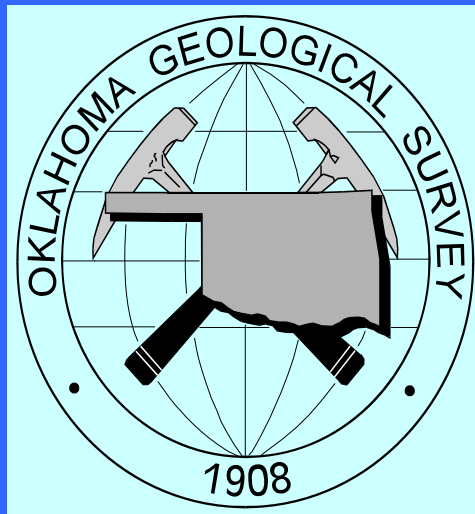


Current Production Trends of the Woodford Shale and Surface to Subsurface Correlations of Overlying and Underlying Formation Boundaries

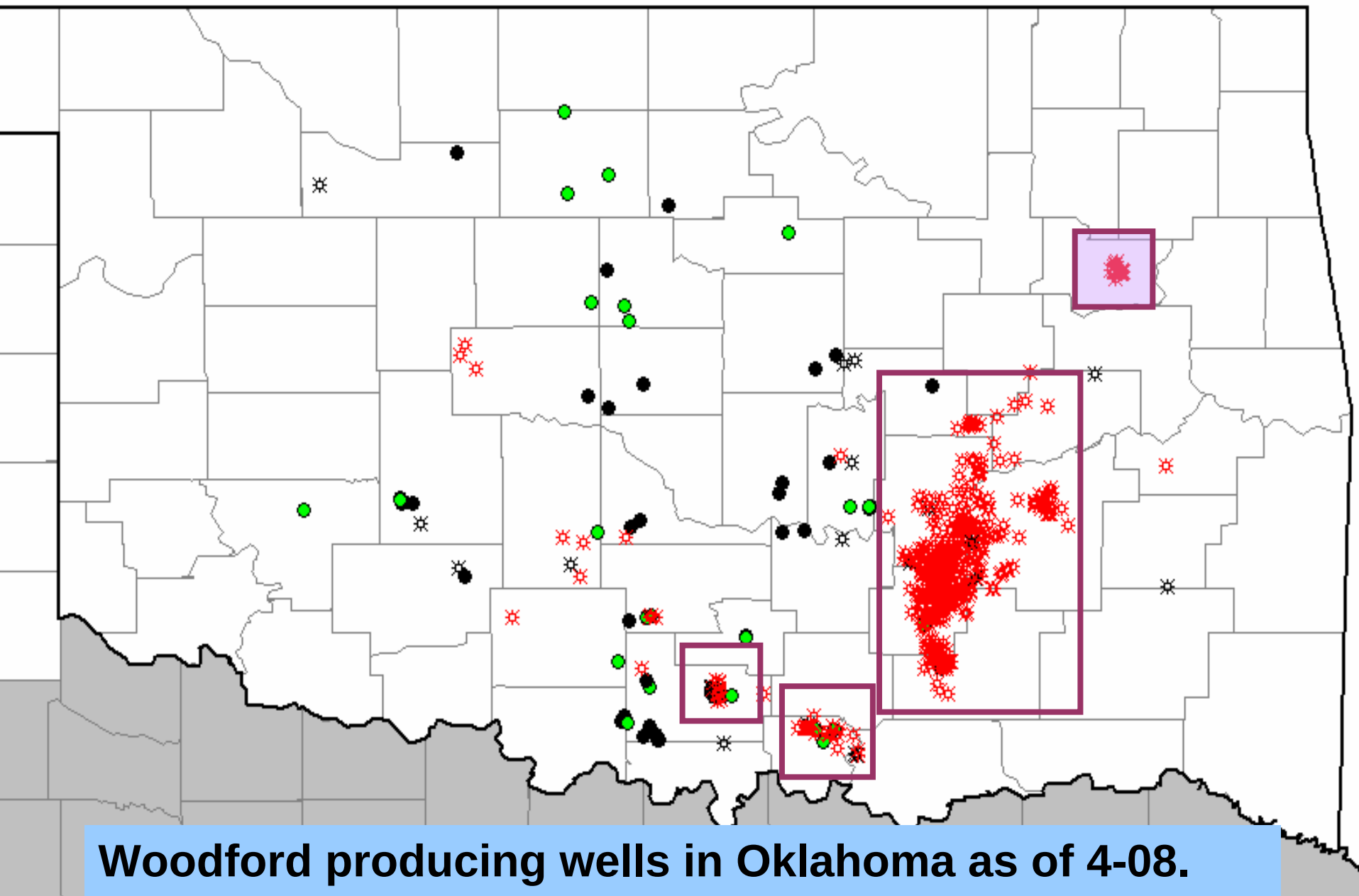
By: Rick Andrews
Oklahoma Geological Survey

October 22, 2008



TALK OUTLINE

- **Regional distribution of Woodford producing wells**
- Surface to subsurface correlation of bounding strata
- Production declines (some of the better wells)



**Woodford producing wells in Oklahoma as of 4-08.
From IHS Energy Data.**

R. 17 E.

R. 18 E.

**Woodford wells
in Wagoner Co.
Oklahoma**

T.
17
N.

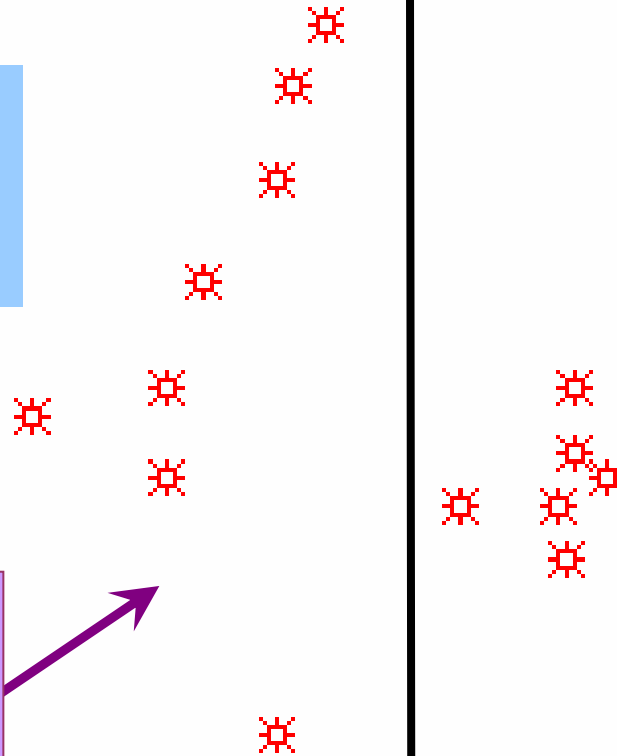
RESOURCES DEVEL

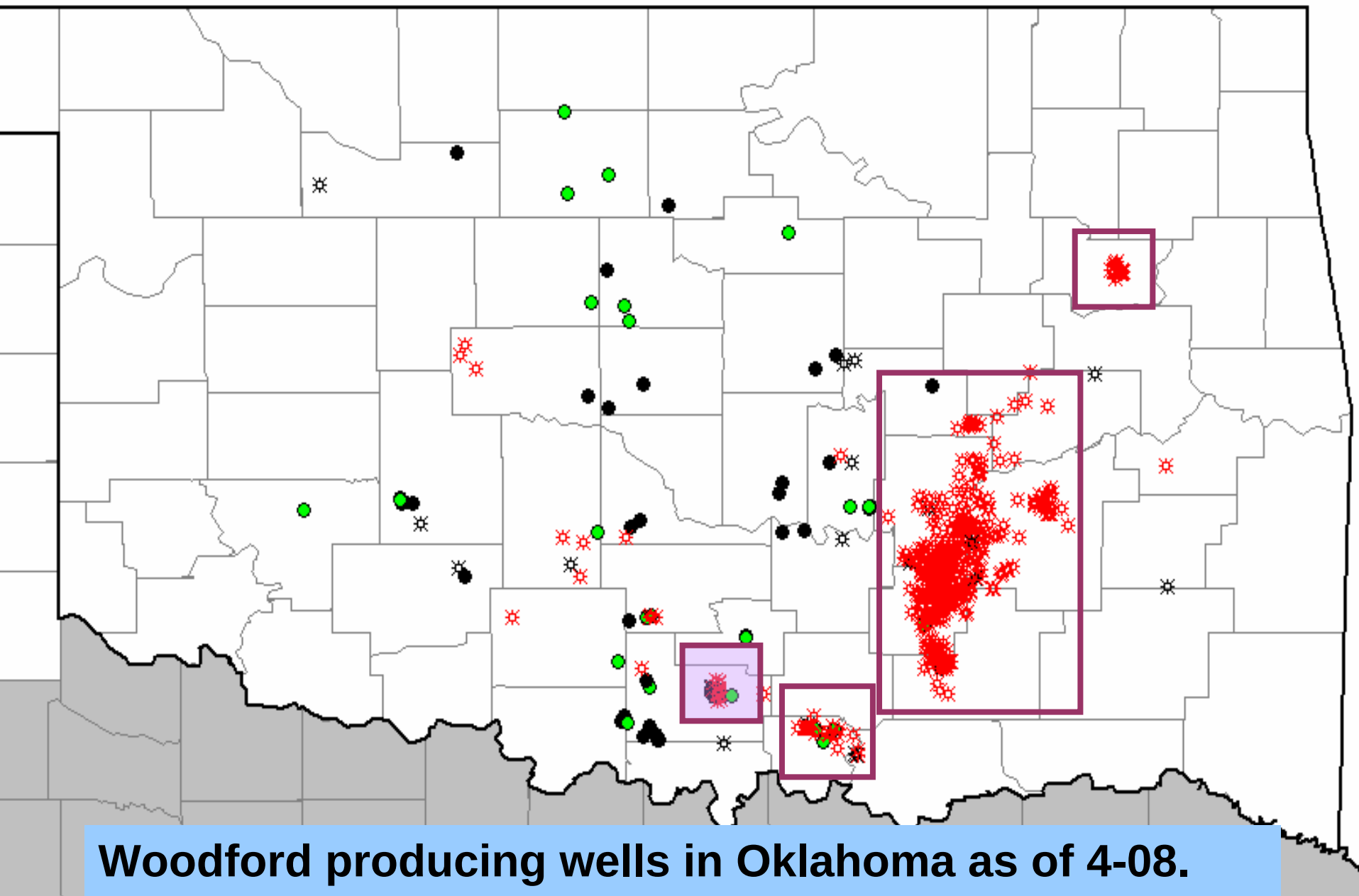
WCS INC

WCT OPERATING

➡ TD ~ 1,000 ft

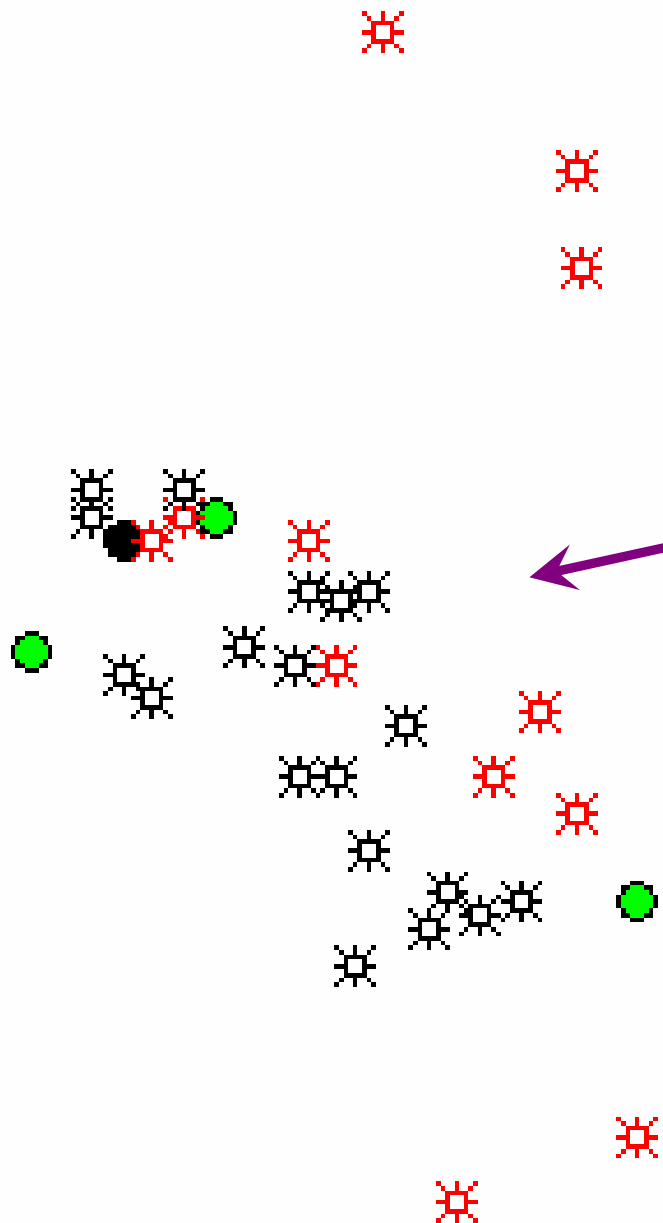
➡ 5-25MMCF cum/well





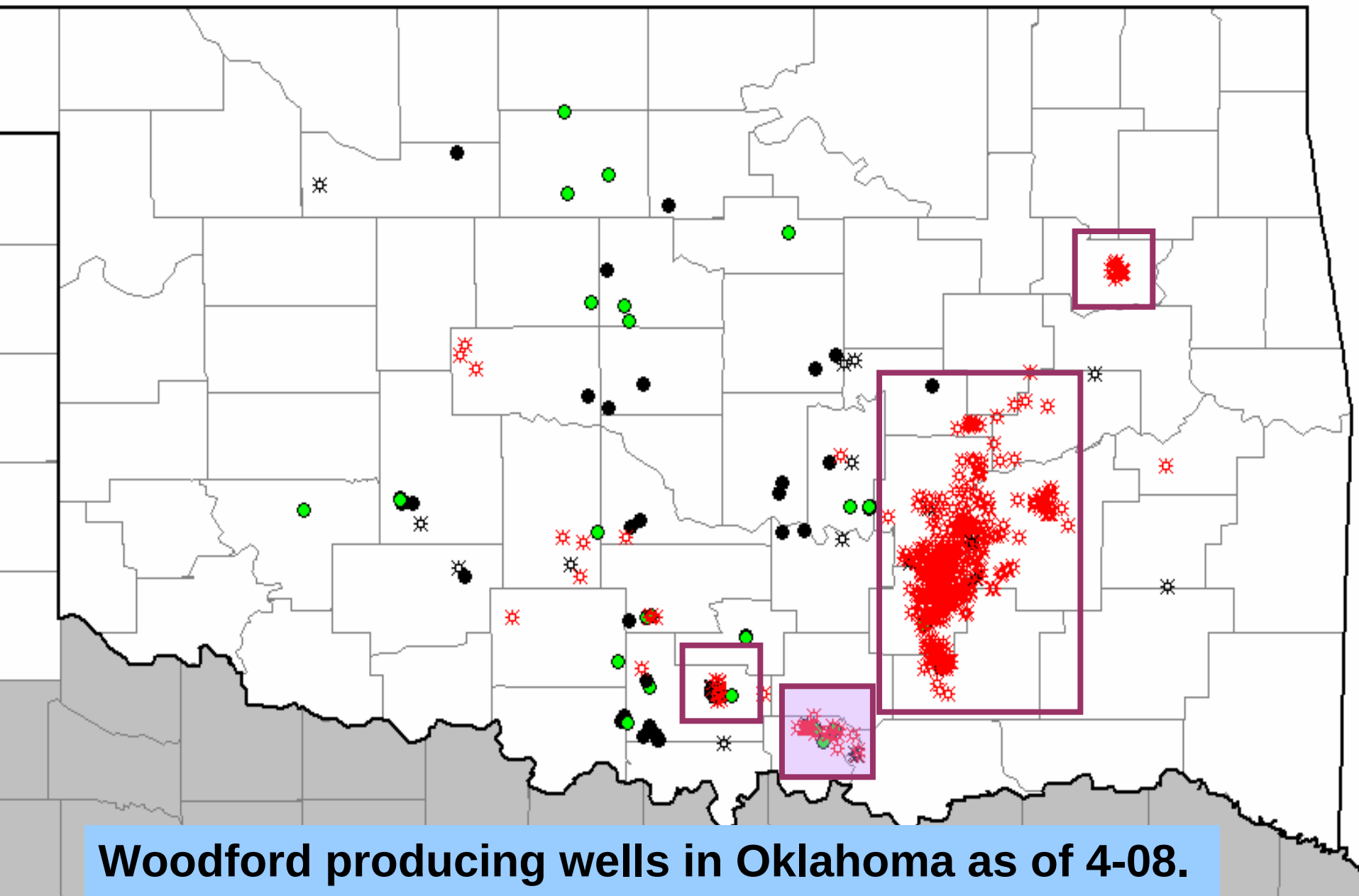
**Woodford producing wells in Oklahoma as of 4-08.
From IHS Energy Data.**

Woodford wells in Carter Co. Oklahoma

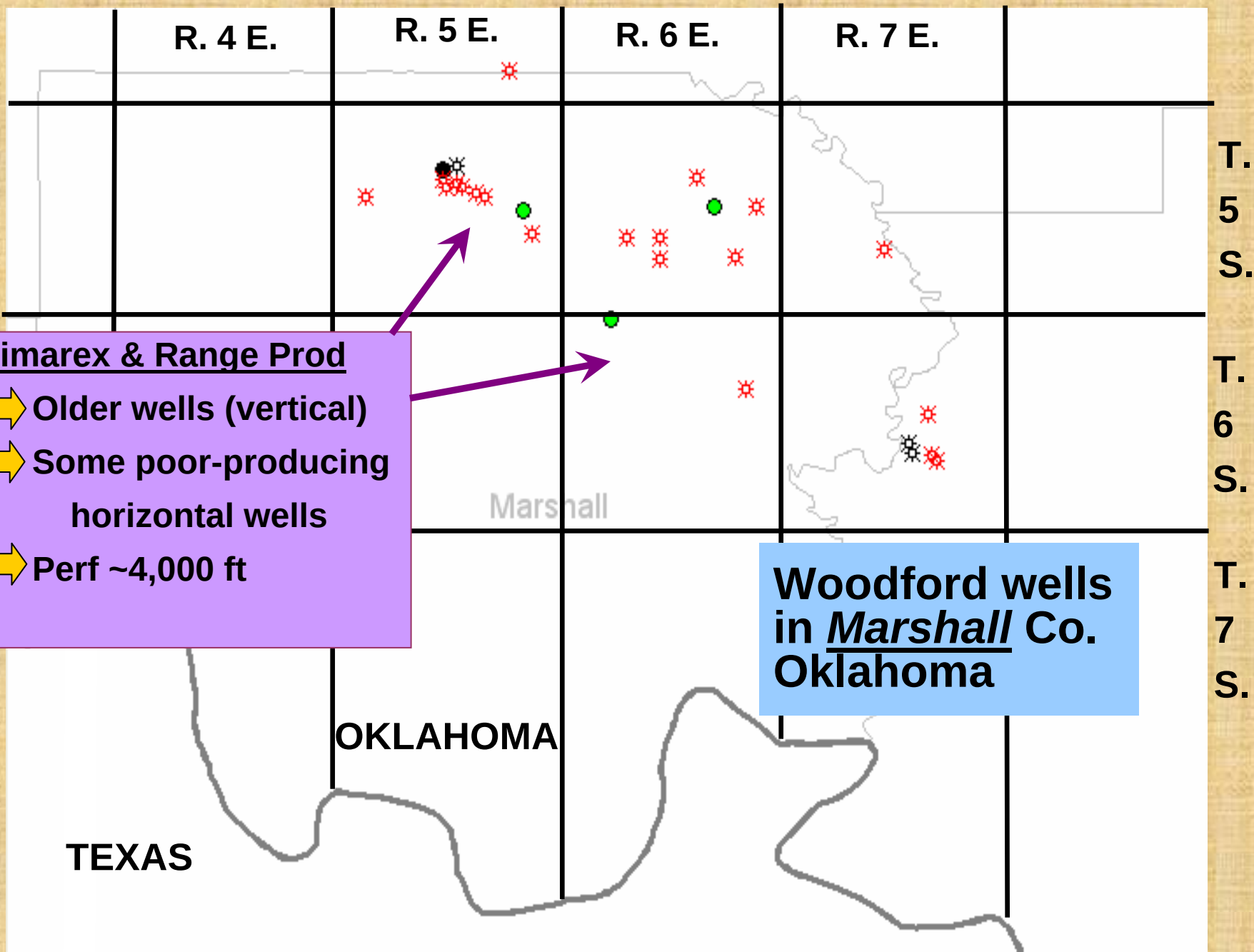


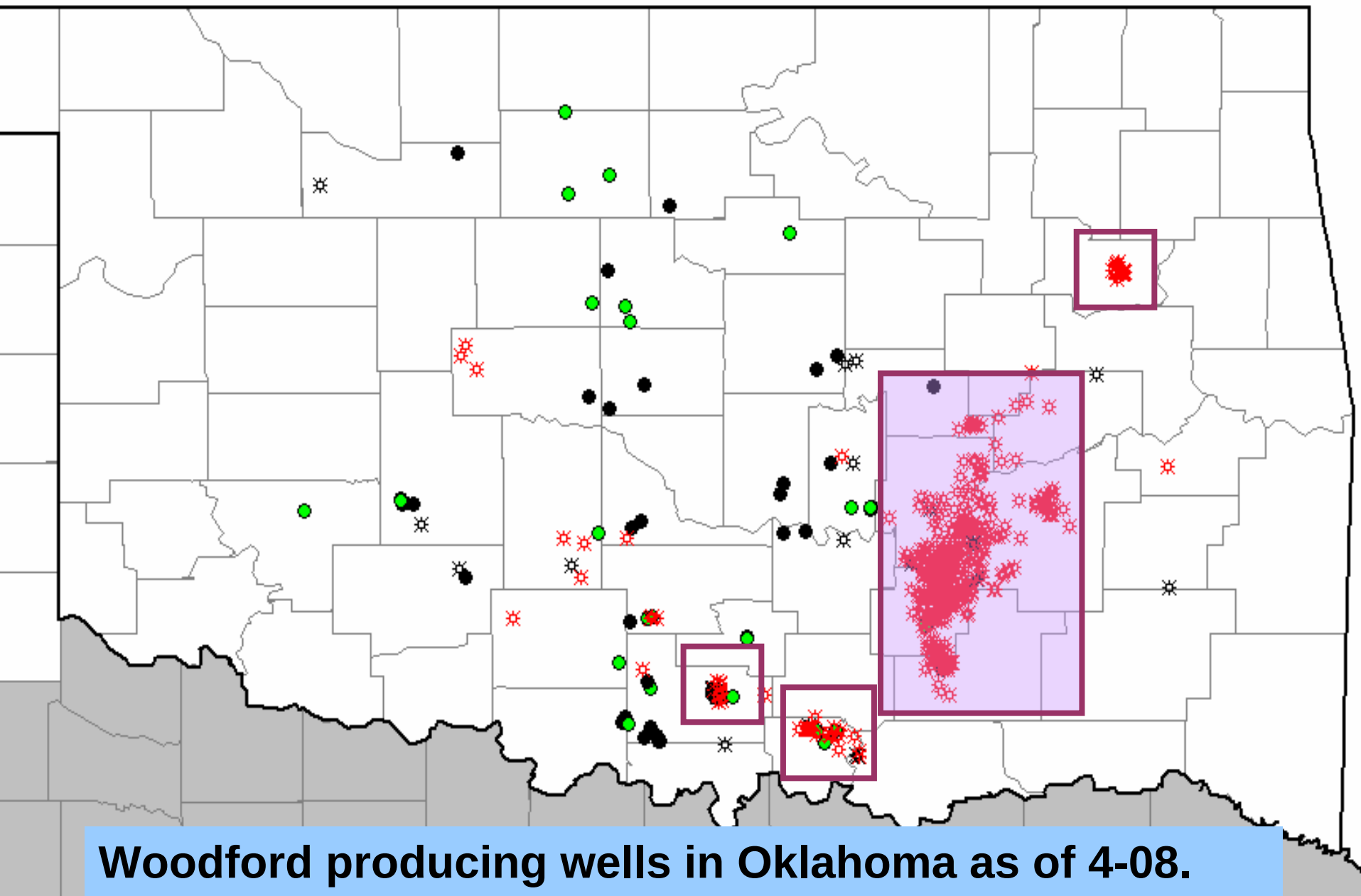
CIMAREX
ONEAL and
CHESAPEAKE

- ➡ Perf ~4,000 ft
- ➡ Mostly older (vert) wells
- ➡ Both oil and gas

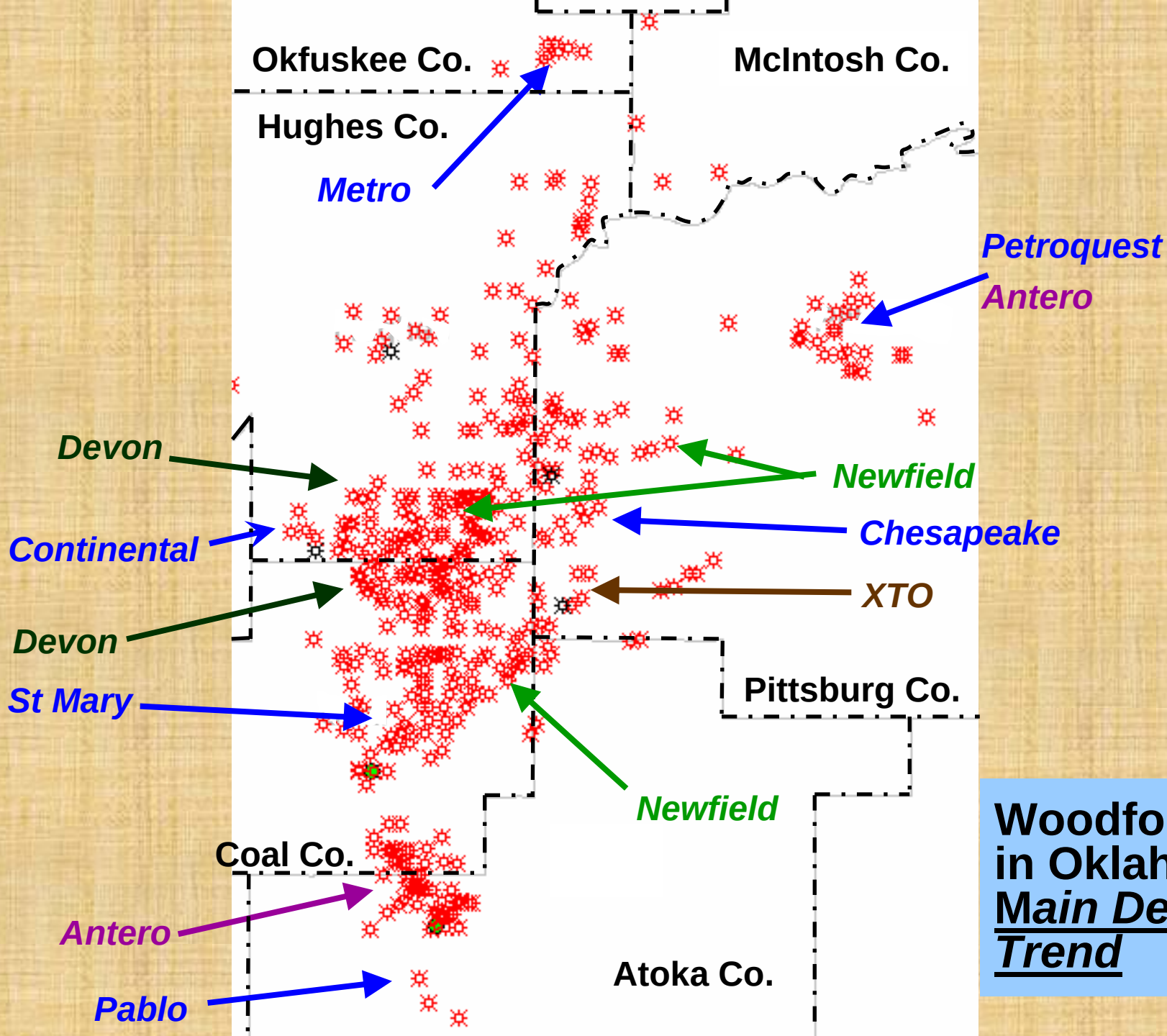


**Woodford producing wells in Oklahoma as of 4-08.
From IHS Energy Data.**





**Woodford producing wells in Oklahoma as of 4-08.
From IHS Energy Data.**



**Woodford wells
in Oklahoma –
Main Deep
Trend**

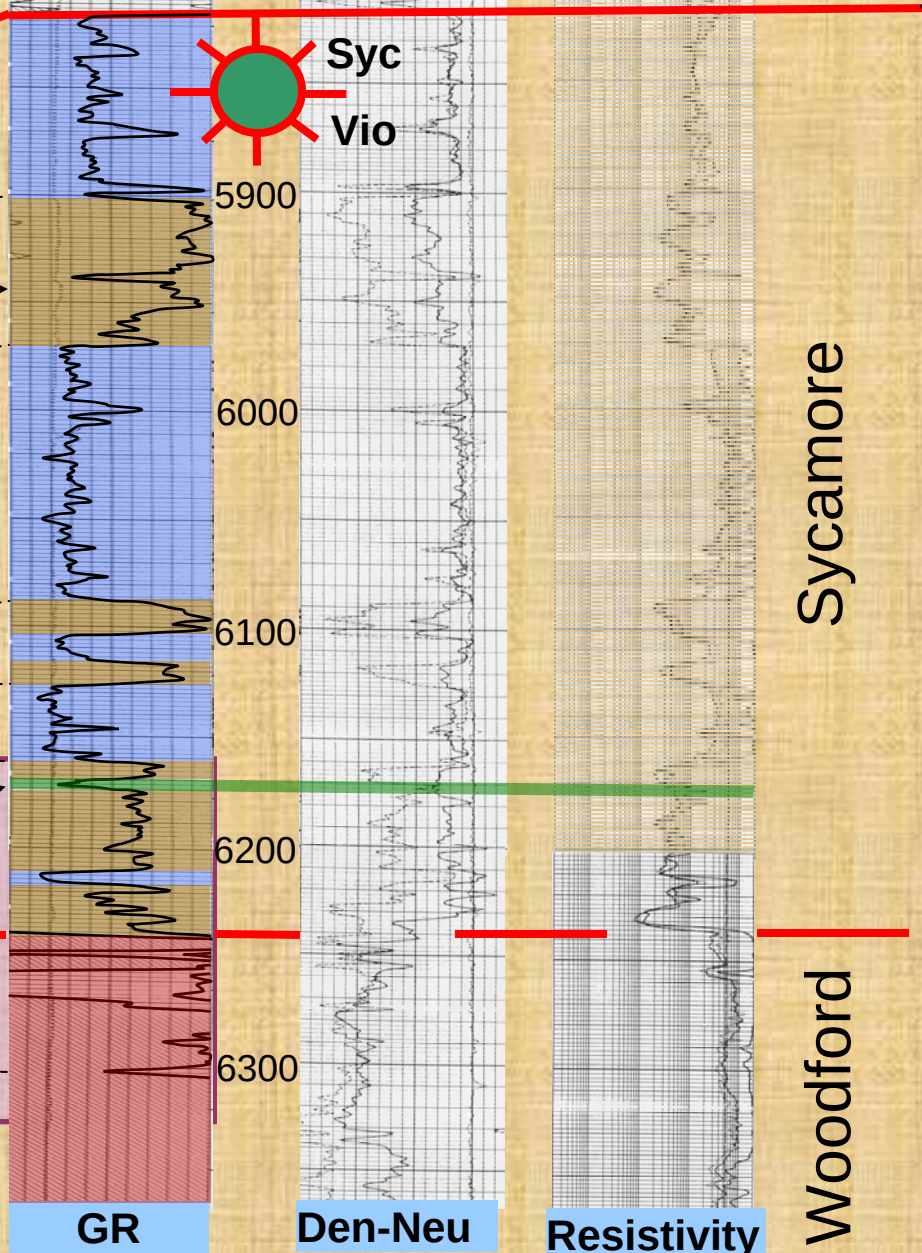
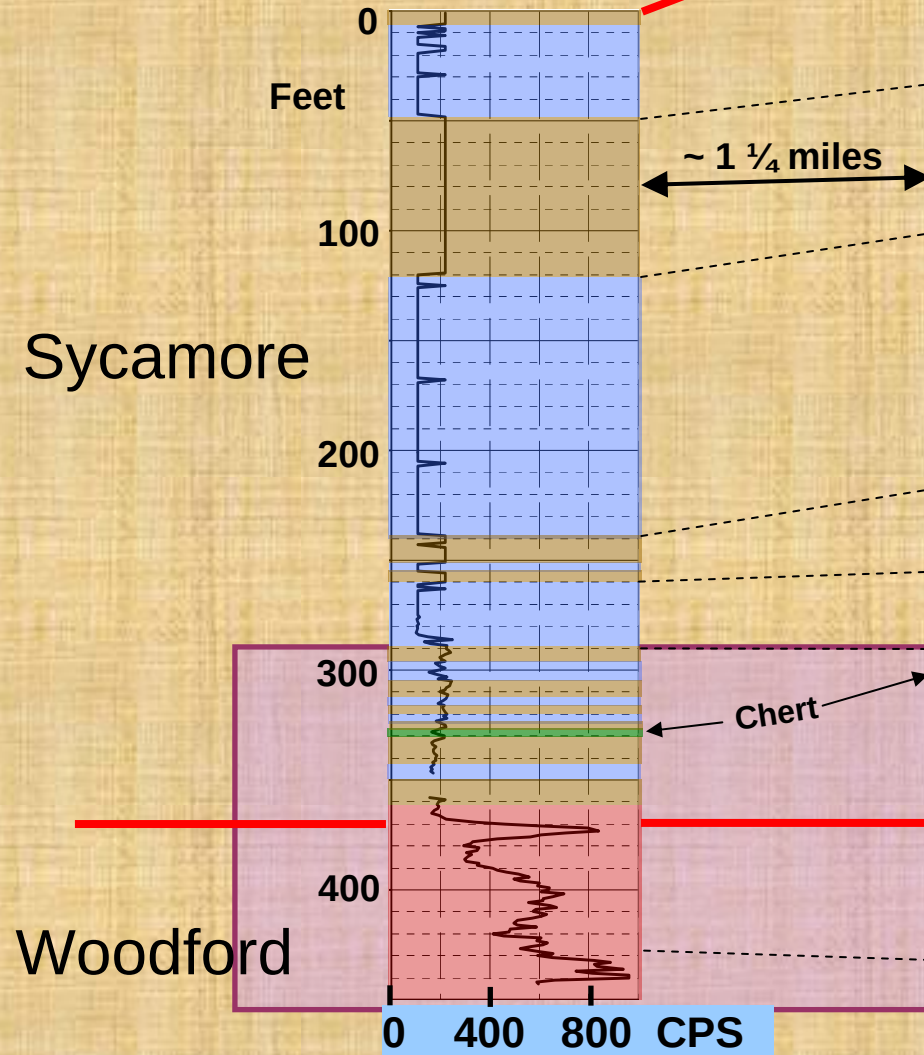
TALK OUTLINE

- Regional distribution of Woodford producing wells
- **Surface to subsurface correlation of bounding strata**
- Production declines (some of the better wells)

West side I-35
SE/4 sec. 25, T2S-R1E

TXO #1 Smith, SW SW 31, T2S-R2E

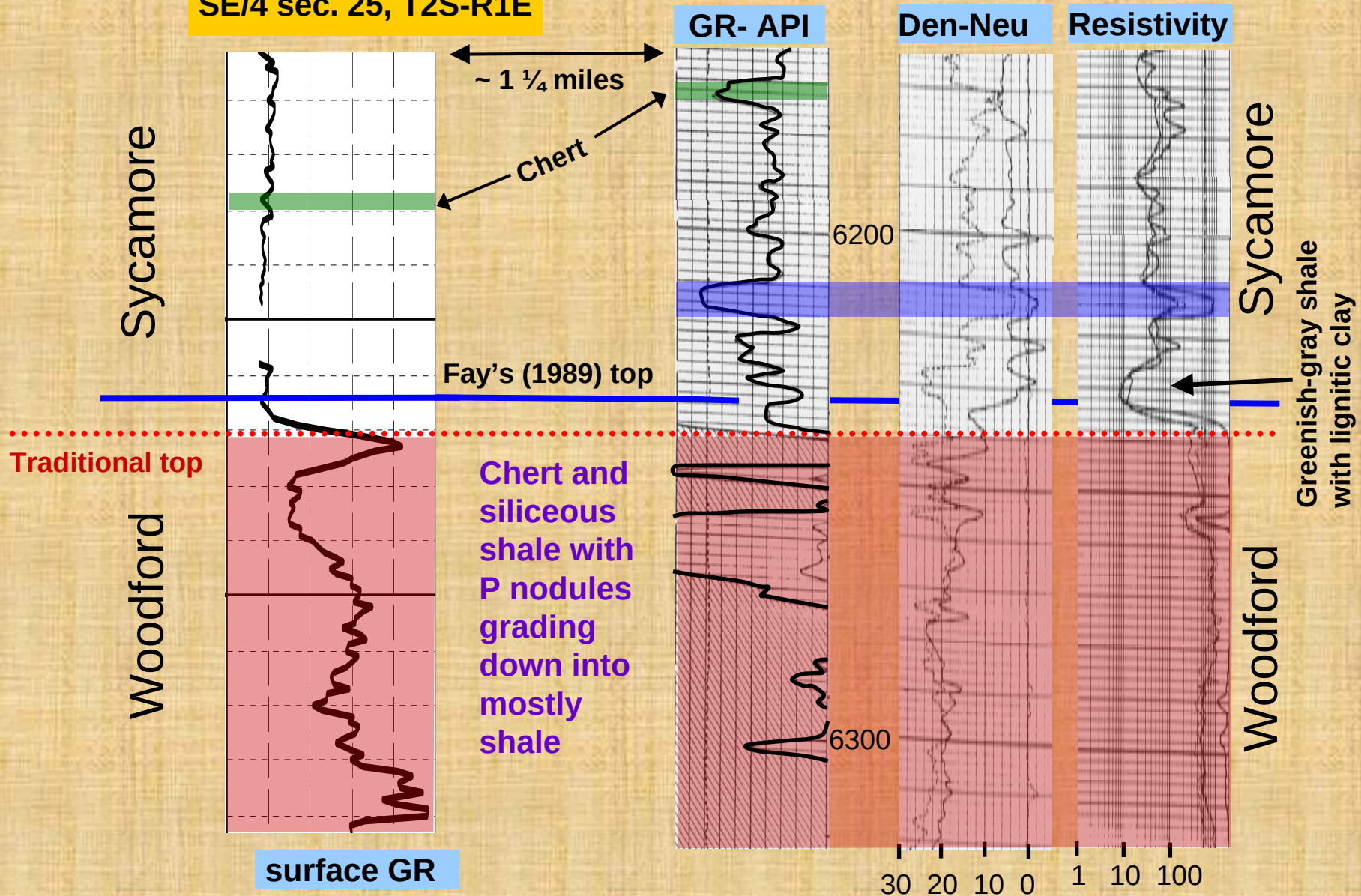
Caney



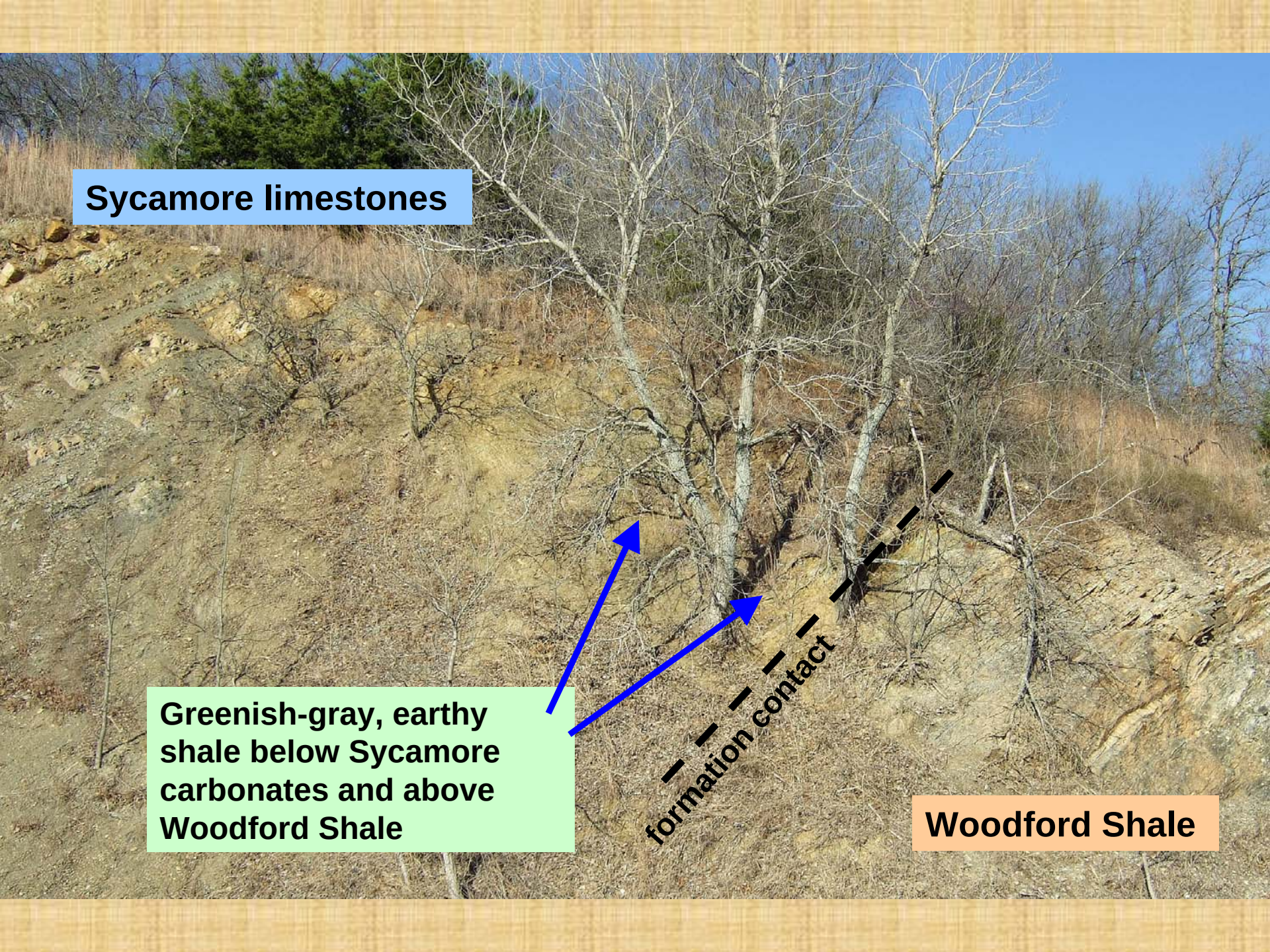
Woodford – Sycamore Strata S/of Arbuckles

West side I-35
SE/4 sec. 25, T2S-R1E

TXO #1 AE Smith, SW SW 31, T2S-R2E



Woodford – Sycamore Contact; So of Arbuckles



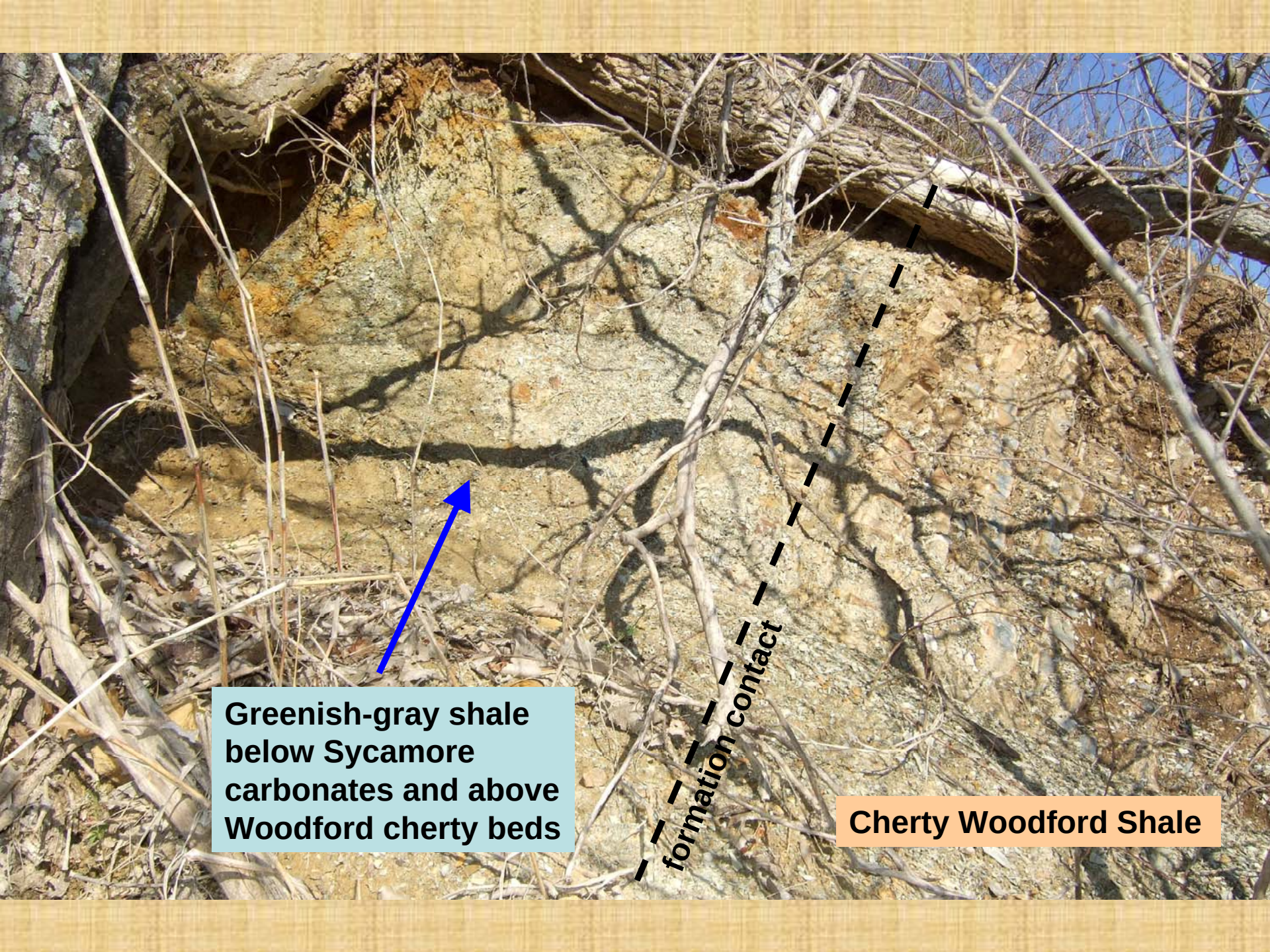
Sycamore limestones

This photograph shows a geological outcrop on a hillside. The top portion of the outcrop consists of light-colored, yellowish-brown rock layers, identified as Sycamore limestones. Below these is a darker, greenish-gray layer of earthy shale. At the base of the outcrop is the Woodford Shale, which is a lighter, tan-colored rock. A dashed black line indicates a 'formation contact' between the shale and the limestone. Two blue arrows point from the text box describing the shale to the corresponding rock layer. The hillside is covered with sparse vegetation, including bare trees and some evergreens at the top. The sky is clear and blue.

**Greenish-gray, earthy
shale below Sycamore
carbonates and above
Woodford Shale**

formation contact

Woodford Shale

A photograph of a geological outcrop showing various rock layers. A blue arrow points to a specific layer of greenish-gray shale. A dashed line indicates a formation contact between different rock units. The outcrop is partially obscured by bare tree branches.

**Greenish-gray shale
below Sycamore
carbonates and above
Woodford cherty beds**

Cherty Woodford Shale

formation contact

Surface GR

<1 mi

Placid Oil Company No. 1 Joyce
C NE SW 20, T1S-R2E

east side of I-35
SW NE NE 30
T 1S R2E

Traditional
formation-
boundary
log picks

east SH-77D
& W/of I-35
SE NW NE 30
T 1S R2E

covered

GR

Den-Neu Por Resistivity

Sycamore
Ls

Woodford Shale

Hunton
Ls

30 20 10 0 1 10 100

Hunton/Woodford/Sycamore Strata N/of of Arbuckles

SW NE NE 30

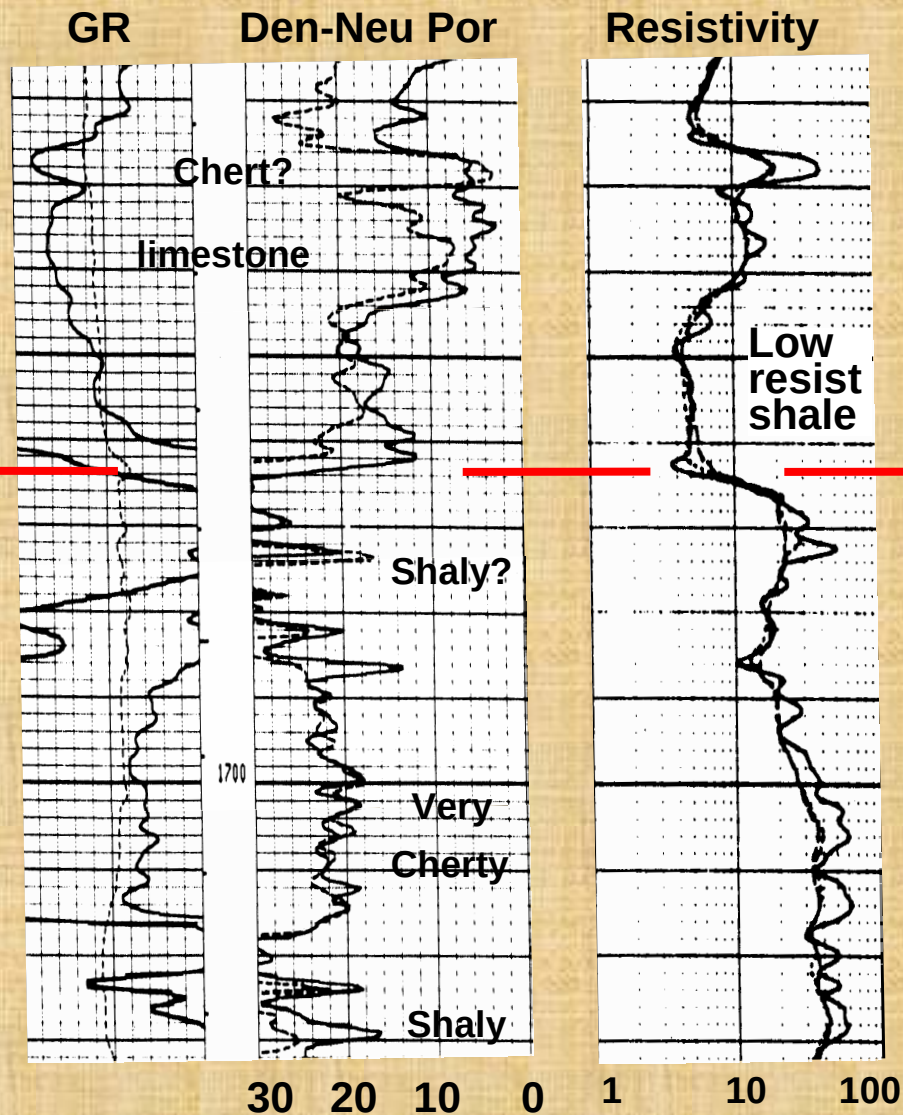
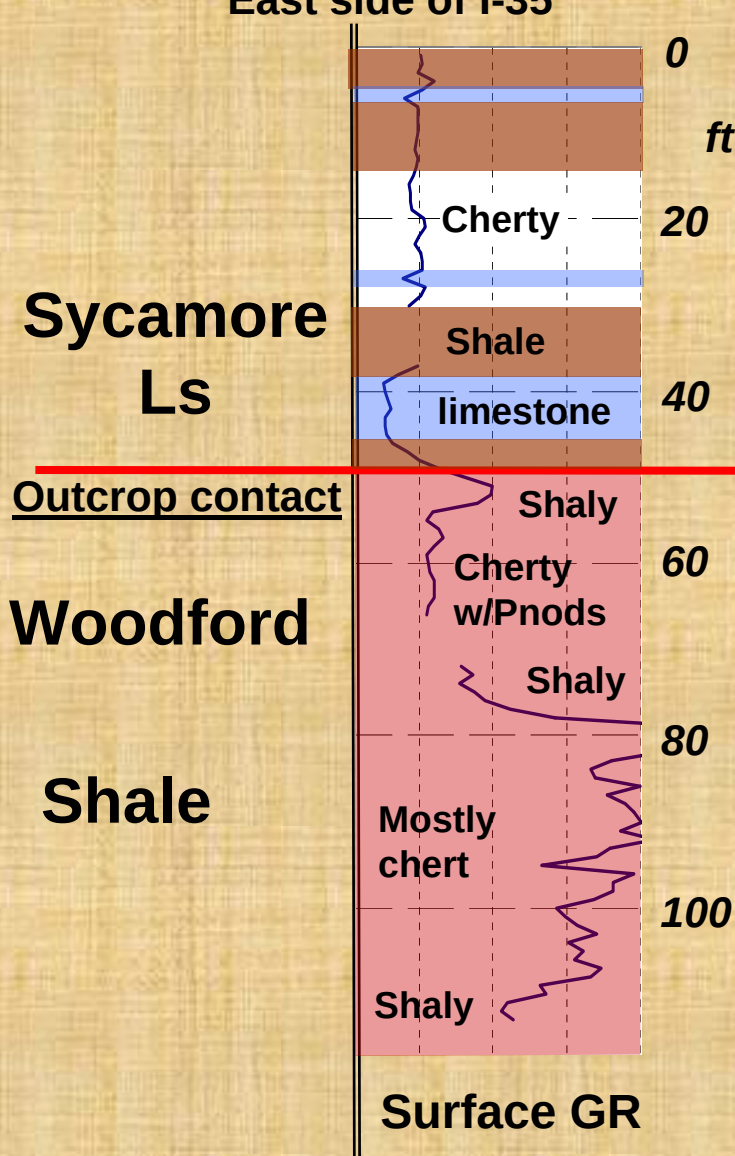
T1S-R2E

East side of I-35

Placid Oil Company No. 1 Joyce

C NE SW 20, T1S-R2E

<1 mi



Woodford – Sycamore Contact N/of Arbuckles

Surface GR

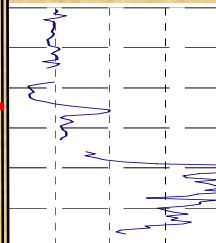
<1 mi

Placid Oil Company No. 1 Joyce
C NE SW 20, T1S-R2E

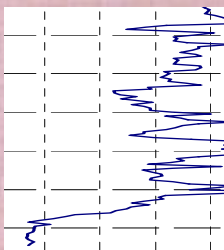
east side of I-35
SW NE NE 30
T 1S R2E

Traditional
formation-
boundary
log picks

east SH-77D
& W/ of I-35
SE NW NE 30
T 1S R2E



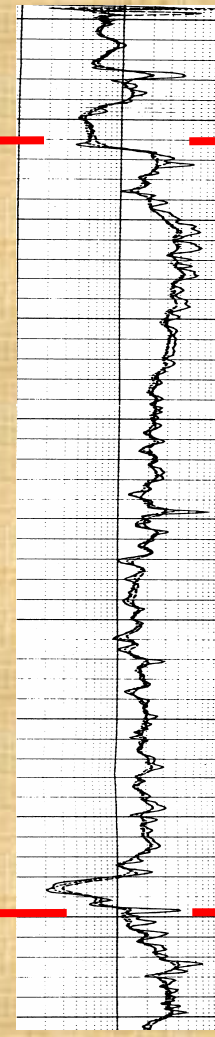
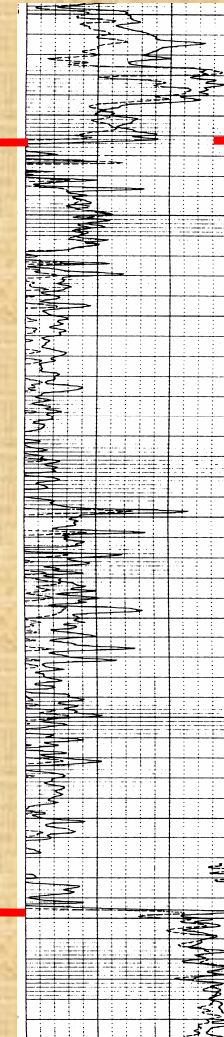
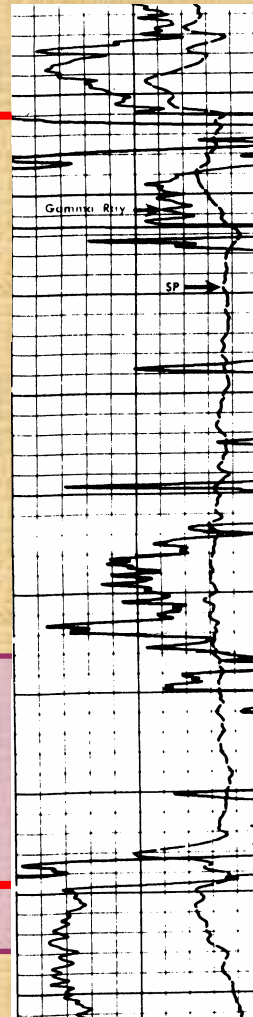
covered



GR

Den-Neu Por

Resistivity



Sycamore
Ls

Woodford Shale

Hunton
Ls

30 20 10 0 1 10 100

Hunton/Woodford/Sycamore Strata N/of of Arbuckles

SE NW NE 30

T 1S R2E

east SH-77D & W/of I-35

Placid Oil Company No. 1 Joyce

C NE SW 20, T1S-R2E

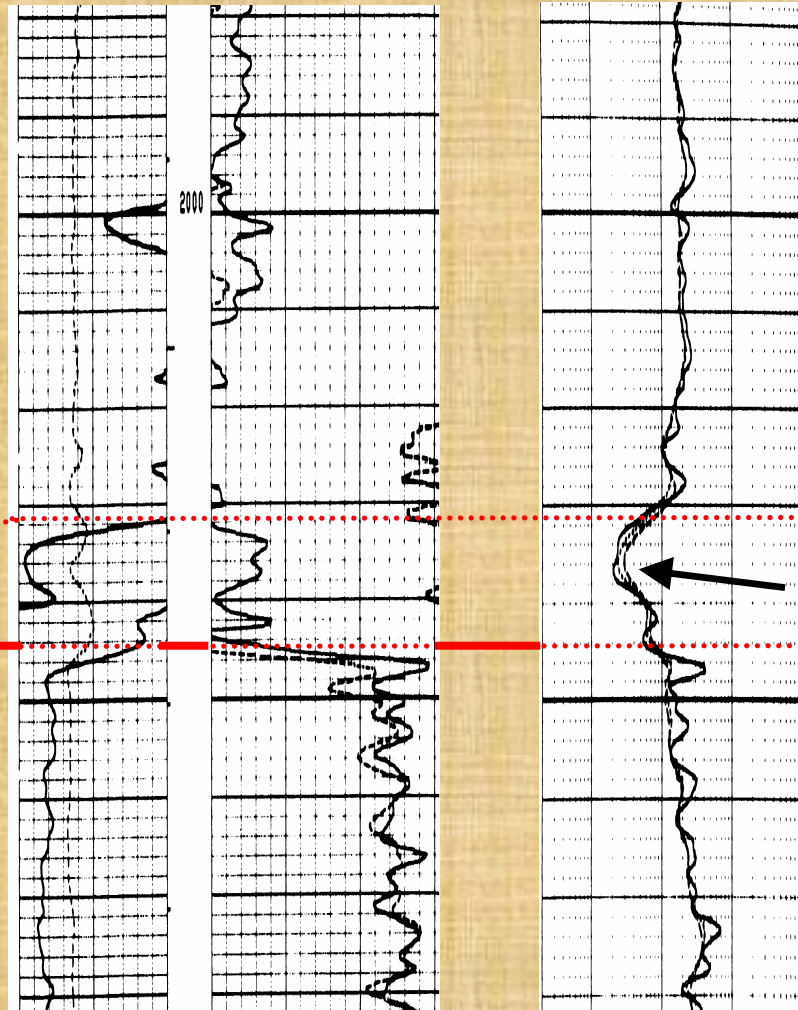
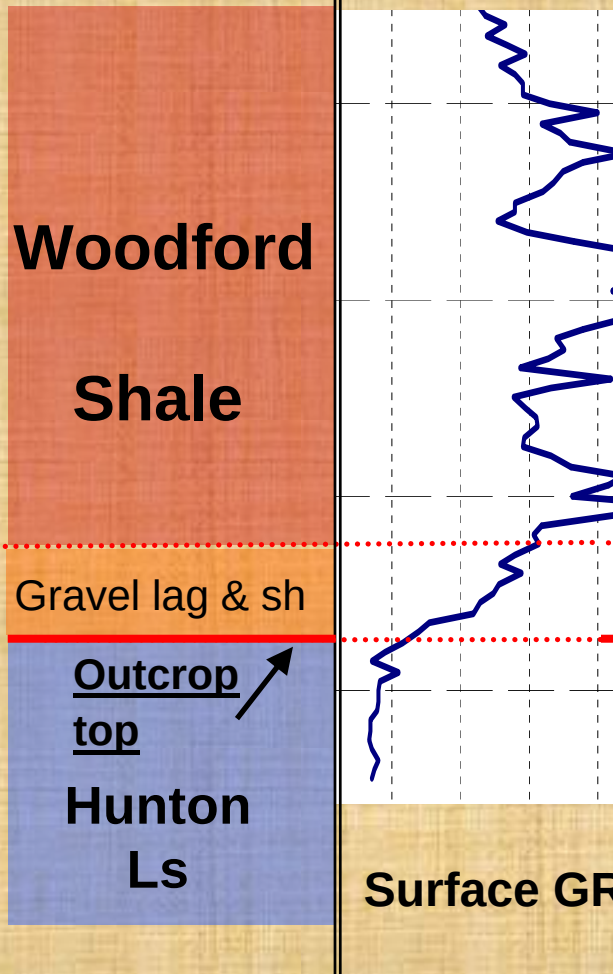
<1 mi

Surface GR

GR

Den-Neu Por

Resistivity



Woodford Shale

Black & green earthy shale

Hunton Ls

Woodford – Hunton Contact N/of Arbuckles

Note: these beds are overturned
Up-section ←

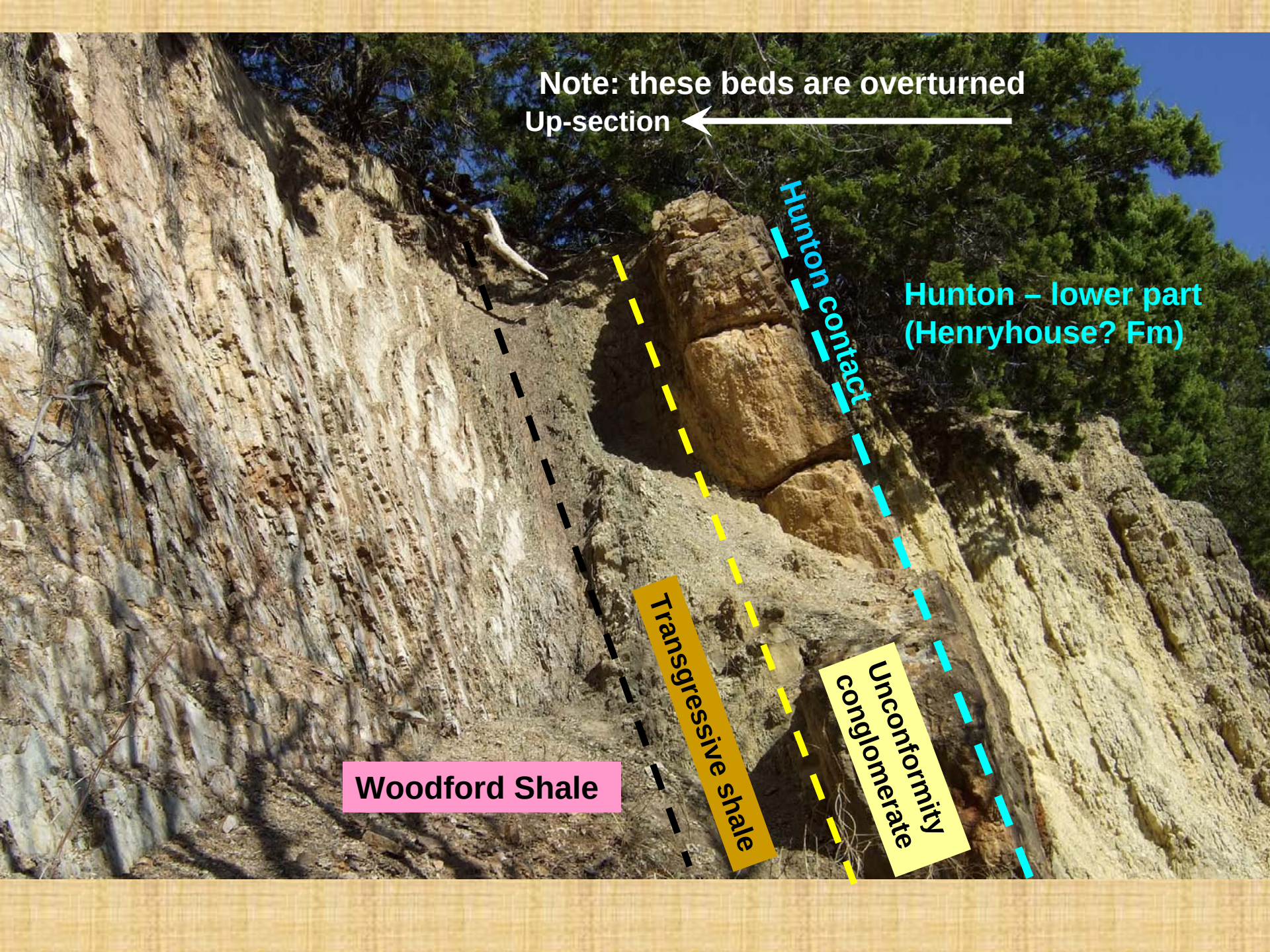
Hunton contact

Hunton – lower part
(Henryhouse? Fm)

Transgressive shale

Unconformity
conglomerate

Woodford Shale



Note: these beds are overturned

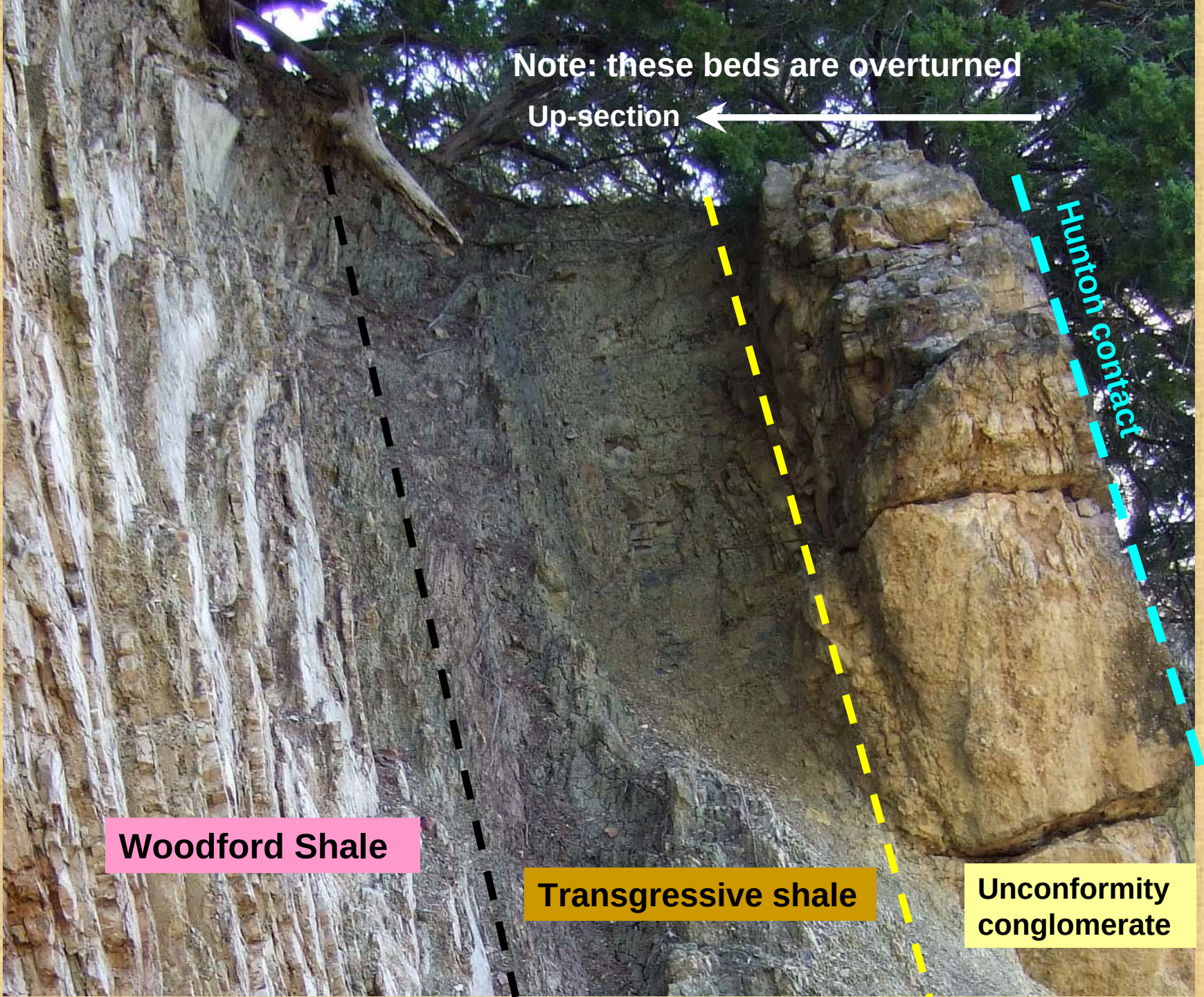
Up-section ←

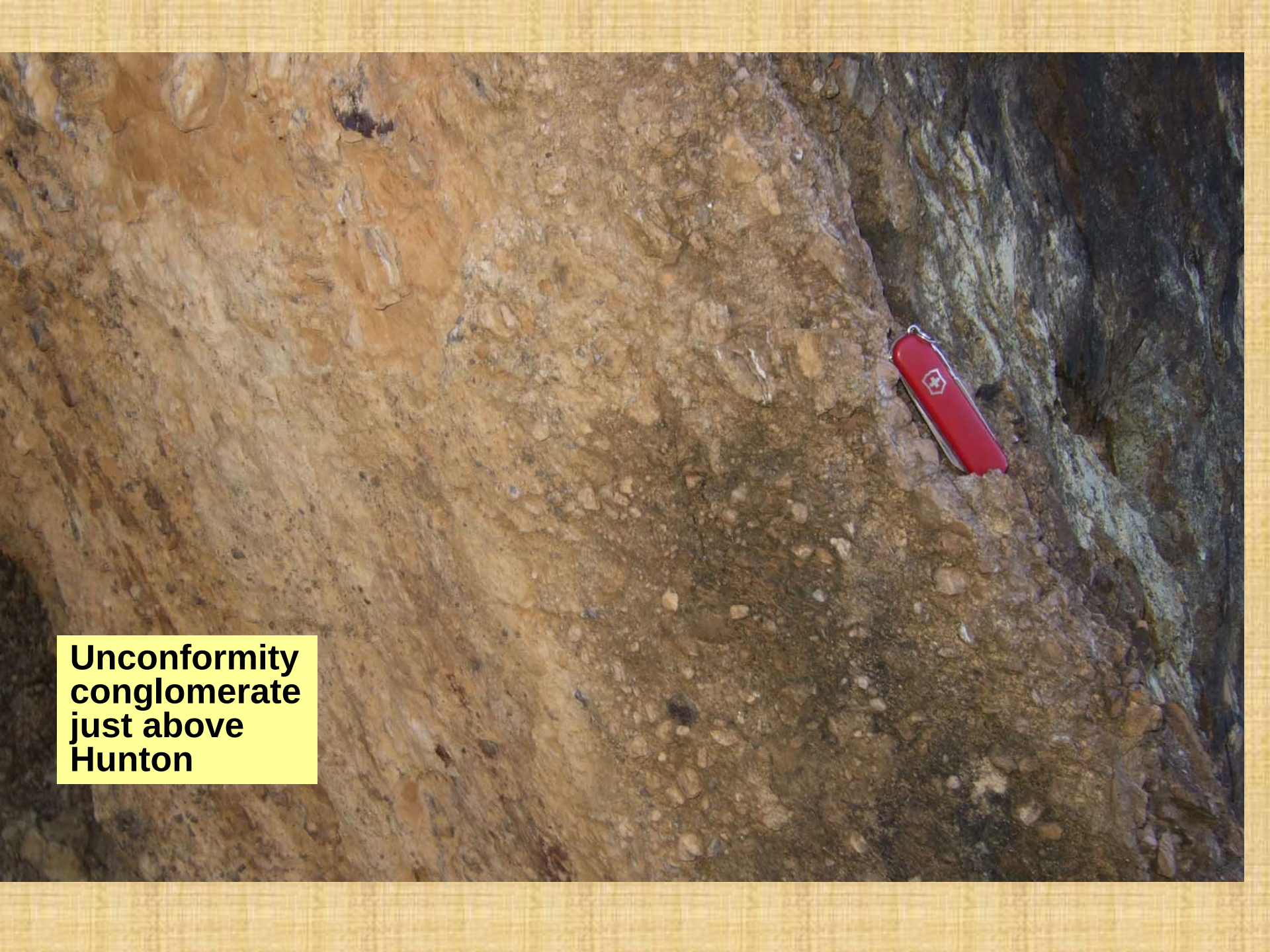
Hunton contact

Woodford Shale

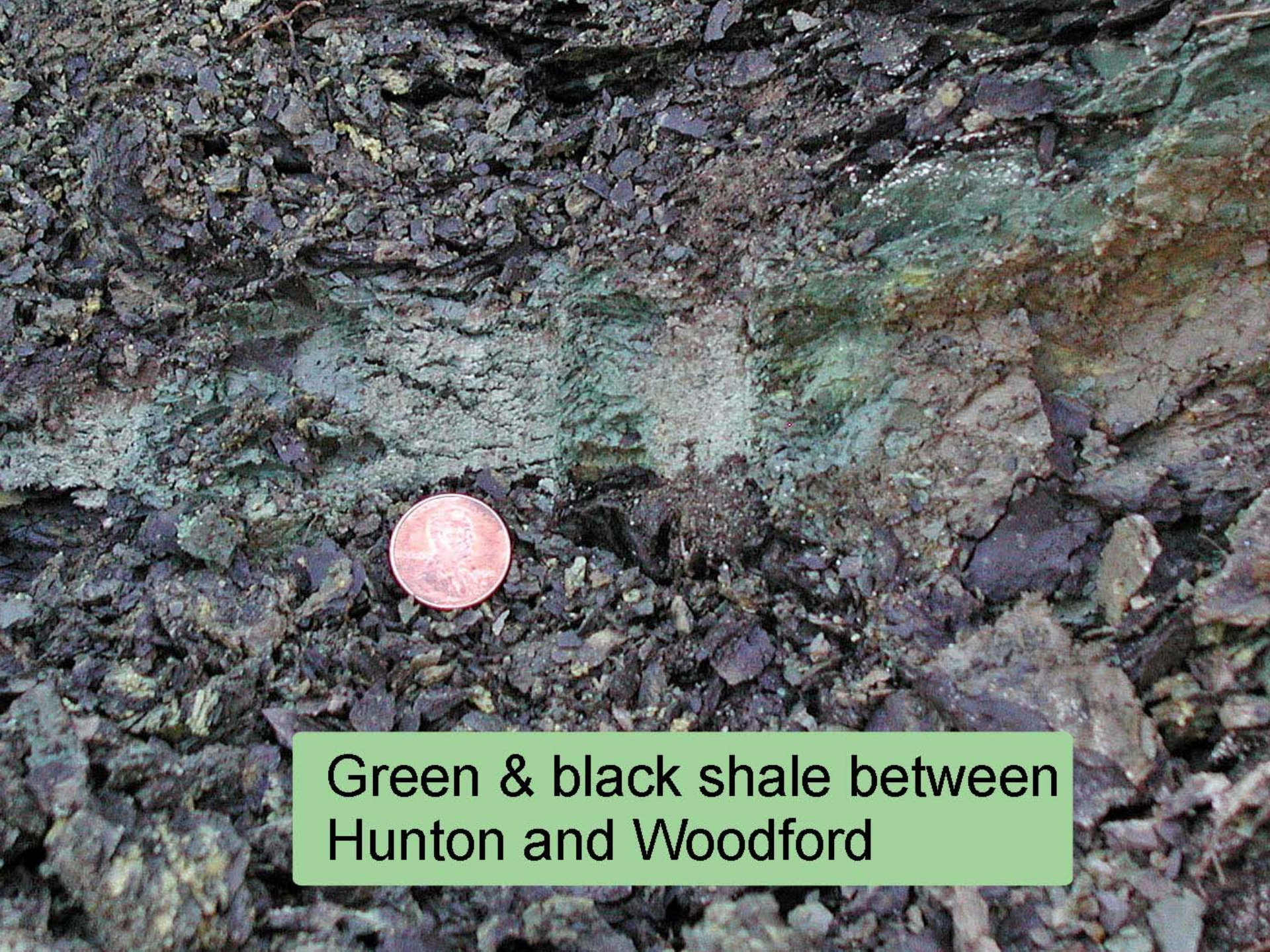
Transgressive shale

Unconformity
conglomerate





**Unconformity
conglomerate
just above
Hunton**



Green & black shale between
Hunton and Woodford

TALK OUTLINE

- Regional distribution of Woodford producing wells
- Surface to subsurface correlation of bounding strata
- **Production declines (some of the better wells)**

Woodford Shale monthly production Jan 2000 through March 2008. Data from IHS Energy

Avg 640 MMCF per well cum
415 horiz wells, 94 >1 MMCF/D
Only 7 >1BCF Cum (~economic)

Monthly Production Gas (MCF) & Oil (BBL)

- Oil (BBL)
- GAS (MCF)
- # of producing wells

Cum prod
125 BCFG

Cum prod
486 MBO

2000 2001 2002 2003 2004 2005 2006 2007 08

Devon 1-20H Billie Jean
NW NW 20, 3N-11E

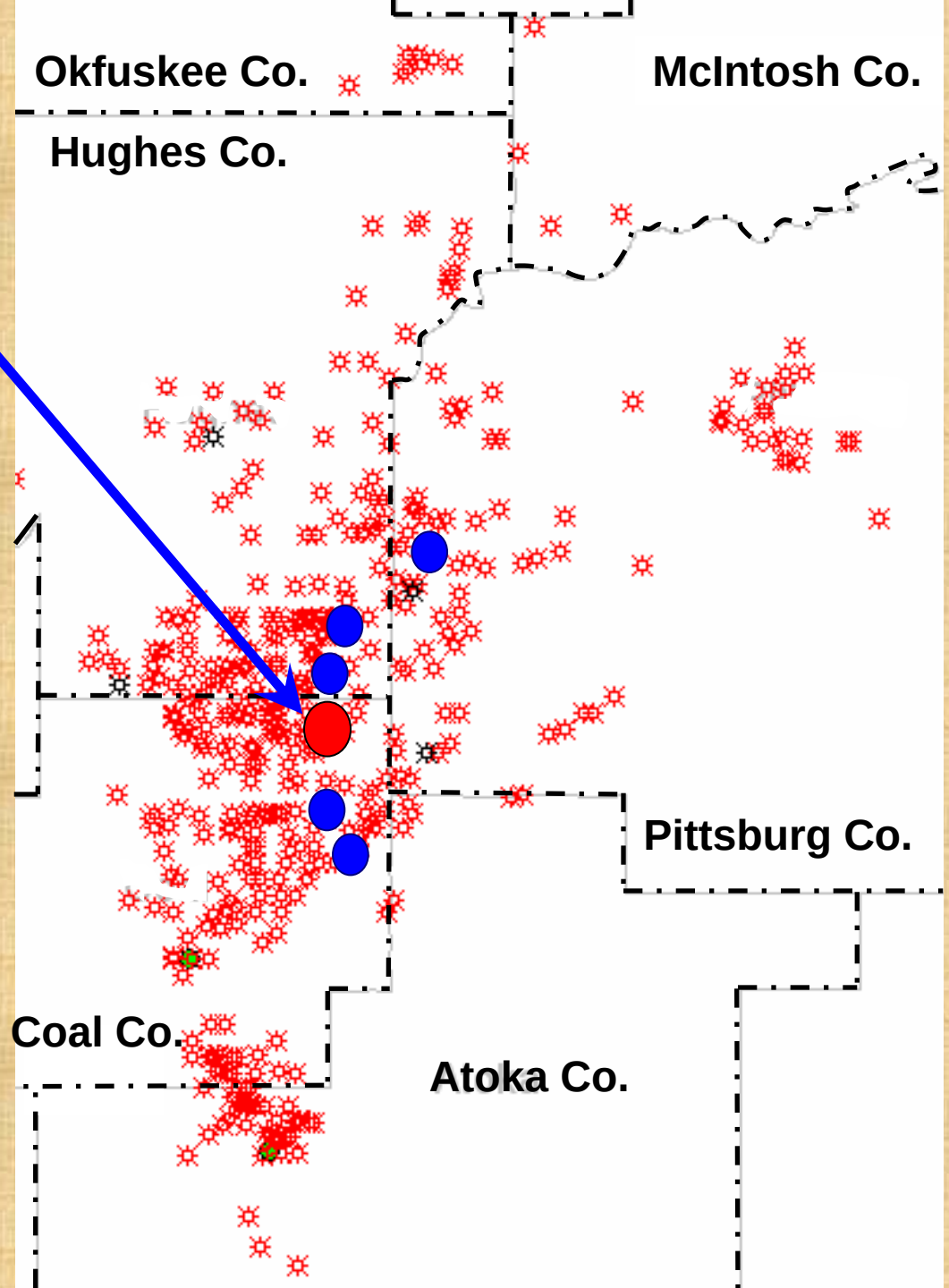
Newfield 1H-32 Wilson
NW NW 32, 2N-11E

Newfield 1H-7 Sprague
NE NW 7, 2N-11E

Newfield 1H-20 Melvin
NE NE 20, 4N-11E

Newfield 2H-31 Patterson
SE SW 31, 4N-11E

Newfield 4H-22 Sherman Ellis
SW SW 22, 5N-12E



Devon 1-20H Billie Jean NW NW 20-3N-11E

Monthly Gas Production (MCF)

NOTES

Horizontal well

- ➡ TVD: 8,105 ft
- ➡ BHL: ~3,700' S
- ➡ IP: 2,266 MCF
- ➡ BHP: 1,433 psi
- ➡ Frac: 75K #sd (initial)
??K #sd
??K #sd

REFRAC

~2 MMCF/D

Cum Prod:
990 MMCF

Pay out??

~425 MCF/D

100,000

90M

80M

70M

60M

50M

40M

30M

20M

10,000

Aug

Dec

April

Aug

Dec

April

Aug

Dec

April

2005

2006

2007

2008

Devon 1-20H Billie Jean
NW NW 20, 3N-11E

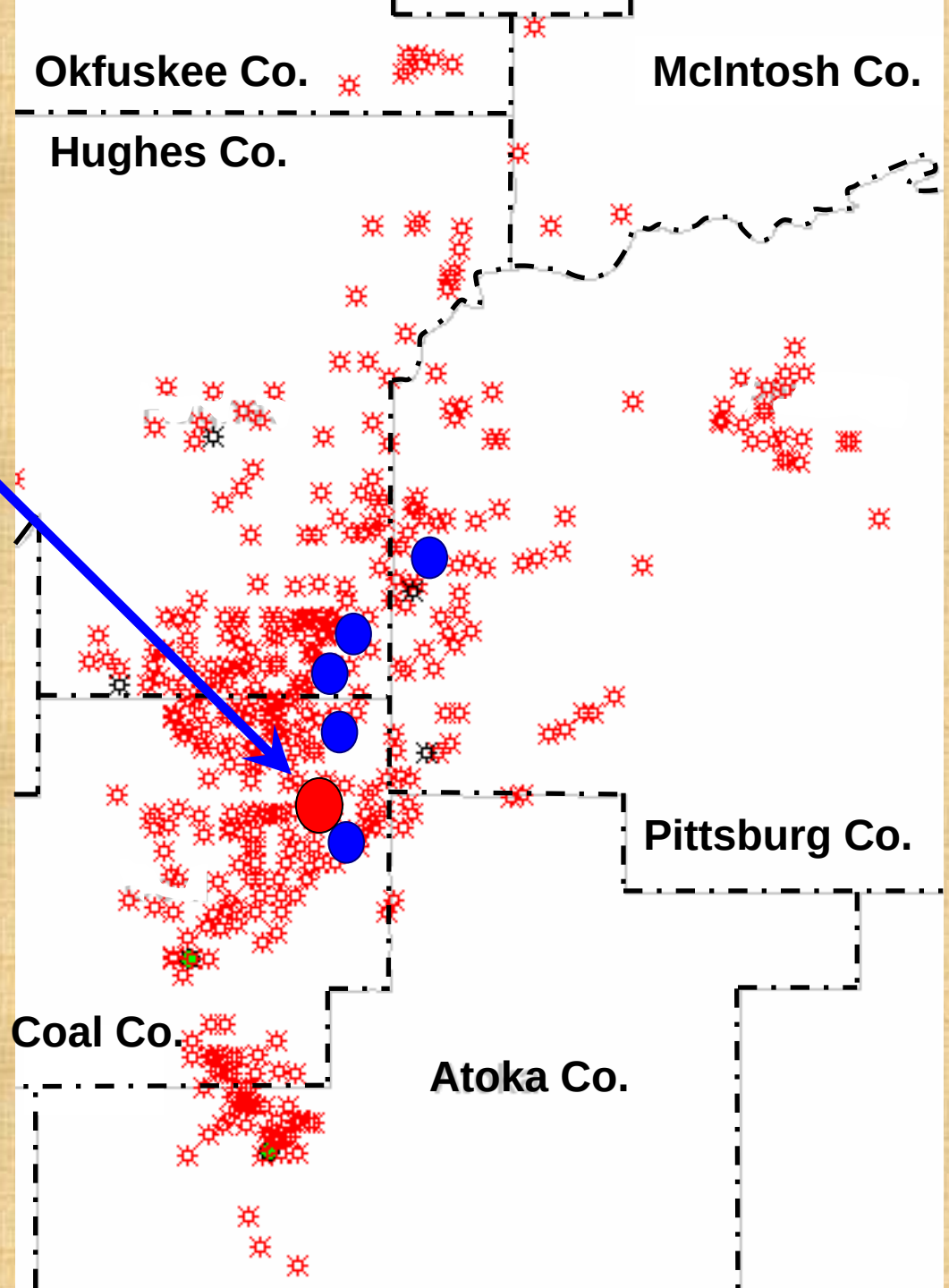
Newfield 1H-7 Sprague
NE NW 7, 2N-11E

Newfield 1H-32 Wilson
NW NW 32, 2N-11E

Newfield 1H-20 Melvin
NE NE 20, 4N-11E

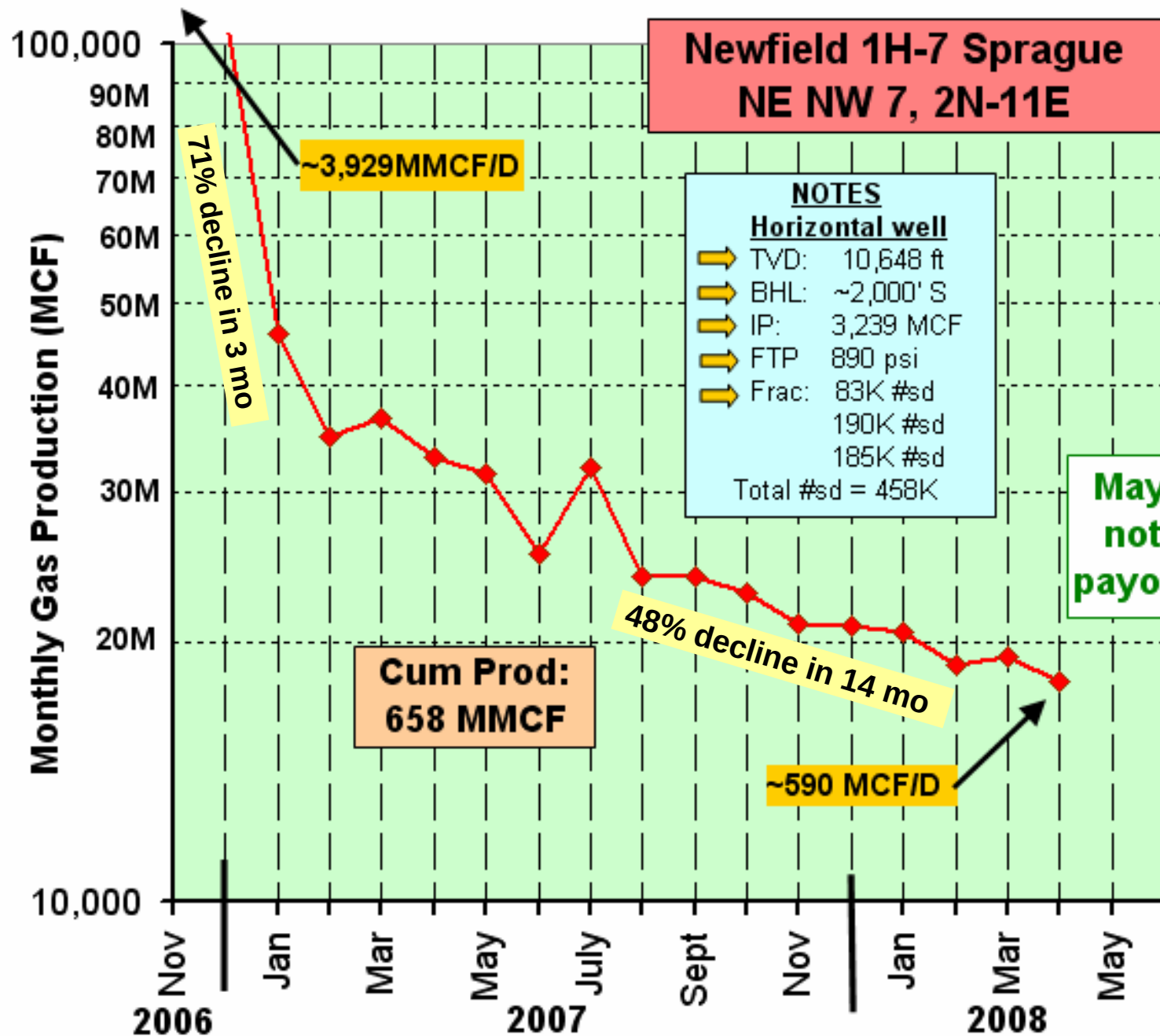
Newfield 2H-31 Patterson
SE SW 31, 4N-11E

Newfield 4H-22 Sherman Ellis
SW SW 22, 5N-12E



Newfield 1H-7 Sprague NE NW 7, 2N-11E

Monthly Gas Production (MCF)



Devon 1-20H Billie Jean
NW NW 20, 3N-11E

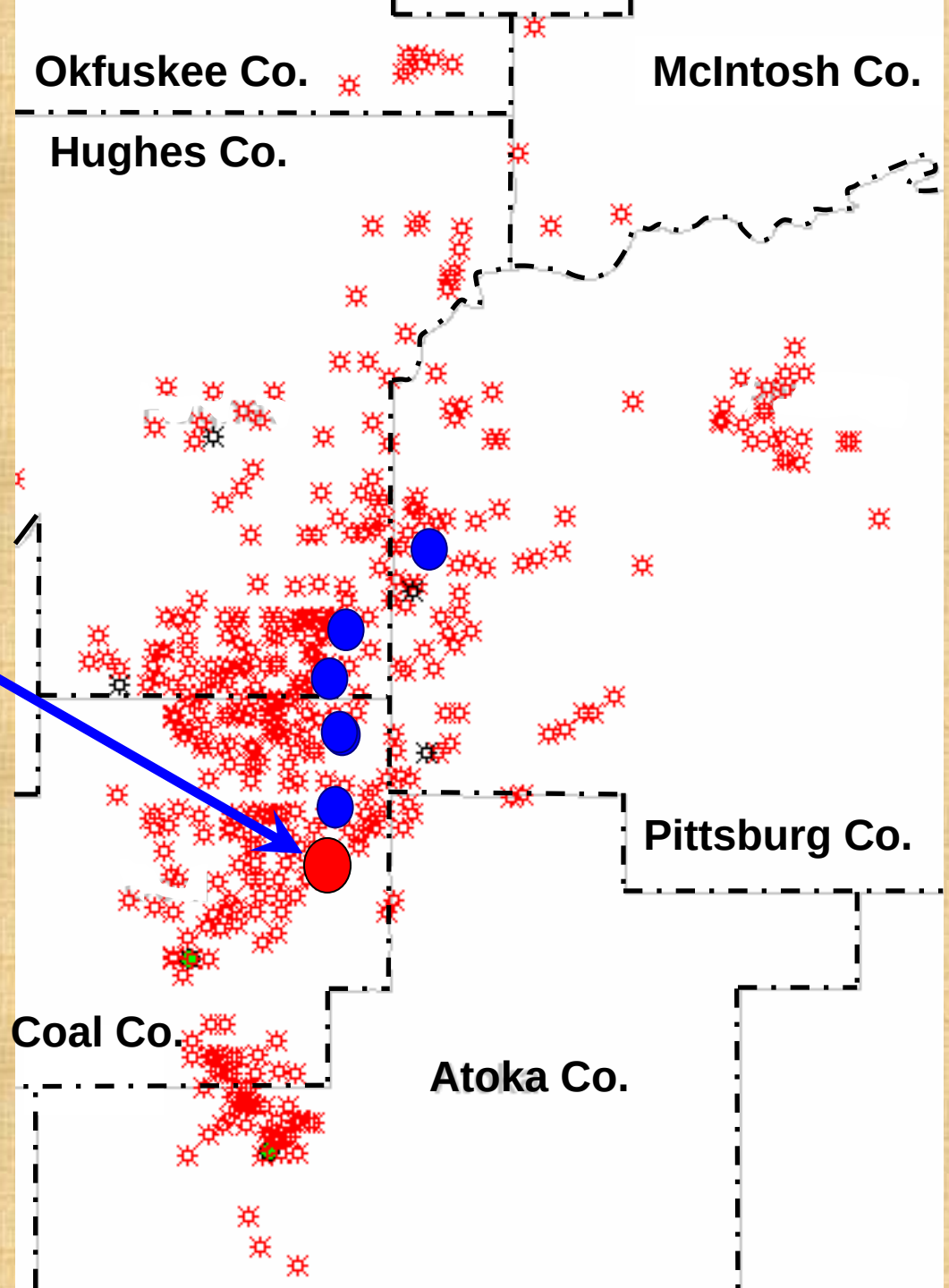
Newfield 1H-7 Sprague
NE NW 7, 2N-11E

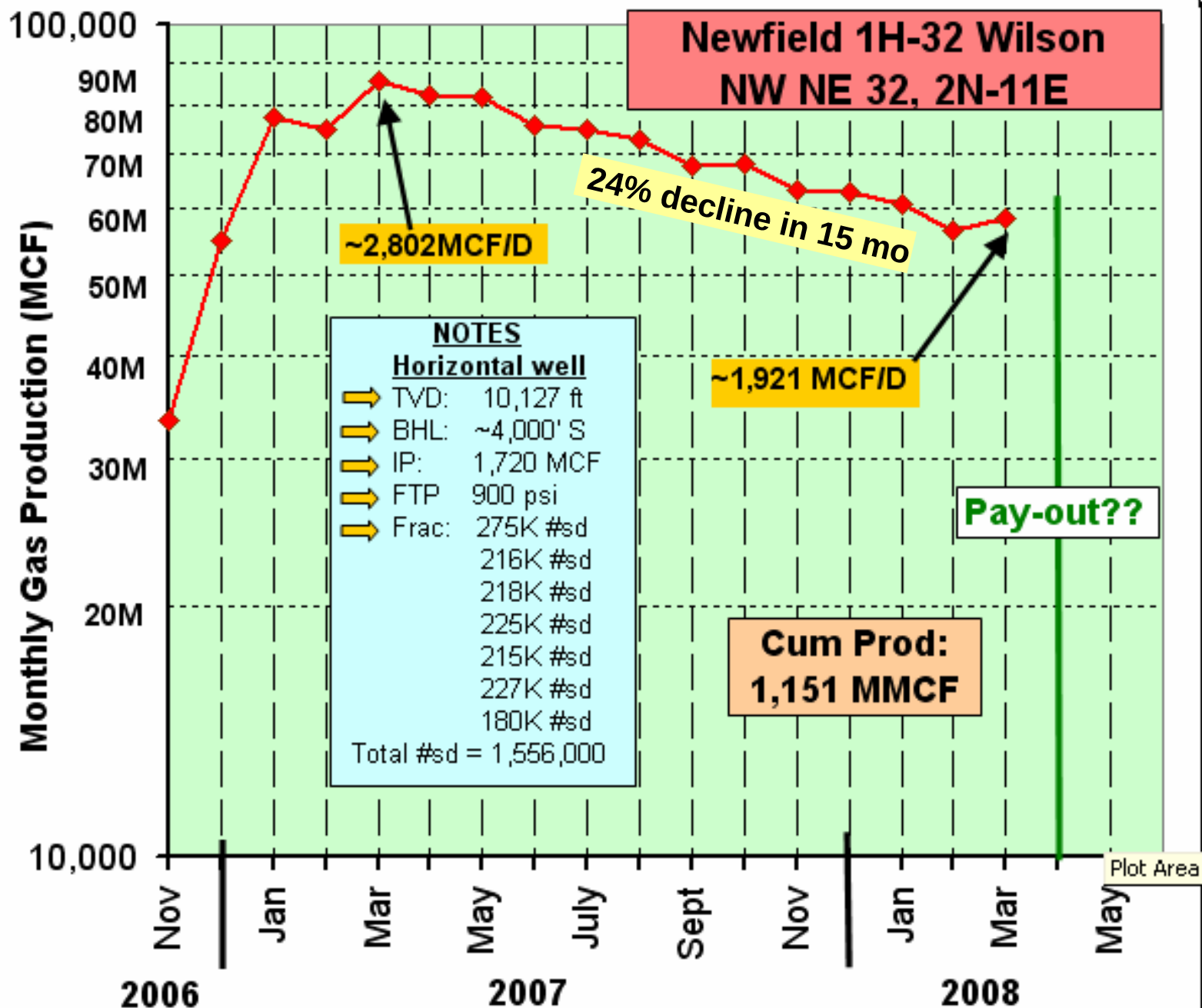
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NE NE 20, 4N-11E

Newfield 2H-31 Patterson
SE SW 31, 4N-11E

Newfield 4H-22 Sherman Ellis
SW SW 22, 5N-12E





Devon 1-20H Billie Jean
NW NW 20, 3N-11E

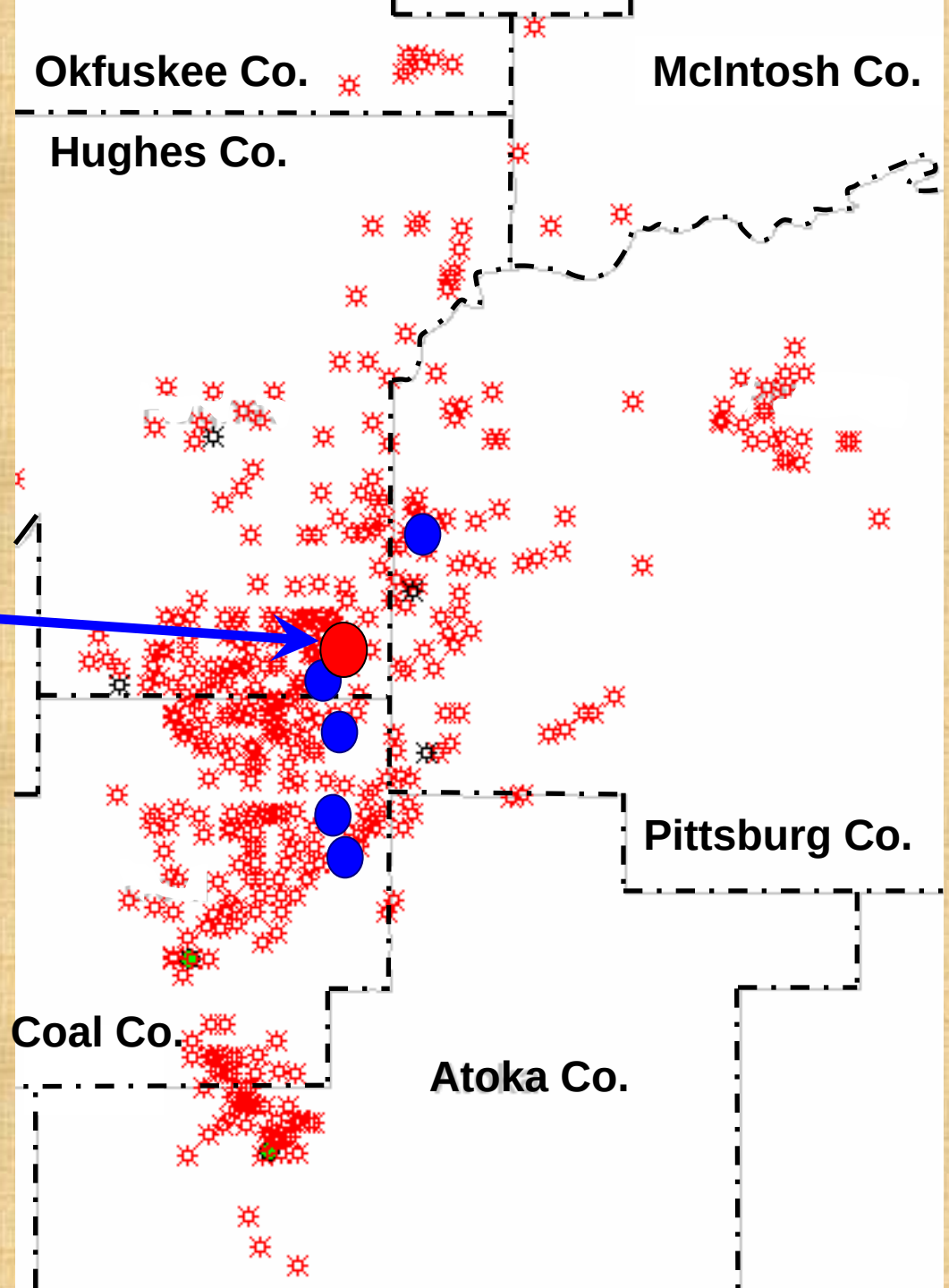
Newfield 1H-7 Sprague
NE NW 7, 2N-11E

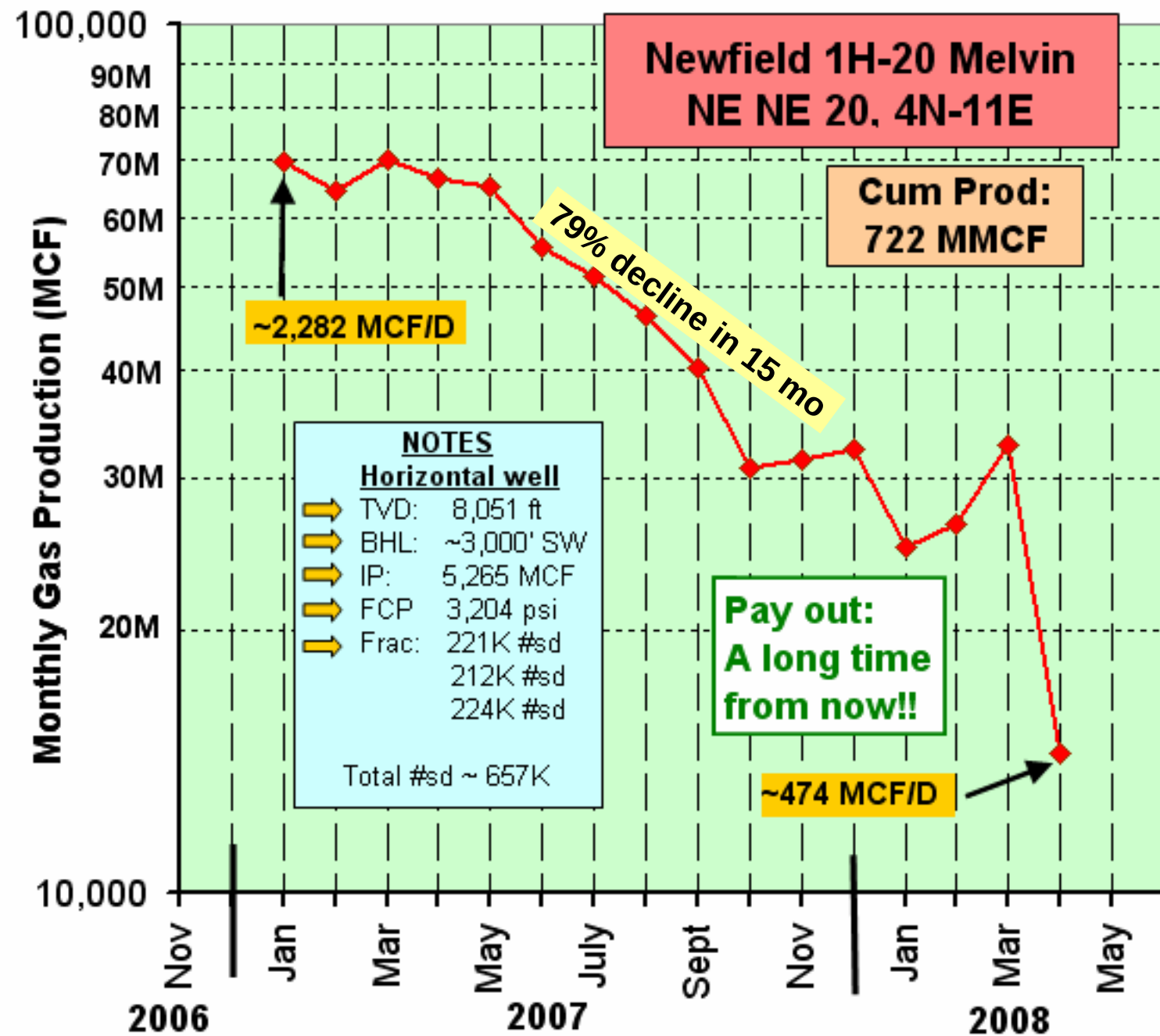
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SE SW 31, 4N-11E

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SW SW 22, 5N-12E





Devon 1-20H Billie Jean
NW NW 20, 3N-11E

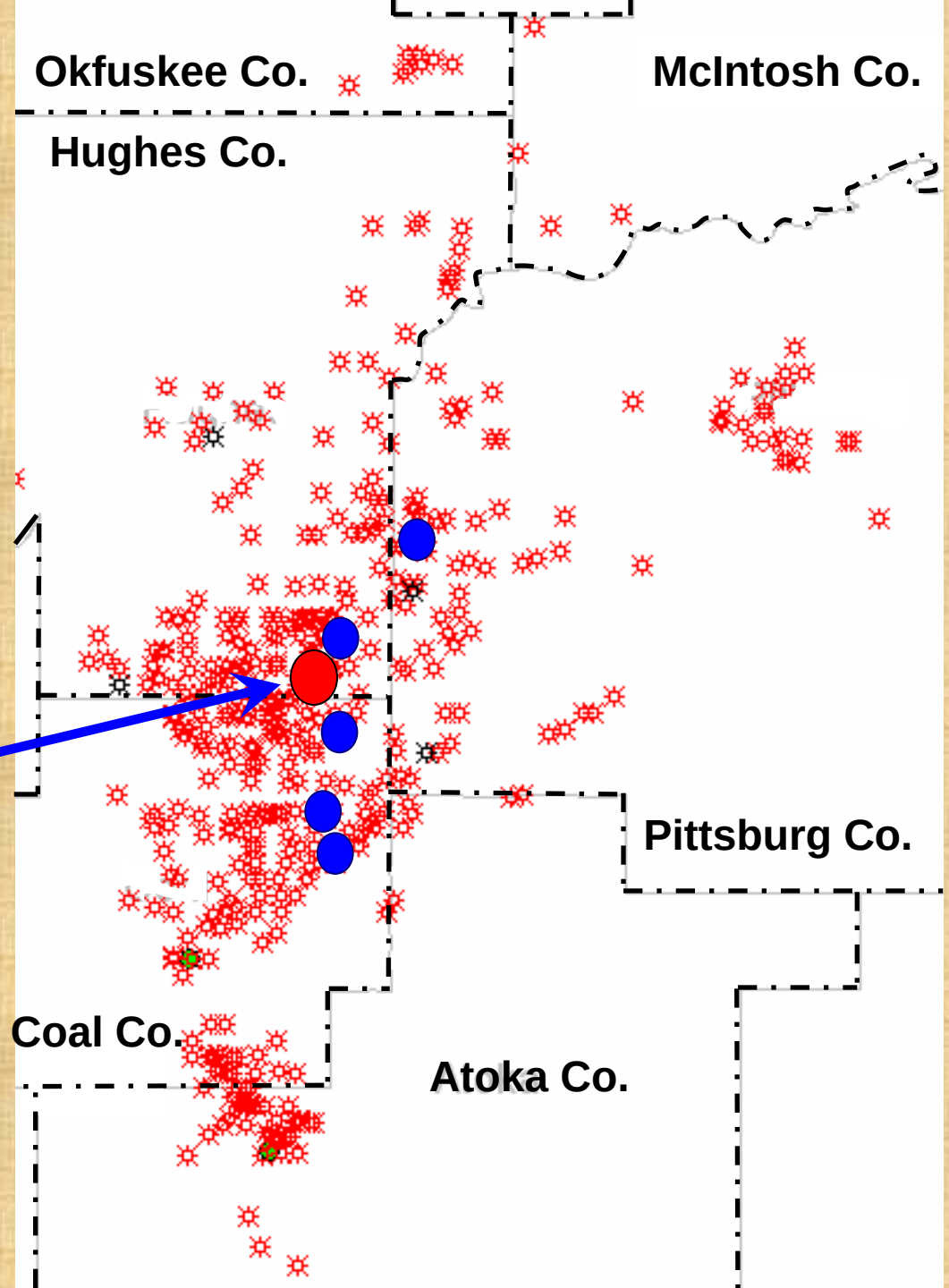
Newfield 1H-7 Sprague
NE NW 7, 2N-11E

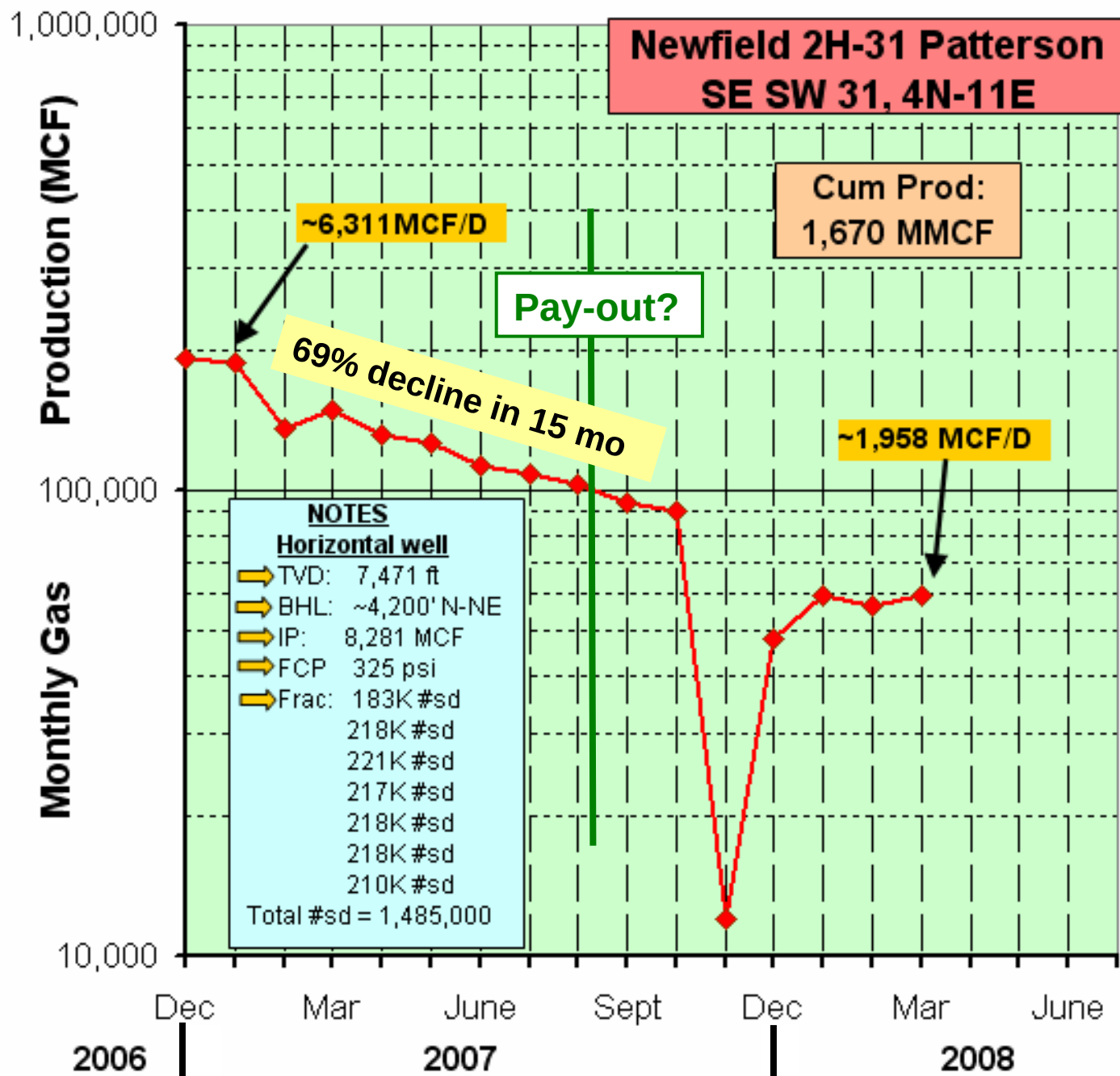
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Devon 1-20H Billie Jean
NW NW 20, 3N-11E

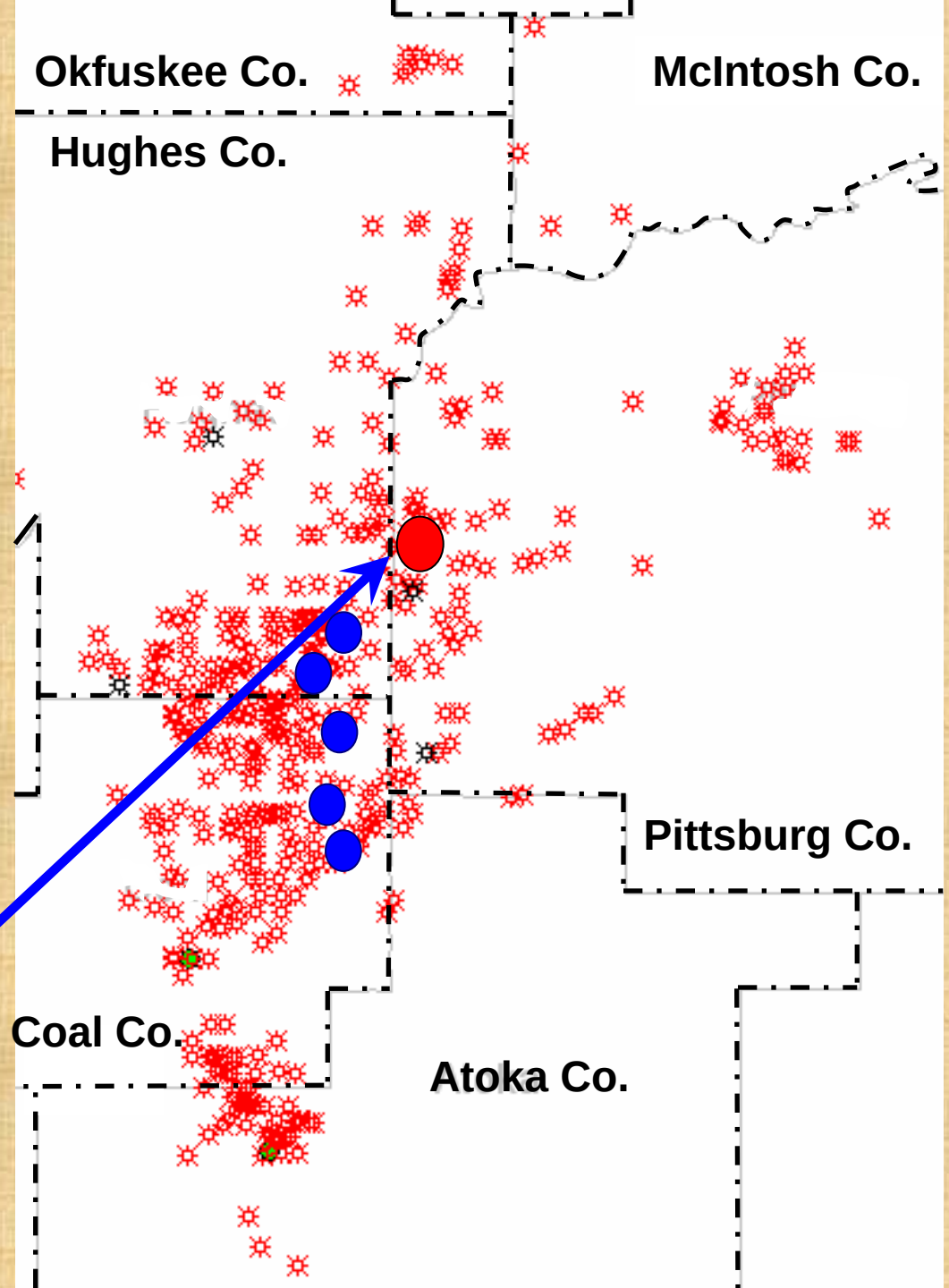
Newfield 1H-7 Sprague
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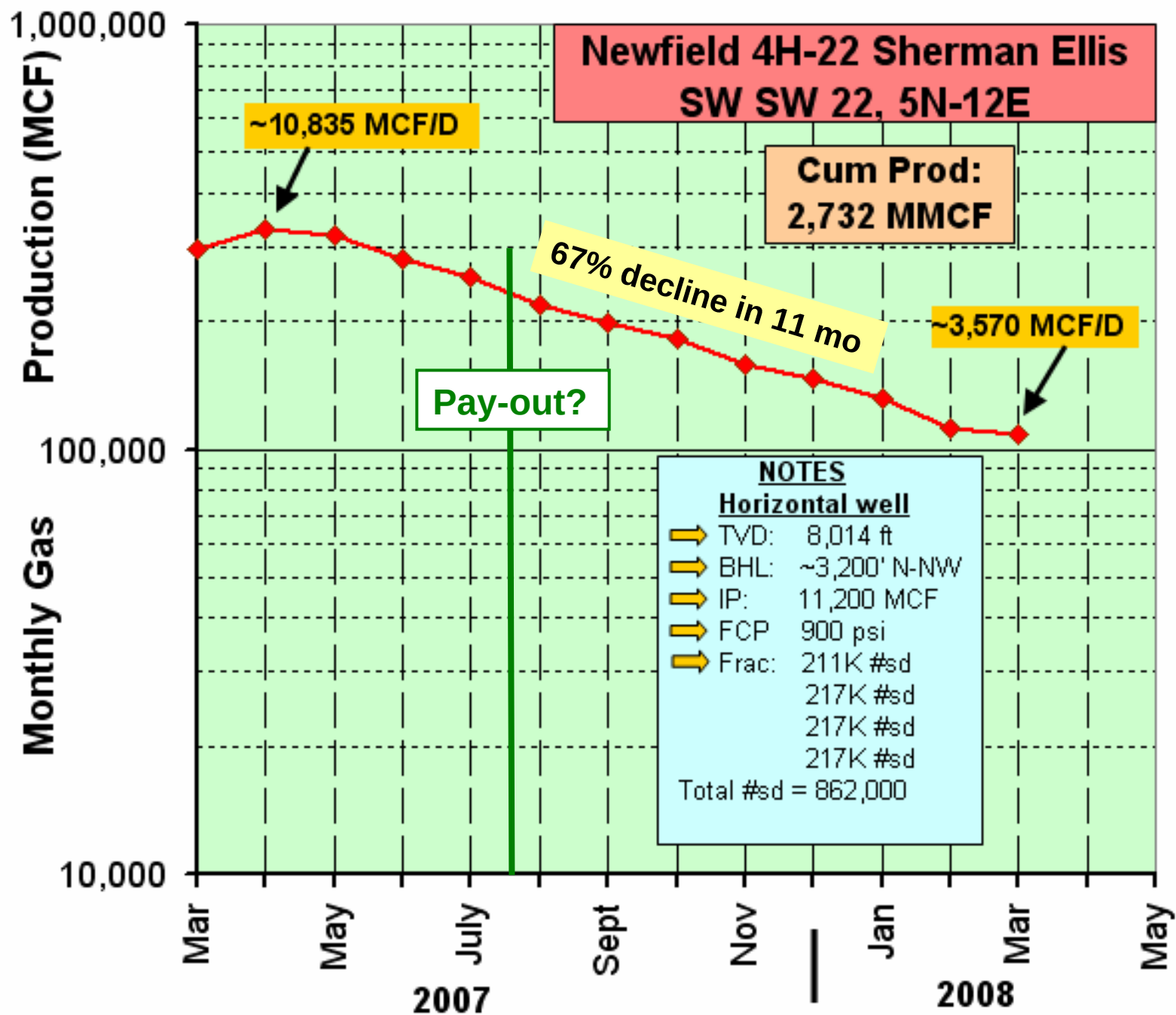
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SW SW 22, 5N-12E





NYMEX Henry- Hub natural Gas Prices - 12 previous months

