Actinides, accelerators and erosion

S.G. Tims and L.K. Fifield
Department of Nuclear Physics, The Australian National University, ACT 0200, Australia.

Fallout isotopes can be used as artificial tracers of soil erosion and sediment accumulation. The most commonly used isotope to date has been $^{137}\text{Cs}$, however, concentrations of $^{137}\text{Cs}$ are significantly lower in the Southern Hemisphere, and furthermore have now declined to 35% of original values due to radioactive decay. As a consequence the future utility of $^{137}\text{Cs}$ is limited in Australia, with many erosion applications becoming untenable within the next 20 years, and there is a need to replace it with another tracer. Plutonium could fill this role, and has the advantages that there were six times as many atoms of Pu as of $^{137}\text{Cs}$ in fallout, and any loss to decay has been negligible due to the long half-lives of the plutonium isotopes. Uranium-$236$ is another long-lived fallout isotope with significant potential for exploitation as a tracer of soil and sediment movement. Uranium is expected to be more mobile in soils than plutonium (or caesium), and hence the $^{236}\text{U}/\text{Pu}$ ratio will vary soil depth, and hence could provide an independent measure of the amount of soil loss. This talk will discuss accelerator based ultra-sensitive measurements of plutonium and $^{236}\text{U}$ isotopes and their advantages over $^{137}\text{Cs}$ as tracers of soil erosion and sediment movement.