

125th Anniversary Annual Meeting & Expo

27-30 October 2013 • Denver, Colorado USA



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Paper No. 10

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FALLOUT RADIONUCLIDES IN CRITICAL ZONE STUDIES, FRONT RANGE, COLORADO

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Fallout radionuclides meteoric ¹⁰Be, ¹³⁷Cs and ²¹⁰Pb adhere strongly to mineral and organic matter and are useful for studying sediment transport on hillslopes. Different half-lives and depth-dependent distributions of these isotopes make them useful over different timescales in critical zone studies. Meteoric ¹⁰Be is a tracer for late Pleistocene to Holocene processes whereas ¹³⁷Cs and ²¹⁰Pb are useful for measuring sediment movement over the past century. Given that these nuclides have different affinities for soil organic material near the soil surface, different depth dependent processes can be evaluated. Here, we discuss meteoric ¹⁰Be, ¹³⁷Cs and ²¹⁰Pb analyses from over 20 hillslope pits and valley deposits in the Boulder Creek Critical Zone Observatory, Front Range, Colorado. Inventories of meteoric ¹⁰Be, ¹³⁷Cs and ²¹⁰Pb along steep, hillslope catenas in forested, unburned areas highlight the mobility of soil at both short and long timescales. Meteoric ¹⁰Be inventories on hillslope transects increase downslope and highlight the redistribution of the entire mobile regolith column (40 cm, on average) over the last 21 ka. ¹³⁷Cs and ²¹⁰Pb data exhibit lower concentrations and inventories within the steepest or foot-slope locations on individual hillslope transects, indicating surface erosion of the upper 5 cm over the last 50 years. The sensitivity of ¹³⁷Cs and ²¹⁰Pb concentrations and inventories to shallow soil disturbance is well illustrated by examining soil profiles on burned hillslopes and valley deposits associated with post-fire erosion and flooding of the 2010 Fourmile Fire. A pair of adjacent, steep hillslope pits, where one represents a location protected from post-fire erosion, shows ~3 cm of truncation in the ¹³⁷Cs and ²¹⁰Pb profile and removal of ash-rich surface material enriched in these isotopes. Furthermore, analysis along Fourmile Canyon below these hillslope sites demonstrates that overbank fine grained, ash-rich organic material within post-fire floods deposits is enriched in ¹³⁷Cs and ²¹⁰Pb indicating that high levels of these isotopes are being washed far downstream. While the short-lived radionuclides demonstrate that fires trigger sediment transport over the last century, we will use meteoric ¹⁰Be analyses to evaluate the role of wildfires in longer-term hillslope evolution.

Session No. 165

T18. Critical Zone Evolution: Climate and Exhumation

Monday, 28 October 2013: 1:00 PM-5:00 PM

Mile High Ballroom 2C (Colorado Convention Center)

Geological Society of America *Abstracts with Programs*. Vol. 45, No. 7, p.409

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