Export and sources of organic carbon in the Lena River catchment, Siberia

LISELOTT KUTSCHER[12*], PER S. ANDERSSON[2], CARL-MAGNUS MÖRTH[1], DON PORCELLI[3], CATHERINE HIRST[12] AND TROFIM MAXIMOV[4]

[1]Department of Geological Sciences, Stockholm University, 10691 Stockholm, Sweden. (*presenting author; liselott.kutscher@geo.su.se)

[2]Swedish Museum of Natural History, Laboratory for Isotope Geology, Stockholm, Sweden

[3]Department of Earth Sciences, University of Oxford, Oxford, UK

[4]International Center for BioGeoScience Education and Scientific Training (BEST) of North-Eastern Federal University, Yakutsk, Republic of Sakha (Yakutia), Russia

Permafrost thaw due to warming climate threatens to release large amounts of organic carbon (OC) from vast areas in the northern hemisphere. The Lena River basin has the largest annual export of OC to the Arctic Ocean. The basin is mainly underlain by continuous permafrost that is vulnerable to climate driven thawing, with possible future shifts in OC fluxes. Hitherto, data used for carbon export calculation and future prediction of changes have been based on data primarily collected in the main channel of Lena.

Here we present spatial data on concentrations of dissolved organic carbon (DOC), particulate organic carbon (POC), C/N ratios, $\delta^{13}C_{DOC}$, and $\delta^{13}C_{POC}$ from the main channel of Lena and 35 tributaries covering different landscape types and permafrost depths. The two largest tributaries, Aldan and Viliuj, which constitute almost 50% of the basin area, contributed 21% and 10% of the total OC exported to the Arctic Ocean respectively while the remaining area contributed 69% of the total OC. DOC concentrations, $\delta^{13}C_{DOC}$ and $\delta^{13}C_{POC}$, showed significant geographical differences, especially between the lowland area of Central Siberian Plateau and the mountain area of Verkhoyansk. Carbon isotopes and C/N ratios showed that DOC, which made up about 95% of the total OC, primarily originates from fresh plant material and soil organic matter (SOM). This indicates that DOC transport probably was dominated by relatively surficial flowpaths. The POC was more influenced by aquatic primary production and SOM erosion.

Our results indicate that climate driven shifts in OC fluxes to the Arctic Ocean will be dependent on spatial changes in hydrology and OC mobilization in the various contributing areas of the Lena River.