

The Lower Devonian Upper Gaspé Limestones in Eastern Gaspé: Diagenetic Evolution of a Fracture Reservoir and Hydrocarbon Migration Record

Denis Lavoie* and Guoxiang Chi
Geological Survey of Canada – Quebec Office, Quebec City
delavoie@nrcan.gc.ca

and

Martin G. Fowler
Geological Survey of Canada – Calgary Office, Calgary

The Lower Devonian Upper Gaspé Limestones consist of the Forillon, Shiphead and Indian Cove formations. The depositional basin and stratigraphic succession were controlled by synsedimentary extensional faults delineating three major paleogeographic domains; a Northern proximal outer shelf, a Central distal outer shelf and a Southern toe of slope. Oil seeps are present in fractured limestones of the Central domain with ongoing limited gas production.

Primary porosity occurs in brachiopod-rich facies in the Indian Cove Formation of the Northern domain. Meteoric dissolution enhancement of porosity is locally seen. This porosity enhancement is restricted to the Northern domain, no evidence of hydrocarbon migration was found there.

Multiple events of burial-seated fracture, dissolution and calcite cementation are found in the Central and Southern domain successions. Petrographic evidence argues for three distinct diagenetic events prior to development of vertical stylolites related to the Acadian orogeny. C and O stable isotopes, and fluid inclusion microthermometry of the fracture-filling calcite cements indicate significantly higher thermal conditions for the Southern domain and for the western sector of the Central domain. The eastern part of the latter has been previously documented to be of low maturation level and the site of hydrocarbon occurrences, all consistent with our new isotopic and fluid inclusion data which suggest lower thermal conditions compared to adjacent areas. Highly fluorescent hydrocarbon fluid inclusions are present in fracture-filling calcite cement. API values average around 40, and GC-MS analysis of limited volume of decrypitates only suggest a Devonian or older black shale marine source rock.