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Goethite and hematite content in loess-palaeosol sediments from North Bulgaria revealed by rock magnetic methods and diffuse reflectance spectroscopy (DRS)

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Climatically significant magnetic signal of loess/palaeosol deposits is dominated by the strongly magnetic ferrimagnetic fraction, but sometimes it contradicts with the pedological criteria for the degree of soil formation. It is mainly the case with old palaeosol complexes of intense red coloring and clay illuviation, in which hematite obviously plays an important role. The establishment of comparative data from rock magnetic studies and independent analytical methods like diffuse reflectance spectroscopy (DRS) contribute to outline the environmental significance of hematite and goethite in loess/palaeosol sediments. This has an important implication for a better view on their role as remanence carriers of the palaeomagnetic record.

Twenty samples from two loess/palaeosol sections in North Bulgaria – Orsoja and Durankulak – were subjected to DRS and rock magnetic studies. The latter mainly concentrate on combined demagnetization of isothermal remanence (IRM) imparted in a field of 2T. Initial alternating-filed demagnetization at 100mT peak field was used to eliminate the strong signal from the ferrimagnetic fraction. The remaining signal was stepwise thermally demagnetized up to 700^oC. Thermal unblocking at low temperatures up to 210^oC was attributed mainly to goethite, and the final demagnetization after 650^oC step – to hematite. The contribution of the different phases to the total initial signal was calculated and the signal ratio goethite/hematite was determined by magnetic means. Independently obtained through the DRS parameters (E/D = goethite/hematite; B/C = weathering degree) indicate that goethite is a typical compo-

nent of the European loess and probably the major FeOOH polymorph of hydrated Fe-oxides. The decreased goethite/hematite ratio in palaeosols suggests higher hematite content, probably of pedogenic origin. A comparison between DRS and magnetic data shows that in the samples from the two sections studied, goethite and hematite differ in their grain size (e.g. remanence carrying ability) and crystallinity.