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Discrimination of Ferri- and Antiferromagnetic Iron Oxides and Oxyhydroxides of Pedogenic Origin

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A b s t r a c t

Ultrafine iron oxides and oxyhydroxides are generated through a variety of processes during soil formation such as for instance weathering or redox cycling. Among these minerals, ferrimagnetic magnetite or maghaemite often dominate the magnetic signature of soils, clearly marking humid periods in loess/paleosol sequences, due to their large spontaneous magnetisation. Most pedogenic iron, however, occurs in anti-ferromagnetic minerals such as haematite and goethite, whose magnetic contribution is easily over-looked, because of their weak spontaneous magnetisation and high coercivity. Because of their different formation paths, a correct discrimination between ferri- and antiferromagnetic pedogenic minerals is important for the correct interpretation of palaeoclimatic archives involving pedogenesis.

Current rock magnetic methods do not provide satisfactory results, in particular with respect to the relative contribution of various iron minerals to the magnetic susceptibility. Preliminary results will be presented of a combined approach for the discrimination of ferri- and antiferromagnetic pedogenic minerals based on temperature dependent measurements of the frequency dependence of magnetic low-field susceptibility and of high-field hysteresis. These techniques are combined with selective pedogenic iron oxide dissolution, i.e., with the citrate-bicarbonate-dithionite method (cf. Mehra and Jackson 1960) in order to eliminate the contribution of primary minerals. Frist results obtained from different palaeosol horizons of the loess/palaeosol sequence of Lingtai, central Chinese Loess Plateau will be discussed before and after CBD extraction.

Keywords: loess/palaeosol, pedogenesis, frequency dependence of magnetic low-field susceptibility, CBD-extraction, palaeoclimate.

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