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[PS]Paleozoic Hydrothermal Dolomites in Eastern Canada: Multiple New Targets for Oil and Gas Exploration*

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Abstract

In North America, significant hydrocarbon reservoirs are hosted by interpreted hydrothermal dolomites. In the Paleozoic succession of eastern Canada, Lower-Middle Ordovician, Lower-Upper Silurian and Lower Devonian hydrothermal dolomites (HTD) have been recently documented and dolomite-oriented exploration activities have resulted in significant discoveries and production.

The Ordovician cases occur in passive margin to foreland basin carbonates. Based on stable (O and C) and radiogenic (Sr) isotopes ratios, and fluid inclusions microthermometric data, it is proposed that hot (over 150°C) and saline (over 24wt% $NaCl_{equi.}$) fluids moved upward along extensional to strike-slip faults commonly rooted in crystalline basement as suggested by the elevated $^{87}Sr/^{86}Sr$ ratios (over 0.710200) of the pervasive dolomites; these faults were active during the Middle Ordovician Taconian Orogeny. Gas discoveries in southern Quebec and oil production in western Newfoundland have been recently announced.

The Silurian HTD formed in Lower Silurian carbonate platforms and Upper Silurian reef complexes through high temperature (over 200°C) saline (over 26wt% $NaCl_{equi.}$) fluid migration along extensional faults after the late Early Silurian onset of the Acadian foreland basin. Significant contribution of Ordovician mafic to ultramafic basement is indicated by the anomalously high $\delta^{18}O_{SMOW}$ ratios (over +10‰) of the dolomitizing fluid. The first exploration wells targeting the Silurian HTD have been recently announced.

The Lower Devonian HTD are found in outer shelf muddy carbonate facies in close vicinity of dextral transpressional Acadian (Middle Devonian) faults. Very $\delta^{18}O_{PDB}$ depleted saddle dolomite cements are found in carbonate breccias host of gas and small oil fields that are currently in production in eastern Gaspé.

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