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CRACKING THE CRETACEOUS CODE

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Comparative Reservoir Characterization and Development Optimization of the Viking and Doe Creek Formations

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ABSTRACT

The Doe Creek Formation and Viking Formation were deposited during the Cretaceous (~95–100 Ma) within shallow marine shoreface environments, resulting in comparable reservoir characteristics. The Viking Formation, situated conformably between the Westgate Formation and Joli Fou Formation in west-central Saskatchewan, is a light oil reservoir (~35° API) with core porosity ranging from 18–22%, average permeability of ~50 mD, and water saturation (S_w) of approximately 0.4. Production performance varies significantly depending on well configuration (e.g., parent, child, or infill), with an average EUR of ~38 Mbbbl/ ERH length well, and up to 94 Mbbbl/ ERH length well in high-performing areas such as Kiyuu Lake.

Operational challenges in the Viking include cost control and delineation of remaining prospective zones within a mature play. These are addressed through extended lateral drilling, increased wells per pad, and integration of gas chromatographic data to identify underexplored lands. The light-to-medium gas (LM) ratio has proven instrumental in refining the waterline boundary, particularly in the Plato area, enabling the economic development of additional sections beyond previously defined limits.

Building on extensive development within the Viking Formation (~3,000 horizontal wells drilled in Saskatchewan), exploration and development were extended into the Doe Creek Formation in northwestern Alberta near Spirit River. The Doe Creek, deposited conformably between the Howard Creek Formation and Dunvegan Formation, exhibits reservoir properties analogous to the Viking, including light oil (~35° API), 15–25% porosity, permeability ranging from 40–150 mD, and water saturation (S_w) of ~0.4. Since 2022, six wells have been drilled with variable outcomes, initially guided by a Viking ERH co-frac type curve and executed using comparable drilling and completion parameters. Subsequent 2025 wells incorporated the Viking LM ratio cutoff to selectively exclude water-prone stages, resulting in water cuts below 40% in areas where offset wells had previously encountered elevated water production.

Future work aims to optimize reservoir exploitation by standardizing LM ratio thresholds across the Viking play and incorporating machine learning techniques applied to drill cuttings analysis to enhance waterline detection in areas lacking fully developed LM datasets.