Assessment of the geothermal reservoir potential of the Great Oolite in the Upper Rhine Graben: a structural approach

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Résumé

The formation of the Great Oolite (Dogger, Middle Jurassic) constitutes a major aquifer in the Rhine Graben, studied in the past for its oil potential and more recently for its geothermal potential. A new structural analysis conducted as part of the PEPR *Sous-sol bien commun* project in the Rhine Graben, on three quarries on the western edge, has made it possible to reassess the deformation chronology and discuss the implications for reservoir properties.
As already highlighted by several studies on regional geology, two main fault networks can be observed in the quarries studied: N-S oriented faults and NE-SW faults, aligned with the main structural trends of the Rhine Graben. They share common features: normal movement associated with a sinistral component, and they are arranged in lens-shaped and anastomosing clusters, intersected by corridors spaced at the decametric scale. Their curved layout determines both the heterogeneity of the fillings, ranging from tectonic breccias to thin clay films, and the development of karst networks. The latter appear either infilled by fine laminated deposits (paleokarst) or still open, indicating successive reactivations or even current activity.

Analysis of tectoglyphs indicates that N-S faults are later, corresponding to reactivations of NE-SW faults. Two scenarios are considered. In the first, the N-S faults would have formed during the Late Cretaceous (E-W extension), before the NE-SW faults were established during the Oligocene during a NW-SE extension. The Alpine influence during the Miocene, through NW-SE compression, would then explain the observed sinistral movement. However, the absence of an inverse component on the reactivated faults, which are instead marked by normal movement, only fits with the NE-SW faults being newly formed in the Oligocene, while the N-S faults appear in the Miocene in a transtensive context ($\sigma 3$ WSW-ESE), without a direct structural imprint of Alpine orogenesis.
The discontinuous nature of the fillings and karsts associated with faults directly controls local reservoir properties, generating both small, closed compartments and large karst conduits. This heterogeneity challenges the evaluation of the impact of N-S faults on reservoir functioning, which is the subject of ongoing studies.

Mots-Clés: Structural analysis, Rhine Graben, Faults, Filling, Reservoir properties, Chronology

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