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Education

Ph. D. Chemical Oceanography, MIT/WHOI Joint Program in Oceanography, February 2017

Thesis Title: The cobalt cycle in the Tropical Pacific Ocean, Advisor: Mak Saito

B.A. Chemistry and English Literature, Washington University in St. Louis, June 2011

Professional Appointments

Assistant Professor, Department of Oceanography, University of Hawai'i January 2020 – present

Simons Foundation Postdoctoral Fellow in Marine Microbial Ecology Oct. 2018 – Dec. 2019
Supervisor: Dr. Seth John, USC

Postdoctoral Scholar, University of Southern California April 2017 – Oct. 2018
Supervisor: Dr. Seth John, USC

Postdoctoral Investigator, Woods Hole Oceanographic Institution Jan. 2017 – March 2017
Supervisor: Dr. Mak Saito, WHOI

Graduate Research Assistant, Woods Hole Oceanographic Institution June 2011 – Jan. 2017
Supervisor: Dr. Mak Saito, WHOI

Awards

National Science Foundation OCE-2049151: US GEOTRACES GP17-OCE and GP17-ANT: Mapping zinc speciation in the Southern Ocean overturning circulation to test the zinc scavenging hypothesis (\$289,691), 2021.

National Science Foundation OCE-2022969: Quantifying Iron Turnover in the Upper Ocean via Time-series Measurements at Station ALOHA (\$460,241), 2020.

Simons Foundation Life Sciences: Scholar Award: Nutrient Limitation Thresholds in the North Pacific Gyre (\$59,501), 2020.

Simons Foundation Life Sciences Grant 672990: Acquisition of a triple quadrupole ICP-MS to quantify the supply and demand of iron and other metal micronutrients in the open ocean (\$194,500), 2019.

Simons Foundation Postdoctoral Fellowship in Marine Microbial Ecology, 2018.

Carl-Gustaf Rossby Prize. Program in Atmospheric and Ocean Sciences, Earth and Planetary Sciences Departments, Massachusetts Institute of Technology, 2017.

Magna Cum Laude, Washington University in St. Louis, 2011.

Helmholz Award, Department of Chemistry, Washington University in St. Louis, 2011.

Publications

Hawco NJ, Fu F-X, Yang N, Hutchins DA, John SG. Independent iron and light limitation in a low-light adapted *Prochlorococcus* from the deep chlorophyll maximum. *ISME J.* 15, 359-362, 2021.

Cohen NR, McIlvin MR, Moran DM, Held NA, Saunders JK, **Hawco NJ**, Brosnahan M, DiTullio GR, Lamborg C, McCrow JP, Dupont CL, Allen AE, and Saito MA. Dinoflagellates alter their carbon and nutrient metabolic strategies across environmental gradients in the central Pacific Ocean. *Nature Microbiology*, 6, 173-186, 2021.

Hawco NJ, Barone B, Church MJ, Babcock-Adams L, Repeta DJ, Weak EK, Foreman RK, Björkman KM, Bent S, Van Mooy BAS, Sheyn U, Delong EF, Acker M, Kelly RL, Nelson A, Ranideri J, Clemente TM, Karl DM, and SG John. Iron depletion in the deep chlorophyll maximum: mesoscale eddies as natural iron fertilization experiments. In Review. Pre-print DOI: 10.1002/essoar.10507481.1.

Foreman RK, Björkman KM, Funkey CP, **Hawco NJ**, Wilson ST, Rohrer T, White AE, John SG, Karl DM. Phosphate scavenging during lava-seawater interaction offshore of Kīlauea volcano, Hawaii. *Geochemistry, Geophysics, Geosystems*. In press.

Kelly RL, Bian X, Feakins SJ, Fornace KL, Gunderson T, **Hawco NJ**, Niggemann J, Paulson SE, Pinedo-Gonzalez P, West AJ, Yang SC, and John SG. Delivery of Metals and Dissolved Black Carbon to the Southern California Coastal Ocean via Aerosols and Floodwaters Following the 2017 Thomas Fire. *Journal of Geophysical Research: Biogeosciences*, 126, e2020JG006117.

Yang N, Merkel CA, Lin Y-A, Levine NM, **Hawco NJ**, Jang H-B, Qu P-P, DeMers MA, Webb EA, Fu F-X, Hutchins DA. Warming iron-limited oceans enhance nitrogen fixation and drive biogeographic specialization of the globally important cyanobacterium *Crocospaera*. *Frontiers in Marine Science*, 8, 118, 2021.

Hawco NJ, Barone B, Church MJ, Babcock-Adams L, Repeta DJ, Wear EK, Foreman RK, Björkman KM, Bent S, Van Mooy BAS, Sheyn U, Delong EF, Acker M, Kelly RL, Nelson A, Ranieri J, Clemente TM, Karl DM, John SG. Iron depletion in the deep chlorophyll maximum: mesoscale eddies as natural fertilization experiments. In Review.

Hawco NJ,* Tagliabue A,* and BS Twining. Enduring Manganese Deficiency in the Southern Ocean. In Review. *contributed equally

Hawco NJ, McIlvin MR, Bundy RM, Tagliabue A, Goepfert TJ, Moran D, Valentin-Alvarado L, DiTullio G, Saito MA. Minimal cobalt metabolism in the marine cyanobacterium *Prochlorococcus*. *Proceedings of the National Academy of Sciences*, 117 (27), 15740-15747, 2020.

Hawco NJ, Yang S-C, Foreman RK, Funkey CP, Dugenne M, White AE, Wilson ST, Kelly RL, Bian X, Huang KF, Karl DM, John SG. Metal isotope signatures from lava-seawater interaction during the 2018 eruption of Kīlauea. *Geochimica et Cosmochimica Acta*, 282, 340-356, 2020.

Pinedo-Gonzalez P, **Hawco NJ**, Bundy RM, Armbrust EV, Follows MJ, Cael BB, White AE, Ferrón S, Karl DM, and John SG. Anthropogenic Asian aerosols provide Fe to the North Pacific. *Proceedings of the National Academy of Sciences*, 117 (45), 27862-27868, 2020.

Yang S-C, **Hawco NJ**, Pinedo-Gonzalez P, Bian, X, Huang KF, Zhang R, and John SG. A new purification method for Ni and Cu stable isotopes in seawater shows widespread Ni isotope fractionation by phytoplankton. *Chemical Geology*. 547, 11962, 2020.

Publications (continued)

Bundy RM, Tagliabue A, **Hawco NJ**, Morton PL, Twining BS, Hatta M, Noble AE, Cape MR, John SG, Cullen JT, and Saito MA. Elevated cobalt sources in the Arctic Ocean. *Biogeosciences*, 17 (19), 4745-4767, 2020.

Wilson ST*, **Hawco NJ***, Armbrust EV, Barone B, Björkman KM, Boysen AK, Burgos M, Burrell TJ, Casey JR, DeLong EF, Dugenne M, Dutkiewicz S, Dyhrman ST, Ferrón S, Follows MJ, Foreman RK, Funkey CP, Harke MJ, Henke BA, Hill CN, Hynes AM, Ingalls AE, Jahn O, Kelly RL, Knapp AN, Letelier RM, Ribalet F, Shimabukuro EM, Tabata RKS, Turk-Kubo KA, White AE, Zehr JP, John SG, and Karl DM. Kīlauea Lava Fuels Phytoplankton Bloom in the North Pacific Ocean. *Science*, 365, 1040–44, 2019. *co-first author.

Hawco NJ and Saito MA. Competitive Inhibition of cobalt uptake by zinc and manganese in a Pacific Prochlorococcus strain: insights into metal homeostasis in a streamlined oligotrophic cyanobacterium. *Limnology and Oceanography*, 63 (5), 2229-2249, 2018.

Hawco NJ, Lam PJ, Lee JM, Ohnemus DC, Noble AE, Wyatt NJ, Lohan MC, and Saito MA. Cobalt scavenging in the mesopelagic ocean and its influence on global mass balance: Synthesizing water column and sedimentary fluxes. *Marine Chemistry*, 201 (20), 151-166, 2018.

Tagliabue A, **Hawco NJ**, Bundy RM, Landing WM, Morton PL and MA Saito. The role of external inputs and internal cycling in shaping the global ocean cobalt distribution: Insights from the first cobalt biogeochemical model. *Global Biogeochemical Cycles*, 32, 594-616, 2018.

Sanial V, Kipp LE, Henderson PB, van Beek P, Reyss JL, Hammond DE, **Hawco NJ**, Saito MA, Resing JA, Sedwick P, Moore WS, and Charette MA. Radium-228 as a tracer of dissolved trace element inputs from the Peruvian continental margin. *Marine Chemistry*, 201 (20), 20-34, 2018.

Schlitzer R, Anderson RF, Dodase EM, Lohan MC, Geiberta W, Tagliabue A, Bowie A, Jeandel C, Maldonado MT, Landing WM, Cockwell, Abadie C, Abouchami W, Achterberg EP, Agather A, Aguilar-Islas A, van Aken HM, ... Hatta M, **Hawco NJ**, Hayes CT, ... Zunino P, Zurbriek C (*100+ authors omitted*). The GEOTRACES Intermediate Data Product 2017. *Chemical Geology*, 493 210-223, 2018.

Saito MA, Noble AE, **Hawco NJ**, Twining BS, Ohnemus DC, John SJ, Lam PJ, Conway TM, Johnson R, Moran DA, McIlvin MR. The acceleration of dissolved cobalt's ecological stoichiometry due to biological uptake remineralization and scavenging in the Atlantic Ocean. *Biogeosciences*, 14 (20), 4637-4662, 2017.

Noble AE, Ohnemus DC, **Hawco NJ**, Lam PJ, Saito MA. Coastal Sources Sinks and Strong Organic Complexation of Dissolved Cobalt within the US North Atlantic GEOTRACES Transect GA03. *Biogeosciences* 14 (11), 2715-2739, 2017.

Hawco NJ, Ohnemus DC, Resing JR, Twining BS, and Saito MA. A cobalt plume in the oxygen minimum zone of the Eastern South Pacific. *Biogeosciences*, 13 (20), 5697, 2016.

Boiteau RM, Mende DR, **Hawco NJ**, McIlvin MR, Sedwick PN, Saito MA, Delong EF, Repeta DJ. Siderophore-based microbial adaptations to iron scarcity across the eastern Pacific Ocean. *Proceedings of the National Academy of Sciences*, 113 (50), 14237-14242, 2016.

Boiteau RM, Till CP, Raicho A, Bundy RM, **Hawco NJ**, McKenna AM, Barbeau KA, Bruland KW, Saito MA, Repeta DJ. Structural characterization of natural nickel and copper binding ligands along the US GEOTRACES Eastern Tropical Pacific Zonal Transect. *Frontiers in Marine Science* 3, 243, 2016.

Publications (continued)

Sharma AK, Kim J, Prior JT, **Hawco NJ**, Rath NP, Kim J, Mirica LM. Small bifunctional chelators that do not disaggregate amyloid β fibrils exhibit reduced cellular toxicity. *Inorganic chemistry*, 2014.

Sharma AK, Pavlova ST, Kim J, Finkelstein D, **Hawco NJ**, Rath NP, Kim J, Mirica LM. Bifunctional compounds for controlling metal-mediated aggregation of the A β 42 peptide. *Journal of the American Chemical Society*, 2012.

Teaching Activities

Instructor, OCN643: Topics in Marine Chemistry and Geochemistry: Physical Aquatic Chemistry. Department of Oceanography, University of Hawai'i Mānoa, Spring 2021.

Instructor, OCN201: Science of the Sea. Department of Oceanography, University of Hawai'i Mānoa, Fall 2021, Fall 2020.

Guest Instructor, OCN 623: Chemical Oceanography. Department of Oceanography, University of Hawai'i Mānoa, Spring 2021, Spring 2020.

Teaching Assistant, 1.76 Aquatic Chemistry, MIT
Professor Jeff Seewald (WHOI), 2014

Kaufman Teaching Certificate Program, MIT
Instructor: Dr. Lourdes Aleman, 2016

Field Experience

R/V *Kilo Moana*, Hawaii Ocean Timeseries (HOT) 331. Chief Scientist: Fernando Santiago-Mandujano, North Pacific Ocean, December 2020.

R/V *Kilo Moana*, Hawaii Ocean Timeseries (HOT) 325. Chief Scientist: Tully Rohr, North Pacific Ocean, December 2020.

R/V *Kilo Moana*, Hawaii Ocean Timeseries (HOT) 324. Chief Scientist: Fernando Santiago-Mandujano, North Pacific Ocean, November 2020.

R/V *Kilo Moana*, EAGER Chief Scientist Training Cruise. Chief Scientist: Matthew C. Church, North Pacific Ocean, June 2019.

R/V *Kilo Moana*, EAGER Chief Scientist Training Cruise. Chief Scientist: Matthew C. Church, North Pacific Ocean, June 2019.

R/V *Kilo Moana*, Gradients 3 cruise. Chief Scientist: E. Virginia Armbrust, North Pacific Ocean, April 2019.

R/V *Kilo Moana*, Chief Scientist Training Cruise (EAGER). Chief Scientist: Matthew Church, North Pacific Ocean, June 2019.

R/V *Kilo Moana*, Gradients 3 cruise. Chief Scientist: E. Virginia Armbrust, North Pacific Ocean, April 2019.

R/V *Ka'imikai-O-Kanaloa*, HOT-LAVA cruise. Chief Scientist: Sam Wilson, North Pacific Ocean, July 2018.

R/V *Falkor*, EDDIES cruise. Chief Scientist: Sam Wilson, North Pacific Ocean, June-Jul 2017.

Field Experience (continued)

R/V *Kilo Moana*, MESOSCOPE cruise. Chief Scientists: Benedetto Barone and Tara Clemente, North Pacific Ocean, June-Jul 2017.

R/V *Marcus G. Langseth*, Gradients 2.0 cruise. Chief Scientist: E. Virginia Armbrust, North Pacific Ocean, May-June 2018.

R/V *Atlantic Explorer*, BATS cruise B313. Chief Scientist: Matt Enright, April 2015.

R/V *Thomas G. Thompson*, US Geotraces Eastern Pacific Zona Transect. Chief Scientists: Jim Moffett and Chris German, Eastern South Pacific Ocean, October-December 2013.

R/V *Kilo Moana*, Metalloenzyme cruise. Chief Scientists: Mak Saito and Carl Lamborg, Equatorial Pacific Ocean, October 2011.

Synergistic Activities

Session Organizer: Goldschmidt 2020 Virtual Conference. 14m: Biogeochemical Cycling of Trace Elements and their Isotopes in the Oceans (GEOTRACES). June 2020.

Reviewer for Scientific Journals (Chemical Geology, Marine Chemistry, Limnology and Oceanography, Geophysical Research Letters, Proceedings of the National Academy of Sciences, Current Biology, Nature Communications).

Mentor, Partnership Education Program, Woods Hole Oceanographic Institution (2016)

Member: Association for the Sciences of Limnology and Oceanography, Geochemical Society

Department Service: Graduate Student Handbook Committee (2020-2021).

Oral Presentations

Hawco NJ. Timescales of oligotrophic iron turnover at Station ALOHA. Iron at the Air-Sea Interface Workshop. July 2021.

Hawco NJ. Cobalt scarcity in the open ocean. Chemistry Department Seminar, University of North Carolina Wilmington. February 2021.

Hawco NJ, Bundy RM, Tagliabue A, and Saito MA. Minimum cobalt and iron requirements of *Prochlorococcus*: predicting micronutrient limitation thresholds for the ocean's most abundant photoautotroph. Ocean Sciences Meeting 2020, San Diego. February 2020.

Hawco NJ, Yang SC, and John SG. Unique Metal isotope signatures from lava-seawater interaction during the 2018 eruption of Kīlauea. Goldschmidt 2020 Virtual Conference. June 2020.

Hawco NJ. Can cobalt be a limiting nutrient in the oceans. Department of Oceanography Seminar. University of Hawai'i. February 2019 (Invited).

Hawco NJ, Fu F, Hutchins D, John SG. New constraints of iron light colimitations in the deep chlorophyll maximum from culture and field studies. Aquatic Sciences Meeting, San Juan, Puerto Rico, February 2019.

Hawco NJ, Mcilvin MR, Bundy RM, Saito, MA. Interferences of *Prochlorococcus* cobalt metabolism by zinc and manganese. Aquatic Sciences Meeting, Honolulu, February 2017.

Oral Presentations (continued)

Hawco NJ and Saito MA. The cobalt cycle in the tropical Pacific Ocean. EGGS Seminar, Princeton University, October 2016 (Invited).

Hawco NJ, McIlvin MR, Saito, MA. Tracing cobalt uptake and allocation in *Prochlorococcus* with metalloproteomics. Ocean Sciences Meeting, New Orleans, February 2016.

Hawco NJ and Saito MA. An oxygen-driven cobalt cycle in the Eastern Tropical South Pacific. Geochemistry Seminar, Lamont-Doherty Earth Observatory, Princeton University, 2016 (Invited).

Hawco NJ and Saito MA. An ODZ plume of dissolved and labile Cobalt. Geotraces EPZT Synthesis Workshop, Catalina Island, November 2015.

Hawco NJ, McIlvin MR, Goepfert TJ, Saito MA. An oxygen-driven cobalt cycle in the Eastern Tropical South Pacific. Chemical Oceanography Gordon Research Seminar, July 2015.

Hawco NJ, McIlvin MR, Saito MA. Oxygen-driven cobalt distributions in the Equatorial and South Pacific. Ocean Sciences Meeting, Honolulu, February 2014.

Hawco NJ, McIlvin MA, Waterbury JW, Saito MA. A proteomic glimpse into phage-infected *Synechococcus* shows metalloenzyme fluctuations. ALSO Meeting, New Orleans, February 2013.

Poster Presentations

Hawco NJ, John S, Church M, Fu F, Hutchins D. Phytoplankton iron requirements in the Deep Chlorophyll Maximum of oligotrophic gyres. Chemical Oceanography Gordon Research Conference, July 2019.

Hawco NJ, Church M, Nelson A, Barone B, Ranieri J, Kelly R, Pinedo-Gonzalez P, Babcock-Adams L, Acker M, Repeta D, and John S. Evaluating iron limitation scenarios for the deep chlorophyll maximum. Ocean Sciences Meeting, Portland OR, February 2018.

Hawco NJ, McIlvin MR, Goepfert TJ, Saito MA. An oxygen-driven cobalt cycline the Eastern Tropical South Pacific. Chemical Oceanography Gordon Research Conference, July 2015.

*Hawco NJ, McIlvin MR, Saito MA. Cobalt limitation and proteome regulation in a globally distributed marine cyanobacterium. Biometals, Durham NC, July 2014.

Hawco NJ, McIlvin MR, Saito MA. Cobalt limitation and proteome regulation of a low-light adapted *Prochlorococcus* under organic and inorganic phosphate. Chemical Oceanography Gordon Research Conference, July 2013.

*Hawco NJ, McIlvin MR, Moran DM, Waterbury JB, Saito MA. A proteomic glimpse into phage-infected *Synechococcus* shows iron, light, and redox stresses. Marine Microbes Gordon Research Conference, Tuscany (Italy), June 2012.

Hawco NJ, Sharma AK, Mirica LM. Metal cations stabilize Amyloid-Beta soluble oligomers. American Chemical Society National Meeting. Boston, August 2010.

*Poster Prize awarded