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Source
The Geology and Oil and Gas Potential of the Fernie - Elk Valley Area, Southeastern British Columbia
and
The Geology and Oil And Gas Potential of the Flathead Area, Southeastern British Columbia
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Oil and Gas Opportunities in Southeast British Columbia

THRUST FAULTED PALEOZOIC RESERVOIRS BELOW THE LEWIS THRUST

Simplified Geological Map

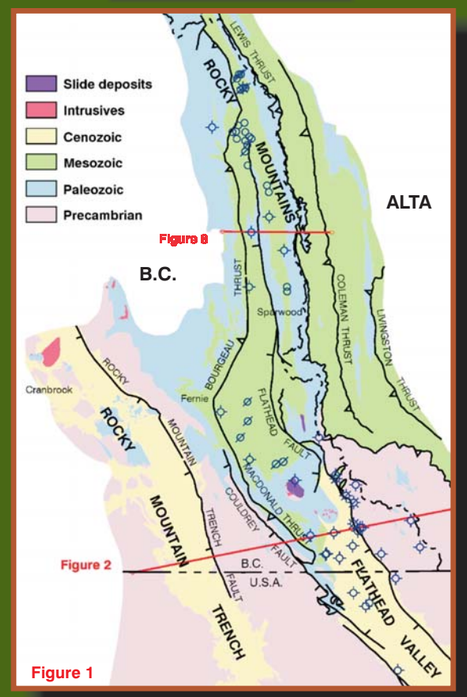

Figure 1

Southeastern British Columbia has a long history of petroleum exploration. Drilling activity began in the early 1900's based on surface oil seeps in Precambrian metasediments. Only minor oil production was established but drilling in the 1980's found significant gas accumulations in thrust faulted Paleozoic strata beneath the Lewis Thrust in the Flathead area. These sub Lewis thrust Paleozoic reservoirs are the most prospective targets in SEBC. This play includes the Waterton, Coleman, and Savanna Creek gas fields in Alberta with initial recoverable reserves of 2,600 BCF, 249 BCF, and 153 BCF, respectively, and the Flathead CO_2-rich gas field in southeastern British Columbia with a raw gas volume of 600 BCF (Figure 4).

Traps in this play occur in large duplexes, such as those at the Waterton and Flathead gas fields, and smaller thrust sheets (Figure 2). These structures developed during the Late Jurassic to Early Tertiary Laramide Orogeny. Reservoirs include the Mississippian Livingstone, Mount Head and Etherington Formations, which are (with their equivalents) the most important hydrocarbon reservoirs in the Rocky Mountain Foreland Fold and Thrust Belt (Figure 5). The principal reservoir facies consists of dolomitized wackestones, particularly those deposited in a mid-ramp setting in the Livingstone Formation. Dolomitization of these rocks occurred during shallow burial, before the Laramide Orogeny. The dolomite facies of the Palliser Formation is also an important reservoir in the play and is the principal reservoir in the Flathead gasfield (Figure 6). The shelf-edge reef facies of the Devonian Peechee Member of the Fairholme Group (Leduc-equivalent) is locally gas bearing where it crosses the productive duplex of the Flathead gas field (Figures 4 and 6). Fracturing is an important factor in these reservoirs, enhancing permeability and establishing communication between stratigraphically separated intervals. (Continued inside)

Structural Cross Section of Flathead Area

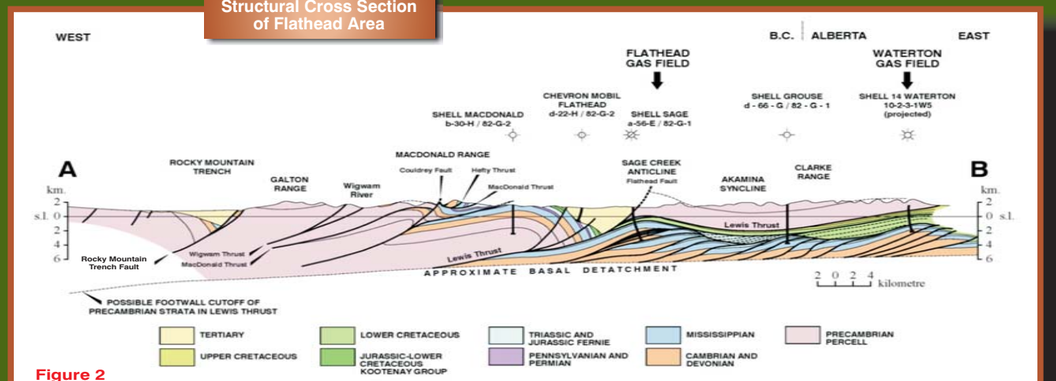

Figure 2

Sub Lewis Thrust - Paleozoic Reservoirs
British Columbia

Phanerozoic Stratigraphic Column

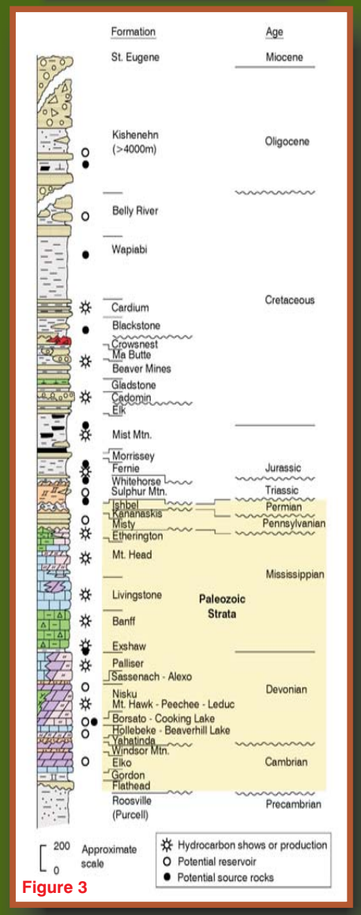

Figure 3

Thrust Faulted Paleozoic Strata Below the Lewis Thrust

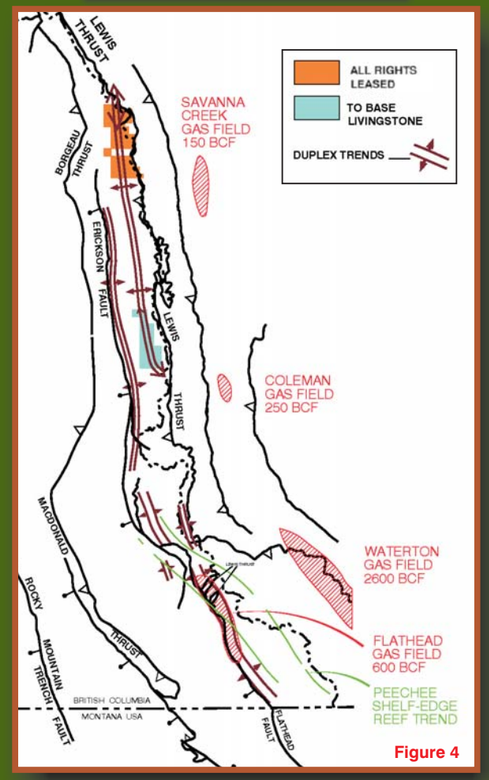

Figure 4

The average net pay thicknesses, production rates and gas compositions for the principal reservoirs in the Flathead gas field are summarized in Table 2, and the distribution of the principal pools is shown in Figure 7.

The P&NG rights for the Flathead gas field are currently available. This field was delineated by Shell in the 1980's to provide CO_2 for enhanced oil recovery projects in Alberta and Saskatchewan, but was abandoned in the low oil price regime of the late 1980's. With the decline of conventional oil production in Western Canada, this CO_2 resource could become economically attractive. Furthermore, the methane content of the largest Mississippian gas pool is between 38 and 53% and could itself become economically viable.

This play can also be extended over a broader area in southeastern British Columbia. The duplex trend that forms the Flathead gas field is interpreted to continue 100 km further to the northwest, parallel to the Flathead fault (Figure 4). This model is confirmed at it's northern end, where the Fording Mountain well penetrated the flank of the duplex (Figure 8). Although the well did not encounter reservoir beneath the Lewis Thrust, it neither penetrated the entire Livingstone Formation nor reached the Palliser Formation. As can be seen on Figure 9, the main porous interval in the Livingstone in the palinspastically closest well is below the level reached by the Fording Mountain well. No other wells are located on this duplex trend north of the Flathead gasfield. Another duplex trend is interpreted to underlie the leading edge of the Lewis Thrust (Figure 4). Four unsuccessful wells are located on this duplex trend, but only one fully penetrated the Livingstone and reached the Palliser Formation. Smaller structures east of the Flathead gas field may also have potential. Two unsuccessful wells have been drilled in this setting, neither of which encountered the Palliser Formation. Although the lack of success demonstrates the reservoir risk in this play, this is a large area with two poorly tested 100+ km long structural trends extending on line with a 600 BCF gas field. Only seven wells have been drilled beyond the field area, and of those only one tested the Palliser Formation, the principal reservoir in the field. The source of the CO_2 in the Flathead gas field was likely related to intrusive rocks west of the field, so that hydrocarbon gases could be anticipated in structures north of the Flathead gas field.

FLATHEAD GAS FIELD RESERVOIRS

Formation	Wells	Average net pay	Flow rates	CO_2 content	CO_2 content	Methane Content
Etherington	3	5m	0.9 to 5 MMCF/D	20% to 90%	20% to 90%	5 - 53
Mount Head	3	4m				
Livingstone	4	18m				
Palliser	3	34m	3 to 11 MMCF/D	~90%	~90%	4 - 9
Peechee	1		1.9 MMCF/D	~100%	~100%	0

Table 2

Structure Contour Map of Livingstone / Baril Flathead Gas Field

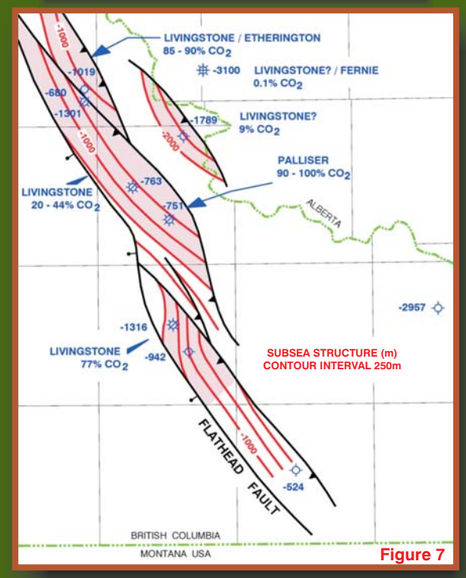

Figure 7

Diagrammatic Cross Section Mississippian and Pennsylvanian Strata

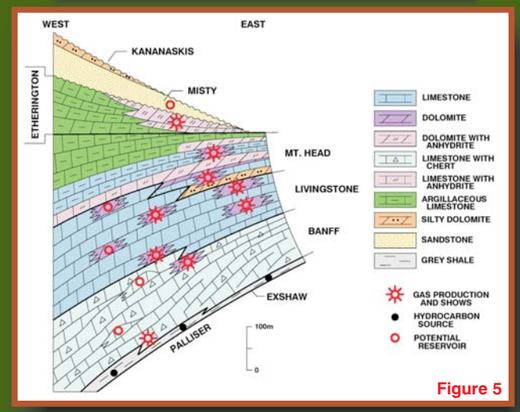

Figure 5

THRUST FAULTED PALEOZOIC STRATA BELOW THE LEWIS THRUST

Mean total gas resource BCF	26,667
Discovered gas resource BCF	7,833
Mean total pools	200
Discovered pools	28
Mean largest pool BCF	10,325
% of play in British Columbia	5%

Source: Osadetz et. al., 1995

Table 1

The Geological Survey of Canada has estimated a mean gas resource potential of nearly 27 TCF for this play, of which only 8 TCF has been discovered. (Table 1)

The mean estimate for the undiscovered gas potential is nearly 19 TCF, and the largest pool may not have been discovered. A significant proportion of this undiscovered resource could occur in the extensive but poorly tested structural trends in southeastern British Columbia.

Diagrammatic Cross Section of Devonian Strata

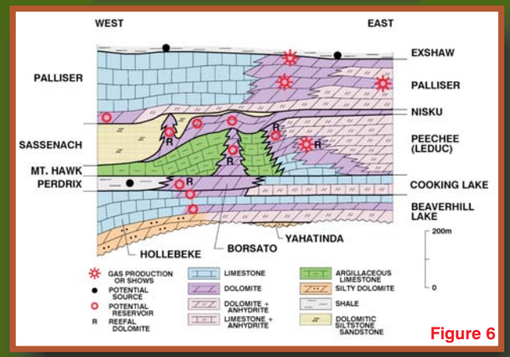

Figure 6

Structural Cross Section Across Central Part of Elk River Valley and High Rock Range

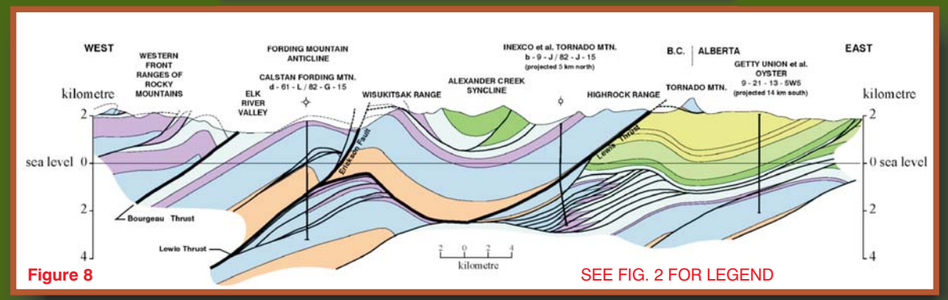

Figure 8

Cross Section showing that d-61-L well did not penetrate entire Livingstone; well reached the top of main porous section in b-9-J well

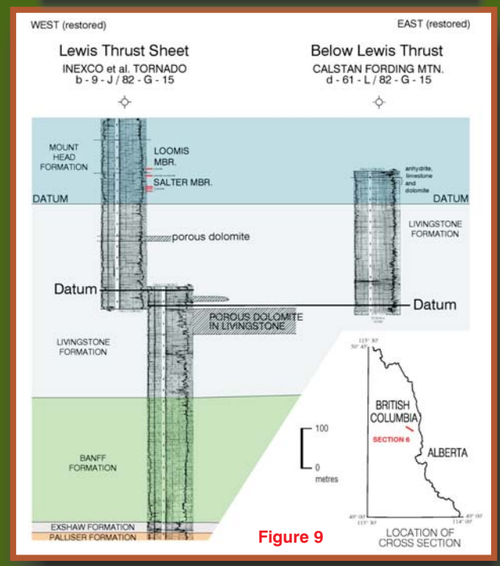

Figure 9