New insights into changing palaeoenvironmental conditions in a sub-profile of the Nussloch loess-palaeosol sequence (P9), detected by in-depth environmental magnetic and diffuse reflectance spectrometry methods

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Résumé

Loess and palaeosol sequences (LPSs) are widespread terrestrial climatic archives in the northern hemisphere covering almost 10 % of its terrestrial surface (Pécsi, 1990). LPS can archive several glacial (cold and dry) and interglacial (warm and humid) cycles. In Western Europe, the Nussloch LPS, located south of Heidelberg in the Rhine River Valley has been extensively studied by multi-disciplinary approaches (e.g. Antoine et al., 2001; Hatté & Guiot, 2005; Zech et al., 2012; Moine et al., 2005; Rousseau et al., 2002; Taylor et al., 2014; Taylor & Lagroix, 2015), providing a record of millennial-scale stadial and interstadial cycles of the last Glacial Period (Moine et al., 2017; Rousseau et al., 2017). The present study targets an in-filled depression flanking the Nussloch loess ridge where previously studied P4 and P8 profiles where sampled. The depression is in-filled with loess, and palaeosol horizons, cross-cutting the depression's surface. Our objective is to understand the timing and mechanism by which the depression was filled, providing insight of local environmental change induced by climate change and time required for soil formation. Two in-filling mechanism hypotheses can be tested: (i) infilling by slope debris or (ii) infilling by accumulation of aeolian dust.

A vertical profile (P9) was sampled where the depression displays a maximum thickness. The P9 profile is 5 meters in depth, and bulk material was continuously sampled at a 5 cm interval rendering 95 bulk samples. Here we provide first results of our ongoing study, and more specifically observations stemming from the integration of magnetic mineral analyses and diffuse reflectance spectrometry (DRS). DRS derived proxies a* (redness) and the Q7/4 ratio (Debret et al., 2011; the quotient of 700 nm and 400 nm backscattered reflectance) increase across two stratigraphic horizons identified as palaeosols in the field. The combined colorimetric and mineral magnetic data sets complemented by anisotropy of magnetic susceptibility analyses and planned geochronological determinations (OSL, charcoal) will shed light on the timing and mechanism of infilling of the depression, and consequently how climate change impacted the local environment.

Keywords: Magnetism, Climatology, Sedimentology

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