

Fifth Annual Conference on Carbon Capture & Sequestration

Steps Toward Deployment

2-B Geologic-MMV (Field)

Importance of Seismic Reflection Data in Planning a Carbon Sequestration Project in Deep Saline Reservoirs

H.E. Leetaru, J. McBride, J. Belluchi, J. Freiburg

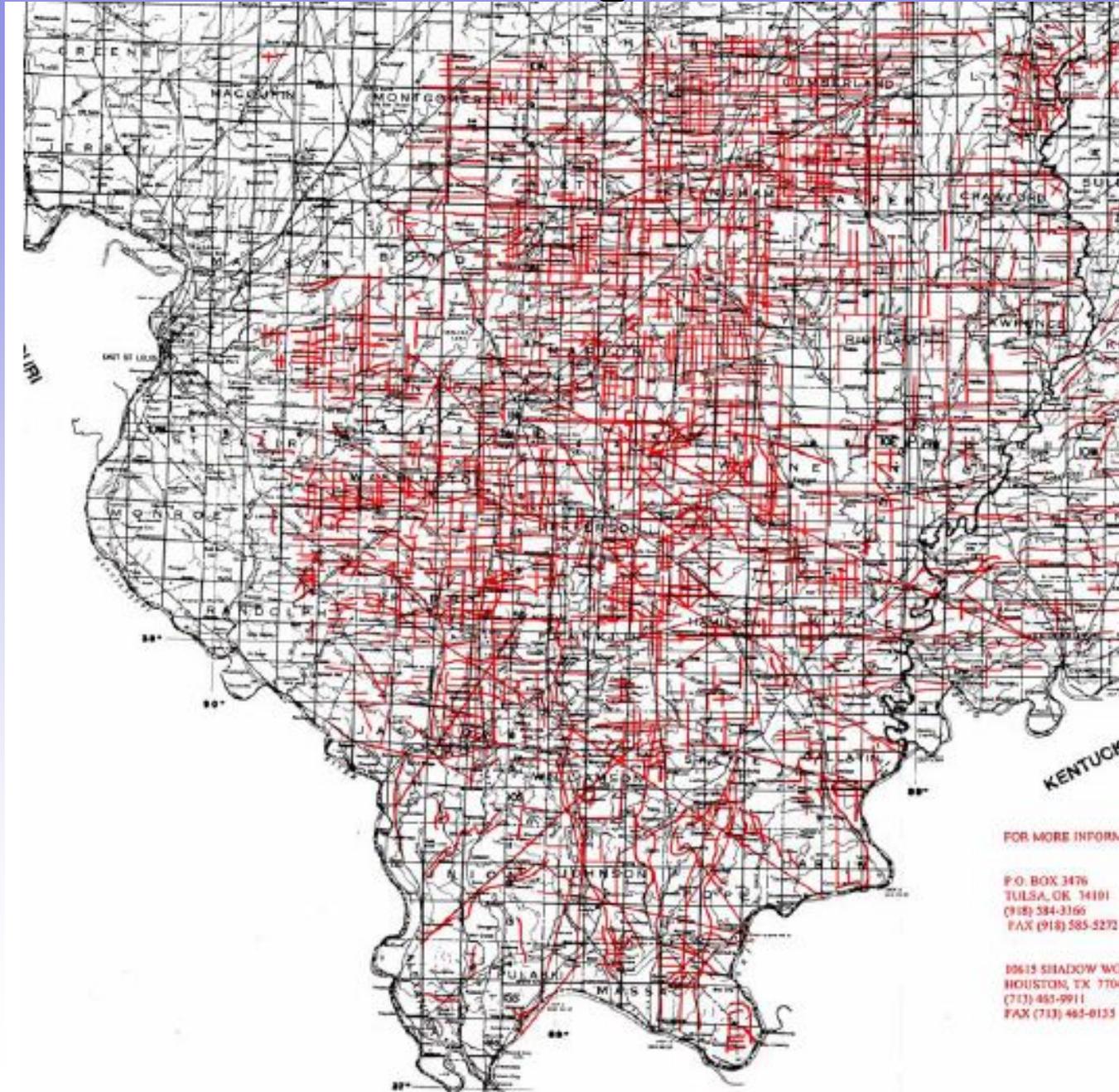
May 8-11, 2006, Hilton Alexandria Mark Center, Alexandria Virginia



Objectives

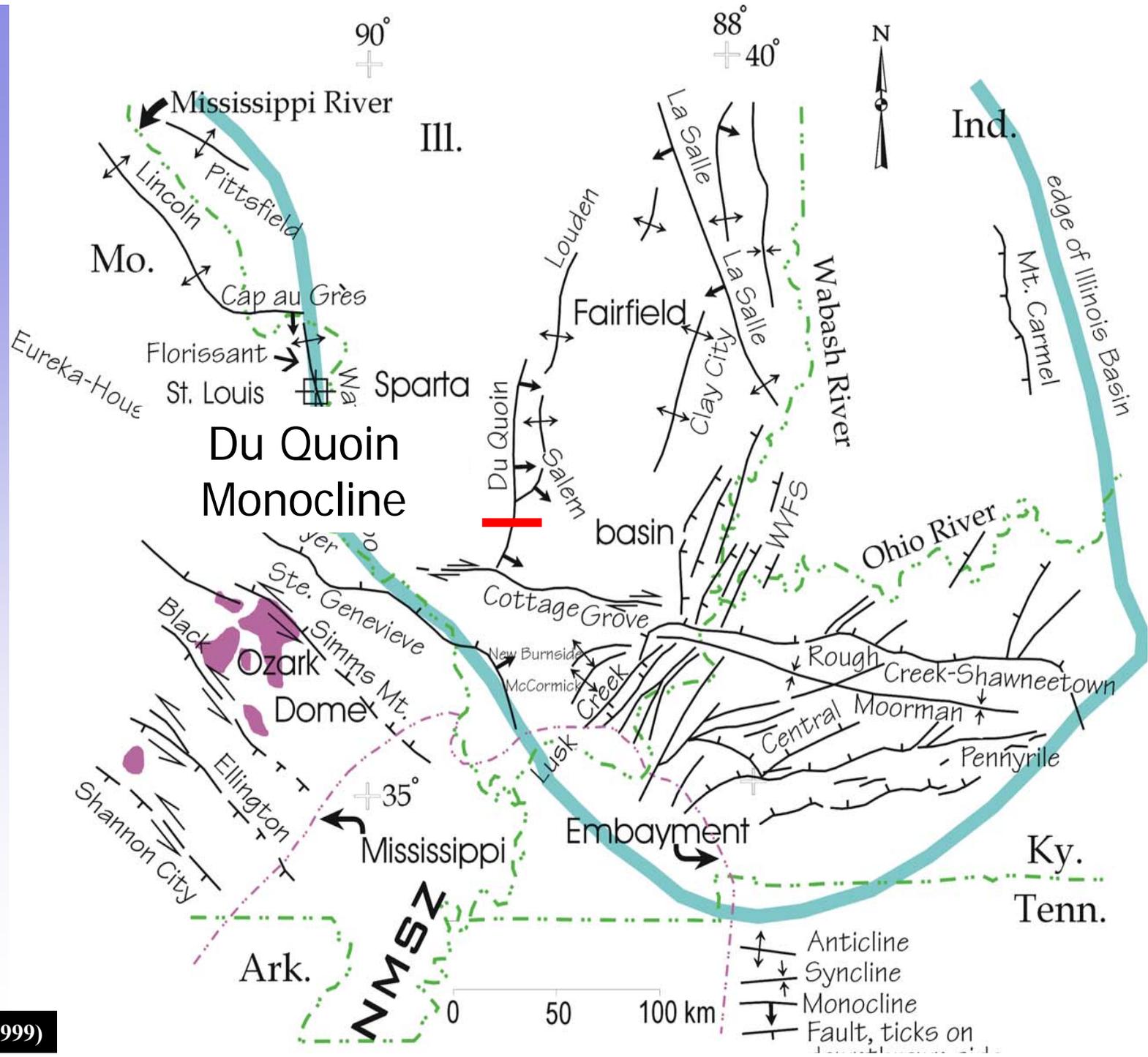
- Characterize fold and fault structures using seismic and borehole data for the purpose of assessing the integrity of sealing strata over candidate CO₂ sequestration reservoirs.
- Understanding Precambrian topography

Seismic Coverage in Illinois



Faulting at a Potential Site

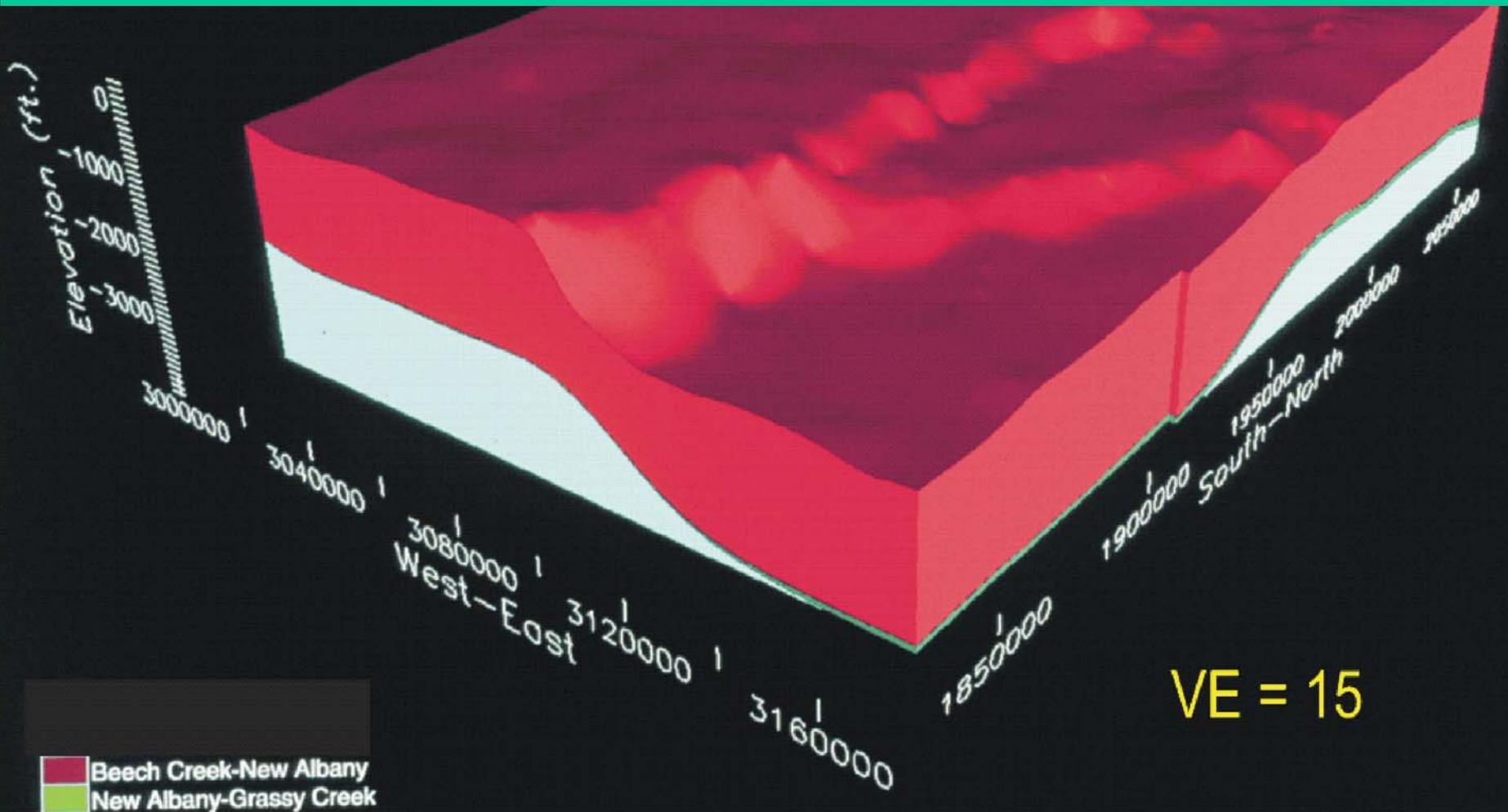
- Some faults may not be sealing and could provide a conduit for fluid flow to shallower horizons



(McBride and Nelson, 1999)

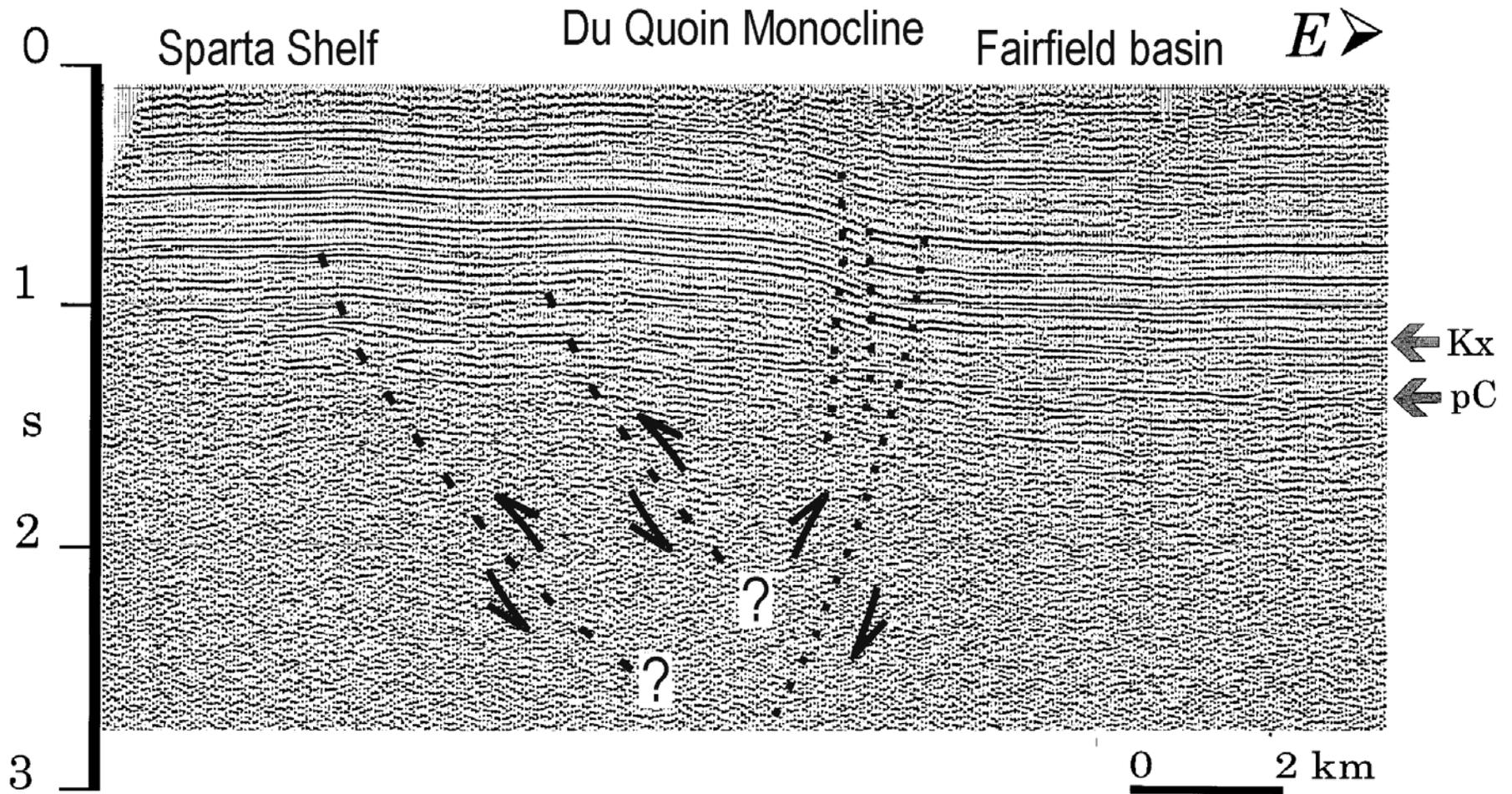
The Du Quoin Monocline Top of Beech Creek Limestone

drill-hole information provides basin shapes, but without structural detail



from Steve Marshak

Seismic reflection record over Du Quoin Monocline



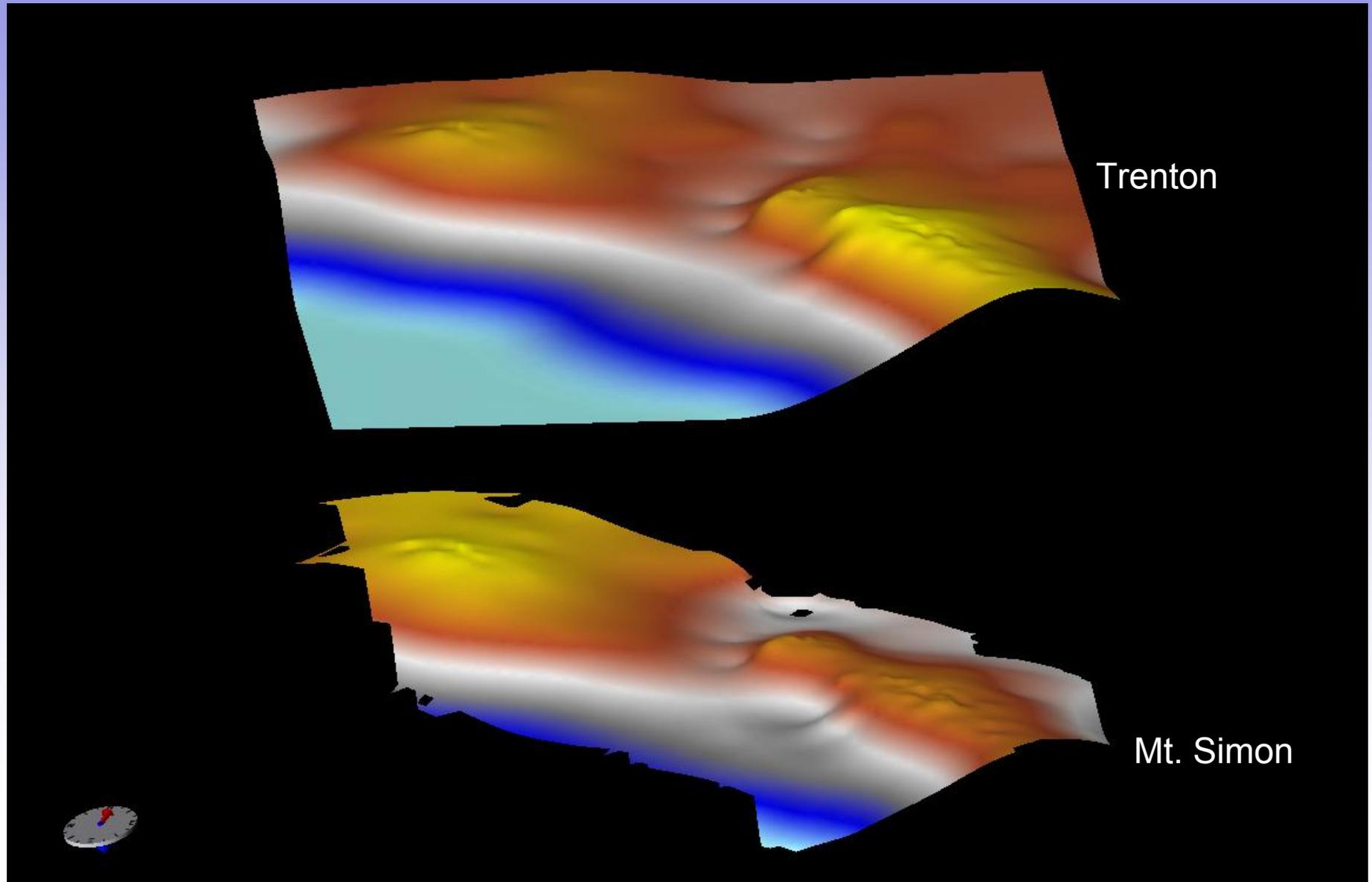
Lines on record indicate smooth rock layer boundaries

Breaks of lines represent offsets and faults

Mapping from Shallow Formations

- The shallow and deeper strata are not aligned directly beneath each other.
- The structural crest may be offset by thousands of feet

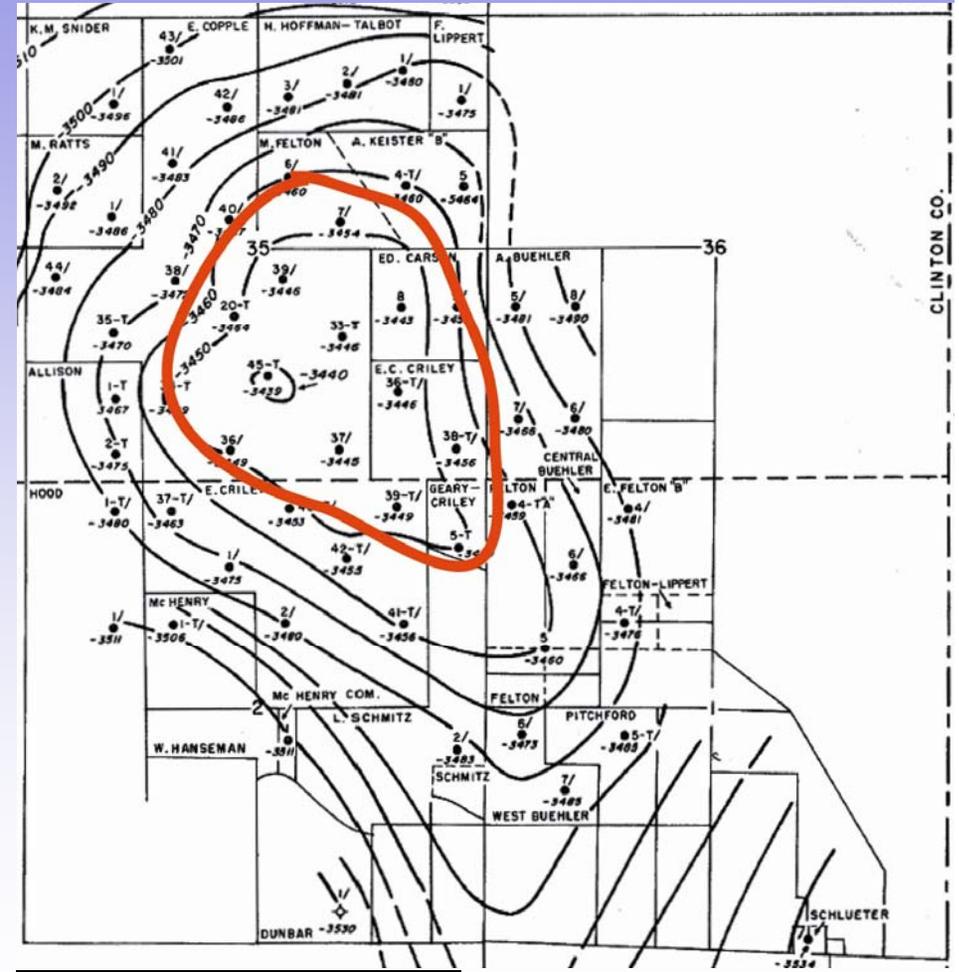
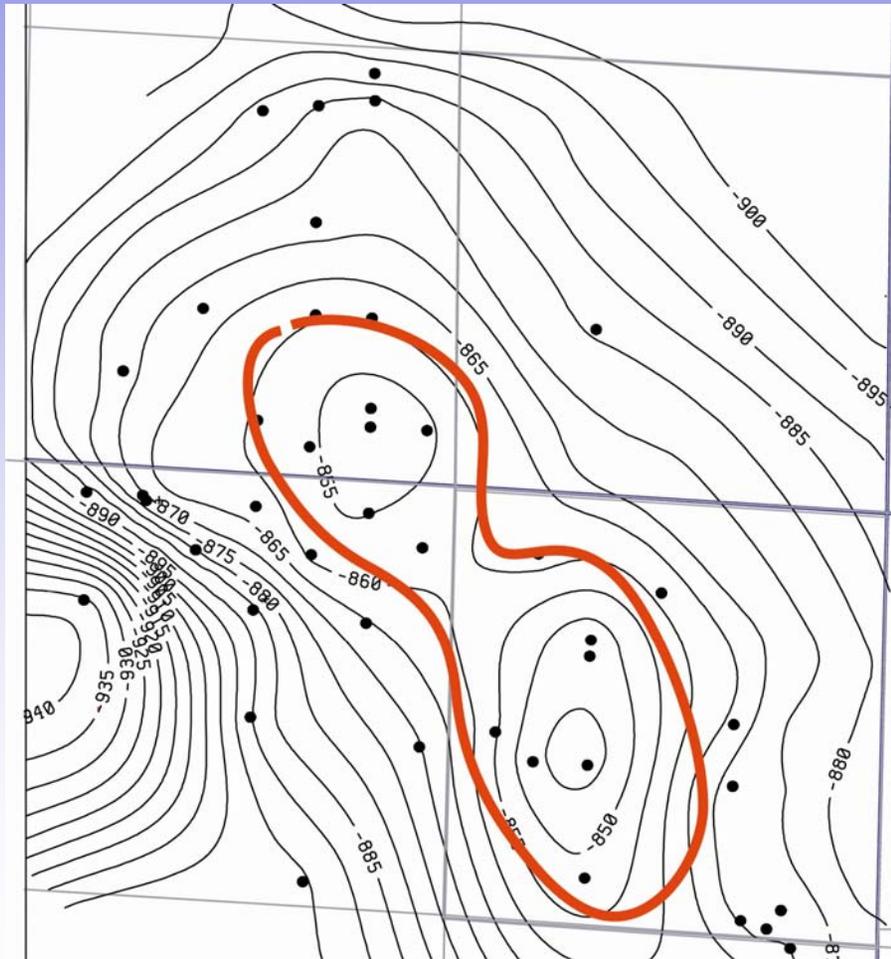
Hersher Gas Storage Field Inversion Structure



Centralia Field

Mississippian

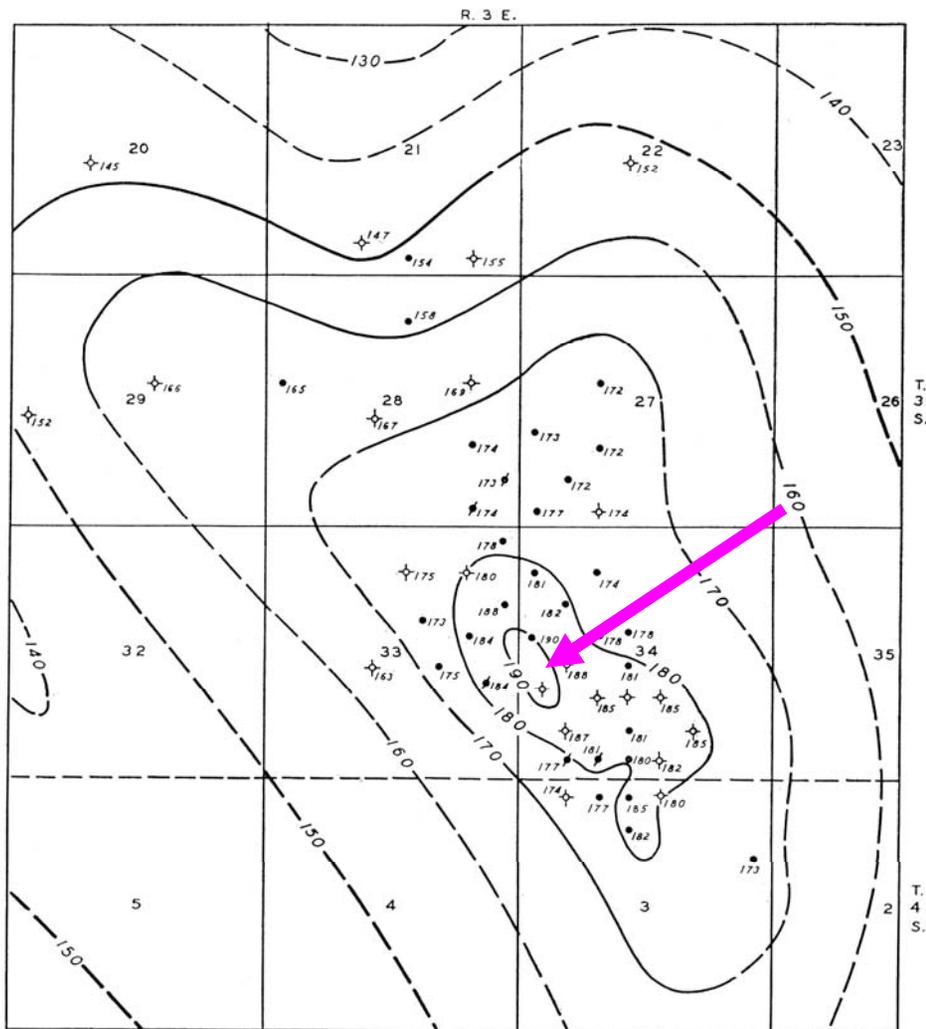
Ordovician



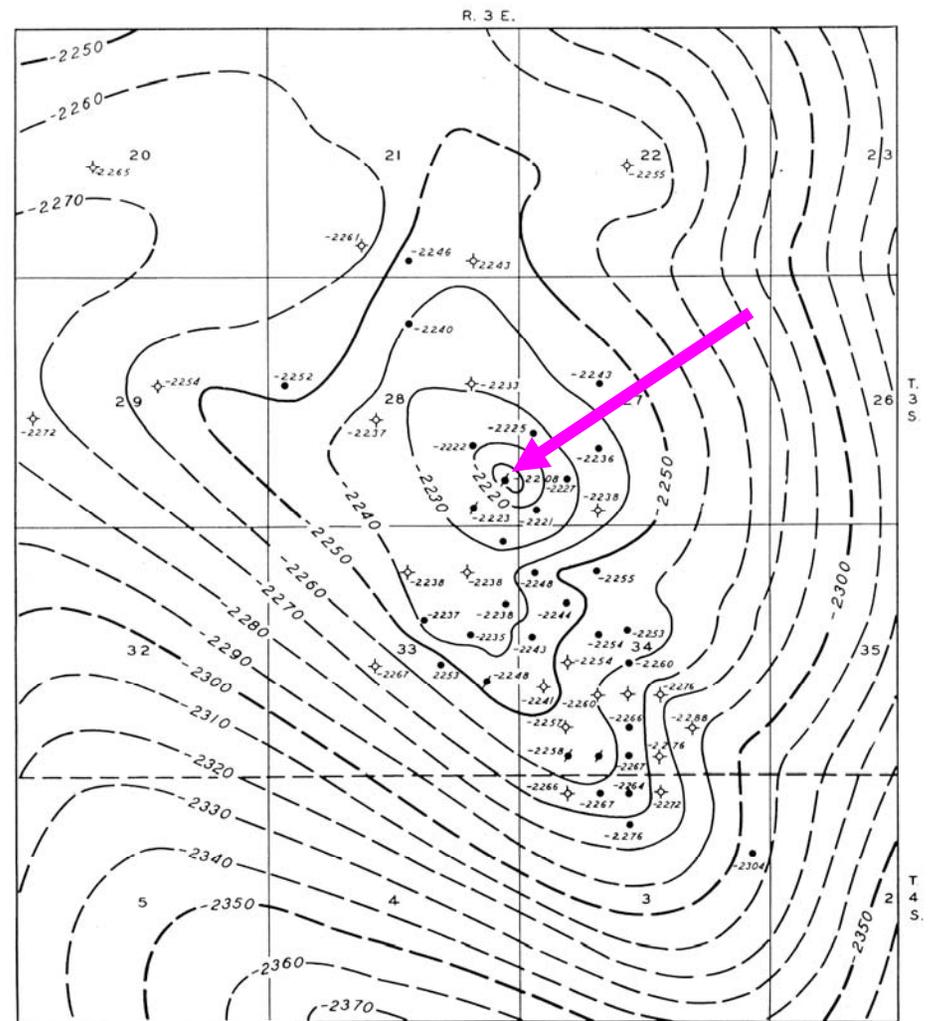
1 mile

Comparison of shallow and deep horizons at King Field

Shallow Horizon
Pennsylvanian



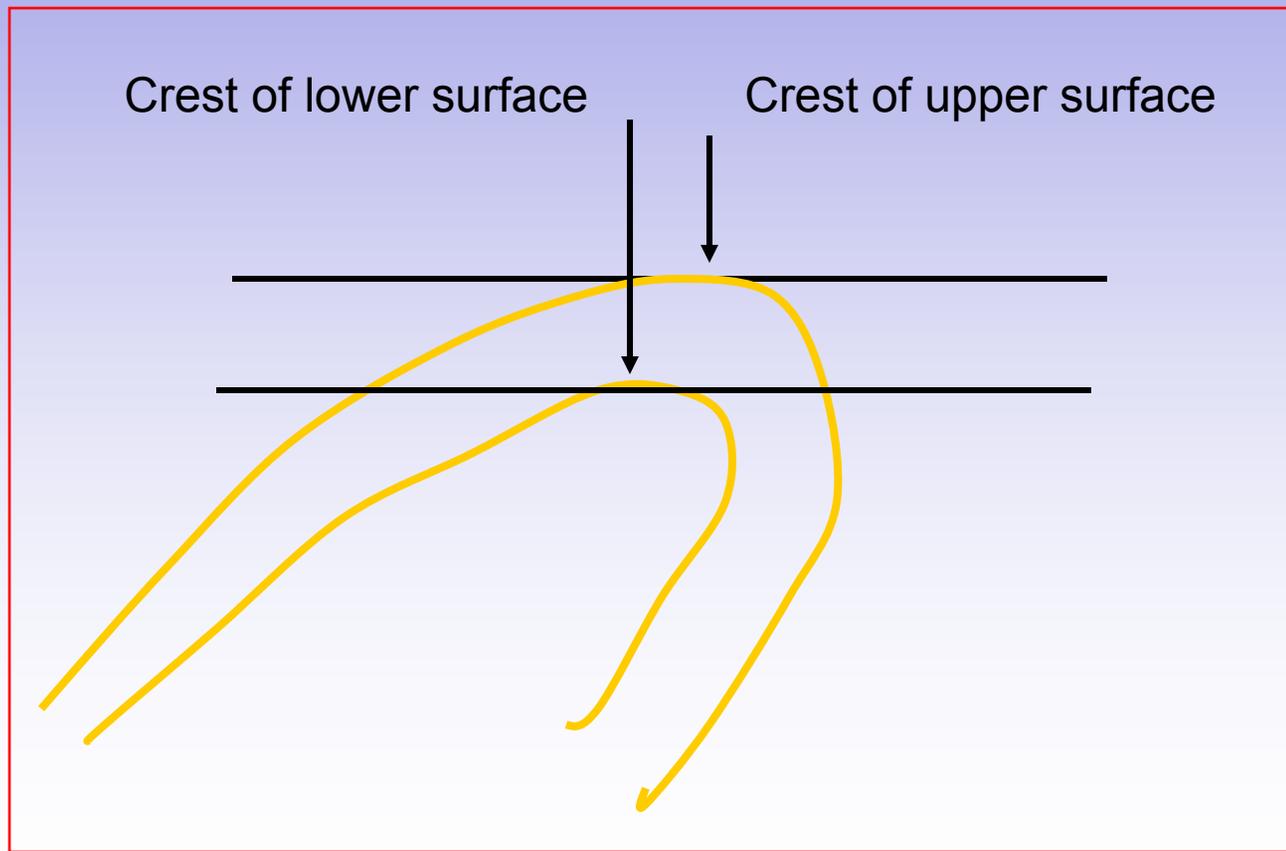
Deep Horizon
Mississippian



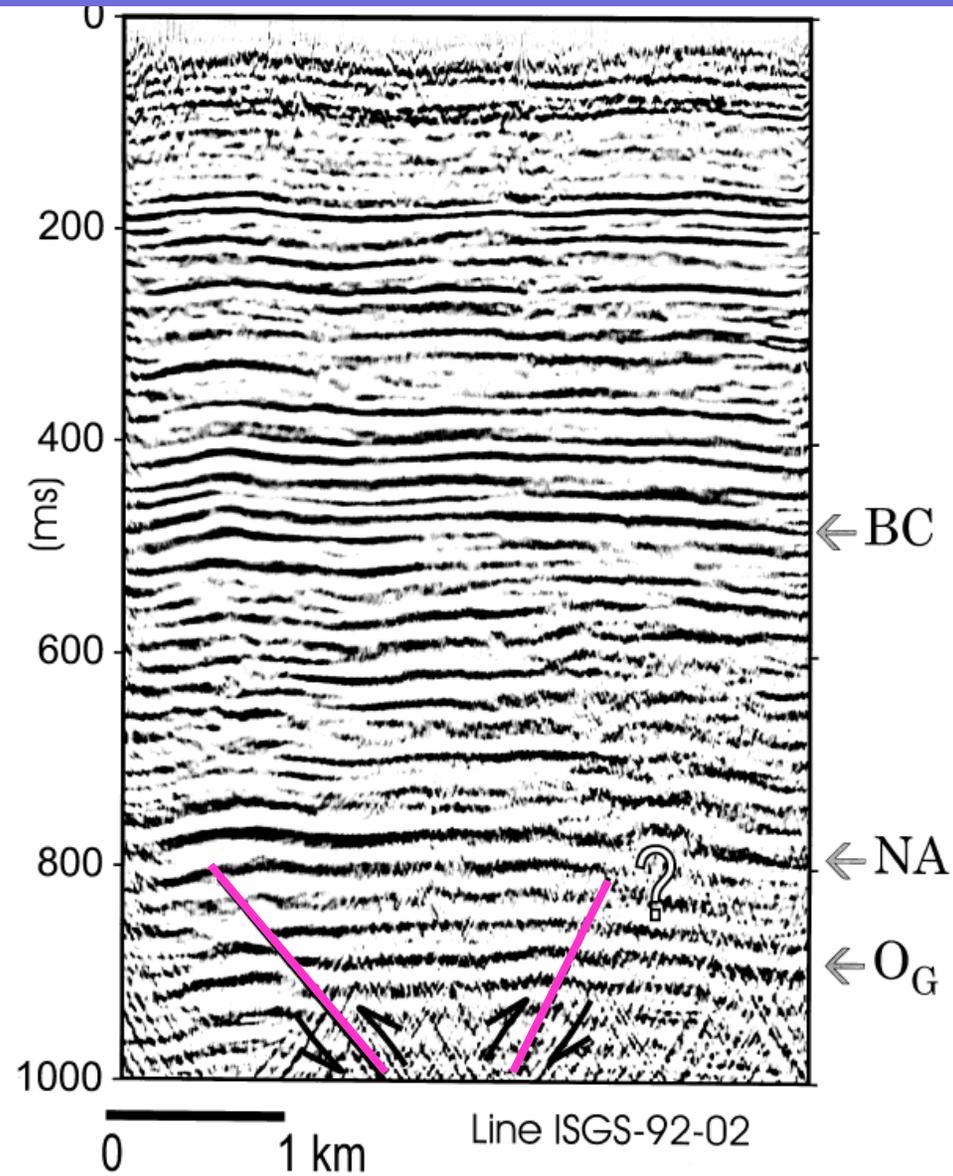
1 Mile

(Folk 1946)

Folds with inclined axial planes cause the crest of the anticline to shift

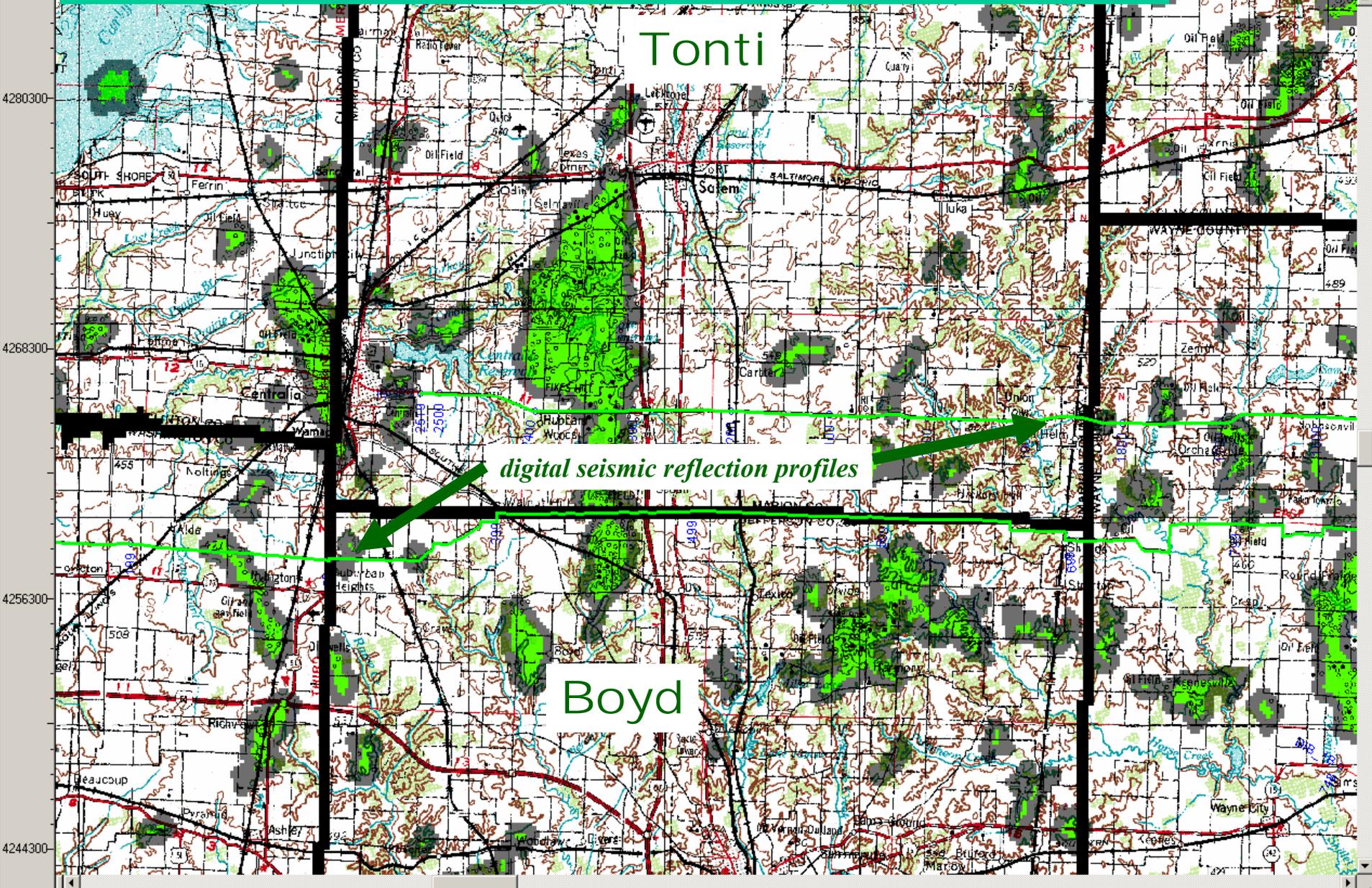


King Field Seismic

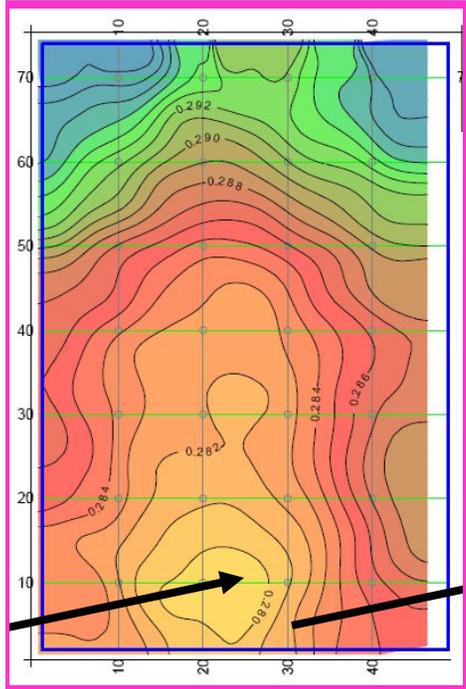


McBride 1999

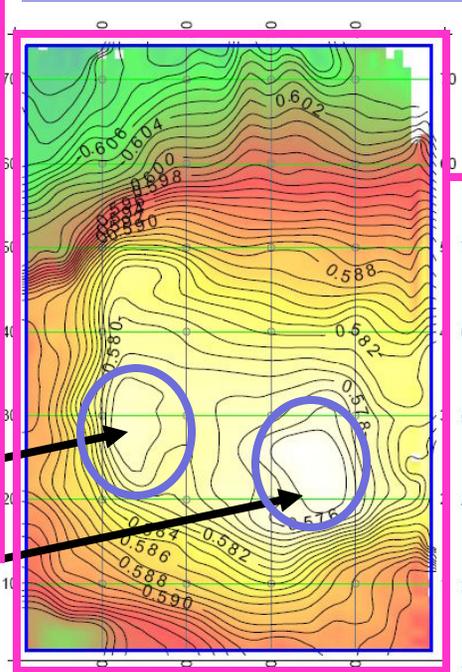
Digital exploration seismic reflection data base



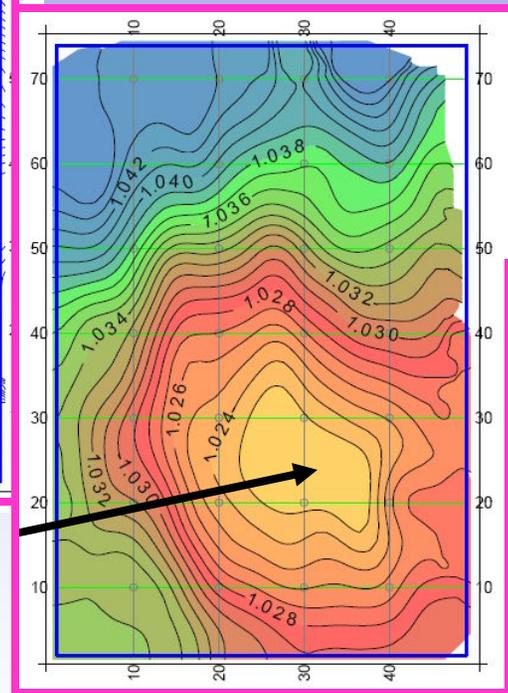
Mississippian Comparison of Structure with Depth



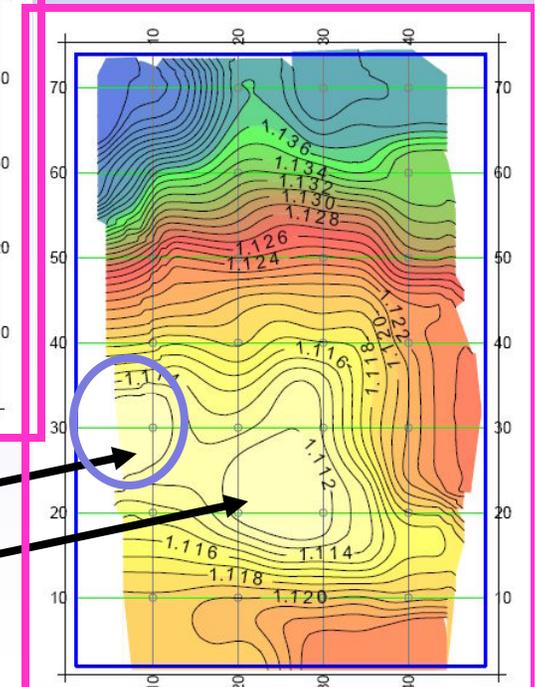
Devonian



B. Knox

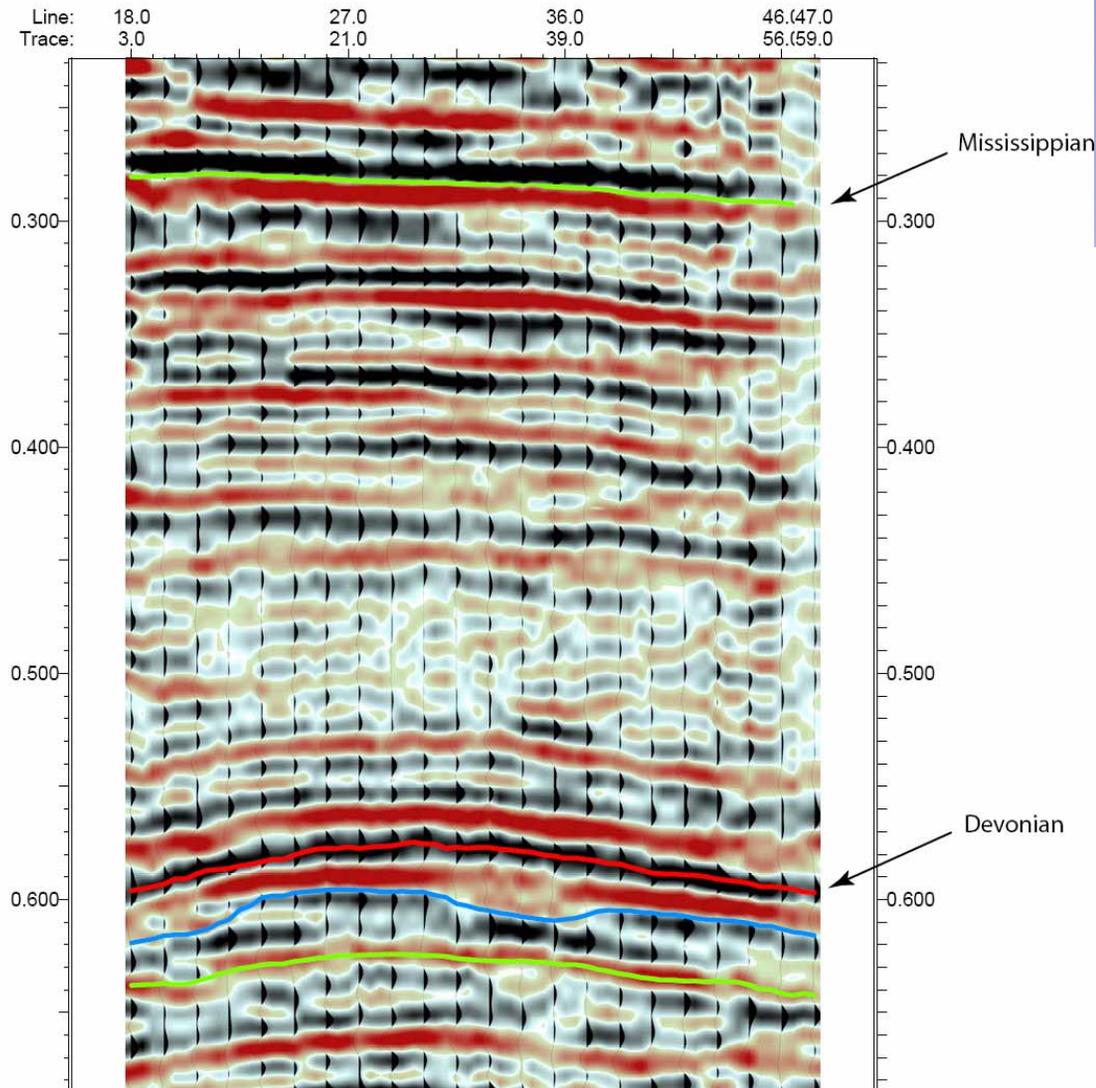


Precambrian

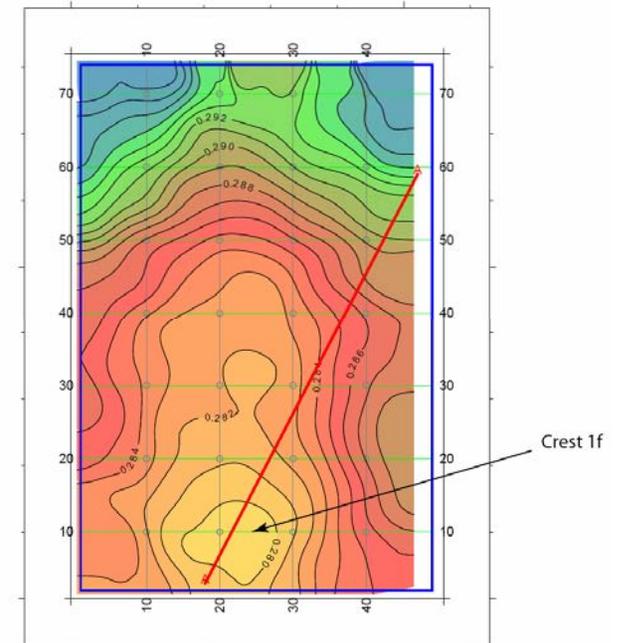


3000 ft

Showing Mississippian and Devonian Structure



Subsurface Seismic Map
Tonti Field, Marion County, Mississippian

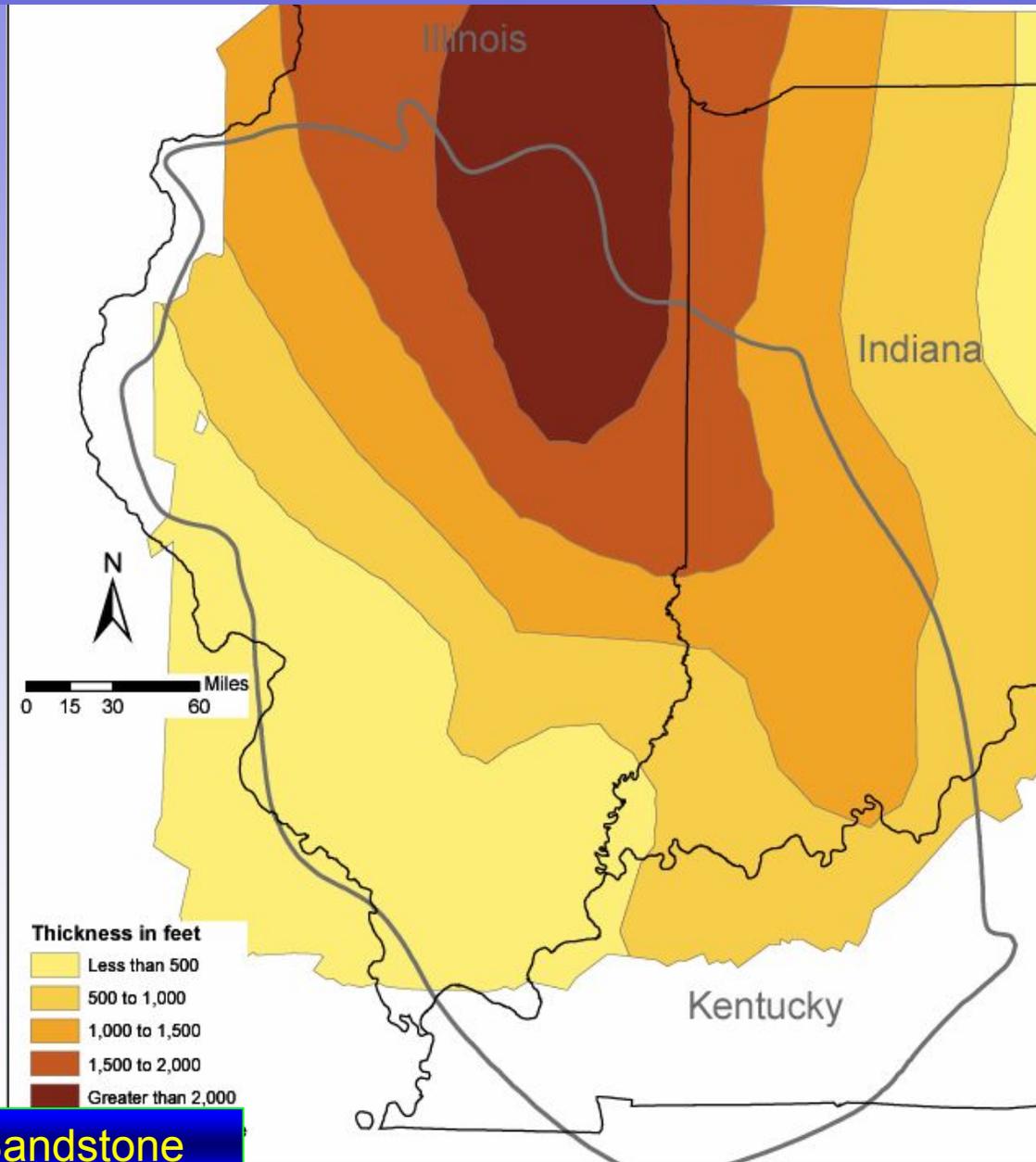
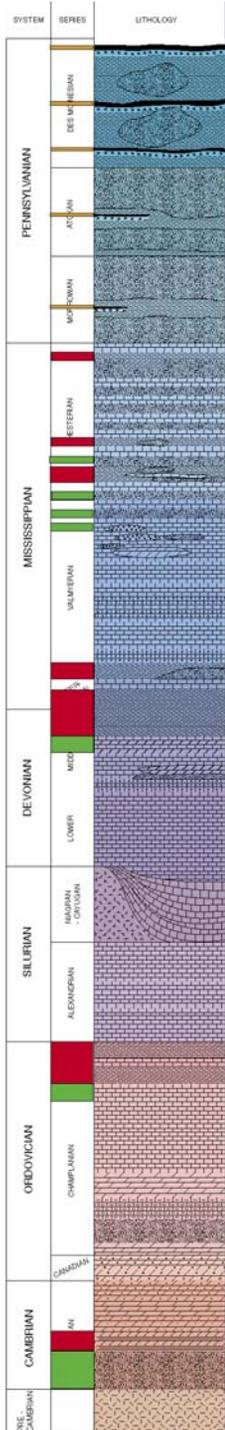


Scale = 1:9021
0 752 1503 2255 ft

Precambrian Highs

- Why should we worry about them?

Thickness of Mt. Simon Sandstone

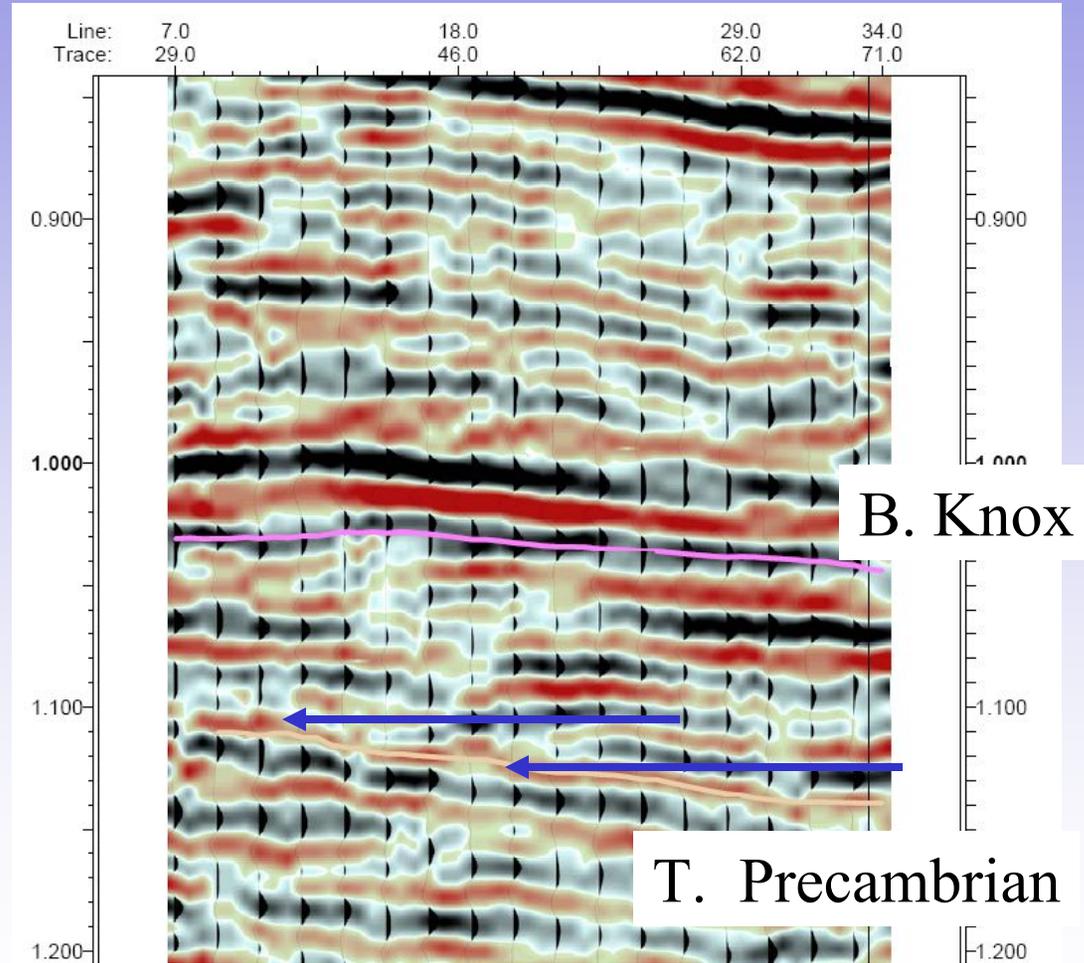
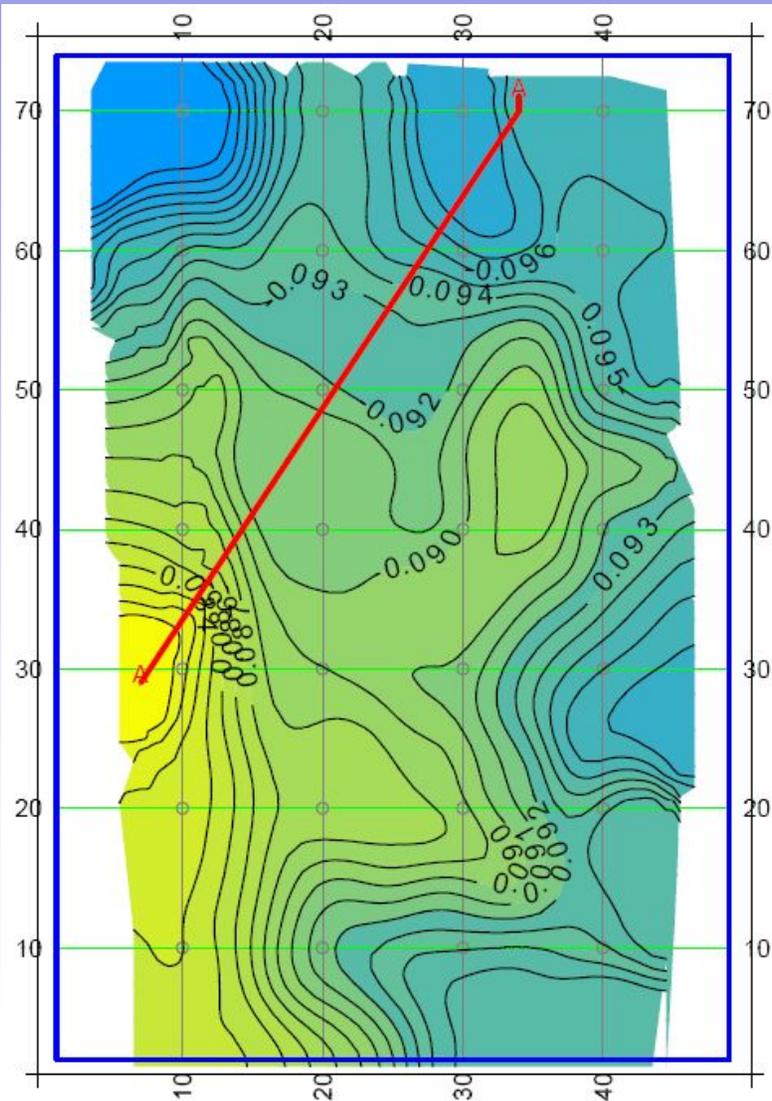


Mt. Simon Sandstone

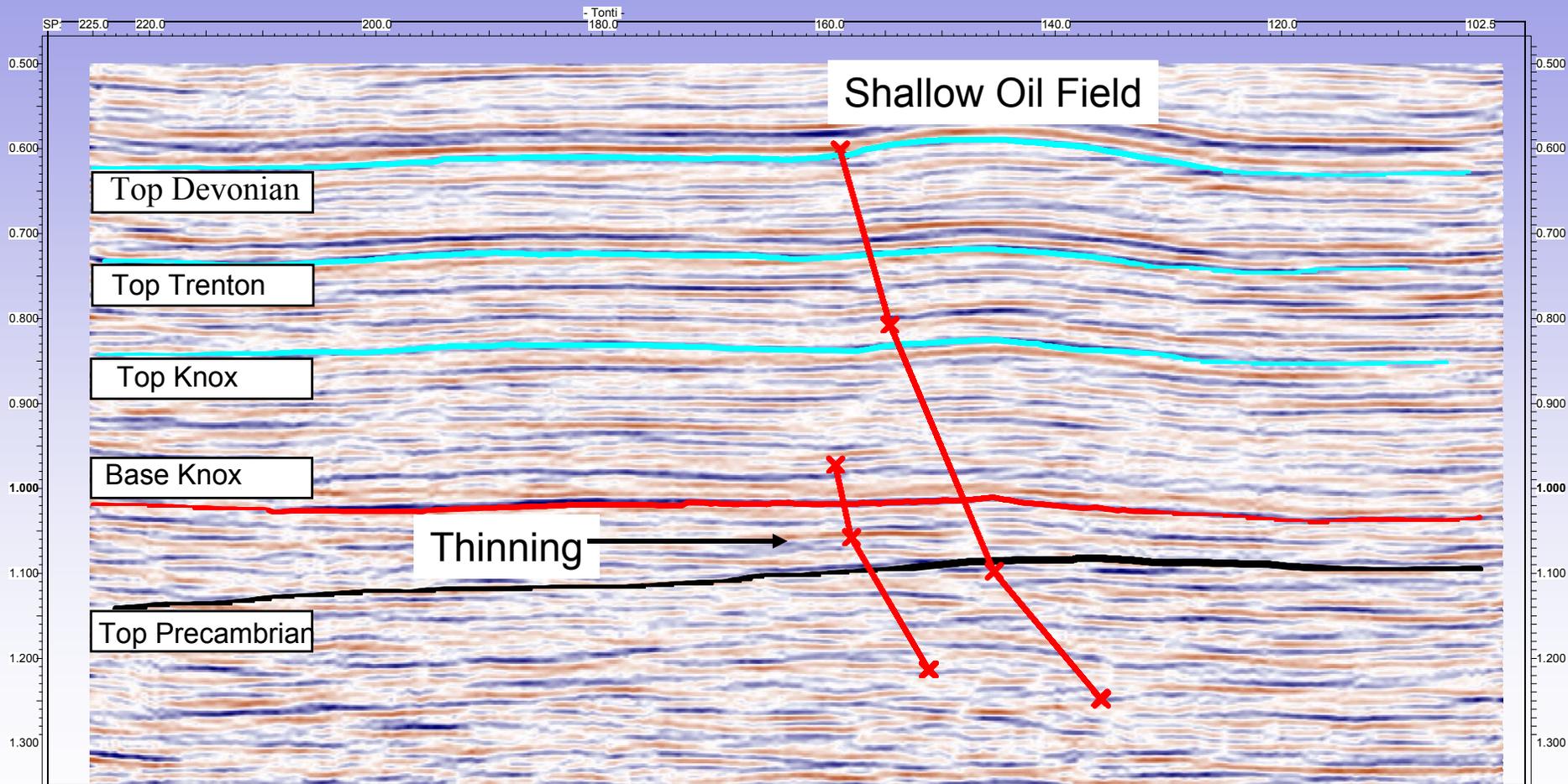
Isopach Thickness of the Mt. Simon Sandstone, Regional

Precambrian Highs

B. Knox to Precambrian Interval



Reflection Seismic Thin Areas May Lack Mt. Simon



Conclusion

- Shallow structure cannot always be used for mapping deep structures
- You need seismic, preferably 3D for locating an injection site