Greenhouse Gas Bubbling from Melting Permafrost Feeds Climate Warming at Much Higher Than Expected Rates

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A study co-authored by a Florida State University scientist and published in the Sept. 7 issue of the journal *Nature* has found that as the permafrost melts in North Siberia due to climate change, carbon sequestered and buried there since the Pleistocene era is bubbling up to the surface of Siberian thaw lakes and into the atmosphere as methane, a greenhouse gas 20 times more potent than carbon dioxide.

In turn, that bubbling methane held captive as carbon under the permafrost for more than 40,000 years is accelerating global warming by heating the Earth even more --- exacerbating the entire cycle. The ominous implications of the process grow as the permafrost decomposes further and the resulting lakes continue to expand, according to FSU oceanography Professor Jeff Chanton and study co-authors at the University of Alaska-Fairbanks.

"This is not good for the quality of human life on Earth," Chanton said.

The researchers devised a novel method of measuring ebullition (bubbling) to more accurately quantify the methane emissions from two Siberian thaw lakes and in so doing, revealed the world's northern wetlands as a much larger source of methane release into the atmosphere than previously believed. The magnitude of their findings has increased estimates of such emissions by 10 to 63 percent.

Understanding the contribution of North Siberia thaw lakes to global atmospheric methane is critical, explains the paper that appears in this week's Nature, because the concentration of that potent greenhouse is highest at that latitude, has risen sharply in recent decades and exhibits a significant seasonal jump at those high northern latitudes.

Chanton points to the thawing permafrost along the margins of the thaw lakes -- which comprise 90 percent of the lakes in the Russian permafrost zone -- as the primary source of methane released in the region. During the yearlong study, he performed the isotopic analysis and interpretation to determine the methane's age and origin and assisted with measurements of the methane bubbles' composition to shed light on the mode of gas transport.

"My fellow researchers and I estimate that an expansion of these thaw lakes between 1974 and 2000, a period of regional warming, increased methane emissions by 58 percent there," said Chanton. "Because the methane now emitted in our study region dates to the Pleistocene age, it's clear that the process, described by scientists as 'positive feedback to global warming,' has led to the release of old carbon stocks once stored in the permafrost."

In addition to Chanton, the John Widmer Winchester Professor of Oceanography at FSU, co-authors of "Methane bubbling from Siberian thaw lakes as a positive feedback to climate warming" include K. M. Walter (Institute of Arctic Biology, University of Alaska-Fairbanks); S. A. Zimov (Northeast Science Station, Cherskii, Russia); and D. Verbyla (Forest Science department, University of Alaska-Fairbanks).

Source: Florida State University