

## Christopher T. Hayes

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### Education:

PhD, Columbia University, Expected October 2013, Earth and Environmental Sciences  
*Thesis:* "Understanding the distribution of Th and Pa in the ocean"  
*Advisor:* Robert F. Anderson

MPhil, Columbia University, 2012, Earth and Environmental Sciences  
MA, Columbia University, 2010, Earth and Environmental Sciences  
*Thesis:* "Opal accumulation rates in the equatorial Pacific and deglacial mechanisms"  
*Advisor:* Robert F. Anderson

BSc, McGill University, Montreal QC, 2008, Honours Chemistry (Environmental)  
*Thesis:* "Ice nucleation activity of organic aerosols"  
*Advisor:* Parisa A. Ariya

**Research Interests:** Chemical oceanography, natural radionuclides, biogeochemical cycles;  
Paleoceanography, paleoclimate, proxy development and validation

**Awards:** Best Student Oral Presentation, Robert Duce Symposium, AMS Meeting 2013  
Gary Comer Abrupt Climate Change Fellow, 2010  
Faculty Fellow, Columbia University, 2008-2013  
Student Travel Grant (Annual AMS Meeting, Jan. 2013, Austin, TX)  
Columbia Graduate School Travel Grant (AGU Fall Meeting 2012)  
Student Travel Grant (V. M. Goldschmidt Conference 2011, Prague, CZ)  
McGill Science Undergraduate Research Award, 2007

### Teaching Assistantships:

Chemistry of Continental Waters (Columbia):	Spring 2012, 2010
Introduction to Chemical Oceanography (Columbia):	Spring 2011, 2009
Introduction to Oceanography (Columbia):	Fall 2009
Organic Chemistry I (McGill):	Summer 2008

### Publications:

**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, doi: 10.1016/j.epsl.2013.03.008.

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, doi: 10.1126/science.1227545.

**Hayes, C. T.**, R. F. Anderson, and M. Q. Fleisher (2011), Opal accumulation rates in the equatorial Pacific and mechanisms of deglaciation, *Paleoceanography*, 26(1), PA1207, doi: 10.1029/2010PA002008.

## HAYES Curriculum vitae 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), doi: 10.1080/01442350802597438.

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(6), doi: 10.1071/EN08055.

### **Manuscripts submitted/in preparation:**

**Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. Serno, G. Winckler, R. Gersonde (2013), Quantifying lithogenic inputs to the North Pacific Ocean using the long-lived thorium isotopes (submitted).

Serno, S., G. Winckler, R. F. Anderson, **C. T. Hayes**, D. McGee, B. Machalett, H. Ren, S. M. Straub, R. Gersonde, G. H. Haug (2013), Eolian dust input to the Subarctic North Pacific (submitted).

**Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. Serno, G. Winckler, R. Gersonde (2013), Chemical fractionation of  $^{231}\text{Pa}/^{230}\text{Th}$  in the Pacific Ocean: paleoceanographic implications (in prep.).

### **Service & professional activities:**

Organizer of Lamont-Doherty Earth Observatory's weekly departmental seminar for Geochemistry, 2012-2013

Co-chair of a session on marine micro-nutrients from the GEOTRACES program for the AGU Fall Meeting, 2012

Geochemical Society member: 2010-present

American Chemical Society member: 2010-present

American Geophysical Union Member: 2009-present

### **Invited talks:**

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, October 2012)

Princeton University (May 2012)

### **Sea-going Experience:**

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  
Chief Scientists: Ed Boyle and Greg Cutter

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

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Chief Scientists: Bill Jenkins and Ed Boyle

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  
Chief Scientist: Rainer Gersonde

### **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:**

**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).

**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. *EOS Trans. AGU*. (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. (22<sup>nd</sup> V. M. Goldschmidt Conference, Montreal, Canada, June).

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. (22<sup>nd</sup> V. M. 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. (22<sup>nd</sup> V. M. Goldschmidt Conference, Montreal, Canada, June).

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. (22<sup>nd</sup> V. M. Goldschmidt Conference, Montreal, Canada, June).

**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. *2012 Ocean Sciences Meeting* (Salt Lake City, UT, February).

## HAYES Curriculum vitae 4

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. Hata (2012), Aerosol supply of soluble trace elements to the ocean evaluated using paired thorium isotopes. *2012 Ocean Sciences Meeting* (Salt Lake City, UT, February).

Jaccard, S.L., **C. T. Hayes\***, 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).

**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. (21<sup>st</sup> V. M. Goldschmidt Conference, Prague, Czech Republic, August).

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.**, and 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).

**Hayes, C. T.**, and 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).

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, M. Q. Fleisher (2009), Deglacial opal accumulation in the equatorial Pacific and signatures of the Southern Ocean. *EOS Trans. AGU*. (AGU Fall Meeting, San Francisco, CA, December).

\*Presenting author, if not first author