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Constraining the origin and evolution of organic carbon-mineral interactions within a fluvial system

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Rivers are important conduits for the transfer of organic carbon from the terrestrial biosphere to ocean sediments, the latter acting as an important long-term carbon sink. Interactions between organic matter and mineral phases exert a key influence on the dynamics of riverine organic carbon by altering both its stability and hydrodynamic properties, and thus the timescales of its transport and storage within a river basin. Research to date has largely focused on how the associations between organic matter and mineral phases develop in soils, leaving open the question as to how these interactions evolve during riverine transport.

Here, we address this question by applying a source-to-sink approach to the Fraser Basin, with a focus on tracing and characterizing organic carbon and minerals from the Fraser River network, to their entry into the Pacific Ocean. The Fraser River and its tributaries afford a complex mosaic of lithologic, climate and ecological gradients, which provide a framework for constraining the provenance, transport patterns and transport timescales of both organic carbon and mineral phases during mobilization and transport through the river basin. We exploit these contrasts by tracing mineralogical (grain size, mineral-specific surface area, cation exchange capacity and clay mineralogy) properties and geochemical ($^{87}Sr/^{86}Sr$, ε_{Nd}) signatures of detrital mineral phases. In addition, we assess the concentrations, hydrogen isotopic compositions (δ^2H), and radiocarbon ages (Fm) of bulk organic carbon as well as higher plant-derived (*n*-alkanes, *n*-alkanoic acids), soil-derived (branched Glycerol dialkyl glycerol tetraethers: brGDGTs) biomarkers in suspended and deposited sediments along the course of the river system. Preliminary results suggest a dynamic interplay between terrestrial organic matter and its mineral host during fluvial transport. This coupled investigation of organic and inorganic tracers provides new insights into the role of organo-mineral interactions on riverine organic carbon dynamics, with important ramifications for the interpretation of sedimentary archives, and for the efficacy and nature of terrestrial organic carbon export and burial.