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

Anadarko Basin Hollis Basin 11 Ouchita Mountain Uplift Anadarko Shelf Broken Bow Uplift Marietta Basin 12 Cimarron Arch **Ouachita Central Region** Cyril Basin Arbuckle Uplift 13 **Ouachita Frontal Thrust Belt** (14) **Arbuckle Mountains** Potato Hills Ardmore Basin (15) Tishomingo-Belton Horst 26 Ozark Uplift Arkoma Basin (16) (17) 6 Pauls Valley-Hunton Horst 7 8 Franks Graben Clarita Horst Wichita Uplift 27 Wapanucka Graben Ada High Criner Uplift (19) Lawrence Horst Cherokee Platform Waurika-Muenster Uplift (10) Nemaha Uplift Wichita Frontal Fault Zone Semonole Structure 20 ANADARKO SHELF CHEROKEE PLATFORM Structural boundaries NEMAHA OZARK Major faults, exposed at, UPLIET interpreted to occur at the UPLIÈT surface. Overthrust faults 26 identified with solid barbs on ANADARKO BASIN hanging wall block. Normal faults identified by hachures on relatively downthrown block. Arrows indicate relative horizontal movement Major subsurface faults. ARKOMA BASIN thrust faults identified with open barbs on hanging wall Plunge of subsurface structure CTW rd 24 WSF Stratigraphic/Structural boundaries Surface contact between rock units. May be approximated or OUACHITA locally generalized MOUNTAINS UPLIFT Buried contact, structural contour, or structural trend Change in rate of thickening of strata or generalized structural trend 0 10 20 30 40 50 Basement outcrop and subcrop Miles Pre-Pennsylvanian strata missing MAJOR FAULT BOUNDARIES

OKLAHOMA **GEOLOGICAL** SURVEY

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

Central Oklahoma Fault Zone Meers Fault Mountain View Fault

Mulberry Fault

COF

MRS

MVF

MBF

NFZ

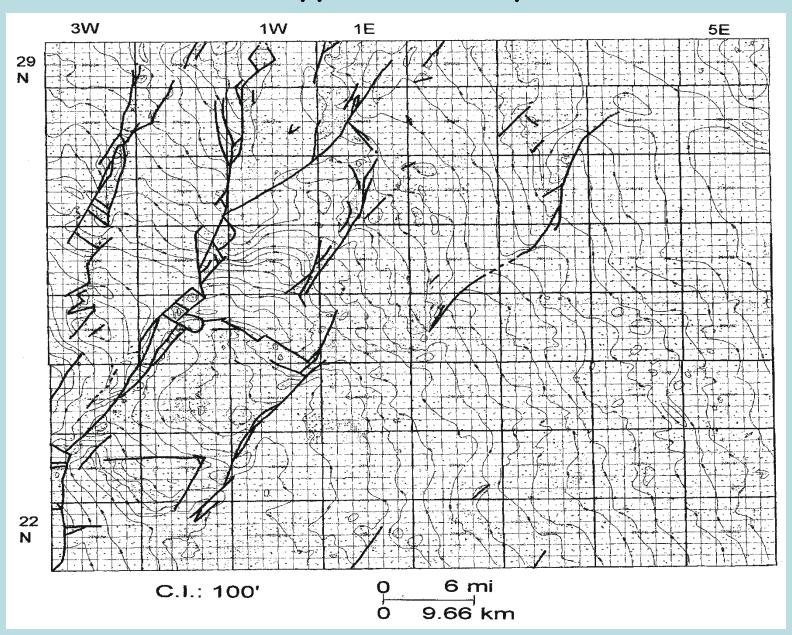
Nemaha Fault Zone

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

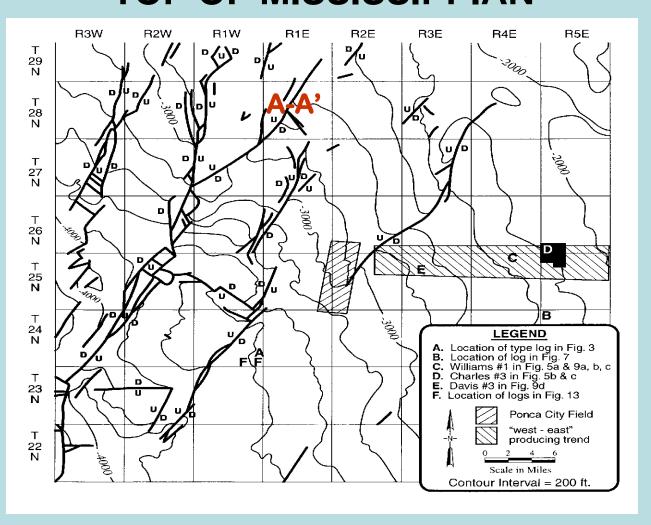
Cherokee Platform & Nemaha Uplift

- 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

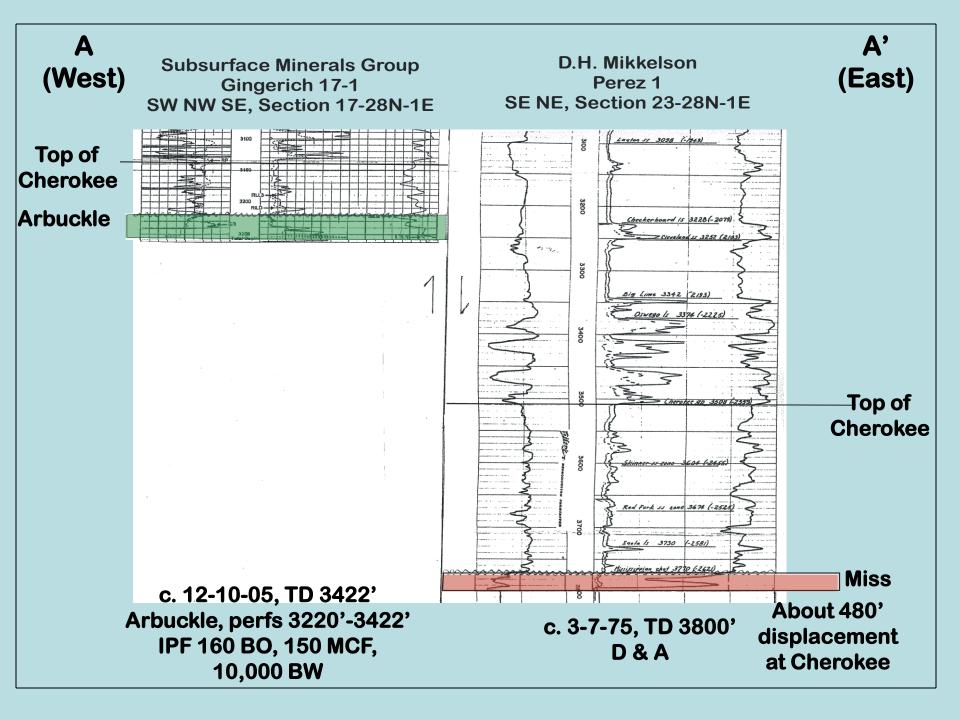
Mississippi Structure Map



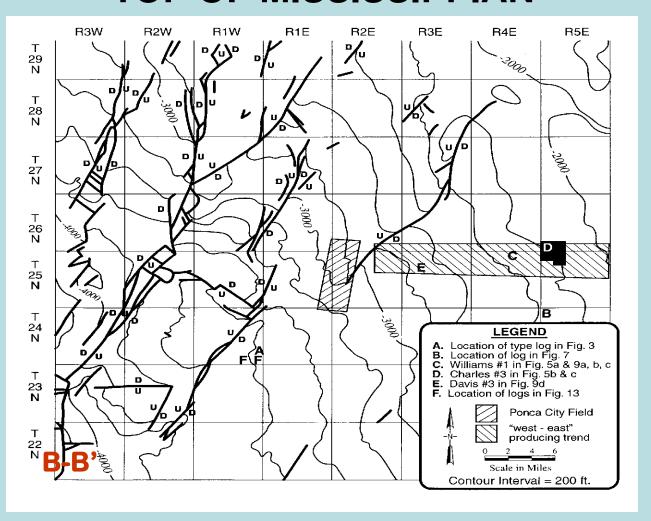
STRUCTURE MAP TOP OF MISSISSIPPIAN



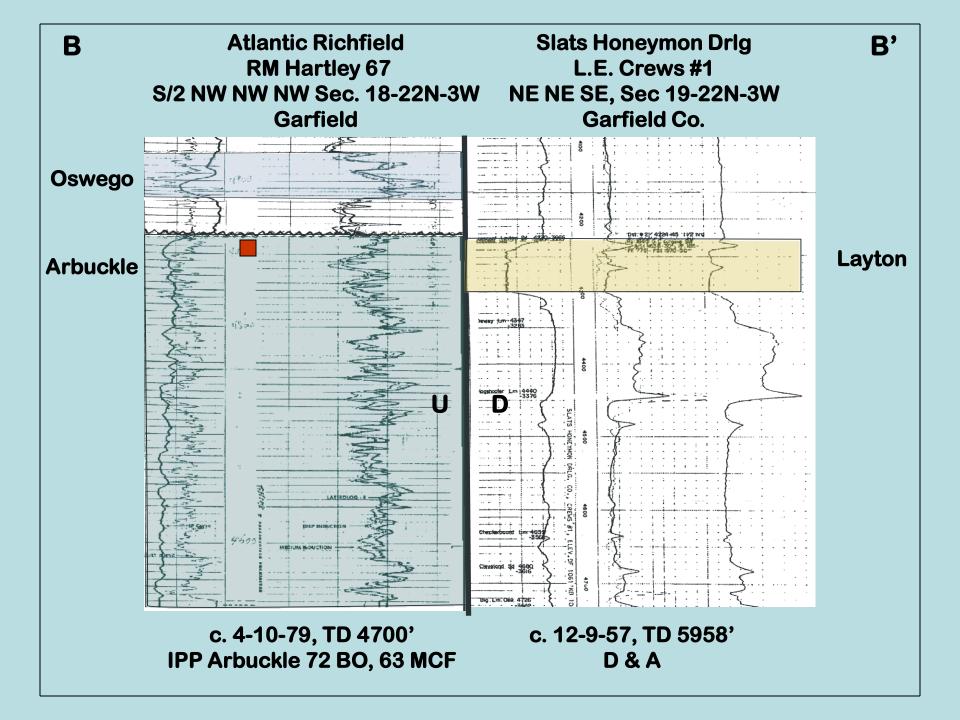
(From Rogers, 2001, Fig. 8)

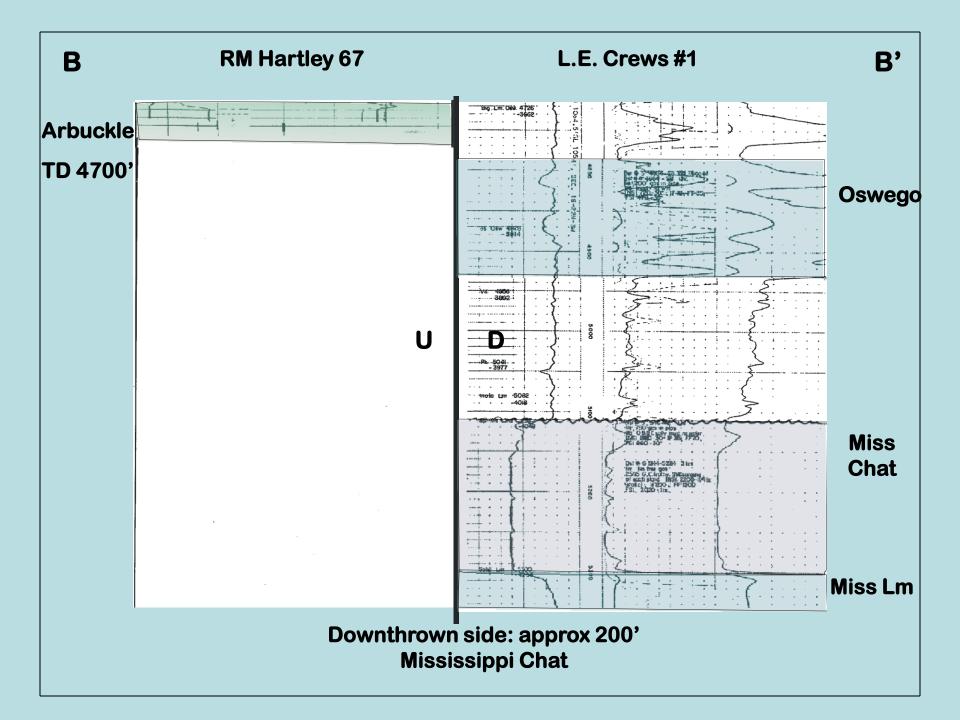


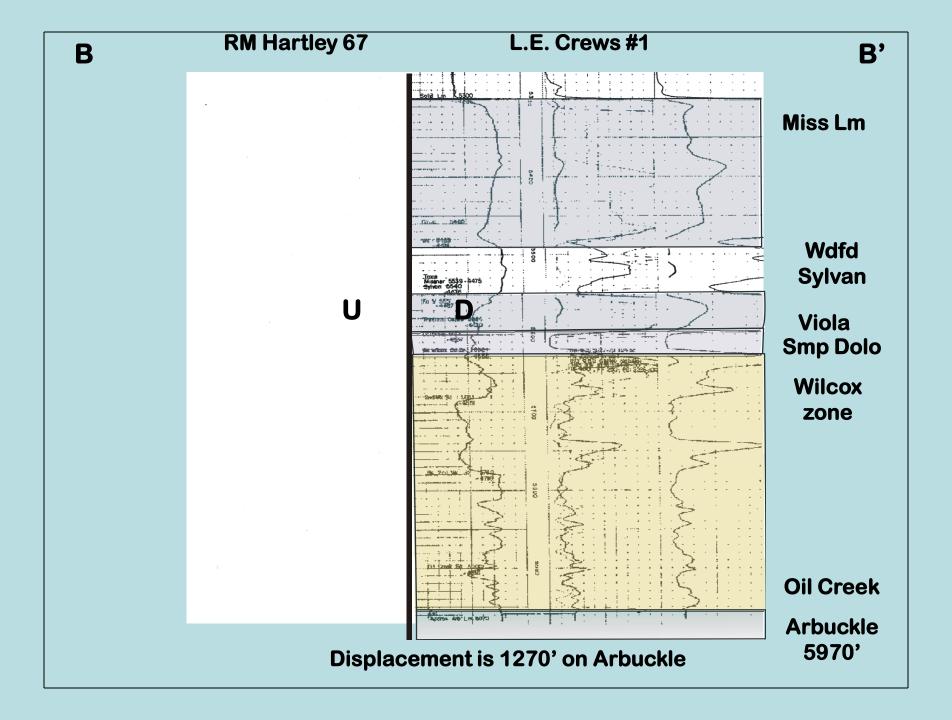
STRUCTURE MAP TOP OF MISSISSIPPIAN



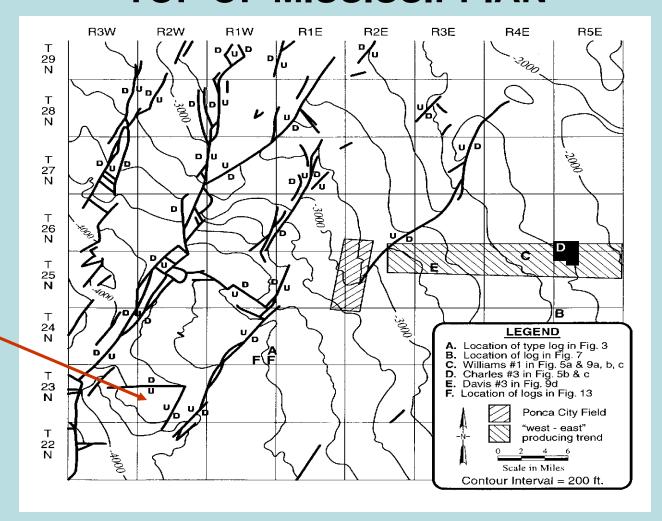
(From Rogers, 2001, Fig. 8)





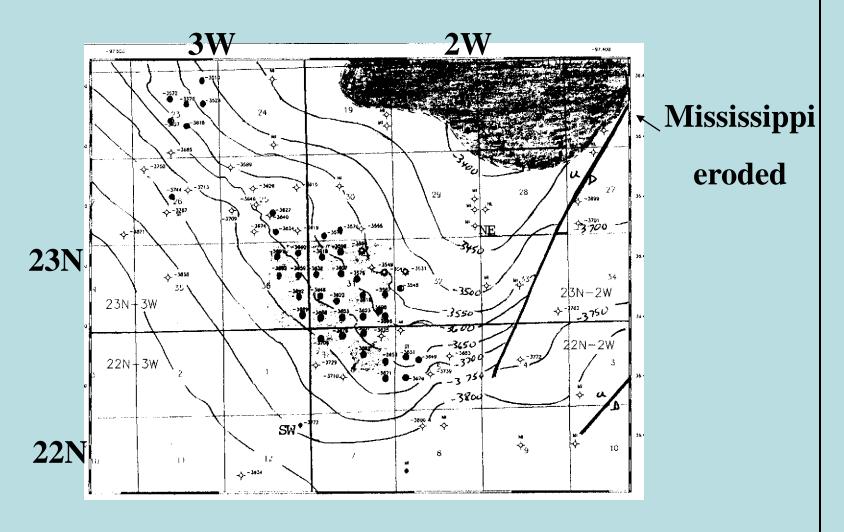


STRUCTURE MAP TOP OF MISSISSIPPIAN

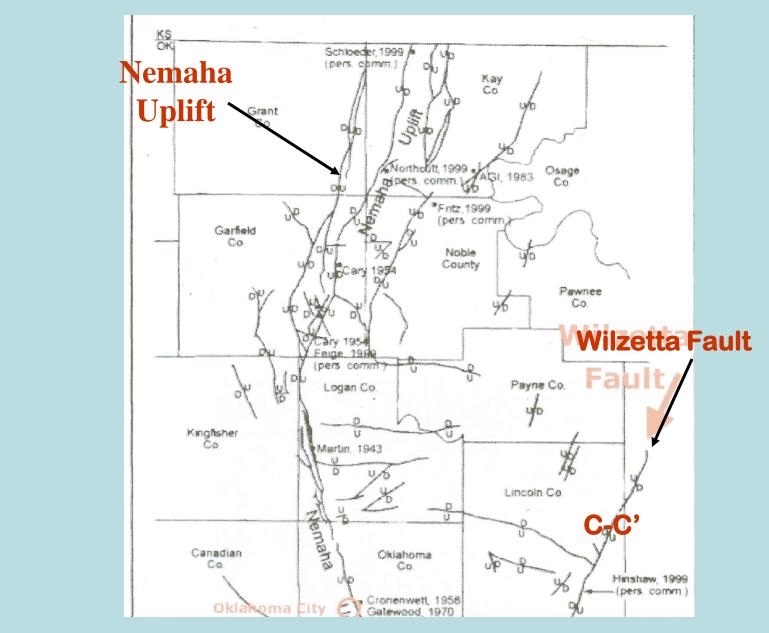


(From Rogers, 2001, Fig. 8)

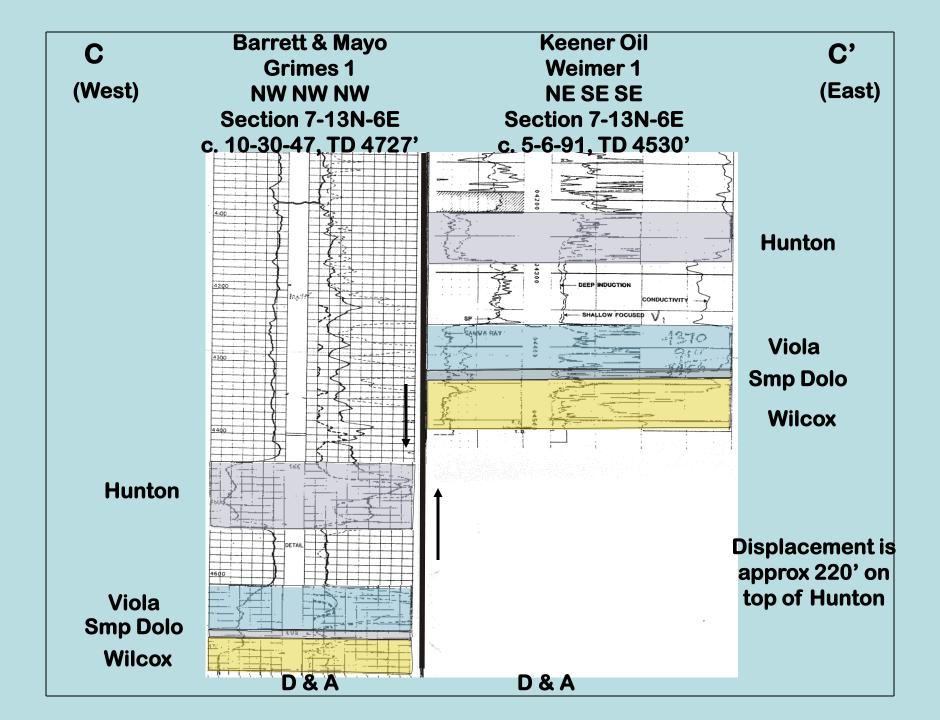
NW ANTELOPE STRUCTURE



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



From Gay, 2003, as taken from Gatewood, 1983



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

Permian Wolfcampian Pennsylvanian Virgilian

Hotson/Kisner Neva Lime Red Eagle Lime

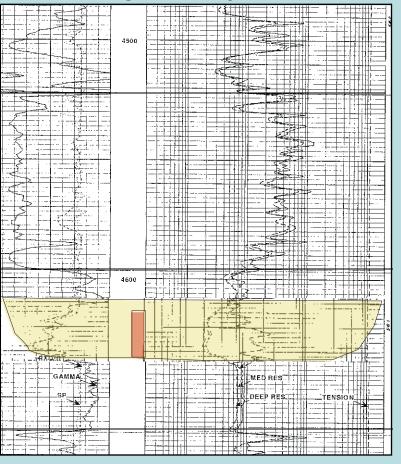
Campbell
Sams
Vertz
Newkirk
Hoover
Elgin
Carmichael
Endicott
Tonkawa

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

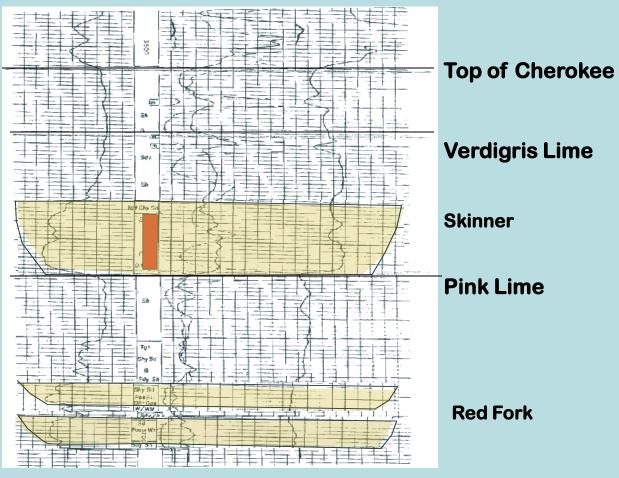
Top Of Cherokee

Prue Sand

Verdigris

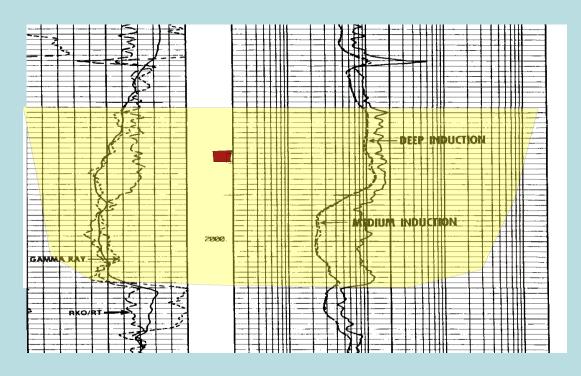
c. 4-15-99, TD 5200' IPP Prue 20 BOPD, 4 BW Cum to date: 30,816 BO

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

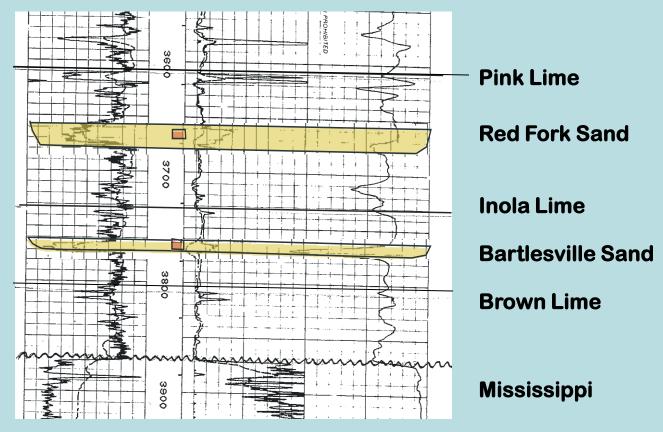
Sentinel Petroleum, Inc. Deer #1 SE SE SW, Section 34-10N-8E Seminole County, OK



Senora Sand

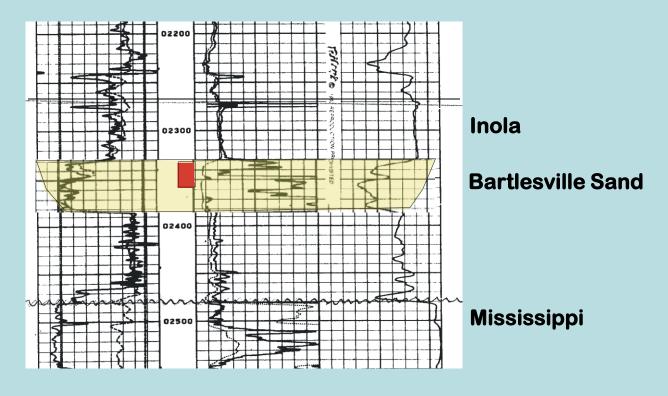
c. 5-27-83, TD 2079'
Perf 1966-1970'.
IPF 230 BOPD, 115 MCFD, NW
Cum to 184,413 BO, 58,707 MCF
Current: 5 BOPD, 20 BW

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



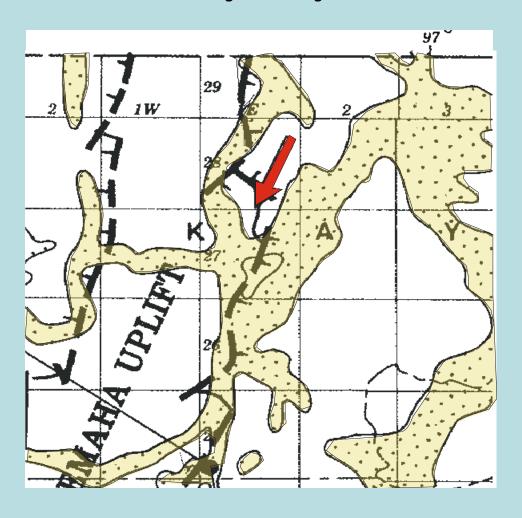
C. 8-27-84, TD 4185'
IPF Red Fork 700 BOPD, 500 MCFD, 80 BW
Tested BvI: 5 MCFD & Viola 3 BIPD, 10 MCFD & 60 BWPD
Cum thru June 2011: 84,584 BO

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



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

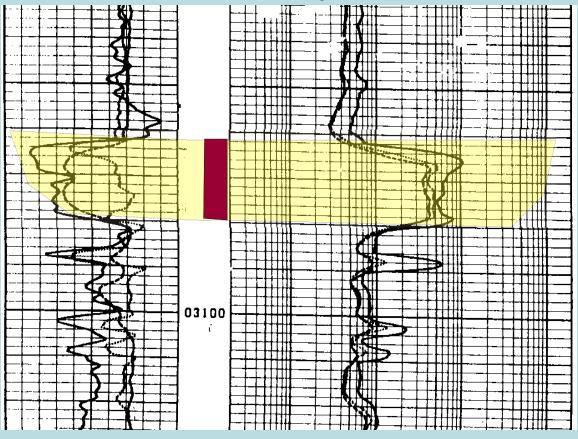
Lower Red Fork Fluvial Dominated Deltaic Sands Kay County



(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

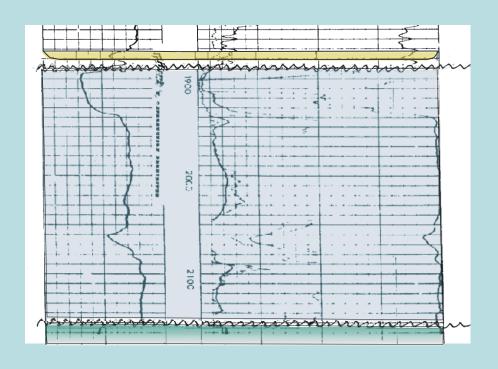


Upper Gilcrease

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

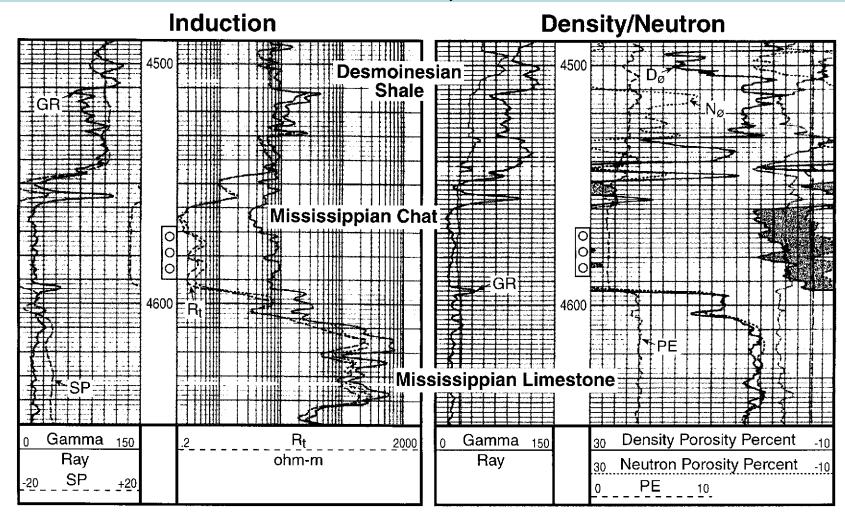


Burbank Sand Mississippi

Arbuckle

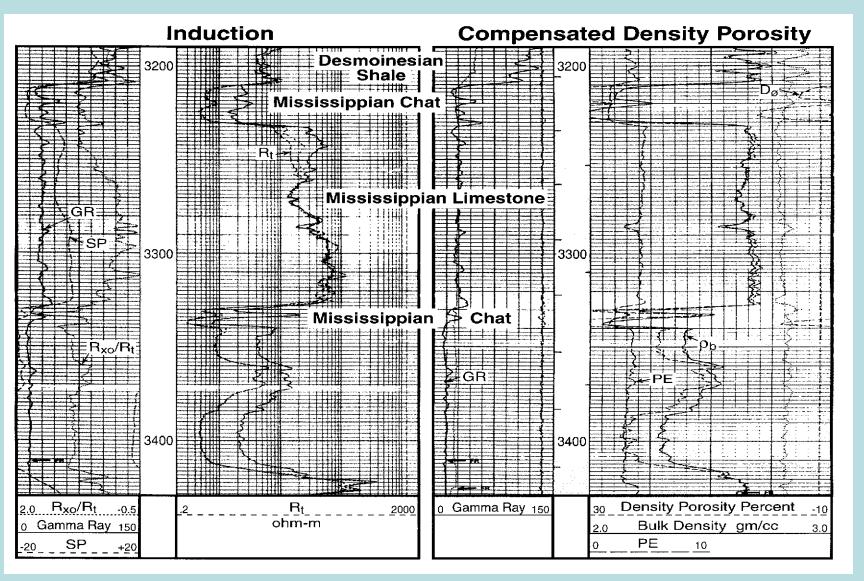
c. 2-25-74, TD 2163'
IP Arbuckle, COF 7000 MCFD
Cum not reported on IHS, verify in
Pawhuska

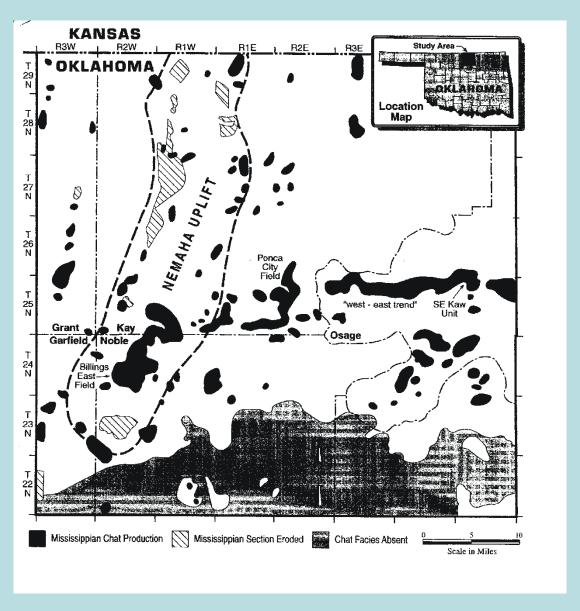
C & H #3, SE SE, Sec 25-24N-1W, Noble Co., Ok



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

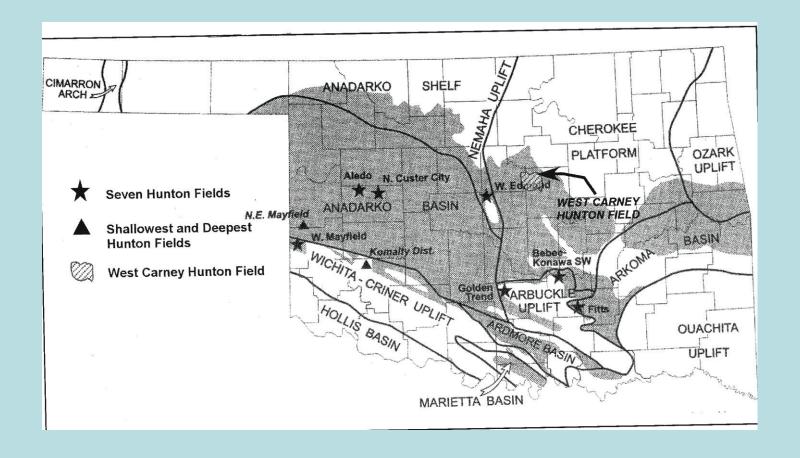




(From Rogers, 2001, Fig 1)

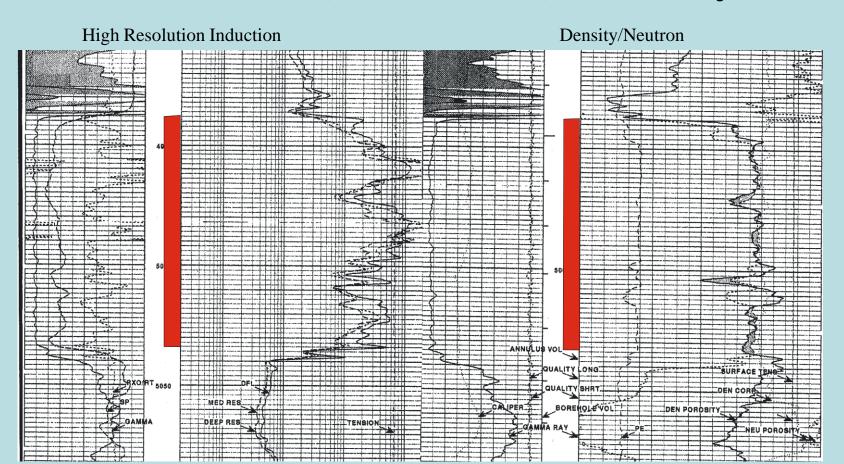
Stratigraphic Column

Woodford **Hunton** Subscrops to southwest Sylvan-subcrops to southwest Viola - subcrops to southwest Wilcox Arbuckle



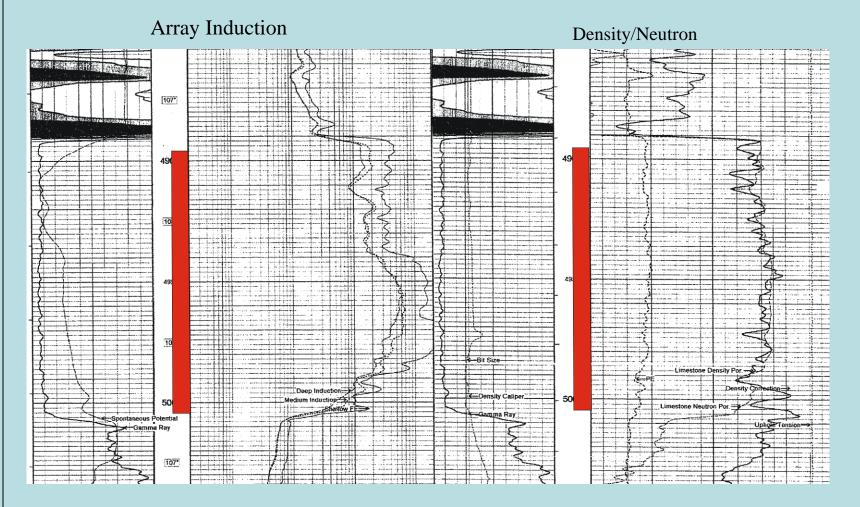
(From Derby et al, 2002, Fig 2, & Northcutt, 2000, Fig 6)

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



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



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

Stratigraphic Column

Woodford Hunton Subscrops to southwest Sylvan-subcrops to southwest Viola - subcrops to southwest Wilcox Arbuckle Jambrian

Marjo Oil Gibbens #2, formerly Rhoades Oil Gibbens #2 SE NW NE, Section 24-15N-3W **Logan County, OK**

Woodford

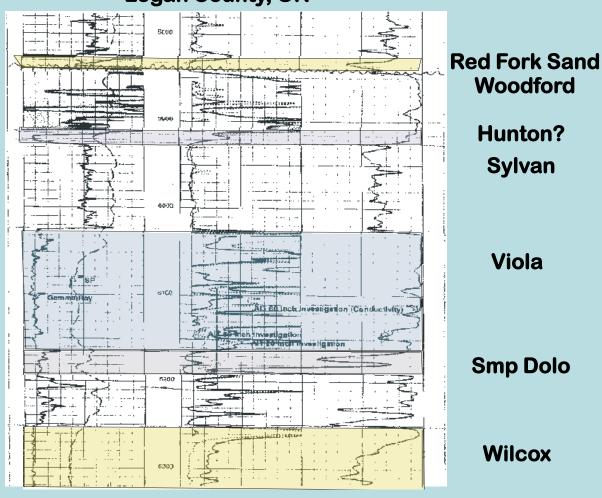
Hunton?

Sylvan

Viola

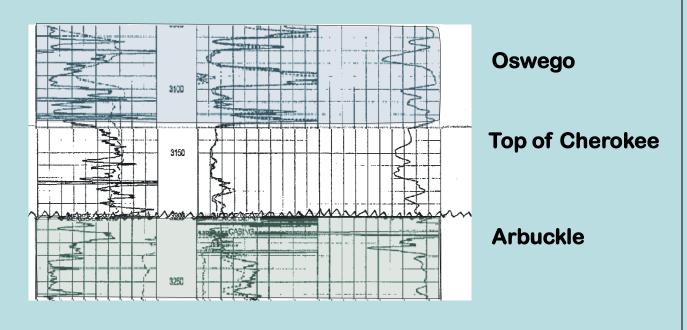
Smp Dolo

Wilcox



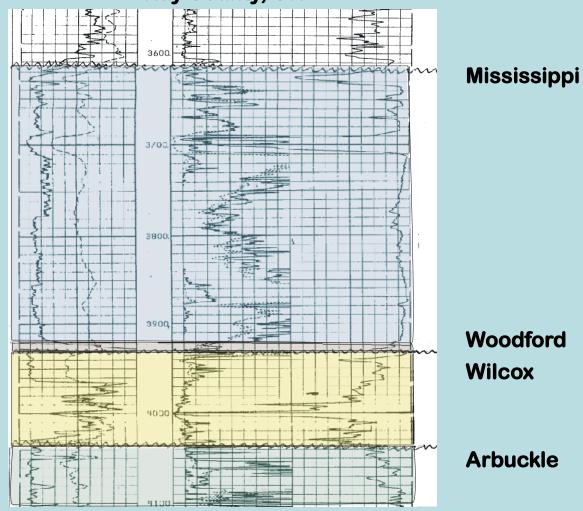
c. 10-21-93 by Marjo, TD 6880' D & A in Arbuckle

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



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



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 Rt of 2.5 ohms (or greater).
- Skinner: generally requires a higher Rt 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

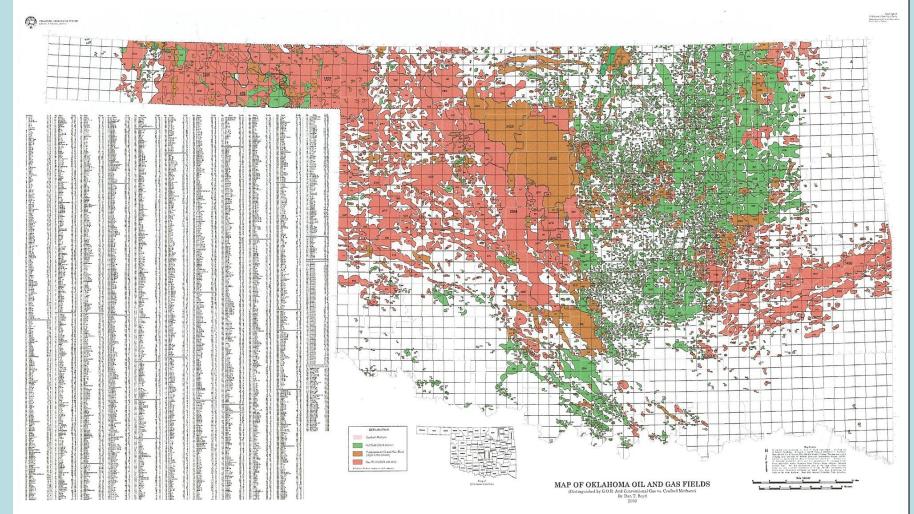
Sandstone: fluvial dominated deltaic sands

Ex: Skinner, Red Fork, Bartlesville

Coal bed methane: Nowata and Washington

Counties in coal beds such as Rowe Coal

Oil & Gas Production



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

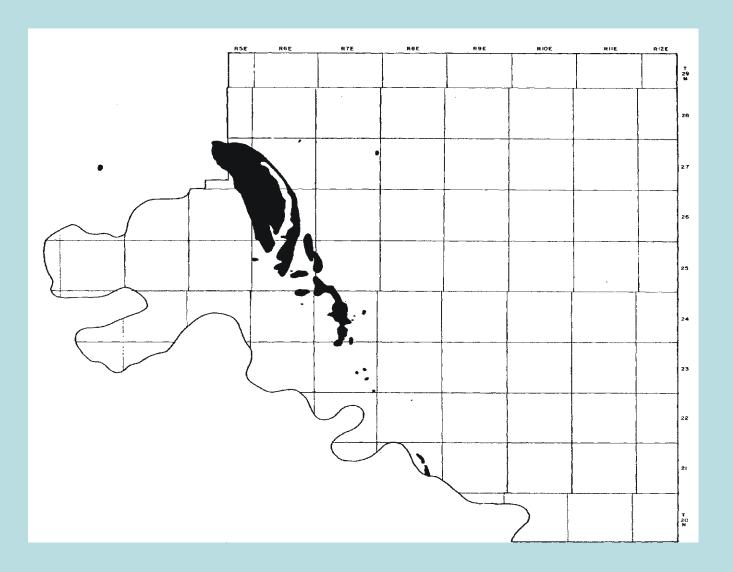
Production data services have data from about 1970 to date

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

Major Fields

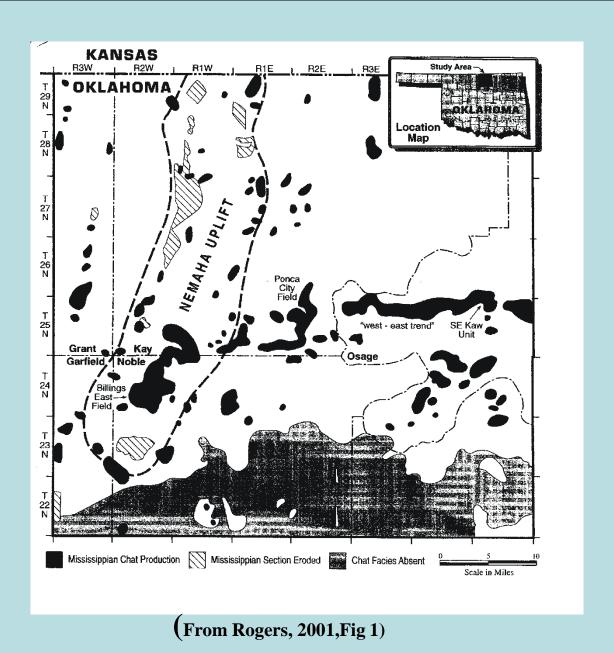
- Burbank: stratigraphic
- South Ceres: shoestring sand lens
- Dilworth: structural
- Ponca City: structural
- Cushing: structural
- Carney: stratigraphic, dewatering
- Autwine: stratigraphic
- Braman: Structural

Burbank Field Osage County, OK

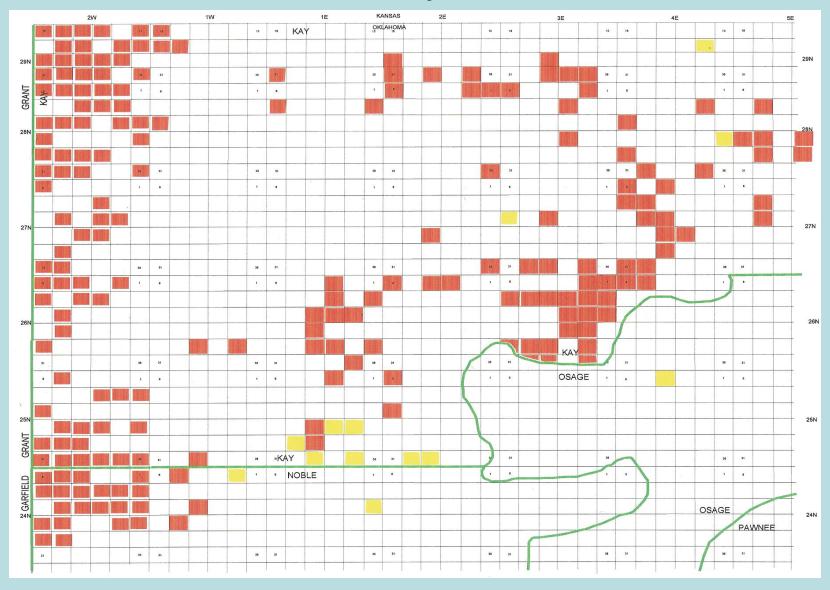


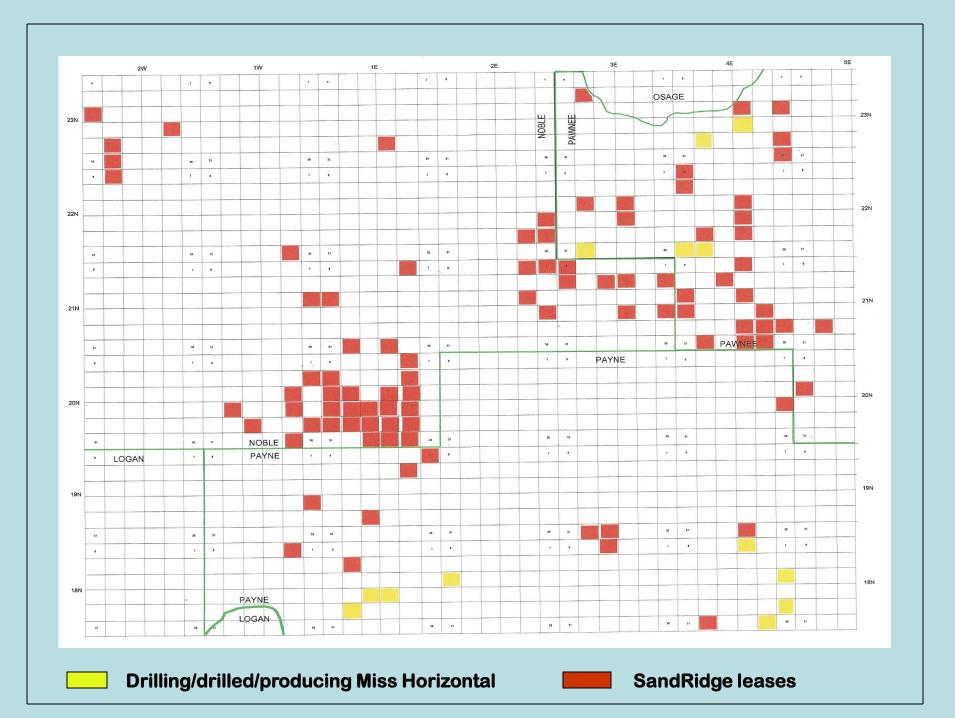
From Clinton, 1955

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Indications of New Activity in Cherokee Platform





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

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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 <u>including but not limited</u> 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.