70 - GROUNDWATER FLOW AND TEMPERATURE FIELD SIMULATIONS IN THE UNCONFINED CARBONATE SYSTEM OF THE TRANSDANUBIAN RANGE, HUNGARY

Ádám Tóth
Department of Physical and Applied Geology, Eötvös Lóránd University, Budapest, Hungary
Judit Mádl-Szőnyi
Department of Physical and Applied Geology, Eötvös Lóránd University, Budapest, Hungary

Gravity-driven regional flow systems of carbonate regions are not well-understood even though their water, geothermal and petroleum resources have great economic importance (Goldscheider et al. 2010, Mádl-Szőnyi 2015). The goal of this study was to find correlation between springs as natural discharge features, structures and flow systems on basin-scale by numerical simulation in the SW part of the Transdanubian Range, Hungary. Scenario modelling was carried out with step by step simulations to follow the effect of topography (linear/sinusoidal), hydrostratigraphy, structures and heat flux on the steady-state flow pattern and temperature distribution applying Comsol Multiphysics.

The Transdanubian Range is mainly built up of Triassic and Early Jurassic carbonates. Beside carbonates Paleozoic metamorphic and Permian-Cretaceous sedimentary rocks can be found in the region. The carbonates are karstified and they are influenced by faults and folds (Haas 2001). There are ~500 springs in the SW Transdanubian Range and they were grouped by multidimensional data analysis and ranked into local and intermediate flow systems (Tóth et al. 2014).

The scenario modelling for the unconfined region could prove the existence and operation of gravity-driven flow systems. Groundwater flow is dominantly lateral due to higher hydraulic conductivity of carbonates compared to siliciclastic formations. However, the geometry and hydrostratigraphy of the basin could modify the flow, e.g. the folded structure efficiently restricts through-flow. Shallow basin and low heat flux can result only in slightly elevated temperature toward the main discharge zone where heat accumulation can be observed only in the deepest part. A low permeability thrust fault causes head drop at the footwall but there is also through-flow across it. These findings are in good agreement with the proposed model of Mádl-Szőnyi (2015).