

Reconstruction of superparamagnetic particles grain size distribution from Romanian loess using frequency dependent magnetic susceptibility and low temperature Mossbauer spectroscopy

Cristian Necula¹, Cristian Panaiotu¹, Victor Kuncser²

¹ Faculty of Physics, Paleomagnetic Laboratory, University of Bucharest, Bucharest, Romania

² National Institute of Material Physics, Bucharest-Magurele, Romania

Corresponding author: [Cristian Necula, c3necula@yahoo.com](mailto:c3necula@yahoo.com)

Abstract: Previous studies have shown that the magnetic parameters of the Romanian loess/paleosol sequences have recorded Quaternary glacial/interglacial cycles over the last 800ka (e.g. Necula et al., 2013, Buggle et al., 2014). Rock magnetic investigations pointed out that the magnetic enhancement in Romanian loess sequences is mainly due to pedogenic magnetite close to superparamagnetic/stable single domain boundary (e.g. Necula et al., 2013). We report the first reconstruction of grain size distribution (GSD) of the superparamagnetic particles for two Romanian loess deposits (Costinesti located at the Black Sea shoreline and Mircea Voda located in the central Dobrogea Plateau) using wide-band frequency spectrum of magnetic susceptibility (FSMS) (Kodama et al., 2013) and low temperature Mossbauer spectroscopy (Kuncser et al., 2007). The FSMS method showed that all paleosol samples display relatively narrow, unimodal GSD pattern with almost the same maximum diameter in all paleosols of about 17 nm. In addition we found an almost uniform GSD both within sites as well as between them proving that the GSD in paleosols is independent of pedogenesis. Loess GSDs on the other hand are slightly broader with maximum diameters shifted to slightly higher value (~18nm). Moreover the shape of loess GSDs differs from paleosols. For example Mircea Voda loess shows a bimodal distribution with a second maximum at about 20 nm diameters suggesting that pedogenesis modifies the GSDs of parent material (Fig. 1). The concentration of SP particles in loess is one order of magnitude smaller than in paleosols (Fig. 1). Of the two loess-paleosol sections studied Costinesti section displays the highest concentrations of superparamagnetic particles. The highest concentration of fine-grained pedogenic particles was found in S3 paleosol consistent with the magnetic enhancement observed for Romanian paleosol. All these suggest that fluctuations in magnetic susceptibility recorded in the Romanian loess deposits are mainly controlled by changes in concentrations of ultrafine pedogenic particles. Low temperature Mossbauer derived GSDs for paleosols agree well with those obtained through

frequency dependence of magnetic susceptibility showing mean diameters of about 15 nm.

Keywords: Romanian loess, frequency dependent magnetic susceptibility, superparamagnetic grain size distribution

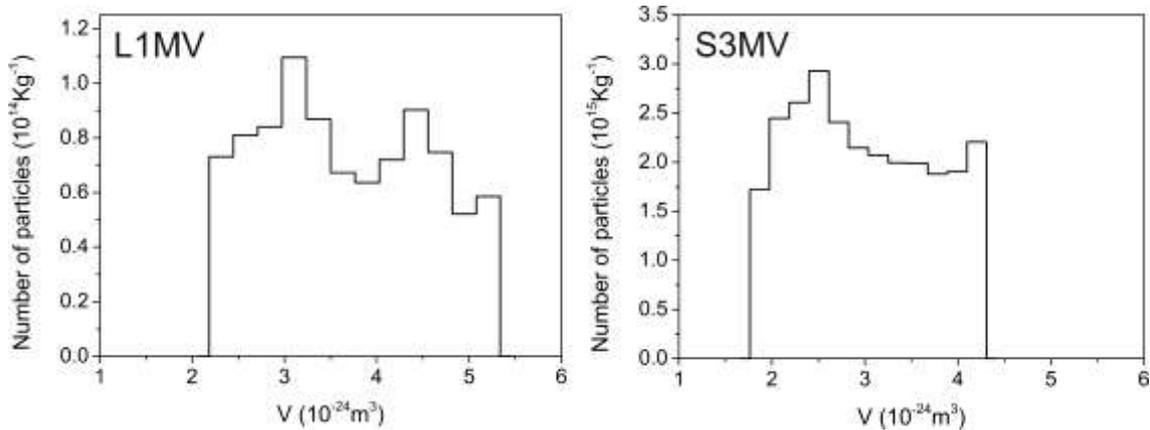


Figure 1: GSD diagrams calculated for L1 loess layer and paleosol S3 from Mircea Voda (MV) loess/paleosol deposit.

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