

**CARBONATE PLAY DEVELOPMENT IN
MESOZOIC SEQUENCES OF THE U.S. GULF RIM
Influence of Physiographic Setting and Structural Controls**

FOR

EAST TEXAS GEOLOGICAL SOCIETY

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SEMINAR OVERVIEW

Most of industry has ignored conventional carbonate plays for years, as higher commodity prices drove the development of unconventional (mostly shale) plays. However, conventional carbonate plays remain a viable economical alternative.

A conventional carbonate play is the juxtaposition of a limestone or dolostone reservoir facies sealed by a micritic carbonate or shale facies, with its hydrocarbons sourced from a nearby organic-rich carbonate or siliciclastic mudstone. Understanding the controls on carbonate play type distribution and geometry is critical for more successful exploration or exploitation in any basin. Hence, delineating potential carbonate plays from seismic or wireline logs requires a sound understanding of the depositional and diagenetic controls that create the reservoir facies. These controls must be evaluated within the context of physiographic setting and the structural framework. Specifically, one must appreciate the environmental controls on carbonate facies development, and the potential pathways for diagenesis and porosity evolution, some of which can be tied to the influence of reactivated basement faults.

This two-day seminar reviews the key controls on Jurassic and Cretaceous carbonate play occurrence and distribution along the U.S. Gulf of Mexico rim, while also documenting the strong influence of physiographic setting, both at the global and local scale. On a global scale, physiographic setting refers to the location of a prospective basin or sub-basin with respect to the paleoequator. Such a position determines the prevailing paleotrade wind systems, which were a critical influence on carbonate sedimentation and play distribution. In this region, Mesozoic carbonate facies with reservoir quality occurred within tropical or subtropical settings, and easterly paleotrade winds often were a major influence on their occurrence and distribution. On a local scale, physiographic

setting refers to the depositional bottom topography associated with a platform or ramp profile. This preexisting bottom topography critically controls the occurrence and distribution of carbonate facies and also early diagenesis. In addition, progressive burial diagenesis influenced their porosity and permeability evolution, with deep-seated faulting often playing a major role in the development of reservoir quality, as well as hydrocarbon entrapment. Therefore, understanding the relative timing of secondary porosity development in these carbonates is often the key to exploiting regional porosity trends, and this point will be stressed in this seminar.

This seminar ends with a detailed evaluation of the attributes (reservoir, source, seal, and trapping mechanism) of conventional Mesozoic carbonate play types along the northern U.S. Gulf rim. These plays are related to physiographic setting and illustrated with representative reservoir analogs. This discussion is backed by rock-based observations and examples that note the various pathways for porosity and permeability evolution, as well as the timing of reservoir development. Seismic attributes are noted, where possible. For most play type case studies, their relationship to regional and/or local structural influences are established, since structuring could initiate the play, help control porosity evolution, set up the trap, or do all three things.

Case studies of Mesozoic carbonate plays discussed in this seminar include:

Jurassic: Smackover; Haynesville (aka, Gilmer or Cotton Valley Limestones) and Knowles (?)

Lower Cretaceous: Sligo; James Limestone; Glen Rose; Edwards; and Knowles (?)

Upper Cretaceous: Brief review of depositional chalk plays*

The ultimate goal of this seminar is to provide participants with guidelines and procedures that enhance their ability to exploit a particular play concept in other areas around the U.S. Gulf of Mexico rim.

***NOTE:** I present a separate one-day, in-depth seminar on the Austin Chalk trend in Texas and Louisiana, if you want a more detailed discussion of depositional chalk plays than I have time for in this seminar (next Austin Chalk Seminar will be held on February 8, 2023 as an online Zoom seminar).

COMMENTS FROM PREVIOUS SEMINARS

“I learned a ton about the reef/ramp models and enjoyed diving deeper into the carbonates of the GOM, especially the Smackover.”

Quality of Instruction: “Outstanding, as always.”

“I appreciate all of the relating of your experiences and I think it is generous too.”

“I really appreciate your time and effort to go over the introduction (basic concepts) the first day of the class. That was excellent and easy to follow.” (submitted by a geophysicist)

Was this seminar helpful in broadening your understanding of Mesozoic carbonate plays around the northern rim of the Gulf of Mexico?: “Absolutely. It is very meaningful to see formations you work around the entire rim. Just that view creates new ideas and angles in your normal area.”

“...but I really benefitted from the overall carbonate review. PLUS, the review gave me new angles to consider the plays I already work.”

“...it was a fantastic seminar and I learned a great deal in the short span of time we had together...”

“I like having the case histories, looking for recurring themes. Explicit suggestions for exploration. I’ll recommend this course for others here in the office.”

“Your course really pulled all of the depositional and diagenetic pieces together. I loved every moment of it! It has really made me think deeper about applying depositional position and diagenetic effects on porosity to each prospect areas. Thank you!”

“I was fortunate enough to be able to attend Jeff’s carbonate plays seminar this week. The seminar was very informative and well structured, providing an in-depth overview of carbonate sedimentology through the lens of oil and gas exploration.”

“Yes, this was a great introduction to the GOM for me. More importantly for my own work, there were a ton of concepts that I feel I can apply to the Mississippian plays I am working on in SE Sask.”

“Quality of instruction was great as always and much appreciated.”

JEFF DRAVIS BIOGRAPHY

Jeff Dravis is a carbonate geologist whose consulting activities primarily focus on aiding in the discovery of oil and gas deposits, or enhancing their development once they are found. He also conducts applied carbonate training seminars for industry every year.

Jeff received his Bachelor of Science degree in Geology from St. Mary's University in San Antonio, Texas. He received a Master of Science degree in Marine Geology from the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences in Florida. His thesis was entitled "Holocene Sedimentary Environments on Eleuthera Bank, Bahamas.," supervised by Dr. Harold R. Wanless. Jeff then entered Rice University, Houston, Texas, to begin work on deep-water carbonates under the direction of Dr. James Lee Wilson. He was awarded a Ph D in Geology; his dissertation was entitled "Sedimentology and Diagenesis of the Upper Cretaceous Austin Chalk Formation, South Texas and Northern Mexico."

Dr. Dravis began his professional career in Houston with Exxon Production Research Company. There, he conducted applied research on carbonate facies, diagenesis and porosity evolution, but also ended heading up Exxon's worldwide training efforts in carbonates. This training included teaching in-house seminars, as well as leading combined modern (Bahamas and Florida) and ancient (Texas and New Mexico) carbonate field seminars (25 days) for the corporation.

In 1986, Jeff started his own consulting practice in Houston. First, he founded Dravis Interests, Inc. to provide technical expertise and training in applied carbonate petroleum geology to the oil and gas industry. Then Dravis Geological Services was created to handle mostly technical consulting projects. Jeff has been involved in 197 technical projects worldwide, working sequences ranging in age from Cambrian to upper Tertiary. He has presented 324 in-house and field seminars to industry, both on a public and private basis, including 73 modern field seminars to Caicos Platform in the southeastern Bahamas, and numerous ancient field seminars to west Texas and New Mexico. His clients are domestic and foreign oil companies, both majors and independents. This is the eighth version of this seminar since the fall of 2020.

Jeff is an Adjunct Professor of Geology at Rice University. Since 1987, he has taught parts of graduate courses, taken students into the field, and served on thesis committees. In 2016, he began teaching the carbonate geology segment of the University of Houston's Professional Master's Program in Petroleum Geology. The next segment will be taught January and February of 2023.

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