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Varying weathering degree indicators within three paleosol layers

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Loess-paleosol layers are prevalent globally. One result of the urbanization, these layers often collapse on the buildings or if the buildings are the top of the bluff, houses can damage as a result of mass movements. Therefore, it is crucial to identify key parameters to predict the changes in the loess-paleosol layers stability. This study focused on three unaltered loess-paleosol profiles in Hungary (Bátaapáti, Nagymaros, Zebegény) where several vertical samples were taken. To assess the extent of weathering, X-ray fluorescence (XRF), Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES), and X-ray Diffraction (XRD) analyses were utilized. XRD provides detailed information about the crystallographic structure and chemical composition of minerals. Further details on the elemental composition of the three loess-paleosol systems were acquired through XRF analysis. Data from the Mastersizer 3000 analyzer were collected to examine particle size distribution, as the clay fraction (<2 μm) percentages elucidate the extent of weathering. Optical microscopic properties of the selected samples were investigated using the 2D image analyzer Morphologi G3-ID. The overall degree of weathering in Bátaapáti is lower, while a higher concentration of smectite in Nagymaros and Zebegény indicates more pronounced weathering activity. Considering paleoclimate and current meteorological conditions, a correlation between chemical weathering and particle size distribution was observed at the three sites. The precipitation of clay minerals affirms the ongoing pedogenesis in all of the locations. An increased proportion of fine particles (<2 μm) in deeper paleosol layers may suggest illuviation due to leaching. In Nagymaros, the illuvial horizon is situated between two loess deposit layers. Consequently, particle size, shape distributions, and chemical compositions indicate an elevated weathering status for Nagymaros, underscoring the advantages of concurrently employing multiple research methods. Support of the National Research, Development, and Innovation Office (Hungary) under contract FK128230 is gratefully acknowledged.