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Age distribution of permfrost soil & surface water particulate organic carbon in the Lena Delta, Siberia

M. Winterfeld (1,2), R. Flerus (1), B. Koch (1), G. Mollenhauer (1,2)

(1) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany (maria.winterfeld@awi.de), (2) University of Bremen, Department of Geosciences, Bremen, Germany

Since several millennia huge amounts of organic carbon (OC) are stored frozen in circumarctic permafrost soils making up almost twice the amount of carbon currently present in the atmosphere. During the course of a proposed rapid climate change in the Arctic large quantities of this old OC are expected to be remobilized in dissolved (DOC) and particulate phases (POC) and exported to the Arctic shelf seas. Previous studies have shown that at present, DOC in Arctic river runoff is predominantly composed of relatively fresh organic material likely derived from the uppermost soil horizons. POC age data are scarce and where present show that it is substantially older than DOC.

With our study we want to add information on the riverine POC exported by the Lena River to the Laptev Sea. Permafrost soil samples and surface water particulate matter (SPM) were collected in July/August 2009/2010 throughout the delta. Additional SPM samples were taken May/June 2011 during the spring flood and shortly after off the Island of Samoylov within the delta.

Particulate organic carbon (POC) contents for 2009 vary between 280μg/L and 2155μg/L with an average of 918μg/L which is within the range of previously reported values. The Δ14C concentrations for POC of the same year show a broad range from -262‰ to -55‰ (average -158‰, which translates into ages of 2380$\pm$30yrs BP and 395$\pm$35yrs BP respectively (average ca. 1300yrs BP). The POC Δ14C concentrations reflect the age distribution found in the upper 1.4m of a permafrost peat cliff on Samoylov Island (-274‰ or 2510$\pm$30yrs BP). Karlsson et al (2011) found that POC samples in the SE Laptev Sea just off the Lena Delta contain young and bioavailable material interpreted to be derived from surface soils, which is in agreement with our late summer data. With the surface water POC contents in the Lena Delta of three consecutive years including one spring flood event presented here we improve our understanding of the interannual and spatial variability of OC export and turnover of a permafrost affected drainage basin and add data to set up a baseline for future changes in quantities and relative fractions of remobilized permafrost carbon.

Karlsson E, Charkin A, Dudarev O, Semiletiv I, Vonk J, Sánchez-García L, Andersson A & Gustaffson Ö (2011). Carbon isotopes and lipid biomarker investigations of sources, transport and degradation of terrestrial organic matter in the Buor-Khaya Bay, SE Laptev Sea. Biogeosciences 8, 1865-1879.