Testing the reliability of the fading correction near saturation for the Infrared stimulated luminescence dating

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The infrared stimulated luminescence (IRSL) signal of K-feldspar/polymineral has a more extended dating range than that of the quartz optically stimulated luminescence (OSL) signal. However, the athermal signal loss, known as anomalous fading, holds back the application of K-feldspar IRSL dating for relatively old sediments. Although the post-IR IRSL (pIRIR) signals without fading were proposed, such athermally stable signals tend to be more difficult to bleach. For dating sediments from difficult-to-bleach environments, one has to choose a signal which still fades and the age has to be corrected for fading. Specifically, for old samples close to or in field saturation, a fading correction model was proposed by Kars et al. (2008) to construct the simulated natural dose response curve and determine the saturation level on the basis of quantum mechanical tunnelling model. However, ~10% underestimation of field saturation level was observed, suggesting a potential age over-correction.

The loess-palaeosol sequences on the Chinese Loess Plateau contain homogenous and quasi-continuous wind-blown dusts with independent age control for the entire Quaternary. Therefore, these loess-palaeosol sequences provide an ideal material to test the reliability of the fading correction model mentioned above, and determine the upper dating limit of multiple IRSL signals from K-feldspar.

In this study, loess samples collected from the Luochuan Potou loess profile are used for the coarse-grained K-feldspar / fine-grained polymineral pIRIR and pulsed IRSL measurements. The natural dose response curve (DRC) is constructed using the natural luminescence intensities from all samples and the corresponding independent ages. After the construction of the simulated natural DRCs following the fading correction model, the natural and simulated natural DRCs are compared to evaluate the reliability of the fading correction near field saturation, and to determine the upper dating limit for the pIRIR and pulsed IRSL signals using the D_0s from both DRCs. We also compared the fading corrected ages following Huntley and Lamothe (2001) and Lamothe et al. (2003) with independent age and evaluate where the methods start to be inapplicable.

Keywords: Luminescence dating, Anomalous fading, Fading correction model, pIRIR dating, Pulsed IR dating, Grain size

