

Hydrothermal Dolomite Ideas Sparks Play

Zebra Hunt May Lead to Elephants

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Editor's note: This is the final report on a three-part series that examines Canadian activity in the prolific Trenton-Black River Trend.

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[Canadians Eye the Prolific Trenton](#)

[Part II: Looking for New Found Oil in Newfoundland](#)
[Structure, Dolomites Look Good](#)



[LEVEL 1: Canada's Appalachian front](#)

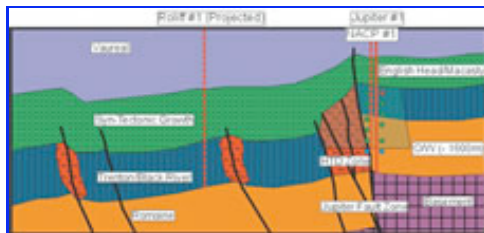
[LEVEL 2: Various 2-D seismic surveys](#)

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Two SEPM sessions titled "Hydrothermally Altered Carbonate Reservoirs: Models and Case Studies" will be presented during the [AAPG Annual Meeting](#) in Dallas.

An oral session will begin at 8 a.m. Monday, April 19, and a poster session will be held Tuesday afternoon, April 20.

Papers and posters will investigate HTD reservoirs from Appalachia, the Western Canadian Sedimentary Basin, the North Sea, offshore Nova Scotia and onshore Ireland.



An Anticosti Island 2-D seismic line, illustrating new Hydrothermal Dolomite (HTD) interpretation. (Click on image to enlarge)

Graphic interpretation courtesy of Corridor Resources

In Canada, this play is all about the rocks.

Some geologists refer to it as "HTD," or hydrothermal dolomite. Others call it thermobaric or zebra dolomite.

Claude Morin, a senior petroleum geologist with Hydro-Québec, uses the French terms "dolomite hydrothermale" and "dolomite baroque" to describe its ribbon-like fabric.

Whatever the descriptor, this rock is characterized by coarsely crystalline, high temperature saddle dolomite and forms the prolific reservoir trends of the Trenton-Black River that stretch across continental North America. The Trenton-Black River fairway -- containing the world class Albion-Scipio and Lima-Indiana oil fields -- crosses into Canada where it is virtually unexplored to date.

Morin, an AAPG member, is part of Hydro-Québec's recently formed oil and gas division, Hydro-Québec Pétrole et Gaz. Two years ago, Hydro-Québec -- North America's giant in hydroelectricity generation -- entered the oil and gas exploration game with a commitment to invest \$C 330 million by 2010.

Morin's mandate is to explore for oil and natural gas in Eastern Québec -- namely the Gaspé Peninsula and the Gulf of St. Lawrence.

Fueled by a new understanding of the mechanisms that create hydrothermal dolomites -- and the critical role that wrench faults play as conduits for high pressure, high temperature dolomitizing fluids -- Morin is re-evaluating geological and geophysical data bases for Trenton-Black River potential in the Appalachian front of Eastern Canada.

He's hunting for an Albion-Scipio look-alike that could be lurking, undetected, in his own backyard.

Morin is keying off the historical natural gas production from Ordovician age carbonates in the St. Lawrence Lowlands in southern Québec (close to the New York state border) and recent oil production tests from Ordovician age dolomite reservoirs on the Port au Port Peninsula in Western Newfoundland.

Lying between these two endpoints -- nestled in the Gulf of St. Lawrence -- is Anticosti Island.

"Oil discoveries in Western Newfoundland at the Port au Port Peninsula, unequivocally demonstrate that the oil system works well east of the Anticosti platform," Morin said

Anticosti Island, Québec

Anticosti Island is remote, accessible only by ferry for oil and gas field operations. Approximately 8,000 square kilometers in size, the island is home to 300 people and 200,000 white-tailed deer.

Anticosti is situated in a favorable structural position, on an inflection point -- or a transform zone -- at the leading edge of the Appalachian thrust front. The island is bisected by the Jupiter Fault Zone, a right lateral, strike-slip feature similar to the Bowling Green Fault Zone of the Lima-Indiana Field that has 500 million barrels of oil and 2 tcf of gas.

During the late 1990s, Shell Canada and Encal Energy (now Calpine Corp.) farmed into Halifax-based Corridor Resources' acreage position, acquiring 400 kilometers of 2-D seismic data and an aeromagnetic survey.

As operator, Shell followed up by drilling five wells over a two-year period from 1998-99; the wells were abandoned, but provided useful data points for calibration. Shell and Calpine relinquished their holdings on Anticosti in late 2002.

Corridor Resources operates eight exploration licenses on the south and central part of Anticosti, totaling just over 400,000 acres. Through a partnership with Hydro-Québec, Corridor has varying interests in an additional 1.1 million acres of exploration land in the northern and southern part of the island; the land comprises 19 leases and five permits with mixed operatorship.

AAPG member Tom Martel, Corridor's chief geologist, described his company's recent shift in exploration thinking at Anticosti:

"Everybody, including us, had been looking for the Romaine formation (the Lower Ordovician, Beekmantown equivalent that produced gas on the Quebec mainland)," he said. "It wasn't until we drilled our third well, Chaloupe #1, that we realized the Middle Ordovician Trenton-Black River formation might be prospective."

While drilling Chaloupe #1 they lost 3,000 barrels per day of mud into the Trenton-Black River formation. The well encountered 70 meters of porosity and fractures in the Trenton-Black River and Romaine formations. Methane shows were recorded while drilling through the Romaine formation.

According to Martel, only two wells on Anticosti can be considered adequate tests of the Trenton-Black River, which occurs at depths between 800 to 2,000 meters.

Using sidewall cores, the Geological Survey of Canada completed fluid inclusion studies in the Chaloupe #1 well, demonstrating several episodes of high temperature, hydrothermal dolomitization in the Trenton-Black River and Romaine formations.

Three wells drilled near the Jupiter Fault Zone (JFZ) show thick hydrocarbon columns, according to Martel. Examination of the chip samples from Chaloupe #1 indicates 41 degree API live oil.

The NACP #1 well was drilled in 1963 adjacent to the JFZ. The well contained HTD with live oil-filled vugs, and was highly fractured in the Trenton-Black River and underlying Romaine formations -- while drilling through the Trenton-Black River and Romaine formations with a continuous coring rig, the operator lost 28,000 barrels of fresh water into the formations.

Martel can't over-emphasize the importance of the seven-kilometer-wide JFZ to the future success of the HTD play. The aeromagnetic survey, he said, illustrates different types of basement rock straddling the JFZ, suggesting significant strike-slip movement.

Based upon seismic interpretation, Martel believes that the JFZ was active during the Middle Ordovician. He describes how the trans-tensional movement on the strike-slip fault results in a void or space, creating the mechanism to "suck up the hydrothermal fluids in a very rapid manner.

"The mechanism," Martel said, "works like a pump, creating a vacuum."

It's a New Game

Last summer, "newcomer" Hydro-Québec shipped five vibrator trucks to Anticosti for the acquisition of a \$C 4.8 million, 325-kilometer 2-D seismic program.

According to Morin, infrastructure for roads is "mostly non-existent."

In areas where the vibroseis trucks couldn't go cross-country, a dynamite source was used for seismic data acquisition. Just under half of the program was acquired with dynamite source.

Hydro-Québec also acquired a magneto-telluric survey to assist in identifying faulting, karsting and voids -- telltale features that point to the existence of hydrothermal dolomite rocks in the subsurface.

"We see classic collapse features like the Albion-Scipio Field," Morin said of his geophysical interpretation. "We're very excited -- it's a new game ... We have a lot of examples (analog) of how this play can work."

Corridor and Hydro-Québec -- jointly and separately -- plan to drill three wells this summer, back-to-back, thus sharing the costs of mobilizing a rig to Anticosti. The drilling program will target the JFZ, testing a related sag feature with a seismic dim zone characteristic of HTD development.

The Chaloupe #1 well also will be redrilled, this time targeting the Trenton-Black River formation.