

Thermal Modelling of the Laurentian Margin Beneath Anticosti Island using AFTA, 1D Well Profiles, and Bulk Fluid Inclusions

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Ordovician-Silurian miogeoclinal rocks of the Laurentian passive margin underlie Anticosti Island. Lower Ordovician carbonates of the Romaine Formation directly overly Grenville basement rocks, and are truncated above by the Sauk angular unconformity. The Mingan Formation sits above the unconformity, and is followed upwards by a thick interval of limestone and shale from the middle Ordovician Trenton-Black River formation. Transgressive organic-rich shales of the Macasty Formation cap this succession. Structurally, units dip moderately to the south-southwest forming a broad monocline in front of the Apalachian thrust belt.

Bottom hole granitic basement samples were obtained from two wells for AFTA analysis, covering the depth spectrum across Anticosti Island, through oil and gas windows. 1D model profiles constrained by AFTA data indicate rapid burial in Ordovician time, with the rate decreasing from Silurian to Carboniferous. Peak post-depositional temperatures (120 C) are estimated at 280 Ma. A second less pronounced thermal event is recorded at about 100-60 Ma. This Cretaceous event relates to rifting of the St. Lawrence aulacogen, and igneous dyke emplacement. Bulk fluid inclusion data were obtained from eight wells. Hydrocarbon migration and hydrothermal paleoflow are indicated. High CO₂ contents restricted to the Romaine Formation suggest that it acted as a fractured hydrothermal aquifer for dolomitizing fluids. Upward fluid breakout and dolomitization of the overlying Trenton-Black River formation, with creation of secondary porosity, occurs near the erosional edge of the underlying Romaine Formation.