

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN CANADA

May 1st, 2022 to April 30th, 2023

Canadian PI's continue to work closely with US and European colleagues on Arctic GEOTRACES synthesis projects resulting in a number of jointly authored manuscripts. The Canadian GEOTRACES community continues to support the Canadian Line P Iron Programme (GPpr07) study making observations of bioactive trace elements and trace element- microbe interactions on time-series cruises completed along Line P in the northeast Pacific.

GEOTRACES or GEOTRACES relevant cruises

- Jean-Eric Tremblay (ULaval) and Jay Cullen (UVic) conducted trace element and isotope sampling in the Canadian Arctic as part of the ArcticNet supported NTRAIN program (<https://arcticnet.ulaval.ca/project/nutrient-fluxes-and-living-marine-resources-in-the-inuit-nunangat/>) in the eastern, central and western Arctic Ocean.
- Jay Cullen (UVic), Maite Maldonado (UBC), Andrew Ross (DFO) Samples for trace elements and copper ligand measurement were collected using GEOTRACES protocols during Line P cruises in 2021 and 2022 as part of the Line P Iron Program, a GEOTRACES Process Study (GPpr07). Samples for Fukushima derived radionuclides were collected in collaboration with John N. Smith (DFO).
- Erin Bertrand (Dalhousie) in collaboration with Rob Middag (NIOZ), found iron limitation in the Iceland basin and conducted incubation experiments to understand the interactions between changing Fe and temperature on phytoplankton physiology. There are interactive effects between Fe and temperature on phytoplankton community composition, nutrient drawdown and protein abundance patterns. <https://www.nioz.nl/en/blog/metalgate-2021-cruise>

New projects and/or funding

- A new project that overlaps with Line P (stations P16, P20 and P26) and expands monitoring of copper ligands in the subarctic NE Pacific to a zone encompassing 38 stations has been approved for funding by the North Pacific Anadromous Fish Commission (NPAFC) and BC Salmon Restoration Initiative Fund (BC SRIF):
- Cullen, J.T., Peña, A., Ross, A.R.S. 2021-2023. Linking salmon survival to climate change through its impact on primary production via nutrient and metal ligand distributions in the North Pacific. International Year of the Salmon (IYS) 2022 Pan-Pacific Winter High Seas Expedition. NPAFC/BC SRIF (\$69 K/yr).
- Funding from the new Fisheries and Oceans Canada (DFO) Competitive Science Research Fund (CSRF) to support sampling and analysis of trace metals and ligands along Line P (GEOTRACES Process Study GPpr07) has also been approved for the next 3 years:
- Ross, A.R.S., Peña, A., Christian, J. 2021-2024. Predicting marine productivity in a changing climate - linking phytoplankton biomass and ecology to ocean conditions and related changes in the availability of essential trace metals. DFO/CSRF (\$43 K/yr).

- Myers, P. (U. Alberta) and 7 others 2022-23 Ecosystems and Ocean Science Contribution Framework Open Call for Proposals. Understanding the bio-physical processes impacting the evolution of Tallurutiup Imanga and Pikialasorsuaq in a warming climate DFO \$717,063

New GEOTRACES or GEOTRACES-relevant publications (published or in press)

- Izett, R, Laura Castro de la Guardia, Melanie Chanona, Paul G. Myers, Stephanie Waterman, Philippe D. Tortell (2022). Impact of Vertical Mixing on Summertime Net Community Production in Canadian Arctic and Subarctic Waters: Insights From In Situ Measurements and Numerical Simulations. <https://doi.org/10.1029/2021JC018215>
- Jensen, J., J.T. Cullen, S.L. Jackson, L. Gerringa, D. Bauch, R. Middag, R.M. Sherrell, J. Fitzsimmons. (2022). A novel relationship between dissolved copper and nickel in the Arctic Ocean. *Journal of Geophysical Research – Oceans.* 127(5) <https://doi.org/10.1029/2021JC018087>
- Krisch, S., M.J. Hopwood, S. Roig, L.J.A. Gerringa, R. Middag, M.M. Rutgers van der Loeff, M.V. Petrova, P. Lodeiro, M. Colombo, J.T. Cullen, S.L. Jackson, L. Heimbürger-Boavida, E.P. Achterberg. (2022). Arctic-Atlantic exchange of iron, manganese, cobalt, nickel, copper and zinc with a focus on Fram Strait. *Global Biogeochemical Cycles.* 36(5) <https://doi.org/10.1029/2021GB007191>
- Kuang, C., S.W. Stevens, R. Pawlowicz, M.T. Maldonado, J.T. Cullen, R. Francois. (2022). Factors controlling the temporal variability and spatial distribution of dissolved cadmium in the coastal Salish Sea. *Continental Shelf Research.* 243, <https://doi.org/10.1016/j.csr.2022.104761>
- Taves, R., D.J. Janssen, M.A. Peña, A.R.S. Ross, K.G. Simpson, W.R. Crawford, J.T. Cullen. (2022). Relationship between surface dissolved iron inventories and net community production during a marine heatwave in the subarctic northeast Pacific. *Environmental Science: Processes and Impacts.* 24, 1460-1473. <https://doi.org/10.1039/D2EM00021K>
- Rogalla B, Colombo M, Allen S, Myers P, Orians K. (2023). Oceanic fingerprints of continental and glacial terrestrial runoff in Inuit Nunangat, the Canadian Arctic Archipelago. *Journal Geophysical Research, Biogeosciences,* e2022JG007072 [doi:10.1029/2022JG007072](https://doi.org/10.1029/2022JG007072)
- Rogalla B, Allen S, Colombo M, Myers P, Orians K. (2022). Sediments in sea ice drive the Canada Basin surface Mn maximum: insights from an Arctic Mn ocean model. *Global Biogeochemical Cycles.* 36, e2022GB007320. [doi:10.1029/2022GB007320](https://doi.org/10.1029/2022GB007320)
- Soetaert, G., R. C. Hamme, and E Raftery (2022) Renewal of seasonally anoxic Saanich Inlet is temporally and spatially dynamic, *Frontiers in Marine Science,* 9, 1001146, [doi:10.3389/fmars.2022.1001146](https://doi.org/10.3389/fmars.2022.1001146).
- Waugh, L.C., I.F. Ruiz, C. Kuang, J. Guo, J.T. Cullen, M.T. Maldonado. (2022). Seasonal dissolved copper speciation in the Strait of Georgia, British Columbia, Canada. *Frontiers in Marine Science.* 9:983763. <https://doi.org/10.3389/fmars.2022.983763>

Completed GEOTRACES PhD or Master theses

- Taves, R. (2022) The Distribution of Trace Metals and their Relationship to Net Community Production during Two Marine Heatwave Events in the Subarctic Northeast Pacific Ocean https://dspace.library.uvic.ca/bitstream/handle/1828/13910/Taves_Robyn_MSc_2022.pdf?sequence=1&isAllowed=y

GEOTRACES presentations in international conferences

- 2022 Anderlini, T., J-É. Tremblay, J.T. Cullen. Trace Metal Distributions in the Western Canadian Arctic. ArcticNet ASM 2022, Dec. 4-8, Toronto ON, Canada.
- 2022 Anderlini, T., J-É. Tremblay, J.T. Cullen. Spatial and Temporal Variability in the Distributions of Dissolved Trace Metals in Surface Waters of Baffin Bay in the Canadian Arctic. ArcticNet ASM 2022, Dec. 4-8, Toronto ON, Canada.
- 2022 Cullen, J.T. Second Knowledge Mobilization Workshop: Advancing the United Nations Sustainable Development Goals (SDGs) on Ocean Sustainability and Climate Action. The Chemical Institute of Canada – Environment Division. Nov. 23, virtual.
- 2022 Anderlini, T., G. Soetaert, J.T. Cullen. Rare Earth Element Distributions in Saanich Inlet and Surrounding British Columbian Waters. CSC 2022, Jun. 13-17, Calgary, AB, Canada.

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