



The cause of extremely high magnetic susceptibility of the S5S1 paleosol in the central Chinese Loess Plateau

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The paleosol layer S5S1, which corresponds to Marine Isotope Stage (MIS) 13, is the most prominent paleosol layer in the central Chinese Loess Plateau (CLP). S5S1 has extremely high magnetic susceptibility, but it remains uncertain whether this is related to climate or to the duration of pedogenesis as material leaching can also lead to magnetic susceptibility enhancement through the enrichment of strongly magnetic particles by prolonging pedogenesis. In particular, there is a relatively low magnetic susceptibility in the western CLP loess sequences, where the deposition rate is about twice of that in the central CLP, or even more; in turn, the duration of the soil formation is much shorter. Therefore, it is important to determine in which degree the extremely high magnetic susceptibility of S5S1 represents a climate signal. To address this question, we investigate the magnetic composition, concentrations, and grain size of magnetic minerals of the S5S1 paleosol at the Xifeng loess section located in the central CLP. We compare the results of S5S1 with other paleosol units, yielding additional insights into the CLP climatic changes during MIS-13. The results show that S5S1 was formed under an oxidizing environment where magnetite and hematite were formed simultaneously. Magnetic enhancement is mainly governed by an almost constant grain size distribution of pedogenic fine-grained magnetite. With the intensification of pedogenesis, the proportion of the magnetite component decreases, while the concentrations of anti-ferromagnetic minerals (mainly hematite) increases, the hematite seems to be an intermediate product in the pedogenic transformation of ferrihydrite to hematite. Changes in the ratio of pedogenic hematite to goethite, as well as in magnetic enhancement, indicate that the S5S1 paleosol developed under extremely humid conditions. In general, the extremely high magnetic susceptibility in the S5S1 paleosol unit is attributed to climate rather than duration of pedogenic weathering.