

AV Sequence Stratigraphic Controls from Complex Reservoir Architecture in Fluvial-Dominated Deltaic and Lowstand Valley-Fill Deposits in the Woodbine Group, East Texas Field*

By

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Abstract

Analysis of >1,500 ft (>450 m) of 30 whole cores and closely spaced log sections with approximately 500 wells in the Woodbine Group in East Texas field and adjacent areas indicates that the sandbody architecture in the field is more complex than inferred from previous studies. Extreme sandbody heterogeneity in the lower Woodbine Group is controlled by the fluvial-dominated deltaic depositional architecture, with dip-elongate distributary-channel sandstones pinching out over short distances (typically <500 ft [<150 m]) into delta-plain and interdistributary-bay siltstones and mudstones. This highstand section is truncated in the northern and western part of the field by a thick (commonly 100- to 150-ft [30- to 45-m]) lowstand, valley-fill succession composed of bedload fluvial deposits of multistoried, coarse-gravel and coarse-grained sandy beds. This valley-fill section in some areas in East Texas field directly overlies muddy, delta-front deposits, from which as much as 100 ft (30 m) of lowstand incision is inferred. Correlation with the Woodbine succession in the East Texas Basin indicates that these highstand and lowstand deposits represent the basal three, fourth-order sequences of the Woodbine Group which comprises a maximum of 14 cycles.

Previous studies of the Woodbine Group inferred well-connected, laterally continuous sheet sandstones in a wave-dominated deltaic and barrier-strandplain setting. This wave-dominated deltaic model is inappropriate, and a full understanding of reservoir compartmentalization, fluid flow, and unswept mobile oil in East Texas field should consider the fluvial-dominated deltaic and lowstand valley-fill sandbody architecture.

Sequence Stratigraphic Controls on Highstand Fluvial-Dominated Deltaic and Lowstand Valley-Fill Deposits in the Woodbine Group, East Texas Field

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F. Bonnaffé, R. G. Loucks, and L. F. Brown**

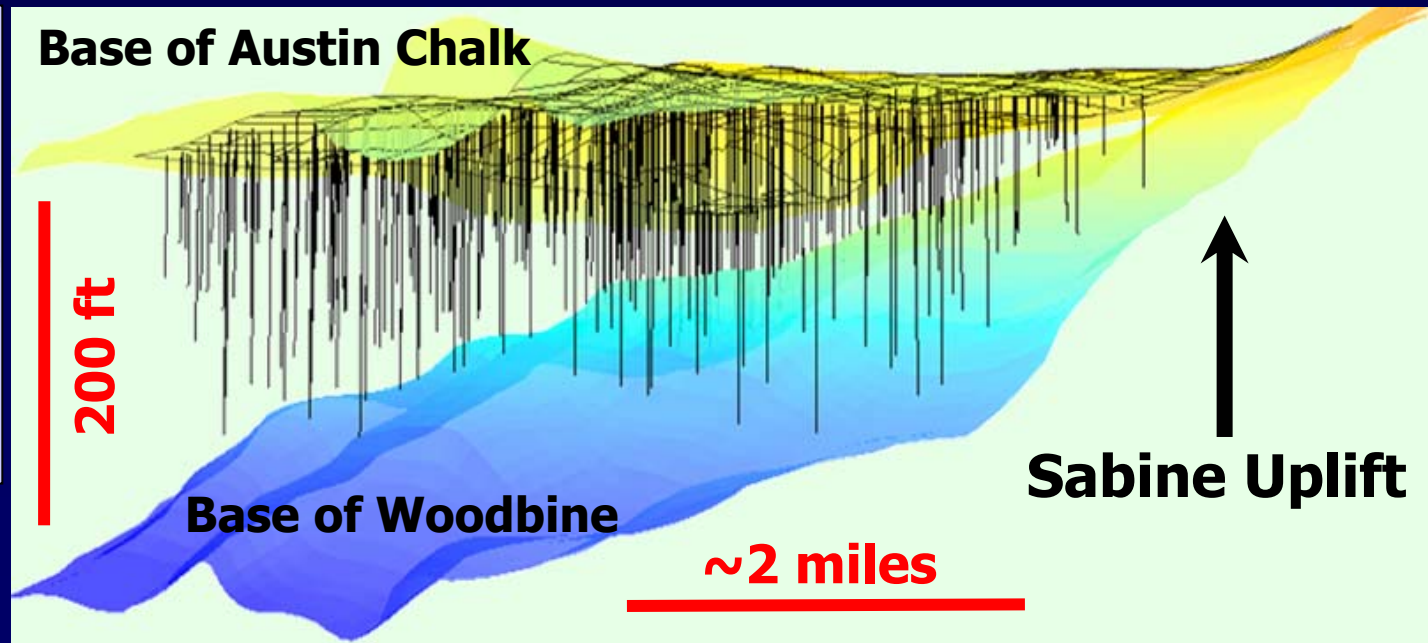
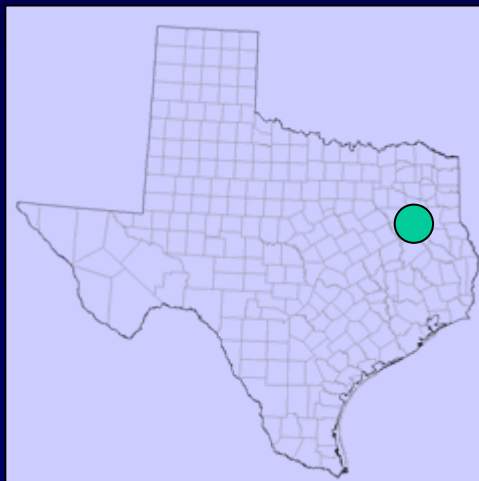
**2008 Annual AAPG Convention
April 21, 2008**



Bureau of Economic Geology
John A. and Katherine G. Jackson
School of Geosciences
The University of Texas at Austin

Vital Statistics: East Texas Field

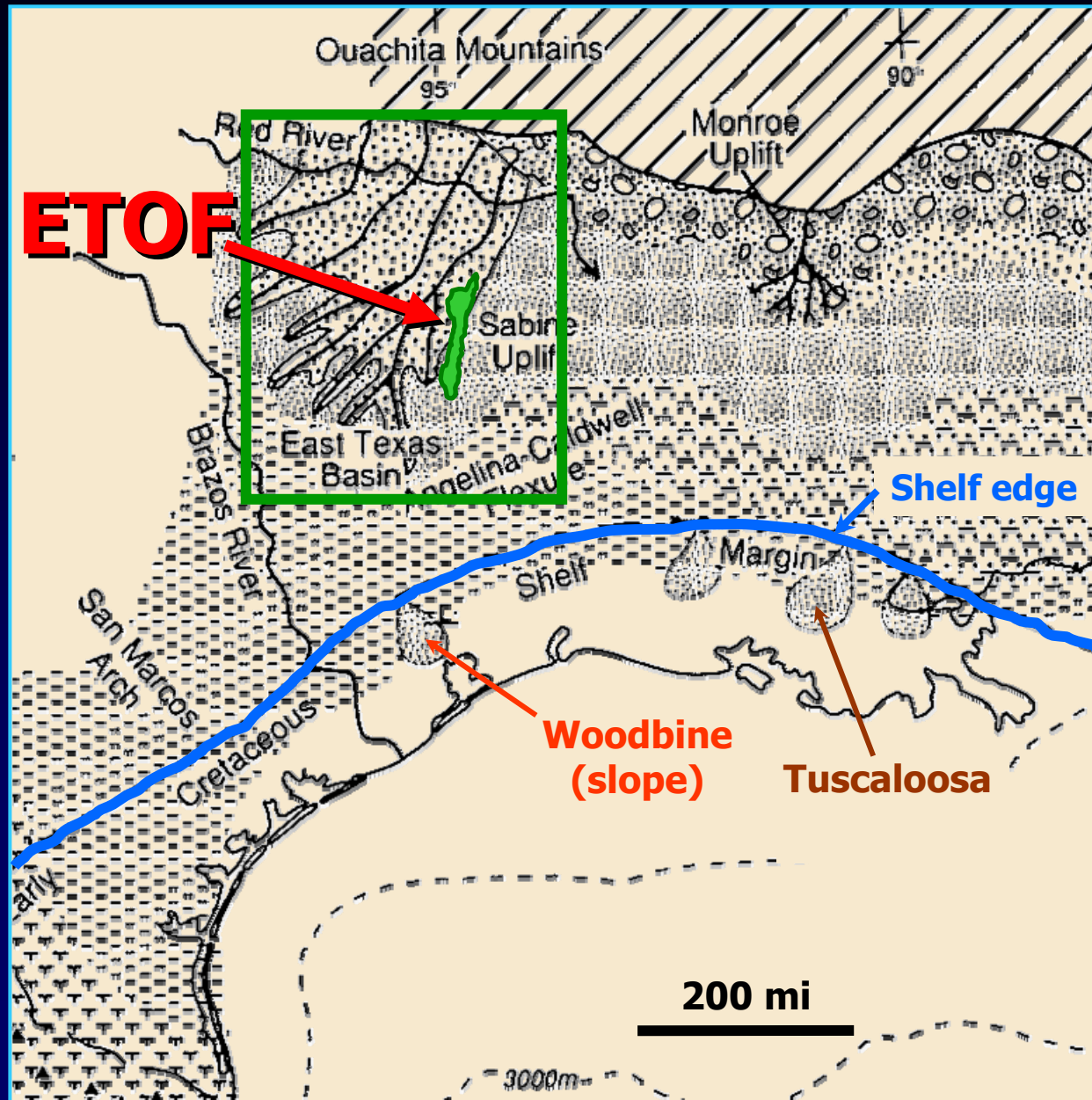
- Discovered in 1930
- Combination trap
- Strong water drive
- Depth $\sim 3,500$ ft
- $\sim 31,000$ wells
- 4.3-acre spacing
- 7.03 Bbbl oil in place
- 5.42 Bbbl produced
- 77% recovery efficiency



East Texas Field Study

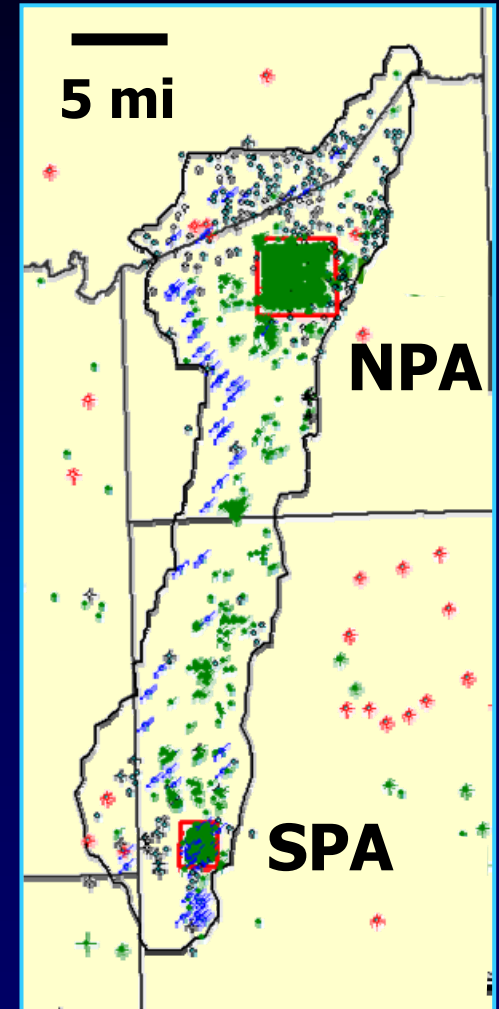
- **New sequence stratigraphic interpretation**
- **New look at the depositional settings: cores**
- **Described 1600' of core from 35 wells**
- **Examined ~500 well logs**
- **Recommendations for additional oil recovery**

Cenomanian Paleogeography



*Modified from
Oliver (1971)
Sohl et al. (1991)*

Regional Setting



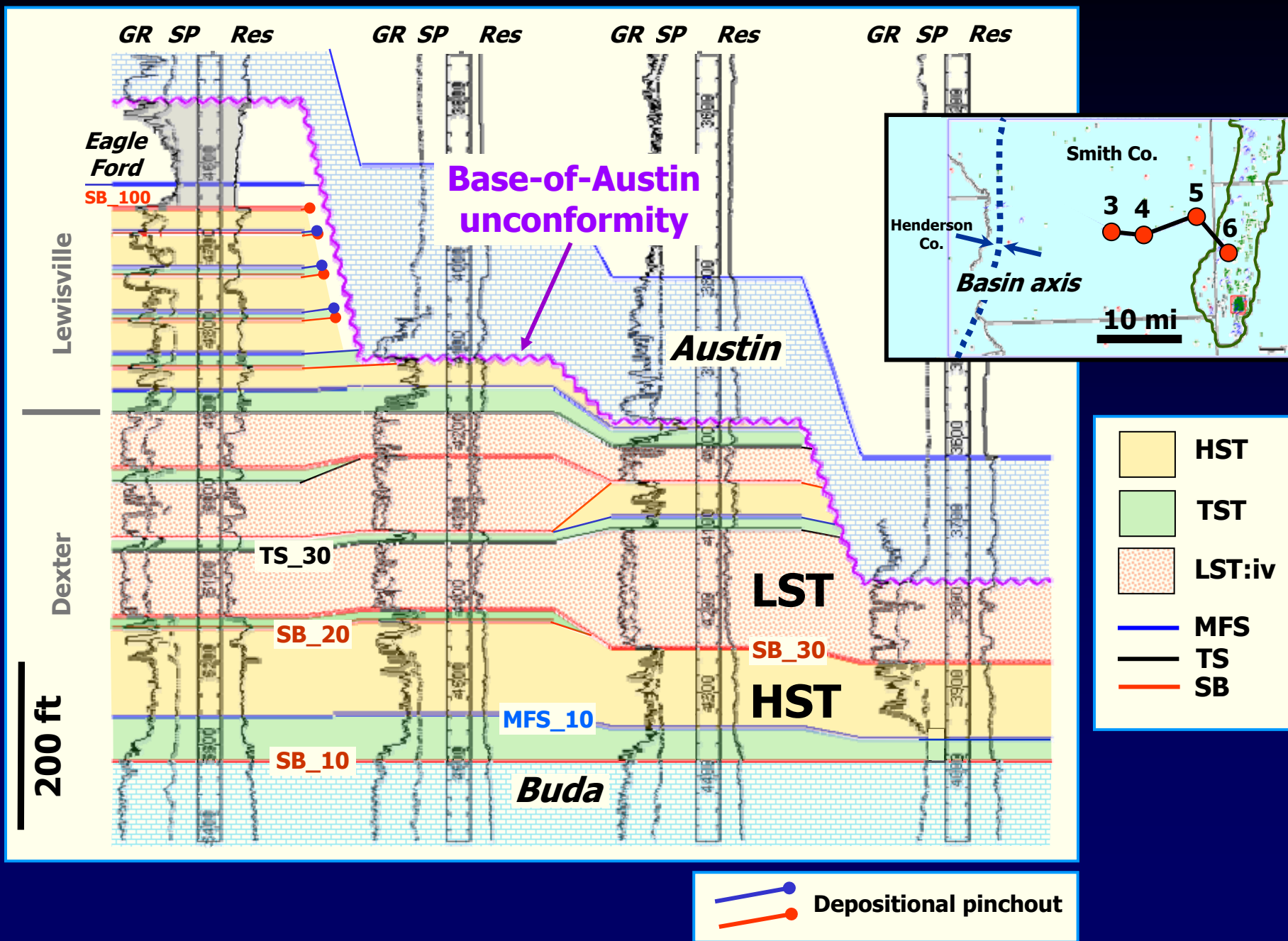
Modified from Siemers (1978)

3

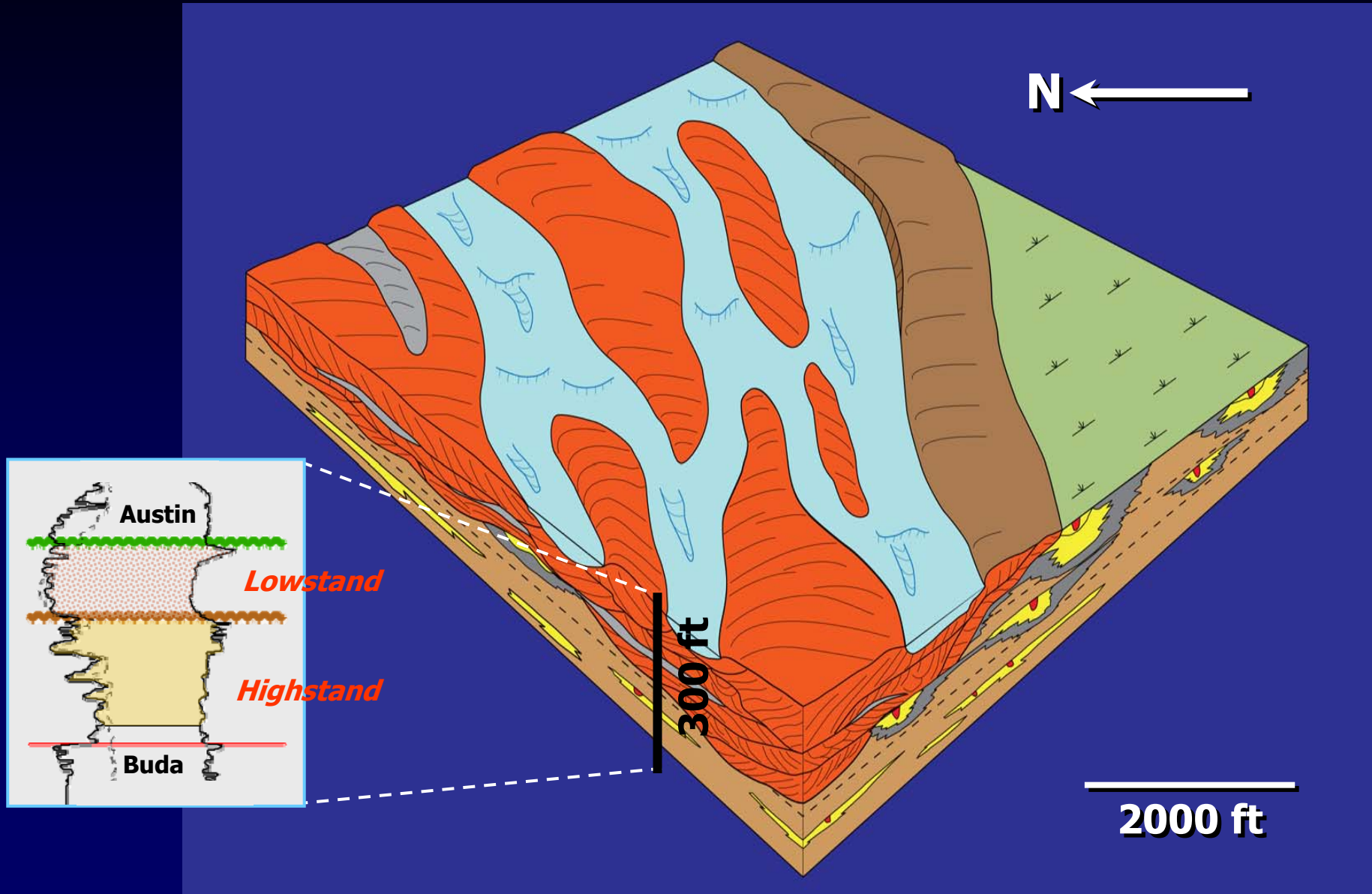
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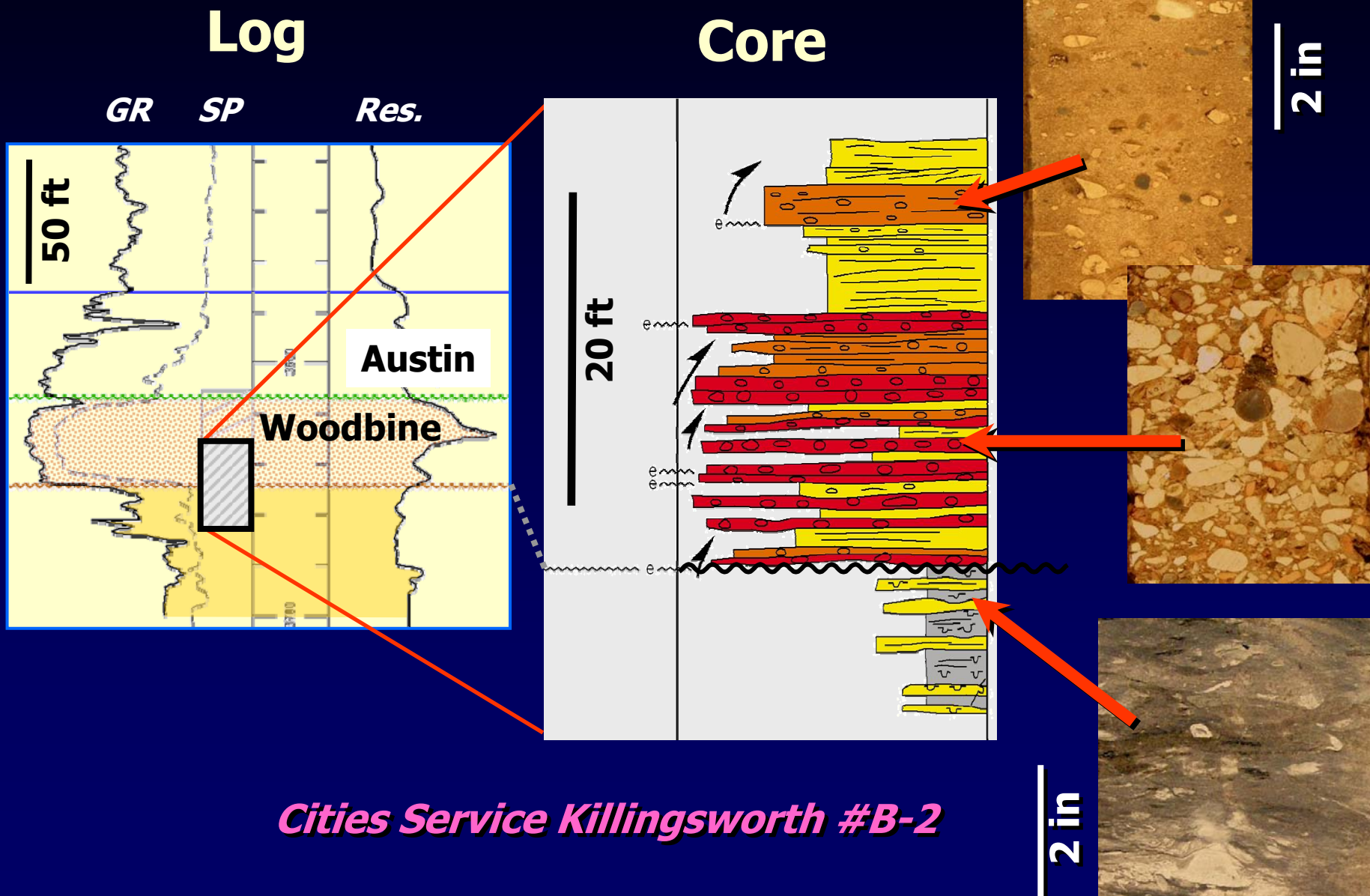
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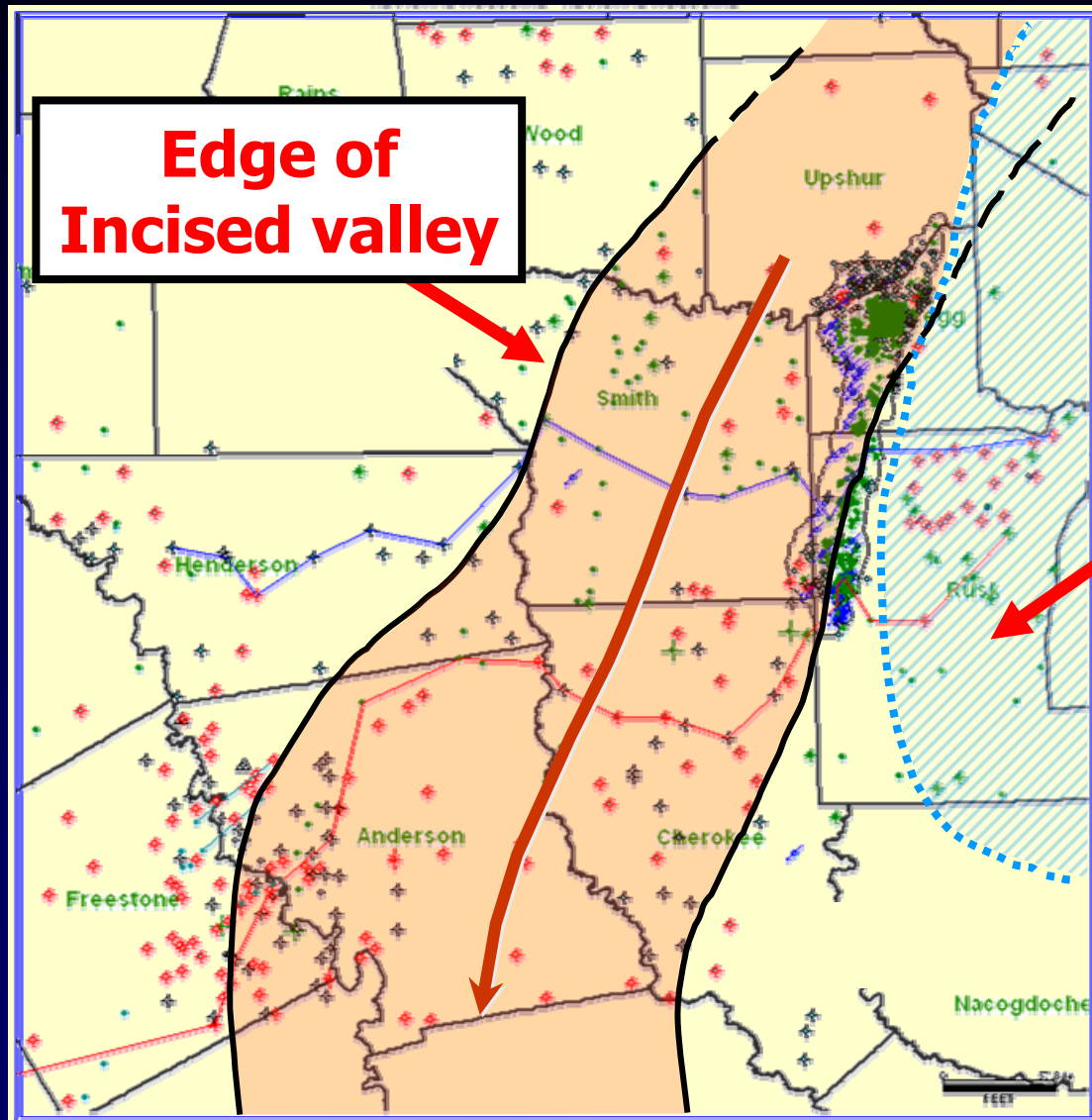
Lowstand Incised-Valley Fill Model



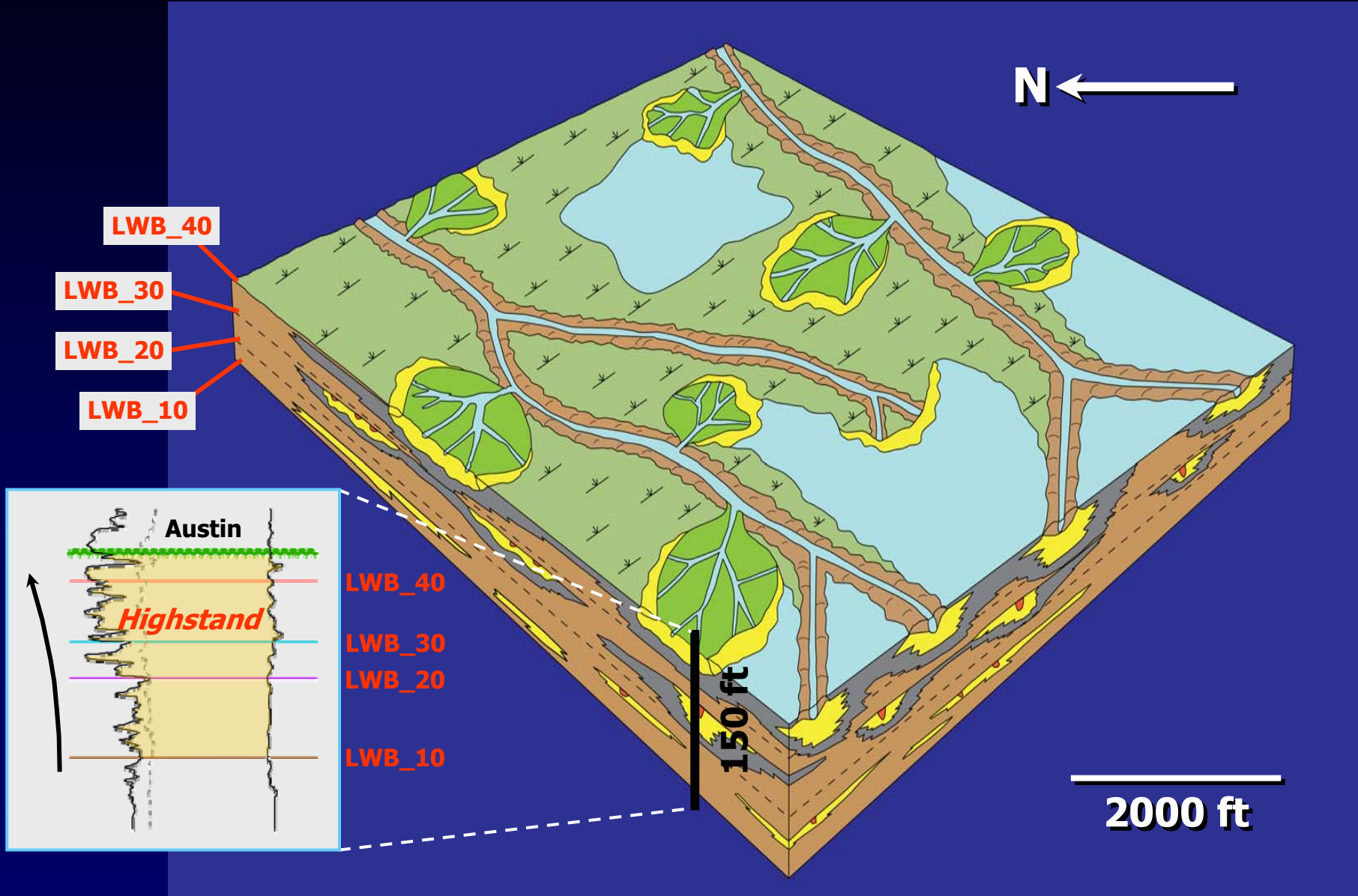
Lowstand Incised-Valley Section



Valley Fill Trend

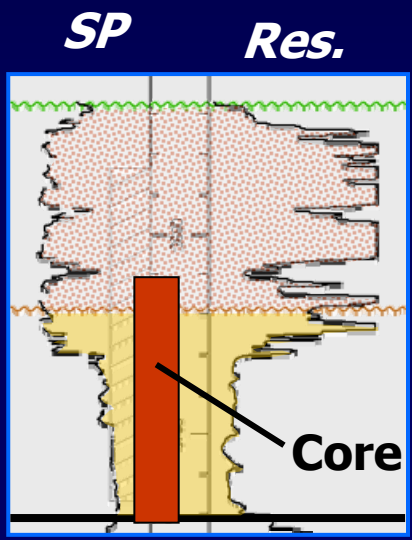


Highstand Deltaic Model



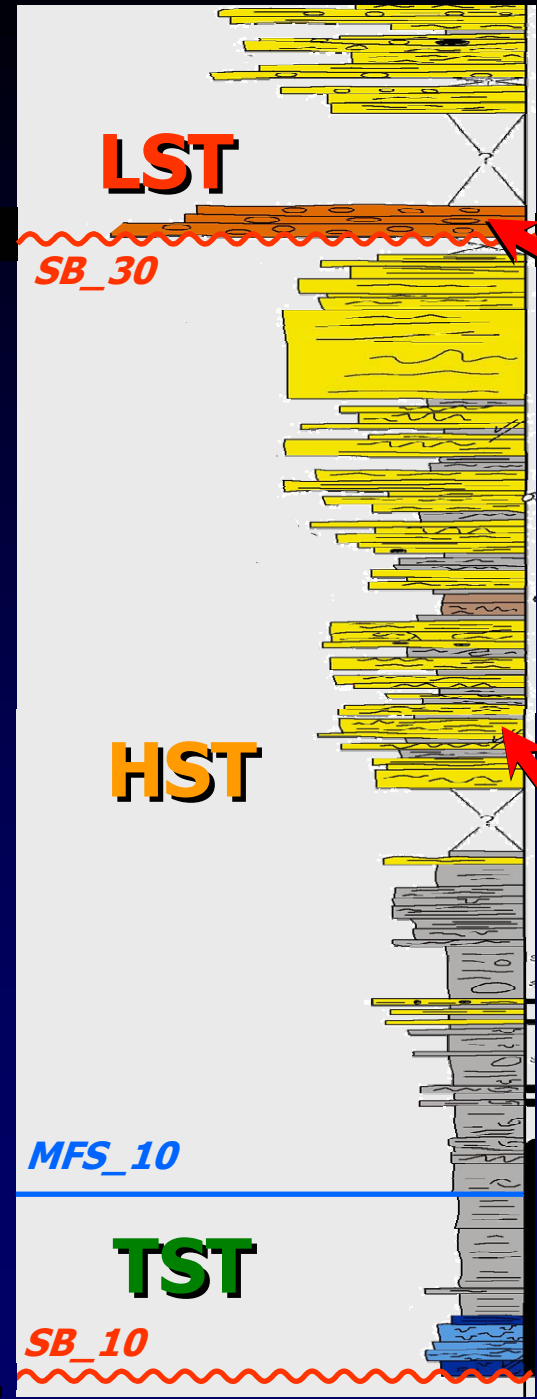
Highstand Deltaic Section

*Shell Watson
#55*



20 ft

Top Buda Ls.



2 in

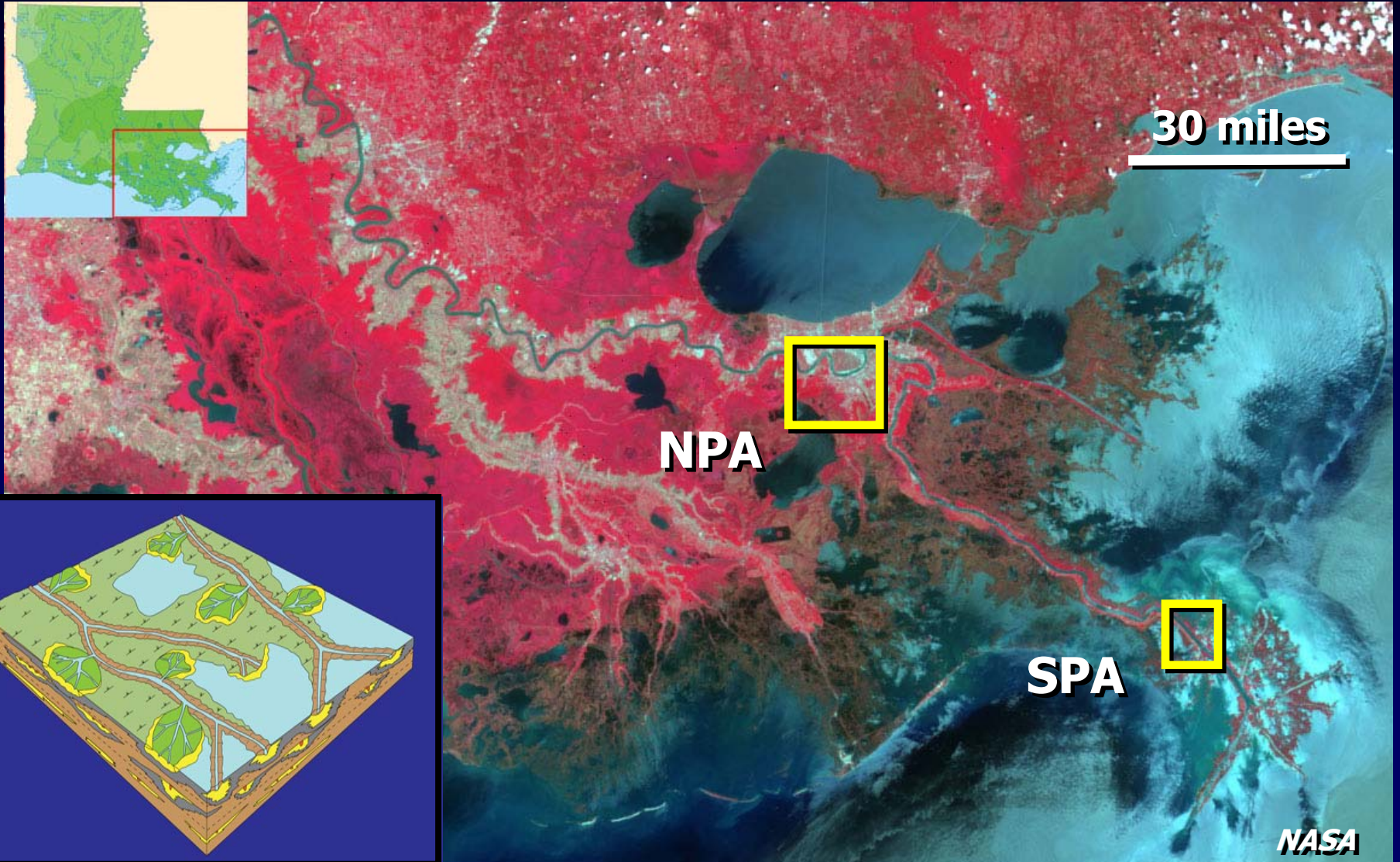


Chert-clast
conglomerate



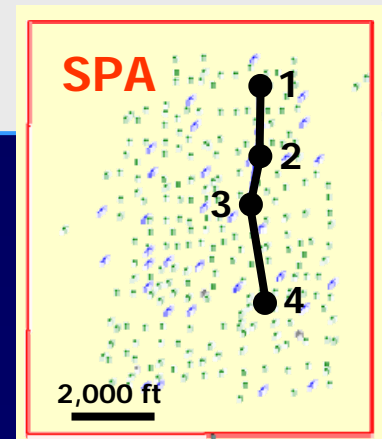
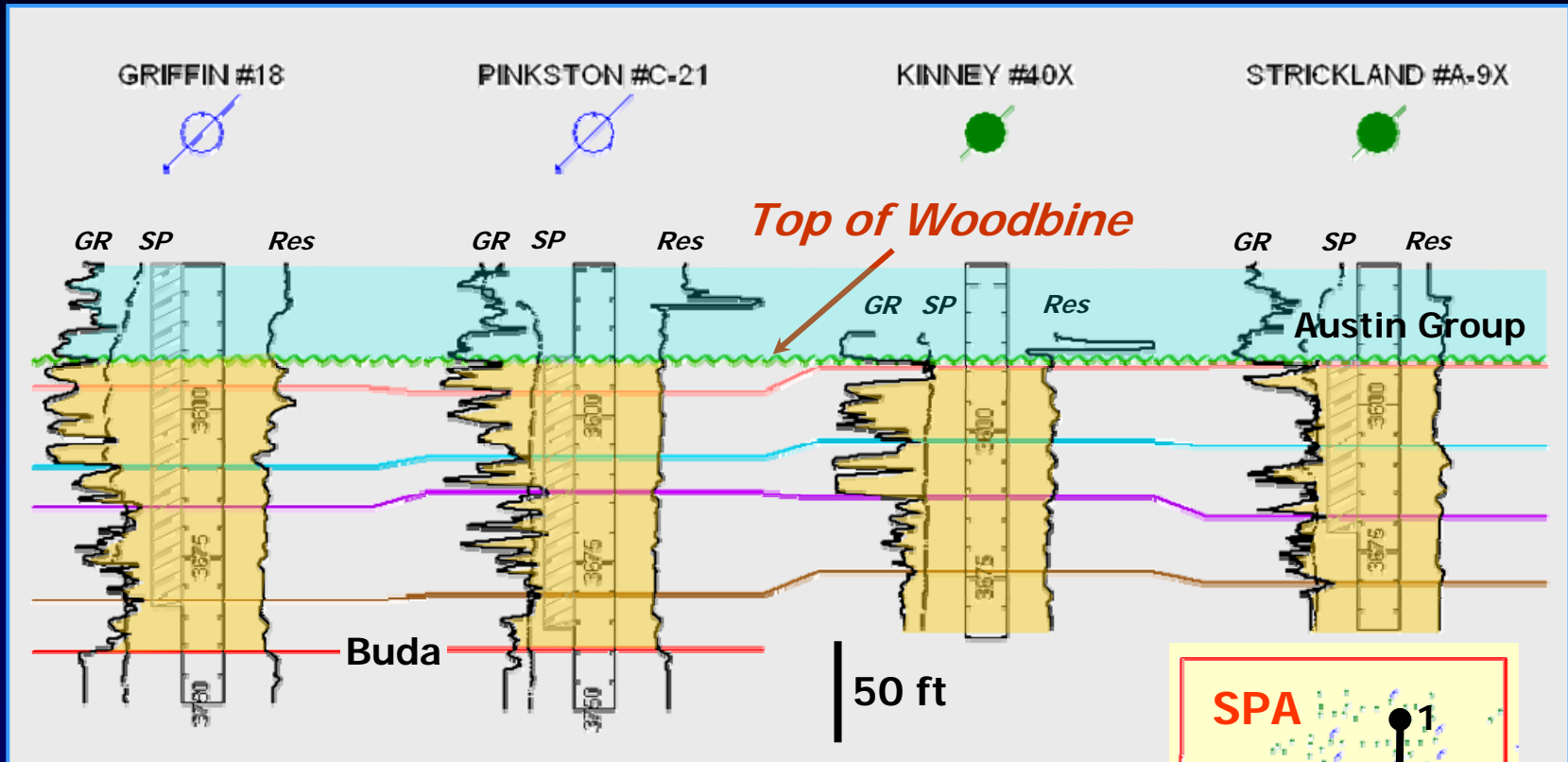
Delta Front

Woodbine Deltaic Depositional Setting: Pilot Areas



Lower Woodbine: South Pilot Area

N 1 2 3 4 S



Lower Woodbine: South Pilot Area

N

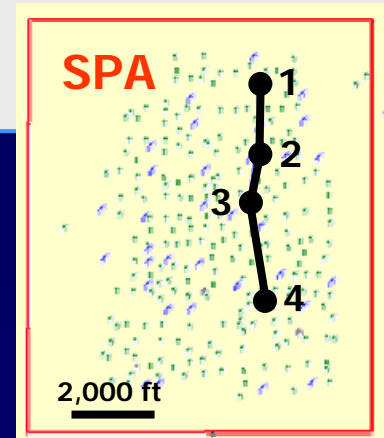
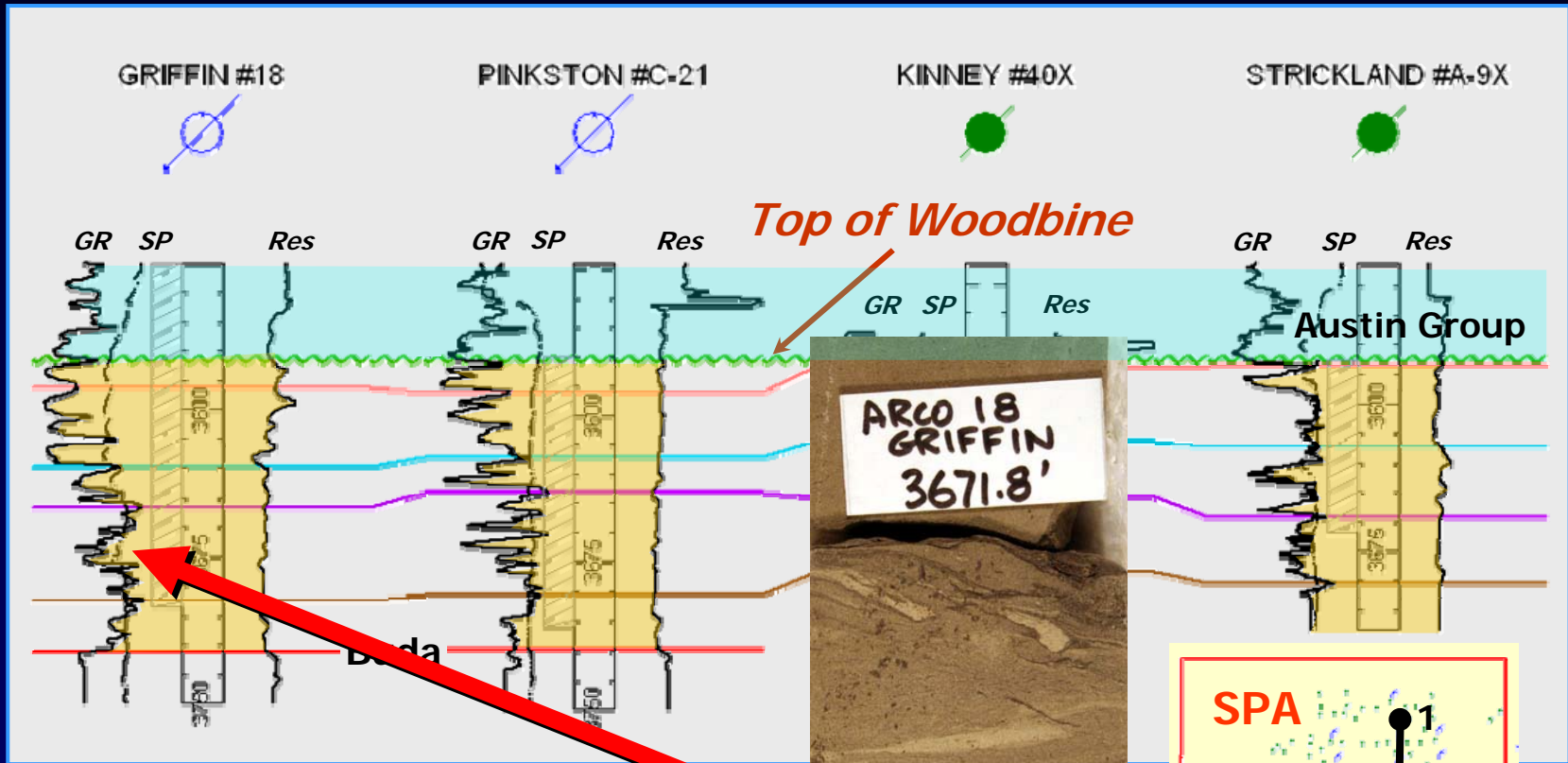
1

2

3

4

S



Lower Woodbine: South Pilot Area

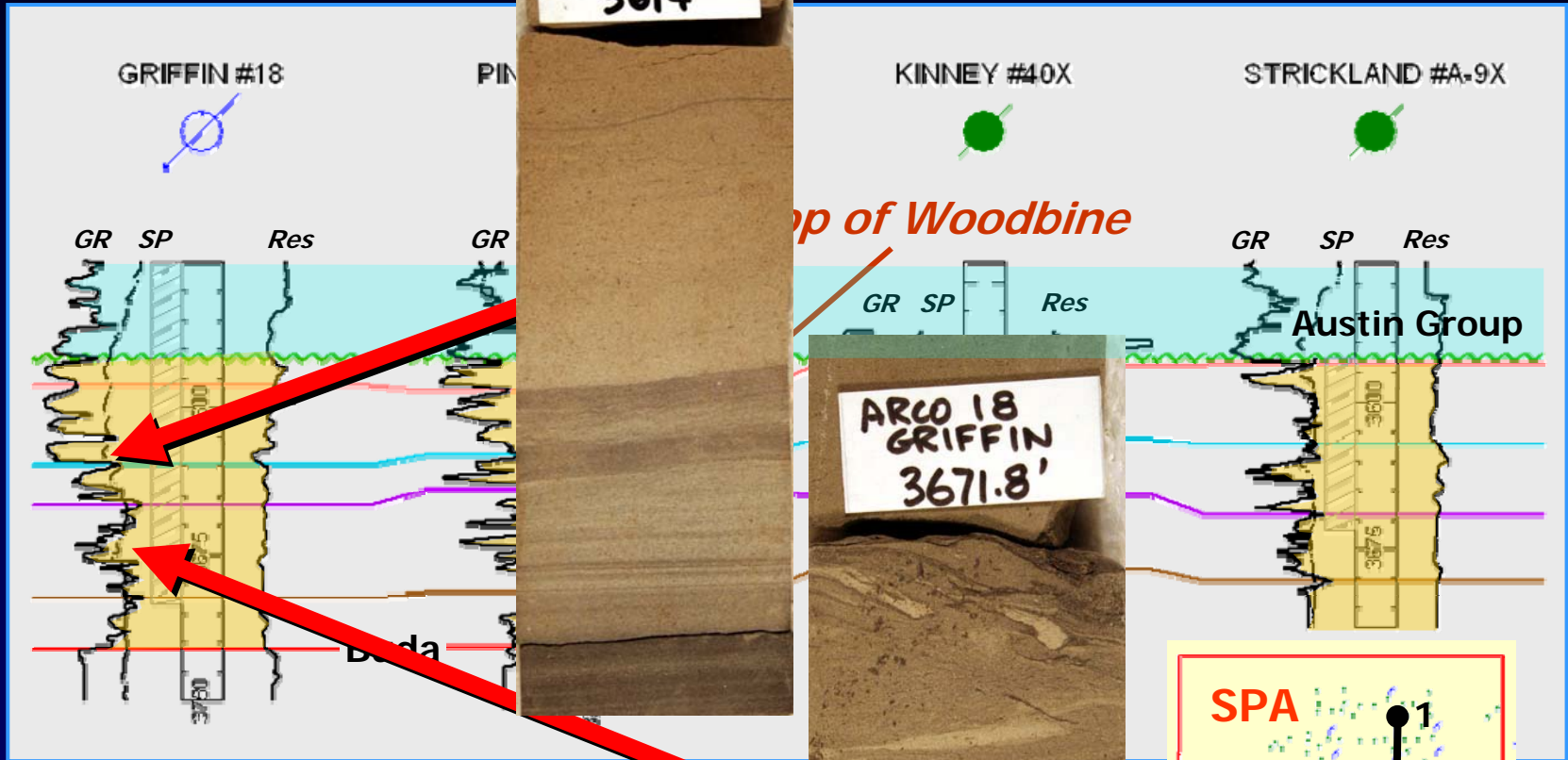
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1

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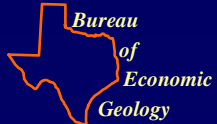


LWB_40

LWB_30

LWB_20

LWB_10



Core labels: 2 in. across

SPA

2,000 ft

Lower Woodbine: South Pilot Area

N

1

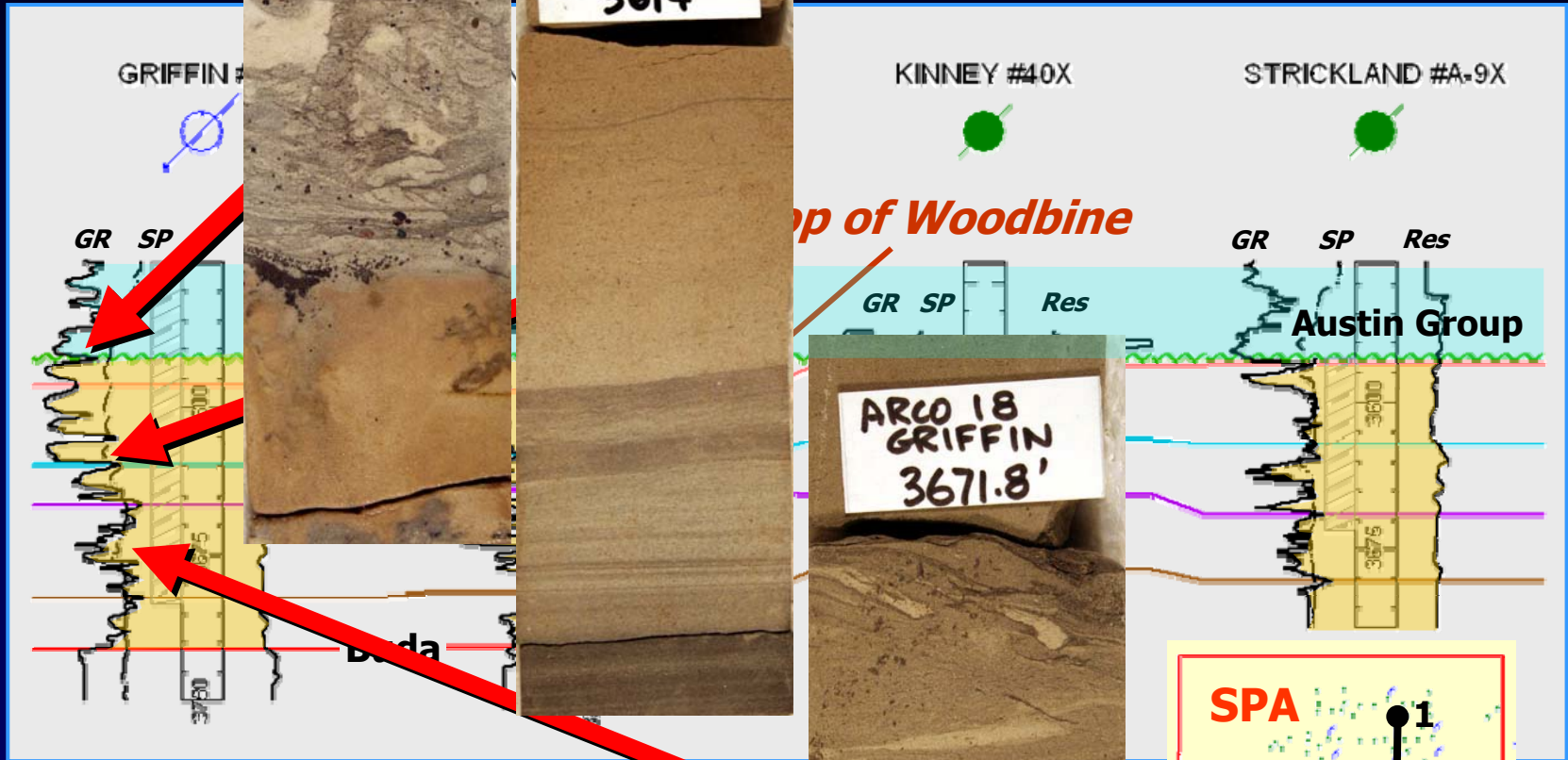
ARCO 18
GRIFFIN
3573.6'

ARCO 18
GRIFFIN
3614'

3

4

S



LWB_40

LWB_30

LWB_20

LWB_10



Core labels: 2 in. across

SPA

1

2

3

4

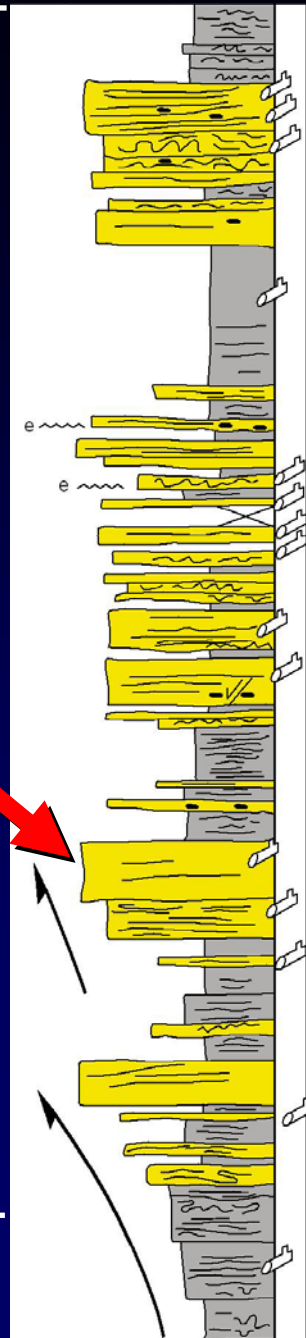
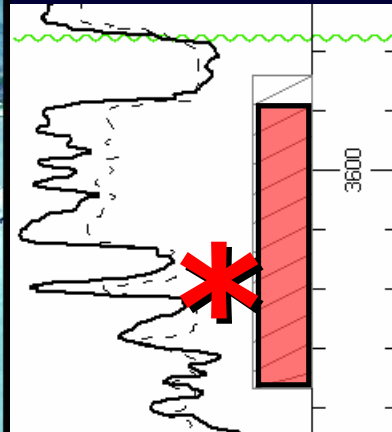
2,000 ft

Channel Mouth Bar Facies

Arco #21 Kinney
3590'—



Log



3650'—

NASA photograph

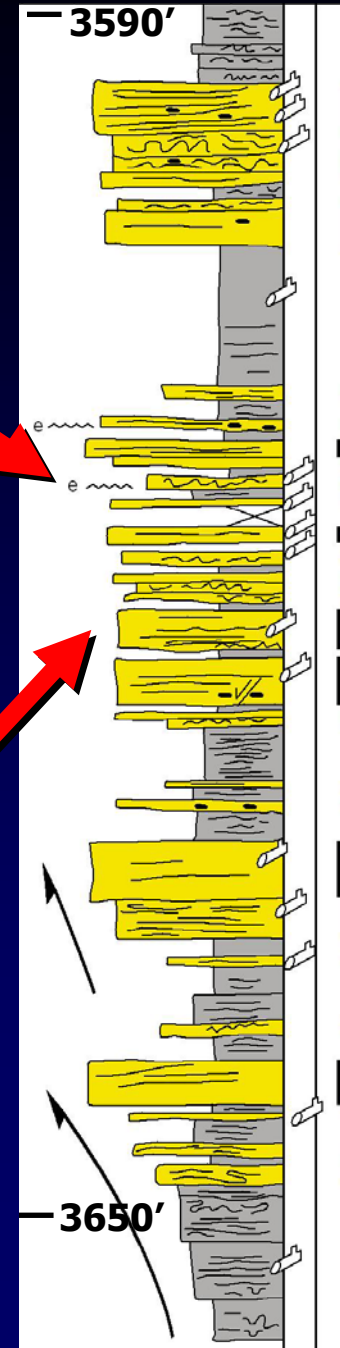
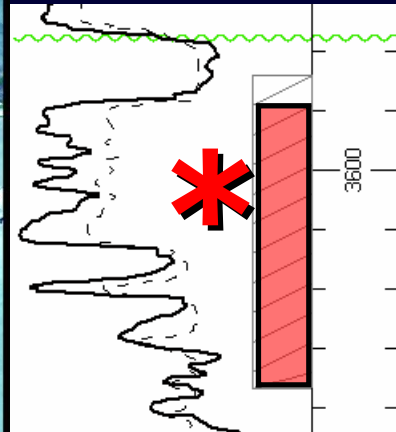
Distributary Channel Facies

Arco #21 Kinney

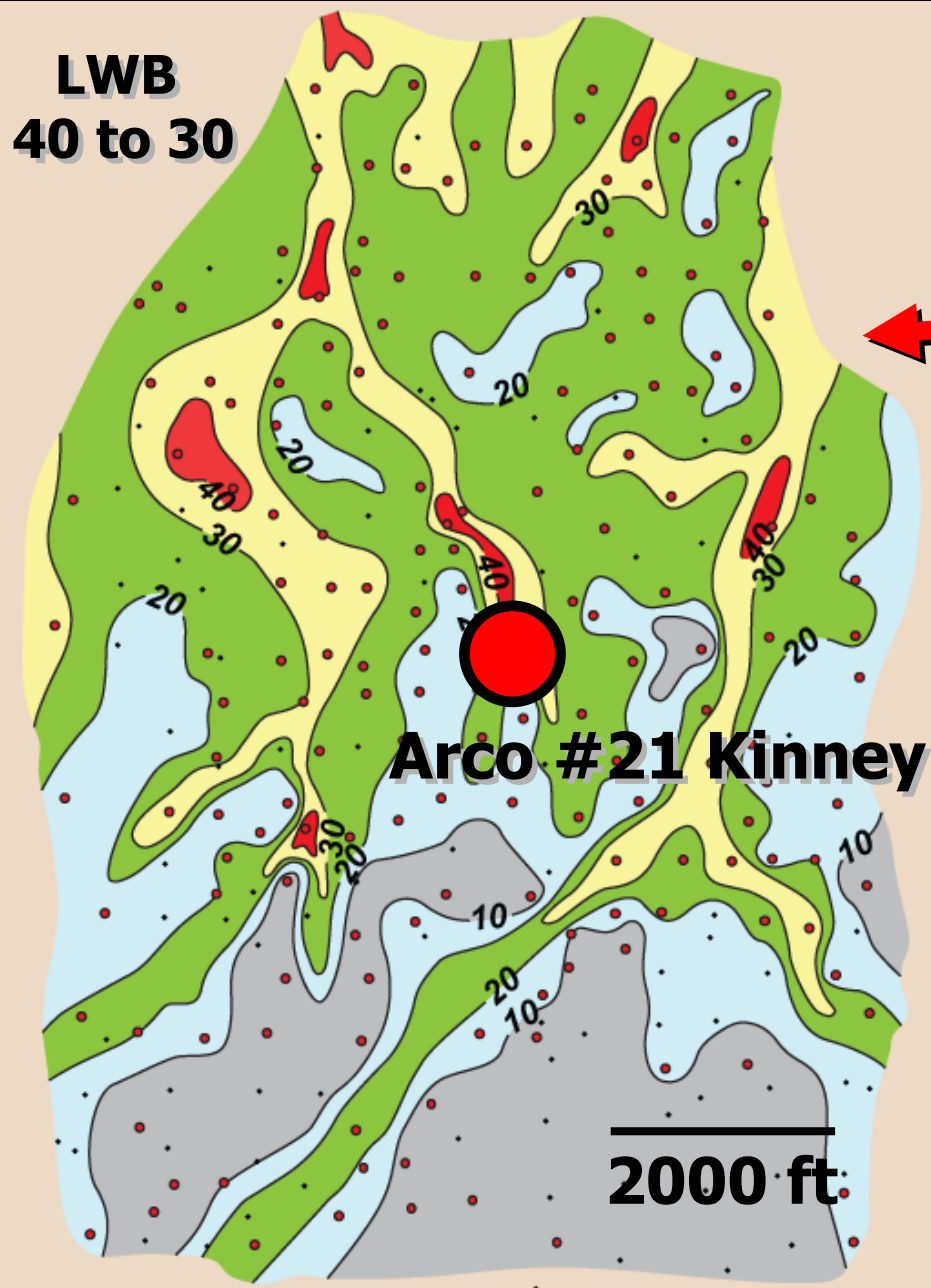


NASA photograph

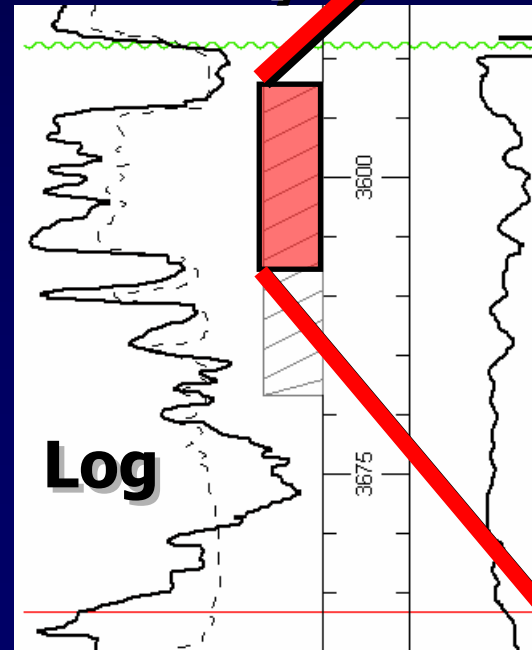
Log



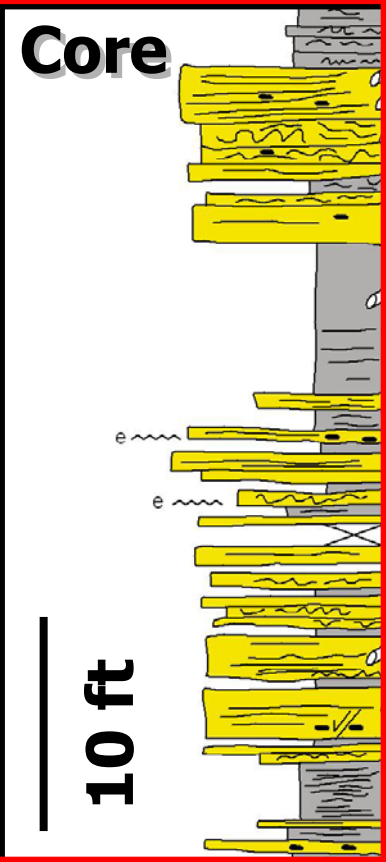
Sandstone Geometry



**Arco #21
Kinney**



Core



Remaining Oil in East Texas Field

- **OOIP \sim 7.03 Bbbl**
- **Cumulative production: 5.42 Bbbl**
- **Remaining oil : \sim 1.6 Bbbl**
- **Residual oil : 1.05 Bbbl**

Development Strategies

- **Well Deepening**

Highstand Deltaic Stringers – Untapped Oil

- **Mini-Waterfloods**

Inject water into poorly connected sand stringers

- **Polymer Flooding**

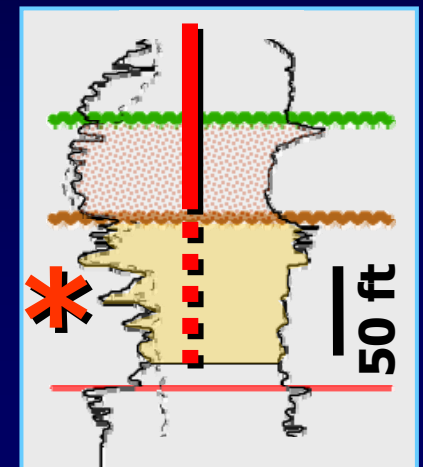
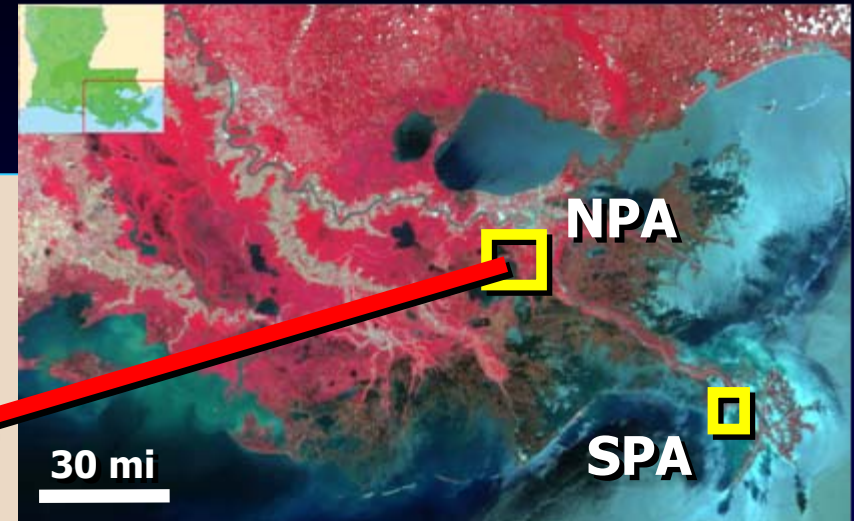
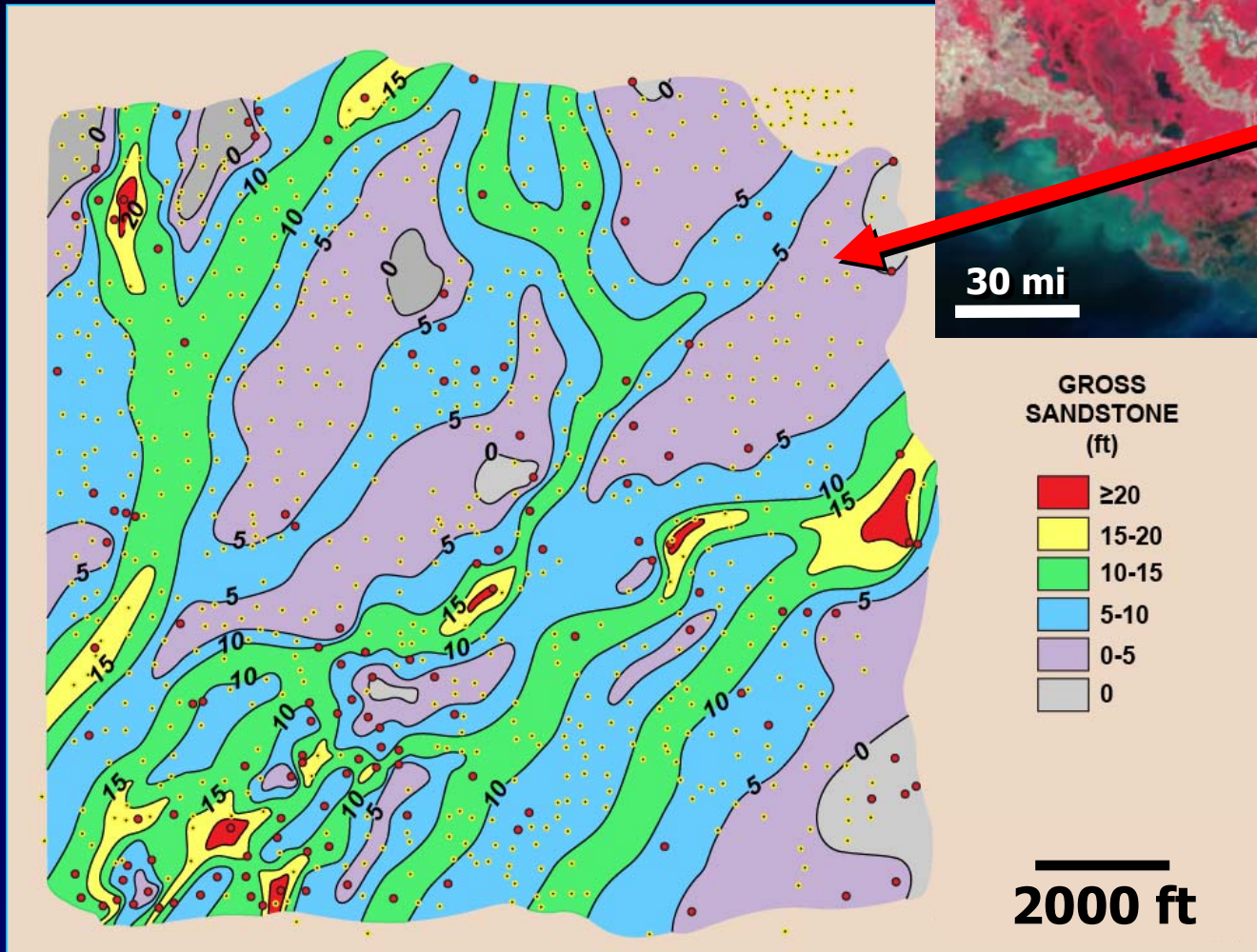
Divert water into poorly swept sands

- **Enhanced Oil Recovery (EOR)**

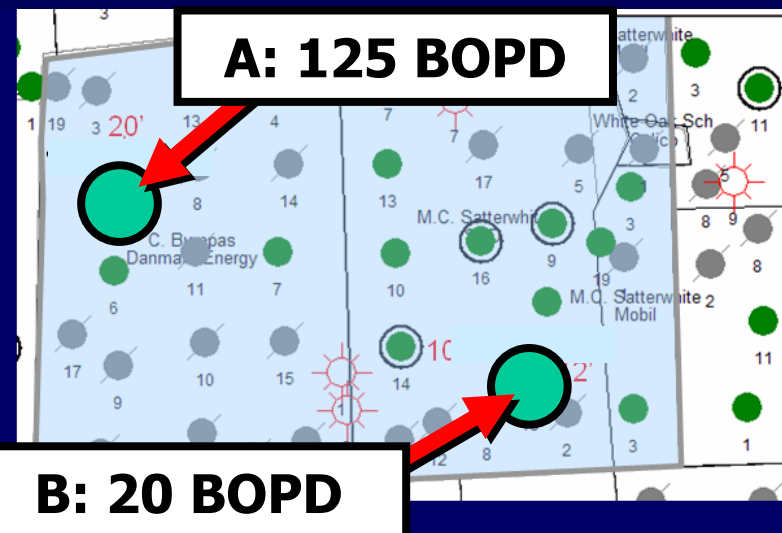
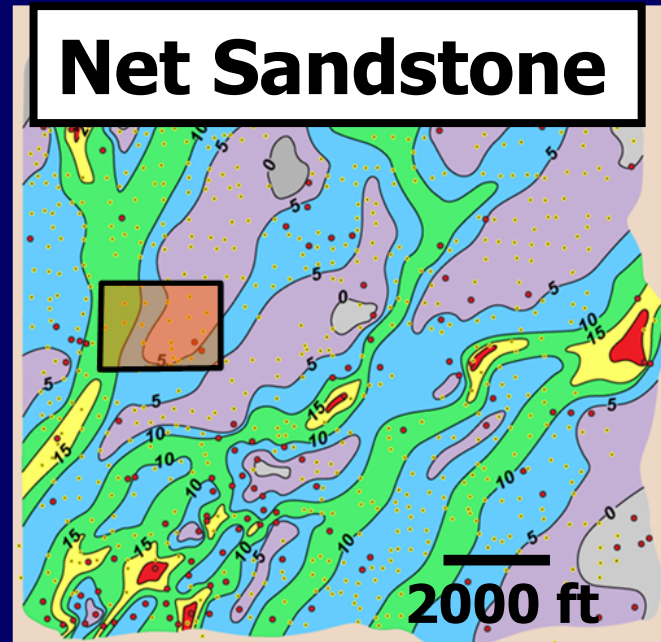
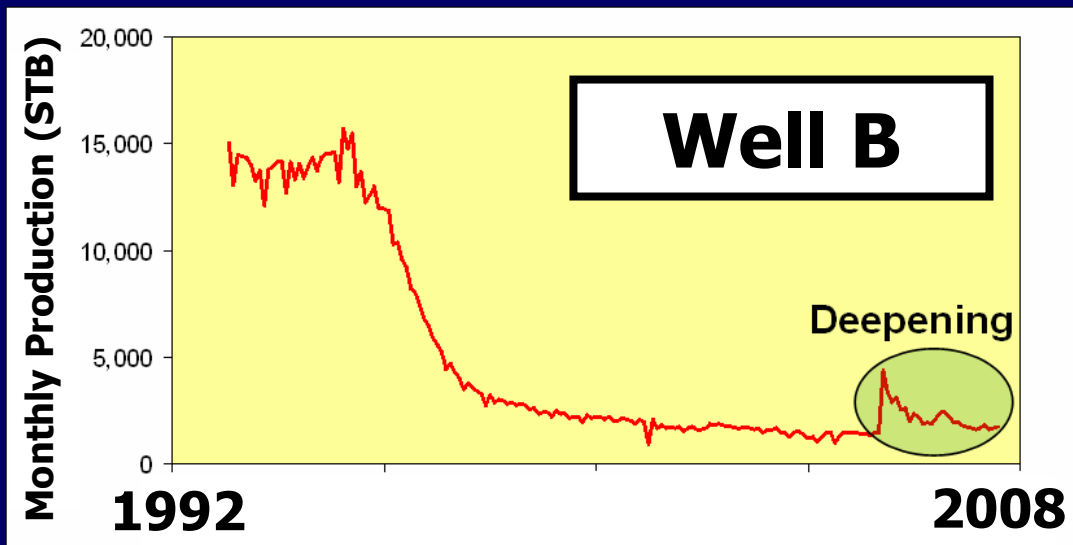
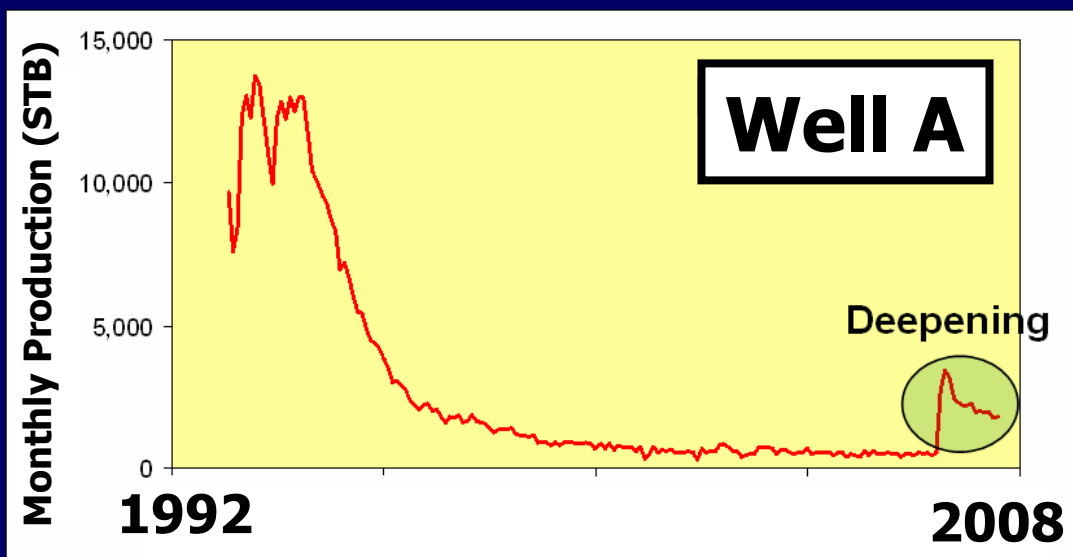
CO₂ Injection

Well Deepening—North Pilot Area

- Wells penetrating lower Woodbine



Well Deepening—North Pilot Area

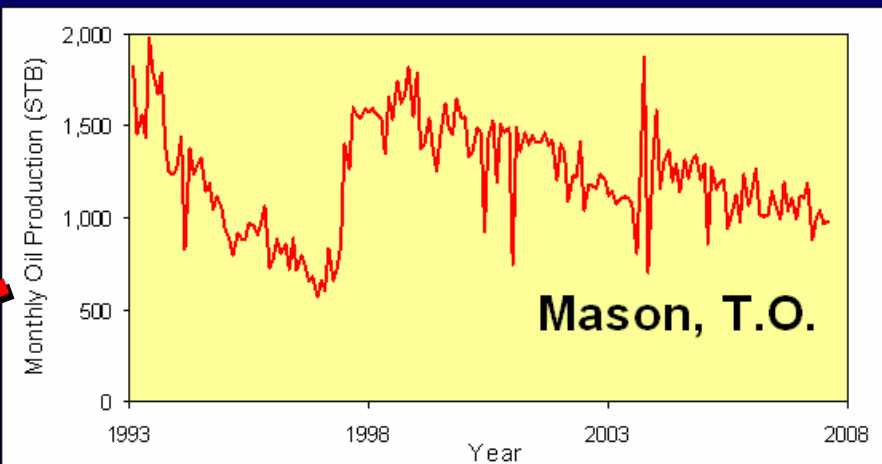
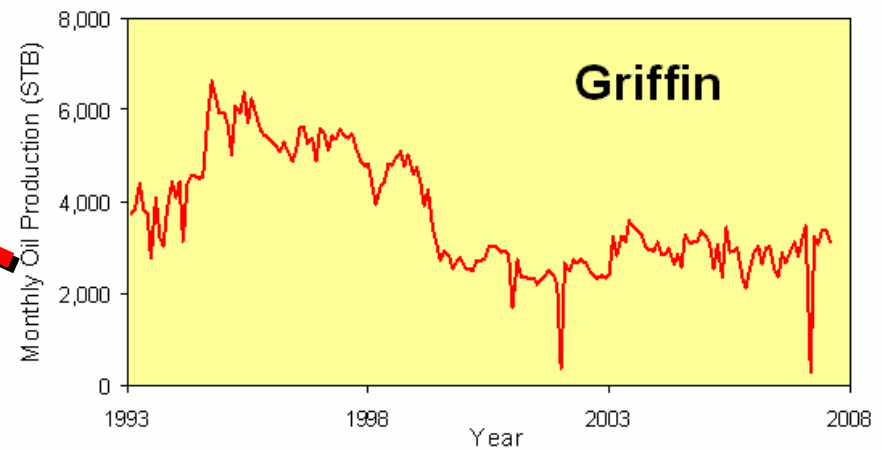
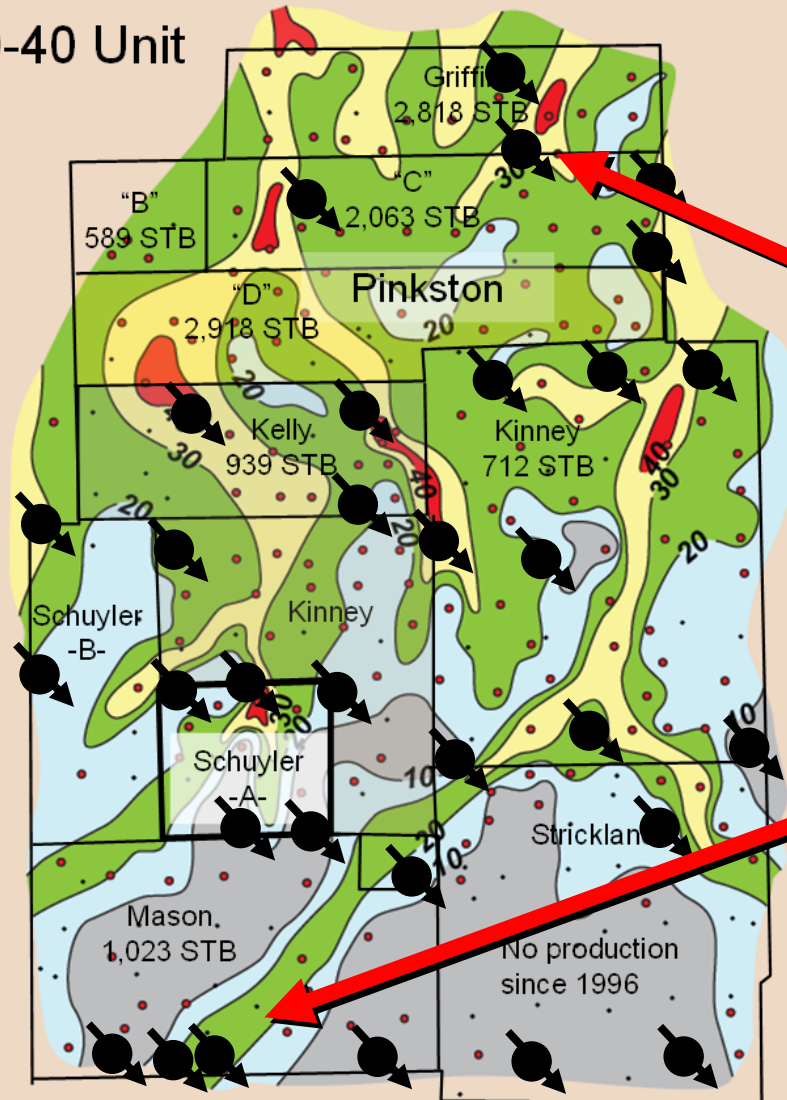


Water Injection: South Pilot Area

2000 ft ———

Up structure —————>

30-40 Unit



Summary

- **New sequence-stratigraphic and depositional model**
- **Potential still exists for well deepening**
- **Waterfloods can be redesigned to take improve sweep efficiency**

Acknowledgments

ETEA

East Texas Engineering Association



State of Texas Advanced Resource Recovery

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