Manuel Colombo, Ph.D.
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Virginia Institute of Marine Science
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B.A.B. Lab: https://colombo-manuel.github.io/

Research and Summary of Highlights

I am a broadly trained biogeochemist and oceanographer, who combines cross-disciplinary expertise and knowledge in the fields of organic and trace element geochemistry. My primary research interests are the study of organic carbon (OC), nitrogen, lipid biomarkers and trace elements (TEs) in rivers, estuaries and marine environments. The geochemistry of OC and that of TEs in the ocean are deeply interlinked, from their sources and sinks (e.g. river outflow, primary production, remineralization of sinking particles) to the internal cycling controlling their distributions. Thereby, I integrate sampling, analytical techniques and data analysis from the TEs and OC realms to gain a comprehensive understating of their cycling, fluxes, source to sink characterization and their role in the ecosystem. I have also been working in the environmental hygiene area developing methods to trace pharmaceuticals in health care centers and monitor their containment.

Work Experience and Knowledge: marine chemistry, trace metal and organic carbon biogeochemistry, environmental chemistry, biology, occupational and environmental health, and professor.

Skills:
- Field work / sample collection.
- Sample processing and analytical techniques (*RPO, GC-FID, GC-MS, HPLC-MS/MS, ICP-HR-MS, etc.*).
- Python & MATLAB programming languages.
- Teaching / sessional Instructor; Canvas & Connect web-based learning system.
- Languages: English (TOEFL) & Spanish.

1. Personal Information

Name: Manuel Colombo
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Position: Assistant Professor, Coastal and Ocean Processes

2. Education

2.1. Post-secondary Degrees

Degree	*Institution*	*Dates*
Ph.D. in Oceanography - *Thesis*: On the biogeochemical processes controlling trace metal distributions in the Canadian Arctic Ocean and Arctic Rivers - Advisor*: Kristin Orians* / External examiner*: Edward A. Boyle*	Department of Earth, Ocean, and Atmospheric Sciences, University of British Columbia, Canada	2014-2019/11 Conferred - 2020
B.Sc. in Biology (Licentiate degree 5 yrs.) - Specialization in Zoology - Honors: *Summa Cum Laude* (GPA: 9.3/10)	National University of La Plata, Argentina	2007-2012/09

2.2. Related Studies

Program/Position	*Institution*	*Dates*
GEOTRACES Summer School - Biogeochemical cycles of trace metals - Workload: Six days	European Institute for Marine Studies, Brest, France	2017/08
Workshop - Lipoproteins and Respiratory Pigments in Invertebrates - Workload: 8 hours	National University of La Plata, Argentina	2009/10

3. Academic Positions / Research Appointments (>11 yr.)

Institution	*Position*	*Activities Developed*	*Date*
Virginia Institute of Marine Science (VIMS) & William & Mary	**Assistant Professor**	———	2024/02-Present
Woods Hole Oceanographic Institution, USA - Marine Chemistry & Geochemistry Department Supervisor: *Valier Galy*	**NSERC Postdoctoral Fellow at WHOI**	- Studying the cycling and biogeochemistry of organic carbon (OC) in the Rio de La Plata estuary, characterizing the OC isotopic composition. - Unraveling the complex processes which control carbon cycling and transport along the river-ocean mixing endmembers. - Sample processing (e.g. solvent extraction, column chemistry, methylation, vacuum line) and analysis of OC, ON, $\delta^{13}C$, $\Delta^{14}C$, $\delta^{15}N$ from bulk sediments and compound-specific lipids. - OC thermal stability analysis by ramped pyrolysis/oxidation technique (RPO) and glycerol dialkyl glycerol tetraethers by HPLC-MS.	2021/05-2023/10
University of British Columbia, Canada - Earth, Ocean and Atmospheric Sciences Department Supervisor: *Maria Maite Maldonado*	**Postdoctoral Researcher**	- Studied the cycling of particulate organic carbon, nitrogen and particulate trace elements (Al, V, Fe, Mn, P) in the Canadian Arctic Ocean.	2020/01-2021/05

University of British Columbia, Canada - Earth, Ocean and Atmospheric Sciences Department Supervisor: *Kristin Orians*	**Ph.D. Candidate**	- Processed and analyzed freshwater and seawater samples for dissolved and particulate trace metals (dTM & pTM) by magnesium-induced coprecipitation and isotope dilution method coupled with ICP-HR-MS. - Studied how gradients in environmental conditions and bedrock geology influence the distribution of dTM & pTM as well as Pb isotopes in small rivers draining the Canadian Arctic Archipelago. - Investigated the sources, sinks and internal cycling of dissolved Pb, Mn and Fe in the Canadian Arctic Ocean.	2014/09-2019/11
University of British Columbia, Canada - Occupational and Environmental Health Lab Supervisor: *Matty Jeronimo*	**Graduate Research Assistant**	- Maintained and troubleshot HPLC-MS/MS and ion-chromatography equipment. - Developed and optimized a method for analyzing pharmaceuticals by HPLC MS/MS. Sampled, extracted and analyzed pharmaceuticals. - Extracted and analyzed nitrates and nitrites by ion-exchange chromatography, organophosphates, levoglucosan, glycols and BETX by GC-MS.	2014/05-2019/12
Luleå University of Technology, Sweden Supervisor: *Sven Knutsson*	**Research Internship**	- Assessed the effects of freeze-thawing on contaminated sediment dewaterability performance.	2013/09-2013/12
National University of La Plata, Argentina - Environmental Chemistry and Biogeochemistry Lab Supervisor: *Eric D. Speranza*	**Research Assistant**	- Determined total solids and organic matter content from different types of samples. - Extracted lipids from fishes, suspended particulate matter, plankton and plants. -Fractioned and purified sterols and fatty acids using solid phase extraction (SPE) cartridges. - Analyzed and quantified different lipid classes using thin-layer chromatography, acyl-fatty acids by GC-FID and sterols by GC-MS.	2011/09-2013/08

4. Awards & Recognitions

Award	*Awarding Institution*	*Amounts ($USD)*	*Date*
27th Dissertation Symposium in Chemical Oceanography – Travel Award	University of Hawaii, USA		2021/10
Thomas S. Byrne Scholarship - Outstanding scientific paper in oceanography	University of British Columbia, Canada (UBC)	500	2019/06

W. H. Mathews Scholarship - Academic Award	University of British Columbia, Canada (UBC)	7,700	2019/04
Chih-Chuang and Yien-Ying Wang Hsieh Memorial Scholarship – Academic Award	University of British Columbia, Canada (UBC)	4,250	2019/04
Travel Award	UBC Postdoctoral Fellow Office	390	2018/08
Travel Award	University of British Columbia, Canada (UBC)	390	2018/08
Outstanding Teaching Assistant Award	University of British Columbia, Canada (UBC)	390	2017/09
Teaching Recognition	University of British Columbia, Canada (UBC)	-----	2015&2017
Faculty of Science Graduate Award	University of British Columbia, Canada (UBC)	2,700	2013/12

5. Contributions to Teaching

5.1. Teaching Experience (9 yr.)

As a sessional instructor, course co-coordinator and teaching assistant I have taught six geosciences and biology related courses targeted to a wide variety of students: from first year introductory courses to advance near-graduating ones. I have performed various duties such as developing and organizing course content, preparing and giving lectures, classes and leading laboratories. During this time, I have been incorporating new teaching strategies (e.g. cameras for microscopes, live projections, blogs, prizes for participation) to make the classes more dynamic and enhance student participation, as well as delivering online courses. I have also co-organized poster sessions where the students present their final projects, among other teaching duties. Detailed teaching statement available upon requests.

University	*Course Name*	*Role*	*Hours/ Week*	*Class Size*	*Date & Sessions*
University of British Columbia, Canada	EESC 106:The Catastrophic Earth	Sessional Instructor	20-40	45-79	2020/07-2021/08 (4 term; Fall, Spring & Summer)
University of British Columbia, Canada	EESC 303: Oceanography	Sessional Instructor	10-25	37-45	2020/07-2020/12 (2 term; Summer & Fall)
University of British Columbia, Canada	EOSC 442: Climate Measurement and Analysis	Course Co-coordinator / Graduate Teaching Assistant	4	30-40	2014/09-2018/04 (8 terms; Fall & Spring)
University of British Columbia, Canada	EOSC 315: The Ocean Ecosystem	Graduate Teaching Assistant	8	105	2016/01-2016/05 (Spring 2016)

University of British Columbia, Canada	EOSC 114: The Catastrophic Earth	Graduate Teaching Assistant	6-12	180-250	2014/09-2019/12 (14 terms; Fall, Spring & Summer)
National University of La Plata, Argentina	Second year course: Introduction to Taxonomy	Undergraduate Teaching Assistant	4	~30	2011/02-2013/09

6. Mentorship

6.1. Non-Graduate Student Mentorship

Employee	*Roles*	*Institution*	
Ilythia Morley	Graduate Teaching Assistant	University of British Columbia, Canada – EESG department	2021/05-2021/07
Tina Deenik	Graduate Teaching Assistant	University of British Columbia, Canada – EESG department	2021/01-2021/05
Denae Weighill	Undergraduate Teaching Assistant	University of British Columbia, Canada – EESG department	2020/09-2020/12
Tina Deenik	Graduate Teaching Assistant	University of British Columbia, Canada – EESG department	2020/07-2020/09

7. Fellowships & Grants

Granting agency	*Project title*	*Amounts ($USD)*	*Role* [1]	*Date*
Natural Sciences and Engineering Research Council of Canada - Postdoctoral Fellowship	Carbon cycling along river-ocean endmembers: A case study of the Rio de La Plata estuary	69,469	PI	2021/05-2023/05
Northern Scientific Training Program - Canadian Polar Commission	Distribution and cycling of dissolved aluminum, gallium, and lead isotopes in the Canadian Arctic Ocean	2,200	PI	2015/04
National Inter-University Council, Argentina	Sterols and fatty acids as organic and anthropogenic sources biomarkers in Del Plata basin	5,150	PI	2011/09-2013/08

1: PI= Primary investigator; CI= Co-investigator

8. Research & Academic Presentations

8.1. Peer Reviewed Publications

[19] Colombo M., LaRoche J., Desai D., Li J. and Maldonado M.T. (2023) Control of particulate manganese (Mn) cycling in halocline Arctic Ocean waters by putative Mn-oxidizing bacterial dynamics. *Limnology and Oceanography 68 (9), 2070-2087.*

[18] Speranza E.D., Jeronimo M. and **Colombo M.** (2023) Initial assessment of multi-compound antineoplastic drug surface contamination in Argentinean health care centers: insights into occupational exposures in South America. *Journal of Oncology Pharmacy Practice (Accepted on June 30nd2023).*

[17] Rogalla B., Allen S.E., **Colombo M.**, Myers P.G. and Orians K.J. (2023) Continental and glacial runoff fingerprints in the Canadian Arctic Archipelago, the Inuit Nunangat ocean. *Journal of Geophysical Research: Biogeosciences 128 (5), 1-22.*

[16] Colombo M., Li J., Rogalla B., Allen S.E. and Maldonado M.T. (2022) Particulate trace element distributions along the Canadian Arctic GEOTRACES section: shelf water interactions, advective transport and contrasting biological production. *Geochimica et Cosmochimica Acta 323, 183-201.*

[15] Rogalla B., Allen S.E., **Colombo M.**, Myers P.G. and Orians K.J. (2022) Sediments in sea ice drive the Canada Basin surface Mn maximum: insights from an Arctic Mn ocean model. *Global Biogeochemical Cycles 36 (8), 1-27.*

[14] Krisch S., Hopwood M.J., Roig S., Gerringa L.J.A., Middag R., Rutgers van der Loeff M., Petrova M.V., Lodeiro P., **Colombo M.**, Cullen J.T., Jackson S. and Achterberg E.P. (2022) Arctic – Atlantic exchange of Iron, Manganese, Cobalt, Nickel, Copper and Zinc with a focus on Fram Strait. *Global Biogeochemical Cycles 36 (5), 1-23.*

[13] Grenier M., Brown K.A., **Colombo M.**, Belhadj M., Baconnais I., Pham V., Soon M., Myers P.G., Jeandel C. and François R. (2022) Controlling factors and impacts of river-borne neodymium isotope signatures and rare earth element concentrations supplied to the Canadian Arctic Archipelago. *Earth and Planetary Science Letters 578, 1-12.*

[12] Colombo M., Rogalla B., Li J., Allen S.E., Orians K.J. and Maldonado M.T. (2021) Canadian Arctic Archipelago shelf-ocean interactions: a major iron source to Pacific derived waters transiting to the Atlantic. *Global Biogeochemical Cycles 35 (10), 1-17.*

[11] De Vera J., Chandan P., Pinedo Gonzales P., John S., Jackson S.L., Cullen J.T., **Colombo M.**, Orians K.J. and Bergquist B.A. (2021) Anthropogenic lead pervasive in Canadian Arctic seawater. *Proceedings of the National Academy of Sciences 118 (24), 1-6.*

[10] Astrakianakis G., Hon C.Y., Jeronimo M., Griffiths A., **Colombo M.**, Kramer D. and Demers P.A. (2020) The Application of Novel Field Measurement and Field Evaluation Protocols for Assessing Healthcare Workers' Exposure to Antineoplastic Drugs. *Journal of Occupational and Environmental Hygiene* 17 (9), 373-382.

[9] Colombo M., Jackson S.L., Cullen J.T. and Orians K.J. (2020) Dissolved iron and manganese in the Canadian Arctic Ocean: on the biogeochemical processes controlling their distributions. *Geochimica et*

Cosmochimica Acta 277, 150-174.

[8] Speranza E.D., **Colombo M.,** Heguilor S., Tatone L.M. and Colombo J.C. (2020) Alterations in the sterol signature of detritivorous fish along pollution gradients in the Río de la Plata basin: from plant to sewage-based diet. *Environmental Research* 184, 109351.

[7] Colombo M., Brown K.A., De Vera J., Bergquist B.A. and Orians K.J. (2019) Trace Metal Geochemistry of Remote Rivers in the Canadian Arctic Archipelago. *Chemical Geology* 527, 479-491.

[6] Colombo M., Rogalla B., Myers P.G., Allen S.E. and Orians K.J. (2019) Tracing Dissolved Lead Sources in the Canadian Arctic: Insights from the Canadian GEOTRACES program. *ACS Earth and Space Chemistry* 3 (7), 1302-1314. ***Editor's Choice paper by the American Chemical Society (ACS)***.

[5] Speranza E.D., **Colombo M.,** Skorupka C. N. and Colombo J. C. (2018) Early diagenetic alterations of sterol biomarkers during particle settling and burial in polluted and pristine areas of the Rio de la Plata Basin. *Organic Geochemistry* 117, 1–11.

[4] Colombo M., Jeronimo M., Astrakianakis G., Apte C. and Hon C.Y. (2017) Wipe Sampling Method and Evaluation of Environmental Variables for Assessing Surface Contamination of 10 Antineoplastic Drugs by Liquid Chromatography/Tandem Mass Spectrometry. *Annals of Work Exposures and Health* 61, 1003–1014.

[3] Speranza E.D., **Colombo M.,** Tatone L.M., Cappelletti N., Migoya M.C. and Colombo J.C. (2016) Fatty acid alterations in the detritivorous Prochilodus lineatus promoted by opportunistic feeding on sewage discharges in the Río de la Plata estuary. *Journal of Fish Biology* 89, 2024–2037.

[2] Rostmark S.C., **Colombo M.,** Knutsson S. and Öberg G. (2016) Removal and re-use of tar-contaminated sediments by freeze-dredging at a coking plant Lulea, Sweden. *Water Environment Research* 88, 847–851.

[1] Jeronimo M., **Colombo M.,** Astrakianakis G. and Hon C.Y. (2015) A surface wipe sampling and LC-MS/MS method for the simultaneous detection of six antineoplastic drugs commonly handled by healthcare workers. *Analytical and Bioanalytical Chemistry* 407, 7083–7092.

8.2. Contributed Scholarly Papers and Conference Proceedings

[13] Rogalla B., Allen S.E., **Colombo M.,** Myers P.G. and Orians K.J. (2023) Tracing the influence of continental and glacial runoff on ocean biogeochemistry in Inuit Nunangat. 57th Canadian Meteorological and Oceanographic Society (CMOS) Congress, St. John's, NL, Canada (national; oral presentation).

[12] Colombo M., Li J., Rogalla B., Desai D., La Roche J., Allen S.E. and Maldonado M.T. (2022) Particulate trace element dynamics in the Canadian Arctic Ocean. Ocean Sciences Meeting, Online (international; oral).

[11] Rogalla B., **Colombo M.,** Li J., Allen S.E., Orians K.J. and Maldonado M.T. (2022) Shelf-ocean interactions in the Canadian Arctic Archipelago as a major source of iron to Pacific derived waters transiting to the North Atlantic. Ocean Sciences Meeting, Online (international; oral).

[10] Rogalla B., Allen S.E., **Colombo M.,** Myers P.G. and Orians K.J. (2021) The role of sediment in sea ice for Mn in the Canada Basin. 55th Canadian Meteorological and Oceanographic Society (CMOS) Congress, Online from Victoria, BC, Canada (national; oral presentation).

[9] Rogalla B., Allen S.E., **Colombo M.**, Myers P.G. and Orians K.J. (2021) Dirty sea ice drives higher Mn concentrations in the Canada Basin. European Geosciences Union (EGU) General Assembly (international; oral presentation).

[8] Colombo M., Jackson S.L., Cullen J.T. and Orians K.J. (2019) Contrasting the distributions of dissolved iron and manganese in seawater of the Canadian Arctic Ocean. Goldschmidt, Barcelona, Spain (international; oral presentation).

[7] Rogalla B., **Colombo M.**, Allen S.E., Orians K.J. and Myers P.G. (2019) Spatial and Vertical Variations of Origin of Water Masses in Baffin Bay. International Union of Geodesy and Geophysics General Assembly, Montreal, Canada (international; oral presentation).

[6] Colombo M. and Orians K.J. (2018) The Distribution of Mn, Ga and Pb in the Canadian Arctic Ocean. Goldschmidt, Boston, USA (international; poster).

[5] Colombo M., Brown K. and Orians K.J. (2018) Trace Metal Distribution in Remote Rivers in the Canadian Arctic Archipelago: Geochemical Characterization of a Pristine Environment. Ocean Sciences Meeting, Portland, USA (international; poster).

[4] Maldonado M.T., Li J., LaRoche J., Desai D., **Colombo M.**, Beaupré-Laperrière A., Orians K.J. and Mucci A. (2018) A Hypothetical Role of Manganese-oxidizing Bacteria on the Distribution of Particulate Metals in the Canadian Arctic Ocean. Ocean Sciences Meeting, Portland, USA (international; oral presentation).

[3] Colombo M., Knutsson S., Rostmark S.C. and Öberg G. (2014) Sustainable management of contaminated sediments: reducing energy demand, climate impact and water pollution in coastal cities. Water Initiative for the Future. Kingston, Canada (national; poster).

[2] Colombo M., Speranza E.D., Cappelletti N. and Colombo J.C. (2013) Sterols analysis by solid phase extraction (SPE) and gas chromatography. Proceedings of the XIX National Organic Chemistry Symposium. Mar del Plata, Argentina (national; poster).

[1] Colombo M., Speranza E.D, Tatone L.M. and Colombo J.C. (2013) Sterols analysis as organic sources biomarkers in Del Plata basin. Proceedings of the XIX National Organic Chemistry Symposium. Mar del Plata, Argentina (national; poster).

8.3. Invited Scholarly Papers and Talks

[4] Colombo M. (2023) Biogeochemistry Across Boundaries. Physical Oceanography Seminar, University of British Columbia, Canada. Nov 2023 (oral presentation).

[3] Colombo M. (2021) On the biogeochemical processes controlling trace metal distributions in the Canadian Arctic Ocean and Arctic Rivers. 27th Dissertation Symposium in Chemical Oceanography, Lihue, Hawaii, USA. Oct 2021 (oral presentation).

[2] Colombo M. (2021) Trace elements as tracers of biogeochemical processes in the Canadian Arctic Ocean. Workshop: Introduction to Biogeochemistry, National University of La Plata, Argentina. July 2021 (oral presentation)

[1] Colombo M. (2020) Lead as a transient tracer of Anthropogenic pollution & Benthic Fe and Mn inputs in the CAA and subsurface Baffin Bay waters. Workshop: Introduction to Biogeochemistry, National University of La Plata, Argentina. Nov 2020 (oral presentation).

8.4. Work in Progress

Jensen L. and **Colombo M.** (2024) Shelf-basin connectivity drives dissolved Fe and Mn distributions in the Western Arctic Ocean: a synoptic view into polar trace metal cycling. *Oceanography (Under Review).*

9. Professional Engagement

9.1. Editorial Board Services, Review Panels, Program Reviews, Etc.

Journal Article Reviews:

Year	*Journal*	*Articles reviewed*
2024	Journal of Geophysical Research: Oceans	1
2023	Global Biogeochemical Cycles	1
2022	Global Biogeochemical Cycles	1
2021	Geochimica et Cosmochimica Acta	1
2020	Chemical Geology	1
	Nature Communications	1
2019	Science of the Total Environment	1
2018	Journal of Occupational and Environmental Hygiene	1

10. Fieldwork Record

Field Campaign	*Position*	*Activities Developed*	*Date*
MUDBENCS – Amazon coastal research cruise Chief scientist*: Brad Rosenheim*	Postdoctoral Researcher	- Sampled, filtered, and processed seawater for trace metal analyses - Deployed multi and gravity core sampling devices and processed sediment core samples.	2023/06 (2.5 weeks)
Canadian Arctic GEOTRACES Cruise Chief scientist*: Roger Francois*	Researcher	- Sampled, filtered, and processed seawater and river samples for trace metal analyses, operated and deployed the trace metal rosette.	2015/07 (3 months)