



Magnetic susceptibility of the Tertiary Red Clay in the Xifeng Section of the Chinese Loess Plateau, Northwest China

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Dustfall continuously occurs in northern China since the early Quaternary period, forming the spectacular Loess Plateau. The Quaternary loess in the Loess Plateau includes many alternations between loess and paleosols, reflecting multiple cyclical paleoclimatic changes in northern China since the early Quaternary. The red clay underlain the Quaternary loess was formed during the Tertiary period, and thus called the Tertiary Red Clay (TRC). In this work, some representative samples of the Quaternary loess and paleosols and TRC of the Xifeng Section in the Chinese Loess plateau, Northwest China, were collected. Magnetic susceptibility and weathering degree of the samples were compared. The Chemical Index of Alteration (CIA) of the TRC (80.4) was close to the Quaternary paleosols (79.7), and significantly higher than the loess (72.5) in the Xifeng Section. Molecular $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratios of the TRC and Quaternary paleosols, 5 and 5.1 on average respectively, were also similar, and significantly lower than the loess, 5.6. Molecular $\text{SiO}_2/(\text{Al}_2\text{O}_3+\text{Fe}_2\text{O}_3)$ ratios of the TRC, Quaternary loess and paleosols were 2.6, 2.8 and 3 on average, respectively. The results indicated that the weathering degree of the TRC was close to that of the Quaternary paleosols, and significantly intensive than the loess. Magnetic susceptibility of the TRC, Quaternary loess and paleosols were $21.6 \times 10^{-8} \text{m}^3 \text{kg}^{-1}$, $50 \times 10^{-8} \text{m}^3 \text{kg}^{-1}$ and $107.2 \times 10^{-8} \text{m}^3 \text{kg}^{-1}$ on average, respectively. Magnetic susceptibility of the TRC was only 1/5 that of the paleosols and 1/2 that of the loess. Further studies indicated that magnetic susceptibility of the samples in Xifeng Section was positively correlated with the contents of acid-ammonium-oxalate extracted amorphous Fe and organic matter, suggesting that organic matter content and the degree of Fe activation had significant effects on the content of magnetic minerals. Therefore, the weakening of magnetic signals of the TRC may be related to the transformation of maghemite into hematite with the aging of Fe oxide minerals. It may also be related to the dissolution of magnetic minerals caused by the fluctuations of groundwater levels. The mechanism of the magnetic weakening of the TRC, however, should be further studied.

Keywords: Chinese Loess plateau; Less and Paleosols; Tertiary Red clay; Magnetic susceptibility.