May 2023 – NRCan: Projects Update #2

In this webinar (2nd of 2 planned sessions) with Natural Resources Canada (NRCan) / Geological Survey of Canada (GSC) personnel, the focus was on ongoing research and related work on the Montney Formation. Omid Haeri Ardakani (PhD, P.Geo.) and Jaime Cesar Colmenares (PhD), Research Scientists with GSC in Calgary were the featured speakers and provided insight into their respective projects.

Prior to the keynote presentations, Stuart Torr, CEO – Integrated Sustainability and CSEE Director, espoused about CSEE's latest initiative, The Energy Ambassadors Program. The objective of this program is to promote, involve, and empower the energy industry's future leaders. As a group, the collective will be asked to collaborate, engage, and interact with their peers regarding issues & challenges facing the energy industry, especially from an evolving energy perspective. Their goal will be to discuss, document, and present possible solutions, while at the same time honing their leadership, technical & communication skills.

As is typical with all the projects undertaken by NRCan / GSC, Omid commenced his presentation by acknowledging the collaborative nature of the work he was about to present. He recognized various individuals and organizations (government, academia & industry) who have contributed to his research presentation, titled "The Geologic and Anthropogenic Sources of H_2S in the Lower Triassic Montney Formation with a Complex Diagenetic History". Although the work continues, the objective of this talk was to summarize the findings to date, including the economic, health & environmental impacts of H_2S, while also trying to understand the sources and formation mechanisms within the Montney formation. This work, which was initiated in 2019, was categorized into four separate sections:

1. Mapping the occurrence of H_2S in the Montney using available public information (AER & BCER).
2. Characterizing the sources of sulfur involved in H_2S production.
3. Understanding the H_2S formation processes in the subsurface, and
4. Evaluating the potential anthropogenic production of H_2S during the hydraulic fracturing process (newly added material).

As part of this extensive study, the effects of numerous properties, conditions, and hypotheses are being investigated, including the effects of temperature on the formation of H_2S. Among other factors, the study also incorporates the lab analysis of field samples for water geochemical properties, isotope geochemistry & microbiology work (including time series sampling), stable isotope geochemistry (or fingerprinting) for source analysis, water mixing work to identify potential connection to frac fluid production, and isotopic characterization studies. It was noted by the speaker that the findings from this extensive study could have an impact on future projects where surface materials are injected into the subsurface such as CCUS (Carbon Capture, Utilization & Storage) and Hydrogen storage.

Like Omid's work, Jaime acknowledged various individuals & entities for their contributions and research. His presentation was titled "Secrets No More! Using Organic and Isotope Geochemistry to Uncover Hidden Facts about the Montney Formation". He noted that this type of workflow and these principles can also be applied to other systems and formations. He also reminded everyone that in addition to using organic geochemistry to study the biosphere & the interactions among the various phases (air, water, earth) including historical life forms, it also provides us with the registry of the past. As materials degrade and break down over geologic time, they leave an archival record when they turn

into different molecules. Similarly in his research work, he is using organic and isotopic geochemistry methods to document the historical biodegradation within the Montney formation. Compounds such as aromatics and saturates are biodegradable and form products such as fatty acids, alcohols, and ketones. Incorporating this work into basin modeling investigations will confirm the degradation timeline and the formation of the various systems (oil vs wet gas vs dry gas). He noted that such research allows for a better understanding of petroleum systems in general and their source, including volume estimation, fluid type, maturity, and potentially other key properties. It is possible, he suggested, that the way we understand hydrocarbon generation in the Montney Formation may need to be reconsidered.