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Using sediment fingerprinting to understand the controls on the fluvial export of sediment associated lead and particulate carbon from eroding peatlands

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Peatlands are an important store of carbon as well as a sink of industrial legacy pollutants such as lead (Pb). However, large areas of peatlands are damaged and degraded which have implications for the long-term storage of carbon and Pb in these settings. One concern surrounds the transfer of Pb contaminated sediment to the fluvial system, and previous work has found evidence that substantial concentrations of Pb may be released as an initial 'lead-flush' during the early stages of storm events. However, the underlying controls on sediment production and how these may influence the timing of contaminated sediment export during hydrological events are unclear.

This study utilises a sediment source fingerprinting approach to assess the controls of sediment production and mobilisation during storm events in the Peak District National Park, southern Pennines (UK). The blanket peats of the Peak District embody many problems and pressures faced by peatlands globally, and are amongst the most heavily eroded and contaminated in the world. Suspended sediment was collected using time integrated mass samplers (TIMS), deployed for the first time in a vertical stack, to allow the relative changes in the sediment sources during changing discharge conditions in a small headwater stream to be assessed.

This study has found evidence of suspended sediment enriched in peat-derived material early in storms, thus confirming accepted models of organic sediment exhaustion during the course of storm events, and that organic sediment transport becomes limited between storms which occur in quick succession. The timing of this organic sediment exhaustion is linked to catchment wetness and rainfall intensity. The contaminated surface layer of the peat is releasing Pb into the fluvial system throughout the year, but a flushing of Pb early in storm events is only evident under certain meteorological and hydrological conditions. The findings of this study pose questions over future sediment release under predicted changes in climate.