



Detailed investigation of a red clay soil profile formed on limestone in the Bükk Mountains (NE Hungary)

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According to leading international research mediterranean red soils are mostly regarded as residual soils which are the products of the in situ dissolution of limestone, with possible influencing effects of eolian sediments. According to the Hungarian scientific literature the possible origin and formation of these soils could be also quite different with different explanations: (1) besides of limestone and dolomite the accompanying red clay in the parent rock takes also part in the formation of these soils; (2) these relict soils were formed on the red clay, found in the cracks and cavities of rocks; (3) red soils are the products of the weathering and soil formation processes of earlier geological periods.

The aim of the present research was the detailed investigation of a representative red clay soil profile found over the limestone of the Bükk Mountains. Results could provide information on the pedogenesis of the red clay soils and on their relationship with the parent rock.

Both disturbed- and undisturbed sampling was applied. Measured parameters were: pH (aqueous, and KCl), CaCO₃ (Scheibler calcimeter), grain size distribution, content of organic matter, mineralogical composition (by thermal analysis, X-ray powder diffraction and micromorphology), elemental analysis (by electron microscopy and ICP-OES). These methods are suitable for the qualitative and quantitative assessment of the hitherto unknown mineralogy (silicate composition) of the samples, which provides new data on soil formation and on the influence of the parent rock and of other parameters/sources on soil development.

X-ray diffraction measurements and thermal analyses revealed that the most abundant soil mineral was quartz and not calcite. Besides of quartz, clay minerals, feldspars and oxide-hydroxides were also characteristic to the samples. The X-ray diffraction analysis of the parent rock material confirmed that it was composed of pure calcite (99.5%) with minor amounts of quartz and silicates (0.5%). The investigated red clay soil contained considerable amounts of silicates, which cannot be the product of the weathering of limestone parent rock solely. These findings were also confirmed by the results of the micromorphological investigations as well as by the elemental analyses. The investigated soil profile was located at top position, and not in a dolina or in the crack of limestone or at the bottom of a slope (as usual for red clays). Besides of high amounts of quartz and kaolinite, montmorillonite, illite and aluminosilicates as well as traces of rutile were also indicated. According to the presence of the minerals, indicating former tropical/subtropical climate and according to the characteristics of soil formation it was concluded that the investigated soil was presumably developed on such a red clay which had formed from the residues of eolian (glacial loam) as well as from miocene rhyolite tuff sediments. Limestone could only serve as the bedrock, and as such no weathering of it could have affected the soil formation processes.

The research was made in frame of the „EFOP-3.6.1-16-2016-00018 – Improving the role of research+development+innovation in the higher education through institutional developments assisting intelligent specialization in Sopron and Szombathely”.