# The Arbuckle Group: Exploring the Great American Carbonate Bank Reservoir

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## Abstract

The Greek philosopher, Epictetus, once said that "No great thing is created suddenly!" This is certainly true of the Great American Carbonate Bank as it took all of the early Ordovician and more to build. The Great American Carbonate Bank or GACB was a term coined by Jim Derby and Bob Ginsberg to describe the extensive section of mostly peritidal carbonates that was deposited over much or what is now North America during the Cambrian through earliest Middle Ordovician.

The Arbuckle Group of the Mid-continent comprises the mid-southern portion of the GACB and represents the key to understanding Arbuckle reservoirs due to its thickness, depositional features and diagenetic overprint that can be observed along excellent exposures in the Arbuckle Mountains and in logs and cores from wells in the Ardmore, Anadarko and Arkoma basins.

The Arbuckle is a cyclic carbonate dominated by intertidal and shallow subtidal facies. The depositional model is represented by an extensive dominantly regressive tidal flat with peritidal facies that are amazingly consistent no matter the thickness of the Arbuckle section.

Reservoirs in the Arbuckle are complex and porosity is controlled primarily by original depositional fabric and diagenesis. Upper subtidal and lower intertidal facies typically have the most conducive depositional fabric to reservoir development. Diagenetic changes are a continuum that begins with early diagenesis, including hypersaline/evaporative conditions, vadose and phreatic conditions and followed by deep phreatic to late thermal diagenesis. There is evidence that porosity formed during multiple diagenetic phases and dissolution cause by karstification.

The Arbuckle Group contains multiple unconformities and disconformities at major sequence boundaries. Paleokarst is especially prevalent beneath the post-Arbuckle unconformity, and is commonly found within the Arbuckle Group especially along major sequence boundaries with related unconformity surfaces.

Arbuckle strata especially within third-order sequence boundaries are correlatable across the basins. Within the sequence boundaries cycles can be further grouped into packages of sequences that are comprised mostly of either intertidally-dominated or subtidally-dominated cycles. Detailed local to regional correlation of the "facies bundles" can be made with gamma-ray and resistivity logs; however, facies are often obscured by strong diagenetic overprint which makes detailed correlation difficult.

The Arbuckle Group is an important petroleum reservoir in the Mid-continent and it has great exploration potential especially for natural gas; however, exploration has been difficult due to the complexity of the reservoir and the lack of a comprehensive reservoir model. Exploration is enhanced by understanding the complex relationships of depositional process, stratigraphic relationships, paragenesis and structural overprint.

There are no major source rocks below or within the Arbuckle Group so the best reservoirs are structurally related and juxtaposed to source rocks or along migration pathways.

A great Oklahoma philosopher once said that, “Often the simplest answer requires the most complex explanation.” This is true of the Arbuckle reservoir model. Reservoir development is typically along sequence boundaries especially where facies have strong diagenetic overprints from dolomitization and dissolution associated with paleokarstic events, coupled with a structural history that facilitates migration & entrapment of hydrocarbons. Since there are no major source rocks in the Arbuckle Group large accumulations are developed primarily by structural cross-fault seals. Nevertheless, there may be opportunities for Arbuckle resource plays in Oklahoma and Kansas due to long-range, regional migration resulting in higher oil saturations in reservoirs related to unconformities at the top of the Arbuckle Group.