# PS Integrated Approach for Unconventional System Analysis and Modeling: The Lower and Middle Triassic of Western Canada\*

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#### **Abstract**

The recent development of self-contained source-reservoir systems in North America has triggered a regain of interest for fine-grained and organic-rich deposits. Challenges faced by the industry and active research in geomechanics, petrophysics, organic geochemistry and source rock sedimentology among other disciplines, have demonstrated that unconventional systems are extremely complex and heterogeneous at all scales. The Lower and Middle Triassic in the Western Canada Sedimentary Basin has been the target of oil and gas exploration and production for over 60 years and hold one of the largest known unconventional resource of North America. The Montney and Doig Formations form a self-contained source-reservoir system extending over more than 100,000 square kilometers in Alberta and British Columbia, with thickness reaching up to 350 m from the base of the Montney to the top of the Doig Phosphate zone. The Montney formation forms a prograding clastic ramp with conventional reservoirs in shoreface and foreshore deposits as well as in turbidites. In the distal part of the basin, fine-grained offshore and offshore transition deposits are the host of huge unconventional resources. The top of the Montney Formation correspond to a major erosional unconformity on which the Doig Phosphate was deposited during a subsequent transgression. The Montney Formation contains interbedded organic-rich and organic-lean fine-grained deposits and large amounts of bitumen resulting from the thermal cracking of in-situ and migrated petroleum. Consequently, the distribution of organic matter reflected by TOC data is a function of both the depositional architecture and the burial history of the basin. Understanding the geological controls on the distribution of initial sedimentary organic matter as well as on subsequent maturation and petroleum expulsion and migration is key to better predict the distribution of fluid and rock properties in this self-contained source-reservoir system. Process-based approaches such as stratigraphic forward modeling and basin modeling provide a mean to evaluate the impact of these geological factors and to quantify them. In this paper, we will present results form a multidisciplinary analysis on the Montney-Doig unconventional system, including sedimentology, sequence stratigraphy, organic geochemistry and basin analysis and discuss how to integrate this information into a process-based workflow coupling stratigraphic modeling and basin modeling.

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