Diagenesis, Petrophysics and Reservoir Quality Models of the Montney Formation - A Major Siltstone Reservoir in Western Canada

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Abstract

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 influencing those types of plays are well understood. 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, focusing on geochemistry, rock fabric, paragenesis and petrophysical properties. Initial analysis is directed at the Talisman 6-17-083-25W6M well in British Columbia, Canada. XRD and SEM high-resolution microscopy, 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, 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 gypsum 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 is identified throughout the rock. Quartz dissolution indicates high pH values, at least locally and was probably associated with an early generation of carbonate cementation.

Analysis of Montney cores in the Talisman 6-17-083-25W6M indicates 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. Results were assembled into GAMLS (Geologic Analysis via Maximum Likelihood System) software to create a predictive characterization model for reservoir quality.