



Fault analysis as part of urban geothermal exploration in the German Molasse Basin around Munich

Jennifer Ziesch (1), David C. Tanner (1), Sabine Hanstein (2), Hermann Bunes (1), Charlotte M. Krawczyk (3,4), and Rüdiger Thomas (1)

(1) Leibniz Institute for Applied Geophysics, Hannover, Germany (jennifer.ziesch@liag-hannover.de), (2) DMT GmbH & Co.KG - Geo Engineering & Exploration, Essen, Germany (sabine.hanstein@dm-group.com), (3) GFZ German Research Centre for Geosciences, Potsdam, Germany (lotte@gfz-potsdam.de), (4) Technical University of Berlin, Berlin, Germany

Faults play an essential role in geothermal exploration. The prediction of potential fluid pathways in urban Munich has been started with the interpretation of a 3-D seismic survey (170 km²) that was acquired during the winter of 2015/2016 in Munich (Germany) within the Bavarian Molasse Basin. As a part of the research project GeoParaMoL*, we focus on the structural interpretation and retro-deformation analysis to detect sub-seismic structures within the reservoir and overburden. We explore the hydrothermal Malm carbonate reservoir (at a depth of ~3 km) as a source of deep geothermal energy and the overburden of Tertiary Molasse sediments.

The stratigraphic horizons, Top Aquitan, Top Chatt, Top Bausteinschichten, Top Lithothamnien limestone (Top Eocene), Top and Base Malm (Upper Jurassic), together with the detailed interpretation of the faults in the study area are used to construct a 3-D geological model. The study area is characterised by synthetic normal faults that strike parallel to the alpine front. Most major faults were active from Upper Jurassic up to the Miocene. The Munich Fault, which belongs to the Markt-Schwabener Lineament, has a maximum vertical offset of 350 metres in the central part, and contrary to previous interpretation based on 2-D seismic, this fault dies out in the eastern part of the area.

The south-eastern part of the study area is dominated by a very complex fault system. Three faults that were previously detected in a smaller 3-D seismic survey at Unterhaching, to the south of the study area, with strike directions of 25°, 45° and 70° (Lüschen et al. 2014), were followed in to the new 3-D seismic survey interpretation. Particularly noticeable are relay ramps and horst/graben structures. The fault with a strike of 25° ends in three big sinkholes with a maximum vertical offset of 60 metres. We interpret this special structure as fault tip horsetail-structure, which caused a large amount of sub-seismic deformation. Consequently, this area could be characterised by increased fluid flow.

This detailed understanding of the structural development and regional tectonics of the study area will guide the subsequent determination of potential fluid pathways in the new 3-D subsurface model of urban Munich.

This project is funded by the Federal Ministry for Economic Affairs and Energy (BMWi).

Lüschen, E., Wolfgramm, M., Fritzer, T., Dussel, M., Thomas, R. & Schulz, R. (2014): 3D seismic survey explores geothermal targets for reservoir characterization at Unterhaching, Munich, Germany, *Geothermics*, 50, 167-179.

* <https://www.liag-hannover.de/en/fsp/ge/geoparamol.html>