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Vegetal Undercurrents - Obscured Riverine Dynamics of Plant Debris[1]

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In fluvial systems, processes regulating the transport, dispersal, and preservation of organic carbon (OC) associated with fine-grained particles are well understood. However, relatively few studies have examined hydrodynamic controls on coarse organic matter. We investigated spatial and depth-related variations in sedimentological, geochemical, and biomolecular characteristic of suspended sediments from the Mackenzie River. Macroscopic observations, elevated OC, plant-derived biomarker, and radiocarbon (^{14}C) contents reveal the systematic transport of coarse submerged plant debris above the active riverbed. Plant fragments subjected to waterlogging within the landscape or during fluvial transfer are mobilized and entrained into channels by annual flood events, bank erosion, and surface runoff. Sufficient flow strength and buoyant properties prevent plant debris from settling and keep it in suspension in the water column near the riverbed. Turbulences, such as helical flow motion, resulting from competing forces when passing through a river bend, further concentrate lithogenic and organic debris forming sediment-laden plumes. The absence of discrete OC in hemipelagic sediments suggest the preferential trapping of these materials within hydrodynamically quiescent deltaic and neritic environments. Rapid export and high sediment accumulation rates during the spring freshet reduce oxygen exposure times and microbial decomposition promoting the sequestration of discrete biospheric OC. Undercurrents enriched in coarse, relatively fresh plant fragments appear to be reoccurring features, highlighting a poorly understood yet significant mechanism operating within the terrestrial carbon cycle.

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