Comparing the accuracy and precision of luminescence ages for partially-bleached sediments using single grains of K-feldspar and quartz

Glacial settings are considered to be the most challenging context for the application of luminescence dating. The optically stimulated luminescence (OSL) signal of quartz is often preferred for luminescence dating in partially-bleached settings as it resets (or bleaches) more rapidly in response to sunlight than the post-IR IRSL (pIRIR) signal of K-feldspar, and can therefore better characterise the well-bleached part of the partially-bleached De distribution. However, the relative bleaching extents of single grains of quartz and K-feldspar have not yet been compared for sedimentary samples from the natural environment. Here we compare the De distributions and accuracy and precision of ages determined using single grains of quartz and K-feldspar from sedimentary samples deposited in a proglacial setting with independent age control. We found that the extent of bleaching of the OSL signal of quartz and pIRIR225 signal of K-feldspar was similar (with similar over-dispersion), and therefore the pIRIR225 signal bleached to similarly low levels as the OSL signal of quartz in this partially-bleached setting. We also observed a consistent offset in over-dispersion between quartz and K-feldspar of ~10% that can be linked to scatter arising from internal dose-rates of K-feldspar and should be included when applying age models. The results here demonstrate that the accuracy and precision of ages determined using the pIRIR225 signal of single grains of K-feldspar were similar to the OSL signal of quartz. However, K-feldspars were 5–18 times more efficient than quartz at determining the population of interest for age calculation as a larger proportion of K-feldspar grains emitted a detectable luminescence signal in comparison to quartz. These findings contradict our current understanding of the bleaching of K-feldspar and quartz grains in the natural environment, and are likely applicable to other partially-bleached settings (e.g. fluvial, alluvial).