Diagenesis, Petrophysics and Reservoir Quality Models of the Montney Formation – a Major Siltsone Reservoir in Western Canada

Noga Vaisblat, Nicholas B. Harris

Petrophysical and diagenetic models are important for evaluating the economic viability of a reservoir. Such models are routinely developed for sandstone and shale reservoirs, as many of the parameters and processes influencing those types of plays are well constrained. Our understanding of siltstone reservoirs however is much less advanced, and appropriate parameters for reservoir quality modeling are needed.

We are developing a reservoir quality model for the Lower Triassic Montney Formation, a westward-thickening accumulation of fine, well-sorted siliciclastic and carbonate sediments in the West Canada Sedimentary Basin, integrating geochemistry, rock fabric, paragenesis and petrophysical properties. XRD and SEM and QEMSCAN were used to determine quantitative mineralogical composition. Diagenetic phases and paragenetic sequences were identified by SEM imaging and thin section petrography. Core analyses, including mercury injection porosimetry and, continuous flow permeability measurements were compared with estimates made by standard well logs analysis.

Results show that original mineralogy is the primary control over rock composition, which includes quartz, feldspar, plagioclase, carbonate minerals, pyrite and marcasite, apatite, muscovite and clay minerals (illite, chlorite and detrital clays). Halite and to a lesser extent anhydrite were also found in many samples. Cementation and authigenic clay minerals crystallization clearly reduced primary porosity, including precipitation of calcite, dolomite, feldspar and quartz cements. Porosity was enhanced by dissolution of carbonate minerals and feldspar and quartz.

Analyses of Montney core samples indicate porosities of 0.5 – 5 % and air permeabilities of 10-3 to 5 md. Neither porosity nor permeability shows an obvious relationship to rock composition.

In order to up-scale results obtained from SEM and thin section, data was assembled into GAMLS (Geologic Analysis via Maximum Likelihood System) software. GAMLS enable correlation between log response and accurate mineralogical and petrophysical data to create a predictive characterization model for reservoir quality.