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Open questions on fluid movement in sedimentary basins - a review based on the Oberrheingraben

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Sedimentary basins have been studied for decades mainly because of the interest in oil and gas. Today another interest is the utilization of geothermal energy.
The questions raised in the latter case are always “Where is enough hot water?, What are the quantities? Will the water quality be able to support sustainable reservoir operations”. The answering of these questions requires a very detailed knowledge of the subsurface and/or a very profound knowledge of the relevant processes concerning the fluid movement in the upper crust.
The considered water is meteoric water so it has to seep away than percolate into greater depth where it is heated. Due to numerous drillings in the Rheingraben, we know well that there are hot spots, with an extremely steep geothermal gradient, for instance at Landau or even below Frankfurt. However, which is the driving force for these hot spots? How can we perform measurements to deduce the flow paths? How can we drill exactly into this path of hot water?
Undoubtedly, fracture zones have a decisive relevance. However, even after decades of research on fracture zones the understanding is still limited. Fractures are a very complex result of tectonics, mineral content and fluid rock interactions. Hydrothermal deposits show this nicely.
Geophysical prospecting is a powerful tool for improving the knowledge about the structure of the subsurface. Yet, it needs to be put in context with the geology.
Where there are no drillings available, outcrops have to be studied and the respective rocks have to be measured on a large scale (in numbers and space).
Finally, all available information have to be compiled together and models have to be run in order to understand the relevant processes. These models require the upscaling of data, which have been determined on different scales to the numerical grid-scales, which are typically distinctly larger.