Tectono-Diagenetic Evolution of the Saint-Flavien Gas Reservoir at the Structural Front of the Québec Appalachians

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The Beekmantown Group (Lower Ordovician) of the Saint-Flavien reservoir has produced 162X 10^6 m^3 of natural gas between 1980 to 1994 before its conversion into gas storage that became operational in 1998. The integration of stratigraphic and structural features, carbonate and organic matter petrography and geochemistry for 13 drill holes help to define tectono-diagenetic succession and the nature and origin of porosity for these reservoir dolostones.

The Beekmantown Group consists of a numerous 5^{th} order shallowing upward cycles of variable thickness (1.0 to 3.5 m). These cycles consist of a basal subtidal shale covered by subtidal to intertidal-supratidal carbonates. Early dolomitization has preserved some pores in the intertidal facies. Near surface post-dolomite karstification has created vugs that were filled by early marine calcite cement. Horizontal stylolites constitute the first interpreted burial diagenetic features. Late migrated bitumen are thermally altered or vaporised at temperature exceeding 220°C as native coke, partly due to overthrusting of Appalachian nappes. Breccias and fractures were then generated and subsequently filled with K-feldspar, quartz, illite and xenomorphic calcite. Horizontal shear zones and vertical stylolites were produced during folding and thrusting. Dissolution has preferentially affected late fracture-filling calcite and generated most of the actual porosity during or soon after the Taconian orogeny. Porosity has been mostly produced by fracture-controlled, post-Taconian dissolution of early to late xenomorphic calcite in intertidal dolomitic slightly porous facies at the top of rhythmic cycles that compose the Beekmantown Group.

The Saint-Flavien Structure should be used as a case history for gas exploration in Quebec Humber zone.