U-series isotopics constrain timescale of bedrock comminution and glacial incision in Taylor Valley, Antarctica

GRAHAM HARPER EDWARDS[1]*, TERRENCE BLACKBURN[1], SLAWEK TULACZYK[1], GAVIN PICCIONE[1]

[1]Department of Earth and Planetary Sciences, University of California Santa Cruz, Santa Cruz, CA 95064, USA (*correspondence: ghedwards@ucsc.edu)

Taylor Glacier, an outlet of the East Antarctic Ice Sheet, occupies its maximum Holocene extent in Taylor Valley, Antarctica. Climate and ice thicknesses predict exclusively cold-based, non-erosive conditions for Taylor Glacier that are thought to have persisted since before the Pleistocene [1]. Yet, this model is challenged by the presence of subglacial brines and Pleistocene drifts in Taylor Valley that evidence sequential glacial advances capable of mobilizing, and perhaps comminuting, large volumes of sediment.

Since widespread fine-particle production is expected to coincide with bedrock erosion, we apply the principles of U-series comminution dating to resolve the timing of glacial incision of Taylor Valley. The technique relies on the measurable fractionation of U-series intermediate daughter nuclides in silt-sized siliciclastic particles by the physical ejection of nuclides from grain surfaces by alpha decay recoil [2]. Over geologic timescales, daughter loss manifests bulk-silt U-series isotopic compositions below the secular equilibrium of ancient primary bedrock sources. Quartz-feldspar silts isolated from tills entrained in the basal ice of Taylor Glacier exhibit a composition of $(^{234}U/^{238}U) = 0.968 \pm 0.023$, an activity ratio significantly below secular equilibrium that reflects pre-Holocene comminution. This datum supports a model in which Taylor Glacier is not contemporarily comminuting sediments, but rather has entrained sediments of older provenance. Investigation of more Taylor drift deposits and additional U-series nuclides will allow improved resolution of the timescales of Pleistocene comminution and incision in Taylor Valley.

[1] Denton *et al*. (1993) *Geogr. Ann. Ser. A, Phys. Geogr.* **75**, 155-204. [2] DePaolo *et al*. (2006) *EPSL*, **248**, 379-95.