Geophysical Research Abstracts,
Vol. 11, EGU2009-1566, 2009
EGU General Assembly 2009

Molecular 14-C analyses on lipid biomarkers in the water column and surface sediments reveal rapid aging of remobilized terrestrial organic carbon in a sub-Arctic basin

J. Vonk (1), Ö. Gustafsson (1), and B. van Dongen (2)

(1) Dept of Applied Environmental Sciences (ITM), Stockholm University, Stockholm, Sweden (jorien.vonk@itm.su.se), (2) School of Earth, Atmospheric and Environmental Sciences, The University of Manchester, United Kingdom

Riverine export of terrestrial organic carbon (terrOC) plays an important role in the global carbon cycle. Molecular composition, phase associations, transport and remineralization processes determine the fate of terrOC in the world's shelf areas, thereby potentially influencing climate through various carbon-climate feedback links. The vast sub-Arctic and Arctic terrestrial carbon pools, freeze-locked in northern peatlands, could be of particular interest in a warming climate scenario. The Kalix River, flowing into the Bothnian Bay in the northernmost Baltic Sea is one of Europe's largest unregulated rivers, draining sub-Arctic peatland prone to climate-warming effects. The Kalix is believed to resemble the great western Siberian-Arctic rivers that are far less accessible but draining similar, still partly frozen, high carbon content areas.

Here we present compound-specific radiocarbon analysis (CSRA) on terrestrial lipid biomarkers in surface water particulate OC (POC) from the Kalix – Bothnian Bay system. In combination with bulk 14-C and CSRA on surface sediments from the same off-river transect this shows (1) a rapid apparent aging of long-chain n-alkanoic acids from water column to surface sediments and (2) long-chain n-alkane 14-C ages in surface sediments that are similar and even older than catchment peat basal ages.

This combines with mass balance modelling results for this system to suggest a higher reactivity of remobilized recalcitrant terrOC than previously thought. We hypothesize that the terrOC is released from two different pools. Soil surface layers release humic-rich, easily degrading OC that mostly stays in suspension whereas OC that is coated to heavier mineral particles from deeper soil layers degrades slower and settles faster. Fraction modern 14-C signals in the range 0.18 – 0.47 of presumably mineral-bound terrestrial OC in surface sediments may indicate ongoing remobilization of ancient carbon reservoirs.