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Potentials of reconstructing the formation and transformation of slope deposits by the use of soil micromorphology

Susann Müller and Heinrich Thiemeyer

Goethe University Frankfurt/Main, Institute of Physical Geography, Frankfurt/Main, Germany
(susann.mueller@em.uni-frankfurt.de)

Pleistocene periglacial slope deposits were studied in the Spessart mountains (central Ger-many). The standard research methodology was supplemented by soil micromorphology. Thin section analyses are providing new possibilities for reconstructing the formation of slope deposits.
Three periglacial cover beds of Late Pleistocene age constitute the parent material of the studied soils: The “basal layer” consisting of frost-shattered downslope dislocated bedrock material and two layers containing additionally considerable amounts of decalcified loess (“intermediate layer” and “upper layer”). The slope deposits were formed in periglacial envi-ronmental conditions by a multiplicity of abreast and consecutively acting processes (e.g. solifluction, cryoturbation, aeolian processes, aquatic denudation). These loose rock covers are layers in the sense of geologic-sedimentological forming rather than pedogenetic hori-zons.
In addition to the sampling for standard analyses (e.g. grain size distribution, pH-values, heavy mineral analysis), undisturbed soil samples were taken from each horizon for thin sec-tion preparation, description and interpretation.
The lower part of the upper layer shows clay coatings which are attributed to recent illuviation processes. Moreover, it contains aggregates of clayey material embedded in a silty ground-mass. This material is probably inherited from the underlying intermediate layer consisting of two groundmass types: The silty groundmass type represents the great amount of loess in the slope deposit. The second groundmass type, clayey with included silt-sized grains, is mostly recognisable in forms of separated aggregates. Additionally, fractured clay coatings occur in both groundmass types. We conclude that these fragments are part of reworked ma-terial of a palaeosoil instead of preserved in-situ soil material in the intermediate layer. Thus, the formation of this palaeosoil must have taken place in a period between the development of the basal and the intermediate layer when stable slope conditions allowed pedogenesis. However, a precise chronological classification beyond this relative stratigraphy has not yet been worked out because of general dating problems of periglacial slope deposits. Only the upper layer can be classified to the Younger Dryas because of its content of indicative min-erals from the Allerød Laacher See-Eruption. There is a lack of datings yet for the intermedi-ate layer and the basal layer as well.
The content of reworked clayey palaeosoil material is masked by recent clay illuviation in the soil profile. The two types of clay can reliably distinguished only by thin section analysis. Therefore micromorphology advances the understanding of both, slope deposits and soil formation.
Additionally, transformation processes of slope deposits like bioturbation can be recognised in the thin sections as well as various types of microstructures supporting the differentiation between colluvial sediments and pleistocene periglacial slope deposits.