Geothermal potential assessment of the carbonate Hungarian Transdanubian Range

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ABSTRACT
For economic geothermal production, natural reservoirs with suitable hydraulic parameters, and a favorable quantity of heat and production fluids are necessary. These parameters need to be investigated in the reconnaissance phase of fluid-based geothermal exploration. Generally, observation wells are used to identify the subsurface conditions and evaluate the preliminary geothermal potential. Without proper borehole information, the evaluation of reservoirs, especially heat and fluid fluxes are quite complicated, almost impossible.
In turn, springs, which are natural discharge points of flow systems, can reflect the subsurface flow and temperature conditions, therefore they can provide information about the groundwater flow pattern. Springs in the Transdanubian Range were grouped by multidimensional data analysis based on elevations of spring outlets, volume discharge, temperature and chloride ion content to characterize the subsurface temperature conditions and flow systems.
The Transdanubian Range, situated in Central Hungary, is mainly built up of Mesozoic confined and unconfined carbonates with hydraulic conductivities of 10^{-6}–10^{-5} m/s. Therefore, there is a regional aquifer which can be characterized by sufficient hydraulic parameters. Joint interpretation of springs and numerical simulations revealed that at the unconfined parts the highest temperature is only ~30 °C. Consequently, the geothermal investment in unconfined regions would not be economic in spite of 1000–m–thick carbonate with suitable hydraulic parameters.
In the Budapest region the position of springs is complex. In the unconfined part, cold karstwater can be found but under the siliciclastic cover, a considerable heat accumulation occurs in carbonates of at least 100 °C. In this adjoining confined and unconfined area conditions regarding reservoir, fluid and heat are all suitable for economic geothermal production.
The reinterpreted conclusion of the previous studies and our study is that the siliciclastic cover is responsible for heat accumulation in carbonates therefore the position of the unconfined and confined parts is critical for geothermal heat utilization in carbonates.
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