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The Last Glacial Maximum in the Northern European loess belt: Correlations between loess-paleosol sequences and the Dehner Maar core (Eifel Mountains)

Joerg Zens (1), Lydia Krauß (1), Wolfgang Römer (1), Nicole Klasen (2), Stéphane Pirson (3), Philipp Schulte (1), Christian Zeeden (1), Frank Sirocko (4), and Frank Lehmkuhl (1)

(1) RWTH Aachen University, Department of Geography, Aachen, Germany (joerg.zens@geo.rwth-aachen.de), (2) University of Cologne, Institute of Geography, Cologne Luminescence Lab, Germany, (3) Direction de l'archéologie, Service public de Wallonie, Namur, Belgium, (4) Johannes Gutenberg University, Institute of Geosciences, Mainz, Germany

The D1 project of the CRC 806 "Our way to Europe" focusses on Central Europe as a destination of modern human dispersal out of Africa. The paleo-environmental conditions along the migration areas are reconstructed by loess-paleosol sequences and lacustrine sediments. Stratigraphy and luminescence dating provide the chronological framework for the correlation of grain size and geochemical data to large-scale climate proxies like isotope ratios and dust content of Greenland ice cores. The reliability of correlations is improved by the development of precise age models of specific marker beds. In this study, we focus on the (terrestrial) Last Glacial Maximum of the Weichselian Upper Pleniglacial which is supposed to be dominated by high wind speeds and an increasing aridity. Especially in the Lower Rhine Embayment (LRE), this period is linked to an extensive erosion event. The disconformity is followed by an intensive cryosol formation. In order to support the stratigraphical observations from the field, luminescence dating and grain size analysis were applied on three loess-paleosol sequences along the northern European loess belt to develop a more reliable chronology and to reconstruct paleo-environmental dynamics. The loess sections were compared to newest results from heavy mineral and grain size analysis from the Dehner Maar core (Eifel Mountains) and correlated to NGRIP records. Volcanic minerals can be found in the Dehner Maar core from a visible tephra layer at 27.8 ka up to ∼25 ka. They can be correlated to the Eltville Tephra found in loess section. New quartz luminescence ages from Romont (Belgium) surrounding the tephra dated the deposition between 25.0 + 2.3 ka and 25.8 + 2.4 ka. In the following, heavy minerals show an increasing importance of strong easterly winds during the second Greenland dust peak (∼24 ka b2k) correlating with an extensive erosion event in the LRE. Luminescence dating on quartz bracketing the following soil formation yielded ages of 23.6 + 2.1 ka at the base and 22.1 + 2.0 ka above, which are in excellent agreement with the Greenland interstadial 2 (∼ 23.5-22.5 ka b2k). Intensive frost weathering and solifluction indicate distinct moister conditions with periodical thawing of permafrost. The influence of eastern winds is subordinated and a stronger oceanic influence is more probable. The interstadial ends with a massive accumulation of primary, unstratified loess mainly by easterly winds according to heavy mineral contents from the Dehner Maar (∼22-19.5 ka) suggesting increasing continentality and aridity. This change corresponds with the first retreat of the Scandinavian ice sheet from the Brandenburg to the Frankfurt stage. The results indicate that the development of loess sections is associated with the complex interaction of changes in temperature, wind directions, and differences in moisture availability. Grain size, heavy minerals and distinct phases of soil development as well as erosion events recorded such major changes in paleo-environmental conditions and can be correlated by luminescence dating precisely.