EGU21-10532
https://doi.org/10.5194/egusphere-egu21-10532
EGU General Assembly 2021

Decoding geochemical signals of the Schwalbenberg Loess-Palaeosol-Sequences — A key to Upper Pleistocene terrestrial ecosystem responses in western Central Europe

Mathias Vinnepand[1,2], Peter Fischer[1], Christian Zeeden[2], Philipp Schulte[3], Sabine Fiedler[1], Olaf Jöris[4], Ulrich Hambach[5], Kathryn Fitzsimmons[6], Charlotte Prud'homme[6], Zoran Péric[6], Wolfgang Schirmer[7], Frank Lehmkuhl[3], and Andreas Vött[1]
[1]Institute of Geography, Johannes Gutenberg-University Mainz, Mainz, Germany
[2]LIAG - Leibniz Institute for Applied Geophysics, Hannover, Germany
[3]Department of Geography, RWTH Aachen, Aachen
[4]MONREPOS Archaeological Research Centre for Human Behavioural Evolution, Neuwied, Germany
[5]BayCEER & Chair of Geomorphology, University of Bayreuth, Bayreuth, Germany
[6]Terrestrial Palaeoclimate Group, Max-Planck-Institute for Chemistry, Mainz, Germany
[7]Wolkenstein 24, Ebermannstadt, Germany

The Schwalbenberg Loess-Palaeosol-Sequences (LPS) in the Middle Rhine Valley, Germany, comprise unprecedented complete records of Upper Pleistocene terrestrial ecosystem response to global climate changes. However, direct correlation of the Schwalbenberg geochemical signals with climate archives of supra-regional northern hemispheric relevance remains complicated. This is due to the complex interplay of pre-, syn-, or post-depositional processes that left their traces in the terrestrial record. In particular, the use of different element ratios to derive weathering indices may be complicated as dust sources change through time, and as ecosystems respond to changing conditions. In this study, we decode interfering geochemical signatures and re-evaluate proxies, commonly applied, regarding their suitability and meaning for understanding the evolution of the Schwalbenberg LPS. We undertake a systematic approach, firstly dividing the 30 m long Schwalbenberg REM3 LPS according to our core description. In a second step, we integrate LOG-ratios indicative of provenance shifts, sediment reworking dynamics and weathering into multivariate analysis. We apply Principle Component Analyses (PCA) and Linear Discriminant Analysis (LDA) to datasets comprising sediments deposited under similar environmental conditions. In doing so, we sensitively quantify subordinate processes and conditions, such as the impact of varying source- and weathering-signals in all proxies. Our results show that in particularly K/Rb and Mg/Ca ratios contain a strong provenance signal in loess deposits, whereas the Ca/Al_d ratio (Al_d: dithionite extractable) best indicates the maturity state of Gelic Gleysols. Integration of our filtered datasets with a high-resolution age model enables direct correlation of the variability of principal components on sub-millennial scales with Atlantic-driven climate oscillations. More specifically, PC2 appears to reflect changes in mineral dust accumulation and indicates increasing dust input in response to climate cooling towards the end of interstadials,

highlighting the accretionary nature of the Schwalbenberg LPS during transitional periods from interstadial to stadial depositional modes.