

Regional Thermal Maturity Evaluation of Devonian-Mississippian Source Rock Strata in the Western Canada Sedimentary Basin: Implications for Thermal History and Petroleum Exploration

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Optical indices provide a sensitive method for evaluating thermal histories and thermal maturity of hydrocarbon source rocks relative to hydrocarbon generation thresholds. An extensive regional thermal maturity evaluation of the WCSB was undertaken using per cent reflectance in oil of vitrinite and solid bitumens for four Devonian to Mississippian source rock groups in British Columbia, Northwest Territories, Alberta, and Saskatchewan: Middle Devonian Elk Point-Beaverhill Lake group, Upper Devonian 'Woodbend group', Upper Devonian 'Winterburn group' and, Upper Devonian to Lower Mississippian Exshaw-Bakken formations. Regional patterns of iso-reflectance contours define thermal maturity anomalies throughout the WCSB, many of which appear to be linked to either major fault systems, gravity anomalies, or to regions where significant hot fluids are interpreted to have had focused flow in the past (e.g. mineralization zones, regions of reefs etc.). Regional isorefectance contours of maturity also show consistent SW-NE and E-W trending maturity excursions which in many instances are directly 'downdip' from economic accumulations of petroleum. This relationship defined for those well explored regions of the WCSB may provide an indication of the potential location of undiscovered resources in under-explored regions of the basin.