High-Temperature Dolomites in the Ordovician Section of Anticosti Island, Eastern Canada: Implications for Hydrocarbon Reservoirs Development

Denis Lavoie*
Natural Resources Canada - GSC-Québec
880 Chemin Ste-Foy, Quebec City, QC, Canada
delavoie@nrcan.gc.ca

and

Guoxiang Chi
Department of Geology, University of Regina
3737 Wascana Parkway, Regina, SK, Canada

ABSTRACT

Hydrothermal dolomitization played a key role in the development of hydrocarbon reservoirs for Ordovician carbonates along the ancient continental margin of Laurentia. Following the documentation of hydrothermal fluid circulation in the oil-reservoir host Lower Ordovician St. George Group in Newfoundland, the study of the Ordovician succession on Anticosti Island was initiated.

The peritidal facies of the Lower Ordovician Romaine Formation recorded multiple events of dolomitization and a late hydrocarbon migration. A late hydrothermal event generated significant porosities imperfectly filled by high temperature saddle dolomite (average T_h: 120°C) derived from a highly saline fluid (24 wt% $NaCl_{equi}$). A later hydrocarbon inclusion-rich calcite (average T_h: 70°C) filled part of the fractures. Even if locally highly porous, unfractured zones of the Romaine have low permeabilities.

The open marine limestones of the Middle-Upper Ordovician Mingan Formation have received less attention. Three dolomitization events are documented. These generated replacement dolomites and only pore-filling calcites were observed. The latest replacement dolomite is characterized by high temperature (average T_h: 105°C) and highly saline (24 wt% $NaCl_{equi}$) fluid inclusions. It has been assumed that the hydrothermal fluids used the Romaine aquifer for circulation and breached into the Mingan at the erosional edge of the Lower Ordovician platform in northern Anticosti. However, circulation of these fluids along some major extensional faults altered the Middle-Upper Ordovician Mingan Formation. As they move upwards, the fluids were slightly colder but generated secondary porosity as suggested by gas shows from the Mingan interval in southern Anticosti wells.