FOREWORD

This volume of Geoscience Reports is published annually by the Resource Development and Geoscience Branch of the Oil and Gas Division, British Columbia Ministry of Energy, Mines and Petroleum Resources. This publication highlights petroleum-related geological activities carried out in British Columbia by ministry staff and affiliated universities, federal government and industry researchers. The 2010 volume contains seven articles that cover a wide range of topics focussing mainly on new play concepts and unconventional gas development in the Horn River Basin, the northern Foothills and the Dawson – Ft. St. John region (Montney play area). Other contributions include a paper on Triassic porosity-trend mapping to identify possible sites for carbon sequestration and a paper on oil and gas prospectivity in the Nechako Basin.

The first paper in the volume by Chelsea Fefchak and John-Paul Zonneveld, both from the University of Alberta, focuses on the sedimentology of the Upper Triassic Artex Member of the Charlie Lake Formation in northeastern British Columbia. The economic significance of the Artex Member is exemplified by prolific hydrocarbon production in the Brassey Field. The authors show that the Artex Member at the Brassey Field is an aeolian sand dune succession. The paper demonstrates the importance of lithofacies interpretations and highlights how paleo-topographic depressions control deposition of the Artex reservoir facies.

Evaluation of potential source rocks in pre-Givetian (Middle Devonian) strata in northeast BC is critical to furthering the exciting play concept that tremendous hydrocarbon accumulations may occur in these strata. Filippo Ferri from the BC Resource Development and Geoscience Branch and Martyn Golding from the University of British Columbia, address this important question in an evaluation of the hydrocarbon source rock potential of Ordovician and Silurian sediments in Halfway River map area in the northern foothills. Over 500 metres of silty dolomite, calcareous siltstone, and quartzite of the upper Skoki Formation and Road River Group were examined. Calcareous siltstones of the Road River Group are shown to have the best source rock characteristics. More basinal equivalents of the Skoki Formation, farther west in the Kechika Trough, are identified as potential source-rocks that require further testing.

New data on surface equivalents of the prolific Montney and Doig formations are provided by Filippo Ferri (BC Resource Development and Geoscience Branch), Martyn Golding and James Mortensen (University of British Columbia), John-Paul Zonneveld (University of Alberta) and Michael Orchard (Geological Survey of Canada). Ferri and his co-authors studied a key section of the Toad Formation in the Halfway River map area. Sedimentologic descriptions, spectral gamma-ray measurements, and samples for Rock-Eval analysis and thermal maturation determination were obtained for a 600 m thick sequence of the Toad Formation. The sequence of calcareous siltstones and fine sandstones is interpreted as a coarsening-upward succession of distal turbidites, which become more proximal in the upper part of the section. A correlation of the surface sequence with subsurface sections is also presented.

Two articles directly relating to development within the Horn River shale basin deal with potential sand sources for hydraulic fracturing (paper by Hickin *et al.*) and water budget information in the basin (see paper by Johnson).

A timely study of potential hydraulic fracture sand sources is provided by Adrian Hickin, Filippo Ferri and Travis Ferbey, from the BC Ministry of Energy, Mines and Petroleum Resources, and Rod Smith from the Geological Survey of Canada. The study was prompted by a dramatic increase in the demand for hydraulic fracture proppant (frac sand), required to develop the enormous unconventional gas resources of the Horn River and Montney plays. A preliminary assessment of bedrock and unconsolidated samples collected during previous regional projects is presented. Thin sections and distribution maps of prospective bedrock units are provided. For unconsolidated samples, geochemistry and grain-size data and grain photographs are also provided. Results suggest that quartz arenites of the Liard, Monteith and Monach formations and feldspathic arenites of the Charlie Lake Formation are the most prospective bedrock units of those assessed. The most prospective Quaternary sand units include: well-rounded, quartz-rich sands in the Komie area on the western edge of the Horn River Basin; fine-grained quartz sand in the Fontas dune field; and quartz-rich glaciofluvial deltaic sands from the Redwillow area south of Dawson Creek. Other dune fields in the Kiskatinaw and Pine River areas and eskers, in and around the Horn River Basin, are also identified as potential exploration targets.

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A second paper, applicable to the Horn River Basin, is a conceptual water model for the basin presented by Elizabeth Johnson of the BC Resource Development and Geoscience Branch. This paper provides a valuable information base needed for water management in areas of shale gas development in northeast British Columbia. Johnson discusses water modelling, important information sources, specific features that will affect hydrological predictions in the region and information gaps. Results of the analyses show that precipitation is not uniform across the basin, and that evapotranspiration is a very important component, at times exceeding precipitation. Other important parameters in the water balance include groundwater flow, which maintains stream water quality and quantity, and frost/permafrost, which controls subsurface flow, infiltration and recharge rates.

Ed Janicki from the BC Resource Development and Geoscience Branch provides an update on Triassic porosity-trend mapping initially conducted 2008. The work is intended to identify possible sites for carbon sequestration. Wireline logs from an additional 200 wells were added to the initial study of 600 wells to improve data density and extend the study area. The best prospects for carbon storage identified in the paper are thick, porous sections of the Halfway and Baldonnel formations near the southern end of the studied area. Secure locations might also include more isolated, lightly drilled areas around the edge of existing Triassic oil and gas producing regions.

The most recent results of a multi-year project aimed at evaluating the oil and gas prospectivity of the Nechako Basin, in British Columbia's interior, are provided in the paper by Riddell from the BC Resource Development and Geoscience Branch. This paper presents a summary of 17 radiometric dates and 69 apatite fission-track analyses. The new radiometric ages provide constraints on the distribution of prospective rocks and the locations of important structures. The apatite fission-track data constrain the time limits of a rock's most recent passage through oil and gas windows and indicate whether it has been heated enough for hydrocarbon generation since trap-forming tectonic events occurred.

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