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The environmental behaviour of beryllium-7: implications for its use as a soil erosion tracer

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Beryllium-7 is a cosmogenic fallout radionuclide (FRN) that can be employed as a tracer in soil erosion studies. Owing to its short half life (53.3 days), estimates of soil redistribution from a single event or wet season can be derived, complimenting medium-term ^{137}Cs-based data. The ability of ^{7}Be to provide robust quantification of soil erosion over short timescales is vital when considering the potential for climate change to influence precipitation patterns and shifts in landuse. A major requirement of the technique is the capacity of the FRN to adsorb to soil particles and remain bound during transport. To date, little attention has been given to the geochemical behaviour of ^{7}Be. The research reported here aims to develop knowledge of ^{7}Be adsorption behaviour in a range of soil types and environmental conditions to support its use as a tracer at the catchment scale.

Four agricultural soils common to south Devon, UK were selected for experiments designed to investigate^{7}Be solid-phase partitioning in soils and tracer stability under changing environmental conditions. Preliminary results from two key aspects of the work are reported here. The BCR three-step sequential extraction procedure was adopted to investigate ^{7}Be adsorption to operationally-defined soil fractions. Early findings indicate that ^{7}Be is largely associated with Fe/Mn fractions with up to 67% adsorbed to this reducible phase. This supports the use of ^{7}Be as a soil erosion tracer at the slope-scale but may have implications for ^{7}Be mobility under reducing conditions in deposition zones. In addition, batch experiments have been undertaken to evaluate ^{7}Be behaviour in the dissolved phase focusing upon the role of DOC as a complexing agent in soil solutions since soil solution DOC can increase following manure and compost application. Results will be used to underpin the application of ^{7}Be as a sediment tracer within an Interreg IVA funded research programme addressing wetland restoration as a catchment management tool.