Permeability Heterogeneity in Bioturbated Strata, Cardium Formation, Pembina Field, and the Identification of Potential Waterflood Opportunities

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Bioturbated sediments representing distal expressions of paralic depositional environments are increasingly being exploited for hydrocarbons in the supergiant Pembina Field (Cardium Formation), Alberta, Canada. These strata were previously considered unproductive due to limited vertical and horizontal connectivity between permeable beds. In these “tight oil” plays (0.1 – 10 md), pressure decay profile permeametry data indicates that sand-filled burrows provide vertical permeable pathways between bioturbated and parallel laminated sandstone beds in the central, north-east and north-west parts of the field; enabling the economic exploitation of hydrocarbons via horizontal drilling and multi-stage fracking. As the exploitation of bioturbated strata progresses in the Pembina Field, additional primary targets are being sought out and horizontal waterflooding is being considered in areas where current horizontals exist. Proximal to historical produced conventional targets, reservoir analysis indicates that areas where the bioturbated facies average permeability is between 0.35 mD and 0.85 mD, and sandstone isopach thicknesses are between 0.25 m and 2.5 m should be targeted in east-central Pembina.