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Coal Bed Methane Production in the Münsterland Basin, Germany – Past and Future

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Growing demands on energy and high energy prices have lead to a re-evaluation of the coal bed methane (CBM) potential in Germany. For research reasons the Technical University of Aachen is holding a concession area in NW Germany, located in the Münsterland Basin. This concession covers an area of about 3460 km2. The southern part of the concession area involves one of the most developed, densely populated mining districts in Western Europe, the Ruhr Area. The Upper Carboniferous coal measures there are covered by northward thickening Cretaceous strata which not only limits the coal mining activity to the south of the basin but also represents a challenge to CBM production technology. This is currently restricted to a depth of about 1200 m.

Mine gas has been successfully produced in the Ruhr Area for decades. With the successive closure of coal mines, gas production rates will decrease and consequently production of CBM will become more important. The Münsterland Basin contains a large portion of known Carboniferous coals in western Germany and the production of mine gas proofs that there is a significant resource of natural gas in place. Estimates of the amount of gas in place are at about 3 Trillion m3 in Germany's mining districts of which 2 Trillion m3 are expected to occur in the Ruhr Area alone.

First exploration efforts on CBM were made by a consortium of Ruhrgas AG and Conoco-Phillips Inc. in the 1990s. Because of low production rates, relatively high exploration and production costs, and the low gas prices at that time this project was stopped. The present study investigates the reservoir quality and geometry in order to better estimate the potential gas content for a general economic benefit assessment.

The structural inventory of the study area comprises NE-SW trending folds and thrusts which are crossed obliquely by faults. Potential gas accumulations may be found in anticlinal structures paired with thrusts. However, these gas accumulations will add up to only minor amounts of migrated free gas. Good prospects for high CBM production may be formed by tectonically fractured central parts of folds which have been studied in the mining districts. Relatively high gas contents are also expected in areas where the Cretaceous Emscher Mergel seals underlying Carboniferous strata. Leakages are expected to occur along normal faults. First microstructural investigations confirmed that there is an open cleat system in most coals. Even layers of macroscopically dense coal developed micro fractures. Some cleats are filled with minerals but do not fill the cleat space entirely.

Interpretation of published data has shown, that CBM contents vary significantly between different reservoir blocks. In order to define reservoir blocks we analyse selected areas on a small scale. This will enable us to construct detailed facies and reservoir quality maps using existing well material and wireline logs. In addition, we apply structural, facies, and reservoir models on seismic and well data. This will allow us to predict gas contents more accurately than in the past and to estimate hazard potential with high costs incurred for example through high water production.

Operationally, multi lateral drilling gives access to one or more target horizons by drilling one large caliper well from which several smaller caliper wells branch out. This technology together with newly developed

stimulation techniques (hydraulic fracturing, multi frac technologies, cavitation) allows CBM production from complex reservoir geometries and tight reservoirs.