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Long-term survival of detrital gold in glaciated landscape based on cosmogenic 3He in detrital grains from Scotland

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The ability to measure cosmogenic ^{3}He from individual detrital mineral grains [1] provides the potential to tease out details of sediment storage and transport that are unavailable from bulk sample analysis, and may, for instance, shed light on the conditions necessary to form economic alluvial placer deposits. While extremely long exposure histories have been measured in detrital grains from unglaciated regions [1], the effect of repeated glacial cycles in removing economically valuable detrital minerals is unknown. Here we report the cosmogenic ^{3}He content of 36 (2-50 mg) native gold grains from the beds of 8 streams in upland Scotland in order to determine their ability to survive glaciation.

Measured ^{4}He concentrations vary from 4 to 299 x 10^{13} atoms/g these variation on the ^{4}He concentrations may be related to the presence of U and Th in the mineral lattice or U- and Th-rich mineral inclusions. Based on measured Li contents (<1 ppb) the nucleogenic ^{3}He contribution in all samples is negligible. Minimum cosmogenic ^{3}He exposure ages have been determined using production rate of 25 atoms/g/year and assuming no shielding. 33 grains yield exposure ages that are consistent with survival of detrital gold from before the Last Glacial Maximum (i.e > 20 Ka). These grains yield ages up to 4 Ma. This implies that a significant proportion of the detrital gold has survived several glacial cycles and may have implications for long-term preservation of economic minerals in glaciated regions.

[1] O. Yakubovich, F.M. Stuart, A. Nesterenok & A. Carracedo (2019). *Chemical Geology* 517, 22-33.