Regional-Scale Depositional and Diagenetic Variations in Passive Margin Carbonates of the Lower Paleozoic Anticosti Basin, Eastern Québec, Canada

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Stable isotope geochemistry and fluid inclusions of diagenetic mineral phases together with basin-wide stratigraphic and sedimentologic information were used to investigate the diagenetic evolution and reservoir potential of the Lower Ordovician passive margin carbonates of the Romaine Formation in the western Anticosti Basin. The Romaine strata comprise a basal siliciclastic-rich transgressive unit onlapping the Precambrian basement overlain by pervasively to partially dolomitized peritidal and subtidal facies assemblages stacked into two large scale sequences and capped by a regional paleokarst unconformity. Petrography shows two main stages of dolomitization: i) an early, synsedimentary to shallow burial stage characterized by planar, relatively fine crystalline replacement dolomite, and ii) a later stage characterized by non-planar, more coarsely crystalline replacement dolomite and pore- and fracture-filling dolomite. Stable isotope and fluid inclusion data and associated MVT mineral assemblages suggest at least two pulses of late stage dolomitization; the first pulse is related to intraformational waters heated during burial and the second pulse is associated with warm, highly saline basin-derived brines. Significant but localized porosity in the Romaine dolostones resulted mainly from dissolution and replacement of precursor limestones and early replacement dolostones during the late dolomitization stage. Hydrocarbon fluid inclusions present in late burial calcite cement filling pores and fractures of these porous dolostones suggest that hydrocarbon migration occurred after the main development of secondary porosity in the Romaine strata.