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Reservoir Characterization for Energy Security

Developing Workflows for Large-Scale Modeling of Tight Reservoirs: A Case Study of the Montney Formation

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ABSTRACT

Tight, unconventional reservoirs have become increasingly critical to North America's oil and gas production, with the Montney Formation emerging as one of the continent's most prolific plays. However, delineating regional geological trends within such reservoirs remains a persistent challenge due to their inherent heterogeneity and complex depositional histories. This work aims to establish a robust workflow for regional-scale modeling of unconventional reservoirs, using the Montney Formation as a representative case.

The Lower Triassic Montney Formation is a regionally extensive stratigraphic unit deposited during the Lower Triassic within the Peace River Basin, along the northwestern margin of Pangea (Davies et al., 1997). It encompasses a range of depositional environments, including lower and upper shoreface sandstones, coarse siltstones, finely laminated distal to offshore siltstones, and turbidite channels and fan complexes (Markhasin, 1999; Davies et al., 1997; Zonneveld & Moslow, 2010, 2018). This variability contributes to the formation's complex stratigraphy and poses significant challenges for consistent reservoir characterization.

To address these complexities, this study leverages ARC's internal regional stratigraphic framework and proprietary core database to develop a scalable modeling workflow. The stratigraphic framework supports the construction of a high-resolution 3D structural model, which serves as the foundation for integrating petrophysical data. Grain density data from ARC's core database are used to generate a regional grain density model, which in turn facilitates the estimation of key reservoir properties, including porosity, permeability, water saturation, and other reservoir parameters.

Incorporating public core and log datasets into regional reservoir models remains a significant challenge due to inconsistencies in data quality, format, and availability. Despite their high value for subsurface characterization, these datasets require substantial effort to compile and standardize. This challenge is further compounded by ongoing reductions in general and administrative (G&A) capital across the energy sector, which have led to leaner technical teams and limited resources for large-scale data. The workflow presented in this study addresses these constraints by streamlining the incorporation of stratigraphic and petrophysical data into a unified modeling framework. By extending predictive capabilities beyond ARC's land holdings, it supports basin-wide evaluation of reservoir quality and offers a scalable methodology applicable to other tight formations with complex depositional architectures.



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