CONVENTIONAL OIL POOLS OF BRITISH COLUMBIA

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INTRODUCTION

Oil exploration in the Peace River region of northeastern British Columbia began in the 1920s in conjunction with widespread settlement resulting from agricultural development. Exploration resumed (Janicki, 2008) in earnest in the late 1940s after the building of the Alaska Highway and the discovery of oil at Leduc in Alberta, which demonstrated the potential of the Western Sedimentary Basin. Production at Leduc began in 1955 with an oil well in the Boundary Lake Field along the Alberta border near Fort St. John. Throughout the 1960s, 1970s and into the early 1980s, oil companies also found and developed many oil fields[1] in northeastern British Columbia. Many of the early fields initially produced thousands of barrels per day and continue to produce most of British Columbia's oil. In recent decades, though, new discoveries of large conventional oil pools have been few and far between. Most of the more recently developed oil pools[2] consist of only one or two wells with considerably less than one million barrels of recoverable oil. Levels of oil production in the province peaked at around the year 2000 and have been in decline ever since, despite the relative stability and general upward trend of oil prices. Conventional oil exploration in northeastern British Columbia now presents expensive technical challenges because undiscovered accumulations are small and subtle.

At current oil prices, the economics for oil exploration in northeastern British Columbia are marginal; however, new technologies such as horizontal drilling, 3D seismic, reservoir modelling, multistage fracking and improved recovery techniques provide the possibility for greater oil production from existing conventional oil fields. Horizontal drilling has already been successful in extending the life of many existing conventional pools in British Columbia or making marginal pools economic. Some near-depleted pools could be ideal candidates for enhanced recovery using CO_2 (Janicki, 2010) or for carbon capture and storage. As these new technologies become more established and refined, the cost for their application has decreased, which in turn may enable companies to reconsider the economics of conventional oil in northeastern British Columbia.

Conventional oil production from existing oil fields has a number of attractive advantages when compared with unconventional oil:

- Risk is relatively low because the geology can be well understood using publically available information or seismic information that can be purchased cheaply.
- Small companies can make a good economic return with relatively small investments because the capital outlays are generally far less than for unconventional oil.
- The regulatory environment is well established and straightforward.
- Farm-ins can be arranged with current mineral rights holders.
- Prospective lands around the edges of existing fields might be unleased and therefore available.
- Enhanced recovery from existing fields causes a relatively light environmental footprint because much of the necessary surface infrastructure is already in place; therefore, extensive—and often controversial—fracking is not usually necessary.
- British Columbia produces generally high gravity conventional crudes.
- Oil—particularly light oil—is likely to be valuable for decades to come because no other energy sources can match it for portability and uses beyond transportation.

[1]Field: "The surface area underlaid or appearing to be underlaid by one or more pools, and the subsurface regions vertically beneath that surface area" (Government of British Columbia, 1996).

[2]Pool: "Underground reservoir containing an accumulation of petroleum or natural gas, or both, separated or apparently separated from another reservoir or accumulation" (Government of British Columbia, 1996).

PUBLICATION

Little new information has been published about British Columbia's conventional oil fields since production began to decline in the late 1990s. Until 1997, the British Columbia Ministry of Energy and Mines (now the Ministry of Energy, Mines and Natural Gas) regularly published updated sets of oil and gas pool maps. Although the British Columbia Oil and Gas Commission maintains a current set of pool maps and data, their maps are not available to the public in a readily accessible, consolidated format. This paper summarizes the key points of an upcoming open file publication (currently under review) that will take the Oil and Gas Commission's oil pool database and reproduce it in a format that details the main points of major oil pools and provides pertinent comments on geological characteristics.

This paper presents one example from the many pools to be profiled in an upcoming open file report. To some extent, the information provided will be patterned after Sikabonyi (1964), who put together a "reference volume helpful during their (oil companies) daily work". Although Sikabonyi stated that the purpose "was not to outline and interpret, but to collect and to compile the existing information", the open file will include some interpretational content to direct users' attention to important aspects of each pool that might not be obvious at first glance. Each pool to be profiled in the open file has been selected because it either has more than one well or some other significance. The format will allow for the addition of more pools in revisions.

OPEN FILE CONTENT

The most recent set of oil and gas pool information (from 1997) included just maps, whereas the new open file will provide additional information and updated maps. Each pool profiled will provide a map (Fig. 1), representative wireline logs (Fig. 2) and a page (Table 1) outlining reservoir parameters for the pool. The page of parameters will be divided into three categories:

- 'field parameters' will include the field code and pool code numbers assigned to each pool by the Oil and Gas Commission for ease of reference,
- 'reservoir data' will provide engineering characteristics of the pool such as porosity and oil formation volume factor, and
- 'reserves' will outline the amounts of oil produced and amounts remaining.

Notes at the bottom of the page will summarize some features of interest for a pool.

The reservoir parameters on the data sheet are those considered by the author to be the most fundamental for defining a pool's potential production performance and for estimating reserves. The final reservoir parameters listed in the open file may be slightly different depending on feedback received from workers who may use this publication. The author welcomes input from readers on what information should be considered for updates.

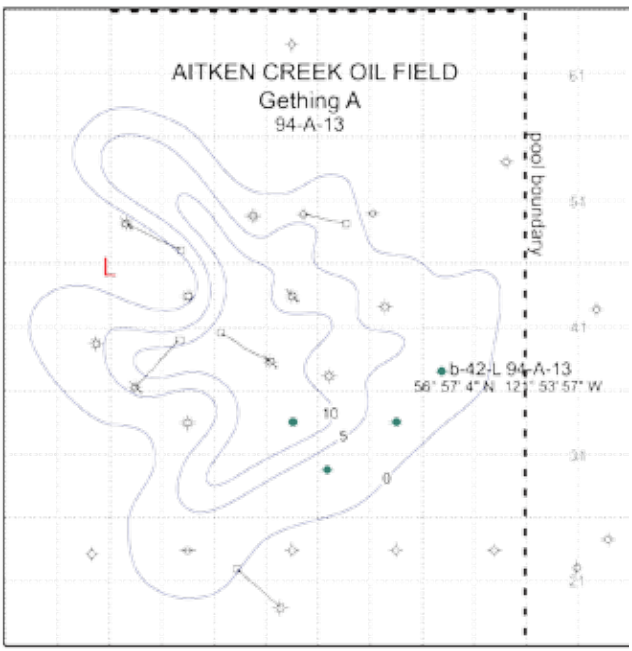

Figure 1: Example of a map provided for each pool profiled in the upcoming open file release. Contour interval is 5 m net Gething A oil pay, and the discovery well is b-42-L-94-A-13. The entire updip portion of the pool (northwest) in undrained by oil wells and gas is being injected into the updip side of the pool (contours are from the British Columbia Oil and Gas Commission).

Metric versus Imperial

Many of the wells that will be profiled in the new open file were drilled prior to the widespread adoption of the metric system by the oil industry in 1978 (federal metric legislation did not come into full effect until 1980); therefore, some wells are outlined with a combination of metric and imperial units. For ease of cross-reference with original logs and well files, depths are given in feet for wells drilled prior to 1978. Pressures are given in the more familiar units of pounds per square inch (psi) and the metric equivalent of kilopascals (kPa).

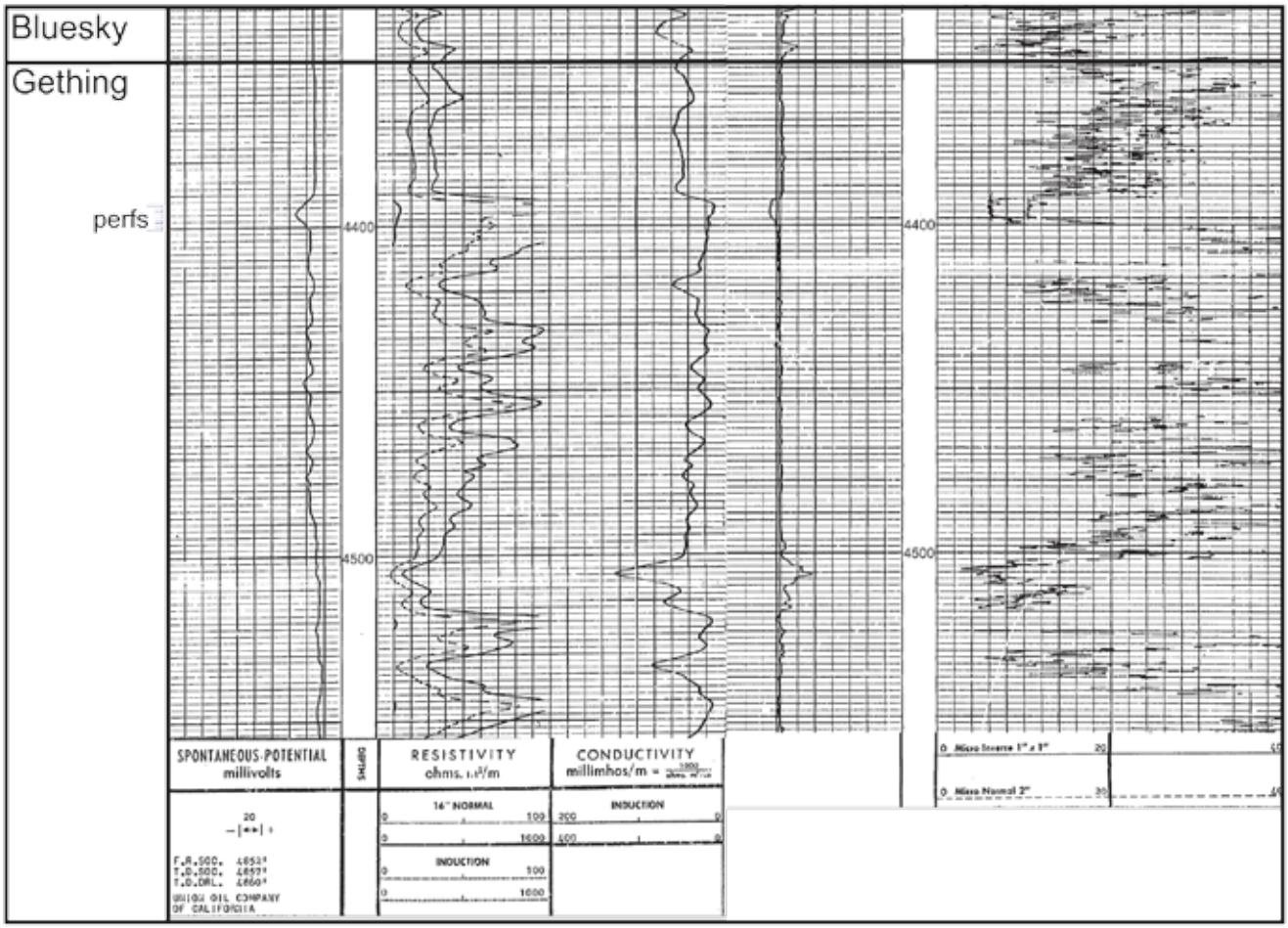

Figure 2: Example of representative wireline logs provided for each pool profiled in the upcoming open file release: elog and microlog for discovery well b-42-L-94-A-13. The microlog indicates good permeability across the perfed interval (4392'–4400').

FUTURE PUBLICATIONS

A digital format for the open file will allow for the addition of pools or the correction of inaccuracies as they are identified. Future work on oil fields and pools will build upon the foundational information in the open file. Focus will turn to the fields and pools showing the greatest promise for gains in production after the application of new technologies. Subsequent publications on oil fields and pools will contain much greater levels of detail and interpretation, similar to what can be found in field and pool studies such as those done by Rose (1990), Hogg (1998) and Janicki (2003).

TABLE 1: EXAMPLE OF THE PAGE OUTLINING RESERVOIR PARAMETERS FOR EACH POOL PROFILED IN THE UPCOMING OPEN FILE RELEASE. AITKEN CREEK OIL FIELD, GETHING A: FIELD PARAMETERS, RESERVOIR DATA AND RESERVES.

AITKEN CREEK OIL FIELD
Gething A

Field Parameters

Field code: 0200 **Pool Code:** 2700A *These numbers are assigned by OGC to the pool*
Discovery well: 200/b-042-L 094-A-13/00 **WA#:** 00485 **Rig Release:** 1962/12/10
Other oil and gas shows: Gething gas *This line shows other overlapping productive formations*
Number of producing wells (November 2012) Oil: 4 Gas: 10 Injection: 4

Reservoir Data

Average depth of producing zone: 4348 ft., 1325 m *Depth is given in feet for older wells*
Lithology of reservoir rock: sandstone
Trap type: stratigraphic
Estimated maximum reservoir thickness: 12 m
Area of pool: approximately 1630 acres or 660 hectares within contour limits
Drive mechanism: gas depletion
Average porosity (%): 12
Average net pay: 5 m
Average permeability: 74 millidarcies
Average water saturation (%): 27
Oil formation volume factor (%): 131
Gravity (degrees API): 42
Original pressure: 1561 psi, 10 763 kpa

This section provides data that could be used to estimate reserves. Figures are provided by the Oil and Gas Commission.

Reserves

Estimated Original Oil in Place: 14 055 160 barrels
Recovery Factor (%): 65 (gas injection)
Estimated Recoverable Oil: 9 135 850 barrels
Cumulative Oil Production: 8 547 580 barrels
Remaining Recoverable Oil: 588 270 barrels
Remaining Original Oil in Place (%): 39
Cumulative Water Production: 91 090 barrels

Figures in this section are provided by the Oil and Gs Commission.

Notes: Recovery is very high due to gas injection. This pool is part of the Aitken Creek gas storage project and a number of the wells are gas injection.

Notes are observations made by the author perhaps not immediately apparent to the reader.

REFERENCES

British Columbia Ministry of Energy, Mines and Natural Gas (1997): Geological reference book (net pay maps); *British Columbia Ministry of Energy, Mines and Natural Gas*, Stock #116C (out of print).

Evoy, R.W. (1998): Reservoir geometry of the Doig Formation, Buick Creek Field, northeastern British Columbia; in Oil and gas pools of the western Canada sedimentary basin, Hogg, J.R., Editor, *Canadian Society of Petroleum Geologists*, Special Publication S-51, pages 127–135.

Government of British Columbia (1996): Petroleum and natural gas act; *Government of British Columbia,* RSBC 1996, Chapter 361, Part 1—Definitions.

Hogg, J.R., Editor (1998): Oil and gas pools of the western Canada sedimentary basin; *Canadian Society of Petroleum Geologists*, Special Publication S-51, 161 pages.

Janicki, E.P. (2003): Hydrocarbon pools of the southwestern Great Slave Plain, Northwest Territories; *Northwest Territories Geoscience Office*, Open File 2003-05.

Janicki, E.P. (2008):Petroleum exploration in northeastern British Columbia; in Geoscience Reports 2008, *British Columbia Ministry of Energy, Mines and Natural Gas*, pages 41–59.

Janicki, E.P. (2010): Triassic porosity trends in northeastern British Columbia—update February 2009; in Geoscience Reports 2010, *British Columbia Ministry of Energy, Mines and Natural Gas*, pages 93–97.

Labute, J.G., Evoy, W.R. and Clegg, M. (1998): The Middle Triassic Halfway "C" pool, northeastern British Columbia; in Oil and gas pools of the western Canada sedimentary basin, Hogg, J.R., Editor, *Canadian Society of Petroleum Geologists*, Special Publication S-51, pages 111–125.

Rose, M.L., Editor (1990): The Canadian Society of Petroleum Geologists oil and gas pools of Canada series; *Canadian Society of Petroleum Geologists*, Volume 1, unpaginated binder.

Sikabonyi, L.A. (1964): Oil and gas fields of northeastern British Columbia, a reference volume, 1st edition; *West Canadian Graphic Industries Ltd*., unpaginated binder.