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Gas Shale Petroleum Systems in the Second White Speckled Shale (SWS) and Belle Fourche Formations (Upper Cretaceous Colorado Group), Alberta, Canada

Organic-rich shales have been well studied as source rocks for hydrocarbons found in coarser-grained reservoirs in petroleum systems, however less is known about the shale gas potential of these fine-grained units. Gas is stored within the shales as an adsorbed phase on the kerogen, at the top of coarsening-upwards cycles, and within fracture and micro-fracture porosity. The organic geochemical characteristics of the shale, and the structural influence in an area, play important roles in determining the volume of gas that may be retained in the shale reservoir porosity.

The Upper Cretaceous Second White Speckled Shale (SWS) and underlying Belle Fourche formations are examples of shales with possible gas production potential in Alberta. The study area is located in west central Alberta (Twp 54 to 62 and Range 15W5 to W6). Detailed core logging, geophysical well log correlation, and high frequency sample collection for organic geochemistry (Rock-Eval/TOC pyrolysis to determine kerogen type, TOC, thermal maturity) were completed to assess the SWS and Belle Fourche formations. The SWS has TOC values ranging from >1 to 5 wt % and type II organic matter, whereas the Belle Fourche has TOC values around 2% and a mixture of kerogen types II and III. Thermal maturity increases towards the west, to a maximum of 442°C for cores analysed in this study. Quantitative 1-D modelling further west suggests that gas generation has occurred in the SWS and Belle Fourche units, indicating good prospectivity for shale gas production in the western portions of the study area.