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Rachel L Kelly, Ph.D.

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Professional Profile

Dr. Kelly is a geochemist who specializes in environmental metal chemistry, microbiology, and oceanography. She has extensive knowledge of transition metals (e.g., iron, lead, copper, zinc, nickel, manganese, cobalt) and has studied these metals in many geologic (particulates, aerosols, seawater, freshwater) and biologic (microogranisms, viruses) samples.

Dr. Kelly's Ph.D. dissertation focused on identifying metal sources to natural environments, investigating the transport of metals, and determining if these metals are causing shifts in microbial community biomass or structure. Dr. Kelly has more than 8 years of experience performing chemical, biological, and data analyses, including isotopic fingerprinting, tracking viral infection, and building machine learning algorithms. In addition to her laboratory experience, Dr. Kelly also has extensive field work experience both on land and at sea. She participated in 6 major research expeditions, which included investigating the chemical impacts of the 2018 Kilauea eruption (Hawaii) and the 2017 Thomas Fire (California) on nearby coastal waters. Throughout her Ph.D., Dr. Kelly participated in several international scientific collaborations, including the Simons Collaboration on Ocean Processes and Ecology and the Tara Oceans Foundation.

Dr. Kelly has worked on projects to evaluate the larger environmental impacts of metals. She has measured metals at trace concentrations in hundreds of samples collected across the global ocean and compared her measurements to historical metal data. Using machine learning algorithms and environmental data, she then identified the likely sources of metals to the sampling regions. Dr. Kelly also studied the transport of metals and burnt organic matter released by the 2017 Thomas Fire and a subsequent flash-flood event to identify the impacts of wildfire-associated chemicals on nearby river and coastal waters. Dr. Kelly has also evaluated the effects of metals on microbial life. For example, she looked at how increases in aqueous concentrations of the micronutrient iron affected the viral infection of marine bacteria. She also designed a novel approach to measure the relative bioavailability of various recycled iron sources to a natural marine community using isotopic fingerprinting.

Academic Credentials & Professional Honors

Ph.D., Geological Sciences, University of Southern California, 2022

B.S., Marine Science, University of South Carolina, 2016

Prior Experience

Research Assistant, University of South Carolina, 2014-2016

Professional Affiliations

American Bar Association (ABA), Section of Environment, Energy, and Resources (SEER)

Publications

Hawco NJ, Barone B, Church MJ, Babock-Adams L, Repeta DJ, Wear EK, ... Kelly RL, ... & John SG. Iron depletion in the deep chlorophyll maximum: mesoscale eddies as natural iron fertilization experiments. Global Biogeochemical Cycles, 35(12), e2021GB007112.

Yang SC, Kelly RL, Bian X, Conway TM, Huang KF, Ho TY, ... & John SG. Lack of redox cycling for nickel in the water column of the Eastern tropical north pacific oxygen deficient zone: Insight from dissolved and particulate nickel isotopes. Geochimica et Cosmochimica Acta, 309, 235-250, 2021.

Kelly RL, Bian X, Feakins SJ, Fornace KL, Gunderson T, Hawco NJ, Liang H, Niggemann J, Paulson SE, Pinedo-Gonzalez P, West AJ, Yang SC, 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. e2020JG006117.

Hawco NJ, Yang SC, 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.

Wilson ST, Hawco NJ, Armbrust EV, Barone B, Björkman KM, Boysen AK., ... Kelly RL, ... & Karl DM. Kīlauea lava fuels phytoplankton bloom in the North Pacific Ocean. Science, 365, 1040-1044, 2019.

Zhang R, Kelly RL, Kauffman KM, Reid AK, Lauderdale JM, Follows MJ, & John SG. Growth of marine Vibrio in oligotrophic environments is not stimulated by the addition of inorganic iron. Earth and Planetary Science Letters, 516, 148-155, 2019.

Gorsky G, Bourdin G, Lombard F, Pedrotti ML, Audrain S, Bin N, ... Kelly RL, ... & Chabot G. Expanding Tara Oceans protocols for underway, ecosystemic sampling of the ocean-atmosphere interface during Tara Pacific expedition (2016-18). Frontiers in Marine Science, 6, 750, 2019.

Presentations

Oral Presentations

Kelly RL, John SG, Cohen N, Saito M, & Pinedo-Gonzalez P. Tara Pacific – trace metals. Annual Tara Pacific Meeting, Nice, France, 2020.

Kelly RL & John SG. Global nickel distributions and the potential for nickel limitation in subtropical gyres. Simons Collaboration on Ocean Processes and Ecology Early Career Webinar, 2020.

Kelly RL & John SG. Iron goes rogue: the unexpected effects of iron limitation on viral dynamics. University of Southern California Marine and Environmental Biology Department Retreat, Wrigley Marine Science Center, Catalina Island CA, 2018.

Kelly RL & John SG. Iron goes rogue: the unexpected effects of iron limitation on viral dynamics. Paleo Seminar, Earth Sciences Department, University of Southern California, 2018.

Poster Presentations

Kelly RL, Cohen N, Pinedo-Gonzalez P, Hawco N, Lombard F, Bourdin G, & John SG. The effect of trace metals on global microbial communities: trace metal analysis from the TARA Pacific Expedition. Ocean Sciences Meeting, San Diego CA, February 2020.

Kelly RL, Pinedo-Gonzalez P, Hawco N, Yang SC, Bian X, Liang H, … & John SG. Thomas Fire: analysis of metals in aerosols, coastal waters, and flood waters. Chemical Oceanography Gordon Research Conference, Holderness NH, July 2019.

Kelly RL & John SG. Reducing, reusing, and recycling Fe in the microbial loop. Simons Collaboration on Ocean Processes and Ecology Annual Meeting, New York City NY, December 2018.

Kelly RL & John SG. The effect of host iron (Fe) and zinc (Zn) limitation on viral infection dynamics between Vibrio and Vibriophage. Ocean Sciences Meeting, Portland OR, February 2018.

Kelly RL & John SG. Iron goes rogue: the unexpected effects of iron limitation on viral dynamics. Simons Collaboration on Ocean Processes and Ecology Annual Meeting, New York City NY, December 2017.

Kelly RL & John SG. Effects of iron limitation on the growth and viral infection of Vibrio splendidus. Southern California Geobiology Symposium, Los Angeles CA, April 2017.

Peer Reviews

Journal of Geophysical Research

Limnology and Oceanography