

Evaluation of Water-Saturations Determined from Crushed-Rock and Full-Diameter Core Samples, Montney Tight Gas Siltstone Play, Western Canada

James M. Wood

Encana Corporation

Summary

The efficacy of crushed-rock samples versus small plugs or full-diameter core samples for measurement of porosity, permeability and fluid saturation is an important consideration in the evaluation of tight gas and shale gas reservoirs. Crushed-rock core analysis methods originally developed for shale reservoirs are now, in some cases, being extended to low-quality tight gas reservoirs. In this study, crushed-rock and full-diameter core measurements from two wells drilled with oil-based mud are directly compared to evaluate which of the two core analysis methods is more reliable for water-saturation assessment of the Montney tight gas siltstone play in Western Canada. Measurements from the studied full-diameter core samples have wide ranges of water saturation (10 to 45%) and bulk volume water (0.5 to 2.6%). In contrast, measurements from crushed-rock samples have much narrower ranges of water saturation (10 to 20%) and bulk volume water (0.2 to 0.7%). The lower values and limited range of water-content measurements from crushed-rock samples suggest a significant degree of artificial water loss during sample handling in the laboratory. This conclusion is supported by comparing core-measured bulk volume water (BVW) with deep resistivity values from openhole well logs. Consistent with the results of a recent multiwell study (Wood, 2013), full-diameter BVW measurements are found to correlate well with log resistivity indicating they are generally representative of in-situ reservoir conditions. BVW values from the crushed-rock samples, on the other hand, are found to have no significant correlation with log resistivity. The findings of this study suggest caution should be exercised in the use of crushed-rock samples for water-saturation measurements of siltstones or silty shales. Failure to recognize artificial water loss from crushed-rock siltstone samples could lead to an erroneous interpretation of irreducible water saturation at in-situ reservoir conditions with potentially serious implications for resource evaluation and exploitation.

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Reference

Wood, J.M. 2013. Water Distribution in the Montney Tight Gas Play of the Western Canadian Sedimentary Basin: Significance for Resource Evaluation. SPE Reservoir Evaluation & Engineering, v.16 (3), p.290-302. <http://dx.doi.org/10.2118/161824-PA>.