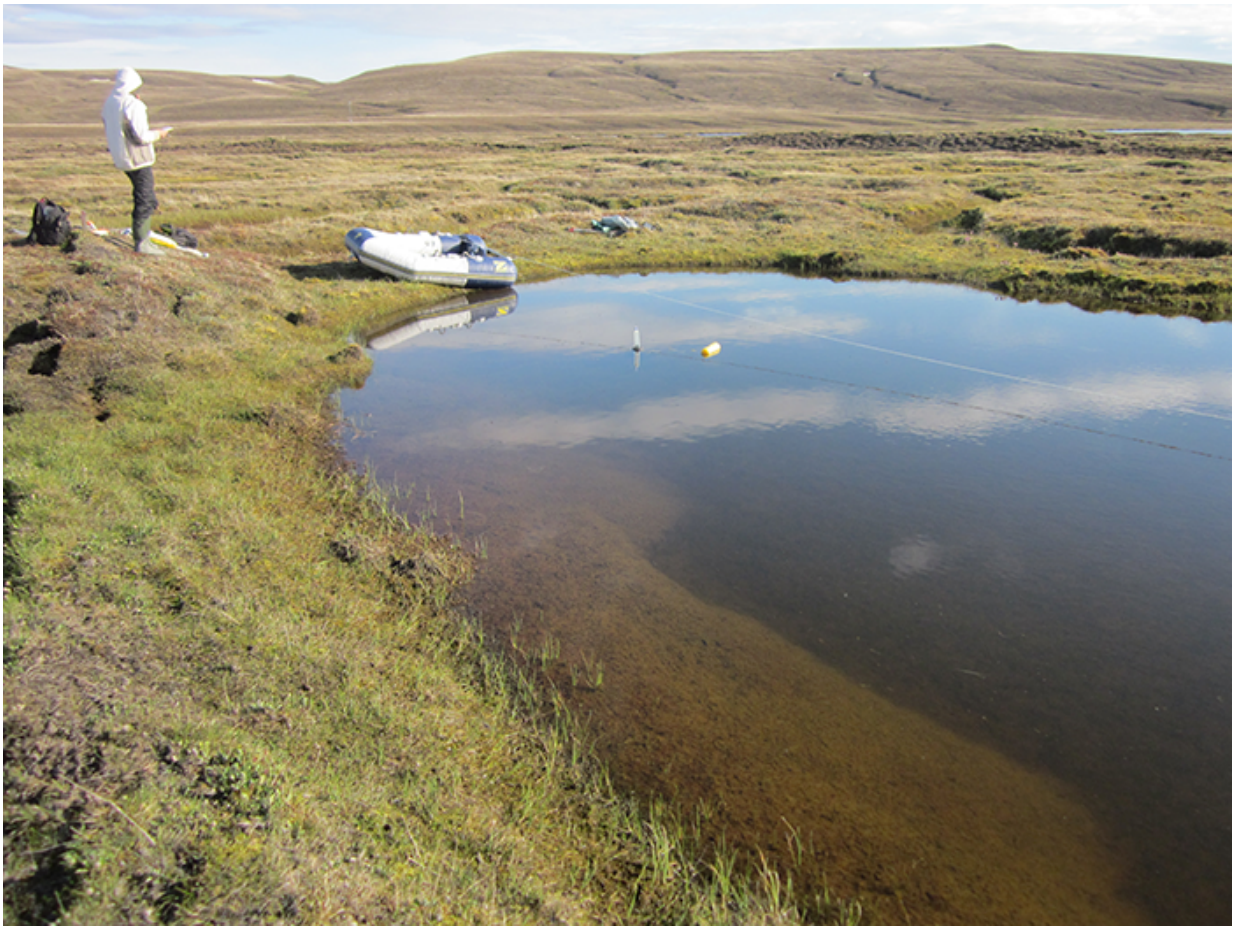
GHG emissions from Canadian Arctic aquatic systems dated for the first time

December 18 2015, by Gisèle Bolduc



For the first time, researchers have successfully dated the carbon dioxide

(CO_2) and methane (CH_4) emitted by ponds and lakes on Bylot Island, Nunavut. The research team observed significant variability in age and emission rates of greenhouse gases (GHG) from aquatic systems located in a continuous permafrost zone. The study, whose lead author is Frédéric Bouchard affiliated to the INRS Eau Terre Environnement Research Centre and the Geography Department of Université de Montréal, appeared in the international journal *Biogeosciences*.

Gas samples taken over the summer showed strikingly different ages and emission rates depending on the size and depth of the water bodies. Carbon-14 dating revealed that gas emitted by shallow ponds was a few centuries old, making it relatively "young". Certain ponds, covered by cyanobacterial mats, were identified as CO_2 sinks and sources of CH_4; others, with eroded banks, were significant emitters of both GHG. Compared to ponds, arctic lakes were found to release much older GHG—up to 3,500 years old in the case of CH_4—but at a much slower rate, at least in summer.

"This study demonstrates the significant impact of the combined geomorphological, limnological, and hydrological properties of aquatic systems on CO_2 and CH_4 emissions caused by thawing permafrost," noted Professor Isabelle Laurion."

The research team approach enabled an estimation of GHG emissions caused by two distinct processes: diffusion and ebullition. Researchers found that diffusion can be a significant mode of emission, especially from ponds. Until now, ebullition had been considered the predominant mode of CH_4 emissions in lake systems.

"This study on the age of GHG emitted in the Canadian Arctic is one of very few using data from lakes outside of Siberia or Alaska. It sheds light on the specific role played by aquatic systems on carbon dynamics associated with thawing permafrost, and their potential impact on future

climate change," stated researcher Frédéric Bouchard.

This work sets the scene for further research that must not only measure gas exchange rates, but also account for the age of carbon emitted, since this will impact the systems' potential positive feedback effect on climate.

More information: Modern to millennium-old greenhouse gases emitted from ponds and lakes of the Eastern Canadian Arctic (Bylot Island, Nunavut), *Biogeosciences*. DOI: 10.5194/bg-12-7279-2015

Provided by INRS