INTERIOR BASINS STRATEGY

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INTRODUCTION

The government of British Columbia, through the British Columbia Ministry of Energy and Mines, has a Service Plan goal of achieving a 17% increase in natural gas production and a 31% increase in the number of wells drilled over the next three fiscal years. (*BC Ministry of Energy And Mines*: Service Plan (2004/5 – 2006/7)). One of the key Ministry strategies developed to deliver this goal involves an improved knowledge and information base regarding the provinces petroleum geology and to identify new energy development opportunities within British Columbia. The aim of this strategy is to realize BC's ultimate hydrocarbon potential within its relatively under explored portion of the Western Canada Sedimentary Basin (WCSB) and see development of commercial oil and gas production within its Interior and offshore basins. The achievement of these goals will benefit all British Columbians through increases in oil and gas royalties and tenure disposition fees, and the creation of new employment opportunities.

The Resource Development and Geoscience Branch is mandated to identify, quantify and promote the hydrocarbon potential of onshore regions of British Columbia. In addition, the branch undertakes community relations initiatives, including First Nations, in areas of hydrocarbon potential.

In onshore regions outside of the WCSB, oil and gas potential occurs primarily within Mesozoic and Cenozoic clastic sediments of the Interior Basins. The main areas include, from north to south: the Whitehorse Trough; the Bowser and Sustut basins and the Nechako area (Figure 1). In addition, there are several, small Tertiary basins (*e.g.* Hat Creek) and the onshore portions of the Georgia basin. Although some of these areas have seen limited subsurface exploration (*e.g.* Bowser Basin and Nechako area), these regions remain 'frontier basins' based on infrastructure challenges and lack of extensive geological information.

Recent publications on the oil and gas resource potential of the Intermontane basins suggests upwards of some 18.8 trillion cubic feet (tcf; 5.3 x $10^{11}m^3$) of gas and 7.6 billion barrels (bb; 1.2 x 10^9m^3) of oil (Hannigan *et al*., 1994; 1995; 2001). In light of this, the BC Ministry of Energy and Mines has undertaken several initiatives to better quantify this potential resource and attract industry investment.

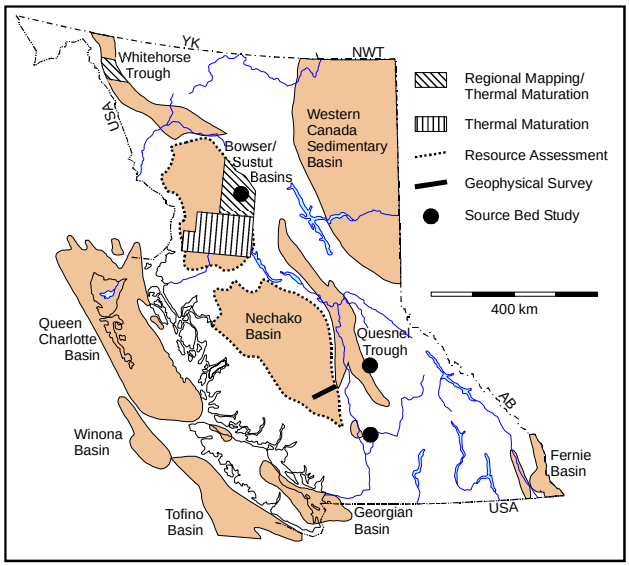

Figure 1. Map of British Columbia showing the outline of its major petroleum basins and location of projects within the Intermontane Basins funded entirely, or in part, by the Resource Development and Geoscience Branch of the BC Ministry of Energy and Mines.

NEW INITIATIVES

The Resource Development and Geoscience Branch (RDGB) has initiated or supported several projects within these areas leading to the capture of new energy-related geoscience information. Projects have started in the Whitehorse Trough, Bowser – Sustut basins and the Nechako area.

Whitehorse Trough

In central Whitehorse Trough, English *et al.* (2003, 2004), through a grant to the University of Victoria, and in conjunction with the RDGB, has gathered baseline thermal maturation and source rock potential data as part of a more regional mapping program. This new rock eval

data has been released as two open file reports (Fowler, 2003, 2004).

Nechako Area and Quesnel Trough

In 2002, the RDGB commissioned Petrel Robertson Ltd. to produce a report on the petroleum exploration potential of the Nechako – Chilcotin area (Hayes, 2002). This paper summarizes describes current surface and subsurface geological information and outlines several areas of varying potential.

Subsequent to this, RDGB entered into a working agreement with the Geological Survey of Canada for a new petroleum resource assessment of the Nechako area. This is an ongoing project and has produced several milestone products including rock eval and total organic content (TOC) analysis of subsurface samples from all interior wells (Osadetz *et al.*, 2003), and new strip logs of all interior wells incorporating digital well logs and qualitative porosity and permeability descriptions (Thornsteinsson *et al*., in press). In addition, a new heat flow model is being generated, which, together with new and current information, will be integrated into a new resource assessment.

The lack of a recognized source horizon was one of the shortcomings listed by Hayes (2002) for the Nechako area and is generally true for all Interior basins. Ferri (2004), in part, addresses this issue through sampling of organic-rich Jurassic and Cretaceous sediments within the Quesnel Trough and within the Bowser/Sustut basins.

The RDGB also acquired new, high resolution gravity and magnetic data along a 30 kilometre transect immediately west of Williams Lake (Figure 1; *see* Best, 2004). The purpose of this survey was to validate the presence of a gravity low delineated by data obtained by Canadian Hunter Exploration Ltd. in the early 1980s (Salt, 1980). One interpretation is that this gravity low represents a thick sequence of sediments, possibly of Tertiary age.

Bowser – Sustut Basins

The Bowser and Sustut basins potentially represent the largest petroleum exploration target area within the Intermontane region (Figure 1). This area has received renewed interest in the last few years as a result of new thermal maturation data indicating that large portions of these basins are within the oil and gas window (Evenchick *et al.*, 2002). Prior to this, much of this area, particularly the Bowser basin, was considered to be over mature with respect to oil and in the upper end of the gas window (Hannigan *et. al.*, 1995). This new data suggests the potential for hydrocarbon resources beyond those described in the report by Hannigan *et al.* (1995).

In light of this new information, the B.C. Ministry of Energy and Mines embarked on a program to better quantify potential resources through the acquisition of new geoscience information. Part of this strategy involved collaborative research with the Geological Survey of Canada leading to a new resource assessment of the basins. An uplift history of the northern two thirds of the Bowser and Sustut basins is being modeled based on apatite fission track analysis from several localities within the basins (O'Sullivan *et al.*, 2004). Sampling during acquisition of data points for this study led to the discovery of oil staining in several samples, analysis of which suggests the presence of two petroleum systems (Osadetz *et al.*, 2003). Further examination of catalogued surface and sub-surface samples and core recognized more oil staining (Osadetz *et al.*, 2004; Evenchick *et al.*, 2004). These occurrences also confirmed the new thermal model generated for these areas.

This new data, together with the impetus from the British Columbia government for more energy-related information in the area, led the Canadian government to initiate a multi-year, multi-million dollar program to better define the geology and energy resources of the Bowser and Sustut basins ("Integrated Petroleum Resource Potential and Geoscience Studies of the Bowser and Sustut Basins"; *see* Evenchick *et al.*, 2004). The province is a partner in this new project which runs from 2003 to 2007.

REFERENCES

Best, M. (2004): Gravity and Magnetic Survey, Nechako Basin Study, Acquisition and Processing Phase; *B.C. Ministry of Energy and Mines;* Petroleum Geology Open File 2004-1.

English, J.M., Mihalynuk, M.G., Johnston, S.T., Orchard, M.J., Fowler, M. and L.J. Leonard (2003): Atlin TGI, Part VI: Early to Middle Jurassic Sedimentation, Deformation and a Preliminary Assessment of Hydrocarbon Potential, Central Whitehorse Trough and Northern Cache Creek Terrane; *in* Geological Fieldwork 2002, *B.C. Ministry of Energy and Mines*, Paper 2003-1, pages 187-201.

English, J.M., Fowler, M., Johnston, S.T., Mihalynuk, M.G. and Wright, K.L. (2004): Thermal Maturity in the Central Whitehorse Trough, Northwest British Columbia; *Resource Development and Geoscience Branch, B.C. Ministry of Energy and Mines,* Summary of Activities 2004, this volume.

Evenchick, C.A., Hayes, M.C., Buddell, K.A. and Osadetz, K.G. (2002): Vitrinite and Bitumen Reflectance Data and Preliminary Organic Maturity Model for the Northern two thirds of the Bowser and Sustut basins, North-central British Columbia; *B.C. Ministry of Energy and Mines*, Petroleum Geology Open File 2002-1.

Evenchick, C.A., Ferri, F., Mustard, P.S., McMechan, M., Osadetz, K.G., Stasiuk, L., Wilson, N.S.F, Enkin, R.J., Hadlari, T. and McNicoll, V.J. (2004): Recent Results and Activities of the Integrated Petroleum Resource Potential and Geoscience Studies of the Bowser and Sustut Basins Project, British Columbia; *in* Current

Research, *Geological Survey of Canada*, 2003-A13, 11 pages.

Ferri, F. (2004): Potential Source Rock Characterization, Intermontane Basins, British Columbia; *Resource Development and Geoscience Branch, B.C. Ministry of Energy and Mines*, Summary of Activities 2004, this volume.

Fowler, M. (2003): Atlin TGI - Rock EVAL VII Program Pyrolysis Results from Whitehorse Trough; *B.C. Ministry of Energy and Mines*, Geofile 2003-1.

Fowler, M. (2004): Rock-Eval VI analysis of samples from the central Whitehorse Trough by the Geological Survey of Canada, Calgary in partnership with the B.C. Ministry of Energy and Mines; *B.C. Ministry of Energy and Mines*, Petroleum Geology Open File 2004-2.

Hannigan, P., Lee, P.J., Osadetz, K.G., Dietrich, J.R. and Olsen-Heise, K. (1994): Oil and Gas Resource Potential of the Nechako-Chilcotin Area of British Columbia; *B.C. Ministry of Energy and Mines*, Geofile 2001-6.

Hannigan, P., Lee, P.J., and Osadetz, K. (1995): Oil and Gas Resource Potential of the Bowser-Whitehorse area of British Columbia; *B.C. Ministry of Energy and Mines*, Geofile 2001-5.

Hannigan, P., Dietrich, J.R., Lee, P.J. and Osadetz, K.G. (2000): Hydrocarbon Resources of Pacific Margin Basins; *in* Canadian Society of Exploration Geophysicists, Annual Meeting, Program and Abstracts.

Hannigan, P., Dietrich, J.R., Lee, P.J. and Osadetz, K.G. (2001): Petroleum Resource Potential of Sedimentary Basins on the Pacific Margin of Canada; *Geological Survey of Canada*, Bulletin 564, 72 pages.

Hayes, B. (2002): Petroleum Exploration Potential of the Nechako Basin, British Columbia; *B.C. Ministry of Energy and Mines*, Petroleum Geology Special Paper 2002-3.

O'Sullivan, P.B., Donelick, R.A., Osadetz, K.G., Evenchick, C.A. and Ferri, F. (2004): Apatite Fission Track Data for Northern Two Thirds of the Bowser Basin; *B.C. Ministry of Energy and Mines*, Petroleum Geology Open File 2004-3.

Osadetz, K.G., Evenchick, C.A., Ferri, F., Stasiuk, L., Obermajer, D.M. and Wilson, N.S F. (2003): Molecular composition of Crude Oil Stains from Bowser Basins *in* Geological Fieldwork 2002, *B.C. Ministry of Energy and Mines*, Paper 2003-1, pages 257-264.

Osadetz, K.G., Jiang, C., Evenchick, C.A., Ferri, F., Stasiuk, L.D., Wilson, N.S.F. and Hayes, M. (2004): Sterane compositional traits of Bowser and Sustut basin crude oils: Indications for three effective petroleum systems; *Resource Development and Geoscience Branch, B.C. Ministry of Energy and Mines*, Summary of Activities 2004, this volume.

Salt, W.T. (1980): Gravity Survey of the Big Creek Area; *B.C. Ministry of Energy and Mines*, Geological and Geophysical Report 2393.

Thornsteinsson, E.T., Osadetz, K.G., Ferri, F. and Hayes, M. (in press): Stratigraphy and Lithology of Petroleum Wells within the Bowser Basin and Nechako area; *B.C. Ministry of Energy and Mines*, Petroleum Geology Open File 2004-4.