[AV]Practical Prospecting: The Past, Present, and Future*

Tom Bowman[1]

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Abstract

The oil and gas exploration and production industry is one of the world's largest industries, and the industry has cycled through many changes since retired railroad conductor Edwin Drake struck oil in 1859 in Titusville, Pennsylvania, and touched off the modern oil industry. There may be no other industry today that demands a more diverse set of human, technological, scientific, and political capabilities than the oil and gas exploration and production industry. Competition for natural resources has driven companies to explore and produce in harsh, remote and even hostile locations and to develop modern technologies to overcome and develop the modern era of the industry. Also, as the environment grows more diverse and unforgiving and the challenges more complex, the skilled prospectors are aging and are growing scarce. Currently the industry is seeing an upturn, but with price fluctuations, industry and technology challenges, the industry has seen its share of good and bad times. As the oil and gas industry evolves into this next phase of oil and gas development, a phase predicated by the use of closely spaced horizontal wells that are drilled into low-permeability formations, the extraction of oil and gas are enhanced with the application of hydraulic stimulation (or permeability enhancement). Yet, there are many new obstacles to overcome.

For the first of many decades, the industry was focused on generating individual prospects for developing oil and gas. Early oil and gas prospectors would take geologic ideas, do the research, expand and map the prospects, acquire geophysical support data, seek approvals, acquire leases and then permit and drill the wells. As completion technologies have changed (i.e., hydraulic stimulation), the modern prospector appears to be going by the way-side; or has the prospectors job changed? What technologies are expected from this change in the industry and how does this affect the modern prospect generator?

How does the industry maintain the skills for future prospect generators to be fostered, mentored, and matured? A look back at the industry timeline and a review of a few of the modern mega-giant unconventional resource plays may answer these questions and help advance prospectors for this and even the next age of the oil and gas industry

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ZAZA ENERGY CORPORATION

Consolidating a Dominant Position in the Eaglebine/Eagle Ford East

Practical Prospecting: The Past, Present, and Future

Tom Bowman

AAPG Playmakers Forum – Houston, Texas

January 2014

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AAPG Playmakers Forum

Cecil Green, one of the owners of GSI who was also a founder of Texas Instruments, once reminisced that geophysics was

"a perfect combination of technology and people. … The high demands of science breed integrity, and modesty as well," he said. "Show me a geologist, a geophysicist who's brimming with ego, and I'll show you a probable newcomer to the business. Mother Earth has a way of quickly showing you you're always the upstart."

Cecil Howard Green (August 6, 1900 – April 11, 2003)

The future

As I read the historical curve of the industry for North America it is now near the crest of maximum production. For a few years—three to five—the present rate of production will be maintained approximately, then the long gradual decline will come. Possibly the permanent decline in production will begin about the time the world's business relations will have entered a period of permanent recovery from the present disrupted conditions which prevail . . . . . .

. . . . . because the most evident places will have been tested, less promising ones will be tried—more failures will be encountered, profits will be lessened, and the financiers‘ enthusiasm for the oil business will decrease, but will be good for the next five or ten years.

. . . . . during this period excellently trained, experienced geologists will be in demand exclusively for geological work.

E. G. WOODRUFF
AAPG Bulletin – July-August, 1921

Scale of the United States

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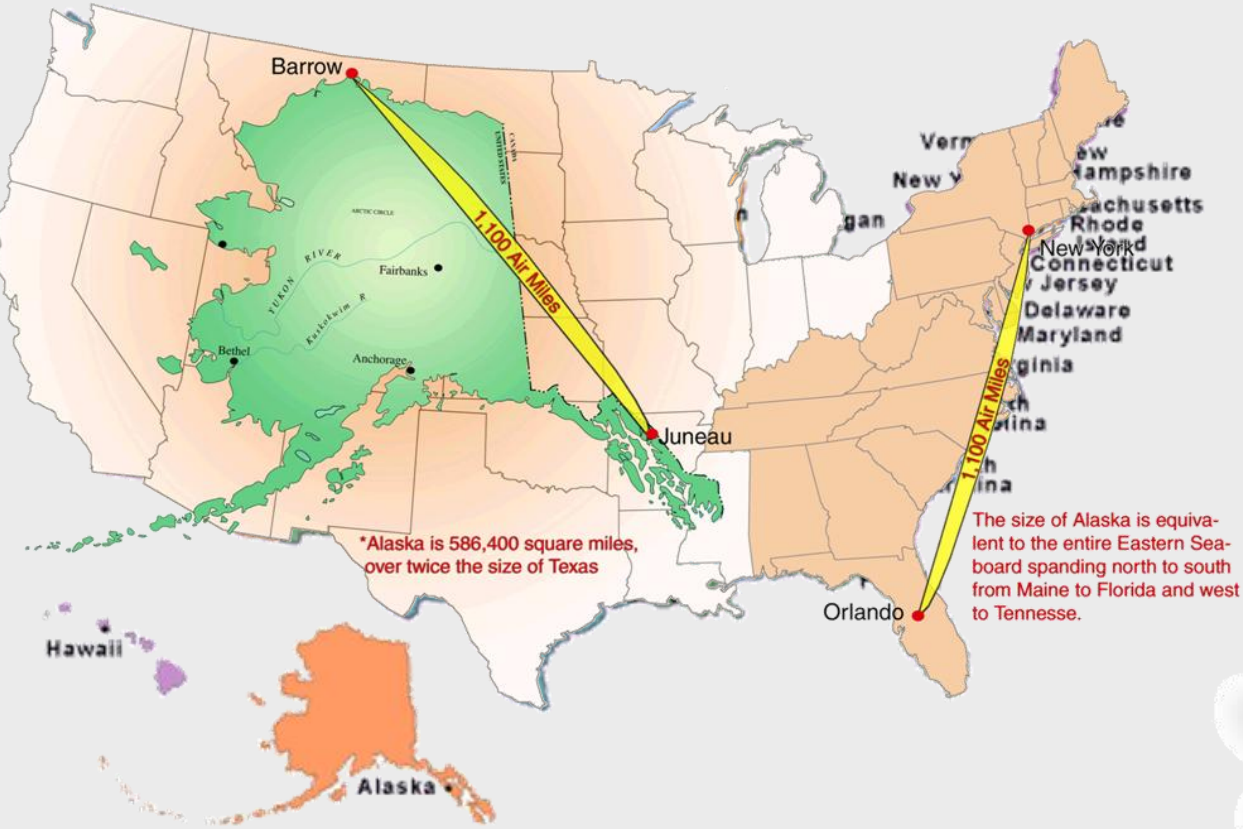

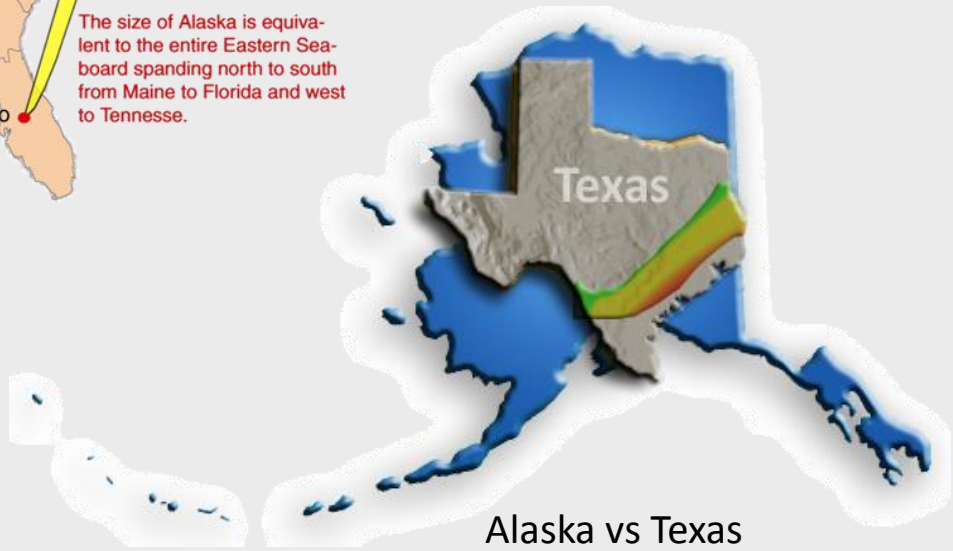

Alaska vs Texas
with The Eagle Ford Trend

West Texas

Delaware and Val Verde Basins, Texas

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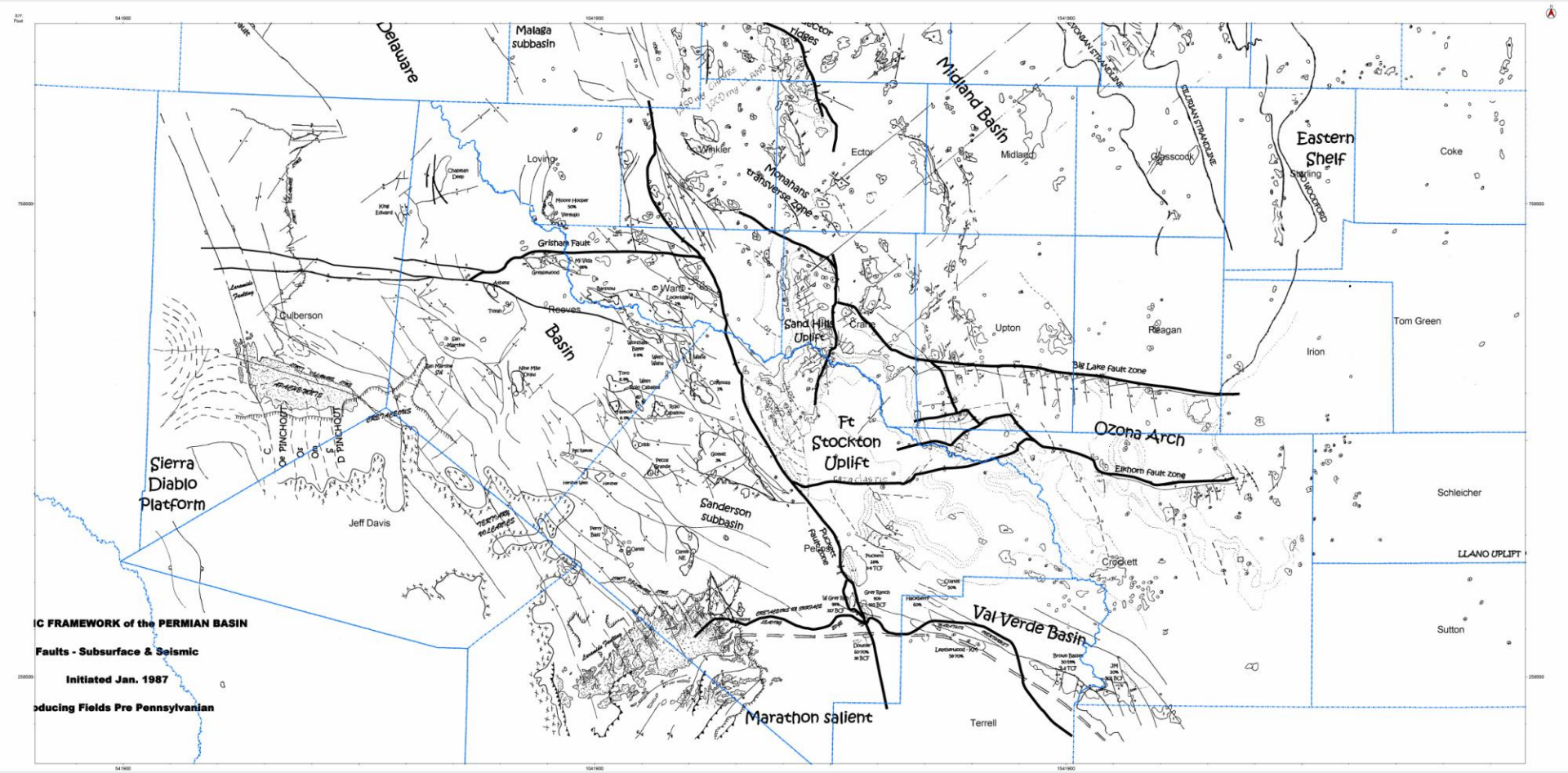
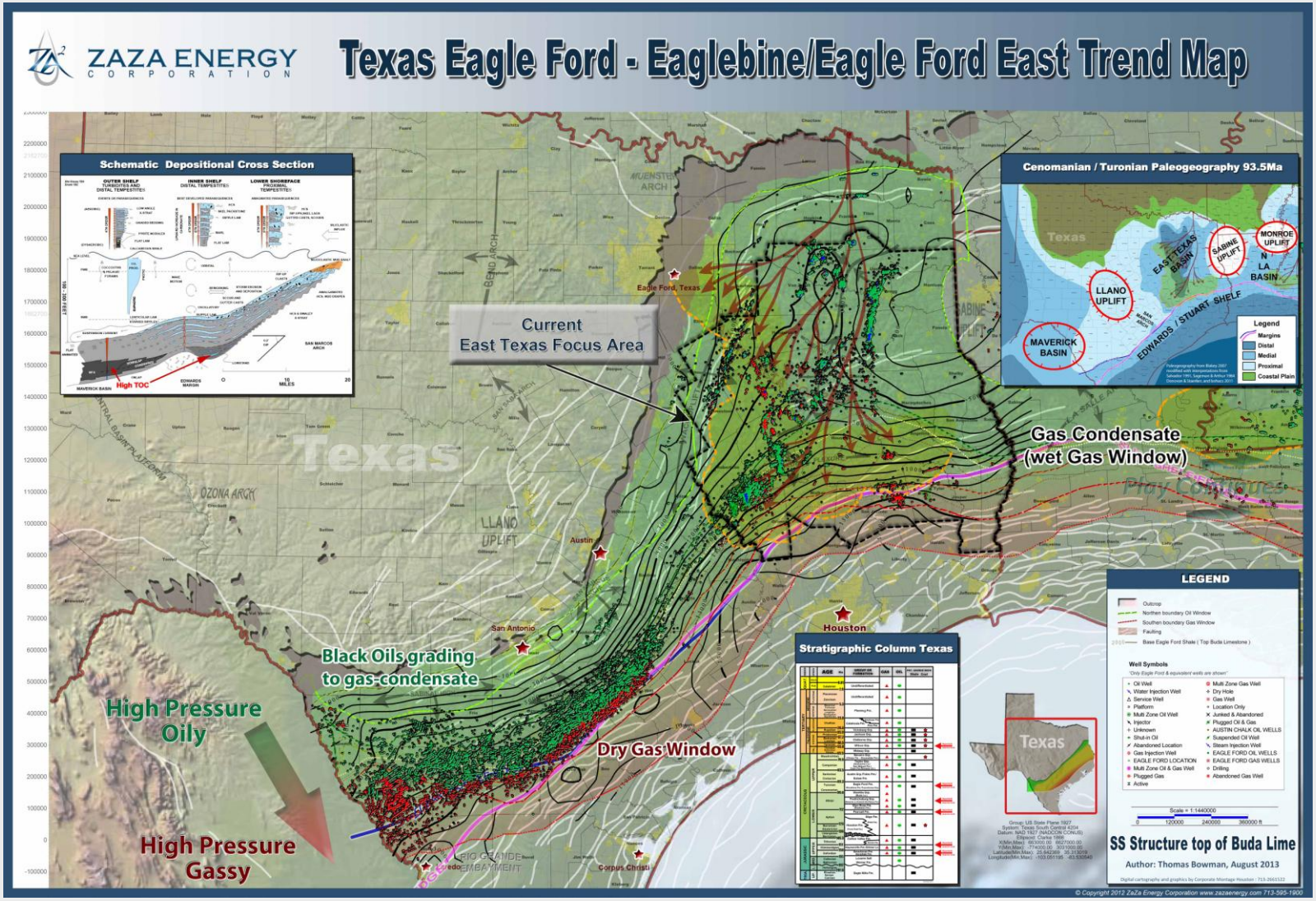
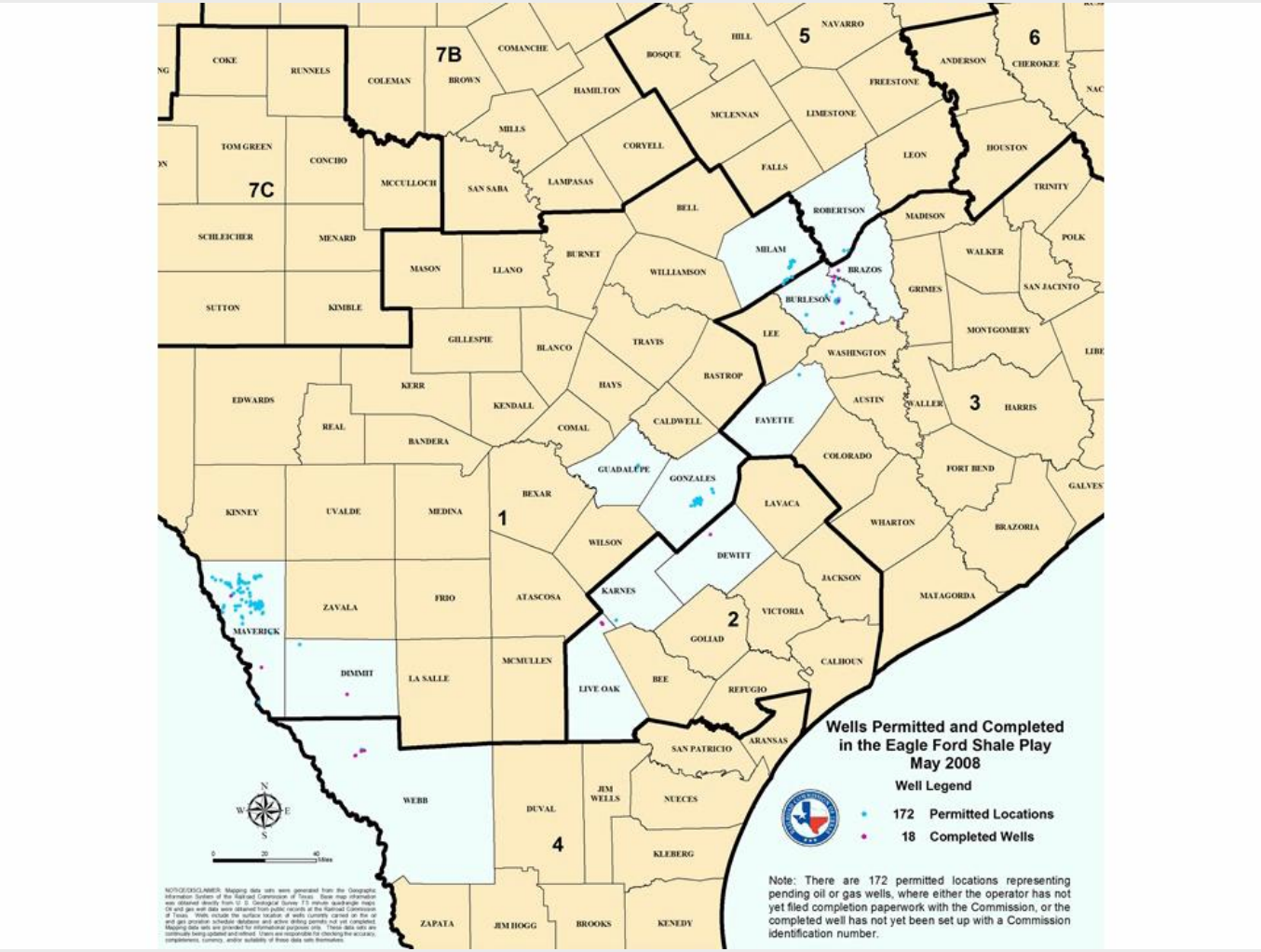


Eagle Ford et. Al.



Historical Review of Eagle Ford



Regional Cross Section

FLATTENED ON BASE OF AUSTIN CHALK

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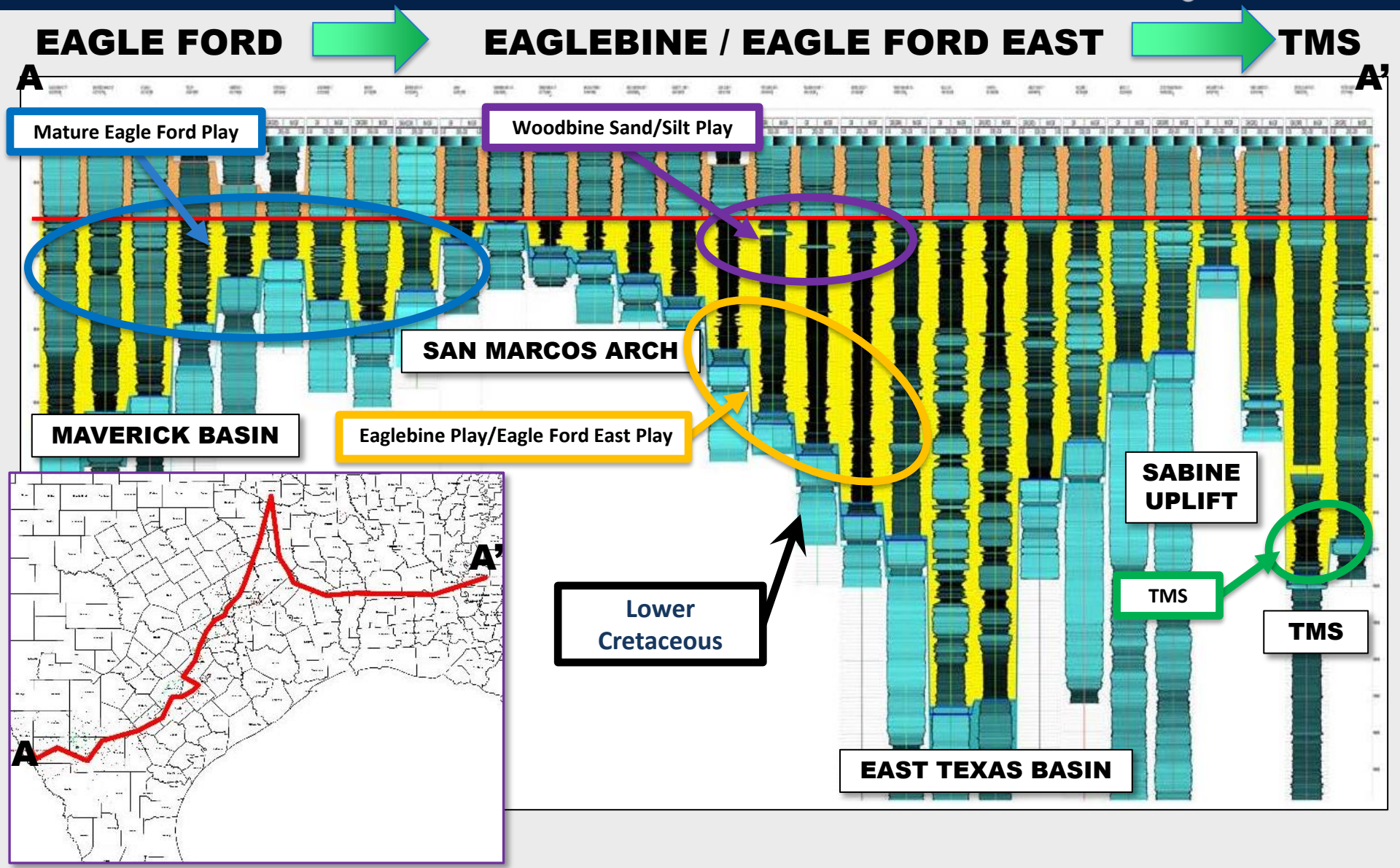

Play Types

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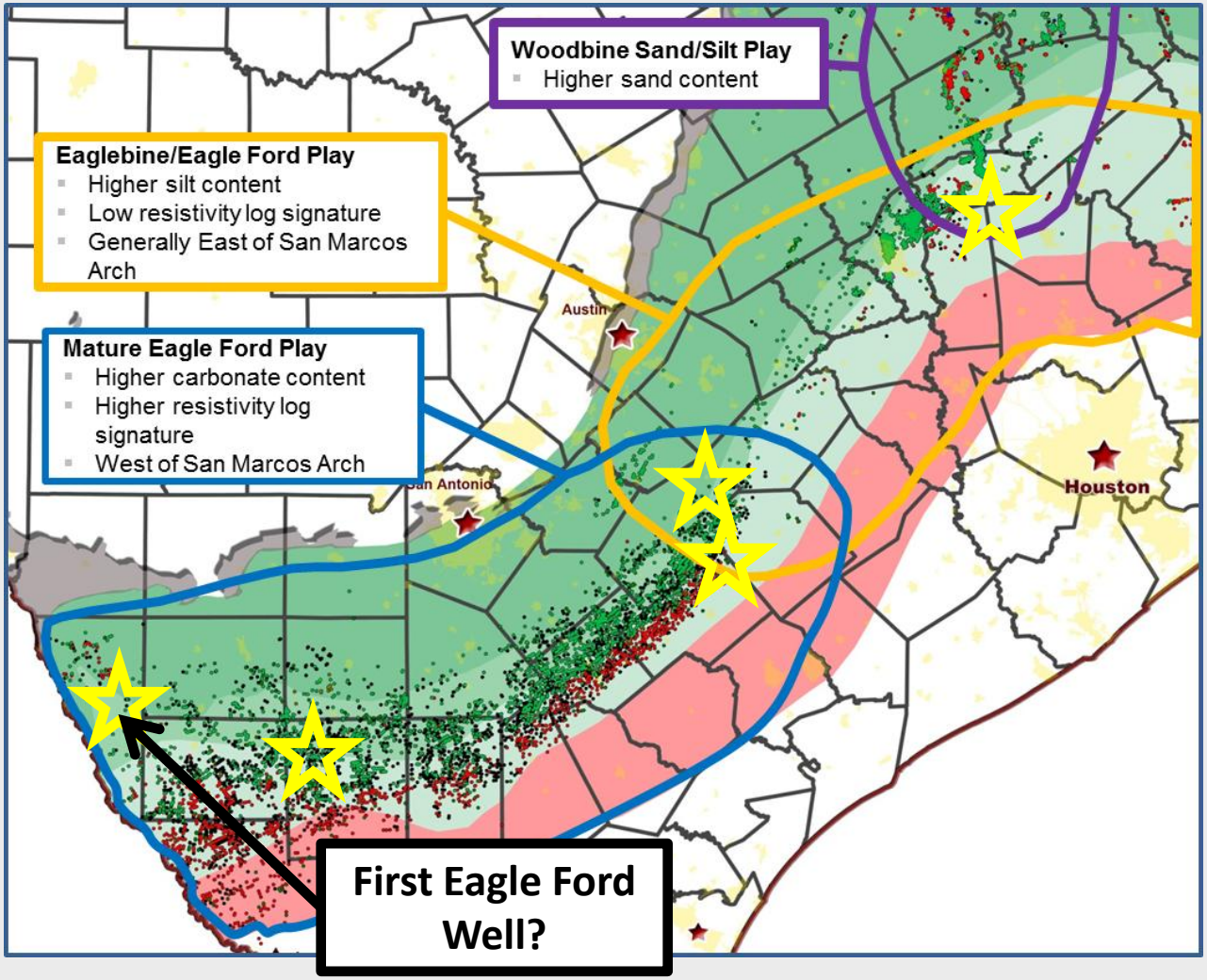
Key Points

- Three Play Types can be defined across the Gulf Coast of Texas
- Mature Eagle Ford in Maverick Basin is dominated by carbonates, generally east of the San Marcos Arch
- East Texas Basin is dominated by Siliciclastic deposition from the Ouachita complex to the north
- The Siliciclastic formations include the Woodbine sands, Sub-Clarksville and the Harris Delta, Kurten Sand, Dexter Sand etc.
- The influx of siliciclastic rocks is interlaced throughout the entire Eaglebine section



* Eagle Ford and Woodbine and equivalent productive wells posted

First Eagle Ford Well?

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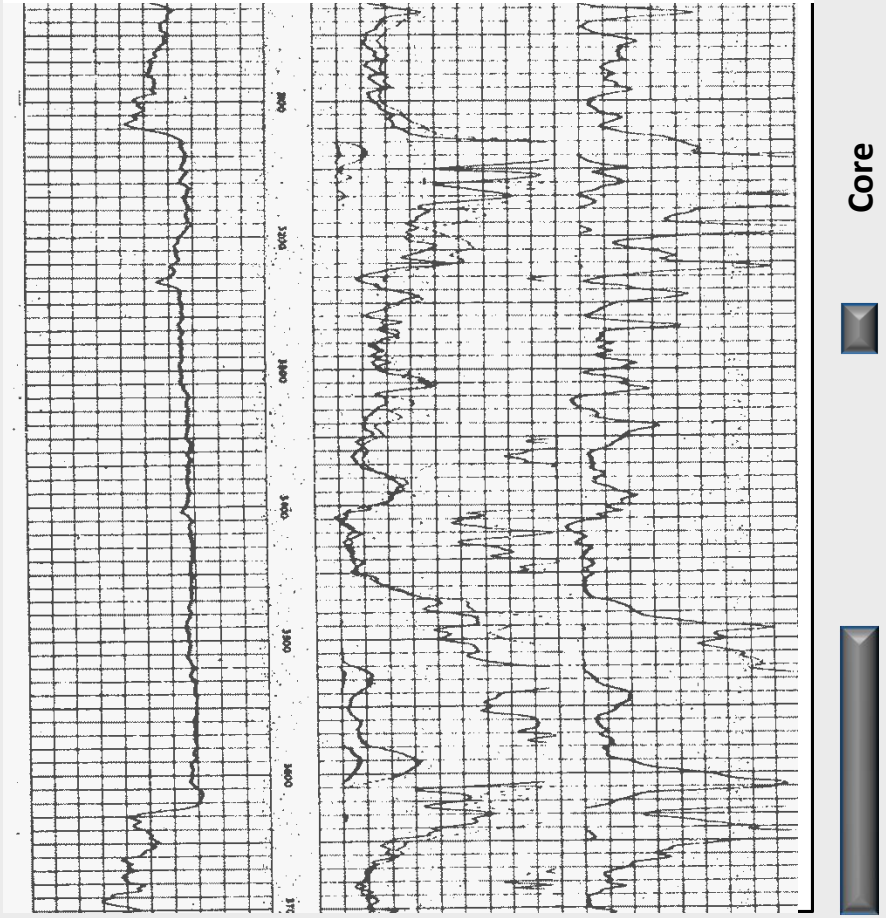
Key Points

- Maverick County Well
- Drilled March 11, 1955
- IP 103 BOPD
- 28.6 degree API Oil
- Produced over 23 MBO
- Cored 7 sections of the Eagle Ford Shale
- DST 6 intervals recovering only Oil-cut Mud (20% Oil)
- Cores indicate oil shows across most intervals
- Good early indications of potential of Eagle Ford Shale potential

42-323-00694
Continental Oil Co
#1 N. J. Chittin



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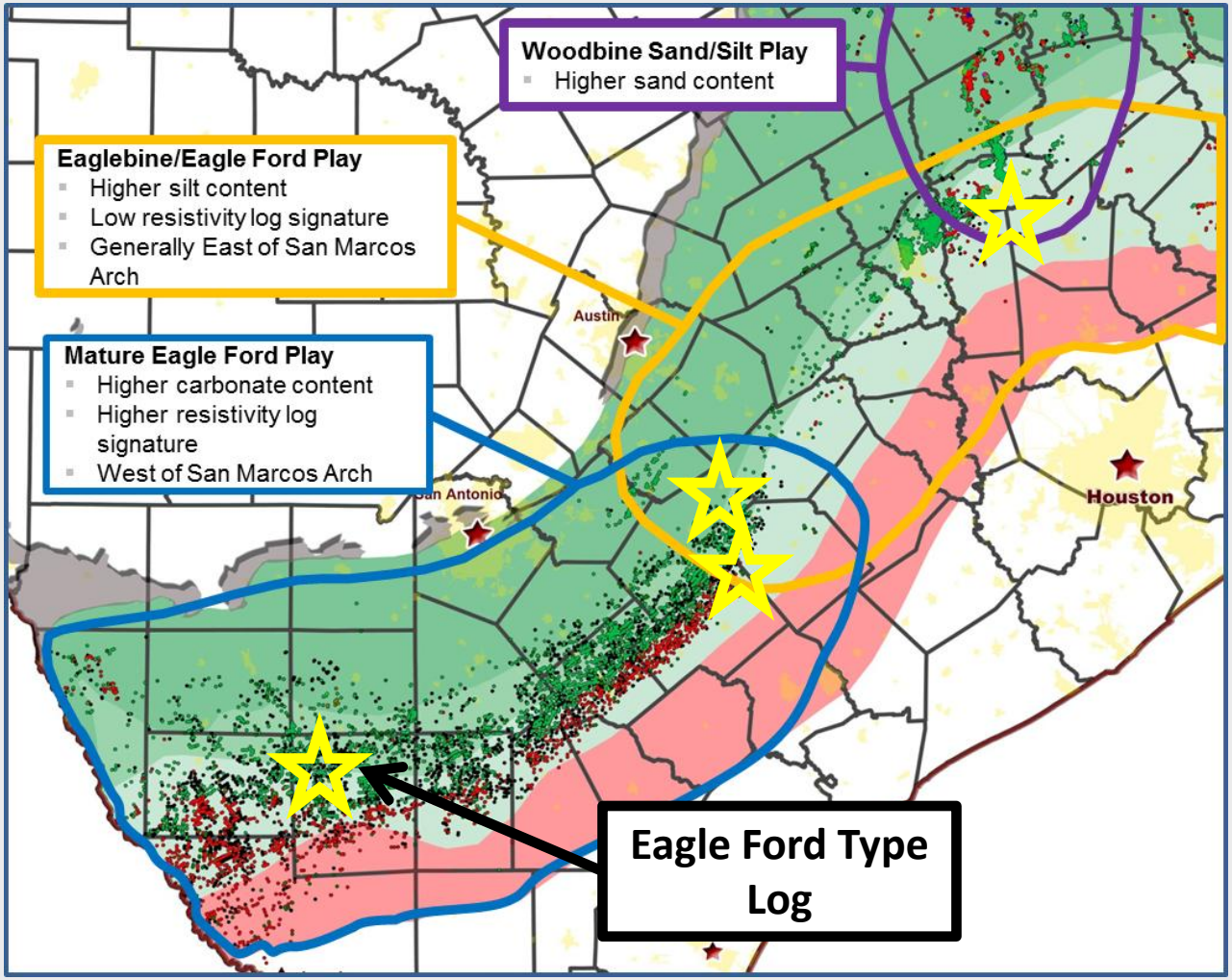

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Eagle Ford Section

La Salle Co., TX

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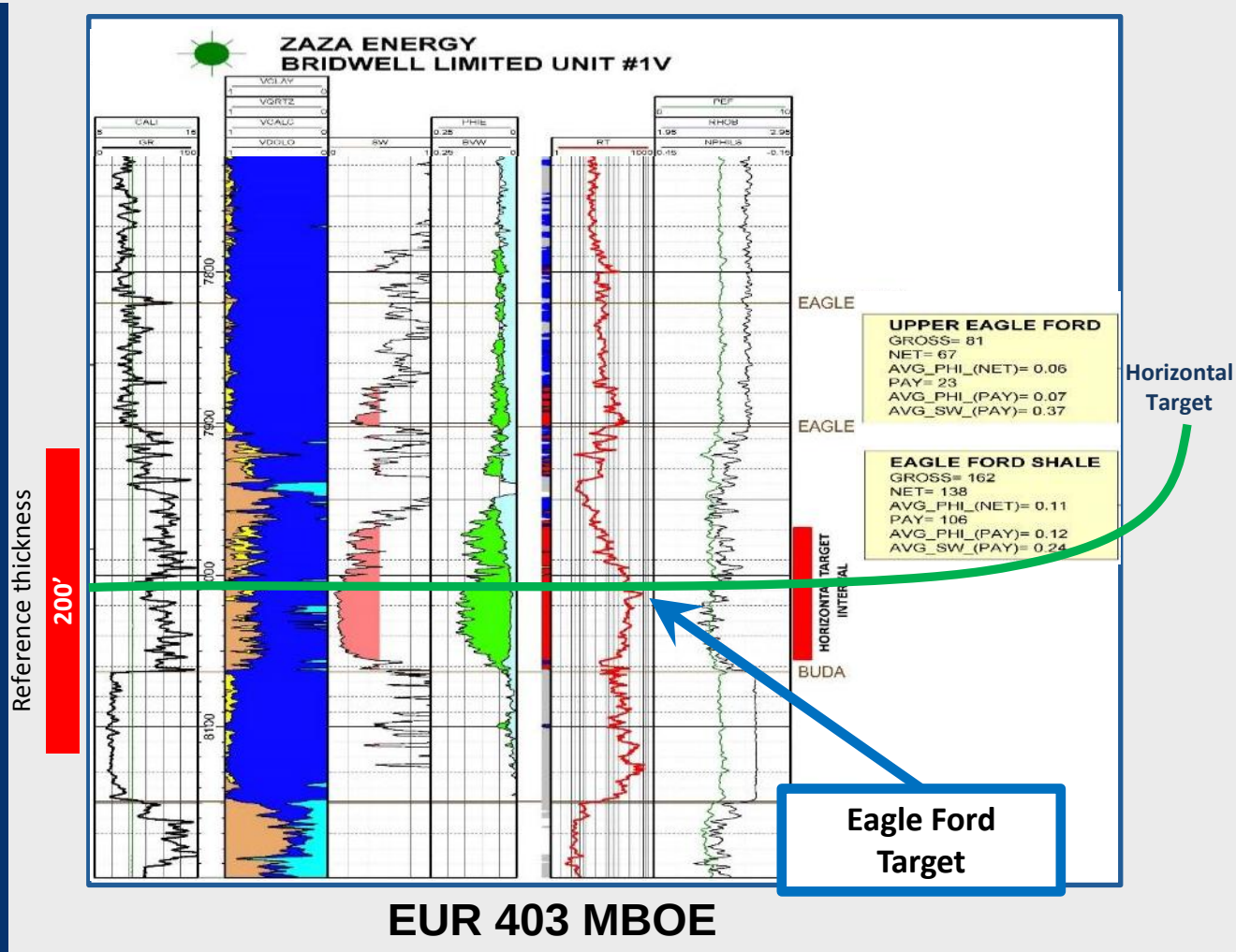
Key Points

- General log calculations can estimate the potential of the Eagle Ford Section in La Salle County, Texas
- A lot of penetrations, very active drilling area
- Gross interval 162', Net interval of 138' based on log Net pay of 106'
- High Liquids yield
- Primary target with high liquids yield
- EUR 403 MBOE
- GOR 1,650 scf/bbl
- Oil API 42°



Compliments of Schepel Petroleum Consulting Inc.

Play Types

ZAZA ENERGY CORPORATION

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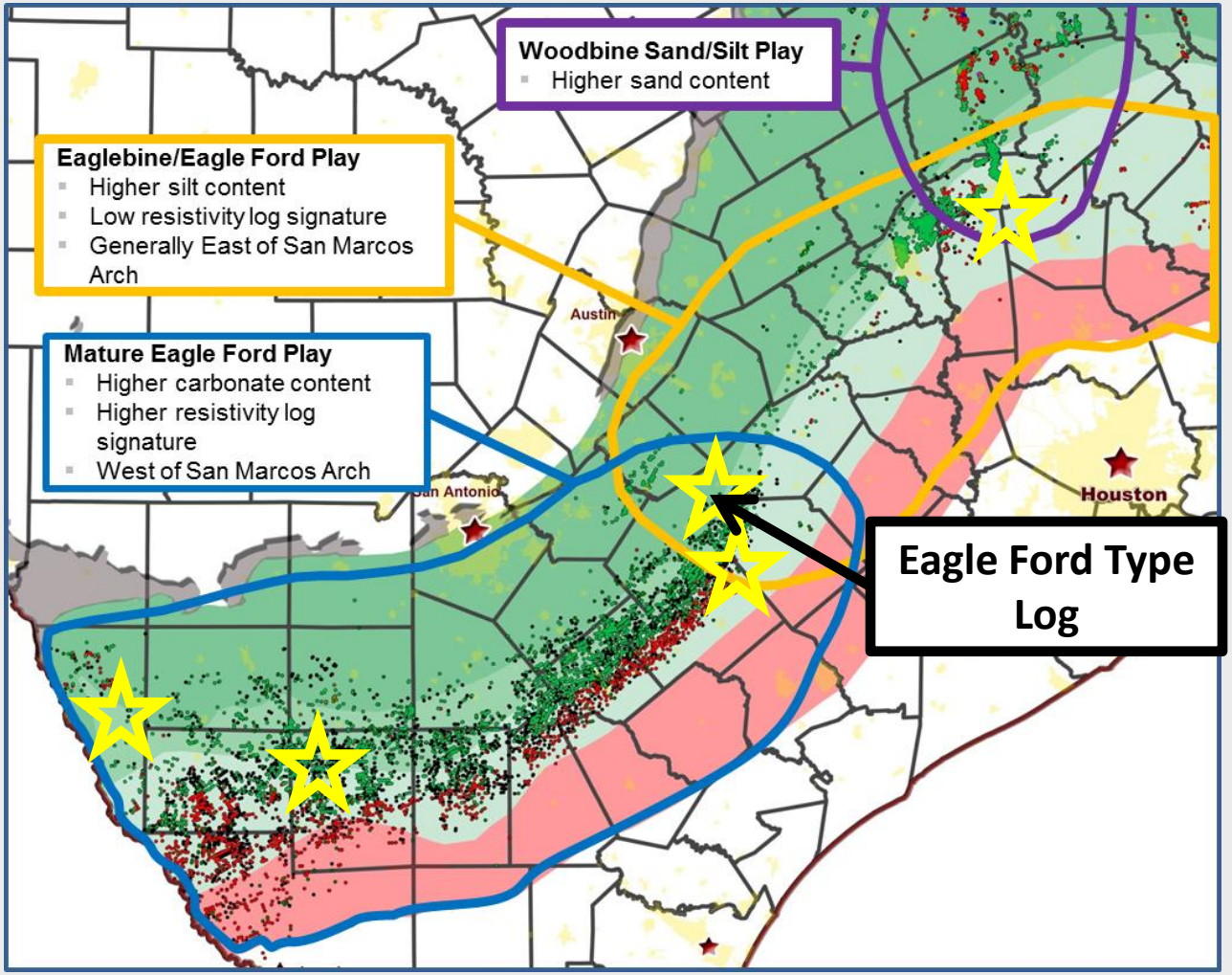

* Eagle Ford and Woodbine and equivalent productive wells posted

Eagle Ford Section

Gonzales Co., TX

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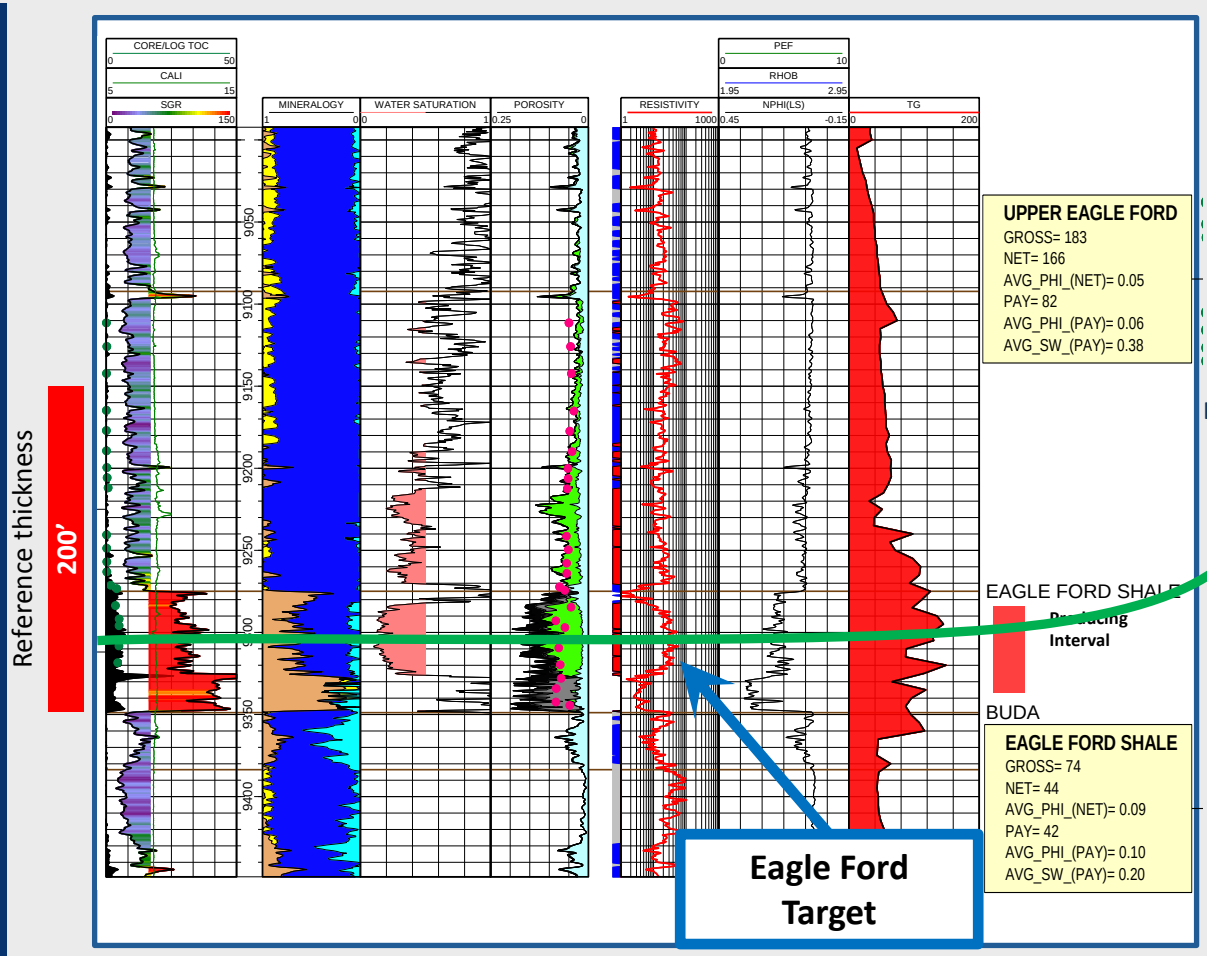
Key Points

- General log calculations can estimate the potential of the Eagle Ford section
- Eagle Ford Shale Gross interval of 74’ base on log Net pay of 42’
- Upper Eagle Ford Gross interval of 183’ based on log Net pay of 166’
- This Well has been on production for 19 months and has produced 120,073 Mbo and 0.75 BCFg
- EUR 391 MBOE



EUR 391 MBOE

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Play Types

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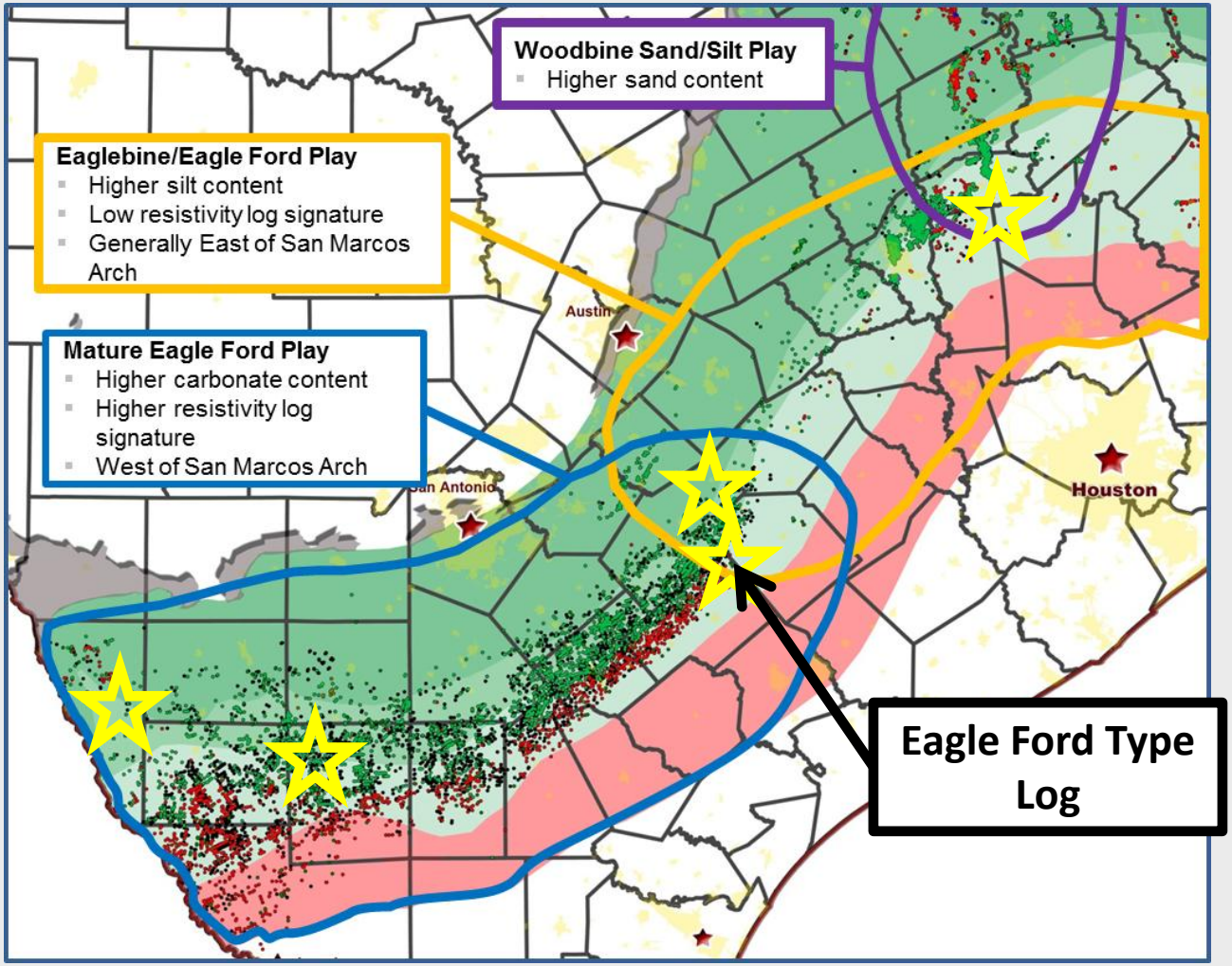

* Eagle Ford and Woodbine and equivalent productive wells posted

Eagle Ford Section

De Witt Co., TX

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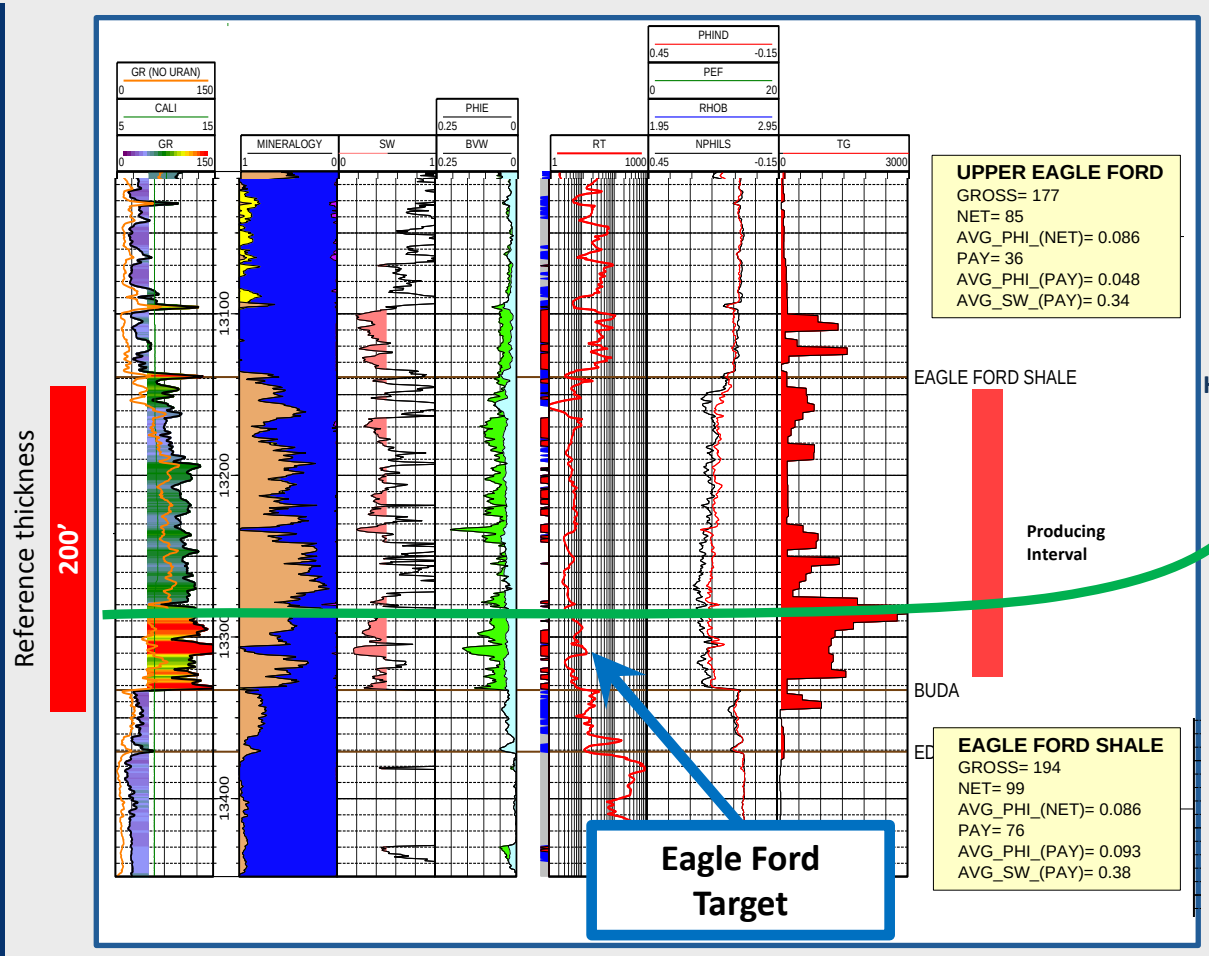
Key Points

- General log calculations can estimate the potential of the Eagle Ford section
- Upper Eagle Ford Gross interval of 177’ based on log Net pay of 85’
- Eagle Ford Shale Gross interval of 194’ base on log Net pay of 99’
- This Well has been tested at over 650 BOPD and 3.5 MMCF/d
- EUR 651 MBOE
- Note the Lower Resistivity of the Shale Section



EUR 651 MBOE

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Play Types

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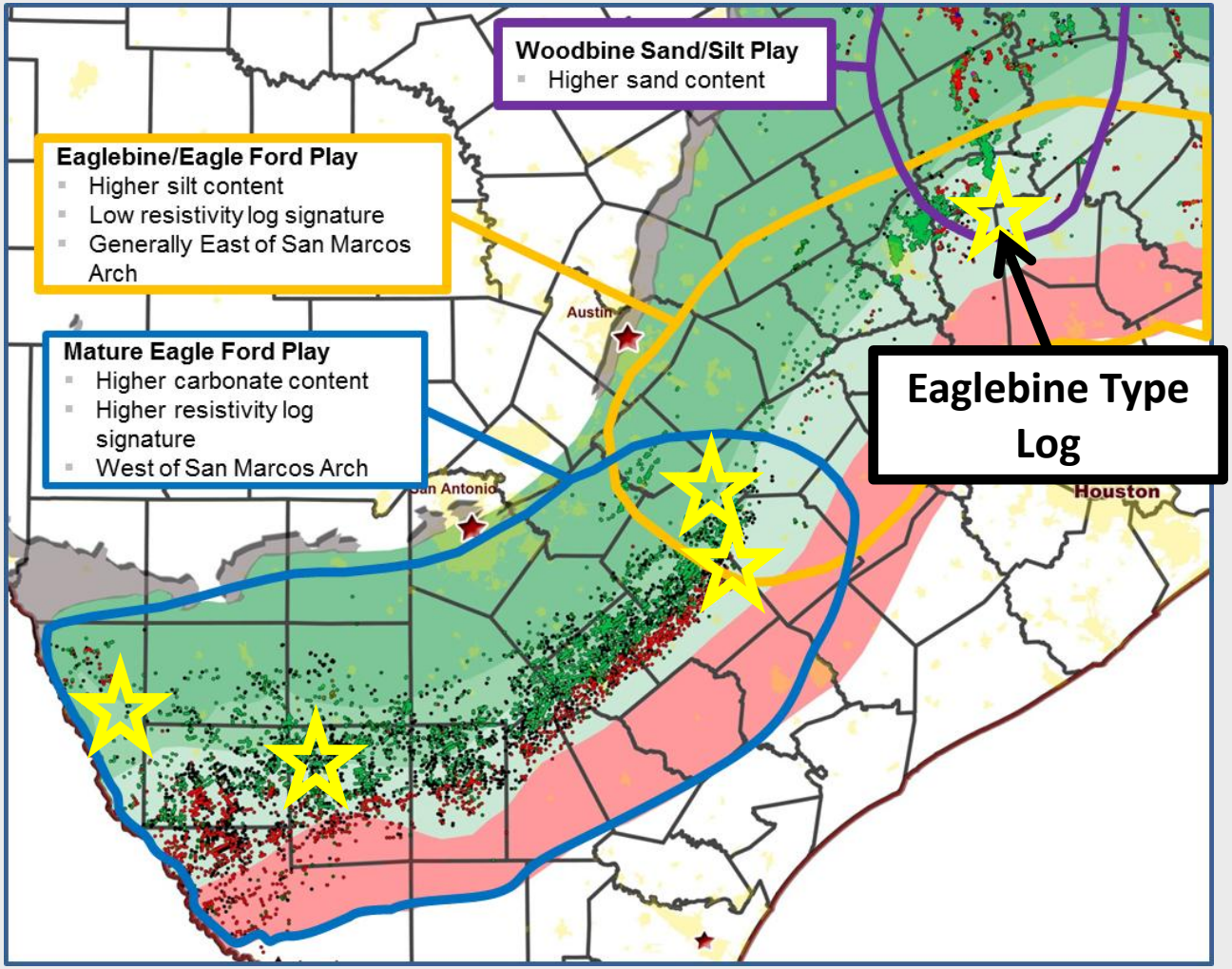

* Eagle Ford and Woodbine and equivalent productive wells posted

Eagle Ford East / Woodbine (Eaglebine)

Walker Co., TX

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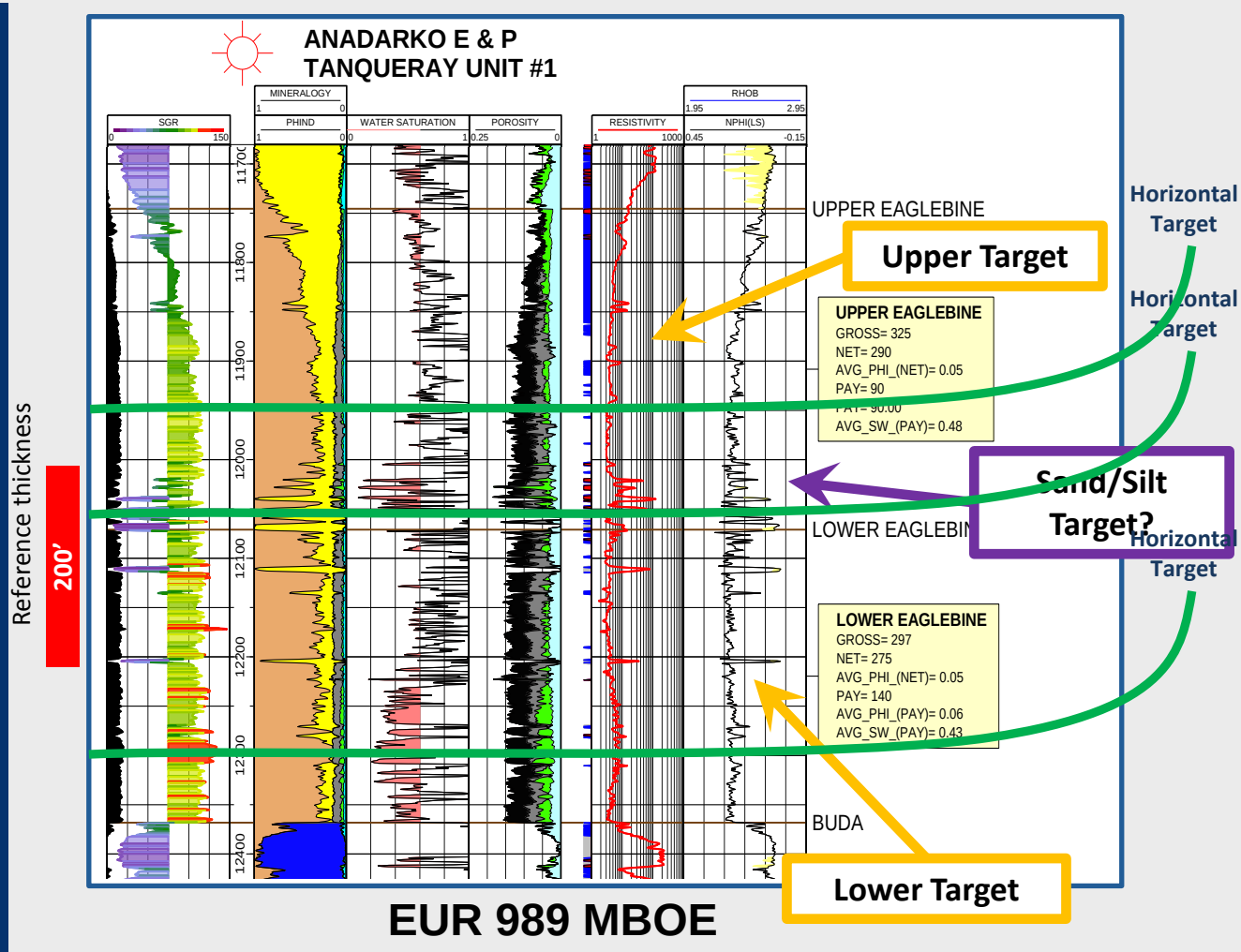
Key Points

- General log calculations can estimate the potential of the Eaglebine section below the Harris Delta
- A lot of penetrations, not a lot of full suite log combinations
- Upper section GIP ~ 30 BCFE / mi^2
- Net interval of 290’ based on log Net pay of 90’
- High Liquids yield +- 7,000 GOR
- Lower section GIP of ~50 BCFE / mi^2
- Net interval of 275’ base on log Net pay of 140’
- Primary target with high liquids yield



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Multiple Productive Formations

BURK ROYALTY CO. LTD – ETHEREDGE #1, 42-225-31198, HOUSTON CO., TX

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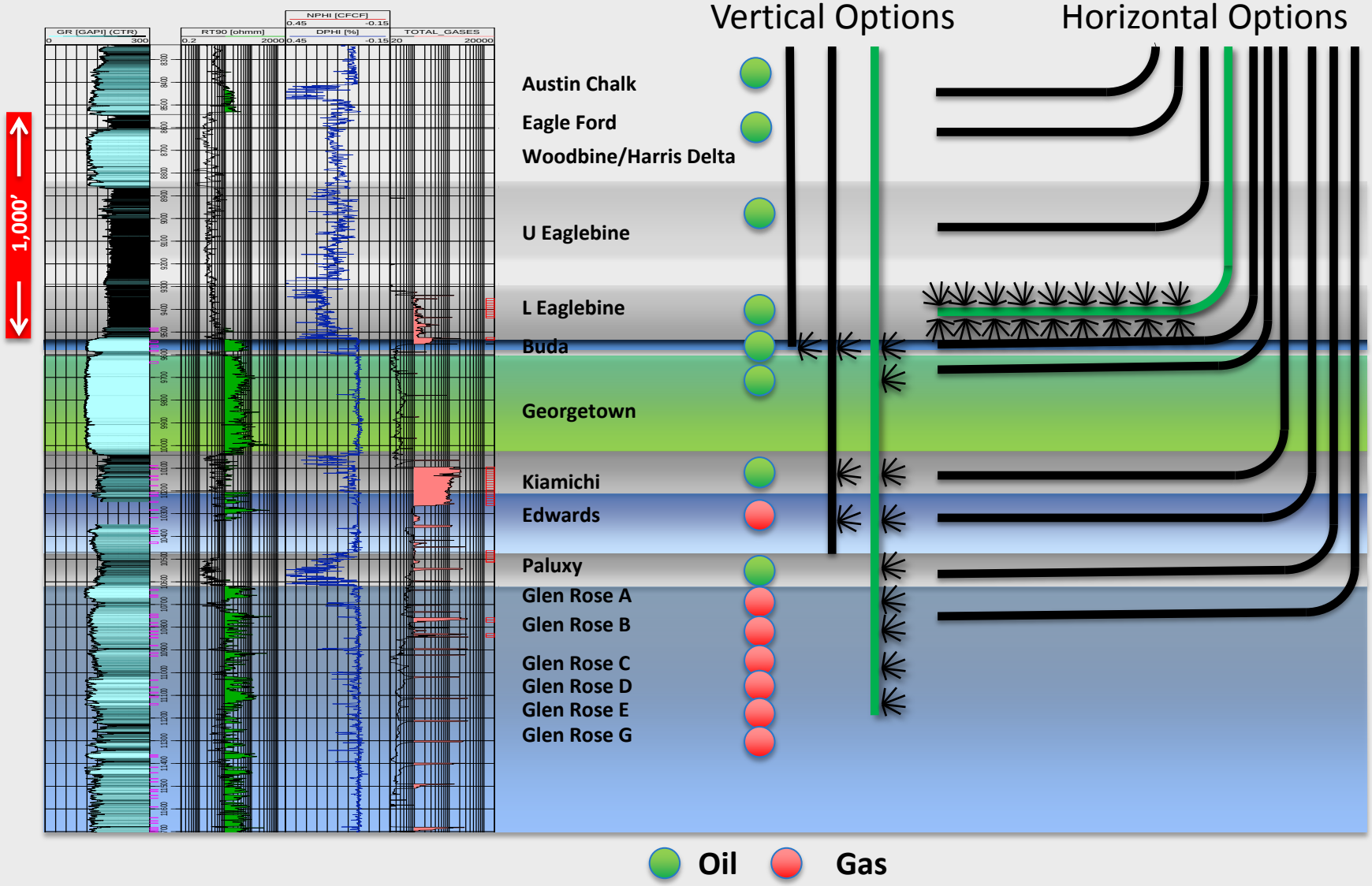
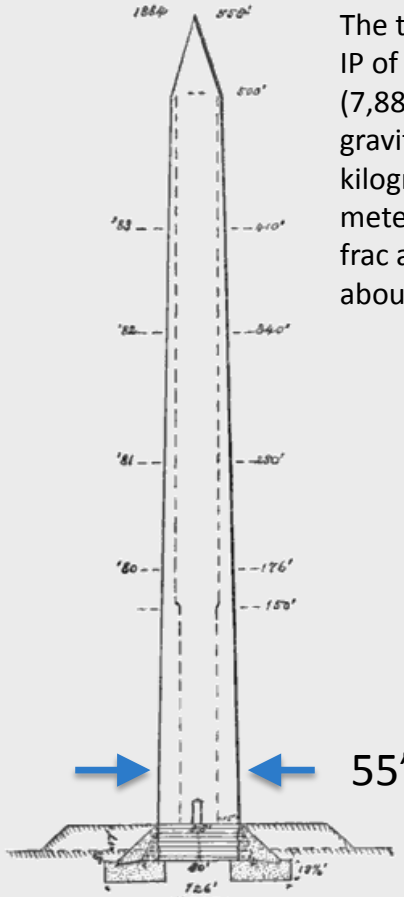


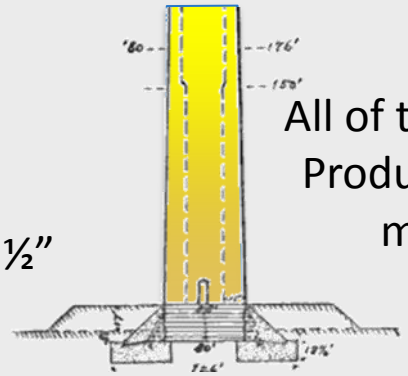
Scale and Fracing

The Washington Monument

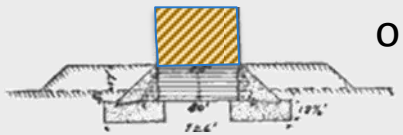
555' 5 1/2"



55’ 1 ½”

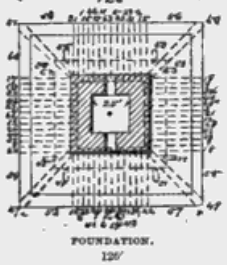


All of the Gold Produced by man



Frac Sand for one well

Total weight of monument:
90,854 tons or
181,708,000 lbs



The total Frac sand on the well with the highest IP in the Eagle Ford (EOG Burrow 5H) reported IP of 7,512 BOpd, 6,877 MCFpd, 1,378 BWpd (8,658 BPEpd) Completed with 15,763,048 lbs (7,881.5 tons) proppant over a lateral length of 5,340 ‘ (12,019-17,359) Proppant has a specific gravity of 2.65, meaning that it is 2.65 times heavier than water. So proppant weighs 2.65 kilograms per liter. The amount of sand used in the frac is a cube of proppant that is about 13.9 meters (about 45.6 feet) on each side. If you ground up the Washington Monument, it would frac about 11.5 wells by weight. Or by volume, the amount of sand used to frac the well is about 6 percent (1/16th) of the Washington Monument.

Figuring that the world has been producing gold at 50 million ounces a year for 200 years. (the Aztecs and the Egyptians produced a fair amount of gold for a long time) Fifty million ounces * 200 years = 10 billion ounces. Ten billion ounces of gold would fit into a cube roughly about 82 feet on a side. That means if you could somehow gather every scrap of gold that man has ever mined into one place, you could only build about one-half of the Washington Monument.

Scale and Fracing

Burrow 5H Eagle Ford Well

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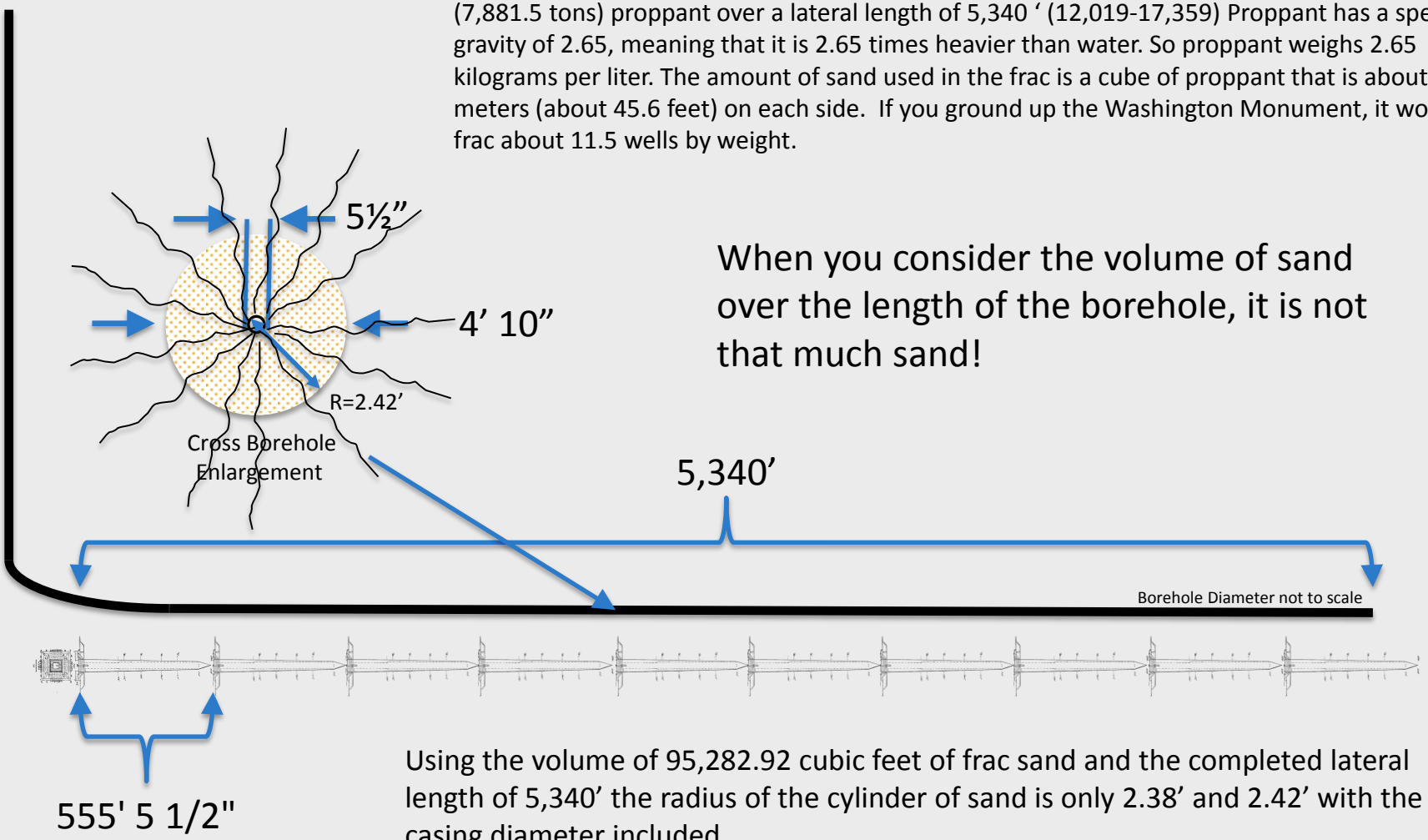

When you consider the volume of sand over the length of the borehole, it is not that much sand!

Using the volume of 95,282.92 cubic feet of frac sand and the completed lateral length of 5,340’ the radius of the cylinder of sand is only 2.38’ and 2.42’ with the casing diameter included.

Unconventional Plays

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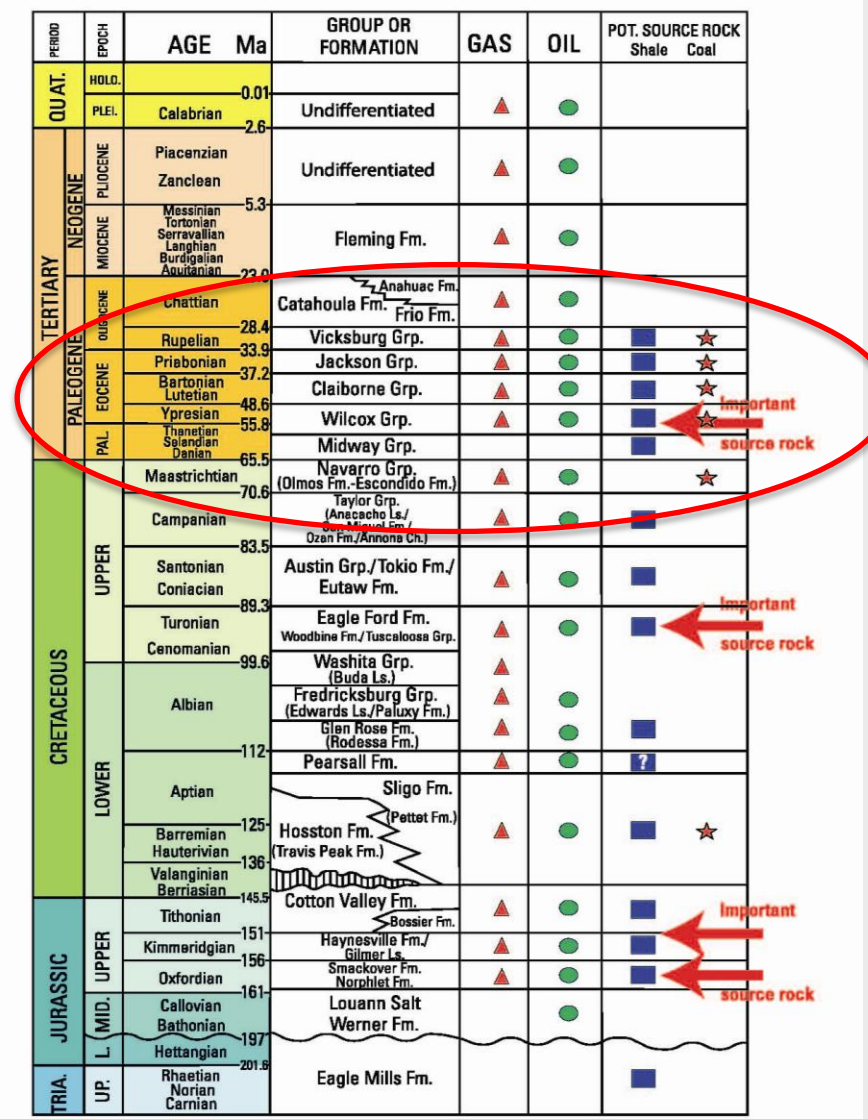
Stratigraphic Section of Northern Gulf of Mexico

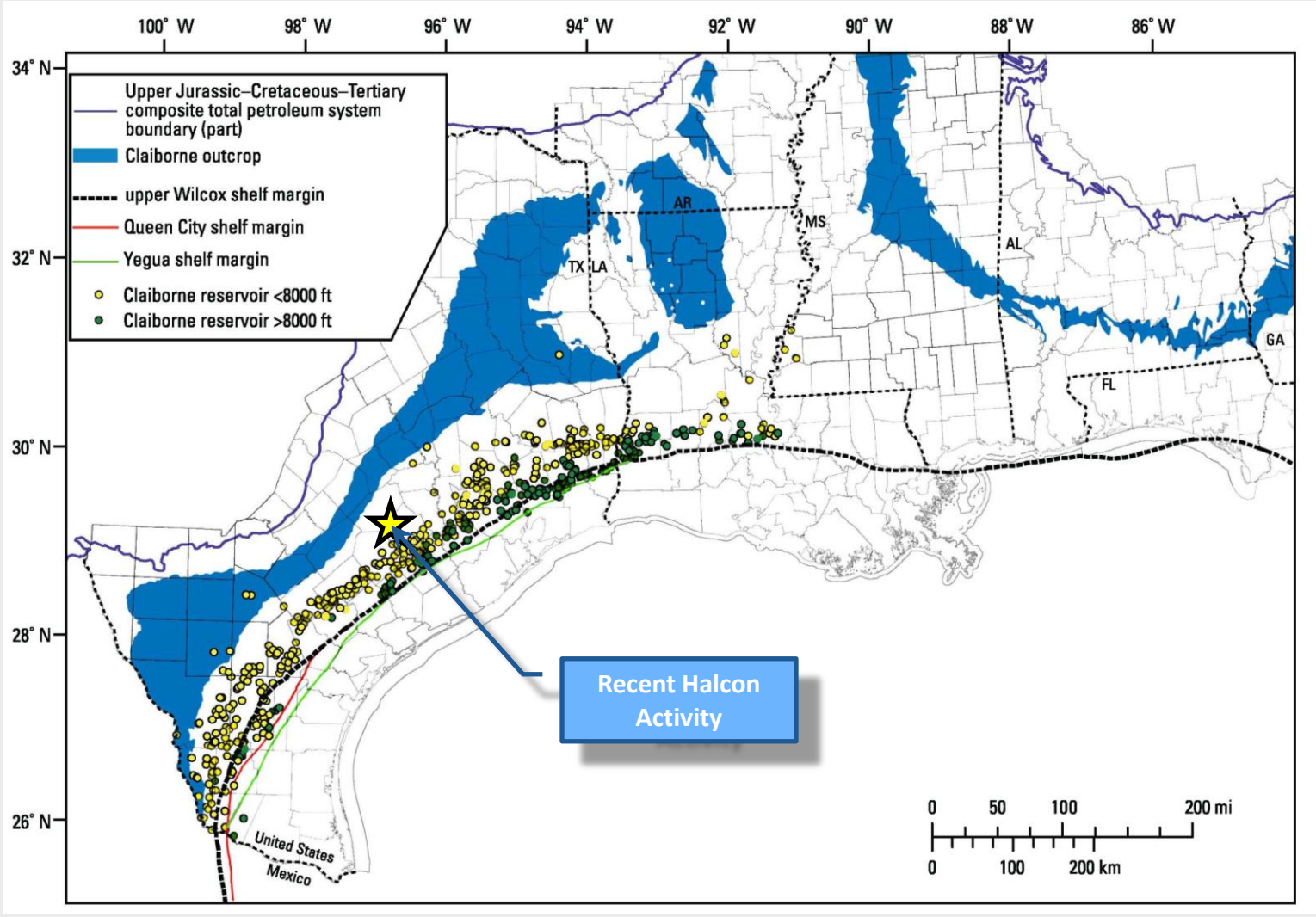


Generalized Mesozoic–Cenozoic stratigraphic section of the northern Gulf of Mexico coastal plain, showing reservoir rocks and potential hydrocarbon source-rock intervals.

From Warwick et al. (2007); modified in part from Nehring (1991), Salvador and Quezada Muñeton (1991), Palmer and Geissman (1999), and Humble Geochemical Services et al. (2002). Numerical time scale from Walker and Weissman (2009), image from Hackley (2010).

Pot. = potential; Mid. = Middle; Pal. = Paleocene; Plei. = Pleistocene; Holo. = Holocene; Quat. = Quaternary; Tria. = Triassic; Up. = Upper; L. = Lower; Grp. = Group; Fm. = Formation; Ls. = Limestone; Ch. = Chalk.

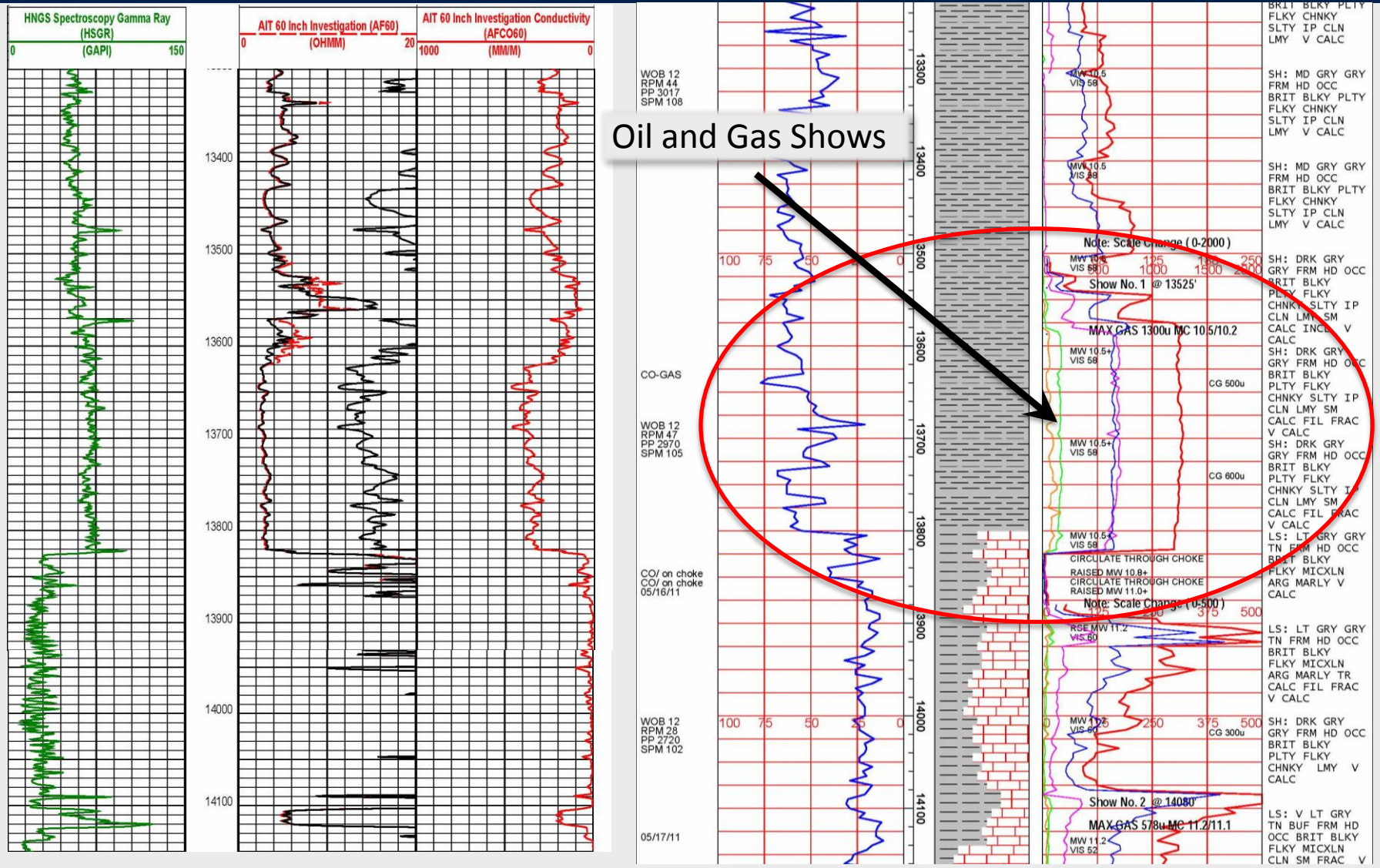
Distribution of Claiborne Reservoirs



Spatial distribution of Claiborne reservoirs less than 8000 ft (2438 m) depth to top and greater than 8000 ft (2438 m) depth to top. Claiborne Group outcrop from Schruben et al. (1994); Wilcox and Claiborne shelf margins from Galloway et al. (2000), Hackley (2010).

Hydrocarbon Shows in Austin Shale

ZAZA ENERGY CORPORATION



Conclusions

- *We have always been concerned about the future*
- *We have always developed ideas and technologies to overcome*
- *Look outside the box and develop new ideas*
- *Look beyond the boundaries (or don't let someone else set the boundaries)*
- *There are always more prospects to develop – keep an open mind*

AAPG Playmakers Forum

No prospect before its time……