CLAY MINERALS IN LAND MOVEMENTS AT HOLLÓHÁZA, TOKAJ MOUNTAINS

ZELENKA, T.,[1] KOVÁCS-PÁLFFY, P.,[2] TRAUBERT, N.[3]

[1] Hungarian Geological Survey [Magyar Geológiai Szolgálat], Stefánia út 14., Budapest, 1143, Hungary
[2] Geological Institute of Hungary [Magyar Állami Földtani Intézet], Stefánia út 14., Budapest, 1143, Hungary
[3] Keviterv Plusz Ltd., Katalin u. 1., Miskolc, 3527, Hungary

Hollóháza is in the northeastern part of Hungary, in the Tokaj Mountains region neighbouring Slovakia. This is a potential area for land movements which derives from the characteristic geological structure of the mountains. There were several unfortunate examples in the recent past for showing the real nature of this phenomenon.

The region of the Tokaj Mountains used to be the part of a former volcanic archipelago, constantly sinking in the Middle-Upper Miocene between fault lines stretching to Hernád and Rongyva streams (NE–SW, NW–SE). Volcanism was calc-alkalic in nature which, in two cycles, resulted in rhyolitic-rhyolitic tuff an then andesitic-dacitic and basaltic-andesitic lava and debris during the Badenian and Sarmatian stages.

Hollóháza is surrounded by the ring-shaped wrecks of the former trenches of a Miocene volcanic caldera, 4–6 kms in diameter. These peaks form the watershed rising over the village by 250–300 m at 500–600 m. The inner area is about 20 km^2, into which approx. 12 million m^3 water quantity filters and runs down to the catchment area of Török stream every year on average out of 600–650 mm rainfall. The rainfall flows towards the village from all directions down the steep slopes, partly as surface water flows and water from the aquifers, partly as fissure water.

The village settled down in the natural cirque of the former caldera. Here rhyolite tuff and clayey sea sediments of various thickness (10–20 m) and volumes (< 20 km^2) are settled on the base andesite. On their border, wells from aquifers are sprung on the valley bottom. The cirque-like depression is divided into two from northwest to southeast by a huge tectonic valley showing lateral movement (Török stream valley). In the southeast it breaks through the trenches of the former caldera like a gorge. From east and west towards the tectonic valley clay and rhyolite tuff layers lean with 10–25%.

The rhyolite tuff with different grain sizes originally fallen into water and alternating with Sarmatian sea clays has been strongly become clayey but the covering humus has a high clay mineral content, too. These rocks swell due to getting in contact with water and slides happen to occur on their surfaces. Andesitic rocks in the basement also became clay mineralised, strongly contributing to the occurrence of slumps.

These geological formation cause different land movements in size due to the high swelling clay mineral content. 11 potential hazardous areas can be delineated in Hollóháza, from which the most dangerous are the southern side of Nagy Hrabó Mount (1.5 million m^3 moved mass), surroundings of the Roman Catholic church (0.3 million m^3) and surroundings of Attila József residential area (2.5 million m^3).

Different slides can be slumps, earth sinks and glides morphologically causing serious damages to buildings, road and public utility networks. Inside the village, at the upper part of Rákóczi Road and near the Porcelain Factory land movements are not present because these are settled on massive lava rocks. Other parts of the village are settled on formations consisiting of strongly clay-minerals-bearing Sarmatian clay alternating with rhyolite tuff which is slide hazardous to a greater extent due to the swelling ability of clay minerals and plays an important role in the damaging changes of the surface.

Table 1: The swelling clay mineral content of rocks in %

Formation	Montmorillonite	Illite-montmorillonite
Humus	29 (20–43)	4 (0–5)
Sea sandy clay	24 (12–50)	4 (0–6)
Rhyolite tuff	52 (34–81)	1 (0–6)
Andesite	74 (58–91)	–