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Reflection seismic investigations for the Unterhaching geothermal power plant

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The Malm (Upper Jurassic) which is present in most parts of the Southern German / Upper Austrian Molasse basin is a highly-productive aquifer with increasing depths and temperatures from north (Danube river) to south (Alps).

A geothermal power plant projected in Unterhaching/Germany, south of Munich, will generate 3.36 MW of electrical power. Two boreholes (doublet) have developed the Upper Jurassic (Malm) at a depth of approx. 3000 m.

Available seismic profiles were reprocessed with the aim of interpreting the facies and thus the degree of karstification of the Malm. The boreholes lying at the margins of the study area could be tied into a stratigraphic interpretation but could not be used for depth conversion down to top Malm. Facies interpretation within the Malm on the basis of clear lateral changes in seismic signatures indicates that rapid facies changes can be expected. The most prospective areas are those where diffractions (indicators for reef facies and karstification) occur together with low velocities (indicators for large amount of water) and especially fault zones.

As a result of these investigations a deviation was recommended for the first borehole (production well Gt 1) drilled in the Unterhaching project. Fault zones with small throws (decametres) could be identified in lines running to the east and to the north of the borehole. In addition clear diffractions and a low velocity zone were identified on the seismic line. The top Malm was predicted with 3017 m true vertical depth (TVD).

Both the location and the hole deviation for the second (injection) well Gt 2 were

completely planned on the basis of the reprocessing results. A nearly NE-SW striking fault zone was interpreted on two parallel profiles with a fault throw of up to 230 m. The structural interpretation of this fault zone reveals not only one single fault zone but a bundle of at least three fault zones. Top Malm was predicted within a depth interval 2960 m to 3020 m. Regional analysis for the whole area reveal that production rates of 150 l/s with a maximum water drawdown of 500 m can be achieved.

Both boreholes were successful. Top Malm was verified by drilling in 3002 m (Gt 1) and 2978 m (Gt 2) as predicted. Hydraulic tests have proven a maximum water temperature of 123 °C for the first well and about 134 °C for the second well. The clearly higher temperature in the second well is assumed to fluid circulation in a deep-reaching fault system which could be connected.