

Timing and Structural Framework of the Ozarks Uplift

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Missouri State University and
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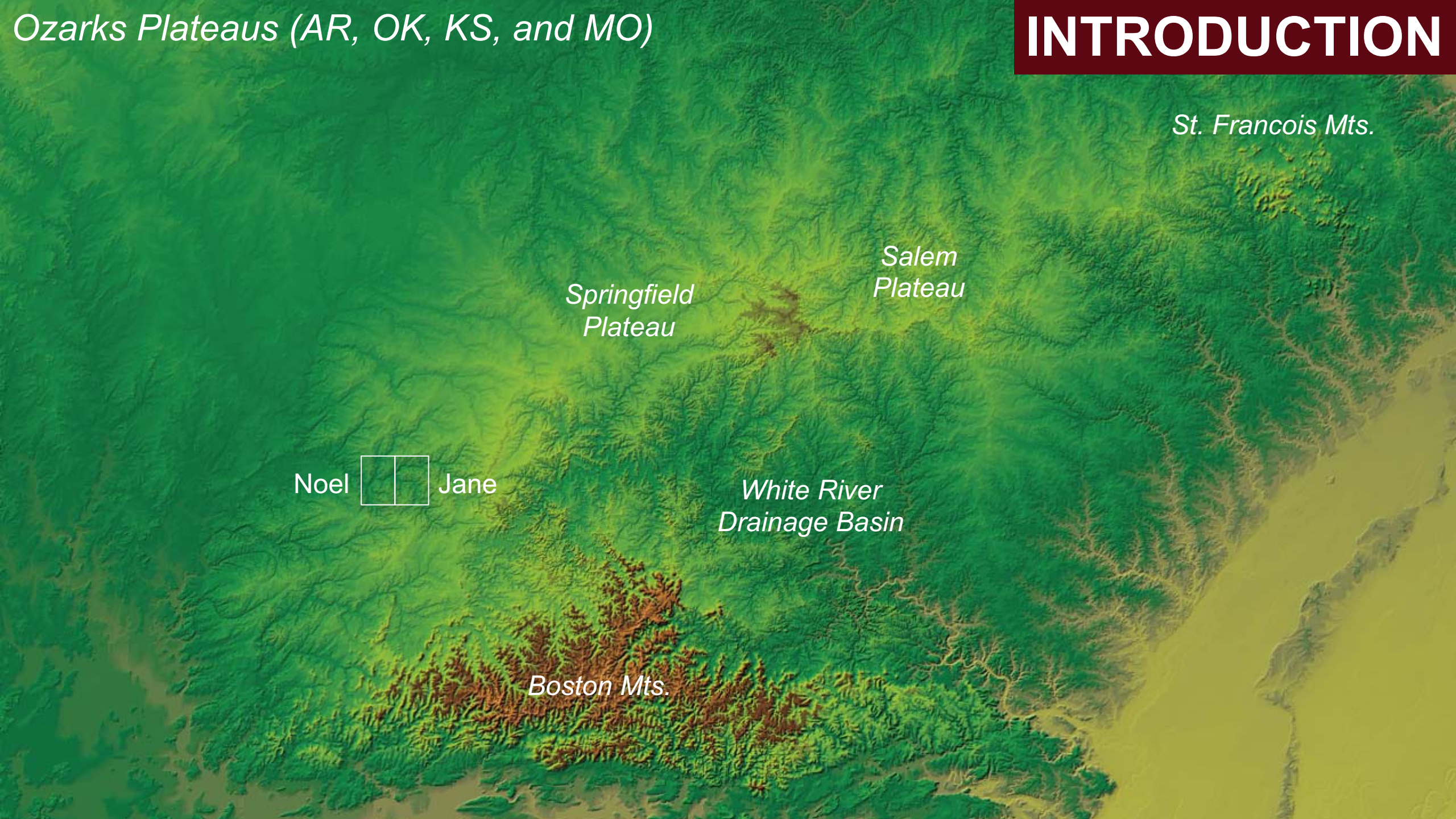
*Geologic Map of the Jane, Missouri 7.5-Minute
Quadrangle, Southwestern Missouri [2014]*

*Geologic Map of the Noel, Missouri 7.5-Minute
Quadrangle, Southwestern Missouri [in progress]*

MSU Students:

Jeremiah Jackson (MS, '11), Dulce Cruz (MS '12), Alica Alexander, Josh Boling, David Brannan, Matt Cauthon, Robert Chester, Chelsea Cobb, Josh Elson, Becka Giboney, Bailey Glass, Scott Healy, Mark Larson, Kevin Newbold, Jeremy Purcell, Laura Thayer, Teddy Wallenmeyer, and Brandon Zaitz

MSU Faculty: Kevin Mickus (gravity) and Robert Pavlowsky (water quality)



St. Francois Mts.

*Springfield
Plateau*

*Salem
Plateau*

Noel  Jane

*White River
Drainage Basin*

Boston Mts.



EXPLANATION

Cenozoic / Quaternary sediment
 Cretaceous System
 Permian System

Pennsylvanian Subsystem
 Mississippian Subsystem
 Silurian and Devonian systems

Ordovician System
 Cambrian System
 Uplifts and Precambrian basement (undivided)



When was the onset of the Ozark Uplift?

1. Pennsylvanian uplift model (King 1959; Cox 2009)
2. High Ozarks model (McCracken 1971)
3. *Mid-Devonian uplift model (Huffman 1959; Koenig 1967; Evans and Bassett 2013)*

What is the framework of the Ozark Uplift?

1. *Hudson (2000) strike-slip on southern edge of Laurentia*
2. *Cox (2009) conjugate strike-slip faults across southern Laurentia*

Take-aways:

1. Tectonostratigraphic sequences indicate onset Mid-Devonian, continued through Mississippian with culmination and docking of Ouachita allochthon in Pennsylvanian
2. Textbook example of syntectonic sedimentation
3. Surface analogue for Mississippi Lime Play (OK; KS)
4. Fault relays with hard and soft linkages between strike-slip faults; ***grabens!***

Significance

Small “Waulsortian” mud mounds may be better for interpreting and understanding the origin of these features





Dinant, Belgium

Google Earth

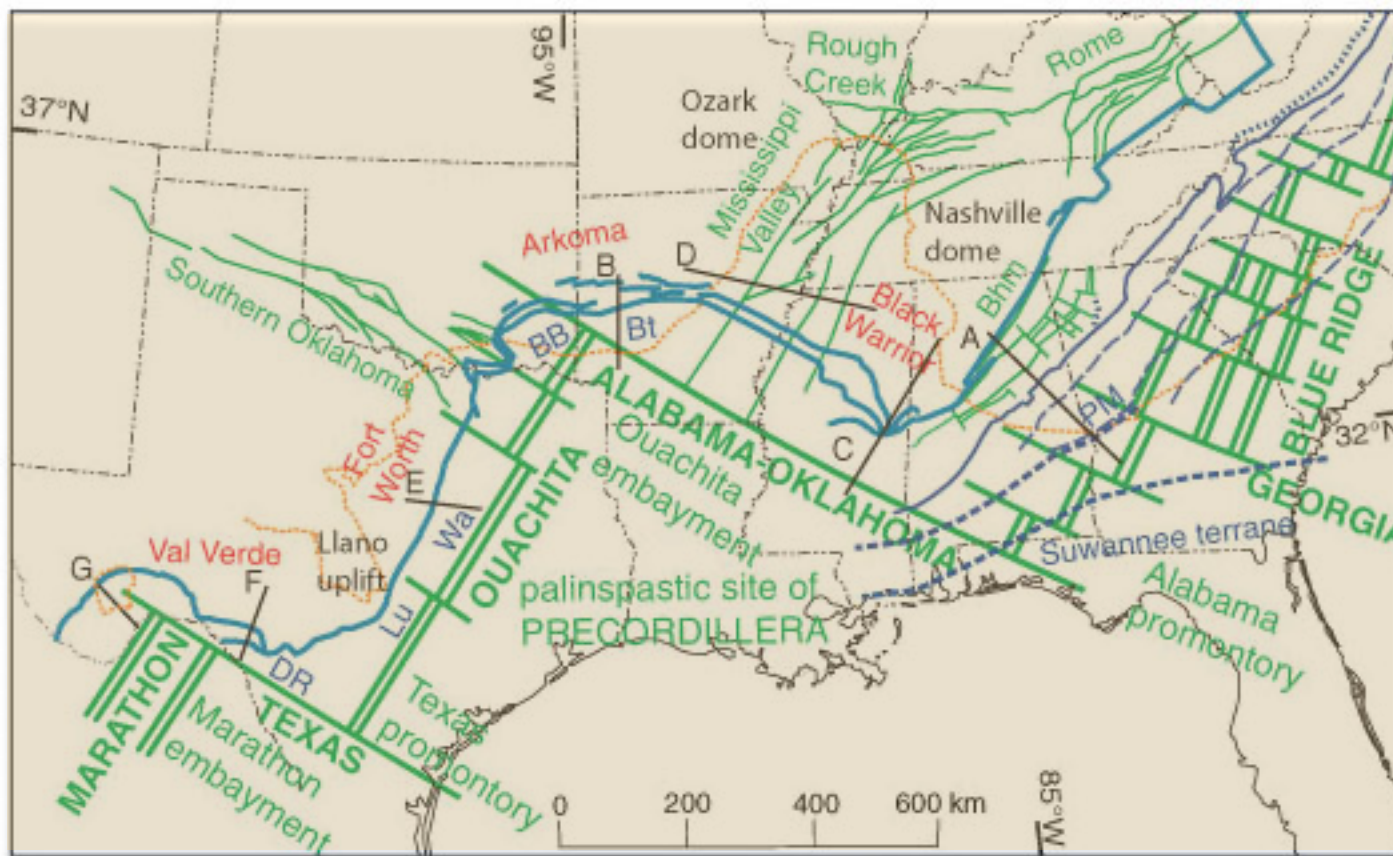


Muleshoe Mound, NM



BACKGROUND

Neoproterozoic Rifting Southern Laurentia



IAPETAN RIFTED MARGIN



intracontinental fault

GULF AND ATLANTIC COASTAL PLAINS

edge of Gulf and Atlantic Coastal Plains

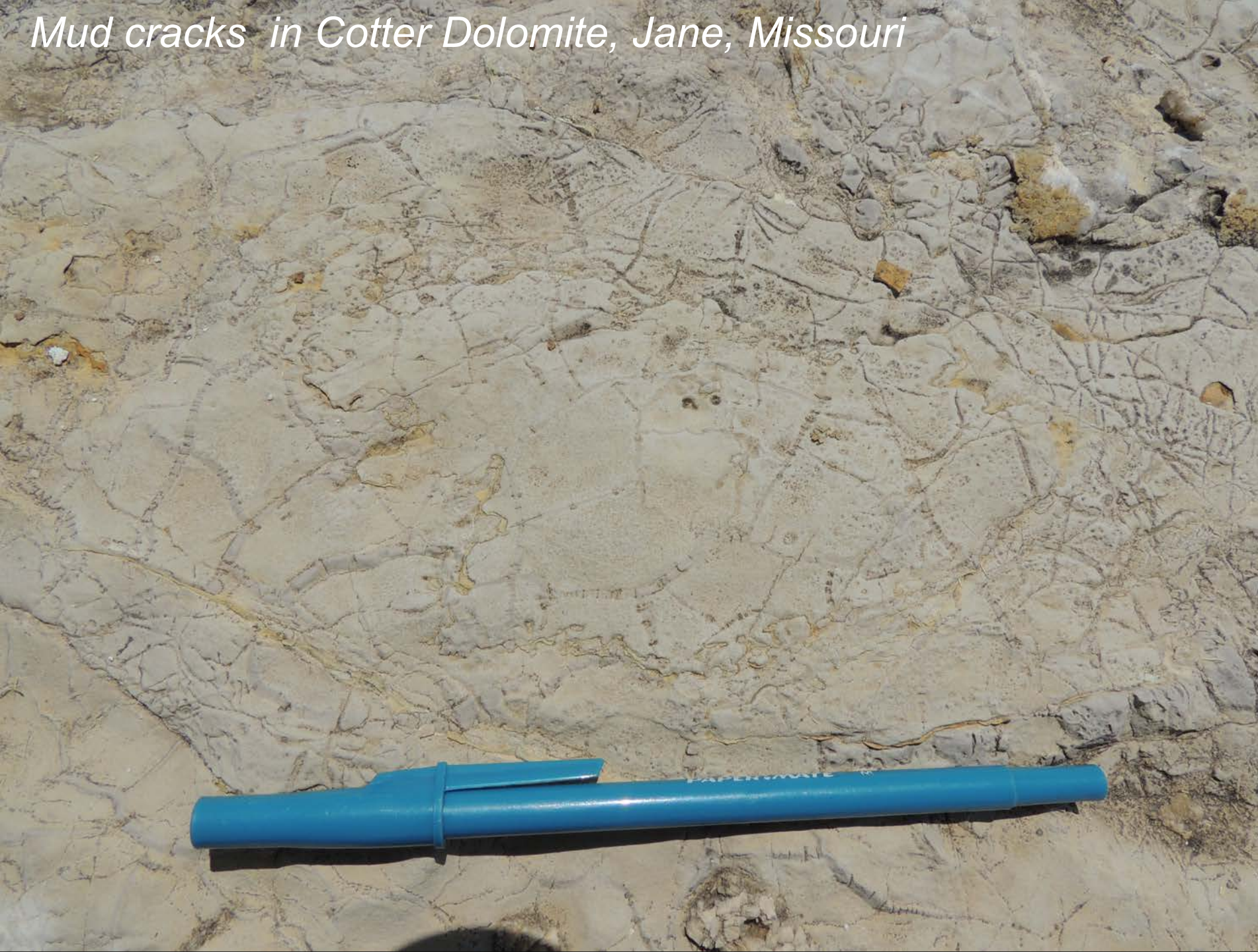
APPALACHIAN-OUACHITA OROGEN

- leading edge of Appalachian and Ouachita thrust belts
- leading edge of Appalachian accreted metamorphic terranes
- shear zones in Appalachian Piedmont metamorphic terranes
- leading edge of Appalachian external basement massifs
- possible limits of Suwannee-Wiggins suture zone

Thomas (2011)

Mud cracks in Cotter Dolomite, Jane, Missouri

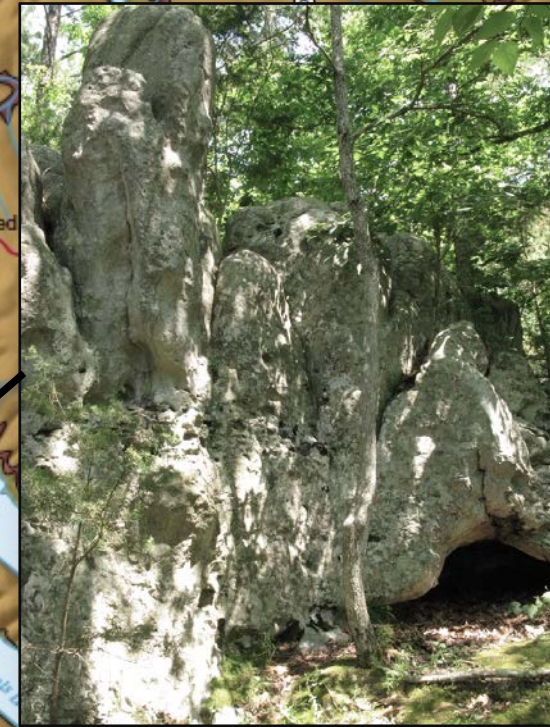
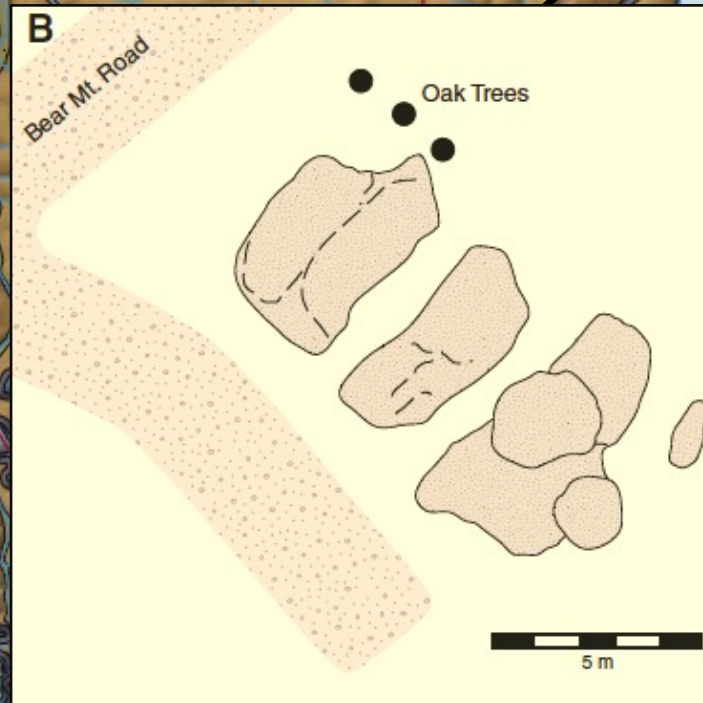
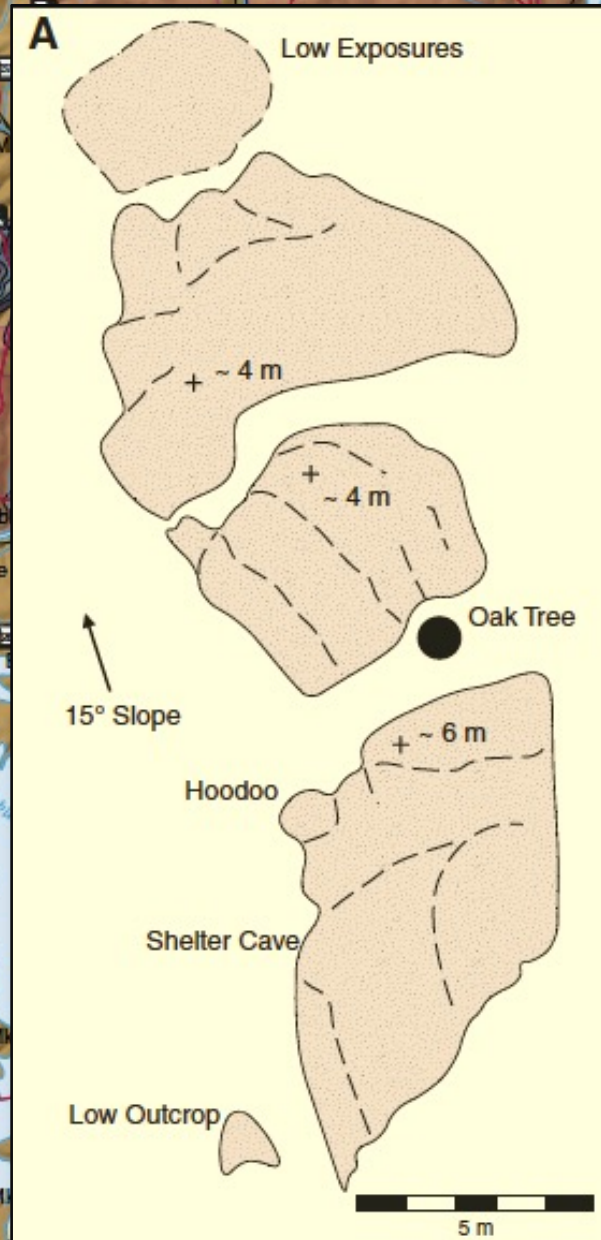
**Early Paleozoic
Passive Margin
Sedimentation**



Cauthon et al. (2014)

Sandstones in Cotter Dolomite, Mincy, Missouri

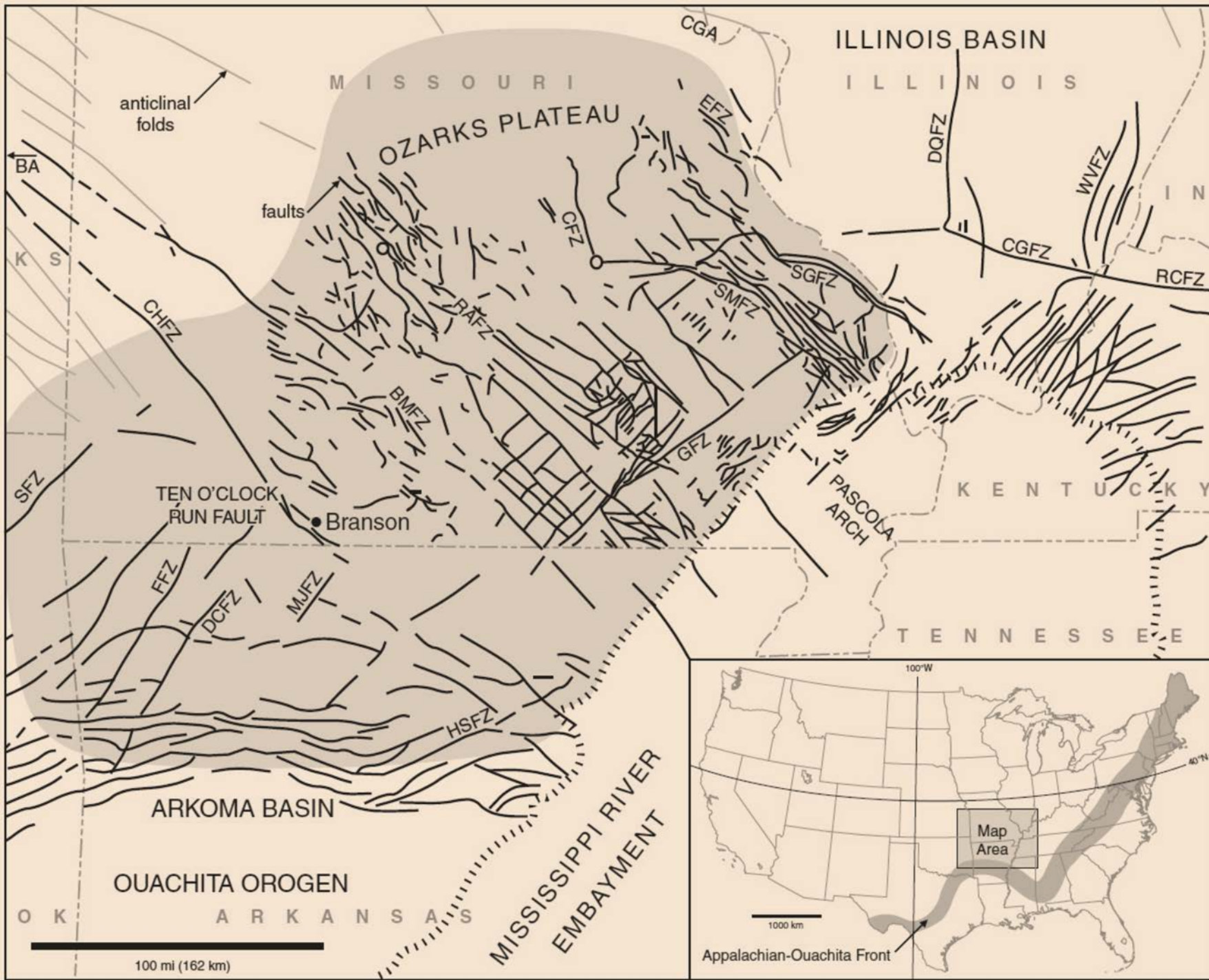
Karst Ages:
M. Ordovician
M. Devonian
Mississippian
Pennsylvanian



Evans (2010)

STRUCTURE

Ozarks Fault Systems

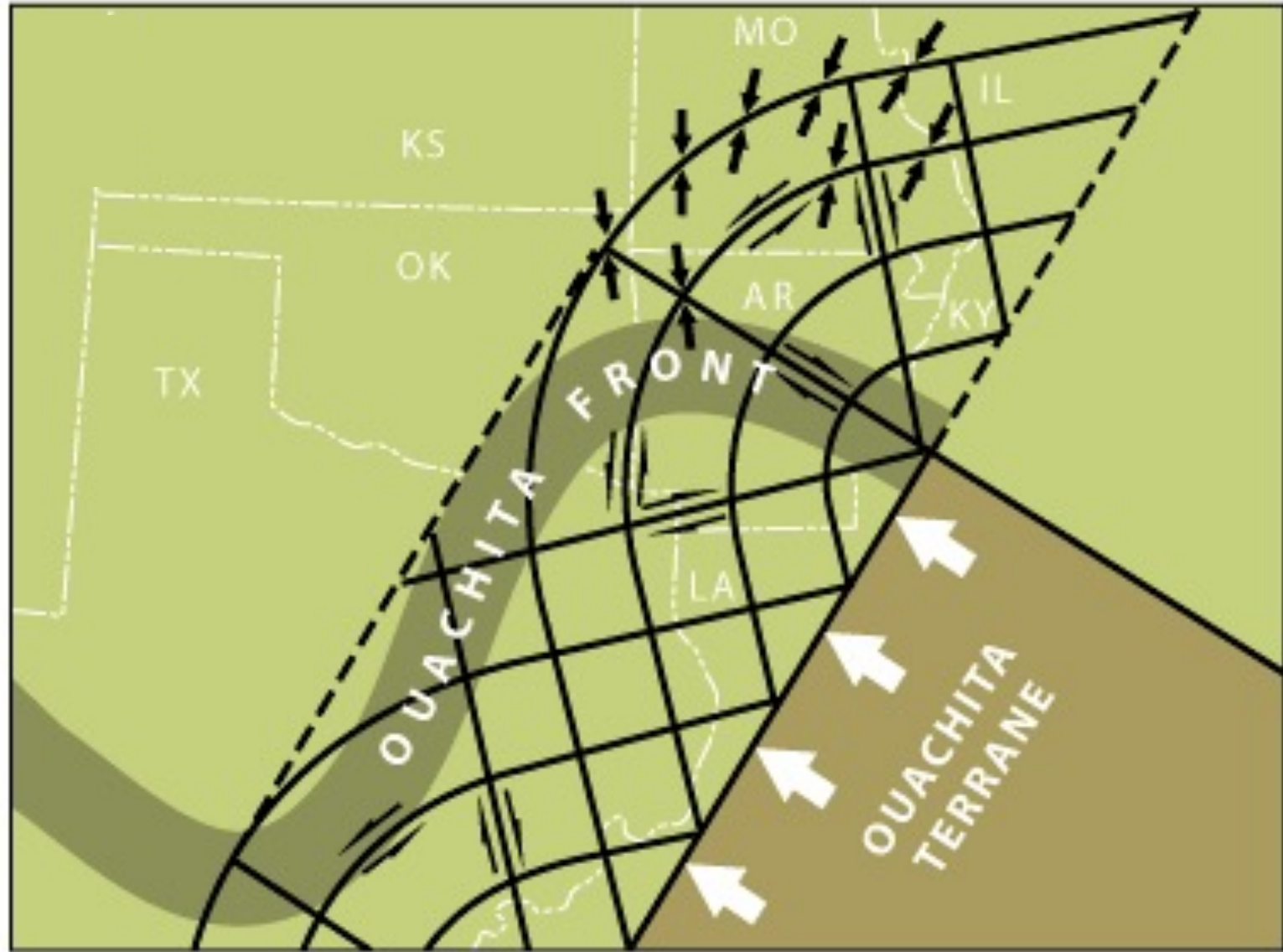


Cox (2009)

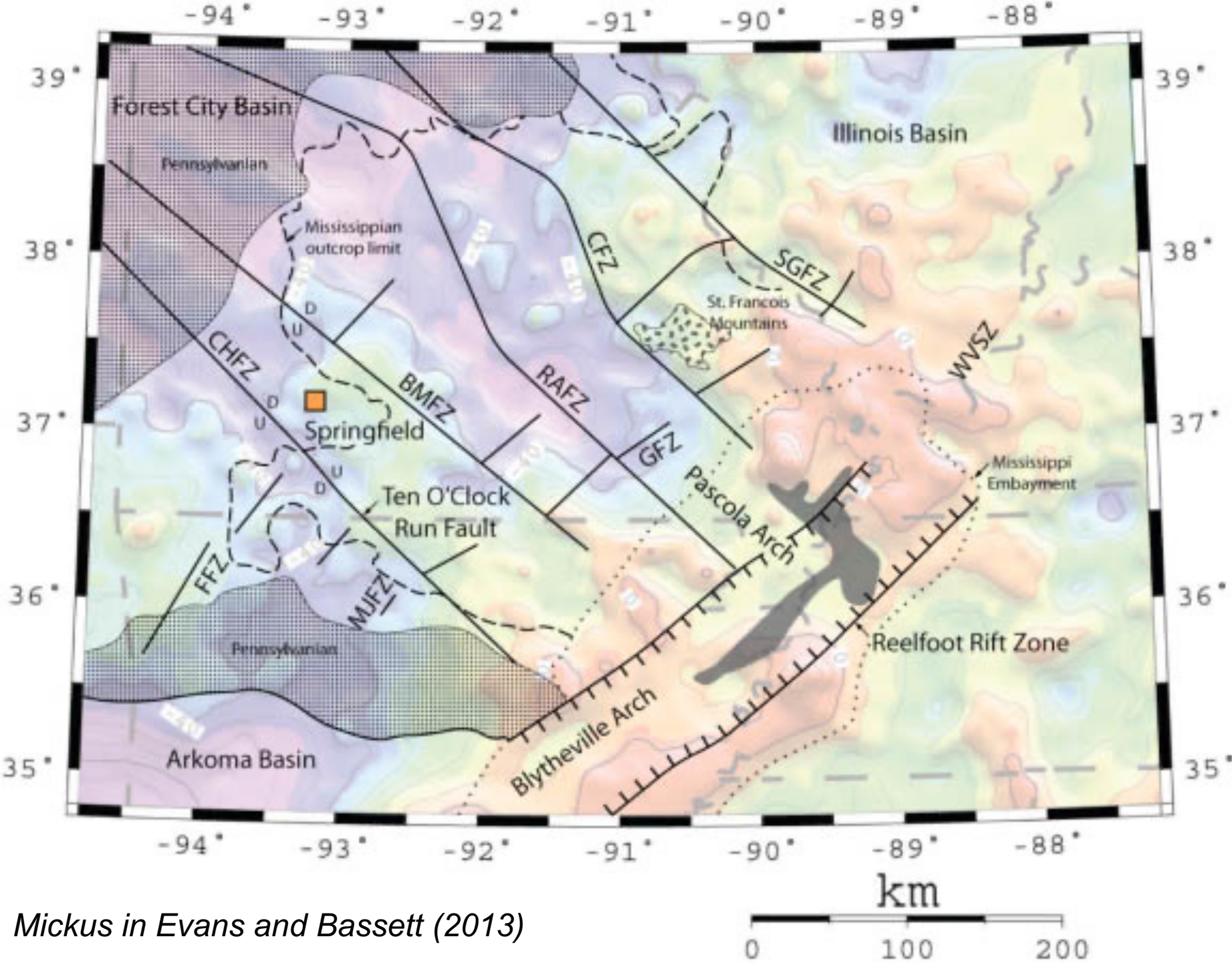
Conjugate Fault Systems and Indenter Model



Cox (2009)



Bouguer Gravity Anomaly Map

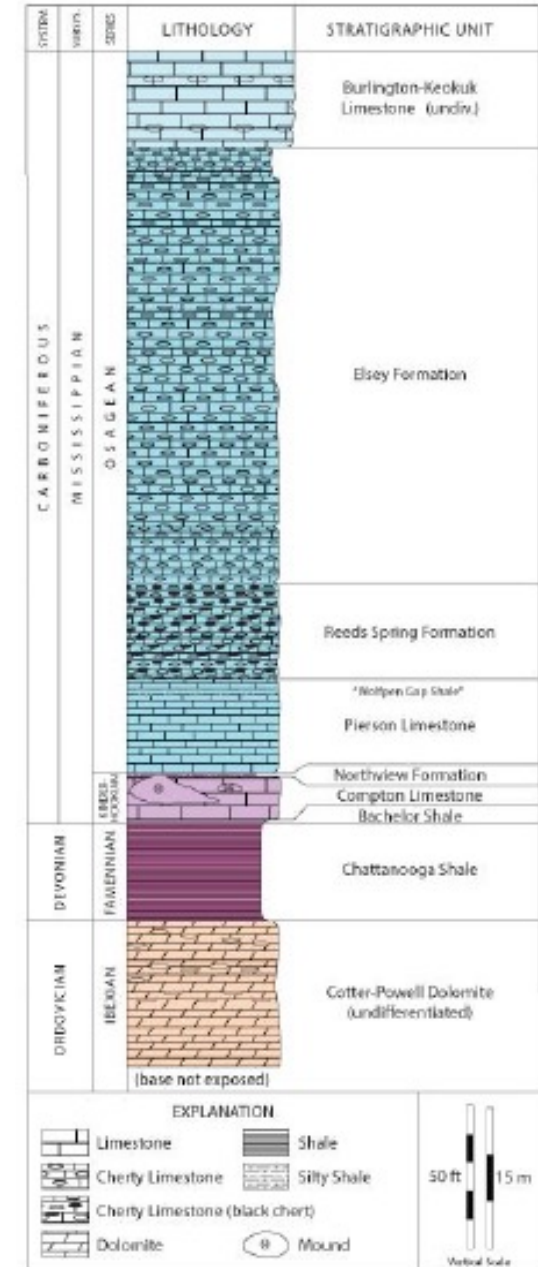


Mickus in Evans and Bassett (2013)

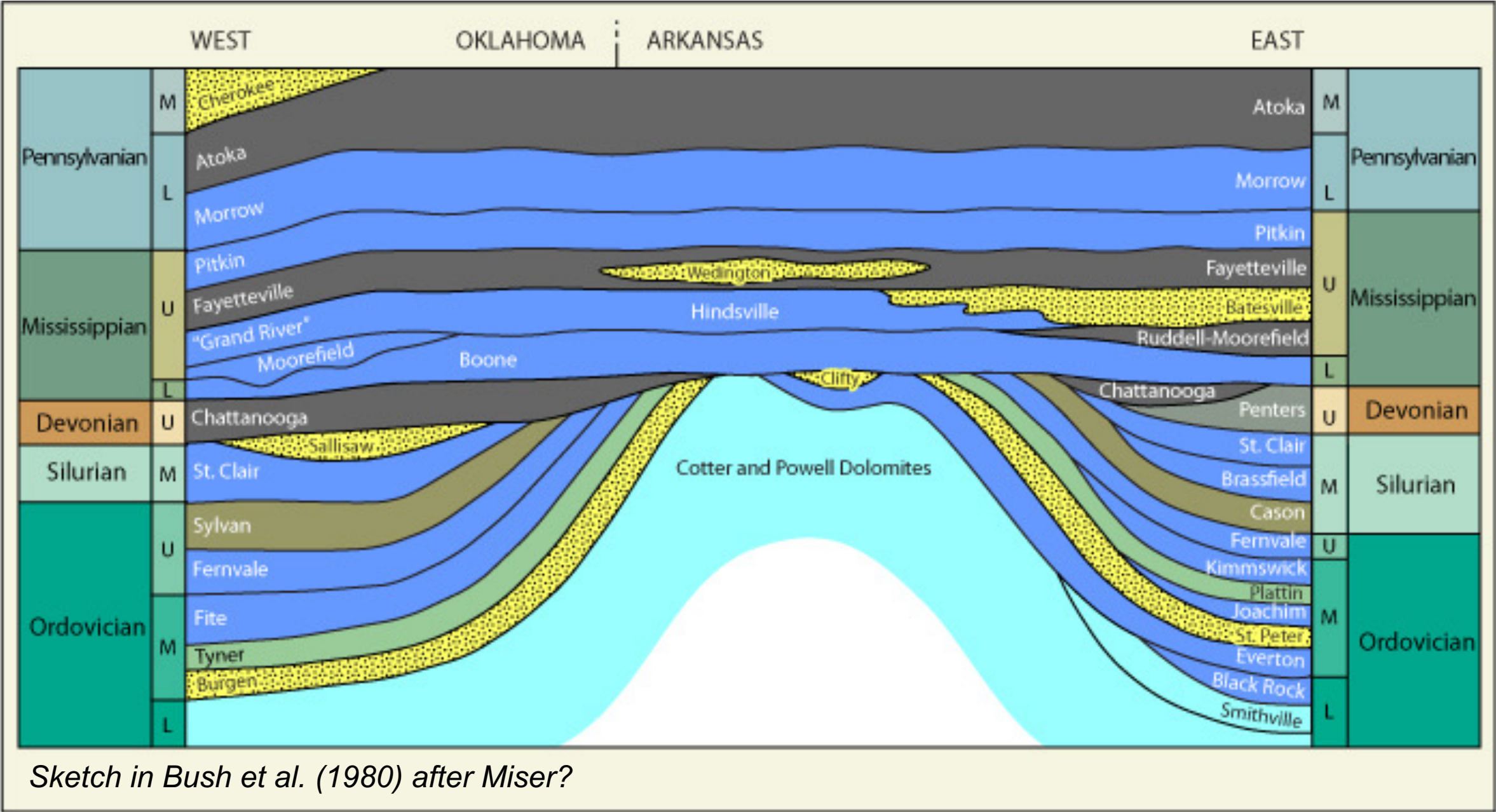
STRATA



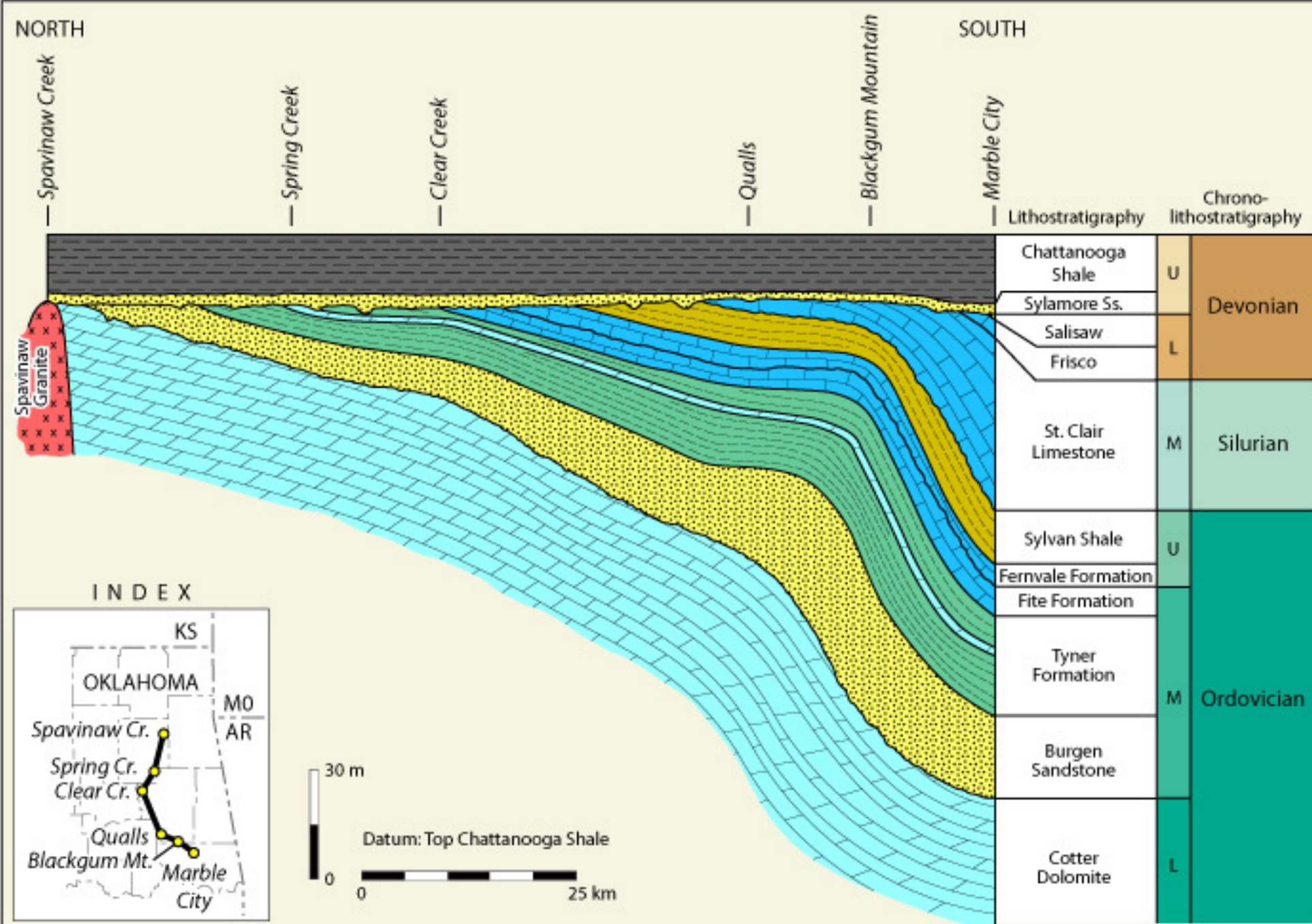
Base of Noel (Chattanooga) Shale, Caverna, Missouri



Sub-Upper Devonian Unconformity, northern Arkansas



Sub-Upper Devonian Unconformity, Oklahoma

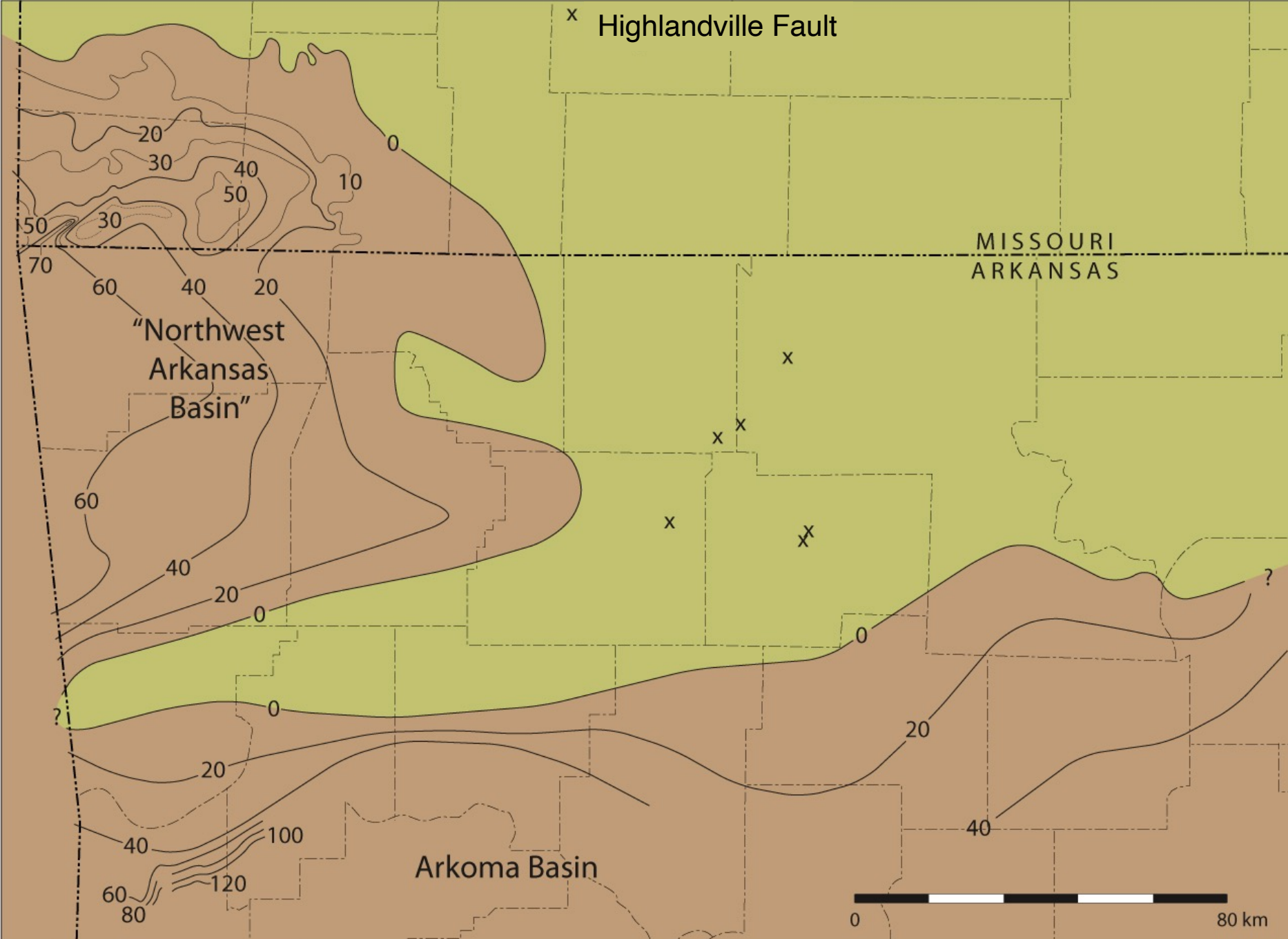


Modified from Huffman (1959)



*Spavinaw Granite, Spavinaw, OK
Delaware Islands of Chenoweth (1968)*

Chattanooga Shale Isopach Map



Wise and Caplan (1962); Haley and Hendricks (1968, 1972); Van Lieu (1959 in Nuelle and Sumner (1981))

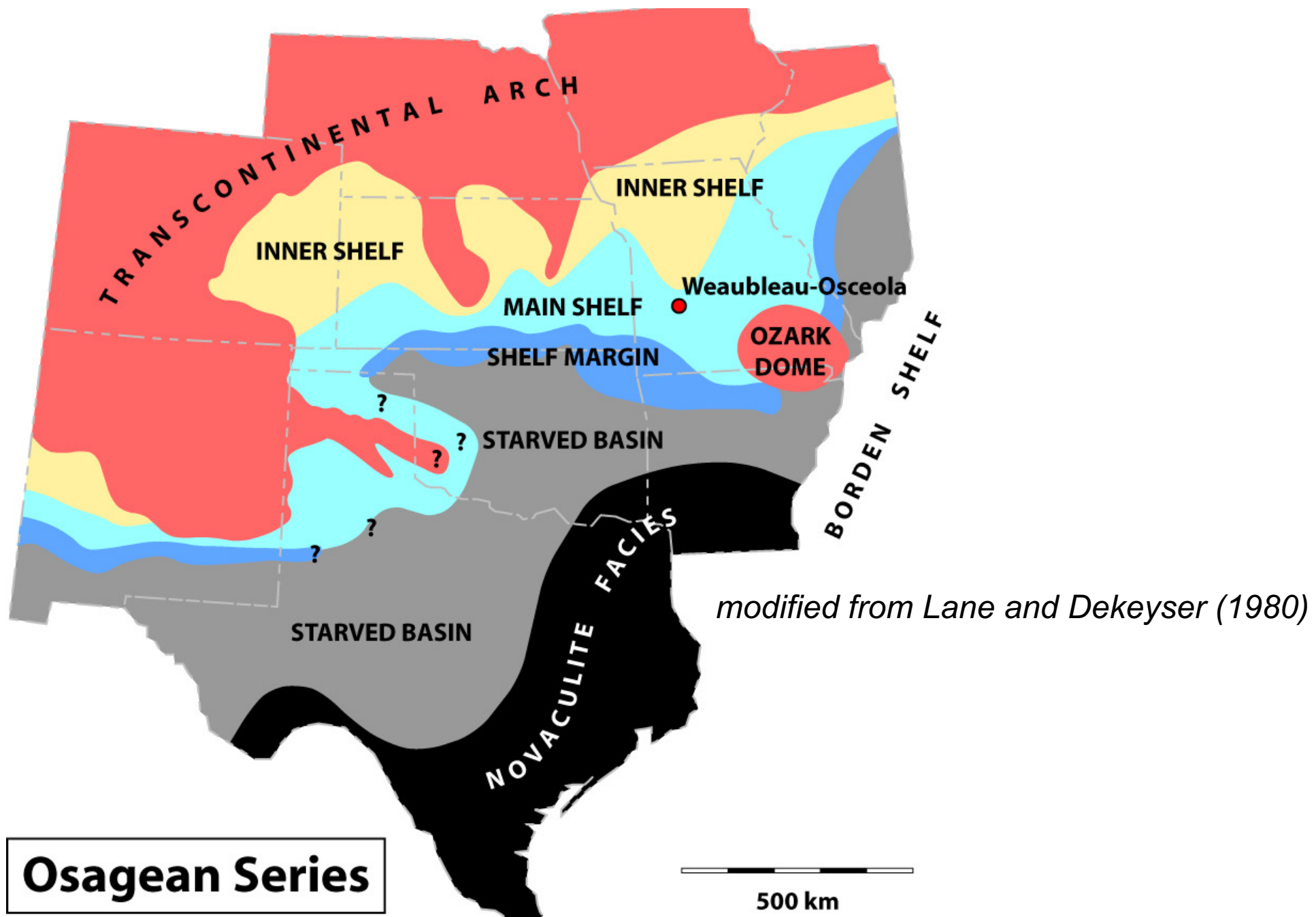
Noel (Chattanooga) Shale, Highlandville Fault

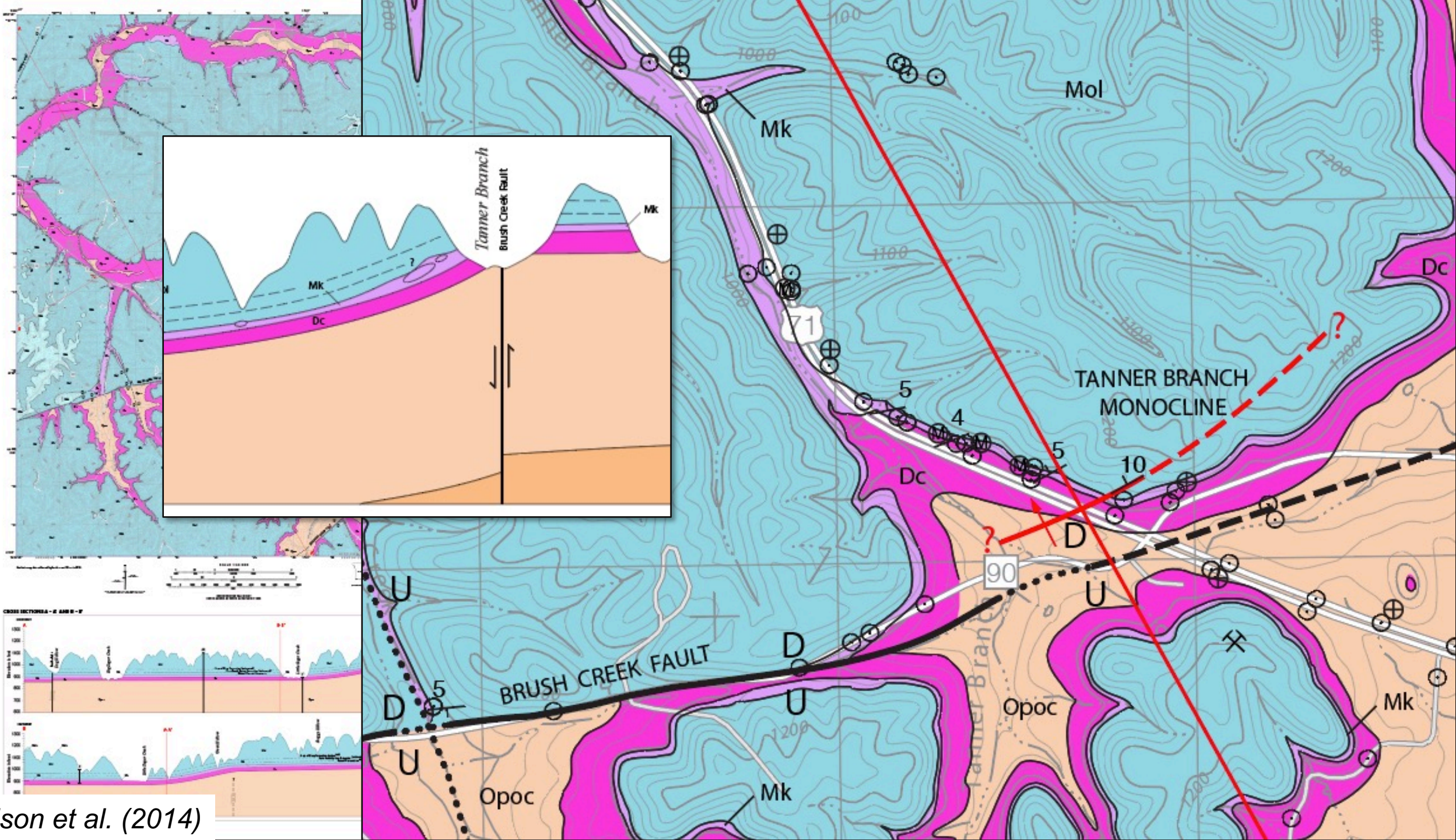


*MoDOT-SMSU
Vista 1 core (86.1 ft)*



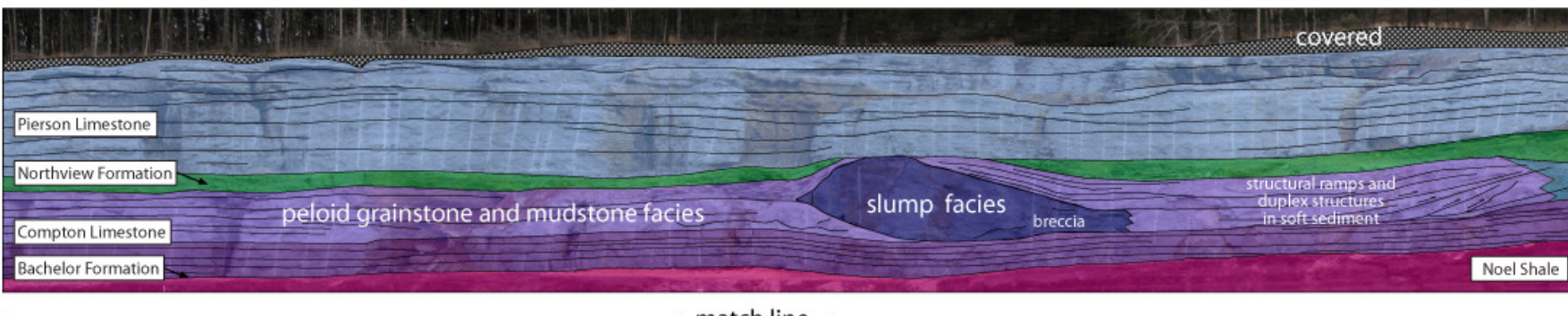
Mid-Mississippian Backstepping Sedimentation on Southern Laurentia



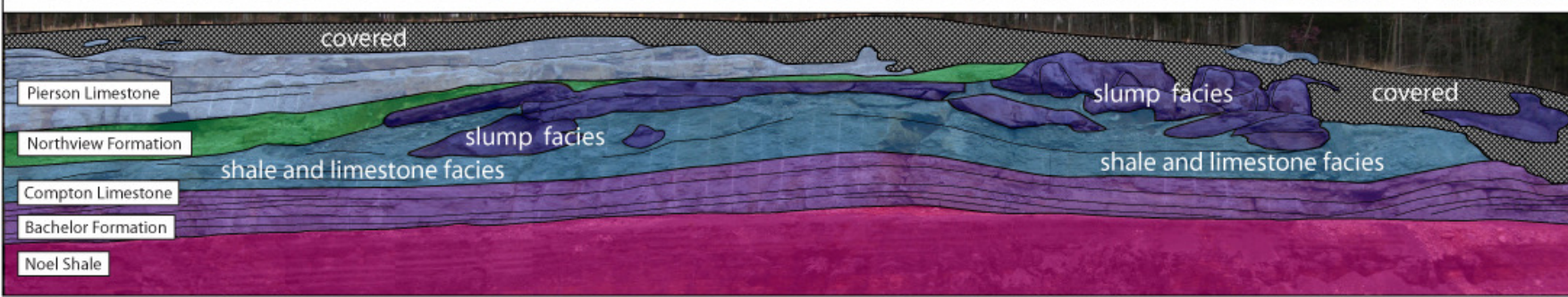
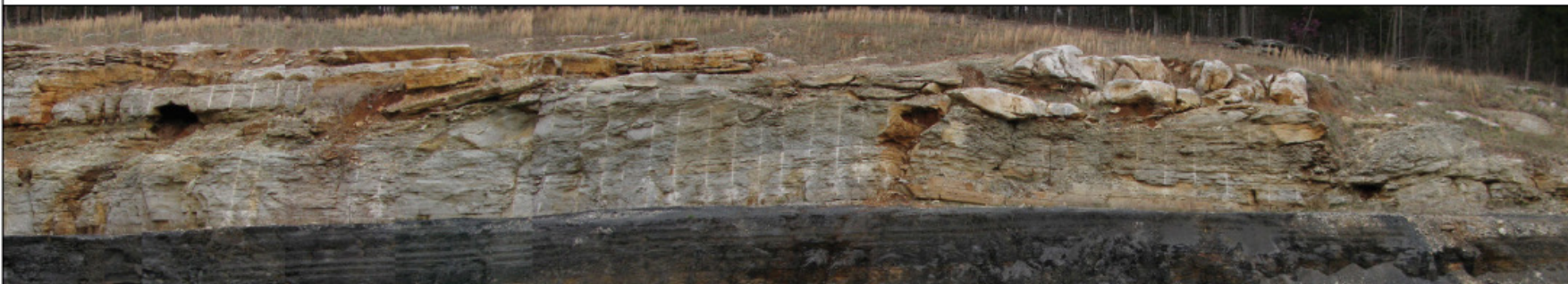


Elson et al. (2014)

WNW



ESE



***En masse* Slumps and Slides; Not Reefs!**

- Few locations next to faults
- Breccias at base
- Structureless lime mudstone; spar-filled cracks in breccia
- No flank beds
- Some cut bedding
- Folding preserved
- Penecontemporaneous movement with slickened sides
- Reoriented geopetal structure
- Water escape structures(?)

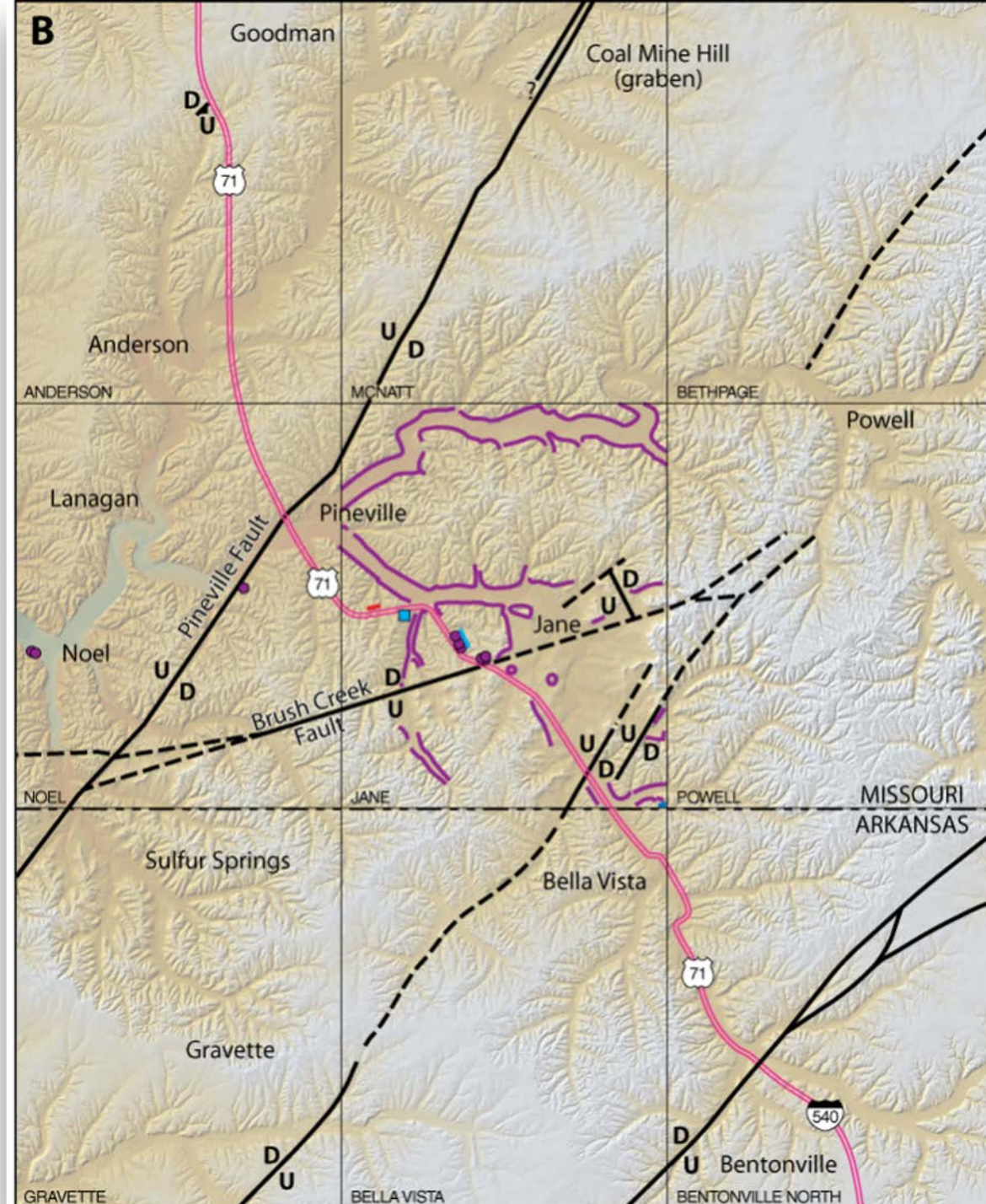
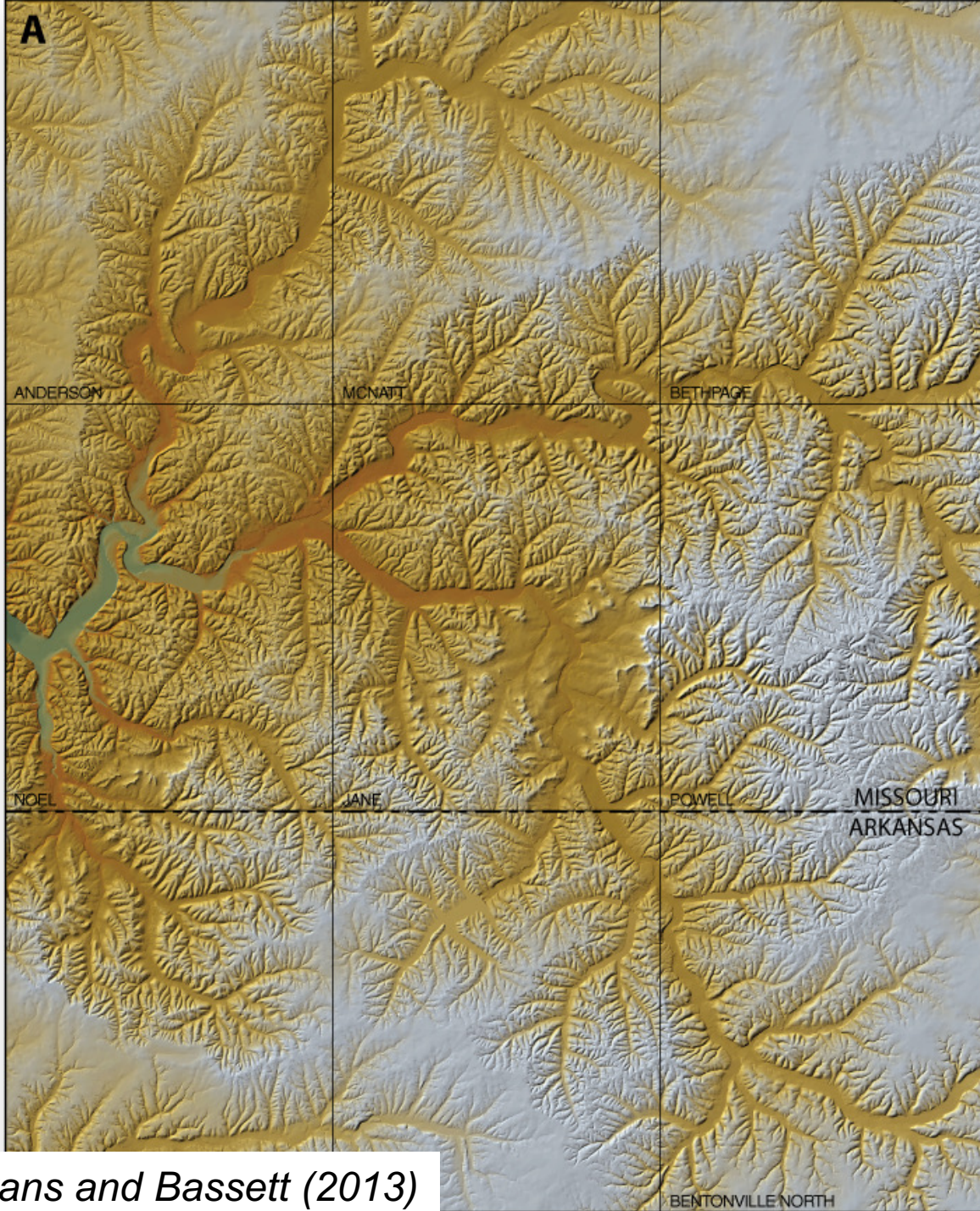
from Evans et al. (2010)
Childress and Grammer (2019)

Evans and Bassett (2013)

Fold in Slide Mass Compton Ls.



Jelly-roll slump in upper Compton Limestone, Jane, Missouri



Evans and Bassett (2013)



Bella Vista Quarry, Caverna, Missouri

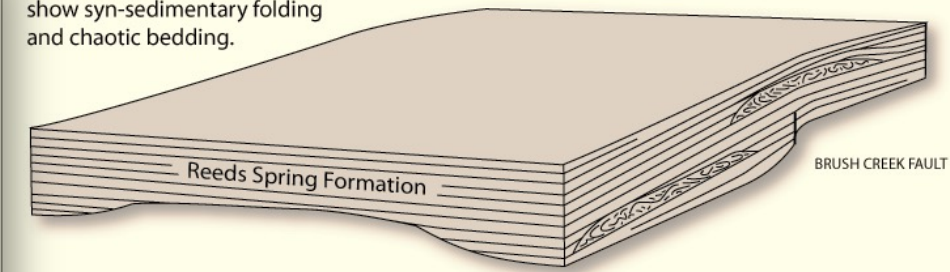
**Erosional Truncation
Wolf Pen Gap
Anticline**



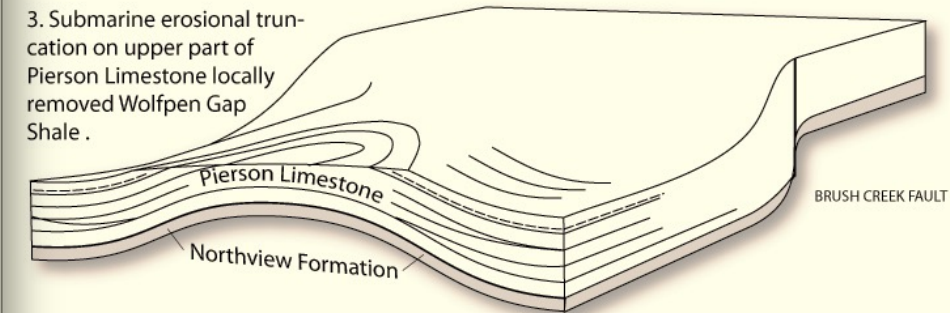


Evans and Bassett (2013)

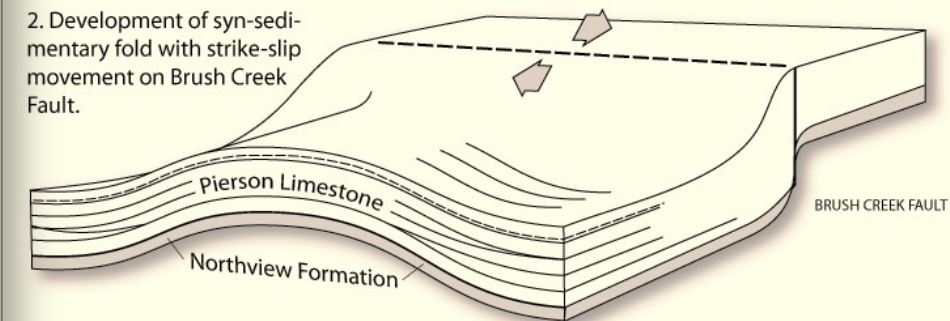
4. Slumps in Reeds Spring Formation show syn-sedimentary folding and chaotic bedding.



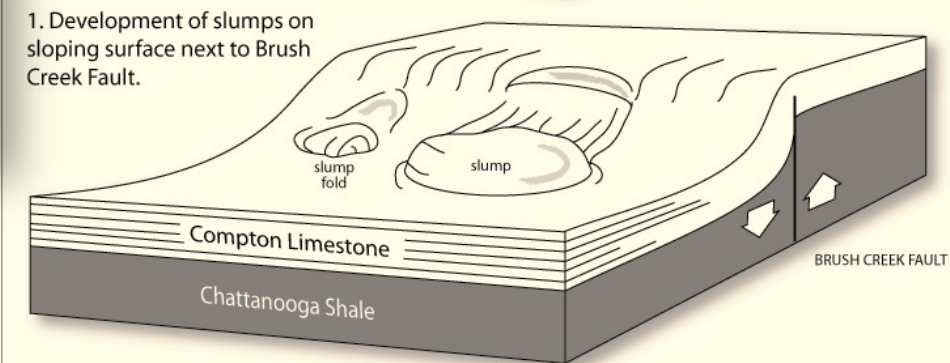
3. Submarine erosional truncation on upper part of Pierson Limestone locally removed Wolfpen Gap Shale.

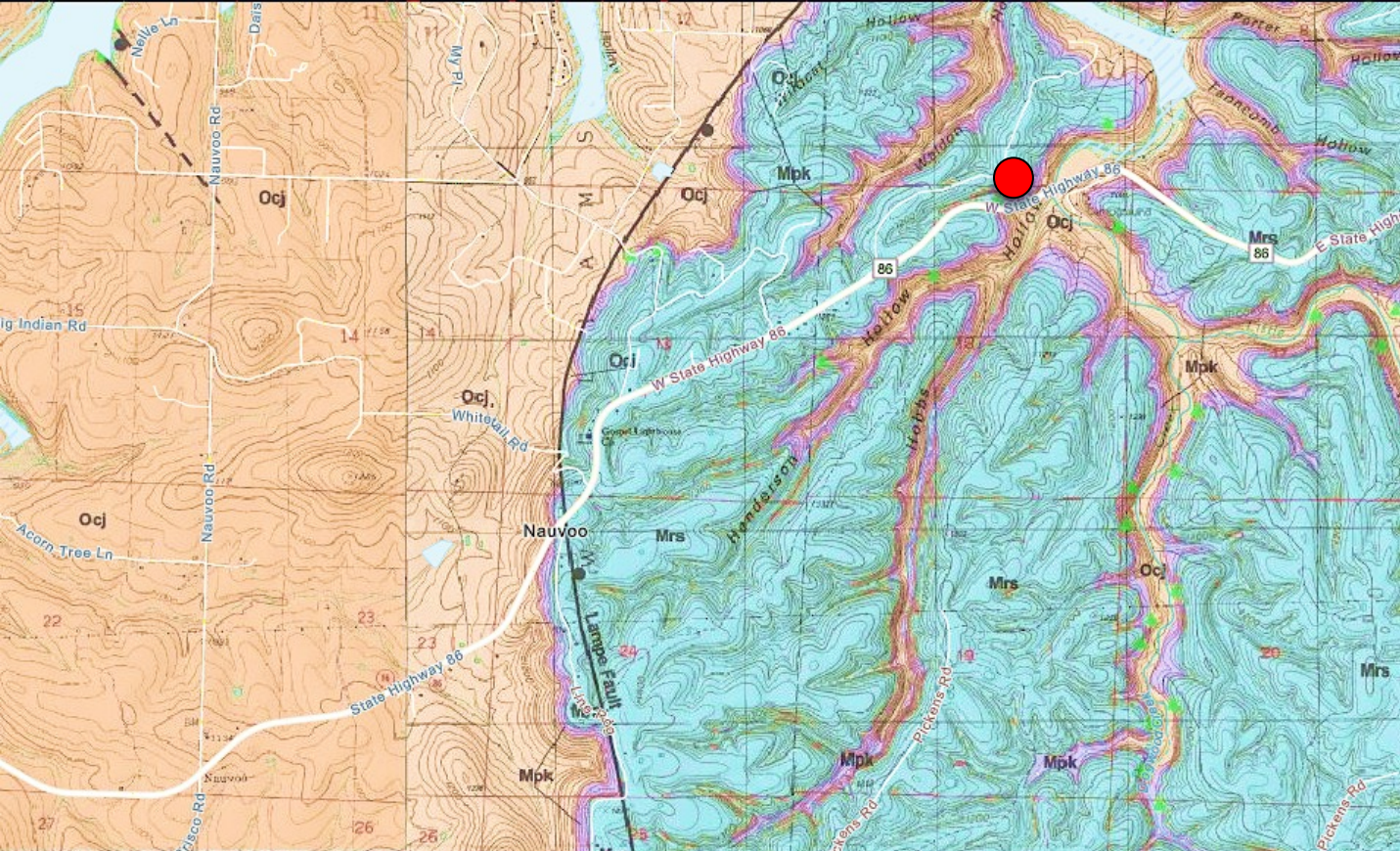


2. Development of syn-sedimentary fold with strike-slip movement on Brush Creek Fault.



1. Development of slumps on sloping surface next to Brush Creek Fault.





**Slide Masses in Compton Ls.
Near Lampe Fault (on downthrown
side)**

Koenig (1960) and Thomson (1975)



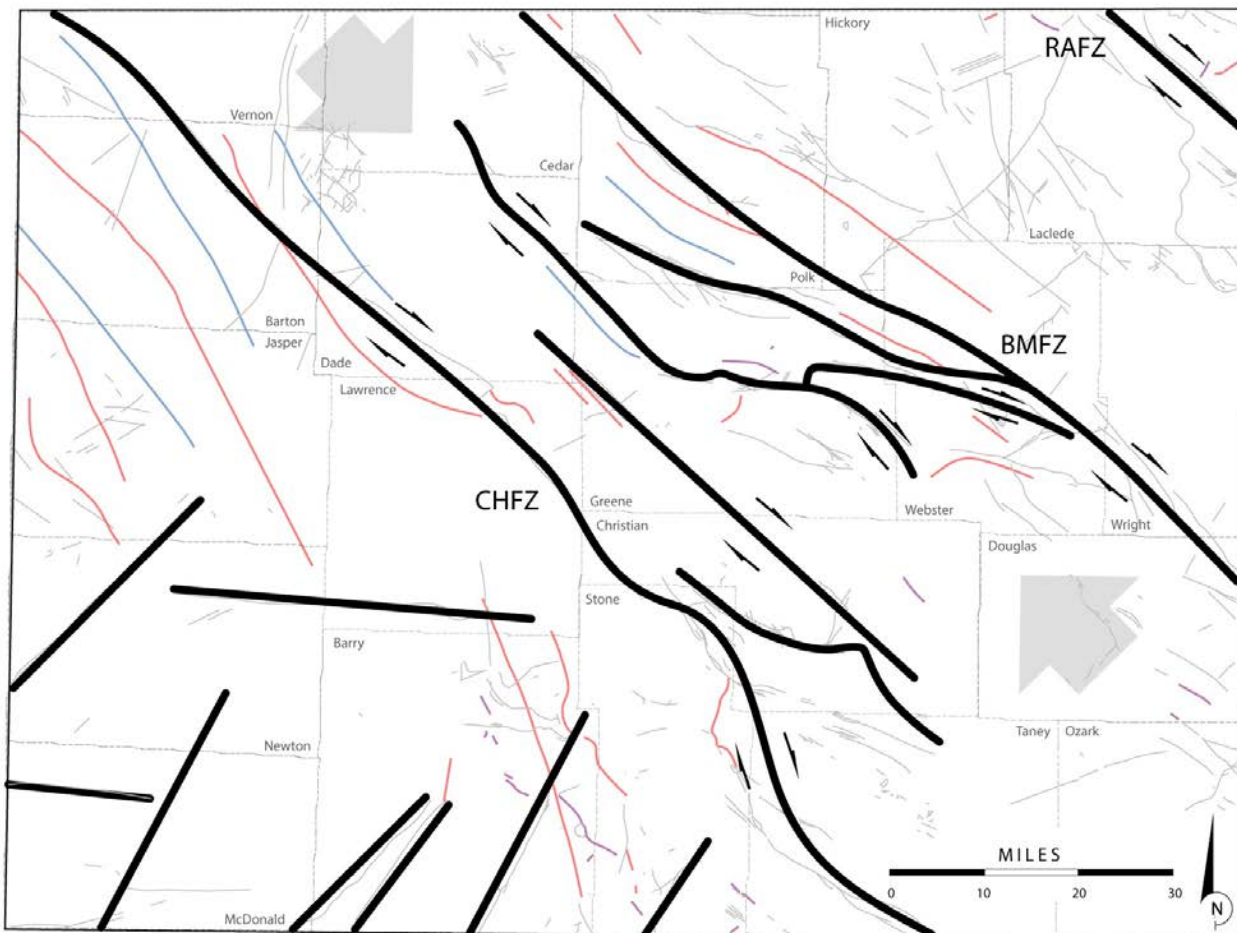
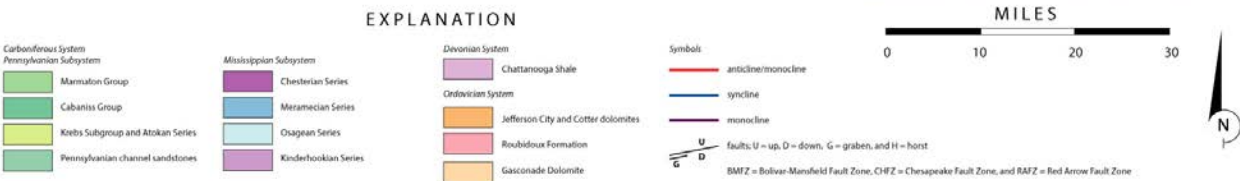
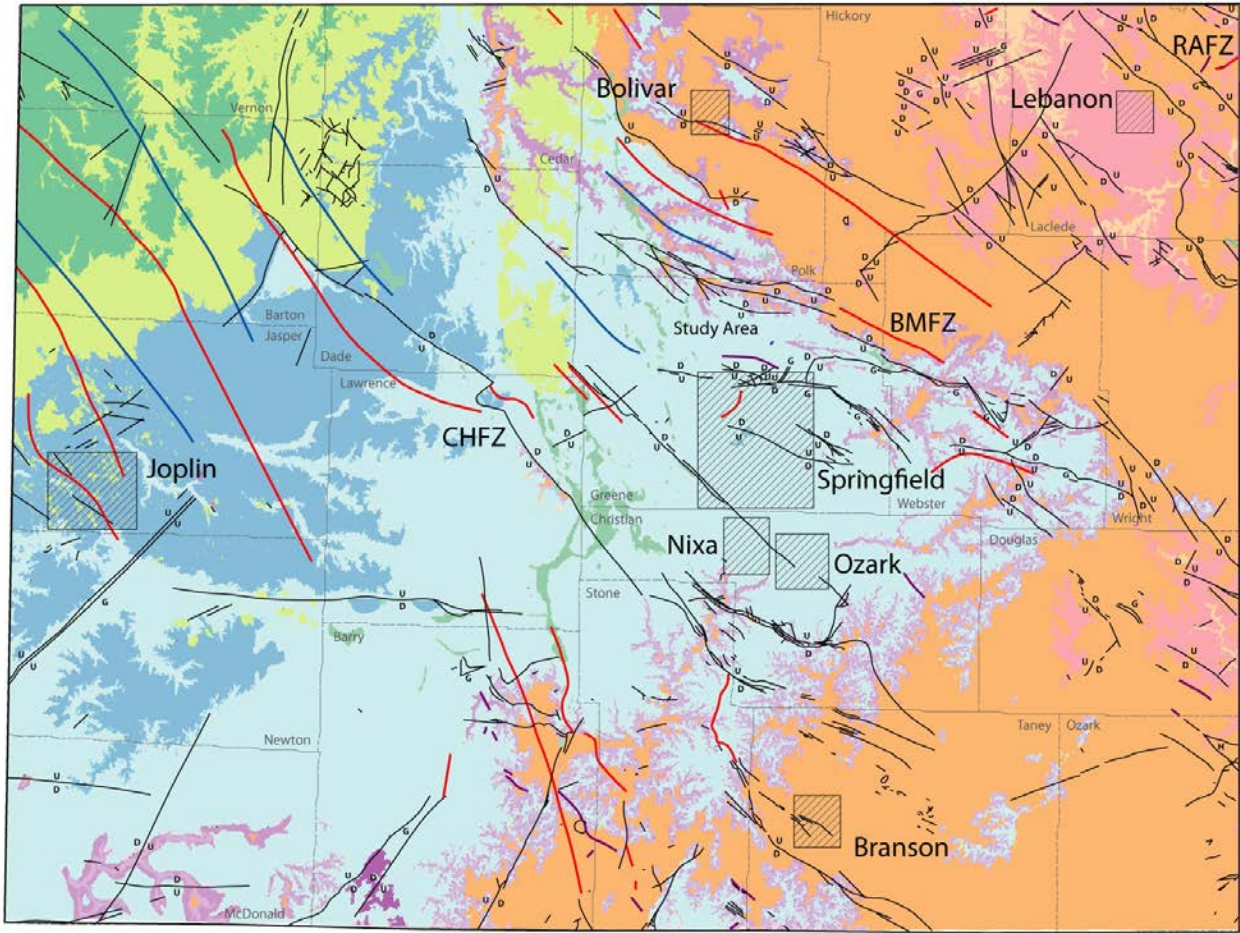
REVISING THE STRUCTURAL MODEL

**Reverse Fault,
Goodman, MO**



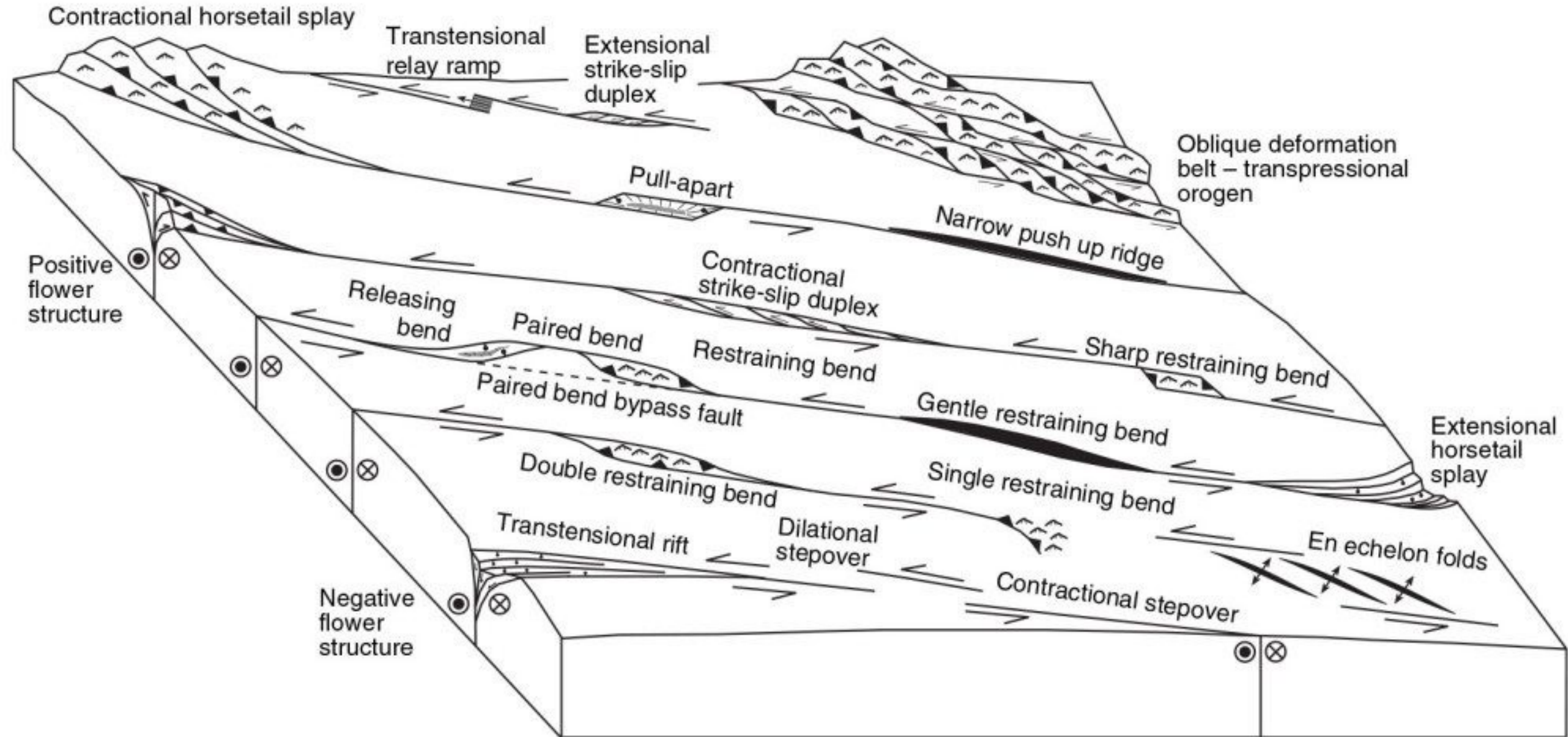


Fault Relays — Hard and Soft Linkages



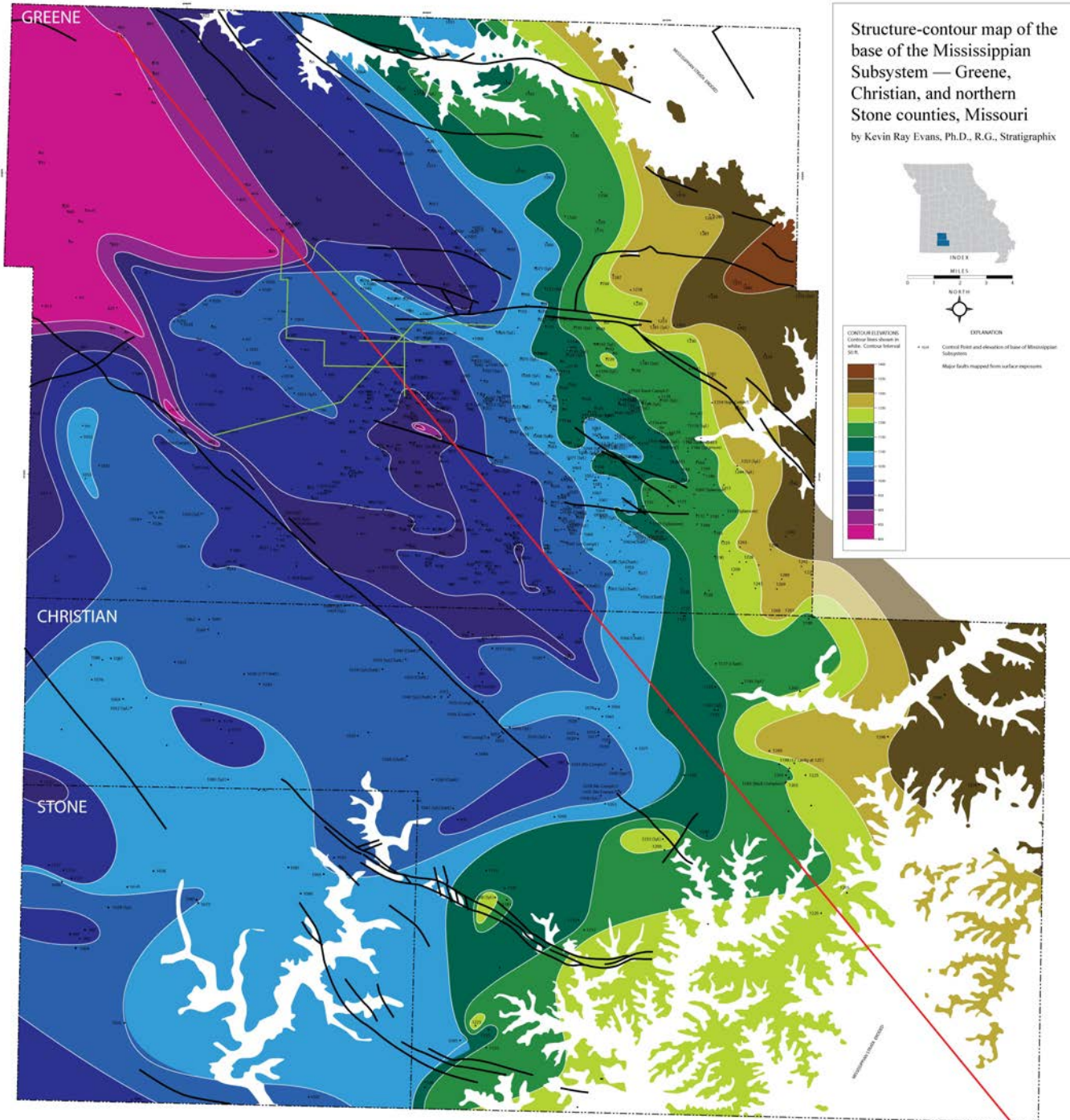
Modified from Missouri Geological Survey GeoSTRAT

Contractional and Extensional Structures in Strike-Slip Fault Systems



Structure Contour Map

Sub-Mississippian Unconformity





SUMMARY AND CONCLUSIONS

- Mid-continent southern Laurentia was passive margin late Neoproterozoic to Middle Devonian
- Uplift and denudation during early to middle Devonian; Arkansas Novaculite foredeep developed, and convergence on southern margin of Laurentia
- Mississippian convergence and renewed uplift; faulting and syn-tectonic sedimentation; major influence on sequence stratigraphy
- Renewed uplift in late Mississippian and early Pennsylvanian; development and filling of Arkoma Basin