

Investigating Heterogeneities in the Basal Cambrian Sandstone

James Simpson and Cameron Tse
Core Laboratories Canada

Theory / Method / Workflow

The Basal Cambrian Sandstone, the dominant formation in Alberta being looked at for carbon capture and storage (CCS), displays variable heterogeneity throughout the section. Vertically, facies/facies associations are largely responsible for this heterogeneity, however, within each facies and rock type, petrophysical properties are difficult to predict and makes sampling for fluid dynamics type testing problematic.

To investigate the cause and extent of heterogeneity, porosity and permeability data was analyzed to determine various hydraulic units with the purpose of high grading sections for further analysis. Legacy porosity and permeability data include full diameter routine analysis, focusing on the Kv/Kh relationship and overburden plug data that looks at the effect of increasing pressures and the effect that has on the porosity and permeability. To demonstrate the heterogeneity, plugs are drilled from the full diameters and properties measured, along with gridded profile permeameter measurements, will validate the variability at various scales.

The cause of the variability in permeability and preferential flow directions can be examined geologically. Characteristics such as facies changes, grain size/sorting/packing, mineralogy, and diagenesis, are mechanisms that affect the overall viability of injecting into the Basal Cambrian Sandstone. Therefore, supplemental thin sections and X-ray diffraction (XRD) on select locations are used to identify mineralogy and diagenetic processes within the formation and the effects they have on the porosity and permeability in the Basal Cambrian Sandstone.

Geological and petrophysical data is integrated and compared to give an overall conclusion about how rapidly properties can change and why within the Basal Cambrian Sandstone. This type of understanding of linking static properties to dynamic properties can aid in the prediction of plume movement through the reservoir in the short and long term.