

# CHEROKEE PLATFORM & NEMAHA FAULT ZONE OKLAHOMA

Suzanne M. Rogers  
March 7, 2012

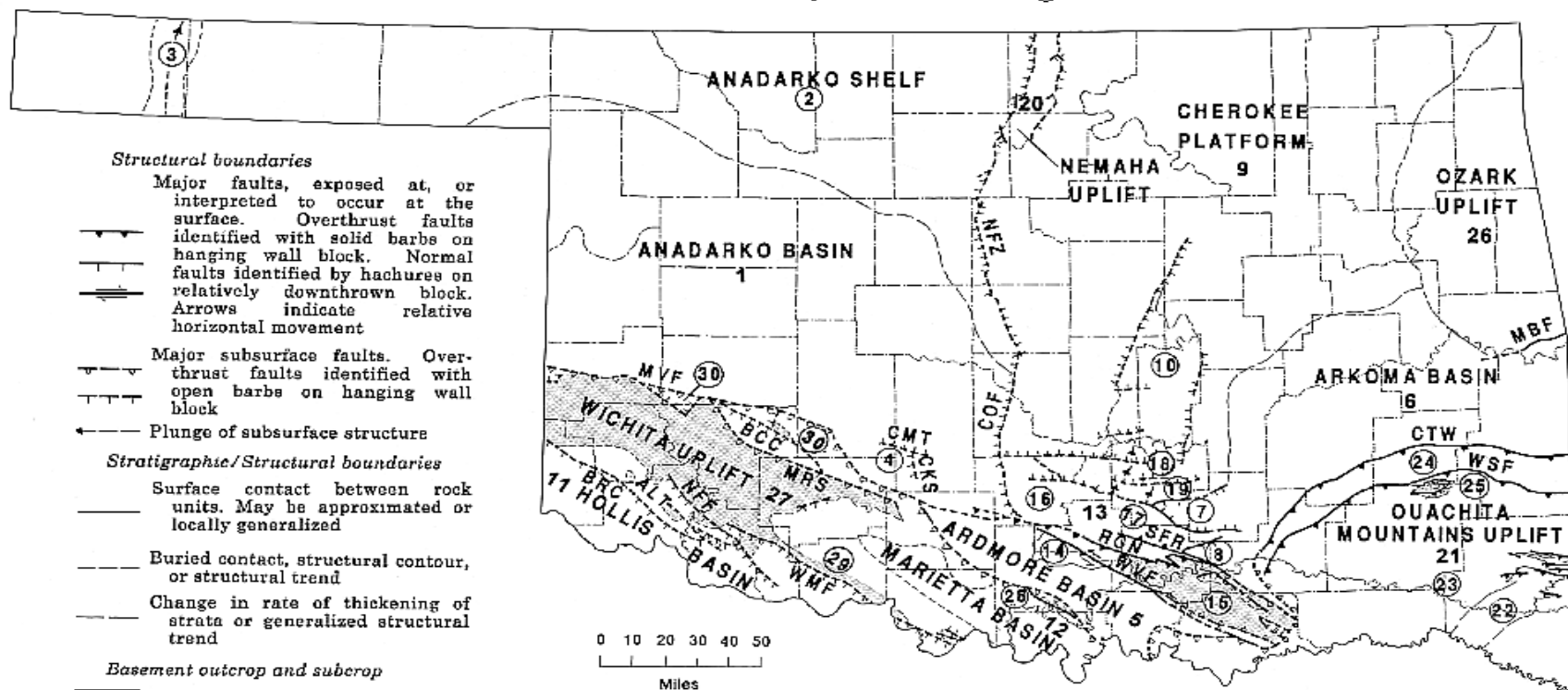
# OUTLINE

- Structure
- Stratigraphy
- Oil & Gas Production
- Summary
- References
- Suggested Reading

# GEOLOGIC PROVINCES OF OKLAHOMA

Robert A. Northcutt and Jock A. Campbell

- |  |  |  |
|--|--|--|
| <p>1 <b>Anadarko Basin</b></p> <p>② Anadarko Shelf</p> <p>③ Cimarron Arch</p> <p>④ Cyril Basin</p> <p>5 <b>Ardmore Basin</b></p> <p>6 <b>Arkoma Basin</b></p> <p>⑦ Franks Graben</p> <p>⑧ Wapanucka Graben</p> <p>9 <b>Cherokee Platform</b></p> <p>⑩ Semonole Structure</p> | <p>11 <b>Hollis Basin</b></p> <p>12 <b>Marietta Basin</b></p> <p>13 <b>Arbuckle Uplift</b></p> <p>⑭ Arbuckle Mountains</p> <p>⑮ Tishomingo-Belton Horst</p> <p>⑯ Pauls Valley-Hunton Horst</p> <p>⑰ Clarita Horst</p> <p>⑱ Ada High</p> <p>⑲ Lawrence Horst</p> <p>20 <b>Nemaha Uplift</b></p> | <p>21 <b>Ouchita Mountain Uplift</b></p> <p>⑳ Broken Bow Uplift</p> <p>㉑ Ouachita Central Region</p> <p>㉒ Ouachita Frontal Thrust Belt</p> <p>㉓ Potato Hills</p> <p>26 <b>Ozark Uplift</b></p> <p>27 <b>Wichita Uplift</b></p> <p>㉔ Criner Uplift</p> <p>㉕ Waurika-Muenster Uplift</p> <p>㉖ Wichita Frontal Fault Zone</p> |
|--|--|--|



## MAJOR FAULT BOUNDARIES

ALT Altus Fault  
 BCC Blue Creek Canyon Fault  
 BRC Burch Fault  
 CMT Cement Fault  
 CKS Chickasha Fault  
 CTW Choctaw Fault

COF Central Oklahoma Fault Zone  
 MRS Meers Fault  
 MVF Mountain View Fault  
 MBF Mulberry Fault  
 NFZ Nemaha Fault Zone

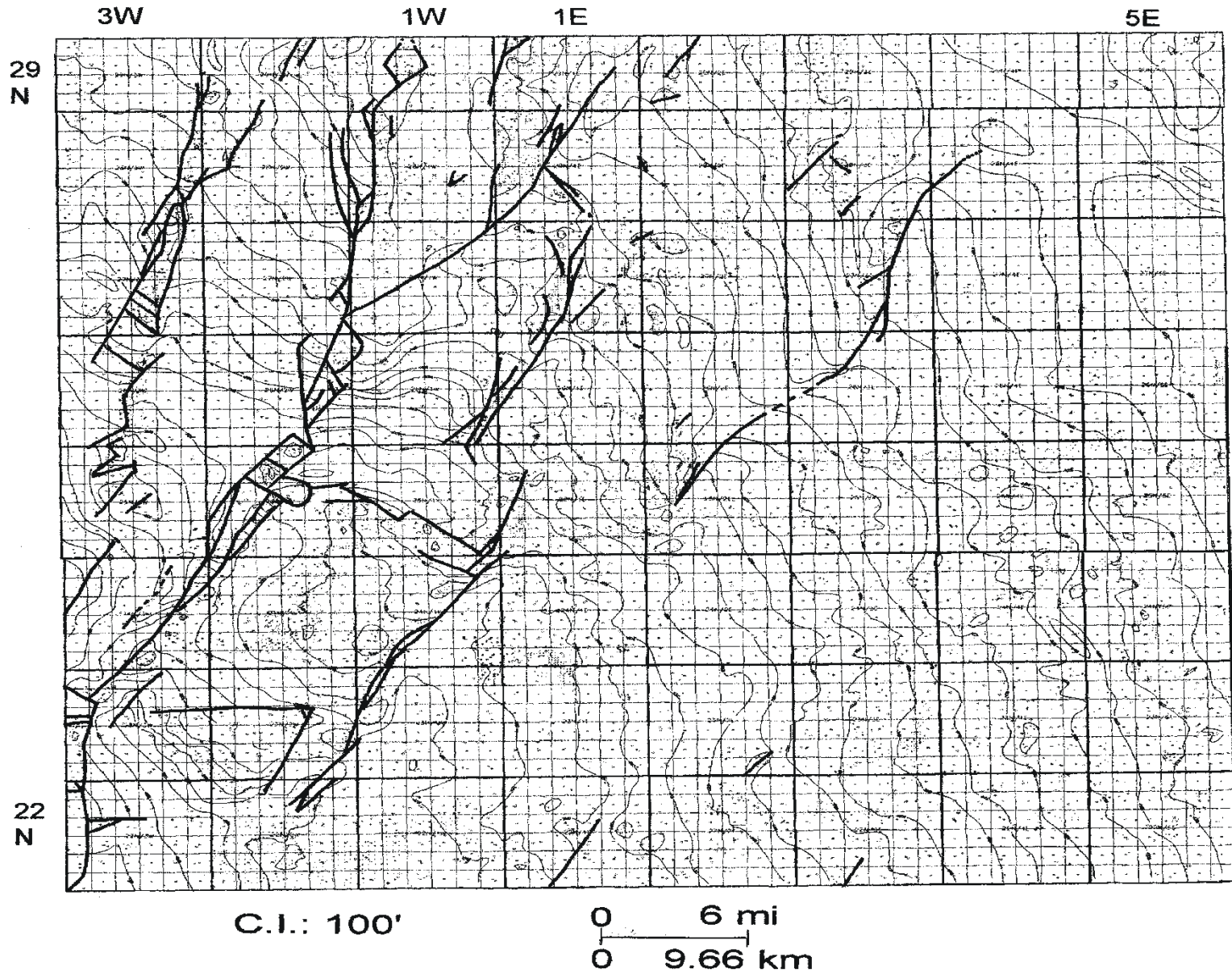
NFF North Fork Fault  
 RGN Reagan Fault  
 SFR Sulphur Fault  
 WVF Washita Valley Fault  
 WMF Waurika-Muenster Fault  
 WSF Windingstair Fault

# **Cherokee Platform & Nemaha Uplift**

- Faulted areas comprised of nearly vertical faults**
- Displacement varies from next to nothing to several hundred feet or more**
- Regional Dip: west-southwest from eastern portion of Platform to Nemaha Uplift**

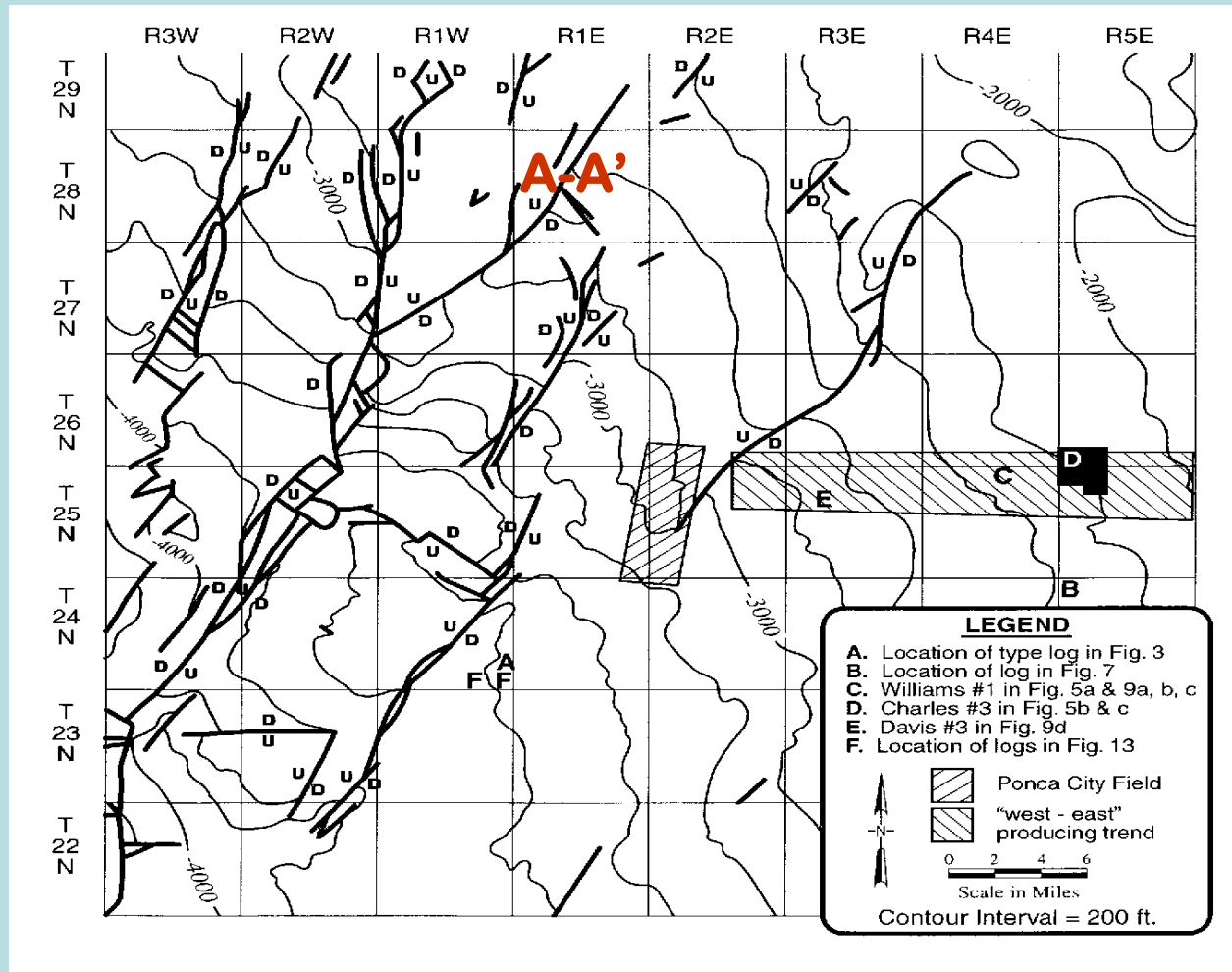


# Mississippi Structure Map



# STRUCTURE MAP

## TOP OF MISSISSIPPIAN



(From Rogers, 2001, Fig. 8)

**Subsurface Minerals Group**  
**Gingerich 17-1**  
**SW NW SE, Section 17-28N-1E**

**D.H. Mikkelsen  
Perez 1  
SE NE, Section 23-28N-1E**

**A'**  
**(East)**

## Top of Cherokee

**c. 12-10-05, TD 3422'  
Arbuckle, perfs 3220'-3422'  
IPF 160 BO, 150 MCF,  
10,000 BW**

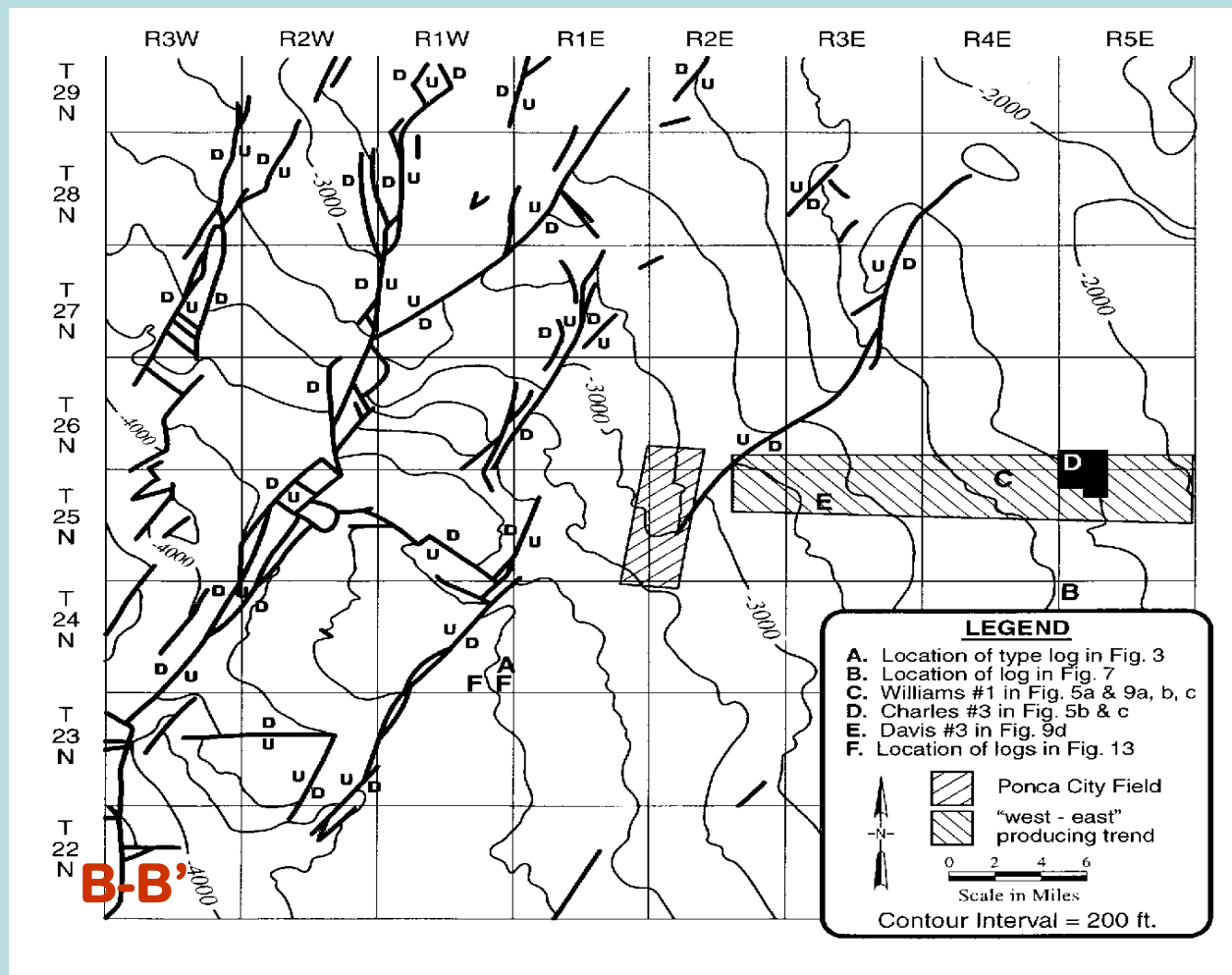
**c. 3-7-75, TD 3800'**  
**D & A**

## About 480' displacement at Cherokee

**Miss**

# STRUCTURE MAP

## TOP OF MISSISSIPPIAN



(From Rogers, 2001, Fig. 8)

**B**

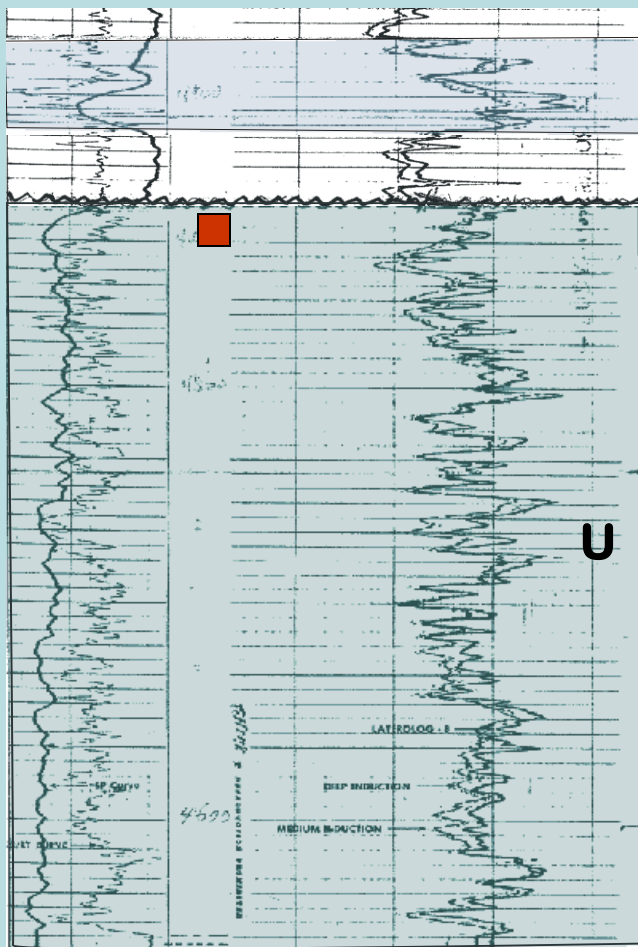
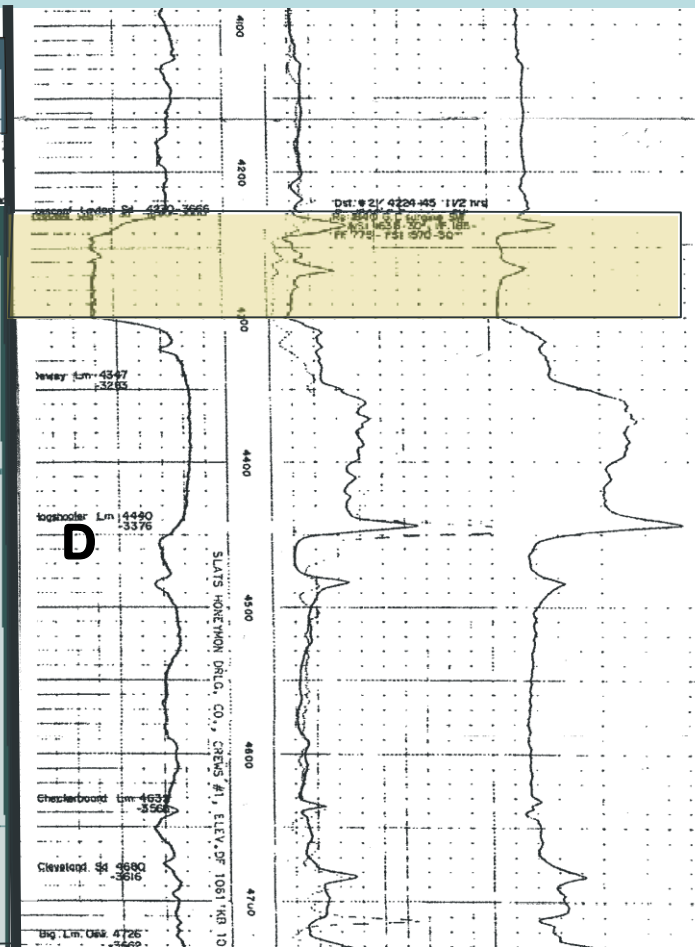
**Atlantic Richfield  
RM Hartley 67**

**S/2 NW NW NW Sec. 18-22N-3W  
Garfield**

**Slats Honeymon Drlg**

**L.E. Crews #1**

**NE NE SE, Sec 19-22N-3W  
Garfield Co.**

**B'****Oswego****Arbuckle****U****D****Layton**

**c. 4-10-79, TD 4700'  
IPP Arbuckle 72 BO, 63 MCF**

**c. 12-9-57, TD 5958'  
D & A**



**B'**

# Oswego

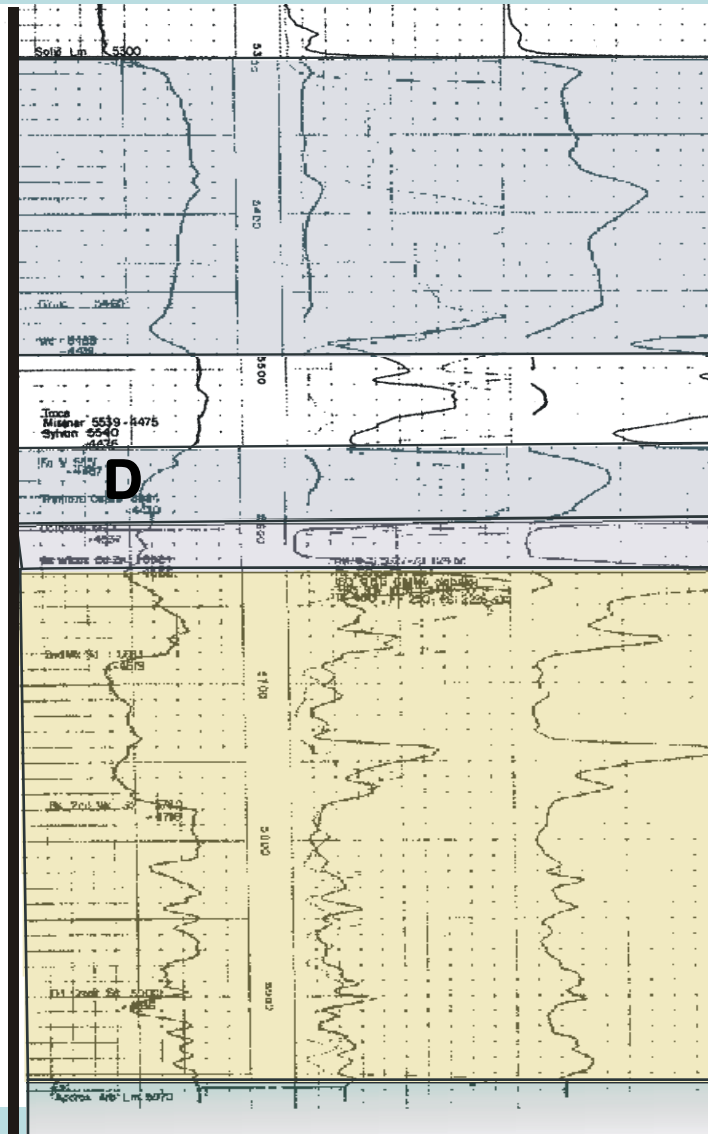
# Miss Chat

Miss Lm

U

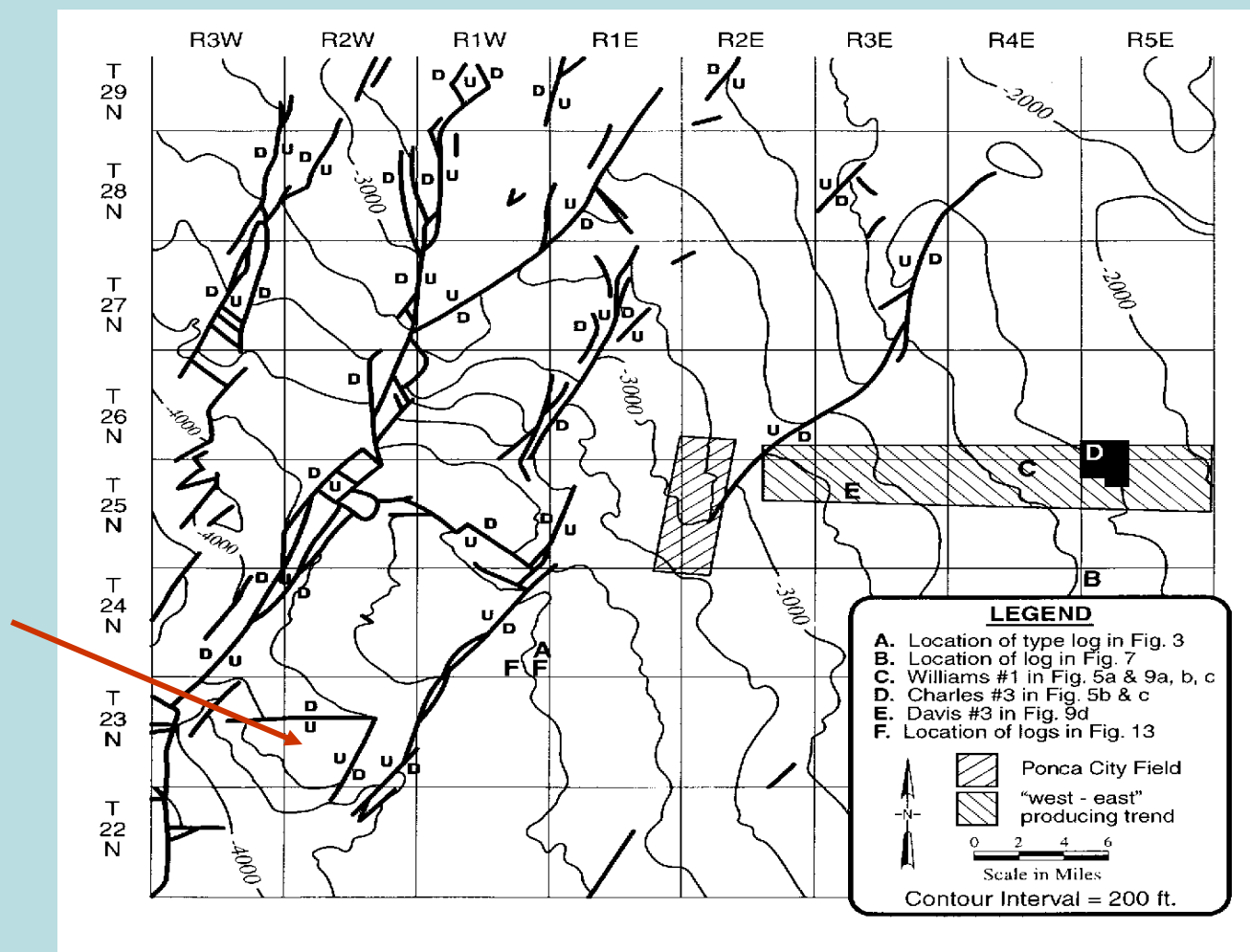
D

**Downthrown side: approx 200'  
Mississippi Chat**

**B****RM Hartley 67****L.E. Crews #1****B'****U****D****Miss Lm****Wdfd  
Sylvan****Viola  
Smp Dolo****Wilcox  
zone****Oil Creek****Arbuckle  
5970'****Displacement is 1270' on Arbuckle**

# STRUCTURE MAP

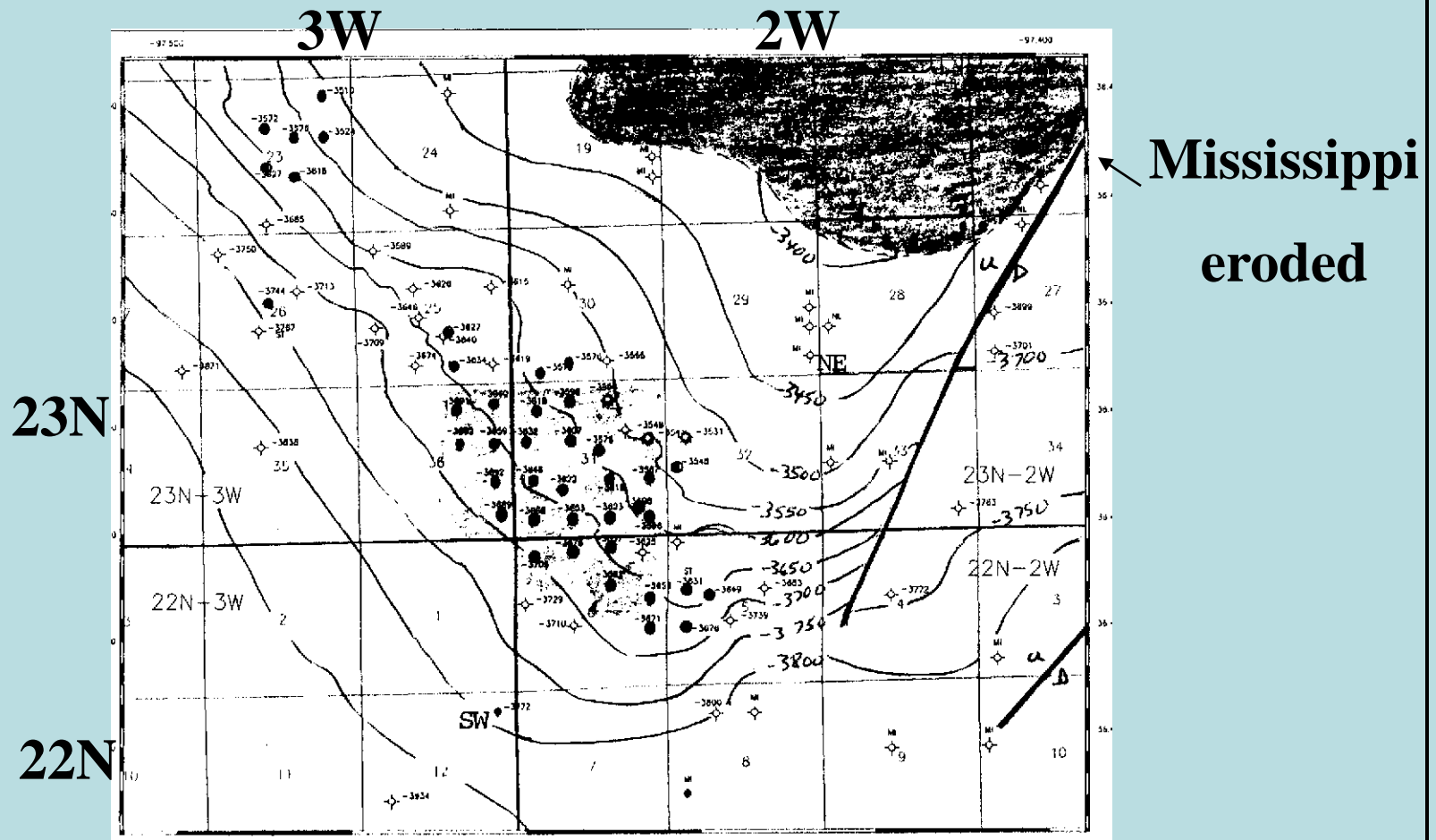
## TOP OF MISSISSIPPIAN



(From Rogers, 2001, Fig. 8)

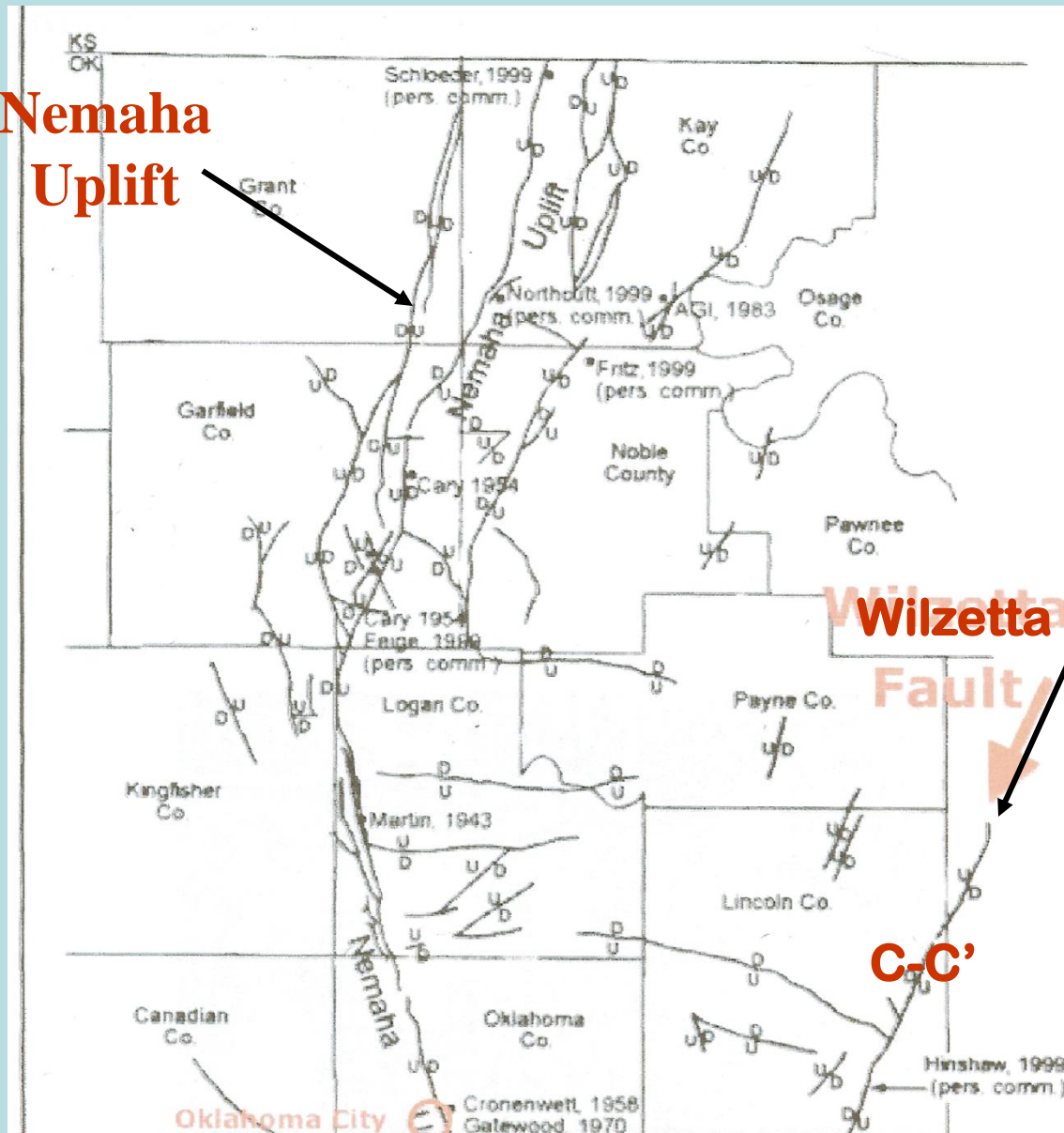


# NW ANTELOPE STRUCTURE



Mississippi Chat cum: 2.3 BCF & 715,755 BO  
to date including unit production

**Nemaha  
Uplift**



**Wilzetta Fault**

**C-C'**

**From Gay, 2003, as taken from Gatewood, 1983**

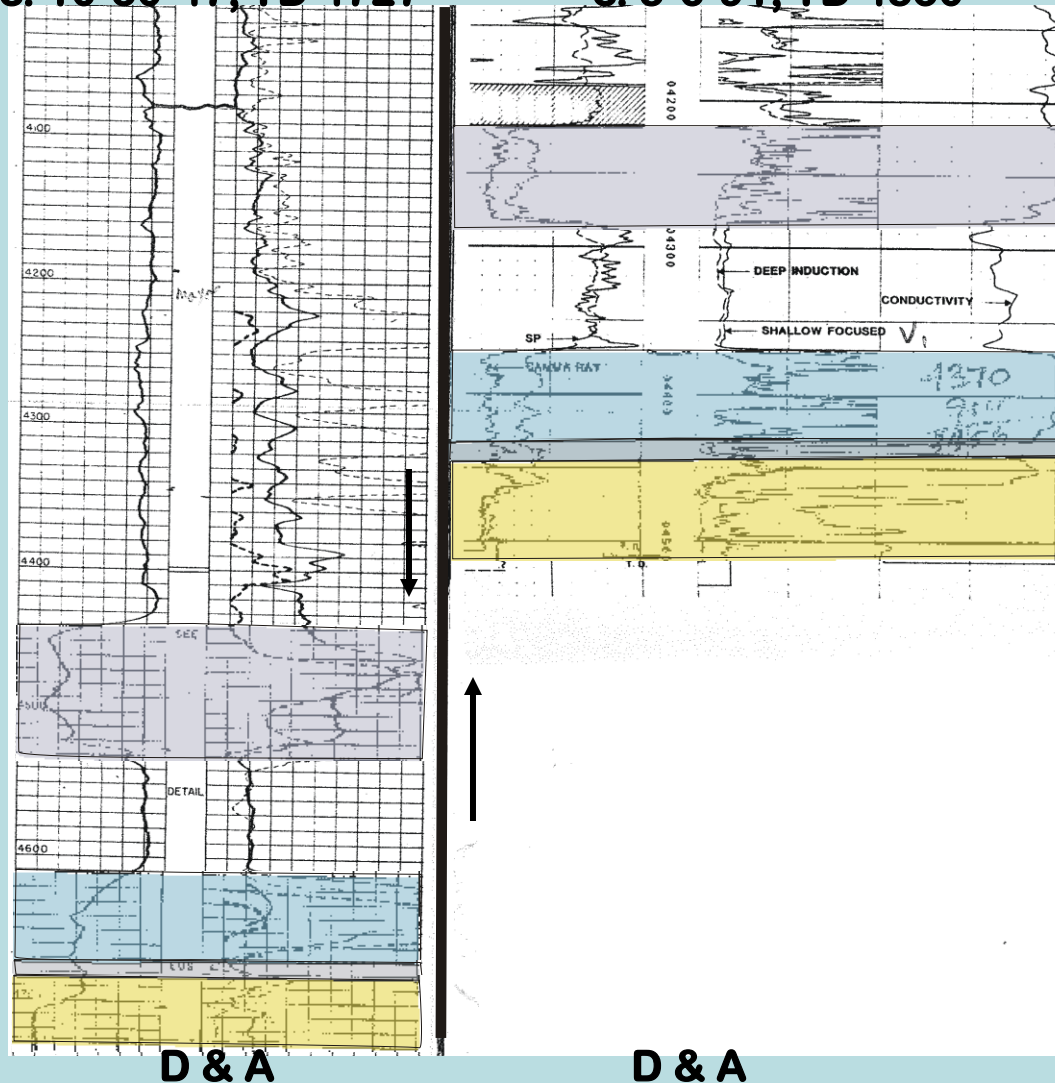
**C**  
(West)

**Barrett & Mayo  
Grimes 1  
NW NW NW  
Section 7-13N-6E  
c. 10-30-47, TD 4727'**

**Keener Oil  
Weimer 1  
NE SE SE**

**Section 7-13N-6E  
c. 5-6-91, TD 4530'**

**C'**  
(East)



**Hunton**

**Viola  
Smp Dolo  
Wilcox**

**Displacement is  
approx 220' on  
top of Hunton**

**Hunton**

**Viola  
Smp Dolo  
Wilcox**

**D & A**

**D & A**

# **STRATIGRAPHY**

- **Same basic stratigraphic column**
- **Unconformities abound from Top of Cherokee to TD**
- **Penn sands trend from N/NE to S/SW –source to N/NE**

# Stratigraphic Column

<b>Permian</b>	<b>Wolfcampian</b>	Hotson/Kisner Neva Lime Red Eagle Lime
<b>Pennsylvanian</b>	<b>Virgilian</b>	Campbell Sams Vertz Newkirk Hoover Elgin Carmichael Endicott Tonkawa

# Stratigraphic Column

## Pennsylvanian

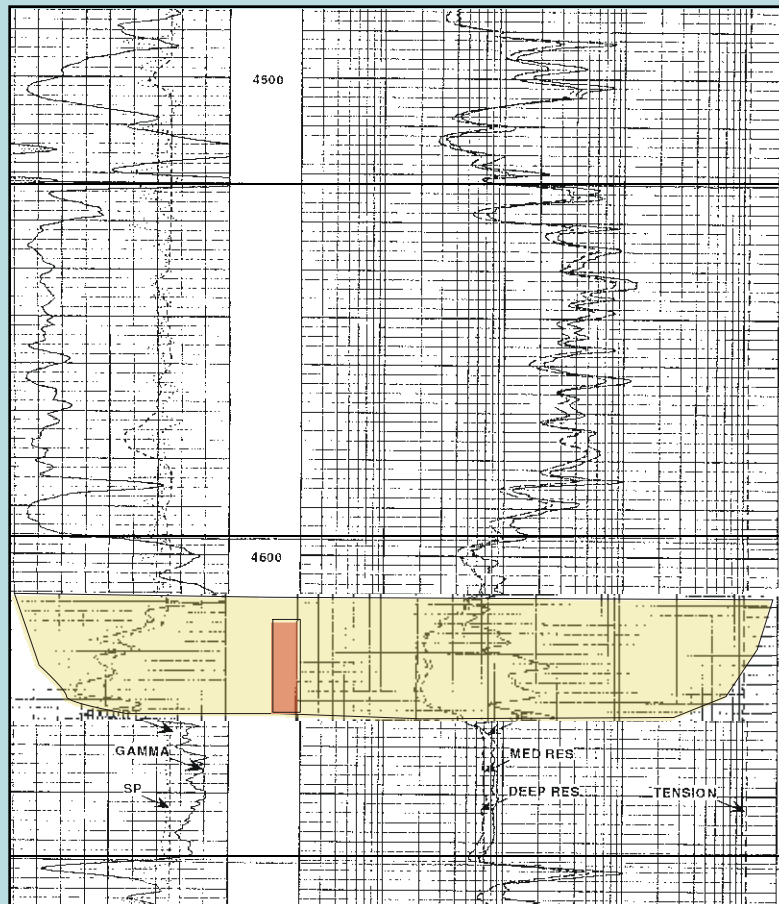
### Missourian

Perry Gas  
Cottage Grove  
Layton  
Cleveland

### Des Moinesian

Peru  
Oswego  
Prue  
Skinner-north platform  
Senora - south platform  
Red Fork  
Bartlesville  
Booch in south platform

**Sentinel Petroleum, Inc.**  
**Flash #1**  
**NE NE, Section 23-15N-1E**  
**Logan County, OK**



**Oswego**

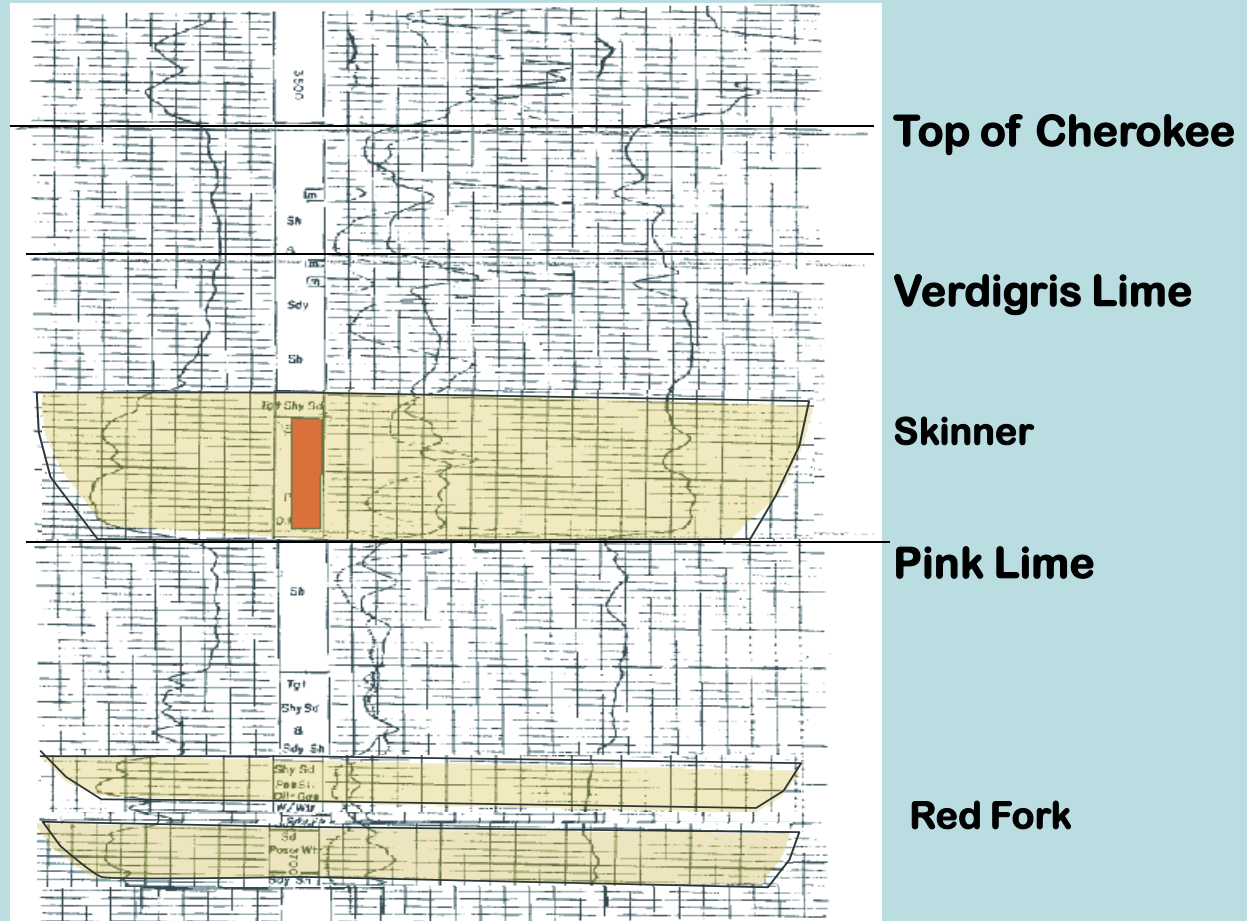
**Top Of Cherokee**

**Prue Sand**

**Verdigris**

**c. 4-15-99, TD 5200'**  
**IPP Prue 20 BOPD, 4 BW**  
**Cum to date: 30,816 BO**

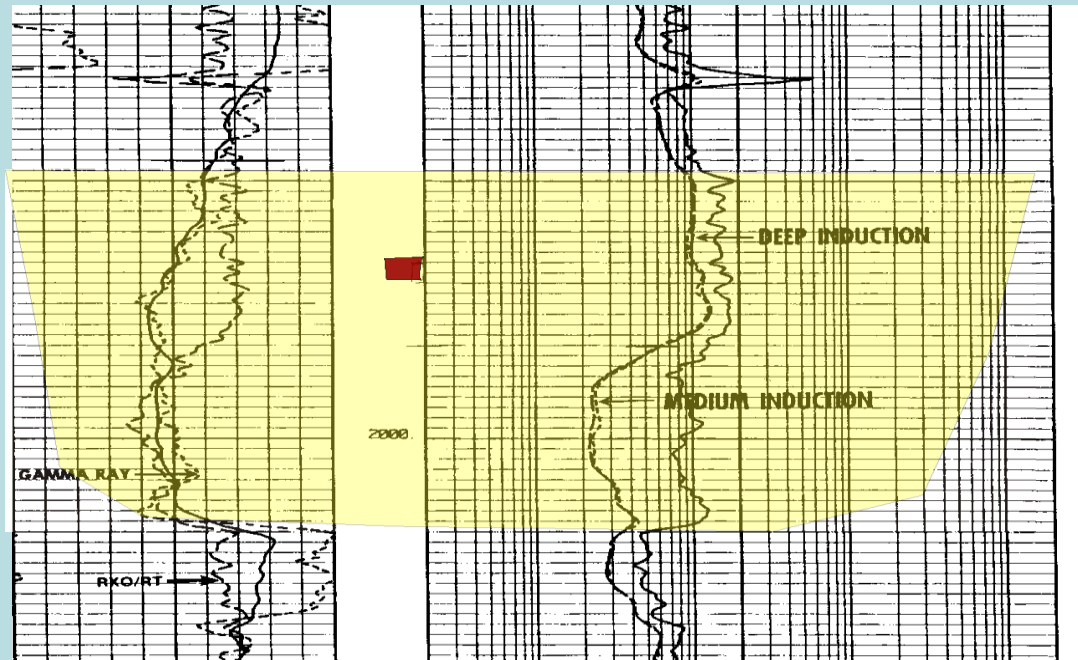
**Schermerhorn Oil Co.**  
**Tune 3**  
**NW NW NW, Section 24-27N-1E**  
**Kay County ,OK**



**c. 6-3-56, TD 3708'**  
**IPF Skinner 243 BOPD, NW**  
**no cum available**



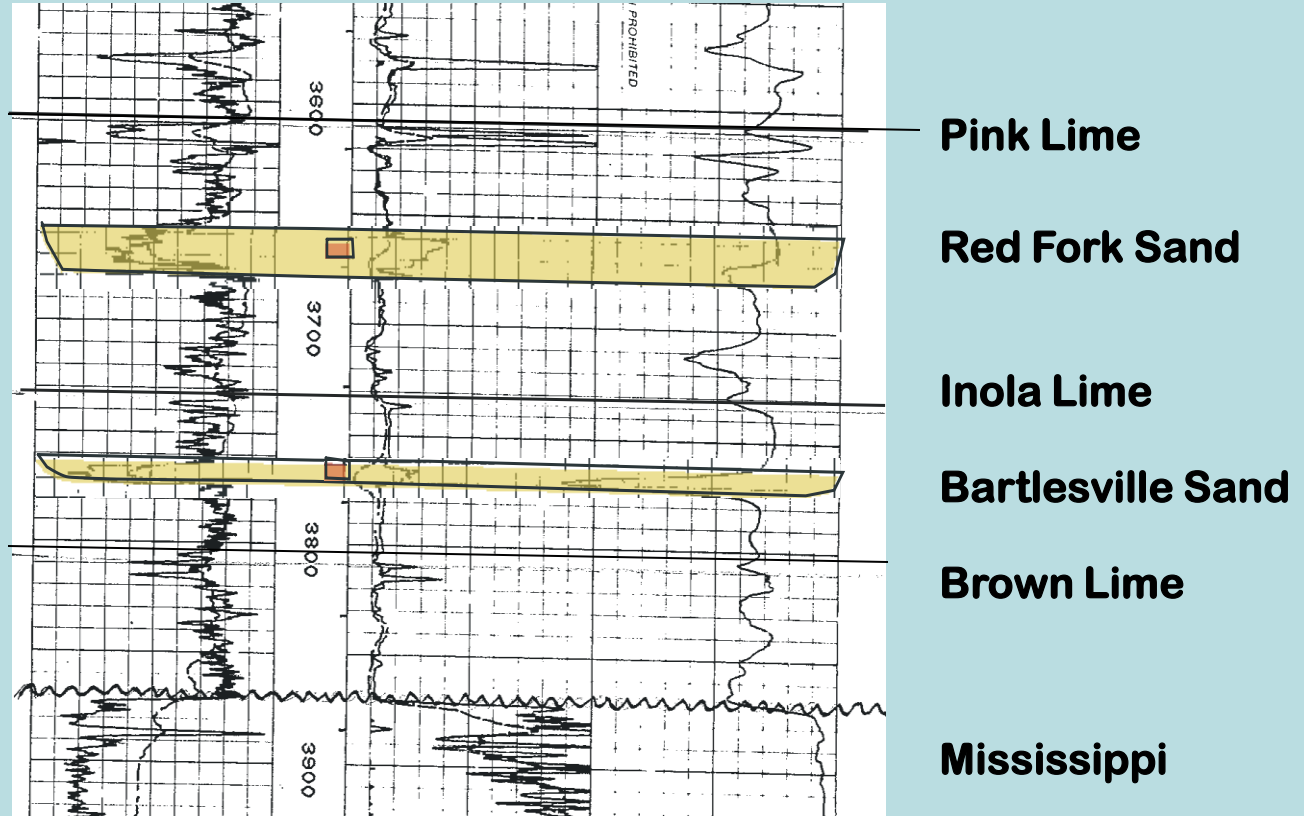
**Sentinel Petroleum, Inc.  
Deer #1  
SE SE SW, Section 34-10N-8E  
Seminole County, OK**



**Senora Sand**

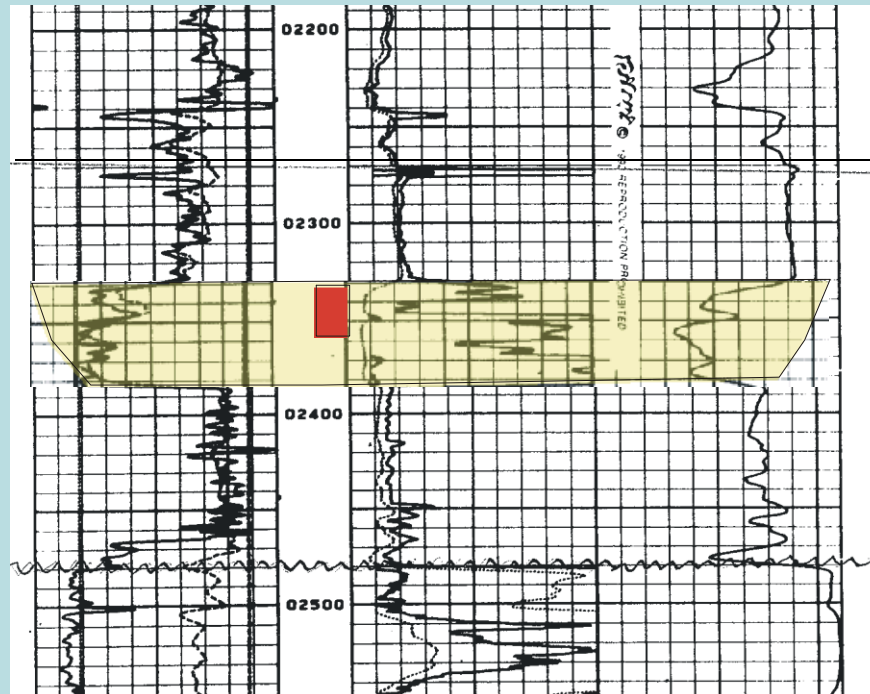
**c. 5-27-83, TD 2079'  
Perf 1966-1970'.  
IPF 230 BOPD, 115 MCFD, NW  
Cum to 184,413 BO, 58,707 MCF  
Current: 5 BOPD, 20 BW**

**Garfield Resources  
Mighty Mouse #1  
SE SE NE, Section 9-18N-4E  
Payne County, OK**



**C. 8-27-84, TD 4185'**  
**IPF Red Fork 700 BOPD, 500 MCFD, 80 BW**  
**Tested Bvl: 5 MCFD & Viola 3 BIPD, 10 MCFD & 60 BWPD**  
**Cum thru June 2011: 84,584 BO**

**Petroleum Resources  
28-3 Mills  
SE SW NE, Section 28-21N-9E  
Osage County, OK**



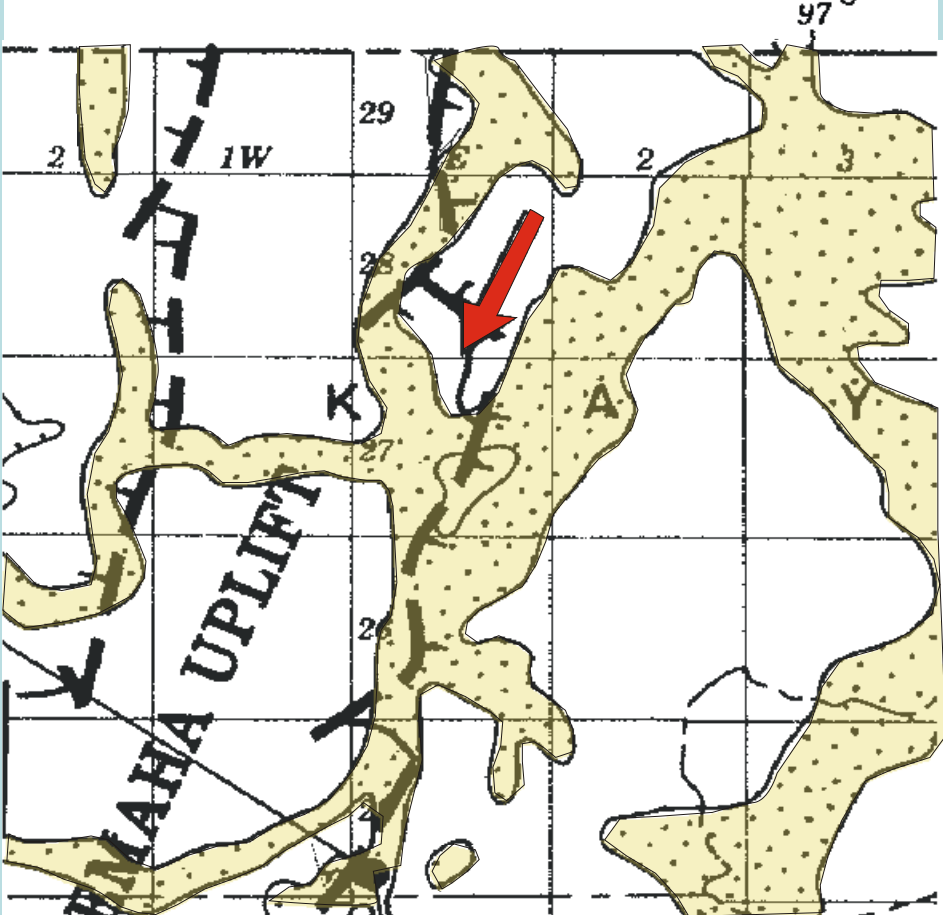
**Inola**

**Bartlesville Sand**

**Mississippi**

**c. 3-18-86, TD 2840'  
IPP Bartlesville 47 BOPD, trace gas, 94 BW  
2 wells made 4,046 BO  
Production should be verified at Pawhuska**

## Lower Red Fork Fluvial Dominated Deltaic Sands Kay County



**(From Andrews, 1997, Plate 1)**

# Stratigraphic Column

**Pennsylvanian**

**Atokan**

**Absent - north platform  
Gilcrease & Dutcher -  
south platform**

**Morrowan**

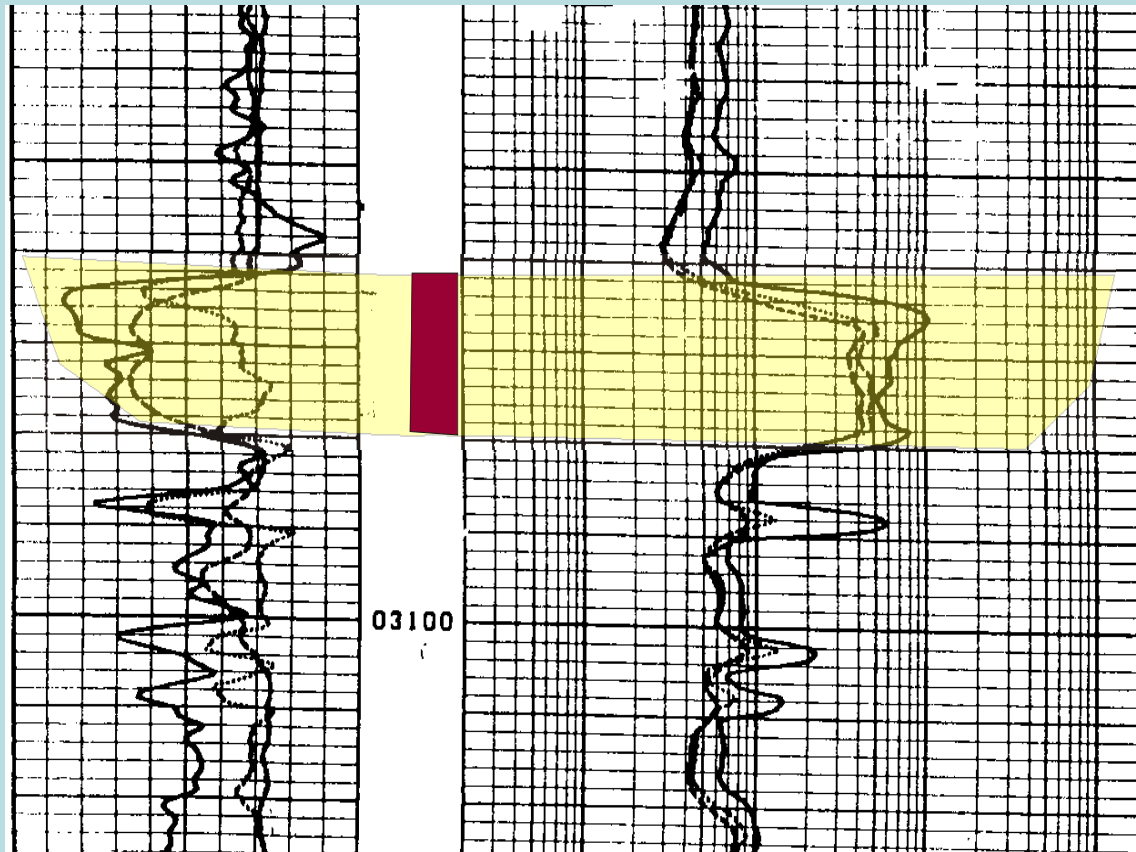
**Absent - north platform  
Cromwell - south platform**

**Mississippian**

**Osagean**

**Mississippi Chat  
Mississippi Lime**

**Sentinel Petroleum, Inc.  
Thlocco #4(aka Berryhill #1)  
NE SW SW, Sec. 6-9N-9E  
Seminole County, OK**



**Upper  
Gilcrease**

**c. 1-25-85, TD 3355'  
IPF 35 BO, 40 MCF, 10 BW  
Cum: 99,254 BO & 258,553 MCF  
(inc enhanced recovery oil)**

# Stratigraphic Column

**Pennsylvanian**

**Atokan**

**Absent - north platform  
Gilcrease & Dutcher -  
south platform**

**Morrowan**

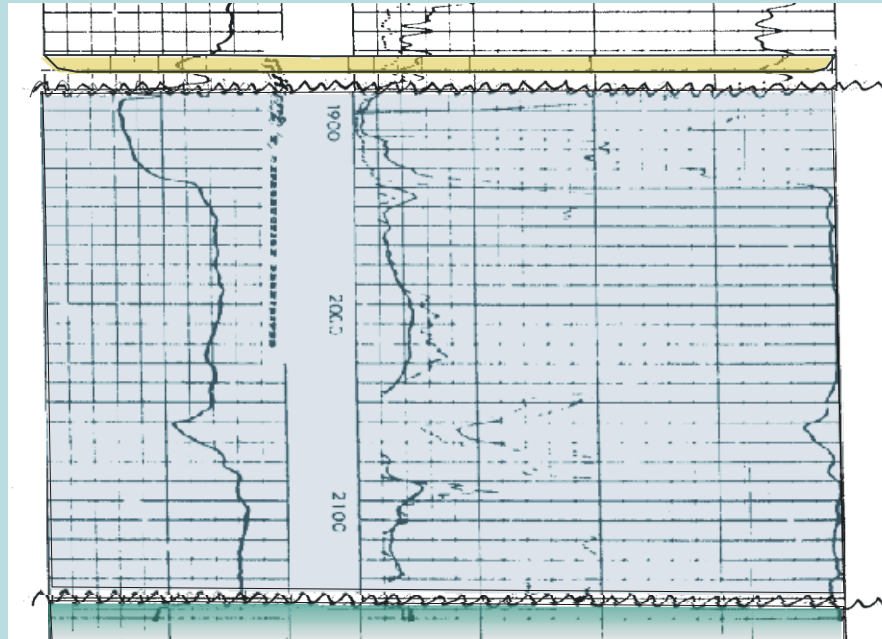
**Absent - north platform  
Cromwell - south platform**

**Mississippian**

**Osagean**

**Mississippi Chat  
Mississippi Lime**

**George Wallace  
Osage 9-1  
SE SW, Section 9-25N-11E  
Osage County, OK**



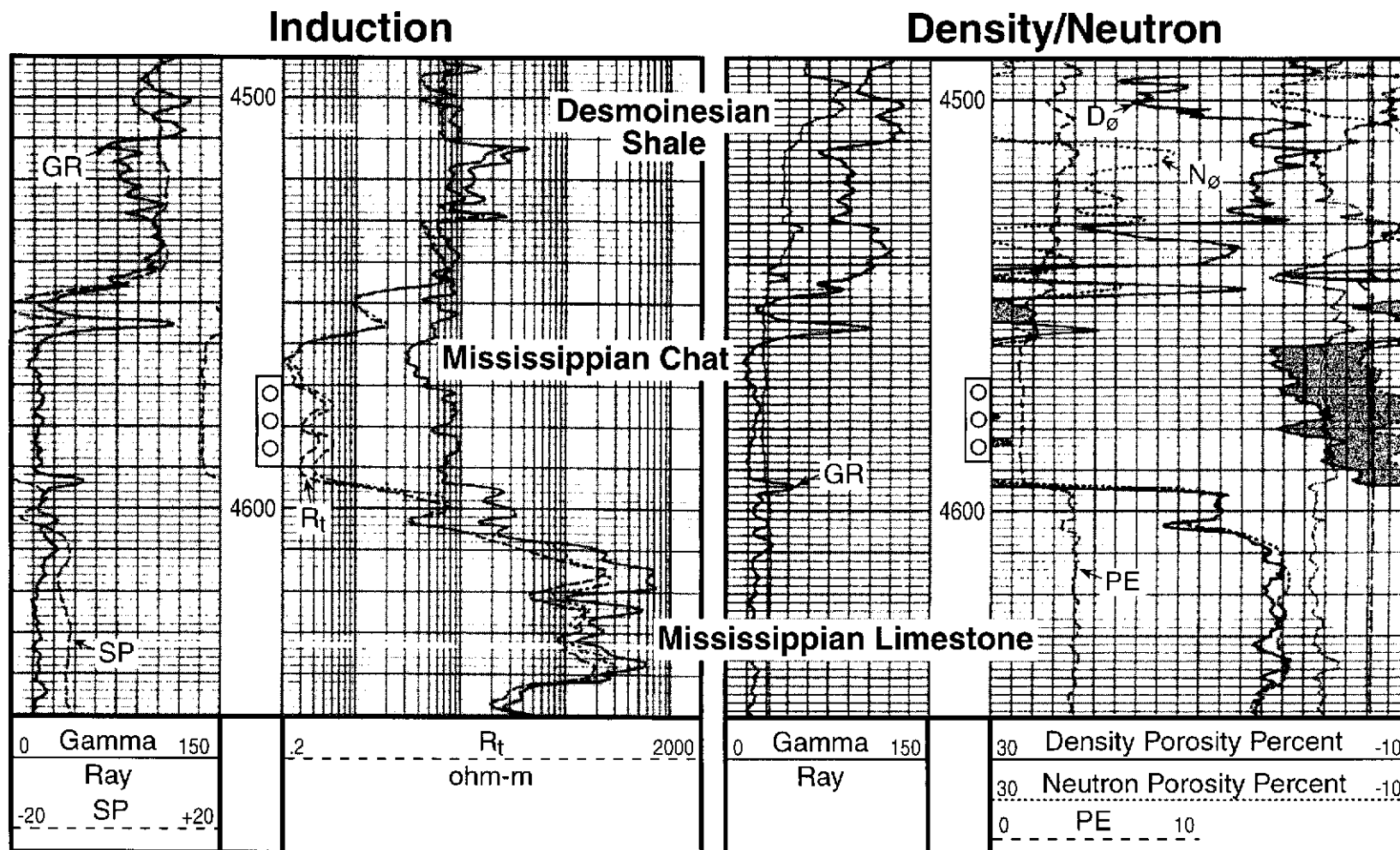
**Burbank Sand  
Mississippi**

**Arbuckle**

**c. 2-25-74, TD 2163'  
IP Arbuckle, COF 7000 MCFD  
Cum not reported on IHS, verify in  
Pawhuska**



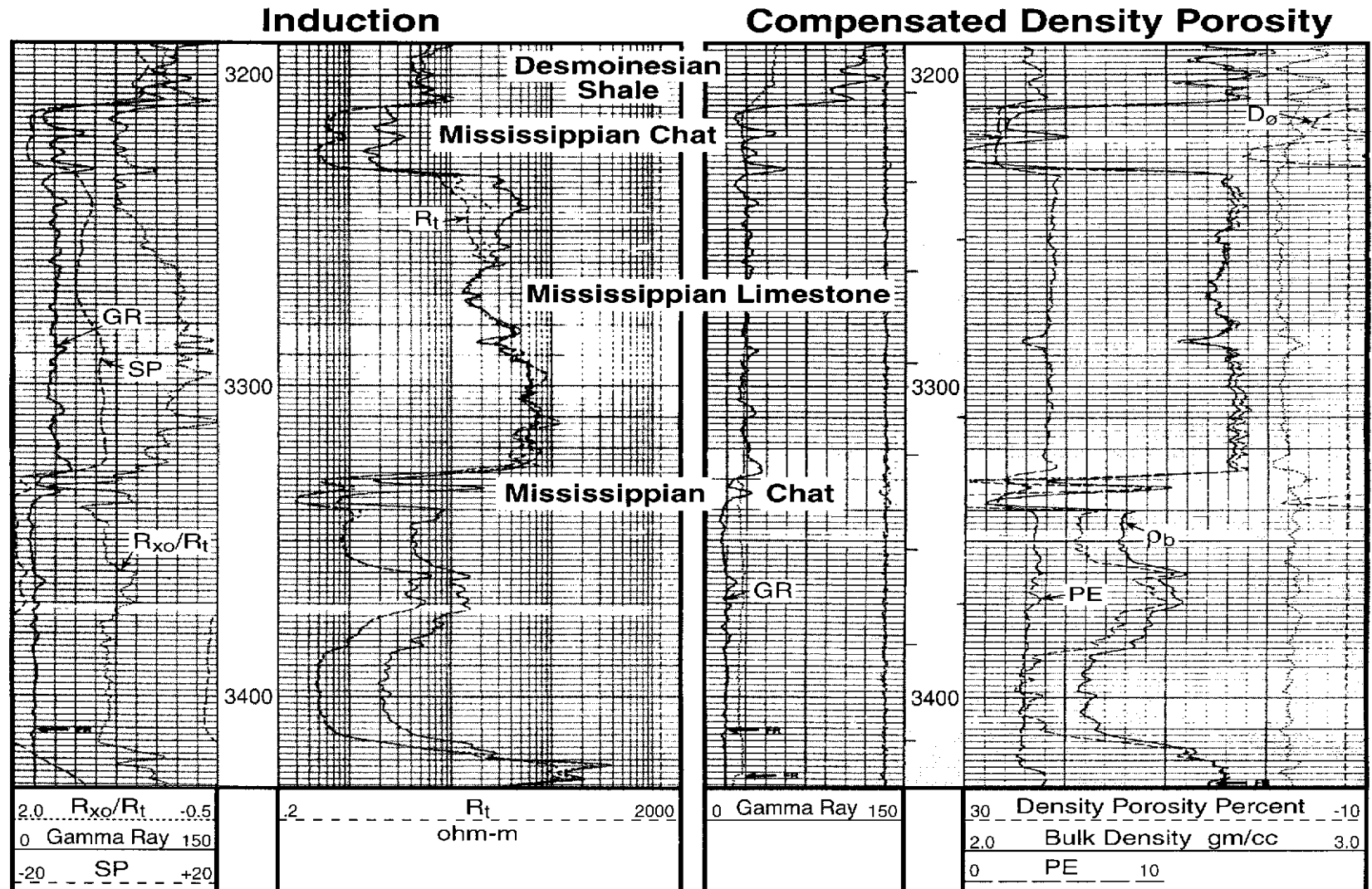
**C & H #3, SE SE, Sec 25-24N-1W,  
Noble Co., Ok**



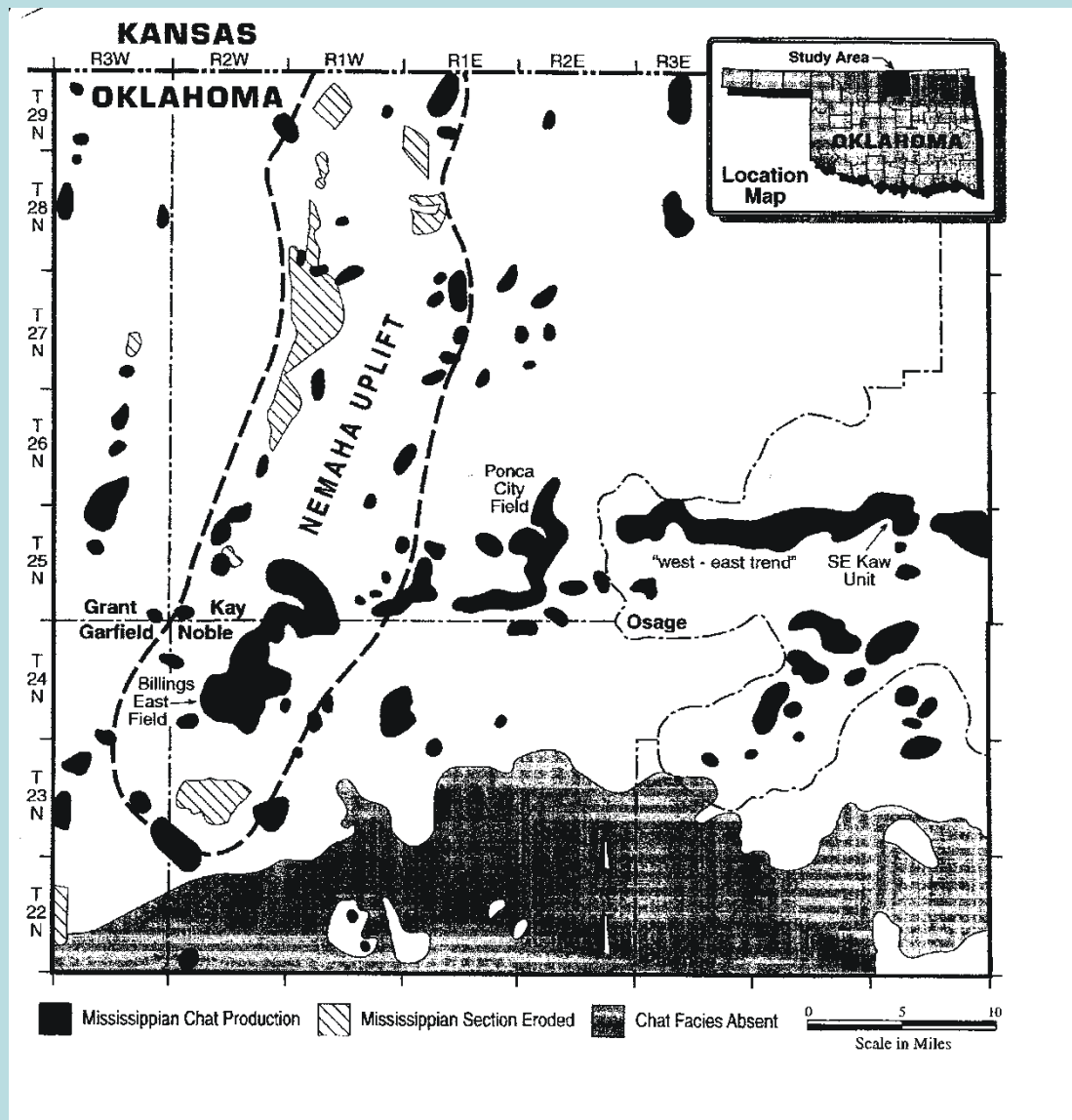
**IPF: 6 BOPD, 275 MCFD, 50 BWPD  
Cum: 4546 BO & 255,023 MCF  
(From Rogers, 2001, Fig. 3)**

# Osage-Davis Bros.24-5-6 1C

## NE NE NE, Sec 6-24N-5E, Osage Co., OK

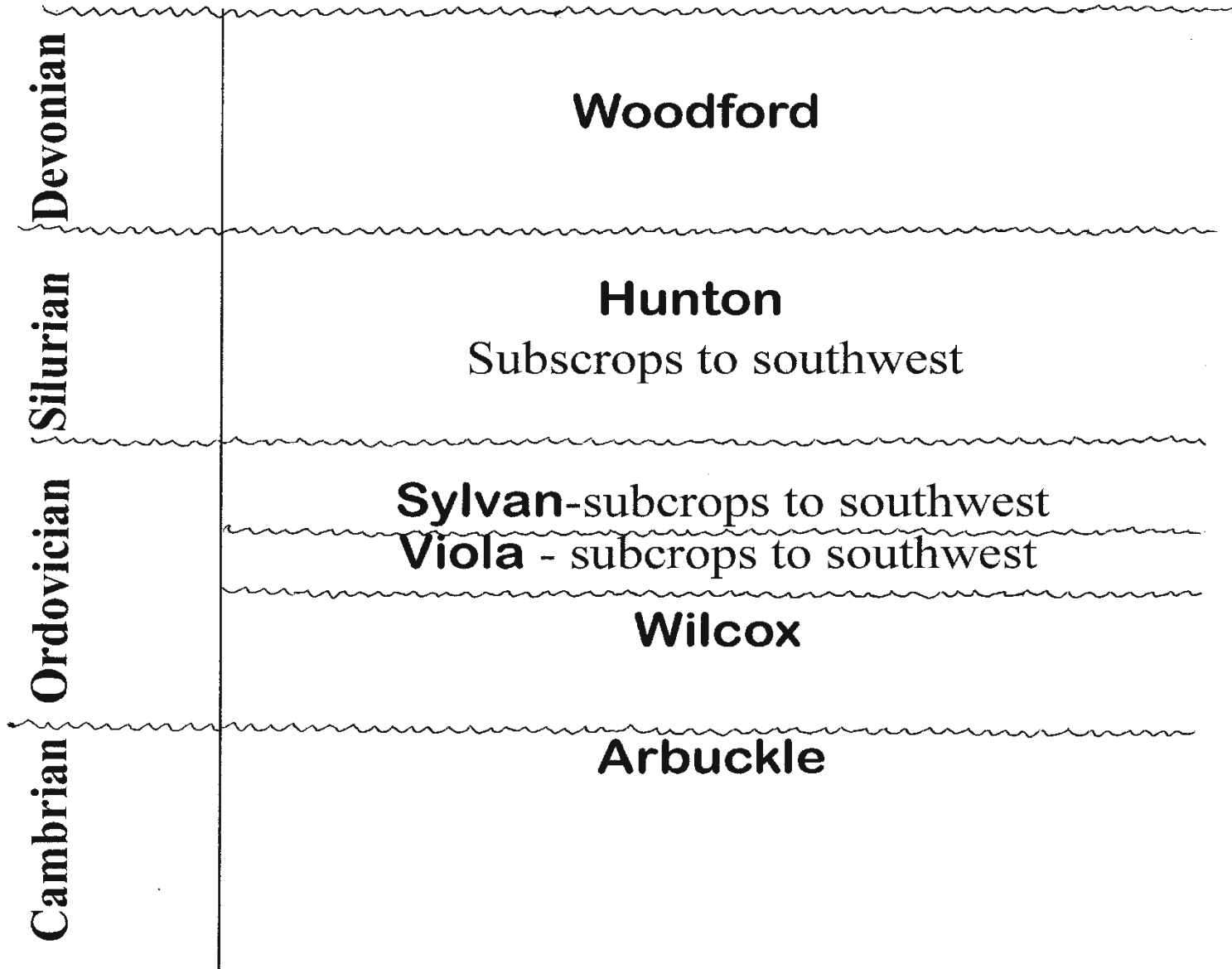


(From Rogers, 2001, Fig.7)

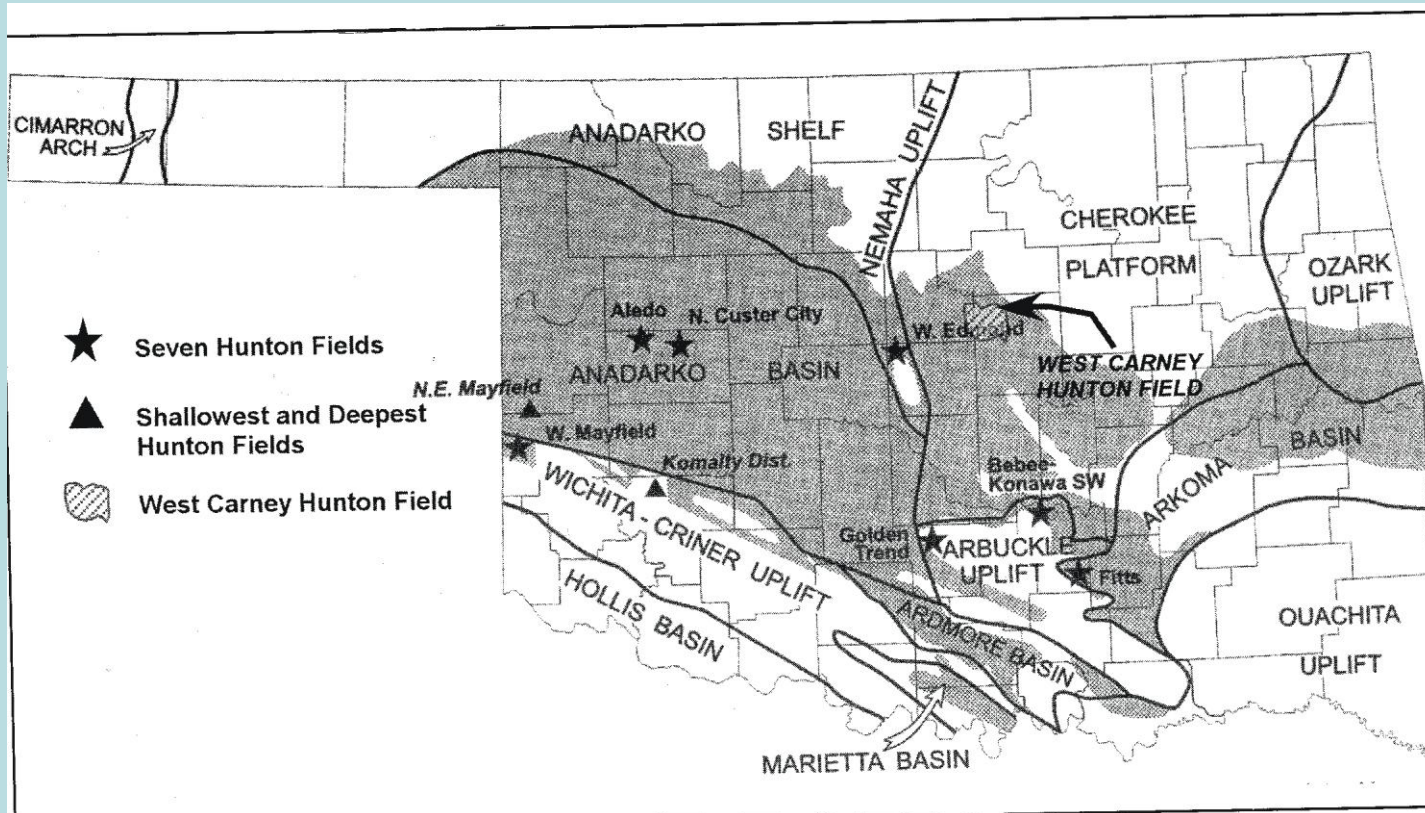


(From Rogers, 2001, Fig 1)

# Stratigraphic Column





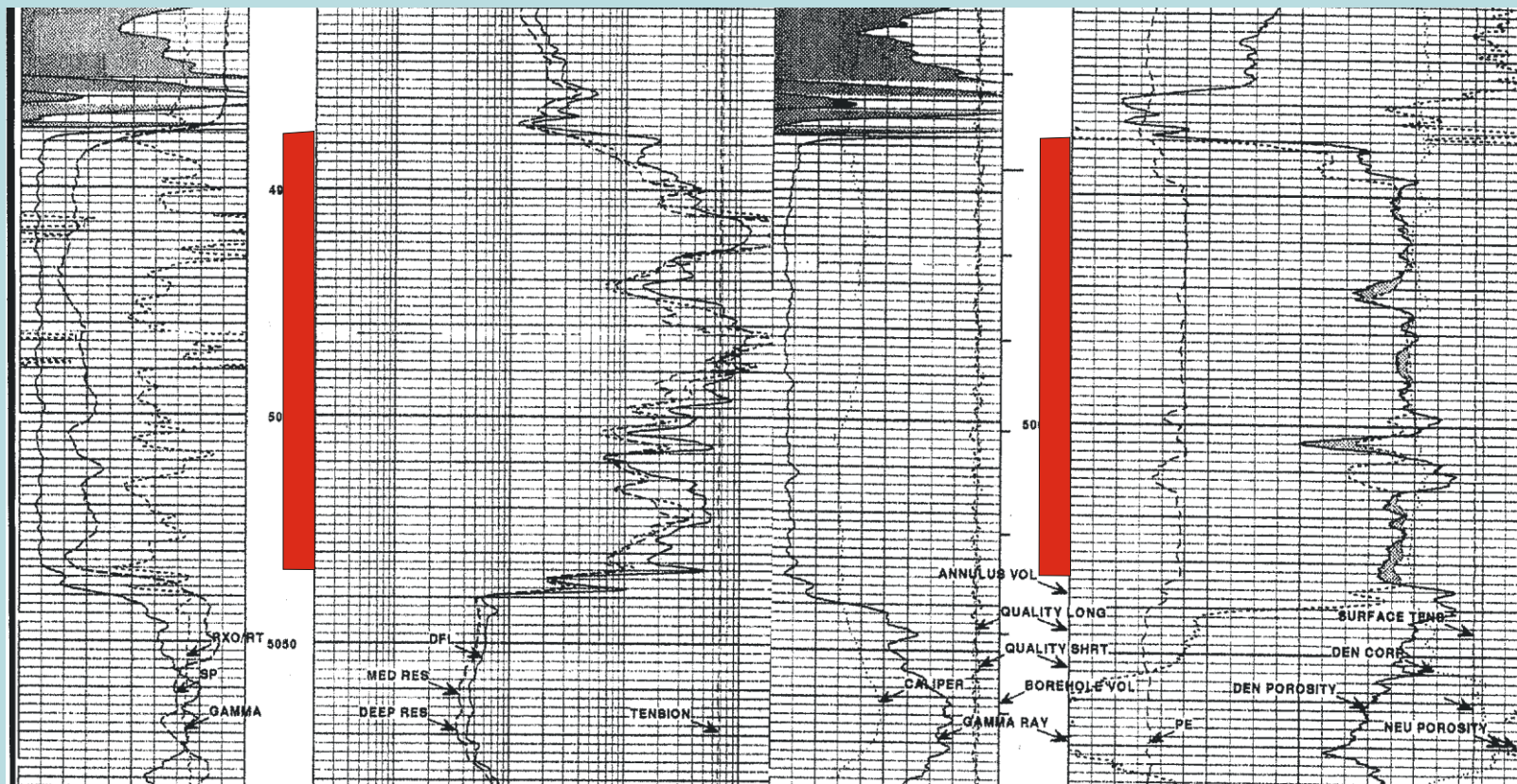


(From Derby et al, 2002, Fig 2, & Northcutt , 2000, Fig 6)

# New Dominion LLC Stevens #1, SE NW, Section 7-15N-2E, Lincoln County

High Resolution Induction

Density/Neutron



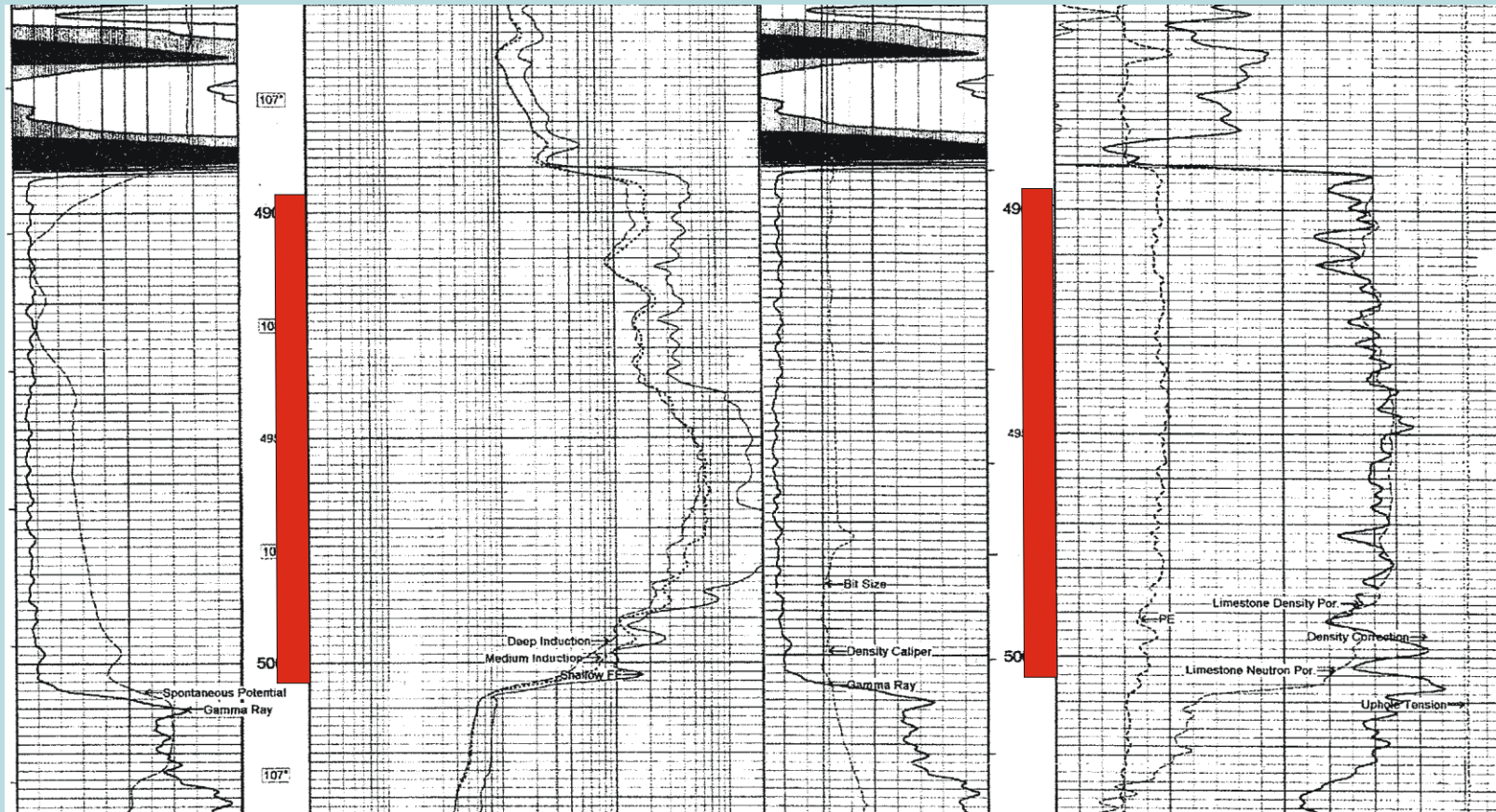
c. 6-23-2000, Hunton, perfs: 4938'-5034'  
IPP 165 BOPD, 556 MCFD, 701 BWPD  
Cum: 143,739 BO & 1,344,026 MCF



**Craig Elder O & G LLC**  
**Keith Starks #1-1, SE SW, Section 1-15N-1E, Logan County**

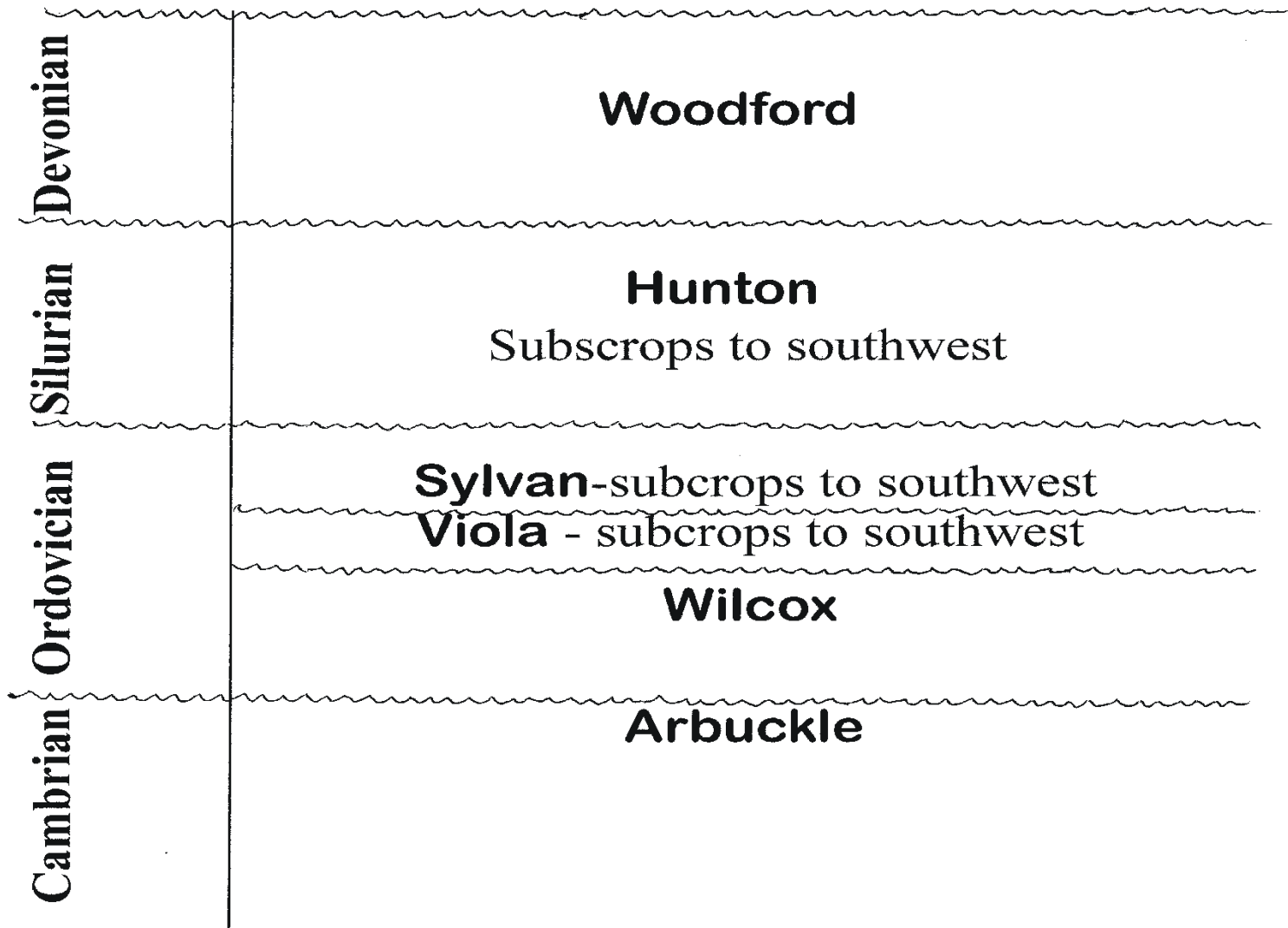
Array Induction

Density/Neutron



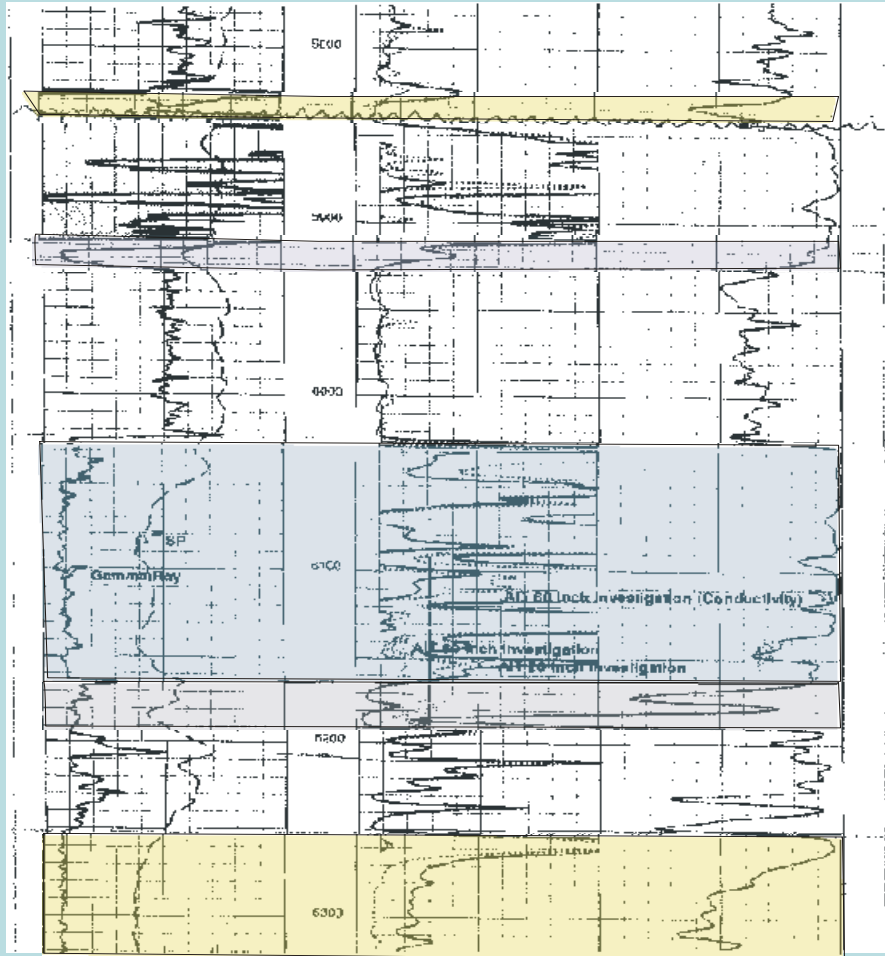
**c. 2-25-2001, Hunton, perfs:4896'-5004'**  
**IPP 97 BOPD, 666 MCFD, 1833 BWPD**  
**Cum: 25,605 BO & 416,665 MCF**

# Stratigraphic Column





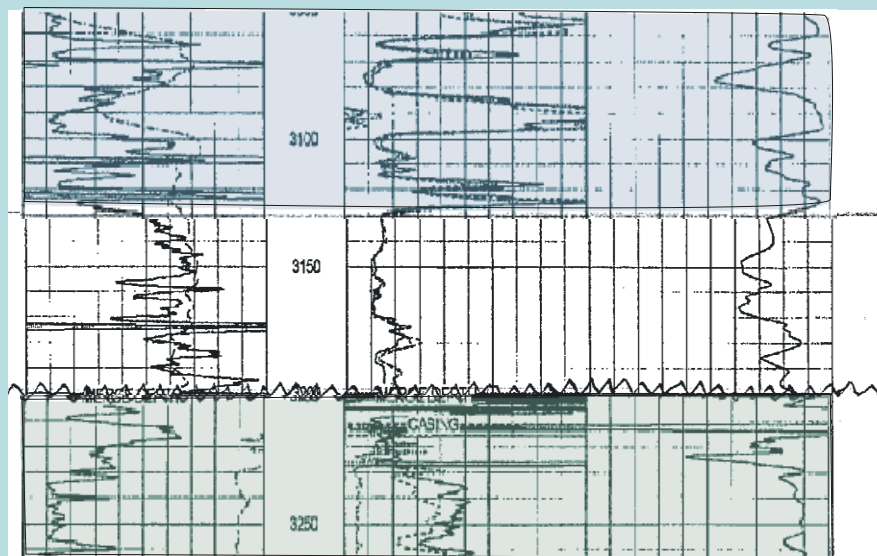
## Logan County, OK



## Wilcox

## D & A in Arbuckle

**Subsurface Minerals  
Arnold 17-1  
N/2 SE SW, Section 17-28N-1E  
Kay County, OK**



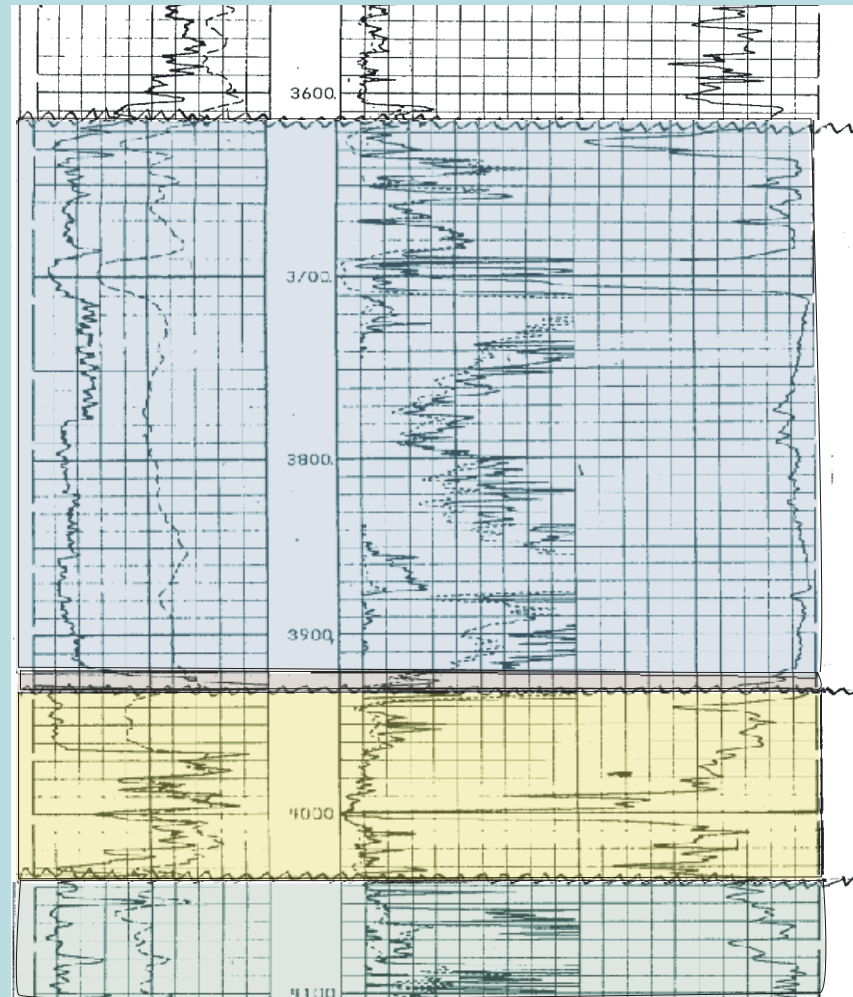
**Oswego**

**Top of Cherokee**

**Arbuckle**

**c. 1-25-2007 in Arbuckle  
TD 3420'  
D & A**

**Ross L. Mayo, Inc  
Marian B. Scott #1  
SW NW SW, Section 32-29N-2E  
Kay County, OK**



**Mississippi**

**Woodford**

**Wilcox**

**Arbuckle**

**c. 6-24-93, TD 4200' in Arbuckle  
D & A**

# What this stratigraphy tells us:

- Area was subject to rise & fall of sea level, erosion & deposition & periods of tectonic activity from possibly as early as Cambrian through late Miss/early Penn time
- When prospecting you have to consider the history of the area & potential for porosity development

# Suggested Rules of Thumb

- Tonkawa, Cleveland, Prue, Red Fork & Bartlesville will likely be productive with an  $R_t$  of 2.5 ohms (or greater).
- Skinner: generally requires a higher  $R_t$  to be productive.
- Tripolitic Miss Chat is better producer than Miss Chert. Arrowhead type sample indicates be careful.
- Mississippi has productive intervals below Chat

# Types of Plays

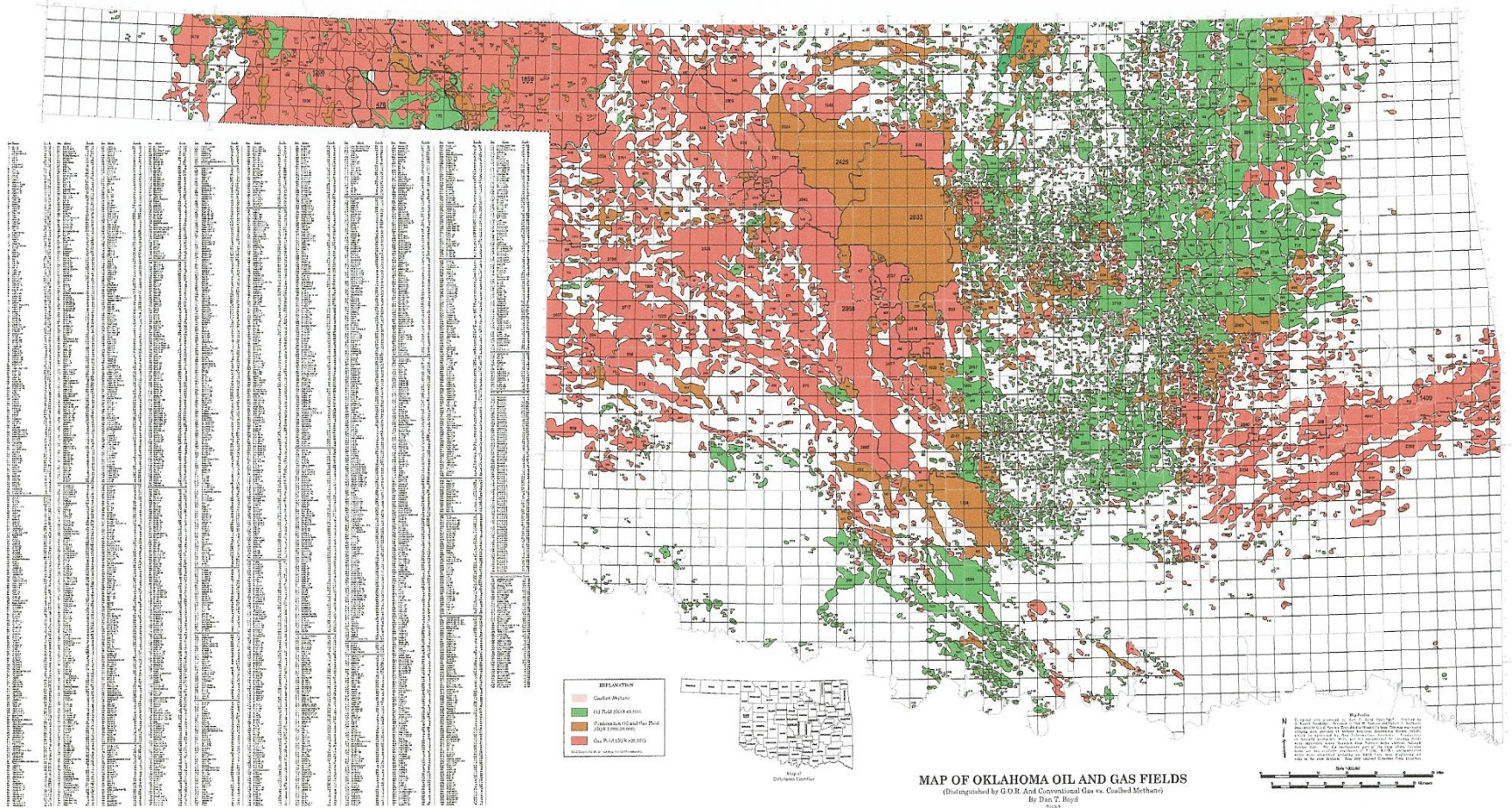
- Structural: carbonate & sandstone
  - Ex: Mississippi and Wilcox
- Stratigraphic: carbonate w/ porosity/perm barrier – Ex: Oswego, Miss Chat, Miss Sandstone: fluvial dominated deltaic sands
  - Ex: Skinner, Red Fork, Bartlesville
- Coal bed methane: Nowata and Washington Counties in coal beds such as Rowe Coal



# Oil & Gas Production

OKLAHOMA GEOLOGICAL SURVEY  
Division of Petroleum Geology

2002-004  
Oklahoma Oil and Gas Fields  
Revised by Dan T. Boyd



From Boyd, 2002

# **Production Summary**

**Cherokee Platform is a prolific producing region**

**Multiple Pay Zones: Kisner through Arbuckle**

**Oil, Gas, Water**

**Old Production (1920's) to present day new discoveries**

**Cumulative production of old wells either in old data books or at OTC**

**Production data services have data from about 1970 to date**

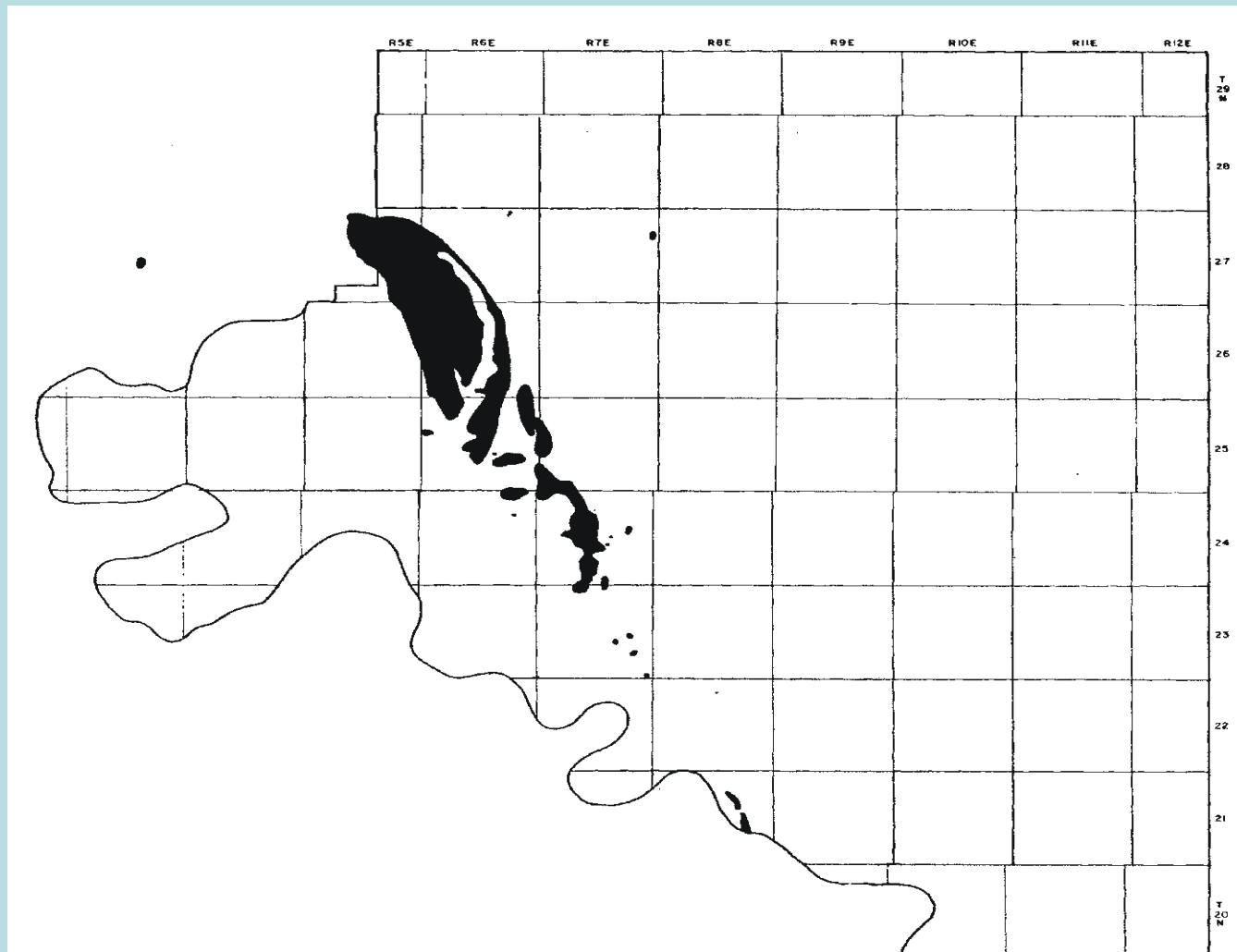
**New methods, better exploration, less worry about produced water and by-passed pay all provide opportunities for tomorrow**



# Major Fields

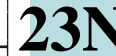
- Burbank: stratigraphic
- South Ceres: shoestring sand lens
- Dilworth: structural
- Ponca City: structural
- Cushing: structural
- Carney: stratigraphic, dewatering
- Autwine: stratigraphic
- Braman: Structural

# Burbank Field Osage County, OK



From Clinton, 1955

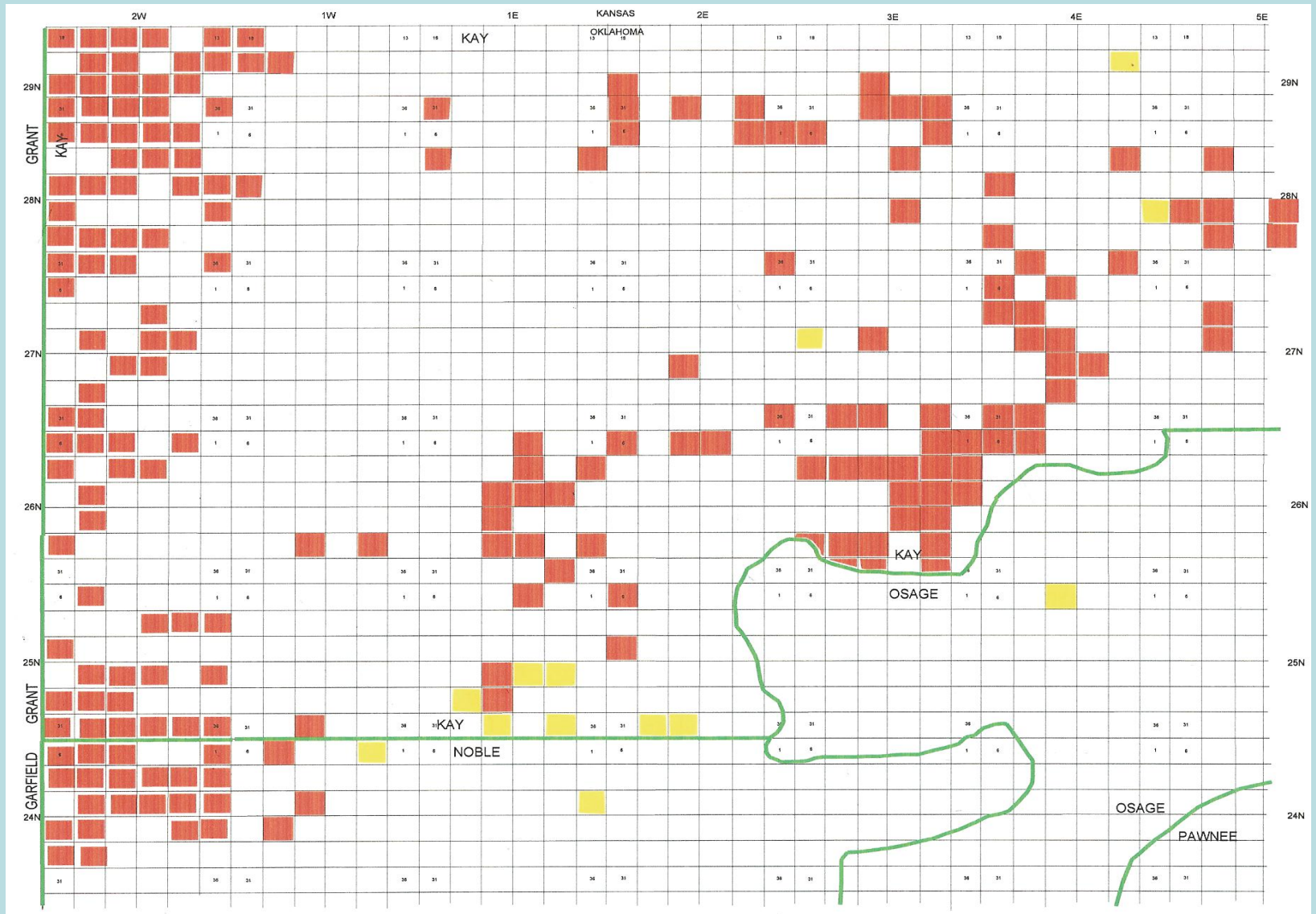
## 1E





(From Rogers, 2001, Fig 1)

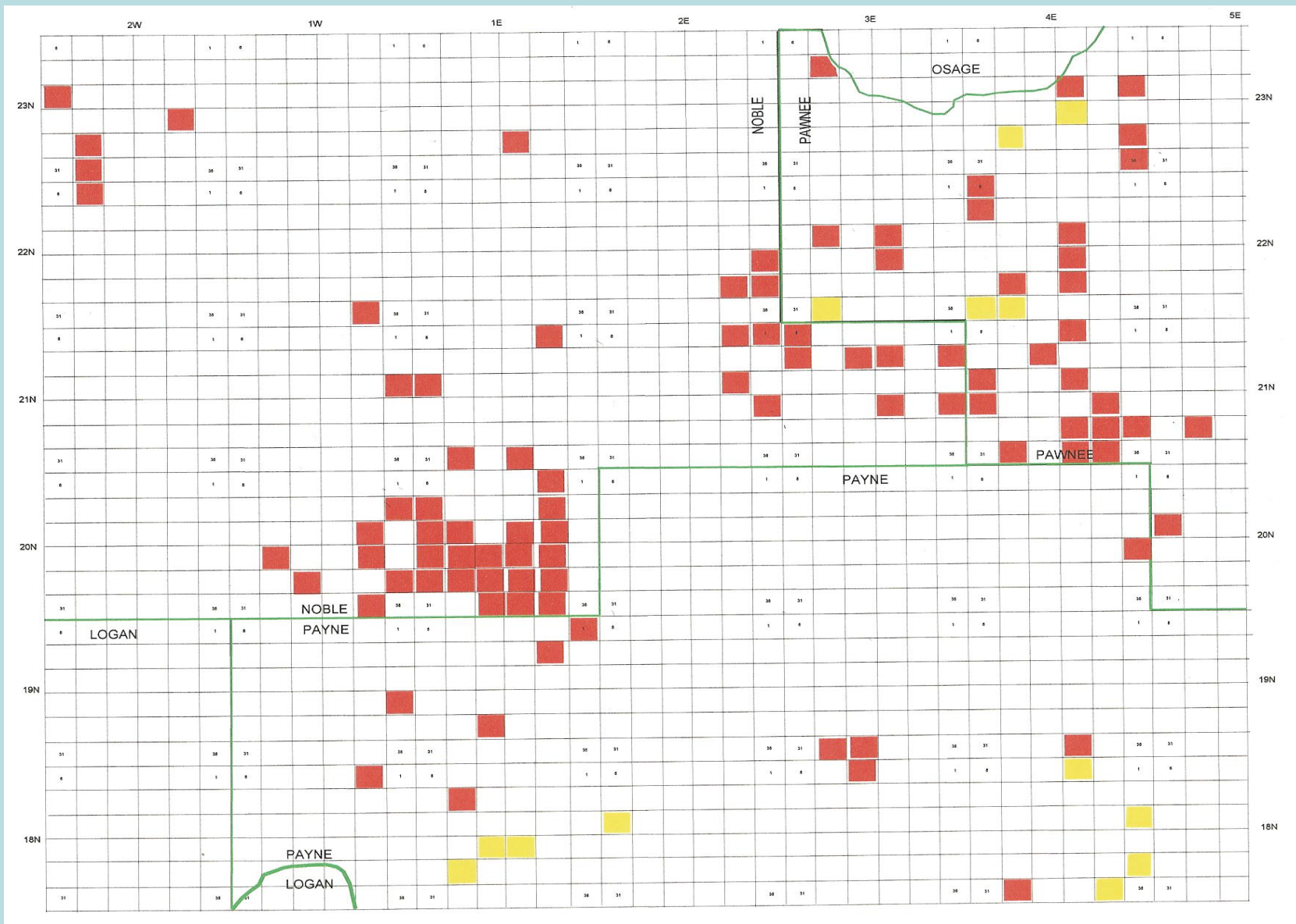
# Indications of New Activity in Cherokee Platform



 Drilling/drilled/producing Miss Horizontal

 SandRidge leases





 **Drilling/drilled/producing Miss Horizontal**

 **SandRidge leases**



# SUMMARY

**Tectonically active region**

**Major unconformities**

**Multiple pay zones at shallow depths (<5000')**

**Developed areas with quality production**

**New techniques & exploration methods result in new development**

**Lots of oil & gas remaining**

# REFERENCES

Andrews, Richard D., Fluvial-Dominated Deltaic Oil Reservoirs in Oklahoma: The Red Fork Play, Oklahoma Geological Survey Special Publication 97-1

Boyd, Dan, 2002, Map of Oklahoma Oil & Gas Fields, available online from OGS site.

Clinton, Rick P., The Geology of Osage Country, Shale Shaker Digest II, Volumes VI-VIII (1955-1958)

Derby, James R., F. Joe Podpechan, Jason Andrews, Sandeep Ramakrishna, 2002, U.S. DOE-Sponsored Study of West Carney Hunton Field, Lincoln & Logan Counties, Oklahoma: A Preliminary Report (Part 1), Shale Shaker, Vol. 53, No. 1

Gay, S. Parker, Jr., 2003, The Nemaha Trend-A System of Compressional Thrust-fold Strike-slip Structural Features in Kansas & Oklahoma, Shale-Shaker Vol. 54, No.2, p. 39.

Northcutt, Robert A., & Jock Campbell, Geologic Provinces of Oklahoma, available online

Reeder, Louis R., The Control of Potential Arbuckle Hydrocarbon Traps in Northeast Oklahoma by Precambrian Topography, Shale Shaker Digest Vol. VIII, 1973-1976, p. 176

Rogers, Suzanne M., 2001, Deposition & Diagenesis of Mississippian Chat Reservoirs, North-Central Oklahoma, AAPG Bulletin, Vol 85, #1, p. 115-129

## **Suggested Reading for Oklahoma Cherokee Platform & Oklahoma Geology:**

Davis, Harold G. III, Wrenching and Oil Migration, Mervine Field Area, Kay County, Oklahoma, Shale Shaker Digest XI, p. 145-158

McBee, William J., Nemaha Strike-slip Fault Zone, Search & Discovery Article #10055 (2003), AAPG

Northcutt, R.A., 2000, Part III, History of Hunton Oil & GAS Exploration & Development in Oklahoma, in Oklahoma Geological Survey Special Publication 2000-2, p. 9-20.

The Shale Shaker, published by the Oklahoma City Geological Society. Older issues through 2005 available on a set of 3 CDs from the OCGS office.

OGS Special Publications covering various reservoirs in Oklahoma including but not limited to the following:

Oklahoma Geological Survey Special Publication 96-2: Fluvial Dominated Deltaic (FDD) Oil Reservoirs in Oklahoma: The Skinner & Prue Plays

Oklahoma Geological Survey Special Publication 97-1: Fluvial Dominated Deltaic (FDD) Oil Reservoirs in Oklahoma: the Red Fork Play

Oklahoma Geological Survey Special Publication 9706: Fluvial Dominated Deltaic (FDD) Oil Reservoirs in Oklahoma: The Bartlesville Play

OCGS Publications in the Shale Shaker, available on CD ROM, containing many good papers on various areas throughout Oklahoma up to 2005.