A-152

Diagenetic controls and reservoir quality of tight limestones from the Upper Cretaceous

J. A. Ölmez, B. Busch, C. Hilgers
Karlsruhe Institute of Technology, Structural Geology & Tectonics, Karlsruhe, Germany

This study focuses on the reservoir quality prediction in former high porosity limestones from the Upper Cretaceous Campanian of the Münsterland Cretaceous Basin in NW Germany (Ahlen-Fm., Beckum Submember), as they unconformably overlie Upper Carboniferous coal-bearing strata. For this study, outcrop analyses were carried out and samples were taken in a vertically stacked profile, focusing on a better understanding of the variability and controlling factors of reservoir properties in tight limestones. The results can be applicable to assess the potential interaction of rising mine-water and future potential for regional geothermal use. Petrophysical (He-pycnometry, Klinkenberg-corrected air permeability and p-wave velocity) and petrographic data sets (transmitted and reflected light microscopy, point-counting and cathodoluminescence) were linked with diagenetic alteration and the detrital composition to understand the controls on reservoir quality. Porosity ranges between 1.0% to 18.7% and permeability from <0.0001 mD to 0.2 mD, while p-wave velocity ranges between 2089 m/s and 5843 m/s. The detrital dominated limestones consist of mostly micrite, calcispheres and partly clay laminae. Mechanical compaction leads to porosity and permeability loss due to grain rearrangement, deformation of fossils (e.g., calcispheres and foraminifera), and ductile clay mineral laminae. Mechanical compaction is recorded by elliptically deformed calcispheres and foraminifera, and formation of compaction bands around clay laminae. Bacterial sulfate reduction leads to formation of framboidal pyrite and marcasite in clay laminae and former hollow fossils and additionally provide the formation of calcite cements. Subsequent early diagenetic authigenic mineral precipitation of inter- and intragranular sparry ferroan calcite reduces porosity and permeability. The studied lithologies can be considered as seals for potentially rising mine-water levels and may limit their potential for geothermal utilization. However, rocks were fractured during burial forming larger veins filled by ferroan calcite and/or strontianite. Later, open fractures overprinted the rocks and veins and thus may enhance the reservoir quality if formed during exhumation.