Mineralogy, Sedimentology and Facies Description of a Potential Cretaceous Shale Gas Play in Western Manitoba

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Cretaceous shale in Manitoba including the Ashville, Favel and Carlile formations located in the extreme southwest corner of the province are excellent candidates for shallow gas exploration. The goal of this study is to provide information needed to improve exploration in the new and unproven unconventional shallow shale gas play. Detailed subsurface mineralogical and geochemical studies are conducted on cores from a number of wells in this area.

Core examination, well-log and petrographic analysis are used to investigate the sedimentary structures, grain size, ichnology and bioturbation degree, and consequently to describe the facies scheme. Six main facies are identified ranging from non-calcareous organic mudstone to highly calcareous, bioturbated very fine-grained sandstone representing a change from offshore fissile shale to shallow water carbonate-rich lithologies. The bioturbation intensity varies from rare to moderate representing more distal environmental settings from relatively anoxic to oxic interfaces. Bentonite beds occur at different intervals in the wells indicating volcanogenic activities at the time of deposition. It may be possible to use these bentonite beds for high resolution dating of the strata as well as for lateral stratigraphic correlations.

X-ray Fluorescence, from core and powdered samples, along with X-ray Diffraction are used to identify mineral composition and elemental abundances. One objective is to look at minerals with a link to their types of occurrence within these units. For example, carbonate occurs in three different forms through shale units including; varying-scale laminae of carbonate within shale beds, coccolith accumulations and as calcite fiber in thin to thick well -preserved bivalves (Inoceramus) laminae. These different styles of carbonate show relatively similar bulk mineralogy. However, each style affects the reservoir properties and behavior in a different way. It is crucial to conduct mineralogical studies in association with sedimentological observations in order to get the most realistic interpretation, understanding and analysis.

Gamma ray values are calculated based on radioactive element concentrations measured through X-ray Fluorescence as well as using a hand-held gamma ray tool (RS 230). Additionally, gamma ray values are acquired using a gamma ray core scanner (SGR). All these gamma measurements are compared with the original high resolution well log gamma ray (LAS). These data help us to formulate the proper calibration method for XRF, RS 230 and SGR and get better result from our measurements.