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Is it possible to disentangle sedimentary and post-depositional processes in loess sequences? – Experiences from the loess sequence Krems-Wachtberg, Lower Austria

Philipp Schulte[1], Tobias Sprafke[2,3], Simon Meyer-Heintze[3], Frank Lehmkuhl[1]
[1]RWTH Aachen, Department of Geography, Aachen, Germany. [2]University of Bern, Institute of Geography, Bern, Switzerland. [3]University of Würzburg, Institute of Geography and Geology, Würzburg, Germany

Abstract

Loess-paleosol sequences (LPs) are sensitive terrestrial archives of past aeolian dynamics and paleoclimatic change. Numerous paleoenvironmental reconstructions from loess records have traditionally depended on the analysis of grain size (GS) distributions. A number of GS based statistical approaches are widely used. However, the GS distribution of a loess sample is not solely a function of aeolian dynamics, but rather of complex polygenetic depositional and post-depositional processes.

At the well-differentiated LPS Duesseldorf Grafenberg (Lower Rhine Embayment, Germany), the ΔGSD_{clr} was identified as promising indicator for post-depositional alteration processes in LPS (Schulte and Lehmkuhl 2018). It is based on two different optical models to calculate GS distributions from laser diffraction data. We apply the ΔGSD_{clr} on the weakly differentiated last glacial LPS Krems-Wachtberg (Lower Austria) in order to evaluate its use in a loess record without distinct paleosols. The 8 m thick LPS records paleoenvironmental fluctuations between 40-20 ka in a sequence of loess sediments, reworked horizons and incipient paleosols, mainly of tundra gley type. A Beckmann Coulter LS 13320 measured GS from samples taken in 2.5 cm resolution along the whole LPS.

ΔGSD_{clr} values range around zero in the entire dataset. Nevertheless, the vertical variation of the ΔGSD_{clr} signature is directly related to post-sedimentary processes and reflect zones alternated by chemical weathering processes. The degree of pedogenesis detected by the ΔGSD_{clr} is markedly lower than suggested by colorimetric data.

We conclude that detailed grain size information (e.g. ΔGSD_{clr} values) can be used as a reliable proxy for past aeolian dynamics. In combination with a robust color-based stratigraphy the comparison of LPS Krems-Wachtberg to the LPS Nussloch and the NGRIP dust and oxygen isotope records is possible.