



Sources and degradation of terrestrial organic matter along the Kolyma paleoriver transect in the East Siberian Sea

Jorien Vonk (1), Laura Sánchez-García (1), Örjan Gustafsson (1), Oleg Dudarev (2), Igor Semiletov (2,3), and Tim Eglinton (4)

(1) Stockholm University, Dept of Applied Environmental Sciences (ITM), Stockholm, Sweden (jorien.vonk@itm.su.se), (2) Pacific Oceanological Institute, Russian Academy of Sciences, Vladivostok, Russia, (3) International Arctic Research Center, University of Alaska, Fairbanks, USA, (4) Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, USA

The circum-Arctic region contains approximately half of the global belowground organic carbon (OC) pool, more than twice as much as CO₂-C currently in the atmosphere. These massive carbon stocks are freeze-locked in the least disturbed permafrost region of the Northern Hemisphere: the East Siberian Arctic, now subjected to the strongest climate warming in the world. Our knowledge is still waning on the fate and degradation status of the terrestrial organic carbon, remobilized through rivers and through eroding coasts.

During the ship-based ISSS-08 research expedition onboard the Yakob Smirnitskiy in late summer 2008 we explored the coastal and shelf areas of the East Siberian Sea. We collected surface water particulate OC (POC) and surface sediment OC (SOC) along an off-river transect (500 km long) in the Kolyma paleoriver canyon. Bulk geochemical and molecular analyses were performed to obtain detailed information on origin, and relative importance of degradation and transport of various components of the terrestrial OC (terrOC).

Surface SOC contents were between 0.80 and 1.4% and POC values decreased from > 300 µg/L outside Kolyma river mouth to about 50 µg/L further downcanyon at mid-shelf. Stable carbon isotope signatures (δ¹³C) increased in SOC from -27.3 per mill near the coast to -23.9 per mill at mid-shelf and in the surface water POC from -29.1 to -23.3 per mill, respectively, consistent with mixing between terrestrial and marine sources. Radiocarbon analyses of both POC and SOC will be interpreted. Certain terrestrial lipids, used as markers for recalcitrant soil organic matter, were detected in the sediments in concentrations of 170-390, 1300-5400 and 630-2800 µg/gOC for high-molecular weight (HMW) n-alkanols, n-alkanoic acids and n-alkanes in sediments respectively. For POC, these concentrations were 11-72, 130-810 and 150-520 µg/gOC for HMW n-alkanols, n-alkanoic acids and n-alkanes, respectively.

The ratio of high-molecular weight n-alkanoic acids over n-alkanes showed lower values for POC than for surface sediments, illustrating that terrestrial matter in the late summer water column is more degraded than in surface sediments. During our sampling period (beginning of September), the annual permafrost thaw layer and thermal degradation of the coasts were at their maximum. We hypothesize that the release of the extensively degraded terrestrial material is revealed through the molecular degradation ratios measured in the POC. In contrast, the surface sediments mostly reflect the large quantities that are released during freshet, when the run-off mainly takes place along the surface and through shallow soil layers, transporting less degraded and younger material.