

# **The Arbuckle Group: Understanding a Great American Carbonate Bank Reservoir**

## **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 of 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 caused 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 has 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.

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Richard D. Fritz received a B.S. degree in 1975 and a M.S. degree in 1977 from Oklahoma State University.

He was employed by Texaco in 1975 before beginning his masters program. His assignment was geophysical analysis of Cambro-Ordovician carbonates in the Illinois Basin and of the pre-Paleozoic section in the Georges Bank area.

During early 1977 he was employed by ERICO in London as a consultant to map parts of the Upper Cretaceous and Jurassic in the North Sea.

Upon completion of his M.S. degree he was employed for 5 years by Exxon Company, U.S.A. in Kingsville, Texas, and Oklahoma City, Oklahoma.

From 1977 to 1979 he worked as a production geologist in Exxon's South Texas Production Division. His assignment was in operations conducting geological exploitation of onshore Frio and Vicksburg oil and gas zones.

He was transferred to Exxon's Oklahoma City district in late 1979, where he worked for nearly 3 years as a geologist. His primary assignment in exploration was to conduct prospect generation and evaluation of the Morrow, Springer, and Hunton in the Anadarko Basin. Other assignments included exploitation of the Morrow, Granite Wash and Cherokee gas pays in the Texas and Oklahoma Panhandles and development of low gravity oil sands in the Unita Basin. He also supervised and trained new geologists on the Upper Morrow and Red Fork plays of western Oklahoma.

In late 1981 he joined ERICO, Inc. in Tulsa. His first assignment was as exploration consultant for the ERICO Morrow-Springer Study and Hunton Study of the Anadarko Basin. Fritz, who is a vice president of MASERA, has been the project director for Masera's domestic studies, including Red Fork, Arbuckle, Misener, Springer-Goddard, and Spiro (all of the Mid-Continent), Trenton of the Michigan Basin, Knox and Carboniferous of the Black Warrior Basin, and Austin Chalk of the Gulf Coast.

Fritz became Executive Director of the American Association of Petroleum Geologists in August, 1999. He is responsible for the management of AAPG headquarters in Tulsa, Oklahoma and the oversight of numerous AAPG programs. In November, 1999, Fritz also became the Executive Director of the AAPG Foundation.