Clay Intraclasts as an Indicator of Depositional Processes and Early Diagenesis in the Upper Colorado Group; Bigstick Gas Pool, Southeastern Alberta and Southwestern Saskatchewan

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The Late Cretaceous Upper Colorado Group strata in southeastern Alberta and southwestern Saskatchewan are mainly comprised of shale with minor interbeds of siltstones, sandstones and bentonites. The prospectivity of these shallow, distal shelf deposits as shale gas reservoirs is addressed through reservoir characterization on scales from laminae to depositional sequences (millimetres to tens of metres) in order to evaluate variability and continuity of the various potential shale reservoir facies. The focus here is one aspect of a larger study; documenting the presence and distribution of clay intraclasts within the Upper Colorado Group, interpretation of the origin of these clasts and how they influence the shale fabric and thereby shale gas reservoir properties.

Visual analysis of a 240 meter long, continuous core from the Bigstick Pool, along with observation of thin sections using transmitted light microscopy and SEM, reveals the presence of abundant mudstone intraclasts within the Second White Specks Formation, Upper Carlile Member, Verger Member, and First White Specks Member. Planktonic microfauna and organic geochemical analyses of within these units indicate they were deposited during periods of more open marine conditions within the upper Colorado Group. The multicolored (tan, brown, red) mudstone intraclasts occur together with reworked shell material in beds with basal scour surfaces, suggesting they were deposited by relatively high-energy events. The clasts were likely transported some distance. Redox sensitive trace elements indicate the partial cementation of these mudstone clasts occurred in a reducing environment. Stratigraphic sections where the mudstone intraclasts were not observed were deposited when the shelf was characterized by relative high rates of sediment accumulation, suggesting these periods did not provide proper conditions for the formation of these semi hardground cemented surfaces.

Observations from this study provide an understanding of the depositional mechanisms and diagenetic processes that affected this shallow, shale-dominated reservoir. Understanding the relationship between these processes in the Upper Colorado Group shales provides important insight for reservoir

characterization. Through the delineation of intervals with clay intraclasts and related pyrite, an enhanced predictive diagenetic and stratigraphic framework can be developed, with important implications for other shale gas reservoirs throughout the Western Canadian Sedimentary Basin.