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Distribution patterns, properties and ages of Pleistocene periglacial slope deposits in the eastern Rhenish Massif

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Pleistocene periglacial slope deposits (PPSD) cover almost continuously the low mountain areas of Germany. They are interpreted as the result of frost weathering, gelisolifluction, cryoturbation, meltwater outwash processes and loess incorporation. Four types of PPSD are distinguished in the German classification system: A Basal Layer consists entirely of debris of the underlying rock, which it usually directly overlies. It occurs in almost every relief position, and several Basal Layers may have formed on top of each other. An Intermediate Layer contains varying proportions of loess. It is only found in relief positions favourable for loess accumulation and preservation. Its position within a vertical sequence of PPSD is usually on top of a Basal Layer. An Upper Layer consists of a mixture of rock debris and loess, and contains generally a lower amount of loess than a possibly underlying Intermediate Layer. It has a remarkably steady thickness of around 50 cm, as confirmed in many studies. The Top Layer is mostly restricted to the surroundings of outcrops of particularly resistant rock in higher regions and mainly consists of rock debris.

PPSD were investigated in the eastern Westerwald area, at the eastern edge of the Rhenish Massif, Germany. Parent rock, exposition, position and shape of slope were expected to be factors influencing the occurrence, thickness and properties of the different types of PPSD. Therefore, profiles were excavated on the main rock types in the area, which are shale, quartzite and diabase. On each rock type, profiles were studied along catenas in NW, SW, SE and NE exposition, each catena including a profile in upper, middle and footslope position.

In upper slope positions on shale an Upper Layer covers directly the rock, independent of exposition. In downslope direction, still above the mid slope profiles, a Basal Layer appears between the Upper Layer and the rock.

In upper slope positions on quartzite, a Basal Layer is already present between an Upper Layer and the rock in all expositions. The total thickness of the PPSD sequence on quartzite grows downslope, mainly due to an increasing thickness of the Basal Layer. In addition, Intermediate Layers contribute to the thickness of the PPSD profile on the lower slopes in SE- and NE-exposition. This can be partly explained by enhanced loess sedimentation on the leeward slopes in an area of predominantly westerly winds. Additionally, sediments were best preserved on E slopes, because thaw-processes leading to remobilization and removal of formerly deposited sediments were less intensive there.

In most of the upper slope profiles on diabase, an Upper Layer covers directly the rock. A Basal Layer starts between the upper and middle slope sites. In SE exposition, an Intermediate Layer appears already on the mid slope. The total thickness of the PPSD sequence reaches its maximum on the footslope, where several Basal Layers may occur on top of one another.

With regard to the formation time of the different layers, it is assumed that Basal and Intermediate Layers could have formed during several cold periods of the Pleistocene. It is however most likely that pre-Wurmian layers were preserved only on footslopes, where several Basal Layers occur on top of each other. All other layers are probably of Wurmian age, because the steep slopes did not allow preservation of older sediments (in contrast to areas of Tertiary peneplains in the central Rhenish Massif). Infrared stimulated luminescence datings confirm the assumption that the Upper Layer was subject to gelisolifluction for the last time during the Younger Dryas, and that the remarkably constant thickness of about 50 cm of the Upper Layer represents the thickness of the active layer at that time.