

Curriculum Vitae

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Carl Howard Lamborg

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Education:

University of Connecticut. Doctor of Philosophy – Oceanography (Chemical), 2003
University of Michigan. Master of Science - Environmental Chemistry, 1992
Oberlin College. Bachelor of Arts - Chemistry (with Honors), 1986

Relevant Experience:

2006-present: Assistant Scientist, Woods Hole Oceanographic Institution, Dept. of Marine Chemistry and Geochemistry.
2003-2006: Post-doctoral Scholar/Investigator, Woods Hole Oceanographic Institution, Dept. of Marine Chemistry and Geochemistry.
1996-2003: Graduate Research Assistant, The Univ. of Connecticut, Dept. of Marine Sciences.
1992-1996: Research Assistant II, The Univ. of Connecticut, Department of Marine Sciences.
1990-1992: Graduate Research Assistant, The Univ. of Michigan, Sch. of Public Health, Department of Environmental Health Sciences.
1986-1990: Research Assistant II, Harvard University, Harvard Sch. of Public Health, Department of Environmental Monitoring and Exposure Assessment.

Fields of Specialization/Interest:

Aquatic and Atmospheric Chemistry, Trace Metal (esp. Mercury) Biogeochemistry, Chemical Oceanography

Awards:

2000: Andres J. Nalwak Award, for service to the Dept. of Marine Science, University of Connecticut
2003: WHOI Post-doctoral Scholarship, endowed by Penzance Discretionary Fund

Professional Organizations:

American Geophysical Union
American Chemical Society
American Society of Limnologists and Oceanographers

Publications:

Buesseler, K.O., T.W. Trull, D.K. Steinberg, M.W. Silver, D.A. Siegel, S.-I. Saitoh, C.H. Lamborg, P.J. Lam, D.M. Karl, N.Z. Jiao, M.C. Honda, M. Elskens, F. Dehairs, S.L. Brown, P.W. Boyd, J.K.B. Bishop and R.R. Bidigare (2008) VERTIGO (VERTical Transport In the Global Ocean): A study of particle sources and flux attenuation in the North Pacific. *Deep Sea Res. II* **55**/14-15:1522-1539.
Lamborg, C.H., K.O. Buesseler and P.J. Lam (2008) Sinking fluxes of minor and trace elements in the North Pacific Ocean measured during the VERTIGO program. *Deep Sea Res. II* **55**/14-15:1564-1577.
Lamborg, C.H., K.O. Buesseler, J. Valdes, C.H. Bertrand, R. Bidigare, S. Manganini, S. Pike, D. Steinberg, T. Trull and S. Wilson (2008) The flux of bio- and lithogenic material associated with sinking particles in the mesopelagic "twilight zone" of the northwest and North Central Pacific Ocean. *Deep Sea Res. II* **55**/14-15:1540-1563.
Dehairs, F., S. Jacquet, N. Savoye, B.A.S. Van Mooy, K.O. Buesseler, J.K.B. Bishop, C.H. Lamborg, M. Elskens, W. Baeyens, P.W. Boyd, K.L. Casciotti and C. Monnin (2008) Barium in twilight zone suspended

- matter as a potential proxy for particulate organic carbon remineralization: Results for the North Pacific. *Deep Sea Res. II* **55**/14-15:1673-1683.
- Trull, T.W., S.G. Bray, K.O. Buesseler, C.H. Lamborg, S. Manganini, C. Moy and J. Valdes (2008) In situ measurement of mesopelagic particle sinking rates and the control of carbon transfer to the ocean interior during the Vertical Flux in the Global Ocean (VERTIGO) voyages in the North Pacific. *Deep Sea Res. II* **55**/14-15:1684-1695.
- Lamborg, C.H., O. Yigiterhan, W.F. Fitzgerald, P.H. Balcom, C.R. Hammerschmidt and J.W. Murray (2008) Vertical distribution of mercury species at two sites in the western Black Sea. *Mar. Chem.* **111**/77-89.
- Buesseler, K.O., C.H. Lamborg, P.H. Cai, R. Escoube, H.P. Johnson, S.M. Pike, P. Masque, D. McGillicuddy and E. Verdeny (2008) Particle fluxes associated with mesoscale eddies in the Sargasso Sea. *Deep Sea Research II* **55**: 1426-1444.
- Balcom, P.H., C.R. Hammerschmidt, W.F. Fitzgerald, C.H. Lamborg and J. O'Connor (2008) Seasonal distributions and cycling of mercury and methylmercury in the waters of New York/New Jersey Harbor estuary. *Mar. Chem.* **109**: 1-17.
- Lamborg, C. (2007) A new twist for mercury. *Science* **318**/5849:402-403.
- Bone, S.E., M.A. Charette, C.H. Lamborg and M.E. Gonneea (2007) Has submarine groundwater discharge been overlooked as a source of mercury to coastal waters? *Environ. Sci. Technol.* **41**/3090-3095.
- Buesseler, K.O., C.H. Lamborg, P.W. Boyd, P.J. Lam, T.W. Trull, R.R. Bidigare, J.K.B. Bishop, K.L. Casciotti, F. Dehairs, M. Elskens, M.C. Honda, D.M. Karl, D. Siegel, M.W. Silver, D.K. Steinberg, J.R. Valdes, B. Van Mooy and S. Wilson (2007) Revisiting carbon flux through the ocean's twilight zone. *Science* **316**/567-570.
- Fitzgerald, W.F., Lamborg, C.H., Hammerschmidt, C.R. (2007) Marine biogeochemical cycling of mercury. *Chemical Reviews* **107**/2: 641-662.
- Hammerschmidt, C.R., Lamborg, C.H., Fitzgerald, W.F. (2007) Aqueous phase methylation as a potential source of methylmercury in wet deposition. *Atmos. Environ.* **41** 1663-1668.
- Lamborg, C.H., K. Von Damm, W.F. Fitzgerald, C.R. Hammerschmidt and R.A. Zierenberg (2006) Hg and Monomethylmercury in Fluids from Sea Cliff Submarine Hydrothermal Field, Gorda Ridge. *Geophys. Res. Lett.* **33**/17: L17606, 10.1029/2006GL026321.
- Santschi, P.H., J.W. Murray, M. Baskaran, C. Benitez-Nelson, T. Eglinton, N.S. Fisher, L.D. Guo, C.-C. Hung, C. Lamborg, B. Moran, U. Passow and M. Roy-Barman (2006) Thorium speciation in seawater. *Marine Chem.* **100**/3-4: 250-268.
- Buesseler, K., C. Benitez-Nelson, S.B. Moran, A. Burd, M. Charette, J.K. Cochran, L. Coppola, N. Fisher, S. Fowler, W. Gardner, L. Guo, O. Gustafsson, C. Lamborg, P. Masque, J.C. Miquel, U. Passow, P. Santschi, N. Savoye, G. Steward, T. Trull, (2006) Ratios of particulate carbon to thorium-234: what do they tell us and how can they be used to estimate sinking fluxes out of the upper ocean. *Marine Chem.* **100**/3-4: 213-233.
- Hammerschmidt, C.R., W.F. Fitzgerald, C.H. Lamborg, P.H. Balcom, C.-M. Tseng (2006) Biogeochemical Cycling of Methylmercury in Lakes and Tundra Watersheds of Arctic Alaska. *Environ. Sci. & Tech.* **40**: 1204-1211.
- Fitzgerald, W.F., D.R. Engstrom, C.H. Lamborg, C.-M. Tseng, P.H. Balcom and C.R. Hammerschmidt (2005) Modern and historic atmospheric mercury fluxes in northern Alaska: Global sources and Arctic depletion. *Environ. Sci. & Tech.* **39**: 557-568.
- Lamborg, C.H., W.F. Fitzgerald, A. Skoog and P.T. Visscher (2004) The abundance and source of mercury-binding organic ligands in Long Island Sound. *Marine Chem.* **90**: 151-163.
- Balcom, P.H., W.F. Fitzgerald, G.M. Vandal, C.H. Lamborg, K.R. Rolffhus, C.S. Langer and C.R. Hammerschmidt (2004) Mercury sources and cycling in the Connecticut River and Long Island Sound. *Marine Chem.* **90**: 53-74.
- Hammerschmidt, C.R., W.F. Fitzgerald, C.H. Lamborg, P.H. Balcom and P.T. Visscher (2004) Biogeochemistry of methylmercury in sediments of Long Island Sound. *Marine Chem.* **90**: 31-52.
- Arimoto, R., C. Schloesslin, D. Davis, A. Hogan, P. Grube, W. Fitzgerald and C. Lamborg (2004) Lead and mercury in aerosol particles from the South Pole collected during ISCAT-2000. *Atmos. Environ.* **38**: 5485-5491.
- Tseng, C.-M., C.H. Lamborg, W.F. Fitzgerald and D.R. Engstrom (2004) Cycling of dissolved elemental mercury in arctic Alaskan lakes. *Geochim. Cosmochim. Acta.* **68**/6: 1173-1184.
- Rolffhus, K.R., W.F. Fitzgerald, C.H. Lamborg and P. Balcom (2003) Evidence for enhanced mercury lability in response to estuarine mixing. *J. Geophys. Res.* **108**/C11: Art. No. 3353.
- Fitzgerald, W.F. and C.H. Lamborg (2003) Geochemistry of mercury in the environment. In: *Treatise on Geochemistry, Vol. 9, Chp 4.*, Elsevier Publ.
- Lamborg, C.H., C.-M. Tseng, W.F. Fitzgerald, P. Balcom, C.R. Hammerschmidt (2003) Determination of the mercury complexation characteristics of dissolved organic matter in natural waters by "reducible mercury" titrations. *Environ. Sci. & Tech.* **37**/15: 3316-3322.

- Tseng, C.-M., P. Balcom, C.H. Lamborg and W.F. Fitzgerald (2003) Dissolved elemental mercury investigations in Long Island Sound using on-line Au amalgamation-flow injection analysis. *Environ. Sci. & Tech.* **37**/6: 1183-1188.
- Lamborg, C.H., W.F. Fitzgerald, W.F., A.W.H. Damman, J.M. Benoit, P.H. Balcom and D.R. Engstrom (2002) Contemporary and historical eolian depositional fluxes of mercury: archival records in ombrotrophic bogs and lake sediments from Nova Scotia and New Zealand. *Global Biogeochem. Cycles.* **16**/4: 1104, doi: 10.1029/2001GB001847.
- Lamborg, C.H., W.F. Fitzgerald, J. O'Donnell and T. Torgersen (2002) An examination of global-scale mercury biogeochemistry using a non-steady state compartment model which features interhemispheric gradients in the atmosphere as constraints. *Geochimica et Cosmochimica Acta* **66**/7:1-14.
- Fitzgerald, W.F., G.M. Vandal, K.R. Rolffhus, C.H. Lamborg and C.S. Langer (2000) Mercury emissions and cycling in the coastal zone. *J. Environ. Sci.* **12**: 92-101.
- Lamborg, C.H., W.F. Fitzgerald, W.C. Graustein and K.K. Turekian (2000) An examination of the atmospheric chemistry of mercury using ^{210}Pb and ^7Be . *J. Atmos. Chem.* **36**/3: 325-338.
- Lamborg, C.H., K.R. Rolffhus, W.F. Fitzgerald and G. Kim (1999) Atmospheric cycling and air-sea exchange of Hg in the South and equatorial Atlantic. *Deep-Sea Res. II.* **46**: 957-977.
- Ackermann, M.N., W.G. Fairbrother, N.S. Amin, C.J. Deodene, C.H. Lamborg, P.T. Martin (1996) Tetracarbonylmolybdenum complexes of 2-(phenylazo) pyridine ligands. Correlations of molybdenum-95 chemical shifts with electronic, infrared, and electrochemical properties. *J. Organomet. Chem.* **523**/2: 145-151.
- Lamborg, C.H., W.F. Fitzgerald, G.M. Vandal and K.R. Rolffhus (1995) Atmospheric mercury in northern Wisconsin: sources and species. *Water, Air and Soil Pollution.* **80**: 189-198.
- Vandal, G.M., W.F. Fitzgerald, K.R. Rolffhus and C.H. Lamborg (1995) Modeling the elemental mercury cycle in Palette Lake, Wisconsin, USA. *Water, Air and Soil Pollution.* **80**: 529-538.
- Keeler, G.J., M.E. Hoyer and C.H. Lamborg (1994) Measurements of atmospheric mercury in the Great Lakes Basin. In: *Mercury Pollution: Integration and Synthesis. Chp. II.5* pp. 231-241.
- Lamborg, C.H., M.E. Hoyer, G.J. Keeler, I. Olmez and X. Huang (1994) Particulate-phase mercury in the atmosphere: collection/analysis method development and applications. In: *Mercury Pollution: Integration and Synthesis. Chp. II.5* C.J. Watras and J.W. Huckabee (eds.) Lewis Pub. Boca Raton. pp. 231-241.
- Lamborg, C.H., W.F. Fitzgerald, G.M. Vandal and K.R. Rolffhus (1993) Atmospheric mercury in northern Wisconsin: chemical characterization and fluxes. In: *The Proceedings of the 9th Intl. Conf. on Heavy Metals in the Environment.* R.J. Allen and J.O. Nriagu (eds.), CEP Consultants Ltd. Edinburgh.
- Vandal, G.M., W.F. Fitzgerald, C.H. Lamborg, and K.R. Rolffhus (1993) The production and evasion of elemental mercury in lakes: a study of Palette Lake, northern Wisconsin. In: *The Proceedings of the 9th Intl. Conf. on Heavy Metals in the Environment.* R.J. Allen and J.O. Nriagu (eds.), CEP Consultants Ltd. Edinburgh.

Graduate Advisors:

Drs. William Fitzgerald, James O'Donnell, Annelie Skoog and Pieter Visscher

Post-doctoral Advisor/Sponsor:

Dr. Ken Buesseler

Teaching

MIT-WHOI JP 12.759 Seminar in Chemical Oceanography (w/ Mark Kurz) – Hot Topics in Marine Chemistry and Geochemistry (last time: S07).

Advising

Ms. Sharon Bone – Summer Student Fellow (Matt Charette principal advisor) – 2004-2005
 Ms. April Abbott – Guest Student – 2008
 Mr. Jorge Barbosa – Summer Student Fellow – 2008
 Dr. Paul Drevnick – Post-doctoral Scholar – 2007-current
 Mr. Dan Ohnemus – Joint Program Graduate Student – 2008-current
 Ms. Kathleen Munson – Joint Program Graduate Student – 2008-current

Current Projects

Active Projects

Collaborative Research: A GEOTRACES Intercalibration of Collection, Handling and Analysis Methods for Mercury Species in Seawater, NSF-OCE – *Principal Investigator*

An Autonomous Aerosol Autosampler (PM10) for Ocean and Atmosphere Research at the Martha's Vineyard Coastal Observatory, NSF-Environmental Technology (B. Peucker-Ehrenbrink) – *Co-Principal Investigator*
Mercury in Bays and Ponds of Cape Cod, WHOI Coastal Ocean Institute - *Principal Investigator*
Mercury Species Sources and Cycling in Waquoit Bay, WHOI SeaGrant - *Principal Investigator*
Mercury Species Cycling and Fluxes in the Oceanic Water Column, NSF-OCE - *Principal Investigator*
Formation of Methylmercury in the Open Ocean (Sargasso Sea), WHOI Independent Study - *Principal Investigator*
Carbon flux through the Twilight Zone - New Tools to Measure Change, NSF-OCE (K. Buesseler, Principal Investigator) – *Co-Principal Investigator*

Project Periods Over – Data Analysis/Writing Continuing

Ocean Acidification and the Role of the Export “Rain Ratio”: A Possible Negative Feedback to Increasing Atmospheric CO₂, WHOI Interdisciplinary (S. Manganini, Principal Investigator) – *Co-Principal Investigator*
Minor and Trace Element Cycling in Sinking Marine Particles, NSF-OCE #0454148 – *Principal Investigator*
Vertical Transport in the Global Ocean, NSF-OCE #0301139 (K. Buesseler, Principal Investigator) – *Participant*
Natural and Anthropogenic Sources of Mercury to the Atmosphere: Global and Regional Contributions, EPA-STAR #R829796 (W. Fitzgerald and D. Engstrom, Principal Investigators) – *Participant*
Biogeochemical Cycling and Fate of Mercury and Methylmercury in the Arctic Alaskan Lakes, NSF-OPP #0425562 (W. Fitzgerald, Principal Investigator) – *Participant*