ASSESSMENT OF UNCONVENTIONAL SHALE GAS OF MISSISSIPPIAN AND LOWER PENNSYLVANIAN SEDIMENTS IN WESTERN GERMANY

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The variation in deposition environments has a significant role on lithofacies that indicates temporal changes in bottom–water oxygenation and organic richness of shale gas potential. The assessment of unconventional shale potential of Mississippian Alum shale, the Kulm-plattenkalk and Lower Pennsylvanian Ziegelschiefer utilizes the typical evaluation workflow for unconventional shale gas potential considering thickness, TOC content, mineral composition and brittleness, porosity and permeability data as well as thermal maturity. This study indicates that the average organic carbon content of both Lower and Upper Alum shale reaches 2.4 wt. % and 2.6 wt. %, respectively and reveling the deposition occurred in an oxygen-depleted marine environment with moderate hydrogen content type II kerogen. In this study, the Kulm-plattenkalk is first time investigated and highlighted as unconventional shale gas potential. The TOC content is ranging between 0.22 % and 6.85 % (average 2.45%) and the average of carbonate content is 21 %. Contrary, the Lower Pennsylvanian Ziegelschiefer Fm was deposited in a shallow marine suboxic to oxic environment with high terrestrial influence and has only a moderate original hydrocarbon generation potential that explicitly illustrate the impact of variation in depositional environment on bottom–water conditions and organic richness. In regard to thermal maturity, the Mississippian and Lower Pennsylvanian shale gas samples are ranging between 1.70 to 2.80 % VRr representing gas generation window. Consequently, most of the samples have already lost about half of their original generation potential due to basin evolution. There was no obvious control of mineralogy on porosity and permeability, but a weak relationship was found between permeability and the average effective pore radii or slit widths. The Mississippian black shale in Western Germany have great similarity in organic richness, thickness, maturity and quartz content compared with the well–known Mississippian US shale gas. However, the differences in the basin evolution, burial and uplift history have significant influence on remaining gas potential.

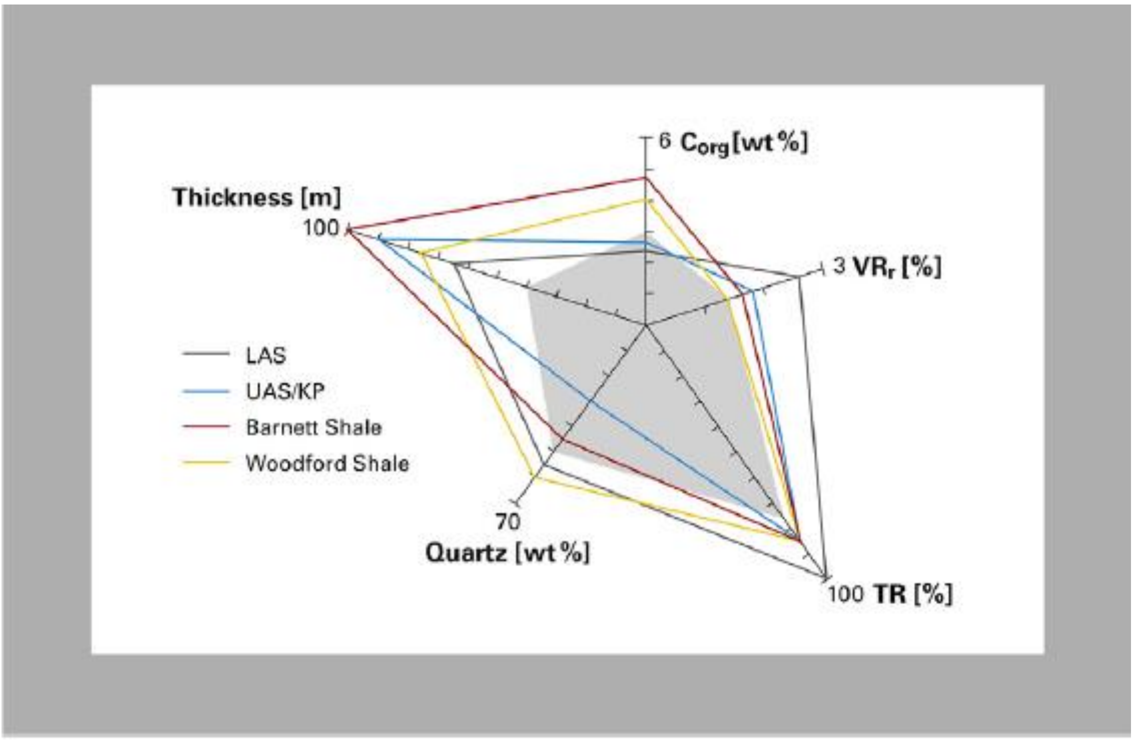

Figure 1 *Comparison of shale gas parameters that control shale gas potential of Mississippian black shale in western Germany with well-known Barnett and Woodford shales (Modified after Jarvie, 2012; Uffmann et al., 2012).*

References

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