^{14}C lipid biomarker 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, 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. Therefore, surface sediments off the five Great Russian Arctic Rivers (GRARs), spanning 140 deg longitude, were investigated for their lipid biomarker composition and 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.

In contrast to the F_{modern} bulk values, which show a decrease across the climosequence from 0.69-0.83 in the west to 0.39-0.50 in the east, CSRA of both the isolated HMW *n*-alkanes and *n*-alkanoic acids indicate on average the release of relative older terrestrial material organic material (OM) by the Western GRARs (F_{modern} 0.24-0.34), compared to the Eastern (F_{modern} 0.31-0.50).

Global warming is expected to affect the permafrost areas in the continental Siberian Arctic, causing them to shrink. This will probably lead to a deeper water penetration of the soil and, consequently, the liberation/transport of 'older' terrestrial material stored in these layers. The eastern GRARs CSRA results indicate that the majority of the source of this terrestrial OM transported to the estuaries in these areas are originating from the 'top' (relative younger) part of the soil. In contrast, the western areas are presently much less influenced by permafrost, indicating that the water can penetrate deeper and consequently can liberate/transport 'older' OM to the estuaries. In addition, this 'older' OM is most likely more degraded, which agrees with the biomarker analyses.

Although this benchmark study suggests presently no major release of remobilized 'old' OM through the eastern GRARs, the results of the western GRARs shows how amplified warming in the Arctic might influence the stored OM; a scenario which would have major implications for the global carbon cycle and climate.

Effect of self-consistently generated plate tectonics on stirring by mantle convection in a 3-D spherical shell

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The stirring of heterogeneities by mantle convection is a key process in explaining geochemical observations, but to date most studies have been performed in only two-dimensional geometry. If 3-D convection has only poloidal motion, then its stirring efficiency is similar to that of 2-D convection [Coltice and Schmalzl, 2006], but the presence of toroidal motion could make a major difference because it can lead to chaotic stirring paths even in a steady-state flow [Ferrachat and Ricard, 1998].

Toroidal flow is mainly associated with plate motions. Two previous studies have assessed the influence of steady-state present-day plate motions on mantle stirring [van Keken and Zhong, 1999; Stegman *et al*., 2002]. Here we instead study flows in which time-dependent plate tectonics is self-consistently generated by the rheology, similar to [Tackley, 2000] but in a spherical shell, and has a toroidal:poloidal ratio in the range observed for the Earth. Several diagnostics are used to measure the efficiency of dispersion and stretching and their spatial variation. Stirring in plate tectonics convection is compared to stirring in other convective flows that have similar convective vigor and wavelength but without plate tectonics. Three-dimensional "plate tectonic" flows are also compared to equivalent two-dimensional flows, in order to test whether the findings of [Coltice and Schmalzl, 2006] still hold when toroidal motion is also present in the 3D cases. The effect of 'realistic' depth-dependence of viscosity and other material properties is also assessed.

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