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The Lower Jurassic Posidonia Shale in southern Germany: results of a shale gas analogue study

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The shale gas potential of Germany was recently assessed by the Federal Institute for Geosciences and Natural Resources (2012 NiKo-Project) and is – in respect of the general natural gas occurrence in Germany - regarded as a good alternative hydrocarbon source. The Posidonia Shale in northern and southern Germany is one of the evaluated rock formation and easily accessible in outcrops in the Swabian Alps (southern Germany). The area of interest in this work is located in such an outcrop that is actively used for open pit mining next to the town of Dotternhausen, 70 km southwest of Stuttgart.
31 samples from the quarry of Dotternhausen were analyzed in order to characterize the immature Posidonia Shale (Lower Toarcian, Lias ε) of southern Germany as a gas shale precursor. Methods included are Rock Eval, Open Pyrolysis GC, SEM, Mercury Intrusion Porosimetry, XRD, and other.
The samples of Dotternhausen contain exclusively type II kerogen. The majority of the organic matter is structureless and occurs in the argillaceous-calcareous matrix. Structured organic matter appears predominantly as alginite, in particular the algae "tasmanite" is noticeable. The TOC content ranges up to 16 wt% with a high bitumen content. The mineral content characterizes the Posidonia Shale as a marlstone or mudstone with varying clay-calcite ratios. The quartz and pyrite content reaches up to 20 wt% and 9 wt%, respectively. The rock fabric is characterized by a fine grained and laminated matrix. The mean porosity lies between 4 and 12 %. Fractures other than those introduced by sample preparation were not observed. The Posidonia Shale is predicted to have an excellent source rock potential and will generate intermediate, P-N-A low wax oil when exposed to higher P-T-conditions (“oil kitchen”). Contact surfaces between the kerogen and matrix will be vulnerable to pressure induced fracturing caused by hydrocarbon formation. Additional porosity will be formed during maturation due to the transformation of kerogen into oil and gas. On the other hand, the porosity is expected to decrease due to diagenetic processes and the blockage of pores by oil and bitumen until reaching a higher maturity (dry gas window). The production of biogenic methane is in general possible, though no methane was recognized within the scope of this work.