"Reservoir characterization of tight gas sandstones of the uppermost Nikanassin Formation in the Western Canada Sedimentary Basin in Alberta, Canada"

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Abstract

The present study focuses on the integration of gas production data with geological proxies using cores, drill cuttings and well logs from the uppermost portion of the tight gas Nikanassin Fm. in the Deep Basin of the Western Canada Sedimentary Basin (WCSB). The approach involves multi-scale description and evaluation techniques of core and cuttings, including multiple laboratory measurements of key reservoir parameters. The ultimate goal is to understand the distribution of reservoir quality within the study area.

The data and interpretations are based on production data, seven cored wells and over a hundred drill-cuttings samples from 12 wells located within the Wapiti and Red Rock gas fields (Figure 1). Reservoir intervals in the uppermost Nikanassin Formation are mainly composed of amalgamated fluvial sandstones on the order of 5 to 50 metres thick within the study area. Detailed analyses were performed using thin sections from 51 samples to investigate the variability of mineralogy, cements, pore sizes/geometries rock textures/fabrics, diagenetic overprints, and fracture abundances in these rocks using petrography and SEM techniques.

The uppermost Nikanassin is composed of some conglomeratic pebble layers which are supported by a poorly sorted matrix of sand, silt and mud and, litharenites which are medium-to very coarse grained, sub-angular to sub-rounded, and poorly sorted. They are composed of quartz, abundant chert and lithic fragments, which are cemented tightly with abundant silica and quartz overgrowth.

Available porosity data from routine core analysis (RCA) was compared with results from the saturation method for porosity (Φ_{Lab}) (Ortega et al, 2012). RCA permeabilities were compared with pulse decay profile permeability (PDPK) from the same parent samples and with the liquid pressure pulse (LPP) permeabilities from drill cuttings. The pores consist primarily of secondary pores including intragranular pores and microporosity from dissolution of mostly chert fragments. Some preserved intergranular pores are exclusively associated with mutually adjacent detrital chert fragments. Cross-correlation between laboratory measurements and petrographic observations indicate that compaction and mobilization of silica may have the greatest influence on the poor reservoir quality with very low porosity and permeability due to grain rearrangement and quartz overgrowth.

A clearer understanding on the most important controls on reservoir quality, grain size distribution, sorting, pore geometries, and mineralogical composition, will help to minimize the uncertainty inherent in porosity and permeability trends and the identification of "sweet spots" for increasing horizontal drilling targets within the upper Nikanassin in the study area.

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References

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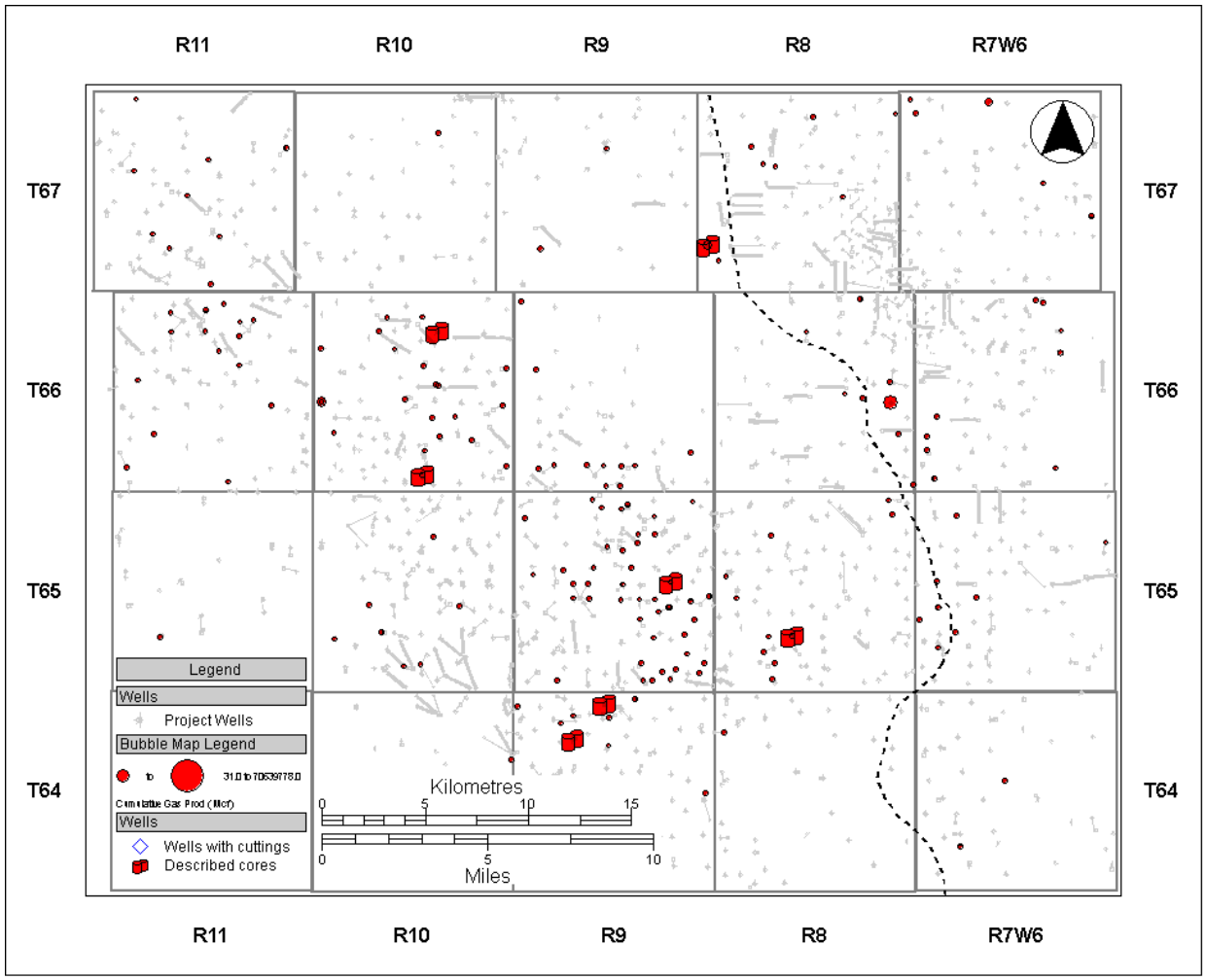

Figure 1: Location of the study area in west – central Alberta, Canada with a detailed view of the study area showing Nikanassin cores and drill-cuttings described in this research.Red circles indicate wells with commingled production from the Monach Formation (upper Nikanassin) and overlying units.