New technique for measuring greenhouse gas production from thawing permafrost

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Thawing permafrost in a peatland on Cree Reserve Lands near Whapmagoostui-Kuujjuarapik, Quebec. Credit: Regina Gonzalez Moguel

A research team led by McGill University geochemist Peter Douglas has used a new method for measuring the rate at which methane is produced by microbes breaking down thawing permafrost. The breakthrough could lead to an improvement in our ability to predict future releases of the potent greenhouse gas as long-frozen layers of soil begin to thaw.

"There is a lot of concern about methane being released from permafrost , but we don't know how available carbon that has been frozen for thousands of years is to microbes," says Douglas, an assistant professor in McGill's Department of Earth and Planetary Sciences.

In a study published online in *Geophysical Research Letters* on March 9, 2020, the researchers combined established radiocarbon dating techniques with 'clumped isotope' measurements of methane collected from lakes in permafrost areas—the first time the latter method had been used in this way. The results revealed a link between the age of the organic matter in the permafrost and the rate of methane production, suggesting that methane is produced more slowly when older carbon is released from permafrost.

"We were not expecting to see such a strong relationship between methane carbon age and estimated rates of production," Douglas says. "Other research has shown that old carbon released from permafrost can be respired quite quickly, and this result seems to be at odds with that."

The researchers, whose study examined lakes in Alaska and Sweden, note that further work is needed to determine whether the apparent link between carbon age and a slower rate of methane production holds true in other environments.

More information: Peter M.J. Douglas et al. Clumped isotopes link older carbon substrates with slower rates of methanogenesis in northern lakes, *Geophysical Research Letters* (2020). DOI:

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