Geophysical Research Abstracts
Vol. 20, EGU2018-8899-1, 2018
EGU General Assembly 2018

Timescales of leaf wax biomarker transport and preservation in alluvial river systems: Rio Bermejo, Argentina

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Rivers are the primary conduits for organic carbon (OC) transfer from vegetation-rich uplands to long-term sinks, and thus are responsible for significant fluxes among different reservoirs of the carbon cycle. Fluxes of terrestrial OC out of river systems are generally less than fluxes into the systems, indicating loss of OC either during active fluvial transport, during residence in the active channel belt, or in older deposits outside of the active channel belt. Sedimentary biomarkers can be used to elucidate the mechanisms of transport, preservation, and/or transformation of OC during its passage from source to sink.

In this study we evaluate the timescales of terrestrial leaf wax n-alkane transport from source to sink. Our natural laboratory is the Rio Bermejo in northern Argentina, which transports sediment and organic matter from the central Andes over 700 km across the foreland and out onto the craton without input of foreign material from tributaries. Rapid channel migration rates in a region of flexural foreland uplift (the forebulge) are responsible for remobilization of floodplain sediment and terrestrial OC, which is delivered to a large continent-scale river downstream

By sampling suspended sediment, river bank sediment, and soil from several locations along the length of the Rio Bermejo, and analyzing the biomarker composition, compound-specific stable isotope ratios, and radiocarbon abundances, we can evaluate the geomorphic and processes that control the timescale of fluvial POC transport. Compound-specific ^{13}C measurements show enrichment of long-chain terrestrial (C_{25}-C_{33}) alkanes with increasing distance downstream, suggesting dilution of mountain-derived POC by input of ^{13}C-enriched floodplain material. We propose that microbial degradation is responsible for preferential preservation of ^{13}C in floodplain sediment over the timescale of 10^2-10^3 years. We will test this hypothesis by employing compound-specific radiocarbon measurements of suspended POC which would in case of downstream aging expected to show increasing age with distance downstream. Controlled laboratory experiments and analysis of modern and aged river bank sediment samples will determine where and over what timescales leaf wax alkanes are oxidized by microorganisms. With these data, we will be able to quantify the loss of OC during fluvial transit and determine the mechanisms responsible, enabling carbon cycle models to account for these losses.