

Hydrocarbon Potential of Southern Alberta: Cambrian to Beaverhill Lake

Please Select:

[Summary](#) · [Basemap](#) · [List of Contents](#) · [Complementary Products](#)

[Download this list as a PDF](#)

List of Contents

HYDROCARBON POTENTIAL OF CAMBRIAN TO BEAVERHILL LAKE

Contents

TABLE OF CONTENTS

LIST OF FIGURES

ENCLOSURES

1 EXECUTIVE SUMMARY

2 GENERAL INTRODUCTION AND DATABASE

2.1 Introduction

2.2 Well Information

2.3 Seismic Database

2.4 Gravity and Magnetic Data

2.4.1 Gravity Data

2.4.2 Magnetic Data

2.5 Geochemical Database

2.6 Hydrodynamic Database

2.6.1 Fluid Recovery Data

2.6.2 Pressure Data

2.6.3 Water Chemistry Data

2.6.4 Production Data

3 INTERPRETATION METHODOLOGY

3.1 Introduction

3.2 Geology

3.3 Seismic Interpretation

3.3.1 Methodology

3.3.2 Seismic Character and Correlation

3.4 Gravity and Magnetic Interpretation

3.5 Geochemistry

3.6 Hydrodynamics

3.6.1 Pressure Elevation Plots and Head Maps

3.6.2 Water Salinity

3.6.3 Hydrodynamic Flow Analysis

4 EXPLORATION AND PRODUCTION HISTORY

4.1 Introduction

4.2 Early History

4.3 Modern History

4.4 Current Activity

4.5 Production

5 STRUCTURAL FRAMEWORK

5.1 Introduction

5.2 Regional Setting and Basin Evolution

5.2.1 Introduction

5.2.2 Regional Setting

5.2.3 Basin Evolution

5.3 Gravity and Magnetic Interpretation

5.3.1 Introduction

5.3.2 Interpretation

5.3.3 Summary

5.4 Structural Framework

5.4.1 Introduction

5.4.2 Basement Structure

5.4.3 Cambro-Ordovician Structure

5.4.4 Devonian Structure

5.4.5 Post Devonian Structuring

5.4.6 Seismic Expression of Structural Style

6 STRATIGRAPHY

- 6.1 Introduction
- 6.2 Precambrian
- 6.3 Cambrian
 - 6.3.1 Basal Sand
 - 6.3.2 Mount Whyte
 - 6.3.3 Cathedral
 - 6.3.4 Stephen
 - 6.3.5 Eldon
 - 6.3.6 Pika/Arctomys
 - 6.3.7 Earlie
 - 6.3.8 Deadwood
 - 6.3.9 Waterfowl/Sullivan/Lynx
- 6.4 Ordovician - Silurian
 - 6.4.1 Finnegan
 - 6.4.2 Red River
- 6.5 Devonian
 - 6.5.1 Elk Point Clastics
 - 6.5.2 Contact Rapids
 - 6.5.3 Winnipegosis
 - 6.5.4 Prairie
 - 6.5.5 Dawson Bay
 - 6.5.6 Watt Mountain
 - 6.5.7 Beaverhill Lake Group
- 6.6 Summary

7 PETROLEUM GEOLOGY

- 7.1 Introduction
- 7.2 Oil and Gas Occurrences
 - 7.2.1 Gas
 - 7.2.2 Oil and Solid Hydrocarbon Residues
- 7.3 Source Rocks - Type, Quality and Maturity
 - 7.3.1 Regional Review of Pre-Pennsylvanian Source Rocks
 - 7.3.2 Cambrian - Middle Devonian Source Rocks
 - 7.3.3 Regional Measured Maturity Trends
 - 7.3.4 Maturity Modelling
 - 7.3.5 Present Day and Palaeo-Maturity Maps
- 7.4 Reservoirs and Seals
 - 7.4.1 Introduction
 - 7.4.2 Cambrian
 - 7.4.3 Ordovician - Silurian
 - 7.4.4 Elk Point Group
 - 7.4.5 Beaverhill Lake Group
 - 7.4.6 Diagenesis
 - 7.4.7 Summary
- 7.5 Hydrodynamics
 - 7.5.1 Introduction
 - 7.5.2 Lower-Middle Cambrian Aquifer
 - 7.5.3 Upper Cambrian - Silurian Aquifer
 - 7.5.4 Elk Point Group Aquifer
 - 7.5.5 Beaverhill Lake Group Aquifer
- 7.6 Migration 141
 - 7.6.1 Primary Migration - Expulsion and Drainage
 - 7.6.2 Secondary Migration
 - 7.6.3 Volumetrics and Migration Efficiencies
- 7.7 Trapping Mechanisms 5
 - 7.7.1 Introduction
 - 7.7.2 Foothills
 - 7.7.3 Plains

8 HYDROCARBON POTENTIAL

- 8.1 Introduction
- 8.2 Cambrian-Ordovician Play Concepts
- 8.3 Elk Point Group Play Concepts
- 8.4 Beaverhill Lake Group Play Concepts
- 8.5 Summary

9 BIBLIOGRAPHY AND REFERENCES

APPENDICES

A WELL SUMMARY SHEETS

B GEOCHEMISTRY

- B-I : Geochemistry
- B-II: Maturity Modelling

C HYDRODYNAMICS

- C-I Screening DST Pressure Data
- C-II Geofluids Water Analyses Screening Procedure
- C-III Calculation and Representation of the Force for the Flow of Water and Oil in Variable Salinity Systems
- C-IV Pressure and Water Chemistry Data Tables

HYDROCARBON POTENTIAL
OF THE CAMBRIAN TO BEAVERHILL LAKE SECTION
OF SOUTHERN ALBERTA

LIST OF FIGURES

- 2.1 Study Area
- 2.2 Well and Seismic Database
- 2.3 Summary of Stratigraphy, Lithology and Symbols Used for Wells
- 2.4 Geochemical Database

- 3.1 Synthetic Seismogram Well Location Map
- 3.2 Synthetic Seismogram - Well 01-31-18-28W3
- 3.3 Synthetic Seismogram - Well 11-25-24-02W4
- 3.4 Synthetic Seismogram - Well 04-13-06-03W4
- 3.5 Synthetic Seismogram - Well 12-19-14-04W4
- 3.6 Synthetic Seismogram - Well 08-17-20-04W4
- 3.7 Synthetic Seismogram - Well 08-08-20-09W4
- 3.8 Synthetic Seismogram - Well 07-26-03-14W4
- 3.9 Synthetic Seismogram - Well 06-15-07-15W4
- 3.10 Synthetic Seismogram - Well 08-24-25-15W4
- 3.11 Synthetic Seismogram - Well 16-09-15-16W4
- 3.12 Synthetic Seismogram - Well 07-12-26-20W4
- 3.13 Synthetic Seismogram - Well 16-35-01-22W4
- 3.14 Synthetic Seismogram - Well 05-18-07-23W4
- 3.15 Synthetic Seismogram - Well 10-11-20-24W4
- 3.16 Synthetic Seismogram - Well 13-21-26-25W4
- 3.17 Synthetic Seismogram - Well 04-12-15-27W4
- 3.18 Synthetic Seismogram - Well 14-05-15-29W4
- 3.19 Synthetic Seismogram - Well 05-29-18-03W5
- 3.20 Synthetic Seismogram - Well 08-13-27-03W5
- 3.21 Synthetic Seismogram - Well 07-35-08-04W5
- 3.22 Synthetic Seismogram Correlation
- 3.23 Interval Velocity vs Depth from Top Devonian
- 3.24 Seismic Character
- 3.25 Seismic Character
- 3.26 Seismic Character
- 3.27 Seismic Character
- 3.28 Kerogen Type from Rock Eval Hydrogen Index (HI) versus T-max
- 3.29 Interpretation of Kerogen Type from Rock Eval S-2 Yield versus TOC
- 3.30 Maturity Modelling in Thrust Terranes
- 3.31 Expulsion Efficiency as a Function of Source Rock Richness and Thickness

- 4.1 Exploration History
- 4.2 Land Map

- 5.1 Summary of Regional Structural Features
- 5.2 Palaeo Structural Elements
- 5.3 Tectonic Evolution Summary
- 5.4 Regional Bouguer Gravity
- 5.5 Regional Magnetic Anomaly
- 5.6 Bouguer Gravity
- 5.7 Residual Bouguer
- 5.8 Magnetic Anomaly
- 5.9 Residual Magnetic Anomaly
- 5.10 Surface Geology and Structural Elements
- 5.11 Regional Structural Cross Section
- 5.12 Structural Cross Sections - 1 and 2
- 5.13 Structural Cross Sections - 3 and 4
- 5.14 Base Cambrian Depth Map
- 5.15 Intra Cambrian Marker (Top Stephen/Top Earlie) Depth Map
- 5.16 Top Cambrian Depth Map
- 5.17 Base Prairie Salt/Base Watt Mountain Depth Map
- 5.18 Top Watt Mountain Depth Map
- 5.19 Top Beaverhill Unit Depth Map
- 5.20 Cross-section and Geoseismic Section Location Map
- 5.21 Geoseismic Section 1
- 5.22 Geoseismic Section 2
- 5.23 Geoseismic Section 3
- 5.24 Geoseismic Section 4
- 5.25 Geoseismic Section 5
- 5.26 Geoseismic Section 6
- 5.27 Fault Architecture Map
- 5.28 Tectonic Domain Map
- 5.29 Geoseismic Section 7
- 5.30 Geoseismic Section 8
- 5.31 Geoseismic Section 9
- 5.32 Geoseismic Section 10
- 5.33 Geoseismic Section 11
- 5.34 Geoseismic Section 12

5.35 Geoseismic Section 13
5.36 Geoseismic Section 14
5.37 Geoseismic Section 15
5.38 Geoseismic Section 16
5.39 Geoseismic Section 17
5.40 Geoseismic Section 18
5.41 Seismically Defined Areas of Salt Dissolution
5.42 Geoseismic Section 19
5.43 Geoseismic Section 20
5.44 Geoseismic Section 21
5.45 Geoseismic Section 22
5.46 Devonian Depth Map - Waterton - Coleman Area
5.47 Surface Structure and Structure Fractal Map - Waterton - Coleman Area

6.1 Summary of Stratigraphic Nomenclature
6.2 Global Seawater Strontium Curve and Oxygen Isotope Trends in the Devonian
6.3 Lithostratigraphic Correlation
6.4 Well Correlation A-A \bar{O}
6.5 Well Correlation B-B \bar{O}
6.6 Well Correlation C-C \bar{O}
6.7 Basement Control
6.8 Basal Sand Isopach
6.9 Pre Top Pika/Earlie Isopach
6.10 Post Pika/Earlie Isopach
6.11 Lithostratigraphic Relationships within the Cambrian
6.12 Red River Isopach
6.13 Lithostratigraphic Relationships within the Elk Point Group
6.14 Type Well for Elk Point Group - 07-16-21-14W4
6.15 Elk Point Clastics/Winnipegosis/Contact Rapids Isopach
6.16 Prairie/Dawson Bay Isopach
6.17 Beaverhill Unit Isopach
6.18 Waterways Isopach

7.1 Oil and Gas Occurrences
7.2 Oil Density Histogram - Hays-Enchant
7.3 Gas/Oil Ratio Histogram - Hays-Enchant
7.4 Stratigraphic Distribution of Source Rocks
7.5 Total Organic Carbon in the Cambrian to Beaverhill Lake
7.6 Total Organic Carbon vs Pyrolysis S-2 Yield
7.7 Organo-facies and Hydrocarbon Yields of the Dawson Bay Source Rocks
7.8 Rock Eval T-max Depth Trends
7.9 Surface Heat Flow as a Function of Basement Age
7.10 Temperature Depth Trends for Selected Southern Alberta Wells
7.11 Geothermal Gradient Depth Trends for Selected Southern Alberta Wells
7.12 Present Day Heat Flow
7.13 Temperature and Maturity Calibration for Foothills Well 15-33-07-03W5
7.14 Burial History Model for Foothills Well 15-33-07-03W5
7.15 Temperature and Maturity Calibration for Foothills Well 05-29-18-03W5
7.16 Hydrothermal Model for Calibration of Temperature and Maturity Data
7.17 Temperature and Maturity Calibration for Plains Well 06-36-19-01W4
7.18 Burial History Model for Plains Well 06-36-19-01W4
7.19 Post-Laramide Regional Uplift Based on Temperature and Maturity Data
7.20 Present Day Regional Maturity of Cambrian Basal Sand
7.21 Mid-Cretaceous Regional Maturity at Cambrian Basal Sand
7.22 Present Day Regional Maturity of the Dawson Bay
7.23 Generation and Maturity of the Dawson Bay in the Hays-Enchant Area
7.24 Stratigraphic Distribution of Reservoirs and Seals
7.25 Reservoir Potential - Cambrian Basal Sand
7.26 Basal Sand Reservoir - Well 16-35-01-22W4
7.27 Basal Sand: Porosity/Permeability Crossplot
7.28 Basal Sand: Porosity vs Depth
7.29 Basal Sand: Permeability vs Depth
7.30 Cambrian Reservoirs - Well 10-29-08-10W4
7.31 Cambrian Reservoirs - Well 08-08-20-09W4
7.32 Reservoir Potential - Red River
7.33 Red River Reservoir - Well 10-25-03-27W3
7.34 Red River Reservoir: Porosity/Permeability Crossplot
7.35 Red River Reservoir: Porosity vs Depth
7.36 Red River Reservoir: Permeability vs Depth
7.37 Reservoir Potential - Elk Point Clastics
7.38 Reservoir Correlation - Elk Point Clastics
7.39 Reservoir Correlation - Elk Point Carbonates
7.40 Reservoir Potential - Elk Point Carbonates
7.41 Type Well Winnipegosis - Well 07-18-19-03W4
7.42 Winnipegosis Reservoir - Well 10-36-16-08W4
7.43 Dawson Bay Reservoir - Well 16-35-02-05W4
7.44 Dawson Bay Reservoir - Well 08-36-12-15W4
7.45 Dawson Bay Reservoir - Well 16-09-15-16W4
7.46 Elk Point: Porosity/Permeability Crossplot
7.47 Elk Point: Porosity vs Depth
7.48 Elk Point: Permeability vs Depth

7.49 Reservoir Potential - Beaverhill Lake
7.50 Reservoir Correlation - Beaverhill Lake
7.51 Type Well Beaverhill Salt - Well 03-32-15-05W4
7.52 Beaverhill Lake Reservoir - Well 08-08-20-09W4
7.53 Beaverhill Lake Reservoir - Well 16-11-20-12W4
7.54 Beaverhill Lake Reservoir - Well 08-36-12-15W4
7.55 Beaverhill Lake Reservoir - Well 16-35-01-22W4
7.56 Beaverhill Lake Reservoir - Well 10-04-01-09W4
7.57 Beaverhill Lake Reservoir - Well 10-25-03-27W3
7.58 Beaverhill Lake: Density/Neutron Crossplot
7.59 Beaverhill Lake: Porosity/Permeability Crossplot
7.60 Beaverhill Lake: Porosity vs Depth
7.61 Beaverhill Lake: Permeability vs Depth
7.62 Beaverhill Lake: Core vs Log Porosity
7.63 Beaverhill Lake: Core Grain Density Histogram
7.64 Beaverhill Lake: Core Porosity vs Density
7.65 Beaverhill Lake: Core Porosity vs Sonic
7.66 Beaverhill Lake: Log Porosity vs Resistivity
7.67 Oxygen Isotopes - Leduc Field
7.68 Strontium Isotopes, Leduc Formation, Central Alberta
7.69 Lower-Middle Cambrian Pressure/Elevation Plot
7.70 Lower-Middle Cambrian Head Map
7.71 Lower-Middle Cambrian Salinity Map
7.72 Upper Cambrian - Silurian Pressure/Elevation Plot
7.73 Upper Cambrian - Silurian Head Map
7.74 Upper Cambrian - Silurian Salinity Map
7.75 Elk Point Group Pressure/Elevation Plot
7.76 Elk Point Group Head Map
7.77 Elk Point Group Salinity Map
7.78 Beaverhill Lake Group Pressure/Elevation Plot
7.79 Beaverhill Lake Group Head Map
7.80 Beaverhill Lake Group Salinity Map
7.81 Expulsion Efficiencies from the Dawson Bay
7.82 Schematic Oil and Gas Migration Pathways
7.83 Summary of Trapping Mechanisms

8.1 Basal Cambrian Inert Gas Play Concept
8.2 Basal Cambrian Inert Gas Play Map
8.3 Elk Point Clastics Play Concept
8.4 Elk Point Clastics Play Map
8.5 Elk Point Dolomites Play Concepts
8.6 Elk Point Dolomites Play Map
8.7 Beaverhill Lake Group Play Concepts
8.8 Beaverhill Lake Group Play Map
8.9 Play Fairway Summary Map

HYDROCARBON POTENTIAL OF THE CAMBRIAN TO BEAVERHILL LAKE SECTION OF SOUTHERN ALBERTA

LIST OF ENCLOSURES

Scale: 1:350,000

1 Database
2 Topography
3 Cambrian - Beaverhill Lake Land Map
4 Surface Geology Map
5 Basin Evolution Summary
6 Bouguer Gravity
7 Residual Bouguer Gravity
8 Magnetic Anomaly
9 Reduced to Pole Magnetic Anomaly
10 Residual Magnetic Anomalies
11 Structural Framework
12 Structural Cross Sections - 1 and 2
13 Structural Cross Sections - 3 and 4
14 Seismic Montage
15 Top Beaverhill Unit Depth Map
16 Top Watt Mountain Depth Map
17 Base Prairie Salt/Base Watt Mountain Depth Map
18 Top Cambrian Depth Map
19 Intra-Cambrian Marker Depth Map
20 Base Cambrian Depth Map
21 Key Well Correlation A-A'
22 Key Well Correlation B-B'
23 Key Well Correlation C-C'
24 Isopach Montage
25 Basal Sand Reservoir
26 Elk Point Reservoir
27 Beaverhill Lake Reservoir
28 Pressure/Elevation Plot: Lower-Middle Cambrian

- 29 Pressure/ Elevation Plot: Upper Cambrian-Silurian
- 30 Pressure/ Elevation Plot: Elk Point Group
- 31 Pressure/ Elevation Plot: Beaverhill Lake Group
- 32 Lower-Middle Cambrian Hydrodynamic Montage
- 33 Beaverhill Lake Group Hydrodynamic Montage
- 34 Summary Distribution of Reservoirs and Hydrocarbon Occurrences
- 35 Play Fairways