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Luminescence dating of feldspar using a novel infra-red photoluminescence signal – first dating results from loess samples

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Luminescence dating has long been used for dating sediments both in geological as well as archaeological context. Following numerous advances in feldspar and quartz luminescence dating in recent decades, a new method for feldspar dating is currently under development: Infrared photoluminescence (IRPL) is a novel technique, which allows the direct and non-destructive measurement of luminescence emitted by trapped electrons in feldspars (Prasad et al., 2017). IRPL arises from radiative excited state to ground state relaxation of trapped electrons within the principal trap in feldspar.

IRPL measurements enable the investigation of two emissions, one at 880 nm and another one at 955 nm (Kumar et al., 2018, 2021). Whilst most research on IRPL has focussed on understanding the physical processes leading to the IRPL emission in feldspars, yet little is known with regard to the application of IRPL as a dating technique. We build upon a first measurement protocol for sediment dating developed by Kumar et al. (2021) and combine the IRPL measurements with a modified post-IR IRSL protocol ($pIRIR_{225}$ with IR stimulation at 50°C, 90°C, 225°C), which allows a comparison of the IRPL signals with three IRSL signals. This integration of the IRPL measurements in a pIRIR protocol might possibly reduce fading to a negligible level due to the successive IRSL and IRPL measurement steps.

First promising results on loess samples with known (independent) age from the Balta Alba Kurgan loess-paleosol sequence in Romania (Scheidt et al., 2021) will be presented. We conducted dose recovery tests, bleaching experiments and equivalent dose measurements using different test doses and will show first results of fading measurements. The dose recovery tests are within 10% of unity for most of the measurements suggesting sufficient performance of our novel IRPL/pIRIR protocol. However, IRPL equivalent doses seem to slightly underestimate previously measured $pIRIR_{290}$ equivalent doses. Possible reasons will be discussed within the EGU presentation.

References

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