# A UHV extraction line for in-situ produced cosmogenic $^{14}C$ to improve the reliability of dating strain markers*

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Application of Terrestrial Cosmogenic Nuclide (TCN) exposure dating method requires knowledge of the surface erosion rate to solve for age. Erosion causes a surface TCN concentration to be lower because the cosmic ray flux attenuates exponentially with mass depth. If erosion rate is unknown, uncertainty in age increases exponentially and asymmetrically with longer exposure and greater mass loss. Unfortunately, measurement of episodic or constant erosion rates has been elusive, and erosion rates of landforms composed of unconsolidated sediment range significantly. Thus exposure ages are either reported as minimum dates (i.e., assuming no erosion) or contribute large uncertainty to the desired quantity (for instance, slip rates). I propose a novel use of cosmogenic $^{14}C$ produced in quartz to establish erosion rates for alluvial surfaces. The proof of concept will be the determination of the average surface erosion rate on alluvial fans in the tectonically active Panamint Valley, California, in order to adjust and reduce the uncertainty in exposure ages based on previous $^{10}Be$ measurements.

The targeted sample sites have already been dated with $^{10}Be$ depth profiles on alluvial fans yielding ages greater than 50 ka (Gosse, unpublished $^{10}Be$ data) but with large uncertainties. At these relatively old ages $^{14}C$ has reached saturation; a dynamic equilibrium concentration that is controlled by decay rate ($t_{½}$ = 5730 a), production rate (~7 atoms $g^{-1}a^{-1}$), and the unknown erosion quantity. By measuring the $^{14}C$ saturation concentration at each site I will (i) determine the erosion rate corresponding to the saturation concentration and thus (ii) more tightly constrain the age calculated from the $^{10}Be$ depth profiles. The shape of a TCN concentration vs. depth profile is a function of exposure duration, burial and erosional history, inheritance and bulk density. The leading source of error in exposure age is therefore erosion uncertainty. A wide range of erosion rates are naturally possible. Currently, erosion rates are estimated using soils, geomorphic observations and general knowledge of the local geology, which leads to variability in estimates and much debate on age constraints. However, the concentration of a short-lived cosmogenic radioisotope will reach different saturation concentrations proportional with erosion rate and production rate. Testing will be done using a new stainless steel UHV $^{14}C$ extraction line developed at the Cosmogenic Isotope Lab at Dalhousie.

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