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Assessment of Undiscovered Natural Gas Resources in Devonian Black Shales,
Appalachian Basin, Eastern U.S.A.

by Robert C. Milici

What do we Assess?

Technically recoverable undiscovered hydrocarbon resources –

- oil, natural gas, natural gas liquids

The Devonian Shale - Middle and Upper Paleozoic TPS

Conventional Oil and Gas Resources

- Accumulations in structural, stratigraphic, combination traps.
- Segregation of fluids within reservoirs (Water, oil, gas cap)

The Devonian Shale - Middle and Upper Paleozoic TPS

Continuous (unconventional) resources

- Blanket-like accumulations, commonly with multi-storied reservoirs.
- Coalbed methane, Radioactive black shales, tight sandstones -

How do we do it?

Conventional: Estimate numbers and sizes of undiscovered fields – maximum, median, minimum, most likely.

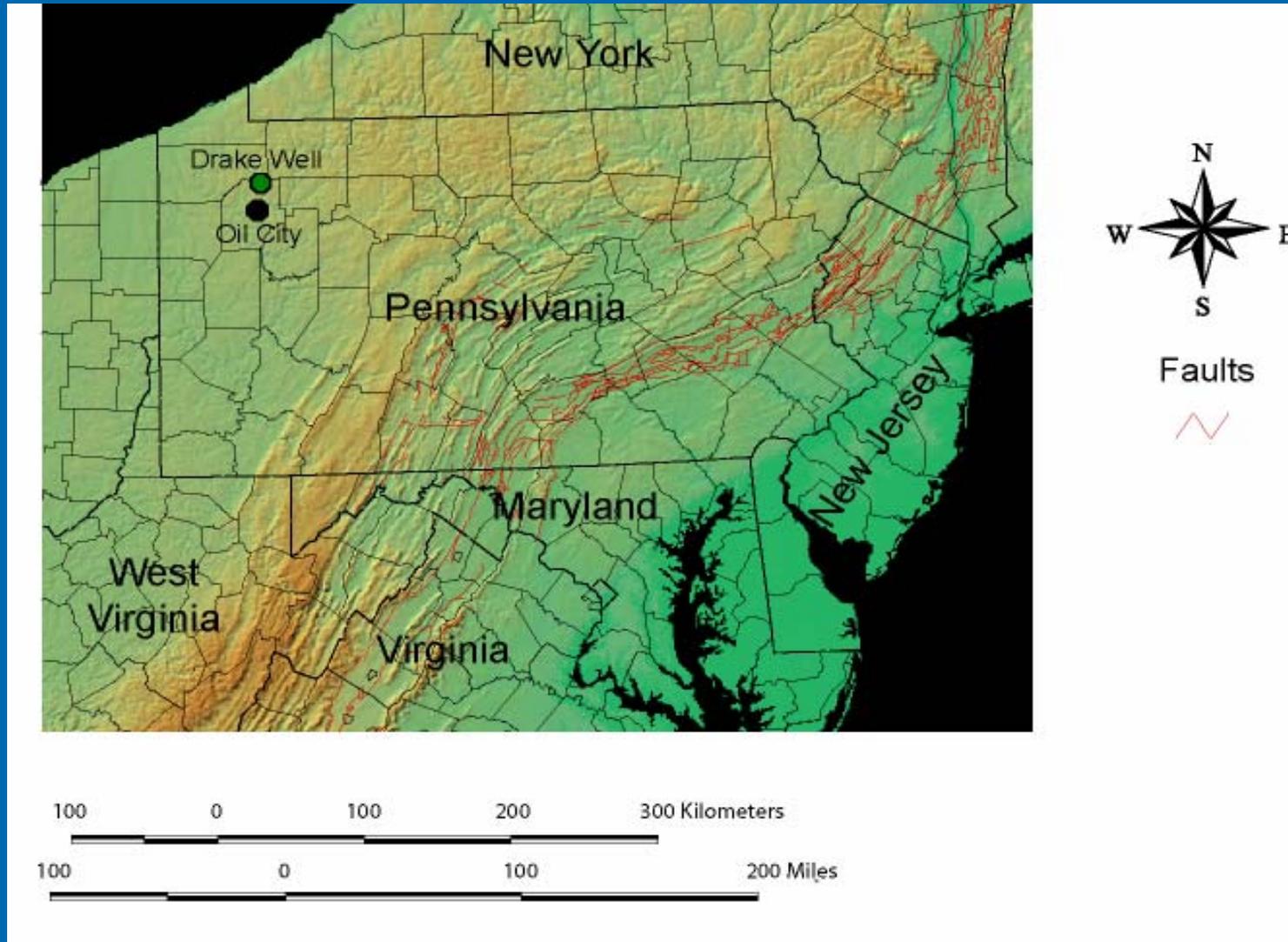
Continuous (unconventional): Estimate numbers of untested cells (40 acres, 80 acres, etc.) and the range of the cumulative production from each cell (max, min, median, mean).

The Devonian Shale-Middle and Upper Paleozoic TPS (Cont.)

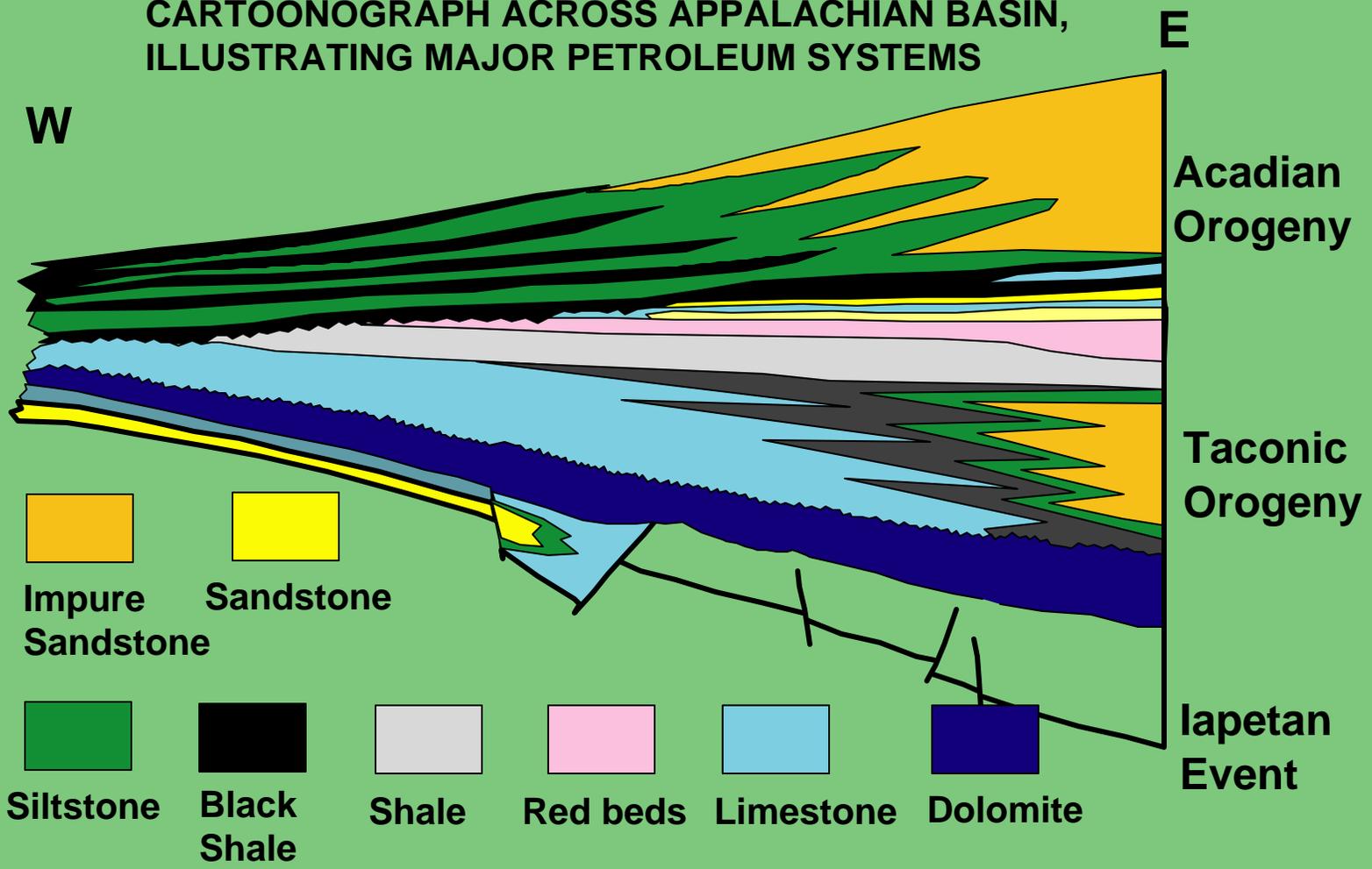
Continuous Oil and Gas Resources

- **Northwestern Ohio Shale (NWOS) AU**
- **Greater Big Sandy (GBS) AU**
- **Devonian Siltstone And Shale (DSS) AU**
- **Marcellus Shale AU**
- Catskill Sandstones and Siltstones AU
- Berea Sandstone AU

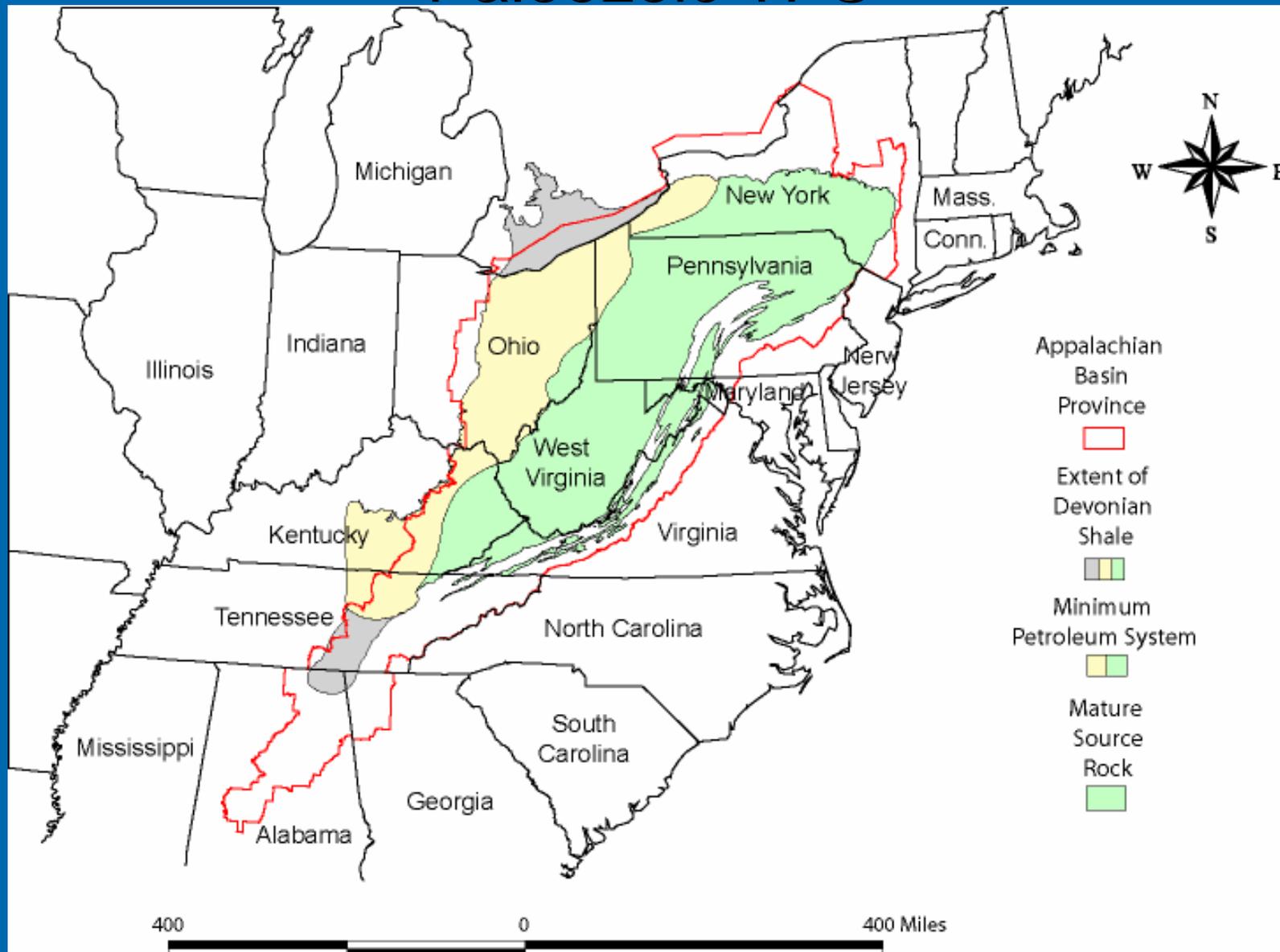
The Drake Well: Where it all began



CARTOONOGRAPH ACROSS APPALACHIAN BASIN, ILLUSTRATING MAJOR PETROLEUM SYSTEMS

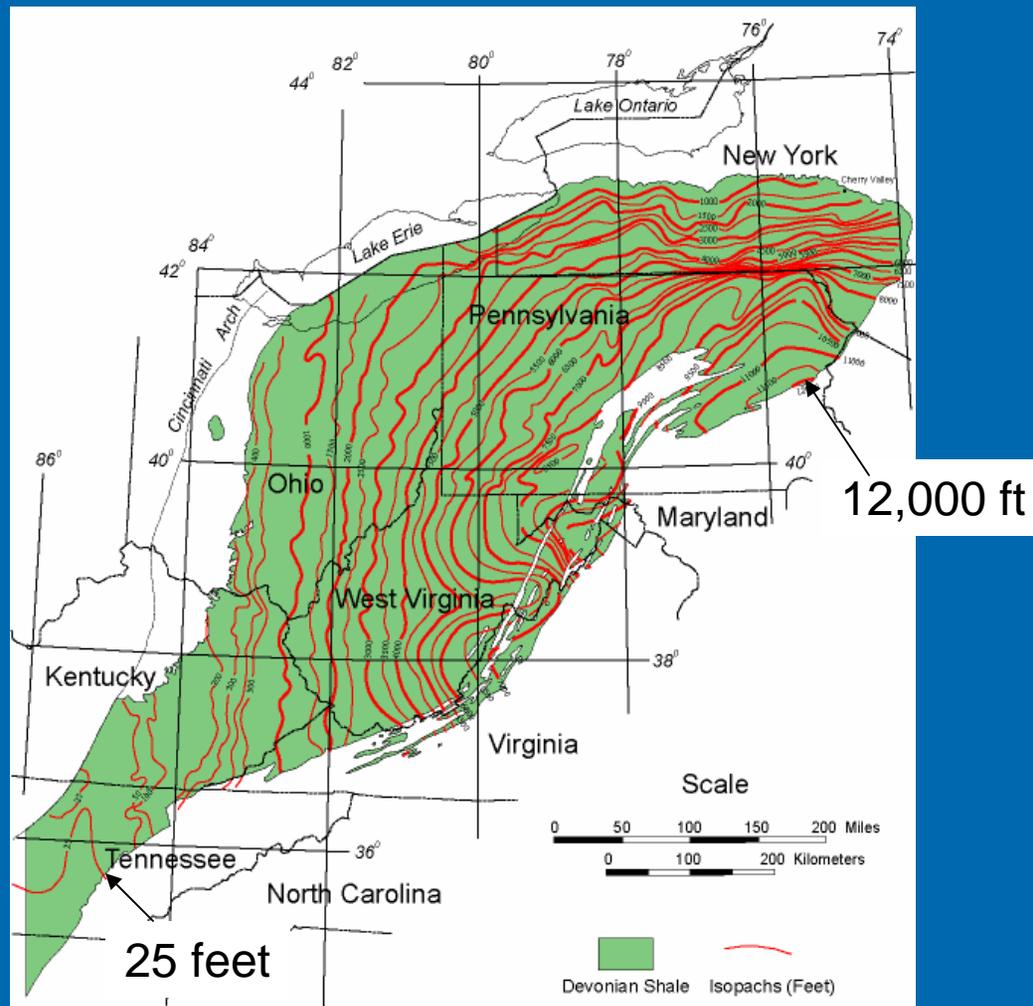


The Devonian Shale-Middle and Upper Paleozoic TPS



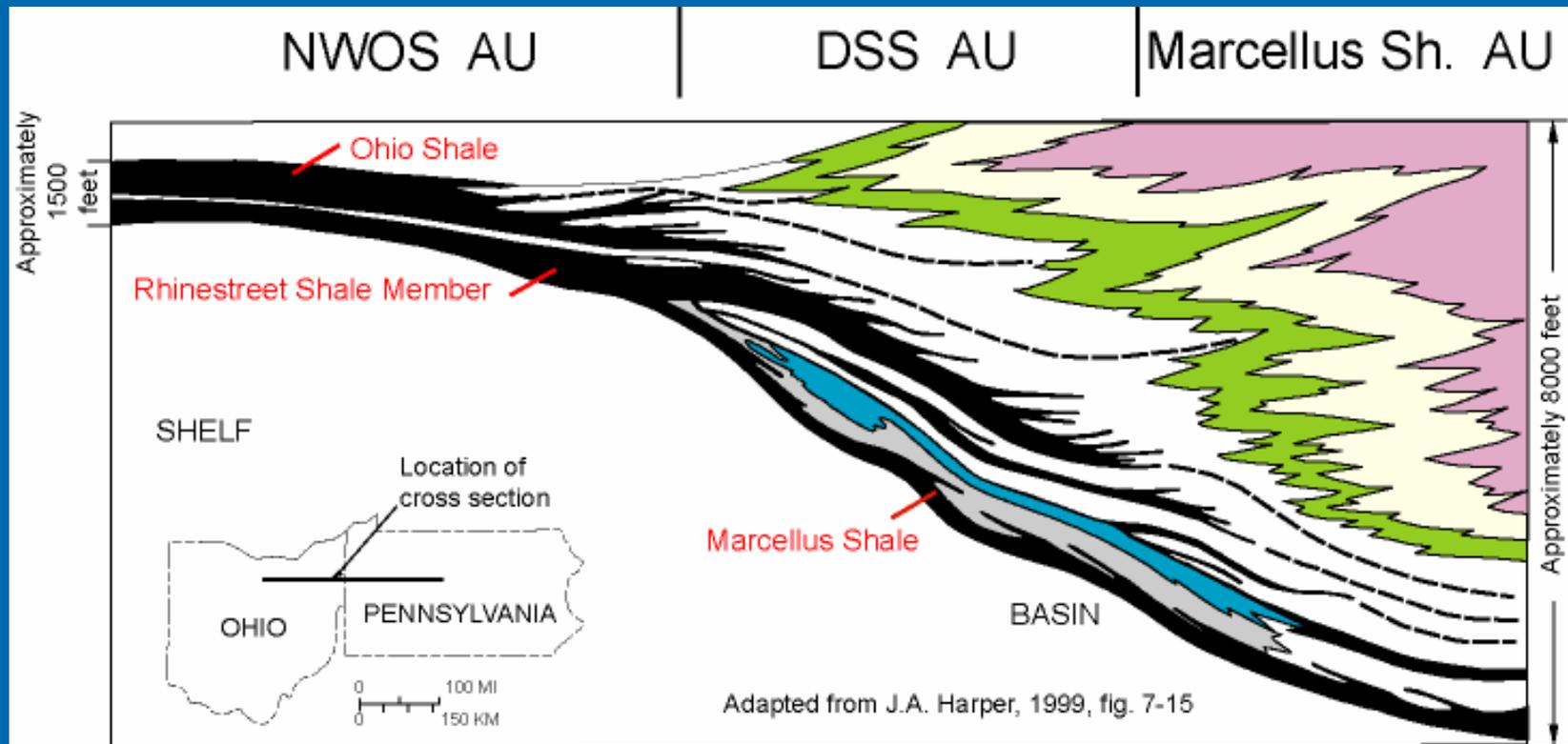
Extent and thickness of Devonian rocks in the Appalachian basin

(adapted from deWitt and others, 1975)



Catskill Magnafacies

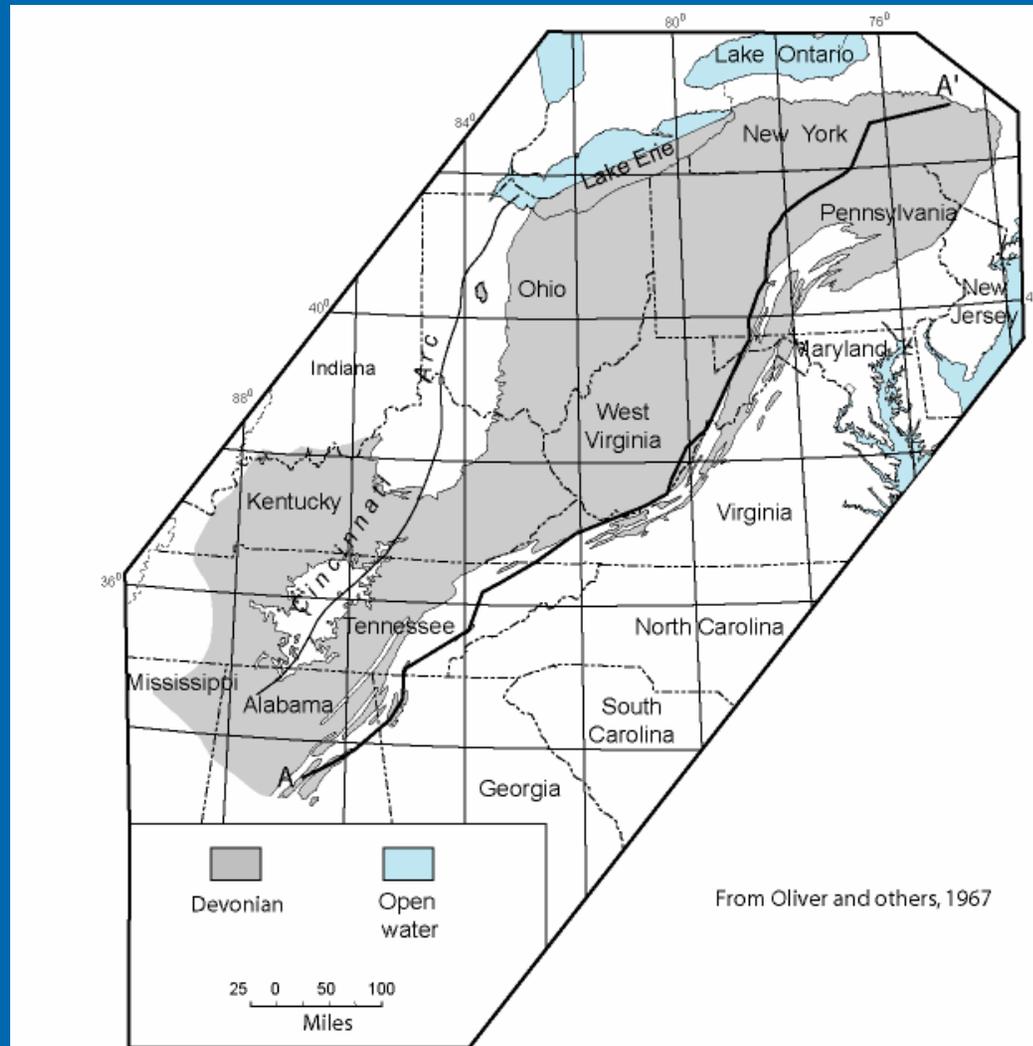
(adapted from Harper, 1999)



Undifferentiated upper Middle Devonian rocks

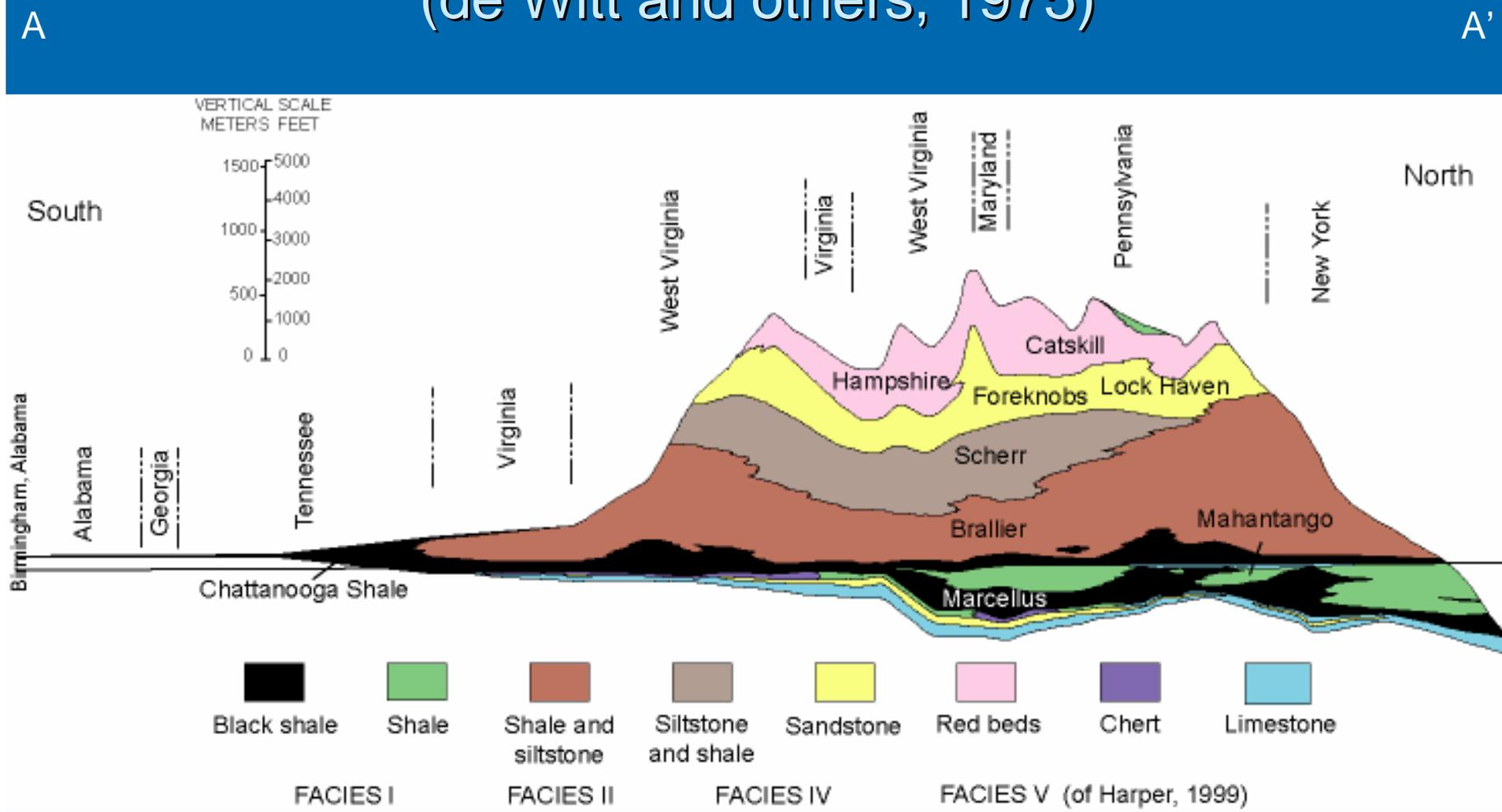
Tully Limestone

Extent of Devonian Shale in Eastern U.S. – Section A-A' (Oliver and others, 1967)

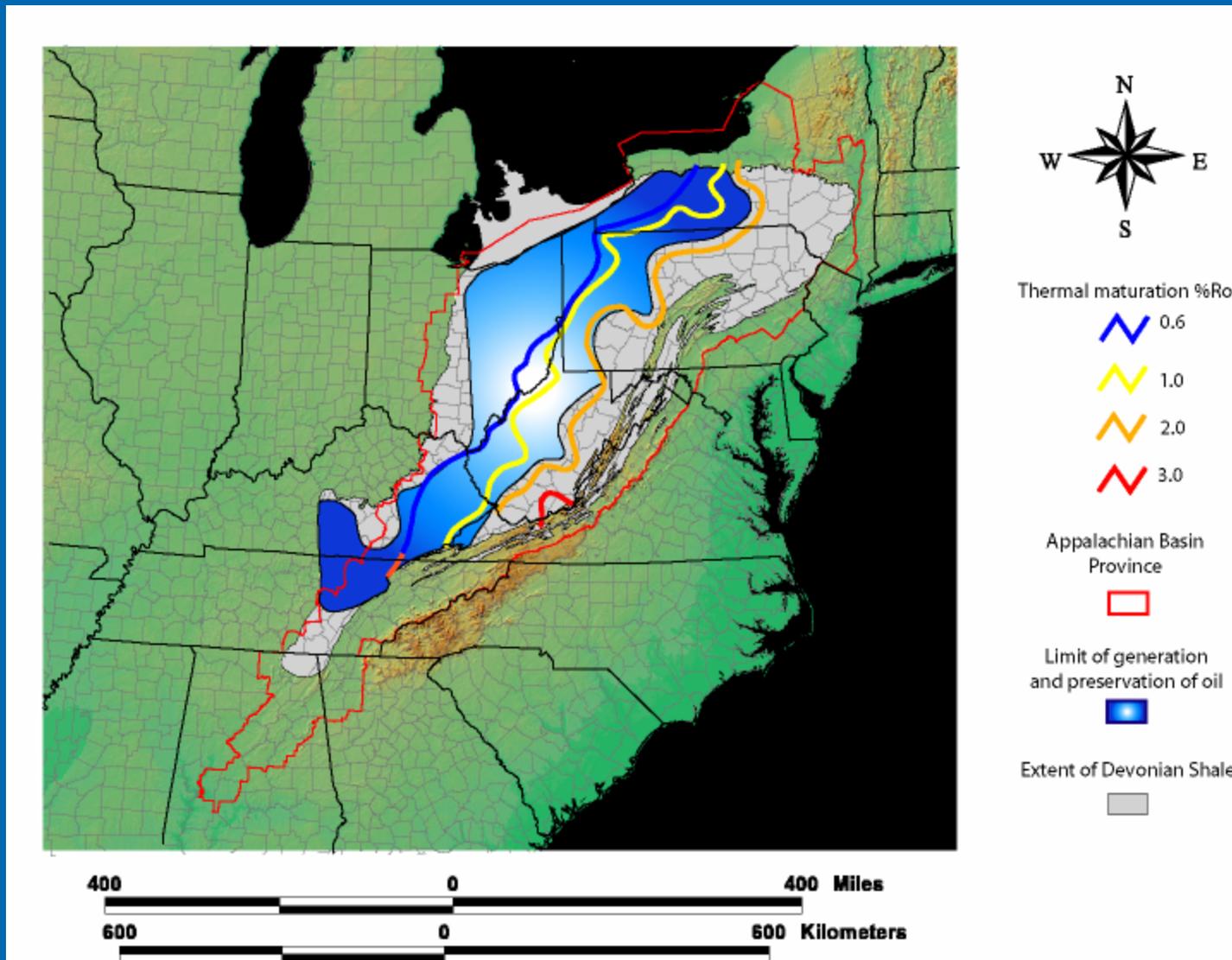


Cross Section A - A'

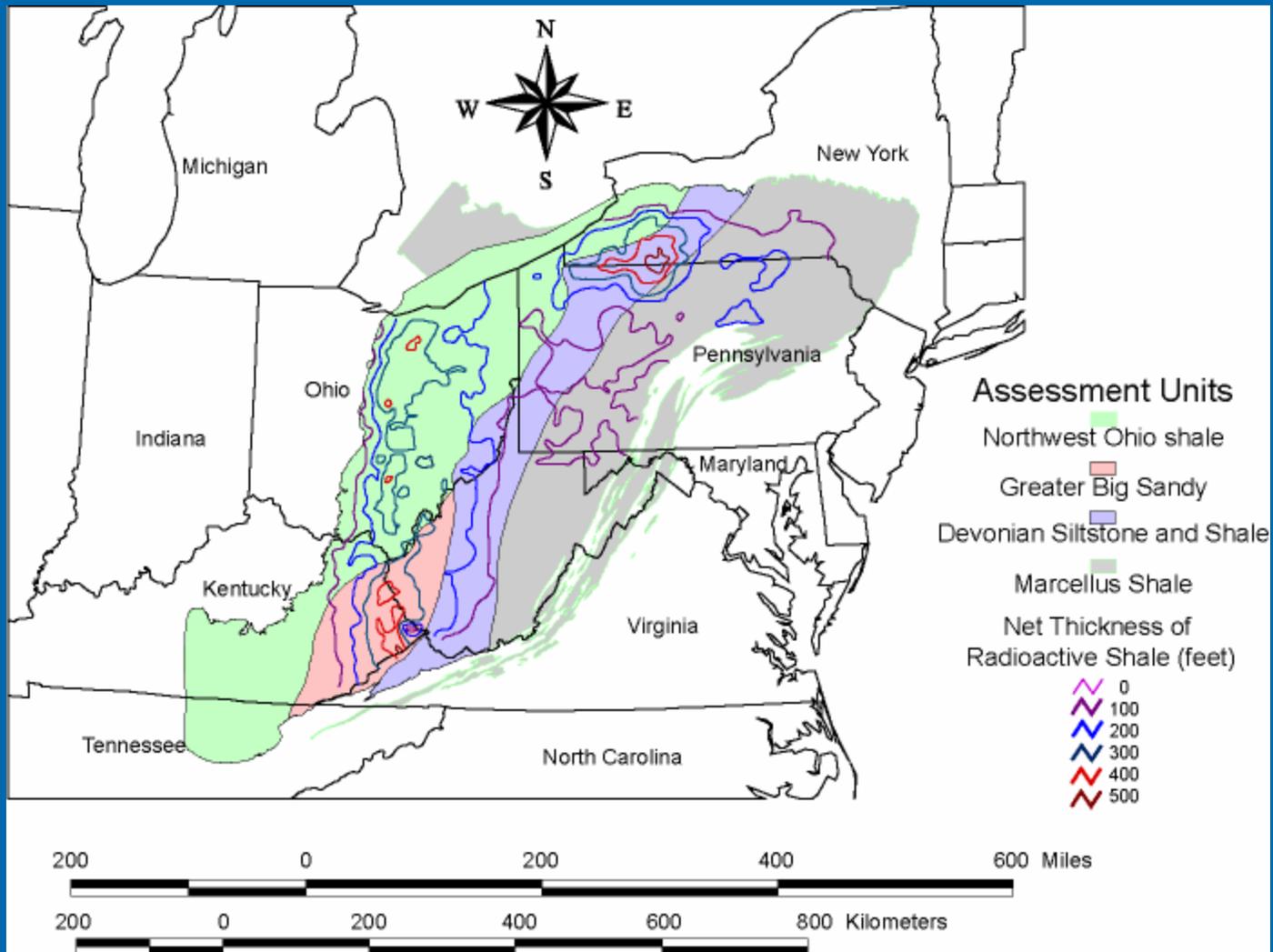
(de Witt and others, 1975)



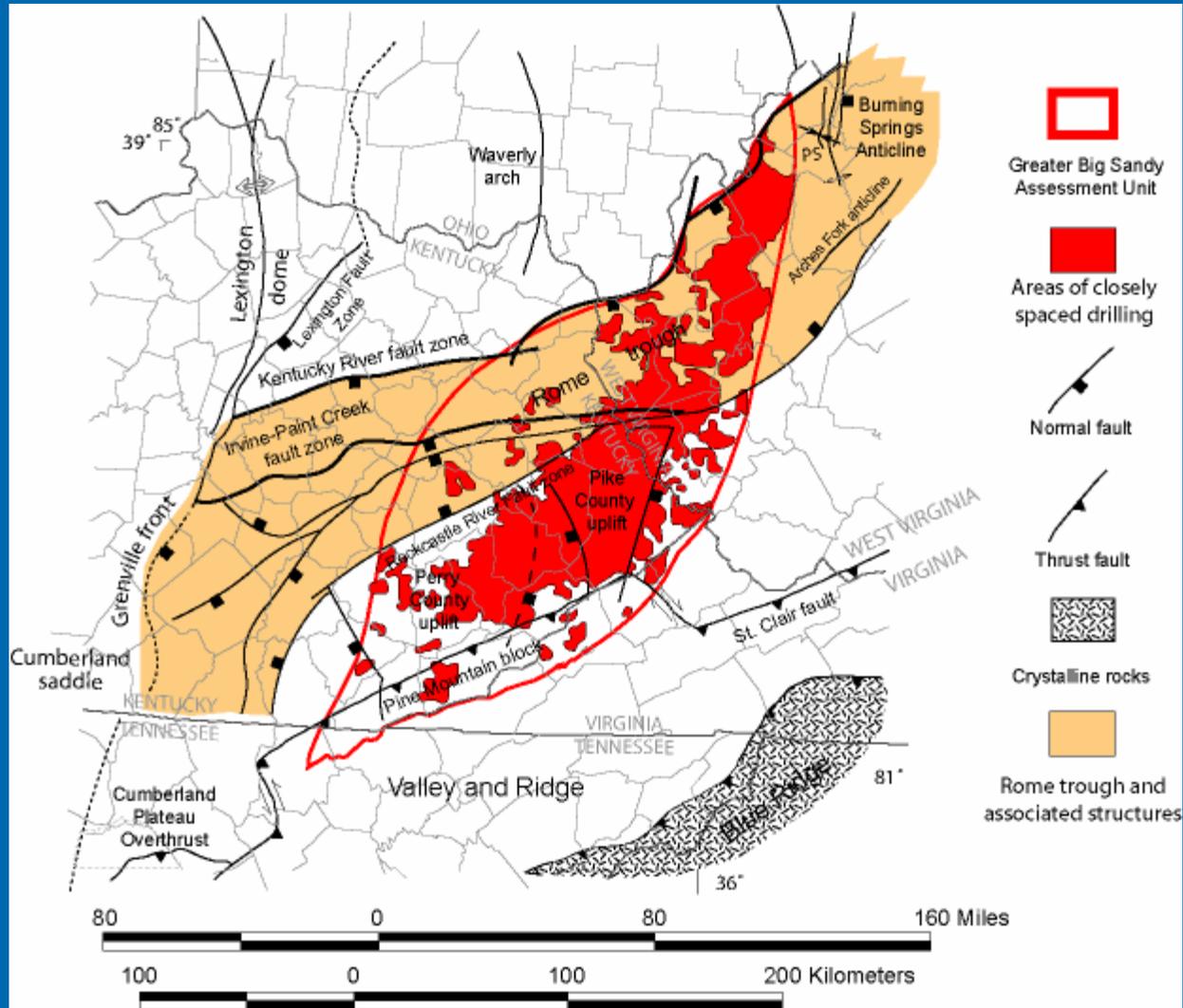
Oil in Devonian Shale and Oriskany Sandstone



Devonian shale assessment units, showing net thickness of radioactive shale

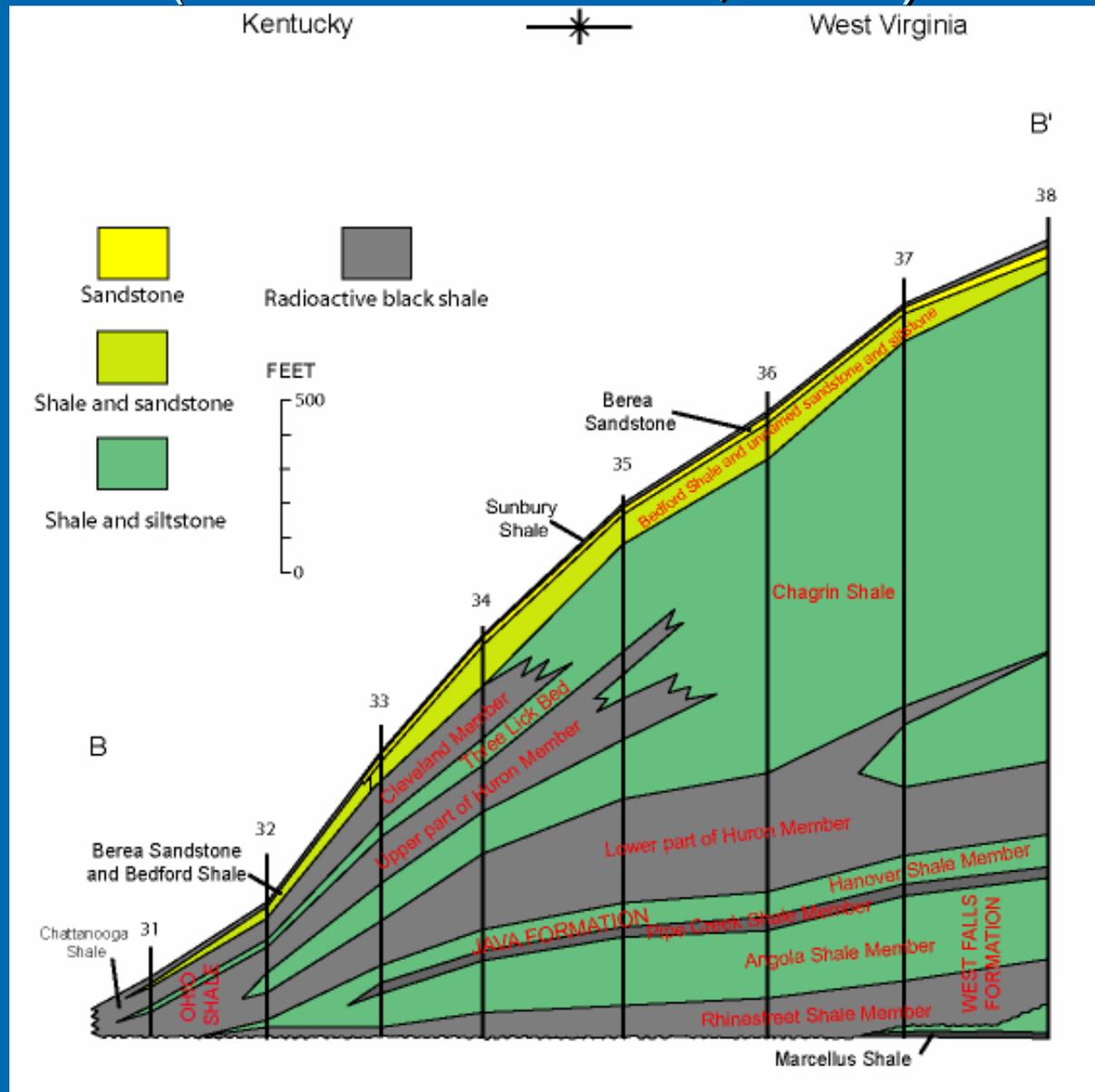


Greater Big Sandy AU



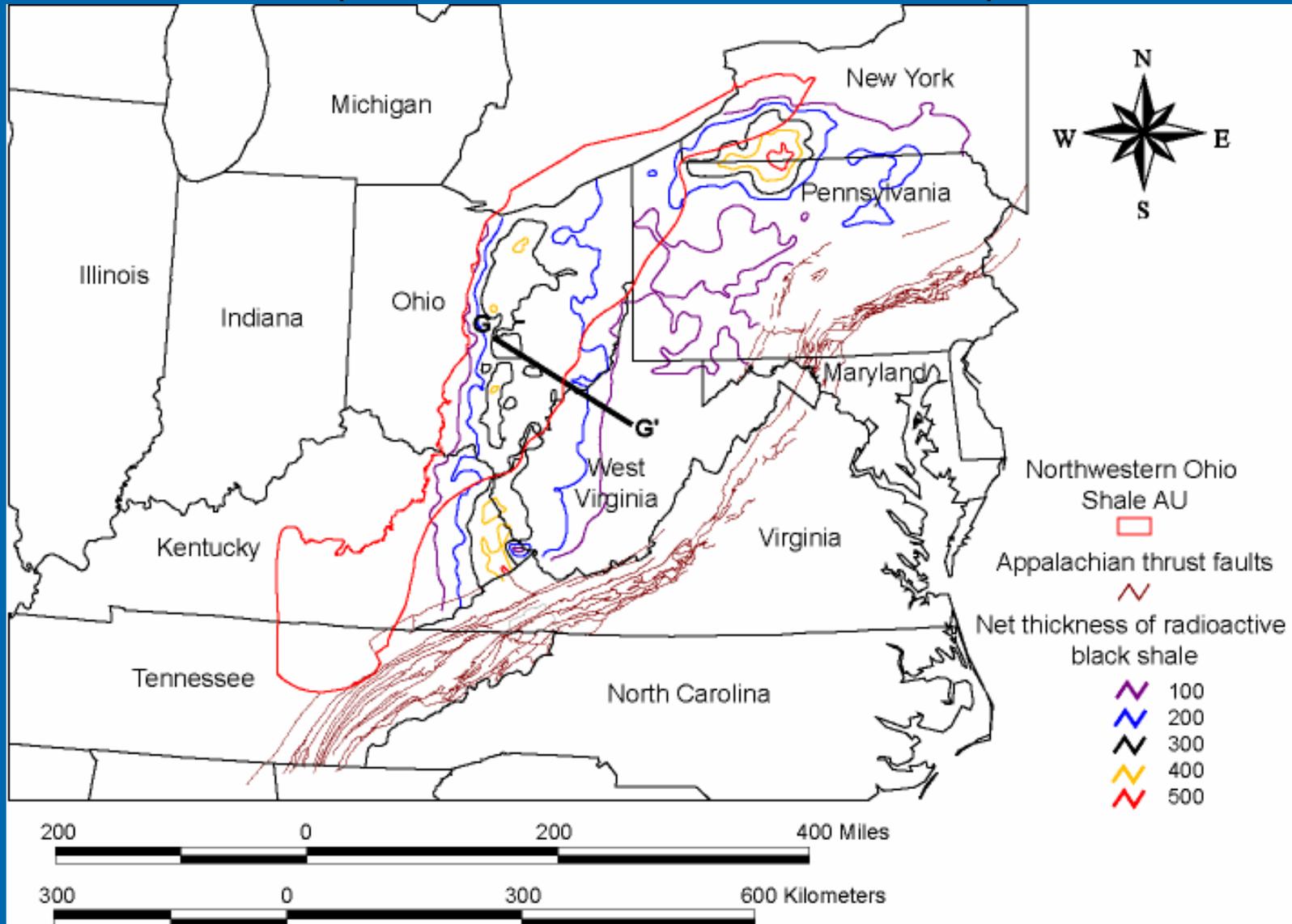
Cross-Section B - B'

(deWitt and others, 1993)



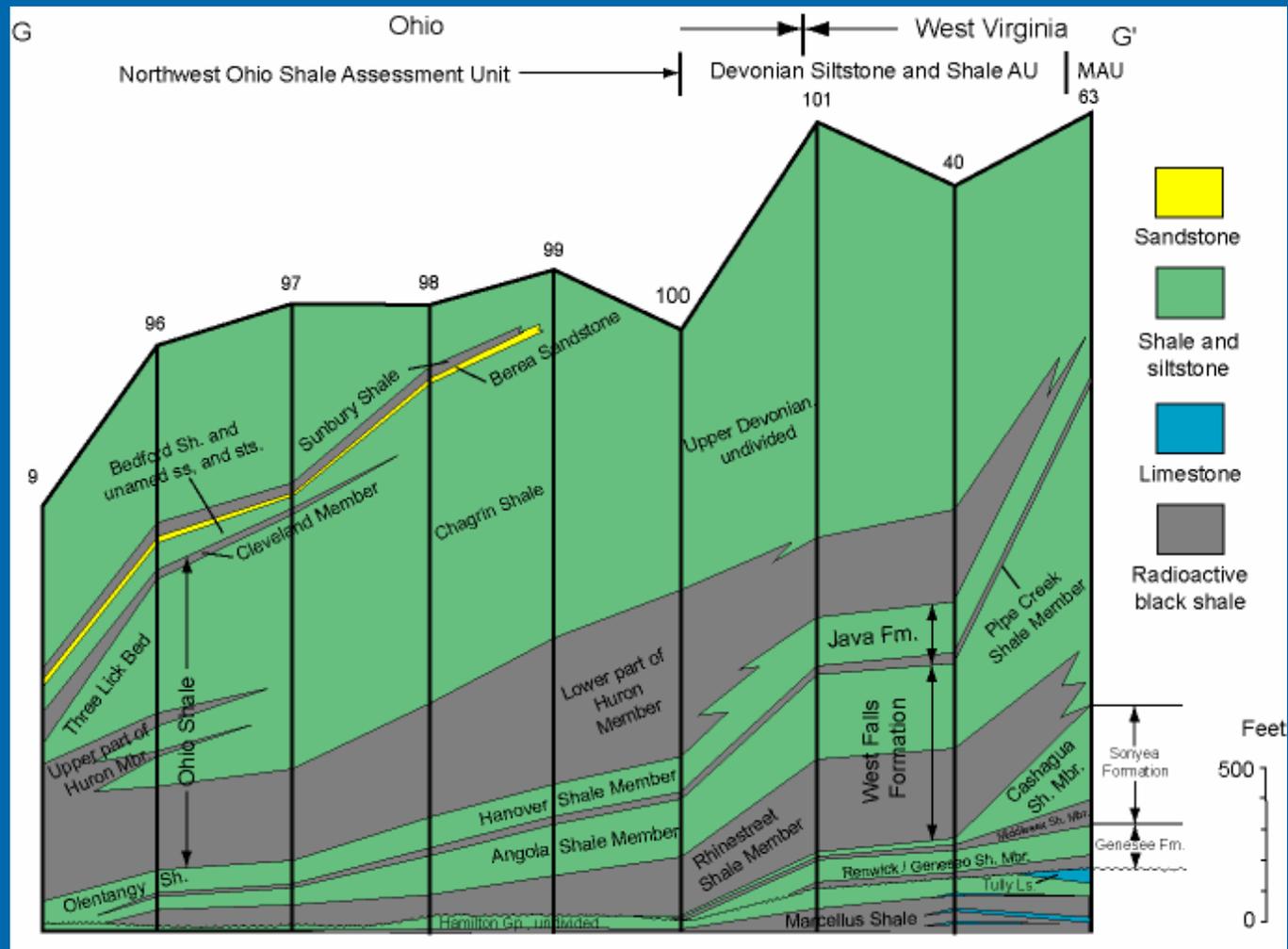
Devonian Shale Thickness

(deWitt and others, 1993)

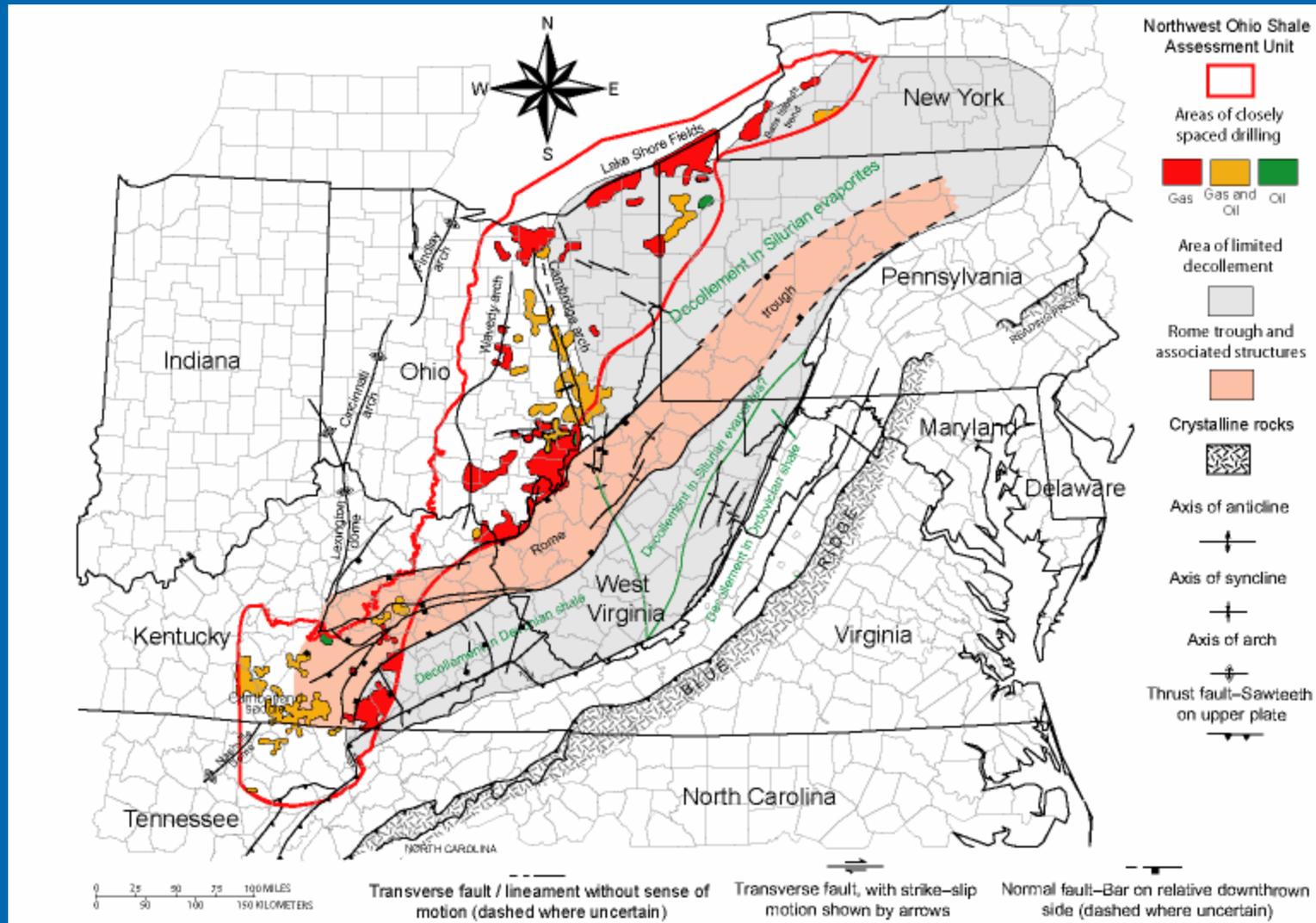


Cross Section G - G'

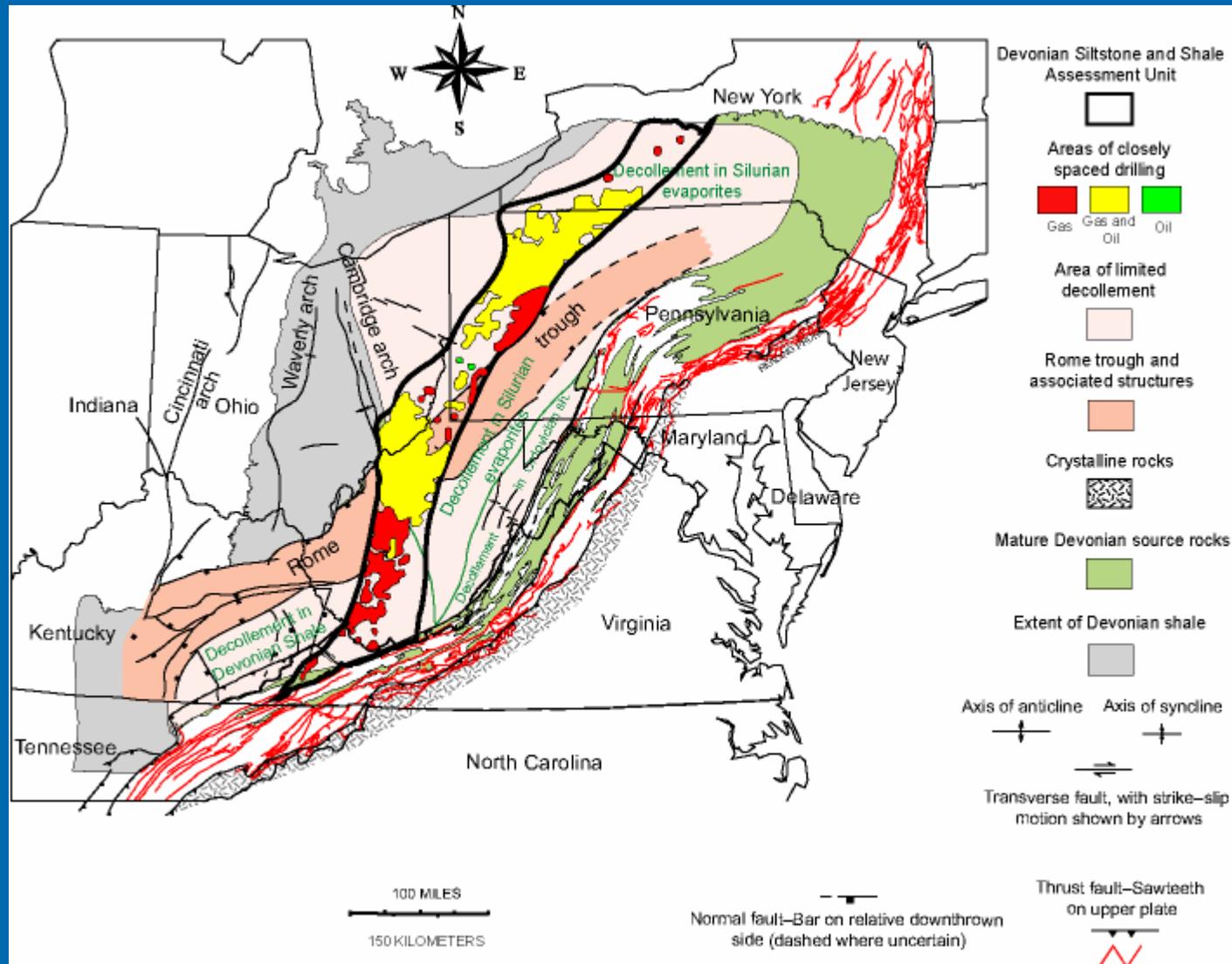
(deWitt and others, 1993)



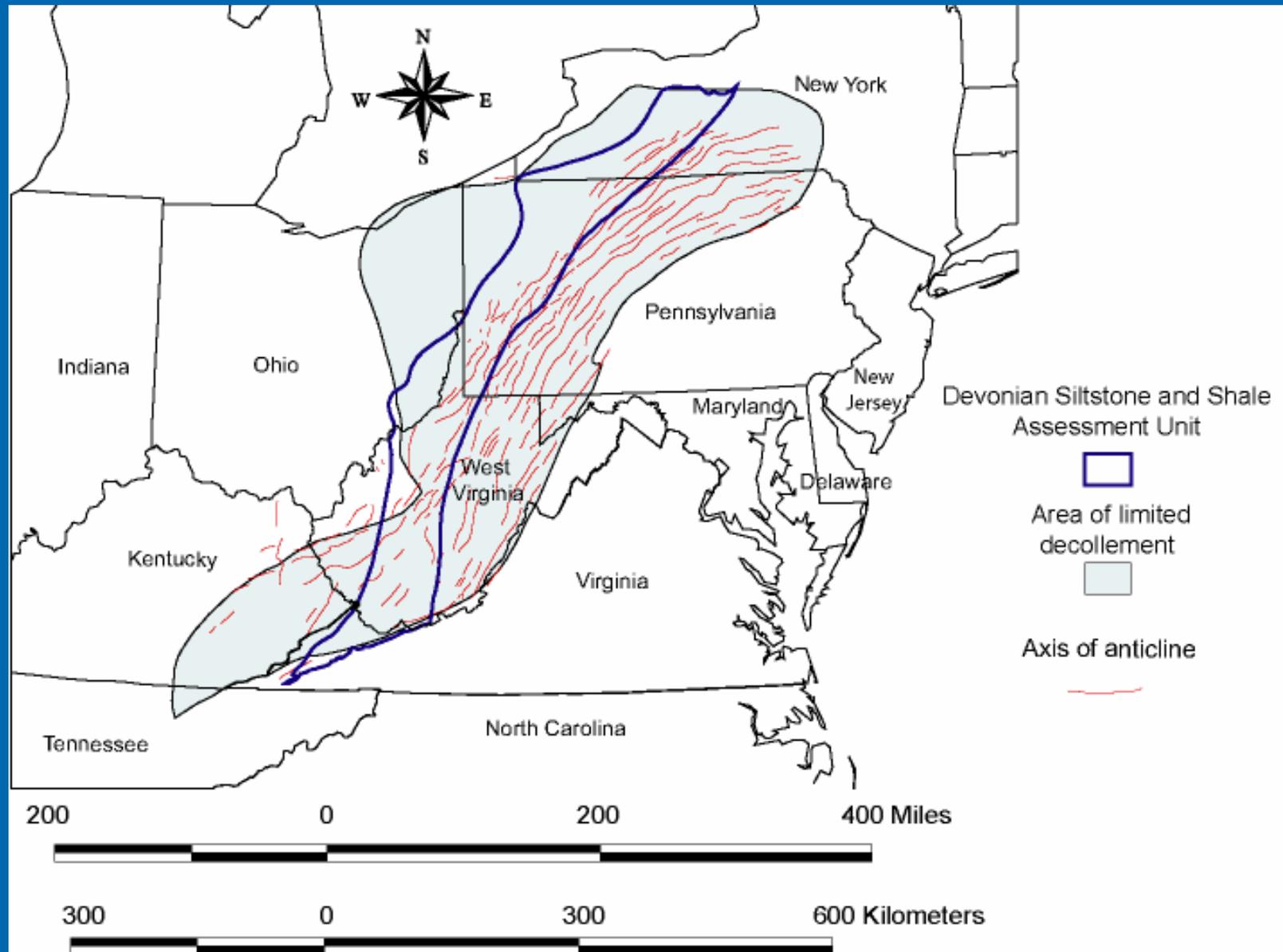
Relation of NWOS to Regional Structure



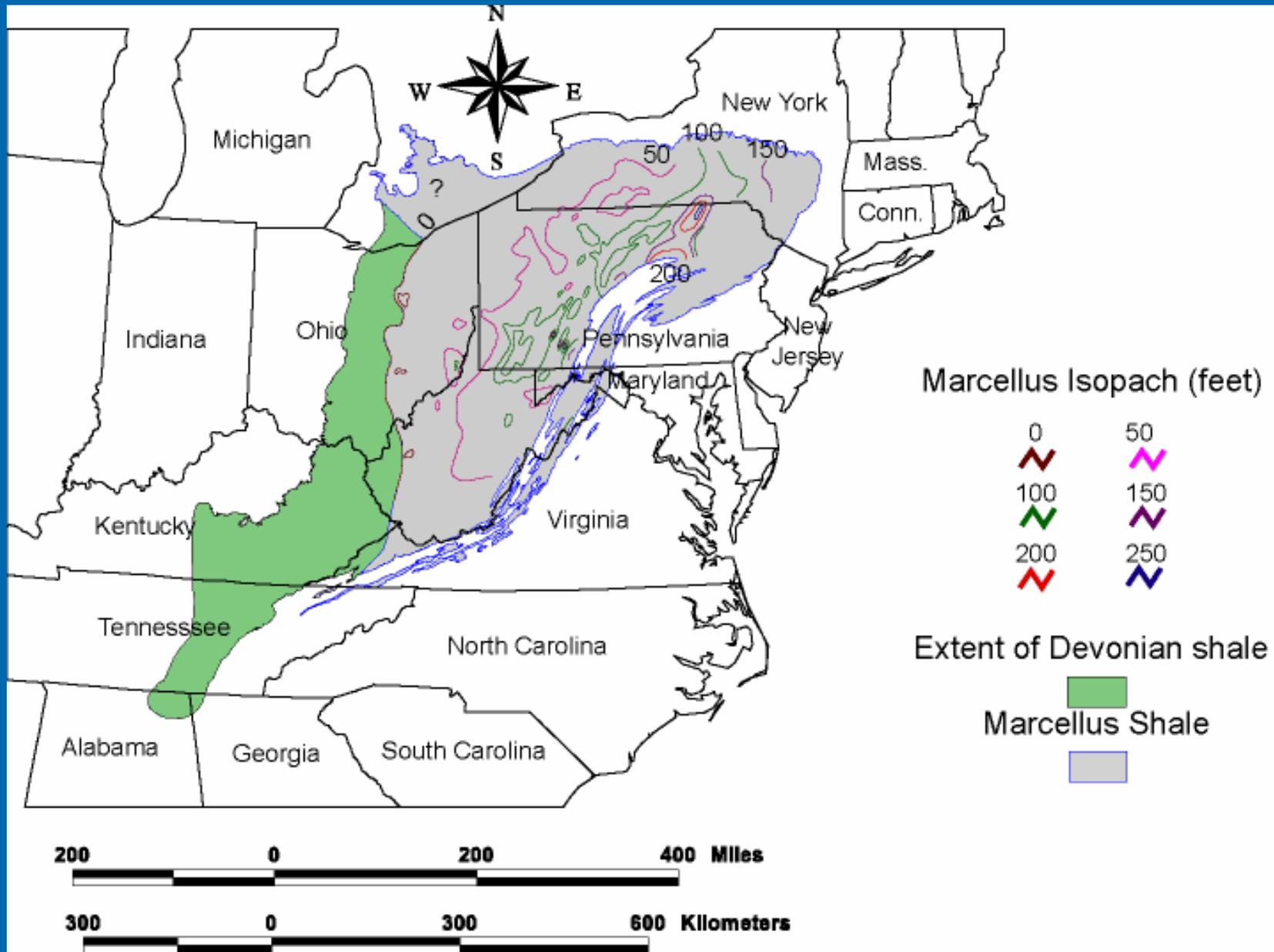
Devonian Siltstone and Shale AU



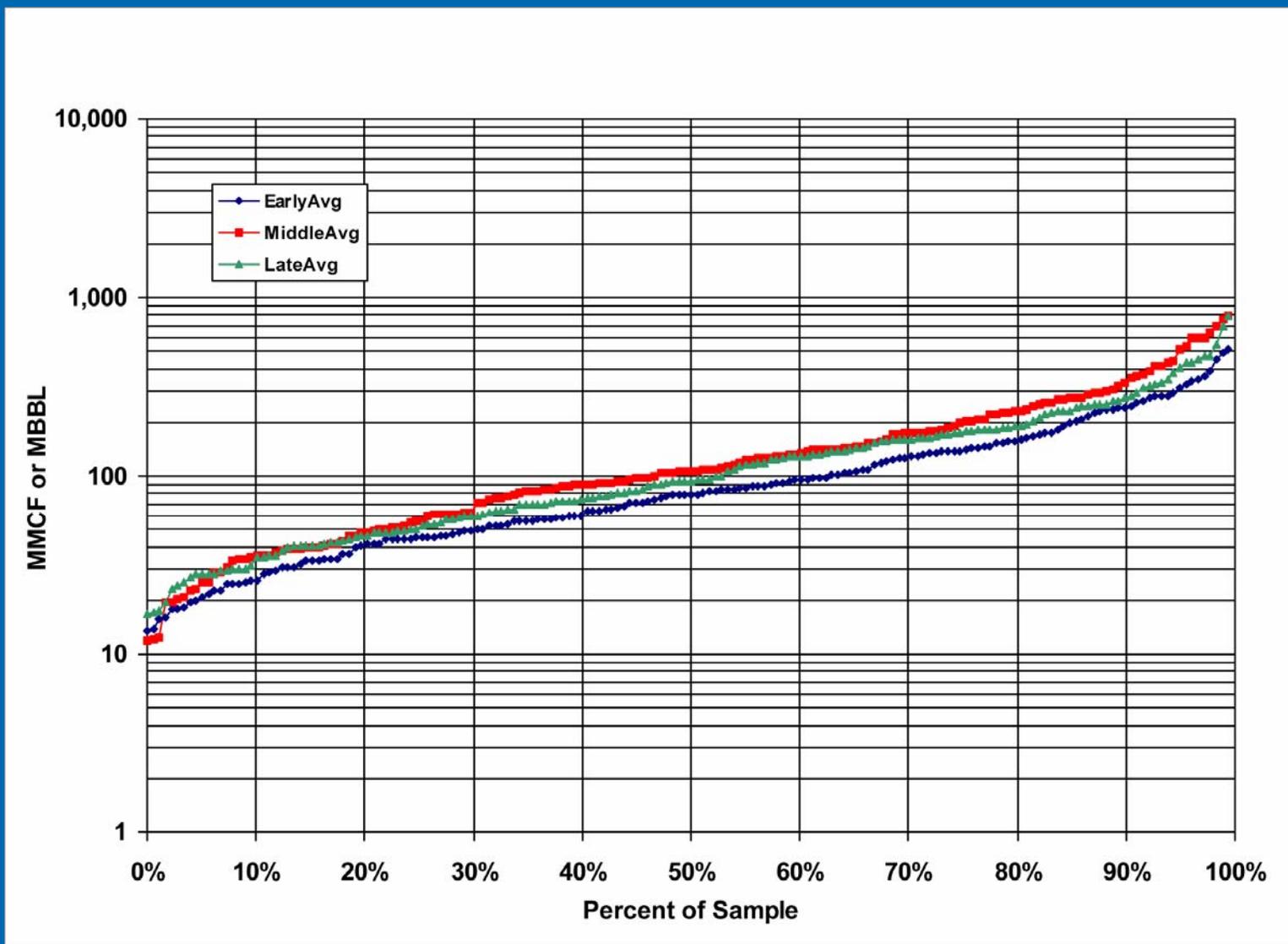
Regional Decollement and Folds



Marcellus Shale

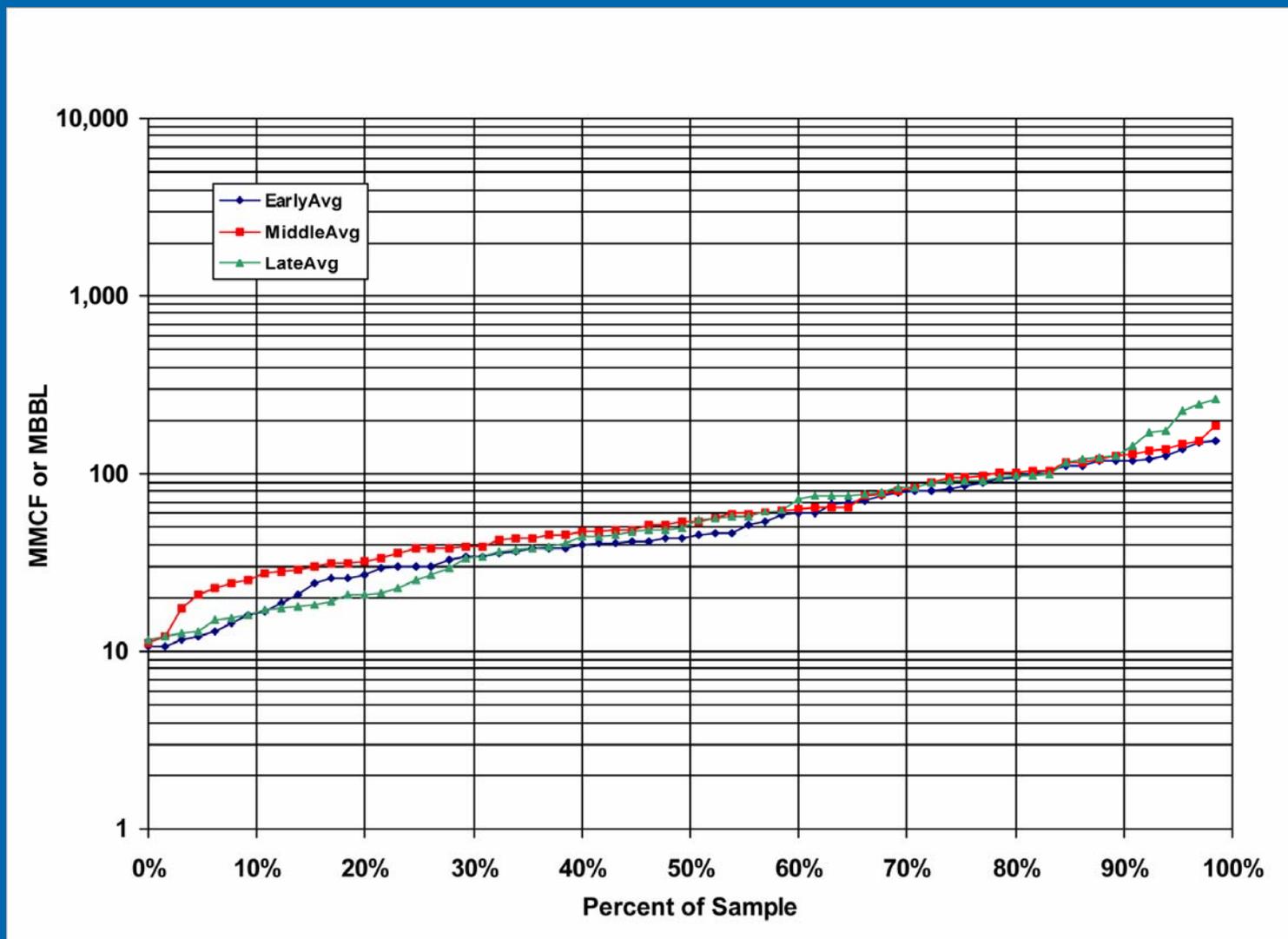


EUR distribution: Greater Big Sandy AU by thirds

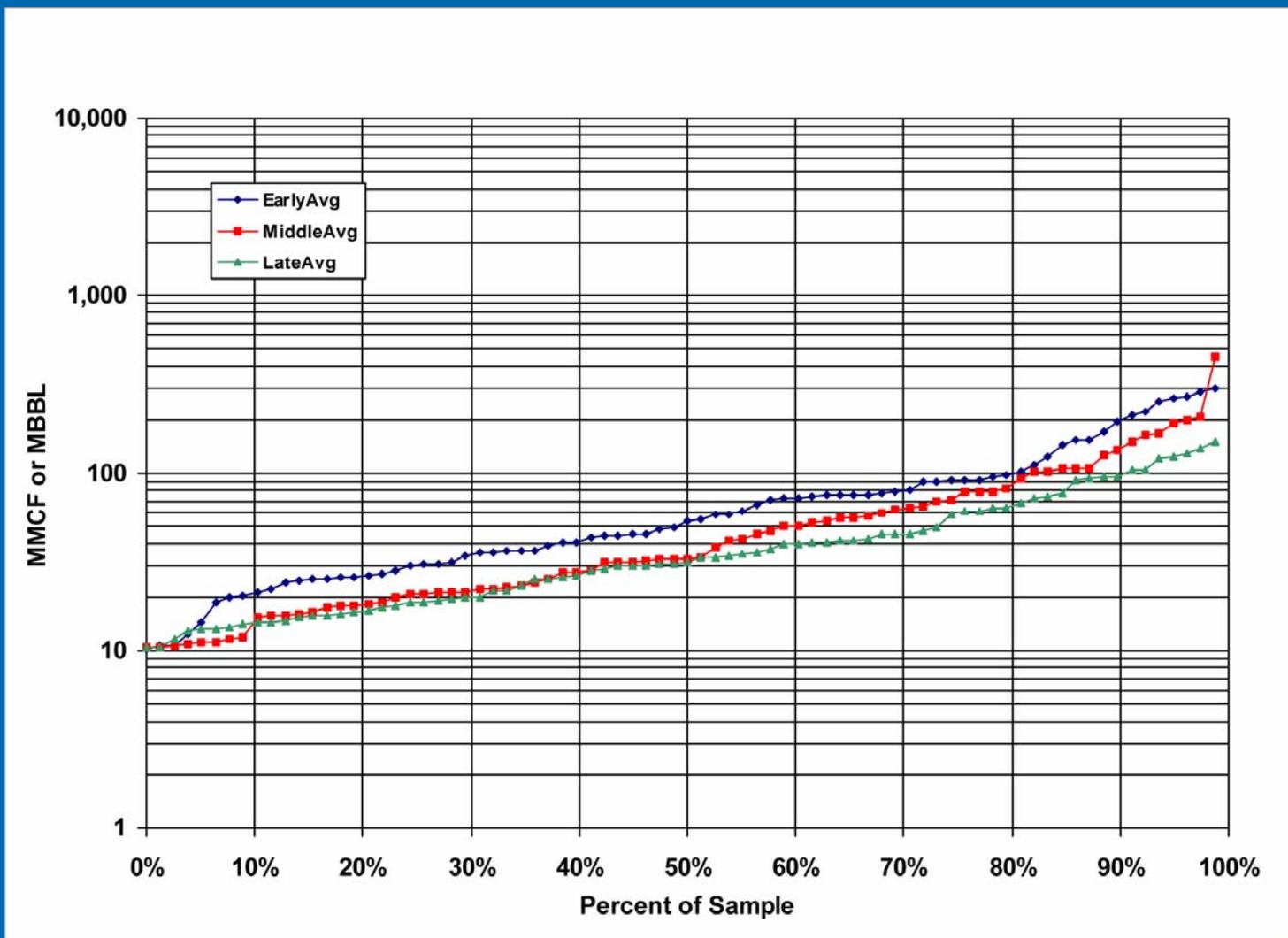


Troy Cook, USGS (unpublished data 2002)

EUR distribution: NWOS AU by thirds

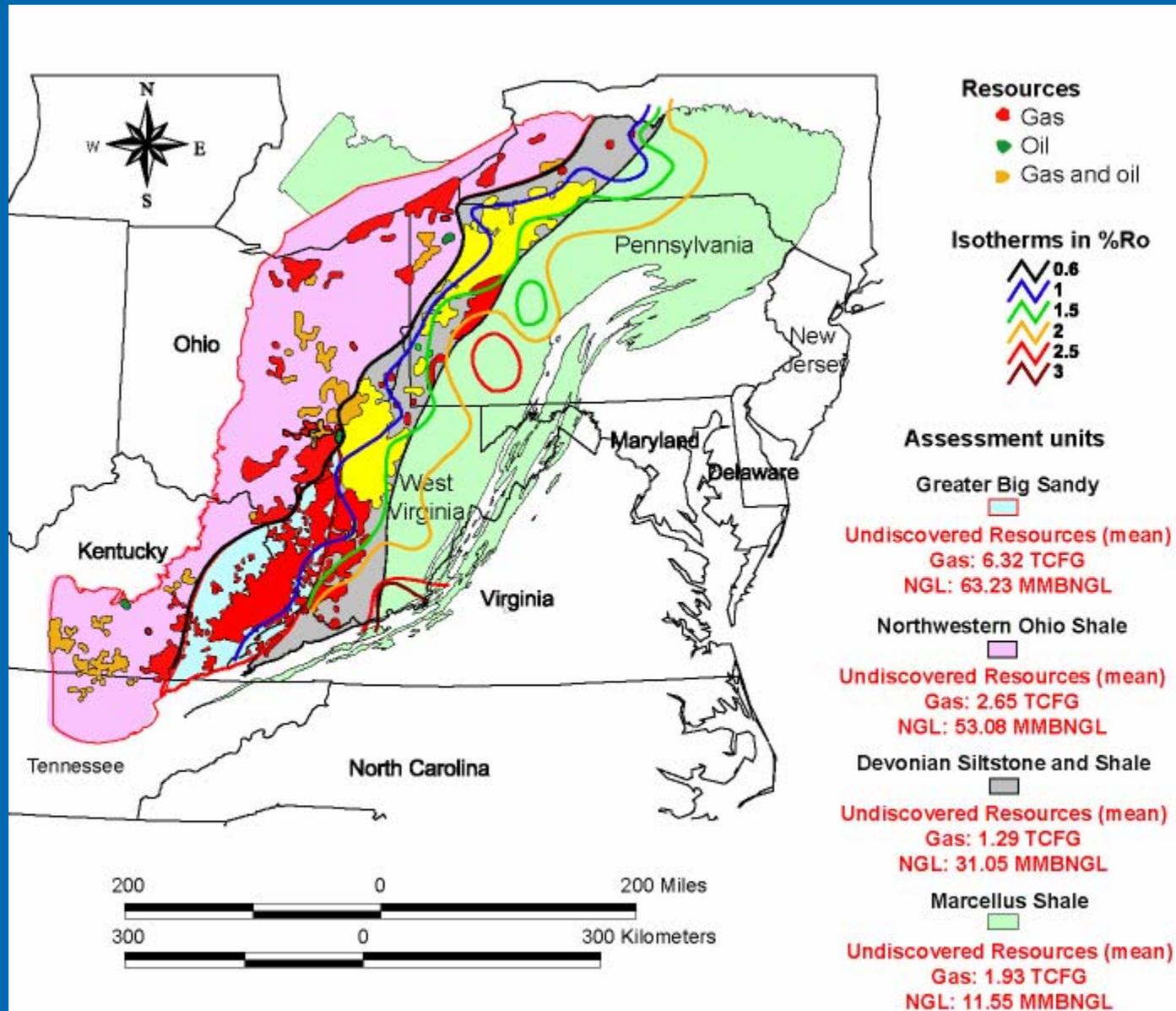


EUR distribution: DSS by Thirds

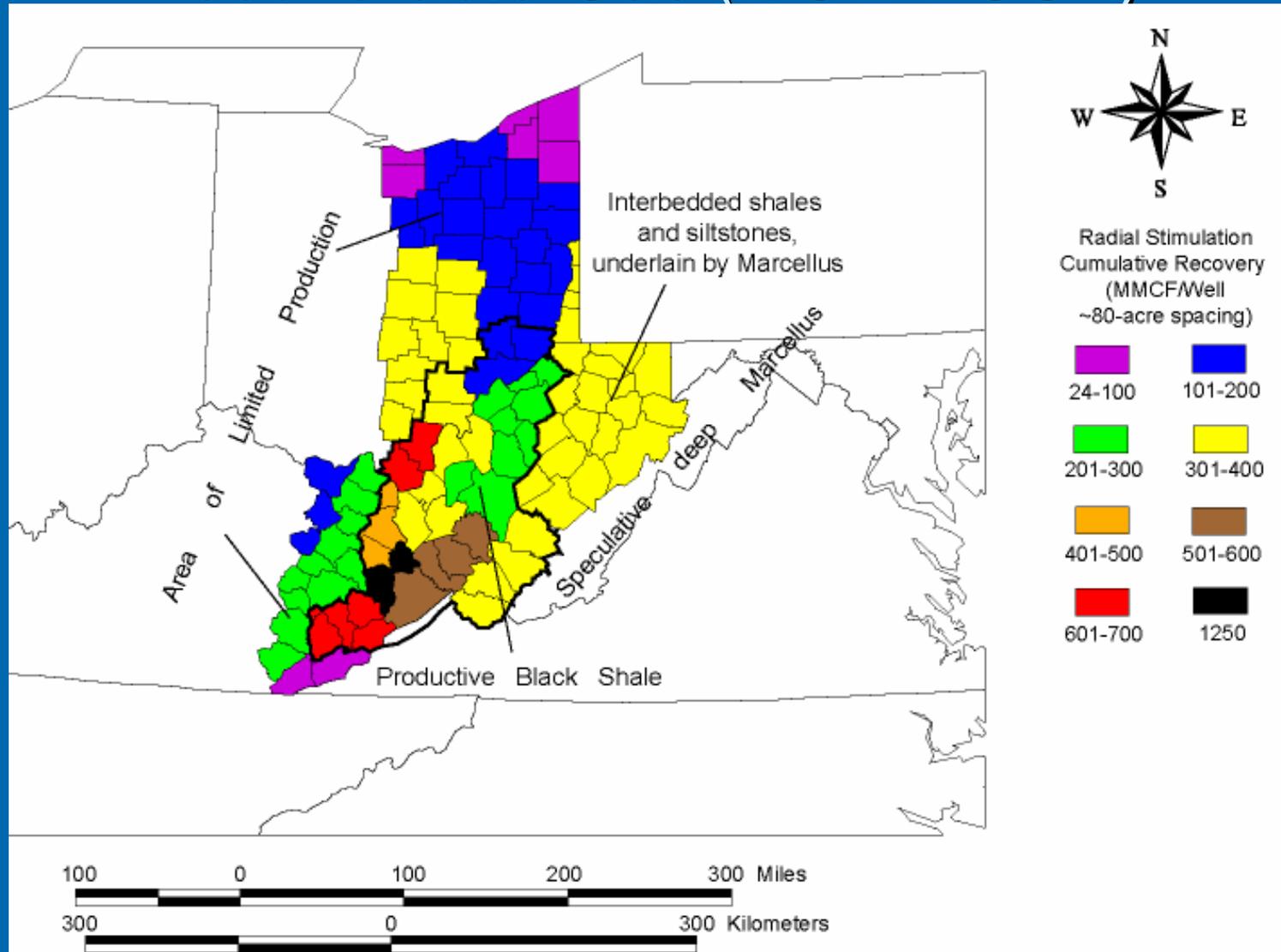


Troy Cook, USGS (unpublished data, 2002)

Undiscovered Resources



Per Well Estimates of Technically Recoverable Gas (DOE EGSP)



Data from Lewin and Associates, Inc., 1983; Kuuskraa and Wicks, 1984; Kuuskraa and others, 1985.

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