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Depositional Environments within the Wilrich Member, Spirit River Formation – North Central Alberta

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Summary

The Wilrich Member of the Spirit River Formation is an emerging liquids-rich gas resource play located within the Deep Basin of North-Central Alberta. Wilrich Member sandstones are regressive marine shorelines that are relatively uniform and continuous. The sandstones form progradational parasequence sets related to the traditional Falher Member sub-units. Since these sandstones are geographically located farther south and because of the overall northward progradation of the Spirit River Formation, it can be inferred these are older and possibly the oldest sandstones of the Spirit River Formation (Macdonald et al., 1988; Zonneveld & Moslow, 2004). Unlike the younger Falher units these sandstone shorelines show a southwest to northeast orientation. Decreasing amounts of organic material to the west support this, with deeper water depths westward (Connolly 1989). This leads to shoreline orientation differing from the younger Falher sub-units 'A' through 'G', which are orientated east-west (Jackson, 1984; Zonneveld & Moslow, 2004). Previously, these Wilrich sandstones were not prospective targets due to tight permeability measurements from core analysis, averaging 0.01 to 0.1 md. However, with horizontal wells and multistage hydraulic fracturing, wells can now be economically produced. The natural gas liquid content produced is highly variable in the region from wells with almost no liquid production to wells with 5-20 bbl/MMcf.

Within the study area (T46 to 57 and R14 to 22 W5) a stratigraphic framework was established by constructing both regional and shorter cross sections. Using core descriptions helps establish the stratigraphic framework by incorporating the shoreline depositional environments, channelized deposits and reservoir facies. Facies descriptions and petrographic analysis in the area, along with the regional stratigraphic framework and potentially source rock proportions of source rock types and total organic carbon (TOC) are evaluated to determine the controlling factors for higher producing horizontal wells within the Wilrich Member.

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