

Correlation of Middle and Upper Devonian shales in the Marcellus-producing regions of Pennsylvania

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Introduction and Purpose

- Introduce MRCSP regional characterization efforts
- Present a cursory history of shale geology in the Appalachian basin
- Explain current interpretive methods as applied to Pennsylvania data
- Provide current lithostratigraphic correlations



Midwest Regional Carbon Sequestration Partnership

- What is it?
- Three phases
- Current regional characterization work
- Support for CCUS
Carbon Capture Utilization & Storage
- EOR/EGR
Enhanced Oil/Gas Recovery

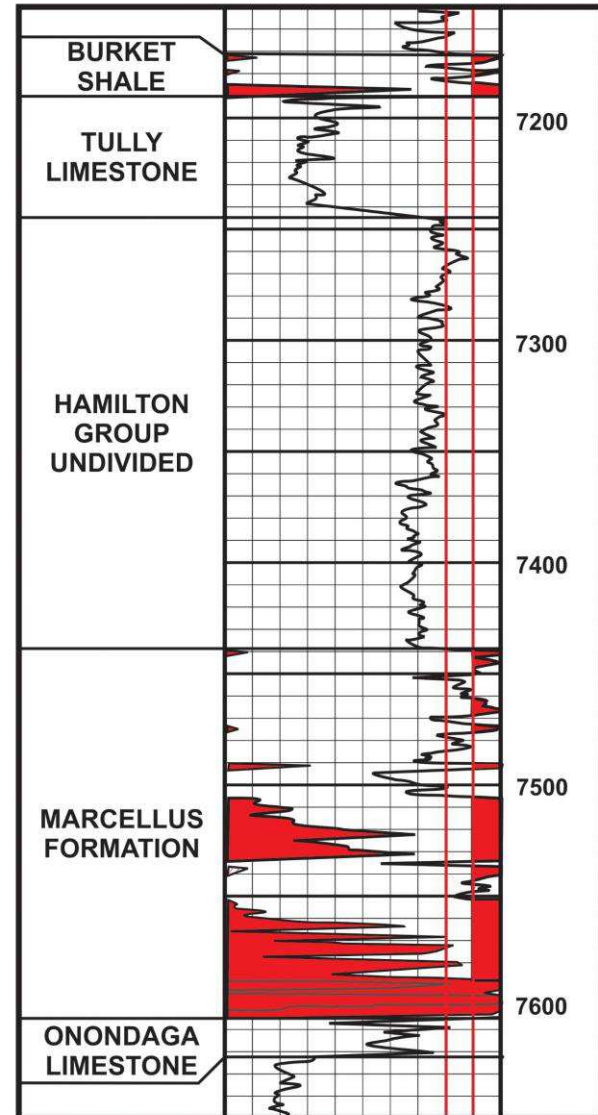
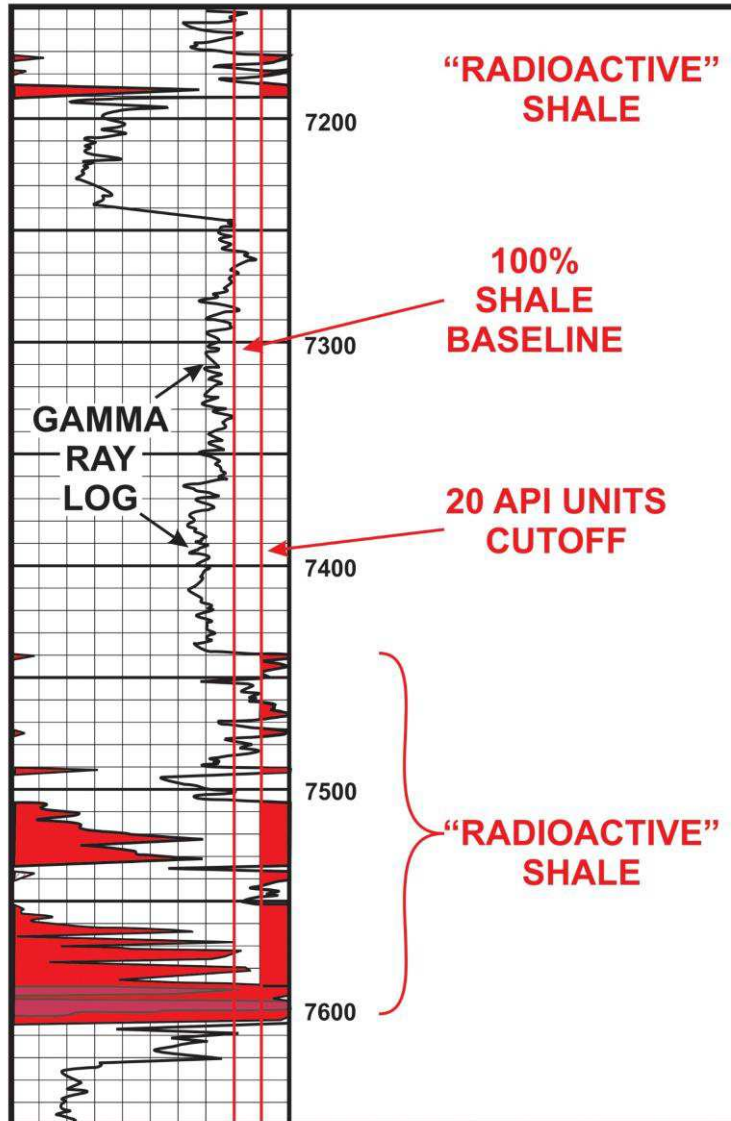


Appalachian Basin Shale Work

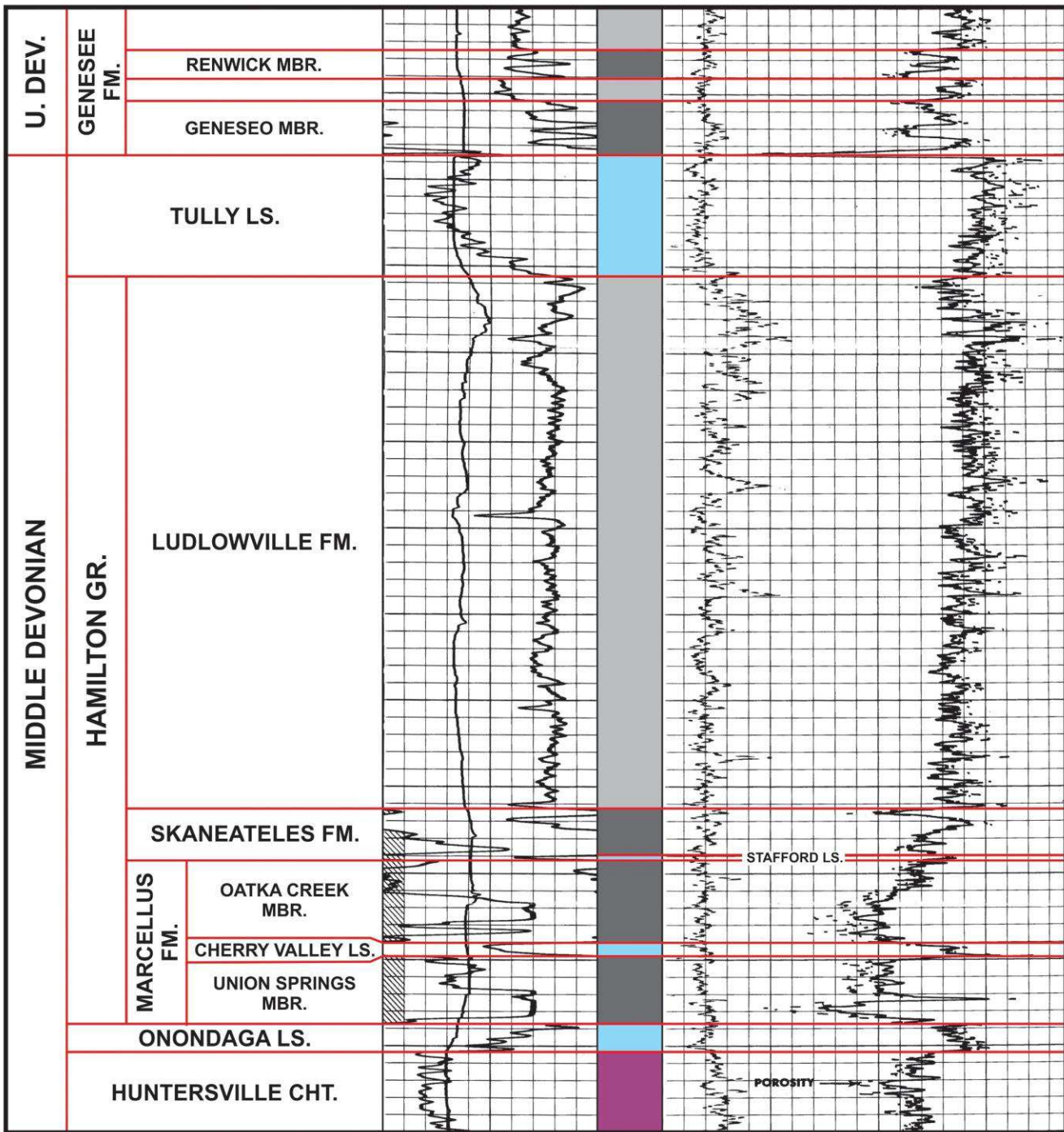
- Eastern Gas Shales Project (EGSP) – correlation based on GR, “Marcellus facies” vs. Marcellus Formation
- Modern Marcellus shale play (2004) – thousands of wells with modern geophysical logs
- Technology and data availability give rise to improved lithostratigraphic interpretations



EGSP Approach



Modern Correlation Log

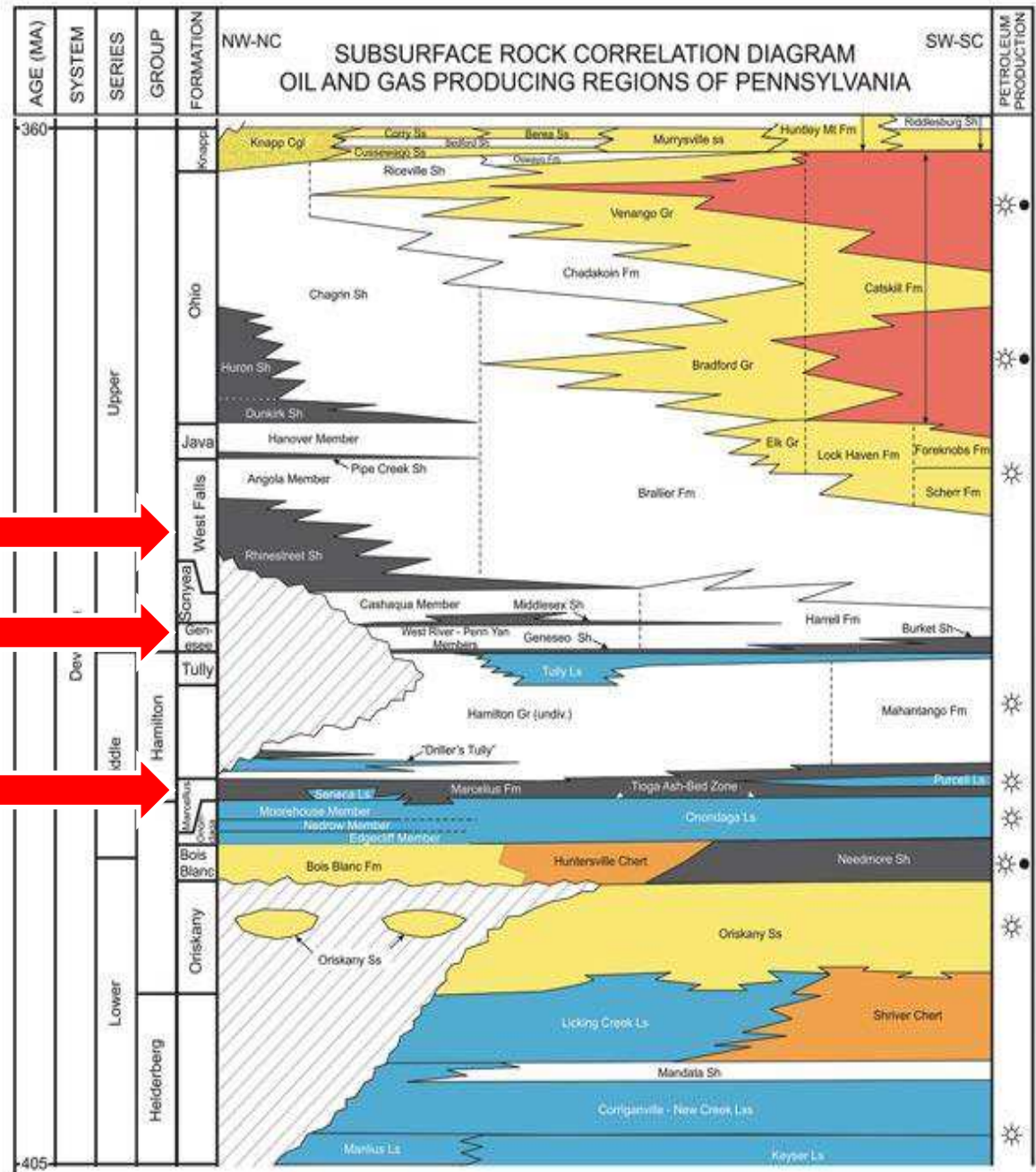


Methods

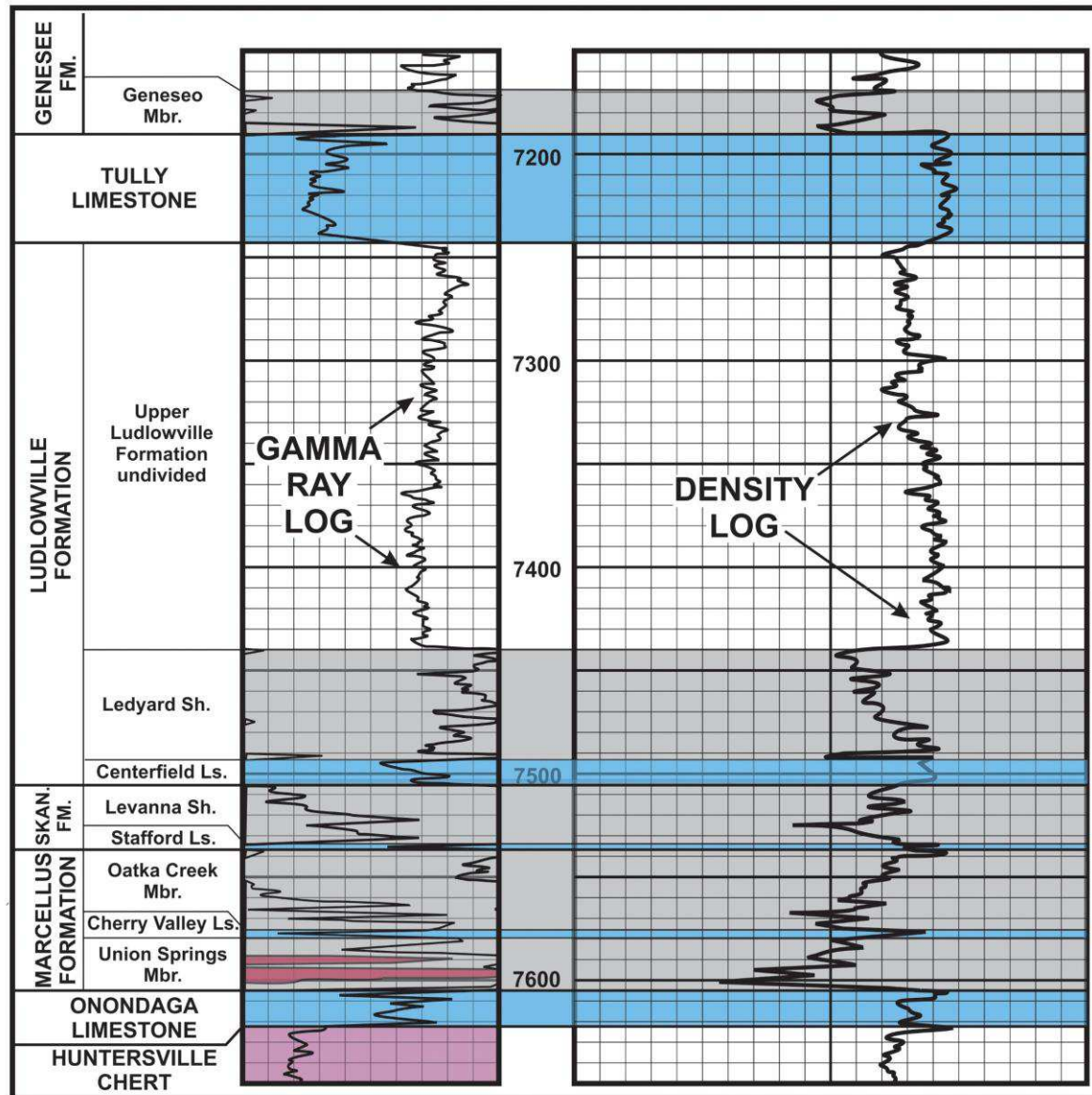
- Regional mapping using geophysical log control for ~3,500 wells in 41 Pennsylvania counties
- Geologic cross sections using New York terminology
- Integration of regional structural controls
- Resolution of correlations to formation and/or member level

Stratigraphic Correlation Diagram

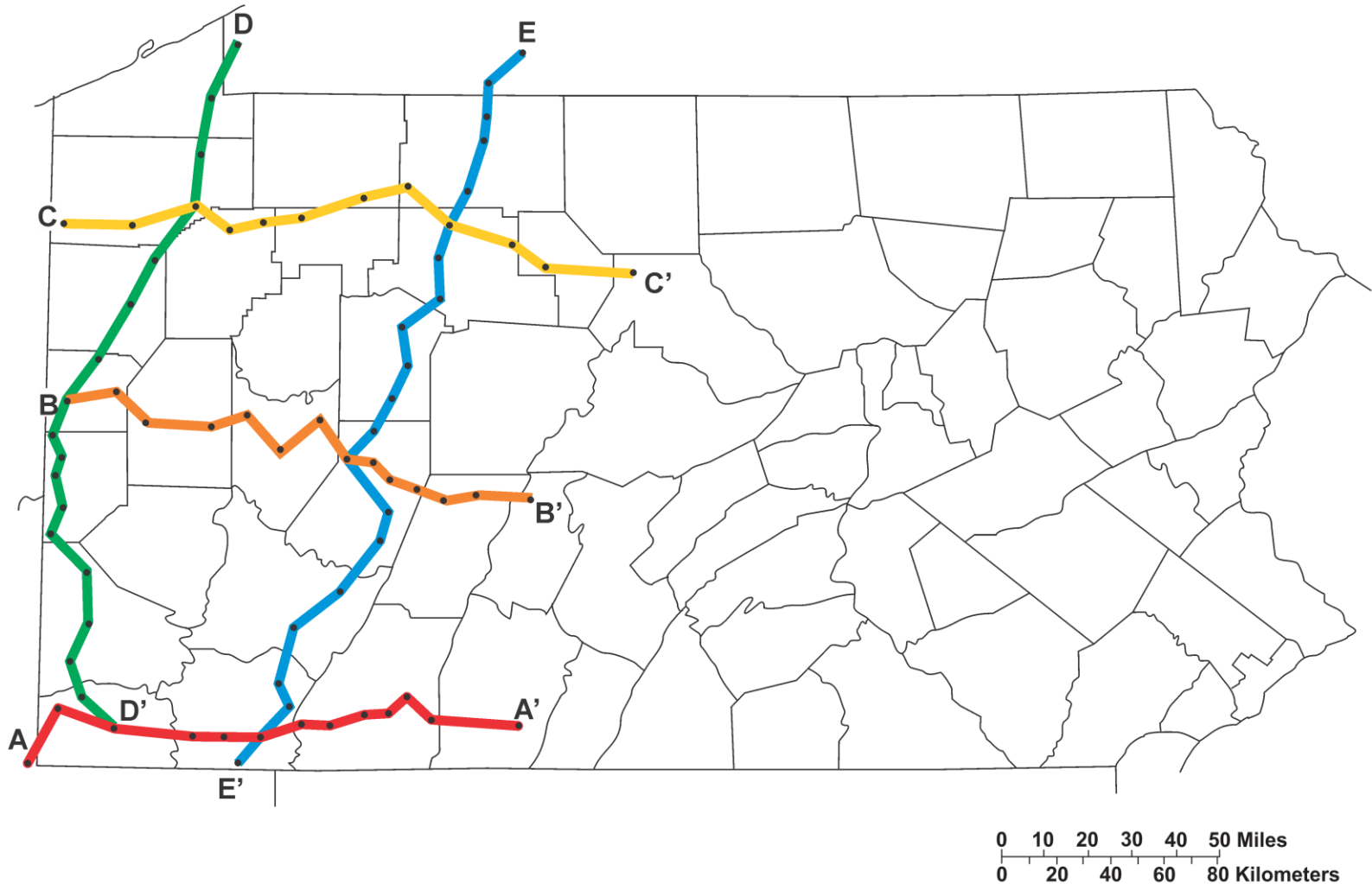
- Rhinestreet
- Middlesex
- Geneseo-Burket
- Marcellus



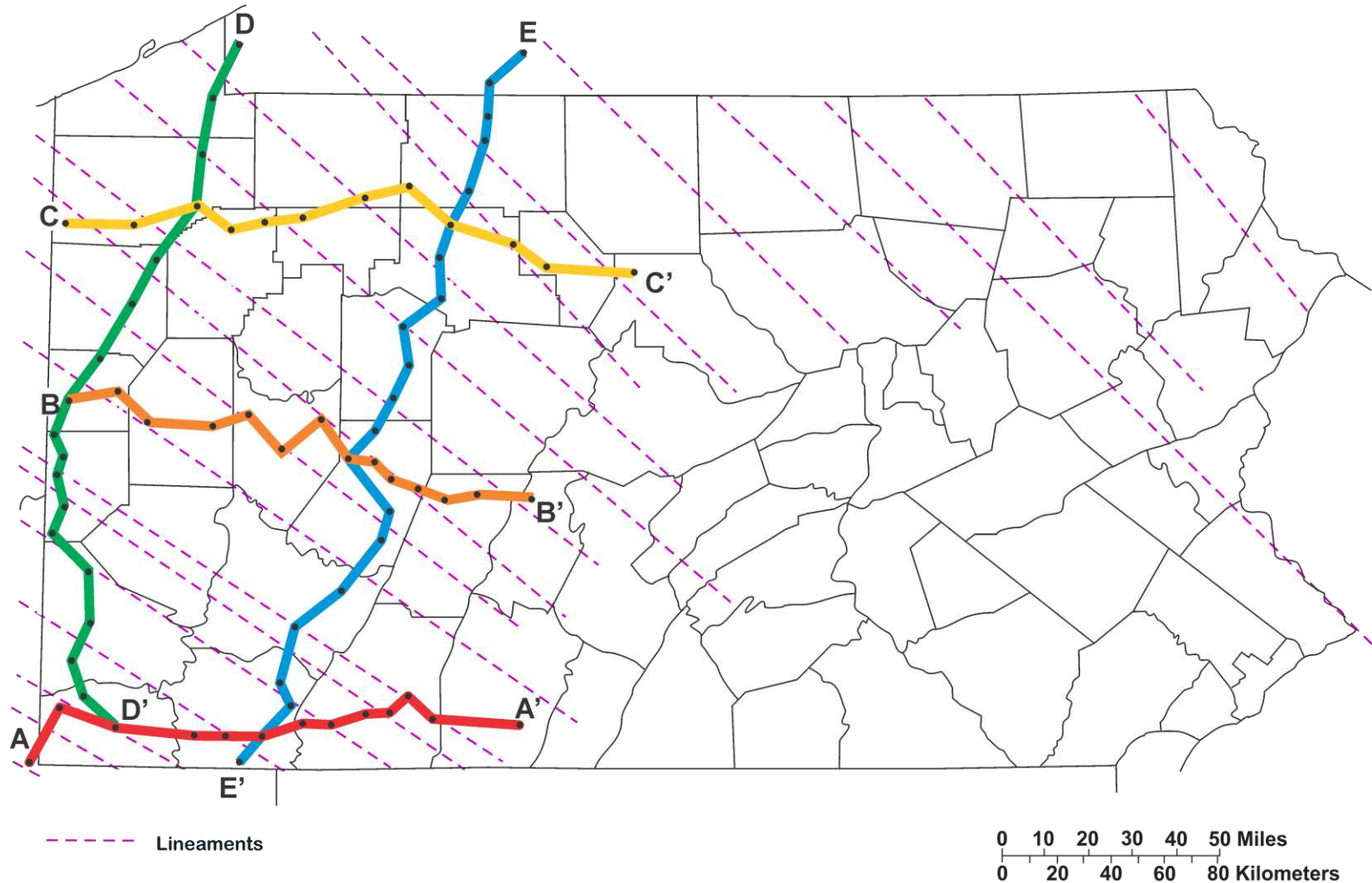
Devonian shale lithostratigraphy



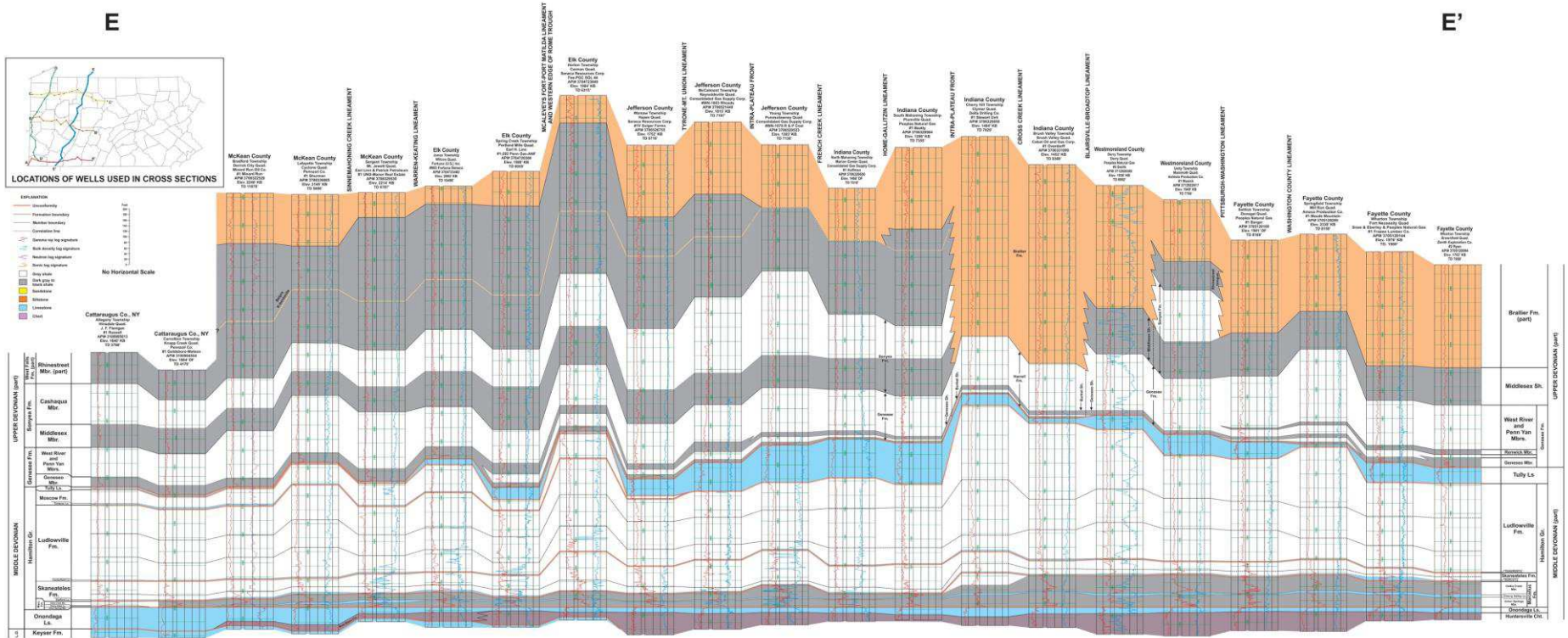
Cross Section Location Map



Cross Section Location Map

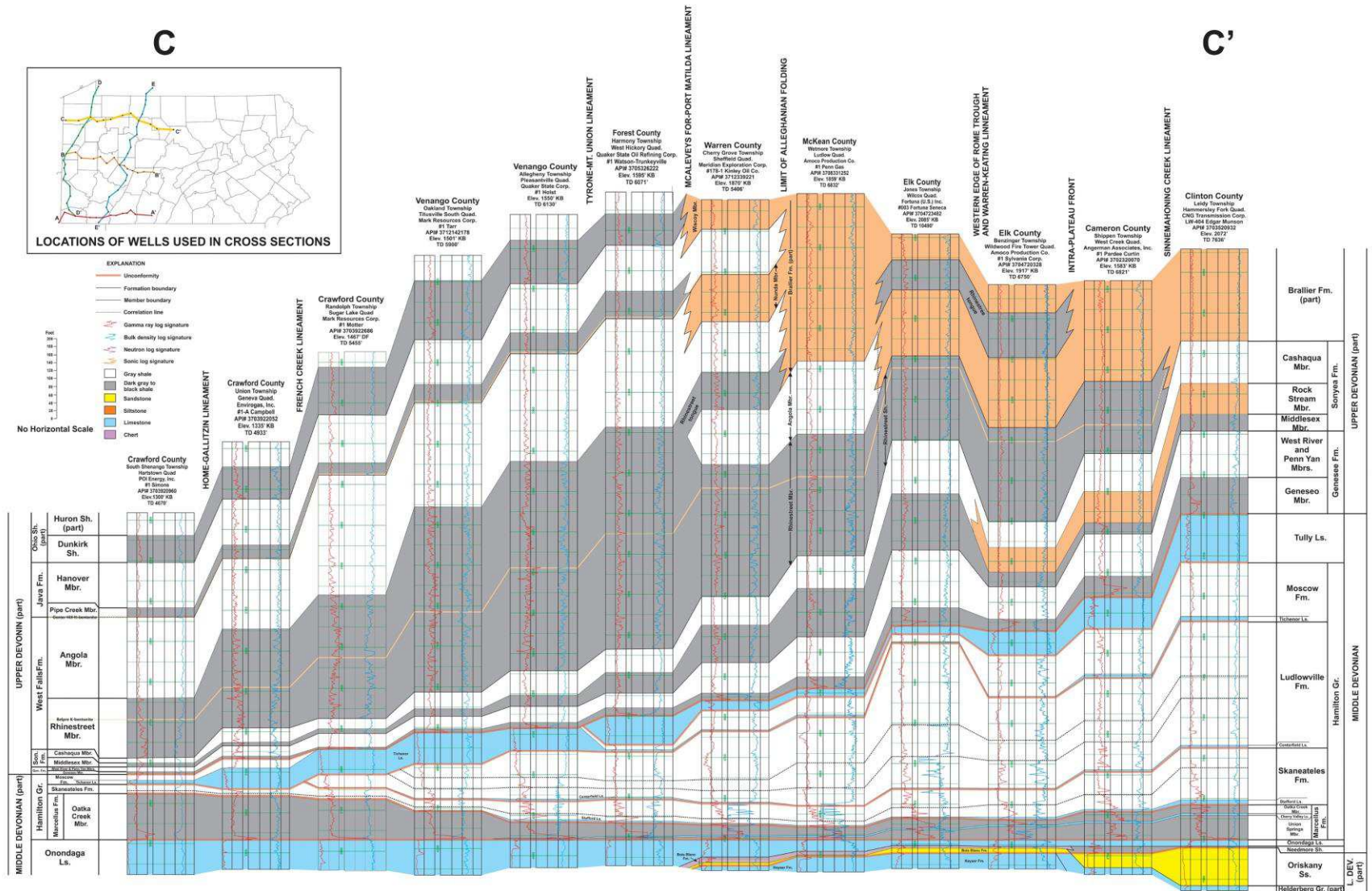


NE-SW Cross Section (Basin Strike)



CROSS SECTION E-E': STRATIGRAPHIC CORRELATION OF MIDDLE AND UPPER DEVONIAN SHALES FROM CATTARAUGUS COUNTY, NY TO FAYETTE COUNTY, PA

W-E Cross Section (Basin Dip)

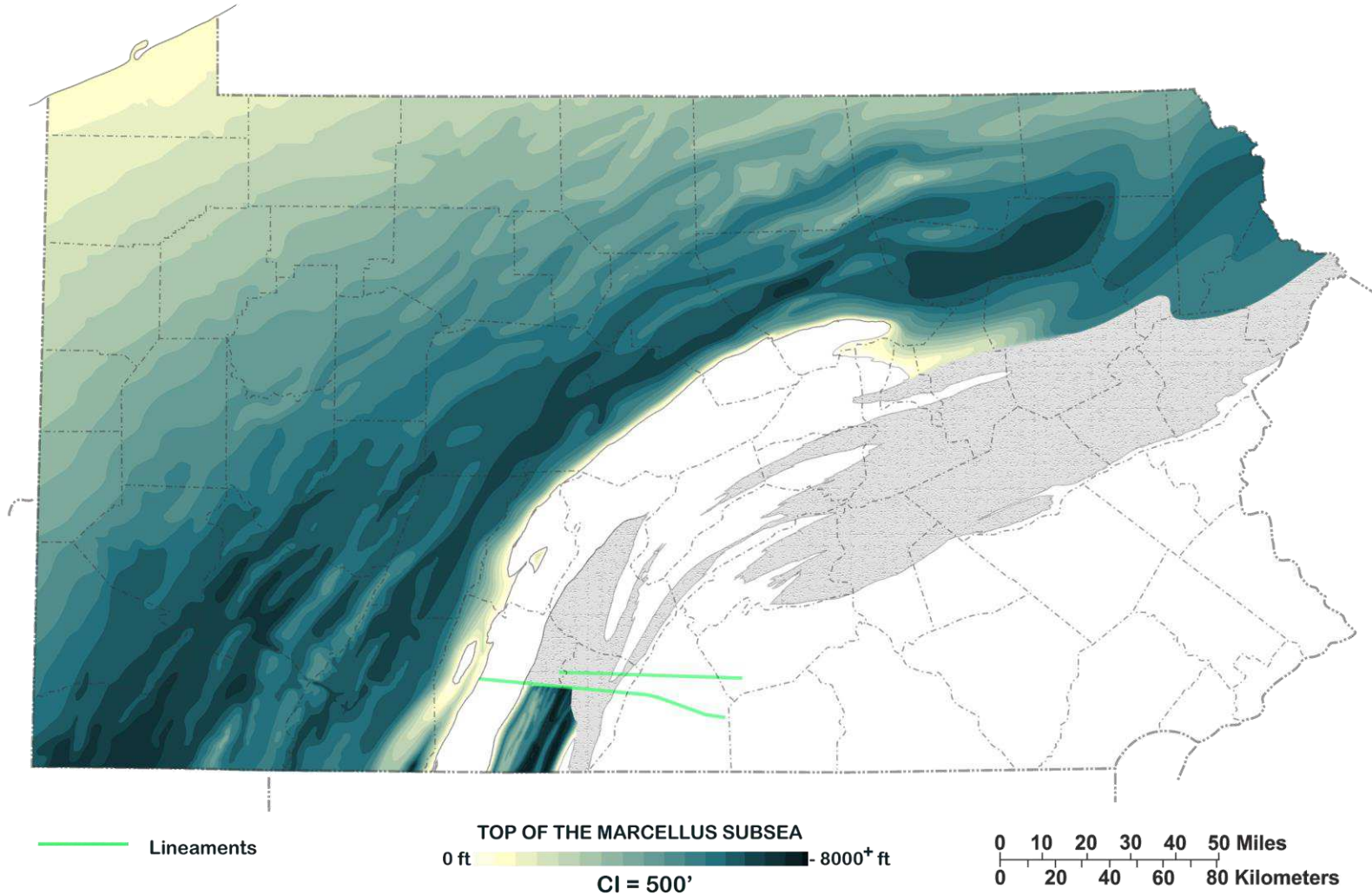


CROSS SECTION C-C': CORRELATION OF THE MIDDLE AND UPPER DEVONIAN SHALES FROM CRAWFORD COUNTY, PA, TO CLINTON COUNTY, PA

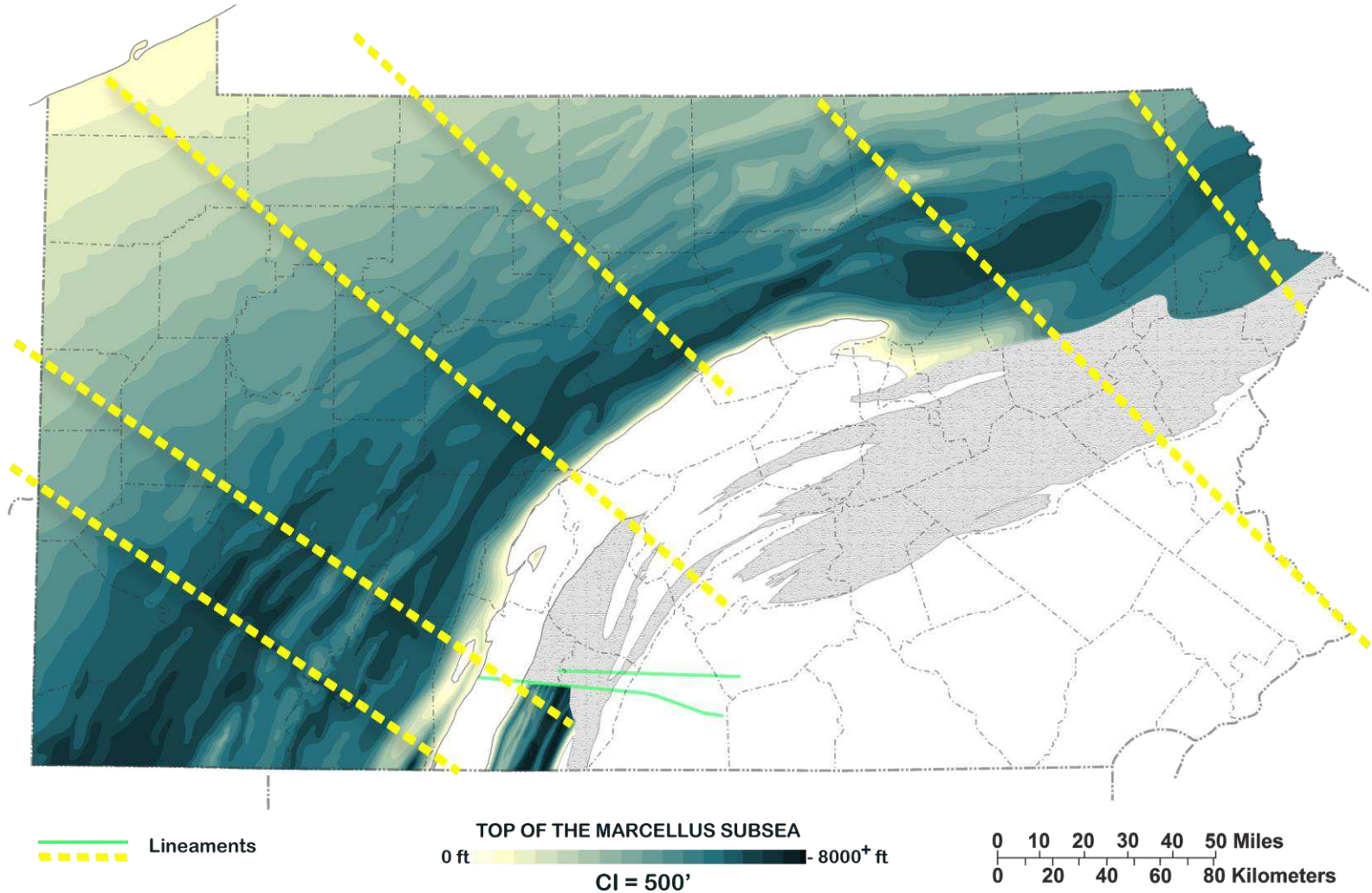
Marcellus Shale



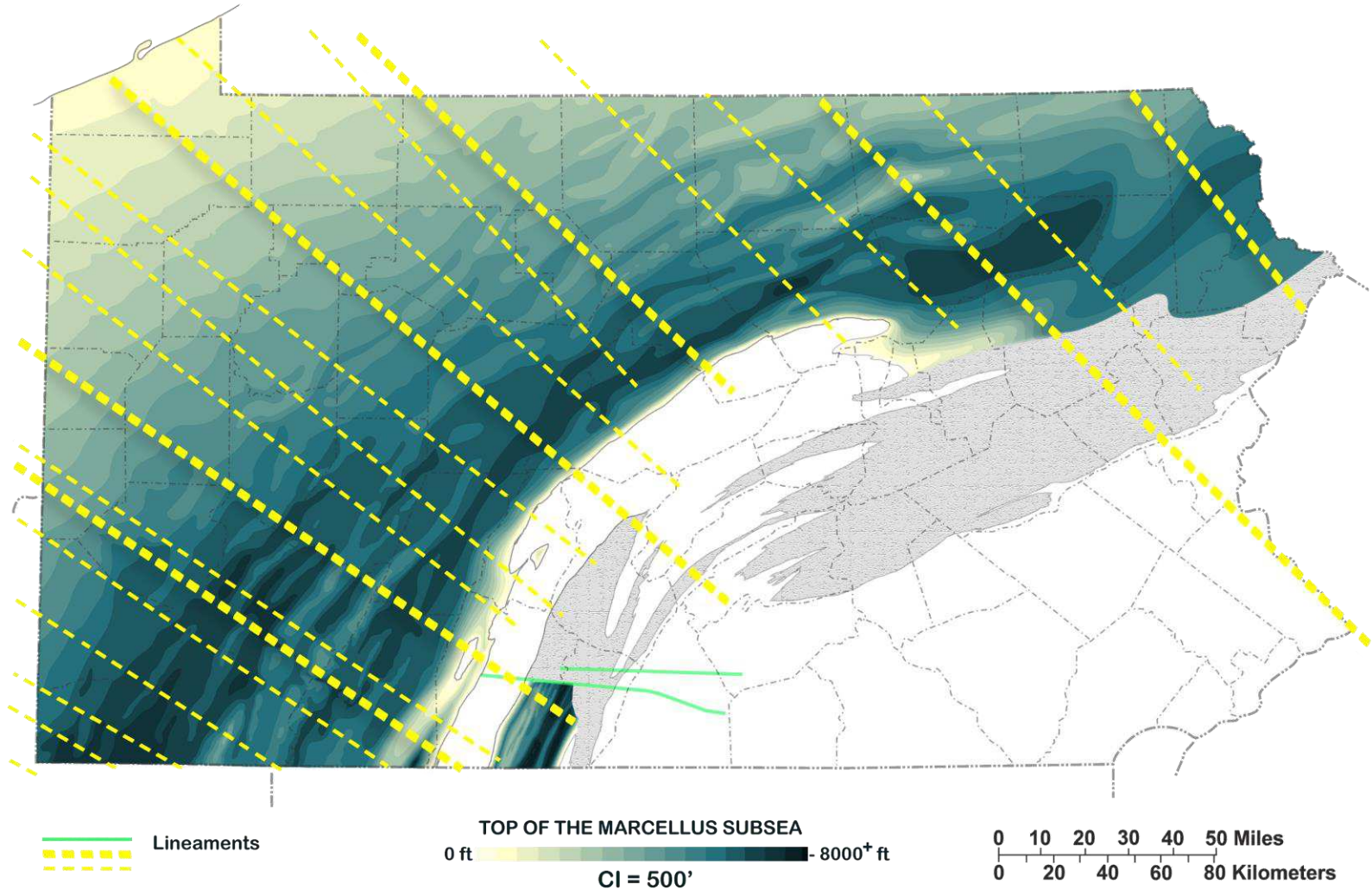
Marcellus Structure Map



Major Lineaments

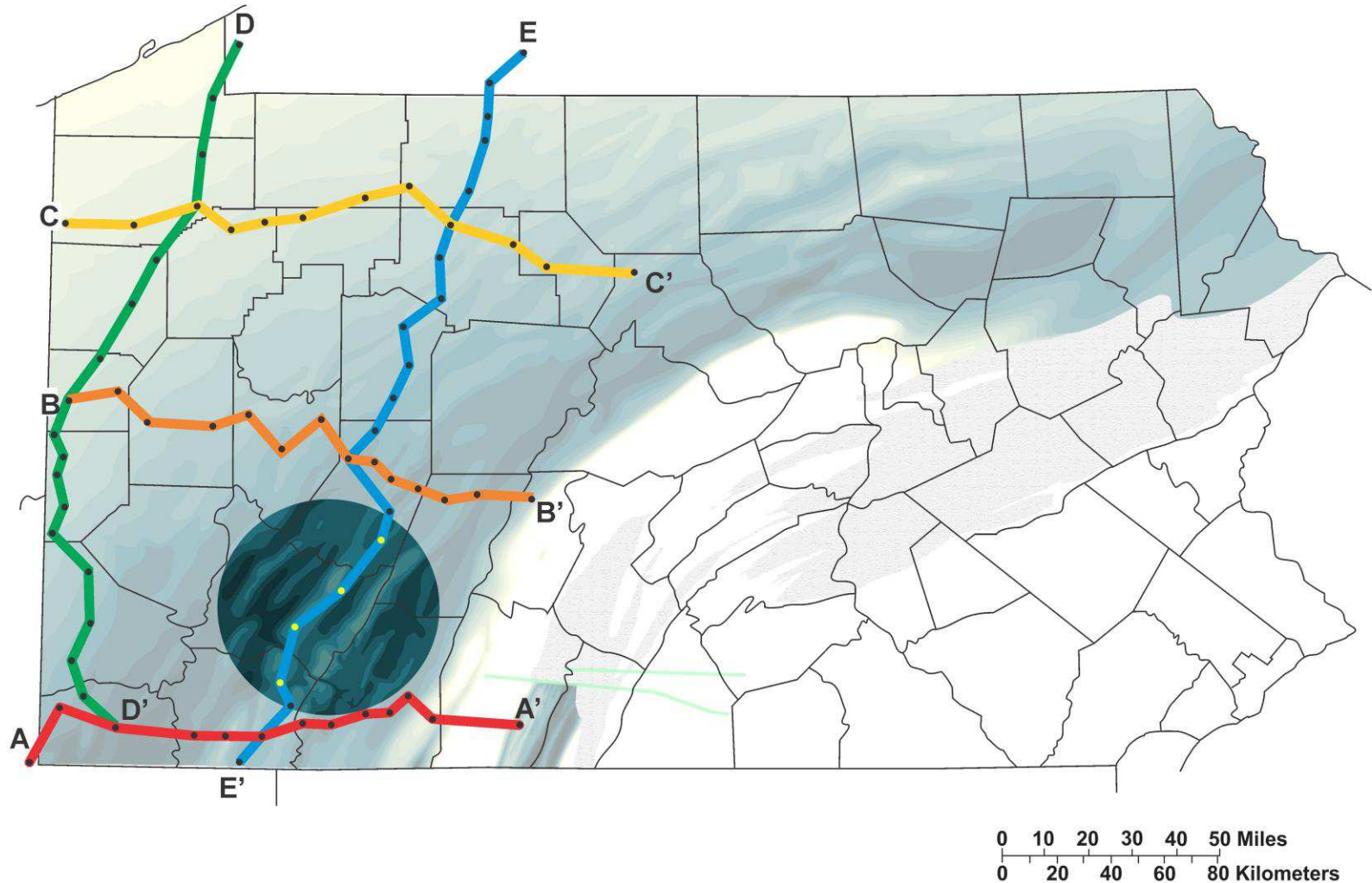


Marcellus Structure Map with Lineaments



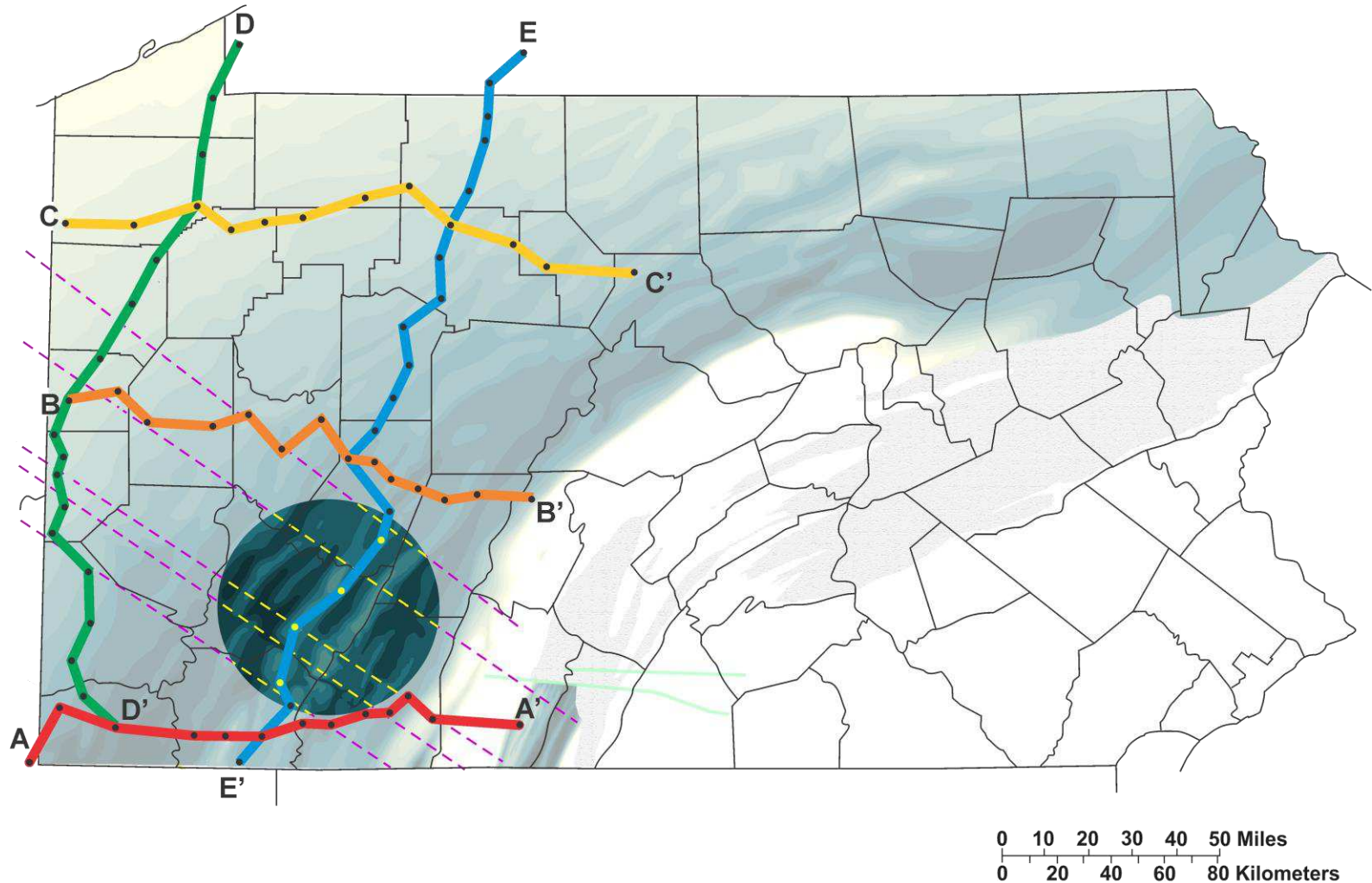
Marcellus

Cross-section Inset 1 along E-E'



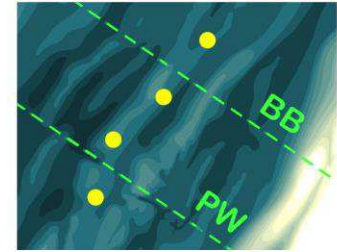
Marcellus

Cross-section Inset 1 along E-E'



Marcellus

Cross-section Inset 1 along E-E'



Indiana County
 Brush Valley Township
 Brush Valley Quad.
 Cabot Oil and Gas Corp.
 #1 Overdorff
 API# 3706331999
 Elev. 1452' KB
 TD 8368'

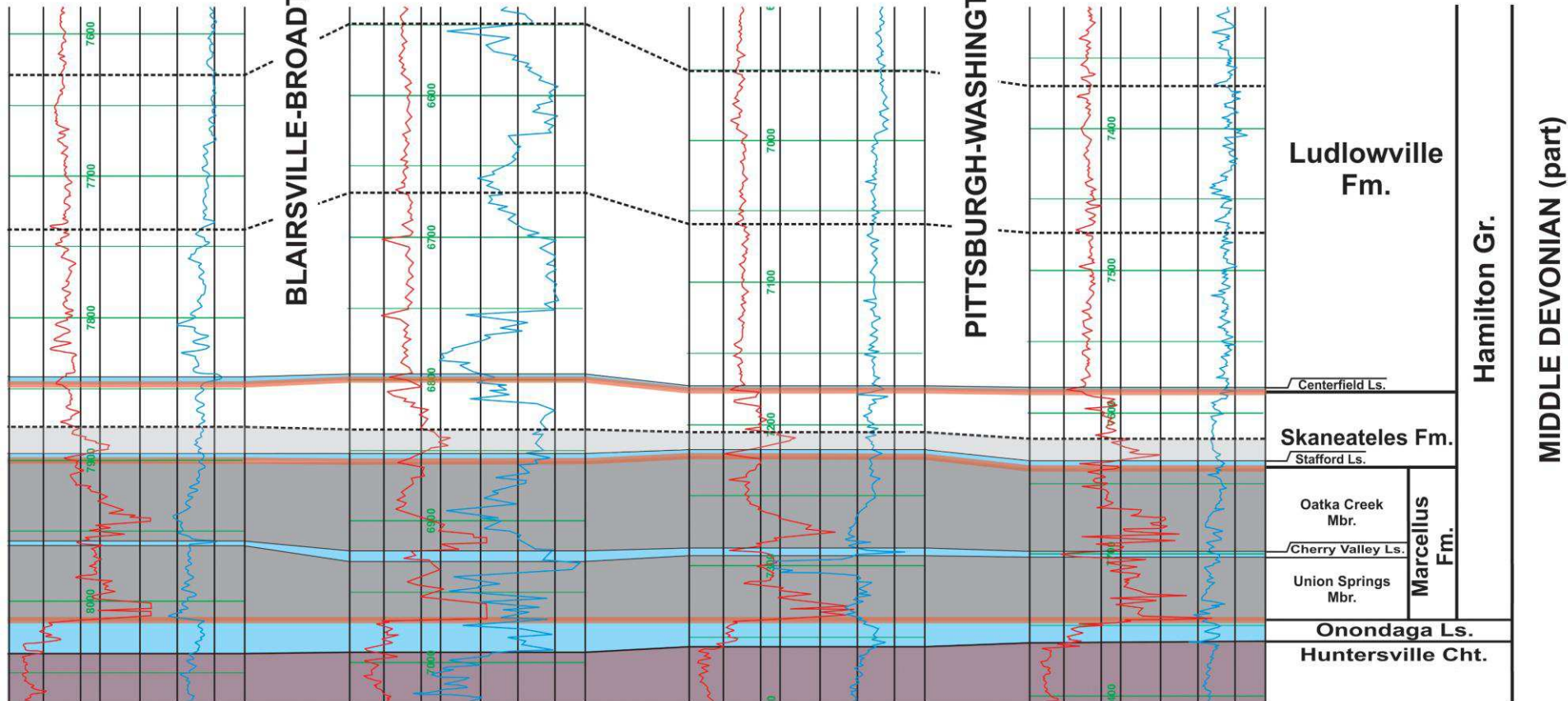
Westmoreland County
 Derry Township
 Derry Quad.
 Peoples Natural Gas
 #5 Smith
 API# 3712920380
 Elev. 1936' KB
 TD 6992'

Westmoreland County
 Unity Township
 Mammoth Quad.
 Ashtola Production Co.
 #1 Musick
 API# 3712922617
 Elev. 1949' KB
 TD 7706'

Fayette County
 Saltlick Township
 Donegal Quad.
 Peoples Natural Gas
 #1 Barger
 API# 3705120169
 Elev. 1901' DF
 TD 8169'

BLAIRSVILLE-BROADTOP LINEAMENT

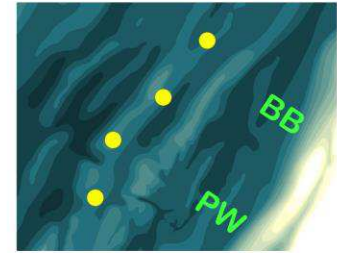
PITTSBURGH-WASHINGTON LINEAMENT



MIDDLE DEVONIAN (part)

Marcellus

Cross-section Inset 1 along E-E'



Indiana County
 Brush Valley Township
 Brush Valley Quad.
 Cabot Oil and Gas Corp.
 #1 Overdorff
 API# 3706331999
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 TD 8368'

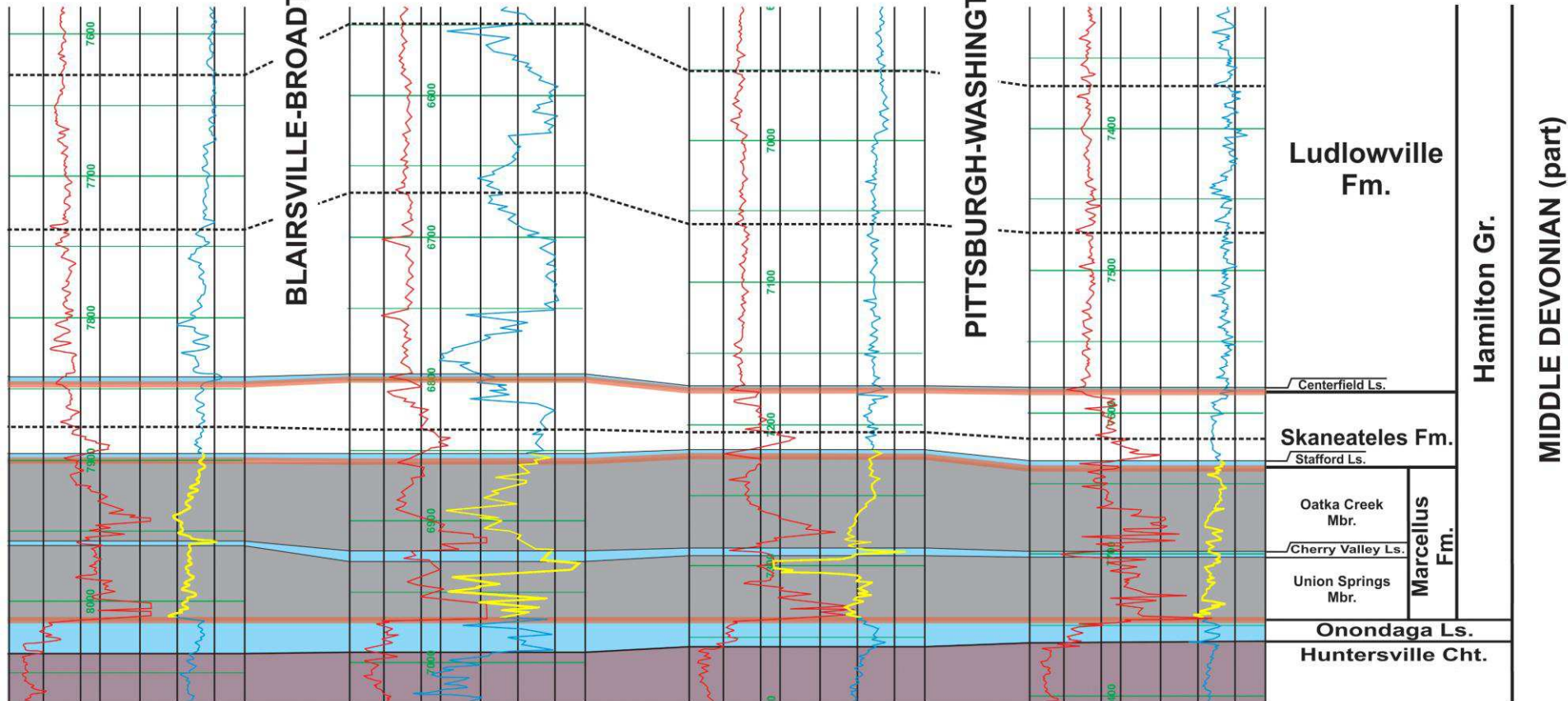
Westmoreland County
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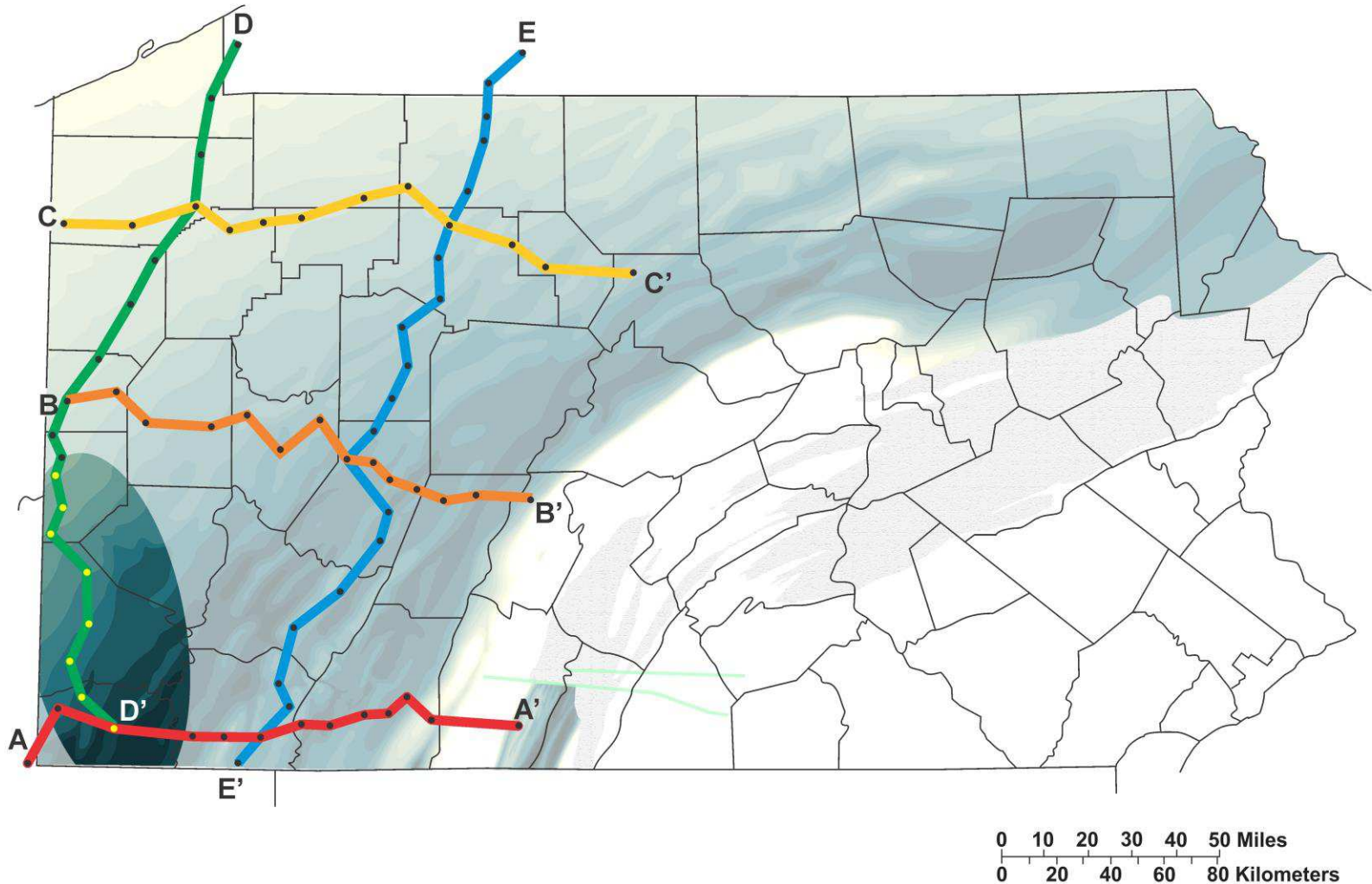
BLAIRSVILLE-BROADTOP LINEAMENT

PITTSBURGH-WASHINGTON LINEAMENT



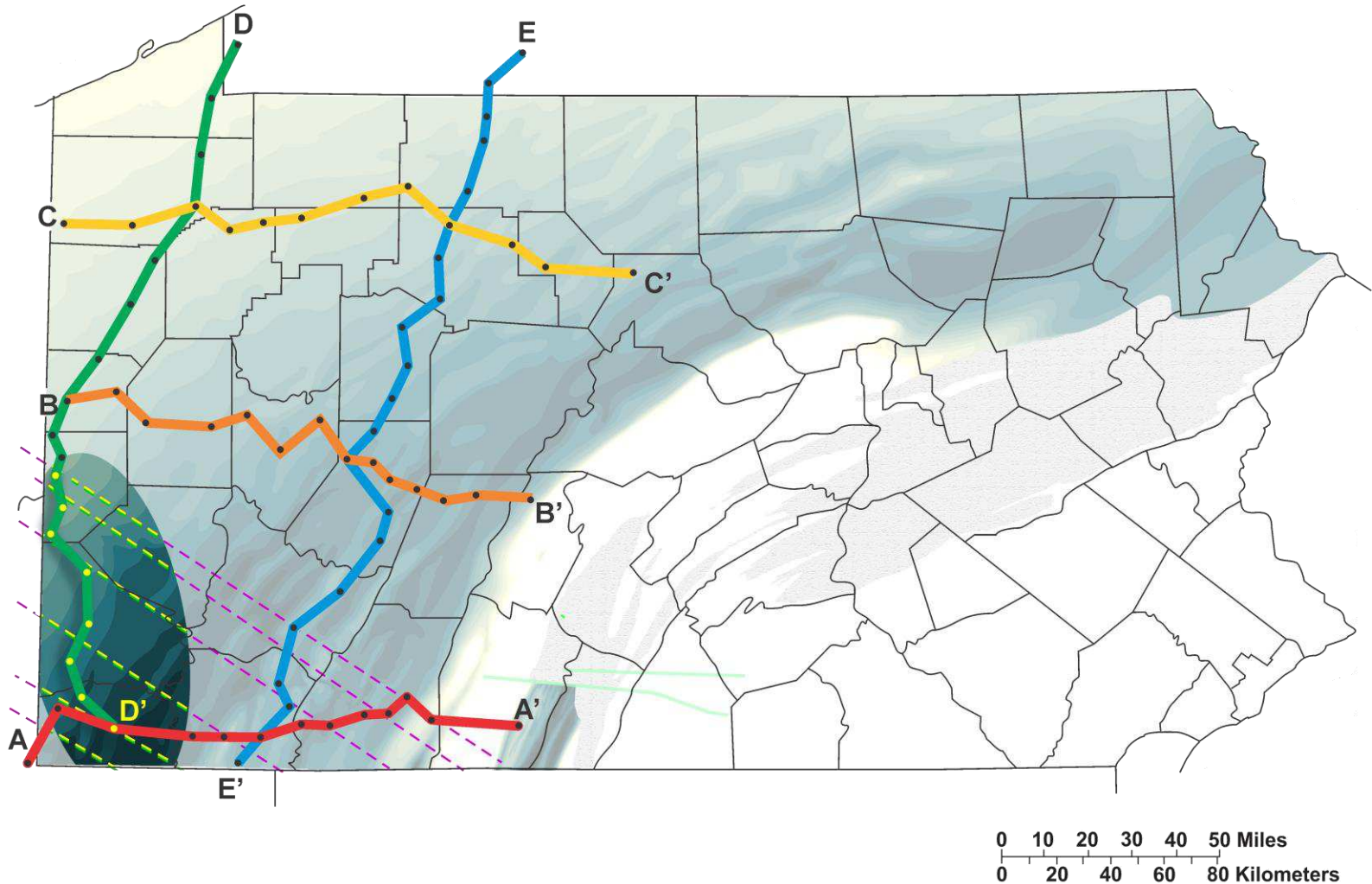
Marcellus

Cross-section inset 2 along D-D'



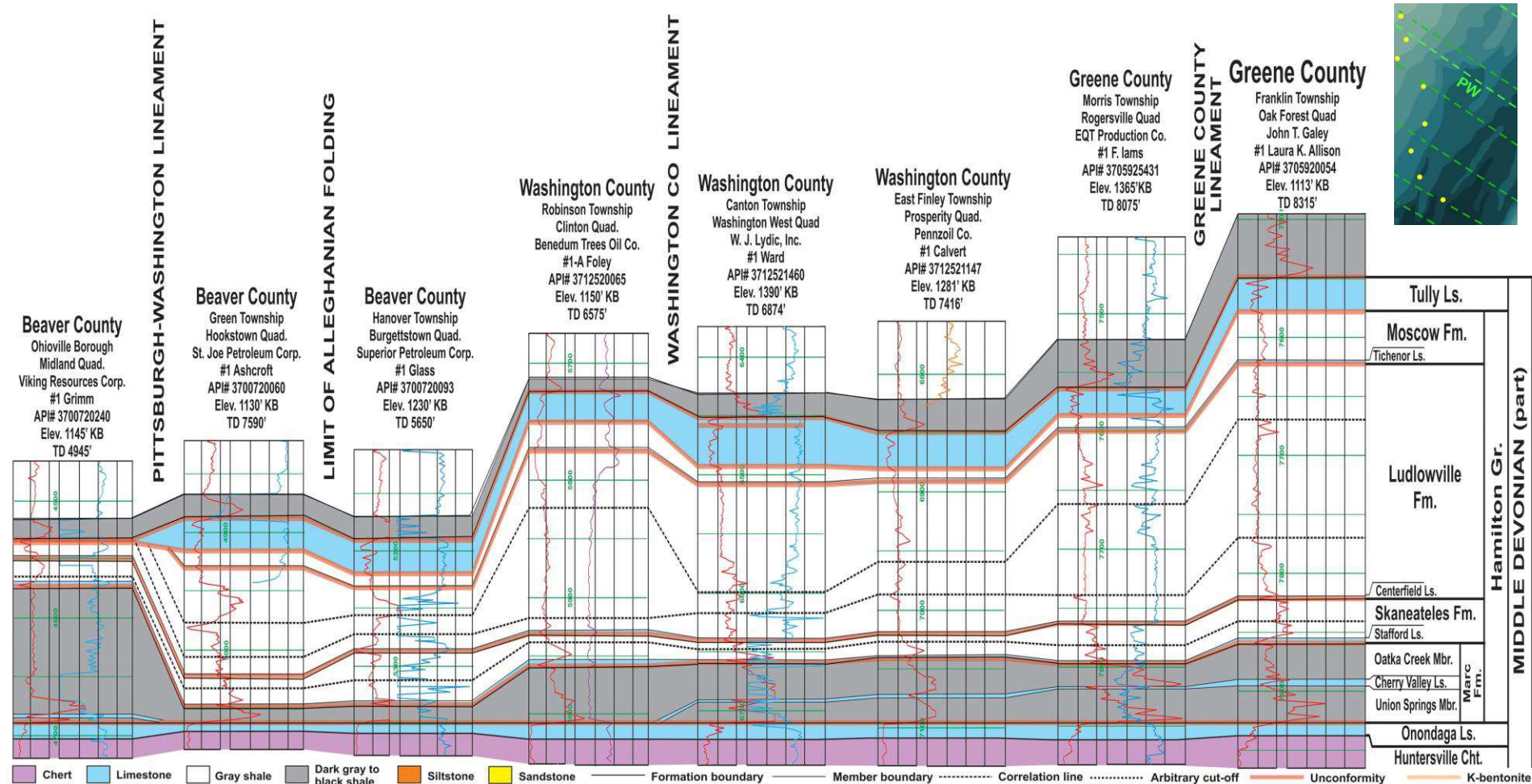
Marcellus

Cross-section inset 2 along D-D'



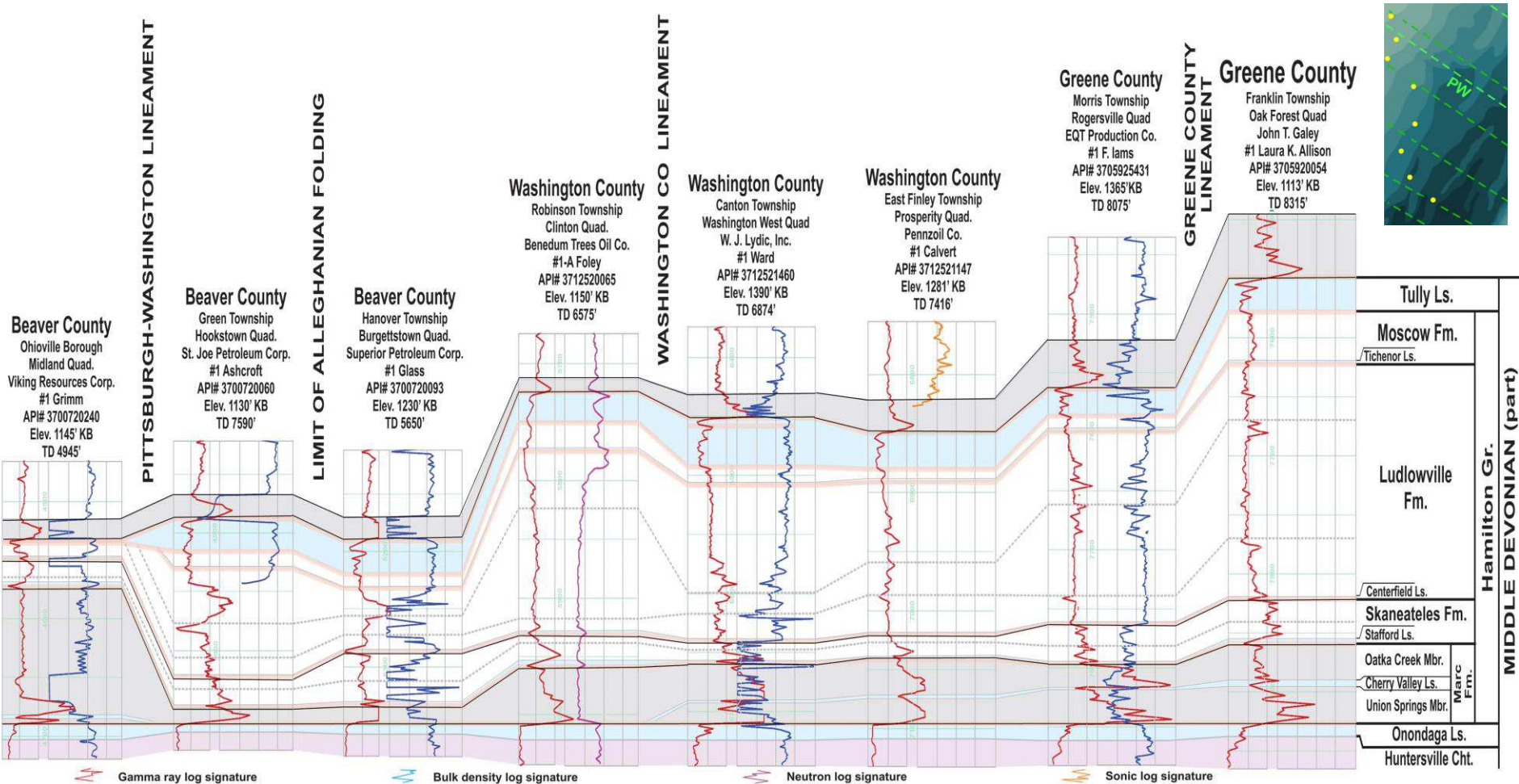
Marcellus

Cross-section inset 2 along D-D'



Marcellus

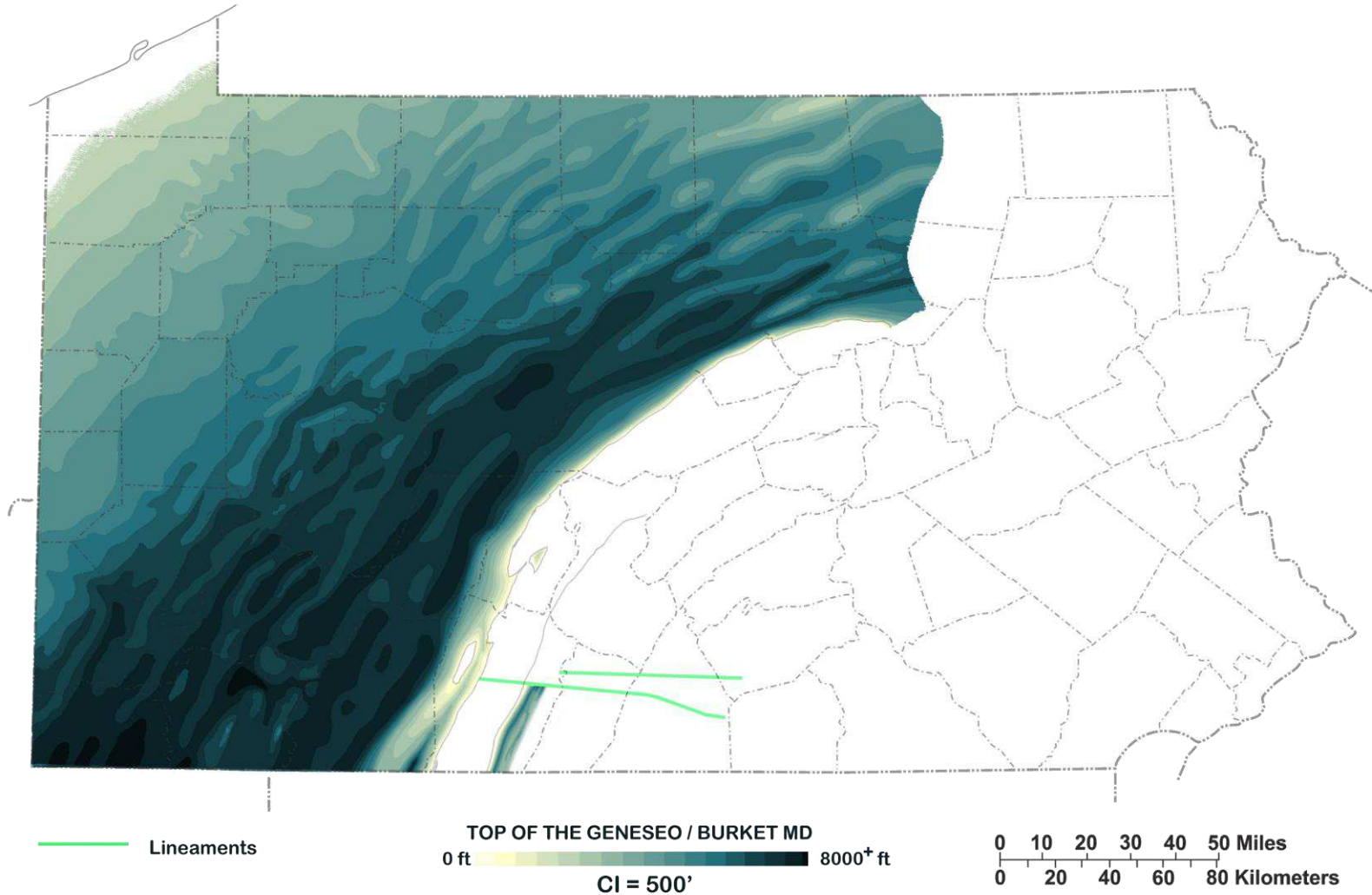
Cross-section inset 2 along D-D'



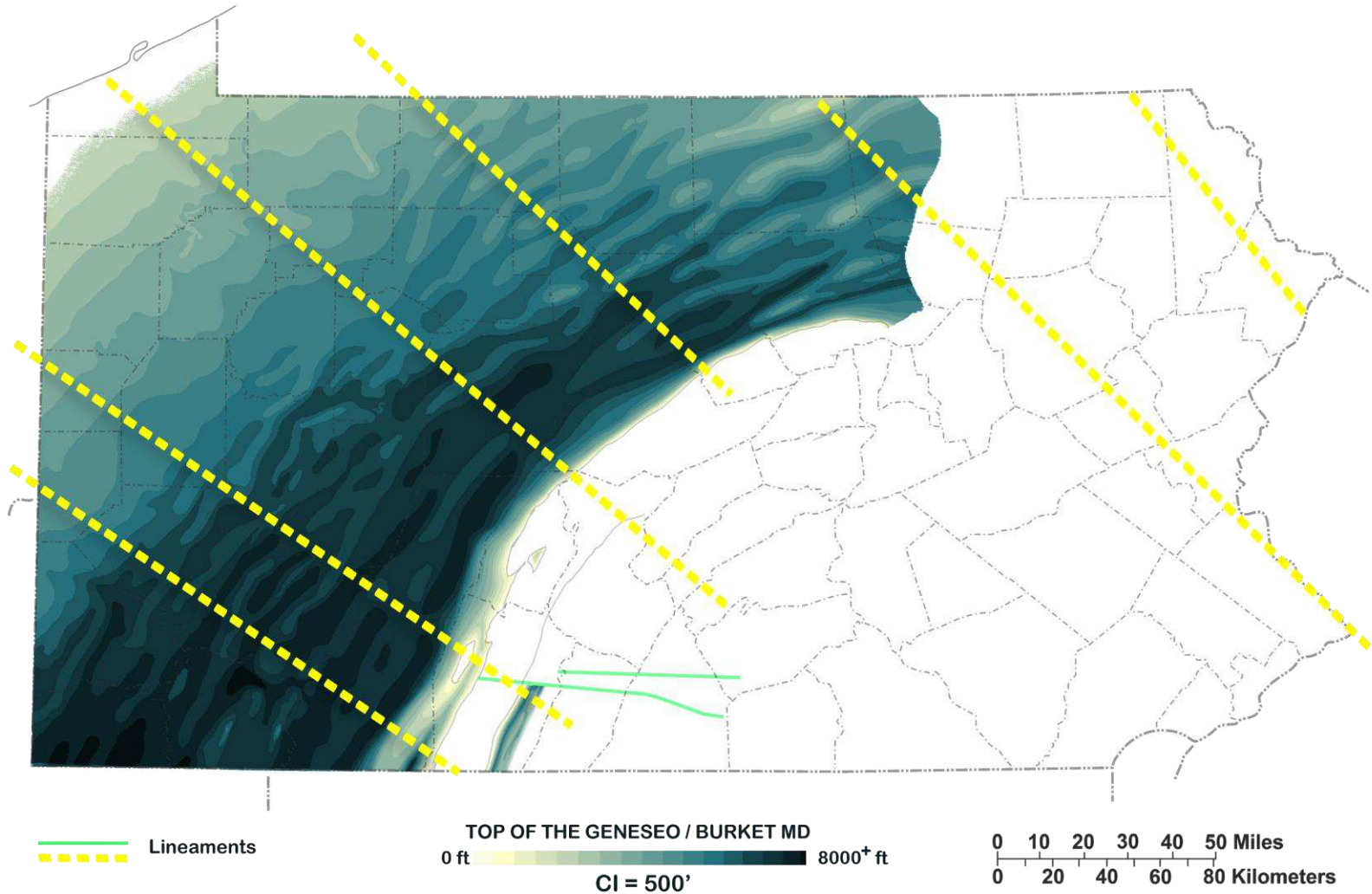
Geneseo and Burket Shales



Measured Depth to Top of Geneseo / Burket

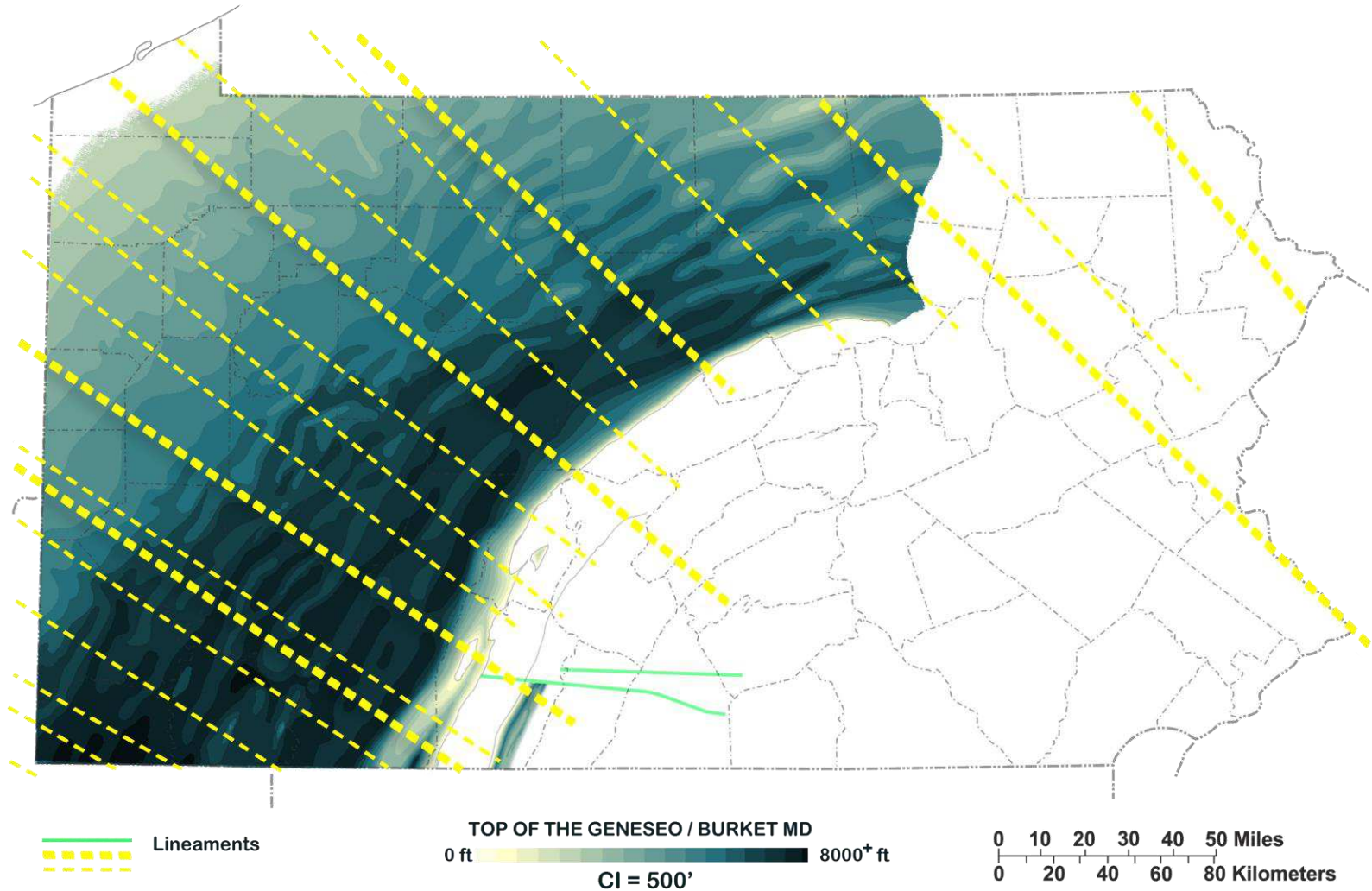


Geneseo / Burket Major Lineaments



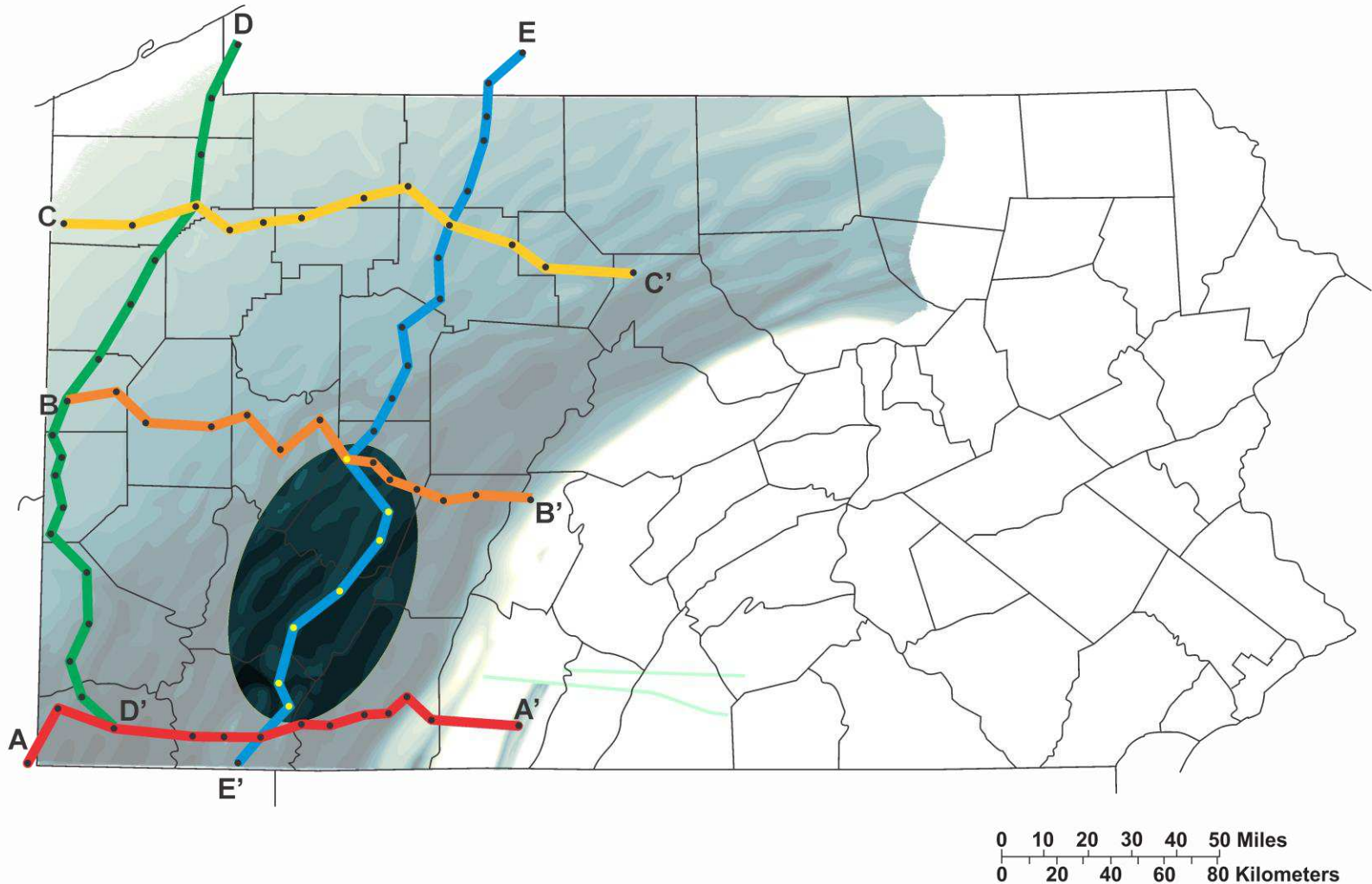
Geneseo / Burket MD

Lineaments



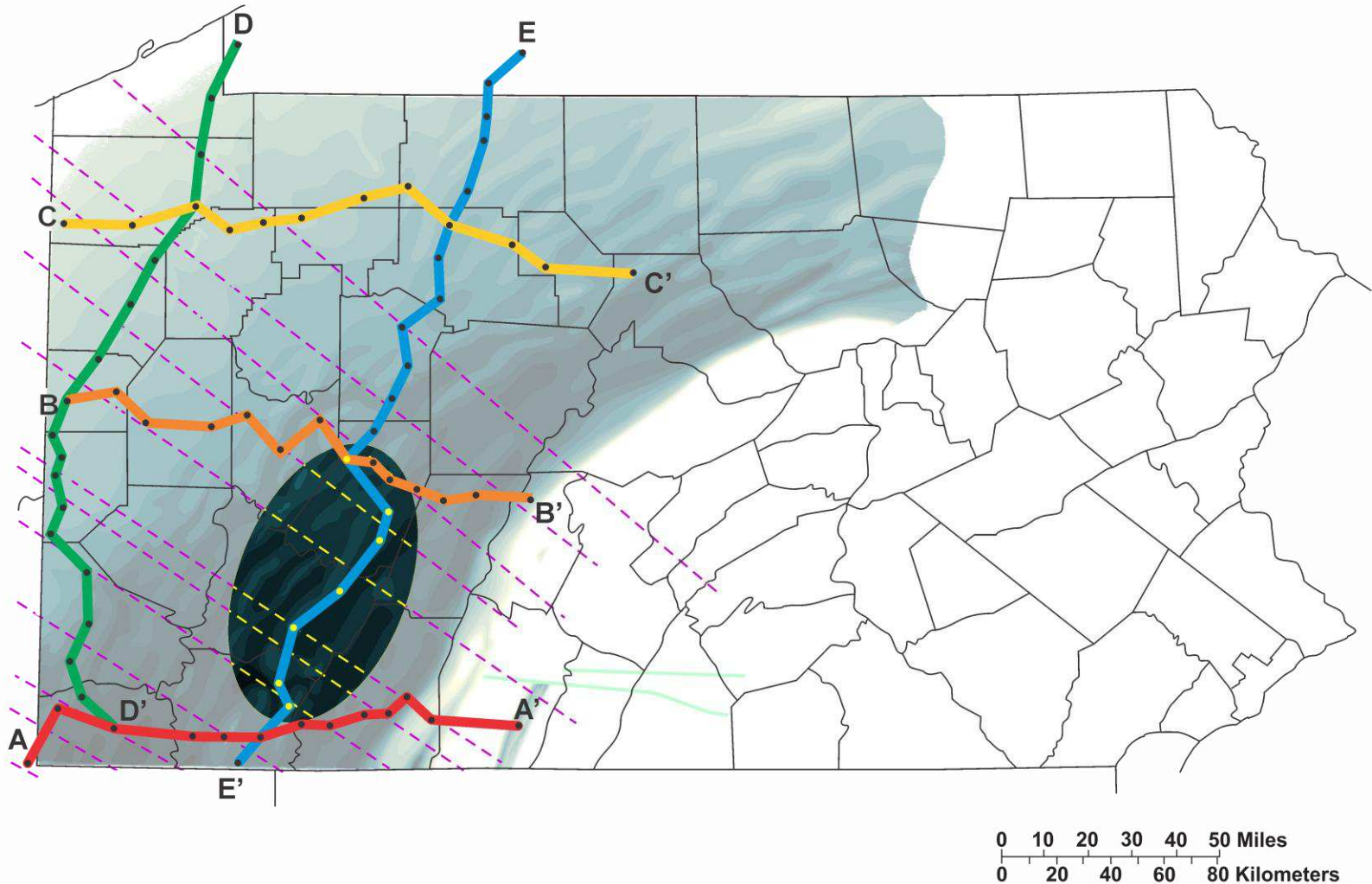
Geneseo / Burket

Cross-section inset 1 along E-E'



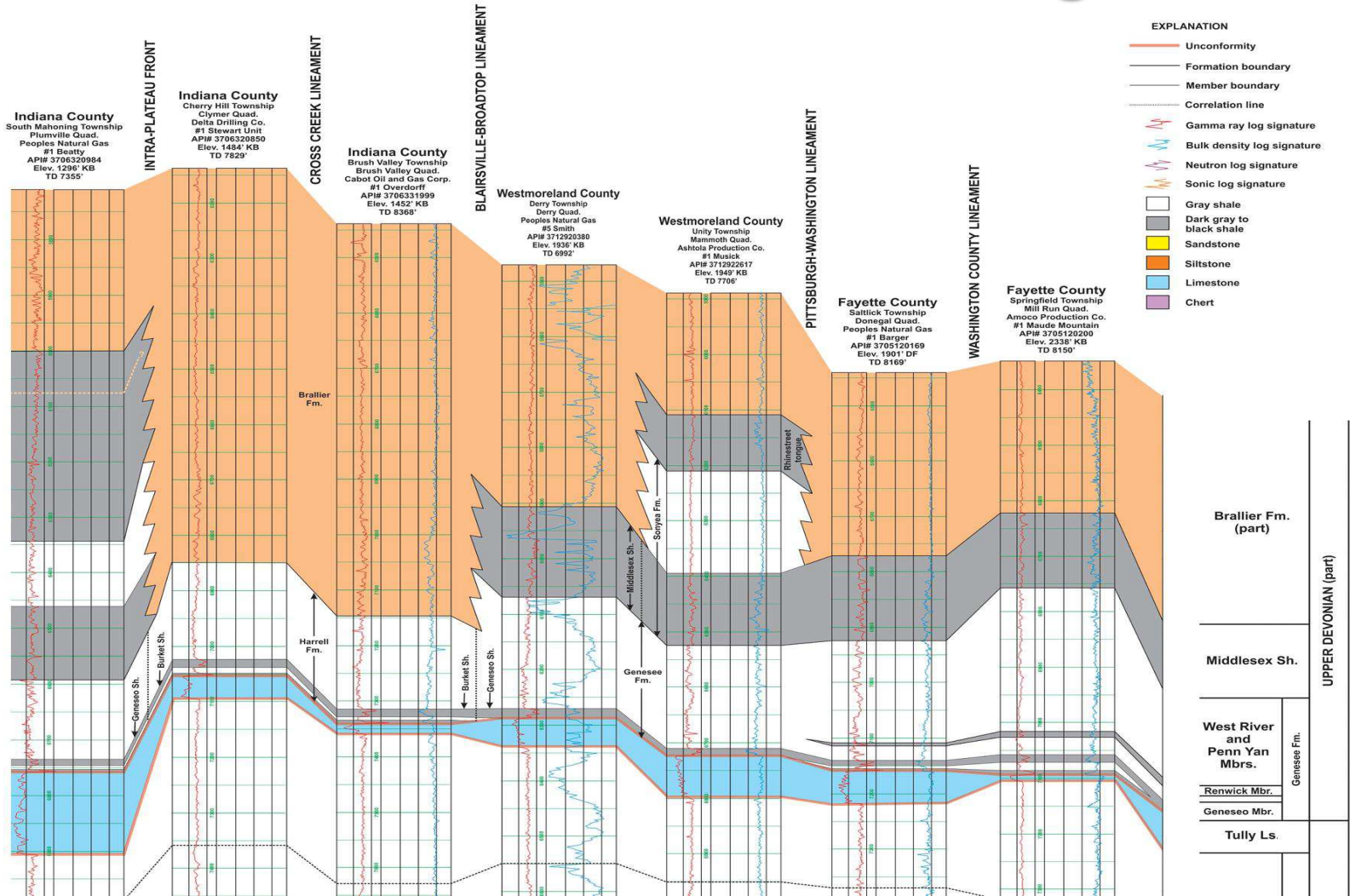
Geneseo / Burket

Cross-section inset 1 along E-E'



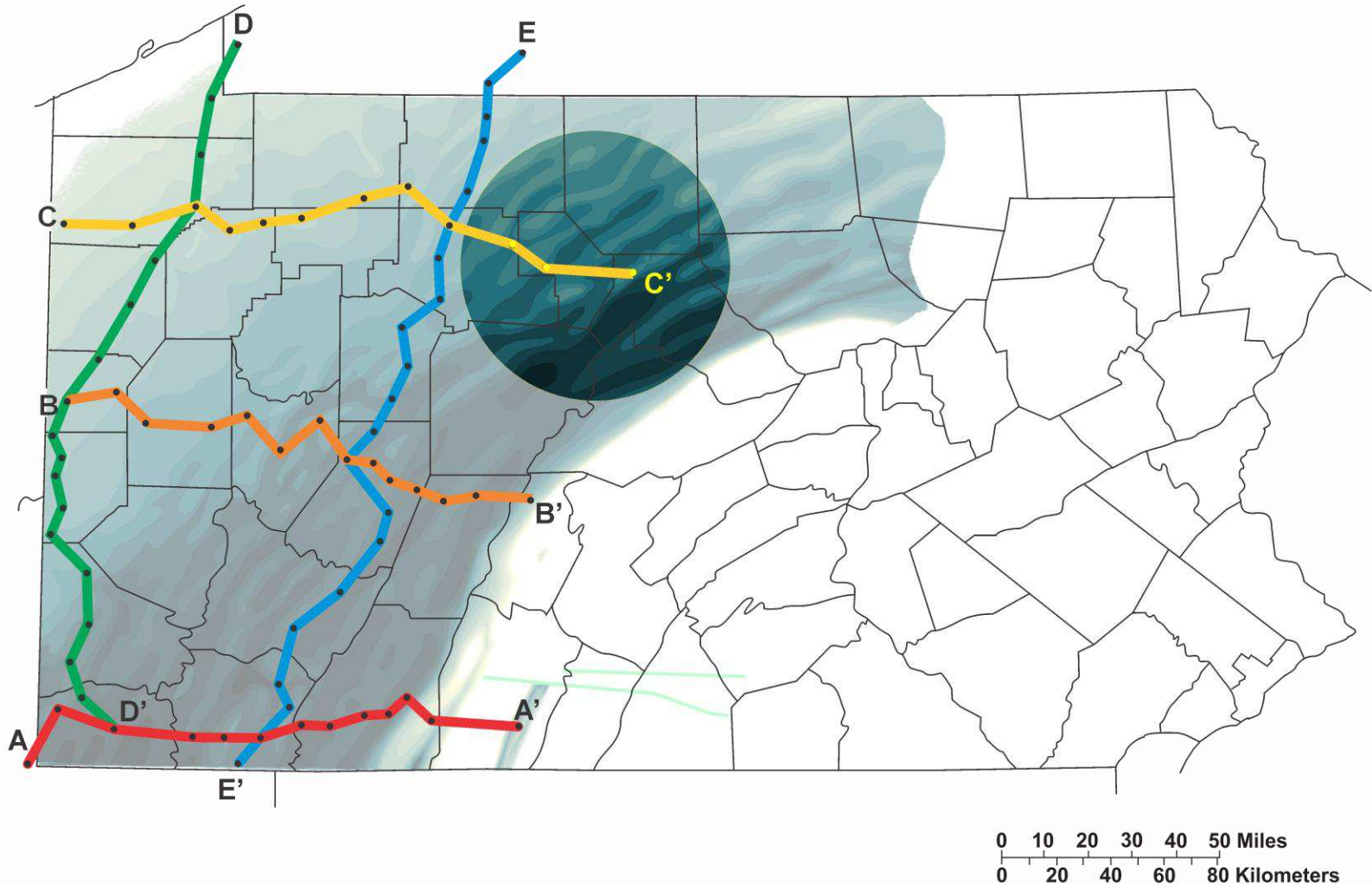
Geneseo / Burket

Cross-section Inset 1 along E-E'



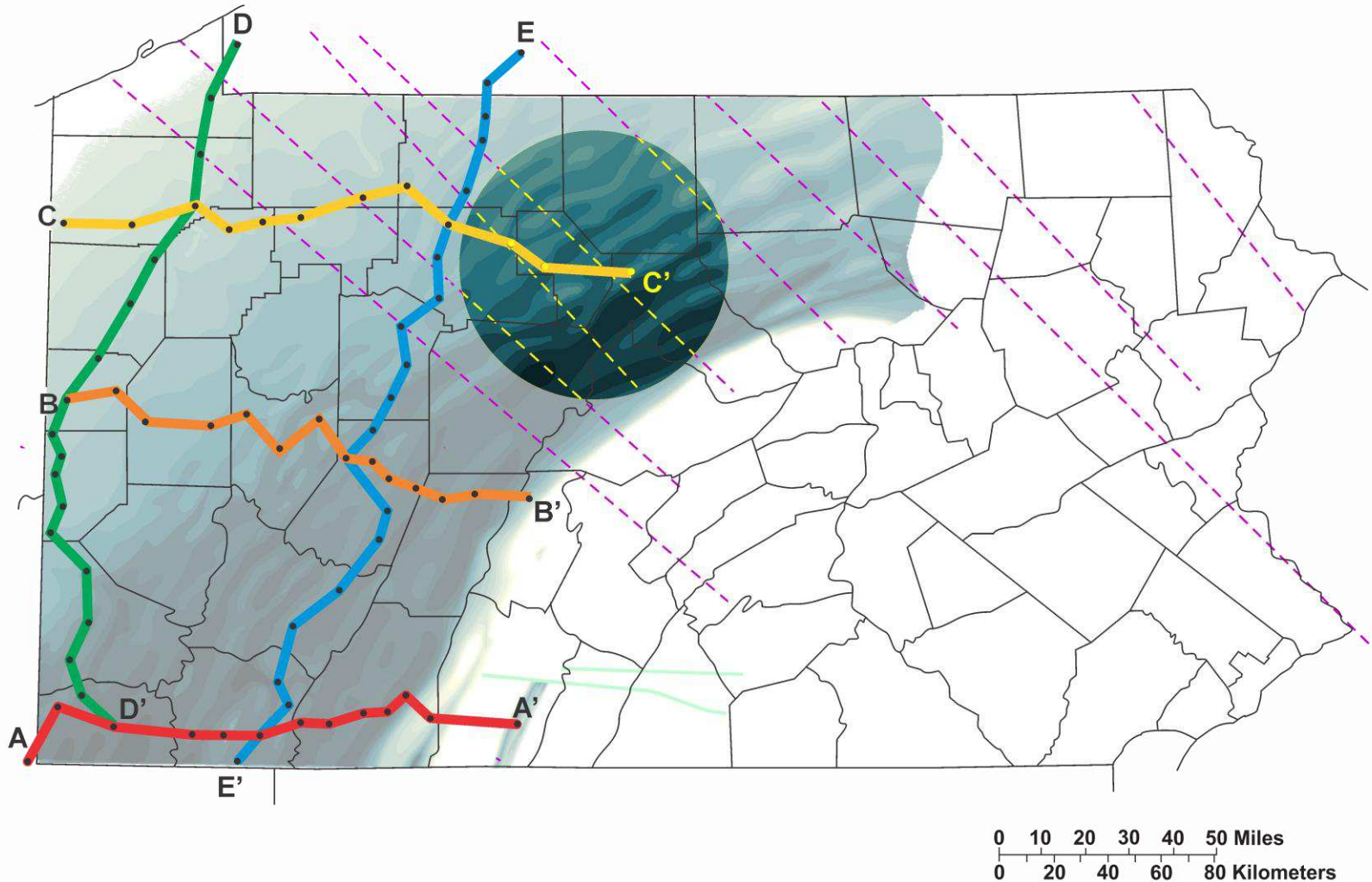
Geneseo / Burket

Cross-section inset 2 along C-C''



Geneseo / Burket

Cross-section inset 2 along C-C''

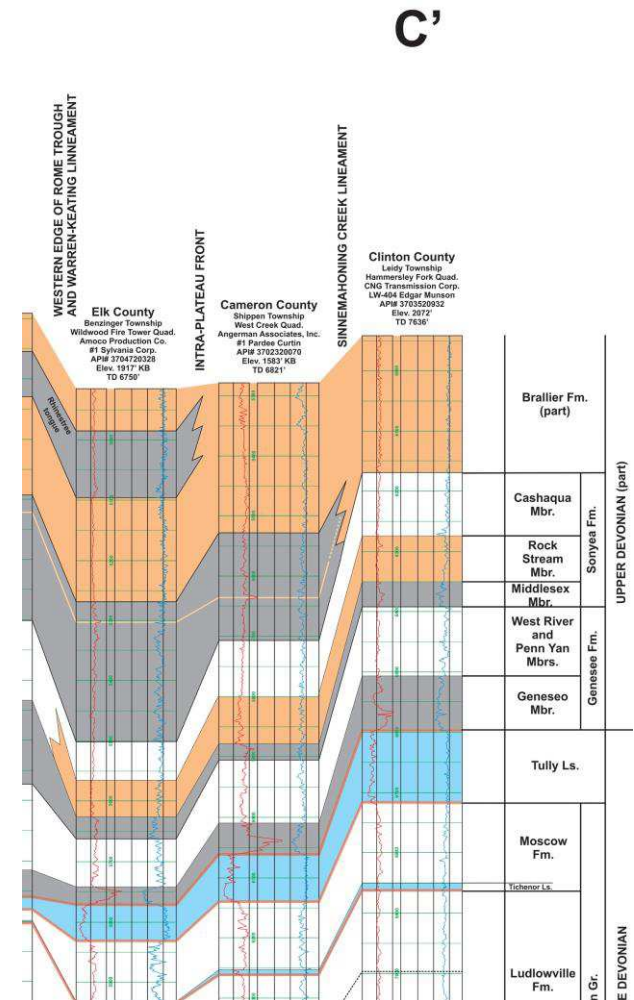


Geneseo / Burket

Cross-section

inset 2

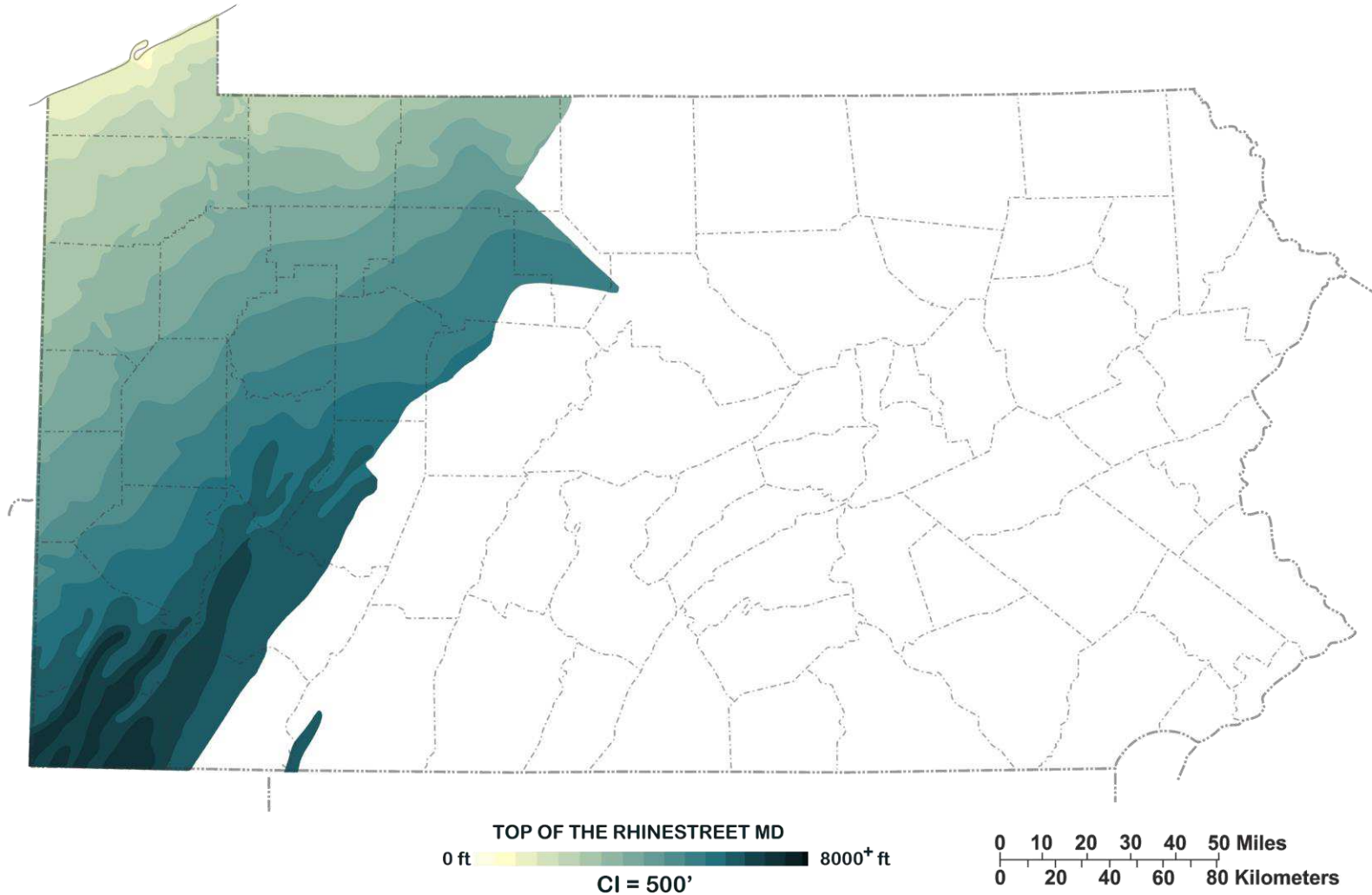
along C-C''



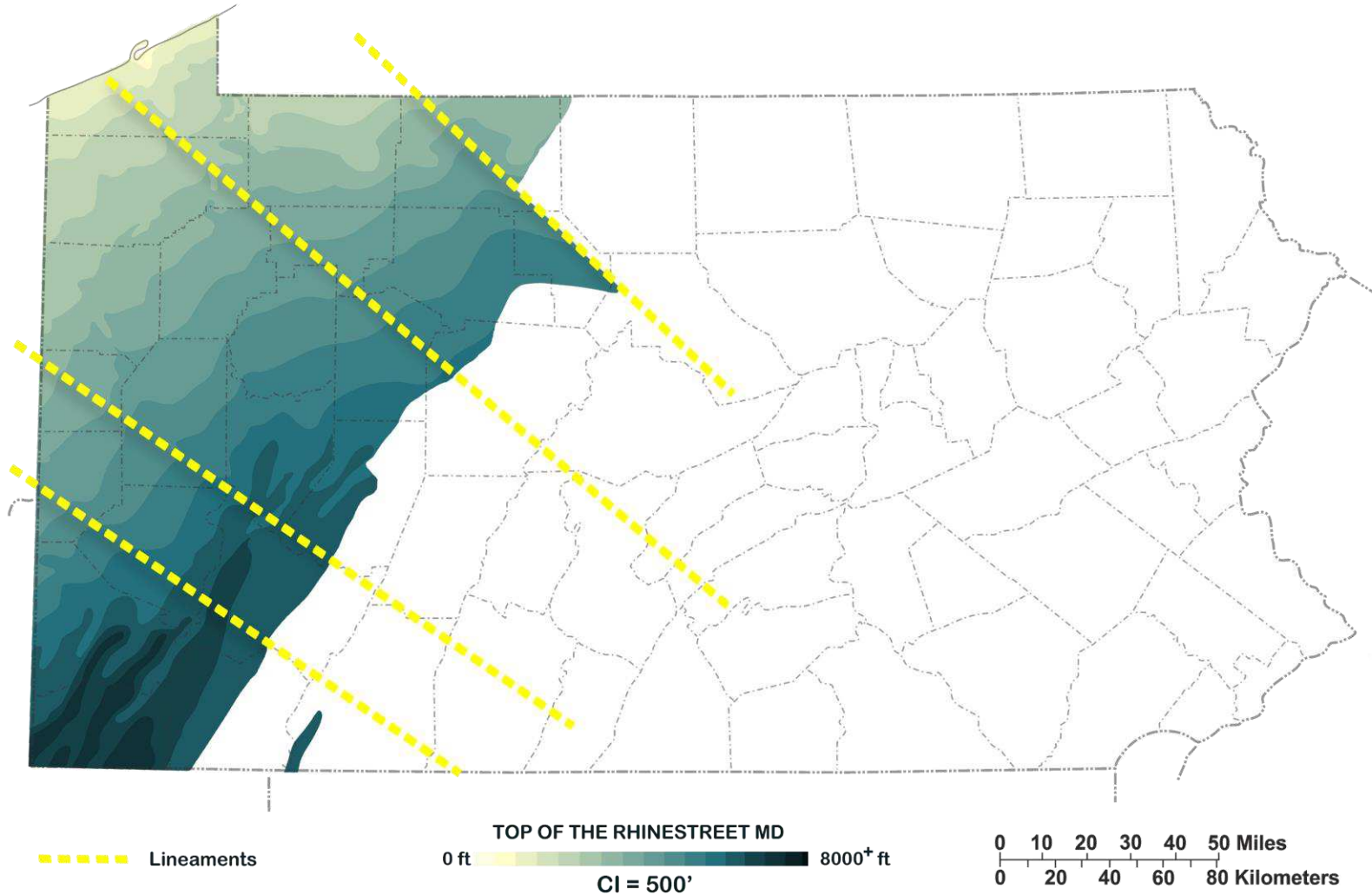
Rhinestreet Shale



Measured Depth to Top of Rhinestreet Shale

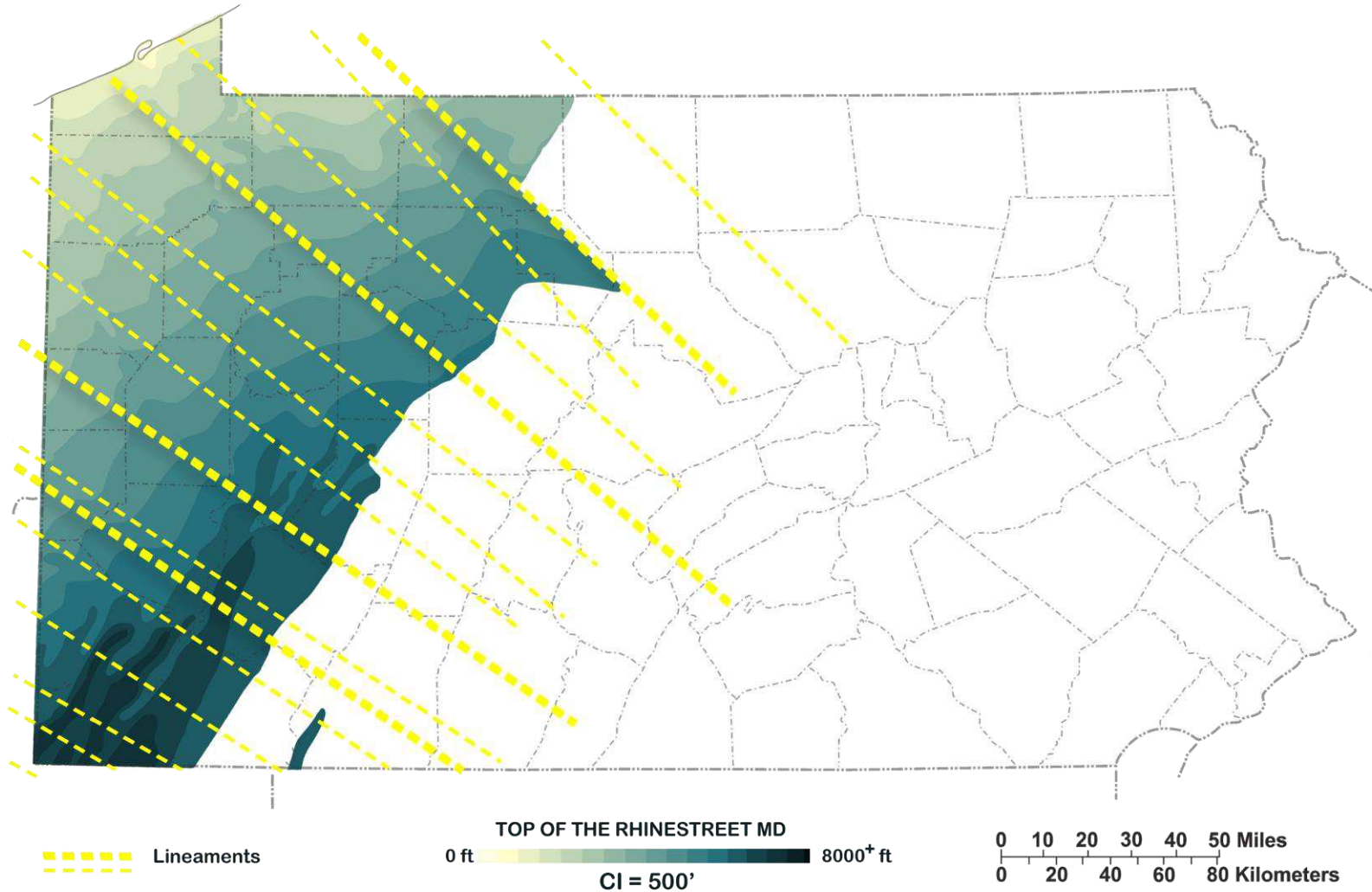


Rhinestreet Shale Major Lineaments



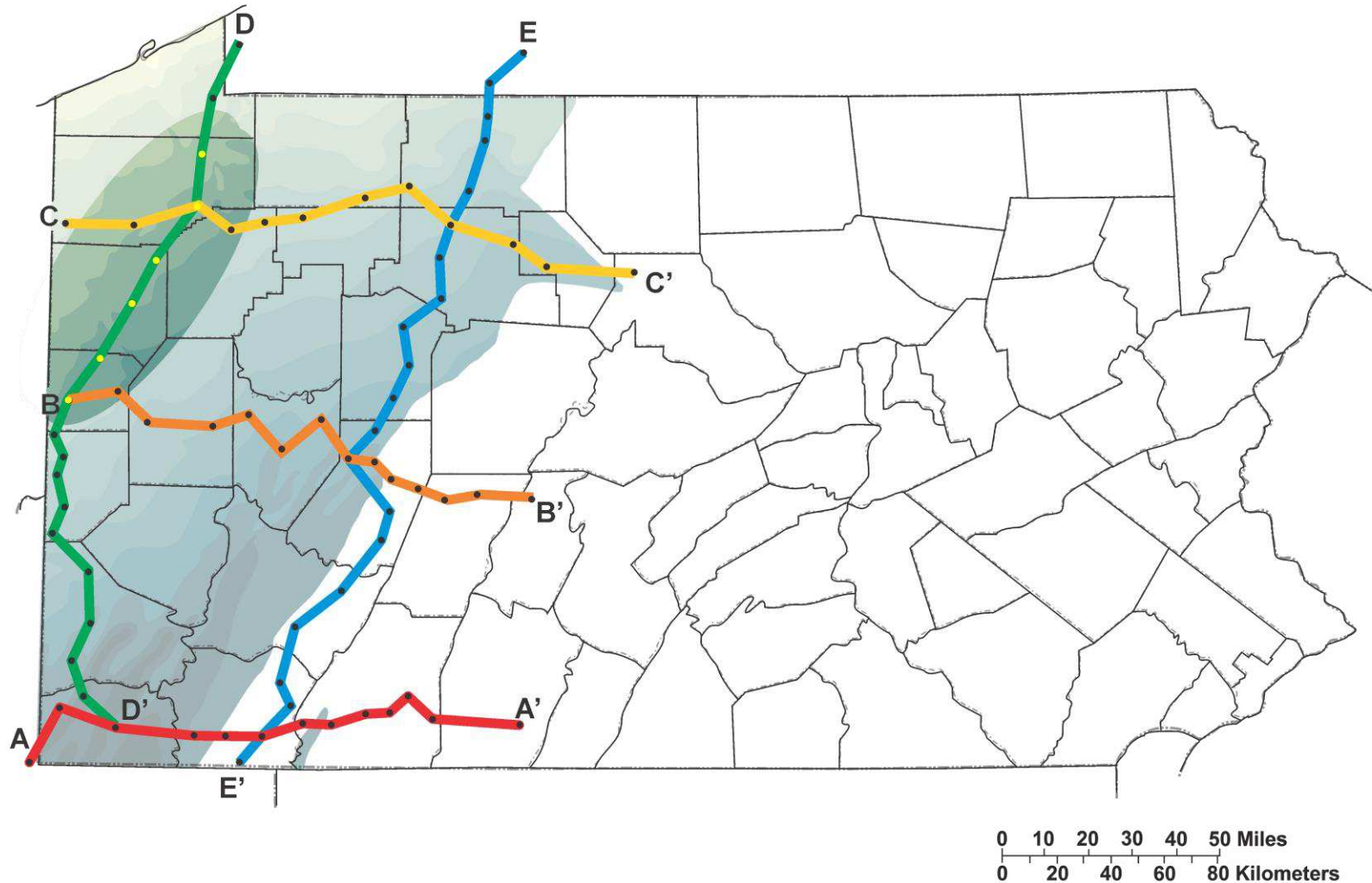
Rhinestreet Shale MD

Lineaments



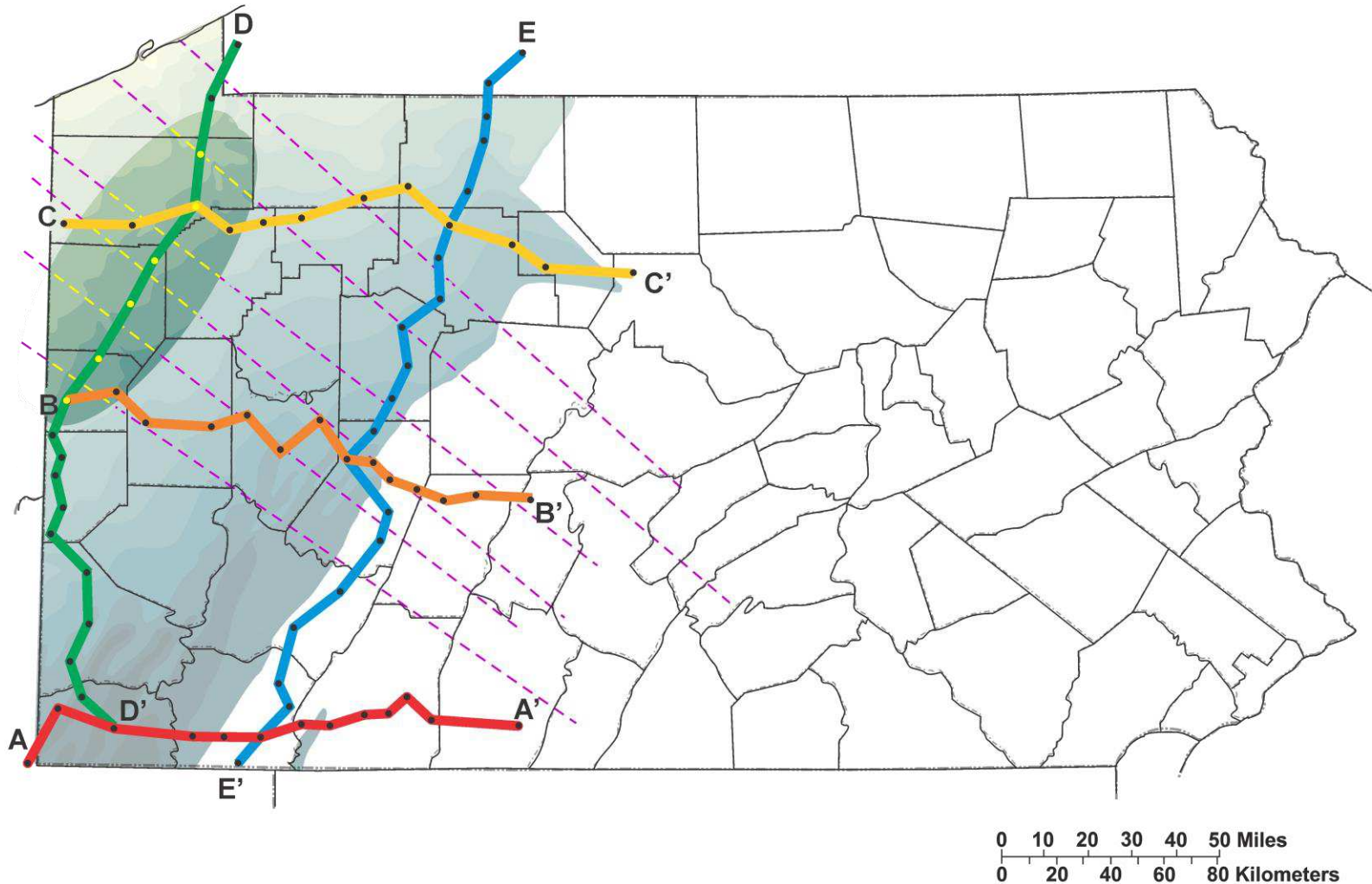
Rhinestreet Shale

Cross-section inset D – D'



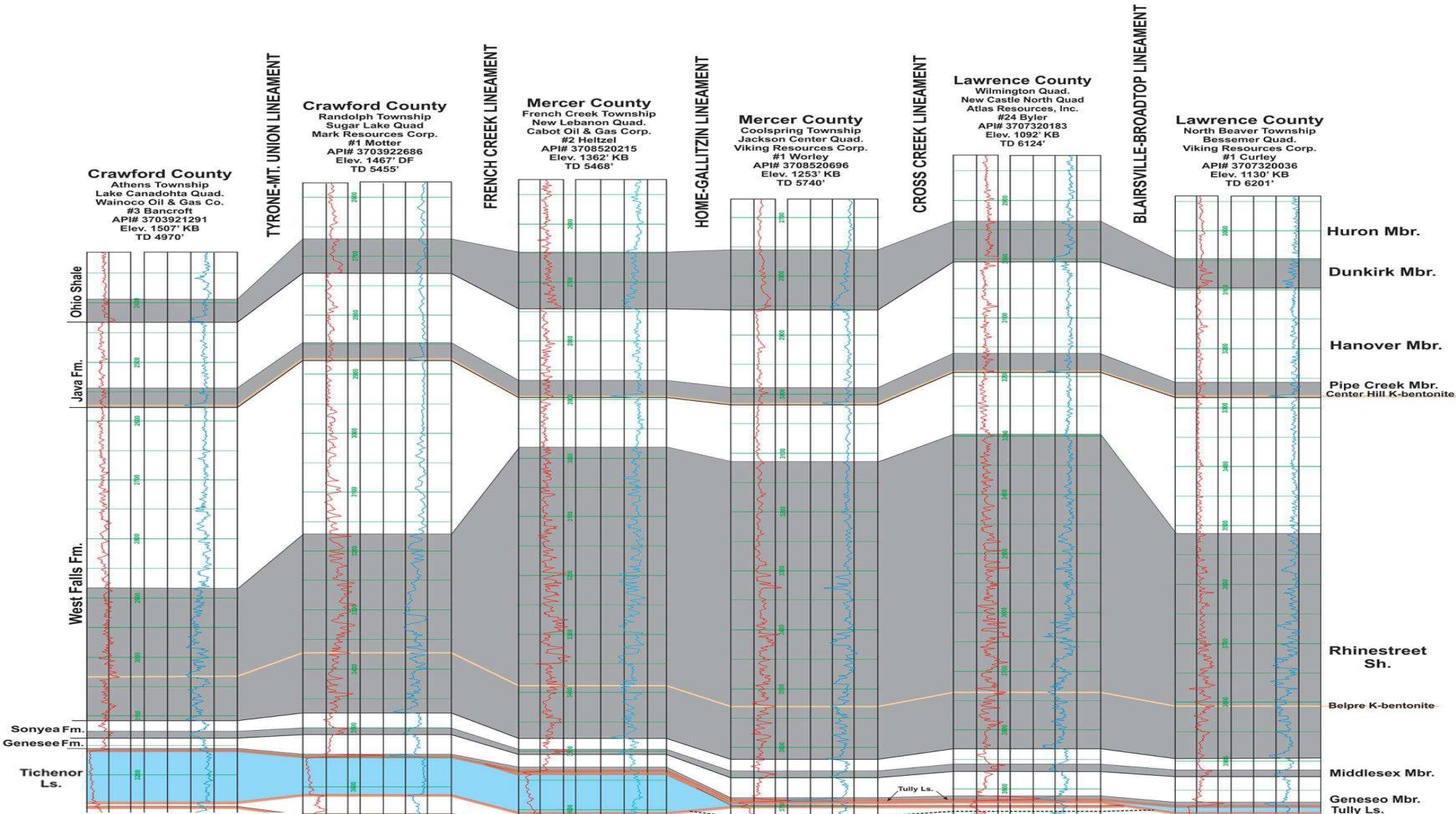
Rhinestreet Shale

Cross-section inset D – D'



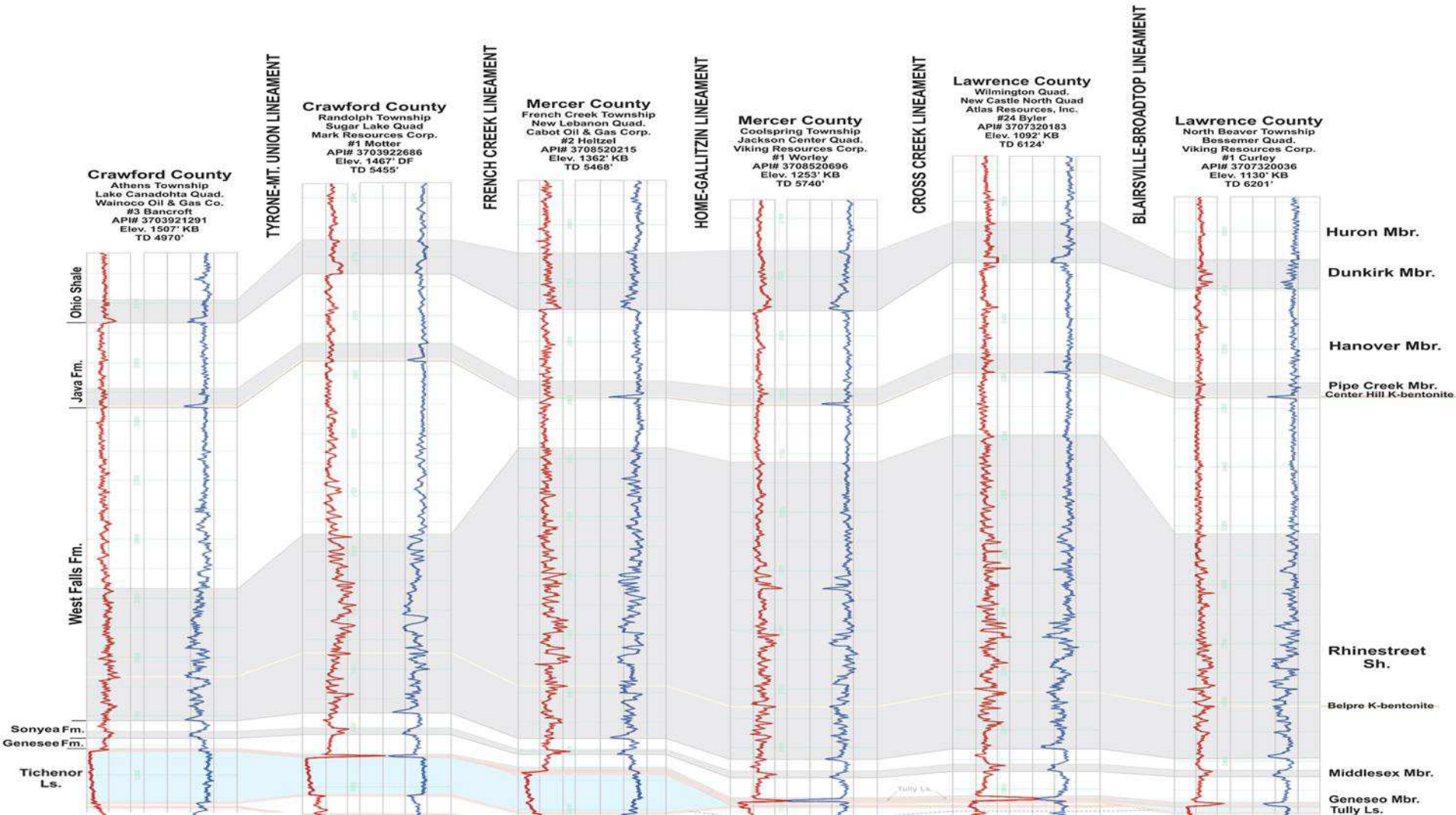
Rhinestreet / Upper Devonian shales

Cross-section Inset 1 along D-D'



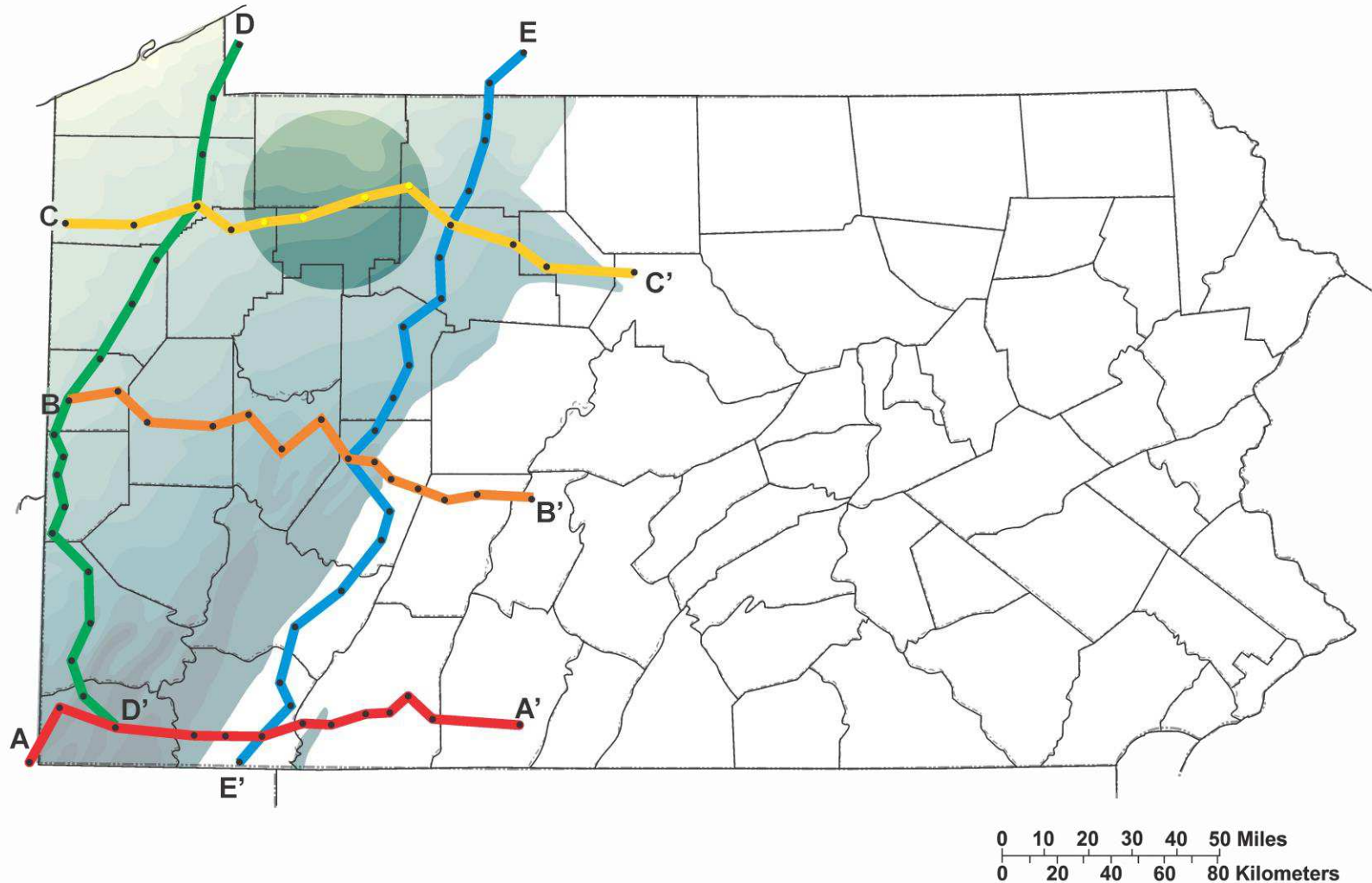
Rhinestreet / Upper Devonian shales

Cross-section Inset 1 along D-D'



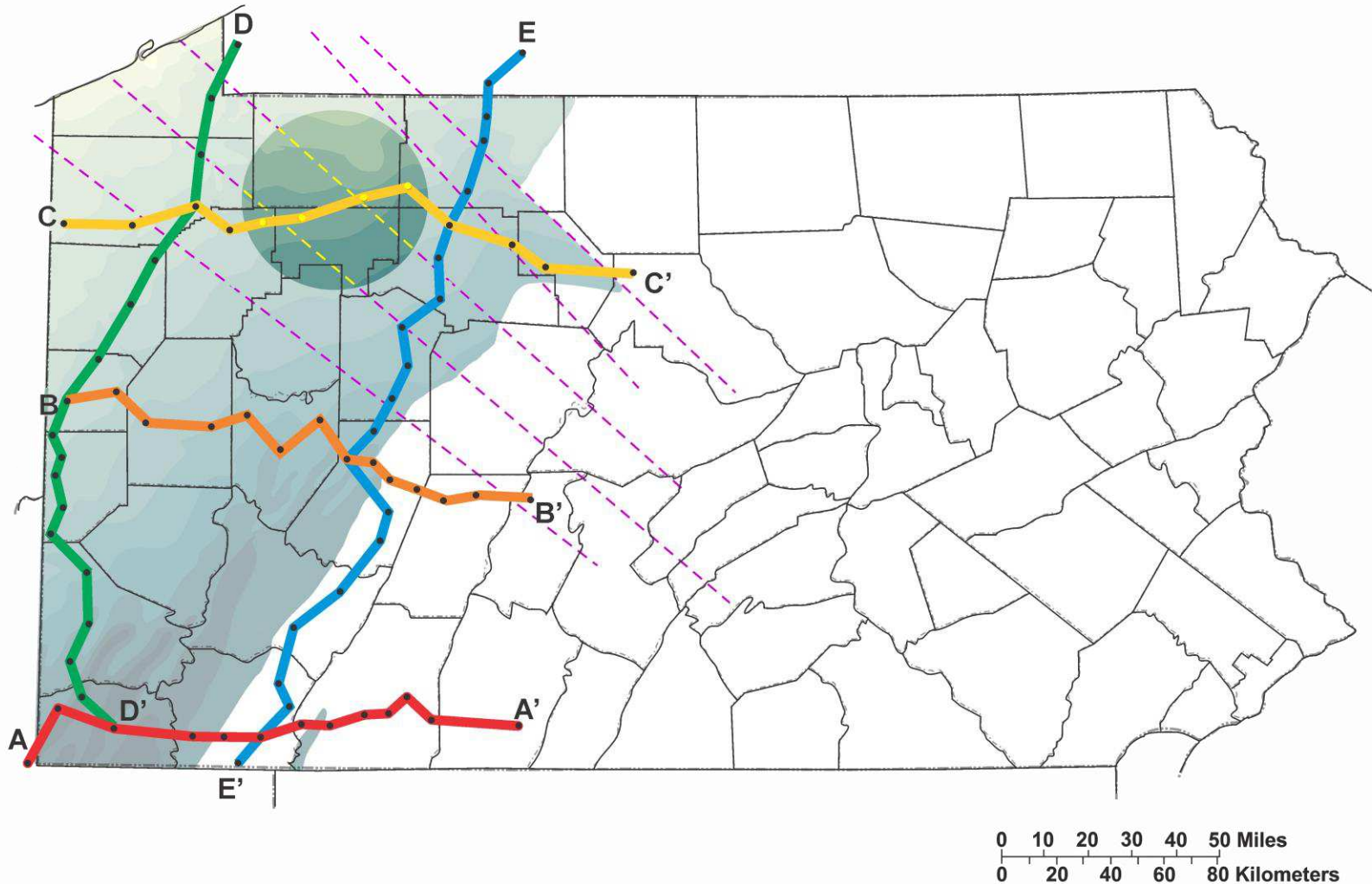
Rhinestreet Shale

Cross-section inset C – C'



Rhinestreet Shale

Cross-section inset C – C'

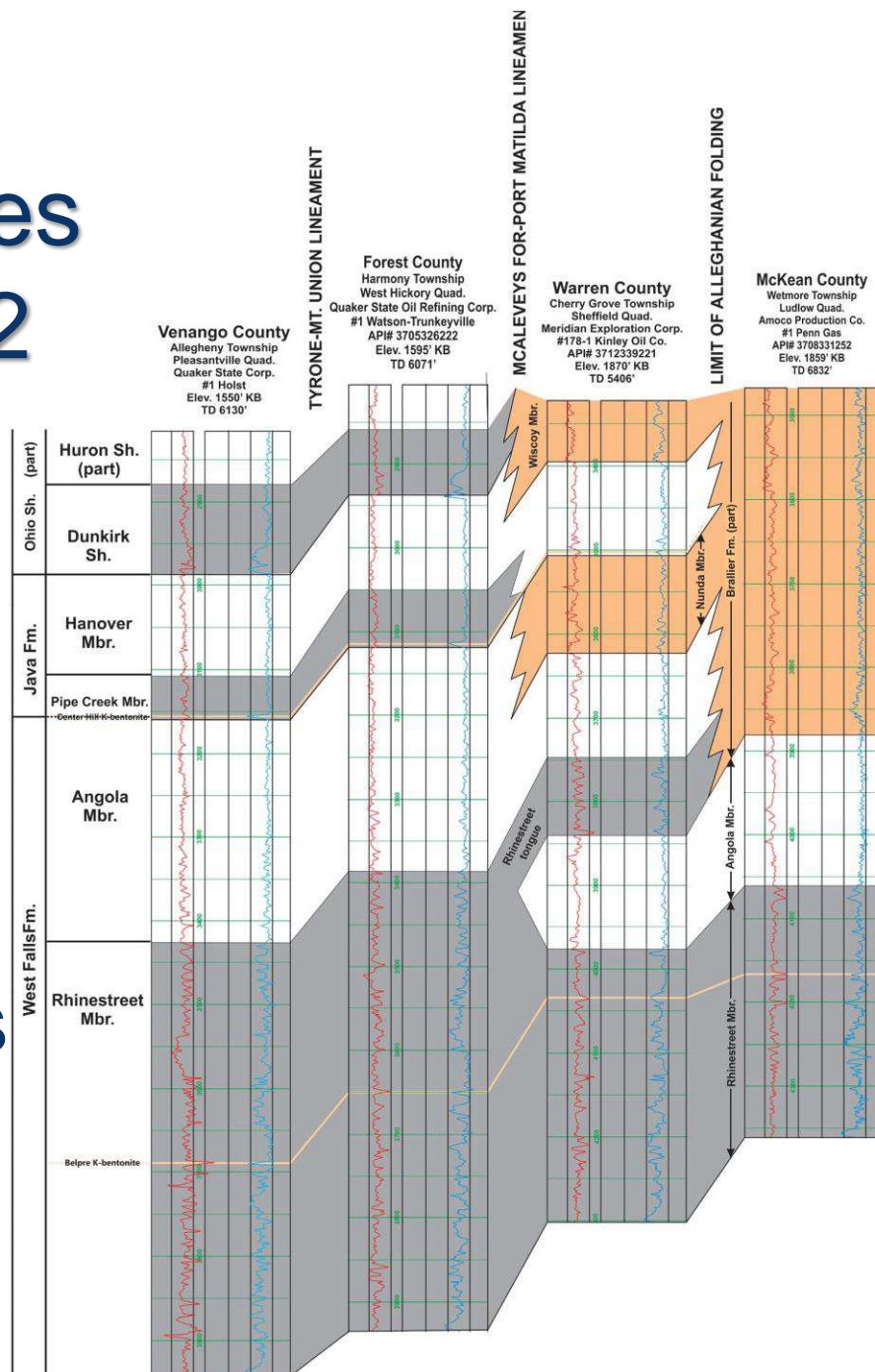


Rhinestreet

Upper Devonian shales

Cross-section inset 2 along C-C'

- Extending cross-section eastward into northern tier.
- Lineaments influence deposition, pinch-outs and TOC.



Key Points

- Builds on decades of shale research in PA
- ~3,500 wells in 41 counties
- Revised shale lithology based on modern log suite (GR/Neutron/Density)
- Revising structure and isopach maps
- Lineaments control deposition, influence TOC and diagenesis



Please visit the MRCSP website to
download our work:

<http://www.mrcsp.org/regional-validation>

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