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MOLECULAR AND ISOTOPIC TRACERS OF TERRIGENOUS ORGANIC CARBON DELIVERY TO THE DEEP ARCTIC OCEAN

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The carbon cycle in the Arctic Ocean is complicated by the delivery and redistribution of terrigenous material through large rivers, sea-ice, and coastal erosion. Although annual inputs of the estimated 12 Mt/yr of terrestrial particulate organic carbon (POC) (Rachold *et al.*, 2003), are dwarfed by the 250 Mt/yr POC from marine primary production (Sakshaug, 2003), evidence suggests substantial proportions of terrestrial organic matter are preserved in offshore sediments (Belicka *et al.*, 2004; Stein & Macdonald, 2004). Building on these observations, our goal was to understand the differential transport mechanisms and remineralization that results in the preservation of terrigenous organic matter in the central Arctic. Lipid biomarkers together with compound-specific stable carbon isotopic composition of particles in the water column and sea-ice were used to examine organic carbon transport mechanisms to the central Arctic basin and its modification during transit. By also applying these measures to sediment cores, the balance of carbon sources over Holocene timescales might be resolved and thus, an understanding of how changing climate scenarios alter the production, utilization, and sequestration of carbon in this ecosystem.

While water column POM reflected mostly marine plankton sources, POM in sea-ice contained a complex distribution of hydrocarbons, sterols, and long-chain fatty acids and alcohols indicating a significant terrestrial component. In sediment cores collected in deep waters (~3000m) of the Alaskan Beaufort Sea, specific biomarkers of terrestrial organic matter show distinct changes in abundance with core depth, suggesting varying delivery of terrigenous organic matter over time (fig. 1). Based upon principal components analysis (Yunker *et al.*, 2005), the fraction of terrestrial organic biomarkers increases from 32% in surface sediments to 50% at 10 cm core depth, implying a removal of the more labile marine components during early diagenesis. Radiocarbon ages between 6000-9000 years for these sediments suggest significant proportions of old, recalcitrant organic matter, including material eroded from the Alaskan coast. ^{210}Pb measurements reflect a low sediment accumulation rate of 32.74 mg cm^{-2} yr^{-1}. Compound-specific stable carbon isotopic composition analyses are currently underway to track deposition of specific terrestrial components over Holocene timescales.

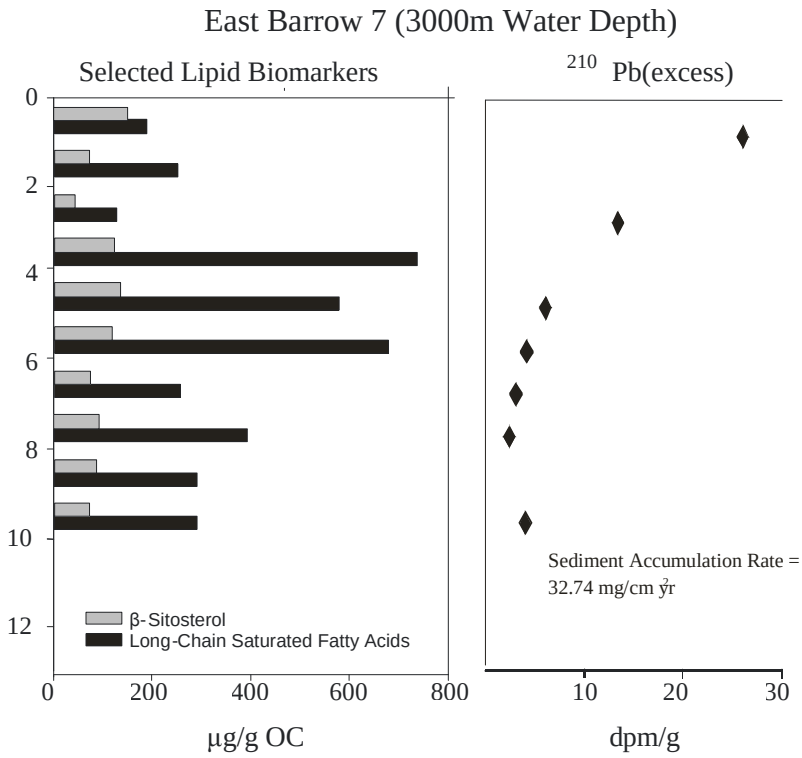

Figure 1. Organic carbon normalized concentrations of β-sitosterol and long-chain (C_{23}-C_{30}) saturated fatty acids and excess ^{210}Pb (dpm/g) in a sediment core collected in ~3000m water depth east of the Barrow Canyon region of the western Arctic Ocean.

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