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Tools to identify eroded and aged organic matter stored in floodplains derived from headwater blanket peat catchments

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Rivers play an instrumental role in landscape evolution, transporting and laterally redistributing eroded sediment and terrestrial organic matter. Although previously considered as passive pipes that deliver particulate organic matter (POM) to the ocean, the depositional landforms associated with river systems are increasingly recognised as having an important function in storing and processing allochthonous POM. Understanding the redistribution of terrestrially-derived organic matter laterally, beyond the bounds of river channels is imperative, especially in eroding peatland systems where POM loads may be large, and are often assumed to be oxidised. Current understanding of the interaction of carbon cycling and the sediment cascade through floodplain systems is limited. We present a range of tools and approaches utilised in floodplains within heavily eroded blanket peat catchments in the Peak District, UK, to identify the presence of eroded allochthonous organic matter. We conceptualise and evaluate these tools in their utility for assessing source of POM in floodplains located in peatland-dominated headwaters and whether it is possible to distinguish differences between allochthonous and autochthonous organic matter stored in these environments. These tools included sedimentological and geomorphological investigation; age determination of the floodplain and stored POM; and molecular and spectroscopic techniques.
Whilst sedimentological characterisation of OM layers within sediment cores was unsuccessful in distinguishing allochthonous material, age approximations using dating techniques was successful. Parallel investigations into the age of the sedimentary deposits using Infrared Stimulated Luminescence and radiocarbon analyses of bulk organic matter revealed that the approximate age of floodplain initiation was substantially younger than the average age of POM layers. The average age was also concurrent with average radiocarbon age of fluvial POM captured during high flows (Evans et al., 2013), supporting the likelihood of eroded peat as the source. Biochemical (Pyrolysis- Gas Chromotography/Mass Spectrometry) and spectroscopic techniques (Fourier Transform Infrared spectroscopy) distinguished subtle differences in sources of OM in floodplain material, but need to be supported by other methods to identify aged peat.