Domination of soil in ^{14}C age spectra in sediments from a major river system – implications for carbon cycling

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We used Ramped PyrOx ^{14}C analysis to thermo-chemically separate and radiocarbon date different pools of organic carbon in a well-dated sediment core and particulate organic carbon (POC) from the Missouri-Mississippi River system. A sediment core from Lake Whittington, an oxbow lake formed in 1937 and attached to the main stem by a channel, was robustly dated by a conspicuous and abrupt fining of sediment to mark the formation of the lake, two ^{137}Cs peaks, and the top of the core (2012). Low-temperature pyrolysates from Ramped PyrOx ^{14}C analysis respond immediately to the bomb curve, whereas high-temperature pyrolysates display a delayed reaction. Both responses occur at an annual-centennial time scale. This suggests a dominance of soil organic carbon being deposited in the lake sediments, corroborating our evidence from fatty acid chain length and lignin composition. Data from Atchafalaya outflow particulate organic carbon (POC), sampled during the highest recorded discharge in 2011, also suggest that maximum age of Mississippi POC is correlated to the age of soils in the basin. Thus, these approaches offer constraint on the role of large river systems such as the Mississippi play in long-term carbon cycle function such as regulated atmospheric CO_2 regulation and climate change through geologic history.