

Cadomin Formation Mechanisms that Control Reservoir Quality and Fluid Sensitivity

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ABSTRACT

Petrographic analysis shows the Cadomin Formation as encountered in North Western Alberta (an area bounded by Townships 60 to 70, Ranges 05 to 10W6) consists of sections of fine to medium grained sublithic sandstone, chert granule to pebble conglomerate or sections of medium grained lithic sandstone overlain by pebble conglomerate. Samples selected from sandstone and conglomerate sections represent low to moderately good reservoir quality clastics. Reservoir quality in the sandstones and conglomerates is controlled by a complex interrelationship between depositional and diagenetic processes.

Subangular to subrounded monocrystalline quartz grains dominate the framework of most of the Cadomin sandstones cored by the various project wells; whereas, lithic grains (mainly chert) heavily dominate the framework of the conglomerate sections. Present in lesser amounts in most sandstone and conglomerate sections are scattered detrital feldspar grains, clay clasts, metamorphic rock fragments and volcanics.

Matrix, consisting of mixtures of compacted detrital clay and compressed and deformed clay clasts, lowered the permeability of both sandstone and conglomerate intervals. Authigenic illite, kaolinite, quartz, dolomite and ferroan dolomite cement the various sections. There was some dissolution of unstable grains and precursor carbonate cements that enhanced intergranular porosity.

Core analysis shows total porosity varies from about 1 to 10%. Effective porosity is lower than total porosity in the Cadomin Formation sandstones and conglomerates and varies from 2% to 6% in the conglomerates and from less than 1% to 7% in the sandstones. Depending on a number of variables including the type and distribution of pores, the mean grain size, the GSPI value, the amount of authigenic cement and the relative volume of clasts and sandstone matrix present in the clastic sections, permeability in samples selected for analysis ranged from less than 0.1 millidarcy to as much as 42 millidarcies. Cross plots constructed from the petrographic data suggest that 1.0 millidarcy be used as a cut-off for a superior reservoir quality Cadomin Formation sandstone or conglomerate and that 0.1 millidarcy permeability be used as a cut-off for a

reservoir that would produce commercial gas. Based on the crossplot assessment we determined critical parameters that must be met in order to develop a commercially viable reservoir.

We note the following reservoir sensitivity conditions in the Cadomin Formation sandstone and conglomerate sections:

- 1) High potential for near well bore filtrate invasion, phase trapping and water block.
- 2) Slight to moderate sensitivity for permeability reduction caused by kaolinite fines migration.
- 3) Slight HCl-HF acid sensitivity with respect to insoluble fluoride precipitation.
- 4) Slight potential for HCl acid-oil incompatibility leading to emulsion or sludge formation.

Very careful assessment of Cadomin Formation sandstone and conglomerate is required to design the most effective fracture stimulation.

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