

# Christopher T. Hayes

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## Education

PhD, MPhil, MA **Columbia University** | New York, NY, 2013–2008  
Earth and Environmental Science  
BSc **McGill University** | Montreal, QC, 2008–2004  
Chemistry (Environmental)

## Professional Experience

2022-present **University of Southern Mississippi** | Stennis Space Center, MS  
*Associate Professor, School of Ocean Science and Engineering*  
2016–2022 *Assistant Professor, School of Ocean Science and Engineering*  
2013–2015 **Massachusetts Institute of Technology** | Cambridge, MA  
*W.O. Crosby Postdoctoral Fellow*  
Department of Earth, Atmospheric and Planetary Science  
2008–2013 **Columbia University** | New York, NY  
*Graduate Research and Teaching Assistant*  
Department of Earth and Environmental Science  
Lamont-Doherty Earth Observatory

## Awards and Accomplishments

Butsch Oustalet Distinguished Professor in Research, 2019  
W.O. Crosby Postdoctoral Fellowship, 2013–2015  
NOAA Climate and Global Change Postdoctoral Fellowship, 2013 (declined)  
Best Student Oral Presentation, R. Duce Symposium, AMS Meeting 2013  
Gary Comer Abrupt Climate Change Fellow, 2010  
Faculty Fellow, Columbia University, 2008–2013

## Courses Taught

Isotope Biogeochemistry (USM, MAR642, 3 credit hours)  
Paleoceanography (USM, MAR683, 3 credit hours)  
The Oceans and Climate (USM, MAR418/591, 3 credit hours)  
Marine Pollution (USM, MAR419/519, 3 credit hours)  
Marine Environmental Science (USM, MAR402, 3 credit hours)

## Pedagogical Development

Kaufman Teaching Certificate Program (MIT, Spring 2015)

## Student Mentoring

Neil Redmond, PhD advisor (USM)	2018–present
Claire McGuire, MS advisor (USM)	2021–present
Yean Das, MS co-advisor (USM)	2021–present
Kacey Lange, MS committee member (USM)	2021–present
Michael Kamowski, MS committee member (USM)	2021–present
Carrie Miller, PhD committee member (USM)	2022–present
Shara Gremillion, PhD committee member (USM)	2022–present
Amy Moody, PhD committee member (USM)	2017–present
Megan Hansen, Undergraduate Intern (USM)	2021-2022
Sarah Raney, MS committee member (USM)	2020–2022
Austin Harris, MS co-advisor (USM)	2019–2021
Nadine Doiron, MS co-advisor (USM)	2019–2021
Allison Savoie, MS advisor (USM)	2018–2020
Evan Rohde, Undergraduate Thesis advisor (USM)	2018–2020
Justin Blancher, MS advisor (USM)	2018–2019
Samuel Glasscock, MS advisor (USM)	2017–2019
Laura Whitmore, PhD committee member (USM)	2015–2019
Habacuc Perez-Triboullier (U.Tasmania), external examiner	2019
Alexandra Bausch, PhD (LDEO), external committee member	2018
Jeffrey Rosen & Ashling Neary, Undergraduate assistants (MIT)	2015
Clio Macrakis, High School intern (MIT)	2014

## Peer-Reviewed Publications in Journals and Books

\*indicates student/post-doc author under Hayes' supervision

40. Wood, M., **C. T. Hayes**, A. Paytan. Global Quaternary carbonate burial: proxy and model-based reconstructions and persisting uncertainties. *Annual Review of Marine Science* 15, in press.
39. Rahman, S., A. Shiller, R. Anderson, M. Charette, **C. T. Hayes**, M. Gilbert, K. Grissom, P. Lam, D. Ohnemus, F. Pavia, B. Twining, S. Vivancos (2022). [Dissolved and particulate barium distributions along the US GEOTRACES North Atlantic and East Pacific Zonal Transects \(GA03 and GPI6\): Global implications for the marine barium cycle](#). *Global Biogeochemical Cycles* 36, e2022GB007330.
38. Xiang, Y., P. J. Lam, A. B. Burd, **C. T. Hayes** (2022). [Estimating mass flux from size-fractionated filtered particles: insights into controls on sinking velocities and mass fluxes in recent U.S. GEOTRACES cruises](#). *Global Biogeochemical Cycles* 36, e2021GB007292.
37. **Hayes, C. T.**, A. M. Shiller, S. A. Milroy (2022). [Towards Constraining Sources of Lithogenic Metals in the Northern Gulf of Mexico](#). *Journal of Geophysical Research: Oceans* 127, e2022JC018523. → Highlighted by [GEOTRACES](#)

36. Rohde, E. E.\*, **C. T. Hayes**, N. Redmond, S. K. Glasscock\* (2021). [Southern Ocean oxygenation changes inferred from redox-sensitive trace metals across Marine Isotope Stage 11](#). *Geochemistry, Geophysics, Geosystems* 22, e2021GC009921.
35. **Hayes, C. T.**, K. M. Costa, R.A. Anderson, E. Calvo, Z. Chase, L. L. Demina, J.-C. Dutay, C. R. German, L.-E. Heimbürger-Boavida, S. L. Jaccard, A. W. Jacobel, K. E. Kohfeld, M. D. Kravchishina, J. Lippold, F. A. Mekik, L. Missiaen, F. J. Pavia, A. Paytan, R. Pedrosa-Pamies, M. V. Petrova, S. Rahman, L. F. Robinson, M. Roy-Barman, A. Sanchez-Vidal, A. M. Shiller, A. Tagliabue, A. C. Tessin, M. van Hulst, J. Zhang (2021). [Global Seafloor Sediment Composition and Flux to the Deep Sea](#). *Global Biogeochemical Cycles* 35, e2020GB006769. → Highlighted by [GEOTRACES](#)
34. Howe, S., C. Miranda, **C. T. Hayes**, R. Letscher, A. N. Knapp (2020). [The dual isotopic composition of nitrate in the Gulf of Mexico and Florida Straits](#), *Journal of Geophysical Research: Oceans* 125, e2020JC016047.
33. Glasscock, S. K.\*, **C.T. Hayes**, N. Redmond\*, E. Rohde\* (2020). [Changes in Antarctic Bottom Water Formation During Interglacial Periods](#). *Paleoceanography & Paleoclimatology* 35, e2020PA003867.
32. **Hayes, C. T.**, J. N. Fitzsimmons, L. T. Jensen, N. T. Lanning, M. Hatta, D. McGee, E. A. Boyle (2020), [A Lagrangian view of trace elements and isotopes in the North Pacific](#), *Journal of Geophysical Research: Oceans* 125, e2019JC015862.
31. Costa, K., **C. T. Hayes**, and 32 others (2020), [<sup>230</sup>Th normalization: New insights on an essential tool for quantifying sedimentary fluxes in the modern and Quaternary ocean](#), *Paleoceanography & Paleoclimatology* 35, e2019PA003820.
30. **Hayes, C. T.**, L.-S. Wen, C.-P. Lee, P. H. Santschi, K. H. Johannesson (2019), [Metals in the Gulf of Mexico: synthesis and future directions](#). In: *Gulf of Mexico Origin, Waters, and Biota: Vol. 5, Chemical Oceanography*. Texas A&M University Press, (ed. T. S. Bianchi), ISBN: 978-1-62349-774-3.
29. **Hayes, C. T.** (2019), [Refractory Metals](#). In: *Encyclopedia of Ocean Sciences, 3<sup>rd</sup> Edition*, Elsevier (eds. J. K. Cochran, H. Bokuniewicz, P. Yager), ISBN: 9780128130810.
28. **Hayes, C. T.**, D. J. Wallace (2019), [Exploring records of Saharan dust transport and hurricanes in the western North Atlantic over the Holocene](#), *Quaternary Science Reviews* 205, 1–9.
27. **Hayes, C. T.**, E. E. Black, R. F. Anderson, M. Baskaran, K. O. Buesseler, M. A. Charette, J. K. Cochran, P. Fitzgerald, P. J. Lam, Y. Lu, S. O. Morris, D. C. Ohnemus, F. J. Pavia, G. Stewart, Y. Tang (alphabetical after first 2 authors) (2018), [Flux of particulate elements in the North Atlantic Ocean constrained by multiple radionuclides](#), *Global Biogeochemical Cycles* 32, 1738–1758. → Highlighted in [Eos](#)
26. **Hayes, C. T.**, R. F. Anderson, H. Cheng, T. M. Conway, R. L. Edwards, M. Q. Fleisher, P. Ho, K.-F. Huang, S. G. John, W. M. Landing, S. H. Little, Y. Lu, P. L. Morton, S. B. Moran, L. F. Robinson, R. U. Shelley, A. M. Shiller, X. Zheng (alphabetical order after 1<sup>st</sup> author) (2018), [Replacement times of a spectrum of elements in the North Atlantic based on thorium supply](#), *Global Biogeochemical Cycles* 32, 1294–1311. → Featured in [Eos](#)

25. R. Schlitzer and 286 others, including **C. T. Hayes** (2018), [The GEOTRACES Intermediate Data Product 2017](#), *Chemical Geology* 493, 210–223.
24. Participants of COME ABOARD and DISCO XXV: A. J. Fassbender and 72 others including **C. T. Hayes** (2017), [Perspectives on Chemical Oceanography in the 21<sup>st</sup> Century: Participants of the COME ABOARD Meeting examine aspects of the field in the context of 40 years of DISCO](#), *Marine Chemistry* 196, 191–190.
23. Wilson, S. T., F. O. Aylward, F. Ribalet, B. Barone, J. R. Casey, P. E. Connell, J. M. Eppley, S. Ferrón, J. N. Fitzsimmons, **C. T. Hayes**, A. E. Romano, K. A. Turk-Kubo, A. Vislova, E. V. Armbrust, D. A. Caron, M. J. Church, J. P. Zehr, D. M. Karl, and E. F. DeLong (2017), [Coordinated regulation of growth, activity and transcription in natural populations of the unicellular nitrogen-fixing cyanobacterium \*Crocospaera\*](#), *Nature Microbiology* 2, 17118.
22. **Hayes, C. T.**, J. Rosen\*, D. McGee, and E. A. Boyle (2017), [Thorium distributions in high and low dust regions and the significance for iron supply](#), *Global Biogeochemical Cycles* 31, 328–347. → Featured on [geotraces.org](http://geotraces.org)
21. **Hayes, C. T.**, D. McGee, S. Mukhopadhyay, E.A. Boyle, and A. C. Maloof (2017), [Helium and thorium isotope constraints on African dust transport to the Bahamas over recent millennia](#), *Earth and Planetary Science Letters* 457, 385–395.
20. Lerner, P., P. J. Lam, O. Marchal, R. F. Anderson, K. Buesseler, M. A. Charette, R. L. Edwards, **C. T. Hayes**, K.-F. Huang, Y. Lu, L. Robinson, and A. Solow (2016), [Corrigendum to “Testing models of thorium and particle cycling in the ocean using data from station GT11-22 of the U.S. GEOTRACES North Atlantic Section” \[Deep-Sea Res. I 113 \(2016\) 57–79\]](#), *Deep-Sea Research I* 118, 101.
19. Baker, A. R., W. M. Landing, E. Bucciarelli, M. Cheize, S. Fietz, **C. T. Hayes**, D. Kadko, P. L. Morton, N. Rogan, G. Sarthou, R. U. Shelley, Z. Shi, A. Shiller, and M. M. P. van Hulst (alphabetical order, after first 2 authors) (2016), [Trace element and isotope exchange at the air – sea interface: progress and research needs](#), *Philosophical Transactions of the Royal Society A* 374, 20160190.
18. Anderson, R. F., H. Cheng, R. L. Edwards, M. Q. Fleisher, **C. T. Hayes**, K.-F. Huang, D. Kadko, P. J. Lam, W. M. Landing, Y. Lao, Y. Lu, C. I. Measures, P. L. Morton, S. B. Moran, D. C. Ohnemus, L. F. Robinson, and R. U. Shelley (alphabetical order) (2016), [How well can we quantify dust deposition to the ocean?](#), *Philosophical Transactions of the Royal Society A* 374, 20150285.
17. Lerner, P., P. J. Lam, O. Marchal, R. F. Anderson, K. Buesseler, M. A. Charette, R. L. Edwards, **C. T. Hayes**, K.-F. Huang, Y. Lu, L. Robinson, and A. Solow (2016), [Testing models of thorium and particle cycling in the Ocean using data from station GT11-22 of the U.S. GEOTRACES North Atlantic Section](#), *Deep-Sea Research I* 113, 57–79.
16. Fitzsimmons, J. N., **C. T. Hayes**, S. al-Subiai, P. L. Morton, R. Weisend, F. Ascani, and E. A. Boyle (2015), [Daily to decadal variability of size-fractionated iron and iron-binding ligands at the Hawaii Ocean Time-series Station ALOHA](#), *Geochimica et Cosmochimica Acta* 171, 303–324.
15. **Hayes, C. T.**, J. N. Fitzsimmons, E. A. Boyle, D. McGee, R. F. Anderson, R. Weisend, and P. L. Morton (2015), [Thorium isotopes tracing the iron cycle at the Hawaii Ocean Time-](#)

[Series Station ALOHA](#), *Geochimica et Cosmochimica Acta* 169, 1–16. → Featured on [MIT News](#)

14. The GEOTRACES Group: E. Mawji, R. Schlitzer, E. Masferrer Dodas, and 133 others, including **C. T. Hayes** (2015), [The GEOTRACES Intermediate Data Product 2014](#), *Marine Chemistry* 177, 1–8.
13. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. M. Vivancos, P. J. Lam, D. C. Ohnemus, K.-F. Huang, L. F. Robinson, Y. Lu, H. Cheng, R. L. Edwards, and S. B. Moran (2015), [Intensity of Th and Pa scavenging partitioned by particle chemistry in the North Atlantic Ocean](#), *Marine Chemistry* 170, 49–60. → Featured on [geotraces.org](#)
12. Anderson, R. F., and **C. T. Hayes** (2015), [Characterizing marine particles and their impact on biogeochemical cycles in the GEOTRACES program](#), *Progress in Oceanography* 133, 1–5.
11. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, K.-F. Huang, L. F. Robinson, Y. Lu, H. Cheng, R. L. Edwards, and S. B. Moran (2015), [<sup>230</sup>Th and <sup>231</sup>Pa on GEOTRACES GA03, the U.S. GEOTRACES North Atlantic Transect, and implications for modern and paleoceanographic chemical fluxes](#), *Deep-Sea Research II* 116, 29–41.
10. **Hayes, C. T.**, A. Martinez-Garcia, A. Hasenfratz, S. L. Jaccard, D. A. Hodell, D. M. Sigman, G. H. Haug, and R. F. Anderson (2014) [A stagnation event in the deep South Atlantic during the last interglacial period](#), *Science* 346, 1514–1517.
9. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. Serno, G. Winckler, and R. Gersonde (2014), [Biogeography in <sup>231</sup>Pa/<sup>230</sup>Th ratios and a balanced <sup>231</sup>Pa budget for the Pacific Ocean](#), *Earth and Planetary Science Letters* 391, 307–318.
8. Serno, S., G. Winckler, R. F. Anderson, **C. T. Hayes**, H. Ren, R. Gersonde, and G. H. Haug (2014), [Using the natural spatial pattern of marine productivity in the Subarctic North Pacific to evaluate paleo-productivity proxies](#), *Paleoceanography* 29, 438–453.
7. Serno, S., G. Winckler, R. F. Anderson, **C. T. Hayes**, D. McGee, B. Machalett, H. Ren, S. M. Straub, R. Gersonde, and G. H. Haug (2014), [Eolian dust input to the Subarctic North Pacific](#), *Earth and Planetary Science Letters* 387, 252–263.
6. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. Serno, G. Winckler, and R. Gersonde (2013), [Quantifying lithogenic inputs to the North Pacific Ocean using the long-lived thorium isotopes](#), *Earth and Planetary Science Letters* 383, 16–25. → Highlighted on [geotraces.org](#)
5. **Hayes, C. T.**, R. F. Anderson, S. L. Jaccard, R. François, M. Q. Fleisher, M. Soon, and R. Gersonde (2013), [A new perspective on boundary scavenging in the North Pacific Ocean](#), *Earth and Planetary Science Letters* 369–370, 86–97. → Highlighted on [geotraces.org](#)
4. Jaccard, S. L., **C. T. Hayes**, A. Martinez-Garcia, D. A. Hodell, R. F. Anderson, D. M. Sigman, and G. H. Haug (2013), [Two modes of change in Southern Ocean productivity over the past million years](#), *Science* 339, 1419–1423.
3. **Hayes, C. T.**, R. F. Anderson, and M. Q. Fleisher (2011), [Opal accumulation rates in the equatorial Pacific and mechanisms of deglaciation](#), *Paleoceanography* 26, PA1207. → Featured in [Eos](#)

2. Ariya, P. A., J. Sun, N. A. Eltouny, E. D. Hudson, **C. T. Hayes**, and G. Kos (2009), [Physical and chemical characterization of bioaerosols - Implications for nucleation processes](#), *International Reviews in Physical Chemistry* 28, 1–32.
1. Mortazavi, R., **C. T. Hayes**, and P. A. Ariya (2008), [Ice nucleation activity of bacteria isolated from snow compared with organic and inorganic substrates](#), *Environmental Chemistry* 5, 373–381.

## Manuscripts Submitted or In Preparation

Schimmenti, D., F. Marcantonio, J. Sarao, **C. T. Hayes**, J. Hertzberg, M. Schmidt. Deglacial variability in phytoplankton community structure and carbon export in the eastern equatorial Pacific Ocean. *Submitted*.

Savoie, A. M.\*, A. Moody, K. Dillion, S. D. Howden, A. M. Shiller, **C. T. Hayes**. Impact of local rivers on coastal acidification in the Mississippi Sound. *In Revision* for *Limnology and Oceanography*.

**Hayes, C. T.**, P. Pollisar. Geochemistry of Marine Sediments. *In preparation* for *Treatise on Geochemistry*.

Redmond, N.\*, **C. T. Hayes**, S. Glasscock\*, E. Rohde\*, R. Anderson, D. McGee. Anomalous  $^{234}\text{U}/^{238}\text{U}$  Isotopic Composition in Southern Ocean Sediments. *In preparation* for *Geochimica et Cosmochimica Acta*.

## Funding History

- |           |  |
|-----------|--|
| 2021–2024 | National Science Foundation: Chemical Oceanography Program. Lead PI with co-PIs R.F. Anderson (Columbia) and R.L. Edwards (Univ. Minnesota): <i>Collaborative Research: U.S. GEOTRACES GPI 7-OCE and GPI 7-ANT: <math>^{230}\text{Th}</math>, <math>^{232}\text{Th}</math> and <math>^{231}\text{Pa}</math> tracers of trace element supply and removal</i> (\$1.8M total; \$461,787 to USM) |
| 2016–2022 | National Oceanic and Atmospheric Administration: Co-I with S. D Howden (USM): <i>Continued development of Gulf of Mexico Coastal Ocean Observing System</i> (~\$1M to USM)   |
| 2017–2022 | National Science Foundation: Chemical Oceanography Program. Co-PI with R. F. Anderson (Columbia) and R. L. Edwards and H. Cheng (Univ. Minnesota): <i>Collaborative Research: Using natural radionuclides to quantify the supply and removal of trace elements in the Pacific Ocean</i> (\$1.3M total; \$249,803 to USM).  |
| 2019      | Mississippi Department of Marine Resources. Howden, S. D. (PI), Hendon, J. M. (Co-PI), Franks, J. S. (Co-PI), Milroy, S. P. (Co-PI), Dillon, K. S. (Co-PI), Hayes, C. T. (Co-PI), Shiller, A. M. (Co-PI), "Monitoring 2019 BCS Impacts (Water Quality)," \$240,941. (June 1, 2019 - August 31, 2019).  |
| 2017–2021 | National Science Foundation: Marine Geology and Geophysics Program. Sole PI: <i>Uranium isotopes and past changes in Southern Ocean circulation</i> (\$239,539 to USM).  |
| 2015–2021 | U.S. Department of Energy: Replacement PI for D.G. Redalje. <i>MAGIC (Marine Algae Industrialization Consortium) – Combining biofuel and high-value bioproducts to</i>   |

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- meet the renewable fuel standard* (\$100,000 to USM, subcontract through Duke University).
- 2017–2019 National Academies Keck Future Initiatives and Gulf Research Program: Discovering the Deep Blue Sea. Lead PI with Co-PI's R. Green (BOEM), M. Sieracki (NSF), L. Gershwin (CSIRO), and A. Kollias (ArtCenter): *Dive In: An Immersive and Wonder-Filled Virtual Reality Experience of Life in the Ocean's Mesopelagic Zone* (\$100,000 to USM).
- 2017–2019 National Academies Keck Future Initiatives: Discovering the Deep Blue Sea and the Gulf Research Program. Co-PI with B. Ballengée (LSU), D. Figueroa (UT-Rio Grande Valley), D. Murphy (USF), and A. Skarke (MSU): *Creating Resilience: Building a Gulf of Mexico NAKFI Alumni Working Group* (\$25,000 to Ballengée Studio LLC)
- 2015 Antarctic Science Bursary of Antarctic Science Ltd. PI, in collaboration with J. Fitzsimmons (Texas A&M) and R. Sherrell (Rutgers): *Tracing continental inputs and organic matter export using the long-lived thorium isotopes on the Western Antarctic Peninsula* (£2380 to MIT)
- 2013–2015 W. O. Crosby Postdoctoral Fellowship: MIT competitive award. Independent projects on trace metal biogeochemistry at the Hawaii Ocean Time-series station, the Northwestern Atlantic and the Southern Ocean (\$134,000)

### **Invited Talks at Universities and Symposia**

- Southeastern Louisiana University: Chemistry and Physics Dept. Seminar (March 2021)
- Tulane University: Office of Health Research, General Public talks for control members in clinical trials (March and November, 2019; January 2021)
- University of British Columbia: Department of Earth, Ocean and Atmospheric Sciences Colloquium (Oct. 2018)
- University of Southern Mississippi: Department of Coastal Sciences Seminar (Oct. 2017)
- Texas A&M University: Oceanography Seminar (Nov. 2016)
- Tulane University: Earth and Environmental Science Seminar (Oct. 2016)
- MIT: Program in Atmospheres, Oceans and Climate Seminar (April 2015)
- University of Southern Mississippi: Department of Marine Science Seminar (April 2015)
- Caltech: Environmental Science and Engineering Seminar (Feb. 2015)
- University of Michigan: Smith Lecture (Nov. 2014)
- MIT: Chemical Oceanography and Geobiology Seminar (Nov. 2014)
- Stony Brook University: SOMAS Seminar (Aug. 2013)
- MIT: Chemical Oceanography and Geobiology Seminar (March 2013)
- Woods Hole Oceanographic Institution: "Climate and Paleo" Seminar (March 2013)
- Dissertations Symposium in Chemical Oceanography XXIII* (Hawaii, Oct. 2012)
- Princeton University: mini-conference on Fe fertilization (May 2012)



## Service & professional activities

### **National and International Academic Community Service**

- Associate Editor for the journal *Global Biogeochemical Cycles* (2021-present)
- Early Career Representative to the Executive Committee of the American Geophysical Union, Ocean Sciences Section, 2018–2020
- Institutional Representative to UNOLS (University-National Oceanography Laboratory Systems), 2017–present
- Conference Planning Committees:
  - Ocean Sciences Meeting 2020, San Diego, CA
  - Goldschmidt 2023, Lyon, France
- Conference Session Convener:
  - Paleo-proxies in the GEOTRACES Era, AGU Fall Meeting 2021
  - Marine biogeochemistry: Particle fluxes and dissolved trace element cycling from source to sink, Goldschmidt Meeting 2021
  - Carbon Storage in the Ocean now and over Time, Goldschmidt Meeting, 2018
  - Marine micro-nutrients from the GEOTRACES program, AGU Fall Meeting, 2012
- Outstanding Student Paper Awards Coordinator, Ocean Sciences Section, AGU Fall Meeting 2016
- Volunteer, National Ocean Sciences Bowl: Hurricane Bowl, Ocean Springs, MS, 2016–2022
- Volunteer, Peter Anderson Festival Outreach, Ocean Springs, MS, 2016
- Officer, Professional Development Organizing Committee for the Center for Microbial Oceanography: Research and Education (C-MORE), 2014–2015
- Organizer, Lamont-Doherty Earth Observatory's weekly departmental seminar for Geochemistry, 2012–2013

### **Peer Reviewer for Submissions to the Following National and International Journals**

<i>Science</i>	<i>Global Biogeochemical Cycles</i>
<i>Nature Geoscience</i>	<i>Geochemistry, Geophysics, Geosystems</i>
<i>Nature Communications</i>	<i>Paleoceanography</i>
<i>Proceedings of the National Academy of Sciences</i>	<i>Analytica Chimica Acta</i>
<i>PLOS ONE</i>	<i>Marine Geology</i>
<i>Philosophical Transactions of the Royal Society A</i>	<i>Marine Chemistry</i>
<i>Geophysical Research Letters</i>	<i>Estuarine, Coastal and Shelf Science</i>
<i>Earth and Planetary Science Letters</i>	<i>Quaternary Science Reviews</i>
<i>Limnology &amp; Oceanography</i>	<i>Chemical Geology</i>
<i>Journal of Geophysical Research-Oceans</i>	<i>Journal of Industrial and Engineering Chemistry</i>
<i>Deep-Sea Research I</i>	<i>Journal of Marine Systems</i>
<i>Biogeosciences</i>	<i>Boreas</i>
<i>Geochimica et Cosmochimica Acta</i>	



## **Peer Reviewer for the Following National and International Funding Agencies**

Ad hoc reviewer for proposals to:

- U.S. National Science Foundation: Chemical Oceanography program
- U.S. National Science Foundation: Marine Geology and Geophysics program
- U.K. Natural Environment Research Council

Panel reviewer for proposals to:

- U.S. National Science Foundation: Chemical Oceanography program (2015)

## **Professional Society Memberships**

- American Chemical Society: 2007–2009
- American Geophysical Union: 2009–present
- Geochemical Society: 2010–present
- Association for the Sciences of Limnology and Oceanography: 2016–present
- American Association for the Advancement of Science: 2018–present

## **USM-level Service**

- Reviewer for USM Honors College Applications (2022)
- Eagle SPUR, USM undergraduate Research Awards reviewer (2017, 2019)
- Search Committee Chair, Assistant Professor in Marine Chemistry, 2021-2022
- Search Committee Member, Assistant Teaching Professor of Marine Science, 2020
- Search Committee Member, Biological Oceanography Faculty, 2018–2019
- Search Committee Chair, Endowed Chair Faculty in Marine Science, 2017–2018
- Search Committee Member, Hydrographic Science Faculty, 2016–2017
- Seminar in Marine Science committee co-chair (2017–present)
- Division Outreach committee chair (2016–present)

## **Ocean and Field Research Expeditions (~149 days at sea)**

- |                                     |  |
|-------------------------------------|--|
| November 2017                       | USM Graduate Student Field Trip and Sampling Expedition<br><i>R/V Point Sur</i> : Gulfport, MS to Deepwater Horizon well site,<br>2 days at sea. Water sampling and student training.                              |
| October 2016                        | USM Graduate Student Field Trip and Sampling Expedition<br><i>R/V Point Sur</i> : Gulfport, MS to Deepwater Horizon well site,<br>2 days at sea. Water sampling and student training.                              |
| April, November 2016,<br>March 2017 | Mississippi Sound and Barrier Island Sampling<br>Assisted Drs. Hannah Box and Dongjoo Jung (USM) in sampling<br>of seawater and groundwater. 5 Day trips to Ship, Horn and<br>Dauphin Island                       |
| July–August 2015                    | SCOPE/C-MORE Summer Cruise<br>Simons Collaboration of Ocean Processes and Ecology<br><i>R/V Kilo Moana</i> (KMI513): Honolulu, HI to Honolulu, HI<br>12 days at sea; Water sampling and filtration/ultrafiltration |

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- May–June 2014 UNOLS Chief Scientist Training Cruise  
R/V *Atlantic Explorer* (AE1410): Bridgetown, Barbados to St. Georges, Bermuda, 9 days at sea; Aerosol and water sampling
- March 2014 Northwest Andros Island, Bahamas (Three Creeks area)  
Water and sediment coring in tidal flats; 3 days in field
- September 2013 Hawaii Ocean Experiment – Phosphorus Rally II (HOE-PhoR II)  
R/V *Kilo Moana* (KM1316): Honolulu, HI to Honolulu, HI, 12 days at sea; Water sampling and filtration/ultrafiltration
- November–December 2011 U. S. GEOTRACES: North Atlantic Zonal Transect, Leg 2  
R/V *Knorr* (KN204-1A+B): Woods Hole, MA to St. Georges, Bermuda to Praia, Cape Verde, 35 days at sea  
Water Sampling Manager
- October 2010 U. S. GEOTRACES: North Atlantic Zonal Transect, Leg 1  
R/V *Knorr* (KN199-4): Lisbon, Portugal to Mindelo, Cape Verde, 20 days at sea; Water Sampling Manager
- July–August 2009 The Innovative North Pacific Experiment (INOPEX)  
R/V *Sonne* (SO-202): Tomakomai, Japan to Busan, South Korea, 50 days at sea; Water, sediment, and plankton sampling

### Prior Research Experience

- 2007–2008 Research Assistant for Dr. Parisa Ariya (Chemistry and Atmospheric and Oceanic Sciences, McGill University) – Bio-aerosols and ice nucleation – Air and snow sampling
- Summer 2006 Research Assistant for Dr. Claire Rutledge (Entomology, Connecticut Agricultural Experiment Station) – Chemical ecology of wood-boring insects – State-wide tree survey, bio-assays, trap maintenance

### Selected Conference Presentations and Abstracts

- Schimmenti, D., F. Marcantonio, J. Sarao, **C. T. Hayes**, J. Hertzberg, M. Schmidt (2022) Dynamic nutrient regime and phytoplankton response in the eastern equatorial Pacific Ocean over the past 25,000 years. Goldschmidt Meeting 2022 (July).
- Wood, M., **C. T. Hayes**, A. Paytan (2022). Global Quaternary carbonate burial: updated reconstructions, persisting uncertainties, and new directions. Goldschmidt Meeting 2022 (July).
- McGuire, C.\*, **C. T. Hayes**, S. Howden, A. Sutton (2022). Real-time changes in carbonate chemistry observations on the Louisiana Shelf during Hurricane Ida. 2022 Ocean Sciences Meeting (virtual, February).

- Leal, A., R. Anderson, M. Fleisher, E. Black, **C. Hayes**, N. Redmond\*, P. Schroedl, X. Li, R. L. Edwards (2022). Comparison of water column and core top thorium-232 fluxes in the Pacific basin (GEOTRACES section GP15). 2022 Ocean Sciences Meeting (virtual, February).
- Hayes, C.T.**, N. Redmond\*, M. Hansen\*, M.Q. Fleisher, R. F. Anderson, E. Black, N. Carracino, S. Rojas, P. J. Lam, R. L. Edwards, X. Li, P. Schroedl (2022). Size-fractionated POC fluxes throughout the water column of the Pacific basin (GEOTRACES section GP15). 2022 Ocean Science Meeting (virtual, February).
- Xiang, Y., P. Lam, A. Burd, **C. T. Hayes** (2022). Estimating mass flux from size-fractionated filtered particles: Insights into controls on sinking velocities and mass fluxes in recent U.S. GEOTRACES cruises. 2022 Ocean Sciences Meeting (virtual, February).
- Redmond, N.\*, **C. T. Hayes**, R. F. Anderson, E. Black, M. Fleisher, X. Li, R. L. Edwards, P. Schroedl (2021). Quantifying meridional transport of scavenged radionuclides over Pacific biogeochemical provinces. American Geophysical Union Fall Meeting. (New Orleans, December).
- Schimmenti, D., F. Marcantonio, **C. T. Hayes**, J. E. Hertzberg, M. Schmidt (2021). Dynamics of biological productivity and carbon export in the easternmost Equatorial Pacific Ocean across Marine Isotope Stages 2-5. American Geophysical Union Fall Meeting. (New Orleans, December).
- Shiller, A., S. Rahman, R. Anderson, M. A. Charette, **C. T. Hayes**, M. Gilbert, K. Grissom, P. J. Lam, D. Ohnemus, F. Pavia, B. Twining, S. Vivancos (2021), Biogeochemical processes controlling the marine Ba cycle: dissolved and particulate barium distributions along the US GEOTRACES North Atlantic and South Pacific Zonal Transects (GA03 and GP16). *Goldschmidt Meeting* (virtual, July).
- Schimmenti D., F. Marcantonio, **C. T. Hayes**, J. Hertzberg, M. W. Schmidt, (2021), Dynamics of biological productivity and carbon export in the easternmost equatorial Pacific Ocean over the last 25,000 years. *Goldschmidt Meeting* (virtual, July).
- Fleisher, M., R. Anderson, E. Black, N. Carracino, R. L. Edwards, **C. T. Hayes**, P. J. Lam, X. Li, N. Redmond\*, S. Rojas, P. Schroedl, (2021). Particle dynamics in the central Pacific Ocean: Insights from Th and Pa isotopes. *Goldschmidt Meeting* (virtual, July).
- Rahman, S., A. Shiller, R. Anderson, **C. T. Hayes**, P. J. Lam, D. Ohnemus, F. Pavia, B. Twining, S. Vivancos, (2021). Particulate excess Ba as a proxy for biological productivity along the North Atlantic and South Pacific GEOTRACES transects. *Goldschmidt Meeting* (virtual, July)
- Black, E., R. Anderson, N. Carracino, R. L. Edwards, M. Fleisher, **C. T. Hayes**, P. J. Lam, X. Li, N. Redmond\*, S. Rojas, P. Schroedl, (2021). Thorium-derived dust fluxes in the Pacific: examining seawater, particle and sediment-based estimates. *Goldschmidt Meeting* (virtual, July).
- Hayes, C.T.**, K. Costa, E. Calvo, Z. Chase, L.L. Demina, J.-C. Dutay, C. R. German, L.-E. Heimbürger-Boavida, S.L. Jaccard, A.W. Jacobel, K.E. Kohfeld, M.D. Kravchishina, J. Lippold, F. Mekik, L. Missiaen, F.J. Pavia, A. Paytan, R. Pedrosa-Pamies, M.V. Petrova, S. Rahman, L.F. Robinson, M. Roy-Barman, A. Sanchez-Vidal, A. Shiller, A. Tagliabue, A.C. Tessin, M. van Hulten, M., J. Zhang, (2020). The Composition and Flux of Seafloor Sediments in the Global Ocean. *AGU Fall Meeting*, (virtual, December).

- Redmond, N.\*, **C.T. Hayes**, S. Glasscock\*, E. Rohde\*, (2020). Potential Remobilization and Sources of  $^{234}\text{U}$  in the Southern Ocean over Five Glacial-interglacial Cycles. *AGU Fall Meeting*, (virtual, December).
- Cochran, D. M., **C. T. Hayes**, C. Hwanseok, P. Papryzski, J. Lee, M. Brazeal, T. Rehner (2020), Comparing Perceptions and Reality: Convergence Among Gulf Coast Residents and Government Data on Water Quality in the Mississippi Sound. *2020 Gulf of Mexico Oil Spill & Ecosystem Science Conference* (Tampa, February).
- Savoie, A. M.\*, A. Moody, A. M. Shiller, K. Dillon, **C. T. Hayes** (2020), Freshwater Endmembers Influencing the Dissolved Inorganic Carbon System of the Mississippi Sound. *Ocean Sciences Meeting* (San Diego, February).
- Hayes, C. T.** (2020), Quantifying African dust deposition to the Gulf of Mexico. *Ocean Sciences Meeting* (San Diego, February).
- Knapp, A. N., S. Howe, C. Miranda, **C. T. Hayes**, R. T. Letscher (2020), The isotopic composition of water column nitrate in the Gulf of Mexico and Florida Straits. *Ocean Sciences Meeting* (San Diego, February).
- Savoie, A. M.\*, **C. T. Hayes**, S. D. Howden (2020), Carbonate chemistry measurements in Mississippi and Louisiana coastal waters. *NOAA Ocean Acidification Community Meeting* (Miami, January).
- Hayes, C. T.**, J. Rosen\*, D. McGee, J. N. Fitzsimmons, A. Annett, R. M. Sherrell (2019), Tracing continental input and organic matter export on the West Antarctic Shelf using the long-lived thorium isotopes. *AGU Fall Meeting* (San Francisco, December).
- Glasscock, S.\*, N. Redmond\*, E. Rohde\*, **C. T. Hayes** (2019), A Millennial-Scale Reduction in Antarctic Bottom Water during the Marine Isotope Stage 11 Interglacial. *AGU Fall Meeting* (San Francisco, December)
- Rohde, E.\*, S. Glasscock, **C. T. Hayes** (2019), Detecting Southern Ocean Circulation Changes during Past Interglacial Periods using Manganese and Rhenium. *AGU Fall Meeting* (San Francisco, December).
- Schimmenti, D., F. Marcantonio, **C. T. Hayes**, J. E. Hertzberg, M. W. Schmidt (2019), Assessing export production on millennial timescales in the eastern equatorial Pacific Ocean. *AGU Fall Meeting* (San Francisco, December).
- Savoie, A. M.\*, J. Rosen\*, S. Howden, **C. T Hayes** (2019), Carbon dynamics off the continental shelf of the Gulf of Mexico. *ASLO Aquatic Sciences Meeting* (Puerto Rico, February).
- Hayes, C. T.**, R. F. Anderson, H. Cheng, T. M. Conway, R. L. Edwards, M. Q. Fleisher, P. Ho, K.-F. Huang, S. G. John, W. M. Landing, S. H. Little, Y. Lu, P. L. Morton, S. B. Moran, L. F. Robinson, R. U. Shelley, A. M. Shiller, X. Zheng (alphabetical order after 1<sup>st</sup> author) (2018), Replacement times of the rare earth elements in the North Atlantic based on thorium supply. *AGU Fall Meeting* (Washington, DC, December). Poster Presentation.
- Glasscock, S. K.\*, **C. T. Hayes**, E. Rohde\* (2018), Using Authigenic Uranium as a Proxy for Bottom Water Oxygen Concentrations in the Southern Ocean During Marine Isotope Stage 11, *Goldschmidt Conference* (Boston, MA, August).

- Hayes, C. T.** (2018), Ocean Cycling of Refractory Elements, *Goldschmidt Conference* (Boston, MA, August). Poster Presentation.
- Hayes, C. T.**, E. E. Black, F. J. Pavia, R. F. Anderson, M. Baskaran, K. O. Buesseler, M. A. Charette, P. Fitzgerald, J. K. Cochran (2018), Sinking flux profiles of carbon and trace elements in the North Atlantic Ocean constrained by multiple radionuclide systems, *AGU Ocean Sciences Meeting* (Portland, OR, February). Oral Presentation.
- Hayes, C. T.**, D. J. Wallace (2017), Exploring records of Saharan dust transport and hurricanes in the Caribbean and Gulf of Mexico over recent millennia, *AGU Fall Meeting* (New Orleans, LA, December). Invited Oral Presentation.
- Hayes, C. T.**, (2017), Extrapolating from thorium to other parts of the periodic table in the ocean, *Gordon Research Conference: Chemical Oceanography* (New London, NH, July). Invited Oral Presentation.
- Kuzminov, A., **C. T. Hayes**, R. Anderson, L. Godfrey, S. Severmann (2017), Uranium paradox: isotope ratios from the Southern Ocean, *Gordon Research Conference: Chemical Oceanography* (New London, NH, July).
- Hayes, C. T.** (2017), Contrasting protactinium regimes between the North Pacific and the North Atlantic, *PAGES Open Science Meeting* (Zaragoza, Spain, May). Invited Oral Presentation.
- Hayes, C. T.**, J. N. Fitzsimmons, P. L. Morton, D. McGee, E. A. Boyle (2017), Diel trace metal variations in the North Pacific subtropical gyre, *ASLO Aquatic Sciences Meeting* (Honolulu, HI, February). Oral Presentation.
- Hayes, C. T.**, S. Severmann, A. Anderson (2016), Uranium-234 anomalies in authigenic uranium as a new oxygenation proxy in the Southern Ocean, *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.
- Lu, Y., R. L. Edwards, H. Cheng, R.F. Anderson, **C. T. Hayes**, M. Q. Fleisher, P. J. Lam, K. F. Huang, L. F. Robinson, X. Wang (2016),  $^{230}\text{Th}$  and  $^{231}\text{Pa}$  in seawater sinking particles from the North Atlantic GEOTRACES Transect. *AGU Fall Meeting* (San Francisco, CA, December).
- Hayes, C. T.**, D. McGee, E. A. Boyle, S. Mukhopadhyay, A. C. Maloof (2016), Isotopic accounts of mineral dust deposition in the northwestern subtropical Atlantic from seasons to recent millennia, *AGU Ocean Sciences Meeting* (New Orleans, LA, February). Oral Presentation.
- Hayes, C. T.**, D. McGee, E. A. Boyle (2015), Thorium isotope observations for the dust proxy from Barbados to Bermuda and at Station ALOHA, *Royal Society Meeting on Ocean Trace Element Chemistry* (London, December). Poster Presentation.
- Wu, Y., S. L. Goldstein, L. Pena, **C. T. Hayes**, R. F. Anderson, R. Gersonde (2015) Constraining the sources of neodymium in the North Pacific Ocean, *AGU Fall Meeting* (San Francisco, CA, December).
- Hayes, C. T.**, A. Martinez-Garcia, A. P. Hasenfratz, S. L. Jaccard, D. A. Hodell, D. M. Sigman, G. H. Haug, R. F. Anderson (2014), A millennial-scale reduction in ventilation of the deep South Atlantic during the last interglacial period, *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.

- Weisend, R., P. L. Morton, W. M. Landing, J. N. Fitzsimmons, **C. T. Hayes**, E. A. Boyle (2014), Particulate trace element cycling in a diatom bloom at Station ALOHA. *AGU Fall Meeting* (San Francisco, CA, December).
- Morton, P. L., R. Weisend, W. M. Landing, J. N. Fitzsimmons, **C. T. Hayes**, E. A. Boyle (2014), Trace element cycling in lithogenic particles at Station ALOHA. *AGU Fall Meeting* (San Francisco, CA, December).
- Hayes, C. T.**, M. Q. Fleisher, R. F. Anderson, P. J. Lam, D. Ohnemus, K.-F. Huang, L. F. Robinson, Y. Lu, H. Cheng, R. L. Edwards, S. B. Moran (2014), Proxy Applications of Pa/Th Investigated with Scavenging Chemistry in the North Atlantic. *AGU Fall Meeting* (San Francisco, CA, December). Poster Presentation.
- Hayes, C. T.**, E. A. Boyle, D. McGee, J. N. Fitzsimmons, R. F. Anderson (2014),  $^{232}\text{Th}/^{230}\text{Th}$  at the Hawaii Ocean Time-Series Station ALOHA: A tool for iron cycling. *AGU Ocean Sciences Meeting* (Honolulu, HI, February). Poster Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, L. F. Robinson, K. F. Huang, D. C. Ohnemus, P. J. Lam, R. L. Edwards, H. Cheng, S. B. Moran (2013), Scavenging intensity and elemental fractionation in the North Atlantic. *Gordon Research Conference: Chemical Oceanography* (Biddeford, ME, August). Poster Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, R. Gersonde (2013), Quantifying lithogenic inputs to the North Pacific Ocean using the long-lived thorium isotopes. *93<sup>rd</sup> Annual AMS Meeting: Robert A. Duce Symposium* (Austin, TX, January). Oral Presentation.
- Anderson, R. F., **C. T. Hayes** (2013), New insights into geochemical proxies from GEOTRACES. *International Conference on Paleoceanography (ICP-11)*. (Barcelona, Spain, September).
- Anderson, R. F., **C. T. Hayes**, M. Q. Fleisher, L. F. Robinson, K.-F. Huang, H. Cheng, L. Sha, R. L. Edwards, Y. Lu, S. B. Moran (2013), Constraining rates of trace element supply and removal using long-lived thorium isotopes. *Mineralogical Magazine*, 77(5) 594 (Goldschmidt Conference, Florence, Italy, August).
- Hayes, C. T.**, R. F. Anderson (2012), Rapid uranium enrichment in the South Atlantic during Marine Isotope Stage 5e. *Gary C. Comer Abrupt Climate Change Conference* (Leeward Farm, WI, September). Oral Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, L. F. Robinson, K. F. Huang, D. C. Ohnemus, P. J. Lam, R. L. Edwards, H. Cheng, S. B. Moran (2012), Scavenging and fractionation of  $^{231}\text{Pa}/^{230}\text{Th}$  in the U. S. North Atlantic GEOTRACES transect. *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.
- Winckler, G., S. Serno, **C. T. Hayes**, R. F. Anderson, R. Gersonde, G. H. Haug (2012), Quantifying dust input to the Subarctic North Pacific-Results from surface sediments and sea water thorium isotopes. *AGU Fall Meeting* (San Francisco, CA, December).
- Serno, S., G. Winckler, R. F. Anderson, H. A. Ren, **C. T. Hayes**, B. Machalett, R. Gersonde, G. H. Haug (2012), Dust fertilization of biological productivity in the Subarctic North Pacific during the last 150 kyr. *AGU Fall Meeting* (San Francisco, CA, December).

- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, R. Gersonde (2012), The nature of boundary scavenging in the North Pacific Ocean. *Mineralogical Magazine*, 75, 1825. (Goldschmidt Conference, Montreal, Canada, June). Oral Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, L. F. Robinson, H. Cheng, R. L. Edwards, and S. B. Moran (2012), Pa and Th distributions along the GEOTRACES North Atlantic Transect. *AGU Ocean Sciences Meeting* (Salt Lake City, UT, February). Oral Presentation.
- Anderson, R. F., **C. T. Hayes**, M. Q. Fleisher, L. F. Robinson, K. F. Huang, R. L. Edwards, H. Cheng, S. B. Moran, R. Gersonde, M. Hatta (2012), Aerosol supply of soluble trace elements to the ocean evaluated using paired thorium isotopes. *AGU Ocean Sciences Meeting* (Salt Lake City, UT, February).
- Robinson, L., K.-F. Huang, M. E. Auro, R. F. Anderson, **C. T. Hayes**, M. Q. Fleisher, H. Cheng, R. L. Edwards, S. B. Moran, M. Saito (2012), Sources, sinks and cycling of seawater  $^{232}\text{Th}$  in the north and south Atlantic basins. *Mineralogical Magazine*, 75, 2291. (Goldschmidt Conference, Montreal, Canada, June).
- Anderson, R., **C. T. Hayes**†, M. Fleisher, L. Robinson, K.-F. Huang, R. L. Edwards, S. B. Moran (2012), Dissolved  $^{231}\text{Pa}/^{230}\text{Th}$  in the U. S. GEOTRACES North Atlantic Zonal Transect. *Mineralogical Magazine*, 75, 1424. (Goldschmidt Conference, Montreal, Canada, June).  
†Presenting author for oral presentation.
- Winckler, G., S. Serno, R. F. Anderson, **C. T. Hayes**, H. Ren, R. Gersonde, G. Haug (2012), Atmospheric dust input to the Subarctic North Pacific. *Mineralogical Magazine*, 75, 2550. (Goldschmidt Conference, Montreal, Canada, June).
- Hayes, C. T.**, S. L. Jaccard, A. Martinez-Garcia, E. D. Galbraith, D. A. Hodell, R. F. Anderson, D. M. Sigman, G. H. Haug (2011), Southern Ocean dynamics regulate atmospheric  $p\text{CO}_2$  variability over the past million years. *Gary C. Comer Abrupt Climate Change Conference* (Leeward Farm, WI, September). Oral Presentation.
- Serno, S., G. Winckler, R. F. Anderson, R. Gersonde, **C. T. Hayes**, G. H. Haug (2011), Modern dust flux and biological productivity in the Subarctic North Pacific. *International Union for Quaternary Research Congress (INQUA-XVIII)* (Bern, Switzerland, August).
- Hayes, C. T.**, R. F. Anderson, R. Gersonde (2011), The influence of boundary scavenging and particle composition on dissolved and buried  $^{230}\text{Th}$  and  $^{231}\text{Pa}$  in the subarctic North Pacific. *Mineralogical Magazine*, 75, 994. (Goldschmidt Conference, Prague, Czech Republic, August). Oral Presentation.
- Serno, S., **C. T. Hayes**, G. Winckler, R. F. Anderson (2010), Deciphering past and modern linkages between dust influx, biological productivity and climate change in the Subarctic North Pacific. *Workshop DUSTSPEC: Dust records for a changing world*, (Palisades, NY, May).
- Hayes, C. T.**, R. F. Anderson (2010), Wind-driven upwelling in the Southern Ocean during glacial terminations. *Gary C. Comer Abrupt Climate Change Conference* (Leeward Farm, WI, September). Oral Presentation.
- Hayes, C. T.**, R. F. Anderson (2010), Wind-driven upwelling in the Southern Ocean across Termination II. *Tenth International Conference on Paleoceanography (ICP-X)* (La Jolla, CA, August). Poster Presentation.



**Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher (2009), Deglacial opal accumulation in the equatorial Pacific and signatures of the Southern Ocean. *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.

## **Professional Workshop Participation**

NSF/National Academies of Sciences Workshop on Future of the NSF Paleo-perspectives on Climate Change (P2C2) program (August 2021).

Gulf of Mexico Science for a Regional Class Research Vessel, Gulfport MS. Co-organizer. (January 2019).

Joint GEOTRACES/PAGES synthesis workshop: Trace element and isotope proxies in paleoceanography. Aix-Marseille, France. Invited speaker (December 2018).

Ocean Sciences Meeting Town Hall, Portland, OR: Developing a framework for trace element, isotope, and other biogeochemical research in the Gulf of Mexico and Caribbean Sea. Invited Speaker (February 2018).

Ocean Sciences Meeting Town Hall, Portland, OR: Release of new (IDP2017) GEOTRACES data product. Invited Speaker (February 2018).

NOAA Office of Exploration and Research workshop, Honolulu, HI: From Seafloor to Surface: Exploration of the Water Column (March 2017). Invited Speaker. Workshop Report: Netburn, A.N. (Editor). 2018. [From Surface to Seafloor: Exploration of the Water Column \(Workshop Report\)](#), Honolulu, HI, 4-5 March 2017. NOAA Office of Ocean Exploration and Research. Silver Spring, MD. NOAA Technical Memorandum OAR OER; 003. 34 pp.

National Academies Keck Futures Initiates, Irvine, CA: NAKFI conference: Discovering the Deep Blue Sea: Research, Innovation, Social Engagement (November 2016).

University of Hawaii, Honolulu, HI: COME ABOARD: Chemical Oceanography Meeting: A Bottom-Up Approach to Research Directions (October 2016).

La Jolla, CA: GEOTRACES cruise planning meeting for Alaska-Tahiti section (Oct. 2016).

Lamont-Doherty Earth Observatory, Palisades, NY: GEOTRACES synthesis meeting on internal cycling of trace elements in the ocean. Working group co-chair (August 2016).

London and Chicheley, United Kingdom: Royal Society Meeting on synthesis of GEOTRACES data: sources and sinks of trace elements in the ocean (December 2015).

University of Bern, Switzerland: IPODS Workshop on Past Ocean Dynamics (Oct. 2014).

Ocean Sciences Meeting Town Hall, Honolulu, HI: GEOTRACES intermediate data product release. Invited Speaker (February 2014).

## **Dissertation & Theses**

*Doctoral Dissertation:*

**Columbia University**, New York, NY, 2013, Earth and Environmental Sciences  
[Marine thorium and protactinium distributions: Tools for past and present chemical flux](#)

## HAYES Curriculum vitae 17

The chapters of this dissertation were developed for publication as numbers [5](#), [6](#), [9](#), [11](#), and [13](#), as listed in the above publication section.

### *Master's Thesis:*

**Columbia University**, New York, NY, 2010, Earth and Environmental Sciences  
*Opal accumulation rates in the equatorial Pacific and deglacial mechanisms*

This thesis was developed for publication as number [3](#) in the above publication section.

### *Undergraduate Thesis:*

**McGill University**, Montreal, QC, 2008, Honours Chemistry (Environmental)  
*Ice nucleation activity of organic aerosols*

This thesis contributed to publication numbers [1](#) and [2](#) in the above publication section.