CSPG ROCK ANALYSIS WORKSHOP

March 21-22, 2019 | University of Calgary & AER Core Research Centre

Best Practices for Routine Core Analysis in the Montney Formation

Patrick J Russell
Core Laboratories

Summary

Routine Core Analysis is a collection of methods to acquire porosity, grain density, bulk density, permeability, and fluid saturations quickly and accurately. There are numerous methods to acquire each of these parameters. On conventional cores, with high porosity and permeability, the selection of methods has little impact on accuracy of the measurements. On unconventional cores, with low porosity and permeability, relative accuracy is much more sensitive to the methods used.

The Montney formation is an unconventional rock type where Routine Core Analysis can be suitable, depending on the methods used and how they are conducted. Although there are many methods with potential sources of error, the focus will be on three of the most important methods:

1. Acquiring accurate water saturation
2. Representing a total porosity state
3. Measuring a matrix permeability (absent of fractures)

Measuring accurate water saturation in Montney core presents the challenge of low water volumes. Small plug samples often contain less than 1mL of water. Any water loss, through evaporation or during the Dean-Stark process, can lead to large errors in water saturation. The less water contained in a sample, the larger the relative error will be. Full Diameter samples have a smaller surface-to-volume ratio to minimize water evaporation and also contain much more water, which minimizes saturation errors.

Representing a total porosity state in Montney core centres on the ability to extract all water, precipitated salt, hydrocarbon liquid, and residual solvents. Without full extraction of these components, total porosity will be suppressed. Further complicating the matter is the presence of organic matter in the form of solid bitumen. Lab evidence has shown this

component can be partially removed, and raises the question of whether it should be removed or retained.

Montney core can be highly prone to induced fracturing from tripping core to surface, transportation, handling, drilling plugs, solvent extraction, and oven drying. By the time a sample is ready for permeability measurement there is a high probability the permeability will be influenced by induced fractures, especially the more laminated the sample. Induced fractures can arbitrarily increase the permeability up to several orders of magnitude. A new gas transport method has been developed that can isolate the permeability measurement to the rock matrix without the influence of induced fractures.

By incorporating these techniques into the Routine Core Analysis process, a more accurate representation of total porosity, grain density, permeability, and saturations can be achieved in Montney core.