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A new/old horizontal target

Mississippi Lime – A ‘Thoughtful’ Challenge

By LOUISE S. DURHAM, EXPLORER Correspondent

The advent of the U.S. shale boom placed the spotlight on horizontal drilling and hydraulic fracturing like never before, and with good reason.

These technologies almost always are referred to in a manner indicating they are specifically associated with the still-hot shale plays.

But what's being overlooked for the most part is that these now-common high tech applications are utilized to drill and complete wells in many fields where there is no shale.

Remember the Austin Chalk drilling frenzy in south Texas beginning in the late 1980s? Then-esoteric horizontal drilling was the key ingredient to make it work.



The Mississippi Lime play is found in southern Kansas and, as seen here, northern Oklahoma. *Photos courtesy of Chesapeake Energy Corporation*

Similarly, the Mississippi Lime play concentrated in northern Oklahoma and southern Kansas is a modern day example of where advanced, improved versions of this technology and others are being used to drill and produce non-shale reservoirs.

This regional carbonate deposit lies beneath the productive Atoka and Morrow sands and above the Devonian-age Woodford and the older Silurian-age Hunton formations.

It might best be called a new/old drilling target, given that vertical wells have been drilled into the Mississippian section in this region for decades, with the Mississippi Lime giving up only marginal production in many instances.

A variety of rocks occur in this relatively new play – including chert, tripolite, specularite and chat, which has yielded minimal hydrocarbon volumes for many years via vertical wells. Some operators equate chat to tripolite or weathered chert.

The Mississippi Chat is a thin, siliceous zone of variable reservoir quality that intermittently develops on top of the Mississippi Lime, according to petroleum geologist and AAPG member Dan Boyd, formerly with the Oklahoma Geological Survey.

There's a steep learning curve to this play, and Boyd cautioned late in 2011 not to expect everything to pan out.

Starting On a Challenge

On the positive side, Boyd was enthusiastic there will be sweet spots.



Chesapeake Energy Corporation

Photos courtesy of

Spyglass Energy Group in Tulsa is among the operators who are zeroing in on these.

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MATSON

Talks Set for Discovery Thinking Forum

Tulsa geologist and AAPG member Shane Matson will present the paper, "The Mississippi Lime: Outcrop to Subsurface and the Evolution of a Play," as part of this year's **Discovery Thinking Forum** at the AAPG Annual Convention and Exhibition in Pittsburgh.

The forum – the seventh presentation of the AAPG 100th Anniversary Committee's program recognizing explorers who have "made a difference" – will be held from 1:15-5 p.m. Monday, May 20, at the David L. Lawrence Convention Center.

Forum co-chairs are AAPG Honorary members Charles Sternbach and Ed Dolly.

This year's forum will offer five talks from seven explorers who will share how they overcame great challenges in both business and geological aspects to find exploration success. The format calls for philosophies of exploration, stories from remarkable careers, professional insights, colorful anecdotes and lessons learned.

Other speakers at this year's forum are:

- ♦ William Zagorski, vice president-exploration for Range Resources, who will discuss "The Marcellus Shale – Geologic Considerations for an Evolving North American Liquids-Rich Play." [Related story.](#)
- ♦ John Roesink and Jason Anderson, senior research geologists, Bill Barrett Corp., who will discuss "The Wasatch-Green River Resource Play, Utah."
- ♦ Robert Spitzer, vice president-exploration, Apache Canada, who will discuss "Horn River Devonian Shale Gas Discoveries in Northeast British Columbia."
- ♦ Marshall Deacon, senior petrophysical adviser, and Robert Lieber, geologic adviser, Noble Energy, who will discuss "Integrated Reservoir Evaluation as a Means for Unlocking Maximum Resource Value in an Unconventional Reservoir: Niobrara Formation, DJ Basin, Colorado."

It's challenging.

"The Mississippi Lime is a new play type," said Spyglass geologist and AAPG member Shane Matson during a presentation on the subject that he gave at the recent Playmaker Forum in Houston. "It brings new metrics to evaluate, new skill sets to be utilized and developed and new nomenclature."

Matson might be said to be carrying on family tradition. He's the great grandson of AAPG's fifth president, Charles Matson, and the grandson of retired petroleum geologist Tom Matson.

Tulsa-based Ceja Corporation drilled the first modern horizontal Mississippian well in 2003 to exploit the tripolite, according to Matson. By 2009, 20 wells had been successfully drilled and completed, essentially kicking off the Mississippi Lime play.

"Three years ago, I was on a logging job for my first horizontal Mississippi Lime well, targeting the low porosity section, or the Dense," Matson said. "We interpreted 1,200 feet of open natural fractures in an 800-foot interval.

"Someone on the well from Schlumberger said that the rock was not just fractured, but shattered," he said.

"We recognized we had discovered a new reservoir.

"We were in Osage County, and there was no announcement of the well, which we had permitted through the Bureau of Indian Affairs," Matson continued. "We went from 45,000 acres to a gross 550,000-acre position in six months."

Water: An Important Aspect

Matson emphasized the entire play is huge in aerial extent, encompassing 30 million acres, where more than a thousand wells have been drilled.

In comparison, the famed Elm Coulee Field in the Bakken play in North Dakota is 12 million acres with 5,000 producing wells, while the East Newark Field in the Barnett covers three million acres with more than 15,000 producing wells.

The complex Mississippi Lime is actually comprised of multiple reservoirs having highly varying petrophysical parameters:

- ♦ Unconventional (un-altered): 2 percent to 5 percent porosity; requires massive stimulation; has low natural deliverability. Possible to understimulate.
- ♦ Semi-conventional (altered): 15 percent to 20 percent porosity; requires stimulation; medium deliverability. Possible to overstimulate and produce abundant water.
- ♦ Conventional (highly altered): 35 percent to 48 percent porosity; no stimulation; high natural deliverability near the wellbore, but doesn't drain large area due to low permeability.

The reservoirs often are stacked or laterally adjacent to one another, according to Matson. The sweep efficiency of the hydrological system increases with porosity.

"The variability of the section coupled with the high fluid volume production has led to another paradigm shift in how the industry interprets reservoir objectives in horizontal carbonate plays," Matson noted.

"This variable reservoir requires thoughtful stimulation design," he said. "You must understand the rock you're stimulating."

Matson emphasized the play is about water.

It's crucial not to underestimate how much water a well will make because there must be adequate disposal capacity for produced fluids.

Handling all this water along with other drilling issues can be mighty power intensive. Matson noted it's estimated there will be a need for another 500 megawatts of generation to fully develop the Mississippian play. 🇺🇸



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