Structural Geometry of the Frontal Ouachita-Arkoma Basin Transition Zone in Western Arkansas*

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Abstract

The Choctaw Fault and Ross Creek Fault are the leading-edge thrusts of the Ouachita fold-thrust belt and form the southern boundary of the Arkoma foreland basin in Oklahoma and Arkansas, respectively. Strain partitioning between the fold-thrust belt and the foreland basin is accommodated by the Wilburton Triangle Zone in the footwall of the Choctaw Fault of Oklahoma; however, few studies document the geometry of Ouachita-Arkoma transition zone in Arkansas. This study uses depth-converted 2-D seismic reflection profiles and well log data to clarify the subsurface structure and establish the presence or lack of triangle zone elements within the accommodation zone between the Choctaw Fault and Ross Creek Fault in north-central Scott County, western Arkansas. Structural interpretation of three depth-converted 2-D seismic profiles shows a triangle zone containing the surficial tip-out of the Choctaw Fault in the footwall of the Ross Creek Fault. This triangle zone is called the Waldron Triangle Zone after nearby Waldron, Arkansas, and is composed of three stacked wedges that share a roof thrust, the north-dipping lower Atokan Decollement, which meets a floor thrust, the south-dipping Stanley Decollement, at a tip line below the Poteau Syncline. Knowledge of accommodation zone structure predicts that the Waldron Triangle Zone dies out west of the seismic data into Oklahoma and coincides with the formation of the laterally equivalent Wilburton Triangle Zone.

References Cited

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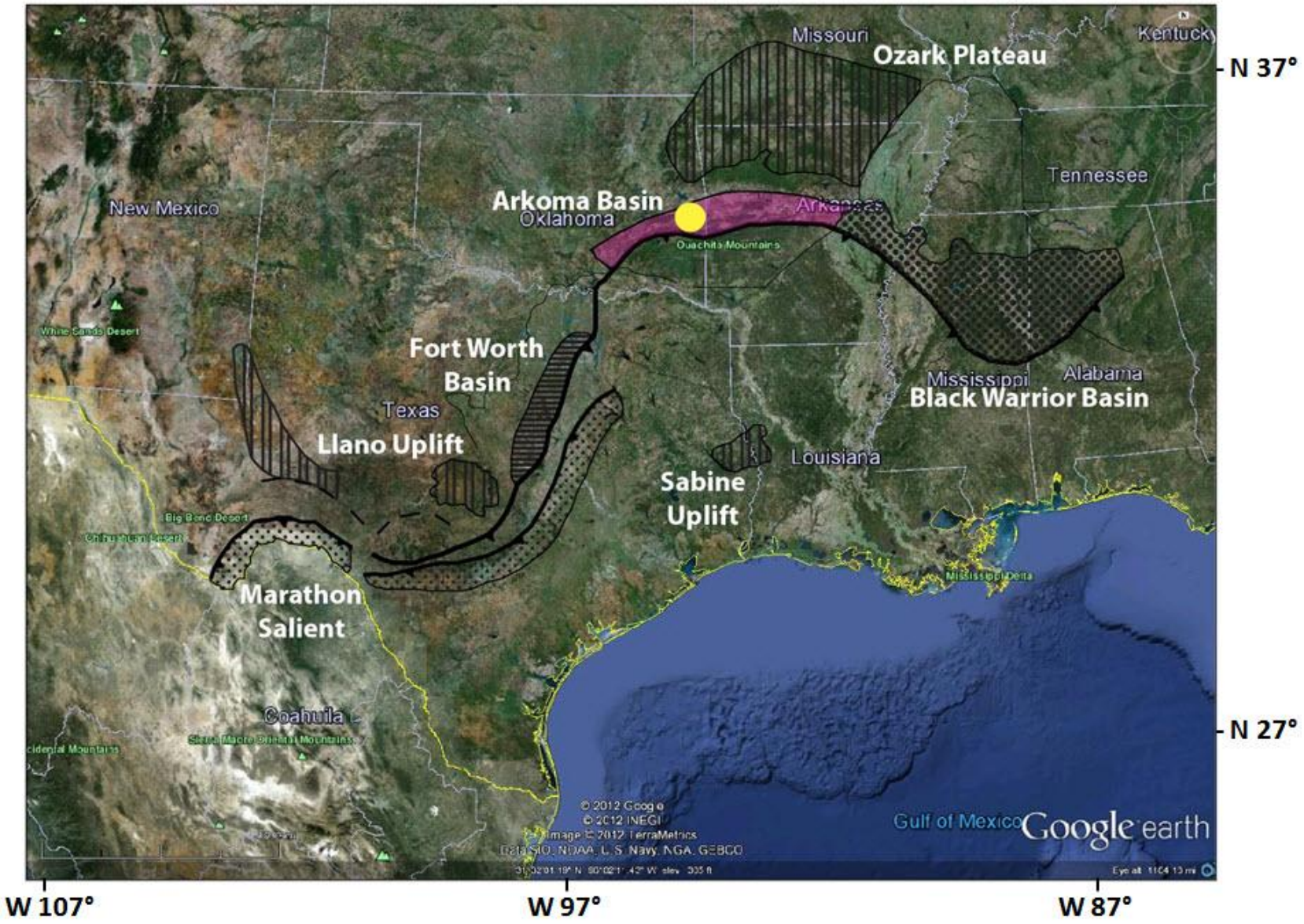
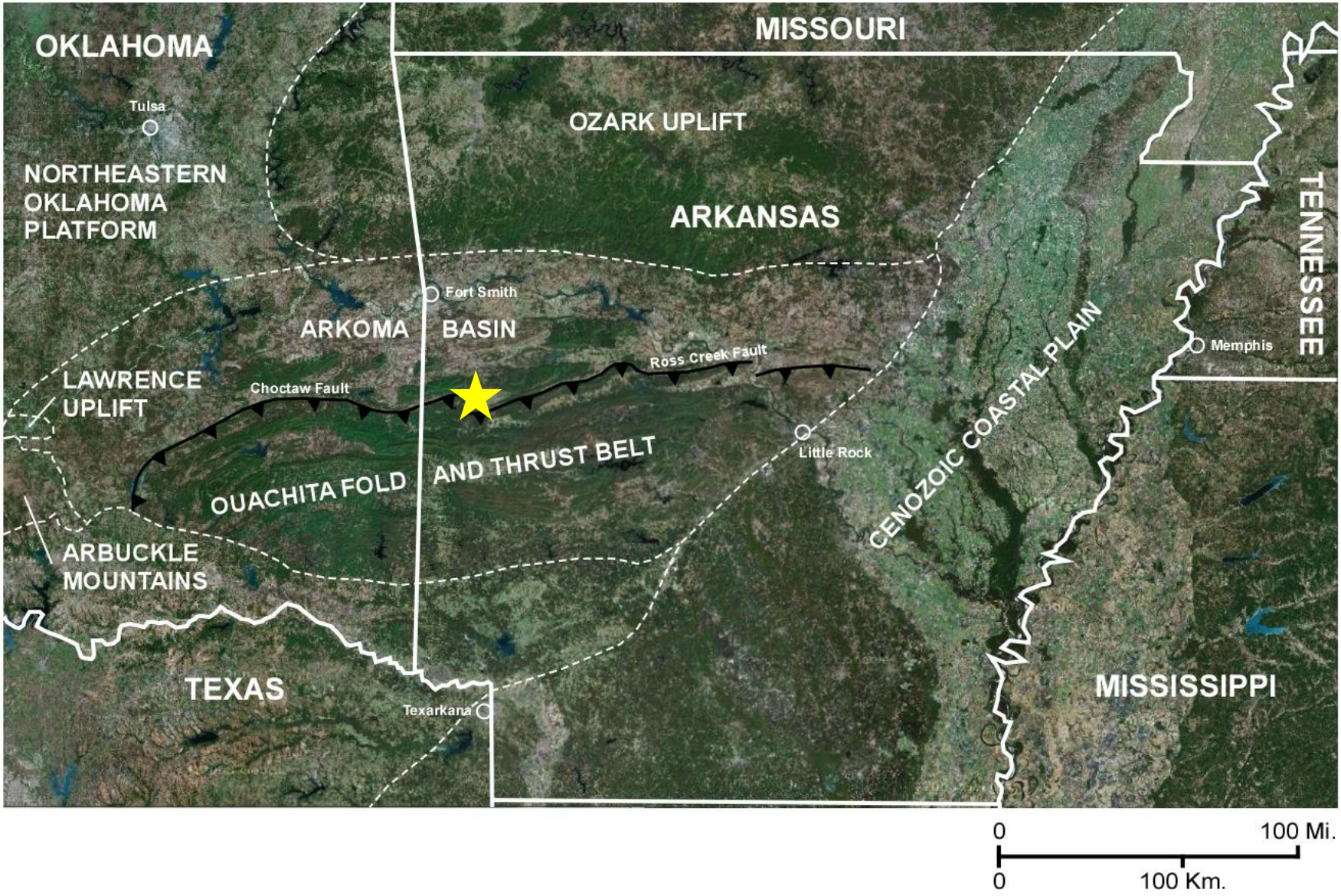
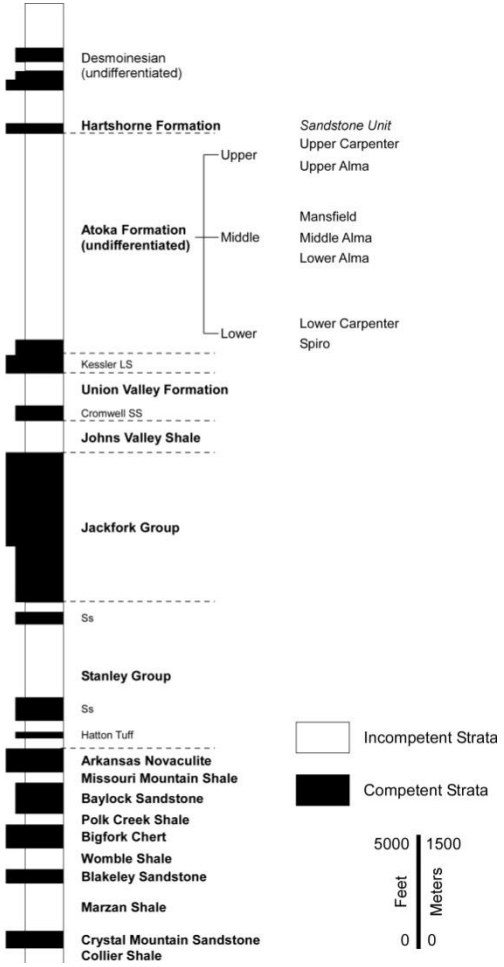


The Arkoma basin is a foreland basin of the Ouachita fold and thrust belt formed during the Pennsylvanian Ouachita Orogeny.



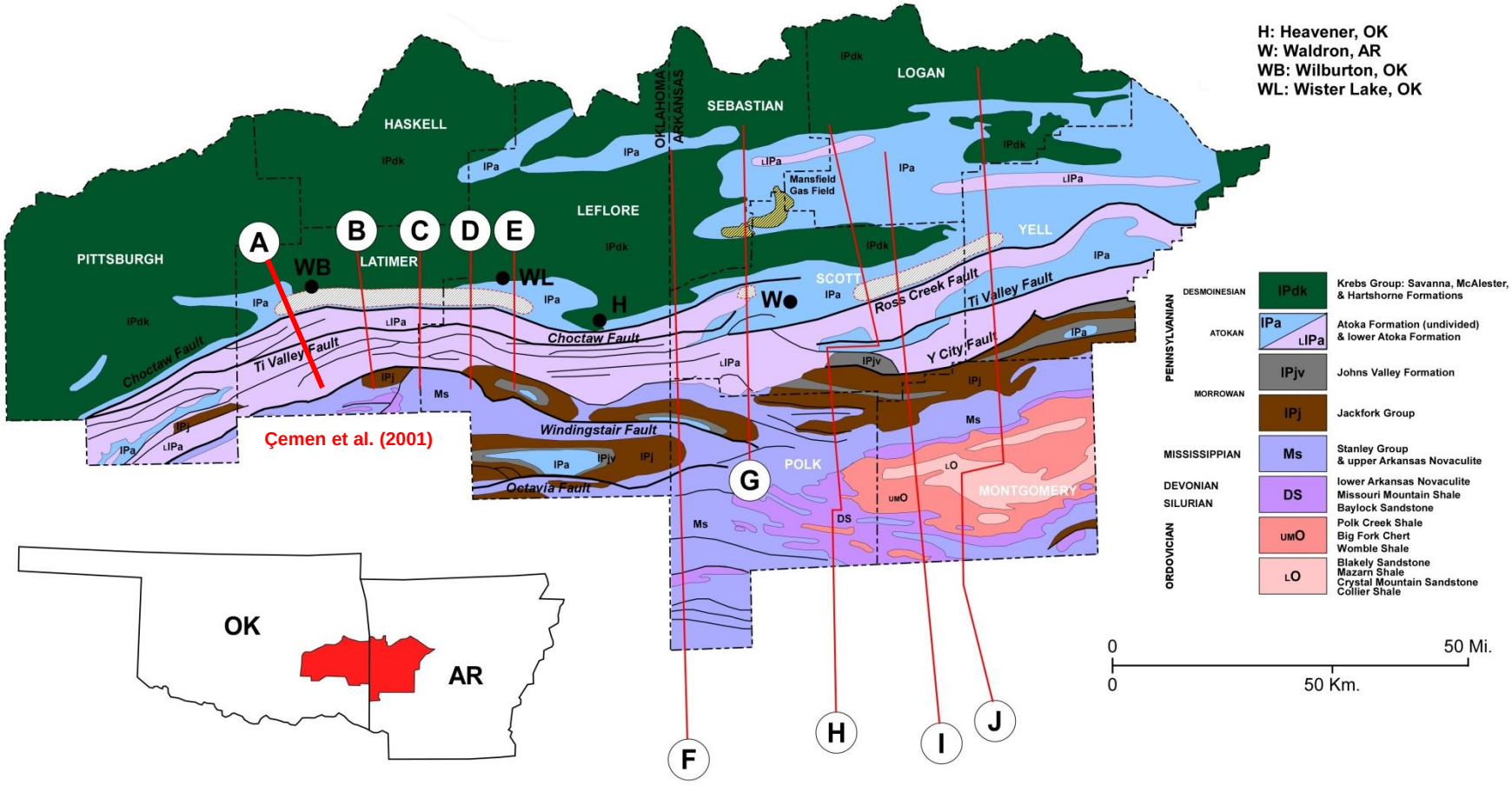
Modified from Sutherland (1988); Satellite imagery from GoogleEarth

Stratigraphy



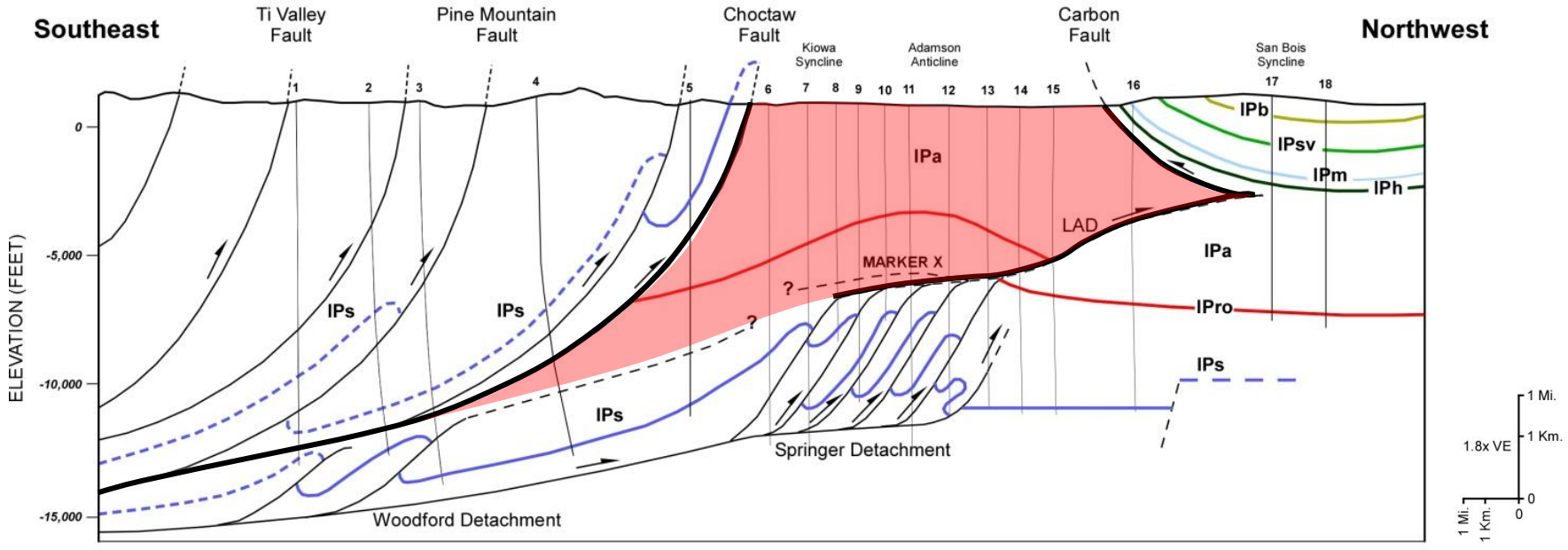
Modified from Arbenz (2004)

Ouachita-Arkoma Transition Zone



Modified from the Geologic Highway Map of the Midcontinent (1966)

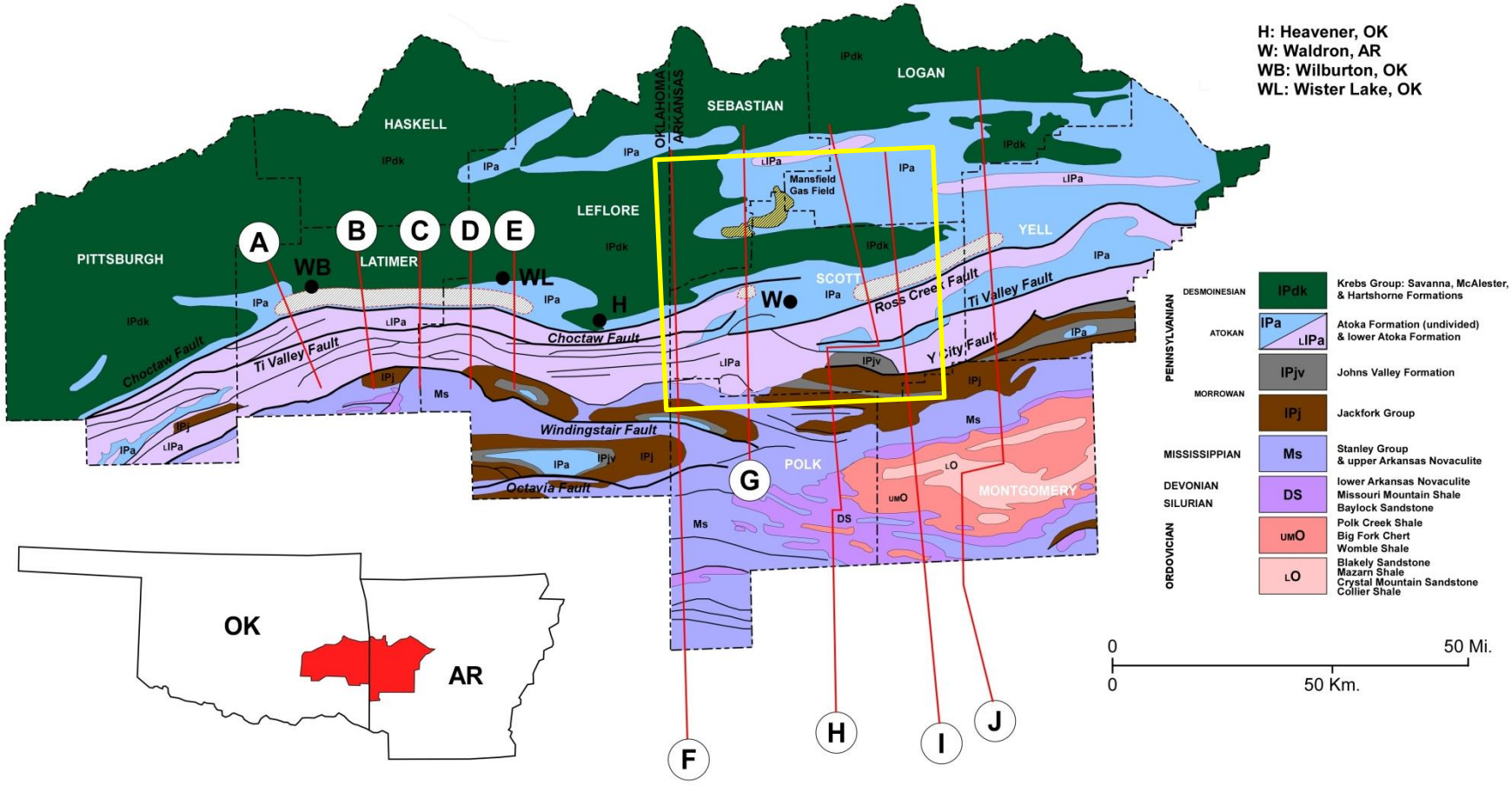
The Wilburton Triangle Zone



LAD: Lower Atokan Detachment **IPb**: Boggy Formation **IPsv**: Savanna Formation **IPm**: McAlister Formation
IPh: Hartshorne Formation **IPa**: Atoka Formation **IPro**: Red Oak Sandstone **IPs**: Spiro Sandstone

Modified from Çemen et al. (2001)

Study Area



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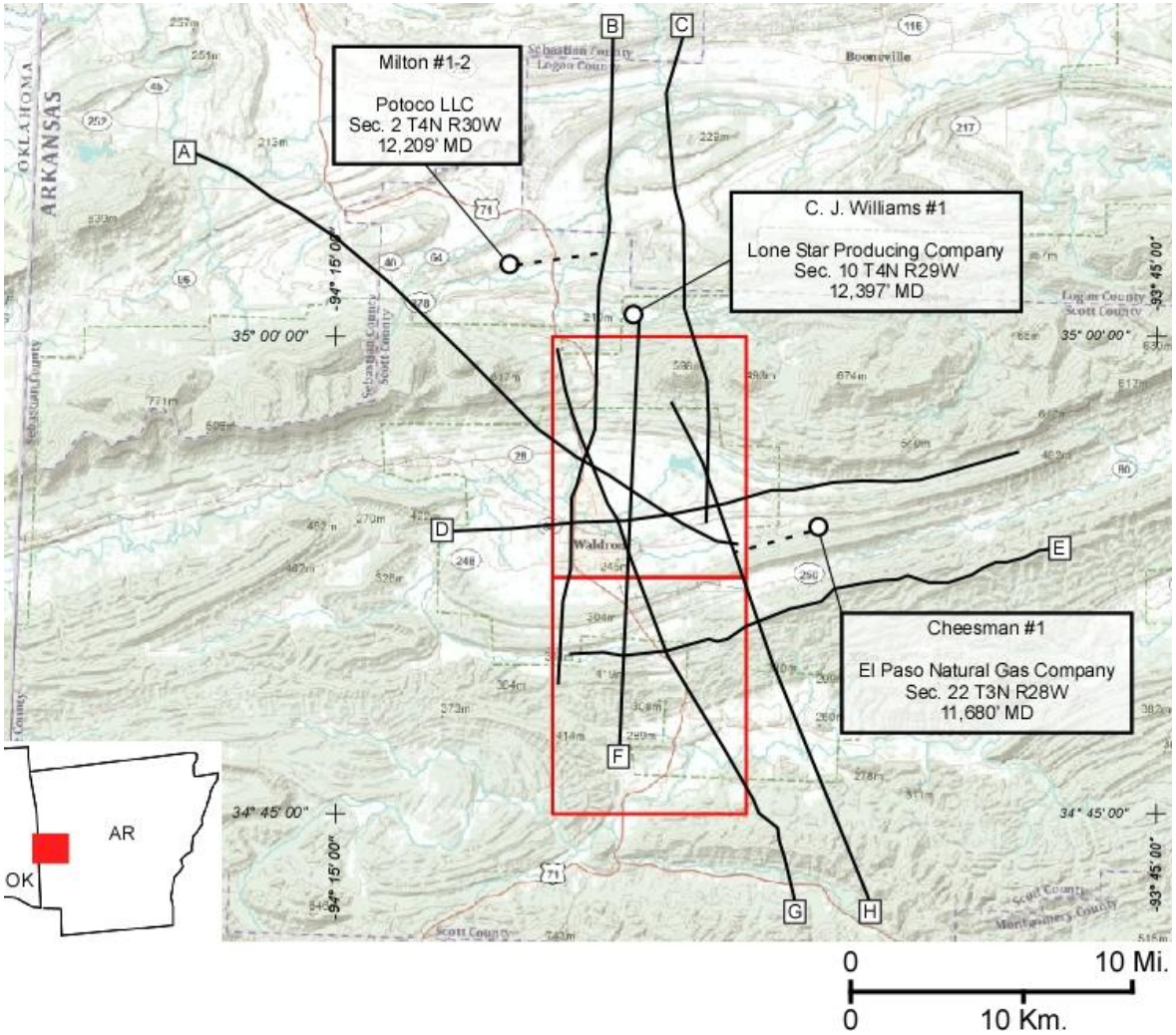
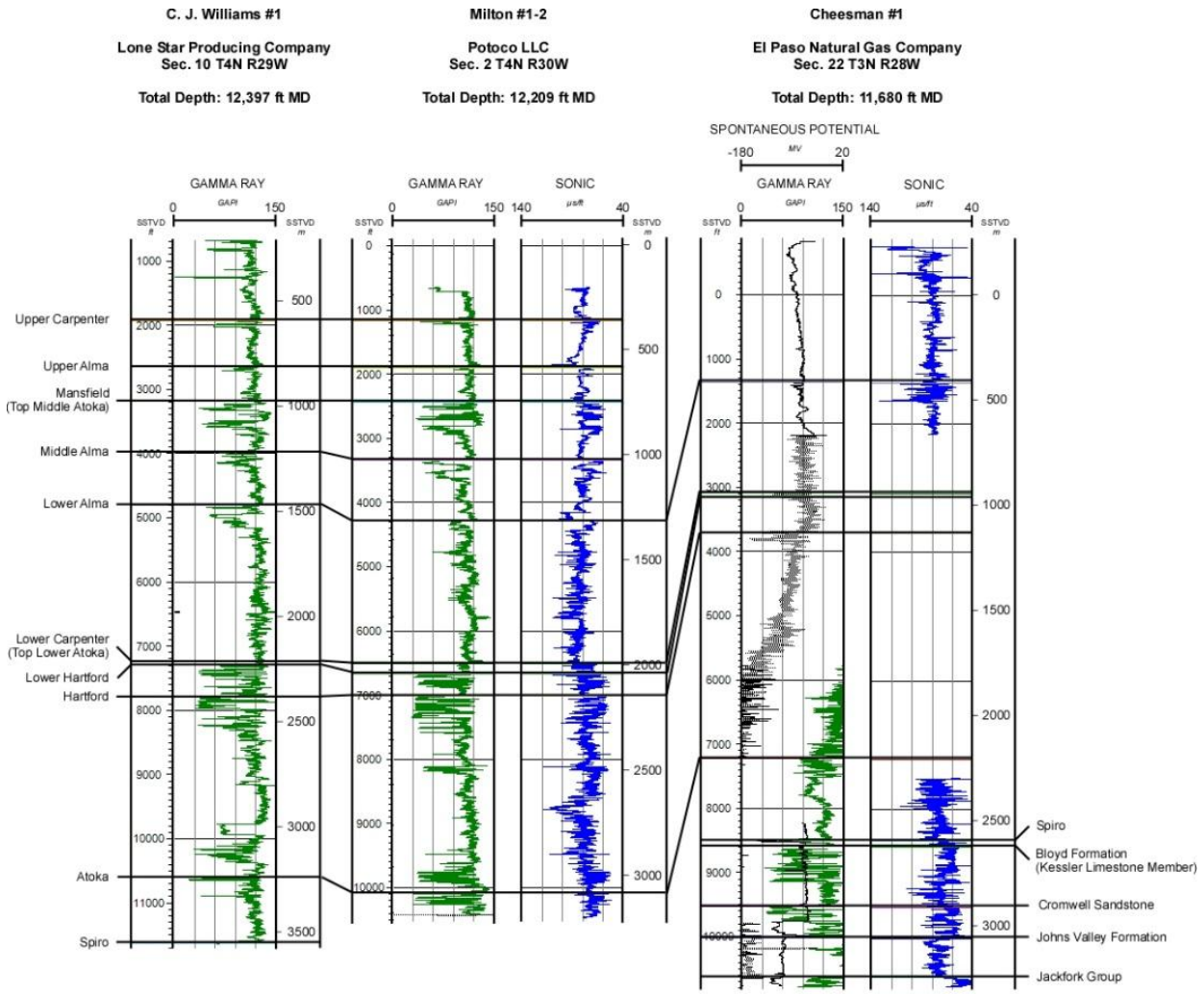
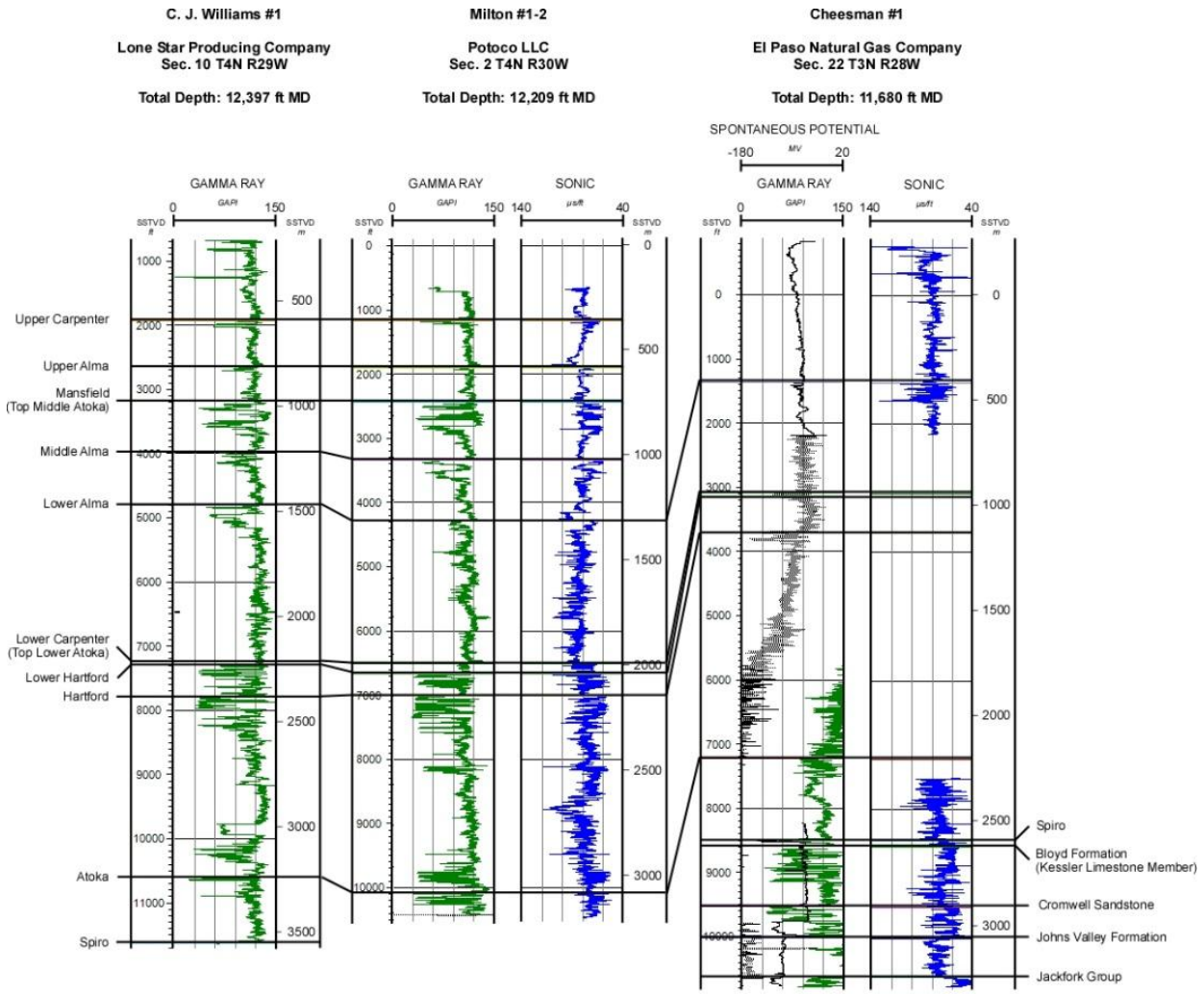


Topographic map from ArcMap 10, seismic data courtesy of Southwestern Energy Company

Formation Interpretation



Well-to-Seismic Ties



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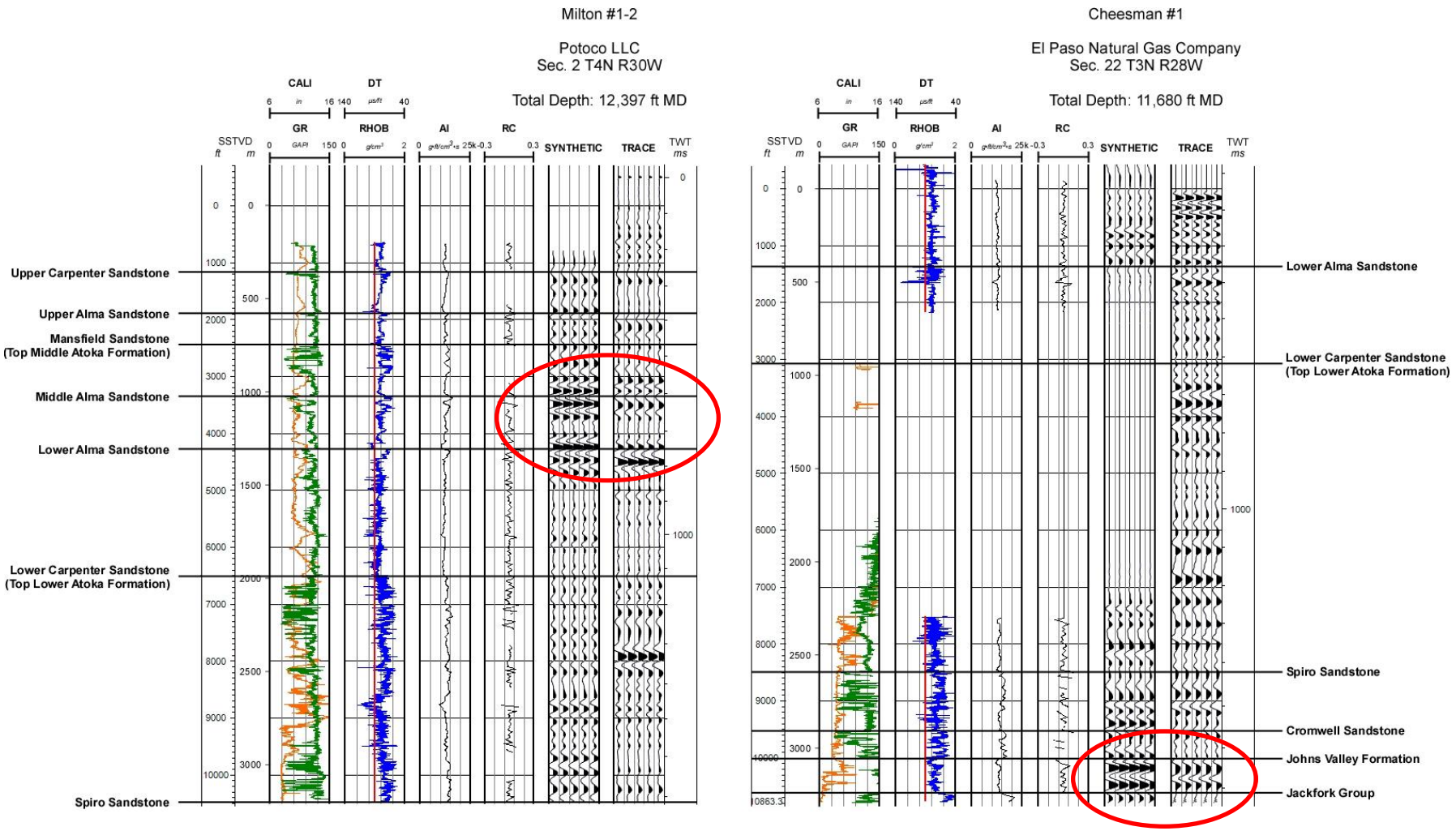
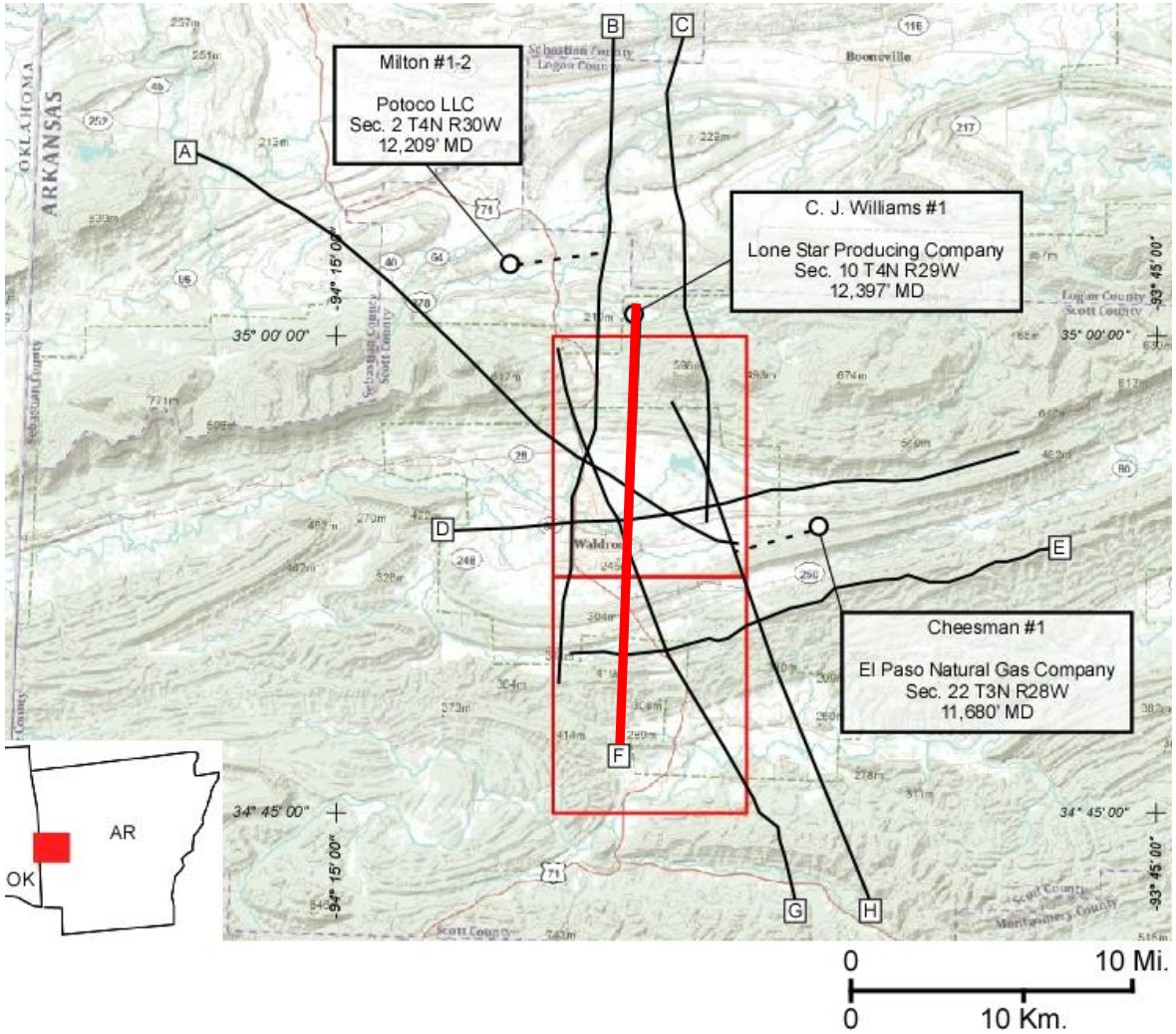


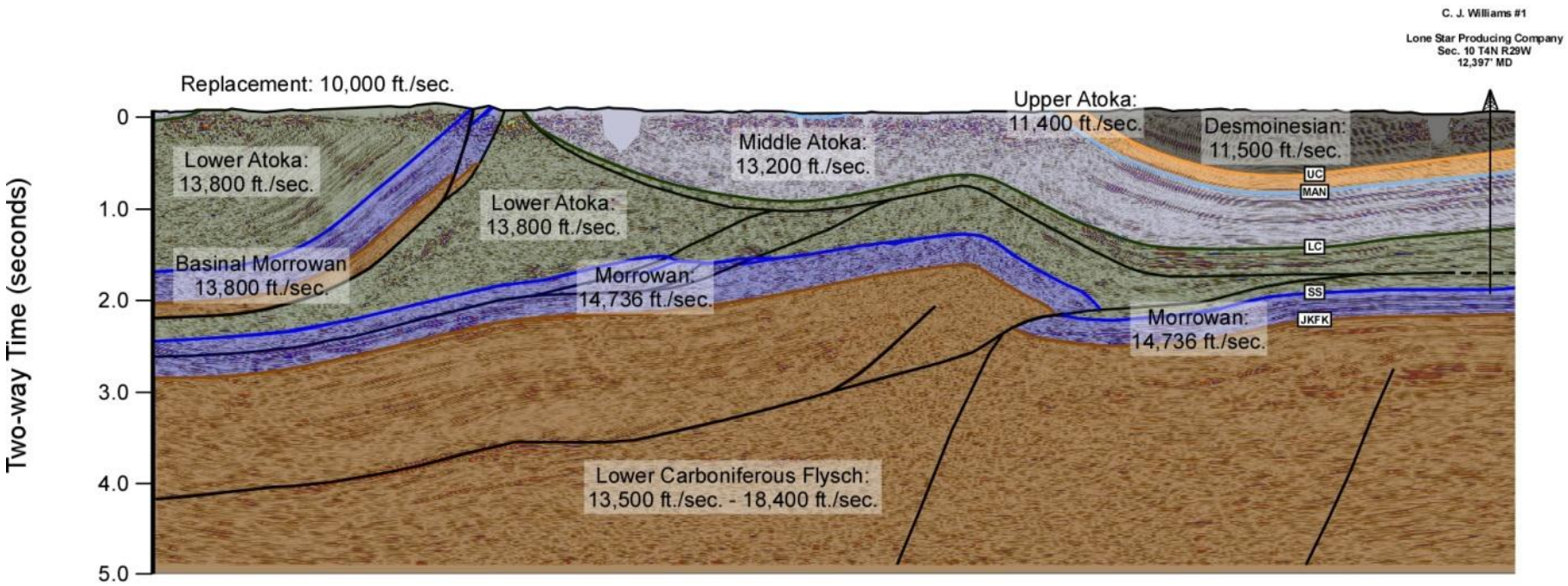
Velocity Model



Topographic map from ArcMap 10, seismic data courtesy of Southwestern Energy Company

Velocity Model

South North



MC: McAlister Formation **HT:** Hartshorne Sandstone **UC:** Upper Carpenter Sandstone **UA:** Upper Alma Sandstone **MAN:** Mansfield Sandstone **MA:** Middle Alma Sandstone **LA:** Lower Alma Sandstone **LC:** Lower Carpenter Sandstone **SS:** Spiro Sandstone **CS:** Cromwell Sandstone **JV:** Johns Valley Formation **JKFK:** Jackfork Group

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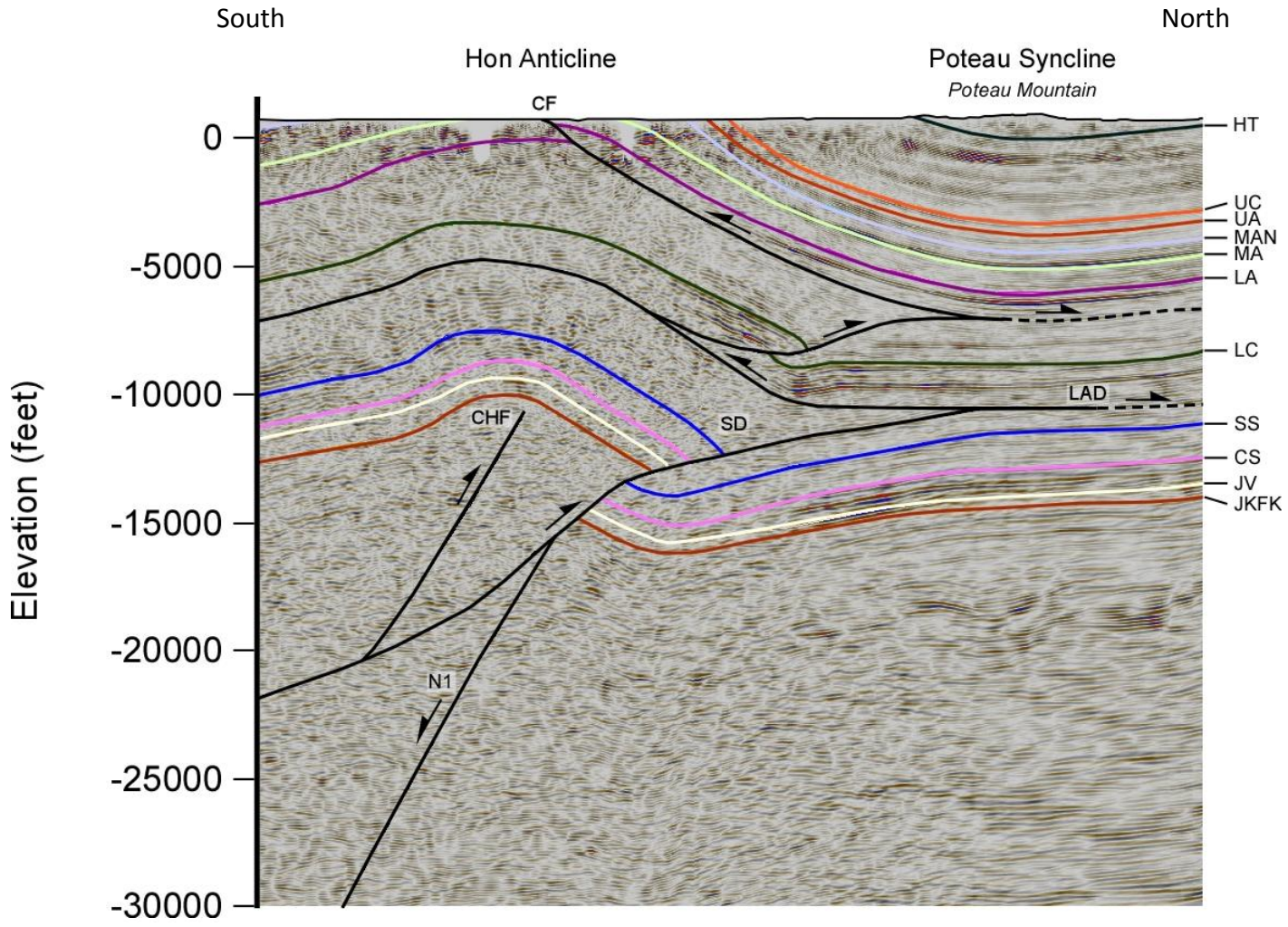
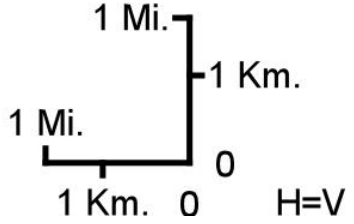
Structural Interpretation – Line 1





HT: Hartshorne Sandstone
UC: Upper Carpenter Sandstone
UA: Upper Alma Sandstone
MAN: Mansfield Sandstone
MA: Middle Alma Sandstone
LA: Lower Alma Sandstone
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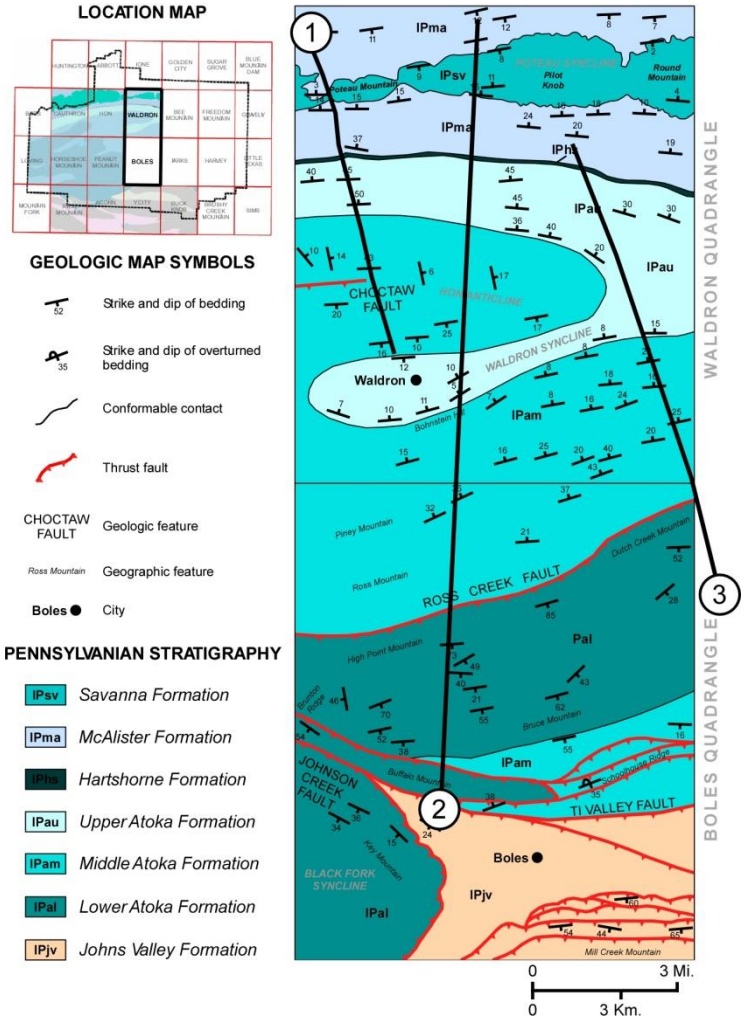
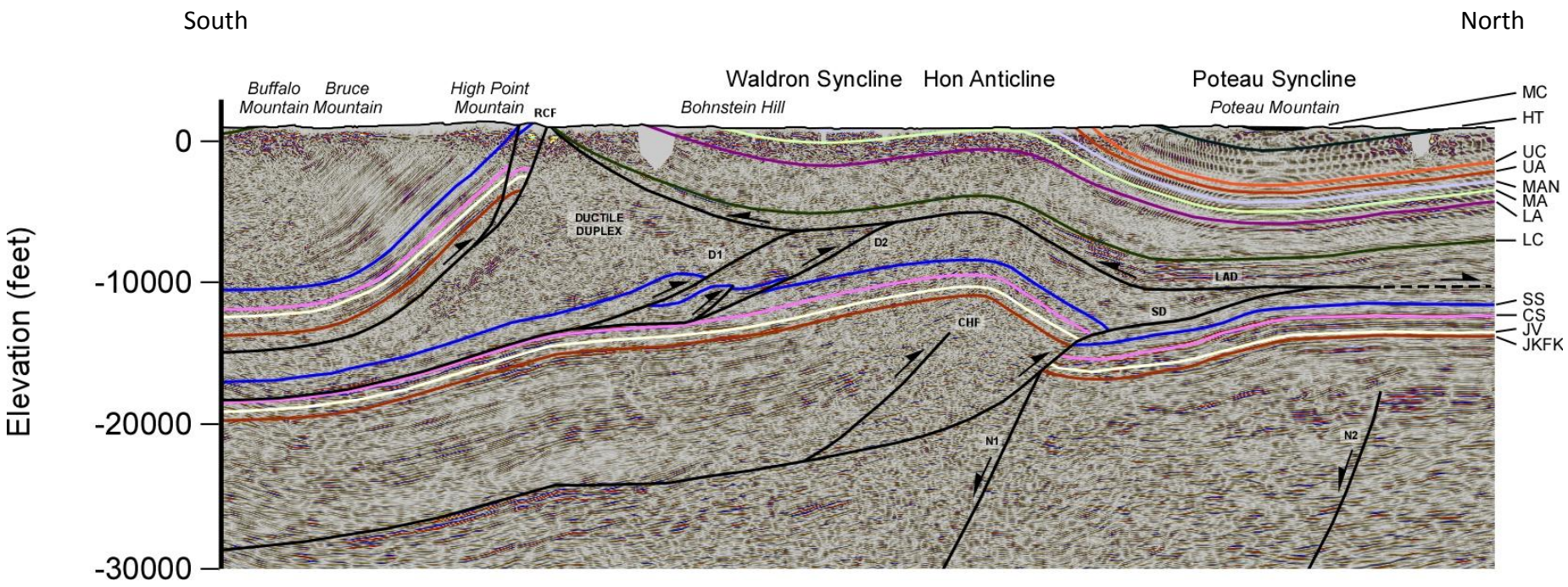


Structural Interpretation – Line 2



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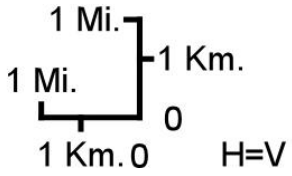

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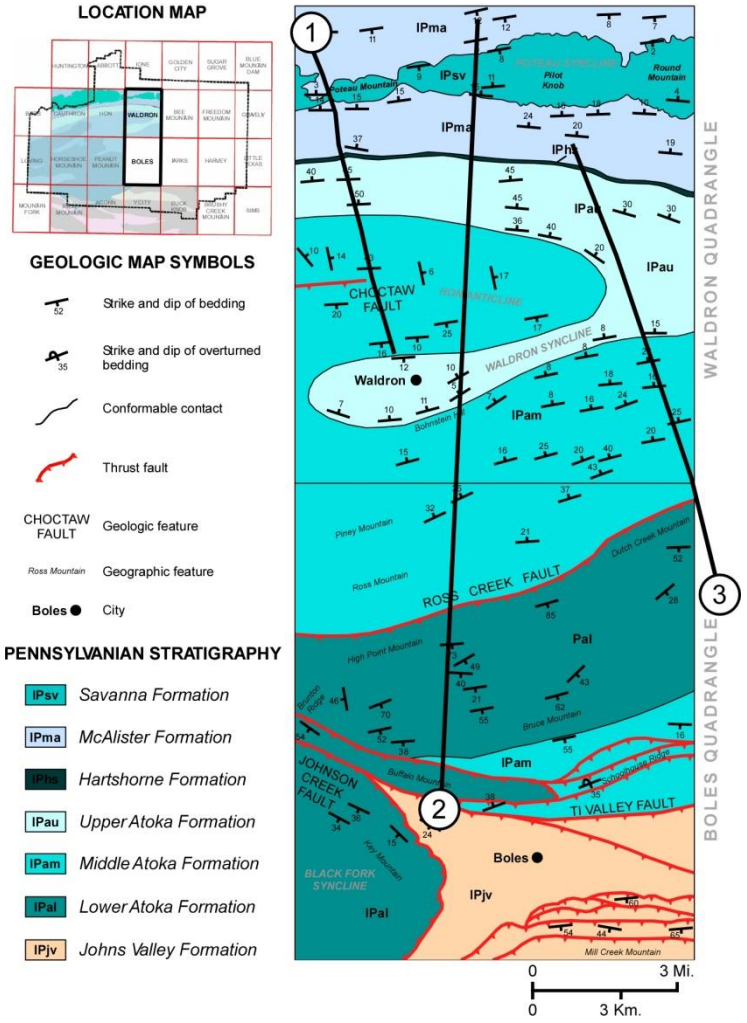
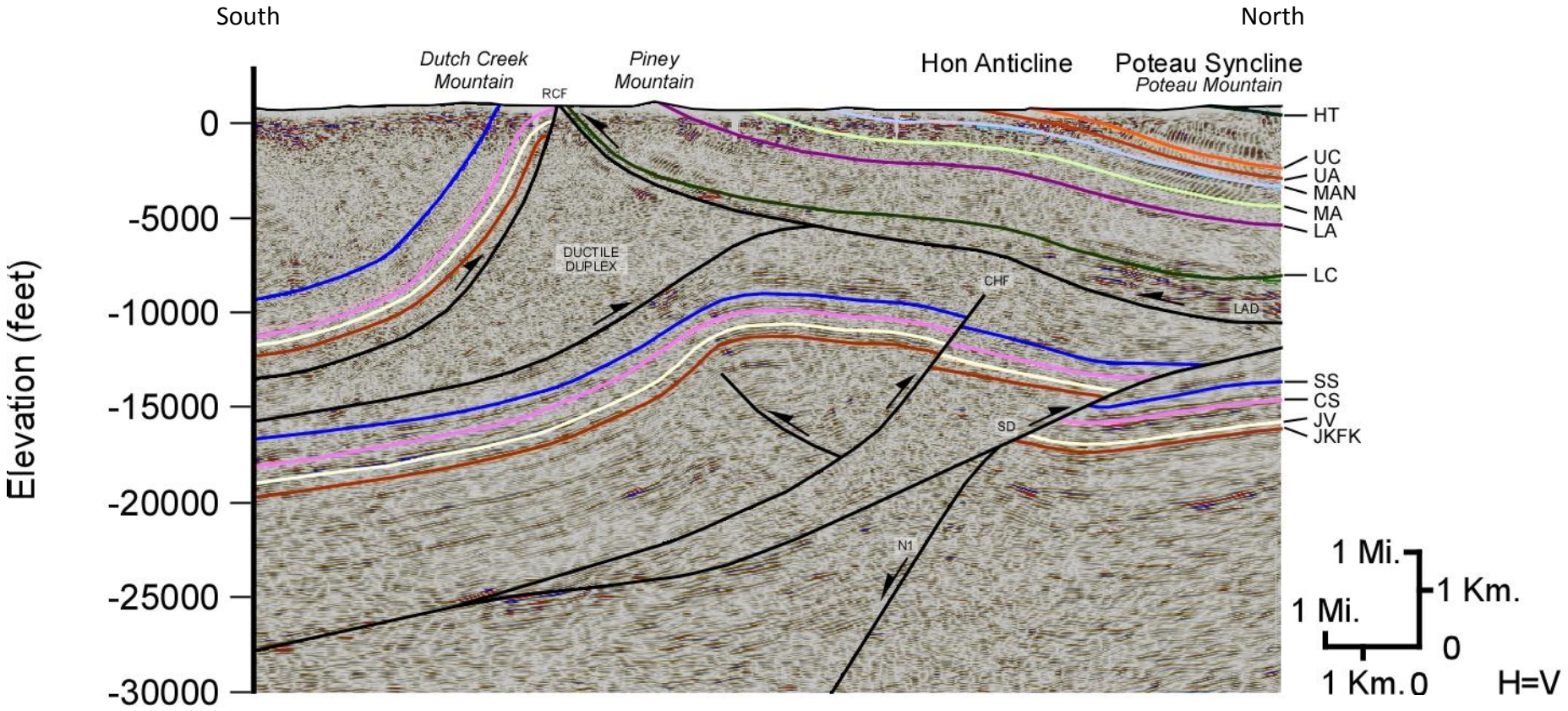


Structural Interpretation – Line 3



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Discussion – WTZ Comparison

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IPb/IPbg: Boggy Formation
IPsv: Savanna Formation
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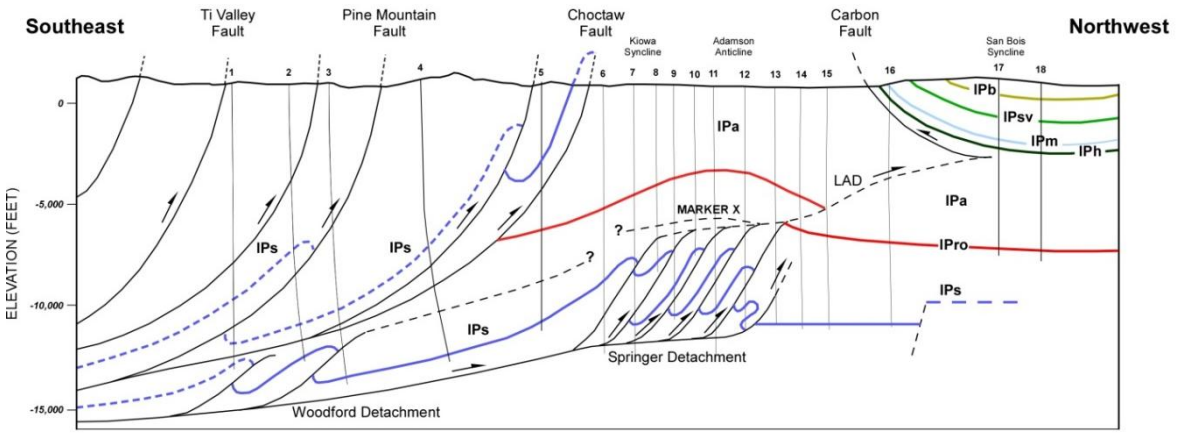

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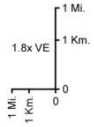

RCF: Ross Creek Fault
LAD: Lower Atokan Detachment
UVD: Union Valley Detachment
CHF: Choctaw Fault
SD: Stanley Detachment
N1: Normal Fault
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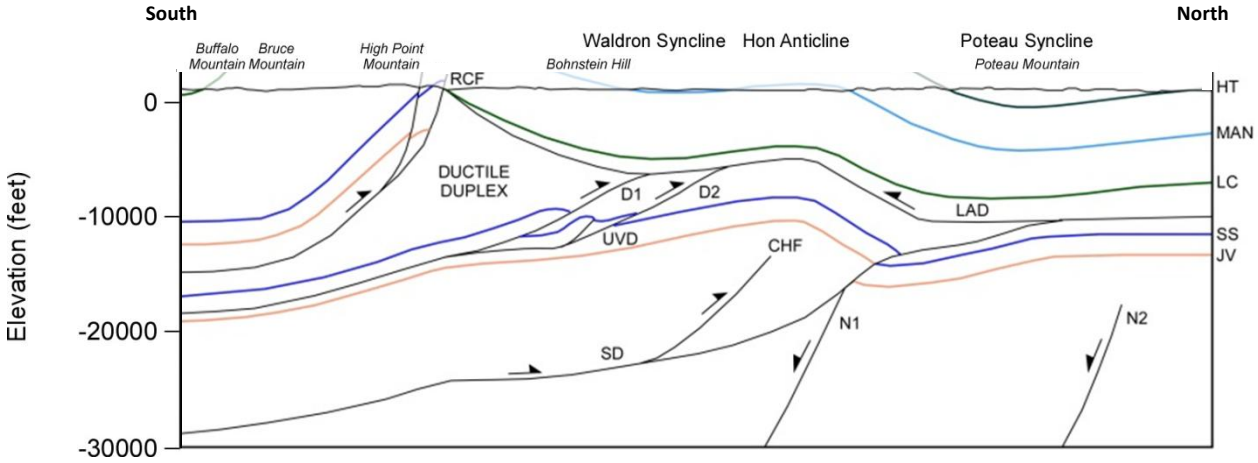

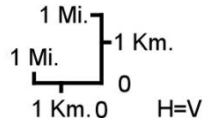

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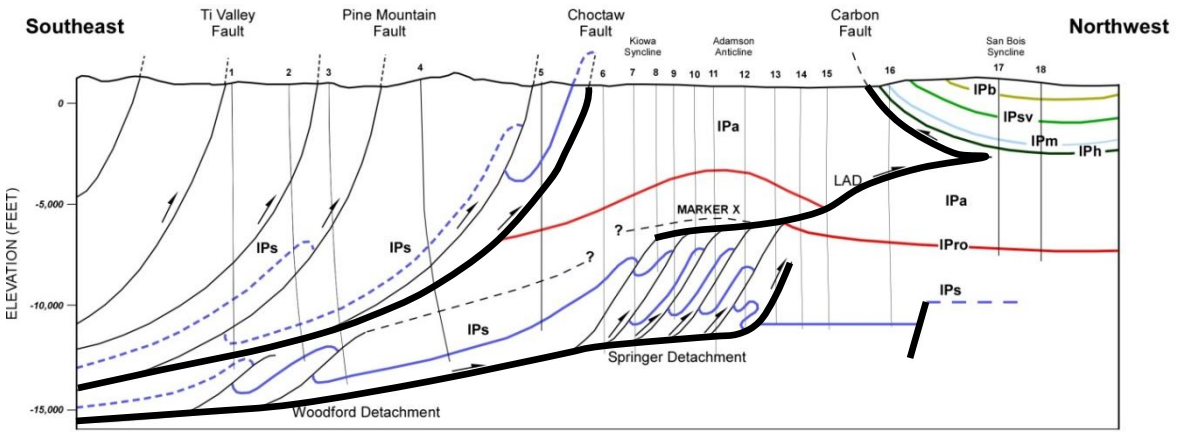

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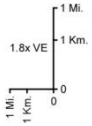

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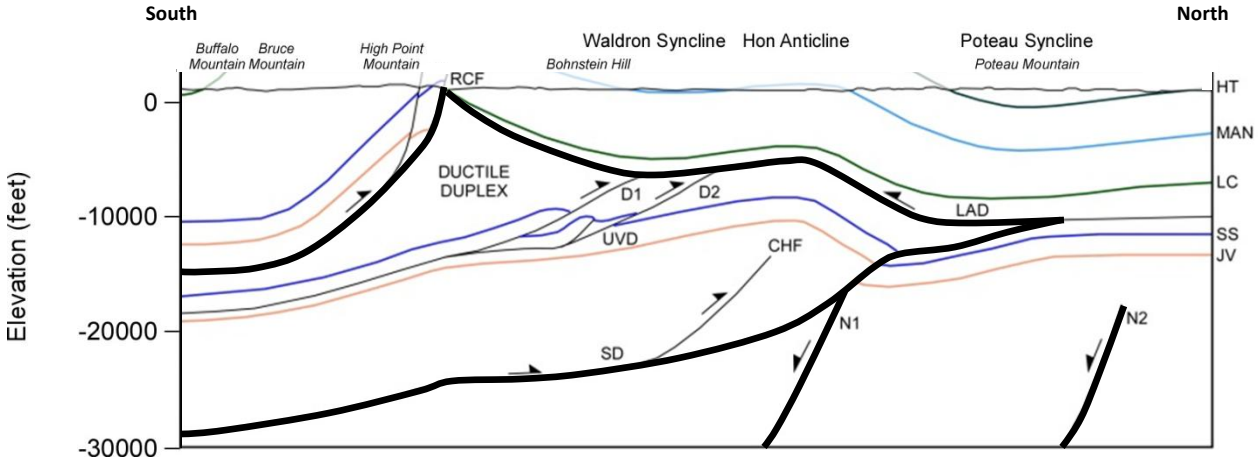

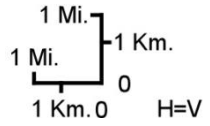

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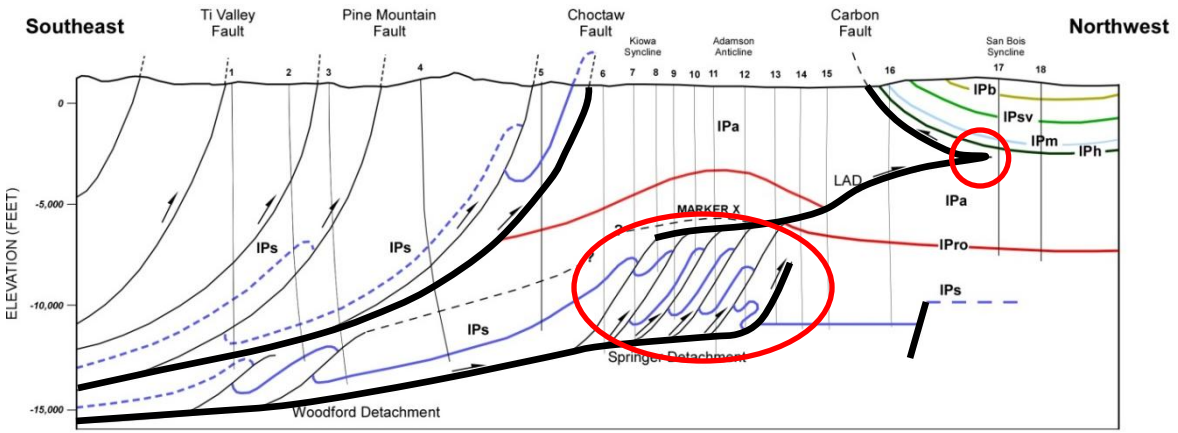

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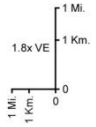

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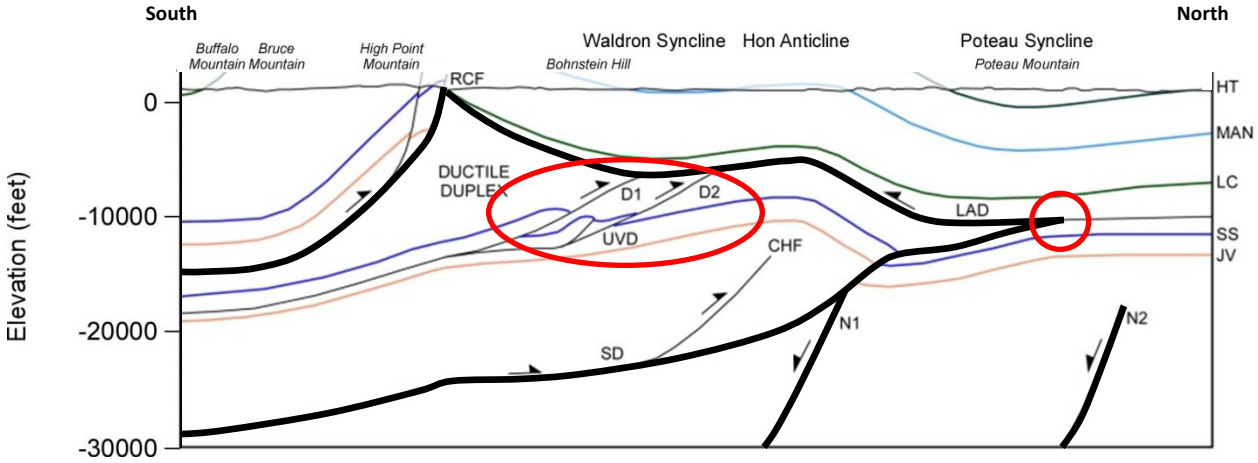

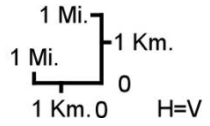

Conclusions

- **In Western Arkansas, the Triangle zone is Lateral equivalent to the Wilburton Triangle Zone (OK)**

- **The Triangle Zone Geometry consists of three stacked wedges:**
  - Upper – ductile duplex of lower Atokan shale
  - Middle – duplex of Spiro Sandstone, dies out eastward
  - Lower – hanging wall anticline of Miss. – Penn. flysch