



The AIG10 drilling project (Northern Peloponnesus, Greece): From geological investigations, geophysical logging, and hydrogeological testing to modelling

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The investigations in this DFG-ICDP-EU project framework are aimed at the exploration of the thermo-hydraulic conditions in the area near Aigion, northern Peloponnesus, Greece. The project comprises geologic-tectonic mapping, the performance of hydraulic borehole experiments and geophysical well logging, as well as the modelling of a regional 2-D cross section. The work interacts with the EU Corinth Rift Laboratory project and its subprojects which focus on the investigation of fault mechanics and the relationship with fluid flow, fluid chemistry, fluid pressure, stress- and strain fields as well as seismicity.

The borehole, drilled to intersect the Aigion fault at depth, provided the opportunity for a direct access to the geological formations and to an active fault as well as for evaluating by a series of hydraulic tests the in-situ hydrogeological conditions. Knowledge of the subsurface hydraulics is the basis to evaluate the mode of subsurface heat transfer, which is a prerequisite for determining the terrestrial heat flow in the area.

Geologically, the area is part of the Olonos-Pindos tectonic nappe, which is overthrust on the Tripolitza unit during the Alpine orogeny. Recognition of stratification encountered in the AIG10 borehole is based on field investigations, online analysis of well, core descriptions, monitoring of drilling parameters, as well as a preliminary geophysical well-log interpretation. The borehole has crossed at least one thrust-fault zone and a major normal fault zone at 760 m.

An 80 km² geologic-tectonic map (scale 1:10 000) with an 22 km N-S cross section for developing a conceptual model and defining the model architecture was developed.

Hydrochemical analyses of 89 springs and pumping stations as well as six pumping tests are available for calibrating and verifying the conceptual model. Two open-hole pumping tests and one artesian production test were performed during the drilling activities of the AIG10 borehole. Below the fault zone, pressure and flux increased suggesting karstic water-flow conditions. A water-pressure difference of more than 0.5 MPa between the hanging wall and the footwall provides evidence that the Aigion fault zone acts as an impervious zone. A preliminary conceptual hydrogeological model, containing flow parameters and flow paths is developed

The experimental data and the conceptual hydrogeological model are the basis for a numerical 2-D model of coupled heat and fluid flow. In this modeling the data from thermal well-logging and the thermal properties of the rocks determined in the laboratory are also incorporated. Using these data, the heat-flow density is calculated from the temperature gradients in depth intervals where the heat transfer is mainly by conduction/diffusion. The modelling will quantify to which amount the supposedly undisturbed heat-flow density in the aquicludes might be affected by the fluid flow in the aquifers and to which amount the heat-flow density needs to be corrected for this effect before using it in 1-D temperature and rheology modeling at crustal scale.