

# **Integration of Source Rock Distribution, Thermal Maturation, Mechanical Compaction and Petroleum Retention and Expulsion to Unconventional Petroleum System Modeling The Case of the Western Canadian Sedimentary Basin**

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## **ABSTRACT**

Basin modeling is a widespread and recognized tool used to perform petroleum system analysis. Recent improvements have been made to extend their application to unconventional petroleum systems (Romero-Sarmiento *et al.*, 2013). Particularly, it has been showed that they brought powerful analysis to better assess these new prospects, particularly for retention mechanisms related to adsorption on the organic matter and organic porosity creation during the source rock maturation. Accurate restoration of organic matter distribution and description of retention and expulsion remain key aspects among the elements to reach a better insights of these systems.

Source rocks characteristics such as the total organic carbon (TOC) or the hydrogen index (HI) are of primary importance to evaluate these unconventional prospects, even more than in conventional petroleum systems since the source is also the reservoir. Extrapolation of these parameters is often based on basic interpolations of well data corrected from the thermal maturity to establish maps of organic matter richness. Numerical forward genetic models are another, more advanced approach, to build such maps (Mann and Zweigel, 2008; Chauveau, 2013; Chauveau *et al.*, in prep). However, they are relatively time consuming and require stratigraphic expertise. In this work we propose an intermediate and (almost) instantaneous approach that provides initial TOC and HI maps constrained on available well data and consistent with the processes of deposition and preservation of marine organic matter.

This new approach helps to consistently restore the distribution of organic matter richness in sedimentary basins. This information can then be used as an input data in a basin modeling tool (TemisFlow<sup>TM</sup>) which already integrates source rock maturation, gas adsorption mechanisms, organic porosity creation and compaction (Romero-Sarmiento *et al.*, 2013) together with expulsion mechanisms driven by Darcy flow migration (Schneider and Wolf, 2000).

The integrated approach is illustrated and discussed on the natural case study of the Western Canada Sedimentary Basin (WCSB) with a special focus on the Montney-Doig Formations which are currently highly explored for both conventional and unconventional resources.