Testdose dependence and possible field saturation using pIRIR$_{290}$ at the Urluia loess-paleosol sequence, Romania

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Abstract

Eolian deposits such as loess-paleosol sequences (LPS) are being used intensively for paleoenvironmental research by investigating proxy data variability. In order to accurately interpret this variability through time, reliable age models are necessary. At the 16m long Urluia LPS in Romania correlative and luminescence age models do not agree with each other. Radiometric ages for the oldest samples do not fit the correlative age model. In a depth between 7.7-8.7 m is a steep increase in equivalent doses by ~260 Gy (ca. 60 ka). In the lower part of the profile, only a minor increase in equivalent doses was observed, which might suggest field saturation of these samples. As there are no sedimentological indicators of erosion in the sequence, the reason for the sudden increase and a corresponding overestimation of ages with regards to the expected stratigraphy remains elusive. Here, we present an observed dependency of testdose size on the saturation characteristics and dose recovery ratios (cf. Colarossi et al., 2018) and discuss whether this might be responsible for the problematic differences between the age models.

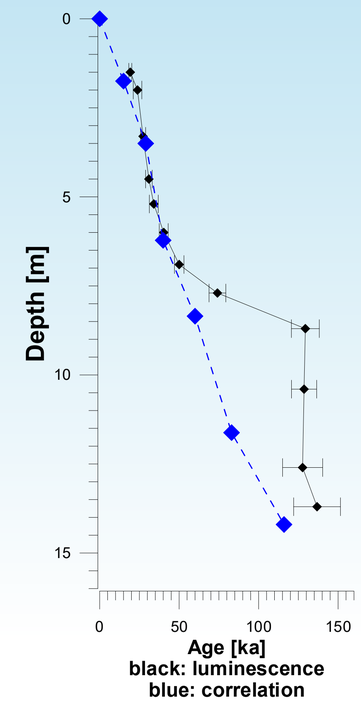
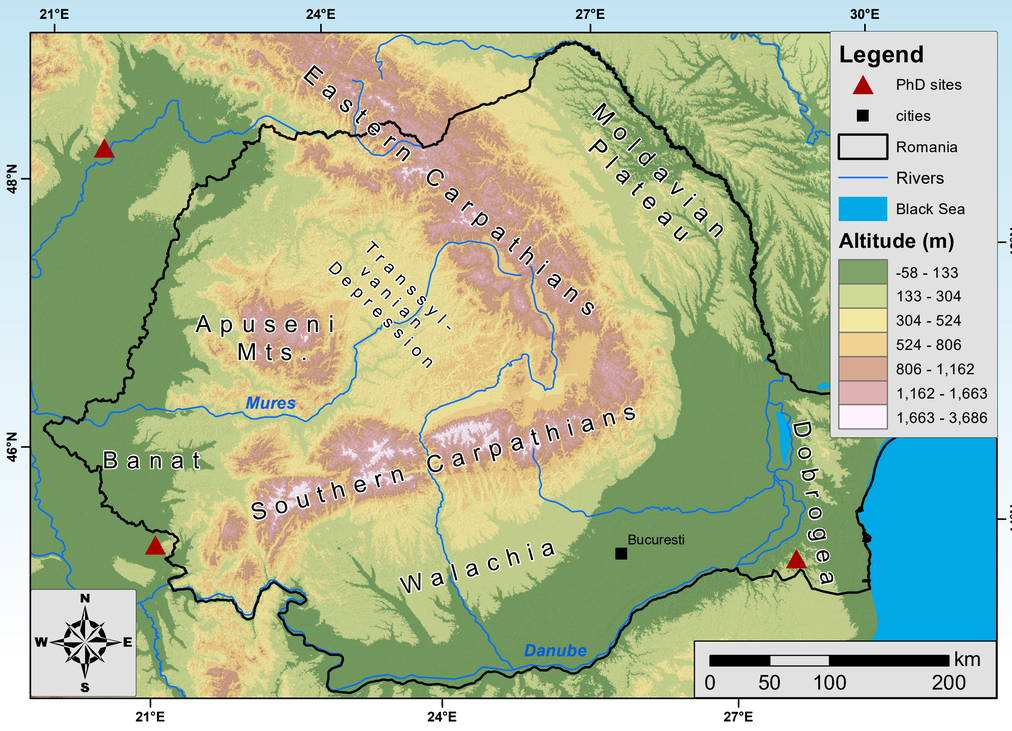


Fig.1 (left): Comparison of age depth models compiled using the luminescence pIRIR$_{290}$ ages (black) and a correlative age model (blue). The correlative age model is based on the magnetic susceptibilty, grain size and color data and a correlation to d^{18}O Greenland and NGRIP CH_4.

Fig.2 (right): Geophysical map of Romania showing the altitude, important landscape features, and the location of Urluia in the Dobrogea province in the East (red triangle).



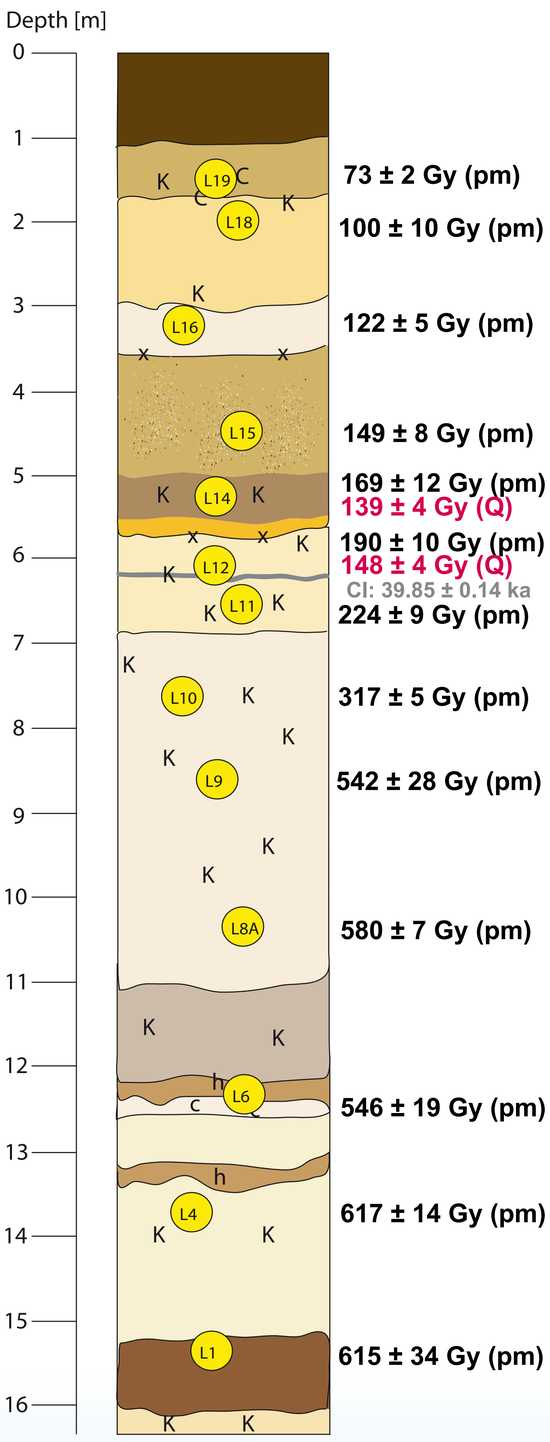


Fig. 3: Stratigraphie of the Urluia loess-paleosol sequence showing the position of luminescence samples and the Campagnian Ignimbrite tephra, dated elsewhere (Giaccio et al., 2017)

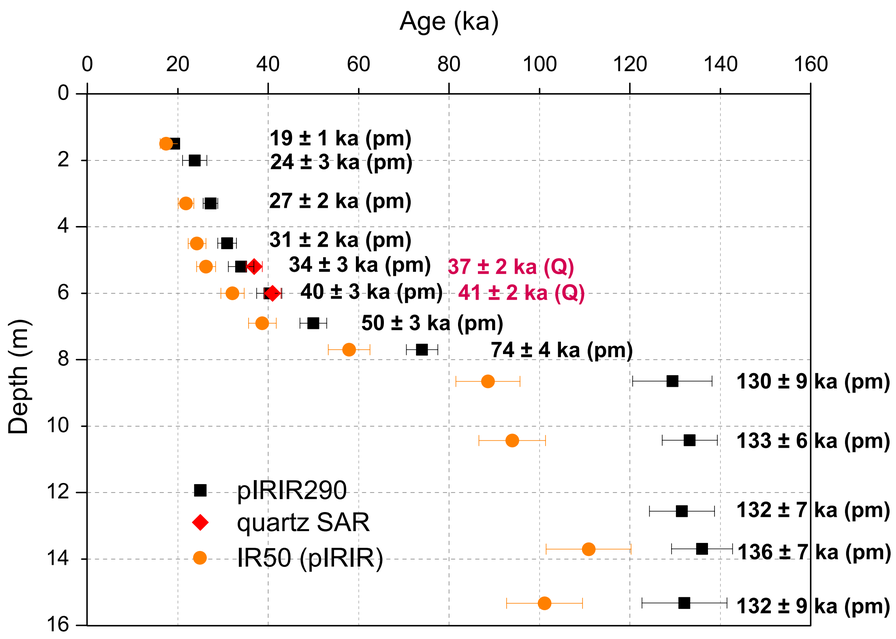


Fig. 4: Age depth plot of the Urluia LPS showing the ages using pIRIR$_{290}$ (Thiel et al., 2011), quartz SAR (Murray and Wintle, 2003), and for comparison the IR$_{50}$ signal from the pIRIR measurement.

Quartz SAR

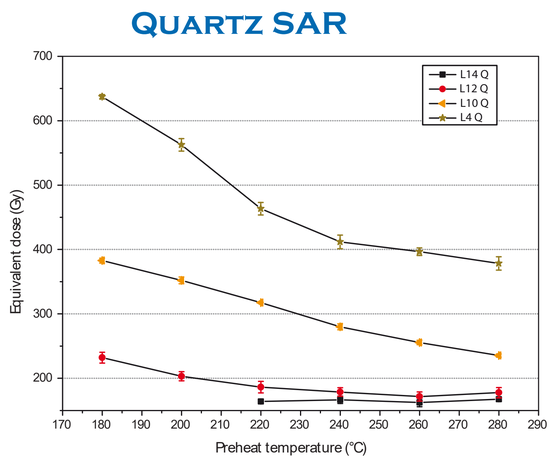


Fig. 5: Preheat Plateau Test of the quartz samples. Great dependency of preheat temperature on equivalent dose detected for samples L10 and L4 indicating that these are not suitable for dating.

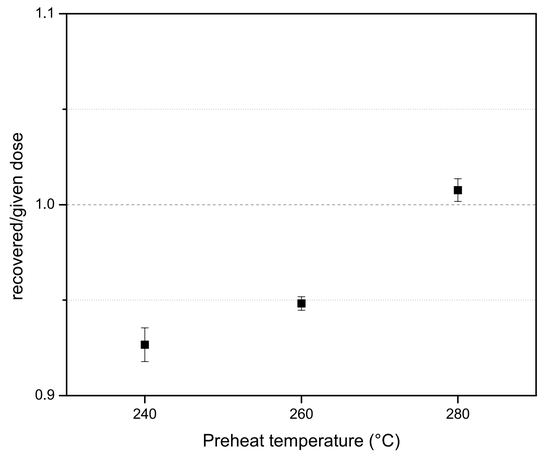


Fig. 6: Dose recovery test (right) of quartz samples L12 shows that measurements with the higher preheat temperatures are suitable for dating as given doses are recovered satisfactorily. De measurement were undertaken with a preheat temperature of 280°C.

Polymineral pIRIR$_{290}$

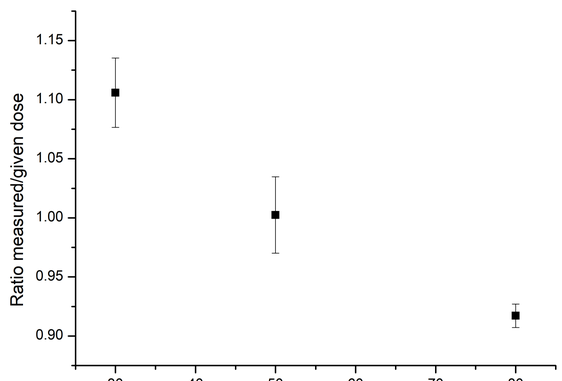


Fig. 7: Some of the high-doses pIRIR290 measurements show a strong dependency of test dose on equivalent dose and dose recovery results. Shown is an expample of sample L10.

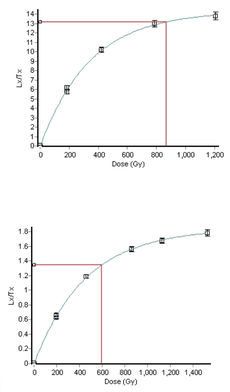


Fig. 8: Examples of different dose response curves while using a high and low testdoses. Top: testdose of 330Gy (46% of De). Bottom: testdose of 20Gy (3% of De).

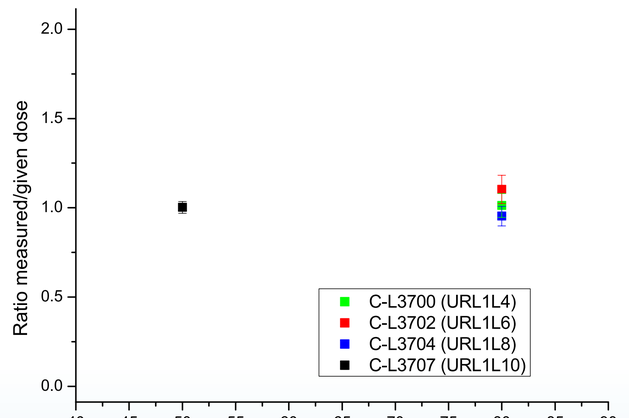


Fig. 9: While there are problems (see Fig.7), the dose recovery test results can be enhanced by applying higher testdoses. This is especially the case for the samples in the lower half of the profile (>500Gy).

Conclusions

- **testdose dependency discussed in Colarossi et al. (2018) also evident in the pIRIR$_{290}$ protocol**
- **testdose dependency in natural and regenerated signals (DRT)**
- **height of testdose influences shape of dose response curve, saturation characteristics, and De**
- **unclear of this is the reason for the sudden increase in De at Urluia**

Acknowledgements

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