

# Energy from the Earth An Overview of Special CSEG Sessions at the 2022 Williston Basin Petroleum Conference

DRAGA TALINGA AND RICHARD GRAY

## Introduction

The Williston Basin Petroleum Conference is held annually in Saskatchewan and North Dakota in alternating years and focuses on all Earth energy sources and technical innovations, from hydrocarbons to geothermal, lithium, helium, hydrogen and CO<sub>2</sub> storage to mitigate emissions. This year the event took place in Regina, Saskatchewan, on May 17-18, and the theme was “**Energy from the Earth**”.

This report is derived from the contributions of the Canadian Society of Exploration Geophysicists (CSEG) to the conference, where for the first time, two special sessions were hosted on the use of integrated geophysics and geology to characterize hydrocarbon, mineral and geothermal resources and for the geological sequestration of excess CO<sub>2</sub>. The CSEG sessions consisted of seven oral presentations grouped thematically into two sessions centred around oil & gas and minerals and less conventional industries like alternative energy and carbon sequestration.

## Summary of CSEG presentations

In the first session, **John Duhault** presented “Conventional Interpretation in an Unconventional Environment: Extending the Life of Your Company’s Lands and Facilities”, an overview of interpretation workflows for evaluating the hydrocarbon potential of zones other than the target reservoir and identifying drilling hazards such shallower depleted reservoirs. In a case study from Central Alberta, he showed how to identify potential prospects above and below the target Cardium zone, such as in the Basal Belly River Formation and the Cretaceous, Jurassic and Devonian sections. He emphasized how this evaluation would increase the profitability of a company’s existing assets and extend the life-of-field.

In his paper “Seismic Exploration – A Multifaceted Exploration Tool”, **Darryl Robbins** described how seismic data provides a critical subsurface analysis for activities across many industries, such as oil & gas, helium, potash and carbon sequestration and monitoring. He pointed out the significant advancement of seismic acquisition, which now acquires higher quality data with a significantly reduced seismic footprint, in a shorter amount of time, and with high consideration for the environment. His presentation addressed the different types of seismic, their use, and how the design and techniques can help collect quality data in an eco-friendly manner.

**Calin Dragoie** provided a comprehensive summary of the different geosteering approaches in “Application of Geosteering in Bakken Development Wells”, from simple correlation geosteering using offset wells, to geomodel steering along known structures, and more complex methods such as resistivity forward modelling, stochastic inversion, or a combination of the above techniques. Using examples from the Bakken and Torquay plays in the Williston Basin, he discussed how specific challenges such as fast-paced drilling, thin reservoir and flat Gamma Ray signatures in the pay zone could be addressed with customized geosteering workflows and geomodel-based hybrid approaches to accurately assess the stratigraphic location within the formation while the well is in-zone. He also emphasized the need to balance the cost versus benefits when using these customized geosteering workflows.

In her presentation “Geophysics for Potash Mining”, **Neda Boroumand** provided a historical overview of the application of Geophysics to potash mining, mine development and geohazard management. Through a set of examples from the potash industry, she discussed how geophysical methods such as seismic reflection and refraction, fracture mapping and microseismic monitoring, ground penetrating radar, time-domain electromagnetics and radio-frequency imaging could be used to understand anomalous geologic structures and solve geohazard and inflow problems for mine layout and safety.

In the second session, in his paper “Geological Storage of Carbon and Role in Geophysics”, **Don White** emphasized that geophysical methods will play an essential role in all stages of the CO<sub>2</sub> sequestration projects, from site selection to geological characterization and long-term monitoring. He explained how Canada is a world leader in implementing pilot carbon storage projects and gave an overview of the Aquistore CO<sub>2</sub> Storage Project in Saskatchewan, which injected approximately 400 kilotonnes of CO<sub>2</sub> into a deep saline formation since it began injection in 2015. A variety of geophysical methods were used to monitor the containment of the CO<sub>2</sub> plume in the reservoir, with the time-lapse seismic imaging proven effective over the first five years. He specified that no induced seismicity or related surface deformation has been documented using passive seismic monitoring, GPS measurements and InSAR surveillance. The site has been used to expand our knowledge about carbon sequestration and develop other geophysical methods, including electromagnetics, borehole gravity, and fibre-optic distributed acoustic sensing (DAS) systems.

In his presentation “Seismic Acquisition and Geophysical Interpretation – An Exploration Tool in Nonconventional Industries”, **Roger Edgecombe** summarized the many advances of the 3D seismic method from its introduction in the mid-1980s, especially over the last decade. He stressed that understanding the fundamentals and limitations of the seismic technology - acquisition, processing, and interpretation - permits the adoption to other industries of this critical oil and gas exploration tool, and of the entire seismic expertise and workflows. The application and integration of existing subsurface expertise in seismic, geological mapping, geomodelling, and well design, drilling and completions are directly transferable to emerging

industries, with understanding the problem being the key to success. Several case studies from various nonconventional and emerging industries showed that a fit-for-purpose seismic design could create excellent value in exploration and development.

The CSEG special session wrapped up with a presentation from **Kelly Skuce**, “A DEEP Dive into Geothermal”, which focussed on how the classic concepts of petrophysical investigation can be modified and applied to the search for medium-temperature geothermal resources. Kelly expanded on the work he did helping the DEEP project drill the deepest well in Saskatchewan and successfully pilot and showcase the potential for geothermal in Western Canada. He highlighted the similarities and differences between classic oil and gas uses of petrophysics and how workflows and techniques can be modified for alternative subsurface uses.

The goal of the special sessions was to continue to raise awareness of the expertise that the geophysical community can bring to any project involving the subsurface. We hope this overview of the presented CSEG papers will give the reader an understanding of the extensive knowledge, studies and expertise shared at this conference. In 2023, Regina will host the Williston Basin Conference again in May, and in 2024 the conference will return to Bismarck, North Dakota.



## About the authors



**Draga Talinga ([draga@shaw.ca](mailto:draga@shaw.ca))** is a Senior Geophysicist with extensive experience in oil & gas, research and consulting. She worked on various multidisciplinary topics, from the basin to the reservoir scale, in different tectonic and depositional environments in basins in Canada, the US, Australia, Romania and Norway. Draga holds a B.Sc. and an M.Sc. from the University of Bucharest, a Ph.D. from the University of Calgary, and a Postdoctoral Fellowship from Simon Fraser University, all in Geophysics. Her current professional interest is using integrated quantitative analysis for the geological, geomechanical and petrophysical characterization of the subsurface.

**Richard Gray ([rik\\_gray@hotmail.com](mailto:rik_gray@hotmail.com))** is a Geophysical Consultant with extensive Canadian and international experience in seismic acquisition and processing in addition to subsurface project management. With a BSc. in Geology and Geophysics from Durham University, Richard’s current professional interest is focused on the continued use of geophysics to drive quality decisions for all subsurface projects and the effective implementation of geophysics for monitoring of CCS projects.

