



Exploration of a deep carbonate hydrogeothermal aquifer

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Geothermal energy is an increasing part of the worldwide energy supply. Deep aquifers for hydrogeothermal use must have very high porosities to provide a sufficient flow rate. The exploration of these hydrogeothermal reservoirs have to include all information which helps to predict these areas of high porosity and high permeability: lithology, facies, and structural framework. Therefore exploration techniques known from hydrocarbon exploration are used: 2D and 3D seismic surveys, including log data. A constraint is the amount of exploration costs. By which geophysical means it is possible to build a geological model which predicts the petrophysical parameters with a sufficient high possibility?

There are three geological provinces in Germany with hydrogeothermal potential: the North German Basin, the Upper Rhine Graben, and the Southern German Molasse Basin. Within the Southern German Molasse Basin the hydrogeothermal aquifer comprises carbonate rocks of the Upper Jurassic which were lowered to a depth of approximately 3500 m. The interpretation of a 3D seismic survey shows the distribution of carbonate facies, structural framework, and karst formation. All three aspects are related among each other: faults can facilitate karst formation especially where reefs had been formed. Seismic attributes were used to enhance the visualization of these geologic features. The result is an overall understanding of geologic processes which formed areas of high porosity. In this way the advantage of 3D seismic surveys is obvious. Mapping of these areas can be done also within 3D seismic surveys. The appropriate choice of the seismic method depends on the exploration stage and the extent of the reservoirs. Elongated reservoirs which may be formed by carbonate solution along faults may be explored by 2D seismic lines to lower the costs of a geothermal project.