2d Kinematic, Thermal and Petroleum Modeling along the Calgary-Banff Transect

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An integrated study along the Banff-Calgary transect, using IFP's basin modeling tools provides a quantitative framework for understanding the history and evolution of the two major petroleum systems that account for successive migration of oil and gas charges into the primary reservoirs in the Foreland. Subsidence and subsequent erosional profiles were computed using a 1D thermal model constrained by wells and vertical profiles extracted from the balanced section. Thermal histories were calibrated against observed values and patterns of organic maturity rank. The resulting thermal history was employed in a 2D forward kinematic and thermal modeling, which reconstructed both the evolution of foothills structural geometries at intervals between its present and pre-orogenic architecture, and the history of thermal maturity-petroleum generation windows for potential source rocks. Intermediate geometries resulting from forward THRUSTPACK modeling were ultimately used to constrain boundary conditions for a subsequent 2D regional fluid flow analysis using CERES software. CERES was also used to derive instantaneous pore fluid pressures in potential reservoirs, and to compute the hydrocarbon migration and charge for compressive structures. The main evolutionary stages of fluid circulation in subthrust prospects can be summarized as follows: - From the time of deposition to -100 Ma: Burial compaction dewatering is the dominant process and fluids are buffered by the sedimentary successions. - From -100 to -63 Ma: Active foreland belt compaction and compression « squeegee » is the dominant process and fluids of an exotic origin flow through Mississippian reservoirs from the west at velocities reaching 2 mm/Y. - From -59 Ma to Present: Active local thrusting closes the hydrodynamic regime and terminates exotic fluid flow into the Mississippian reservoirs. Results of the study produce current petroleum distributions in suitable reservoir strata that are consistent with geological and geochemical constraints on petroleum systems and accumulations.