

Laurence Yeung, Ph.D.

EDUCATION

Ph. D., Chemistry, California Institute of Technology (Caltech)	2010
B. A. with Highest Honors, Chemistry, Oberlin College	2004

PROFESSIONAL APPOINTMENTS

Associate Professor (with tenure), Depts. of Earth, Environmental & Planetary Sciences and Chemistry, Rice University	2021 –
Maurice Ewing Career Development Chair in Earth Systems Science	2020 –
Assistant Professor, Dept. of Earth, Environmental & Planetary Sciences	2015 – 2021
Assistant Researcher, Dept. of Earth, Planetary & Space Sciences, UCLA	2013 – 2014
NSF Earth Sciences Postdoctoral Fellow, Dept. of Earth & Space Sciences, UCLA	2011 – 2013
Postdoctoral Research Associate, Dept. of Earth Sciences, USC	2010 – 2011

HONORS AND AWARDS

National Science Foundation CAREER Award	2020 – 2025
David and Lucile Packard Foundation Science & Engineering Fellowship	2017 – 2022
Best Paper Award (First runner up), <i>Environmental Science & Technology</i>	2019
Soehngen Institute of Anaerobic Microbiology (SIAM) Visiting Scientist, Radboud University	2017
F. W. Clarke Medal, Geochemical Society	2016
Christine Mirzayan Science & Technology Policy Fellowship, National Academy of Sciences	2014
NSF Earth Sciences Postdoctoral Fellowship	2011 – 2013
Sid Benson Student Poster Award, ACS Division of Physical Chemistry	2009
Davidow Graduate Research Fellowship in Environmental Science	2006 – 2008
Phi Beta Kappa and Sigma Xi	2004
Harry N. Holmes Medal for High Achievement in Chemistry, Oberlin College	2004
Lubrizol Undergraduate Research Award for Outstanding Talk	2004
Undergraduate Analytical Chemistry Award, ACS Division of Analytical Chemistry	2003
Frank Fanning Jewett Award for Achievement in Chemistry, Oberlin College	2002
John Fredrick Oberlin Scholar, Oberlin College	2000 – 2004

GRANTS (\$2.3 million in external grants as lead PI)

GP-IN: Inclusive Learning Through Earth, Environmental and Planetary Sciences (ILEEPS). National Science Foundation ICER-2120039. 1/2022 – 12/2024: \$314,904, Co-I (Lead PI: C. Nichol).
URG ² : Undergraduate Research in the Geosciences for Underrepresented Groups. David and Lucile Packard Foundation 2021-72656. 10/2021 – 9/2022. \$20,800 (Rice Co-I portion; Lead PI: M. Donelle/UW)
CAREER: Robust constraints on primary productivity from first principles. National Science Foundation EAR-1945316. 6/2020 – 5/2025: \$583,743, sole PI.
Collaborative Research: Interrogating the free troposphere during the last deglaciation, National Science Foundation AGS-2002422. 5/2020 – 4/2023: \$274,639, Lead PI.
Constraining the role of dyke swarms as a phosphorus source during the Great Oxidation Event. Future Investigators in NASA Earth and Space Science and Technology. 9/2019 – 8/2022: \$45,000, Lead PI (Co-I: M. Torres, Student: A. Banerjee)
Multiple stable isotope analysis of sulfate minerals from Shergottites and Nakhilites as probe to Martian atmosphere, hydrosphere, and lithosphere. NASA Solar System Workings. 10/2018 – 9/2021: \$392,933 Co-I (Lead PI: T. Sun).
Origin and cycles of life-essential ingredients in young rocky planets. Nexus of Exoplanet Systems Science, NASA Astrobiology Institute. 7/2018 – 6/2023: \$7,672,795 Co-I (Lead PI: R. Dasgupta).
What can the atmosphere say about the state of a planet? David and Lucile Packard Foundation Science & Engineering Fellowship. 10/2017 – 9/2022: \$875,000, sole PI.
New constraints on marine oxygen cycling. National Science Foundation OCE-1533501. 9/2014 – 8/2018: \$203,480. Lead PI (Collaborative Research).

High-precision triple-isotopologue analysis of N₂. National Science Foundation EAR-1349182. 9/2014 – 8/2018: \$189,999, Lead PI (Collaborative Research).
 EAR-PF: ‘Clumped’ isotope geochemistry of ¹⁸O₂ for paleohydrology and paleobiology. National Science Foundation EAR-1049655. 3/2011 – 2/2013: \$170,000, sole PI.

PUBLICATIONS (*h-index*: ISI 16, Google Scholar 19) Rice University *grad student/[†]undergrad/[‡]postdoc

Submitted or in revision

1. **Yeung, L. Y.**, “Photochemical and biological tracers from clumped isotopes in O₂ and N₂,” in *Handbook of Isotopologue Biogeochemistry* (eds. N. Yoshida, A. Gilbert, and J. Foriel): SpringerNature. In review.
2. [‡]Hayles, J. A., **L. Y. Yeung**, M. Homann, B. Shen, *A. Banerjee, *H. Jiang, B. Shen, and C. T. A. Lee, “Three-billion-year secular evolution of the triple oxygen isotope composition of marine chert,” *Earth Planet. Sci. Lett.* in revision. EarthArXiv preprint doi:10.31223/osf.io/n2p5q.
3. [‡]Condit, C. B., M. E. French, [‡]J. A. Hayles, **L. Y. Yeung**, and C. T. A. Lee, “Fluid and stress state at the base of the subduction seismogenic zone,” *Geochem. Geophys. Geosyst.* in revision.
4. *Banerjee, A., **L. Y. Yeung**, L. T. Murray, and X. Tie, “Clumped-isotope constraint on upper-tropospheric cooling during the Last Glacial Maximum,” *PNAS* in revision.

Published or in press

1. **Yeung, L. Y.**, L. T. Murray, *A. Banerjee, [‡]Y. Yan, X. Tie, E. L. Atlas, S. M. Schaufli, and K. A. Boering, “Effects of ozone isotopologue formation on the clumped-isotope composition of atmospheric O₂,” *J. Geophys. Res. Atmos.* 126 (2021) e2021JD034770.
2. *Bhattacharya, J., **L. Y. Yeung**, L. Cong, G. R. Dickens, and T. Sun, “Size-fraction specific isotopic variations as a framework for interpreting early Eocene bulk sediment carbon isotope records,” *Paleoceanogr. Paleoclimatol.* 36 (2021) e2020PA004132.
3. [†]Deme, S., **L. Y. Yeung**, T. Sun, and C. T. A. Lee, “Stable isotope (C, N, O, H) study of a comprehensive set of feathers from two *Setophaga citrina*,” *PLoS ONE* 16 (2021) e0236536.
4. **Yeung, L. Y.** and [‡]J. A. Hayles, “Climbing to the top of Mount Fuji: Uniting theory and observations of oxygen triple isotope systematics,” *Rev. Mineral. Geochem.* 86 (2021) 97-135.
5. Hassanzadeh, P., C.-Y. Lee, *E. Nabizadeh, S. J. Camargo, D. Ma, and **L. Y. Yeung**, “Effects of climate change on the movement of future landfalling Texas tropical cyclones,” *Nat. Commun.* 11 (2020) 3319.
6. Ash, J. L., [‡]H. Hu, and **L. Y. Yeung**, “What fractionates oxygen isotopes during respiration? Insights from multiple isotopologue measurements and theory,” *ACS Earth Space Chem.* 4 (2020) 50-66.
7. **Yeung, L. Y.**, L. T. Murray, P. A. Martinerie, [‡]H. Hu, *A. Banerjee, E. Witrant, A. Orsi, and J. Chappellaz, “Isotopic constraint on the twentieth-century increase in tropospheric ozone,” *Nature* 570 (2019) 224-227.
8. **Yeung, L. Y.**, J. A. Haslun, N. E. Ostrom, T. Sun, E. D. Young, M. A. H. J. van Kessel, S. Lücker, and M. S. M. Jetten, “*In situ* quantification of biological N₂ production using naturally occurring ¹⁵N¹⁵N,” *Environ. Sci. Technol.* 53 (2019) 5168-5175. (*ES&T best paper awards 2019, first runner-up*)
9. *Li, B., **L. Y. Yeung**, [‡]H. Hu, and J. L. Ash, “Kinetic and equilibrium fractionation of O₂ isotopologues during air-water gas transfer and implications for tracing oxygen cycling in the ocean,” *Mar. Chem.* 210 (2019) 61-71.
10. **Yeung, L. Y.**, [‡]J. A. Hayles, [‡]H. Hu, J. L. Ash, and T. Sun, “Scale distortion from pressure baselines as a source of inaccuracy in triple-isotope measurements,” *Rapid Commun. Mass Spectrom.* 32 (2018) 1811-1821.
11. **Yeung, L. Y.**, “Low oxygen and argon in the Neoproterozoic atmosphere at 815 Ma,” *Earth Planet. Sci. Lett.* 480 (2017) 66-74.
12. **Yeung, L. Y.**, [‡]S. Li, I. E. Kohl, J. A. Haslun, N. E. Ostrom, *H. Hu, E. A. Schauble, T. P. Fischer, and E. D. Young, “Extreme enrichment in atmospheric ¹⁵N¹⁵N,” *Sci. Adv.* 3 (2017) eaao6741.
13. Young, E. D., I. E. Kohl, B. Sherwood Lollar, G. Etiope, D. Rumble III, *S. Li, M. A. Haghnegahdar, E. A. Schauble, K. A. McCain, D. I. Foustoukos, C. Sutcliffe, O. Warr, C. J. Ballentine, T. C. Onstott, H. Hosgormez, A. Neubeck, J. M. Marques, I. Pérez-Rodríguez, A. R. Rowe, D. E. LaRowe, C. Magnabosco, **L. Y. Yeung**, J. L. Ash, and L. T. Bryndzia, “The relative abundances of resolved

- $^{12}\text{CH}_2\text{D}_2$ and $^{13}\text{CH}_3\text{D}$ and mechanisms controlling isotopic bond ordering in abiotic and biotic methane gases,” *Geochim. Cosmochim. Acta* 203 (2017) 235-264.
14. **Yeung, L. Y.**, L. T. Murray, J. L. Ash, E. D. Young, K. A. Boering, E. L. Atlas, S. M. Schauffler, R. A. Lueb, R. L. Langenfelds, P. B. Krummel, L. P. Steele, and S. D. Eastham, “Isotopic ordering in atmospheric O_2 as a tracer of ozone photochemistry and the tropical atmosphere,” *J. Geophys. Res. Atmos.* 121 (2016) 12,541-12,559.
 15. Lee, C. T. A., **L. Y. Yeung**, R. McKenzie, Y. Yokoyama, K. Ozaki, and A. Lenardic, “Two-step rise in atmospheric oxygen linked to the emergence of continents,” *Nat. Geosci.* 9 (2016) 421-427.
 16. **Yeung, L. Y.**, “Combinatorial effects on clumped isotopes and their significance in biogeochemistry,” *Geochim. Cosmochim. Acta* 172 (2016), 22-38.
 17. **Yeung, L. Y.**, J. L. Ash, and E. D. Young, “Biological signatures in clumped isotopes of O_2 ,” *Science* 348 (2015), 431-434. (L.Y.Y. and J.L.A. equal contributors)
 18. **Yeung, L. Y.**, W. M. Berelson, D. E. Hammond, M. G. Prokopenko, C. Wolfe, and N. Rollins, “Upper-ocean gas dynamics for biogeochemical applications using radon profiles in the Eastern Tropical South Pacific,” *Deep-Sea Res. Pt. I* 99 (2015), 35-45.
 19. **Yeung, L. Y.**, J. L. Ash, and E. D. Young, “Rapid photochemical equilibration of isotopic bond ordering in O_2 ,” *J. Geophys. Res. Atmos.* 119 (2014): 10,552 – 10,566.
 20. Young, E. D., **L. Y. Yeung**, and I. E. Kohl, “On the $\Delta^{17}\text{O}$ budget of atmospheric O_2 ,” *Geochim. Cosmochim. Acta* 135 (2014), 102-125.
 21. **Yeung, L. Y.**, E. D. Young, and E. A. Schauble, “Measurements of $^{18}\text{O}^{18}\text{O}$ and $^{17}\text{O}^{18}\text{O}$ in the atmosphere and the influence of isotope-exchange reactions,” *J. Geophys. Res. Atmos.* 117 (2012), D18306.
 22. **Yeung, L. Y.**, W. M. Berelson, E. D. Young, M. G. Prokopenko, N. Rollins, V. J. Coles, J. P. Montoya, E. J. Carpenter, R. A. Foster, D. K. Steinberg, D. C. Capone, and P. L. Yager, “Impact of diatom-diazotroph assemblages on carbon export in the Amazon river plume,” *Geophys. Res. Lett.* 39 (2012): L18609.
 23. **Yeung, L. Y.**, M. Okumura, J. Zhang, T. K. Minton, J. T. Paci, A. Karton, J. M. L. Martin, J. P. Camden, and G. C. Schatz, “ $\text{O}(^3P) + \text{CO}_2$ collisions at hyperthermal energies: Dynamics of inelastic scattering, oxygen isotope exchange, and oxygen-atom abstraction,” *J. Phys. Chem. A* 116 (2012): 64-84.
 24. Prokopenko, M. G., O. Paulius, J. Granger, and **L. Y. Yeung**, “Exact evaluation of gross photosynthetic production from the oxygen triple-isotope composition of O_2 : Implications for the net-to-gross primary production ratios,” *Geophys. Res. Lett.* 38 (2011): L14603.
 25. Robichaud, D. J., **L. Y. Yeung**, D. A. Long, M. Okumura, D. K. Havey, J. T. Hodges, C. E. Miller, and L. R. Brown, “Experimental Line Parameters of the $b^1\Sigma_g^+ \leftarrow X^3\Sigma_g^-$ Band of Oxygen Isotopologues at 760 nm Using Frequency-Stabilized Cavity Ring-Down Spectroscopy,” *J. Phys. Chem. A* 113 (2009) 13089-13099.
 26. **Yeung, L. Y.**, M. Okumura, J. T. Paci, G. C. Schatz, J. Zhang, and T. K. Minton, “Hyperthermal O-Atom Exchange Reaction $\text{O}_2 + \text{CO}_2$ through a CO_4 Intermediate,” *J. Am. Chem. Soc.* 131 (2009): 13940-13942.
 27. Huntington, K. W., J. M. Eiler, H. P. Affek, W. Guo, M. Bonafacie, **L. Y. Yeung**, N. Thiagarajan, B. Passey, A. Tripathi, M. Daëron, R. Came, “Methods and limitations of ‘clumped’ CO_2 isotope (Δ_{47}) analysis by gas source isotope ratio mass spectrometry,” *J. Mass Spectrom.* 44 (2009): 1318-1329.
 28. **Yeung, L. Y.**, H. P. Affek, K. J. Hoag, W. Guo, A. A. Wiegel, E. L. Atlas, S. M. Schauffler, M. Okumura, K. A. Boering, and J. M. Eiler, “Large and unexpected enrichment in stratospheric $^{16}\text{O}^{13}\text{C}^{18}\text{O}$ and its meridional variation,” *Proc. Natl. Acad. Sci. USA* 106 (2009): 11496-11501. (L.Y.Y. and H.P.A. equal contributors)
 29. Robichaud, D. J., J. T. Hodges, P. Masłowski, **L. Y. Yeung**, M. Okumura, C. E. Miller, and L. R. Brown, “High-Accuracy Transition Frequencies for the O_2 A-Band,” *J. Mol. Spec.* 251 (2008): 27-37.
 30. Robichaud, D. J., J. T. Hodges, L. R. Brown, D. Lisak, P. Masłowski, **L. Y. Yeung**, M. Okumura, C. E. Miller, “Experimental intensity and line shape parameters of the oxygen A-band using frequency-stabilized cavity ring-down spectroscopy,” *J. Mol. Spec.* 248 (2008): 1-13.
 31. **Yeung, L. Y.**, M. J. Pennino, A. M. Miller, and M. J. Elrod, “Kinetics and Mechanistic Studies of the Atmospheric Oxidation of Alkynes,” *J. Phys. Chem. A* 109 (2005): 1879-1889.
 32. Miller, A. M., **L. Y. Yeung**, A. C. Kiep, and M. J. Elrod. “Overall Rate Constant Measurements of the Reactions of Alkene-Derived Peroxy Radicals with Nitric Oxide,” *Phys. Chem. Chem. Phys.* 6 (2004): 3402-3409.

33. Babonneau, F., **L. Yeung**, N. Steunou, C. Gervais, A. Ramilia, and M. Vallet-Regi, "Solid State NMR Characterization of Encapsulated Molecules in Mesoporous Silica," *J. Sol-Gel Sci. Techn.* 31 (2004): 219-223.
34. **Yeung, L. Y.** and M. J. Elrod. "Experimental and Computational Study of the Kinetics of OH + Pyridine and Its Methyl and Ethyl-Substituted Derivatives," *J. Phys. Chem. A* 107 (2003): 4470-4477.

In preparation

1. *Valerio, D. and **L. Y. Yeung**, "Has light-dependent oxygen consumption been underestimated in the marine and global budgets of O₂?" in preparation for *EPSL*.
2. ‡Hu, J., ‡Y. Yan, **L. Y. Yeung**, and S. G. Dee, "On the origin of negative deuterium excess in snow and ice samples from McMurdo Dry Valleys and Allan Hills Blue Ice Areas, East Antarctica," in preparation for *Climate of the Past*.
3. *Li, B., ‡Hu, H., W. M. Berelson, J. F. Adkins, and **L. Y. Yeung**, "On the use of oxygen isotopologues as biogeochemical tracers in the Pacific ocean," in preparation for *JGR Oceans*.

PEER-REVIEWED REPORTS

1. National Research Council (as NAS Board on Life Sciences staff). *Value and Sustainability of Biological Field Stations in the 21st Century*. The National Academies Press: Washington, D.C. (2014).
2. National Research Council (as NAS Board on Life Sciences staff). *Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond*. The National Academies Press: Washington, D.C. (2014).
3. National Research Council (E. S. Brown, **L. Yeung**, and K. Sawyer, rapporteurs), *Sustainable Infrastructures for Life Science Communication: Workshop Summary*. The National Academies Press: Washington, D.C. (2014).

INVITED LECTURES (ACADEMIA, NON-CONFERENCE)

- 2021 Woods Hole Oceanographic Institution (Climate & Paleo), Woods Hole, MA
Woods Hole Oceanographic Institution (Marine Chemistry & Geochemistry), Woods Hole, MA
- 2020 Texas A&M University, College Station, TX
University of Chicago, Chicago, IL
- 2019 Schlumberger Geochemistry Special Interest Group
- 2018 University of Rochester, Rochester, NY
Stony Brook University, Stony Brook, NY
University of Science and Technology China, Hefei, China
Shanghai Ocean University, Shanghai, China
National Institute of Standards and Technology, Gaithersburg, MD
- 2017 Radboud University, Nijmegen, Netherlands
Texas A&M University, College Station, TX
- 2016 Oberlin College, Oberlin, OH
Princeton University, Princeton, NJ
- 2015 Louisiana State University, Baton Rouge, LA
- 2014 Carnegie Institution of Washington, Washington, DC
Rice University, Houston, TX
University of California, San Diego, CA
- 2013 Johns Hopkins University, Baltimore, MD
National Institute of Standards and Technology, Gaithersburg, MD
University of Chicago, Chicago, IL
University of Utah, Salt Lake City, UT
- 2012 California Institute of Technology, Pasadena, CA

Harvard University, Cambridge, MA

2009 University of California, Berkeley, CA
University of Southern California, Los Angeles, CA

INVITED LECTURES (CONFERENCES)

1. “Using the ice-core record to investigate the ancient free troposphere,” Hercules Dome Ice Coring Project Workshop, University of Washington/Zoom, May 2021.
2. “O₂ clumped isotopes for paleoatmospheric applications: promises, progress, and challenges,” ICECAP Workshop, Harvard University/Zoom, July 2020.
3. “Unlocking stable-isotope constraints on past atmospheric chemistry,” Cryosphere and Atmospheric Chemistry (CATCH) Open Science Workshop, Berkeley, CA, December 2019.
4. “Atmospheric ¹⁵N/¹⁵N as a tracer of nitrogen cycling from local to planetary scales,” American Geophysical Union Fall Meeting, Washington, DC, December 2018.
5. “Paleoclimate at altitude,” David & Lucile Packard Foundation Fellows 30th Reunion Meeting, San Diego, CA, September 2018.
6. “Astrobiology – Future: Searching for life using isotopic biosignatures,” Marilyn Madness!, Carnegie Institution of Washington (Washington, DC), October 2016.
7. “High-resolution mass spectrometry: A ‘bigger boat’ for biogeochemistry,” VISTAS meeting, Michigan State University (East Lansing, MI), October 2016.
8. “Medal: The diversity of isotopic ordering in small molecules,” V. M. Goldschmidt Conference, Yokohama, Japan, June 2016. (Medal lecture)
9. “Applying clumped isotopes of O₂ to atmospheric and biogeochemical problems,” European Geosciences Union General Assembly, Vienna, Austria, April 2016.
10. “‘Anticlumping’ and other combinatorial effects on clumped isotopes: Implications for tracing biogeochemical cycling,” American Geophysical Union Fall Meeting, San Francisco, CA, December 2015.
11. “Atmospheric chemistry and dynamics recorded in the isotopic ordering in O₂ and CO₂,” V. M. Goldschmidt conference, Florence, Italy, August 2013. (Keynote)
12. “Using oxygen isotopes to link microbial ecology with carbon export: Diatom-diazotroph associations in the Amazon river plume,” INTRAMIF meeting, Università deli Studi (Florence, Italy), August 2013.
13. “Insights from studying five isotopologues of O₂,” 3rd International Clumped Isotope Workshop, Harvard University (Cambridge, MA), January 2013.
14. “New approaches for studying past global biosphere productivity,” National Science Foundation Workshop on Future Directions in Geobiology, Carnegie Institution of Washington (Washington, DC), August 2010.

OTHER LECTURES

1. “Environmental Diversity,” Rice Scientia Lecture Series, Houston, TX December 2019.
2. “The chemistry of the atmosphere: A tug-of-war between life and light,” Gulf Coast Undergraduate Research Symposium Keynote, Rice University, Houston, TX, November 2017.
3. March for Science, Houston, TX, April 2017.
4. “Moving beyond clumped-isotope thermometry,” Houston Isotope Technology Society, Houston, TX, November 2016.
5. “Where else might there be life? How will we know?” Rice Science Café, Black Lab Pub, Houston, TX, March 2016.
6. “To thermometry and beyond: rare-isotope clumping in O₂ for atmospheric and biogeochemical problems,” Oregon State University, Corvallis, OR, May 2014.
7. “A Physical Chemist’s Approach to Atmospheric Geochemistry,” Caltech, guest lecture for *Ge 10: Frontiers in Geological and Planetary Sciences*, February 2009.

MEETING ABSTRACTS (Rice University *grad student/†undergrad/‡postdoc)

1. “Field and microstructural constraints on viscous rheology at the base of the subduction seismogenic zone,” (*C. Condit, lead author) AGU Fall Meeting, December 2021

2. “Clumped isotope constraints on free tropospheric temperature changes since the Last Glacial Maximum,” (*A. Banerjee, lead author) AGU Fall Meeting, December 2021
3. “On the origin of negative deuterium excess observed in snow and ice sample from McMurdo Dry Valleys and Allan Hills Blue Ice Areas, East Antarctica,” (‡Y. Yan, lead author) AGU Fall Meeting, December 2021.
4. “Evidence for multiple middle Eocene warming events in the Lutetian-Bartonian chemostratigraphic record from the southwest Pacific,” (*J. Bhattacharya, lead author) AGU Fall Meeting, December 2021.
5. “Evaluating online calculations of oxygen clumped isotopes in a global chemistry-transport model for paleoatmospheric applications,” AGU Fall Meeting, December 2020.
6. “Interpreting early Paleogene bulk sediment carbon isotope records using size fraction-specific isotopic variations,” (*J. Bhattacharya, lead author) AGU Fall Meeting, December 2020.
7. “Nitrogen cycling and circulation in Baffin Bay investigated with isotopic measurements of nitrate, nitrous oxide, and nitrogen gas,” (C. Manning, lead author) ASLO Ocean Sciences Meeting, San Diego, CA, February 2020.
8. “New biogeochemical and atmospheric tracers locked in O₂ and N₂,” David & Lucile Packard Foundation Fellows Meeting, Monterey, CA, September 2019.
9. “Stable isotope compositions of size fractions of early Paleogene sediments: Implications on bulk carbonate stable isotopic analysis,” (*J. Bhattacharya, lead author) Geological Society of America Annual Meeting, Phoenix, AZ, September 2019.
10. “Tracing tropospheric temperatures at the last glacial maximum with O₂ clumped isotopes,” (*A. Banerjee, lead author) V.M. Goldschmidt Conference, Barcelona, Spain, August 2019.
11. “The isotopic mass dependence of respiratory O₂ consumption revisited and implications for primary productivity estimates,” V.M. Goldschmidt Conference, Barcelona, Spain, August 2019.
12. “Isotopic constraint on the 20th-century increase in tropospheric ozone,” (L. Murray, presenting author) International Global Atmospheric Chemistry Project Chemistry-Climate Modeling Initiative Workshop, Hong Kong, China, August 2019.
13. “*In situ* quantification of biological N₂ production using naturally occurring ¹⁵N¹⁵N,” DASIM Tracing Denitrification Conference, Giessen, Germany, March 2019.
14. “Three-billion-year Secular Evolution of Oxygen Isotopes in Seawater Inferred from Chert $\delta^{18}\text{O}$ and $\Delta^{17}\text{O}$,” (‡J. Hayles, lead author) American Geophysical Union Fall Meeting, Washington, DC, December 2018.
15. “Fluid infiltration promotes both ductile and brittle deformation within the deep crust: Examples from Southwestern Montana and the Central Alps,” (‡C. Condit, lead author) American Geophysical Union Fall Meeting, Washington, DC, December 2018.
16. “Evolution of tropospheric O₃ from preindustrial to present inferred from ¹⁸O¹⁸O in polar firn and ice,” American Geophysical Union Fall Meeting, Washington, DC, December 2018.
17. “Movement of Future Harvey-like Hurricanes,” (*V. Gonzales, lead author), Rice Data Science Conference, Rice University, Houston, TX, October 2018.
18. “Effect of Climate Change on Future Harvey-like Hurricanes and the implications for Houston,” (P. Hassanzadeh, lead author) Rice Houston Engagement and Recovery Effort Symposium, Rice University, Houston, TX, October 2018.
19. “Constraints on marine oxygen cycling and transport from five O₂ isotopologues (³²O₂, ³³O₂, ³⁴O₂, ³⁵O₂, and ³⁶O₂),” (‡H. Hu, lead author) International Symposium on Isotopomers, Baton Rouge, LA, March 2018.
20. “Utility of the triple oxygen isotope composition of ancient chert for constraining ancient seawater $\delta^{18}\text{O}$,” (‡J. Hayles, lead author) International Symposium on Isotopomers, Baton Rouge, LA, March 2018.
21. “Kinetic isotope effects for O₂ air-water gas transfer and implications for estimating marine gross oxygen productivity,” (*B. Li, lead author) ASLO Ocean Sciences Meeting, Portland, OR, February 2018.
22. “Constraints on marine oxygen cycling and transport from five O₂ isotopologues (³²O₂, ³³O₂, ³⁴O₂, ³⁵O₂, and ³⁶O₂),” (‡H. Hu, lead author) ASLO Ocean Sciences Meeting, Portland, OR, February 2018.
23. “Triple-oxygen isotope constraints on seawater $\delta^{18}\text{O}$ and temperature,” (‡J. Hayles, lead author) American Geophysical Union Fall Meeting, New Orleans, LA, December 2017.
24. “Theoretical calibration of the quartz-water triple oxygen isotope thermometer,” (‡J. Hayles, lead author) Geological Society of America Annual Meeting, Seattle, WA, October 2017.
25. “Limits on atmospheric oxygen and argon concentrations at 815 Ma,” Geological Society of America Annual Meeting, Seattle, WA, October 2017.

26. "An extreme enrichment in atmospheric $^{15}\text{N}^{15}\text{N}$: biotic and abiotic contributions," V. M. Goldschmidt Conference, Paris, France, August 2017.
27. "'Medium resolution' applications of the Perspective IS; oxygen and beyond," (S. Rablen, lead author), V. M. Goldschmidt Conference, Yokohama, Japan, June 2016.
28. "High-precision measurements of $^{15}\text{N}^{15}\text{N}$, $^{14}\text{N}^{15}\text{N}$, and $^{14}\text{N}_2$ in N_2 and potential applications to oceanic nitrogen cycle research," (‡ S. Li, lead author), ASLO Ocean Sciences Meeting, New Orleans, LA, February 2016.
29. "Triple-isotopologue Analysis of N_2 as a Tracer of the Global Nitrogen Cycle," (‡ S. Li, lead author), 5th International Workshop on Clumped Isotopes, St. Petersburg, FL, January 2016.
30. "Automated clumped-isotope analysis of O_2 on a compact, high-resolution gas-source isotope ratio mass spectrometer," 5th International Workshop on Clumped Isotopes, St. Petersburg, FL, February 2016.
31. "Isotopic (Re)ordering Signatures of Stratospheric and Tropospheric O_2 ." 2015 American Geophysical Union Fall Meeting, San Francisco, CA, December 2015.
32. "Equilibrium and non-equilibrium fractionation of Δ values: Towards a clumped-isotope intuition," 4th International Workshop on Clumped Isotopes, ETH (Zurich, Switzerland), August 2014.
33. "Biological influences on isotopic ordering in O_2 ," (J. L. Ash, lead author) V. M. Goldschmidt conference, Sacramento, CA, June 2014.
34. "Constraining historical NO_x concentrations using variations in atmospheric $^{18}\text{O}^{18}\text{O}$: A status report," American Geophysical Union Fall Meeting, San Francisco, CA, December 2013.
35. "Towards tracing long-term trends in atmospheric free radicals using rare-isotope clumping in O_2 ," American Geophysical Union Fall Meeting, San Francisco, CA, December 2012.
36. " $^{18}\text{O}^{18}\text{O}$ and $^{17}\text{O}^{18}\text{O}$ in the atmosphere," V. M. Goldschmidt Conference, Montréal, Canada, June 2012.
37. "Impact of diatom-diazotroph assemblages on carbon export in the Amazon river plume," ASLO Ocean Sciences Meeting, Salt Lake City, UT, February 2012.
38. "Net community and gross photosynthetic production rates in the Eastern Tropical South Pacific, as determined from O_2/Ar ratios and tripe oxygen isotopic composition of dissolved O_2 ," (D. Hammond, lead author) ASLO Ocean Sciences Meeting, Salt Lake City, UT, February 2012.
39. "High-precision measurements of $^{17}\text{O}^{18}\text{O}$ and $^{18}\text{O}^{18}\text{O}$ in air," American Geophysical Union Fall Meeting, San Francisco, CA, December 2011.
40. "Oxygen triple-isotope evidence for enhancement of CO_2 sequestration efficiency by diatom-diazotroph assemblages in a giant river plume," V. M. Goldschmidt conference, Prague, Czech Republic, August 2011.
41. "Progress towards high-precision measurements of $^{17}\text{O}^{18}\text{O}$ and $^{18}\text{O}^{18}\text{O}$ in natural samples for biogeochemical applications," 2nd International Workshop on Clumped Isotopes, Imperial College (London, UK), August 2011.
42. "Net community and gross photosynthetic production rates in the Eastern Tropical South Pacific, as determined from O_2/Ar ratios and tripe oxygen isotopic composition of dissolved O_2 ," (M. Prokopenko, lead author), American Geophysical Union Fall Meeting, San Francisco, CA, December 2010.
43. "Comparison of Radon-222 and satellite-wind-based estimates of gas exchange in the Eastern Tropical South Pacific Ocean," (W. Berelson, lead author), American Geophysical Union Fall Meeting, San Francisco, CA, December 2010.
44. "Understanding the triple-isotopic mass dependence of equilibrium oxygen solvation," American Geophysical Union Fall Meeting, San Francisco, CA, December 2010.
45. "Export POC flux calculated from ^{234}Th measurements, sediment traps and O_2 supersaturation in the Eastern Tropical South Pacific," (W. Haskell, lead author) American Geophysical Union Fall Meeting, San Francisco, CA, December 2010.
46. "Clumped-isotope constraints on stratospheric CO_2 ," 1st International Workshop on Clumped Isotopes, University of Washington (Seattle, WA), April 2010.
47. "Dynamics of isotope exchange between hyperthermal $\text{O}(^3\text{P})$ and CO_2 ," ACS National Meeting, Washington, DC, August 2009. (Awarded Sid Benson student poster prize)
48. "A 'clumped-isotope' study of stratospheric CO_2 reveals a new atmospheric process," V. M. Goldschmidt Conference, Davos, Switzerland, June 2009.
49. "Meridional Variation in $^{13}\text{C}^{18}\text{O}^{16}\text{O}$," AGU National Meeting, San Francisco, CA, December 2008.

50. "SI traceable laboratory determinations of A-Band line parameters for O₂ isotopologues with remote sensing implications," (D. Long, lead author) American Geophysical Union Fall Meeting, San Francisco, CA, December 2008.
51. "Dynamics of isotope exchange between hyperthermal O(³P) and CO₂," ACS National Meeting, New Orleans, LA, April 2008.
52. "Frequency-stabilized cavity ring-down spectroscopy of the oxygen A-band spectrum," (D. Robichaud, lead author), American Chemical Society National Meeting, April 2008.
53. "A Crossed Molecular Beam Study of O(³P) + CO₂ Reactions at High Collision Energies," 25th Informal Symposium on Photochemical and Kinetic Processes in the Atmosphere, University of California-Los Angeles, February 2008.
54. "Low-uncertainty measurements of O₂ A-band line positions," (D. Robichaud, lead author) American Geophysical Union Fall Meeting, San Francisco, CA, December 2007.
55. "Anomalous Isotope Effects in the O(¹D) + CO₂ Isotope Exchange Reaction," 24th Informal Symposium on Photochemical and Kinetic Processes in the Atmosphere, California State University-Los Angeles, February 2007.
56. "Anomalous Isotope Effects in the O(¹D) + CO₂ Isotope Exchange Reaction," American Chemical Society National Meeting, San Francisco, CA, September 2006.
57. "Kinetics Studies of the Atmospheric Oxidation of Alkynes," American Chemical Society National Meeting, San Diego, CA, March 2005.
58. "Kinetics Studies of the Atmospheric Oxidation of Alkynes," American Chemical Society Cleveland Chapter Meeting-in-Miniature, Cleveland, OH, March 2004. (Awarded prize for outstanding student talk)
59. "Kinetics of Pyridine + OH Reactions: Atmospheric Lifetimes," US/France REU Program Workshop, National Science Foundation, Arlington, VA, April 2003.
60. "Kinetics of Pyridine + OH Reactions: Atmospheric Lifetimes," American Chemical Society Cleveland Chapter Meeting-in-Miniature, Oberlin, OH, March 2003.

TEACHING EXPERIENCE

Courses at Rice University

ESCI 115/301 – Introduction to the Earth

ESCI 325 – Oceans, Atmospheres, and Climate

ESCI 415/615 – Trace Element and Isotope Geochemistry

ESCI 430/630 – Trace Element and Isotope Geochemistry

ESCI 433/633 – Isotope Geochemistry

ESCI 540 – Earth's Atmosphere

ESCI 555 – Mountains, Climate, and Carbon/Following Carbon

ESCI 557 – Planetary Habitability

NSCI 520 – Public Science Communication Seminar (guest lecturer)

Instructor, International GeoBiology Short Course, USC

2011

STUDENTS AND POSTDOCS MENTORED

Bing Yuan, Rice EEPS – Ph.D. student	2021 –
Weidi Liu, Rice APPL – Ph.D. student	2020 –
Yuzhen Yan, Rice EEPS – Postdoctoral Scholar	2019 –
Yi Hou, Rice EEPS – Ph. D. candidate	2018 –
Asmita Banerjee, Rice EEPS – Ph.D. candidate, NASA FINESST grantee	2017 –
Boda Li, Rice EEPS – Ph.D. candidate	2015 –
Lisa Meng, University of California, Berkeley	2019, 2021
Joyeeta Bhattacharya, Rice EEPS Ph. D. '21 – Postdoctoral Scholar, U. Oklahoma	2020 – 2021
David Valerio, Rice EEPS M. S. '21	2019 – 2021
Samiksha Deme, Rice '21 – planning graduate school in public health	2018 – 2021
Justin Hayles, Rice EEPS – NSF Postdoctoral Fellow – Scientist, Jacobs Engineering	2016 – 2019
Huanting Hu, Rice EEPS – Postdoc – Research Specialist, Shanghai Jiao Tong University	2016 – 2018
Ian Mellor-Crummey, Rice '17 – Fine art photographer, Digital Media Support Specialist	2015 – 2017
Shuning Li, Rice/UCLA – Postdoc – Assistant Research Professor, Peking University	2015 – 2017

Daniel Petrizzo, UCLA Earth & Space Sciences, Ph.D. 2013 – Scientist, NASA JPL
 Hannah Aldern, UCLA '14 – Recruiting Associate, Open Philanthropy Project
 Vanessa Brillo, UCLA '12 – Wellsite Geologist, Horizon Well Logging
 Heather Widgren, Caltech '10 – Research Scientist, Carbon Materials

PROFESSIONAL SERVICE & OUTREACH

Reviewer, *National Research Council, Proceedings of the National Academy of Sciences, Science Advances, Nature Communications, Nature Geoscience, Geology, Earth and Planetary Science Letters, Global Biogeochemical Cycles, Geophysical Research Letters, Journal of Geophysical Research, Geochimica et Cosmochimica Acta, Reviews in Mineralogy and Geochemistry, Limnology and Oceanography, G³, ACS Earth and Space Chemistry, Rapid Communications in Mass Spectrometry, Journal of Atmospheric Chemistry, Scientific Reports, National Science Foundation (CBET, OCE, GG, EAR, ANT, MRI), U.S. Department of Agriculture, Deep Carbon Observatory, National Aeronautics and Space Administration (Emerging Worlds, Exobiology), Kavli Foundation-Department of Energy Science Public Engagement Partnership*

Member Representative for Rice University, University Corporation for Atmospheric Research 2021 –
 Member, Advisory Board, NSF GOLDEN-Rewards project 2021 –
 Member, Ken Kennedy Institute 2019 –
 Member, Water Quality Steering Committee, Galveston Bay Foundation 2017 –
 Session Convener, *Novel approaches to light stable isotopes in the Geobio- and Biogeosciences, V. M. Goldschmidt Conference, Honolulu, HI* 2020
 Selection committee, 2019 Science Innovation Award, European Association for Geochemistry 2018
 Organizing committee, International Symposium for Isotopomers 2018 2018
 Speaker, March for Science-Houston 2017
 Panelist, Communicating Science Conference (ComSciCon) Houston 2017
 Committee, Deep Carbon Observatory/American Geosciences Institute Diversity Grant Program 2016
 Panelist, Scientific Outreach/Non-Profit, MD Anderson Presidential Career Symposium 2016
 Discussion leader, 5th International Clumped Isotope Workshop, St. Petersburg, FL 2016
 Second place, Ocean 180 Video Challenge and Finalist, BLUE Ocean Film Festival (Animation) 2014
 3-minute oceanography outreach video viewed by over 30,000 middle-school students around the world
 Founding producer, *PHD TV* 2012 – 2013
 Educational videos and podcasts available freely to the public with >1 million views YouTube
 Session Convener, *Stable-isotope tracers in the atmosphere: Insights into chemical, physical, and biological cycling*, AGU Fall Meeting, San Francisco, CA 2012

UNIVERSITY SERVICE

Environmental Faculty Task Force 2019

Committees in the Department of Earth, Environmental and Planetary Sciences

Diversity, Inclusion, and Justice (Co-chair) 2020 –
 Graduate Admissions (Chair) 2019 –
 Laboratory and Safety 2016 –
 Magazine 2016 –
 Strategic Planning 2016 –
 Seminars 2015 –
 Wiess Visiting Scholar 2016 – 2018
 Graduate Admissions 2015 – 2018
 Faculty Search 2015 – 2016
 Wiess Postdoc Search 2015 – 2016

Thesis committee member for: Shah Bahauddin (PHYS), Alexander Bui (CEVE), Proteek Chowdhury, Trevor Cole, Emily Fulk (SSPB), Damanveer Grewal, Debadrita Jana, Hehe Jiang, Will Larsen, Xinyue Luo, Alexandra Malouta, Andrew Moodie, Loredana Suci, Brian Strasert (M.S., CEVE)

External thesis reviewer for: Prasanna K. (PhD, Indian Institute of Science-Bangalore)