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Alaskan ice retreat uncovers new methane seeps

Scientists have found that retreating glaciers and melting permafrost in Alaska are releasing up to 70% more methane – a potent greenhouse gas – than previously thought. If this estimate is true for the rest of the Arctic, this could have serious implications for global warming, say the scientists.

Over many thousands of years, dead plant and animal matter in sediment is slowly decayed by microorganisms and by heat, producing methane gas. Over time, methane accumulates in underground reservoirs and gradually escapes to the atmosphere through cracks in the rock. In the Arctic, glaciers and permanently frozen ground – known as permafrost - act as a lid, trapping most of the methane. But a warming climate means that permafrost is beginning to thaw and glaciers are retreating, opening up previously ice-covered cracks in the rock where methane can escape, known as seeps.

Scientists know that seeps exist in the Arctic but their impact over such a large area is difficult to quantify. In the new study, scientists used aerial photography and ground surveys of 6,700 lakes in Alaska between 2008 and 2010, to look for patterns of holes in the ice cover created by bubbles of gas seeping from below.

The search revealed 77 previously undocumented seep sites across Alaska, containing more than 150,000 individual seeps. Most of these seep sites were found on the boundaries of present day retreating glaciers or thawing permafrost. In Greenland, seeps were found in exactly the area where glaciers have retreated over the last 150 years since the end of the Little Ice Age (1650-1850).

Methane seeps of similar size and intensity are known to exist on the sea floor but most of the methane dissolves out of the bubbles during the accent through deep water, meaning that most of it never reaches the atmosphere. However, Arctic lakes are shallow and more than 99% of the methane escapes directly to the atmosphere.

As well as being released over time from deep with sedimentary rock, methane is also released from shallow lakes by the microbial decomposition of relatively modern organic matter. But carbon dating of the gas emanating from some of the Alaskan seeps matched that of methane found in nearby coal beds and natural gas reservoirs, confirming its *geologic* rather than *ecologic* origin. This is the first time scientists have been able to identify geologic methane as a source of GHG emissions to the atmosphere in the Arctic due to degradation of the cryosphere cap.

Based on the rate of methane release measured in both types of seep, the scientists' calculations increase the current estimate of Alaska's natural methane emissions by 50-70%. Currently, 1,200 Pg of methane is thought to be stored under the Arctic ice, which is nearly 250 times more than the global atmosphere currently holds. If the same pattern exists in other parts of the Arctic and if climate warming intensifies, the scientists warn that a very significant amount of methane could be released as a result, further accelerating climate change.

Source: Antony, K. M. W., Antony, P. Grosse, G. & Chanton, J. 2012. Geologic methane seeps along boundaries of Arctic permafrost thaw and melting glaciers. Nature Geoscience. DOI: 10.1038/NGEO1480.

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