# Multi-Scale Reservoir Compartmentalization in a Lower Cretaceous Glauconite Compound Incised Valley System, Strathmore Area, Alberta

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The Lower Cretaceous Glauconite Formation in the Strathmore area of central Alberta represents a complex compound piedmont incised valley-fill (IVF) system developed under low to intermediate accommodation conditions. A series of oil and gas pools, displaying a complex set of hydrocarbon water contacts, are located along this 22.5 km northeast to southwest trending incised valley fill system. Exploration and development along this trend is complicated due to variations in depositional facies , reservoir quality, multiple sequences, and larger scale structural elements that result in multi-scale reservoir compartmentalization.

The stacking patterns of the IVF sequences show a cyclicity in framework components and facies distribution that may be related to changes in the basin geometry and source and has a direct influence on reservoir quality. The best quality reservoir resides in 2 of the 6 IVF systems, a chert quartz and a chert quartz feldspar rock type with porosities ranging from 18-24% and permeabilities > 1000 md. Poor reservoir quality lithic sandstones with porosities < 12% and permeabilities < 1 md typify the intervening IVF's. The presence of pore-filling bitumen has further complicated production efforts in the hydrocarbon bearing reservoir compartments.

Facies variations also occur in a pattern through the successively aged incised valley fills. The best rock quality is typically a fluvial sandstone, overlain successively by fluvial estuarine, tidal point bars characterized by IHS (inclined heterolithic stratification), and central basin muds. The younger incised valley fill although similar in framework grain composition is dominantly fluvial estuarine rather than fluvial, perhaps indicating that the basin is becoming more tidally influenced through time.

The large scale structural influence adds an additional element to the reservoir compartmentalization. This particular east-west trending Glauconite incised valley fairway also appears to be somewhat controlled by two significant E-W trending faults and is also affected by a significant change in regional dip which may be related to a hinge line that tracks north-south through the study area. The bitumen distribution within the sandstones along this fairway appears to be, at least in part, controlled by structural factors. The use of 3D seismic is critical for the interpretation of the structural compartments in this region.

Seismic data (3D) has proven to be an essential tool for exploration along this complicated IVF trend, however, detailed knowledge of the stratigraphy and facies is essential for seismic interpretation. The Glauconite reservoir zone occurs as a trough between the overlying coal marker peak and underlying Ostracod peak. The 3D seismic characteristics in the Glauconite zone are complicated due to facies changes and affects of other seismic artifacts. The regional dip and the N-S hinge line can be imaged using 3D seismic, however, the seismic resolution of smaller scale east-west trending faults are dependant on the quality of the data, and the degree of faulting. The structural influences appear to have compartmentalized the NE-SW trending IVF's into numerous individual pools, with hydrocarbon – water contacts that progressively decrease to the southwest.

Multi-scale compartmentalization within this Glauconite IVF trend occurs at four different scales. These scales range from the micro-scale petrographic rock types, to facies variations, to the larger scale sequences and incised valley fill cuts, and finally the large scale structural compartments. These complexities on different scales represent an exploration challenge which may be helped by a thorough understanding and integration of geology, 3D seismic interpretation and reservoir engineering.