). 2008. Obtained a BS in Chemical Engineering at UCLA.

## INVITED PRESENTATIONS

- UCSD-SIO. Global climate, the Pacific Ocean, and vertical oceanic chemical reorganization. May 2023.
- OSU. Global climate, the Pacific Ocean, and vertical oceanic chemical reorganization. May 2023.
- UCSC. Global climate, the Pacific Ocean, and vertical oceanic chemical reorganization. May 2023.
- UCSB. Global climate, the Pacific Ocean, and vertical oceanic chemical reorganization. April 2023.
- USF. Global climate, the Pacific Ocean, and vertical oceanic chemical reorganization. March 2023.
- U of AZ. Reorganization of deep-sea circulation and carbon storage after the last ice age. Feb. 2023.
- WHOI. Reorganization of deep-sea circulation and carbon storage after the last ice age. Jan. 2023.
- NOAA CDR Task Force meeting. Can we use C isotopes for MRV? October 2022.
- IntCal Focus Group Meeting. Reorganization of deep-sea circulation and carbon storage after the last ice age. Sept. 2023.
- International Conference on Paleoceanography. Plenary Lecture. 2022.
- UCI. Radiocarbon at the bottom of the Ice Age ocean. 2022.
- UC Riverside. Radiocarbon at the bottom of the Ice Age ocean. May 2022.
- American Museum of Natural History. Radiocarbon at the bottom of the Ice Age ocean. 2021.
- University of Delaware. Radiocarbon at the bottom of the Ice Age ocean. 2020.
- UCLA. Virtual Seminar. 2020
- Woods Hole Oceanographic Institute. Virtual Seminar. G&G. 2020.
- Dalhousie University. Oceanography. 2020
- Laguna Woods Earth Day. The fundamental causes of climate change and some solutions. 2019.
- Belhaven Middle School. Linwood, NJ. How to become an Earth scientist. 2019.
- UConn. Anomalous >2000 year old surface ocean reservoir age as evidence for deglacial geologic carbon release. 2019.
- UC Santa Cruz. Rethinking iron fertilization & the marine biological pump on seasonal to ice age timescales. 2019.
- GEOTRACES/PAGES workshop (Aix, France). **Plenary Lecture**. Rethinking iron fertilization & the marine biological pump on seasonal to ice age timescales. 2018.
- University of South Florida. Rethinking iron fertilization & the marine biological pump on seasonal to ice age timescales. 2018.
- University of Washington. Rethinking iron fertilization & the marine biological pump on seasonal to ice age timescales. 2018.

University of Southern California. Rethinking iron fertilization & the marine biological pump on seasonal to ice age timescales. 2018.

Oregon State University. Iron recycling is critical for new primary production in all nitrate-rich, iron-limited ocean regions. 2018.

Wally Broecker's Changelings / Comer Foundation Climate Conference. A song of Ice and Fire and CO<sub>2</sub>: linking seafloor volcanism and CO<sub>2</sub> 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 CO<sub>2</sub>: linking seafloor volcanism and CO<sub>2</sub> efflux during the deglaciation. 2017.

Pomona College. A song of Ice and Fire and CO<sub>2</sub>: linking seafloor volcanism and CO<sub>2</sub> efflux during the deglaciation. 2017.

CICESE (Centro de Investigación Científica y Educación Superior de Ensenada) A song of Ice and Fire and CO<sub>2</sub>: linking seafloor volcanism and CO<sub>2</sub> efflux during the deglaciation. 2017.

UCSD-Scripps Institution of Oceanography. Iron recycling drives New Production in HNLC region. 2017.

UC Riverside. The future of ENSO from Plio-Pleistocene sediments. 2016.

California Institute of Technology. Iron recycling drives New Production in HNLC region.

Stanford University. How to survive a High Nutrient-Low Chlorophyll region: insight to the internal cycling of iron and nitrogen. 2015.

UC Santa Barbara. How to survive a High Nutrient-Low Chlorophyll region: insight to the internal cycling of iron and nitrogen. 2015.

USC. Building a new view of the Plio-Pleistocene tropical climate. 2015.

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. 2014.

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. 2013.

Dalhousie University. Nitrogen Cycle in the Ocean, Past and Present Workshop. 2011.

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. 2010.

UCLA. New insight to tropical Pacific circulation using isotopic tracers. 2009.

USC. Tropical Pacific nutrient dynamics of the past 1-Myr. 2008.



## RESEARCH FIELD EXPERIENCE (Select)

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

## INCLUSIVE EXCELLENCE TRAINING & SERVICE

- Creator/Producer: Southern California Biogeochemical Ocean Observations and Models (SoCal BOOM). An annual symposium begun in 2022.
- Creator/Producer/Director: First Generation BEES (Becoming an Earth & Environmental Sciences) Workshop for local, Orange Country First-Generation college students (every Spring and Fall). 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. 2003.

## PROFESSIONAL SERVICE

- Committee Member: UCI Committee for Diversity, Equity, and Inclusivity at the Department of Earth System Sciences CURRENT
- Scientific Steering Committee: Ocean Carbon Biogeochemistry Program CURRENT
- Chair: Goldschmidt Geochemistry Meeting 2020. 14a: Using Multiple Proxies and/Or Multiple Archives to Constrain Earth System Processes
- Organizer: So. California Biogeochemistry Ocean Observations and Models Symposium (SoCal BOOM) 2020.
- Organizer: Ocean Memory SEED Workshop (Ocean & Cognition) (June 2020). Location Lewes, DE.
- Chair: Ocean Sciences 2020: *Linking microbial, isotope, micro-nutrient, and other approaches to understand carbon and nutrient cycling in the ocean*
- Organizer: Ocean Memory Workshop 3.0. Catalina Island, California. 2019.
- 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*.

Chair: Goldschmidt 2013 (17c: Changing ocean oxygen: Past, present, future)

Reviewer: AGU-Geophysical Research Letters (>15), AGU-Global Biogeochemical Cycles (>10), AGU-Journal of Geophysical Research-Oceans (>5), AGU-Paleoceanography (>10), Deep Sea Research (2), Earth and Planetary Science Letters (2), EGU-Biogeosciences (2), Limnology and Oceanography (>5), Marine Chemistry (2), National Geographic Society (1), National Research Foundation-South Africa (2), Nature Geoscience (1), NSF OCE-Marine Geology and Geochemistry (>10), NSF OCE-Chemical Oceanography (>5), NSF-International Ocean Discovery Program (2), Philosophical Transactions of the Royal Society A (1), Nature Geoscience (2), Science (1).

## MEDIA

UCI News (March 29, 2023). UC Irvine Earth system scientists uncover ice-age shift in Pacific Ocean circulation. <https://news.uci.edu/2023/03/29/uc-irvine-earth-system-scientists-uncover-ice-age-shift-in-pacific-ocean-circulation/>

news|wise (March 29, 2023). UC Irvine Earth system scientists uncover ice-age shift in Pacific Ocean circulation. <https://www.newswise.com/articles/uc-irvine-earth-system-scientists-uncover-ice-age-shift-in-pacific-ocean-circulation?sc=rssn>

Newsbreak (March 29, 2023). Scientists uncover ice-age shift in Pacific Ocean circulation. <https://www.newsbreak.com/massachusetts-state/2974116365173-scientists-uncover-ice-age-shift-in-pacific-ocean-circulation>

Phys.org (March 29, 2023). Scientists uncover ice-age shift in Pacific Ocean circulation. <https://phys.org/news/2023-03-scientists-uncover-ice-age-shift-pacific.html>

(March 30, 2023). 地球システム科学者が太平洋循環の氷河期シフトを発見(UC Irvine Earth system scientists uncover ice-age shift in Pacific Ocean circulation). <https://tiisys.com/blog/2023/03/30/post-119350/>

EurekaAlert! (March 29, 2023). UC Irvine Earth system scientists uncover ice-age shift in Pacific Ocean circulation. <https://www.eurekaalert.org/news-releases/984380>

Environmental Monitor (March 7, 2018). *Iron Hoarding and Recycling by Aquatic Plants in the Pacific*. <https://www.fondriest.com/news/iron-hoarding-recycling-aquatic-plants-pacific.htm>

Geochemical News (Feb 20, 2018). Top Story: *Oceanographers solve mystery of phytoplankton survival in nutrient-poor Pacific*.

<https://phys.org/news/2018-02-oceanographers-mystery-phytoplankton-survival-nutrient-poor.html>  
UC Irvine News (Feb 14, 2018). *UCI oceanographers solve mystery of phytoplankton survival in nutrient-poor Pacific; Essential iron is hoarded and recycled by the climate-regulating*

*aquatic plants*. <https://news.uci.edu/2018/02/14/uci-oceanographers-solve-mystery-of-phytoplankton-survival-in-nutrient-poor-pacific/>