Re-evaluation of the geothermal potential at Geretsried: Preliminary results of the new structural and facies interpretation of the 3D seismic data

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Abstract

There has been a continuous effort in recent years to reduce exploration risk because the number of geothermal projects is rapidly increasing worldwide. Application of a new classification scheme of geothermal resources, as introduced by Moeck et al. (2014), can mitigate risk before drilling. According to this classification scheme, i.e., the geothermal play concept, geothermal resources are grouped into various play types, based on geological characteristics. Reservoir characteristics, attributed to a specific play type and associated exploration strategies, can therefore be used as analogues for new site exploration in an undeveloped geothermal field of the same play type.

As part of our research project PlayType*, this study focuses on the re-evaluation of the geothermal potential of the Geretsried site in the South German Molasse Basin, based on the 'play type' concept. Using a 3-D seismic survey (~50 km2), we carried out a structural and stratigraphic interpretation of the Geretsried field. Our primary objective is to understand the facies distribution within the reservoir and the tectonic evolution. To do this, we apply best exploration practices that have been developed in foreland basin settings to evaluate the carbonate reservoir of the Upper Jurassic, with regard to its main building components; fault zones and depositional facies.

The preliminary results of the structural interpretation clearly show that central and northern parts of the study area are characterized by "thin-skinned" tectonics: the faults in the Molasse are unconnected to the faults in the carbonate platform. In the southern part, in contrast, a through-going fault displaces both the Molasse and Mesozoic strata. There are indications of reverse and thrust deformation with a substantial displacement across the Tertiary segment of the fault, whereas the Mesozoic segment shows normal fault geometries and a smaller displacement. Based on these observations, we hypothesize that this fault zone experienced several phases of deformation, which in turn could have a positive effect on secondary porosity in the damage zone. To prove the multiphase evolution of the southern fault and determine the timing of faulting activity, we intent to apply quantitative fault zone analysis (Moeck et al., 2015; Budach et al., 2018).

Carbonate facies interpretation in the Upper Jurassic sequence is based on reflector shape. As a first step, we analyse reflector terminations and reflection configuration. The analysis reveals a prominent mound-like structure that is approximately 1 km wide and 3.5 km long. It strikes NNE-SSW, from the centre of the study area to its southern edge. The flanks of the identified structure are characterised by onlapping geometries and can be delineated with confidence. The internal reflection configuration is heterogeneous and shows chaotic to sub-horizontal reflectors of medium amplitude. We interpret the structure to be an organic build-up that may have possessed a higher initial porosity. Taking into account the complex und often ambiguous reflection image within the Upper Jurassic sequence, we plan to apply geometrical and texture attributes to guide the seismic stratigraphic analysis as a next step.

We conclude that the southern part of the Geretsried field is more promising for potential future geothermal exploration because of its favourable facies distribution and reactivated fault system.

* https://www.leibniz-liag.de/en/research/projects/third-party-funded-projects/playtype.html

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