

New insights on the age-old debate: understanding saturation and porosity measurements in unconventional reservoirs

Brent R. Nassichuk, Cory Twemlow, Albert Cui, Raphael Wust

Trican Geological Solutions, 621-37th Ave NE, Calgary, AB, T2E 2M1, bnassichuk@trican.ca

Porosity and saturation measurements in conventional reservoirs have become a routine and well understood testing procedure. Evaluation of unconventional reservoirs however has proven difficult and is prone to error, largely due to incompatible methodology. Conventional methods have been adapted and applied to unconventional reservoirs but often do not account sufficiently for the intrinsic difficulty in evaluating low permeability and low porosity systems. Small errors in measurement in low porosity rocks are compounded, likely resulting in underestimation of calculated reserve volumes.

The focus of this study is to evaluate current methodologies and understand the sources of error inherent in the techniques for saturation and porosity measurements. With understanding the limitations of current testing methods, a modified solvent extraction process has been developed to address the deficiencies in historical methods. Critical to the process is defining the endpoint of the extraction process to a clear level of certainty. The new test method involves using thermal desorption gas chromatography to assess the effectiveness of the extraction process. Through an iterative loop of extraction and evaluation, the process provides a quantitative feedback for assessing extraction completion. Utilizing the modified extraction process has been shown to effectively increase porosity by up to 1.5 porosity units (15-20% increase) in tight and ultra-tight rocks such as the Montney and Duvernay formations.