

CATHERINE LAROSE

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PERSONAL PROFILE

Catherine Larose is a newly recruited CNRS CR2 (2013) who completed her PhD in Earth Sciences in 2010. She has published over 15 articles related to biogeochemistry, contaminant cycling and extreme environments (h = 13) and is developing one of the only French Arctic snow microbiology research themes at the EMG laboratory. Catherine Larose has participated and led over 10 field campaigns in the Arctic and is regularly an invited lecturer at international conferences (ex: Jacques Monod, Polar and Alpine Microbiology, Bageco). CL has co-supervised three PhD projects (financed by NORA and Trainbiodiverse ITN training networks- 2 have defended in 2015) and currently has 4 new PhD students funded by either the EU or France. Dr. Larose and is an associate editor of *Frontiers in Terrestrial Microbiology* (Nature Publishing Group). She is also a work package leader for the recently financed ITN grant MicroArctic, related to microorganisms in arctic terrestrial ecosystems. The EMG group has been a pioneer (since the 1990's) in the development of new methodologies for molecular ecology of a range of environments.

EDUCATION

2007-2010 Doctorat Sciences de la Terre, Univers, Environnement, Université de Grenoble, France, Laboratoire de Glaciologie et Géophysique de l'Environnement et le Laboratoire d'Adaptation et Pathogénie Microbienne

Titre: *Interactions entre composition chimique et populations microbiennes de la neige: quelles sont les conséquences sur le cycle du mercure en Arctique ?*

2004-2006 M.Sc. Sciences de l'environnement, Université du Québec à Montréal (UQÀM), Canada, Centre de Recherche en Géochimie et en Géodynamique (GEOTOP) et le Réseau collaboratif de recherche sur le mercure (COMERN). Directeur de recherche : M. Lucotte, Professeur, UQÀM

Titre: *Toxicocinétique du mercure chez le doré et la perchaude dans les lacs de la forêt boréale.*

2001-2004 B.Sc. Sciences biologiques, Université du Québec à Montréal, Canada

Projet de recherche: *Validation d'un protocole de préparation des échantillons en vue de la détermination des taux de production photochimique et métabolique de CO₂*

EMPLOYMENT

2013-present CNRS research scientist, Section 30, Environmental microbial genomics group, University of Lyon

2010-2013 Post doctoral fellow, Environmental microbial genomics group, University of Lyon

PROFESSIONAL MEMBERSHIPS

Dr Larose is a founding member of the European Polar and Alpine Microbiology society.

Dr Larose is also on the editorial board of *Frontiers in Microbiology*, part of the Nature Group publications.

SKILLS

- Molecular Ecology : DNA, RNA protein extraction from complex environments, molecular fingerprinting (RISA), cloning-sequencing, quantitative PCR, omics techniques (preparing libraries, sequencing), DNA microarrays.
- Microbiology : isolation, aerobic and anaerobic cultures, micro- and meso-cosm work
- Biology : enzyme activity measurements, protein extraction and dosing, animal physiology, health bioindicators
- Analytical chemistry : GC (CO₂ and methane), GC/MS (PCBs in soils and sediments), CVAFS (mercury analysis in snow, soil and animal tissue samples), ion chromatography, atomic absorbance (Fe-Mn in water), spectrometry, radiometry
- Statistics : Biostatistics (population analysis, multivariate analysis) in R, JMP and bioinformatics (sequence analyses)
- Extensive experience in Arctic and cold environment (Canada, Greenland, Svalbard) field work: more than 10 years of expeditions as a member and over 10 field campaigns as the expedition leader

RESEARCH

My research focuses on understanding the the relationships between chemical parameters including a central contaminant such as mercury in arctic snowpacks and the microbial communities inhabiting them. Through a number of field studies, we have examined microbial community structure in the snow during the spring in different types of snow and identified potential changes in diversity, activity, function and sources (atmospheric deposition, sea aerosols, etc.) of microbial populations. Snow chemistry (inorganic ions, organic acids, pH, carbon and contaminants) was also studied in detail and related to microbial data (Larose et al, 2013b). We focused mainly on the environmental sources of mercury (Hg) species (bioavailable Hg and methylmercury) and their fate and transfer in the Arctic environment. These results were published in a series of papers (over 10 papers since 2007) and allowed us to improve our understanding of community dynamics in the snow, allowing us to gain insights on potential drivers of the snow ecosystem, and the drivers of mercury cycling in Arctic snow. We were able to experiment with new techniques to analyze microbial community function, such as bioreporters for measuring mercury and omics approaches. Through these studies, we have been able to identify key aspects that impact snow and ice ecosystem functioning in Svalbard (e.g. Maccario et al., 2014, Sanguino et al., 2015).

MENTORING

2016: 4 PhDs have been recruited to work on cryosphere microbiology

Carolina Hoyos (post-doctoral researcher) 2015-present: Microbial adaptations to extreme environments

Christoph Keuschnig (ITN Marie-Curie PhD), 2014-present: Biogeochemical cycling of nitrogen, role of microbial communities (2 publications under review)

Laura Sanguino (ITN Marie-Curie PhD) 2012-2015: Exploring environmental virus-host interactions and their relevance to microbial adaptation using CRISPRs (2 publications, 1 under review)

Lorrie Maccario (PhD) 2012-2015: Snow Ecosystem: Microbial community structure and function in Arctic snowpacks (2 publications, 1 under review)

Adrien Boniface (M2, ENS) 2015: Adaptation et écologie des communautés microbiennes de la neige

Anthony Morris (TFE ECL) 2015: Arctic snow microbial community responses to increases in temperature and carbon inputs

Sébastien David (M2) 2014-2015: Impact des radionucléides sur la structuration microbienne des sols de Fukushima

Eric Capo (M2) 2012-2013: Potentiel de dégradation des hydrocarbures des microorganismes de la neige

2003-present: Training of undergraduate and master's students in field (north of Québec, Arctic) and laboratory techniques. Dr Larose helped define research projects, supervised lab and field work and help revise and prepare reports and oral presentations.

ADMINISTRATION

Member of the International Organizing Committee of the 5th International Polar and Alpine Microbiology Conference in Montana (2013). Organization of a session at the Goldschmidt Conference, 2015.

ACADEMIC AWARDS

2007-2009 PhD scholarship, excellence award, FQRNT (Fonds de recherche sur la nature et les technologies, Canadian funding agency)

2005-2006 Master's scholarship, excellence award, FQRNT (Fonds de recherche sur la nature et les technologies, Canadian funding agency)

2003 Undergraduate research scholarship, excellence award, NSERC, Natural Science and Engineering Council of Canada

FUNDING

2016 **Several different projects were funded in 2016:**

PARCS (Chantier Arctique, PI : Kathy Law), improving understanding about the sources and fate of Arctic pollution and its impacts on climate, ecosystems and human society. (650k€)

INHALE: Investigations of tHe Atmosphere as a real Ecosystem, (PI A. Dommergue): Composition, functioning and dynamics of microbial communities in the atmosphere, impact on biogeochemical cycling (350k€)

MicroArctic Call: H2020-MSCA-ITN-2015, (PI, A Anesio, Bristol University, C.Larose is workpackage leader, funded): understanding of the Arctic environment and the factors that impact ecosystem and organism response to the warming Arctic

Community Coordinated Snow Study in Svalbard (C2S3): 24 scientists from 15 institutes in 8 different countries: relationships and interactions that link carbon aerosols in the Arctic snowpack with other physical and chemical properties of snow, and to establish if and/or how these properties affect, or are affected by, microbial communities in the snowpack (100k€).

Montre-moi ta langue: (PIs M. Suchet, PL Patoine, University of Sorbonne, C Larose, ECL) a collaborative project linking literature and microbiology in cold environments

- 2015** French polar institute IPEV (Institut Polaire Emile Victor) project : ALCHEMI, 2015-2018): Microbial functioning in the Arctic (100k€)
- 2011** French polar institute IPEV (Institut Polaire Emile Victor) project : CHIMERPOL III, 2011-2014): Dynamics of the snow ecosystem in the Arctic (100k€)
- 2010** Environmental engineering grant National French research Institute CNRS – CEMAGREF : Metaproteomic approaches for understanding PCB bioremediation (40k€)
- 2009** ARCFAC (European Centre for Arctic Environmental Research) : WAMAS, Winter assessment of mercury processes in the arctic snowpack (12k€)

Publications

1. Maccario L, Sanguino L, Vogel TM, **Larose C.**, 2015. Snow and ice ecosystems: not so extreme. *Res Microbiol.* 166(10):782-95. doi: 10.1016/j.resmic.2015.09.002.
2. Sanguino, L., Franqueville L., Vogel, T. M. and **Larose, C.**, 2015. Linking environmental prokaryotic viruses and their host through CRISPRs. *FEMS Microbiology Ecology.* Doi:10.1093/femsec/fiv046
3. Maccario L, Vogel TM, **Larose C.** (2014). Potential drivers of microbial community structure and function in Arctic spring snow. *Front Microbiol.* 5: 413.
4. **Larose, C.**, Cecillon, S., Prestat, E., Malandain, C., Berger, S., Lyon, D., Dommergue, A., Ferrari, C., Schneider, D., Vogel, T. Interactions between snow chemistry, mercury contamination and microbial population dynamics in an Arctic snowpack. 2013. *PLoS ONE.* 8(11).
5. **Larose, C.**, Dommergue, A., Vogel, T. M. 2013. Microbial nitrogen cycling in Arctic snowpacks. 2013. *Environmental Research Letters.* 8(3).
6. Bowman J. S., **Larose C.**, Vogel T. M., Deming J. W. 2013. Dominance of the surface of young sea ice by Rhizobium spp., widely distributed bacterial members of the polar marine rare biosphere. *Environmental Microbiology Reports.* doi: 10.1111/1758-2229.12047
7. **Larose, C.**, Dommergue, A., Vogel, T. M. 2014. The dynamic Arctic Snow Pack: An Unexplored Environment for Microbial Diversity and Activity. *Biology.* 2(1): 317-330.
8. Douglas, T. A., Loseto, L., Macdonald, R. W., Outridge, P., Dommergue, A., Poulain, A. Amyot, M., Barkay, T., Berg, T., Chételat, J., Constant, P., Evans, M., Ferrari, C., Gantner, N., Johnson, M. S., Kirk, J., Kroer, N., **Larose, C.**, Lean, D., Muir, D., Nielsen, T. G., Poissant, L., Rognerud, S., Skov, H., Sørensen, S., Wang, F., Zdanowicz, C. M. 2013. The ultimate fate of mercury deposited to arctic terrestrial and aquatic ecosystems, a review. *Environmental Chemistry.* 9 (4): 321-355.
9. **Larose, C.**, Dommergue, A., Maruszczak, N., Ferrari, C. P., Schneider, D. 2011. Bioavailable Mercury Cycling in Polar Snowpacks. *Environmental Science & Technology* 45(6): 2150-2156.

10. Castro, L., Dommergue, A., **Larose, C.**, Ferrari, C., Maron, L. 2011. A theoretical study of abiotic methylation reactions of gaseous elemental mercury by halogen containing molecules. *Journal of Physical Chemistry A* 115(22): 5602-5608.
11. Delmont, T., Malandain, C., Prestat, E., **Larose, C.**, Monier, J. M., Simonet, P., Vogel, T. M. 2011. Metagenomic Mining for Microbiologists. *The ISME Journal* <http://dx.doi.org/10.1038/ismej.2011.61>
12. Maruszczak, N., **Larose, C.**, Dommergue, A., Nedjai, R., and Ferrari, C.P. 2011. Post-winter deposition of total mercury and methylmercury in high altitude surface snow from the French Alps. *Science of the Total Environment* 409(19): 3949-3954.
13. Maruszczak, N., **Larose, C.**, Dommergue, A., Paquet, S., Beaulne, J.S., Maury-Brachet, R., Lucotte, M., Nedjai, R., and Ferrari, C.P. 2011. Mercury and methylmercury concentration in high altitude lakes and fish populations from the French Alps related to watershed characteristics. *Science of the Total Environment* 409(10): 1909-1915.
14. **Larose, C.**, Dommergue, A., De Angelis, M., Cossa, D., Averty, B., Maruszczak, N., Soumis, N., Schneider, D., Ferrari, C., 2010. Seasonal changes in snow chemistry lead to new insights into mercury methylation in the Arctic. *Geochimica et Cosmochimica Acta* 74(22): 6263-6275.
15. **Larose, C.**, Berger, S., Ferrari, C. P., Navarro, E., Dommergue, A., Schneider, D., Vogel, T. M., 2010. Microbial sequences retrieved from environmental samples from seasonal Arctic snow and meltwater from Svalbard, Norway. *Extremophiles* 14(2):205-212.
16. Dommergue, A., **Larose, C.**, Faïn, X., Clarisse, O., Foucher, D., Hintelmann, H., Schneider, D., Ferrari, C. P., 2010. Deposition of mercury species in the Ny-Ålesund Area (79°N) and their transfer during snowmelt. *Environmental Science & Technology* 44(3):901-907.
17. **Larose, C.**, Canuel, R., Lucotte, M. and Di Giulio, R.T., 2008. Toxicological effects of methylmercury on walleye (*Sander vitreus*) and perch (*Perca flavescens*) from lakes of the boreal forest. *Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology*, 147(2):139-49.
18. Soumis, N., Lucotte, M., **Larose, C.**, Veillette, F. and Canuel, R., 2007. Photomineralization in a boreal hydroelectric reservoir: a comparison with natural aquatic ecosystems *Biogeochemistry* 86(2):123-135.
19. Canuel, R., de Grosbois, S. B., Lucotte, M., Atikesse, L., **Larose, C.**, Rheault, I., 2006. New evidence on the effects of tea on mercury metabolism in humans. *Archives of Environmental & Occupational Health* 61(5):232-238.
20. Garceau, S., Lucotte, M., Simoneau, M., Laliberté, D. and **Larose, C.**, 2004. Fish growth rates control mercury concentrations in certain sport fishes species from Eastern Canadian lakes. *RMZ-Materials and Geoenvironment* 51(2): 985-989.

Book chapters:

Soumis, N., Lucotte, M., Duchemin, É., Weissenberger, S., Canuel, R., Houel, S. and **Larose, C.**, 2006. Hydroelectric reservoirs as anthropogenic sources of greenhouse gases. In *Water Encyclopedia. Volume 3: Surface and agricultural water*, ed. J. H. Lehr et J. Keeley. p. 203-210. Hoboken, NJ: John Wiley & Sons.

Reports:

Douglas, T., Amyot, M., Barkay, T., Berg, T., Chételat, J., Constant, P., Dommergue, A., Evans, M., Ferrari, C., Gantner, L., Johnson, M., Kirk, J., Kroer, N., **Larose, C.**, Lean, D., Loseto, L., Macdonald, R., Muir, D., Nielsen, G., Outridge, P., Poulain, A., Poissant, L., Rognerud, S., Skov, H., Sørensen, S., Wang, F., 2011. Chapter 3: What is the fate of mercury entering the Arctic environment? In **AMAP Assessment: Mercury in the Arctic. Arctic Monitoring and Assessment Programme (AMAP)**. Oslo, Norway.

