

# Advanced Analysis of Magnetic Resonance Finds Laminated Pay, Eagle Ford Shale

Matrix nonuniformity detailed by combining 50-burst magnetic resonance application and high-resolution density logging

## CHALLENGE

Discriminate intervals with the best production potential in what appears to be uniform matrix on standard log suites.

## SOLUTION

Run the newly developed 50-burst magnetic resonance acquisition application in combination with the Three-Detector Lithology Density (TLD) tool to discern both extremely low-porosity and medium-porosity laminations through statistical analysis.

## RESULTS

Used the improved ability to locate oil-bearing laminated intervals to optimize placement of four additional laterals.



## Conventionally undifferentiated shales

Standard log suites, which were developed for conventional reservoirs, characterize the Eagle Ford shale play as a uniform matrix. Analysis of logs with this conventional resolution cannot easily find where the best potential for oil production may occur.

## Fifty-burst magnetic resonance application and high-resolution density

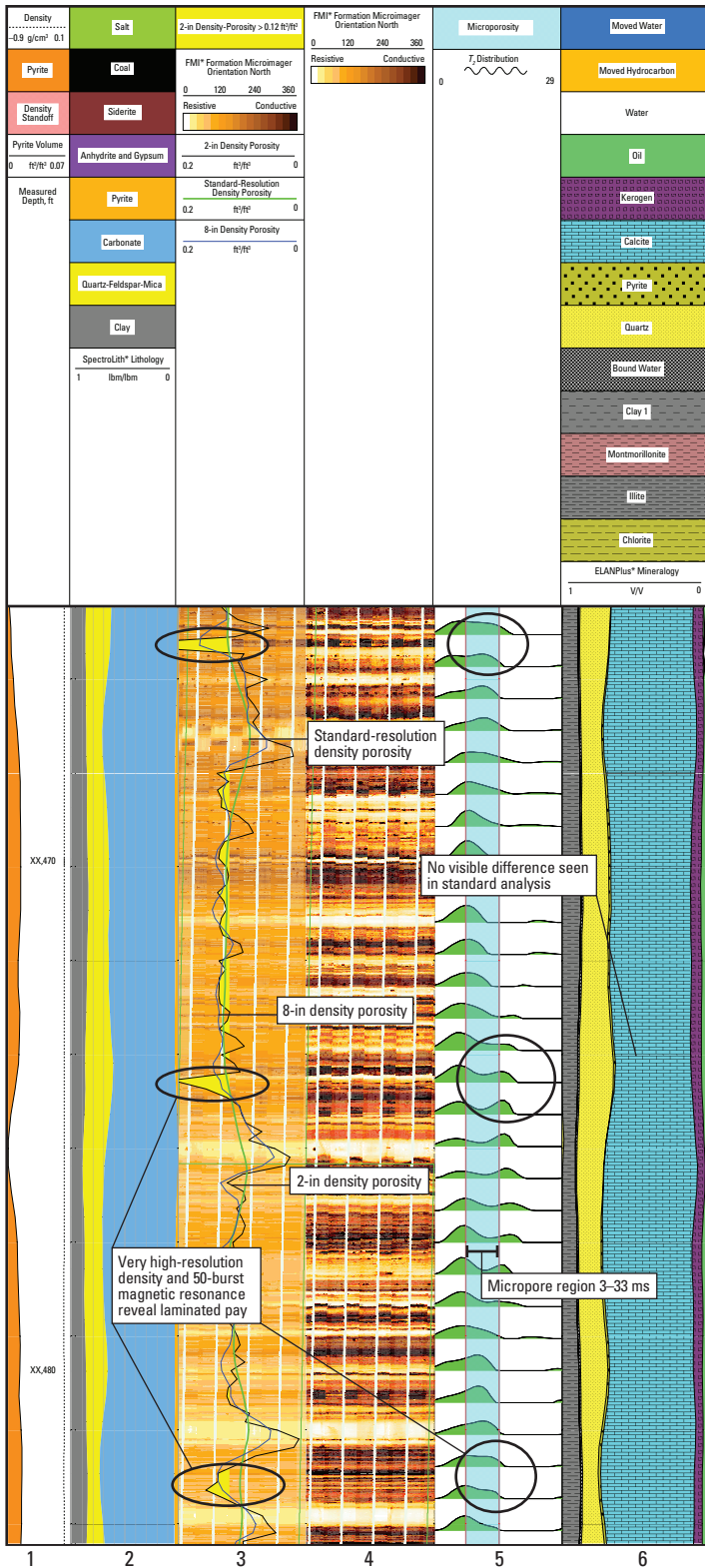
Magnetic resonance logging has long been applied to discern moveable from nonmoveable fluids regardless of the matrix, which is of great utility in clay-bearing formations. The new 50-burst application improves the statistics for the smallest pores by enabling the collection of more data by an advanced prepolarizing magnetic resonance tool. The result is a 6-in or greater resolution of the clay-bound micropore region of the rock.

The TLD tool uses three detectors to obtain a high-resolution 8-in density output. The TLD detector with 2-in resolution is normally applied to correct for minor wellbore changes resulting from the hole condition and mudcake. In the Eagle Ford the matrix is primarily carbonate and the wellbores are typically smooth. This logging environment allows use of the 2-in detector as a stand-alone porosity device to improve the visibility and reliability of the TLD curves.

## Visible laminated pay

The Eagle Ford is highly laminated with thin laminations. Run with a conventional logging suite, the 8-in-resolution density cannot differentiate laminations with substantial porosity. However, logging analysis combining the 50-burst magnetic resonance application and high-resolution TLD readily identifies laminated pay by differentiating very small pores, micropores, and potentially oil-bearing matrix. Standard-resolution analysis presents only an average of the matrix, which cannot discriminate laminations.

# CASE STUDY: Laminated pay identified by advanced magnetic resonance analysis, Eagle Ford Shale



Track 3 overlays the standard-resolution density with the 8-in and 2-in curves. The resolution of the 2-in curve is consistent with the enhanced image curve in Track 4. The 2-in-resolution density shows higher porosity (circled) along certain layers that is as much as 5-pu higher than standard resolution. In the same intervals, the 50-burst application in Track 5 differentiates very small pores, micropores, and potentially oil-bearing matrix. Compared with the detail provided by the TLD and 50-burst logs, the standard-resolution analysis in Track 6 does not show any bedding but merely an average of the matrix.

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