Warmer climate entails increased release of carbon dioxide by inland lakes

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Much organically bound carbon is deposited on inland lake bottoms. A portion remains in the sediment, sometimes for thousands of years, while the rest is largely broken down to carbon dioxide and methane, which are released into the atmosphere. Swedish researchers have shown that carbon retention by sediment is highly temperature-sensitive and that a warmer climate would result in increased carbon dioxide emissions to the atmosphere. The study is published in the current issue of the journal *Nature*.

Particles of different kinds - including microscopic algae, other plankton and humus from surrounding land areas - are continuously deposited on lake bottoms. The breakdown of a portion of this matter by bacteria in the sediment contributes significantly to atmospheric carbon dioxide. Lake sediment nevertheless constitutes an important "carbon sink," serving to store - sometimes for a very long time - a significant portion of the carbon-containing material that does not decompose.

To date, it has been unclear to what extent organic, carbon-containing material remains on lake bottoms, as opposed to being broken down. A group of researchers under the leadership of Professor Lars Tranvik at the Department of Limnology at Uppsala University has found a strong connection between the carbon dioxide production of lake sediment and bottom-water temperature.

"What we have discovered is that a very similar temperature-dependence relationship holds for a wide range of lake-sediment types," says

doctoral student Cristian Gudasz, who was responsible for data collection and evaluation. "Temperature affects carbon-dioxide production in much the same way regardless of a lake's nutrient content and geographic location and the chemical composition of the sediment."

The discovery of a broadly robust temperature-dependence relationship set the stage for an investigation of the effect of temperature on lake sediment in the boreal forest zone that runs through Eurasia and North America and contains millions of lakes. The annual rate at which bound carbon is deposited as sediment in the lakes of the boreal zone will fall by 4-27 per cent, depending on which climate forecasts are borne out, over the next hundred years. The production of carbon dioxide by lake sediment will increase correspondingly, resulting in higher levels of emissions to the atmosphere.

It is becoming increasingly clear that inland water systems play an important role in the global carbon cycle, in spite of the fact that they only cover 3 percent of the land area of the Earth. The study under consideration demonstrates how the role of inland water systems can be expected to change in response to climate change.

Provided by Uppsala University

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