

Fracture Development within the Devonian Carbonates in the Liard Gas Fields

William Jamison
The Upper Crust Inc.

and

Peter Graham
Devon Canada Corp.

The primary producing zones of the Beaver River, Kotaneelee, Pointed Mountain and Liard gas fields are the Lower to Middle Devonian Arnica, Landry, Headless and Nahanni Formations. These units consist predominantly of hydrothermal dolomite characterized by vugs of various dimensions developed in a matrix of very low porosity and permeability. The very high flow rates obtained from some wells has been attributed largely to the existence of a well developed, highly transmissive, tectonic fracture network found within the reservoir units. This natural fracture system has also been credited with providing reservoir storage capacity up to several percent total rock volume and with providing the pathways for early water invasion for many of the wells.

In an effort to quantify these fracture systems, we have systematically measured fracture densities and porosities within core from several of the wells in all four fields. The average density of unfilled or partially filled fractures in most of the wells with high production rates is in the range of 10 to 20 m/m². In several of the wells, high fracture densities occur only in a few relatively thin intervals (metres to tens of metres thick within a reservoir section several hundred metres thick). Most fractures have apertures <20 µm, and contribute insignificant reservoir storage. Locally, fractures with apertures up to several mm's wide, partially infilled and propped by carbonate and quartz cements, provide fracture porosity of 0.4 to 2%, but the average fracture porosity in most wells is <0.1%.