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CONTRASTING LIPID BIOMARKER COMPOSITION AND ^{14}C AGES IN SURFACE SEDIMENTS OFF THE FIVE GREAT RUSSIAN ARCTIC RIVERS

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Numerical climate models forecast an amplified warming in the Arctic continental region (e.g., Zwiers, 2002), making it reasonable to expect that substantial effects of global warming will be first observed here. This will involve effects on the huge amounts of 'old' organic matter stored in Siberian soils. However, existing studies are inconclusive whether there is currently a climate-warming induced release of 'new' old carbon from the land. In addition, the availability of important detailed molecular data of the OM entering the Eurasian Arctic is limited or only available for single river systems. Therefore, surface sediments off the five Great Russian Arctic Rivers (GRARs), spanning 140 deg longitude, were investigated for their lipid biomarker composition to elucidate compositional distinctions of the exported OM across this continent-scale climosequence of the Siberian Arctic. In addition, high molecular weight (HMW) *n*-alkanes and *n*-alkanoic acids were isolated and used for compound-specific radiocarbon analysis (CSRA) to obtain information on the ^{14}C-based reservoir age of the OM currently released from the Russian-Siberian permafrost.

The solvent extracts from all sediments are dominated by terrestrial biomarkers such as HMW *n*-alkanols, *n*-alkanoic acids and *n*-alkanes, branched glycerol dialkyl glycerol tetraethers, sterols (mainly β-sitosterol) and triterpenoids (Fig 1.). These estuarine sediments host only minor contributions of marine biomarkers (e.g., the ratio of terrestrial HMW to marine low molecular weight *n*-alkanes was between 17 and 80), further confirmed by the total organic carbon (TOC) to total nitrogen ratio (10 to 16), the $\delta^{13}C_{TOC}$ (-25.0 to –27.4 ‰), and the branched and isoprenoid tetraether (BIT) index (0.88 to 0.92).

A large contribution of C_{23}-C_{25} *n*-alkanes to the total HMW *n*-alkanes, particularly in the Ob estuary sediment, suggests substantial contribution of *Sphagnum*-derived OM. The C_{23}-C_{25} contribution decreases from the west (Ob) to the east (Kolyma; Fig. 1), possibly indicating a decrease in the contribution of *Sphagnum* or, alternatively, a shift within the *n*-alkane distribution of the *Sphagnum* species, due to more arid conditions in the east. Another distinction in OM composition across the climosequence is the higher concentrations of *n*-alkanoic acids and β-sitosterol, in the Indigirka and Kolyma estuaries, compared to the more

western estuarine sediments (Fig. 1). Furthermore, the ratio of long-chain *n*-alkanoic acids to long-chain *n*-alkanes exhibits a west-to-east continent-scale trend (Fig. 1). This suggests that the OM exported by the eastern rivers are experiencing less degradation, which is consistent with increasing permafrost and a shorter annual thaw period from west to east along the Siberian Coast.

Taken together, this benchmark study suggests resolvable large-scale trends in OM lipid biomarker composition across the west-east set of the five GRARs, which reflects both differences in vegetative cover and climate. The resolved OM compositional differences may assist in predicting how the composition and decomposition of Arctic river-exported OM may change if the climate in the eastern Russian-Arctic region becomes more like the current state in the western part. In addition, CSRA of the isolated HMW *n*-alkanes and *n*-alkanoic acids will provide information which will contribute towards the understanding to what extent old carbon is now remobilized from the long-term repository represented by the Russian-Siberian permafrost and transported to the Eurasian rim of the Arctic Ocean; a scenario which would have major implications for the global carbon cycle and climate.

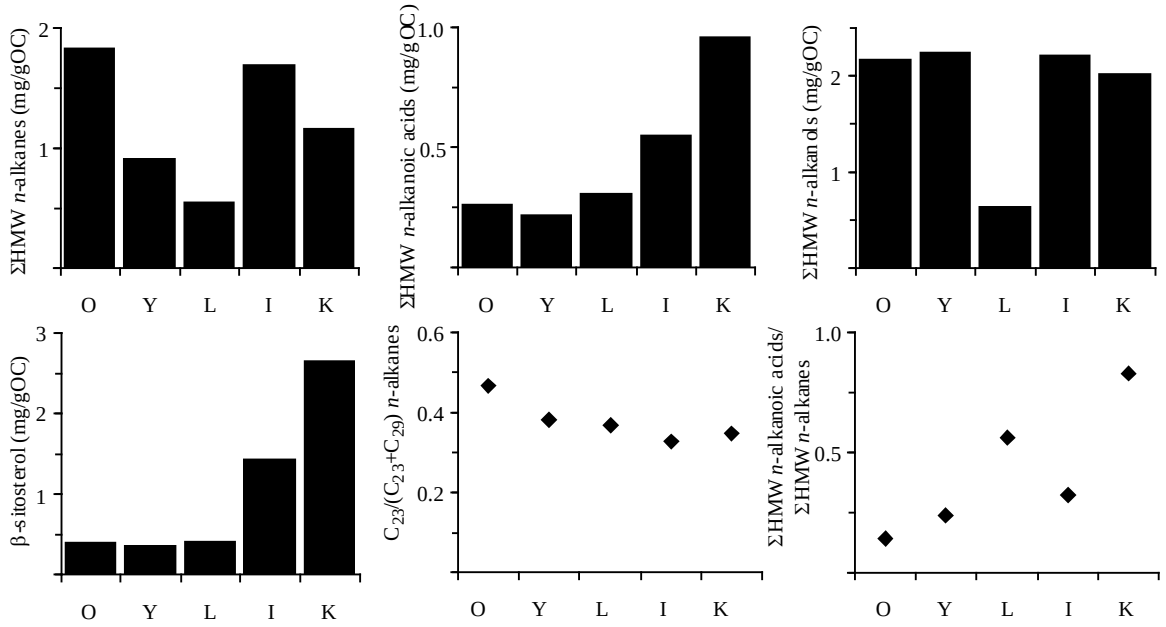

Figure 1. Abundances of terrestrial biomarkers and the ratios of C_{23} *n*-alkanes to the sum of C_{23} and C_{29} *n*-alkanes and the summed concentrations of the *n*-alkanoic acids to the *n*-alkanes along the Eurasia-Arctic climosequence. The rivers in order from west to east: Ob (O), Yenisey (Y), Lena (L), Indigirka (I), Kolyma (K).

REFERENCES

Zwiers, F.W., 2002. Climate change - The 20-year forecast. Nature, 416, 690-691.