

“Tight gas sandstones of the uppermost Nikanassin Group”

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Abstract

This study analyzes rocks from the Nikanassin Group, a well-known gas bearing strata in the Deep Basin of Alberta. The Late Jurassic – Early Cretaceous Nikanassin Group is unconformably overlain by the Cadomin Formation and conformably overlies the Fernie Formation. It contains the Monteith, Beattie Peaks, and Monach formations, from oldest to youngest, respectively¹. Original gas-in-place from the Nikanassin Group has been recently estimated to range from 10 to 100 billion cubic feet per section². The wide range of production rates is likely a function of the abundance of natural fracture networks and the complexity of the reservoir facies along the Deep Basin and the Alberta Foothills³.

The study area is located approximately 400 km northwest of Edmonton, Alberta, and partly covers the north and southeast portion of the Wapiti gas field and the northwest portion of the Red Rock gas field. It encompasses 2000 km² and is bound in the NW by township 67 range 11W6 and in the SE by township 64 range 7W6 (Figure 1).

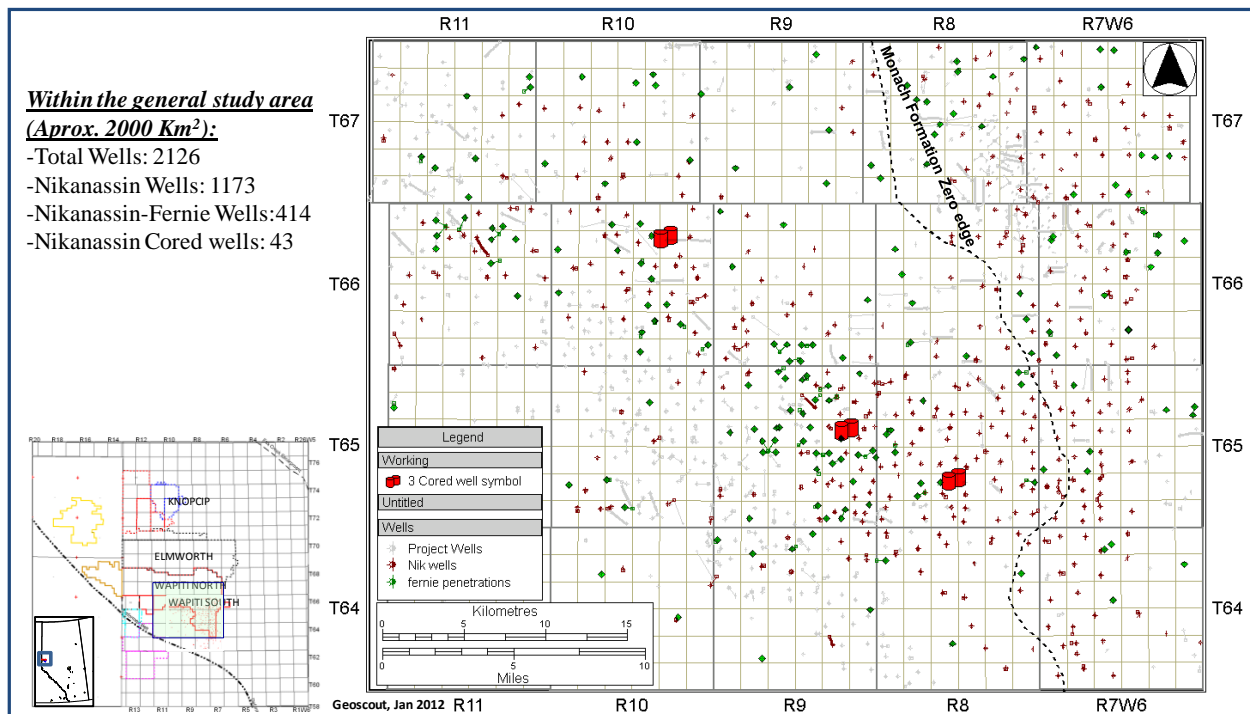


Figure 1: Location of the study area in west – central Alberta, Canada with a detailed view of the study area showing Nikanassin wells, and the adjacent Oil & Gas fields.

Specifically, the stratigraphic interval investigated in this study is the **Monach Formation** which corresponds to the uppermost portion within the Nikanassin Group in the Deep Basin of Alberta. It is the youngest stratigraphic unit and is unconformably overlain by the conglomeratic Cadomin Formation and overlying the interbedded sandstone, siltstone and coal of the Beattie Peaks Formation⁴ (Figure 2). Reservoirs of the Monach Formation within study area is mainly amalgamated sandstone which reaches up to 150m of gross thickness in the undeformed strata in the northwest, to 0m at the subcrop edge in the east. The sandstone is predominantly composed of medium to very coarse sand, sub-angular, with moderately to well sorted grains with silica cement. The dominant pore geometry is represented by microporosity from dissolution mainly of chert fragments. The presence of microfractures and slot-like pores significantly contributed to increasing permeability and production rates from Monach Formation adjacent to the deformed belt. Porosity from routine core analysis range from 1.5% to 8 % and, permeability values falls between 0.05 and 1 millidarcy (mD).

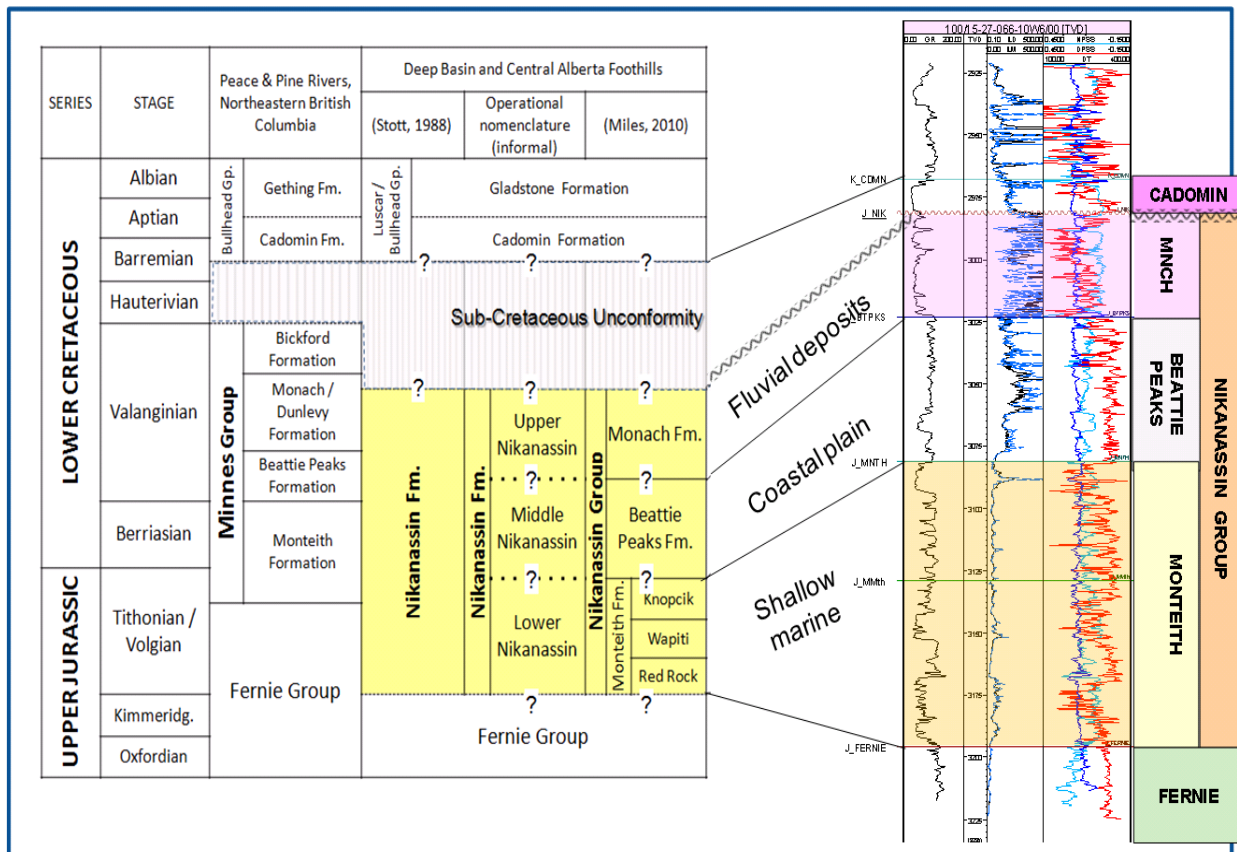


Figure 2: Lithostratigraphic chart of Nikanassin Group in the vicinity of T66-10W6. Adapted from Stott (1998), Miles (2010), and Solano 2010.

This study focuses on: 1) the definition of the sedimentary facies across the study area through detailed core descriptions and well-log interpretations; 2) interpretation of depositional environment; and 3) investigation of the relationship between petrophysical properties and sedimentary features. Different sources of reservoir data are examined in order to provide an integrated geological analysis of this tight gas reservoir. Drill cores offer the most complete

sampling of rocks encountered in the subsurface. Based on this detailed core observations of physical sedimentary structures, grain size, and lithology, a total of six facies are identified along a SE-NW transect (Figure 3). The interpreted vertical facies sequence combined with well logs allows for data to be extrapolated laterally.

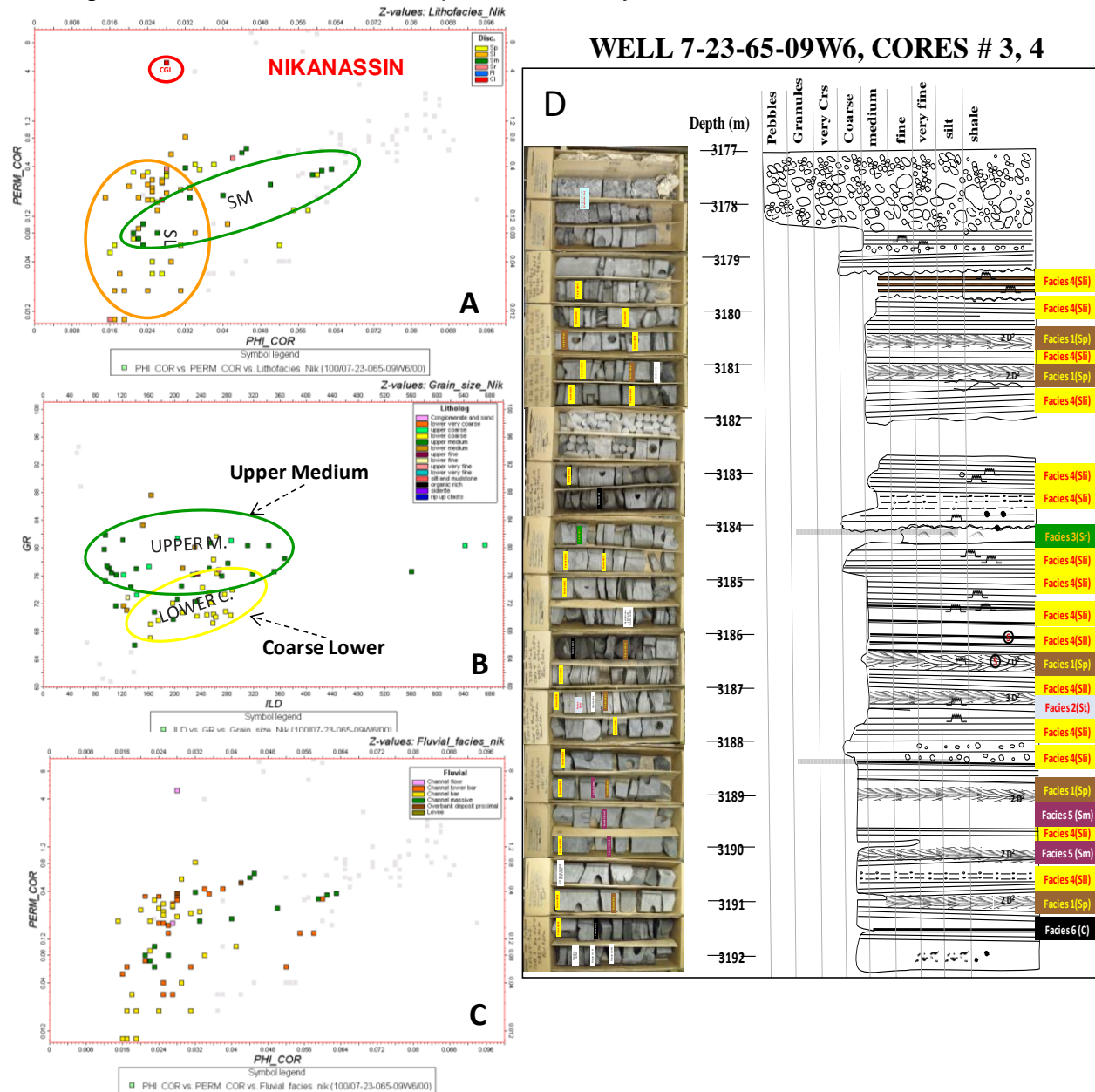


Figure 3: A. Porosity vs. permeability distributions grouped by the interpreted grain size (core logging). B. Gamma Ray plotted against resistivity, and constrained by the interpreted grain size (core logging). C. Porosity vs. permeability distributions grouped by the interpreted fluvial facies. D Core log description and whole core interval highlighted interpreted facies.

The sedimentologic description and the interpretation performed on these cores infer that the observed fining upward packages are associated with fluvial depositional environment. Further correlation of these sedimentary features with petrophysical properties measured on cores allows for the analysis of any existent relationship, and provides a link to mappable and

predictable geological patterns/processes such as sedimentary facies, mineralogy and diagenesis.

Preliminary results suggest some degree of correlation between typical well logs and measured properties with some of the features logged from cores (Figure 3). For example, higher permeability values are found likely associated with medium grain size instead of coarser grain size. In order to validate the previous assumption regarding which factors affect directly permeability further analysis will be performed doing a standard petrographic analysis on selected samples which at present suggest severe diagenetic controls on porosity and permeability.

The understanding on the most important controls, including grain size distribution, sorting, pore geometry, and mineralogical composition, will help us minimize the uncertainty inherent in permeability prediction.

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