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Identification of the phases and mechanisms of Colluvisols formation in different soil regions

Tereza Zádorová[1], Vít Penížek[1], Magdalena Koubová[2], Daniel Žížala[1], Radka Kodešová[1], Ondřej Drábek[1], Václav Tejnecký[1], Miroslav Fér[1], Aleš Klement[1], Antonín Nikodem[1], Tomáš Hrdlička[1], **Jessica Reyes Rojas**[1], Marko Spasic[1], Petra Vokurková[1], Lenka Pavlů[1], Karel Němeček[1], Aleš Vaněk[1], and Lenka Lisá[3]

[1]Czech University of Life Sciences, Dept. of Soil Science and Soil Protection Praha, Czech Republic (zadorova@af.czu.cz)
[2]Czech Geological Survey, Praha, Czech Republic (magdalena.koubova@geology.cz)
[3]Institute of Geology of the Czech Academy of Sciences, Praha, Czech Republic (lisa@gli.cas.cz)

Colluvisols represent an important part of the soil cover, occupying concave slope elements especially in landscapes with undulating relief. Their development reacts to changes in land use or climate, manifested by intense erosion activity or longer resting periods with predominantly in-situ pedogenesis. In climatically, pedologically and historically different regions, diverse colluvial profiles can be encountered. In this study, we investigated deep colluvial profiles in three agricultural plots in Czechia with different soil cover, climatic and geological conditions in order to identify differences in the depositional pattern and erosion history of the areas. In each of the plots, two profiles (depths ranging from 200 to 400 cm) were opened in the toe-slope and side valley areas. Individual layers were investigated by various methods, including optically stimulated luminescence dating, 137Cs activity, concentration of vertically stable geochemical tracers (organochlorine pesticides, nutrients) or micromorphology and clay mineralogy, allowing the layers to be linked to periods of human activity. In all study areas, a significant difference in the colluvial deposition mechanism was found in the toe-slope and side valley areas. While the positions in the side valleys were mainly composed of older material with a minimum concentration of human-bound substances, the profiles in the toe-slopes are characterized by a significant deposition of recently accumulated material. The most pronounced redistribution of material was recorded in the Chernozem area on loess. In the toe-slope area, maxima of 137Cs, DDT (up to 350 µg/kg) and phosphorus were found at 100-140 cm, indicating the very low age of this layer (from the mid-20th century). The mineralogical and chemical composition of this layer and the layer below (140-220 cm) shows considerable similarities to the substrate material, indicating severe truncation of the source soils and accumulation of ploughed parent material. In contrast, in the side valley, this new material was found only in the topsoil, with approximately 3 m of older, humus-rich material beneath. This area is therefore not an area of recent deposition, but rather of material transport. The original buried Chernozem was found in both cases at a depth of about 300-350 cm. In the Cambisol area, the combination of rill and sheet erosion led to the formation of a highly stratified profile with a large variation in texture or humus content. The maximum of human-bound substances (137Cs, HCB, DDT) was found at a depth of 1 m, underlain

by older material with signs of post-depositional pedogenesis (weathering and redox processes). The area of side valley was, as in the previous area, almost unaffected by recent sedimentation. In Luvisol area, the concentration on human-bound substances was generally lower and affected only the upper, humus-rich layer (ca 80 cm) of the Colluvisols, both at the toe-slope and the side valley. Below this layer, the profiles are characterised by relatively pronounced pedogenesis in the sedimentary material (clay coatings visible at the thin sections), indicating slower sedimentation and a longer period of sedimentary quiescence.

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