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RESEARCH EXPERTISE

dissolved gases, isotope geochemistry, biogeochemical tracers, chemical oceanography, groundwater chemistry, mass spectrometry, biogeochemical instrument development, in situ instrumentation

EDUCATION

PhD, Chemical Oceanography 2016
- Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography
- **Thesis:** Insight into chemical, biological, and physical processes in coastal waters from dissolved oxygen and inert gas tracers. http://doi.org/10.1575/1912/8589

BSc, Combined Honors, Chemistry and Earth and Ocean Sciences (with distinction) 2010
- University of Victoria, Canada
- **Thesis:** Investigation of the nitrous oxide cycle within an anoxic coastal pond in Cape Cod, MA

EXPERIENCE

Postdoctoral Research and Teaching Fellow with Philippe Tortell and Roger Beckie, UBC 2017–present
- Investigating Canadian Arctic greenhouse gas cycling and groundwater geochemistry in British Columbia. Co-instructor for Field Methods in Groundwater Hydrology. *Publications 8-10, 12, T1-T2, S1-S3.*

Graduate Research Assistant supervised by Rachel Stanley and David Nicholson, WHOI 2011–2016
- Developed a gas equilibration mass spectrometer for on-site measurement of dissolved noble gases in water. Participated in three field experiments to quantify air-sea gas exchange (from inert gases) and biological productivity (from the triple oxygen isotope composition of O_2). *Publications 4-7, 11.*

Research Assistant supervised by J. Scott McIndoe, UVictoria 2010–2011
- Contributed to development of novel mass spectrometer-based techniques for real-time reaction monitoring. Applied techniques to study mechanisms of palladium-catalyzed cross-coupling reactions. *Publication 2.*

Summer Student Fellow supervised by Karen Casciotti, WHOI 2009
- Studied N cycling in an anthropogenically-influenced anoxic lake by measuring the concentration and isotopic composition of N_2O and nutrients. Investigated biological pathways to N_2O production through incubations.

Research Assistant supervised by Roberta Hamme, UVictoria 2008
- Quantified denitrification rates in a seasonally-anoxic estuary by interpreting an annual time series of O_2 concentration and O_2/N_2/Ar ratio data. *Publications 1 and 3.*

PEER-REVIEWED PUBLICATIONS

12) **A new method for tracing denitrification in riparian groundwater**
A Popp, **CC Manning**, M Brennwald, and R Kipfer (2020)
Environmental Science & Technology, 54(3), 1562-1572, https://doi.org/10.1021/acs.est.9b05393

11) **Changes in gross oxygen production, net oxygen production, and air-water gas exchange during seasonal ice melt in Whycocomagh Bay, a Canadian estuary in the Bras d'Or Lake system**.
CC Manning, RHR Stanley, DP Nicholson, B Loose, A Lovely, P Schlosser, and BG Hatcher (2019)
Biogeosciences, 17, 3351-3376, https://doi.org/10.5194/bg-16-3351-2019

10) **Advancing knowledge of gas migration and fugitive gas from energy wells in northeast British Columbia, Canada**.
AG Cahill, R Beckie, B Ladd, E Sandl, M Goetz, J Chao, J Soares, **C Manning**, C Chopra, N Finke, I Hawthorne, A Black, KU Mayer, S Crowe, T Cary, R Lauer, B Mayer, A Allen, D Kirste, L Welch (2019)
Greenhouse Gases: Science and Technology, 9, 134-151, https://doi.org/10.1002/ghg.1856

9) **An intercomparison of oceanic methane and nitrous oxide measurements**.
ST Wilson, HW Bange, DL Arevalo-Martinez, J Barnes, AV Borges, I Brown, JL Bullister, M Burgos, DW Capelle, M Casso, M de la Paz, L Farias, L Fenwick, S Ferron, G Garcia, M Glockzin, DM Karl, A Kock, S Laperriere, CS Law, **CC Manning**, A Marriner, J-P Myllykangas, JW Pohlman, AP Rees, AE Santoro, M Torres, PD Tortell, RC Upwstill-Goddard, DP Wisegarver, GL Zhang, G Rehder (2018)
Biogeosciences, 15, 5891-5907, https://doi.org/10.5194/bg-15-5891-2018

8) **Refined estimates of net community production in the Subarctic Northeast Pacific derived from $\Delta O_2/Ar$ measurements with N_2O-based corrections for vertical mixing**
RW Izett, **CC Manning**, RC Hamme, and PD Tortell (2018)
Global Biogeochemical Cycles, 32, http://doi.org/10.1002/2017GB005792

7) **Revising estimates of aquatic gross oxygen production by the triple oxygen isotope method to incorporate the local isotopic composition of water**
CC Manning, EM Howard, DP Nicholson, B Ji, ZO Sandwith, and RHR Stanley (2018)
Geophysical Research Letters, 44, http://doi.org/10.1002/2017GL074375. Software: http://doi.org/10.5281/zenodo.376786

6) **Impact of recently upwelled water on productivity investigated using in situ and incubation-based methods**.
CC Manning, RHR Stanley, DP Nicholson, JM Smith, JT Pennington, MR Fewings, ME Squibb, and FP Chavez (2017)
Journal of Geophysical Research: Oceans, 122, http://doi.org/10.1002/2016JC012306.

5) **Quantifying air-sea gas exchange using noble gases in a coastal upwelling zone**.
CC Manning, RHR Stanley, DP Nicholson, and ME Squibb (2016)
IOP Conference Series: Earth and Environmental Science. 35, 012017, 13 pages, http://doi.org/10.1002/2017GL074375. Software: http://doi.org/10.5281/zenodo.594531

4) **Continuous measurements of dissolved Ne, Ar, Kr, and Xe with a field-deployable gas equilibration mass spectrometer**.
CC Manning, RHR Stanley, and DE Lott (2016).
Analytical Chemistry 88, 3040–3048, http://doi.org/10.1021/acs.analchem.5b03102

3) **Nitrate elimination and regeneration as evidenced by dissolved inorganic nitrogen isotopes in Saanich Inlet, a seasonally anoxic fjord**.
A Bourbonnais, MF Lehmann, RC Hamme, **CC Manning**, and SK Juniper (2013)
Marine Chemistry 157, 194-207, http://doi.org/10.1016/j.marchem.2013.09.006

2) **Powerful insight into catalytic mechanisms through simultaneous monitoring of reactant, products and intermediates.**
KL Vikse, Z Ahmadi, **CC Manning**, DA Harrington, and JS McIndoe (2011)
Angewandte Chemie International Edition 50(36), 8304-8306, http://doi.org/10.1002/anie.201102630

1) **Impact of deep-water renewal events on fixed nitrogen loss from seasonally-anoxic Saanich Inlet**
CC Manning, RC Hamme, and A Bourbonnais (2010)
Marine Chemistry 122, 1-10, http://doi.org/10.1016/j.marchem.2010.08.002

PEER-REVIEWED TECHNICAL REPORTS

T2) **Controlled natural gas release experiment in a confined aquifer, northeastern British Columbia: activity report 2018-2019**
AG Cahill, B Ladd, J Chao, J Soares, T Cary, N Finke, **C Manning**, C Chopra, KU Mayer, A Black, R Lauer, C van Geloven, L Welch, S Crowe, B Mayer and RD Beckie
Geoscience BC Summary of Activities 2019: *Energy and Water*, Geoscience BC, Report 2020-02, p. 145-160. http://www.geosciencebc.com/s/SummaryofActivities.asp

T1) **Implementation and operation of a multidisciplinary field investigation involving a subsurface controlled natural gas release, northeastern British Columbia**
AG Cahill, B Ladd, J Chao, J Soares, T Cary, N Finke, **C Manning**, C Chopra I Hawthorne, ON Forde, KU Mayer, A Black, S Crowe, B Mayer, R Lauer, C van Geloven, C., L Welch, and RD Beckie (2019)
Geoscience BC Summary of Activities 2018: *Energy and Water*, Geoscience BC, Report 2019-2, p. 95–104.
http://www.geosciencebc.com/s/SummaryofActivities.asp

SUBMITTED MANUSCRIPTS

S3) **Dissolved oxygen and triple oxygen isotope measurements provide different insights into gross oxygen production in a shallow salt marsh pond**
EM Howard, AC Spivak, JS Karolewski, KM Gosselin, ZO Sandwith, **CC Manning**, and RHR Stanley (in revision for *Estuaries and Coasts*, 2020)

S2) **River inflow dominates methane emissions in an Arctic coastal system**
CC Manning, VL Preston, SF Jones, APM Michel, DP Nicholson, PJ Duke, M Ahmed, K Manganini, BGT Else, and PD Tortell (revised manuscript submitted, 2020)
EarthArXiv preprint https://doi.org/10.31223/osf.io/cs7nx

S1) **Standard operating protocols for N_2O and CH_4 data reporting and archiving**
A Kock and **CC Manning** (under review, 2019)

GRANTS, SCHOLARSHIPS AND FELLOWSHIPS

2018–2020	NSERC Postdoctoral Fellowship ($90 000)
2014	WHOI Ocean Ventures Fund for graduate student research ($6000)
2014	WHOI Coastal Ocean Institute award for graduate student research ($1294)
2012–2015	NSERC Post-Graduate Scholarship D ($63 000)
2012–2014	Canadian Meteorological and Oceanographic Society scholarship ($10 000)
2011–2012	NSERC Post-Graduate Scholarship M ($17 300)
2009	Woods Hole Oceanographic Institution Summer Student Fellowship ($8000)
2008	NSERC Undergraduate Student Research Award ($4500)

OTHER ACTIVITIES

2019–2020	Co-instructor for Field Methods in Groundwater Hydrology (UBC undergrad and graduate course)
2019	Canadian Arctic research cruise on CCGS Amundsen (22 days)
2018	Canadian Arctic research cruise on CCGS Amundsen (21 days)
2018	Coastal fieldwork in Cambridge Bay, Nunavut (10 days)
2018	Hydrogeological fieldwork in Hudson's Hope, BC (15 days)
2018	UBC Instructional Skills Workshop, run by the the Centre for Teaching, Learning and Technology
2018	Mitacs Foundations of Project Management workshop
2017	Canadian Arctic research cruise on CCGS Amundsen (42 days)
2015–2017	Developed open access policies for scientific publications at WHOI and MIT
2015	9th Annual Graduate Climate Conference, program designer and biogeochemistry session chair
2015	MIT/Imperial College London Global Fellows Program
2014	Communicating Ocean Sciences (semester long course on teaching methods at WHOI)
2014–2016	WHOI Women's Committee, member and webmaster
2008–	sixteen presentations as first author at research conferences, and six departmental seminars