



Characterization of the regional groundwater flow system in South Transdanubia (Hungary)

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In South Transdanubia (Hungary) there are remarkable geothermal and hydrocarbon resources. The area is also characterized by natural thermal water discharge at the boundary of outcropping carbonate hills and adjacent sedimentary basin. These regional discharge areas are favourable sites of hypogenic caves as well. These geofluid systems and groundwater related phenomena are usually investigated separately and their interactions are just neglected. The aim of this study was to give all these resources and phenomena a common framework applying the dynamic system approach and complete the regional hydraulic and hydro-geochemical assessment of the area. During the measured data based hydraulic assessment pressure-elevation ($p(z)$) profiles, tomographic fluid potential maps and hydraulic cross sections had been constructed to determine the vertical and horizontal fluid flow conditions. The hydrochemical study (concentration- and temperature-elevation profiles, concentration map series) helped to understand the geofluid systems more accurately.

As a result, two kinds of fluid flow systems could be identified in the study area, namely gravitational flow systems superimposed on an overpressured flow system. In the gravitational flow systems down to about $z=(-500)$ m a.s.l. recharge (downward flow), midline (lateral flow) and discharge (upward flow) areas were identified. Between about $z=(-500)-(-1500)$ m a.s.l. horizontal and upward flows become dominant everywhere. The regional horizontal fluid flow direction tends toward S-SE. In the overpressured flow system upward flows dominate, while fluids are driven from the deeper sub-basins towards their margins, i.e. northward. The overpressure dissipates between (-2000) and (-1500) m a.s.l. Based on the general hydrochemical analysis, deep regions represent $\text{Na}^+-\text{Ca}^{2+}-\text{Cl}^- - \text{SO}_4^{2-}$ hydrochemical facies, while the shallow part of the basin is dominated by $\text{Ca}^{2+}-\text{Na}^+-\text{HCO}_3^-$. The transition of the gravitational and overpressured flow systems is reflected also by the mixed geochemical characters of the waters.

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