Study shows microbes may accelerate loss of permafrost in Greenland

April 7 2015, by Bob Yirka

Among the best preserved kitchen-middens in the world, the Qajaa site has until now been preserved by permafrost in one of the most Northern World Heritage sites. Credit: Bo Elberling

(Phys.org)—A small team of researchers working in Greenland has found that as microbes become active in permafrost, they produce heat, which can increase the rate of permafrost loss. In their paper published in *Nature Climate Change*, the researchers, affiliated with the University

of Copenhagen and the National Museum of Denmark describe simulations they created that showed possible impacts of microbe activation in permafrost areas.

In the most northern latitudes it is so cold year round that the soil and rock never thaw—that means that organic material from plants that die never has a chance to decompose. Over many years, a layer of such material has built up, which represents a tremendous carbon store. Scientists have been concerned about the impact of global warming on these regions, suggesting that if temperatures up north grow warm enough to melt the permafrost, the atmosphere is likely to see a big increase in carbon dioxide. As temperatures have risen, scientists have created models to predict a timeline for such an occurrence, but now, due to the efforts of this new research team, it appears those timelines will have be modified.

Suspecting that microbes in the soil might have an impact on warming permafrost, the researchers collected 21 samples of permafrost soil from six sites across Greenland. They then exposed the samples to different temperatures to see what happened. By carefully monitoring heat production by the microbes in the soil they were able to gather enough information to create a computer simulation. That simulation showed that as global temperatures rise, a feedback loop occurs in permafrost areas. Heat causes melting which paves the way for microbes, as they decompose organic material, they produce heat which adds to the increased temperatures, and on and on presumably until all of the material in the permafrost has been melted and decomposed, releasing massive amounts of carbon into the air far earlier than previous models have predicted.

The researchers also note that as the northern regions warm, evidence left behind over thousands of years by people venturing into the region will begin to decay as well as it begins to thaw along with the permafrost.

More information: Permafrost thawing in organic Arctic soils accelerated by ground heat production, *Nature Climate Change*, DOI: 10.1038/nclimate2590" target="_blank">www.nature.com/articles/DOI: 10.1038/nclimate2590

Abstract

Decomposition of organic carbon from thawing permafrost soils and the resulting release of carbon to the atmosphere are considered to represent a potentially critical global-scale feedback on climate change. The accompanying heat production from microbial metabolism of organic material has been recognized as a potential positive-feedback mechanism that would enhance permafrost thawing and the release of carbon. This internal heat production is poorly understood, however, and the strength of this e?ect remains unclear. Here, we have quantified the variability of heat production in contrasting organic permafrost soils across Greenland and tested the hypothesis that these soils produce enough heat to reach a tipping point after which internal heat production can accelerate the decomposition processes. Results show that the impact of climate changes on natural organic soils can be accelerated by microbial heat production with crucial implications for the amounts of carbon being decomposed. The same is shown to be true for organic middens5 with the risk of losing unique evidence of early human presence in the Arctic.

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