

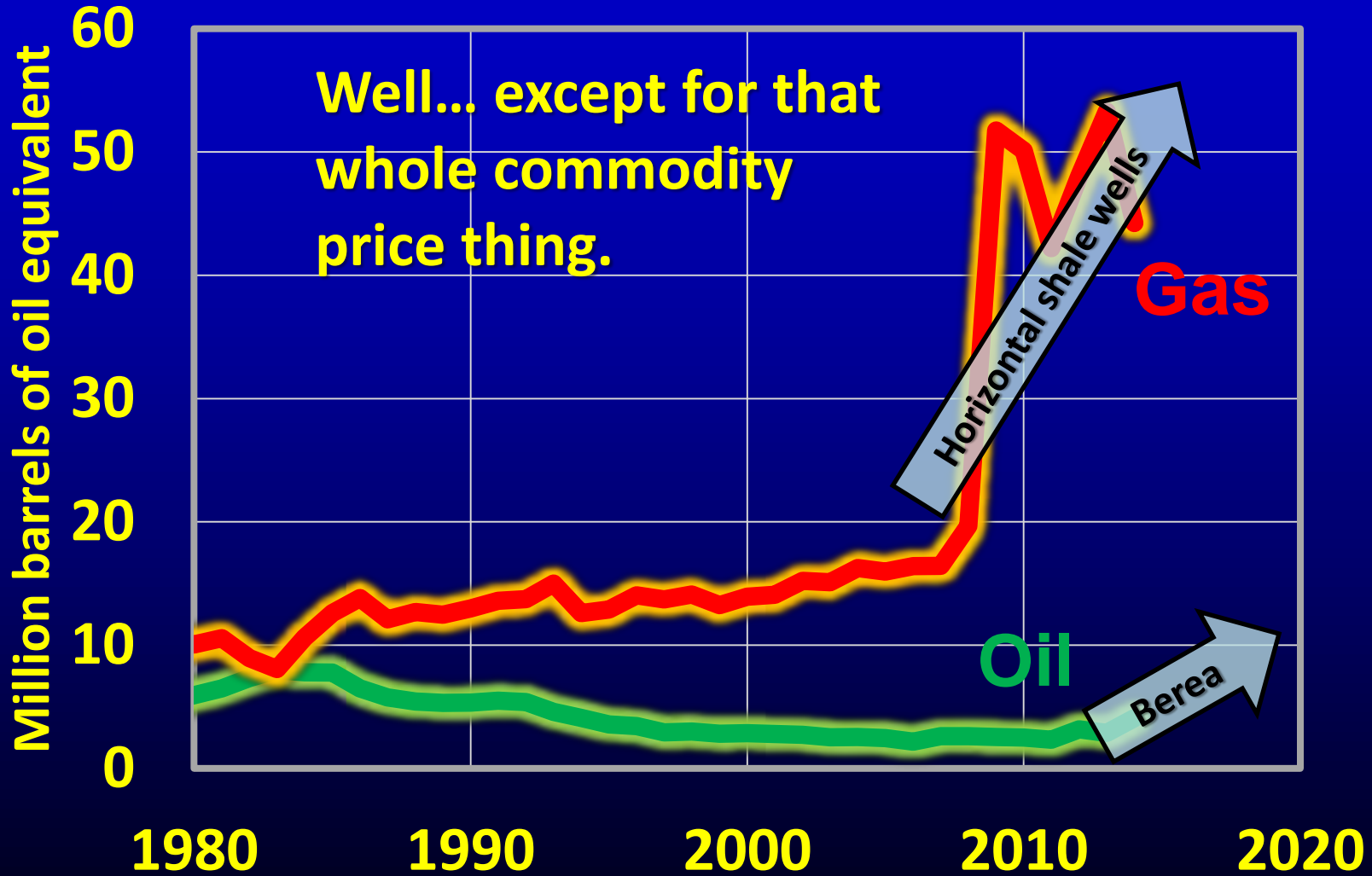
A Review of Oil and Gas Resource Trends in Kentucky

Brandon C. Nuttall



**Governor's Conference on Energy and Environment
Lexington, Kentucky, 9-Sep-2015**

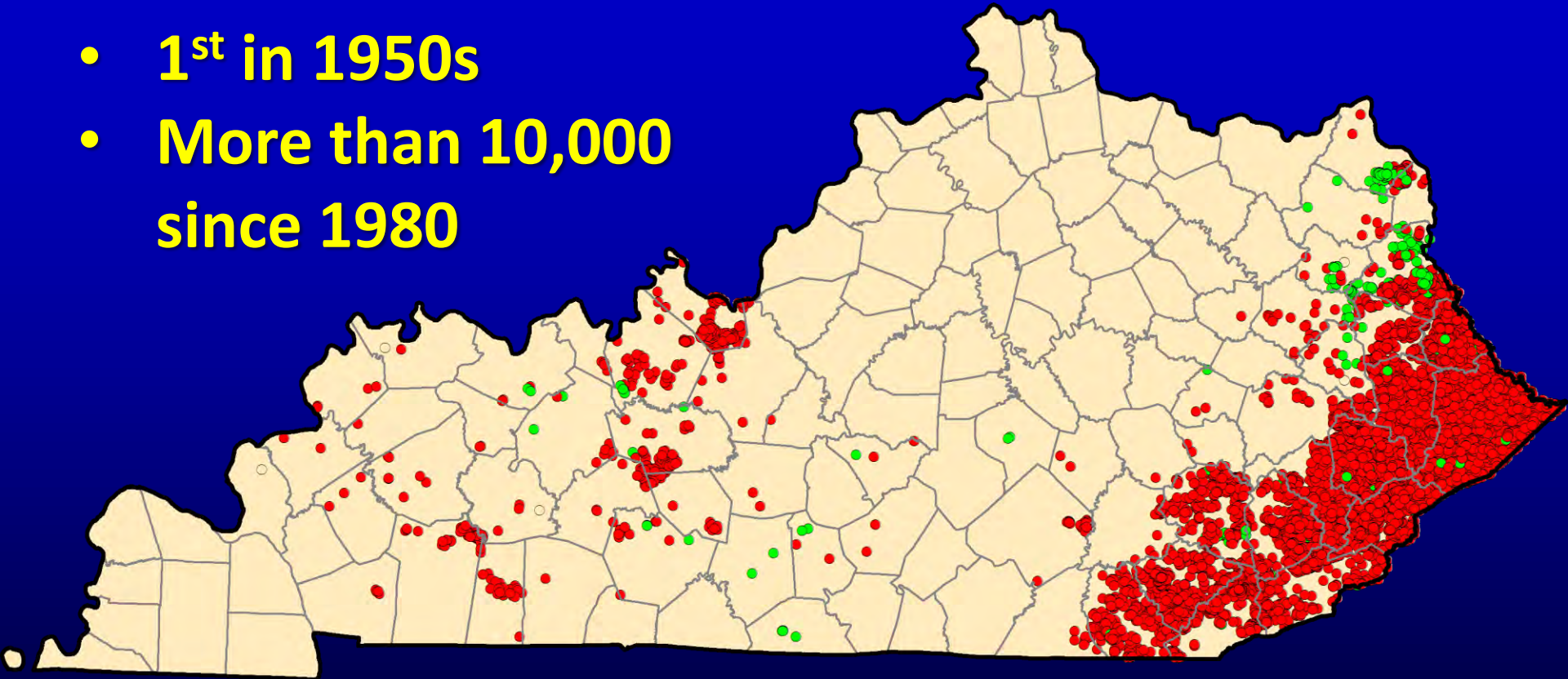
Things are Looking Up in Kentucky



1 Mcf = 0.172 barrels (based on Btu content)

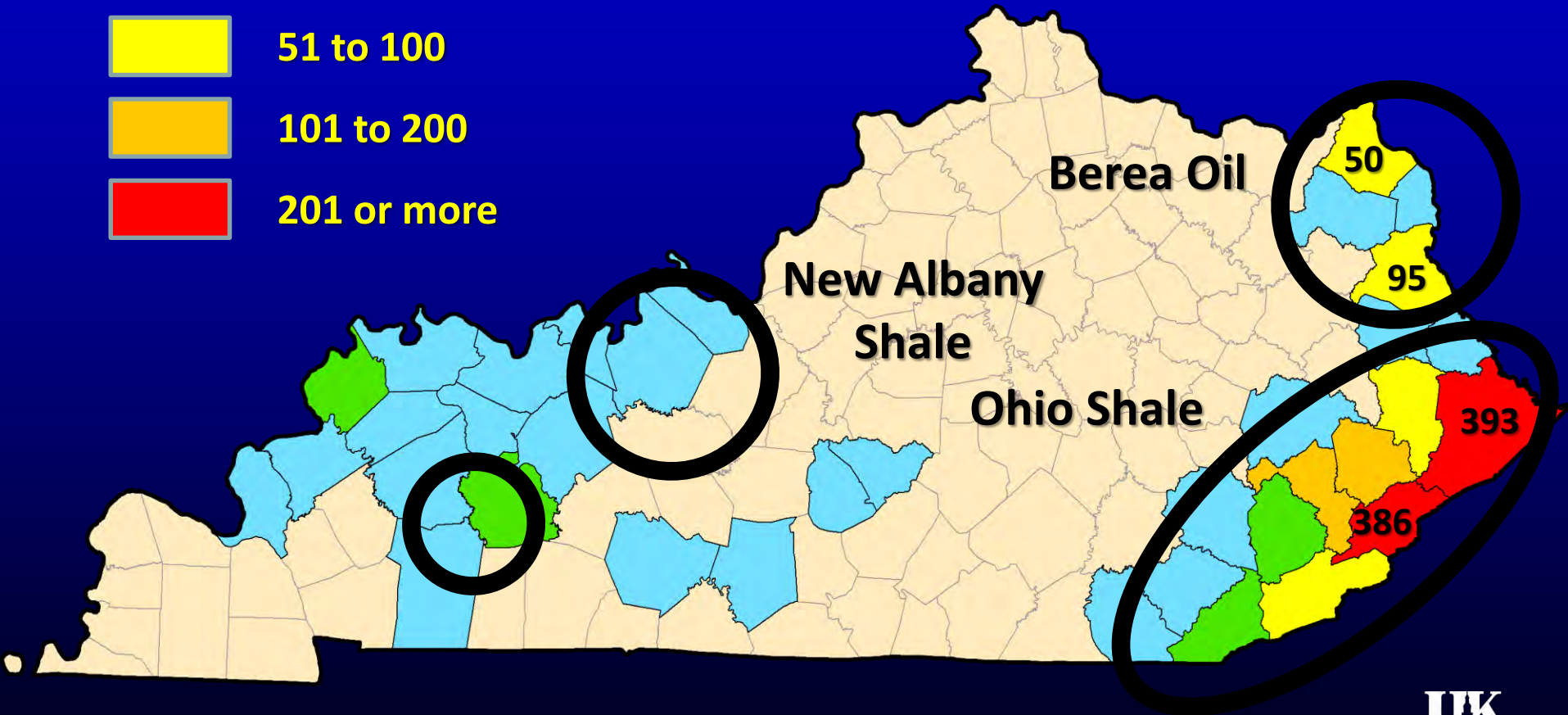
Fracture Stimulation in Kentucky

- 1st in 1950s
- More than 10,000 since 1980



Does not count many thousands of explosive fracture stimulations

Horizontal Wells since 2006



1,464 horizontal wells since 2006

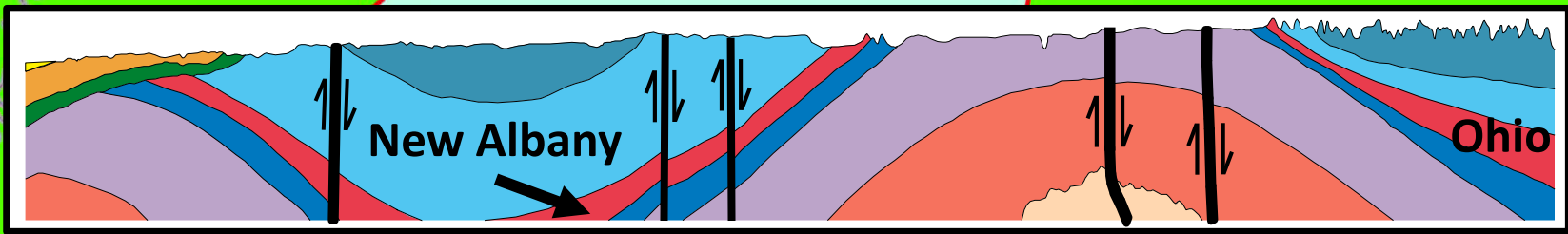
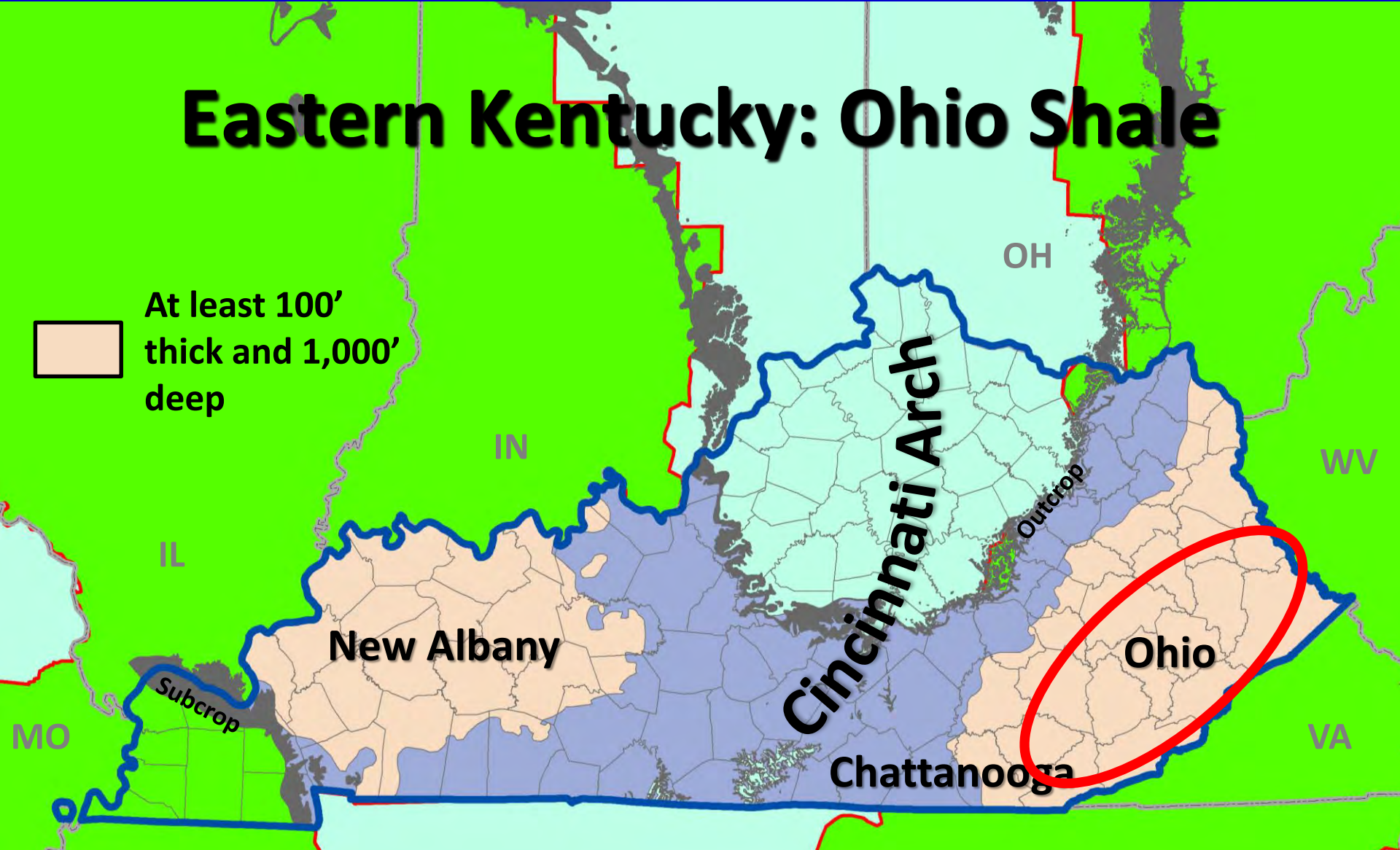


Fractured Black Gas Shale

Upper Huron, AA Highway near Vanceburg, KY

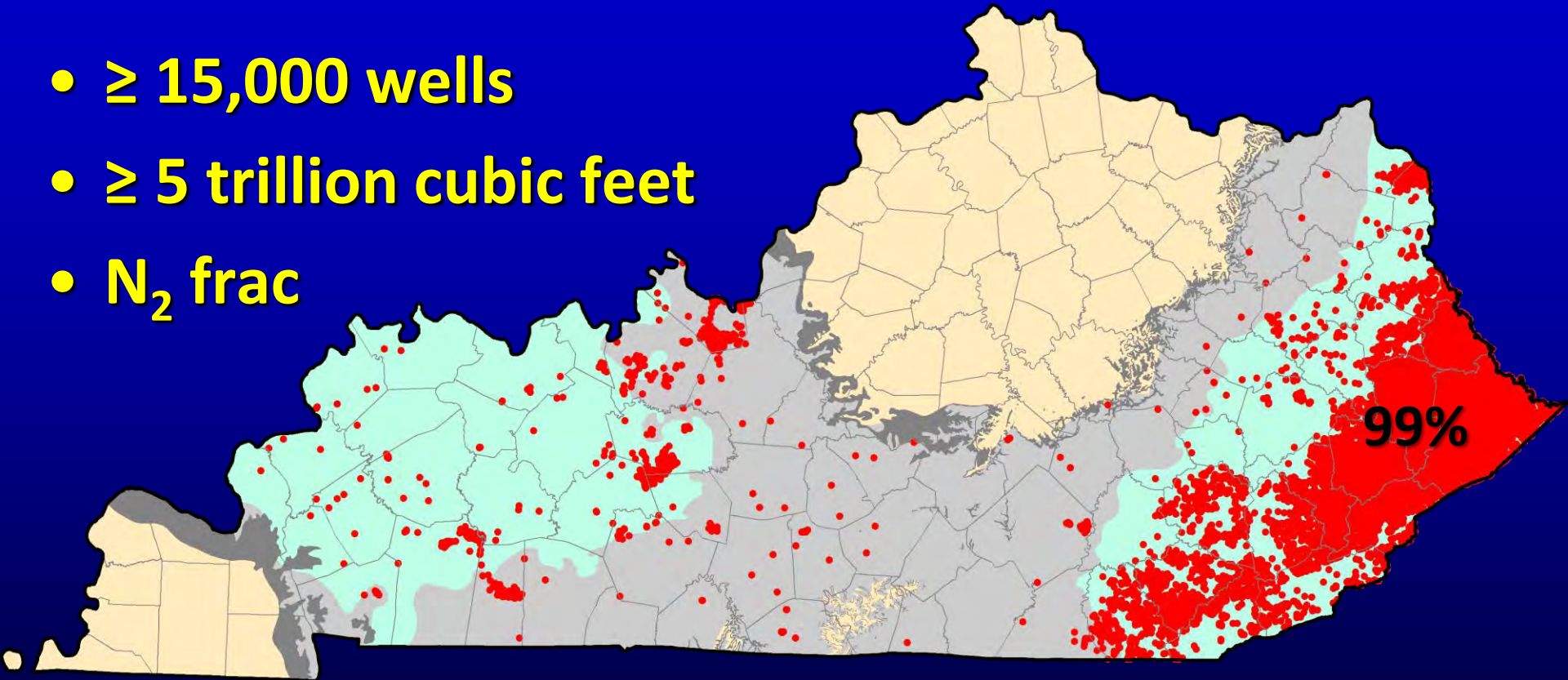
Eastern Kentucky: Ohio Shale

At least 100'
thick and 1,000'
deep



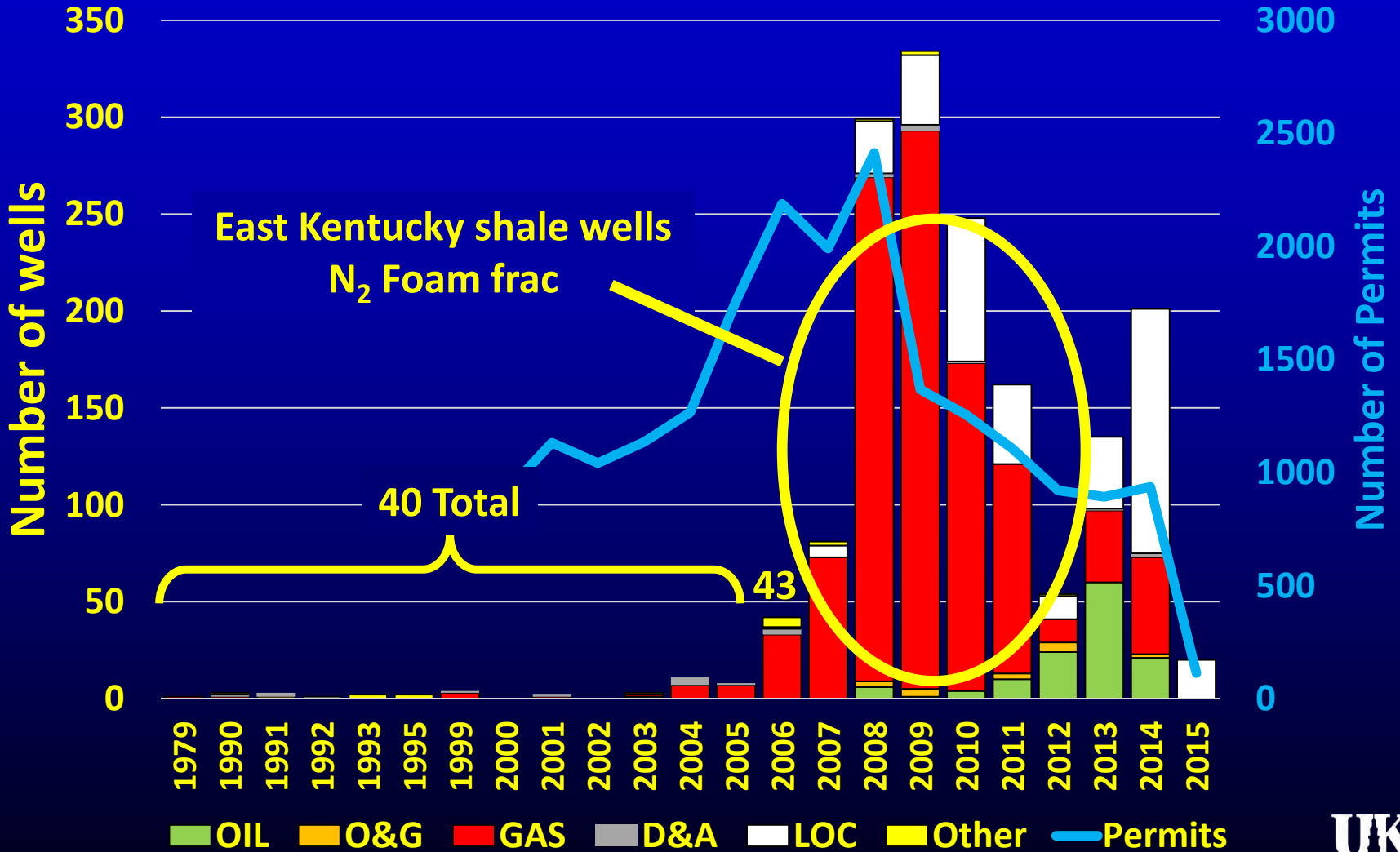
Kentucky Shale Wells

- $\geq 15,000$ wells
- ≥ 5 trillion cubic feet
- N_2 frac



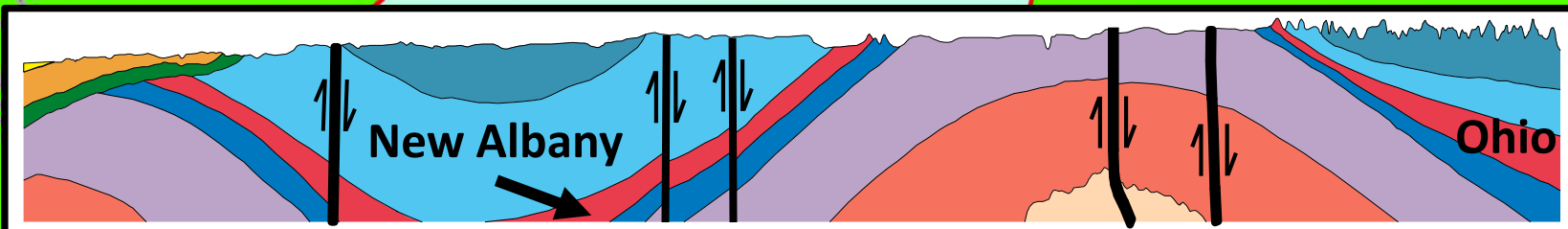
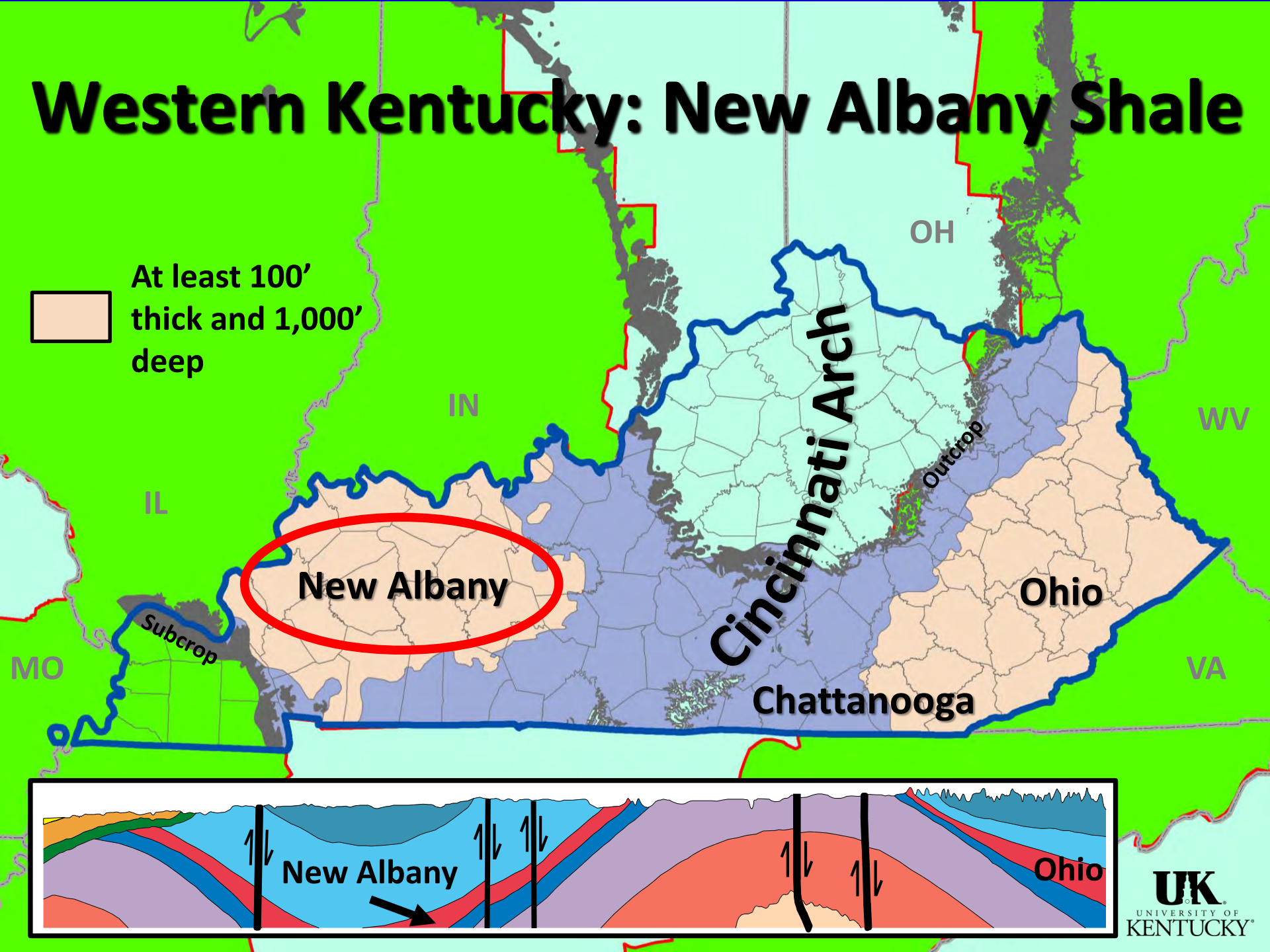
256 Bcf in 2014

Horizontal Wells By Year



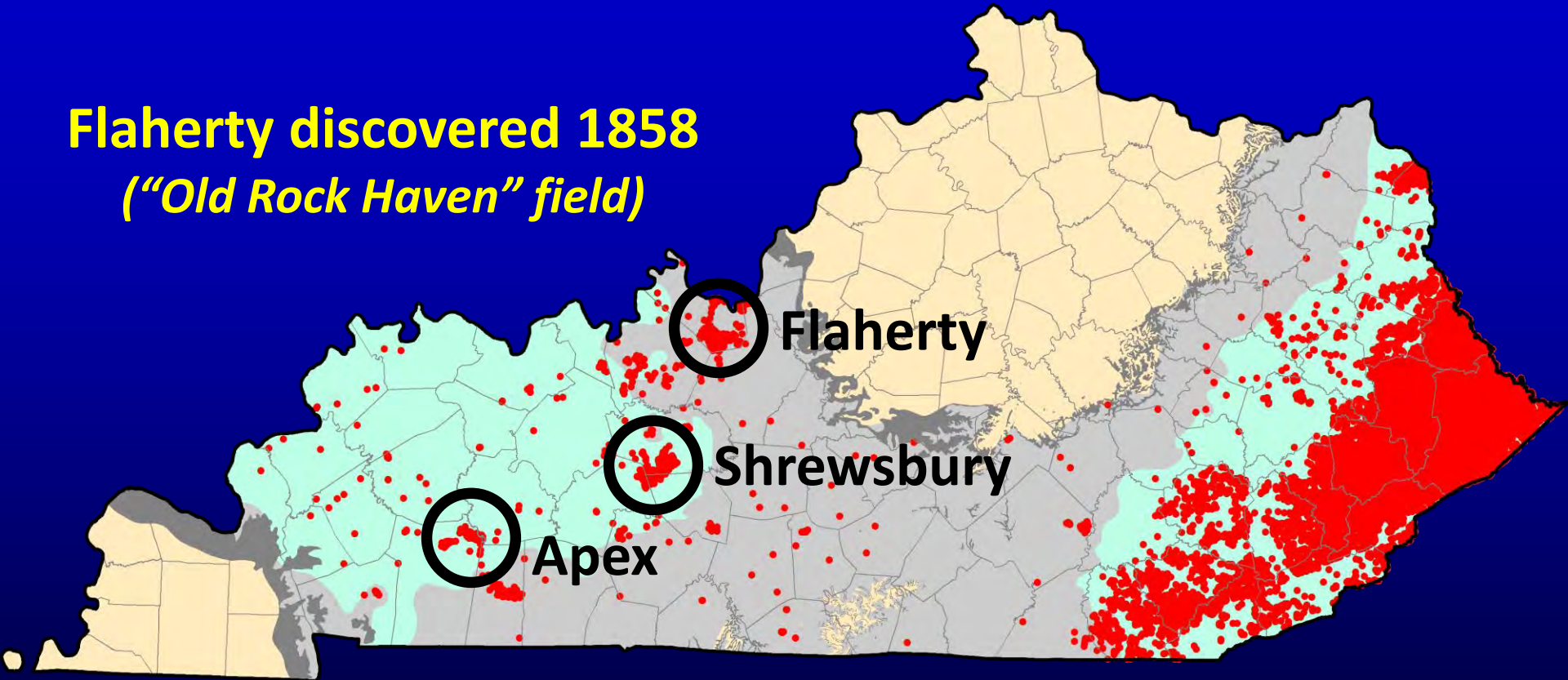
Western Kentucky: New Albany Shale

At least 100'
thick and 1,000'
deep



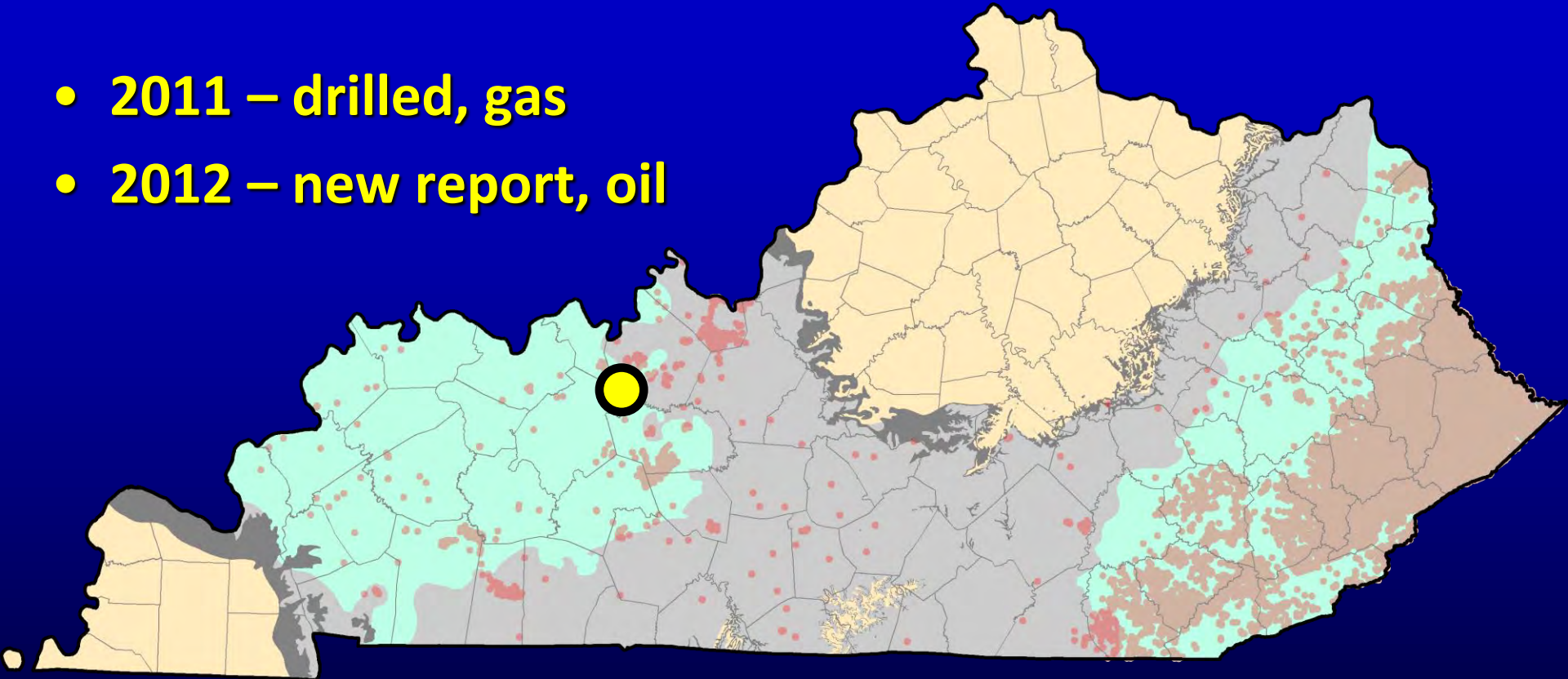
West Kentucky Shale Gas

Flaherty discovered 1858
("Old Rock Haven" field)

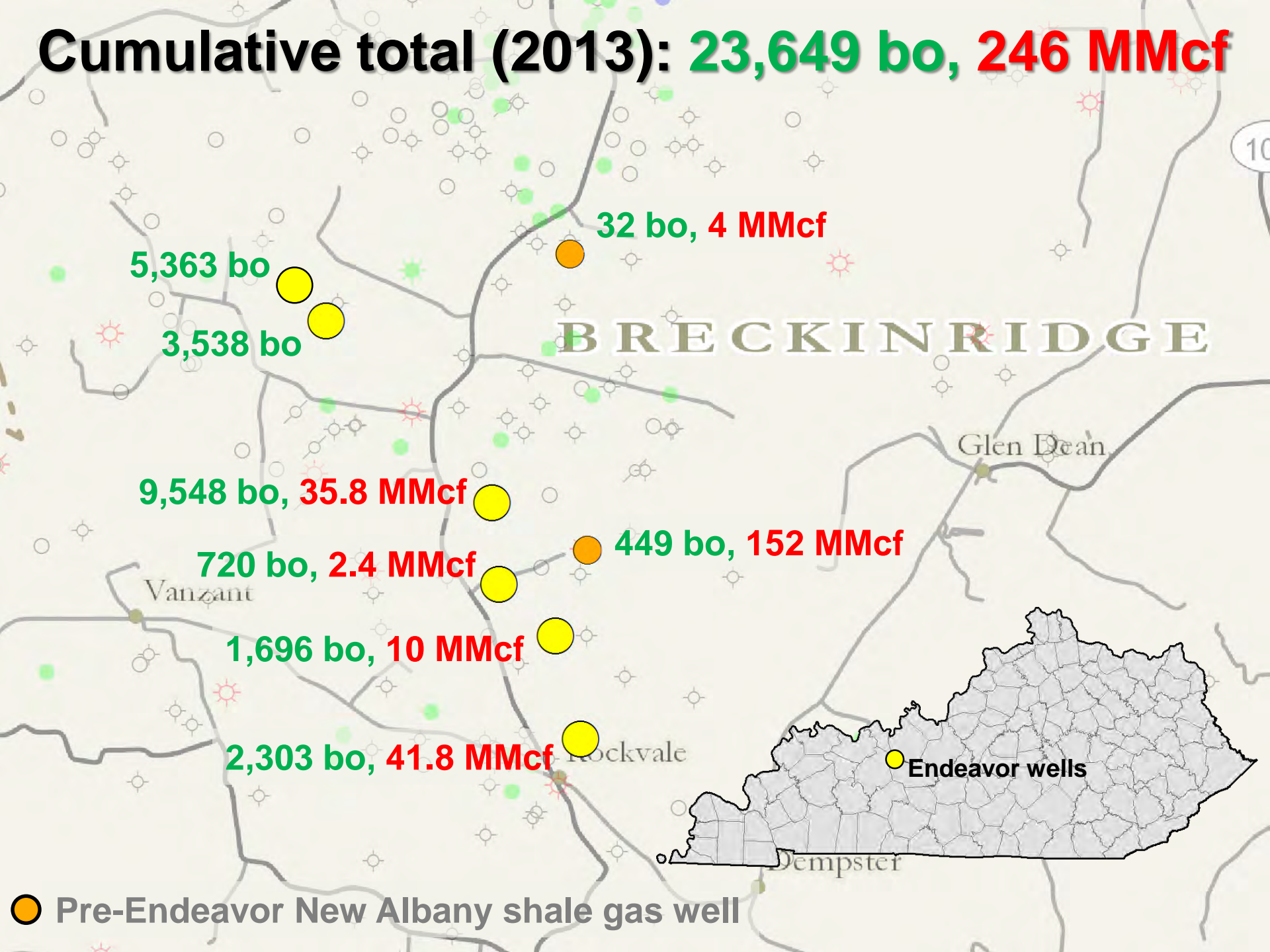


Endeavor Wells in Breckinridge Co.

- 2011 – drilled, gas
- 2012 – new report, oil



Cumulative total (2013): 23,649 bo, 246 MMcf



BRECKINRIDGE

Glen Dean

Vanzant

Rockvale

Endeavor wells

Dempster

● Pre-Endeavor New Albany shale gas well

Breckinridge County Activity

HANCOCK

Map showing well activity in Breckinridge County, Kentucky. The map includes a legend for well types and permit status, and a text box indicating the number of permits since 1/1/2013.

- Endeavor and Hardrock
- Old wells with oil

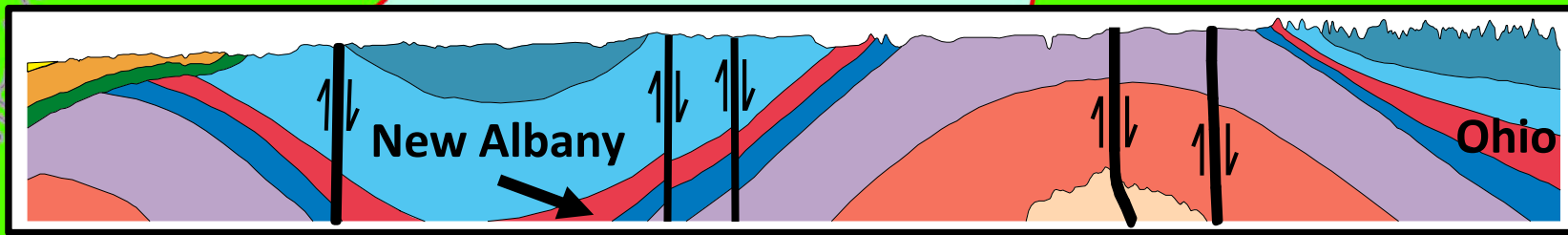
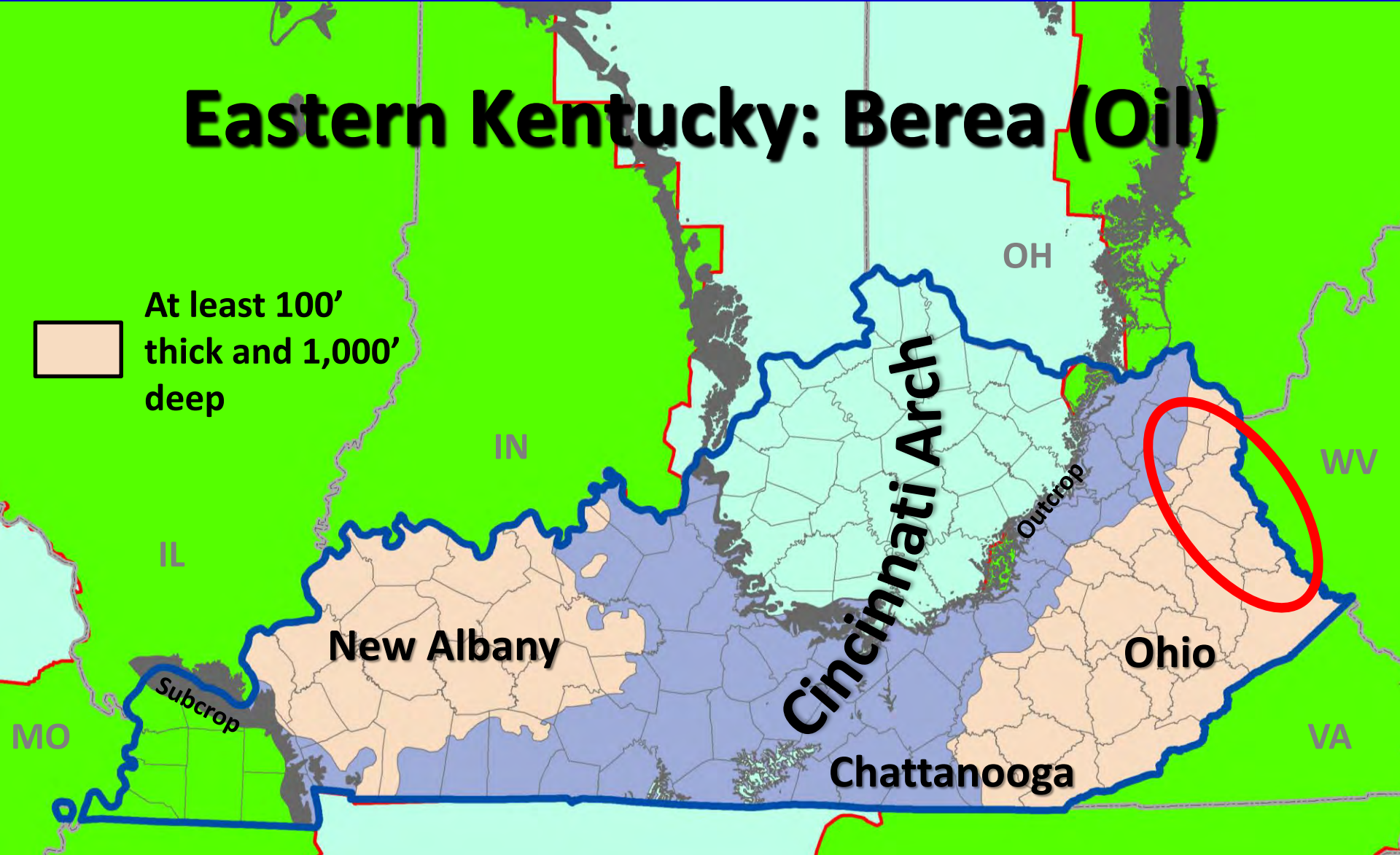
Permits since 1/1/2013

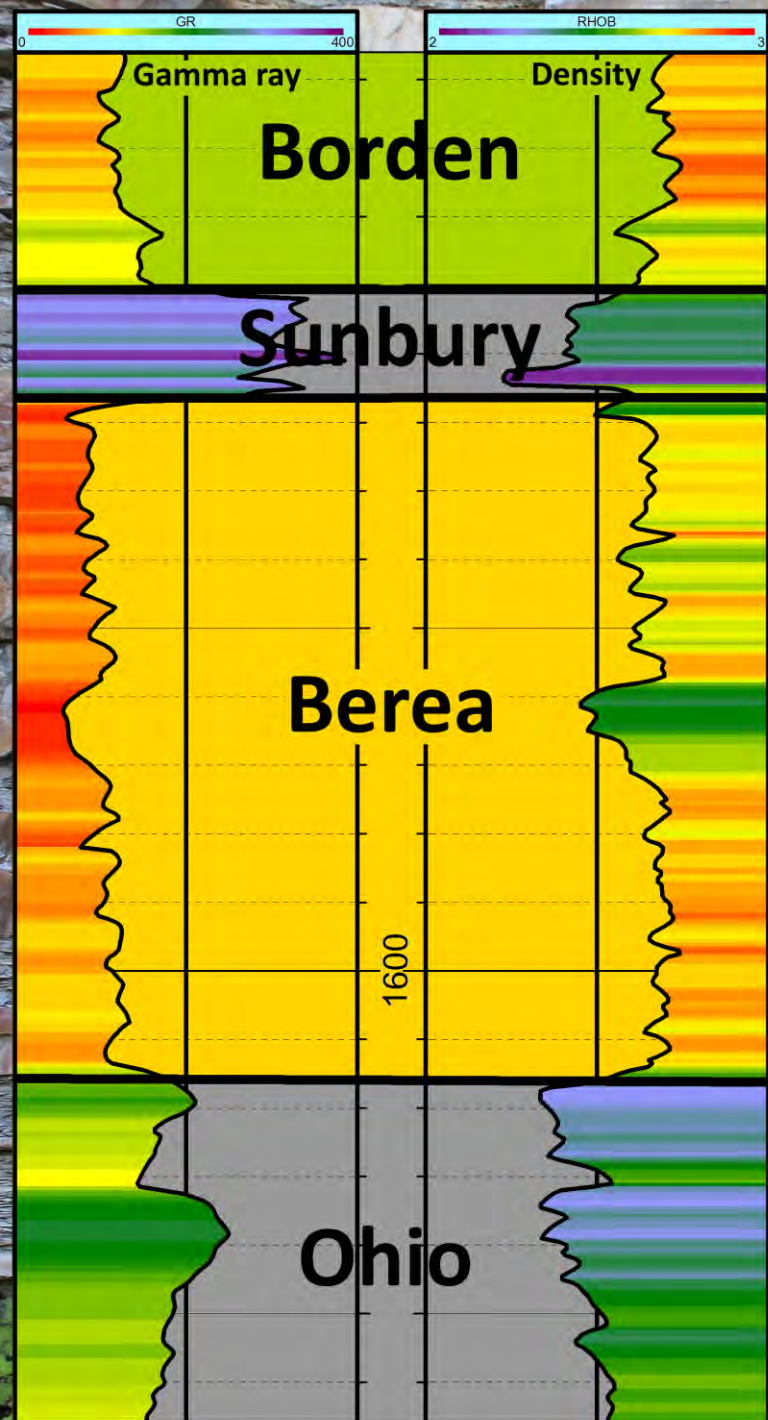
- OIL
- O&G
- GAS
- DRY
- Location
- Expired or cancelled

42 permits

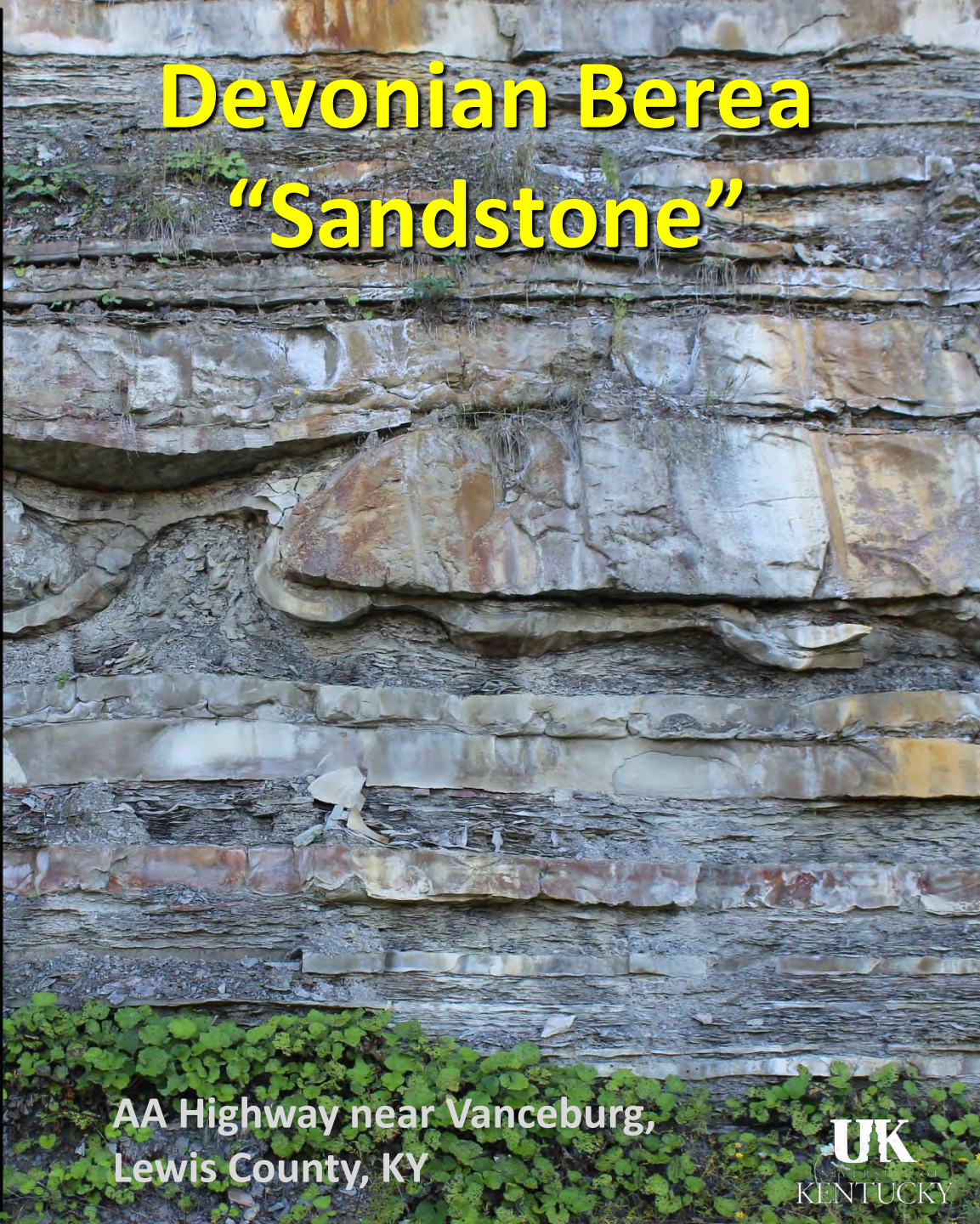
Eastern Kentucky: Berea (Oil)

At least 100'
thick and 1,000'
deep



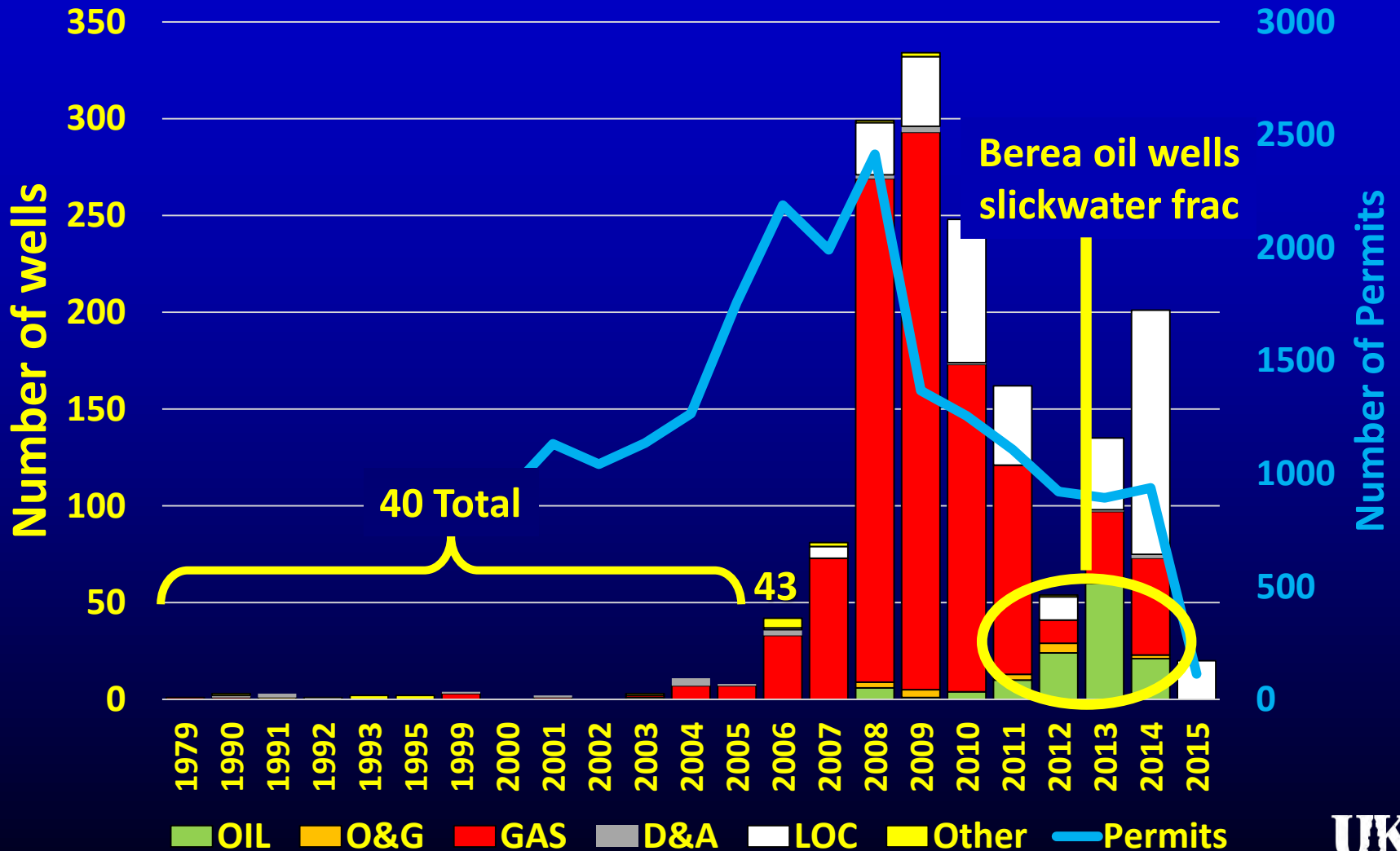


Devonian Berea "Sandstone"



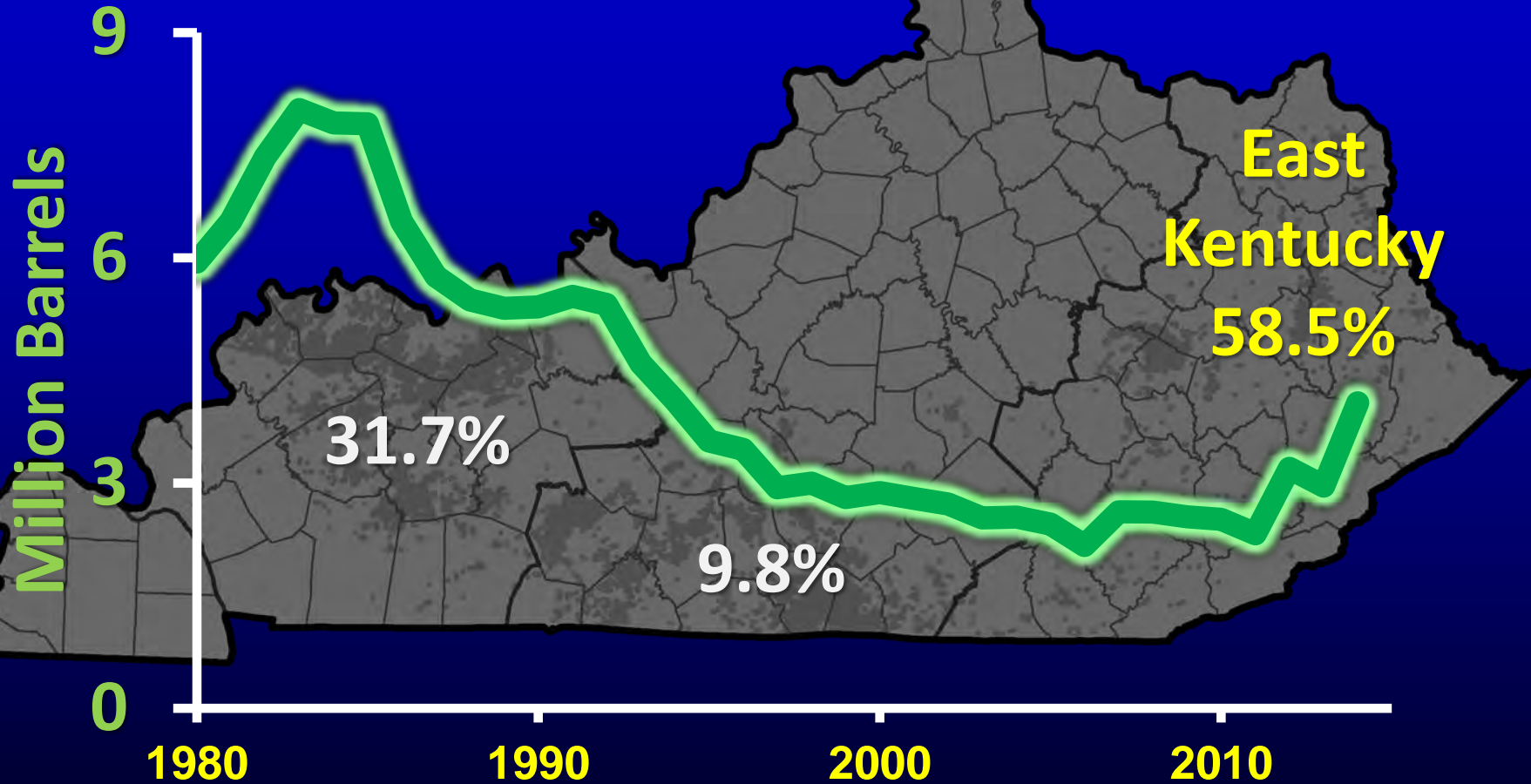
AA Highway near Vanceburg,
Lewis County, KY

Horizontal Wells By Year



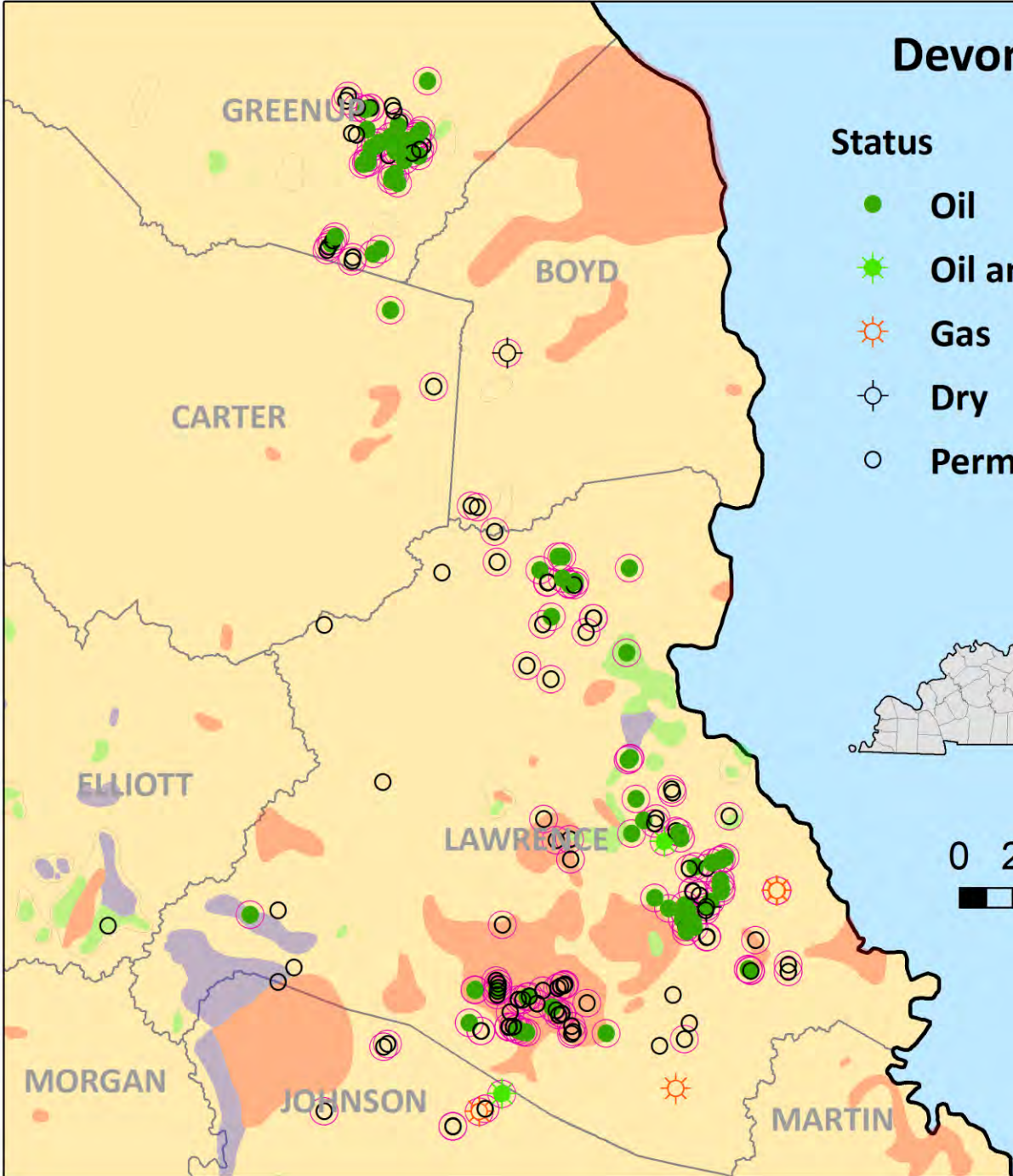
2014 Oil Production: 4.1 MMbo

75% increase over 2011



63 Kentucky counties

Devonian Berea Activity

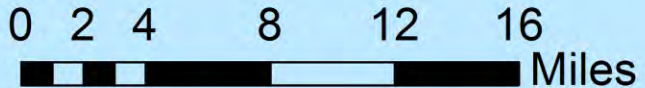


Status

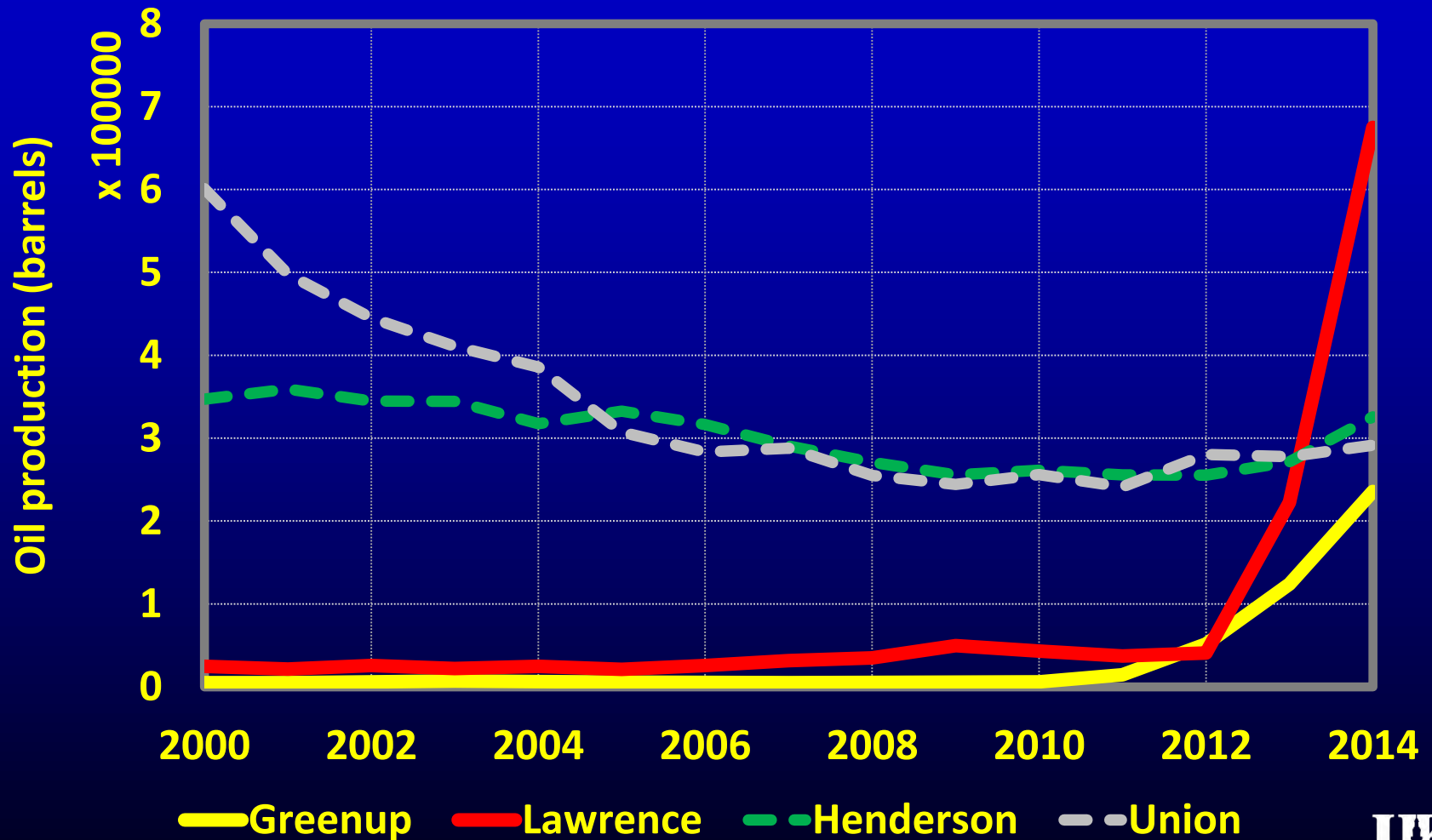
- Oil
- ★ Oil and gas
- ☀ Gas
- ⊕ Dry
- Permitted

Historic fields

- Consolidated
- Oil field
- Gas field
- Waterflood
- Horizontal well

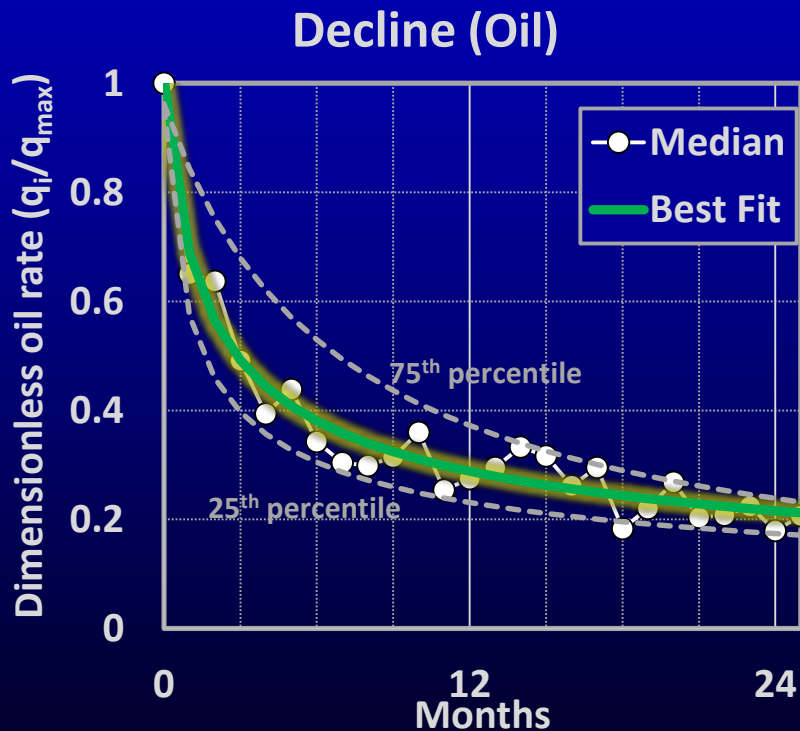


Berea Renaissance

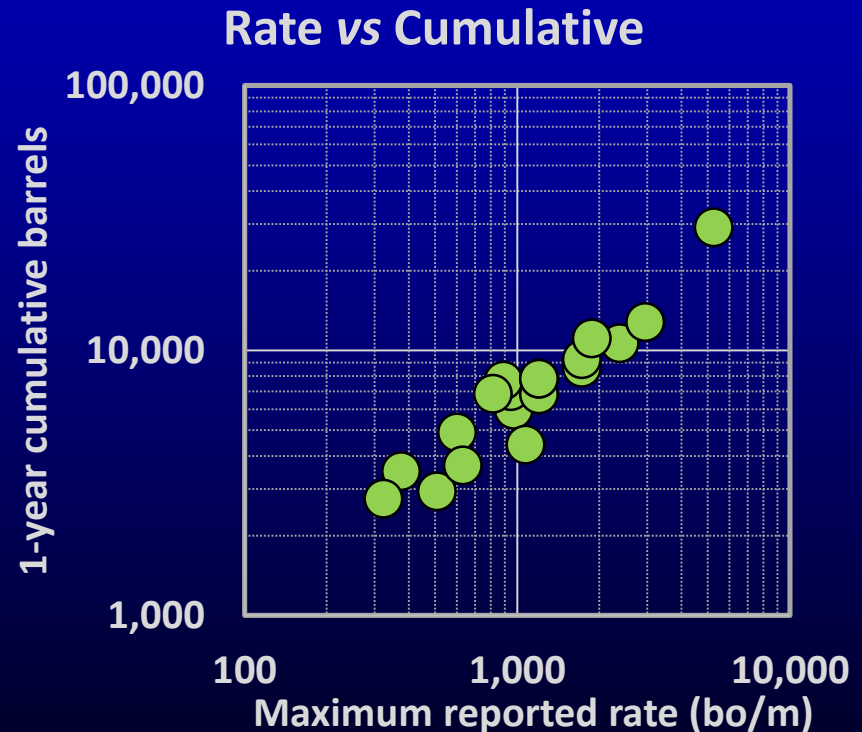


Berea Production Data

50% of wells are predicted to average 20 to 30 barrels per day for up to 2 years.

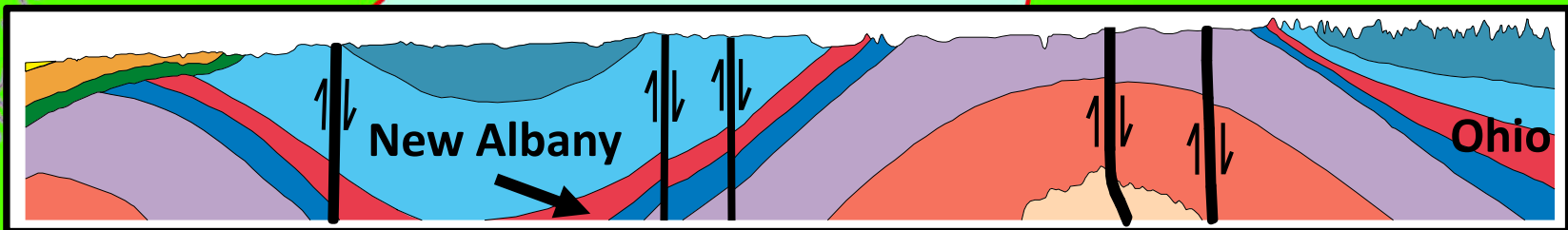
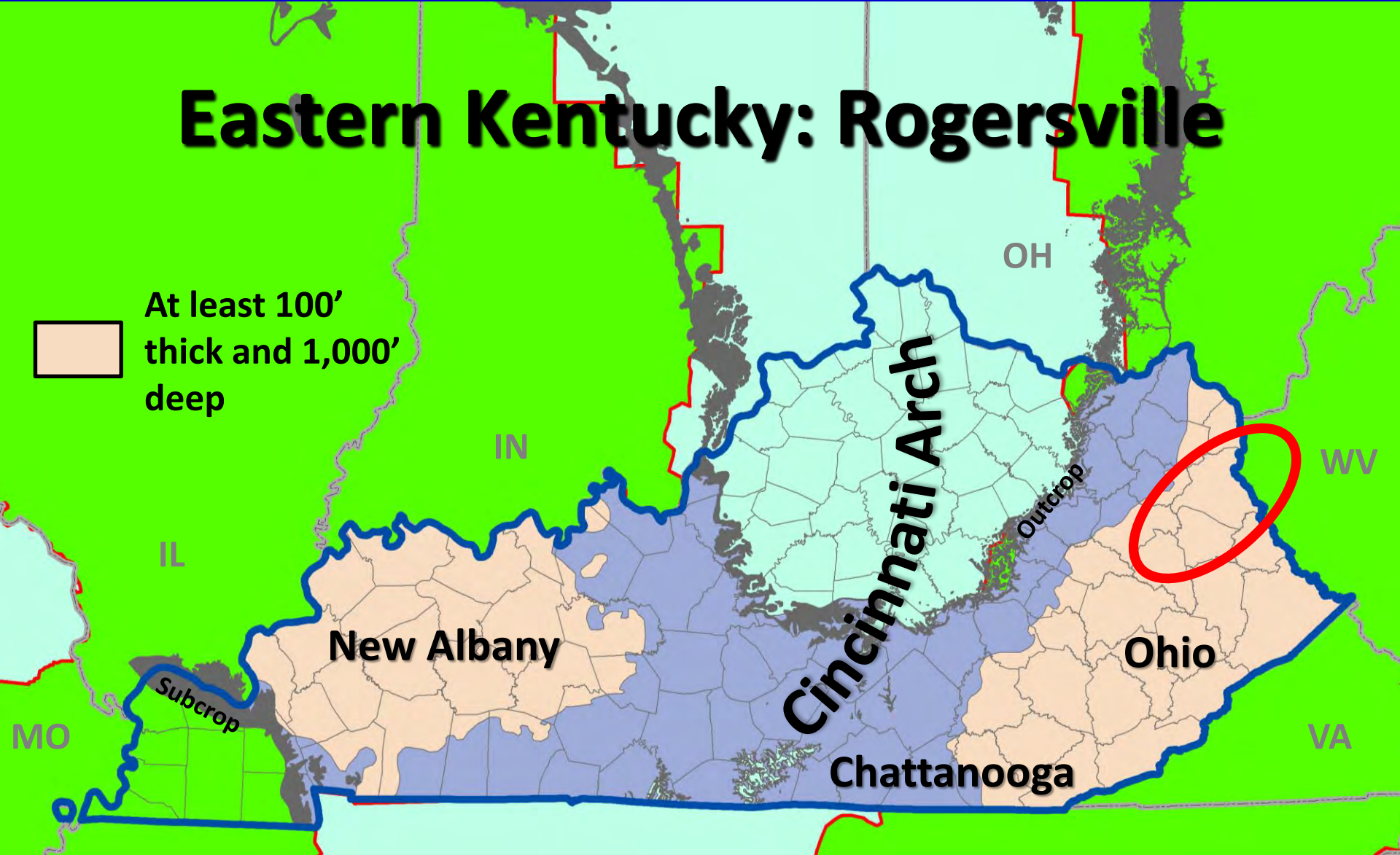


Median of observed production rates each period



Eastern Kentucky: Rogersville

At least 100'
thick and 1,000'
deep



Rogers -ville Play Area



Bruin #1 Young

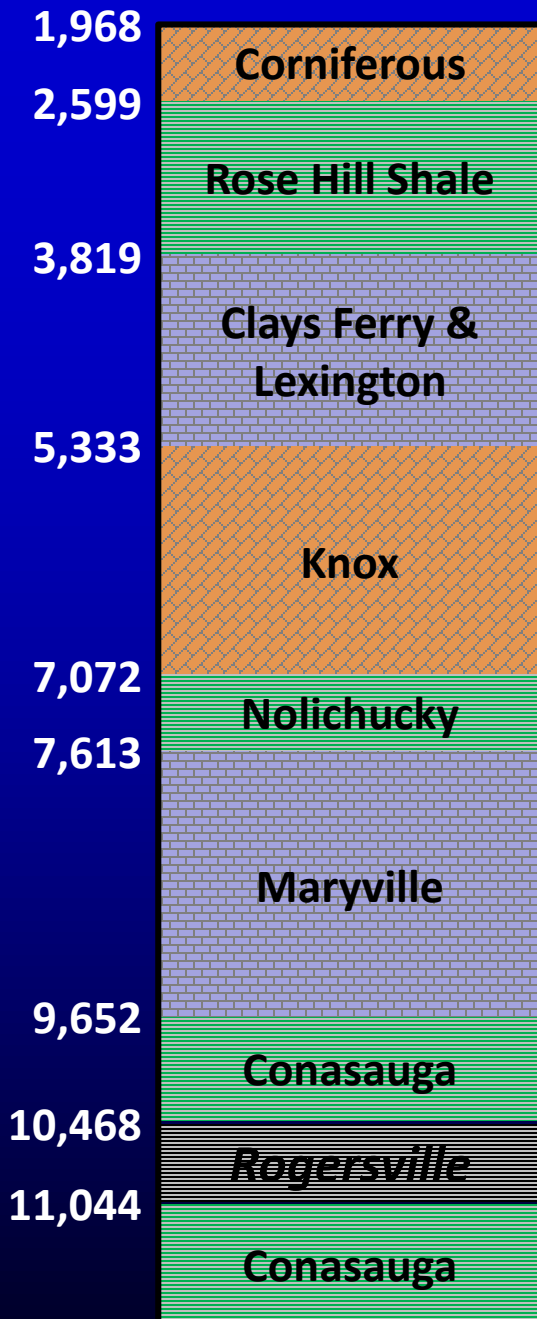
*(Based on data
available in
2004)*

**2+
million
acres**



**1.5-1.6
million
acres**

Bruin #1 Young



TD 11,967, Rome

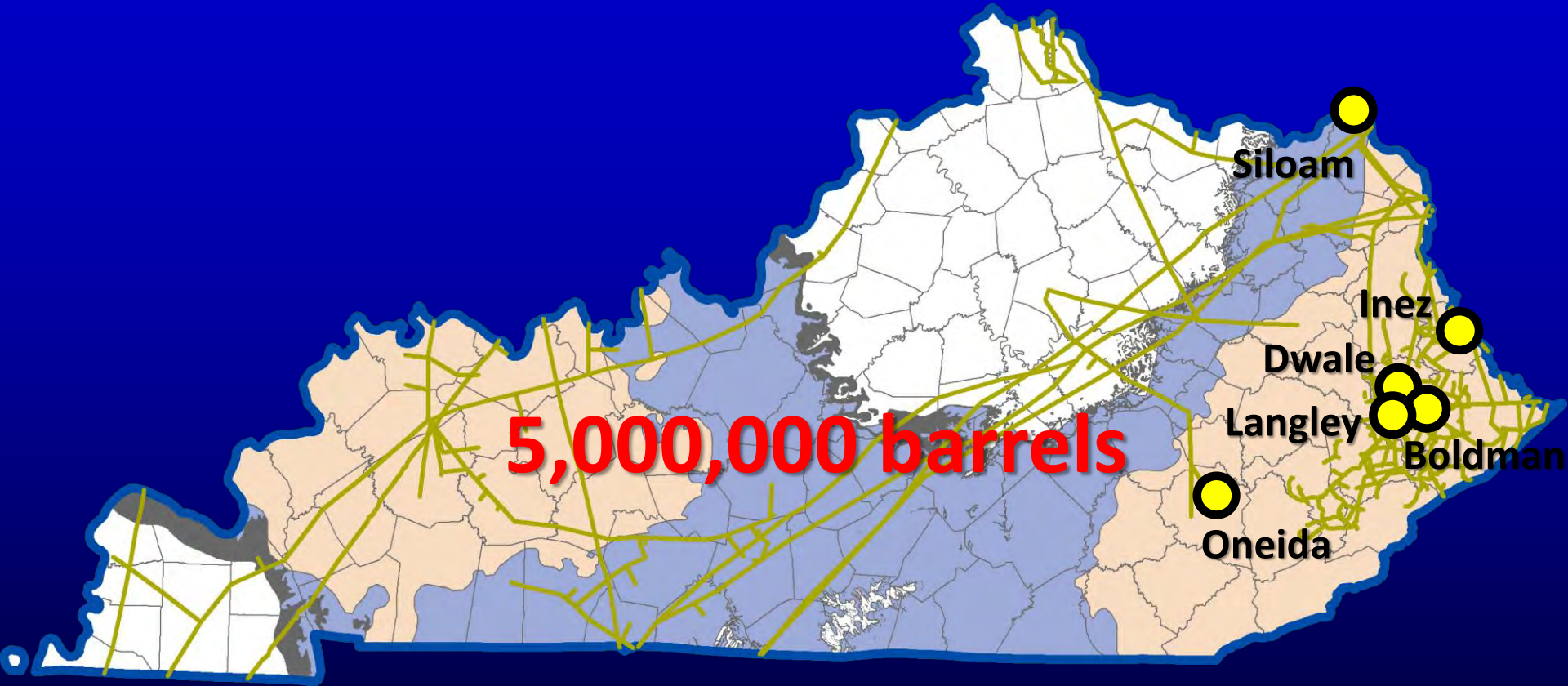
- **Slickwater frac**
- **Tested 115 Mcf and 19 bo (5/6/2014)**
- **Shut-in 5/30/2014**
- **New permit for horizontal lateral**
- **Plan to “flow to sales”**

Rogersville Activity

COUNTY	WELL	TYPE	STATUS
Lawrence (KY)	Bruin #1 Young	V (H)	Wet Gas Well
Lawrence (KY)	Bruin #1 Walbridge	H	Re-permitted
Putnam (WV)	Cabot #50 Amherst	V	Dry Gas
Johnson (KY)	Horizontal Tech #572360 EQT	H	Drilled
Lawrence (KY)	Strat test permit 111649	?	?
Lawrence (KY)	Strat test permit 111720	?	?
Lawrence (KY)	Strat test permit 111721	?	?
Lawrence (KY)	Strat test permit 111757	?	?

One of these drilled and evaluated for HVHF

Natural Gas Liquids



Gas Processing in Kentucky

- Langley at 50% capacity
- Ranger – Y-grade liquids pipeline (ethane rejection to Big Sandy)
- Big Sandy – natural gas pipeline (ethane)
- No ethane cracker

In Summary

- **Kentucky has active shale plays**
 - Ohio (Cleveland, Huron) gas shale
 - New Albany
- **Horizontal wells and fracking are common**
 - Increasing production in historic areas
- **NGL production**
 - Infrastructure limitations
 - Limited publicly available data
- **Rogersville emerging shale play**

In Summary

- Kentucky has active shale plays
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Continued growth depends on commodity prices

Thank you

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