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Cave-soils, the soils forming underneath the surface

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Limestone cave sediments of the Bükk-mountain in the North-Eastern part of Hungary were described, analysed and classified using WRB soil classification system. Cave sediments can be considered as soils, partly on the basis of their origin, partly of processes taking place in them. Based on the results, it can be concluded that cave soils are often shallow, lying directly above the continuous rock. In general they are layered, with clearly distinct layers of alluvial origin. Their organic matter content depends on the nature of the sediment. They often contain considerable quantities of undecomposed organic sediment, acting as the basis for very intensive soil life, which can be detected in the soil structure and may in some cases result in Vermic characteristics. The texture is very variable, ranging from clay to rough gravelly sand.
Almost 100% of the soils are calcareous, the lime content is of secondary origin and its amount is at least 2%. Therefore, the pH values fluctuate from neutral to 8.5, mostly having a value around 8. In rare cases gley formation also occurs, especially on poorly drained areas, where there is no water flow to refresh the dissolved oxygen content. In the “oxy-aquic” state, characterized by high dissolved oxygen content, the iron is not reduced, so gley formation is not induced.
From pedological point of view, cave sediments show a very diverse picture. Besides sedimentary layers, numerous soil formation processes can be detected, which can be considered analogue with surface processes, therefore they definitely need to be classified as soils. According to all these, in the Hungarian classification cave soils are primarily classified as alluvial, colluvial or lithomorphic soils. The WRB classification places them mainly in the Fluvisol and Leptosol Reference Groups, and according to the soils examined in the present work, they can be described with the Leptic (Epileptic), Fluvic (in rare cases Colluvic), Vermic, Calcaric, Eutric, Gleyic, or possibly with the Mollic or Rhodic qualifiers.
Despite the relatively small number of analysed and reference samples during the mineralogical examinations, we can say that clear trends could be observed in the cave sediments. Due to the present and historical heterogeneity of the catchment area, it is difficult to associate the samples with surface soils. It could be established, however, that approximately half of the minerals in the cave soils are quartz, with ratios of 38–73% depending on the texture. Smectite-vermiculite associations were dominant in the clay mineral fraction, making up 80–90% of the whole fraction in seven of the eight samples. The only exception was the Mexikó-2 sample, where relatively fresh, unweathered, unleached illite-muscovite is mixed with intensively weathered kaolinite. The explanation for this probably comes from the different origin of the parent materials deposited on each other, either over time or during sampling. This theory needs to be confirmed by further detailed analysis.

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