The Loess-Palaeosol-Sequences of the Schwalbenberg (Middle Rhine Valley, Germany): Refined Stratigraphy suggests Millennial to Centennial-scale terrestrial ecosystem responses to Upper Pleistocene climatic changes

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In the Central European region, Loess-Palaeosol-Sequences (LPS) provide outstanding terrestrial archives responding to past climate and environments over different spatial and temporal scales. As yet, however, processes involved in LPS formation, and their interplay with changes in ecological conditions, impede robust correlation with other archives of environmental change. The Schwalbenberg LPS (Middle Rhine Valley, Germany) provide unique high-resolution records highly suitable for investigating the physical processes of loess accumulation and its relationship to climatic influences during the Upper Pleistocene. Here we present the first comprehensive multi-proxy dataset for the Schwalbenberg LPS over four dimensions. In the frame of the TerraClime-Project, extensive fieldwork has been carried out along a transect from the interfluve position to the foot slope combining geophysical exploration (electrical resistivity tomography, seismics) with Direct Push borehole geophysical measurements and sediment coring. Sedimentological and geochemical proxy data are used to detect signals of palaeoenvironmental and palaeoclimatic changes allowing to set up a stratigraphical model for the entire Schwalbenberg. We show that the transect approach allows quantification of different formation phases, whether accumulative, erosive or pedogenic in character. Based on this we overcome the bias inherent in studies of individual sections and enable robust correlation with other climate archives. For the time interval ~ 80-15 ka BP correlation of combined lithostratigraphic features and organic carbon contents from Schwalbenberg with the Sofular and NGRIP δ18O-records can be established at millennial to centennial scale resolution, proving the sensitivity of western European LPS to Atlantic-driven climate oscillations in much more detail than in any other terrestrial archive known in the region so far.

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