2014 Eastern Unconventional Oil and Gas Symposium - November 5-7, 2014 in Lexington, Kentucky, USA
http://www.euogs.org

Cambrian Rogersville Shale (Conasauga Group) in the Rome Trough, Ky. and W. Va.:

a potential new unconventional reservoir in the Appalachian Basin

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John Hickman

Cortland Eble

Kentucky Geological Survey
University of Kentucky

Acknowledgements

- Rome Trough Consortium partners
  - Ohio, W. Va. and Kentucky Surveys; Industry and US DOE funding
- Bob Ryder, USGS, retired
- Monte Hay, Hay Exploration

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Outline of Presentation

- Rome Trough regional geology and stratigraphy
- Geochemistry and organic petrography
- New drilling activity and potential for a deep unconventional play

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Rome Trough Consortium 1999-2002

- Regional stratigraphic and structural interpretation
- Homer field study, Elliott County
- Cross sections, core descriptions, paleogeographic maps, gross/net sandstone maps
- Hydrocarbon and source rock geochemistry
- 2004 Open-file report available at KGS

- Study did not consider the unconventional resource potential

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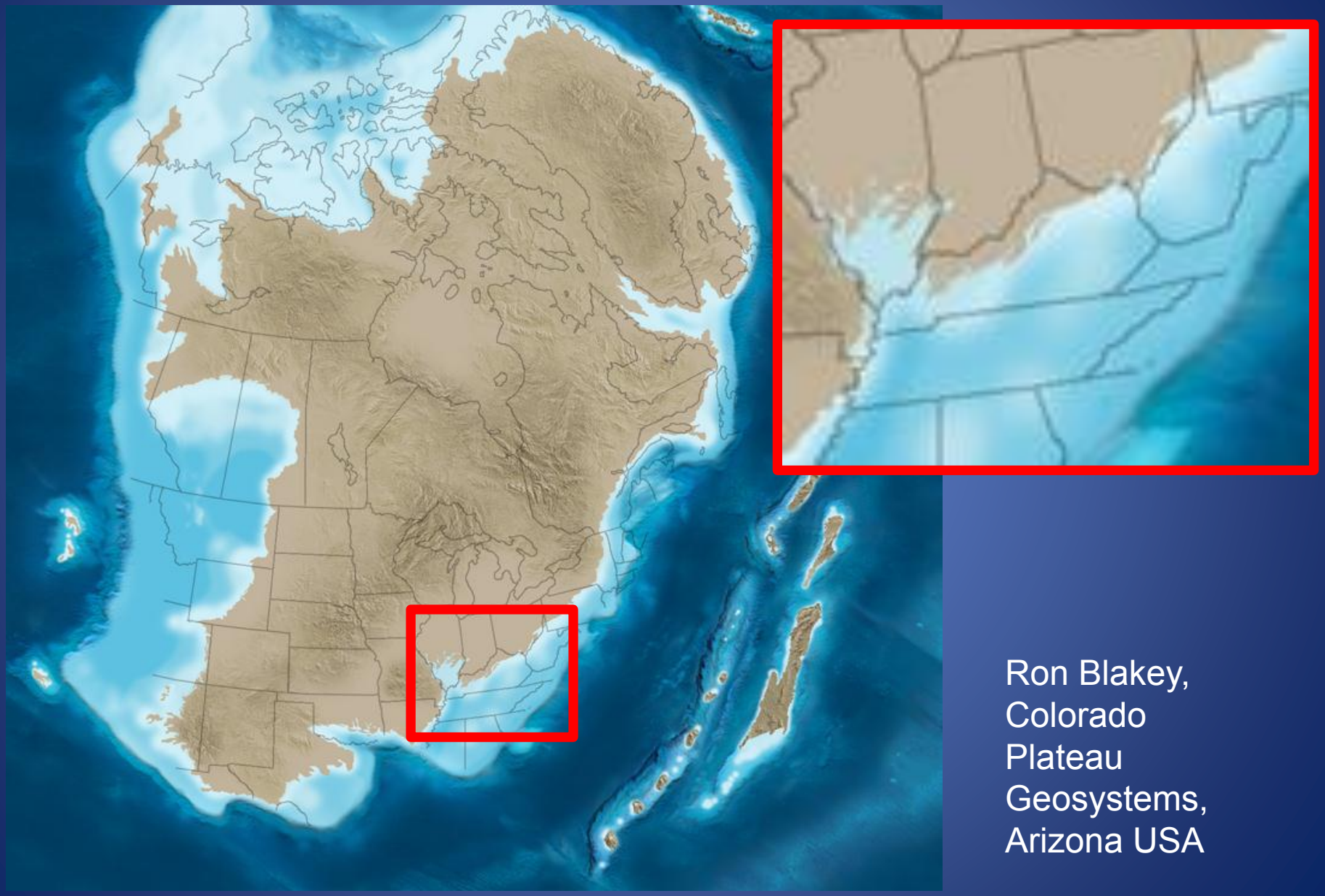
Other Conasauga Production

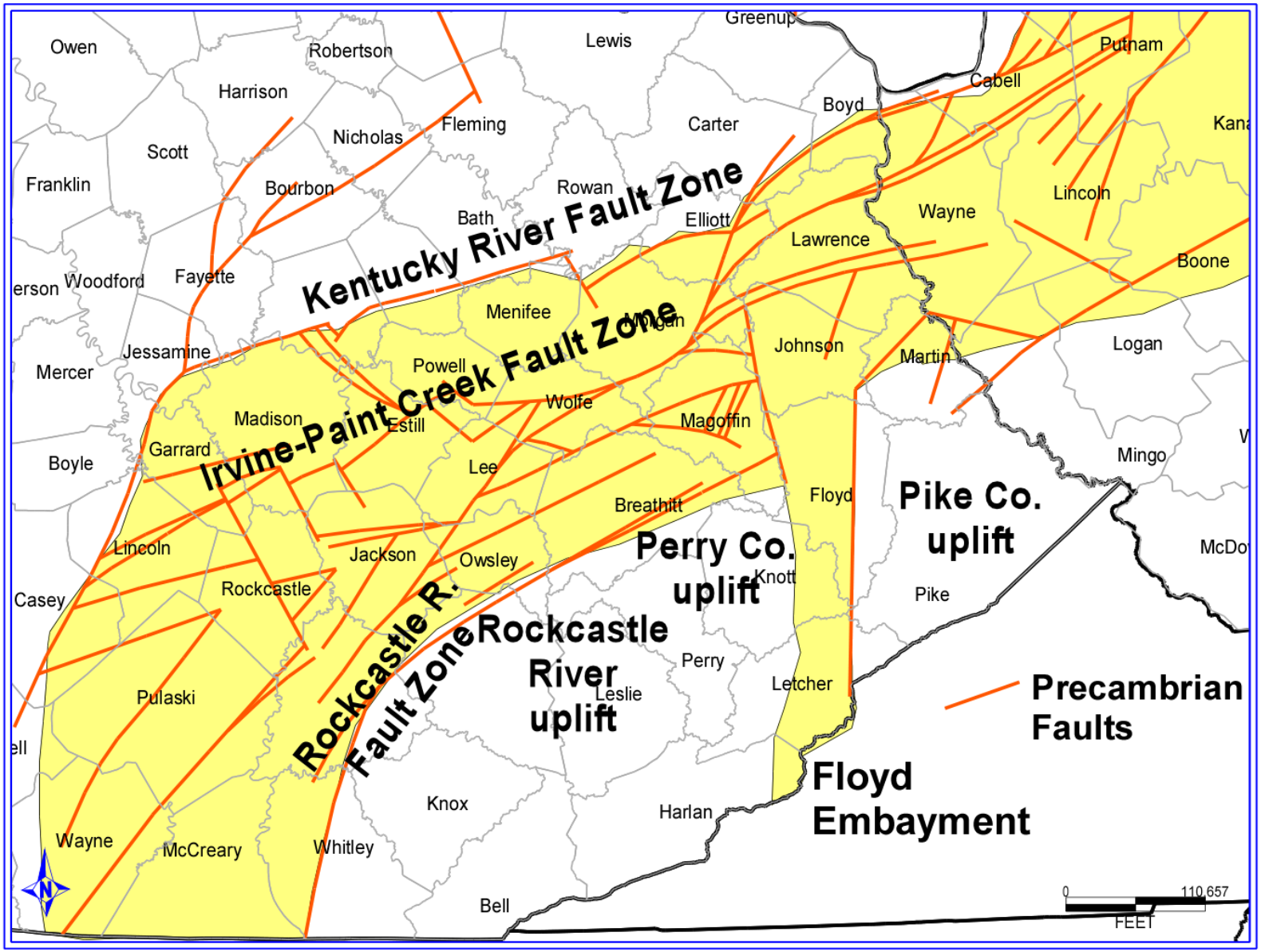
- Limited Conasauga shale gas production, Big Canoe Creek field, Black Warrior Basin, AL
- Very different than Rome Trough
  - Appalachian overthrust mushwad
- 2010 RPSEA report 07122.17.01 (Pashin and others)

Middle Cambrian Paleogeography



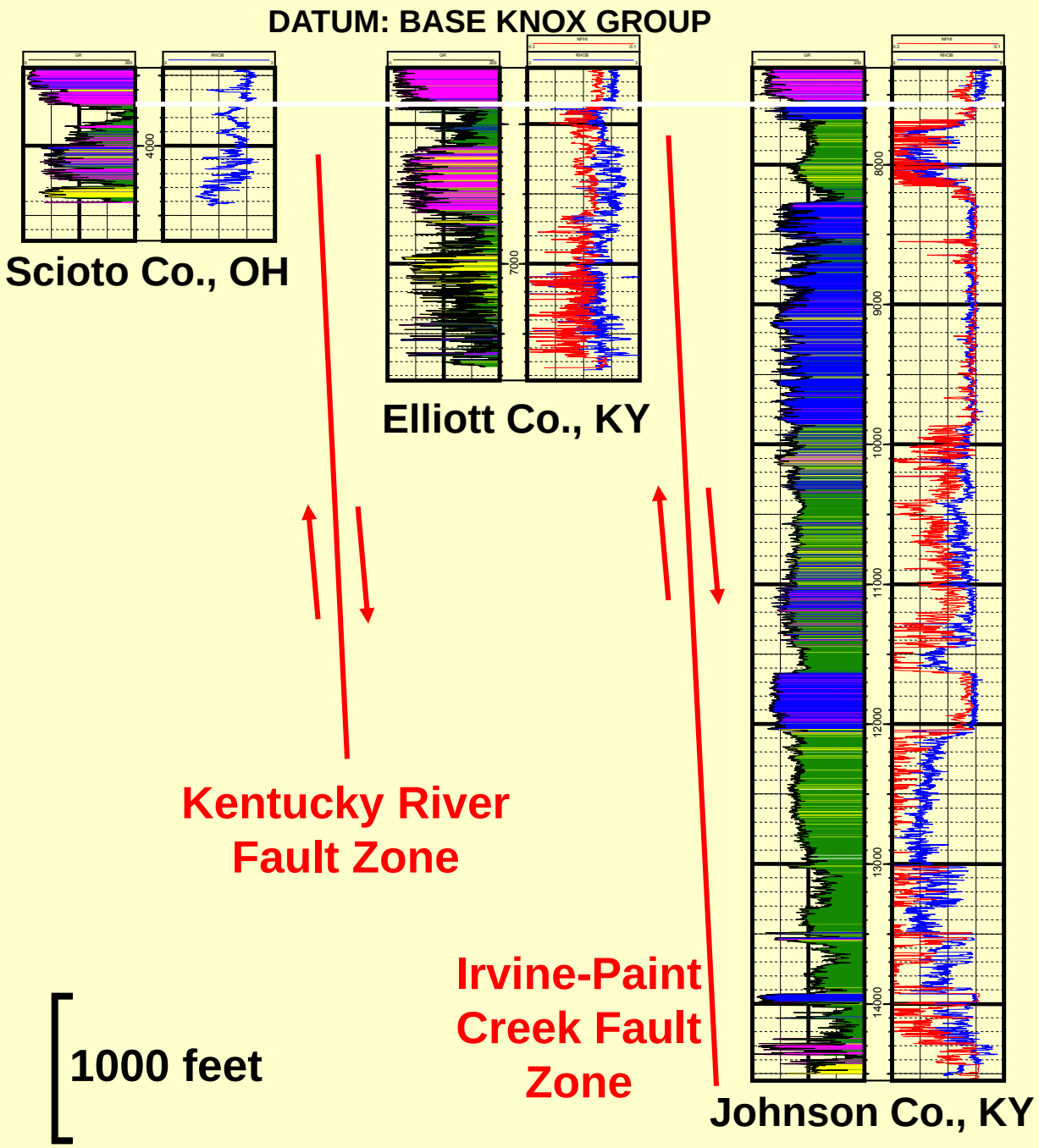
Ron Blakey, Colorado Plateau Geosystems, Arizona USA

Rome Trough Structural Features



Stratigraphic Problem

- Correlations across growth faults
- Prediction of sandstone and shale distribution



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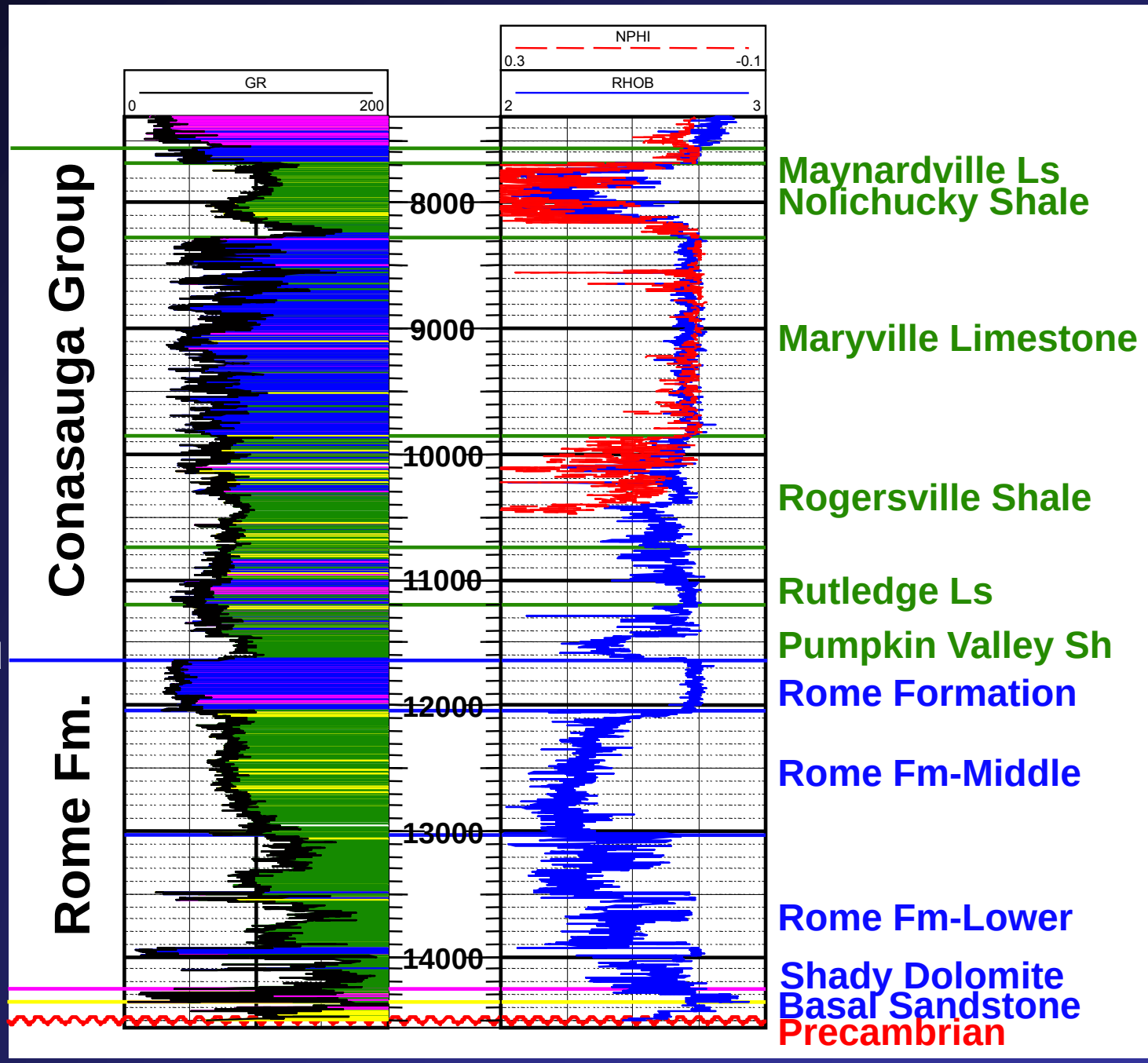
Pre-Knox Type Log

U.S. Signal
Elkhorn Coal
Johnson Co.
Kentucky

Gamma ray shaded
By log-calculated
lithologies



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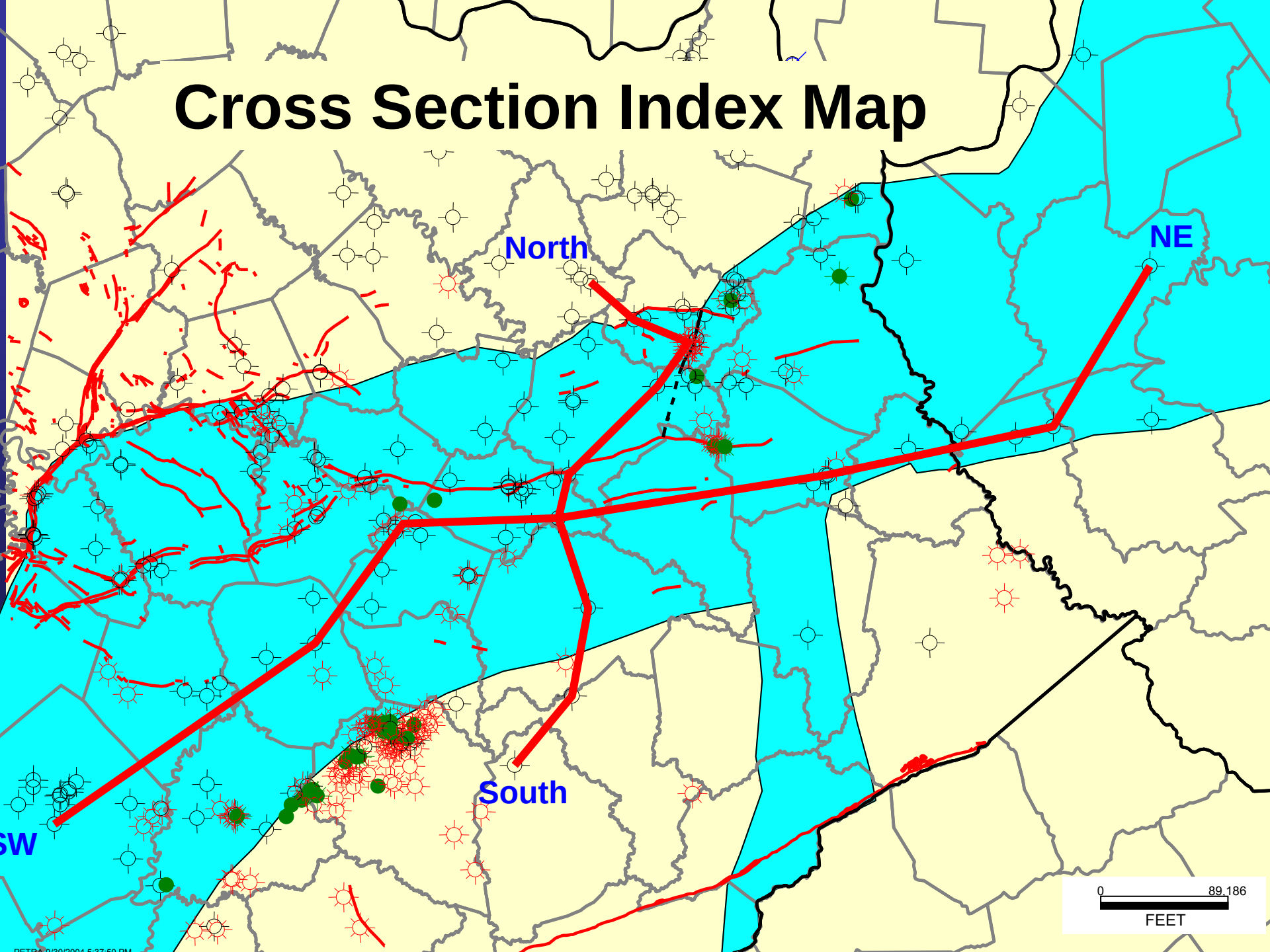
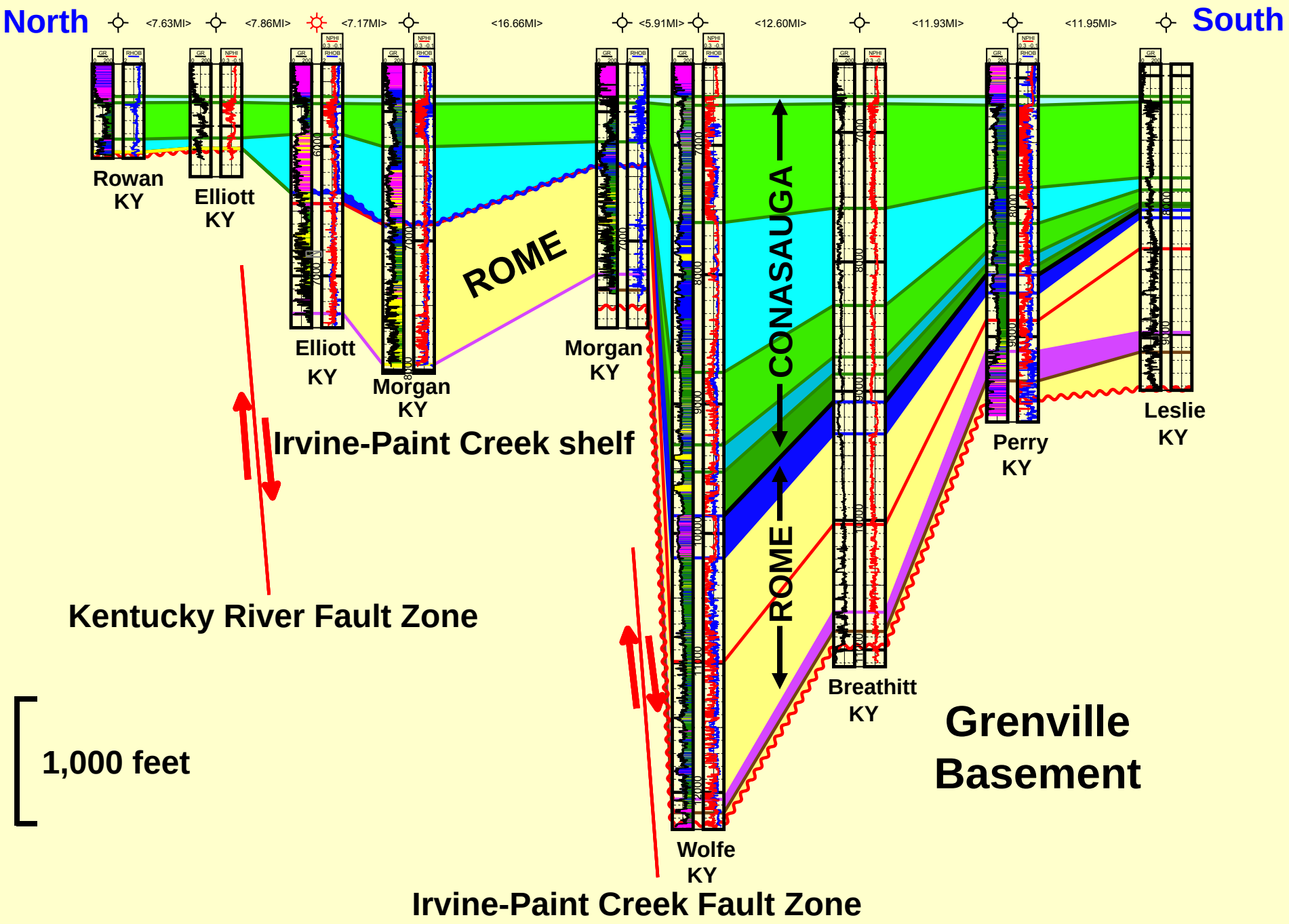
Cross Section Index Map

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South
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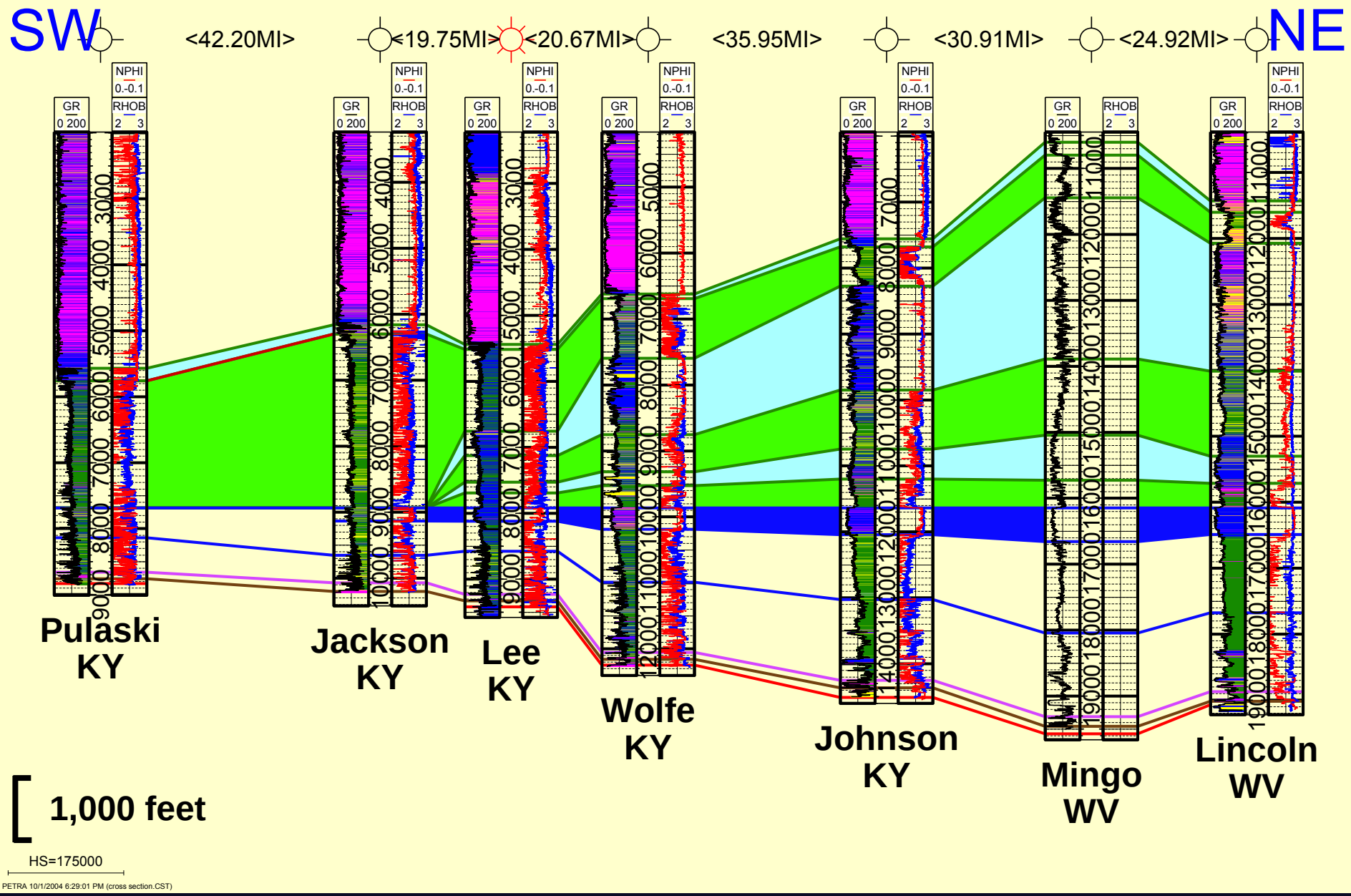
Rowan KY
Elliott KY
Elliott KY
Morgan KY
Morgan KY
Wolfe KY
Breathitt KY
Perry KY
Leslie KY
ROME
CONASAUGA
ROME
Irvine-Paint Creek shelf
Kentucky River Fault Zone
Irvine-Paint Creek Fault Zone
Grenville Basement
1,000 feet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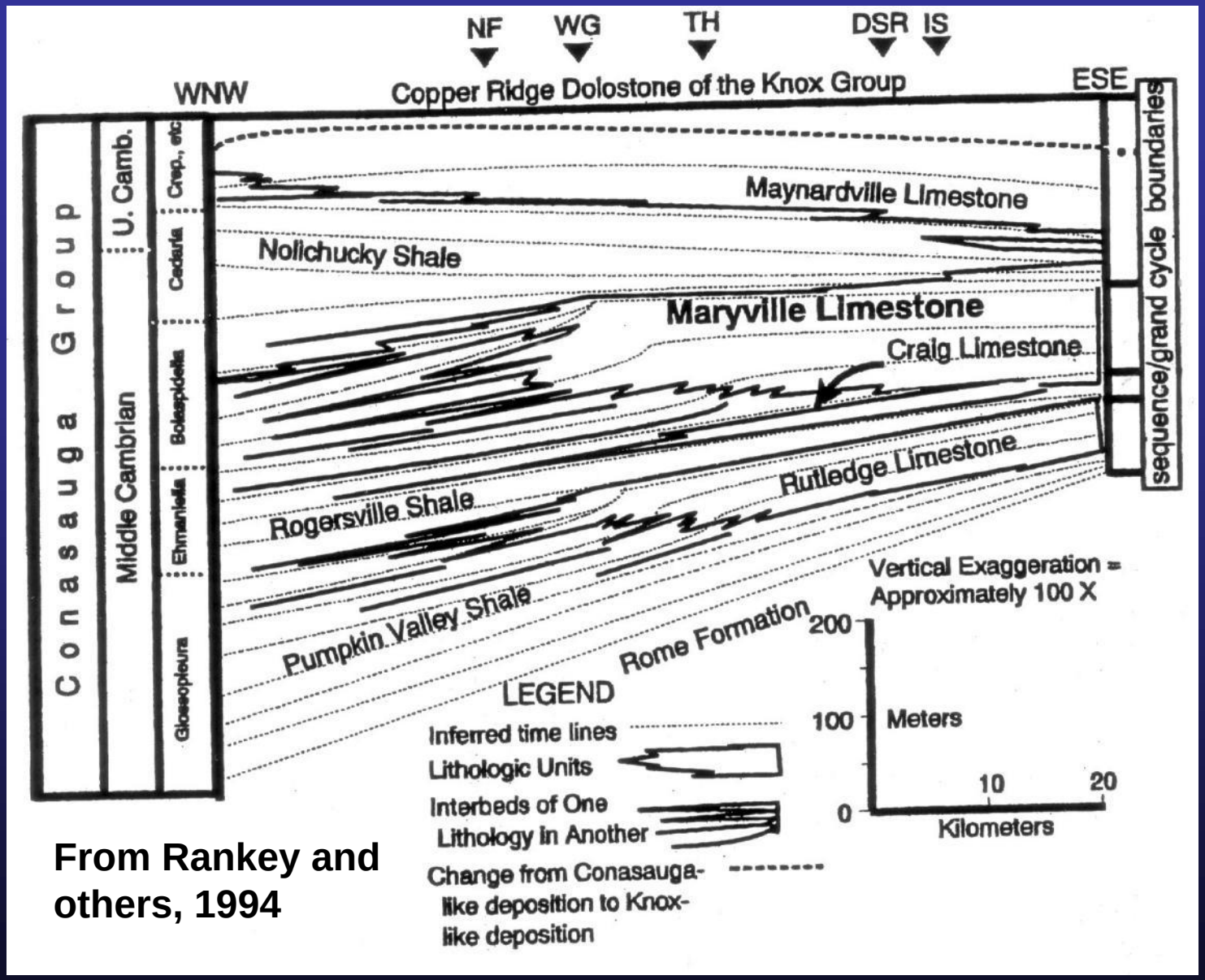
NPHI
0.-0.1
RHOB
2 3
Pulaski
KY
Jackson
KY
Lee
KY
Wolfe
KY
Johnson
KY
Mingo
WV
Lincoln
WV
1,000 feet
HS=175000
PETRA 10/1/2004 6:29:01 PM (cross section.CST)

Conasauga Trangressive-Regressive Cycles

Eastern Tennessee Outcrops



From Rankey and others, 1994

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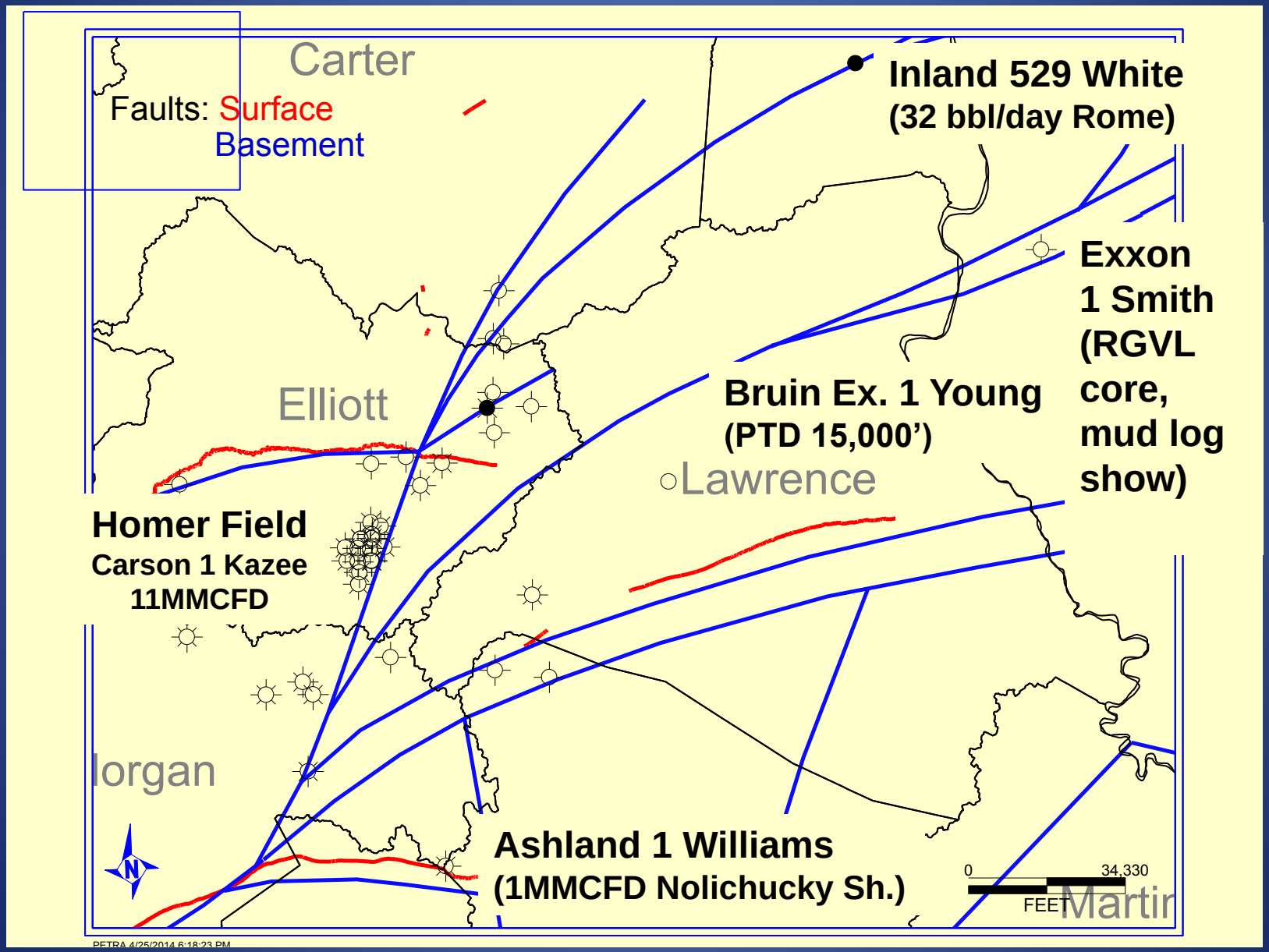
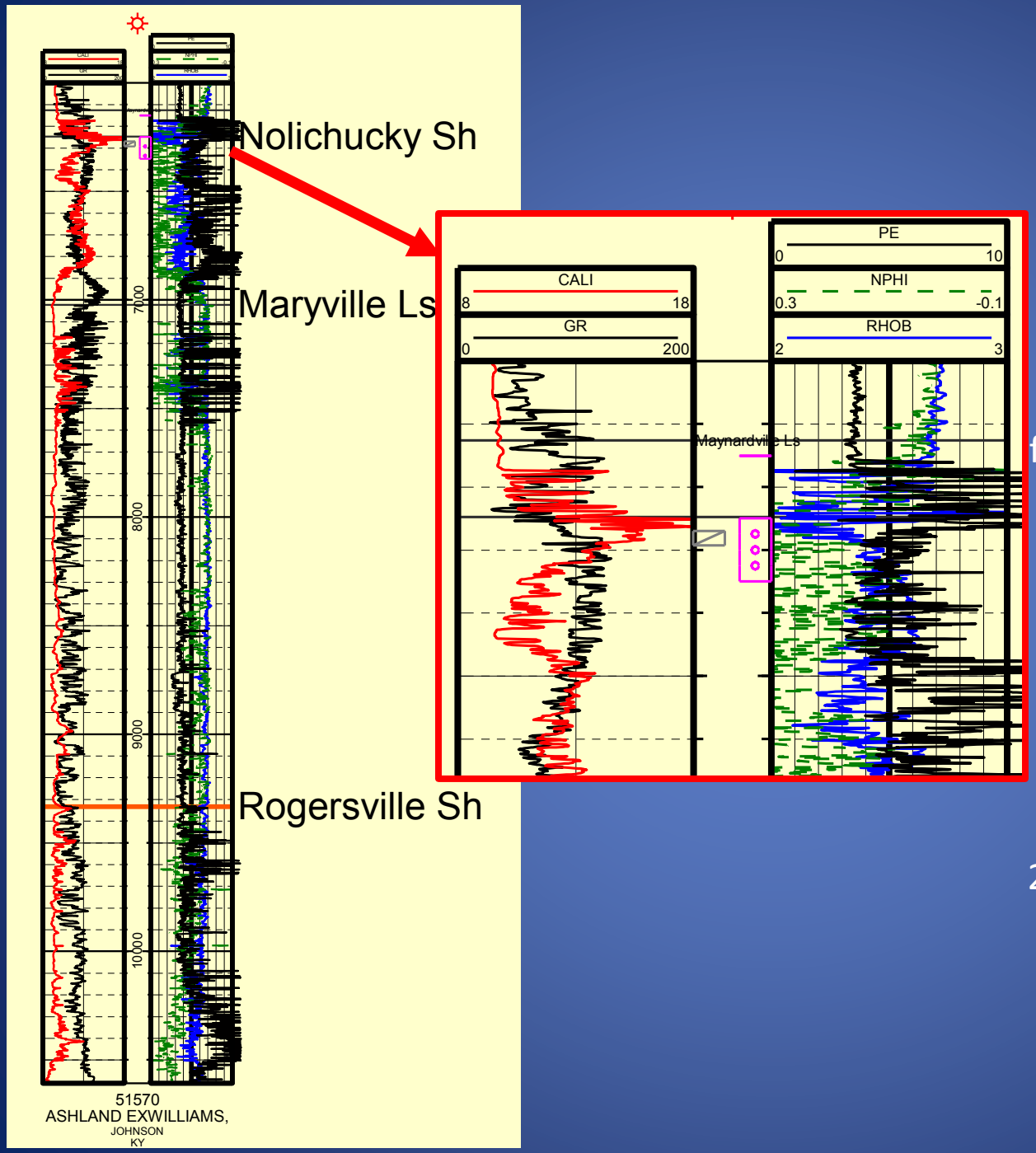
Rome Trough Production



Ashland #1 Williams, Johnson Co.



IP 1.05 MMCFD from fractured Nolichucky Shale @ 6,200 ft

1.2BCF with 42,000 bbl condensate since 1985

Core in Nolichucky, but low TOC - not the source

2011 Production: 7.7 MMCFG with 171 bbl condensate

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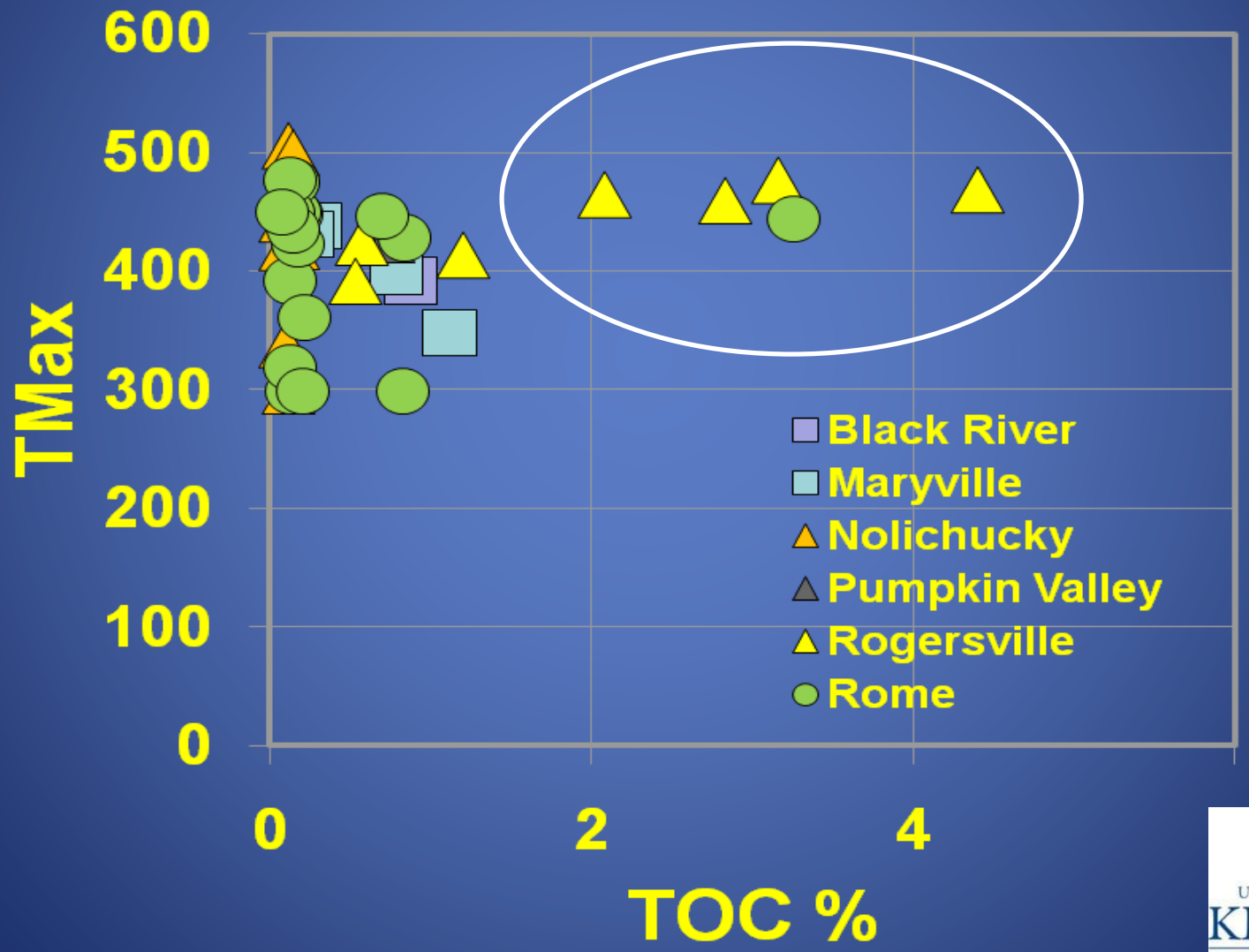
Cambrian Source Rocks in Rome Trough



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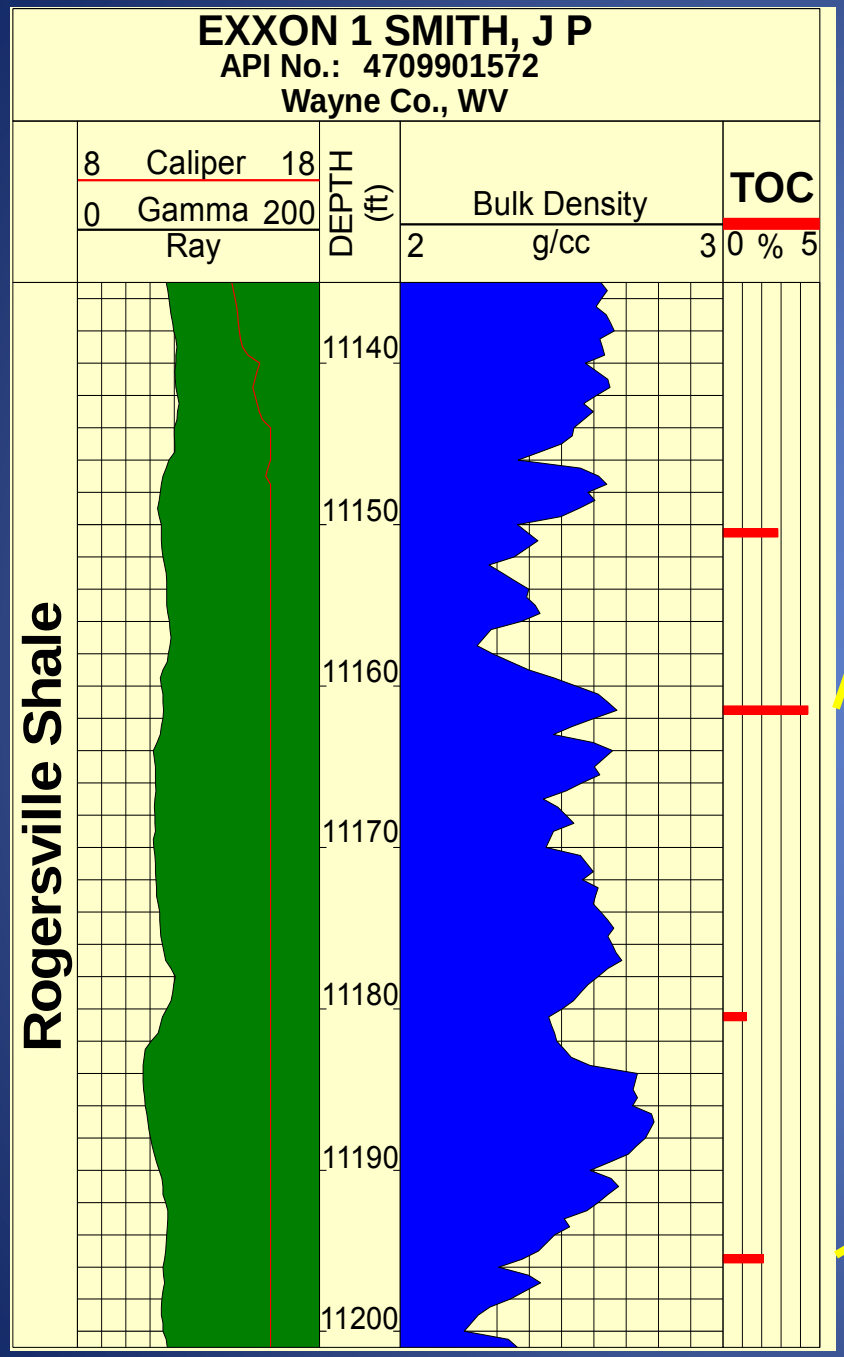
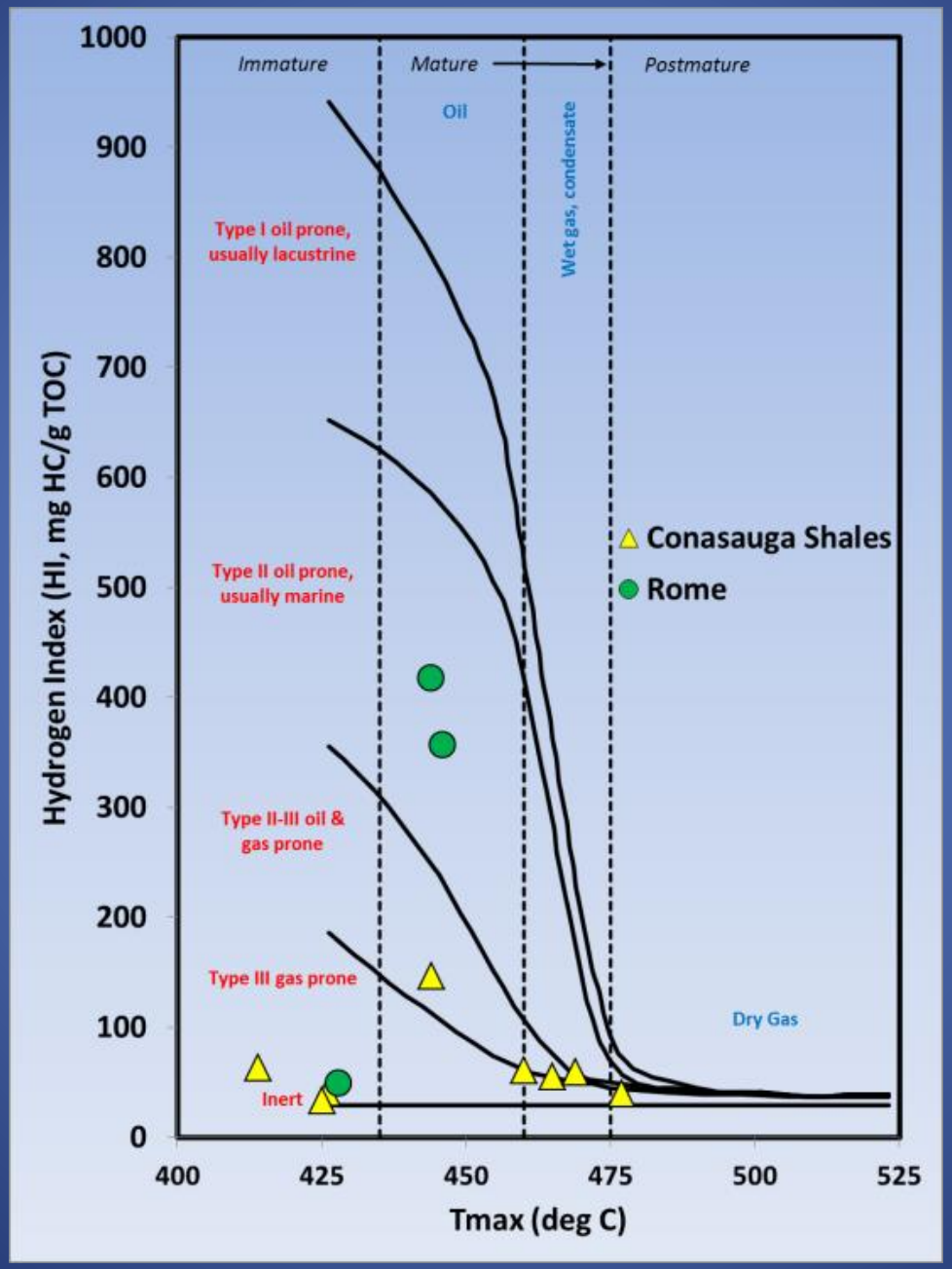
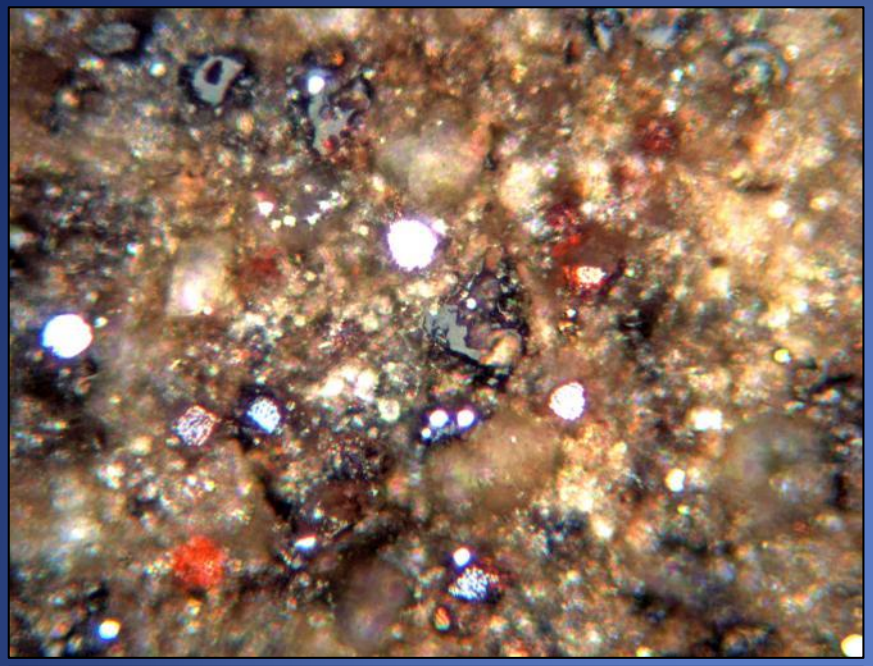


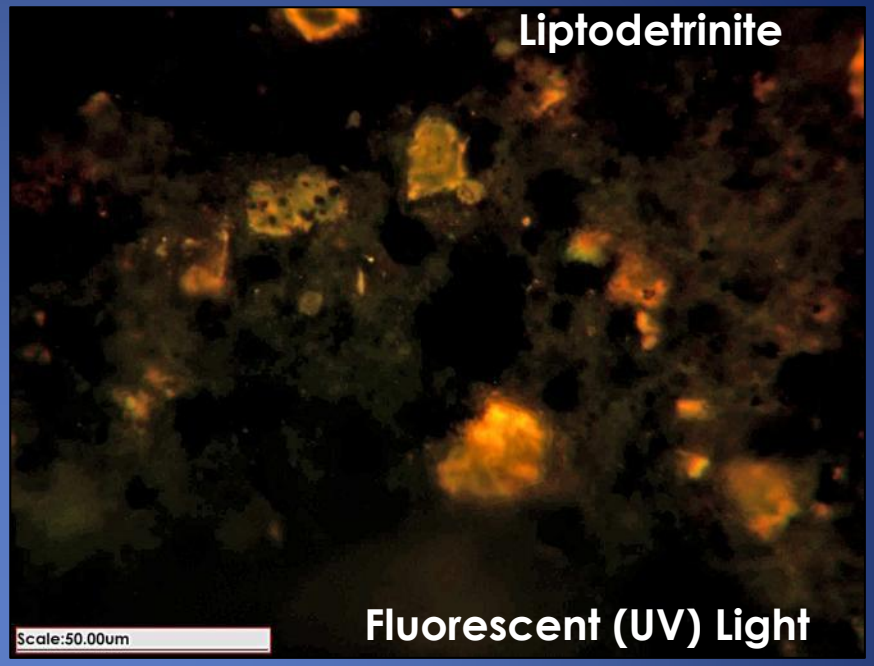
TOC range 1.2–4.4%, n=4

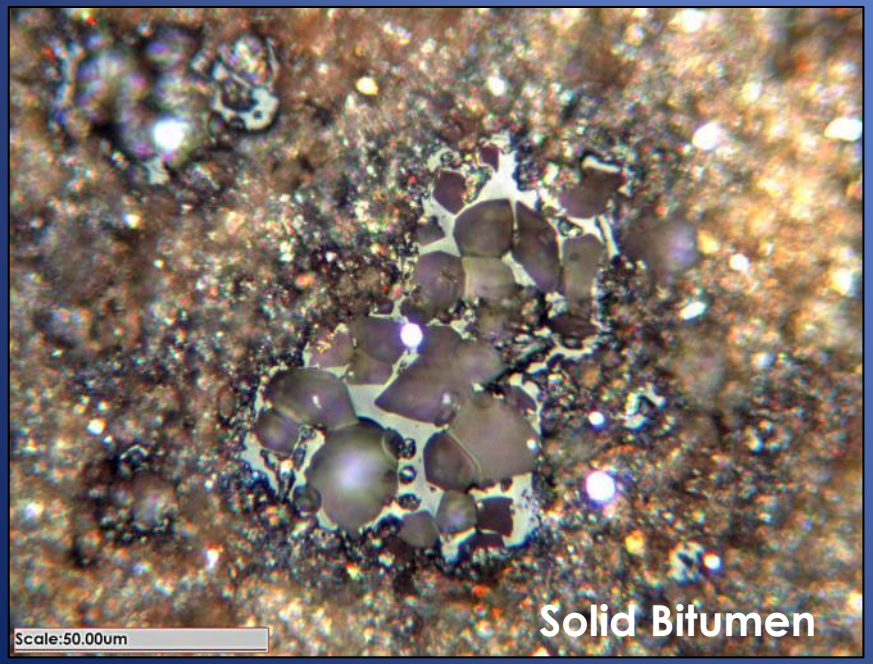
RTC Maturity and Kerogen Data

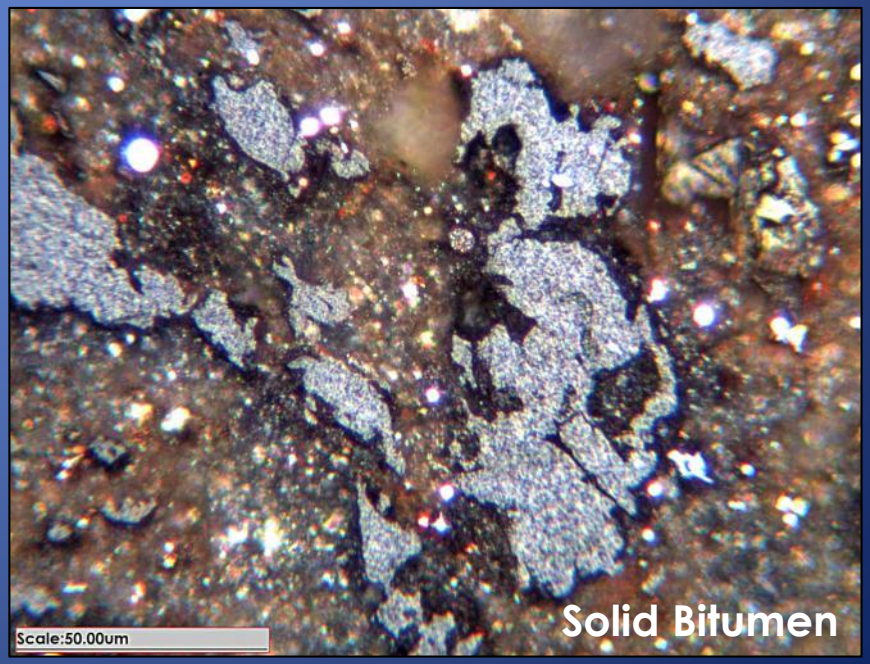


Rogersville Organic Petrography









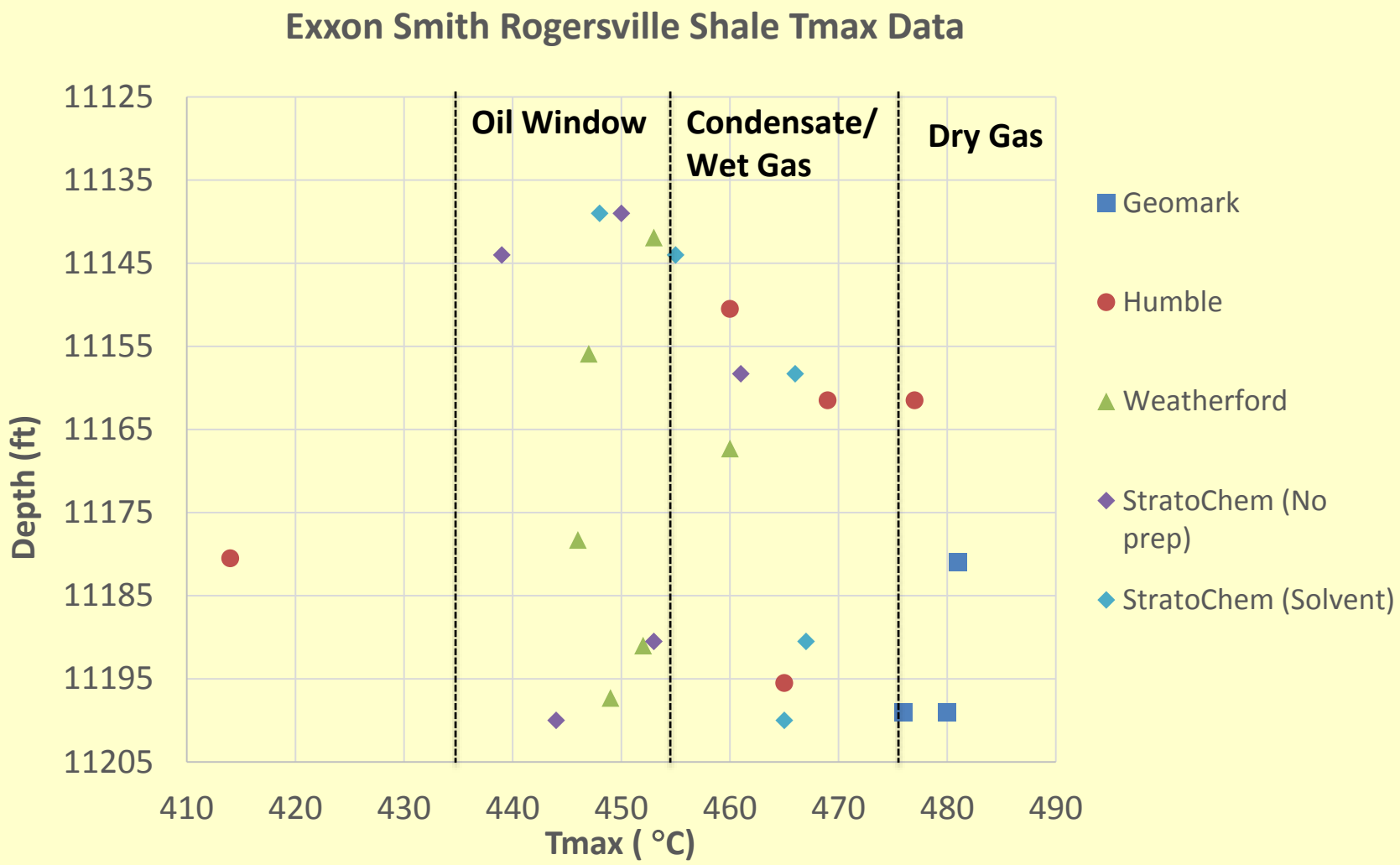
Bitumen Reflectance

	11167	11178	11191	11197
Average Ro random	**1.76**	**1.80**	**1.80**	**1.84**
Maximum Ro random	2.11	2.11	2.04	2.10
Minimum Ro random	1.50	1.47	1.53	1.59
Standard deviation	0.14	0.16	0.13	0.13
Observations	50.00	50.00	50.00	50.00
Calculated Ro equivalent (Ro random * 0.618) + 0.4 (Jacobs, 1989)	**1.49**	**1.51**	**1.51**	**1.54**
Indicated Tmax from calculated Ro equiv.	**480**	**482**	**482**	**484**

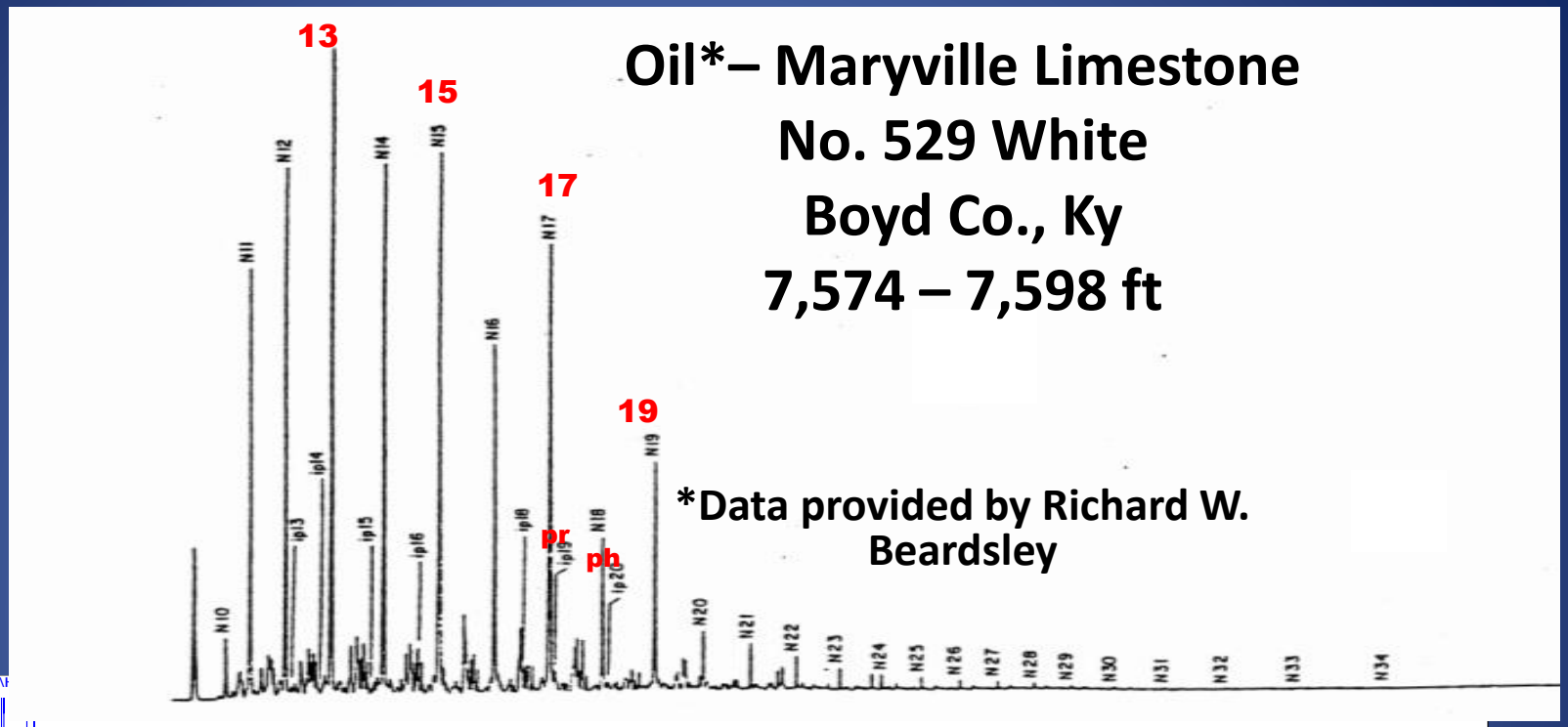
Spectral Fluorescence

	11167	11178	11191	11197
Lambda maximum	638	648	648	645
Indicated Ro	**1.35**	**1.45**	**1.45**	**1.45**
Indicated Tmax from Lambda max.	**473**	**479**	**479**	**479**

Rogersville Tmax Data Variability by Lab

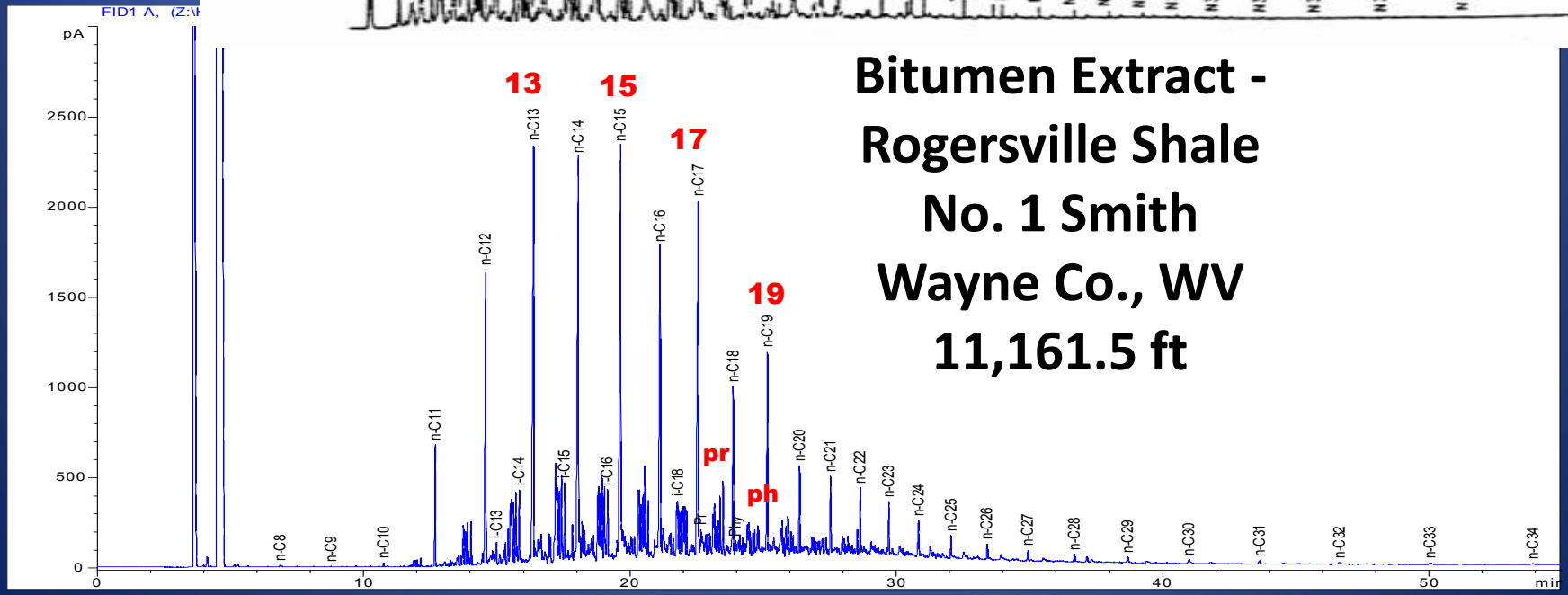


Oil – Source Rock Correlation



Oil*– Maryville Limestone
No. 529 White
Boyd Co., Ky
7,574 – 7,598 ft

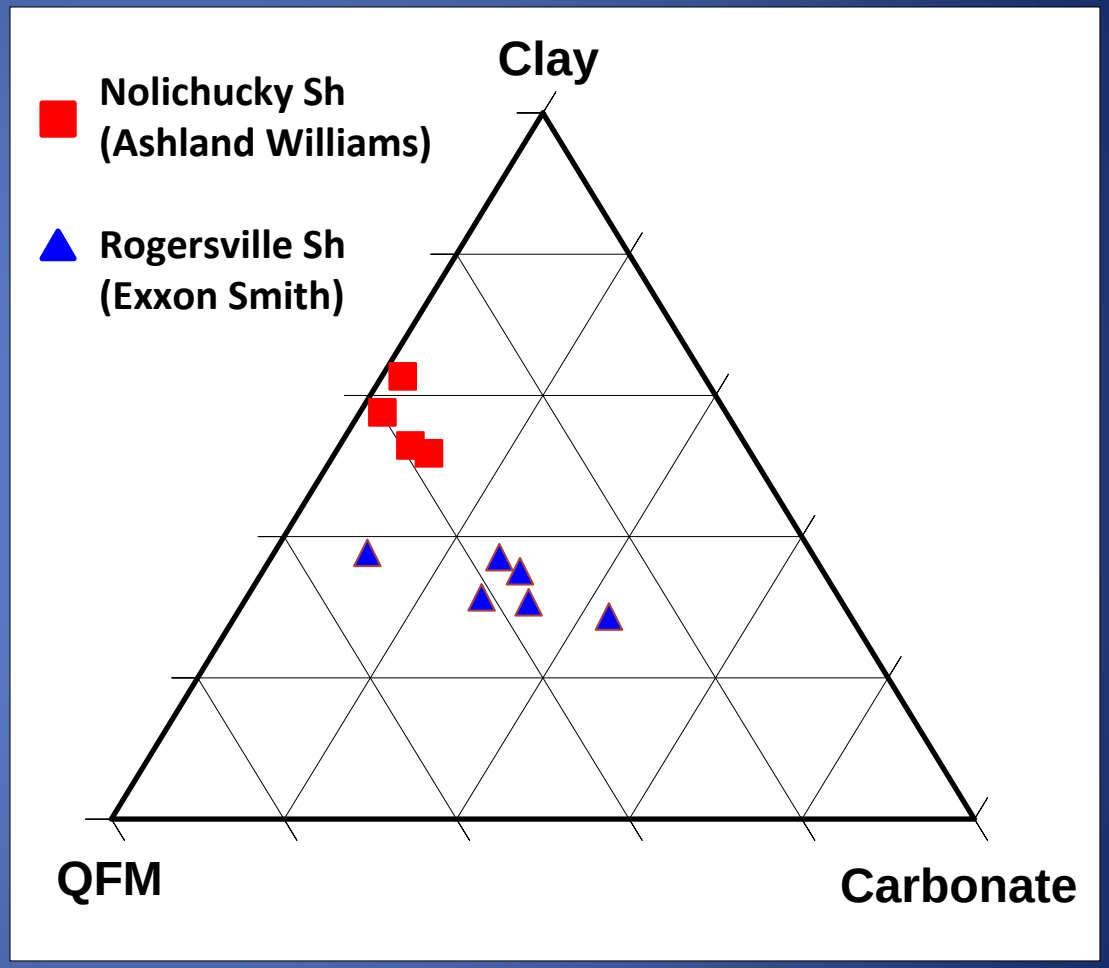
***Data provided by Richard W. Beardsley**



Bitumen Extract -
Rogersville Shale
No. 1 Smith
Wayne Co., WV
11,161.5 ft

Shale Mineralogy

- XRD data from the Rogersville and Nolichucky shales
- Rogersville has:
  - Less clay
  - More quartz & carbonate
- Increased brittleness



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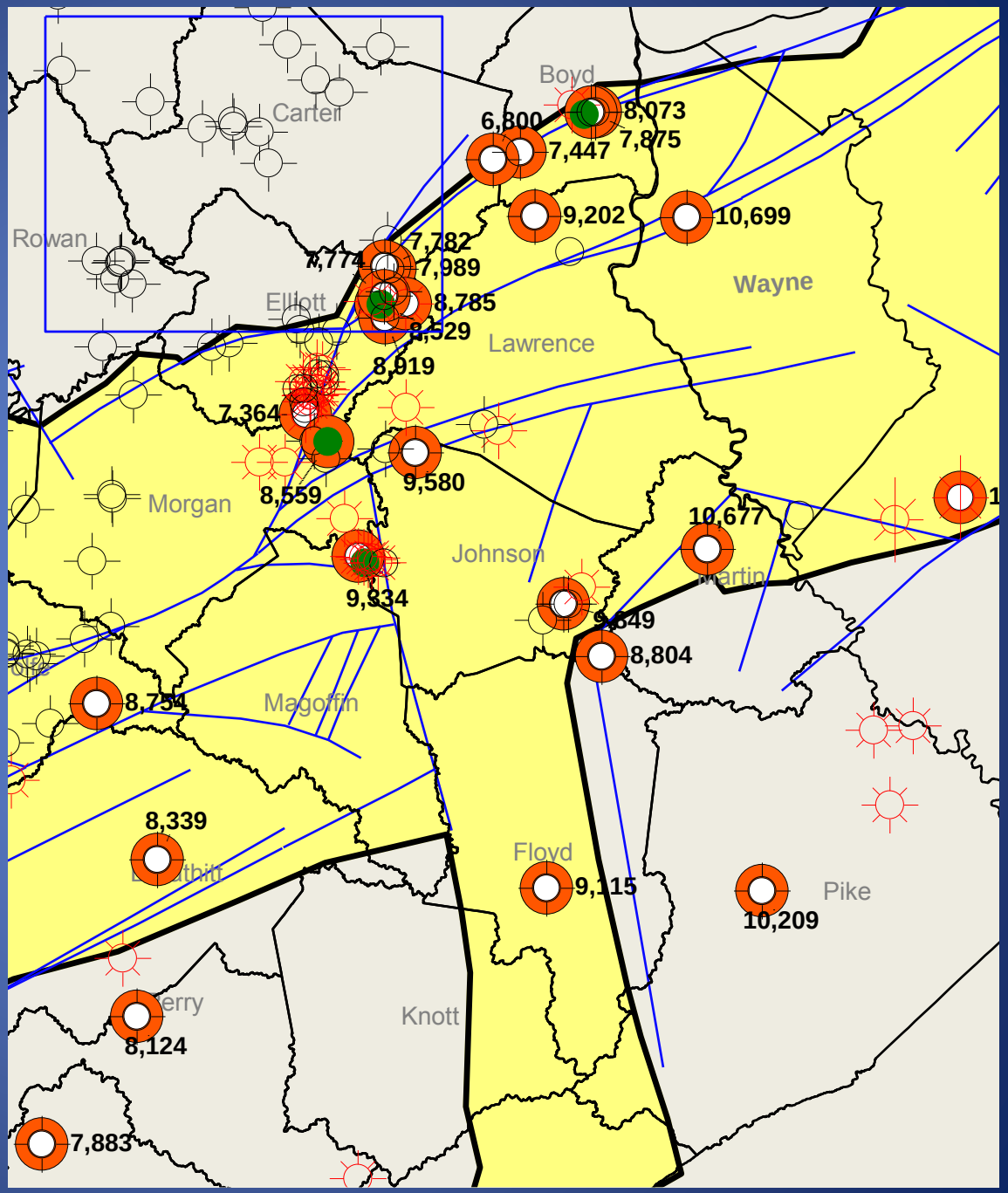
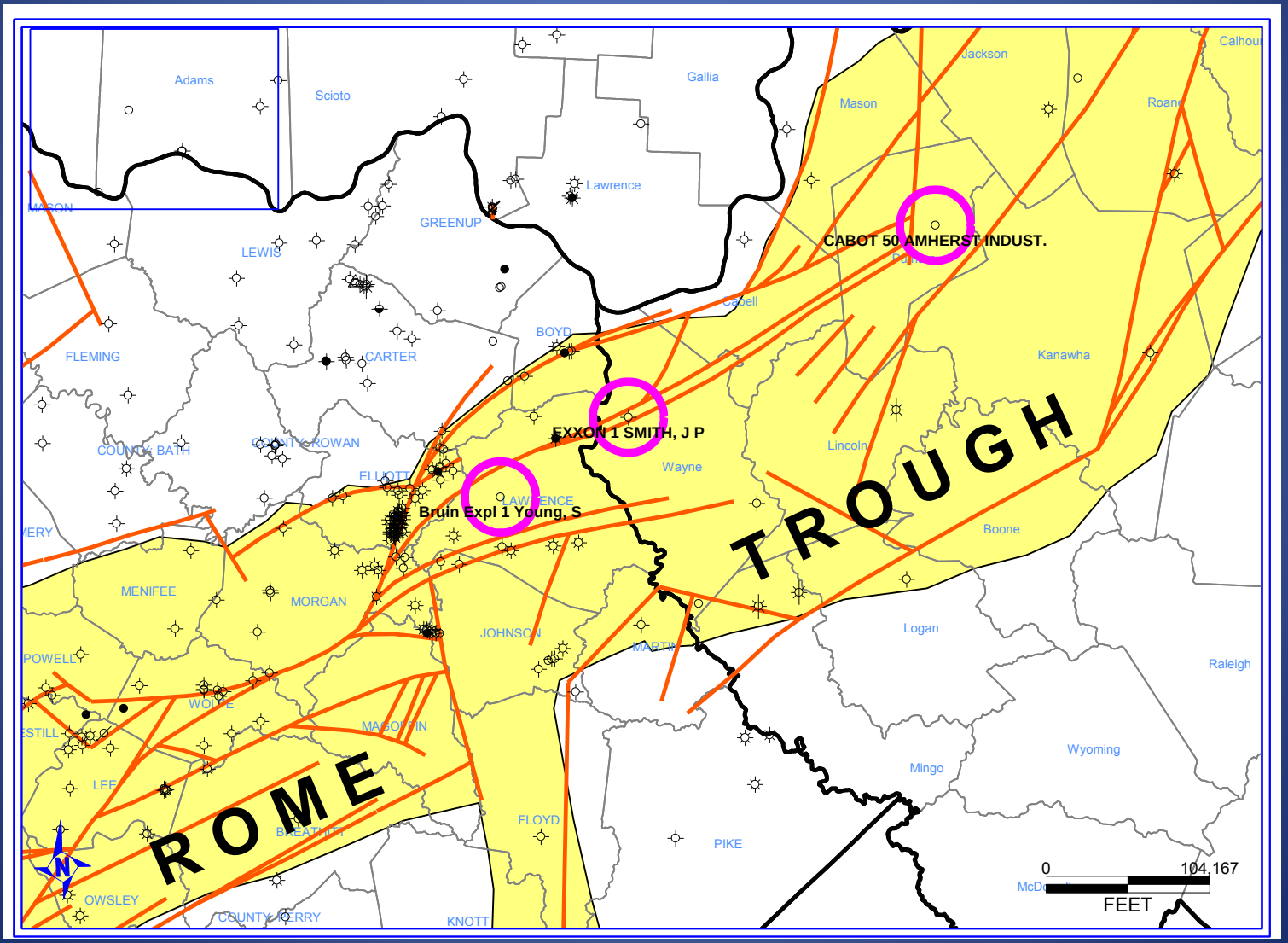
Drilling depth to Rogersville Shale:

8,000–10,000 ft eastern Kentucky



Emerging Cambrian Rogersville Shale Play 2014



Bruin Exploration #1 Young Lawrence County, Kentucky

- Vertical stratigraphic test permitted to 15,000 ft in the Rome Fm. Drilled late 2013, total depth not known.
- Oil and gas permit issued in 2014 to test well
- Logs, samples from strat test held confidential for 5 years; completion report to be released February 28, 2015.
- Well currently shut-in

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Cabot #50 Amherst Industries, Putnam County, WV

- New permit for 14,000 ft gas well to test Rogersville Shale
- Location along strike with Exxon Smith and Bruin wells

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Rogersville Shale Summary

- 5,000 to 10,000 ft deep in eastern Kentucky
- 2–4.8% TOC in parts, and has generated gas & condensate
- Up to 1,100 ft thick in Kentucky, but limited to deeper parts of Rome Trough- and not all is organic rich
- Active leasing in several eastern Kentucky counties; expecting new permits before year-end

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Conclusions

- Viable petroleum system exists in Rome Trough. Rogersville Shale (Conasauga Gp) is primary source interval.
- Conasauga stratigraphic framework for 3-state area is key to predicting source rock distribution
- Rogersville unconventional play should be possible in higher TOC areas, but need to consider depth and economics.

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Conclusions (cont.)

- Source rock quality in Rogersville is variable– *not* a uniform rich source. Controls on TOC distribution not well understood.
- Shallower, less mature areas of RT likely more liquids-prone than deeper areas in W. Va.
- Structure data (seismic, gravity, magnetics) will be a key tool in developing the Rogersville

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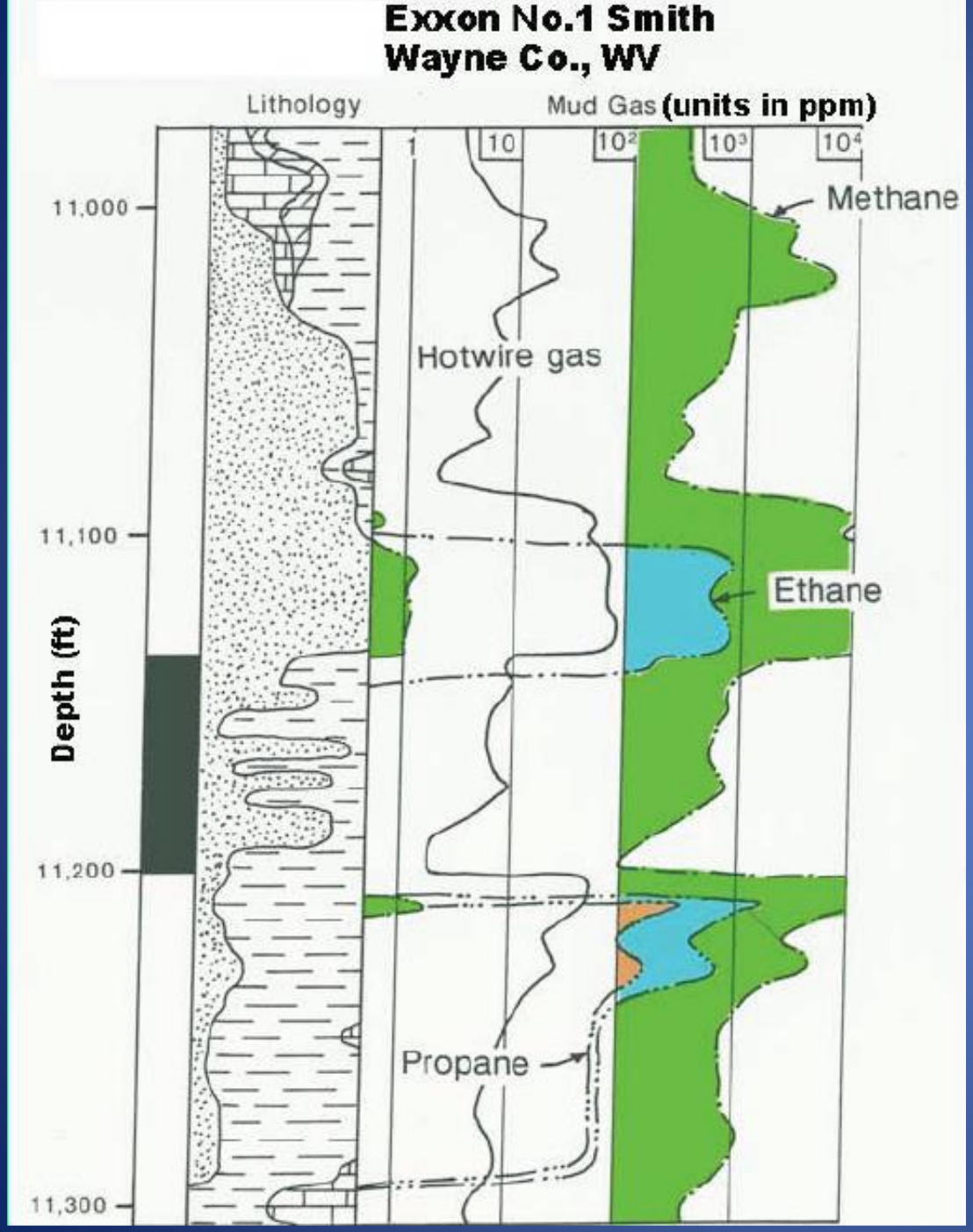

Mud Log Show

Rogersville Shale Interval, Exxon #1 Smith Wayne County, WV

From Ryder and others, 2005 USGS open file report

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