New research identifies diverse sources of methane in shallow Arctic lakes

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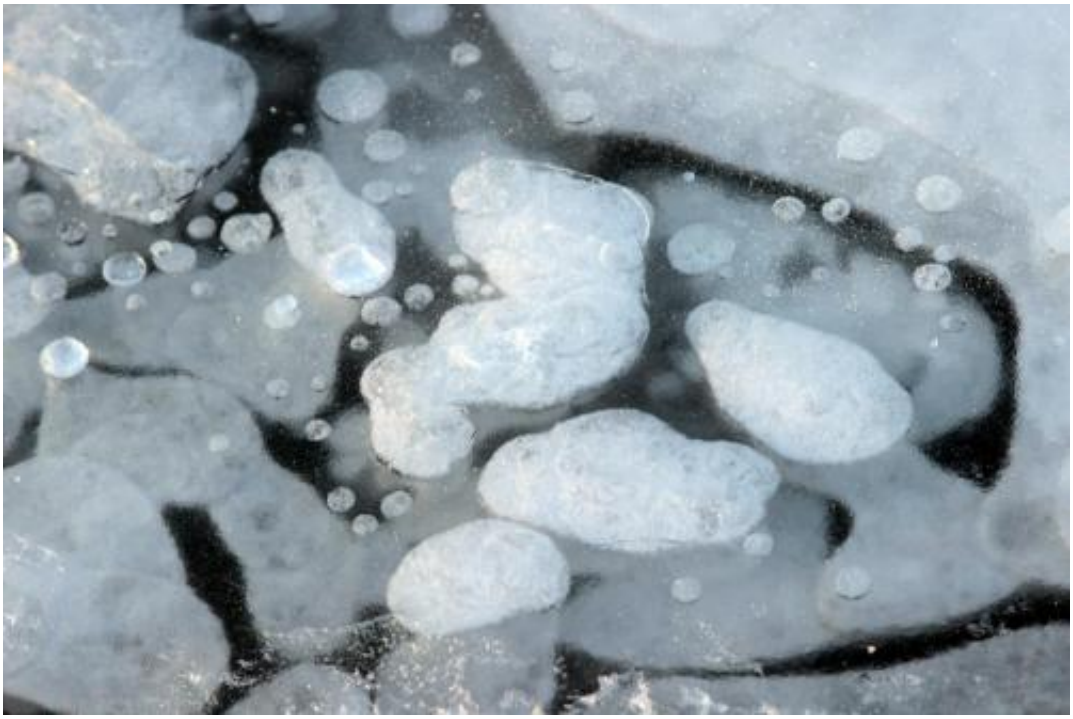

Methane gas bubbles are seen here trapped in the ice of a frozen thermokarst lake, which has an active methane seep. This gas is released into the Arctic atmosphere from both the frozen layer and the underlying waters during the spring thaw. Credit: Kevin Hand, NASA Jet Propulsion Laboratory

New research into the changing ecology of thousands of shallow lakes on the North Slope of Alaska suggests that in scenarios of increasing global temperatures, methane-generating microbes, found in thawing lake sediments, may ramp up production of the potent greenhouse gas -

which has a global warming potential 25 times greater than carbon dioxide.

A study published this month in *Geobiology* - resulting from five-years of collaborative research led by Nevada's Desert Research Institute (DRI) and including scientists from NASA's Jet Propulsion Laboratory (JPL), Montana State University, and University of California, Riverside - illustrates how the decomposition of organic matter in thermokast lake sediments can produce up to three times more biological methane gas emissions when subjected to increased temperatures in a simulated environment.

Further, researchers found that the methane detected in in lake sediments in this region can arise from both ancient theremogenic sources deep in the earth, or from shallow contemporary biological sources. Interestingly, the coastal plain in the North Slope of Alaska is estimated to contain 53-billion cubic feet of natural gas trapped under the permafrost ice cap.

Thermokarst lakes occur as permafrost thaws and creates surface depressions where meltwater accumulates , converting what was previously frozen land into small freshwater lakes with active decomposing sediment layers.

DRI and NASA JPL engineers prepare coring device to sample thermokarst lake sediments in early November on the North Slope of Alaska. Credit: Alison Murray, DRI

While scientists have long understood that methane and carbon dioxide releases from thawing permafrost are important sources of global greenhouse gas emissions, little is known about the sources and rates of methane production (known as methanogensis) from microbial communities found in these changing environments.

"The large amount of organic matter stored in the thaw layer between the water column and the permafrost table serves as a significant source of carbon for methanogensis," explained Paula Matheus Carnevali, a doctoral student at DRI and the study's lead author. "Identifying and

understanding the production sources of methane will improve our ability to generate accurate predictions about the changing climate in the Arctic."

The study focused on methane dynamics within 16 sediment cores collected over a period of four years from two Alaskan thermokarst lakes, near Barrow, Alaska. Samples were obtained from three sites, one proximal to an active, submerged natural gas seep and another from a site approximately one-kilometer away from the seep site. The second lake was located about 13-km to the northwest, and did not have visibly active seeps.

Simulated climate scenarios were performed in a controlled DRI laboratory in Reno, Nevada and scientists analyzed the potential for increased biological production of methane from methanogens found in the lake sediments; the role of the sediment geochemistry in this process; and the temperature dependency of this process.

"This study marks an important step in recognizing that there are different methane sources in close proximity that may respond differently in the changing Alaskan arctic ecosystems," said Alison Murray, Ph.D., a principal investigator on the study and expert in microbial ecology and archaea found in some of Earth's most extreme environments.

"In scenarios of warming climate," Murray said, "our measurements indicate that biological methane production may play a larger role in total methane emissions in the future, which could have a significant impact on our climate."

More information: Full text of the study available online at - onlinelibrary.wiley.com/doi/10 … 1/gbi.12124/abstract

Provided by Desert Research Institute