

**Thermal waters in the Villány region (Hungary) – hydraulic and geochemical interplay
of karst and sedimentary basin
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In the Villány thermal karst area (Hungary) the outcropping Mesozoic carbonates and their subsurface continuation covered by young sediments in the adjacent basin basement form a thick (up to 1500 m) karst reservoir. Majority of the natural springs is characterized by lukewarm waters (20-26°C) with 712-930 mg l TDS in the area. Natural thermal water discharge (52-62°C, 1100 mg l TDS) occurred only in Harkány, as a marshland. According to previous studies, in the Villány Hills on the surface of bare carbonates infiltrating meteoric waters can maintain only the lukewarm springs' discharge, i.e. there might be other water components (especially in case of the sulphuric thermal waters in Harkány). Previous studies suggested e.g. active tectonics-induced mantle fluid contribution or the role of the sedimentary basin. Some caves in the area, discovered by human activity (quarrying), are characterized by phenomena related to thermal waters- tectonically controlled maze-like pattern, morphological features such as spherical niches, and typical minerals such as huntite, aragonite, and calcite as cave popcorn. Some of the caves are connected to thermal waters even today. Different theories exist to explain the formation of these caves and their mineral association, such as hydrothermal activity induced by Neogene basaltic volcanism, sulphuric speleogenesis, or the "classical" mixing corrosion. The thermal waters and the caves were hitherto investigated separately. However, all these phenomena belong to one single system, a hypogenic karst system and they can be evaluated only if their context is understood, i.e. if their common cause is revealed- the pattern of groundwater flow and its thermal and geochemical characteristics. The aims of the present study are i) to evaluate the groundwater flow system based on measured hydraulic data, ii) to characterize the geochemical composition of the waters, using natural tracers to identify different fluid components, and iii) to evaluate the cave forming processes. The research was supported by the National Research, Development and Innovation Office – NKFIH, PD116227 project.

