

# **A SHALE TALE**

## **MARCELLUS ODDS AND ENDS**

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<http://www.parespgov.org/index.tpl>

**PRESENTED AT THE 2010 WINTER MEETING OF THE INDEPENDENT OIL &  
GAS ASSOCIATION OF WEST VIRGINIA**



Portions of this talk are derived from:

**“The Appalachian Basin Marcellus gas play – its history of development, geologic controls on production and future potential as a world class reservoir”**

William A. Zagorski, Gregory R. Wrightstone and Douglas A. Bowman

**Comprehensive Technical Paper in an Upcoming AAPG Memoir**

**“Resource Shale Plays of North America”**

# A SHALE TALE

## MARCELLUS ODD AND ENDS

EXPLOSION



PERFECT STORM



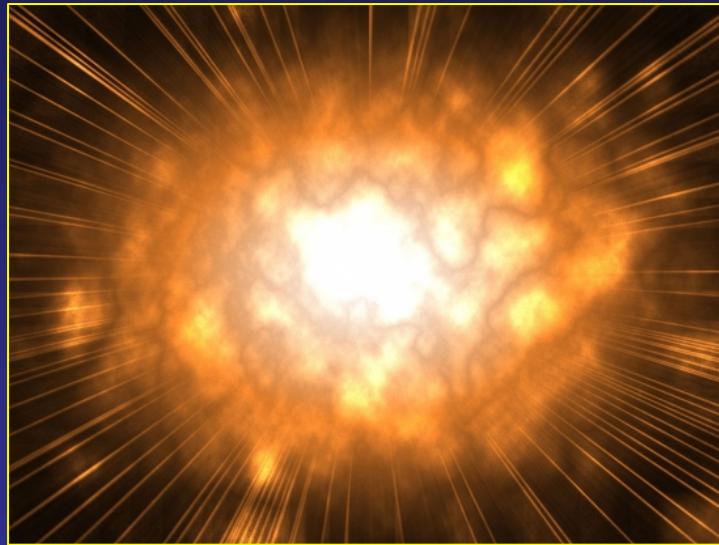
UNDER PRESSURE!!



CONSPIRACY



# EXPLOSION



THE PLAY TAKES OFF...

# MARCELLUS ACTIVITY AS OF NOVEMBER, 2009



Wrightstone 2010

**PA:**

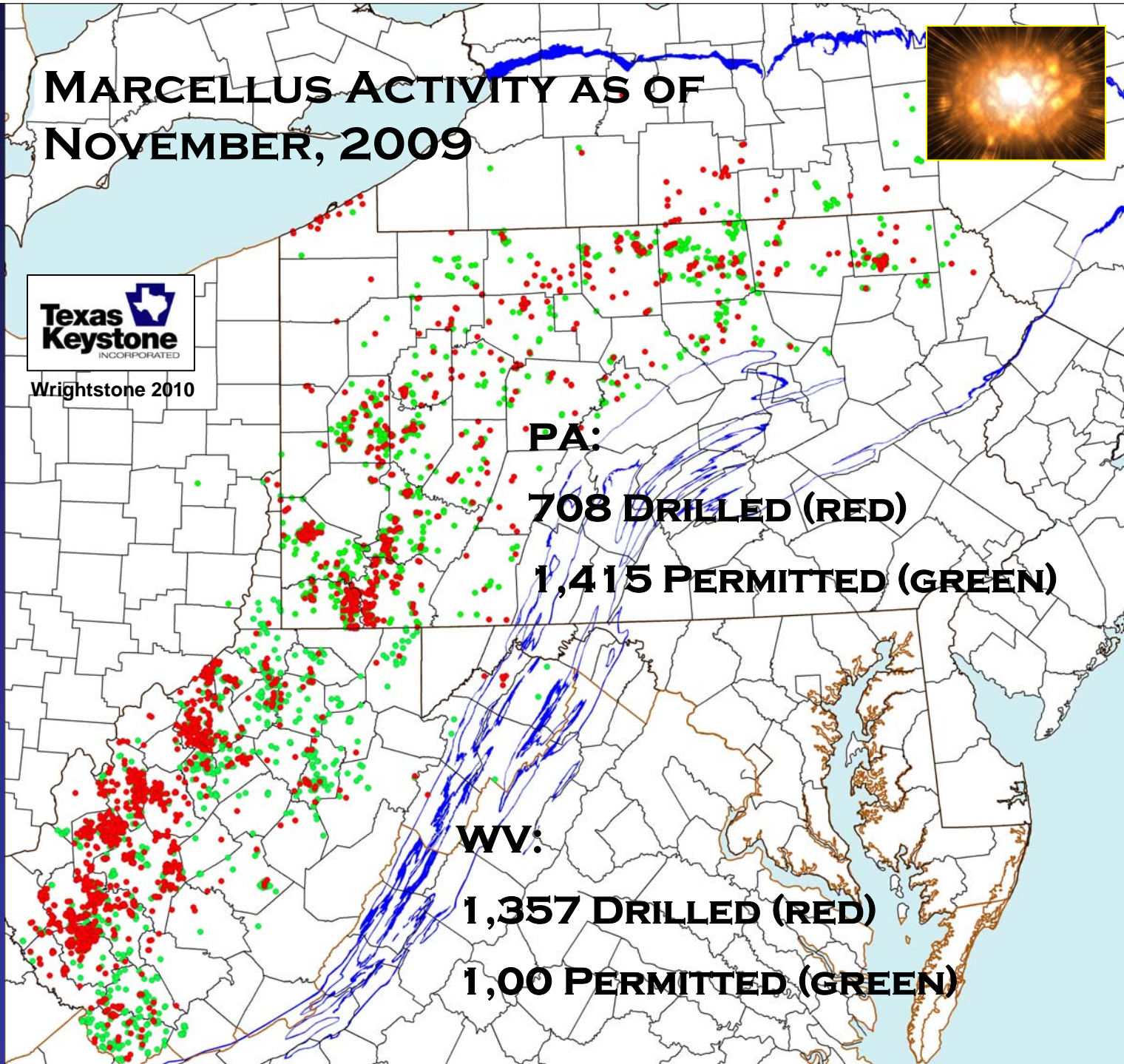
**708 DRILLED (RED)**

**1,415 PERMITTED (GREEN)**

**WV:**

**1,357 DRILLED (RED)**

**1,00 PERMITTED (GREEN)**





**PA:**  
**708 DRILLED**  
**1,415 PERMITTED**



Wrightstone, 2010

**WV HIGH PRESS:**  
**124 DRILLED**  
**(W/COMPL. RPTS)**  
**644 PERMITTED**

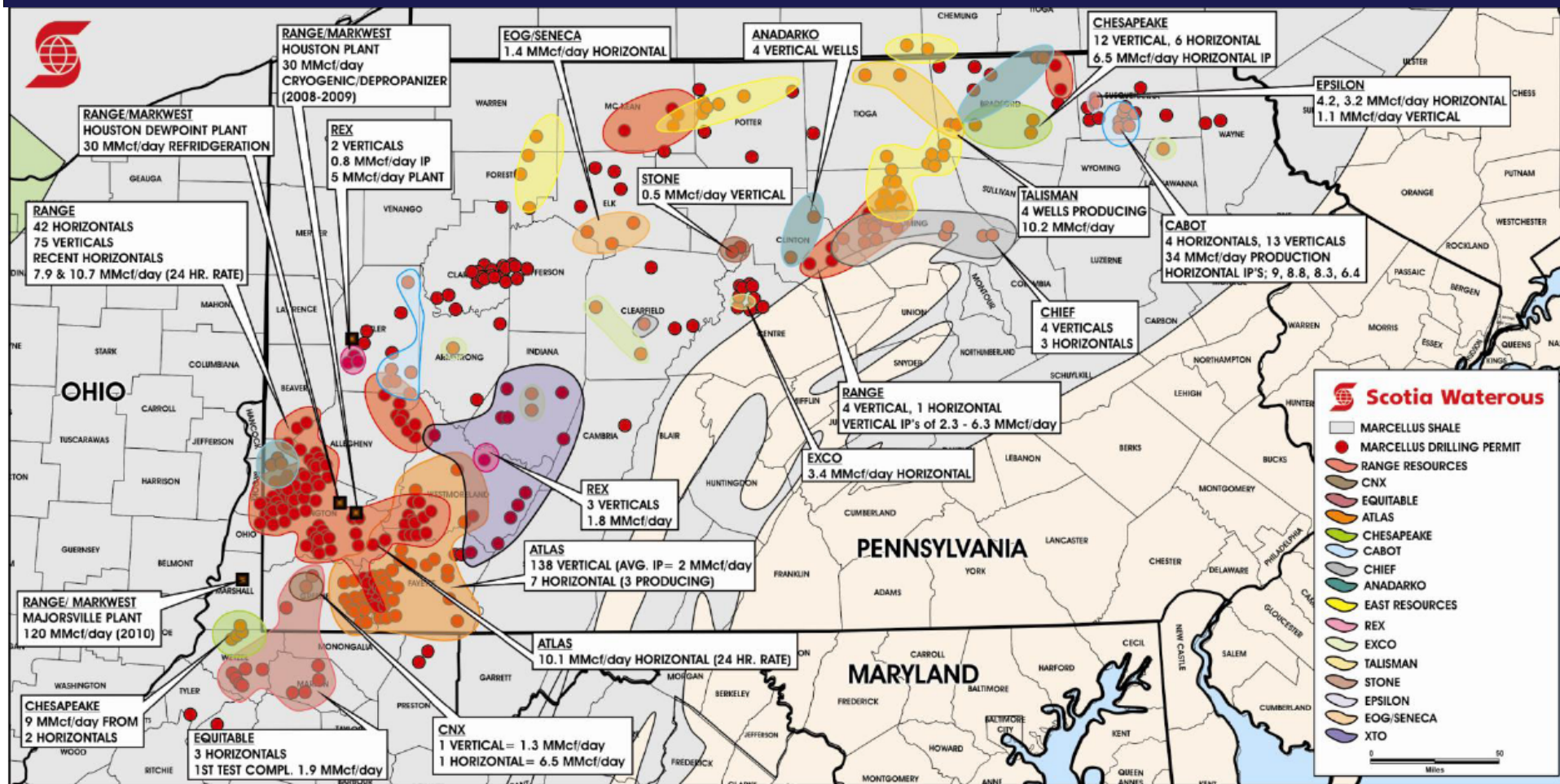
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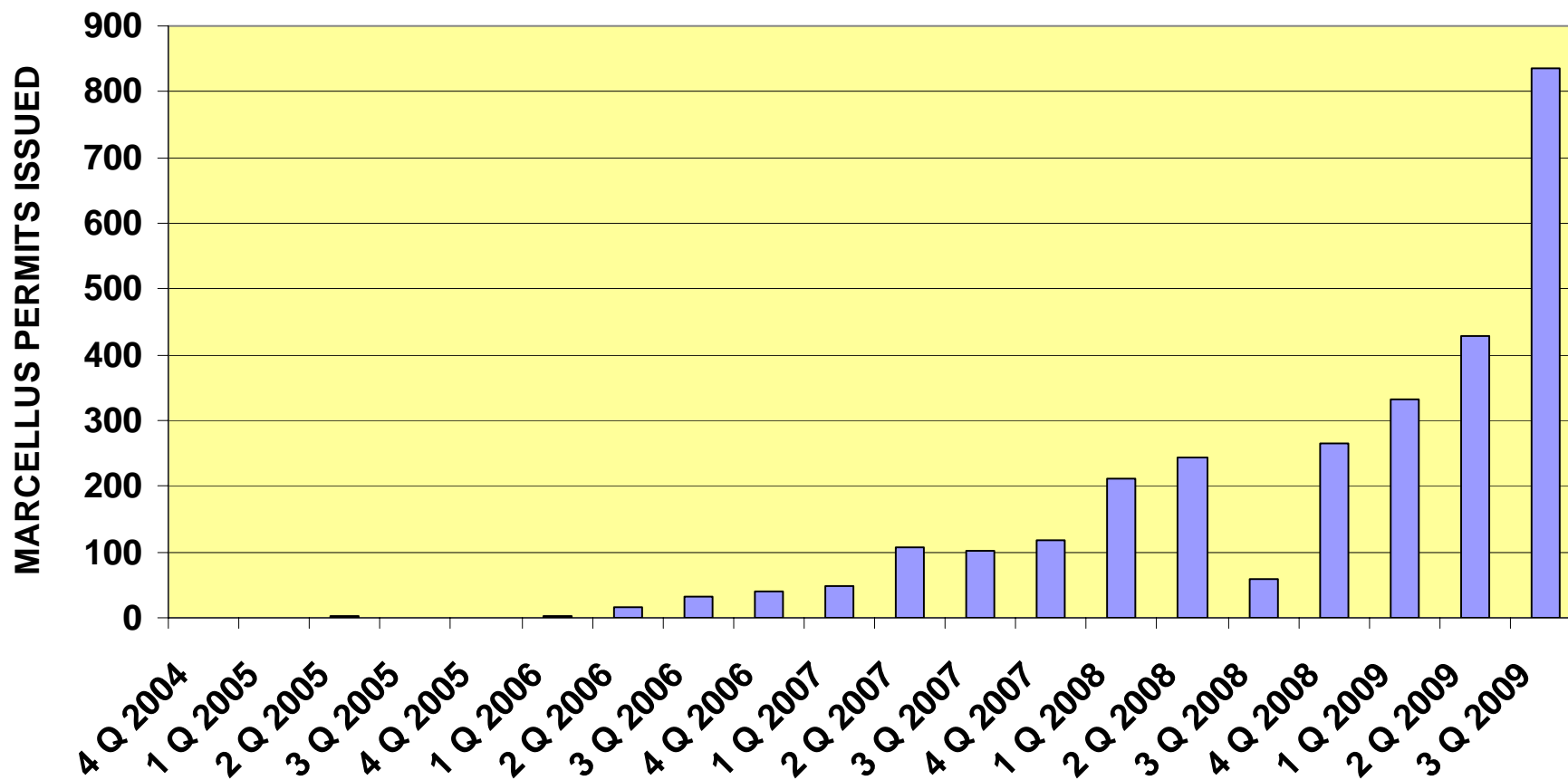






Wrightstone 2010

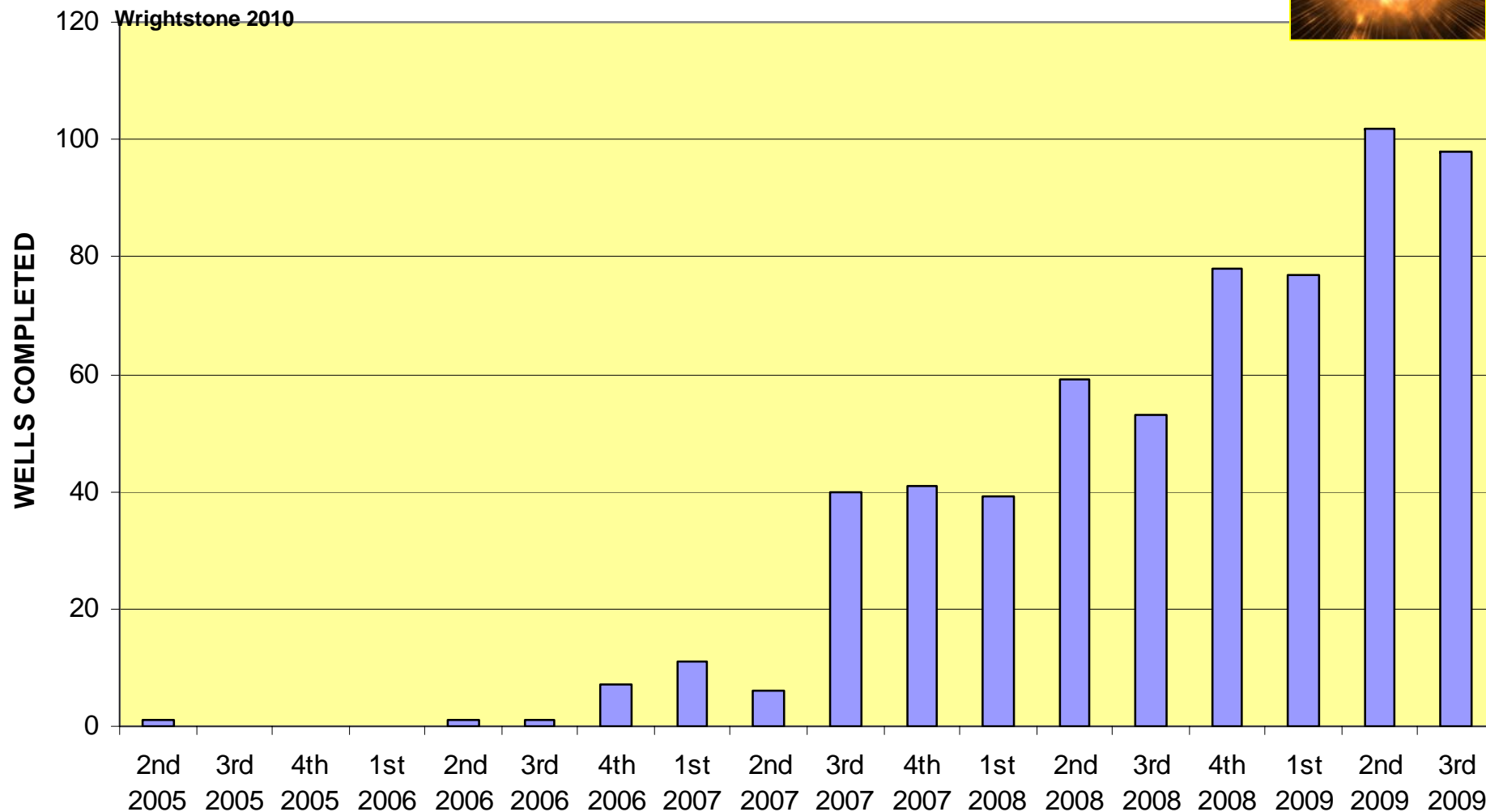
## MARCELLUS DRILLING PERMITS ISSUED - PA By Quarter







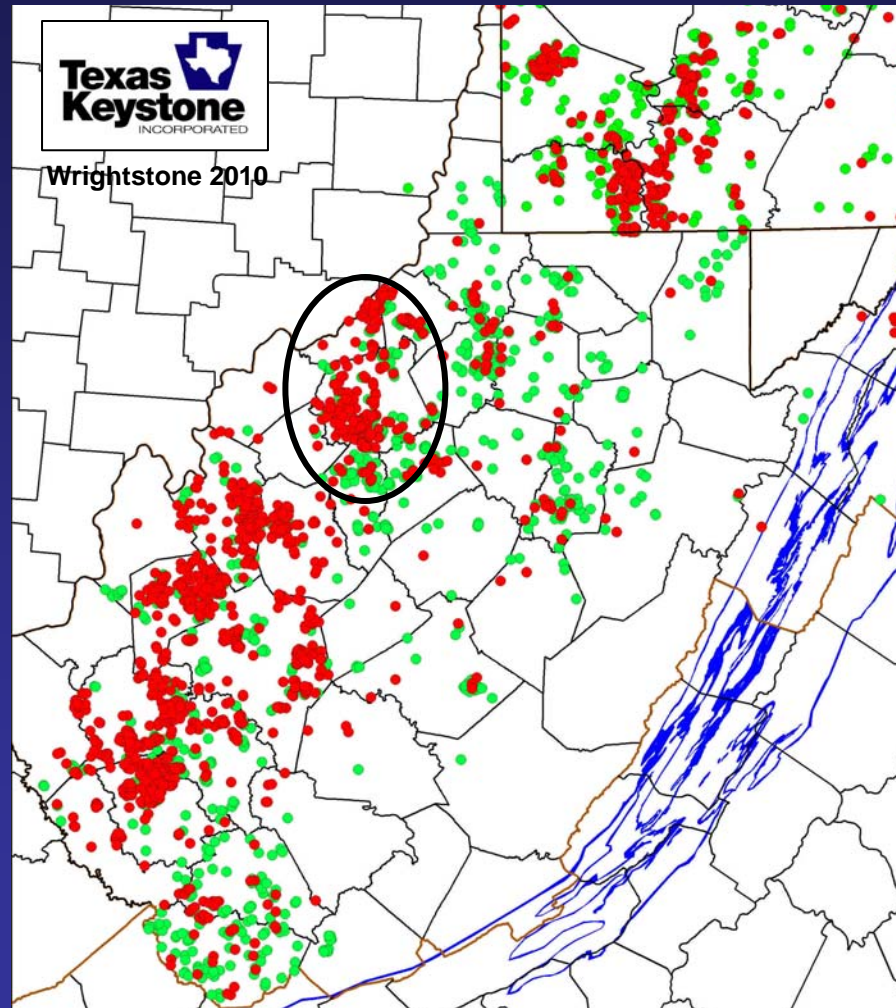
## HIGH PRESSURE AREA MARCELLUS PERMITS ISSUED



**WEST VIRGINIA MARCELLUS WELLS IN HIGH PRESSURE AREA**

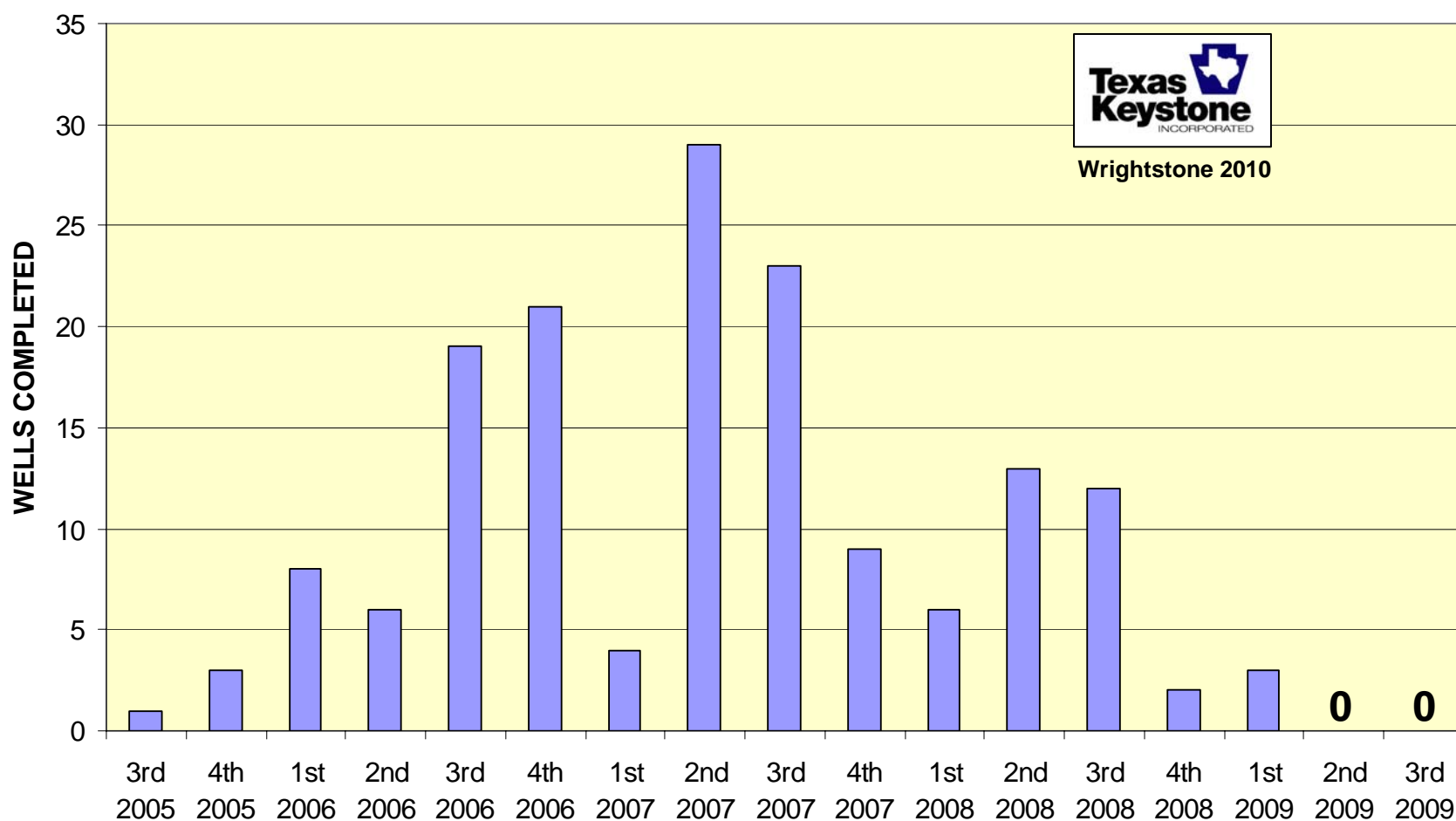
# RITCHIE COUNTY BOOM

2006 - 2007



# RITCHIE COUNTY BOOM... GOES BUST

RITCHIE COUNTY MARCELLUS COMPLETED WELLS





# MARCELLUS

## SO HOW BIG IS IT???



# MARCELLUS

## SO HOW BIG IS IT???



<u>DATE</u>	<u>AGENCY OR AUTHOR</u>	<u>RECOVERABLE (TCF)</u>
2009	HISCOCK & BARCLAY	516
2008	IOGA OF NY	500
2009	ENGELDER	489
2008	DOE	262
2007	ENGELDER & LASH	168
2008	NCI	34.2
2006	USGS	31
2002	USGS	0.8 TO 30.7
2005	USGS	1.3

# MARCELLUS

## SO HOW BIG IS IT???



HOW DOES THE MARCELLUS COMPARE TO OTHER FIELDS WORLD-WIDE?

500 TCF



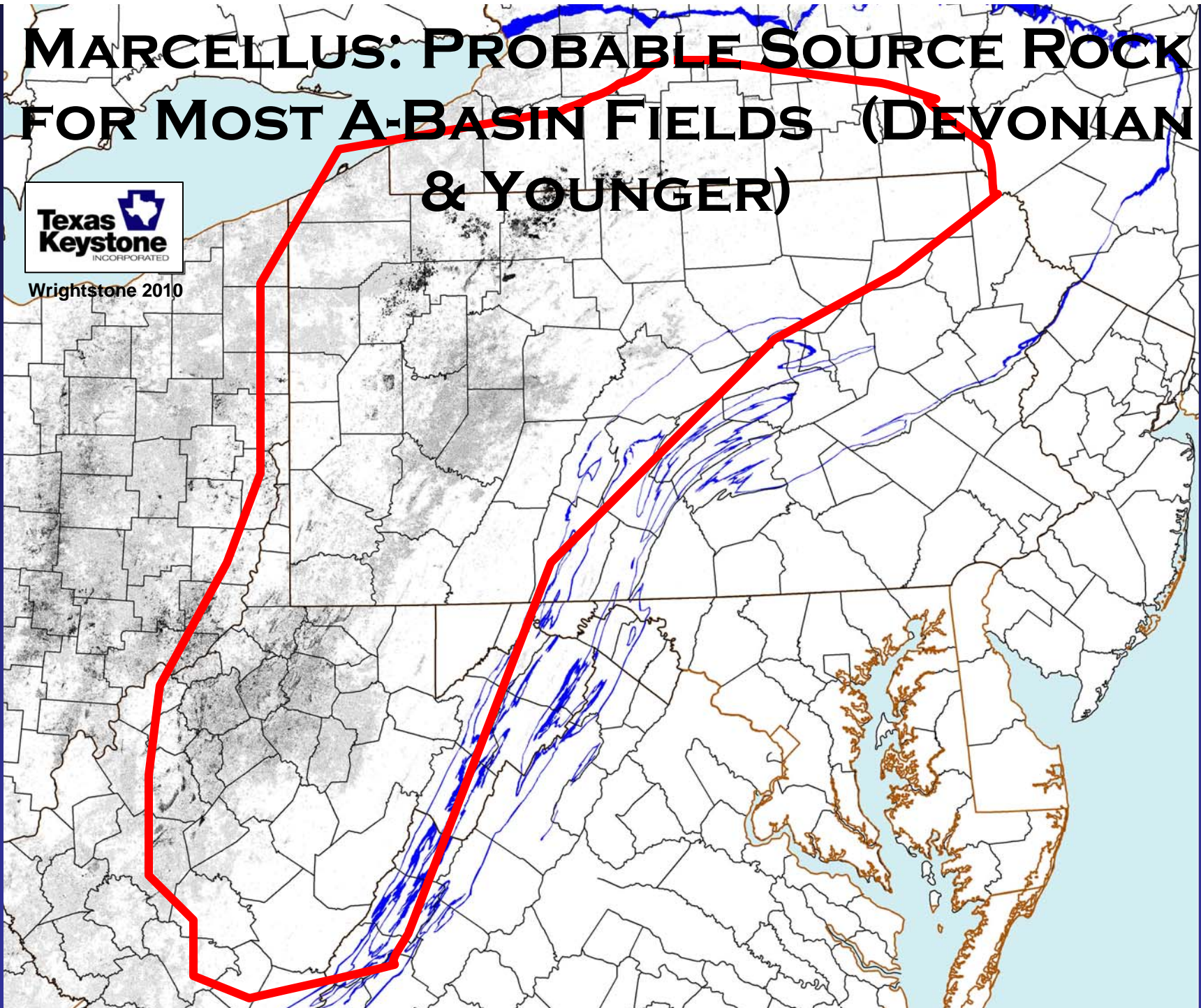
World's 10 Largest Gas Fields (2005)	
	Source: IEA 2005
<u>Field Name</u>	<u>TCF</u>
1. North Field-South Pars (Iran)	1,400
2. Urengoy (Russia)	222
3. Yamburg (Russia)	123
4. Hassi R'Med (Algeria)	123
5. Shtokman (Russia)	110
6. Zapolyarnye	95
7. Hugoton	81
8. Groningen	73
9. Bonavenko	70
10. Medvezhye	68



# MARCELLUS: PROBABLE SOURCE ROCK FOR MOST A-BASIN FIELDS (DEVONIAN & YOUNGER)



Wrightstone 2010





# MARCELLUS: PROBABLE SOURCE ROCK FOR MOST A-BASIN FIELDS (DEVONIAN & YOUNGER)



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**A – BASIN TOTAL  
GAS PRODUCED TO  
DATE: 42 TCF  
(SOURCE: RYDER 1996)**

**TOTAL ORISKANY PRODUCTION: 4.1 TCF**  
**<1% OF TOTAL MARC.**

Ryder, 1996

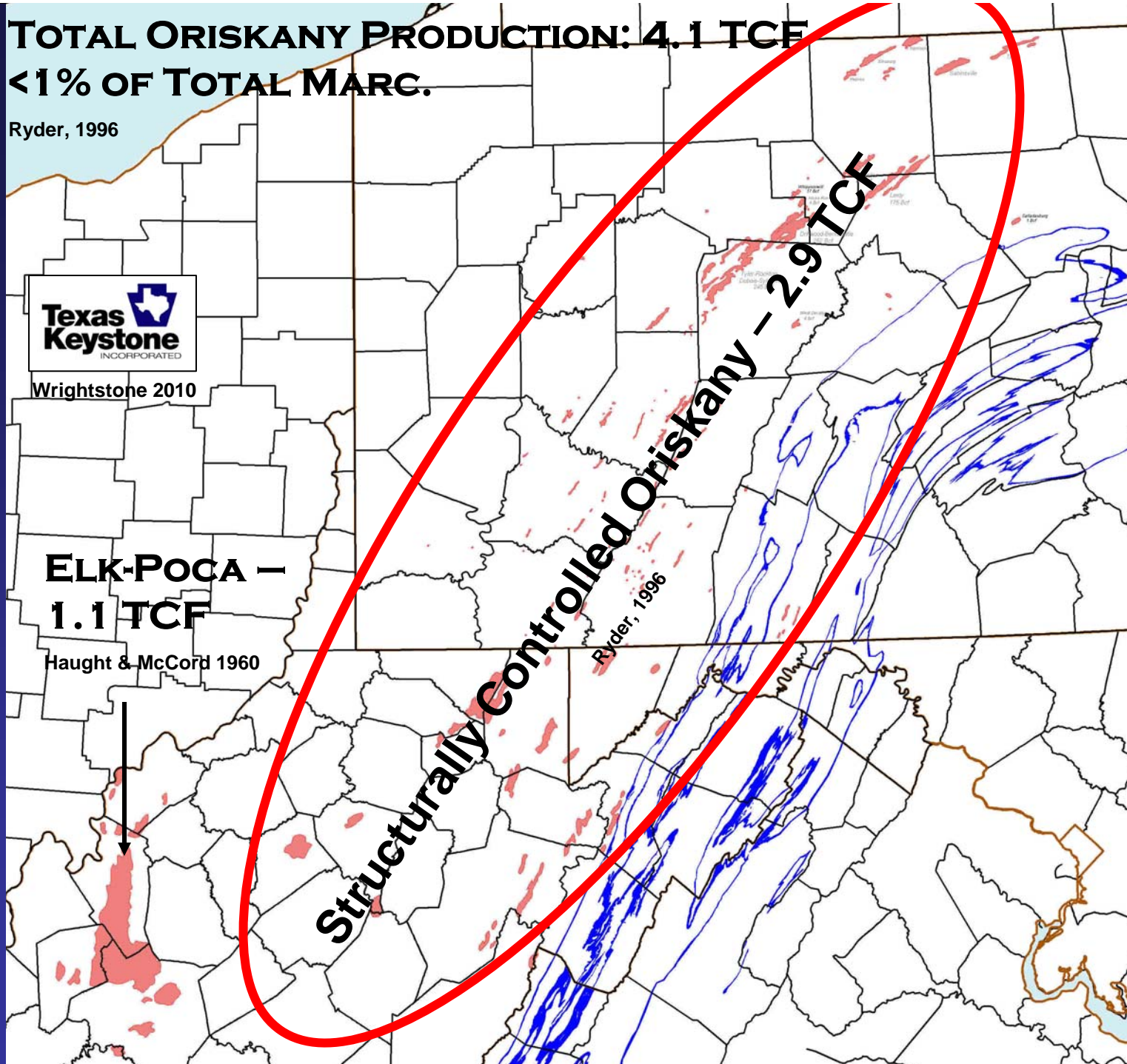


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**ELK-POCA —**  
**1.1 TCF**

Haught & McCord 1960

**Structurally Controlled Oriskany — 2.9 TCF**



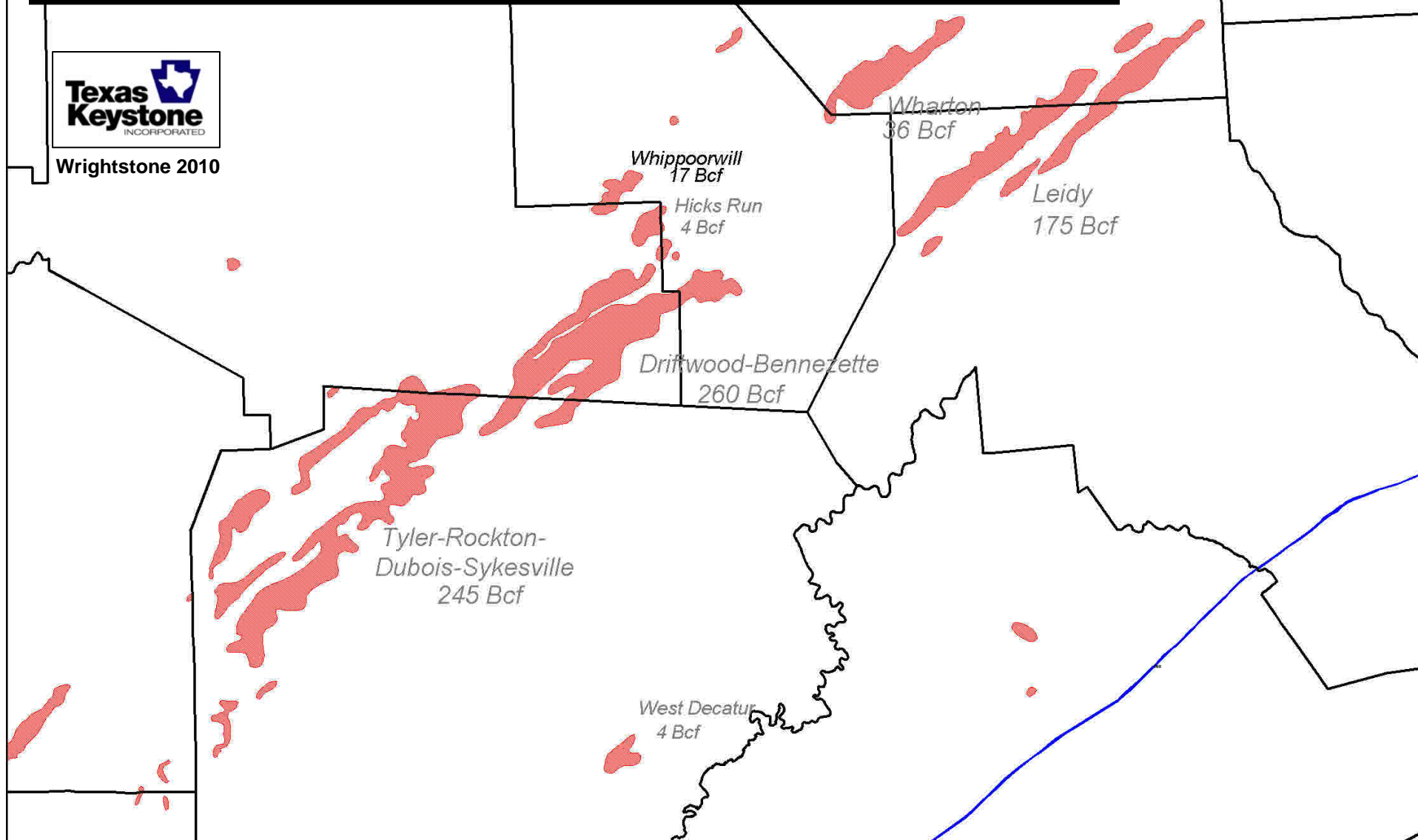


## DRIFTWOOD/BENNEZETTE ORISKANY FIELD – 260 BCF

RANGE IS ESSENTIALLY DISCOVERING A NEW  
DRIFTWOOD/BENNEZETTE EVERY 2 ½ MONTHS!!



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# HOW IN THE WORLD DID WE EVER MISS THIS MONSTER?

Daniel Soeder, 1988 SPE Paper 15213



**TABLE 1—DEVONIAN SHALE CORE ANALYSIS RESULTS**

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Sample	Formation	Depth (ft)	Net Stress (psi)	Porosity to Gas (%)	Permeability $\mu$ d
EGSP-WV-5	Huron shale	3,028	1,750	< 0.10	0.066
Mason County			3,000	< 0.10	0.014
Moore #1 (KY)	Huron shale	2,904	1,750	0.12	0.022
Leslie County			3,000	< 0.10	0.005
EGSP OH-6/4	Huron shale	2,771	1,750	< 0.10	6.80
Gallia County			3,000	< 0.10	4.50
EGSP OH-9	Huron shale	3,245	1,750	0.15	0.001
Meigs County			3,000	< 0.10	< 0.0002
EGSP WV-6	Marcellus	7,448.5	3,000	9.28	19.613
Monongalia County			6,000	8.67	5.909
EGSP OH-6/4*	Huron shale	2,770.8	1,750	< 0.10	8.342
Gallia County			3,000	< 0.10	5.489
EGSP OH-6/5	Huron shale	2,441.4	1,750	0.18	0.248
Gallia County			3,000	< 0.10	0.008
EGSP OH-8	Huron shale	3,325	1,750	< 0.10	0.194
Noble County			3,000	< 0.10	0.078

\* Two plugs from the Well OH-6/4 core were run. A second plug was deemed necessary after first plug emerged from coreholder with a large, longitudinal crack.

# WHY IS THE MARCELLUS SO GOOD?



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## CREATION OF THE MARCELLUS: A “PERFECT STORM” OF

- **MAXIMUM PRODUCTION**
- **MAXIMUM PRESERVATION**
- **MINIMUM DILUTION**





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Marcellus Depositional  
Basin

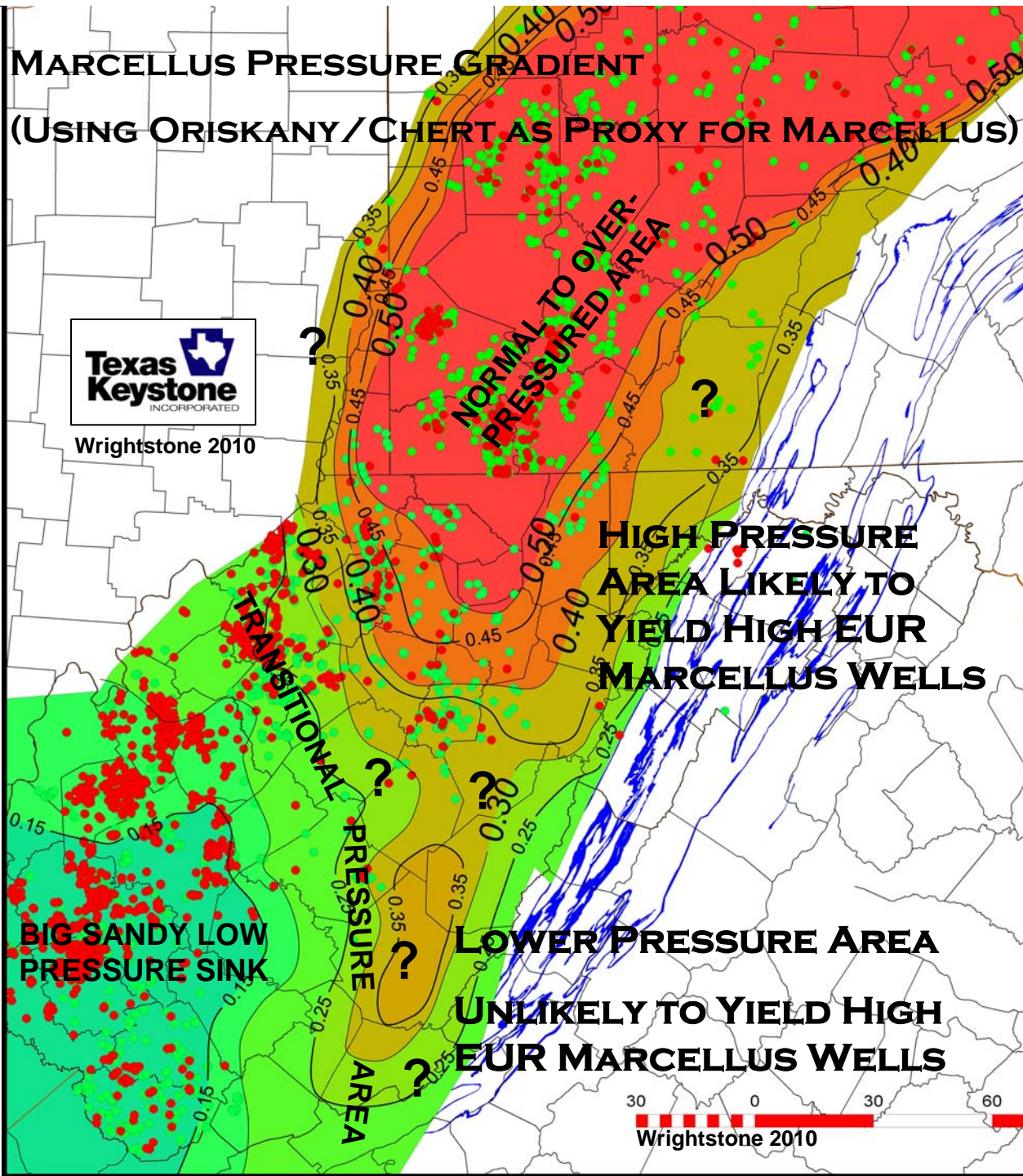
Acadian Highlands

Trade Winds

Middle Devonian Paleogeography – after Blakey 385 Ma



**MARCELLUS PRESSURE GRADIENT  
(USING ORISKANY/CHERT AS PROXY FOR MARCELLUS)**



# CONSPIRACY!?



**American Shale Gas is estimated to hold 2,000 TCF of Recoverable Reserves**

**Enough to supply America's energy needs for 90 years!**

**Yet members of Congress want to shut down the hydro-fracturing necessary to produce this resource. And the Obama Administration shows no inclination to include Gas as part of an approved energy mix.**



**Misinformation and out right lies are fueling the attacks on Marcellus drilling and hydro-fracturing.**

# FRAC ATTACK

## DAWN OF THE WATERSHED

What's in *your* water?



Flesh-eating Zombies created by normal environmental extremists wackos that drank well-water tainted by Marcellus fracturing fluids.



Flesh-eating Zombies were converted back to normal, run-of-the-mill, left-wing, radical environmental extremists by drinking pure, clean water (at the base of a waterfall that happens to be flowing over a Marcellus Shale exposure).

## Much of the disinformation is being spread by Pro Publica

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### Buried Secrets: Gas Drilling's Environmental Threat



#### Quick Links

- » [Natural Gas Drilling: What We Don't Know](#)
- » [Officials in Three States Pin Water Woes on Gas Drilling](#)
- » [How the West's Energy Boom Could Threaten Water](#)



**Feature Story**

## Natural Gas Drilling: What We Don't Know

by Abrahm Lustgarten, ProPublica - December 31, 2009 2:48 pm EST

More than a year of investigation by ProPublica shows that the issues around natural gas drilling are less settled than the industry contends, and that hidden environmental costs could cut deeply into the anticipated benefits. [Read More »](#)

# 21

 of 31 drilling states surveyed have no regulations specific to hydraulic fracturing

# 4

 of 31 drilling states surveyed have detailed regulations guiding hydraulic fracturing

# 10

 drilling states surveyed require that fracturing chemicals be disclosed

# 0

 states surveyed require that the volume of fluid left underground after fracturing be recorded

Sources: State Oil and Natural Gas Regulations Designed to Protect Water Resources, May 2009, U.S. Department of Energy, office of Fossil Energy, National Energy Technology Lab, and the Ground Water Protection Council.



## State Oil and Gas Regulators Are Spread Too Thin to Do Their Jobs

by [Abraham Lurigtarten](#), ProPublica - December 30, 2009 12:36 pm EST

As the gas drilling industry has boomed nationwide, the number of inspectors looking for violations has not kept pace, with some wells going uninspected for years.

## Drilling Wastewater Disposal Options in N.Y. Report Have Problems of Their Own

by [Joaquin Saplen](#) and [Sabrina Shankman](#), ProPublica - December 29, 2009 12:00 am EST

A New York report on drilling in the Marcellus Shale lists options for disposing of the wastewater, but the operators of those facilities say those options aren't feasible.

## In New Gas Wells, More Drilling Chemicals Remain Underground

by [Abraham Lurigtarten](#), ProPublica - December 27, 2009 8:12 am EST

Hydraulic fracturing is exempted from regulation under the Safe Drinking Water Act, but new information raises questions about that exemption.

## Is New York's Marcellus Shale Too Hot to Handle?

by [Abraham Lurigtarten](#), ProPublica - November 9, 2009 5:10 am EST

Wastewater from gas drilling sites is found to be radioactive, leaving big questions about its treatment and disposal.

## Underused Drilling Practices Could Avoid Pollution

by [Abraham Lurigtarten](#), ProPublica - December 14, 2009 12:00 am EST

Innovative industry solutions that may make it easier to exploit U.S. gas reserves with less water and air pollution have not played a prominent role in the national debate over how to drill safely.

## New York State Paves Way for Gas Drilling With Release of Environmental Review

by [Abraham Lurigtarten](#), [Joaquin Saplen](#), and [Sabrina Shankman](#), ProPublica - September 30, 2009 7:57 pm EST

A new review by a state agency proposes guidelines for hydraulic fracturing in the Marcellus Shale, but would not ban drilling within the

## EPA: Chemicals Found in Wyo. Drinking Water Might Be From Fracking

by [Abraham Lurigtarten](#), ProPublica - August 25, 2009 12:36 pm EST

Contaminated wells in Wyoming could become the first to be scientifically linked to a gas-drilling process known as hydraulic fracturing.

## Pennsylvania Orders Cabot Oil and Gas to Stop Fracturing in Troubled County

by [Abraham Lurigtarten](#), ProPublica - September 25, 2009 12:39 pm EST

The shutdown of natural-gas drilling operations follows three recent chemical spills in Susquehanna County.

## Pa. Residents Sue Gas Driller for Contamination, Health Concerns

by [Abraham Lurigtarten](#), ProPublica - November 20, 2009 10:00 am EST

Dimock residents seek to stop Cabot Oil and Gas from drilling in the Marcellus Shale, and want a trust fund for medical treatments.



## Pro Publica was Founded and Funded by Herb and Marion Sandler



**Herb and Marion Sandler, along with their good friend George Soros, founded the left-wing Center for American Progress, a liberal policy institute that has been called the “think tank” for the Obama Administration.**





Flare from the Antelope-2 well site  
Papua, New Guinea  
705 MMCFPD



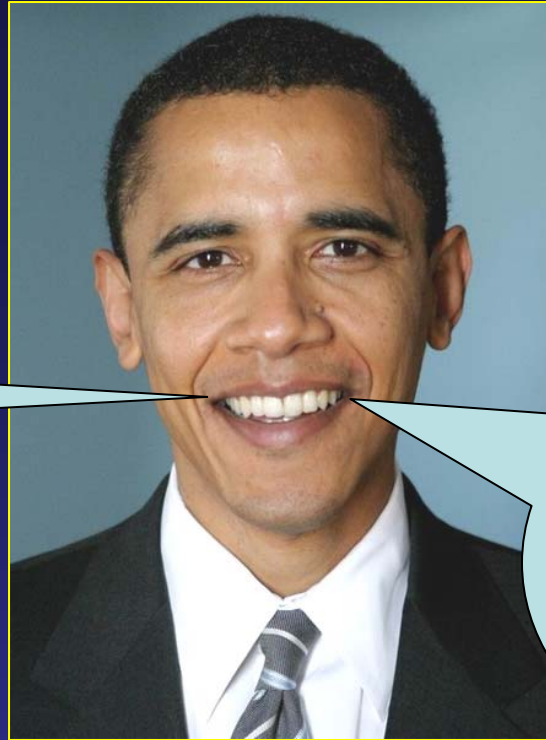
Soros' Fund Management holds a huge stake in InterOil and their recent GIANT Gas Field discovery in Papua, New Guinea

InterOil and Soros are planning to build an \$11 Billion LNG facility.

The economic viability of the InterOil project rests on continued high commodity prices for natural gas.

Full development of the shale resources in the U. S. will drive down the prices of natural gas and puts the entire InterOil project at risk. Mr. Soros does NOT like to lose money.

**NATURAL  
GAS**



Bio-Fuels, Solar, Wind,  
Fuel Cells, Bio-Fuels,  
Solar, Wind, Fuel Cells,  
Bio-Fuels, Solar, Wind,  
Fuel Cells, Bio-Fuels,  
Solar, Wind, Fuel Cells,

Why hasn't the Obama Administration included Natural Gas as part of a common sense solution to our National Energy Plan?

Importantly, natural gas is currently the only available energy source that can significantly reduce our dependence on imported oil for use as a transportation fuel. Clean burning natural gas can be used to fuel all three of the major transportation demands: personal, fleet and interstate long-haul.



We know the role Mr. Soros' radical left-wing organization Moveon.org provided to elect anti-capitalists in 2006 and 2008.

President Obama, Nancy Pelosi and Harry Reid owe Mr. Soros a great deal.





**“quid pro quo Clarisse, quid pro quo”**

**Is throwing Shale Gas development and hydro-fracturing under the bus the reward that George Soros gets for helping elect Barack Obama and his fellow travelers?**