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## The role of photodegradation on the mineralization of permafrost DOM

Flora Mazoyer<sup>1,3</sup>, Isabelle Laurion<sup>1,3</sup>, and Milla Rautio<sup>2,3</sup>

<sup>1</sup>Institut National de la Recherche Scientifique, Centre Eau Terre Environnement, Quebec city, Canada (flora.mazoyer@ete.inrs.ca)

<sup>2</sup>Université du Québec à Chicoutimi, Département des sciences fondamentales, Chicoutimi, Canada

<sup>3</sup>Centre d'Études Nordiques (CEN), Université Laval, Quebec city, Canada

Permafrost thaw leads to the formation of shallow water bodies in which large quantities of terrestrial organic carbon are mobilized as dissolved organic matter (DOM), partly turned into greenhouse gases (GHG). DOM comes from ancient carbon pools trapped in frozen soils for hundreds to thousands of years but also from present-day primary producers. Determining the fate of these pools is fundamental to evaluate the potential of these water bodies to amplify climate warming through their GHG emissions. In addition to the microbial degradation pathways producing CO<sub>2</sub> and CH<sub>4</sub>, DOM can be directly mineralized into CO<sub>2</sub> by sunlight. The CO<sub>2</sub> production rates from photodegradation vary extensively across Arctic regions. The controlling factors and interactions with the microbial communities are not well understood, while photodegradation is likely to rise as the open-water season extends. Determining the photo- and bio-lability of the carbon pools available on thawing permafrost landscapes is needed to predict to what extent these systems can affect the global carbon cycle.

Various DOM and environmental characteristics are considered in my PhD project, including mixing regime, seasonal exposure and light attenuation, as well as the microbial community response to photo-induced chemistry changes in DOM. Study sites include subarctic and arctic peatland areas of Eastern Canada, rich in thaw ponds and where organic matter started to accumulate between 3700 and 5600 years BP. These are non-Yedoma systems that have been poorly studied despite the large amount of organic carbon they store. This presentation will show the results of a lab experiment using a solar simulator where DOM of various origins and ages were tested: thaw pond water and leachates from plants, permafrost active layer, and previously unthawed permafrost. Short term incubations were carried out under five treatments: exposure to light without bacteria (0.2 µm filtration), exposure to light followed by a dark incubation with a bacterial inoculum, dark incubation with a bacterial inoculum, dark incubation with the whole bacterial community (2.7 µm filtration), and dark control without bacteria. A set of optical, biological and chemical characteristics were measured at the beginning and end of incubation. DOM losses (DOC, CDOM, and FDOM) and CO<sub>2</sub> production vary extensively among treatments and DOM pools. They were the highest in dark bacterial incubations of plants leachates. DOM of the subarctic area was quite refractory to degradation in general, except for the biodegradation of the

unthawed permafrost leachate (- 50%). Photodegradation was observed in all water types, with DOM losses faster than biodegradation ones for the Arctic soils leachates and all the ponds waters. The highest CO<sub>2</sub> photoproduction was measured in Arctic unthawed permafrost leachates. Finally, the enhancement of DOM lability to microbes caused by photodegradation was generally observed for unthawed permafrost leachates. Incoming biological and <sup>14</sup>C data, along with multivariate analyses, will improve the characterisation of the trends.