Flow system analysis of the Villány karst region (Hungary) using hydraulic methods and natural tracers

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ABSTRACT
The outcropping Mesozoic carbonates and their subsurface extension covered by young sediments in the adjacent basin basement form a thick (up to 1700 m) karst reservoir in the Villány Hills (South Hungary). The area is characterized by natural thermal water discharge at the boundary of outcropping carbonates and an adjacent sedimentary basin. These regional discharge areas are favourable sites for hypogenic cave development as well. Some caves here are characterized by phenomena related to thermal waters: tectonically controlled maze-like patterns, morphological features (spherical niches), and minerals (huntite, aragonite, calcite as cave popcorns). Some of the caves are connected to thermal waters even today. The groundwater flow system in the Villány area is characterized as a gravity and temperature (density)-difference driven flow system based on earlier research, where infiltrating meteoric waters circulate on the surface of bare carbonates and discharge in karst springs with different temperatures. Lukewarm springs dominate throughout the area, with natural thermal water discharge occurring only in Harkány, as a marshland. Recent studies emphasize the effect of fluids from the adjacent sedimentary basin on the karst reservoir.
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 in the Villány thermal karst area are 1) to evaluate the groundwater flow system based on measured hydraulic data, 2) to characterize the geochemical composition of the waters, using natural tracers to identify different fluid components, and 3) to evaluate the cave forming processes.
The National Research, Development and Innovation Fund has provided financial support to the project under the grant agreement no. PD 116227.

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