

AAPG

March 2008

# EXPLORER

## Appalachian Spring

A new shale play  
emerges in the East



# Marcellus Shale 101

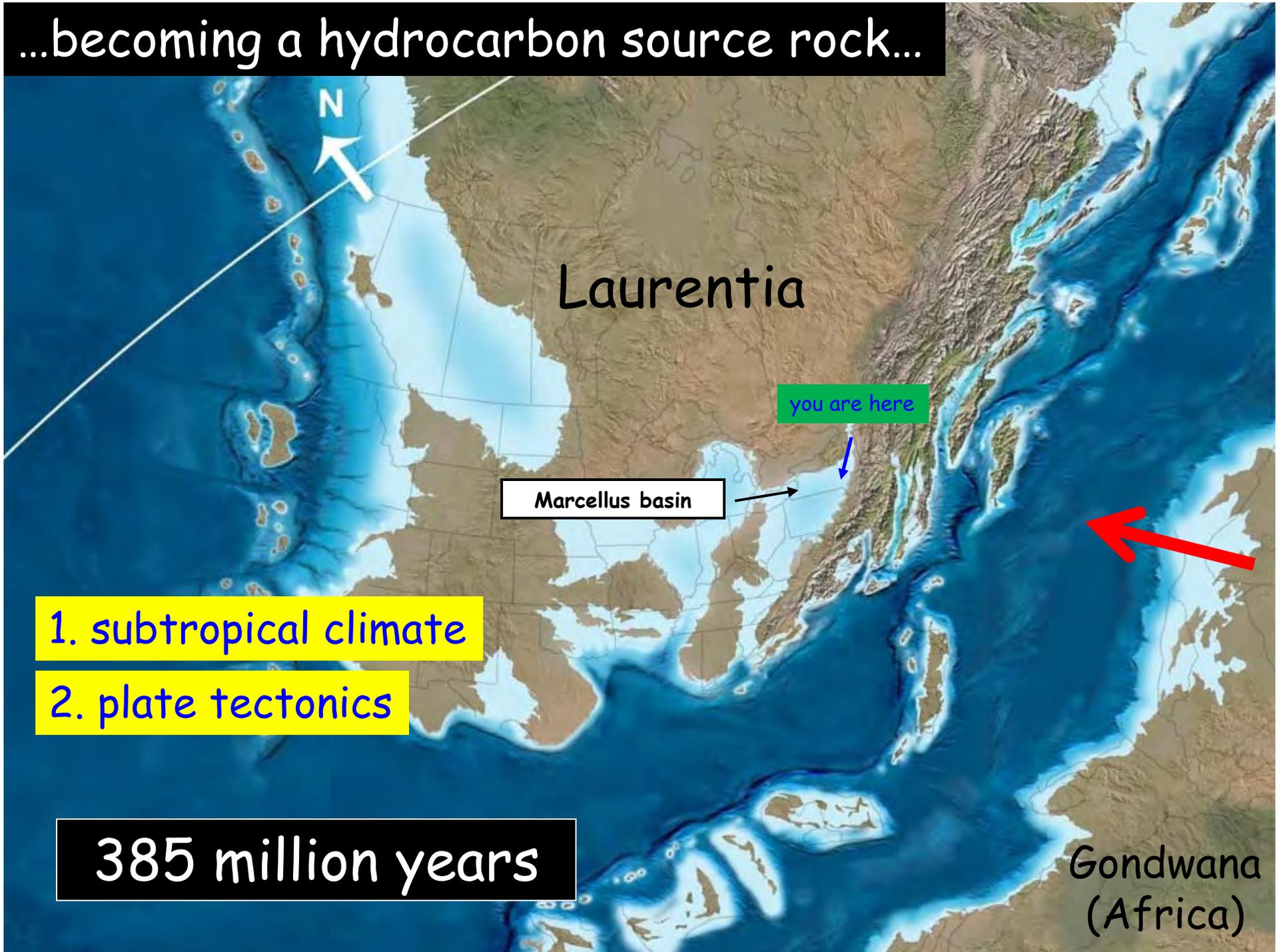
1. What is the Marcellus Shale?
2. Where is the Marcellus Shale?
3. What's all the fuss about?

# 1. What is the Marcellus Shale?

...Devonian (385 million years old) black shale...

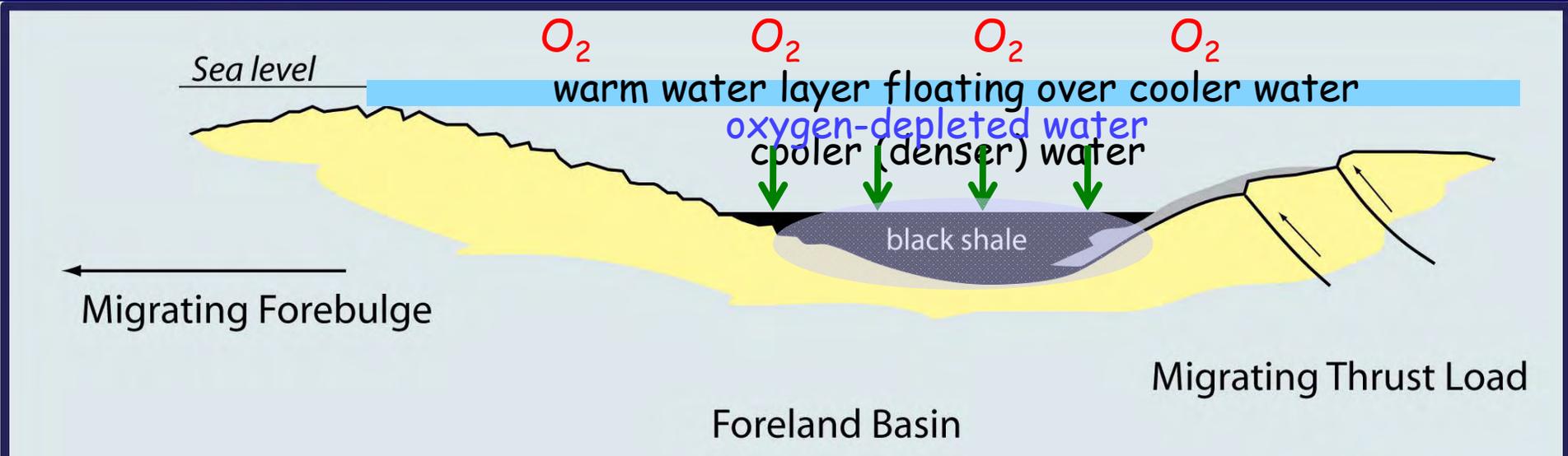


...becoming a hydrocarbon source rock...



...Devonian - extremely warm period of Earth's history...

1. abnormally warm climate (layered ocean);
2. prevents oxygen from reaching the bottom (cooler) water;
3. the bottom water is quickly depleted of oxygen as a consequence of the abundant organic remains of plankton sinking through the water;



a warming climate favors the preservation of organic remains

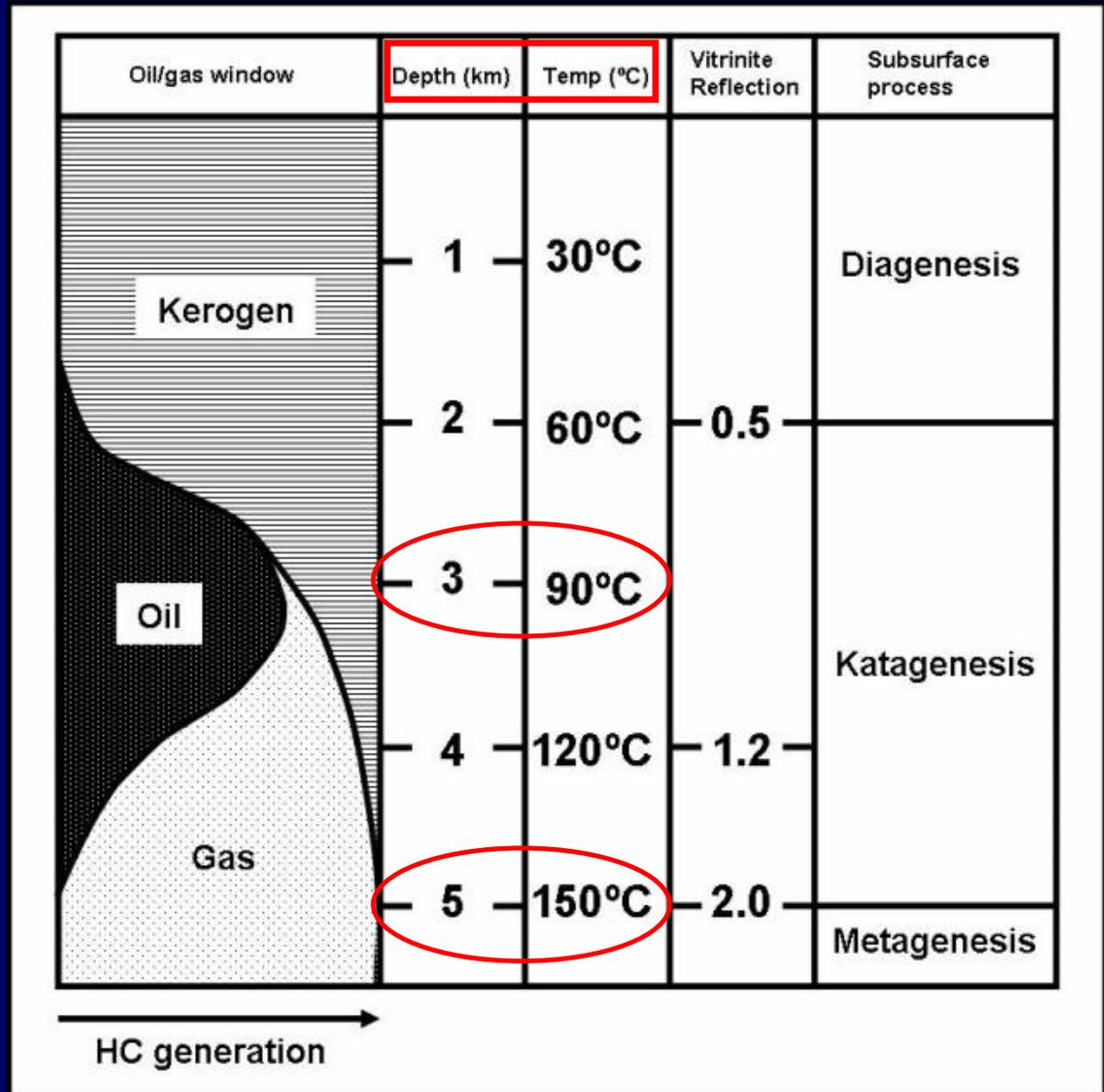
...transformation of organic remains to oil and natural gas...

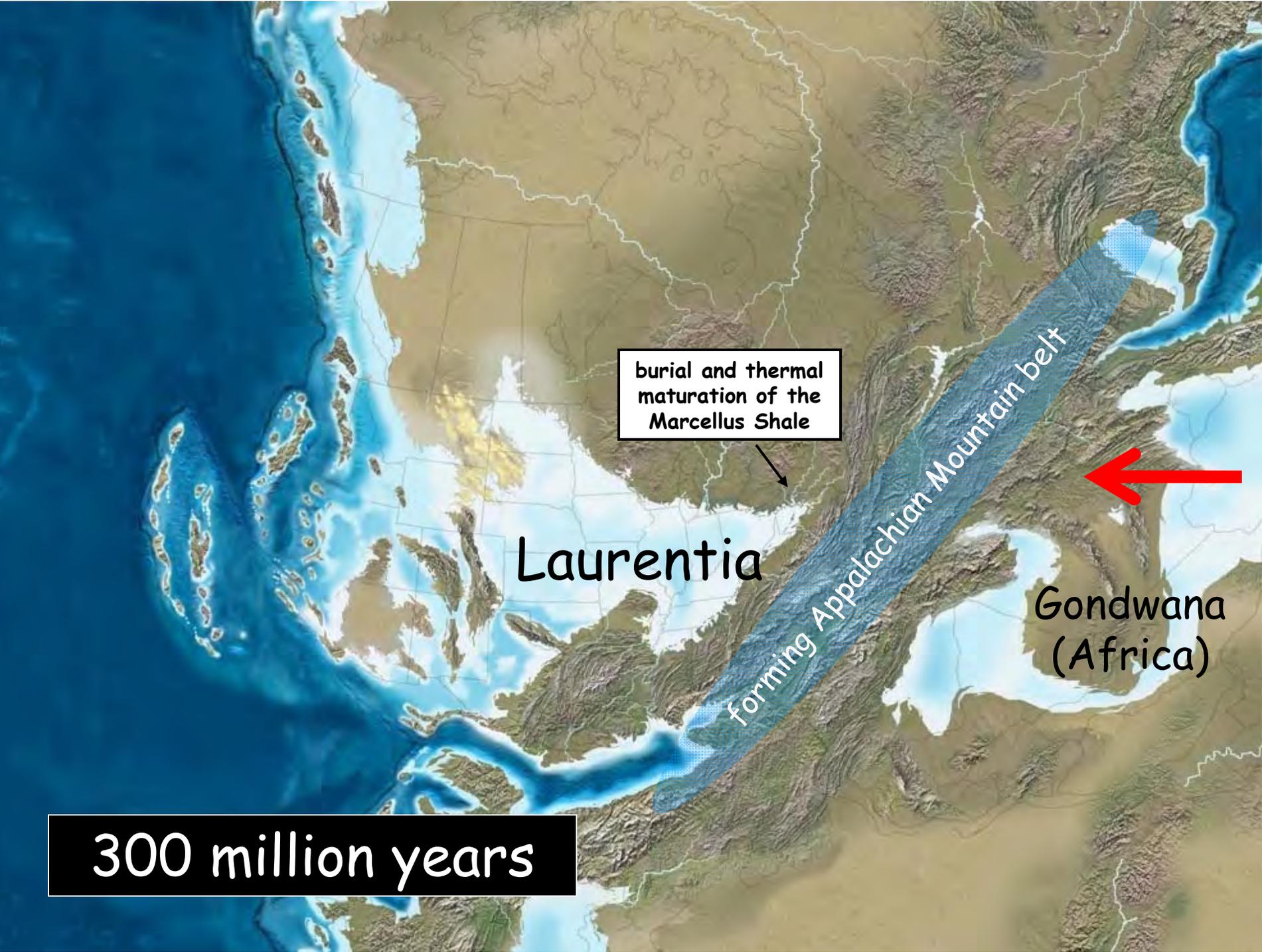
...heat...

oil window



gas window





burial and thermal maturation of the Marcellus Shale

Laurentia

forming Appalachian Mountain belt

Gondwana (Africa)

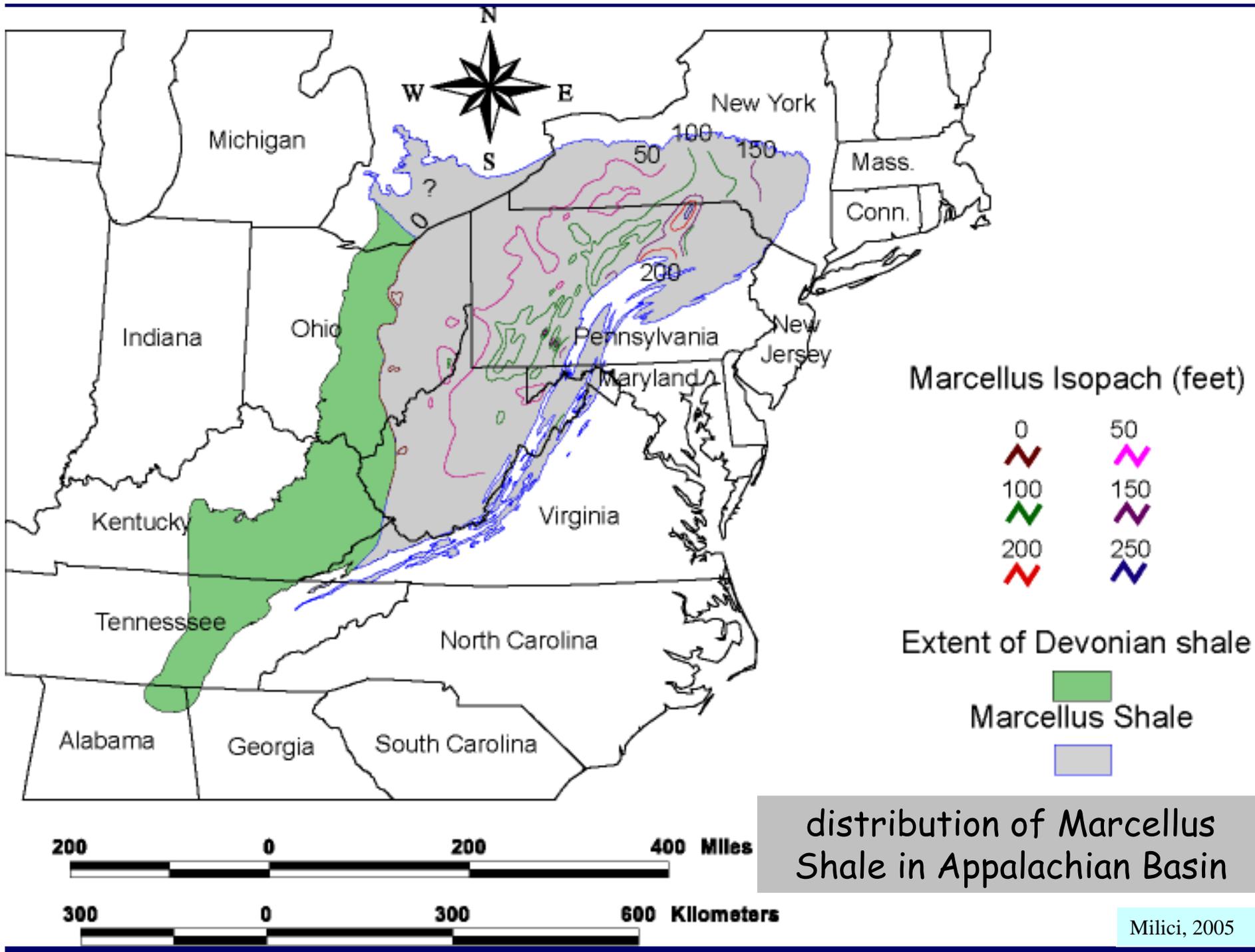


300 million years

## 2. Where is the Marcellus Shale?

...in the subsurface...







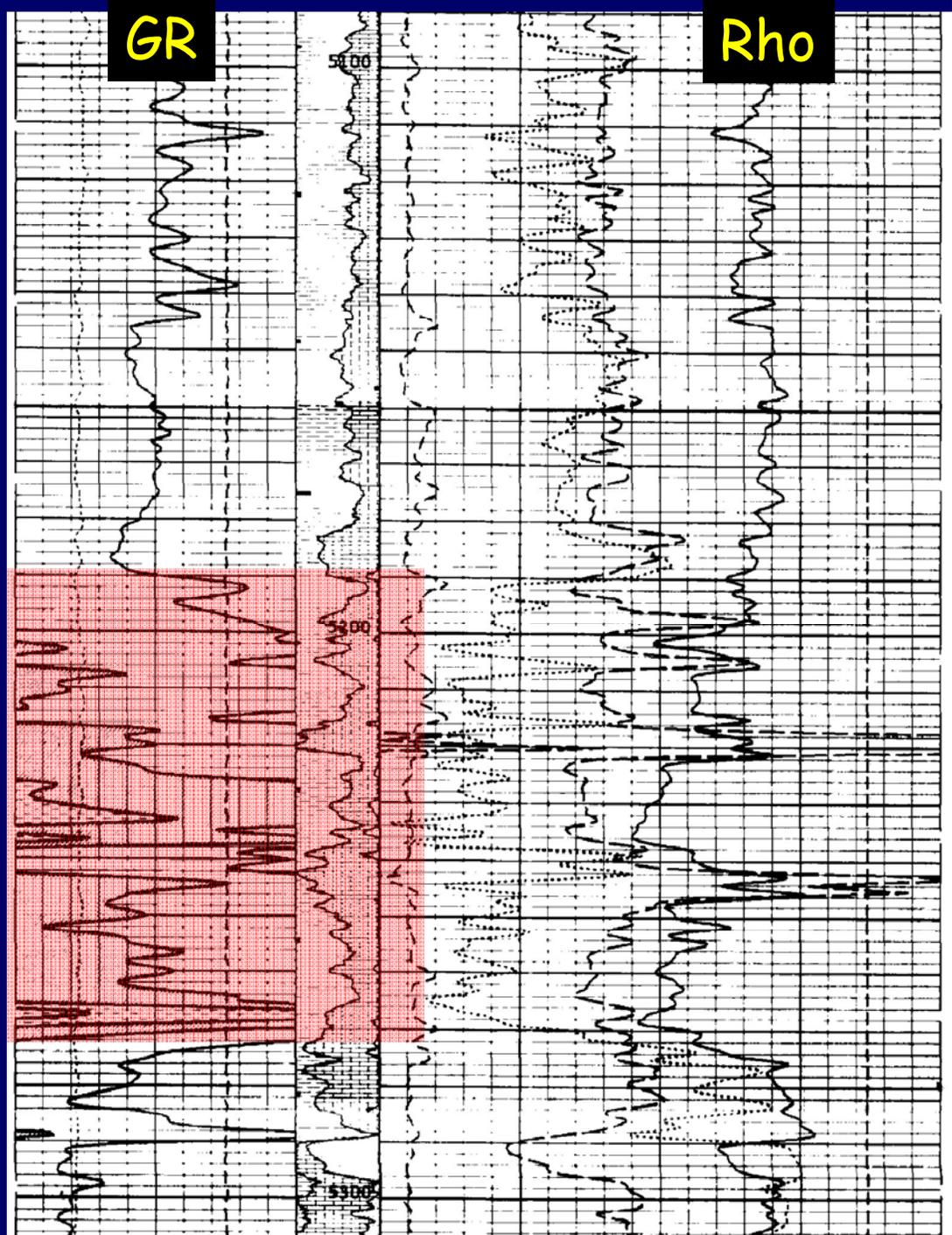


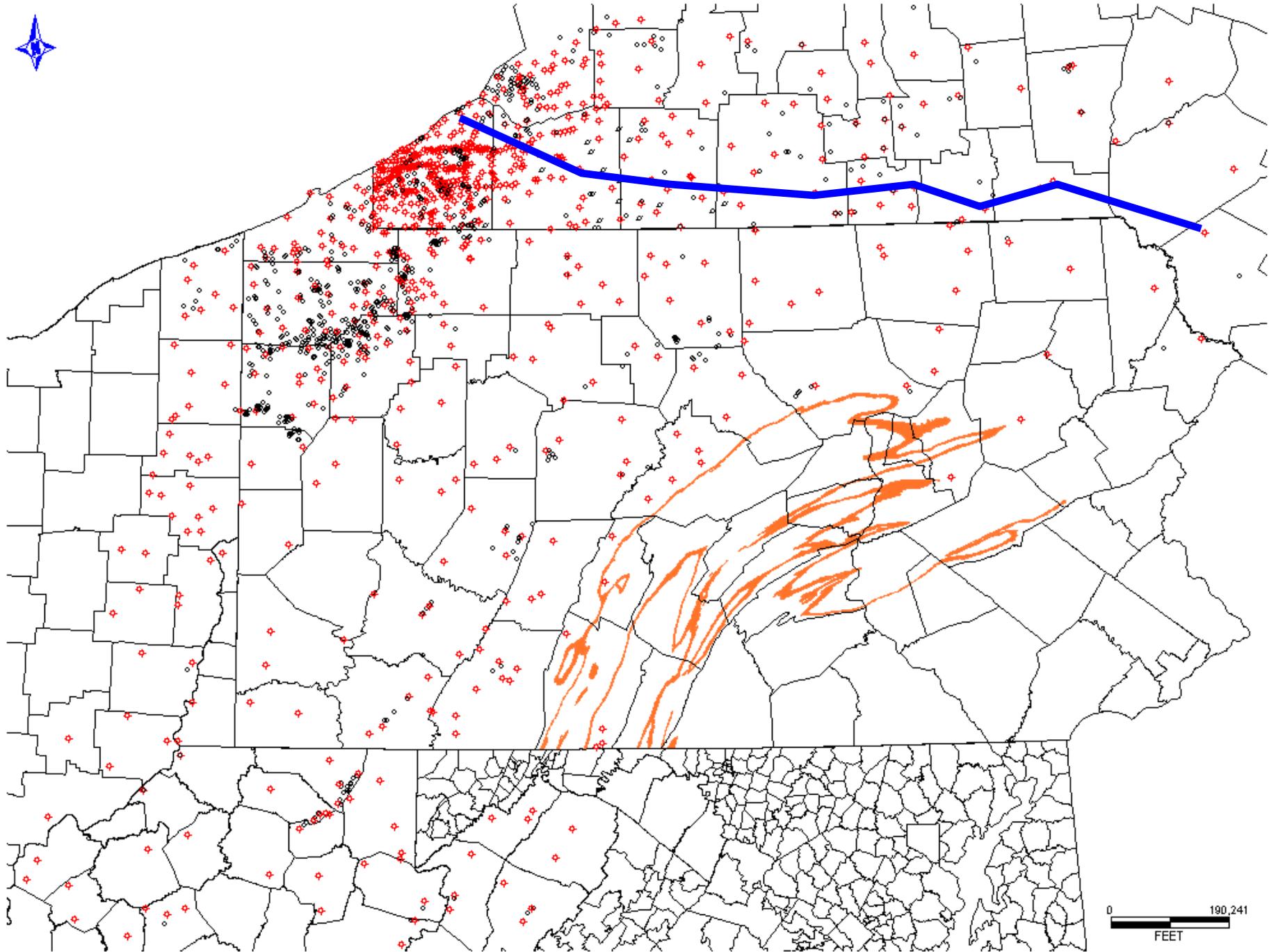
...finding the Marcellus Shale in the subsurface...

...geophysical well logs...

GR = gamma-ray logs; a measure of the natural radioactivity of the rock

Rho = density logs; can be used as a measure of the amount of organic matter in a rock





0 190,241  
FEET

232 miles

Chautauqua  
Cty.

Cattaraugus  
Cty.

Allegany  
Cty.

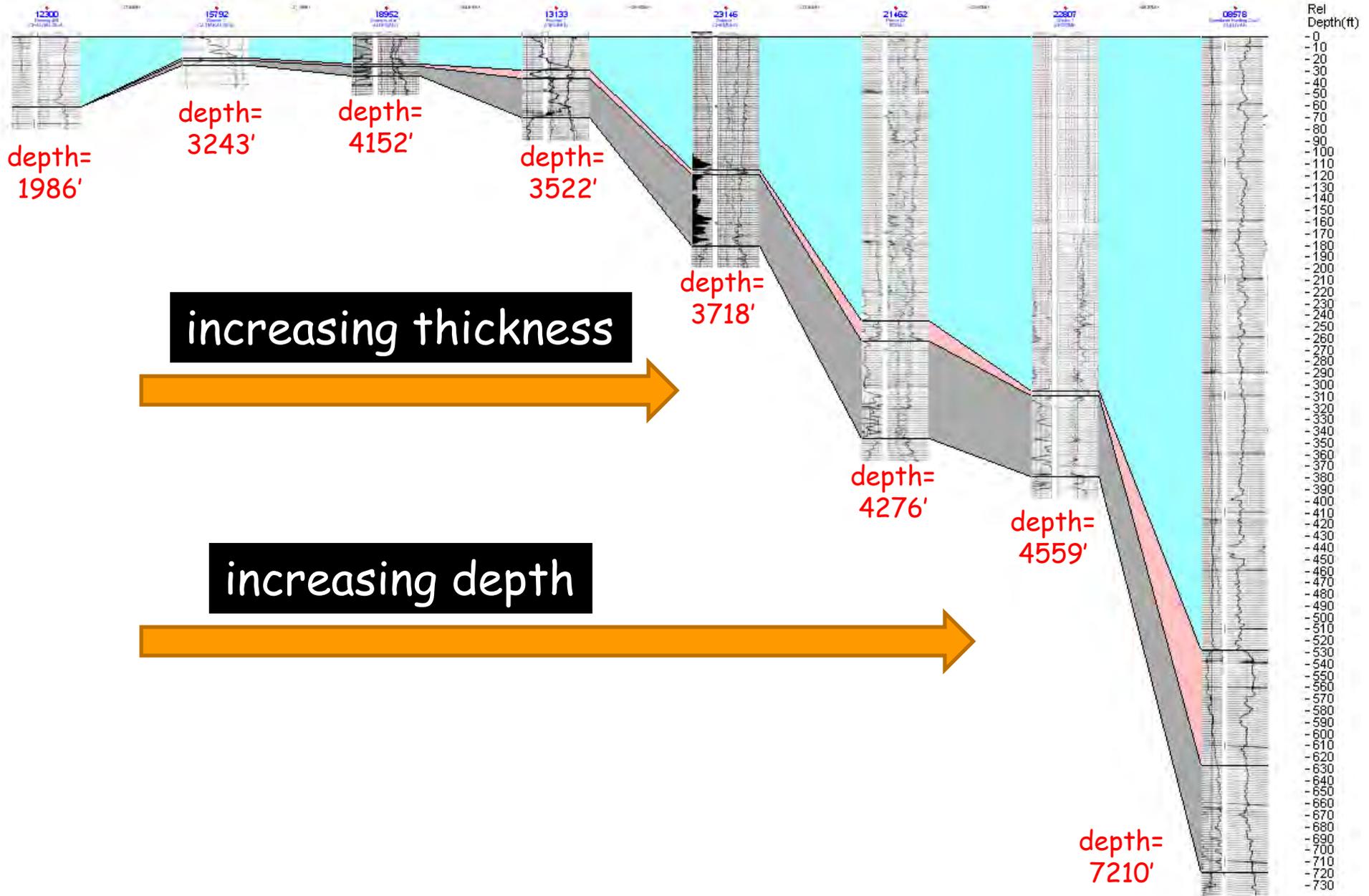
Steuben  
Cty.

Chemung  
Cty.

Tioga  
Cty.

Broome  
Cty.

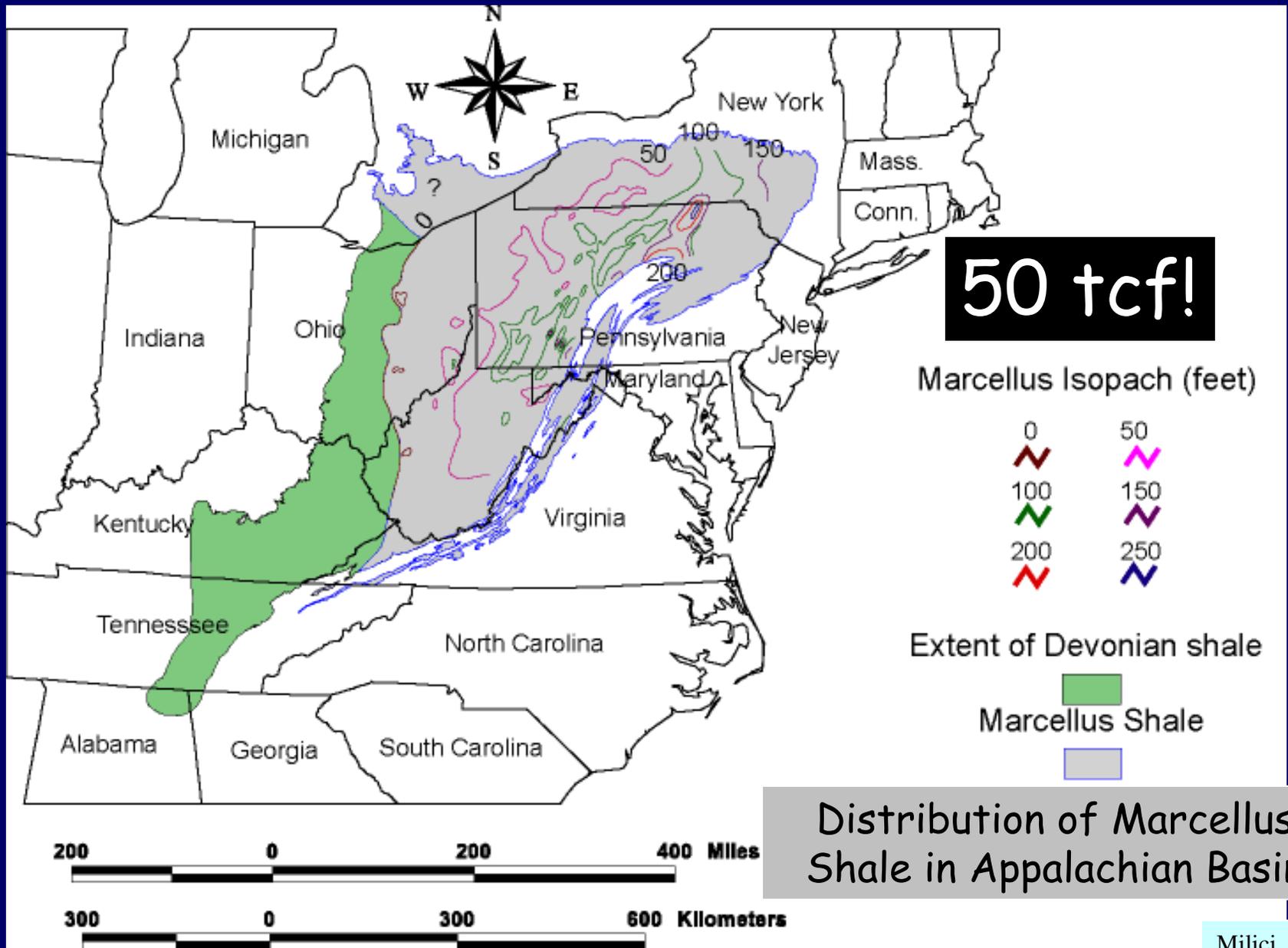
Sullivan  
Cty.



### 3. What's all the fuss about?



# potential reserves



## economics

BTU 1 barrel of oil ~ BTU 6,000 ft<sup>3</sup> of natural gas

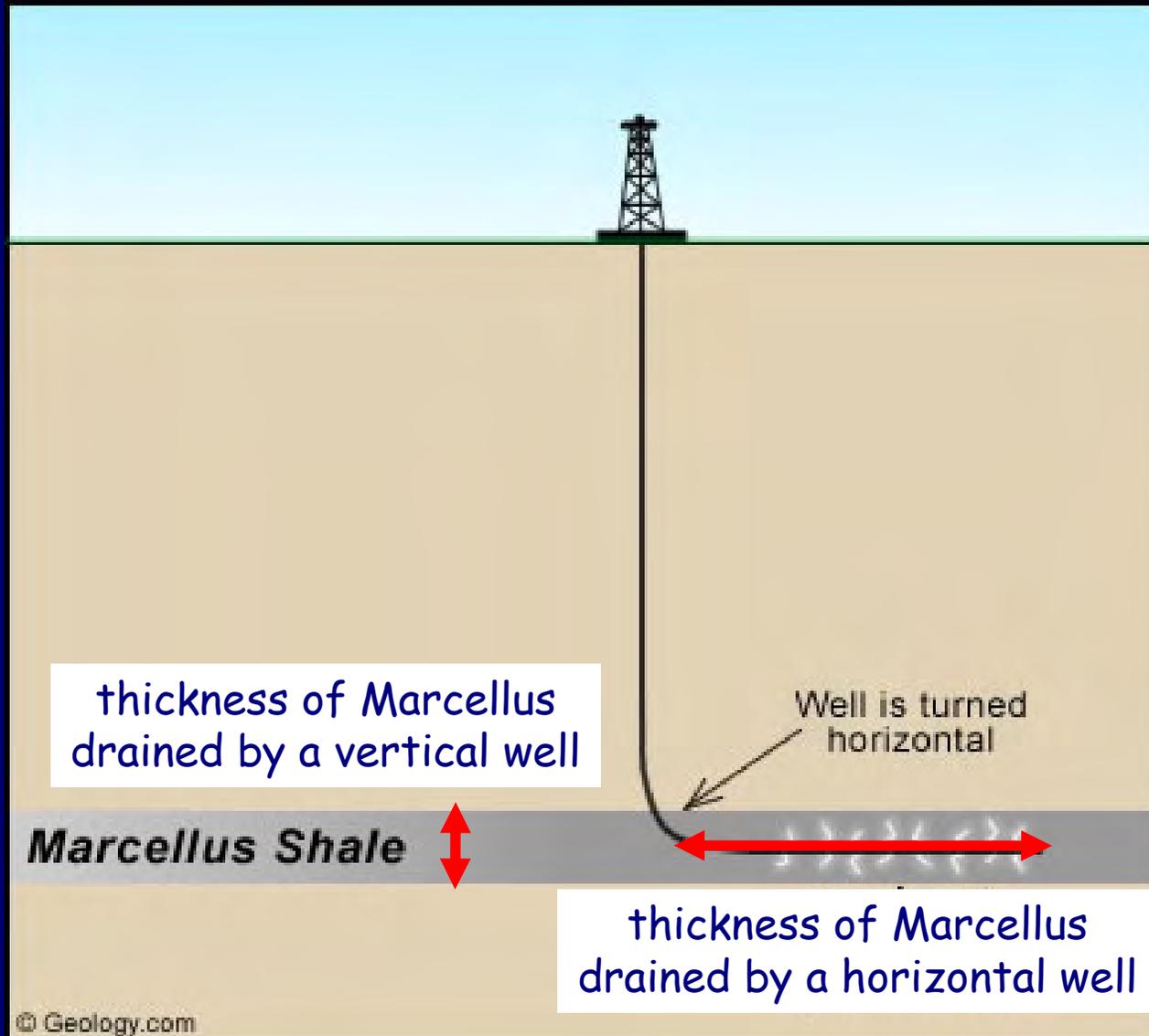
18 July 2008 1 barrel of oil = \$129

18 July 2008 1000 ft<sup>3</sup> natural gas = \$10.57

on this day, the cost of the BTU equivalent of natural gas of a barrel of oil (\$129) was \$63.42

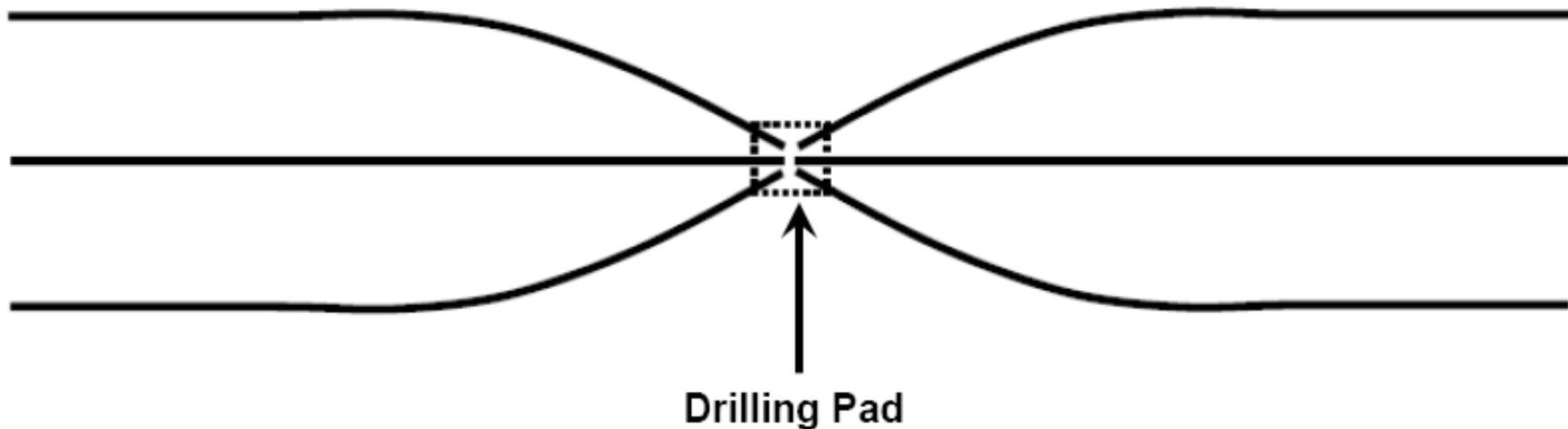
# technology

## horizontal drilling and fracking techniques



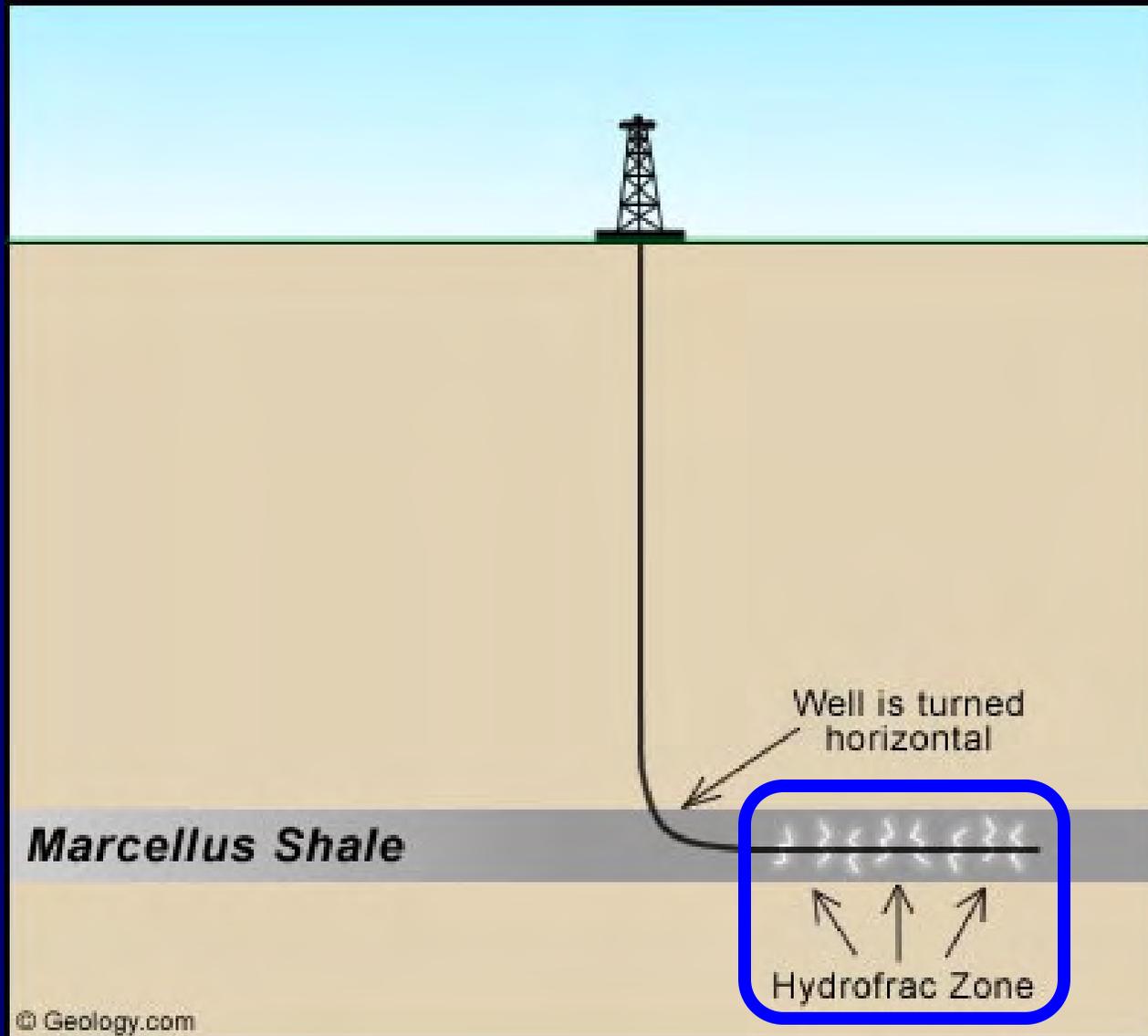
# Horizontal drilling can provide greater access with a smaller footprint

Multiple horizontal wells from a single drilling pad could drain 200 – 400 acres



# technology

## horizontal drilling and **fracking** techniques



technology

horizontal drilling and **fracking** techniques

artificial hydraulic  
fracturing

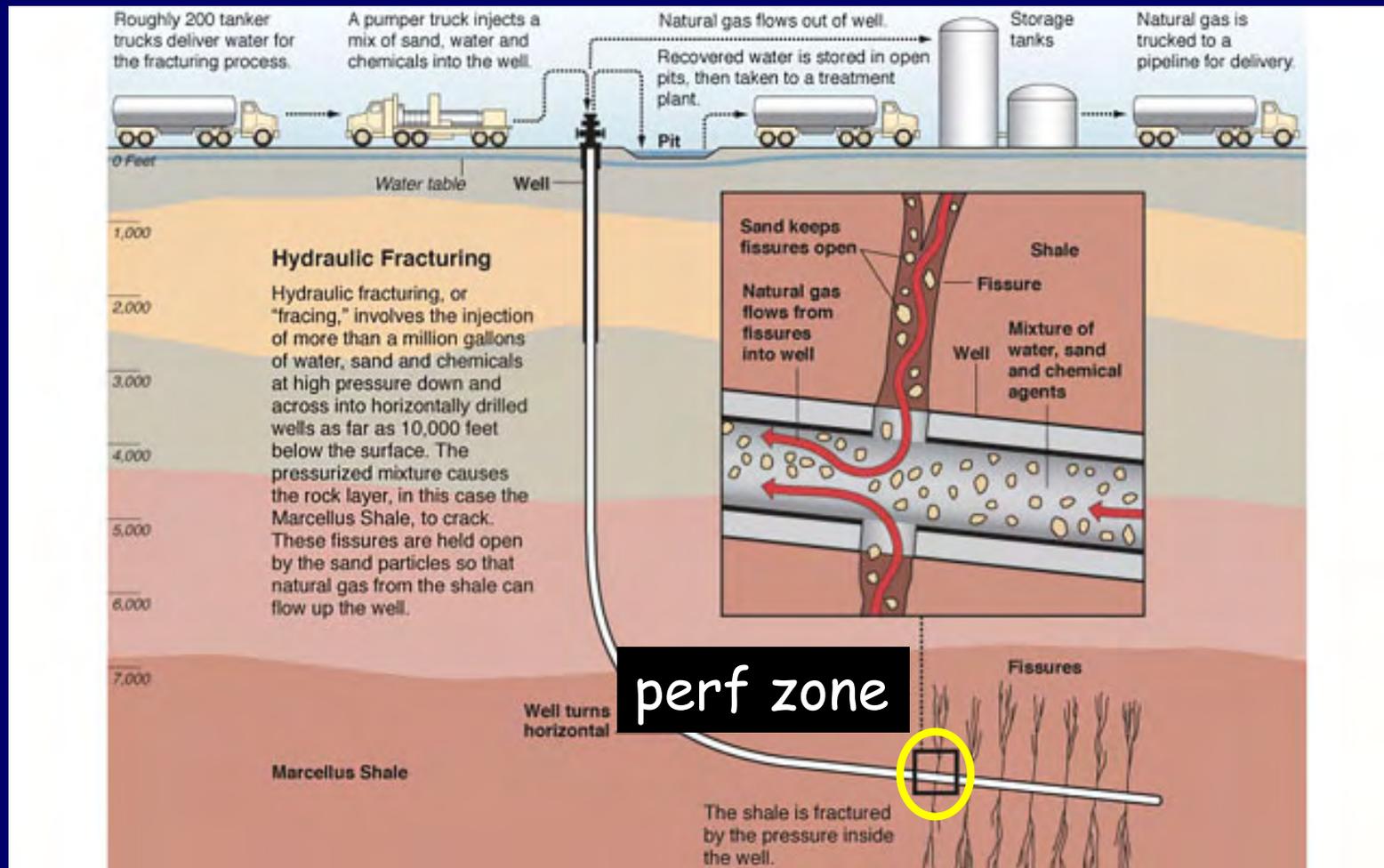


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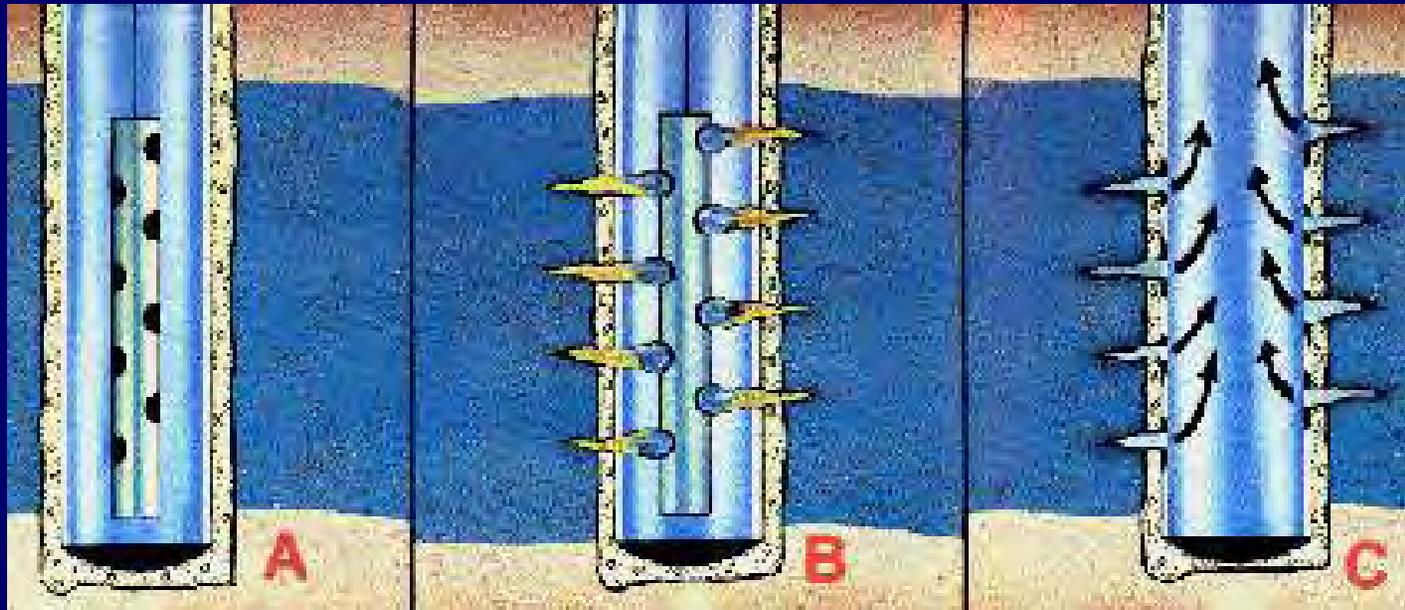
# technology

## horizontal drilling and **fracking** techniques

artificial hydraulic fracturing



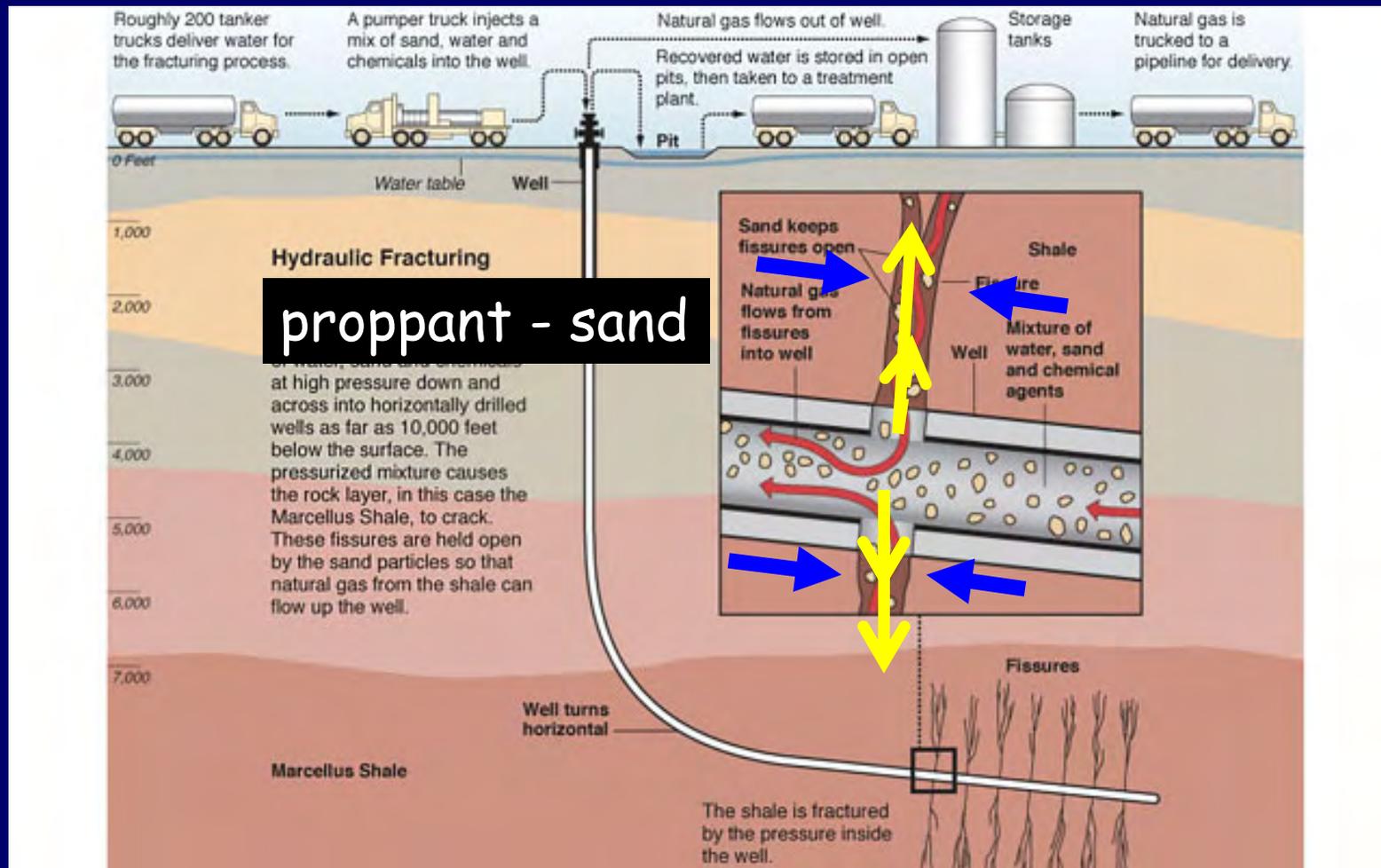
perforating (perfining) a tight (impermeable) reservoir rock



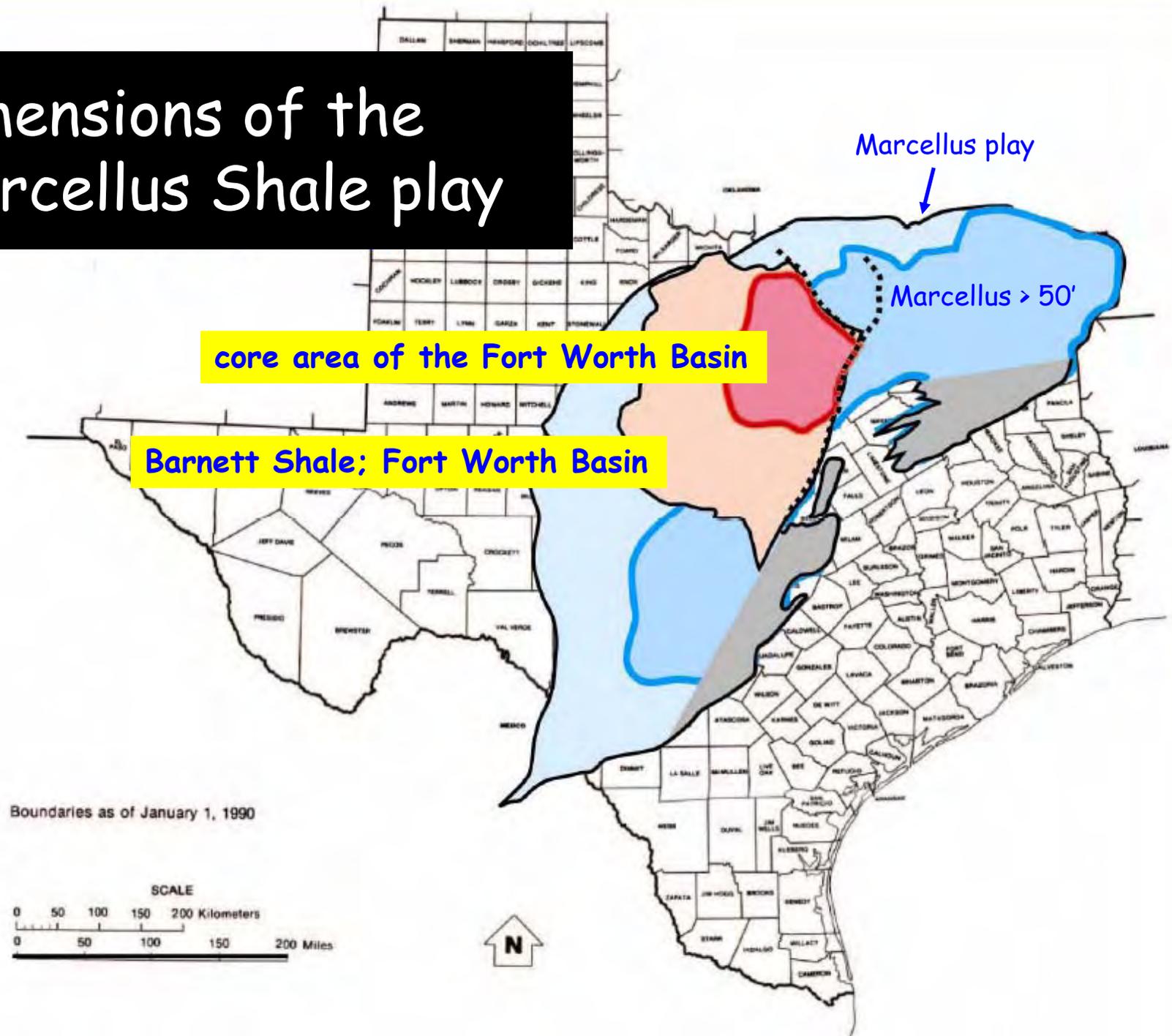
# technology

## horizontal drilling and **fracking** techniques

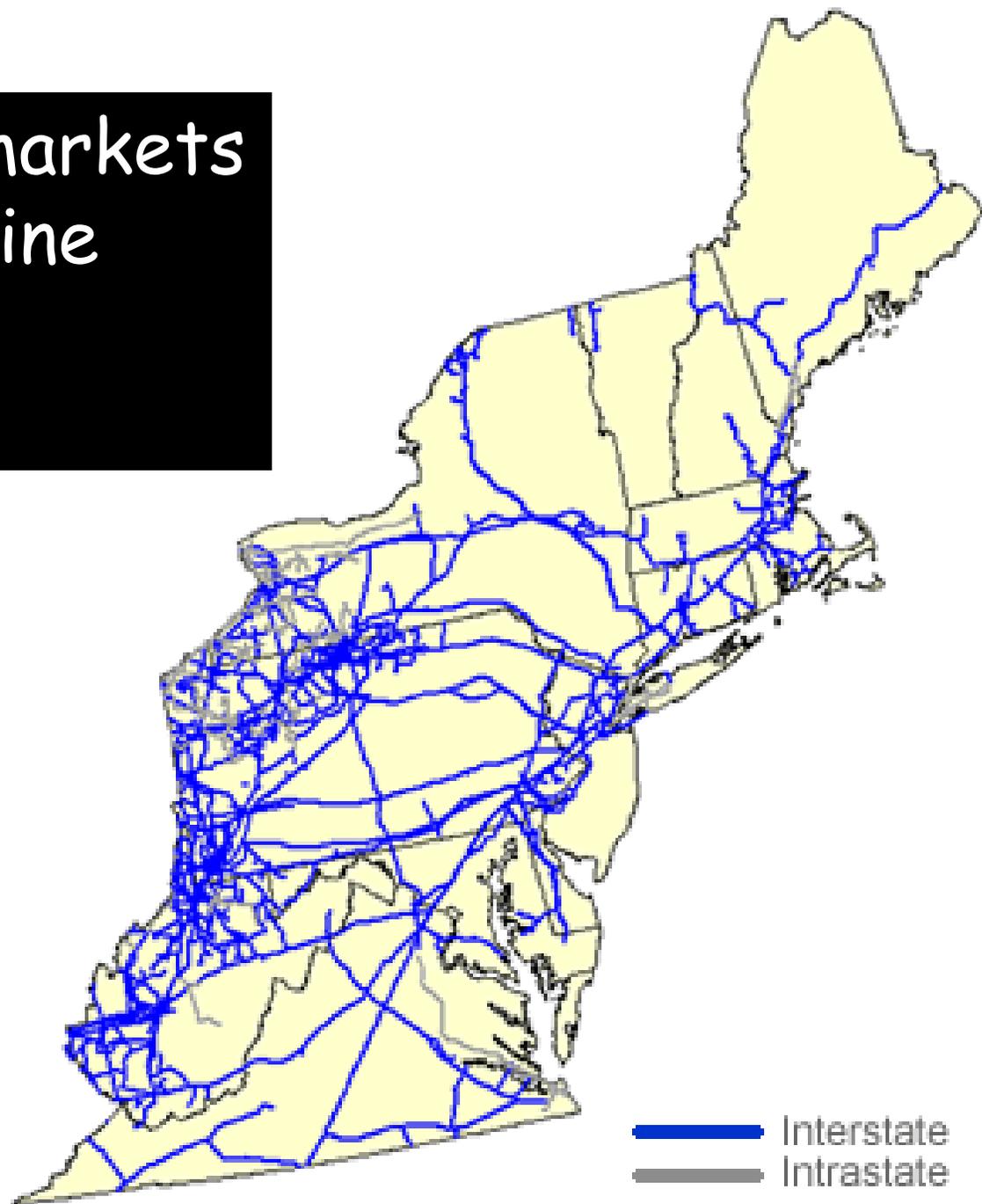
artificial hydraulic fracturing



# dimensions of the Marcellus Shale play



proximity to NE markets  
and a robust pipeline  
infrastructure  
economics



## potential benefits...

- increased employment in exploration, operations, well services, and real estate;
- leasing and royalties flowing to landowners;
- pipelines (construction and maintenance);
- investment by producers;
- cooperate taxes;



Will it work?

# first natural gas well - Fredonia, NY

