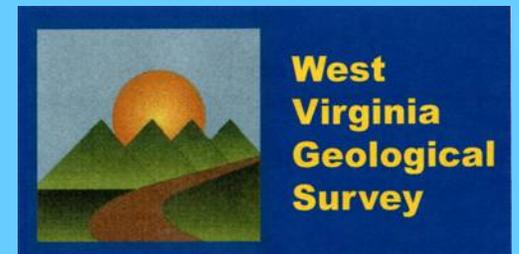


# Overview of Gas and Oil Resources in West Virginia

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avary@geosrv.wvnet.edu

[www.wvgs.wvnet.edu](http://www.wvgs.wvnet.edu)



# WV: Where It All Began



Then  
1858

Now  
2008

## Renewed Interest in Drilling and Production Activity

**Tanglewood**  
Exploration

Tanglewood Exploration is an independent oil and gas exploration and production company currently leasing mineral interests in your area. Should you have an interest in discussing the leasing of your minerals, please contact us. Thank you.

Office: 724-745-6462      Fax: 724-745-9180  
tiscott@tanglewoodexp.com      jrscott@tanglewoodexp.com  
[www.tanglewoodexp.com](http://www.tanglewoodexp.com)

TALKING BUSINESS



A NEIGHBOR WAS CONSIDERING OTHER COMPANIES AND THEN HE HEARD CHESAPEAKE WAS BUYING LEASES IN PRESTON COUNTY. HE KNOWS CHESAPEAKE IS THE NUMBER ONE DRILLER OF CLEAN-BURNING NATURAL GAS WELLS IN WEST VIRGINIA AND THE ENTIRE U.S. CHESAPEAKE IS COMMITTED TO CREATING PROSPERITY AND JOBS IN WEST VIRGINIA, AND IT'S A TRUSTWORTHY COMPANY, SO IT JUST MAKES SENSE TO LEASE TO CHESAPEAKE.

IF YOU'RE INTERESTED IN LEASING YOUR MINERAL RIGHTS, CALL US AT 304.273.0008, AND LET'S TALK SOME BUSINESS.

**Chesapeake**  
ENERGY

NYSE: CHK • [chkenergy.com](http://chkenergy.com)

**ATTENTION PROPERTY OWNERS!**



Atlas America, Inc. We are a Pittsburgh-based oil & gas company that produces oil & gas wells with District Offices in Uniontown, PA.

We have been drilling wells in Fayette, Greene and Westmoreland Counties for over eleven (11) years and currently operate 1,800 wells and have over a hundred (100) local employees.

We are expanding our leasing areas to include the Counties of Monongalia and Preston in West Virginia.

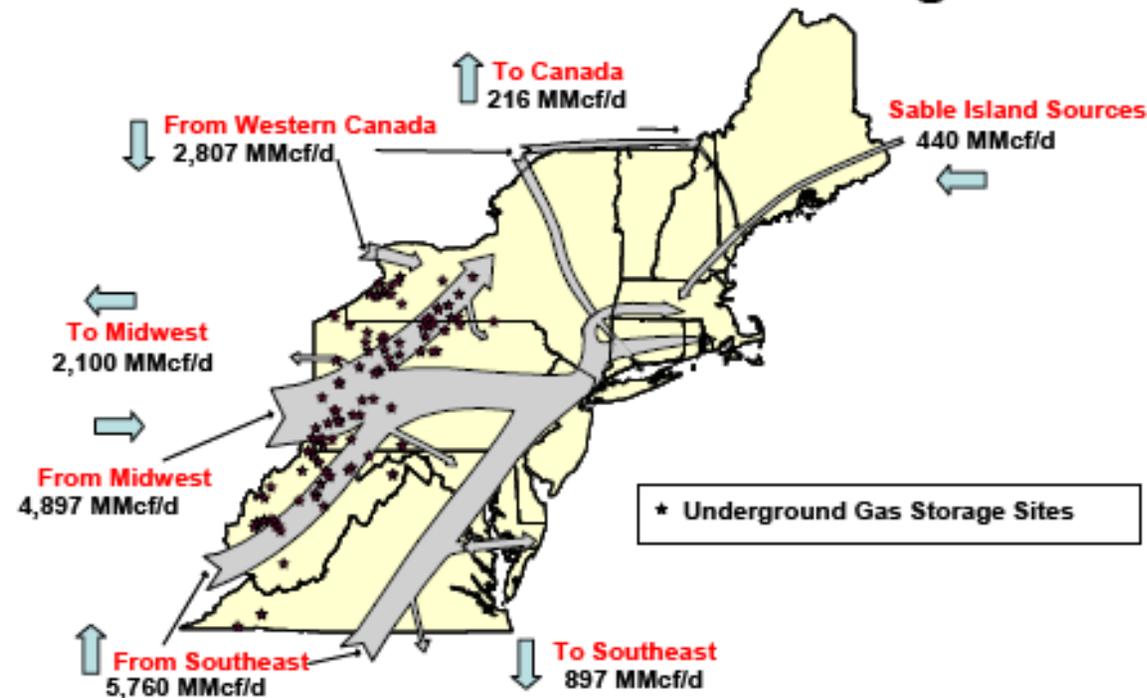
If you own property with 10 acres or more and own your gas rights, we would be interested in leasing your property for the possibility of drilling for natural gas.

Please give us a call...**724-439-4311** (ext. 125) 1018543



# West Virginia's location is ideal for northeast markets

**Figure 8. Gas Pipeline Capacity Into and Out of the Northeast Region**



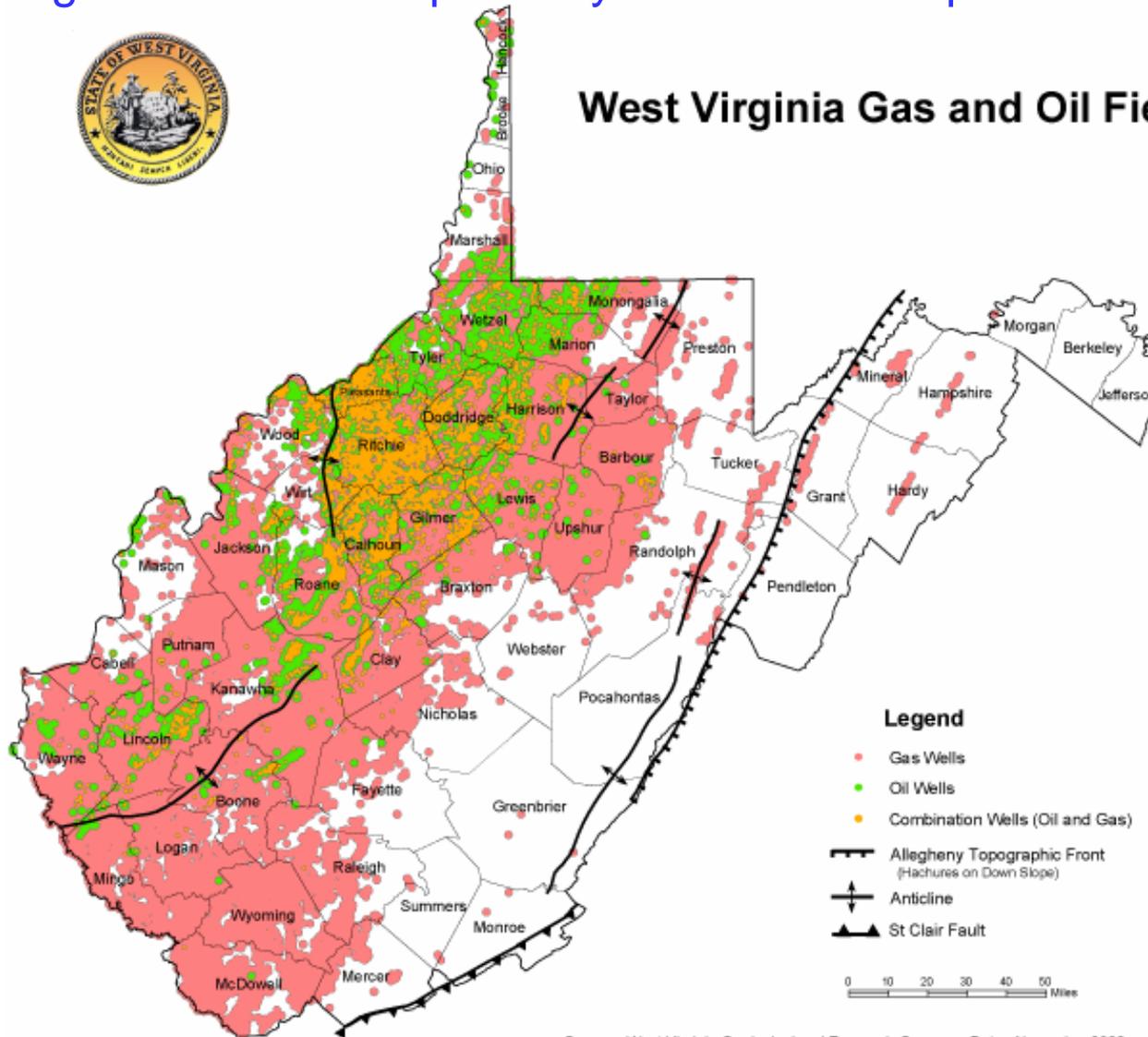
Note: MMcf/d = million cubic feet per day.  
Source: Energy Information Administration, Office of Oil and Gas, Natural Gas Pipeline Capacity Database.

Source: Energy Information Administration

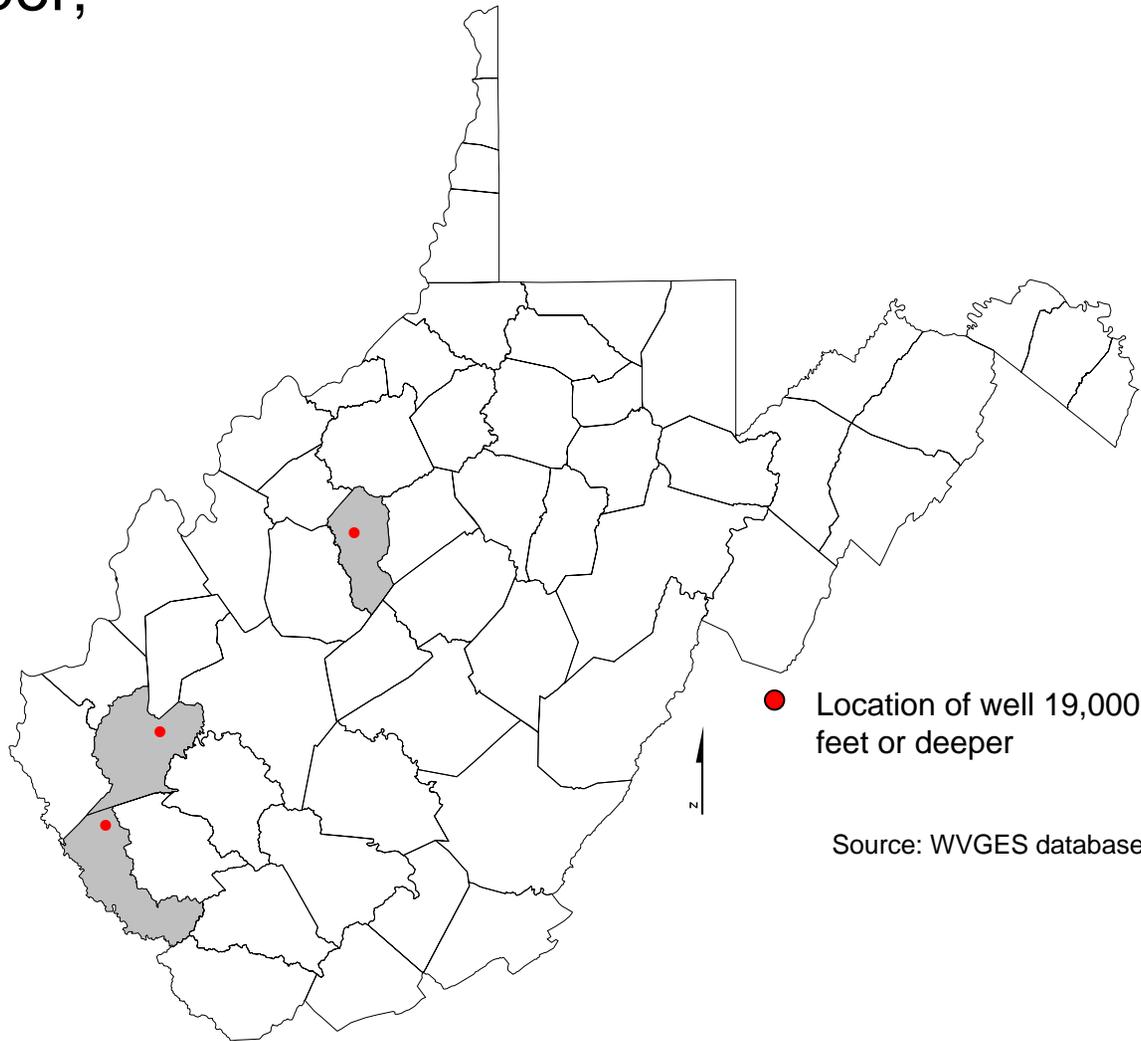
WV's gas and oil fields primarily in the western part of the State



## West Virginia Gas and Oil Fields



Wells 19,000  
feet or deeper;  
n=3



● Location of well 19,000  
feet or deeper

Source: WVGES database



GENERALIZED STRATIGRAPHIC COLUMN  
WITH OIL AND GAS RESERVOIRS  
WEST VIRGINIA

PERMIAN	GEOLOGIC SYSTEMS AND SERIES	TERMINOLOGY USED ON 1968 STATE GEOLOGIC MAP	FORMER TERMINOLOGY (W.VA. GEOLOGICAL SURVEY COUNTY REPORTS) IF DIFFERENT	OIL AND GAS "SANDS" (DRILLERS' TERMS)
		DUNKARD GROUP		CARROLL MIDWELL MADOFF MOUNDSVILLE CON RUN LITTLE DUNKARD BIG DUNKARD
PENNSYLVANIAN	UPPER	MONONGAHELA GROUP		BURNING SPRINGS GAS AND LOWER GAS HORSE NECK SALT SANDS (1st, 2nd, 3rd)
	MIDDLE	ALLEGHENY FORMATION		PRINCETON RAVENCLIFF WAGON
LOWER	POTTSVILLE GROUP		LOWER HANCOCK LITTLE LIME	
MISSISSIPPIAN	UPPER	MADON CHUNK GROUP		BLUE HOBBS BIG LIME KELLEY
	MIDDLE	GREENBRIER GROUP		CLAY INDIAN WEIP
	LOWER	MADDOCK FORMATION POCONO GROUP		GANTS FIFTY FOOT THIRTY FOOT SANDON STRAY GORDON FOURTH FIFTH SEWARD
DEVONIAN	UPPER	HAMPSHIRE FORMATION CHEMUNG GROUP	CATSKILL	ELIZABETH WARRICK FIRST WARRICK SECOND CLARENDON (TOSAI) SPEECHLEY BAILTON (CHERRY GROVE) RILEY BERSON ALEXANDER
	MIDDLE	BRALLIER FORMATION	PORTAGE	
		MARRELL SHALE	GENESSEE	
		MAHANTANGO FM. MARCELLUS FM. ONONDAGA LS. HUNTERSVILLE CHERT NEEDMORE SHALE	HAMILTON	HUNTERSVILLE
	LOWER	ORISKANY SANDSTONE HELDERBERG GROUP		CONYERDUE YIELDS GAS IN OH. AND WESTERN W.VA. DESERAY SAND GAS IN MO., KY., OHIO, PA. AND W.VA. HELDERBERG YIELDS GAS FROM SEVERAL PA. AND W.VA. WELLS "BIG LIME" OF OHIO
	SILURIAN	UPPER	TONOLOWAY FM. WILLS CREEK FM. WILLIAMSPORT FM.	BOSSARDVILLE RONDOUT BLOOMSBURG
MIDDLE		MCKENZIE FM. ROCHESTER SHALE REDFIELD SANDSTONE ROSE HILL FORMATION	NIAGARA CLINTON	KEEFER SANDSTONE GAS IN OHIO, E. KY. AND SP. W. VA. CLINTON SAND OIL IN OHIO AND W.VA. MEDINA GAS SAND IN N.Y. SOME OIL IN N.Y. AND OHIO
LOWER		TUSCARORA SANDSTONE	WHITE MEDINA	
ORDOVICIAN		UPPER	JUNIATA FORMATION OSWEGO FORMATION REDSVILLE SHALE	RED MEDINA GRAY MEDINA MARTINSBURG
	MIDDLE	TRENTON GROUP MARTINSBURG FM. NEALMONT LS.	CHAMBERSBURG MOCCASIN	CHAZY-STONES RIVER YIELDS OIL IN SOUTH CENTRAL KENTUCKY AT YONK. GAS AND OIL IN IND. AND KENTUCKY
		BLACK RIVER GROUP ST. PAUL NEW MARKET LS. ROCKY HOOK SANDSTONE SANDSTONE SANDSTONE SANDSTONE	CHAZY STONES RIVER	
	LOWER	CONOCOCHACHEAGUE FORMATION ELBROOK FORMATION WAYNESBORO FORMATION TOMSTOWN DOLOMITE ARTISTEM FM. HARRERS FM. MAYERTON-LONDON FORMATION CATDCTIN FORMATION		KNOS DOLOMITE OIL IN EASTERN KENTUCKY ROSE HILL SAND TRIPPLEHEAD OIL AND GAS IN OHIO ROME SANDSTONE OIL IN E. KY. OIL IN EASTERN KENTUCKY
CAMBRIAN				
PRECAMBRIAN		CRYSTALLINE ROCKS		

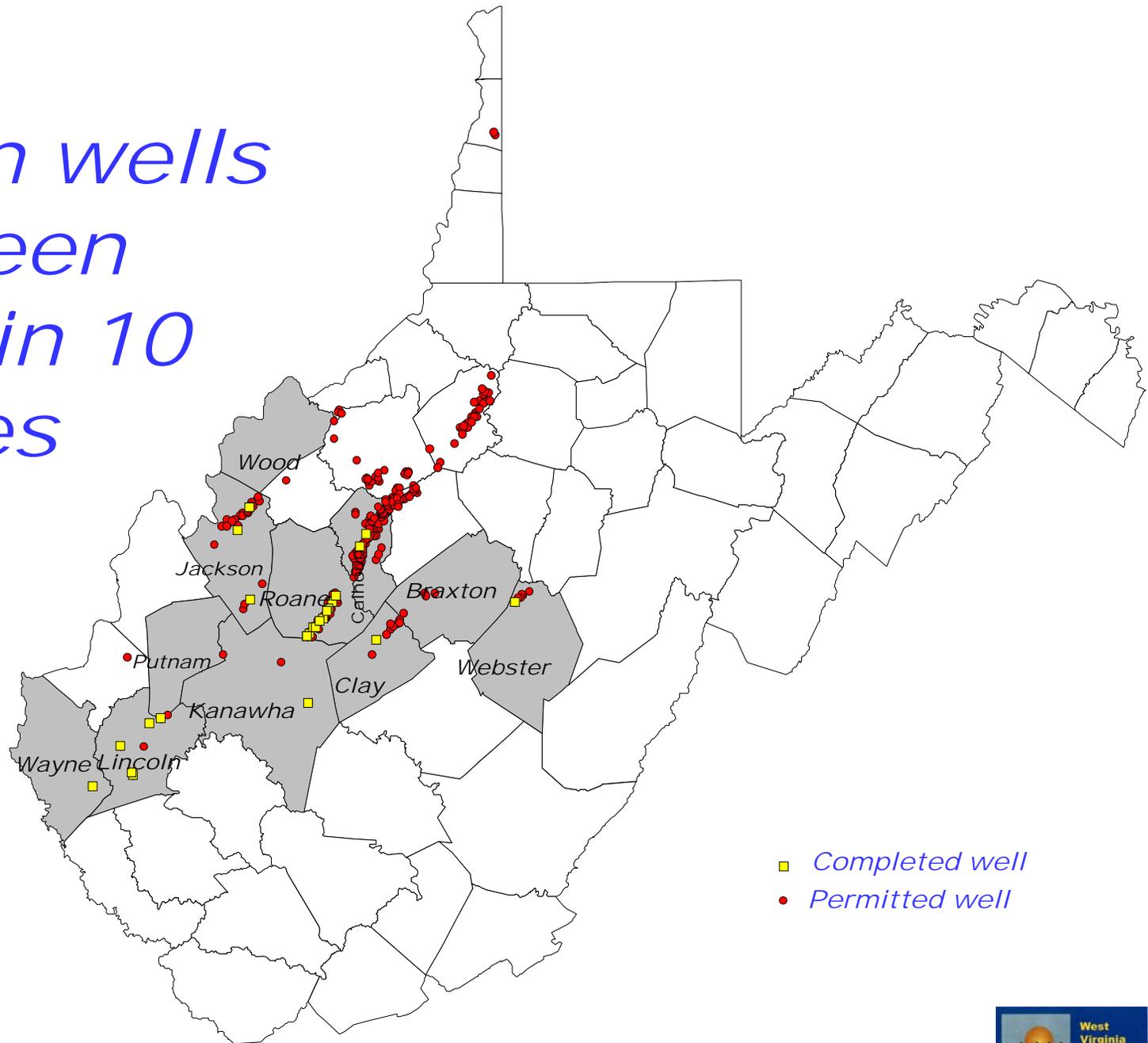
Coalbed methane

Marcellus Shale

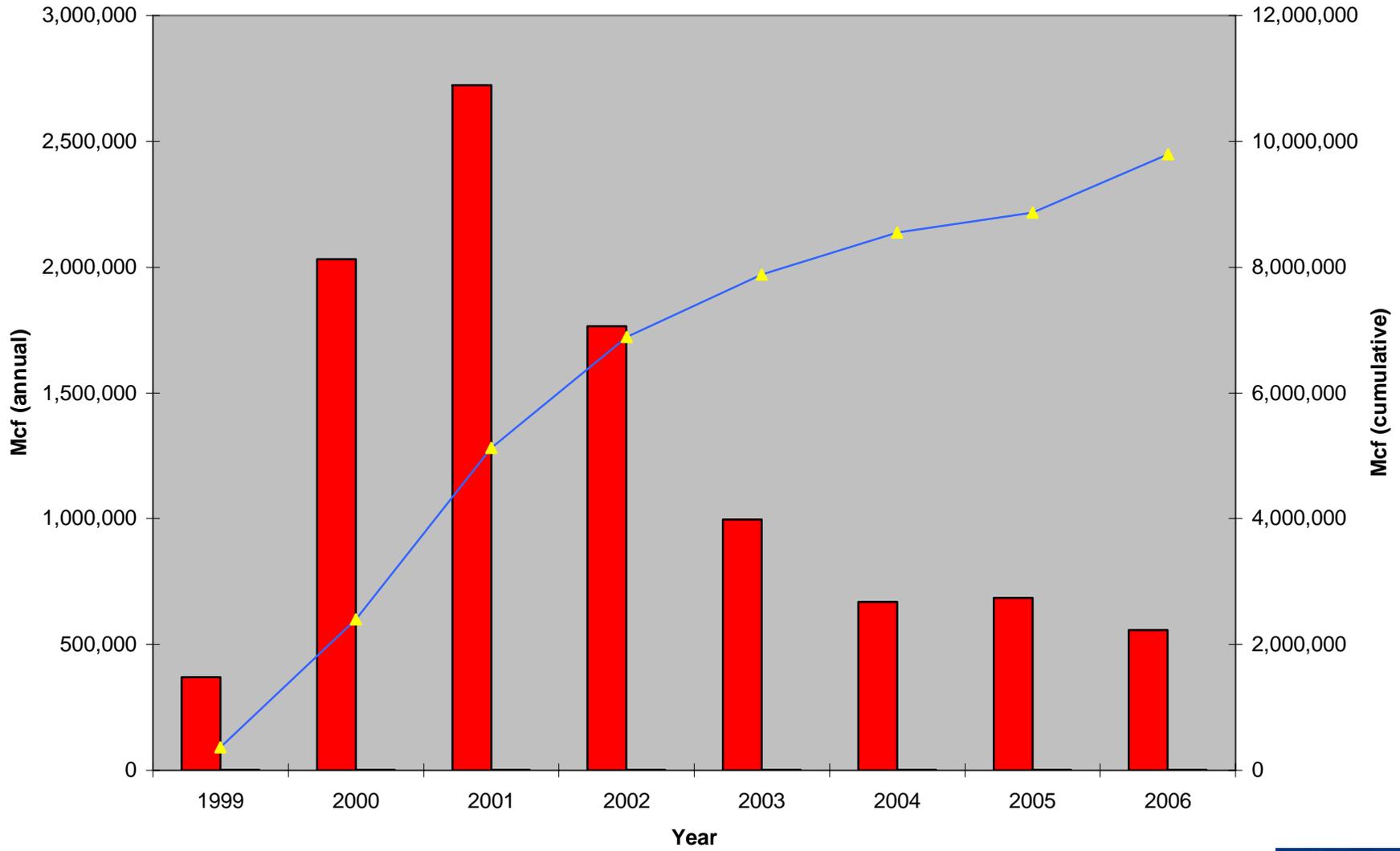
Trenton-Black River

Different age rocks of recent interest to oil and gas producers

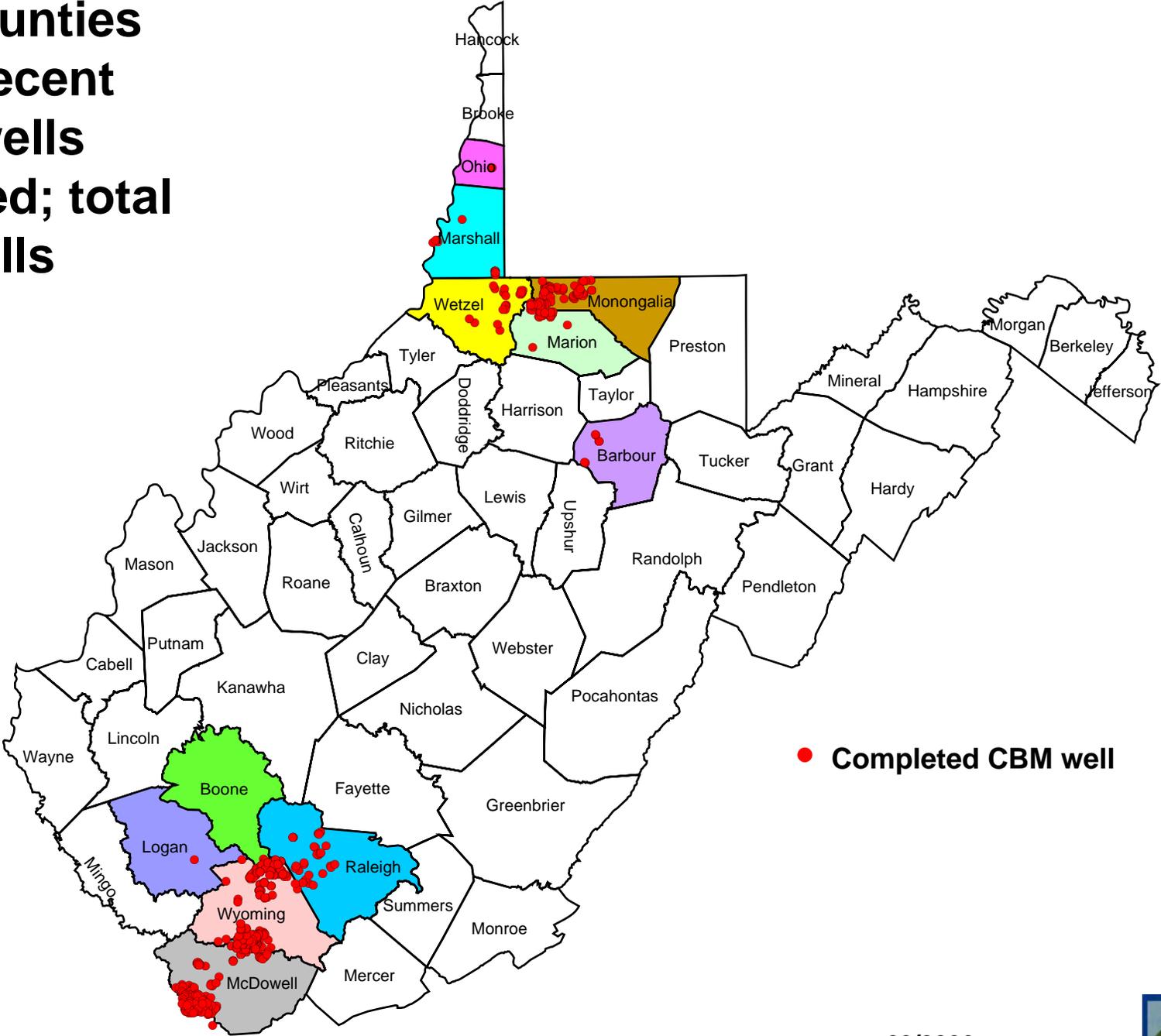
*Recent  
Trenton wells  
have been  
drilled in 10  
counties*



### WV Trenton Gas Production



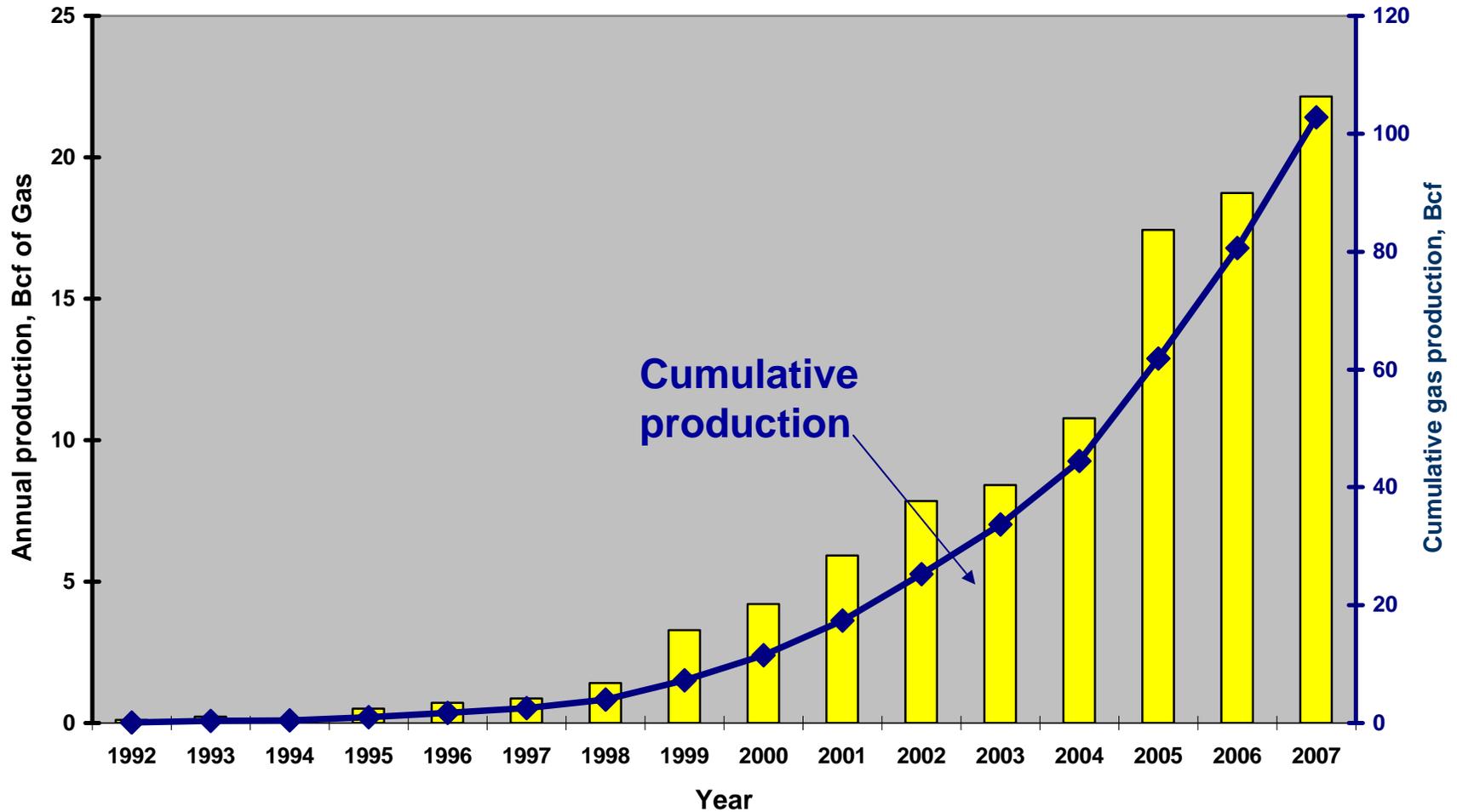
# WV Counties with Recent CBM wells reported; total 690 wells



09/2006



# West Virginia CBM Gas Production



**Annual and Cumulative CBM production for WV;  
total 103 Bcf of gas; 2007 production >22 Bcf.**

# The Marcellus Shale Play

- What is it?
- **Shale** is a fine-grained sedimentary rock.
- The **Marcellus** is a particular rock unit which is Devonian in age.



# A Play

- A play is defined as a group of geologically similar drilling prospects having similar source, reservoir and trap controls of gas migration, accumulation, and storage.
- Patchen, D.G., 1996, Introduction to the Atlas of Major Appalachian Gas Plays, WV Geological and Economic Survey, Volume V-25, p. 1.

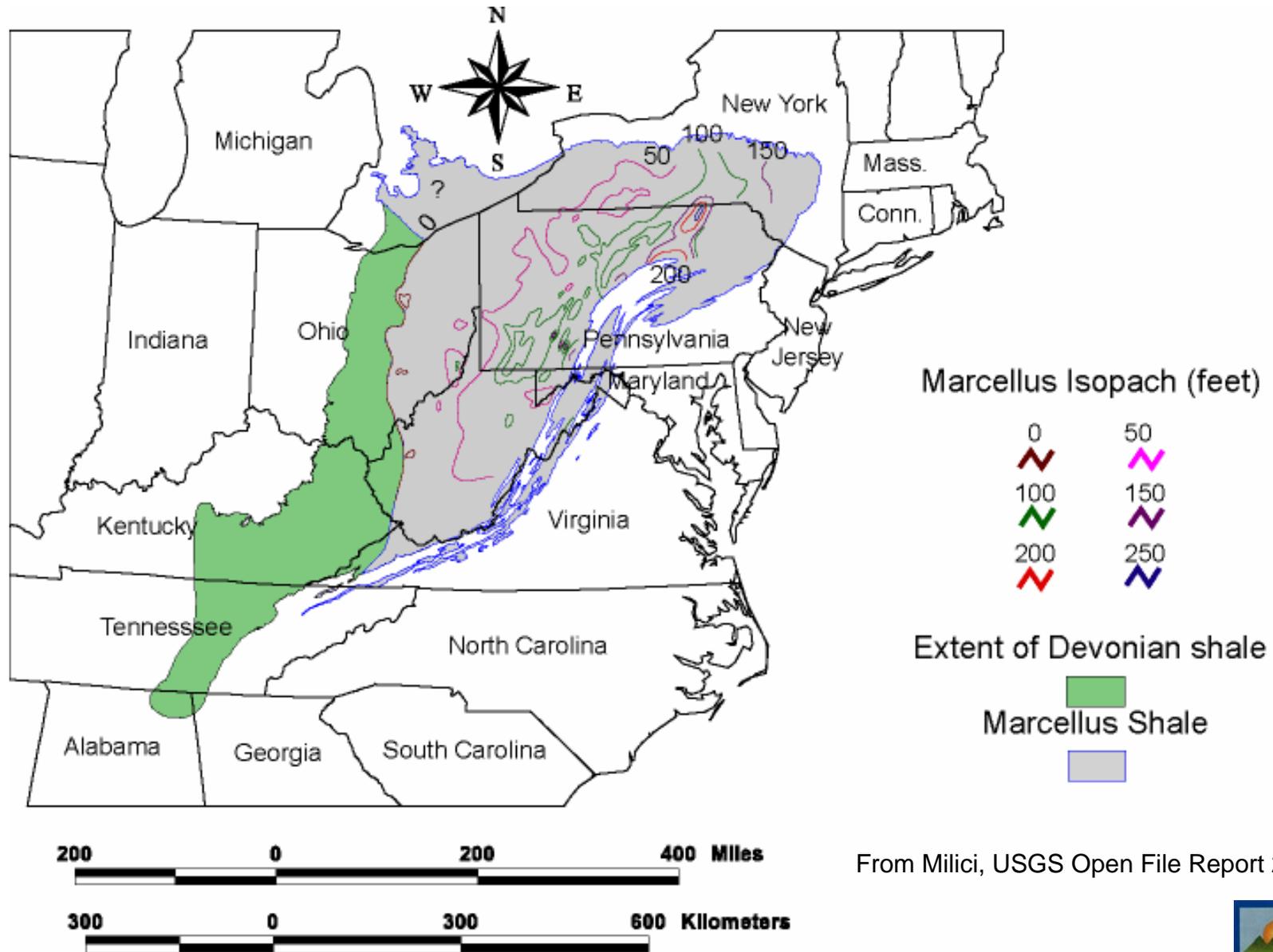
Modified from White, 1980; 1988.

White, D.A., 1980, Assessing oil and gas plays in facies-cycle wedges:  
American Association of Petroleum Geologists Bulletin, v. 64, p. 1158-1178.

--- 1988, Oil and gas play maps in exploration and assessment: American  
Association of Petroleum Geologists Bulletin, v. 72, p. 944-949.

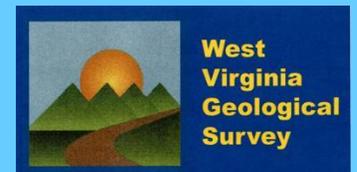
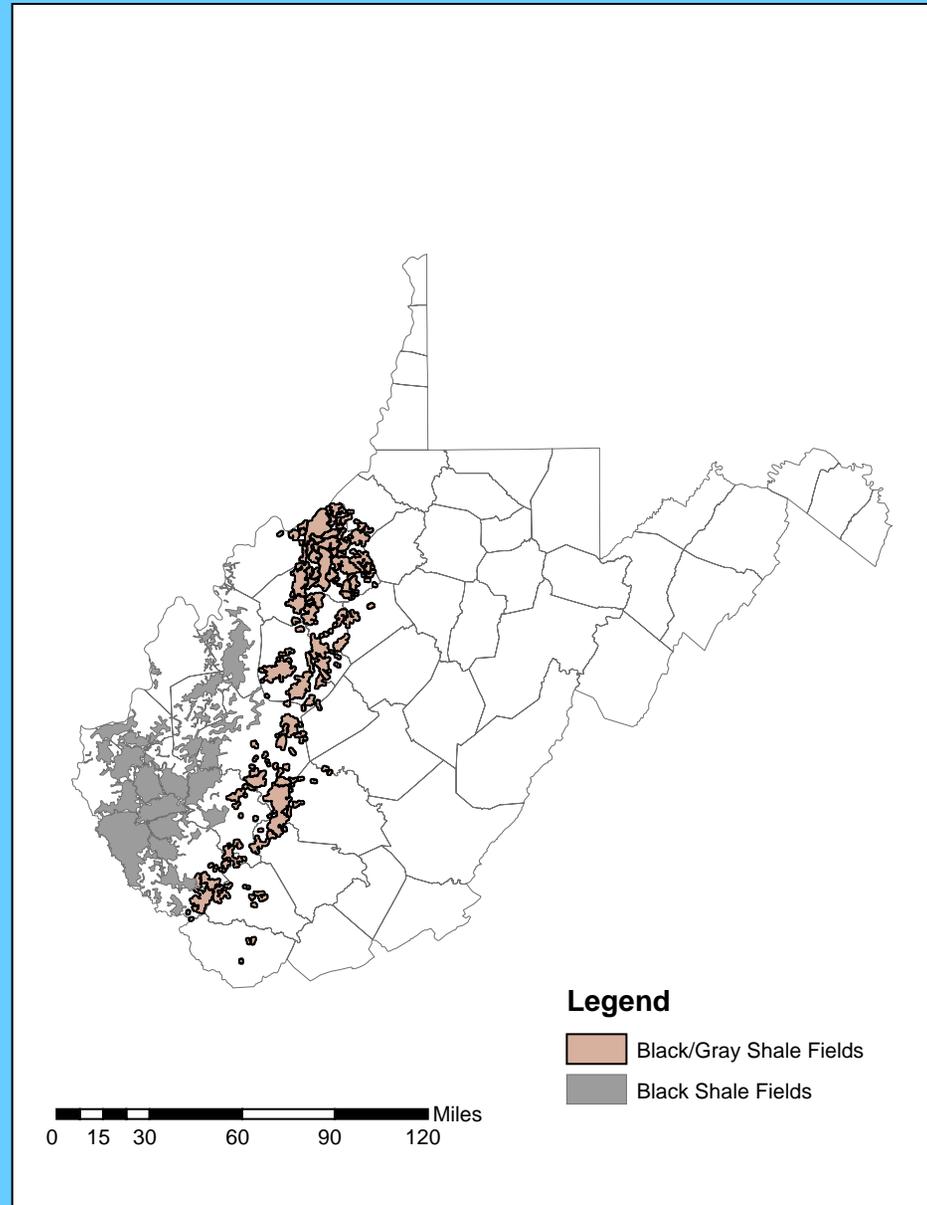


# Marcellus Shale

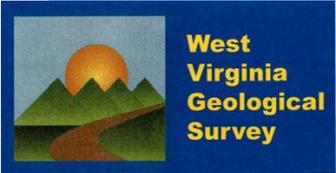
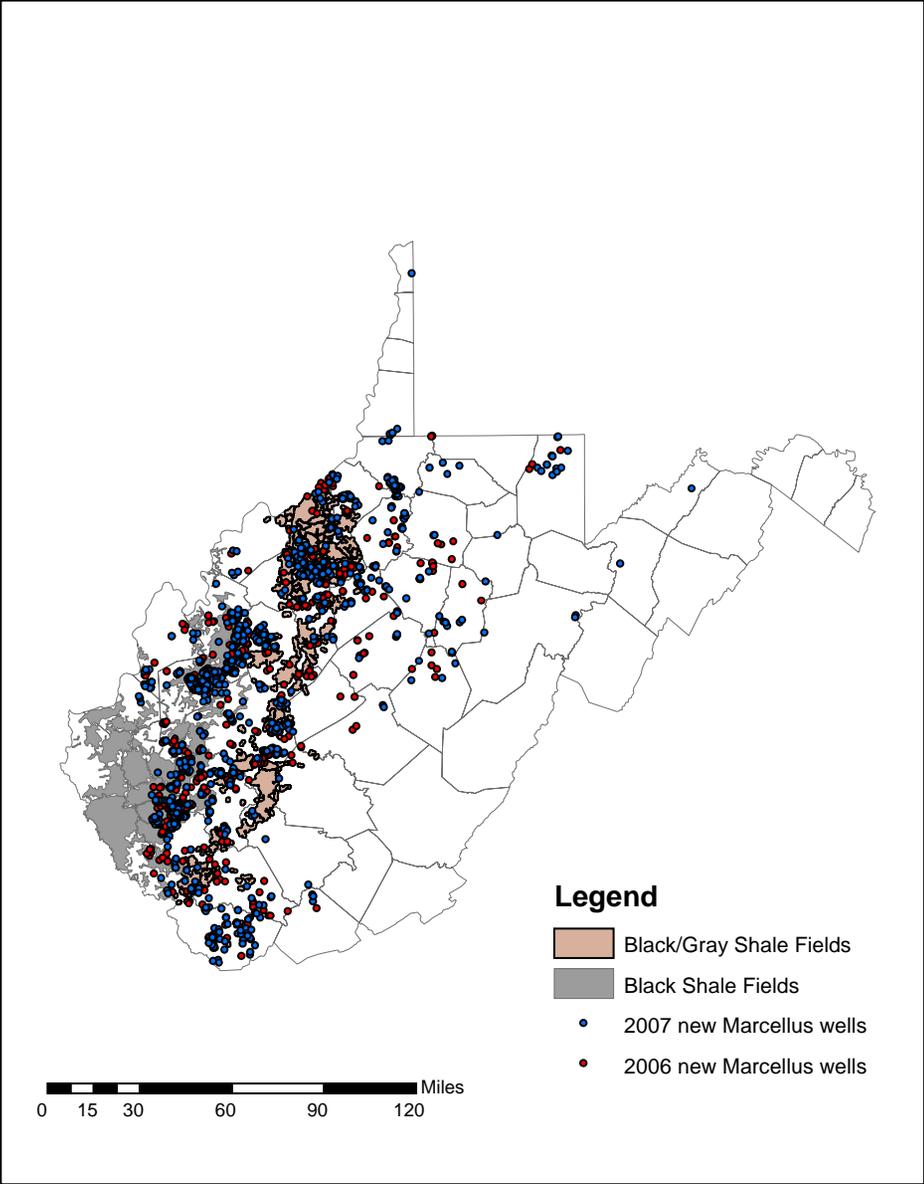


From Milici, USGS Open File Report 2005-1268

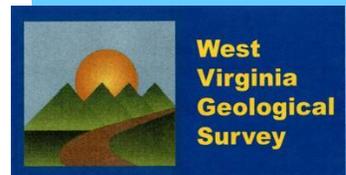
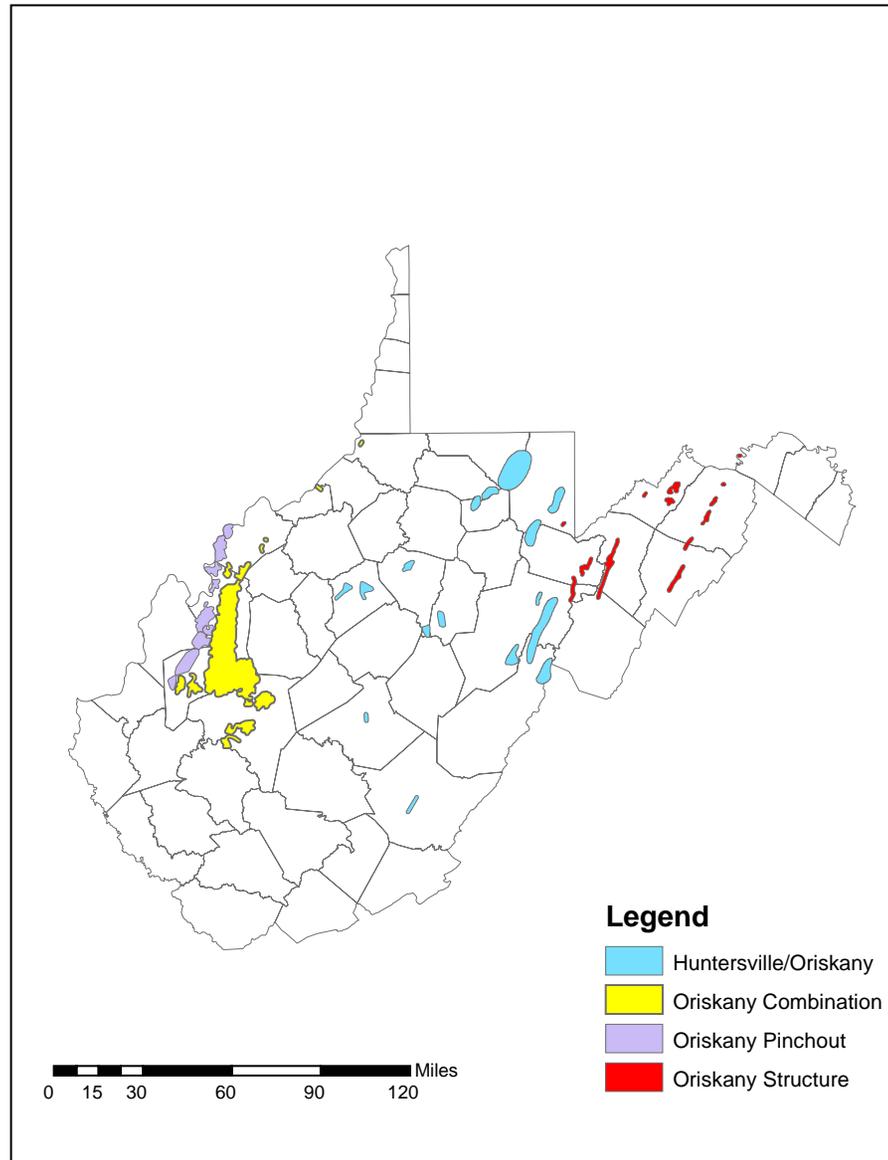
# Historic Devonian Shale Gas Fields



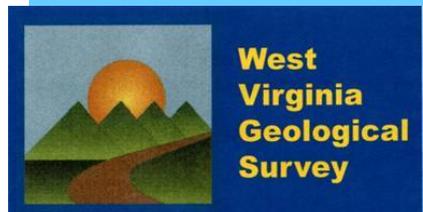
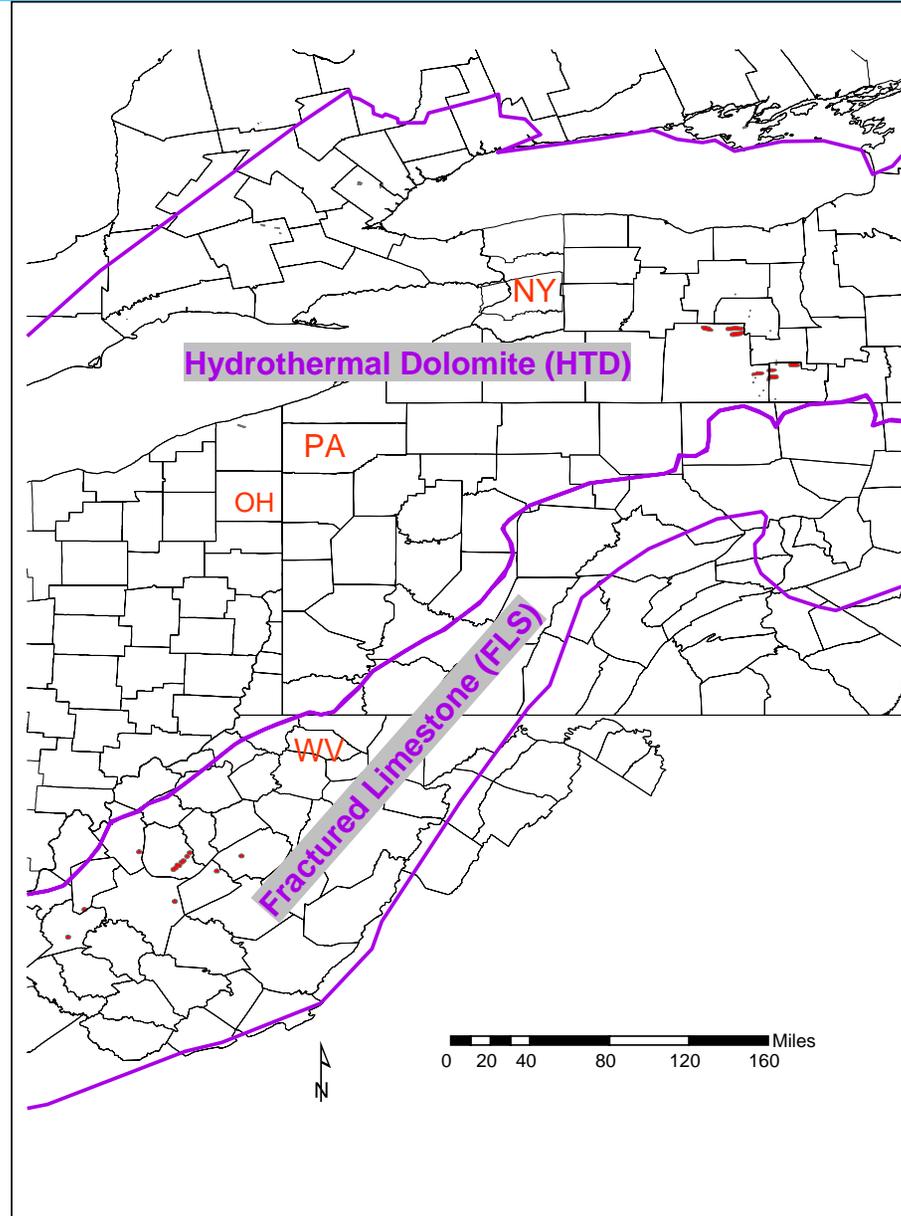
# Historic Devonian Shale Gas Fields and new Marcellus wells permitted in 2006 and 2007



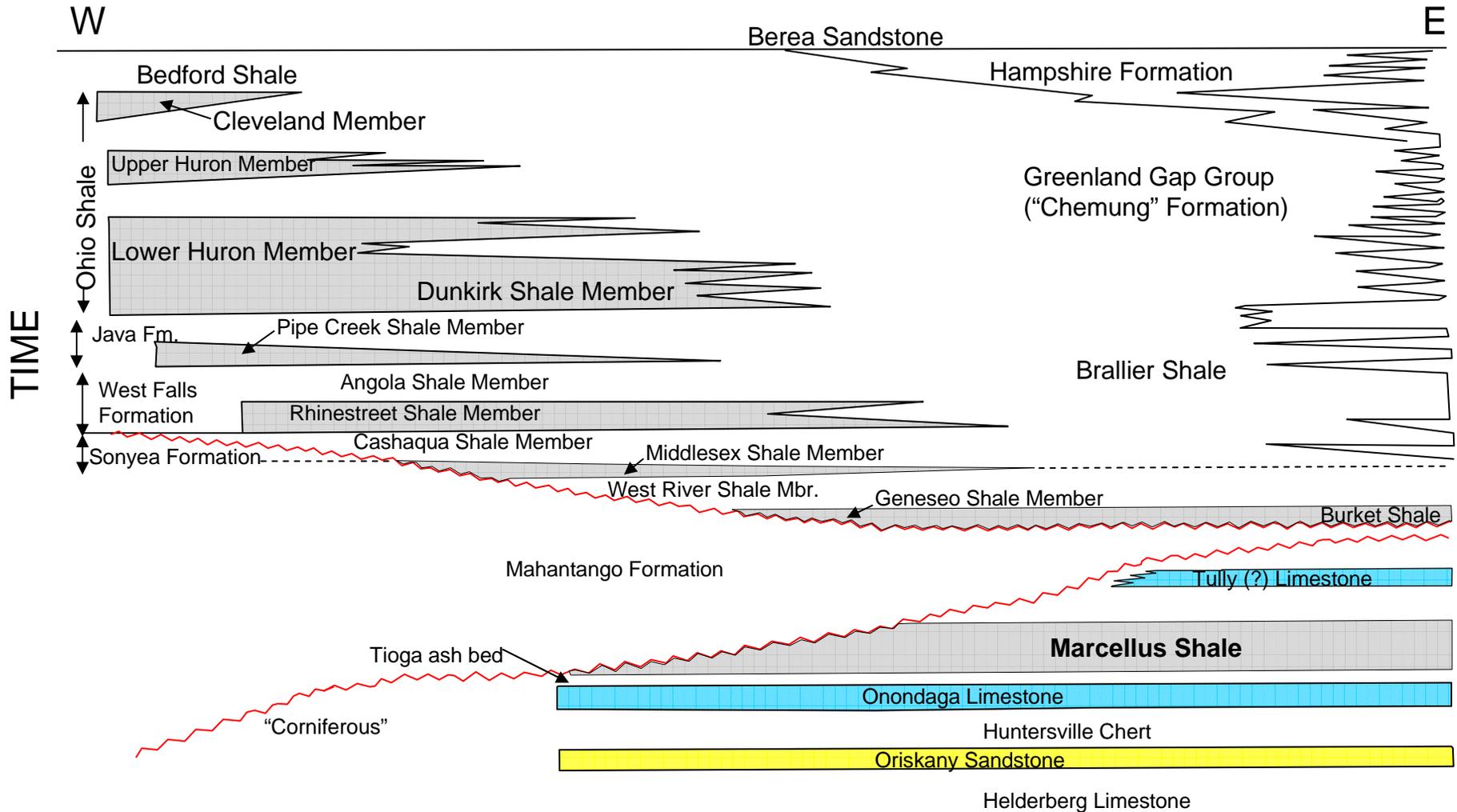
# Huntersville/Oriskany Gas Fields



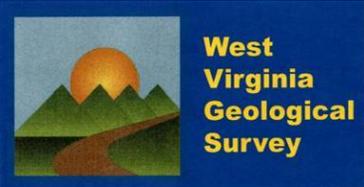
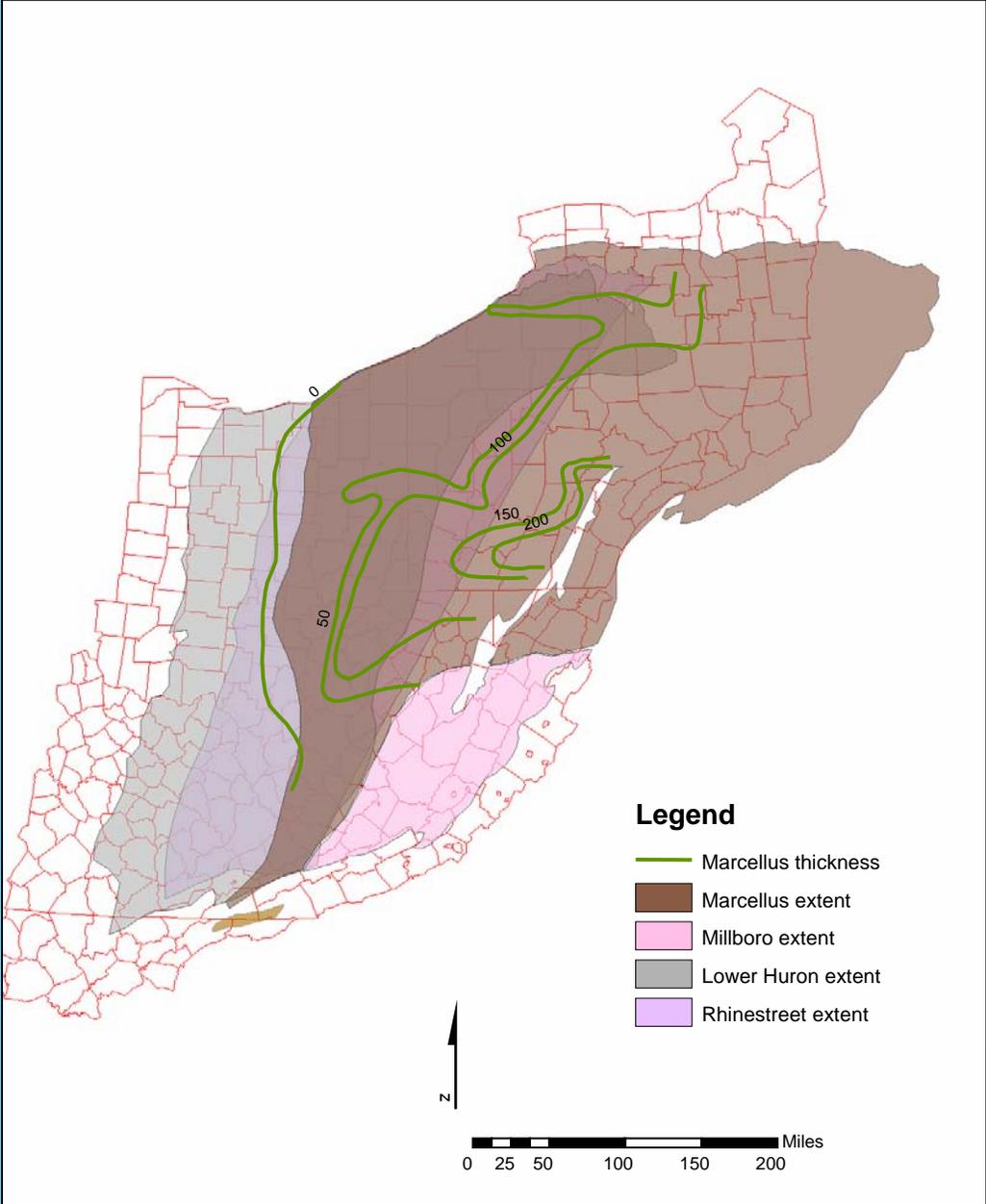
Trenton-Black River play spurred additional deep drilling in last 15 years in limited areas.



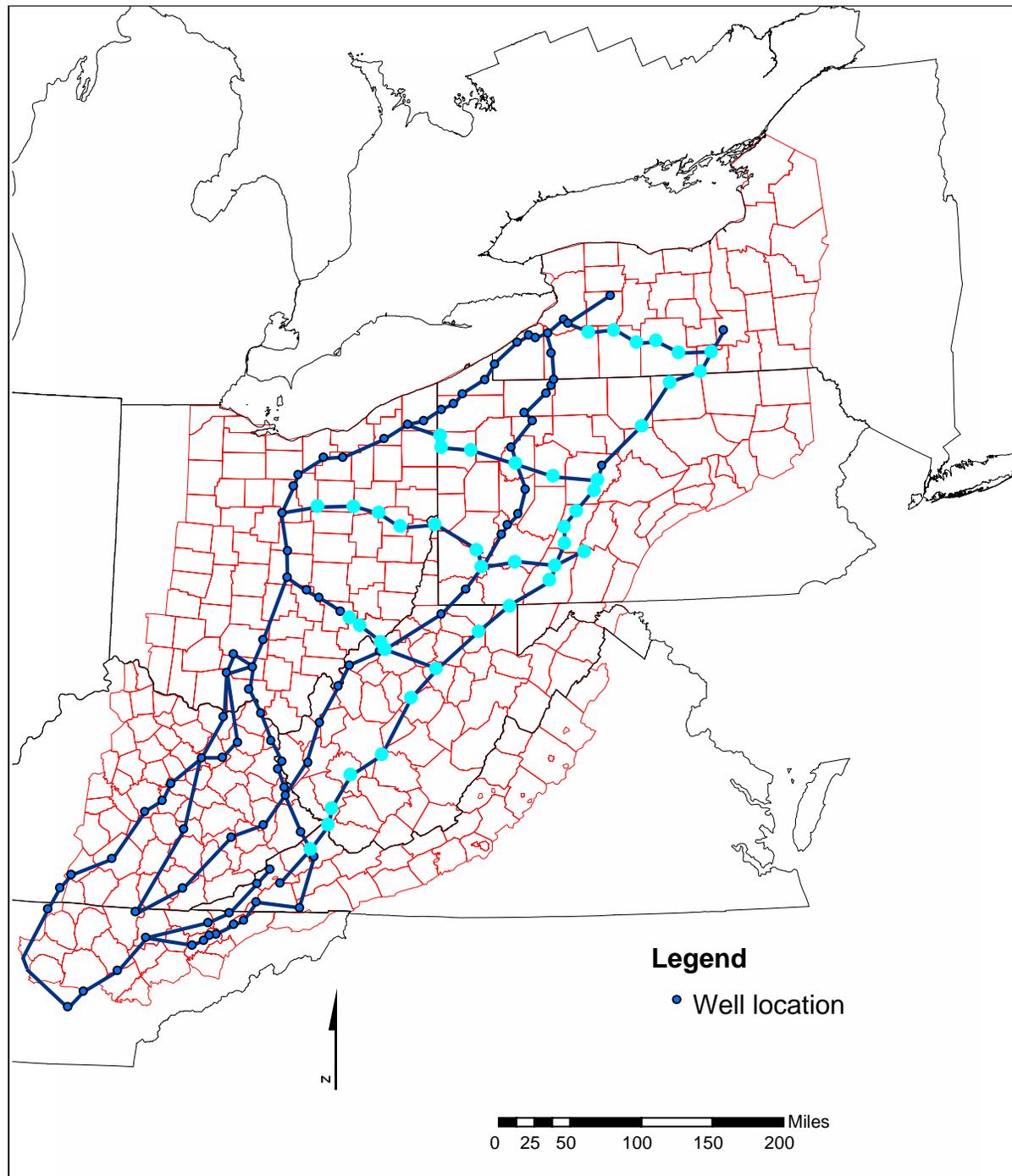
# West Virginia Nomenclature



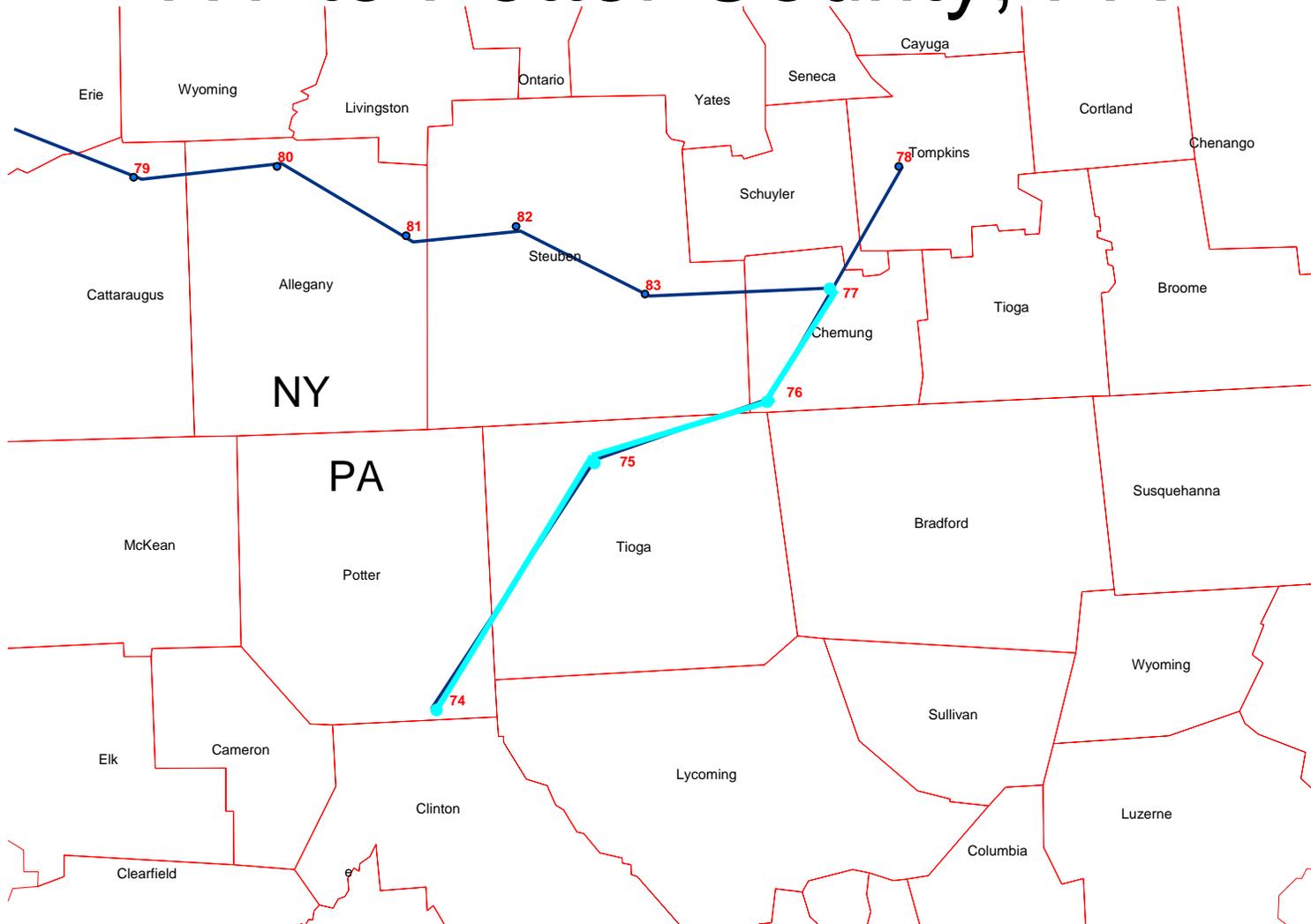
# Extent of Marcellus, Rhinestreet, and Lower Huron



Locations  
of cross  
sections  
from  
USGS  
Bulletin  
1909

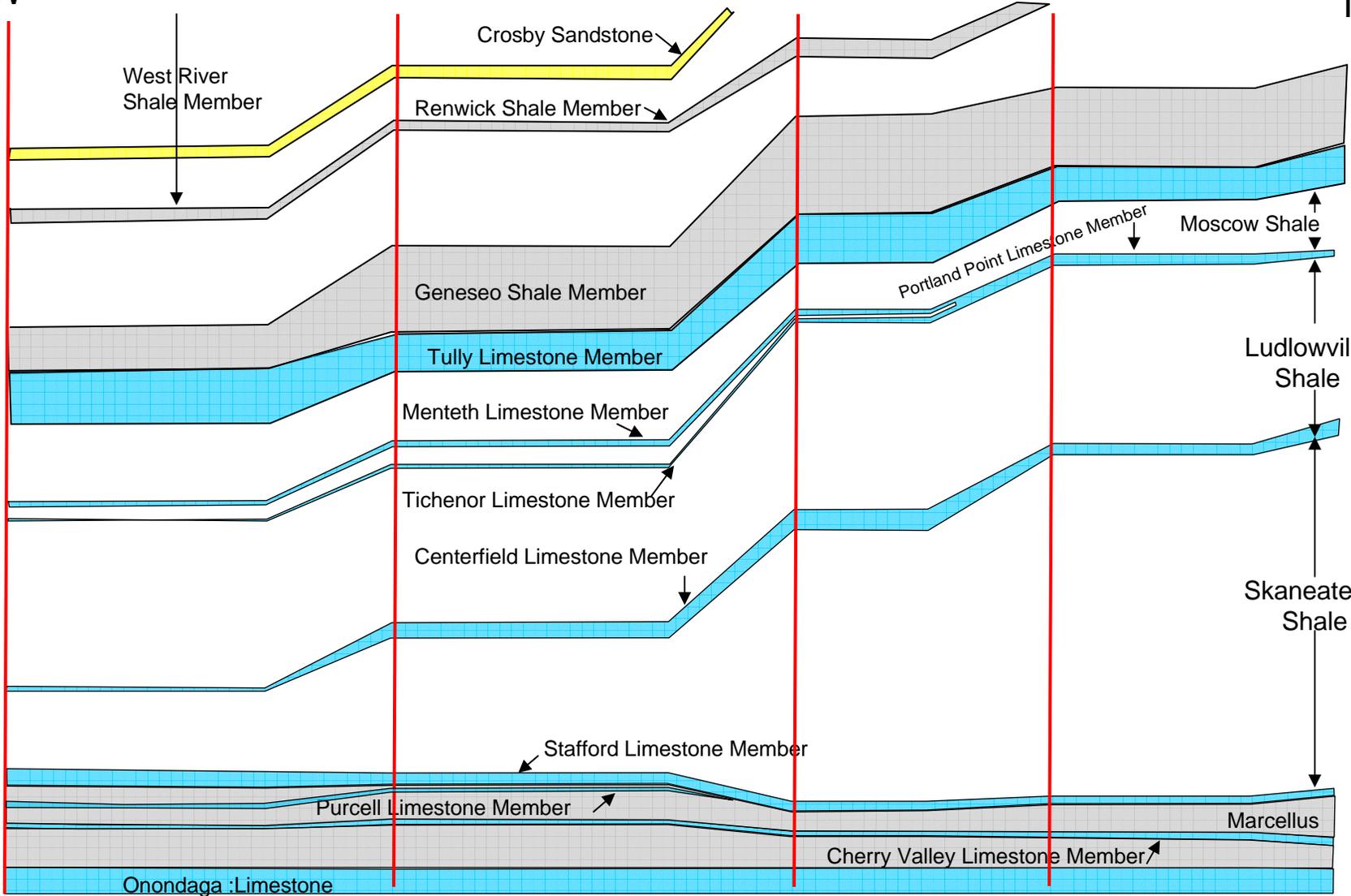


# Cross Section Chemung County, NY to Potter County, PA



SW

NE



74  
Potter Co., PA

75  
Tioga Co., PA

76  
Chemung Co., NY

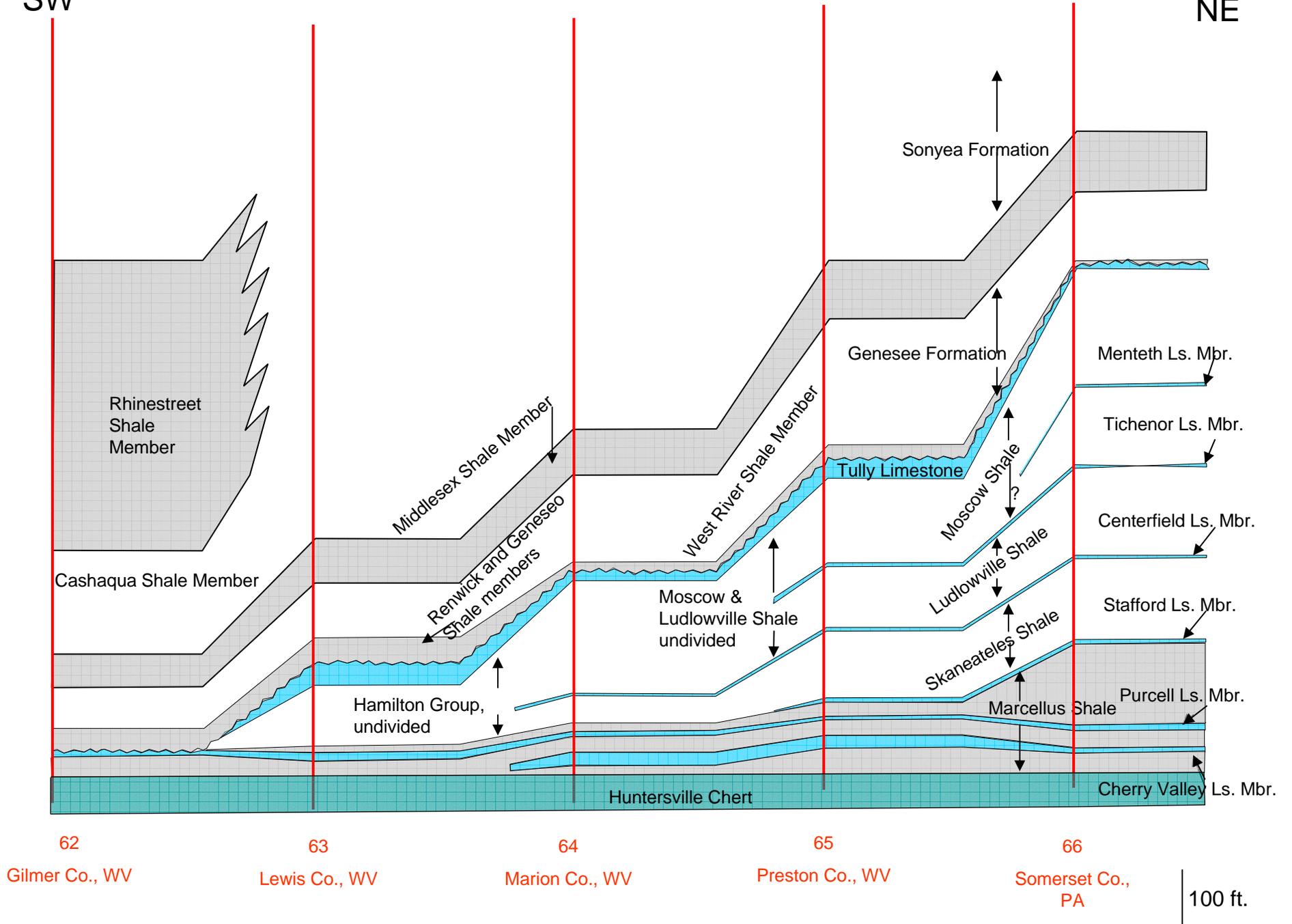
77  
Chemung Co., NY

100 ft.



SW

NE



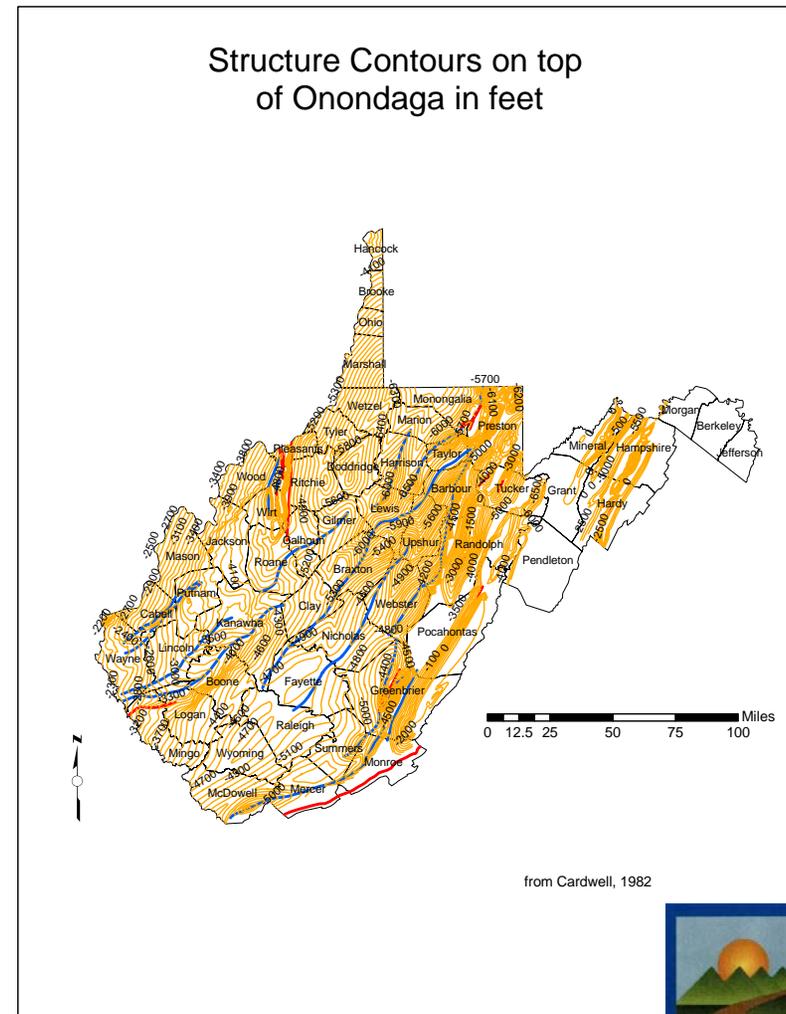
# Where is the Marcellus present in WV?

- It is present below the surface, at varying depths throughout much, but not all of WV.
- It is not present in extreme eastern or western WV.
- It crops out at the surface in parts of the Valley and Ridge province in eastern WV.
- It varies in thickness across WV.



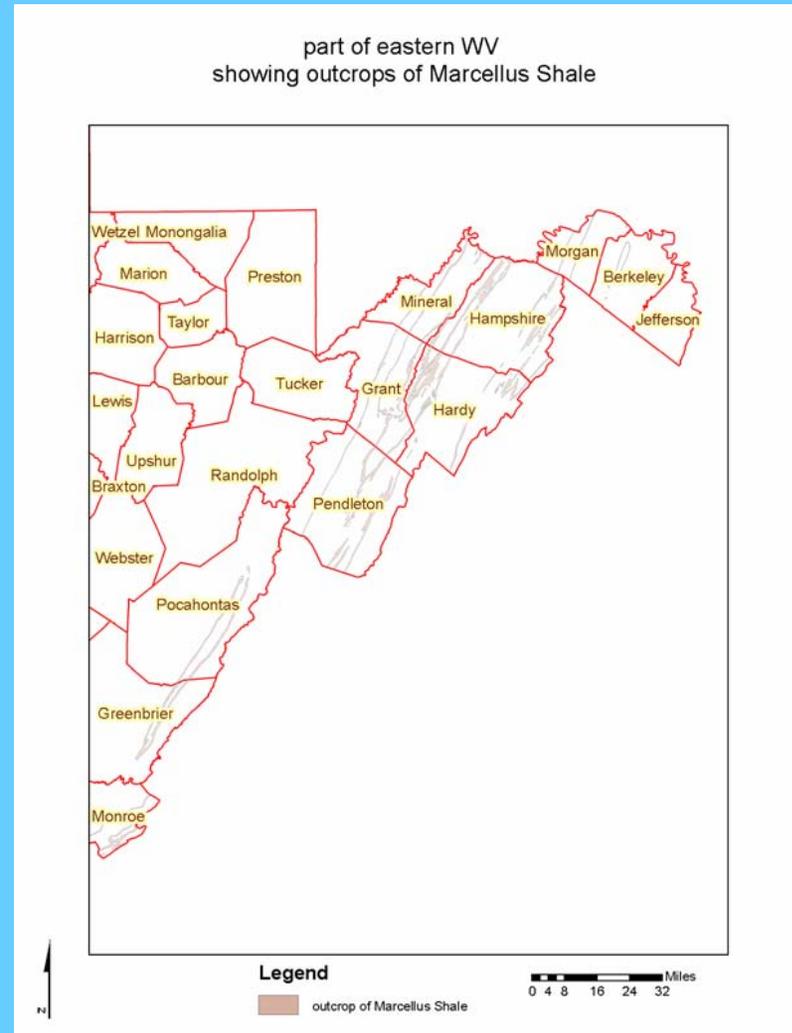
# Elevation of top of Onondaga Limestone, in feet

The Onondaga Limestone immediately underlies the Marcellus, so knowing the elevation of the top of the Onondaga and the surface elevation at a particular location provides a way to estimate the depth of a well drilled all the way through the Marcellus Shale.



# Outcrops of Marcellus

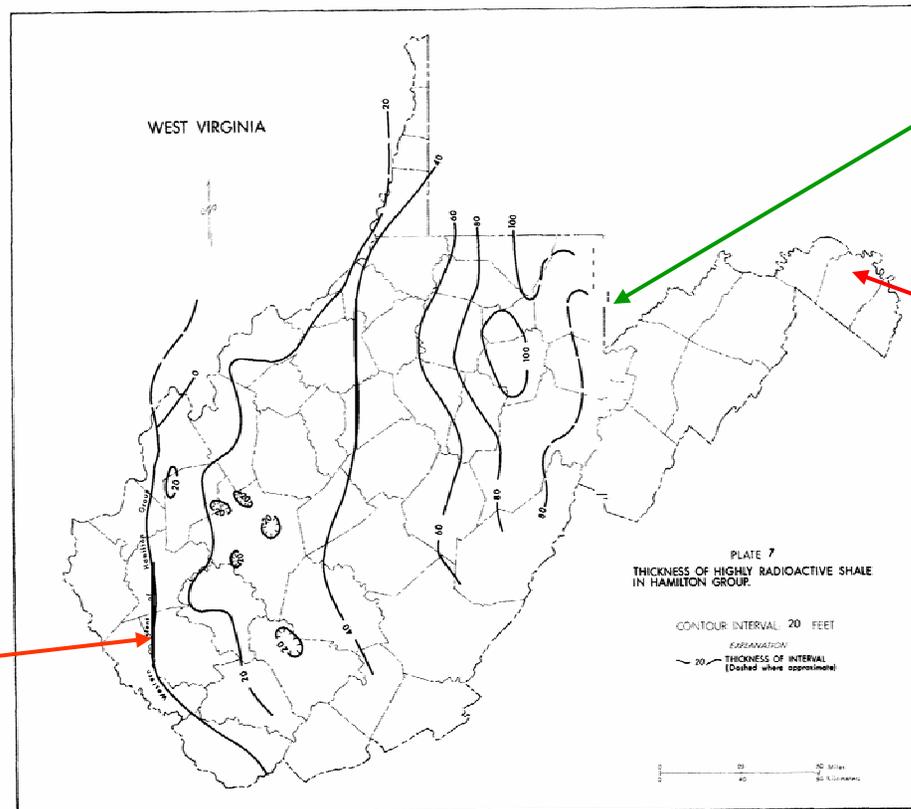
The Marcellus is exposed at the surface in eastern WV as shown by the outcrop map. In the eastern-most counties, older rocks are exposed at the surface and the Marcellus is not present.



From 1968 state geologic map



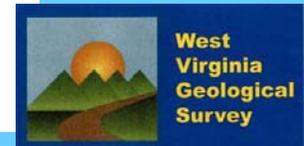
# Thickness in feet and extent of Marcellus Shale in subsurface



Area of  
thicker  
Marcellus

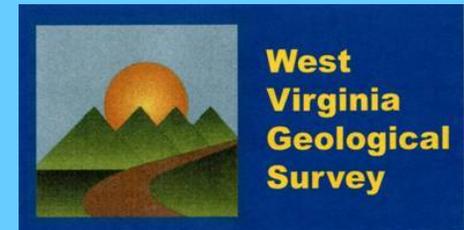
Marcellus  
not present  
east of here

Marcellus  
not present  
west of this  
line



# For Further Information:

- WV Geological & Economic Survey,  
<http://www.wvgs.wvnet.edu/>
- WV Department of Environmental Protection,  
Office of Oil and Gas,  
<http://www.wvdep.org/item.cfm?ssid=23>



# WVGES Interactive Mapping

- <http://www.wvgs.wvnet.edu>  
Information on Devonian Shales including Marcellus Shale
- Using this application, you can determine where the Marcellus is present below the surface, the approximate depth to drill through the Marcellus, and the approximate thickness of the Marcellus.
- We cannot predict presence or absence of natural gas or quantities of gas with this application.

