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Improving the robustness of single grain K-feldspar IRSL sediment age estimates from active tectonic contexts

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The range of applicable contexts for dating fault-offset geomorphic features and seismically deformed sediment has been extended by recent developments in luminescence dating, in particular using the post-IR IRSL (Infra-Red Stimulated Luminescence) at 225 degrees centigrade for single grains of potassium feldspar. Sediments in desert contexts as well as coarse gravels deposited under high-energy fluvial conditions appear to provide consistent age estimates. At first order, single-grain K-feldspar post-IR IRSL-225 is reliable and accurate.

However, situations where a deposit is composed of grains that were well-exposed to light prior to burial is reworked at night or during a storm may pose a limitation. The degree that an earlier event may be distinguished from the final deposition depends on the luminescence characteristics of grains, the age difference between the two depositional events, and the proportions of grains each event provides to the target deposit. This effect may be referred to as “shadowing”.

We are developing new measurement protocols to help identify grains that were well-bleached, that is they were exposed to sufficient daylight to reduce their trapped charge population to a low level before deposition. We are applying IRSL photochronometry, a determination of light exposure duration, for each grain as part of the dating protocol. This is performed with multiple elevated temperature (MET) IRSL, isolating IRSL signals with different sensitivities to light. Age assessment can be based only on responses from grains that were well-bleached, reducing reliance on the assumption that shared apparent age is correctly identifies depositional age populations. The approach can provide age estimates for multiple past events and information about the environmental conditions that existed before final deposition.