geoconvention
Virtual Event
September 21-23
2020
CSPG · CSEG · CWLS · GAC · MAC · IAH

Defying Permian Midland Basin Production Trends: How Geology Helped Define the Edge of a Play

Graham Bain, Bryn Davies, Darrel Koo, Stephen Sagriff, Ryan Luther, Robyn Fiell
RS Energy Group

Summary

With 10 years of heightened horizontal development in the Midland Basin, oil production has grown from 220 Mbbl/d to 1,750 Mbbl/d. Despite the massive increase in volumes and development of the most promising acreage, the Midland Basin is still capable of delivering excellent results – Howard County being a key example and the focus of this study. With results in central and eastern Howard surprising to the upside, we retooled our geologic interpretation to assess how reservoir quality changes across the county might be influencing those results. We used our database of cleaned log data to interpret the changing depositional environment across Howard County. We then compared this to the Western Canadian Sedimentary Basin's Duvernay play, where we see similar trends that may provide insight to the direction of future development of both the Duvernay and Midland Basin.

Observations

Outside of Howard County, we typically observe deteriorating well results at shallower depths in the Midland Basin. Although relatively shallow, Howard deviates from that trend with well productivity on par with some of the best areas of the basin. We believe this exception is dominantly controlled by the depositional environment. We found that Howard County is sheltered from sediment flows coming from the Ouachita-Marathon thrust by the Glasscock Nose of the Eastern Shelf, and it is also in a geologically transitional environment between the Midland Basin and the Eastern Shelf. From west to southeast across the county, the depositional environment transitions from deep basin to shelf slope to shelf edge. This coincides with reservoir changes of increasing amounts of carbonate from shales with thin carbonate interbeds (calciturbidites) to carbonate-dominated gravity flow deposits.

Theory

There are a few possibilities for Howard County's departure from the typical Midland Basin production trend. They include:

1) Increased carbonate content from shelf-derived carbonate debris flows increases the brittleness of the rock and allows for a larger stimulated rock volume.
2) Carbonate debris flows in the transition zone to the Eastern Shelf slope have moldic, vuggy and/or fracture porosity and behave more like conventional reservoirs.
3) Sedimentation from debris flows off the shelf edge led to rapid burial and compaction, resulting in reservoir overpressure in the Howard area.

4) Distance from the Ouachita-Marathon thrust and Howard's isolation from the Glasscock Nose of the Eastern Shelf may have resulted in a very different sediment source compared to the rest of the southern Midland Basin.

Conclusion

Geology still matters in unconventional shale reservoirs. By determining how and where the geology and depositional environment changes, we can get a better understanding of reservoir performance in areas largely untested by horizontal wells such as the western edge of the Midland Basin along the Central Basin Platform. We can also use analogous plays to the Permian Basin to help predict well results in other unconventional shale plays such as the WCSB's Duvernay.