High resolution paleomagnetic and environmental magnetic data from the last interglacial to glacial transition in a loess-paleosol sequence (LPS) from the Lower Danube (Romania) — Implications for the chronology of the S1 pedocomplex in Eurasian LPSs

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The transition from the last interglacial period (Eemian) to the glacial state (Early Würmian) is well recorded in northern hemispheric continental settings in Greenland Ice Cores (e.g. Dansgaard et al., 1993) and Eurasian lake sediments (e.g. Sirocko et al., 2005). However, from a geographical point of view, these Eurasian lake sediments are unevenly distributed. Nonetheless, in the mid-latitude terrestrial realm loess-paleosol sequences (LPS) represent geographically widespread and occasionally temporally highly resolved archives of Pleistocene paleoclimate and particularly of this paleoclimatically important transition (Zeeden et al., 2018). In order to improve our knowledge about this transition in a region where contrasting ecozones meet, a multi-proxy approach was applied to 216 oriented samples (2 cm spacing, contiguous) covering c. 4 m from the top of the last interglacial paleosol (S1, sensu Marković et al., 2015) into the overlaying loess units. The study site is located in the lower Danube Basin (Romania) on the left bank of the Danube at the village Vlasca in the vicinity of the town of Feteşti. The samples were subjected primarily to paleomagnetic analyses and secondly also to environmental magnetic and colorimetric measurements.

Here we report on a high-resolution study of this LPS from the western end of the Eurasian Steppe Belt, providing valuable records of both the Earth's magnetic field and paleoclimate. To analyze the temporal dynamics of climatic changes at a transition from interglacial to glacial conditions, timing is essential and can be provided by paleomagnetic dating. Paleomagnetic methods allow for dating of sedimentary sequences by employing temporal changes of the paleomagnetic field vector in direction and intensity. Obtained individual records are dated by comparison and correlation to independently dated reference records. Furthermore, rock magnetic parameters reflect environmental conditions during sedimentation (and diagenesis) of sedimentary successions and provide independent age control via comparison to temporally well-defined paleoclimatic archives.

No obvious directional variation of the paleomagnetic vector could be detected, but a characteristic pattern of highs and lows in relative paleo-intensity (RPI) in the lower half of the sequence and a drop towards the top of the section gives evidence for the presence of a recorded geomagnetic excursion, the so-called post-Blake event (Channell et al., 2009). This feature, dated to 99 – 98 ka, serves as an absolute time marker and forms the backbone for the multi-proxy age model combining the results of environmental magnetism, colorimetric analyses and paleomagnetic data. The achieved age model for the Vlasca section reveals a time interval of c. 110 – 95 ka and put the demise of the S1 pedogenesis largely into the Eemian (marine isotope stage (MIS) 5e). This contradicts the assumption of equivalence of the entire MIS 5 with the S1 pedocomplex, which is a key legacy of loess research since 50 years at least (e.g. Marković et al., 2015).

The Vlasca section provides high- and continuous sediment accumulation with a mean resolution of 39 years per cm. Moreover, clearly expressed millennial-scale oscillations in environmental magnetic parameters can be correlated with Dansgaard-Oeschger cycles, based on their internal structure and average duration of ~1470 years (e.g. Bond et al. 1999).

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