Geological and geophysical investigation of Havranická jaskyňa cave in Malé Karpaty Mts., Slovakia

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The Havranická jaskyňa cave (174 m long, -50 m deep) is situated in Malé Karpaty Mts., approximately 1 km northwest from town Smolenice. The entrance is located only few meters from the top of Havrania skala (599 m a. s. l.), which is part of hill Havranica (717 m a. s. l.). This area is include to the Považský Nappe, which is part of Hronic Nappe system (Polák et al., 2011). Within the karst regionalization we incorporating it into the Plavecký Karst Area (Stankoviansky, 1974).

The cave is mainly built of dark gray to black, layered Guttenstein Limestones with Middle Triassic age (Polák et al., 2011). However, it is not excluded, that to the cave system the Guttenstein Dolomites interfere. During the research it was taken 5 samples of limestones. These samples were subjected to XRD analysis and also were prepared thin sections. In three samples we observed in thin sections crystals of dolomite, and the XRD analysis confirmed the occurrence of partially dolomitizated limestones and dolomites. These three samples were taken from Zbojnická hall (-36 m), Michal's chamber (-40 m) and 5 meters above Michal's chamber (-45 m).

The cave was formed to subvertical discontinuities of N-S direction, which can be seen also at the surface around the cave entrance. Fractures based on these directions are characteristic of the whole area around the cave. At the inception of the cave origin was another important system of discontinuities - and areas bedding to bow northwards with inclination 36-76°. N-S subvertical direction discontinuities are not only dominating of Plavecká karst; they often occur in other karst areas of the Malé Karpaty Mts. The direction of cave passages have connection with N-S affinity to stab NW-SE form pair system faults. During the Middle Miocen compression was these fault reactivated in the form of slip faults. It is also a prerequisite for their reactivation in Plio-Quarternary stage (Marko, 2012). On these discontinuities occurred to karsting - dissolution of carbonate by atmospheric precipitation, and these activity was followed by the particularly corrosive activity. At present, we cannot find shapes created by erosion. This does not mean, that you do not have to located in the past. They could succumb to the corrosive activities of water percolating, or destruction of the walls related to younger tectonic processes. Examples of such processes can be the Zbojnická hall.

Below this hall Šmída (2010) assumes a greater corrosion hall, after which the neotectonic and gravitational movements collapsing. As a result of this event is the shape-wedge profile of Zbojnická hall. The cave system continues to the north, and the character of passages becomes more vertical (70-80°).

Geophysical measurements on this area were made in 2009 and 2010 (Lačný et al., 2012). By electrical resistance tomography (ERT) we want to find possible continuations of cave passages. The ERT method allows to obtain a sufficient density of data for further details of 2D and 3D modelling (Gambetta, 2009). On the base of these datas we can modelled a 3D model, where we add a polygonal traction points that show points the walls of cave. The latest discoveries in the cave are bound to a steep passages. Based on the new places we assume, that the digging depth of discontinuities is very significant. The deepest point of the cave is currently -50 m, and the speleologists continued into excavation works in vertical passages. According to the model, in the places of the greatest resistance is fiting with the polygonal traction points. These geophysical measurements confirmed the continuation into the deepest part. The depth range of 3D model is more than 70 m and the high resistance place are continued deeper. It means, the cave system will be at least -70 m deep. For relatively short cave system (174 m) is that depth exceptional, and it makes a karst phenomenon of Havranická jaskyňa cave in Malé Karpaty Mts.

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