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HyTheC - Multidisciplinary approach to conceptual modelling of hydrothermal systems in Croatia

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The increase in thermal water utilisation is foreseen by many European and Croatian strategic documents regulating energetics, tourism, environmental protection and sustainable development. Croatian Geological Survey wishes to establish a multidisciplinary group for hydrothermal systems research which will contribute to responsible geothermal development in our country through a 5-year research project HyTheC which started in 2020.

Pannonian part of Croatia has favourable geothermal characteristics and natural thermal water springs emerge at two dozen localities, with temperatures up to 65 °C. These waters have been used for millennia, and in the past fifty years they are a basis for the development of tourism and health care centres which use the thermal water resource for heating, therapy and recreation (Borović & Marković, 2015). As their water demand increased, higher quantities were abstracted and additional intake structures and wells were constructed.

Thermal springs are part of hydrothermal systems which include: recharge areas in the mountainous hinterlands of the springs; geothermal aquifers - in Croatia mostly fractured and karstified Mesozoic carbonate rocks (Borović et al., 2016) - in which water resides and gets heated due to heat flow from the Earth; and discharge areas in places with favourable structural characteristics of higher permeability. The continuous functioning of such systems depends on a delicate balance between groundwater flow velocities, precipitation/dissolution processes and structural framework.

In order to maintain that balance and use thermal water resources in a sustainable manner, a system-level understanding is required. Multidisciplinary methodology (structural geology, hydrogeology, geothermal, hydrogeochemical and geophysical research and remote sensing) will be used to construct conceptual models of systems, perform 3D geological modelling, hydrogeological and thermal parametrisation of the geological units involved in the thermal fluid flow, and conduct numerical simulations of system functioning in undisturbed conditions and with different extraction scenarios.

This methodology will be tested in three pilot areas in Croatia where thermal water is being utilized (Daruvar, Hrvatsko zagorje and Topusko). These three areas have significantly different levels of initial data availability and it shall therefore be determined which methodology and order of application of different methods should be applied while researching the systems with

considerable existing data, medium amount of data and very scarce data, respectively.

Keywords : hydrothermal system, natural thermal spring, multidisciplinary research, Croatia

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