Artificial thermal maturation of source rocks at different thermal maturity levels: Application to the Triassic Montney and Doig Formations

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Here we characterize a maturation series from the Triassic Montney and Doig Formations in the Western Canada Sedimentary Basin (WCSB), in order to investigate the evolution of the source-rock properties and their corresponding kerogen kinetic parameters as a function of the thermal maturity. Organic petrography was used to determine the thermal maturity and the spatial distribution of organic matter particles. Rock-Eval Shale Play analyses were then applied to assess the presence of both free and sorbed hydrocarbons still contained in the sample as well as the hydrocarbon generation potential. Four kerogen samples from Montney and Doig Formations at different thermal maturity levels were finally selected for analysis of bulk-kinetic parameters (e.g. activation energy distribution, frequency factor) using programmed open-system pyrolysis. We also evaluated the type of hydrocarbons and determined the molecular composition of organic compounds which comprise the first two Rock-Eval Shale Play peaks (Sh0 & Sh1) obtained during the improved thermovaporization. TD-GC-MS-FID analyses were carried out on rock samples in order to characterize the composition of hydrocarbons represented by each Rock-Eval Shale Play peak. Free and sorbed low-to-medium molecular weight aliphatic and aromatic hydrocarbons ($<C_{20}$) are the main hydrocarbon components released in the temperature range corresponding to the Rock-Eval Sh0 parameter (100-200°C). Medium and high-molecular weight hydrocarbons (C_{10} to C_{30} aromatics and saturates) are predominant components thermally released in the temperature range corresponding to the Rock-Eval Sh1 parameter (200-350°C). Results show both an increasing activation energy and loss of petroleum generation potential as thermal degradation proceeds.