The influence of Siberian rivers over the preservation of organic matter on Arctic coastal shelves

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Three of the world's largest rivers in terms of water discharge and catchment basin area drain the Siberian Arctic: the Lena, Yenisei and Ob rivers (Milliman, 1991). Their water and solid discharges vary by several orders of magnitude during the year. Snow and ice melting waters get into these Siberian rivers mostly during spring and summer, carrying large amounts of terrestrial OM (organic matter). This material ultimately reaches the shallow seas surrounding the northern Eurasian continent and accumulates in coastal sediments. Here we report on carbon stable isotope ($\delta^{13}C$) and hydrocarbon data in the suspended matter (SM) and surface sediments of the Ob and Yenisei estuaries and Kara Sea shelf (Fig. 1). The preservation of terrestrially derived OM in shelf sediments is estimated based on the sedimentary OC (organic carbon) and $\delta^{13}C$ values.

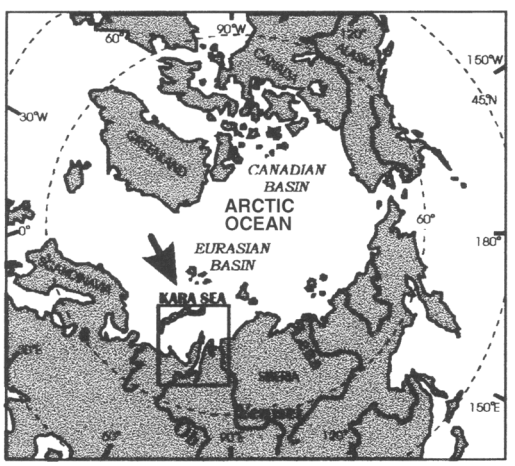

FIG. 1. Estuaries of the Ob and Yenisei rivers and Kara Sea shelf.

Results and discussion

Prevailing odd and high molecular weight ($>C_{25}$) particulate and sedimentary *n*-alkanes indicate major vascular plant wax inputs. The dominance of β,β-hopanes among triterpanes emphasizes the immature character of the OM, while the occurrence of hopenes points out microbial reworking. Likewise, the presence of alkylated polycyclic aromatic hydrocarbons, generated from the aromatization of 3-hydroxy triterpenoids and other constituents of higher plants, further supports the hypothesis of bacterial mediated degradation of the terrestrial OM. The Kara Sea hydrocarbon distributions are similar to those reported in the Laptev Sea, also part of the Eurasian Basin (Broyelle, I., 1997).

In order to quantify the percentage of terrestrial OC sequestered in the sediments of the Kara Sea (%TERR) two different methods were employed (Prahl *et al.*, 1994). The first one is based on the correlation of terrigenous *n*-alkanes (ΣC_{25-36}) and OC measured in riverine sediments (Fig. 2a,b). The slope of the linear regression obtained is used to estimate the %TERR for each coastal sediment of the Kara Sea. The second approach assumes that $\delta^{13}C$ values in coastal sediments derive from the binary mixing of riverine and marine OC. The marine $\delta^{13}C$ endmember is predicted from the *x*-intercept (for y = 0) of the linear regression of $\Sigma C_{25-36}/OC$ *vs* $\delta^{13}C$ values (Fig. 2c). For both methods, the calculations are complicated by different endmembers for the Ob and Yenisei rivers. Nevertheless, these preliminary results suggest that approximately 70 to 85% of the OC preserved in Siberian shelf sediments is of terrestrial origin. These values fall in the range calculated for other tropical or temperate continental margins under the influence of large rivers (Showers and Angle, 1986; Prahl *et al.*, 1994).

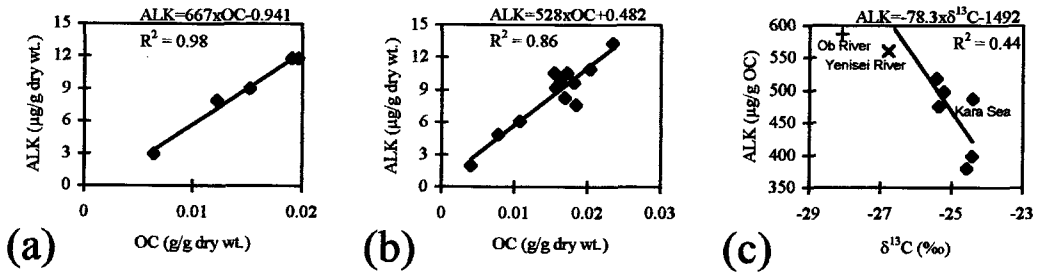

FIG. 2. Terrigenous *n*-alkanes (ALK = ΣC_{25-36}) *vs* OC for the Ob (a) and Yenisei (b) river sediments and terrigenous *n*-alkanes (ALK = ΣC_{25-36}) *vs* $\delta^{13}C$ sedimentary values for the Kara Sea (c).Yenisei and Ob rivers mean ALK and $\delta^{13}C$ values are also indicated in the latter.

Conclusions

$\delta^{13}C$ and hydrocarbon biomarker data indicate that the bulk of the OM preserved on Siberian coastal seas is mainly of continental origin. The contribution of terrestrial OC in shelf sediments of the Kara Sea was estimated to be around 70% of the total sedimentary OC.

References

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