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Characterization of slipped sediments from a loess landslide, Kulcs, Central-Hungary

Beatrix Udvardi (1,2), István Kovács (1), Judit Füri (1), Péter Kónya (1), Zsolt Horváth (1), Anikó Besnyi (1), Mária Földvári (1), László Koloszár (1), Ferenc Fedor (3), Judit Horváth (3), Péter Ács (3), Tamás Fancsik (1), and Csaba Szabó (2)

(1) Hungarian Geological and Geophysical Institute, Environmental Geology Department, Budapest, Hungary (udvbeatrix@gmail.com), (2) Lithosphere Fluid Research Lab, Department of Petrology and Geochemistry, Eötvös University, Budapest, Hungary, (3) Geochem Ltd., Kozármisleny, Hungary

The area of the Danube High Bluffs in Central Hungary is frequently affected by recent landslide activity where landslides have largely been associated with slope deposits, including various Pleistocene sediments as well as the underlying Pannonian layers. Studies , however, have revealed that intense rainfall episodes and flooding periods trigger landslides in the area [1,2]. In this study, we report the results of a case study about the collapsed structure in the toe and at the bulge of Kulcs landslide.
Beside field recordings, previous geotechnical data of Rácalmás-Kulcs area were reinterpreted. A broad range of analytical techniques were employed for the characterization of sediments on the surface and in 6 boreholes on a small area (100 m x 30 m) affected by landslide movements along riverbank.
Sediments from boreholes comprise grey silty flood plain sediment, old weathered loess with loess dolls, fine grained brown paleosoils, red clay, carbonate cemented layers and sand/sandstone. Sandwich-like sediment structure and grain size distribution with high amount of clay and silt (clay, silty clay loam and silt loam texture) are present that affect the flow of underground water. Samples mainly contain quartz (17-62%), carbonates (calcite >dolomite; 0-50%), muscovite and illite (0-25 %) and subordinate amount of chlorite, montmorillonite, feldspars, kaolinite, goethite. The borehole which was drilled outside of the area, affected by the landslide, shows different sediment structure.
Weathering indices and major chemical composition of most of the samples show similar values to Pleistocene-Pannonian sequences from Hungary, excluding Na2O and MnO [3].
The high CPA values (93-98 %) in the paleosoil unit reflect a highly weathered paleosoil. The low values of $Na2O/Al2O_3$ and $K2O/Al2O_3$ with respect to average Upper Continental Crust composition indicating the removal of more soluble elements.
These results are helpful to reveal the cause of landslides and trace sliding planes in sediments where it is not clearly recognizable. The study highlights the importance of paleosoil layers in quaternary loess as these can act as potential sliding planes if the hydrogeological conditions are such.

References: [1] Szabó, J. (2003), Natural Hazards and Earth System Sciences 3, 43-52. [2] Újvári et al. (2009), Geomorphology 109, 197-209. [3] Varga et al. (2011), Quaternary International 240, 71-86.