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Soil formation and mass fluxes in cover beds of the Kowarski Grzbiet (eastern Karkonosze Mountains)

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The Karkonosze Mountains are a Hercynian mid-mountain range located in the Central Europe, at the border of Poland and the Czech Republic. Although granite is the dominant geology in the western and middle part of the mountain belt, the eastern part consists mainly of different types of the schists and gneiss. Small mountain glaciers that developed during the late Weichselian, periglacial conditions as well as an intense activity of slope processes during the Atlantic and at the Atlantic/Sub-Boreal transition have shaped the landscape during the Quaternary and formed sequences of cover beds which became the main parent material of soils.
In our study we focused on the eastern, metamorphic part that is characterised by mica schist, amphibole schist and gneiss. A transect was studied along the slope of Skalny Stol (1281 m as.l) of the Kowarski Grzbiet having NW exposition. This transect included 5 profiles along a slope section from 1269 m asl to 1142 m asl. In all profiles, at least three layers could be distinguished: (a) a basal layer formed probably in the Younger Dryas with features of solifluction – found in almost every relief position (b) a transition periglacial zone, interpreted as a result of cryoturbation, and (c) a top cover having almost no rock fragments and most likely relatively young (Holocene) appeared in all profiles. However, in some soils, colluvial material was found in the topsoil. Within the stony cover bed, at the flat plateaus and in the upper section of slope Hyperskeletic and Skeletic Podzols have developed (the basal and transition layer contained amphibole schist and the top layer only mica schist). In the middle and lower slope position where gelisolifluction layers were detected, colluvial material was superimposed and as a consequence Cambisols and Stagnosols have developed. Consequently, the soil distribution pattern in this landscape is strongly affected by the arrangement of the slope deposits.
Sediments having a different age and origin should reflect different weathering mechanisms and clay minerals formation and transformation processes. To check this hypothesis we: (i) identified clay minerals using qualitative and semi-quantitative methods, (ii) measured total element content in fine earth using X-ray fluorescence, (iii) calculated weathering indexes such as the (K+Ca)/Ti ratio, indexes A and B and (iv) measured erosion rates using 10Be in soils. These measurements confirmed the complex soil formation characteristics of the soils and demonstrated the highly dynamic system of slope deposits (in terms of matter fluxes).