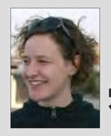
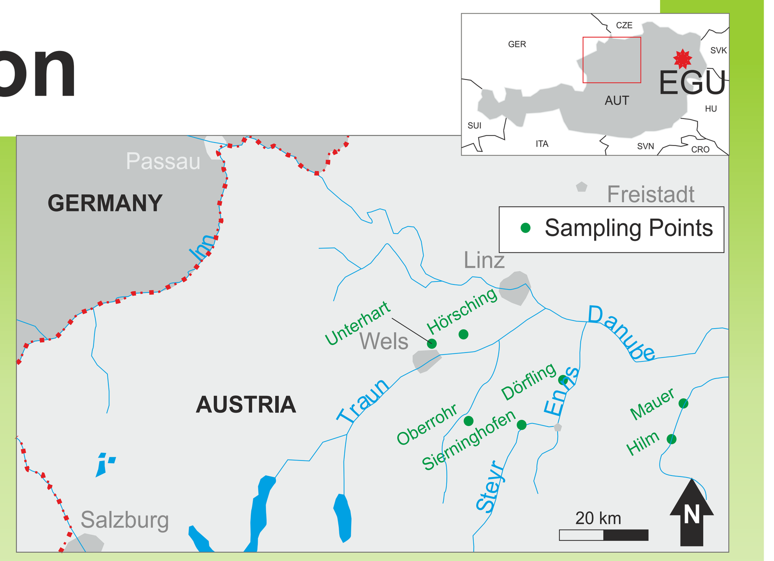
Fluvial terrace gravels of the „Hochterrasse” (N-Alpine Foreland, Austria): luminescence characteristics of quartz and feldspar

Lukas Bickel[1]  , Johanna Lomax[2] , Markus Fiebig[1] 

Overview and motivation



In the early 20th century Penck & Brückner developed the concept of **four big alpine glaciations** based on the succession of four **gravel terraces** in distinct morphostratigraphic positions and their connections to terminal moraines. From $\delta^{18}O$ analyses of deep sea sediments it is known that many more than four glacial periods have occured during the last 2.6 million years. It has proven to be **problematic** to fit the discontinuous record of alpine glacial and glaciofluvial sediments to the continuous $\delta^{18}O$ records for several reasons:

- **destruction of evidence** of older glacial and interglacial periods
- **a priori assumption of direct correlation** between global ice volume and alpine glaciations
- **non-climatic influences** (e.g. tectonic uplift) can strongly influence fluvial dynamics, making significance of glaciofluvial terraces questionable in some cases

It is therefore essential to establish an accurate **numerical chronology** to properly assess this sedimentary legacy. Here we present the first results of feldspar and quartz luminescence properties from proglacial terrace bodies of three valleys of the Austrian northern Alpine Foreland (Traun/Enns/Ybbs valley).

Fig. 1: Panoramic overview of the gravel pit Sierninghofen (junction of Steyr and Enns valley) which is situated in the „Hochterrasse”. The samples of this gravel pit were derived out of a sand lens situated 7.5 m below ground level.

Materials and methods

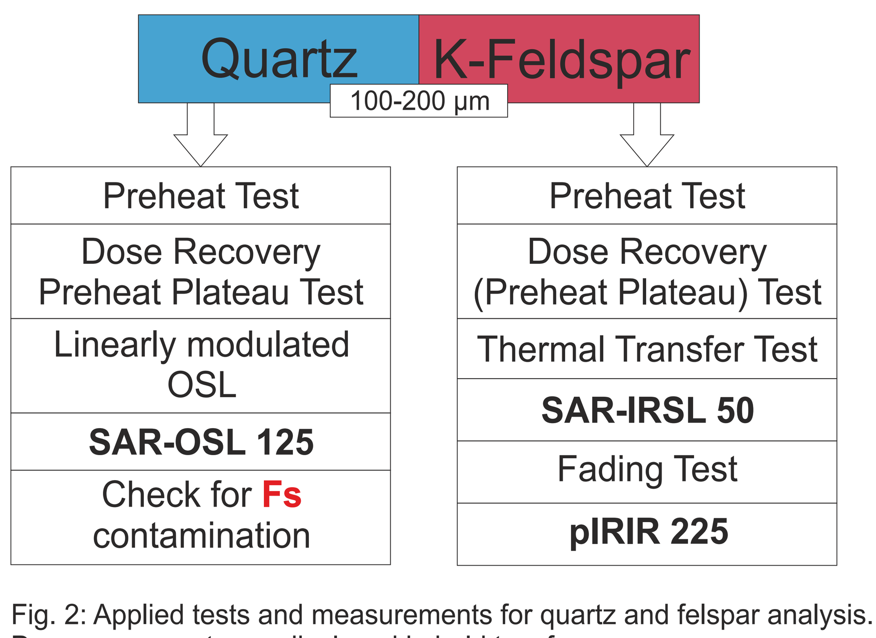


Fig. 2: Applied tests and measurements for quartz and felspar analysis. D_e measurements are displayed in bold typeface.

The samples were derived from **sand lenses/beds** within the gravel body (Fig.1) of the „Hochterrasse”.
The samples were prepared using conventional methods. Various measurements were applied to quartz (blue diode stimulation) and feldspar (IR diode stimulation) **coarse grain** samples (Fig. 2).

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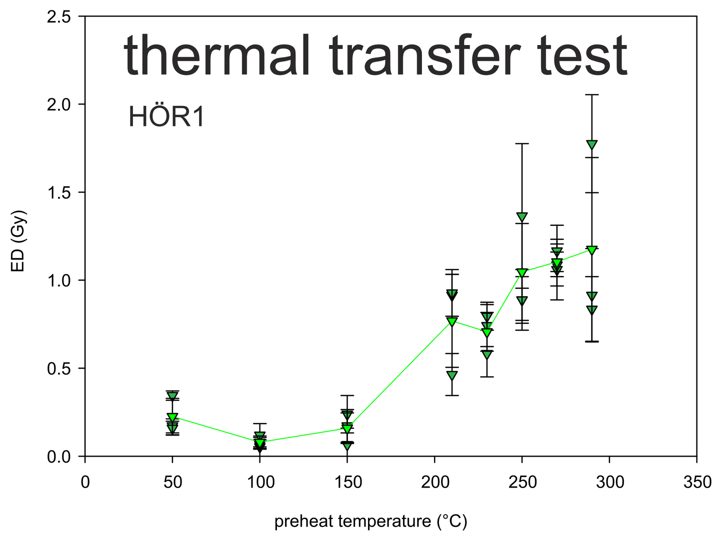
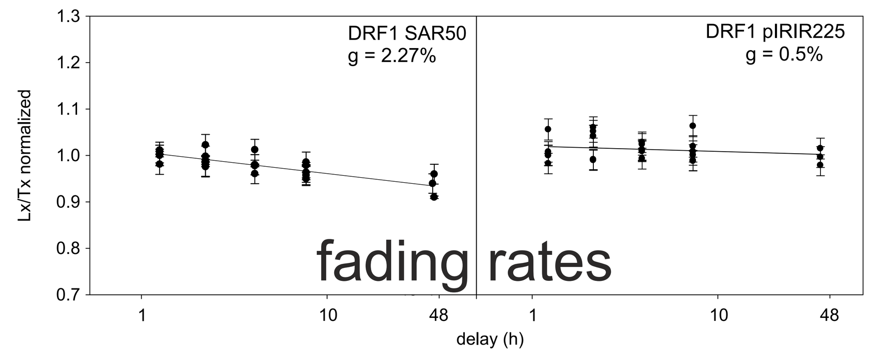
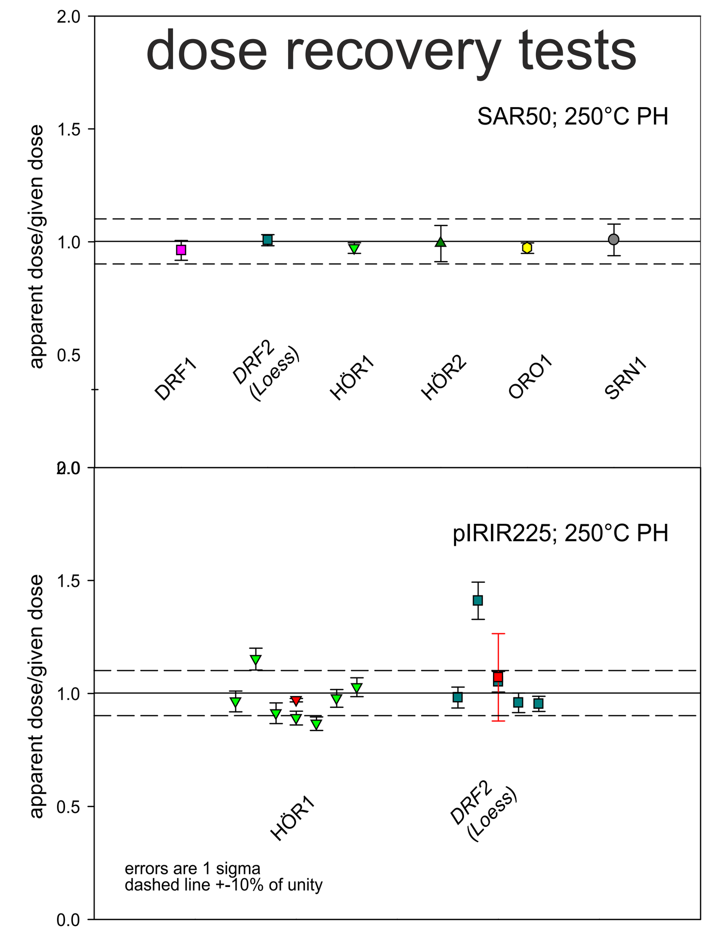
Feldspar

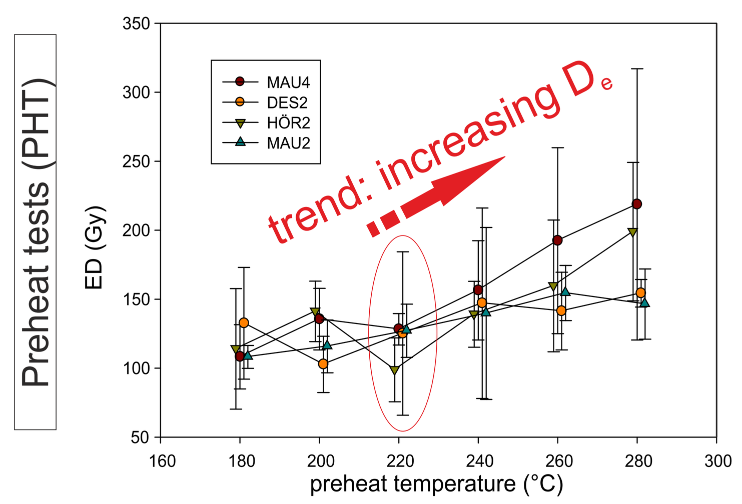


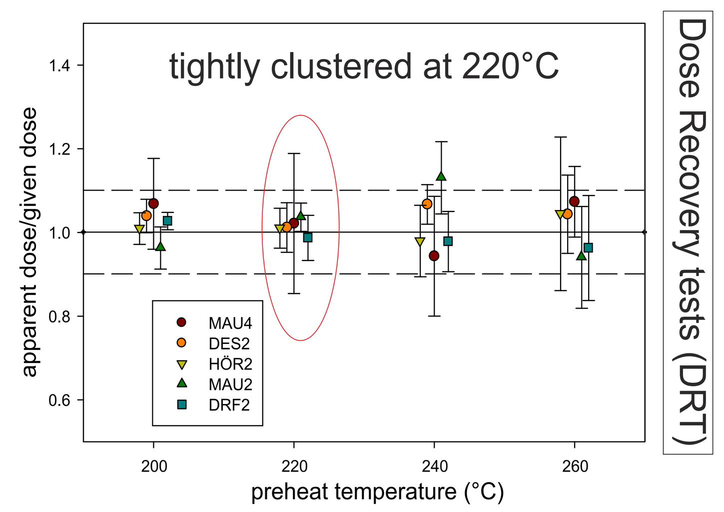


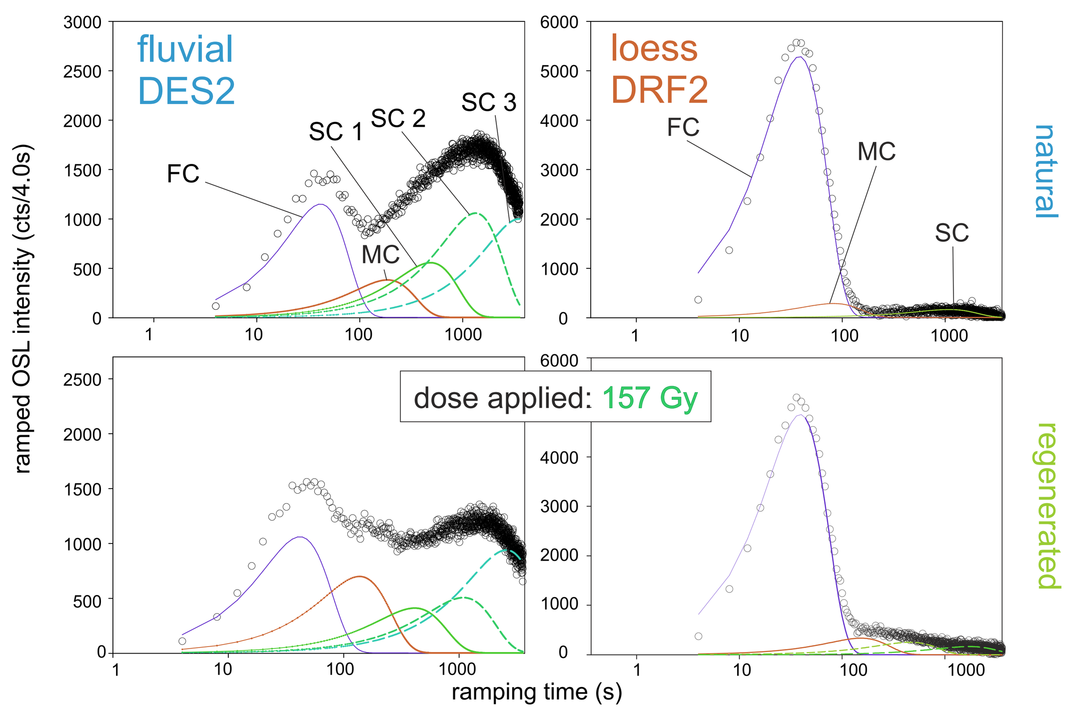


- impact of **thermal transfer** at 250°C preheat max. 1% of paleodose
- post-IR IRSL 225 **residual** doses of up to 11±2 Gy (max 4% of total De)
- Ybbs valley samples show low signal intensities (MAU)
- preheat tests and dose Recovery Tests lead to a preheat temperature of 250°C for feldspar samples
- **ubiquitous measurable fading** rates for **SAR50** protocol (g-values up to 4%)
- **negligible fading** for the **pIRIR225** protocol

Quartz: a problematic case?



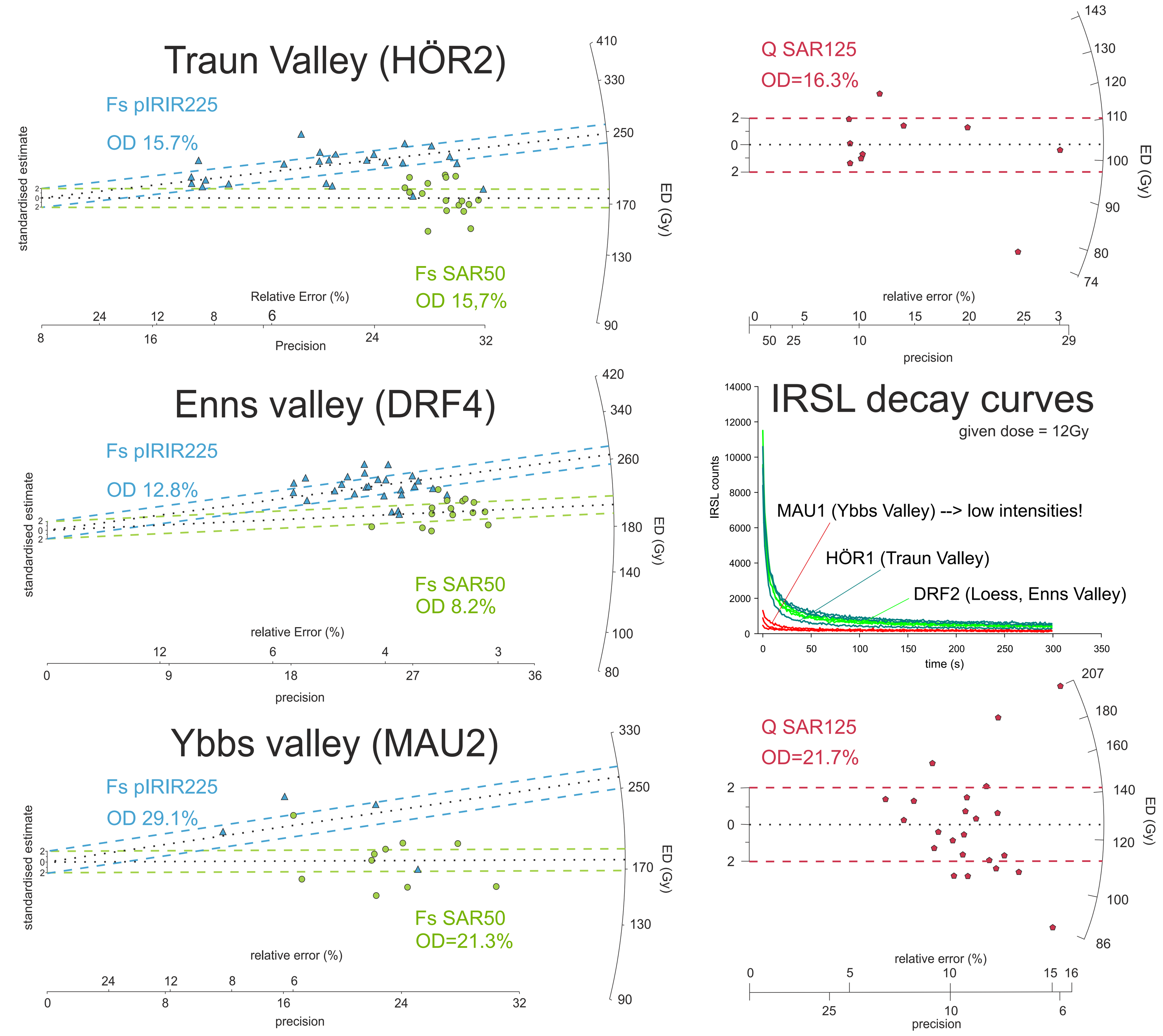




- DRT and PHT lead to a 220°C preheat and 200°C cutheat combination
- LM-OSL: Significant influence of **slower components**! Covering layer (loess) shows FC dominated signal
- weak IR stimlated signals due to Fs **contamination?**
- **low** overall signal intensities

D_e distribution

- ”dark” luminescence signals of the Ybbs valley samples lead to high rejection rate of (1mm) aliquots (see fig. *IRSL decay curves*)
- same applies to quartz aliquots in general (1 and 2 mm aliquots)
- high **scatter of paleodose values** of the Ybbstal samples in comparison with the samples from Traun and Enns valley



Concluding remarks

Fs
- **negligible effect of thermal transfer** at preheat temperatures of 250°C
- pIRIR250 age calculation needs to take **residual doses** into account
- SAR50 fading rates of up to 4% (pIRIR225 0.5%)
- Ybbs valley samples yield very **low signal intensities**

Q
- **slower components** make up a significant proportion of the initial signal
- weak IR stimulated signals can be attributed to feldspar **contamination** but it remains to be checked through **mineralogical investigations**
- generally low signal intensities and high rejection rate

FWF Der Wissenschaftsfonds.

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