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Reconstruction of multiphase Late Glacial/Holocene Soil Formation by integrated Luminescence Dating and Micromorphology - a Case Study from the southern Taunus Foreland, Germany

P. Kühn (1) and A. Hilgers (2)

(1) University of Giessen, Institute of Soil Science and Soil Conservation, Germany, email@address: peter.kuehn@agrar.uni-giessen.de / Phone: +49 641 99 37112 / Fax: +49 641 99 37109

(2) University of Cologne, Department of Geography; Germany, email@address: a.hilgers@uni-koeln.de / Phone: +49 221 470 6667 / Fax: +49 221 470 4917

On a quarry southeast of Wiesbaden (Hesse, Germany), SEMMEL (1995) described a doline filled with loess and colluvial deposits. He reported the remnant of a haplic Luvisol (FAO 1998) that is believed to have developed during the Late Glacial in the loess of the last glacial maximum. The former Luvisol was truncated and fossilized by the formation of three different colluvial deposits about 320 cm thick in total, in which different phases of soil forming processes had taken place. This profile has been recognized as an unique Late Glacial / Holocene soil profile in Central Europe. To clarify the alternating phases of sedimentation and pedogenesis that led to the formation of this soil profile, sampling for both micromorphology and OSL-dating (optically stimulated luminescence) were carried out simultaneously.

The results of both methods confirm the presumption of SEMMEL (2001: 113) that the buried 4Btb and 4 Btwb horizons were formed in the Late Glacial (HILGERS et al. 2003, KÜHN 2003). The micromorphological results of KÜHN (2003) suggest that the base of the profile starts with a weakly developed Late Glacial remnant of a chernozem (4Ahb?), which was not completely changed by the following Luvisol formation. The loess was deposited in the transition from the Last Glacial Maximum to the Late Glacial (12-18 ka, DD8 –DD9). Two phases of autochthonous clay illuviation formed the 4 Btb and 4 Btwb horizons. Only few clay coatings can be attributed to

illuviation processes from the sediments above: in the Cw horizons mainly fragments of clay coatings occur but only few undisturbed clay coatings. The features of clay illuviation are best expressed in the 3 BtbAhb and 4 Btb horizons. The deposition ages of 6.5 to 11.4 ka (DD6, DD4) of the oldest colluvial sediments support the assumption of the Late Glacial/Early Holocene clay illuviation as well as the occurrence of volcanic minerals of the Laacher See Tephra association, which firstly occur in the 3Cw2 horizons but not in the loess of sedimentation phase 4. BAALES et al. (2002) give a weighted mean age of the onset of the Laacher See eruption of 11062 ± 11 ^{14}C yr B.P.

In the oldest colluvial sediments a Chernozem (3 BtAhb) was formed from the Boreal to the Atlantic with degradation features (clay illuviation). These results are in good accordance with the general pedogenic concept of a Boreal Chernozem formation and its degradation with the beginning of the Atlantic period (ZAKOSEK 1962). After the deposition of a humic colluvium clay illuviation processes continued during the Atlantic and Sub-Boreal (DD3: regeneration: 5.3-7.5 ka, additive: 5.9-8.6 ka). This led to the formation of a Bt horizon (2 Bt) which is similar to the Bt horizons of the haplic Luvisols in the surrounding area. In the basal layer of the youngest colluvial deposit (DD2, DD1: 3-7 ka), fragments of clay coatings occur which correspond to Bt horizons in the catchment of the doline at that time. From the occurrence of few fragments of clay coatings in the upper meter and the presence of a calcareous deposit within the uppermost 20 cm can be concluded subsequent erosion of calcareous C horizons of the doline catchment. The development of the haplic Luvisol in the youngest colluvial deposits is very weak according to micromorphological evidence. The micromorphological and geochronological results provide the following model of the alternating sedimentation and soil formation phases.

References

BAALES, M., JÖRIS, O., STREET, M., BITMANN, F., WENINGER, B., WIETHOLD, J., 2002. Impact of the Late Glacial eruption of the Laacher See volcano, central Rhineland, Germany. - Quaternary Research. 58: 273-288.

FAO, 1998. World Reference Base for Soil Resources. FAO, World Soil Resources Report, 84. Rome.

HILGERS, A., POETSCH, T. & SEMMEL, A. 2003. Jungpleistozäne und holozäne Böden und Boden-verlagerungen - ein Beispiel aus dem Taunusvorland bei Wiesbaden. – Geol. Jb. Hessen, 130: 61-71.

KÜHN, P. 2003. Spätglaziale und holozäne Lessivégenese auf jungweichselzeitlichen Sedimenten Deutschlands. - Greifswalder Geogr. Arb., 28; 167 pp.

SEMMEL, A. 1995. Die quartären Deckschichten im Dyckerhoff-Steinbruch am

Kinzenberg westlich Wiesbaden-Erbenheim. – Geol. Jb. Hessen, 123: 133-137.

SEMMEL, A. 2001. Zum oberflächennahen Untergrund entlang der ICE-Trasse Köln/Rhein-Main im Taunusvorland – Geol. Jb. Hessen, 128: 107-114.

ZAKOSEK, H. 1962. Zur Genese und Gliederung der Steppenböden im nördlichen Oberrheintal. – Abh. hess. L.-Amt Bodenforsch., 37; 46 pp.