

Impact of Different Basin Settings on Unconventional Shale Play Development – Upper Alum Shale vs. Bowland Shale (Carboniferous, Germany, United Kingdom)

Hartmut Jaeger¹

¹GeoResources STC , Heidelberg, Germany.

ABSTRACT

The North German Basin (NGB), part of the European Southern Permian Basin, has a complex polyphase basin history with huge Mesozoic and Upper Palaeozoic sediments. In the Carboniferous several 'black shales' were deposited. Some are regionally restricted, but the lower Namurian Upper Alum Shale (UAS) in the NGB has equivalents in Belgium, the Netherlands and the UK, indicating basin wide shale deposition. The Namurian Bowland Shale in England is well known as organic-rich shale sequence and is the major target for unconventional shale exploration in the UK. It was deposited in the Variscan foreland basin in front of the passive continental margin. TOC values are high and kerogen is mixed of oil-prone type II and gas-prone type III, typical for foreland basin plays. Maturation varies, showing good potential for conventional and unconventional oil and gas generation. On the other side of the Variscan basin in front of the active continental margin the UAS is deposited in the Namurian, even in the flysh basin in the southern NGB, dominated by sediment redeposition from the prograding Variscan orogen. The UAS is also target for unconventional shale exploration in the southern NGB and Belgium, due to its 'black shale' habitus and thickness. But source rock data differ strongly: commonly low TOC, very poor kerogen (type IV), very high maturation (upper dry gas – overmature). But poor source rock quality is explained as residual kerogen after intense hydrocarbon generation during high maturity from primary highly productive shales, like the Bowland Shale. New data from the UAS in the southern NGB critically question this model. Integrated maturation analysis revealed much lower maturation in the NGB (upper oil), changing the play interpretation completely. Low TOC values and poor kerogen quality are primary, not due to intense hydrocarbon generation. Highly mature kerogen, dominating most samples, was redeposited in the NGB as 'dead carbon', unproductive for hydrocarbon generation. Thus the UAS in the NGB changes from a highly prospective gas play to an unproductive oil play. This is typical for shale plays in front of a prograding orogen with high input of reworked sediment and kerogen and consequently very poor hydrocarbon potential. In contrast shale plays in front of a passive continental margin (England) show much better prospectivity, giving evidence of the high impact of different basins settings within one basin on source rock development.