### DUG 2012 – San Antonio ZAZA EN

ZaZa Energy Corporation

# Findings in the **Horizontal Woodbine EAGLEBINE**



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## Eaglebine?

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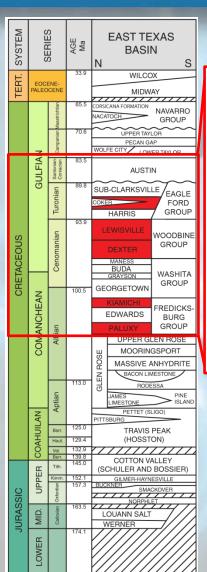
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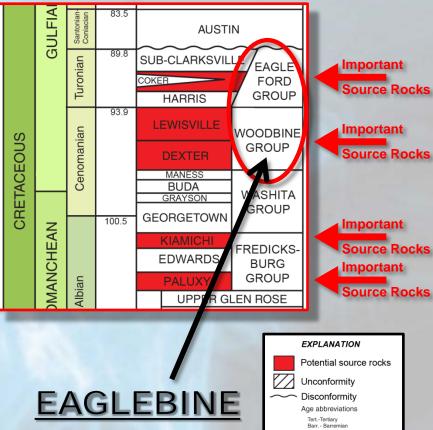
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(modified from Kosters and others, 1989)

- Eaglebine is the combination of the Eagle Ford Group and the Woodbine Group
- Generally the section from the base of the Austin Chalk to the top of the Buda Lime
- Generally containing the Cenomanian and Turonian Series Formations
- The Eaglebine interval contains several conventional formations interlaced with organic rich source rocks
- Additional source rocks are present in the Albian Series in the Kiamichi and Paluxy shales



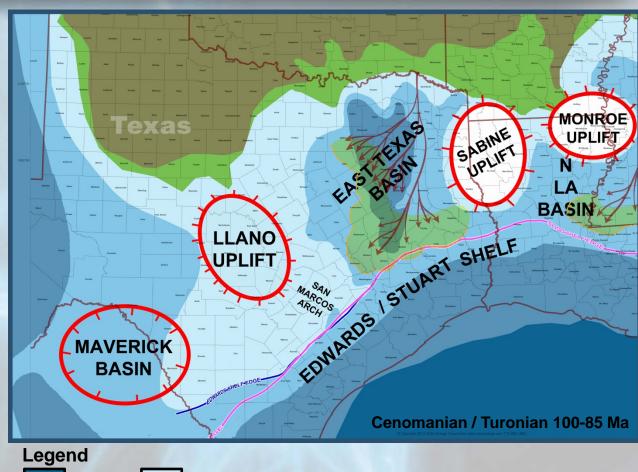




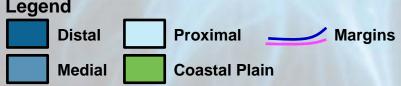
### Cretaceous Paleogeography ZAZA ENERGY

#### **Key Points**

- Eagle Ford in Maverick Basin is dominated by carbonates
- 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
- The influx of siliciclastic rocks are interlaced throughout the entire Eaglebine section





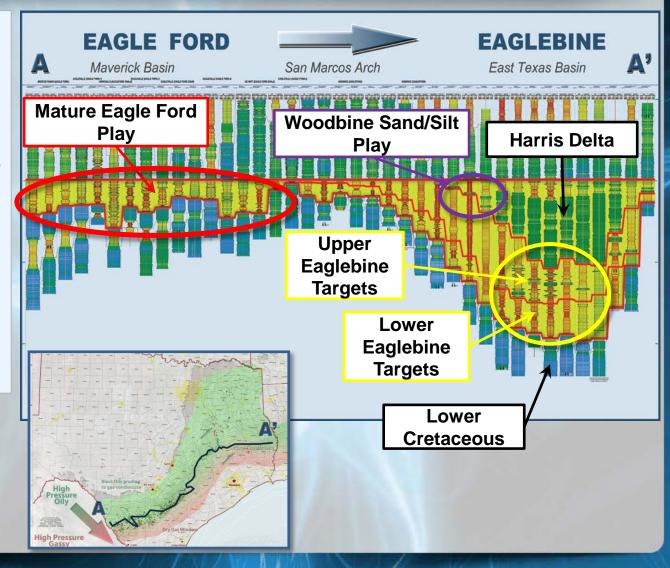


(Modified Paleogeography from Blakey 2007, modified with interpretations from Salvador 1991, Sageman & Arthur 1994 and Bowman 2012)

## Eagle Ford to Eaglebine ZAZA ENERGY

- Eagle Ford Section is 75'-200' thick in the Maverick Basin
- The Eagle Ford section thins to <25' across the San Marcos Arch
- The combination of the Eagle Ford Group and the Woodbine Group (Eaglebine) can exceed thicknesses > 1.000'
- The Harris Delta can exceed 450' in thickness
- Additional potential exists in the Lower Cretaceous Formations – Buda, Georgetown, Edwards and Glen Rose



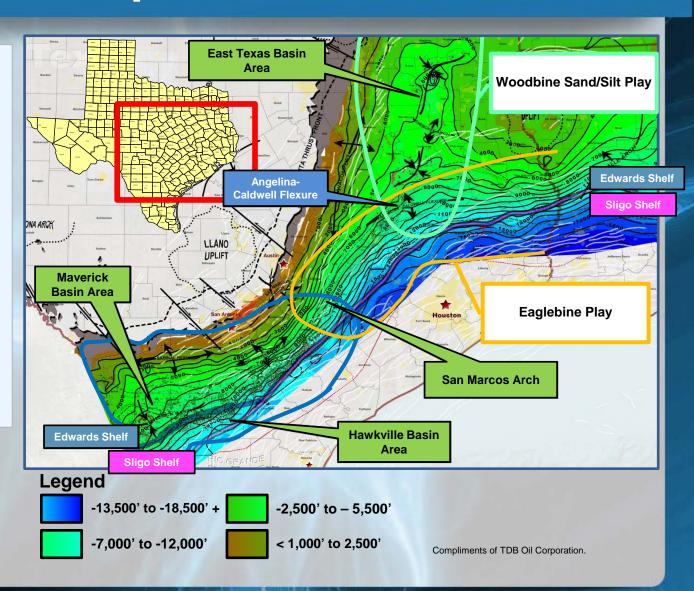


## Structure - Top Buda

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- Structure of the productive economic portions of the Eagle Ford to Eaglebine range from -6,500' to over -15,000'
- GOR is generally associated with depth
- The down-dip limits are currently defined by the Sligo shelf edge
- Three general plays
  - The Eagle Ford Carbonate rich section
  - The Woodbine Sand/Silt Play
  - The Eaglebine Organic shales

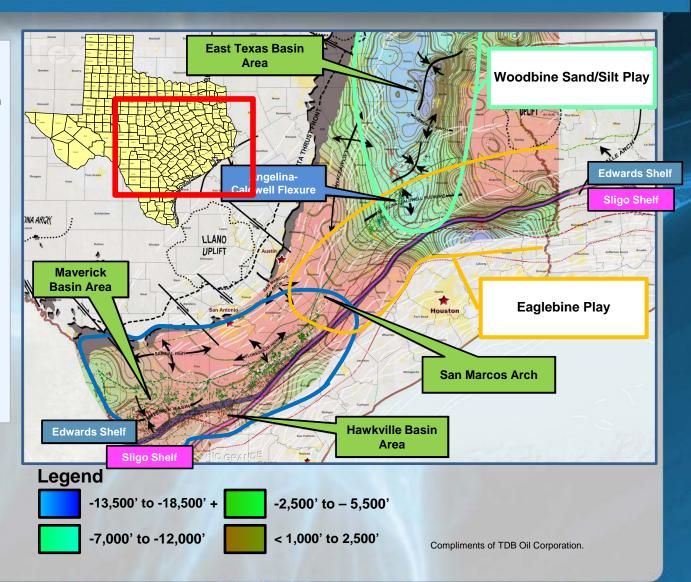




## Isopach – BAC to Buda ZAZA ENERGY

- Eaglebine area of interest is located between the southern portion of the East Texas
   Basin
- The Eaglebine section is the down-dip toe slope portion of the Harris delta system
- Gross thickness for the Eaglebine section exceeds 1,000'
- The Eaglebine section is comprised of organic rich shales interlaced with silica rich sand and silts
- The Eaglebine Isopach is defined as the section from the Base of the Austin Chalk to the top of the lower Cretaceous

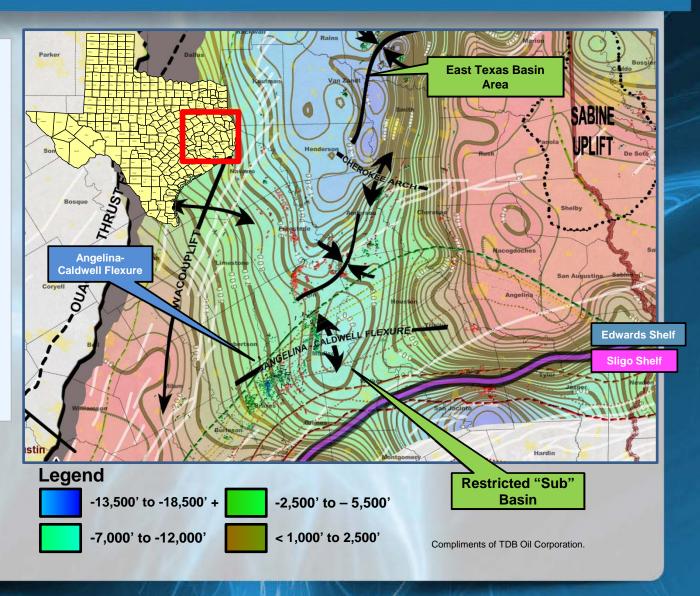




# Isopach – BAC to Buda ZAZA ENERGY

- Thickness in the area exceeds 1,000' of gross section; however, in many areas where the Harris Delta system is the thickest, the organic shale section ranges from 450' to 600'
- There is a restricted "sub-basin" present in the area across the acreage between the Angelina-Caldwell Flexure to the north and the Sligo / Edwards shelf edges to the south
- Several formations in the area are considerably thicker in the sub-basin including the Kiamichi and the Paluxy shales



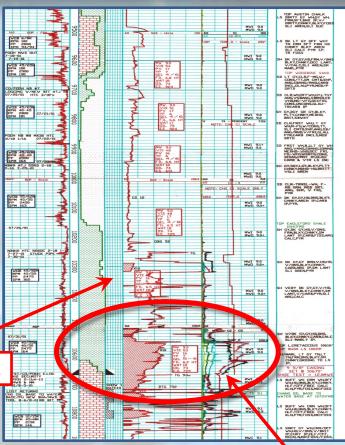


### Eaglebine Mudlog Example ZAZA ENERGY

#### **Key Points**

- Historical mudlogs across area have significant oil and gas shows in both upper and lower Eaglebine section
- Lower Organic Rich section is over 450' thick
- Mudlogs in area show good oil and gas shows through out shale section
- C1-C5 oil and gas shows prevalent throughout section
- Historical wells have produced economic quantities of oil and gas in individual sand lenses throughout Eaglebine section

**Upper Target** 



**Austin Chalk** 

Eagle Ford Sub-Clarksville ລີ ຍຸ

**Harris Delta** 

Eagle Ford

**Noodbine Group** 

Lewisville

Dexter

Pepper

Maness

Buda

-EAGLEBINE

**Lower Target** 

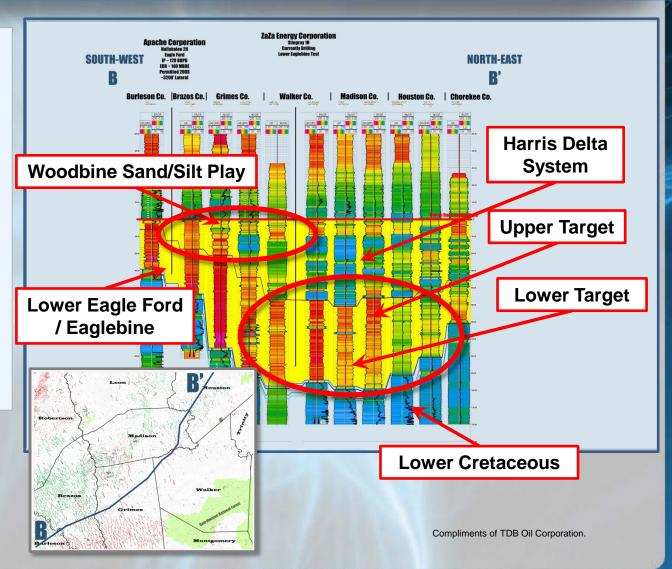


### **N-S Cross Section**

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- There are several conventional and unconventional targets in the East Texas Eaglebine area
  - The Woodbine sand
    / Silt Play
  - Portions of the Harris Delta can be productive
  - The Lower
    Eaglebine Upper
    and Lower sections
    of organic rich shale
    and sand
- Conventional targets have been as little as 2' in thickness
- Unconventional targets are > 250' in thickness



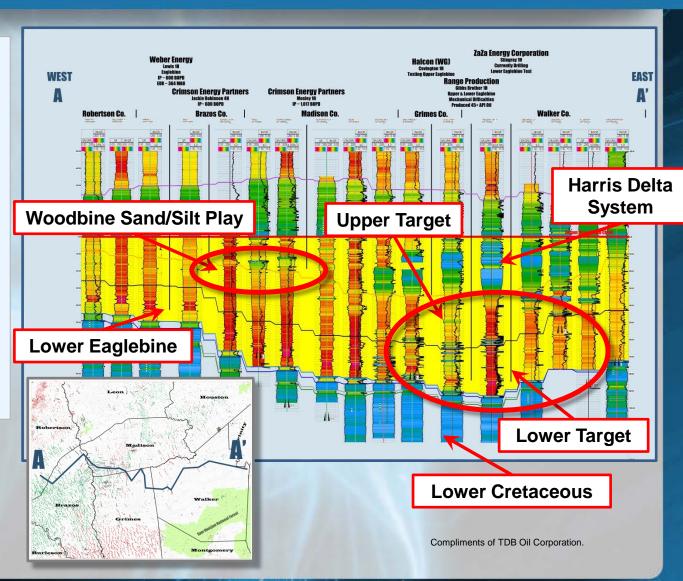


### **E-W Cross Section**

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- The cross section represents the Woodbine sand / silt play, the Upper and Lower organic rich sand / shale Eaglebine targets
- The Eaglebine is recognized as a "hot" shale with increased resistivity that exhibits oil and gas shows on mudlogs across the zone
- The recently successfully completed Weber 1H horizontal well targeted the Lower organic rich Eaglebine in the oil window
- Halcón's Covington 1H well appears to target the Upper Eaglebine
- The Eaglebine is similar to the TMS in Louisiana



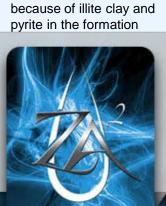


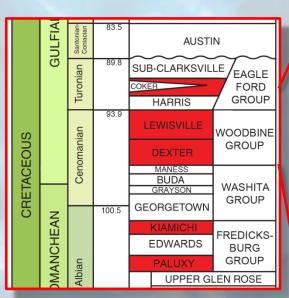
## **Eaglebine Log Section**

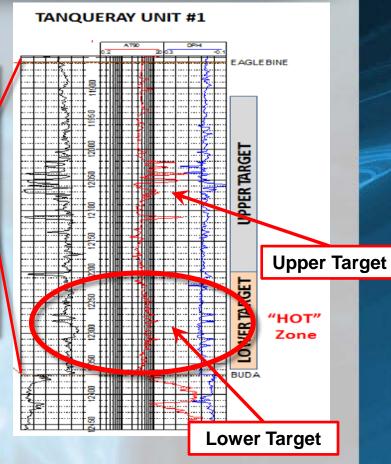
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#### **Key Points**

- Representation of the Eaglebine below the Harris Delta System the "unconventional" section of the Eaglebine
- This section is over 500' thick and is divided into two potential targets
- The Eaglebine is recognized as a "hot" shale with increased resistivity that exhibits oil and gas shows on mudlogs across the zone
- Generally the section has a lower resistivity signature than the Maverick Basin Eagle Ford
- Resistivity is suppressed because of illite clay and pyrite in the formation







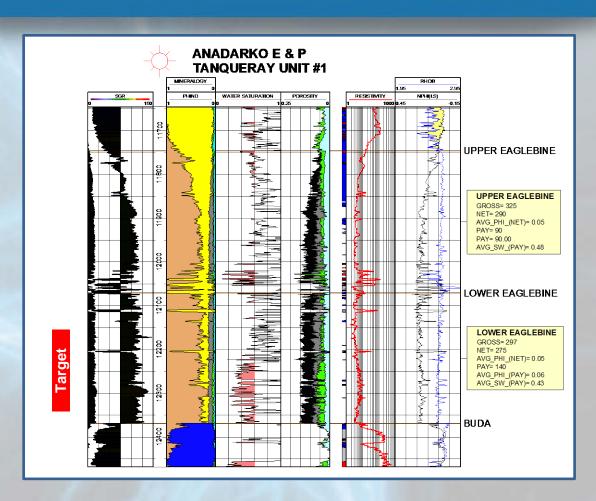
Compliments of Schepel Petroleum Consulting Inc.

# **Tanqueray Unit #1**

### **ZAZA ENERGY**

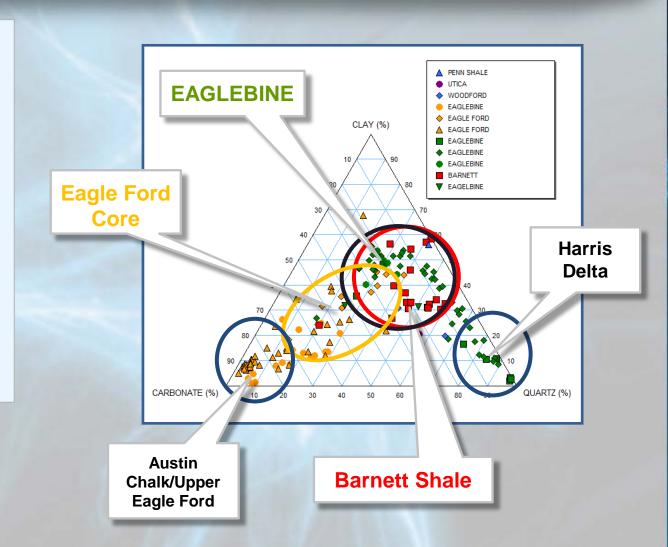
- General log calculations can estimate the potential of the Eaglebine section below the Harris Delta
- A lot of penetrations, not a lot of full suite log combinations
- Upper section GIP ~ 30
   BCFE / mi<sup>2</sup>
- Net interval of 290' based on log Net pay of 90'
- High Liquids yield +- 7,000 GOR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





### XRD Comparison of Shales ZAZA ENERGY

- Analysis of the Eaglebine vertical sections in several historical wells
- Good TOC concentrations throughout section 4-12%
- Good silica concentrations (Quartz) 20-60%
- Low expanding clay concentrations mostly illite
- XRD comparative to Barnett and Woodford shales



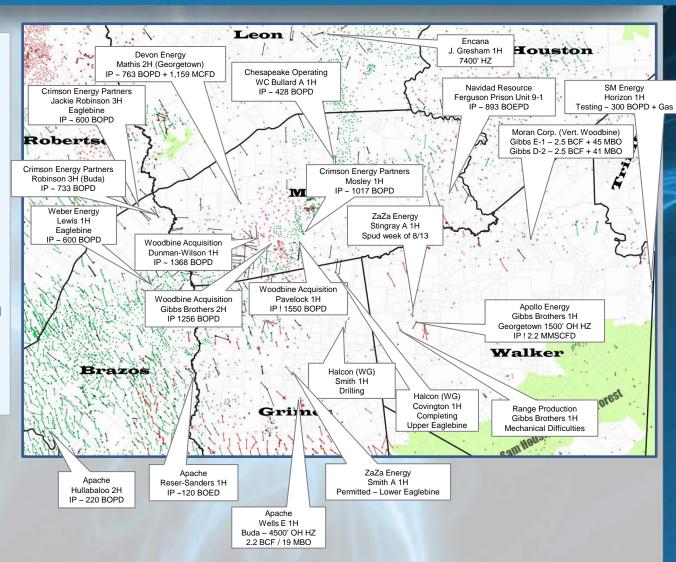


## **Activity Map**

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- 100+ Woodbine sand/silt horizontal completions since 2007
- Recent focus has been on the Lower portion of the Eaglebine following two recent IP's of 600+ Bopd
- The Weber Lewis 1H and the Crimson Robinson 4H
- Encana's oil window target performance appears to be in the 400+ Mboe
- Recent successful wells by Navidad indicate the potential of the commingled vertically completed Lower Cretaceous targets in the area





### Conclusions

### **ZAZA ENERGY**

- Eaglebine is an organic rich section situated between the Austin Chalk and the Buda
- High TOC (4-12%) and High Silica (-+40%) content provide are the right mix for a highly potential resource play
- Broadly speaking the Upper Eaglebine is a collection of sandstone packages making it more conventional in nature, inter-bedded with organic rich shales
- The Lower Eaglebine has characteristics of a typical "hot" shale
- Studies and log data indicate hydrocarbon bearing formations that exhibit higher resistivity and porosity
- Permeability is generally low, but horizontal drilling and multi-stage fracs (10-25 stages) have proven successful in enhancing well productivity
- Optimum depths between 7,500' 13,500'



# Thank You

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