Is Central Europe the ‘witch's brew’ of Pleistocene paleoclimate studies? -The magnetic fabric approach

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The study of Pleistocene climate is one of the fastest growing disciplines in Earth Sciences. One of the best tools to obtain more information about the Pleistocene in terms of the terrestrial environment is the investigation of loess. The different varieties of loess together constitute one of the most widespread terrestrial sediments, which was deposited, altered, and redeposited in the course of the changing climatic conditions.
Central Europe is one of the most complex part of Europe from the sense of the present day’s climate conditions. The climatic components are influenced by all of the North Atlantic, Mediterranean (African) and Siberian (Asian) climate. The recent complexity arise a question about the Pleistocene paleoclimate of the area, and possibly makes it the ‘witch's brew’ of paleoclimate studies.
970 pieces of samples were taken from Paks profile (Central Europe, Hungary), one of the well-known sediment succession of the area, to reveal some component (e.g. wind direction) of the early Middle Pleistocene paleoclimate by anisotropy of magnetic susceptibility (AMS) measurements.
Weak anisotropy, quasi isotropic fabric and poorly defined orientation were revealed by the confidence ellipsoid of individual samples. Despite the character of individual samples, the ‘sample-populations’, related to various layers, had characteristic alignment on stereoplots. Proper changes of the basic AMS parameters (e.g. degree of anisotropy and shape of the susceptibility ellipsoid), were also identified in the profile.
Two main sedimentary environments were revealed by the AMS analysis. The homogeneous loess was characterized by well-defined horizontal foliation plane, strongly oblate (lentil shape) susceptibility ellipsoid. Weak, temporarily changing, W, NE and S(E) transport/deposition (wind) orientations were also defined, indicating influences of North Atlantic, Siberia and Western Asia respectively. The character of the fabric indicated low energy transport and relatively calm environment during deposition.
In contrast, the magnetic fabric of the moderately-poorly sorted, coarser, and partly fine laminated materials show higher variability. The fabric of the sandy aleurite and sand layers are characterized by oblate, triaxial and prolate (rugby ball -like) susceptibility ellipsoid either. Generally, these sediments have stronger anisotropy compared to the loess. AB plane imbrication and the influence of slope during deposition were revealed by the stereoplot analysis. The magnetic fabric, characterized above, suggests stronger, possibly water-lain transport processes and redeposition on slope. The quick changes of the paleoenvironment were indicated by the radical change of the orientation of the transportation in short geological period, and it could be induced by the rapid change of the paleoclimate.
Paleosol horizons, intercalated in sediments, were also observed. Based on the degree of the development and the structure of the paleosol, various magnetic fabrics are defined. Generally, the paleosols are characterized by oblate/triaxial susceptibility ellipsoid and weak anisotropy. Horizontal and quasi inverse fabric were observed on stereoplots. The characters above, possibly indicate the alteration of the fabric by biogenic activity (reworking) and vertical pedogenic processes. SW and W orientation (influence of Mediterranean) were detected in the fabric of

well-developed soils, however these orientations are possibly not reliable due to the effect of pedogenesis.
High variabilities of the paleoenvironment were described during the early Middle Pleistocene in Central Europe. The wind system was possibly similar to the recent ones, however, some component (e.g. orientation of dominant paleowind direction) became stronger during the glacial or interglacial phase.

Keywords: anisotropy of magnetic susceptibility, Middle Pleistocene, wind direction

