

# **Cypress Sandstone Reservoir Characterization Across the Clay City Anticline, Richland and Clay Counties, Illinois\***

**Zohreh Askari<sup>1</sup>, Yaghoob Lasemi<sup>2</sup>, and Nathan D. Webb<sup>2</sup>**

Search and Discovery Article #51364 (2017)\*\*

Posted March 6, 2017

\*Adapted from oral presentation given at AAPG 2016 Eastern Section Meeting, Lexington, Kentucky, September 25-27, 2016

\*\*Datapages © 2017 Serial rights given by author. For all other rights contact author directly.

<sup>1</sup>Illinois State Geological Survey, University of Illinois at Urbana-Champaign, Champaign, IL 61820 ([askari@illinois.edu](mailto:askari@illinois.edu))

<sup>2</sup>Illinois State Geological Survey, University of Illinois at Urbana-Champaign, Champaign, IL 61820

## **Abstract**

The Upper Mississippian Cypress Sandstone is the most prolific siliciclastic unit in the Illinois Basin and commonly produces from southwest trending lenticular reservoirs. The boundaries of Cypress with the overlying Beech Creek Limestone and the underlying Ridenhower Formation are conformable. However, in places thick Cypress sandstone cut into Ridenhower that commonly consists of shale and discontinuous sandstone and limestone beds. A persistent paleosol horizon is present near the top of Cypress recording a subaerial unconformity. Detailed well to well correlation and lithofacies analysis in the deeper part of the basin (Fairfield Basin) have indicated that the Cypress (over 60 meters thick) commonly consists of lenticular sandstone bodies interbedded with shale. In places, shale and siltstone are the dominant lithology or the only lithology present.

In Richland and Clay Counties, along the Clay City Anticline, Cypress oil production is from the upper part of amalgamated thick sand bodies (mainly on anticlinal closures) and from porous lenticular and compartmentalized sandstones developed in the upper part of the formation. Sandstone bodies consist of fine to medium grained sublitharenite to quartzarenite attaining an average porosity of over 18 percent. The Cypress succession comprises: (1) a mainly deltaic unit in which prodelta mudstone passing upward into distal to proximal coarsening-upward distributary channel mouth-bar sandstones or blocky to fining-upward sandstone lenses interpreted as distributary channel fill deposit, (2) a shallow marine succession of mudstone to mature sandstone interpreted as offshore bar or shoreface deposit, and (3) major lenticular, multistory sand bodies at several horizons with shale partings or shale interbeds displaying blocky or bell shaped profile. These sand bodies cut down several meters into the succession and the lowermost horizon may reach the limestone or shale of the underlying Ridenhower Formation. They may correlate with the paleosol horizons reported within the Cypress and are interpreted as incised-valley fills that cut into the previous deposits during fourth-order sea level falls.

## **Reference Cited**

Nelson, W.J., L.B. Smith, and J.D. Treworgy, 2002, Sequence Stratigraphy of the Lower Chesterian (Mississippian) Strata of the Illinois Basin: Illinois State Geological Survey, Champaign, IL, Bulletin 107, 70 p.

# Cypress Sandstone Reservoir Characterization Across the Clay City Anticline, Richland and Clay Counties, Illinois

Zohreh Askari, Yaghoob Lasemi, and Nathan D. Webb

Illinois State Geological Survey, University  
of Illinois at Urbana-Champaign,  
Champaign, Illinois

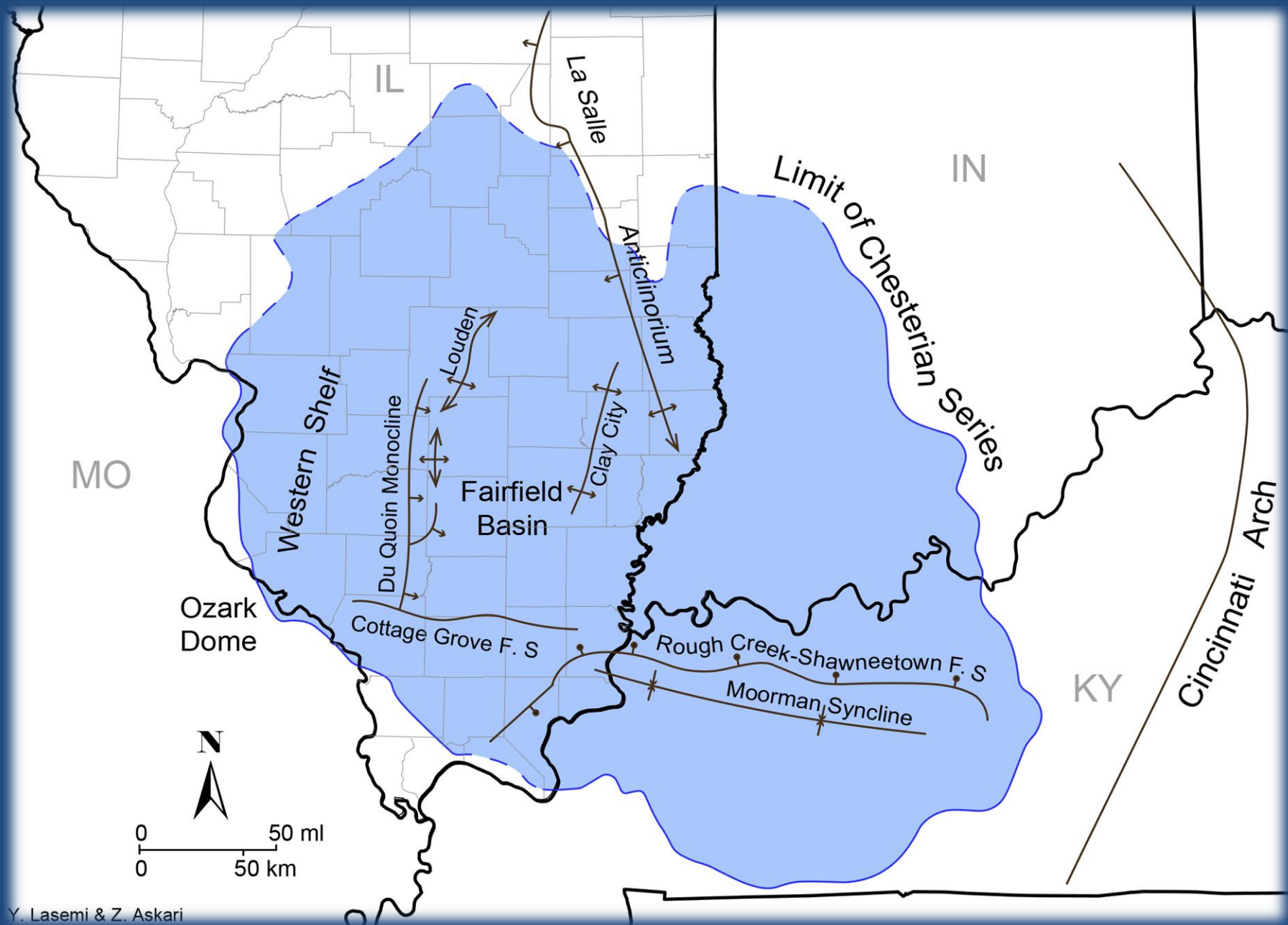


# Acknowledgements

This work is partially funded by the U.S. Department of Energy Cypress Contract No. 1-483042-547014-191100 (N. D. Webb PI). Maps and cross sections were prepared using the IHS PETRA software as part of the University Grants Program.

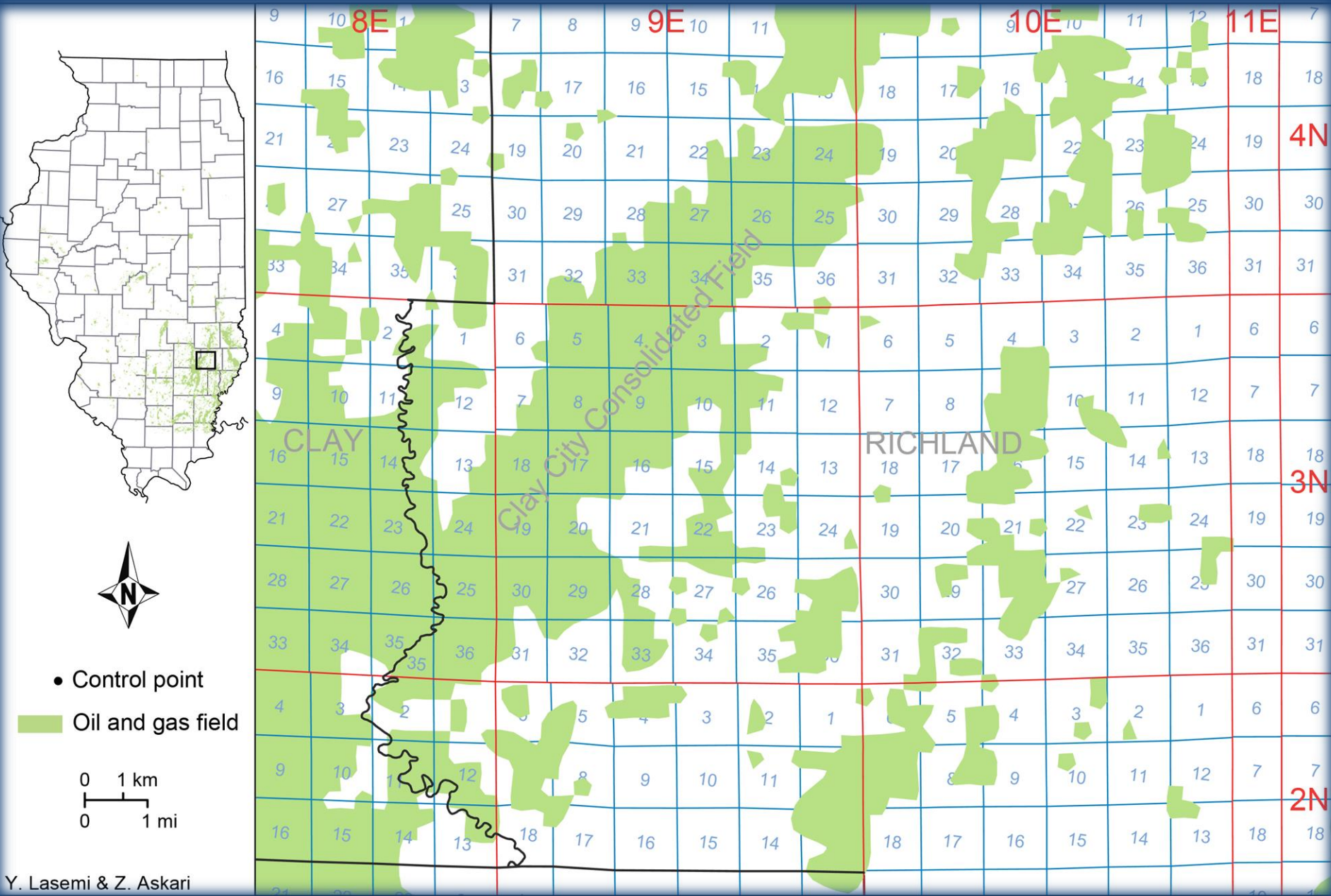
# Objectives

- ❑ Stratigraphy of the Mississippian Cypress Sandstone in the deeper part of the Illinois Basin (Fairfield Basin) using subsurface data.
- ❑ Lithofacies and correlation of the Cypress in the study area.
- ❑ Reservoir units and their lateral and vertical variability across the Clay City Anticline.



Y. Lasemi & Z. Askari

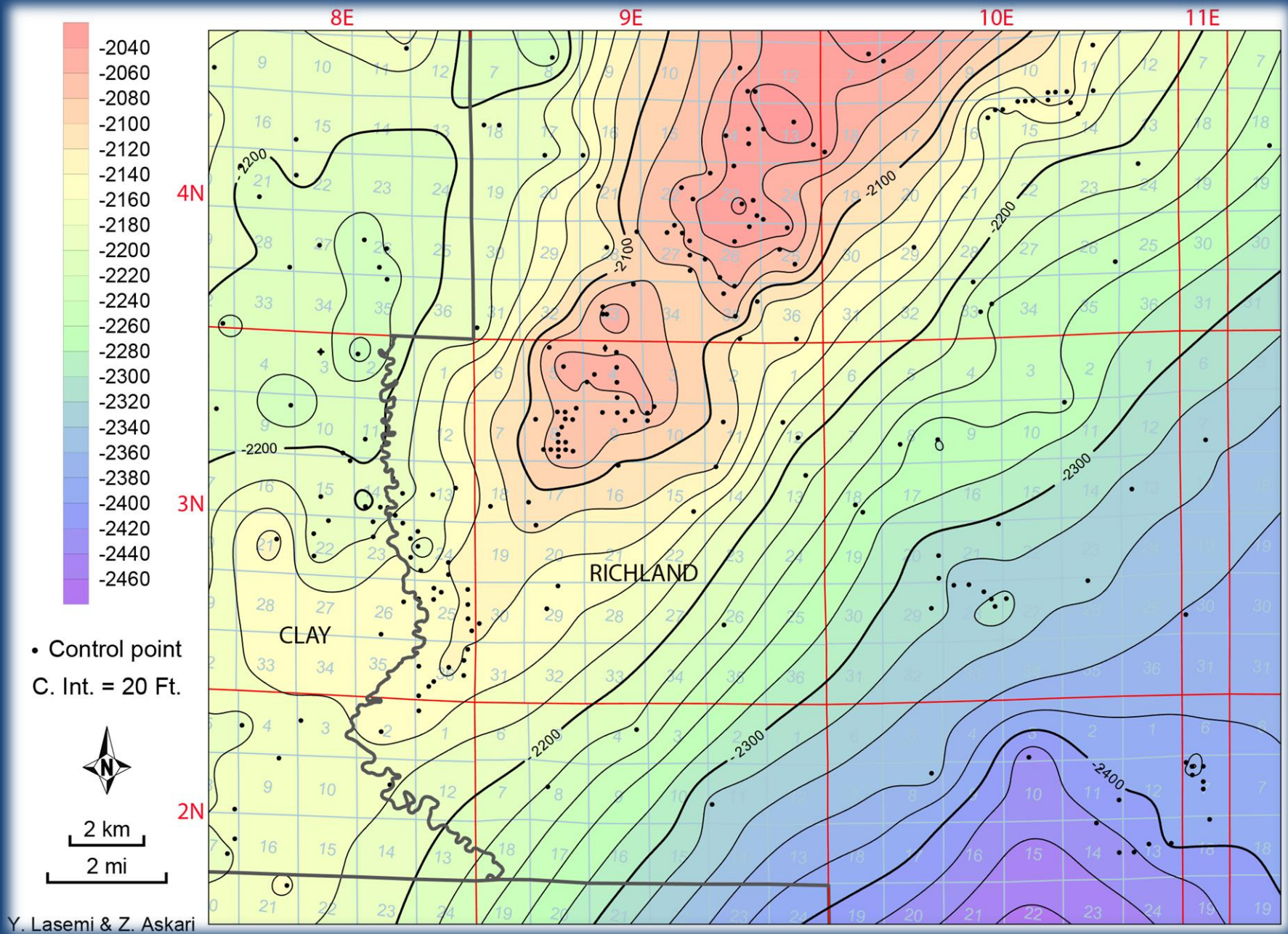
Structural Features of the Illinois Basin (modified from Nelson et al., 2002)



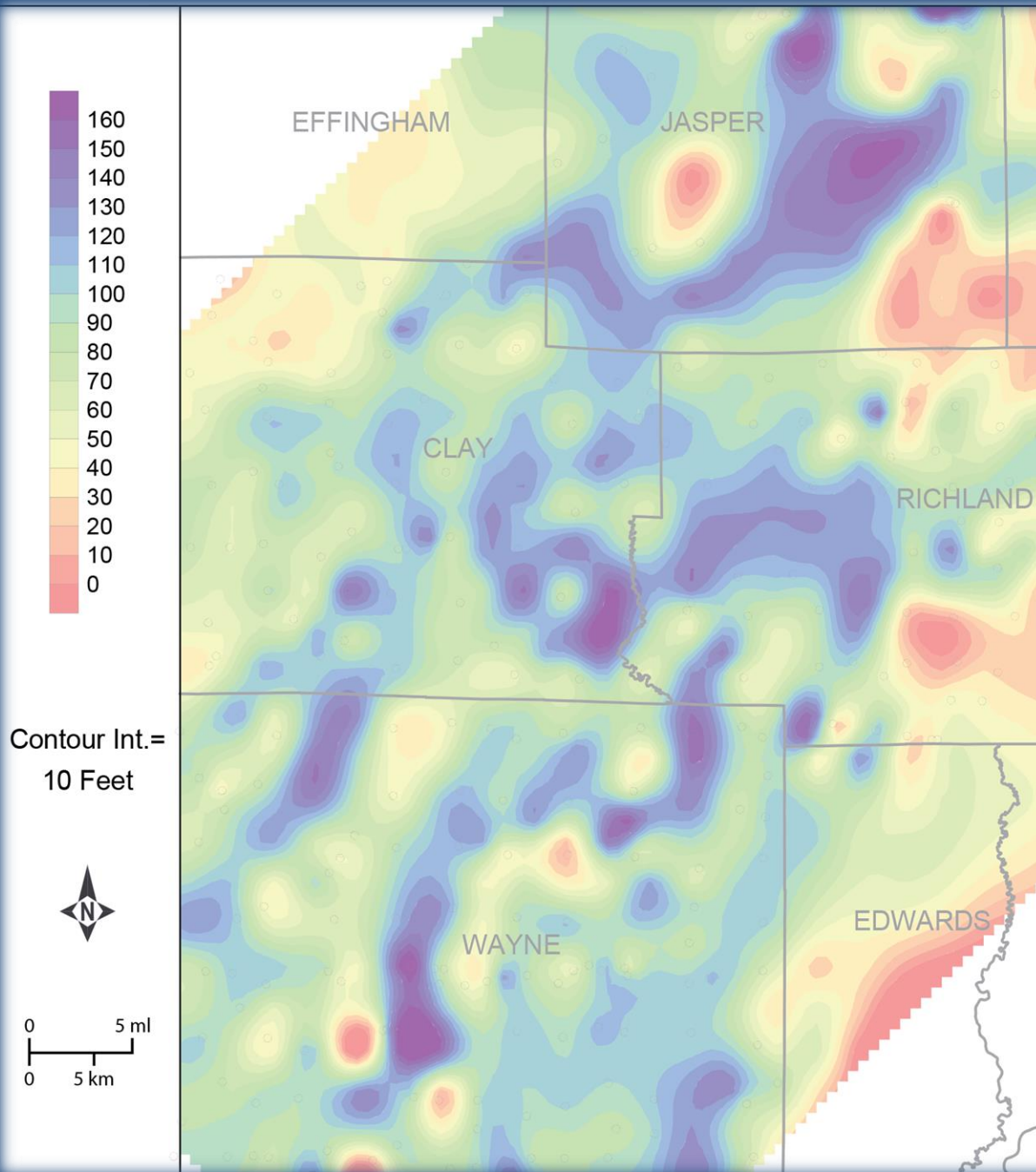
Y. Lasemi & Z. Askari

The Study Area in Clay and Richland Counties, Illinois





Structure Contour Map of the Base of Beech Creek Limestone



**Cypress Net Sand Thickness Map**

Y. Lasemi & Z. Askari

Trend of the Cypress Sand Bodies

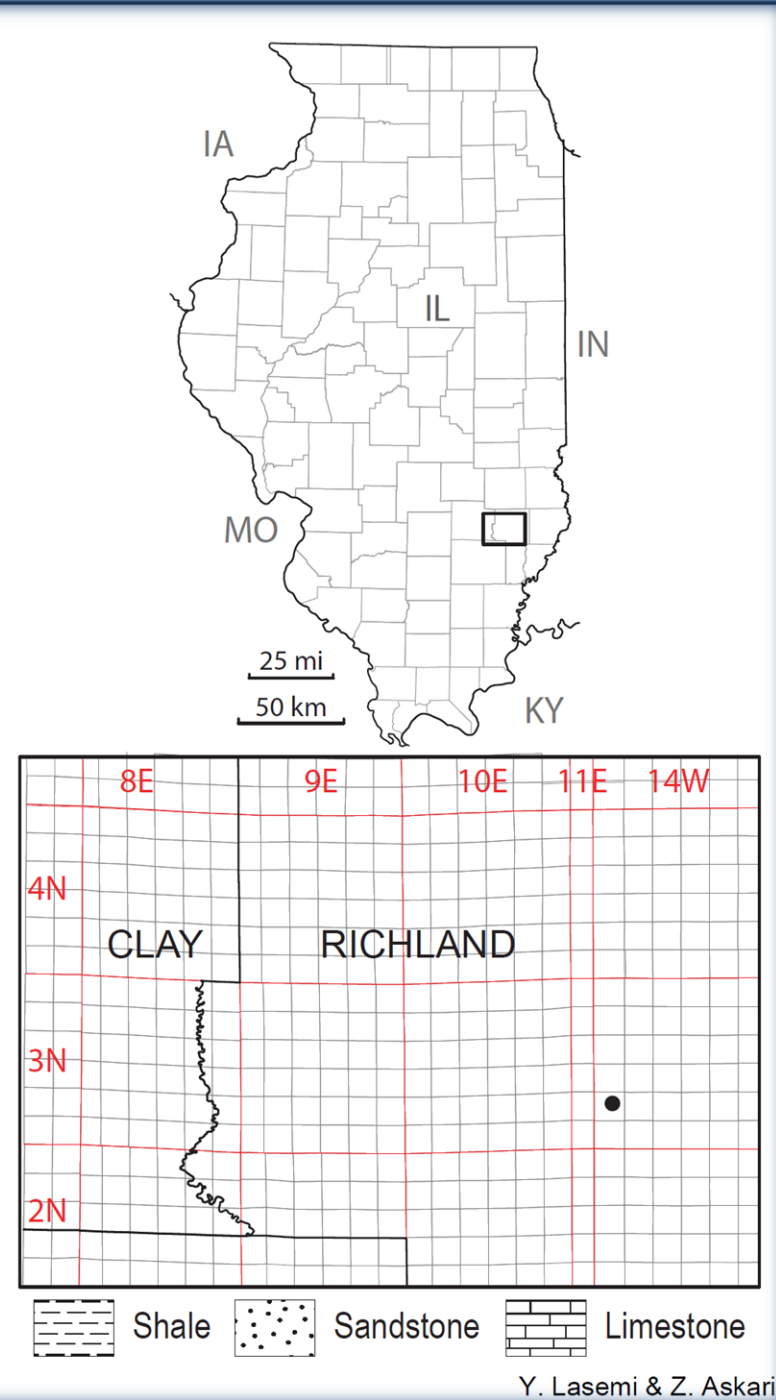
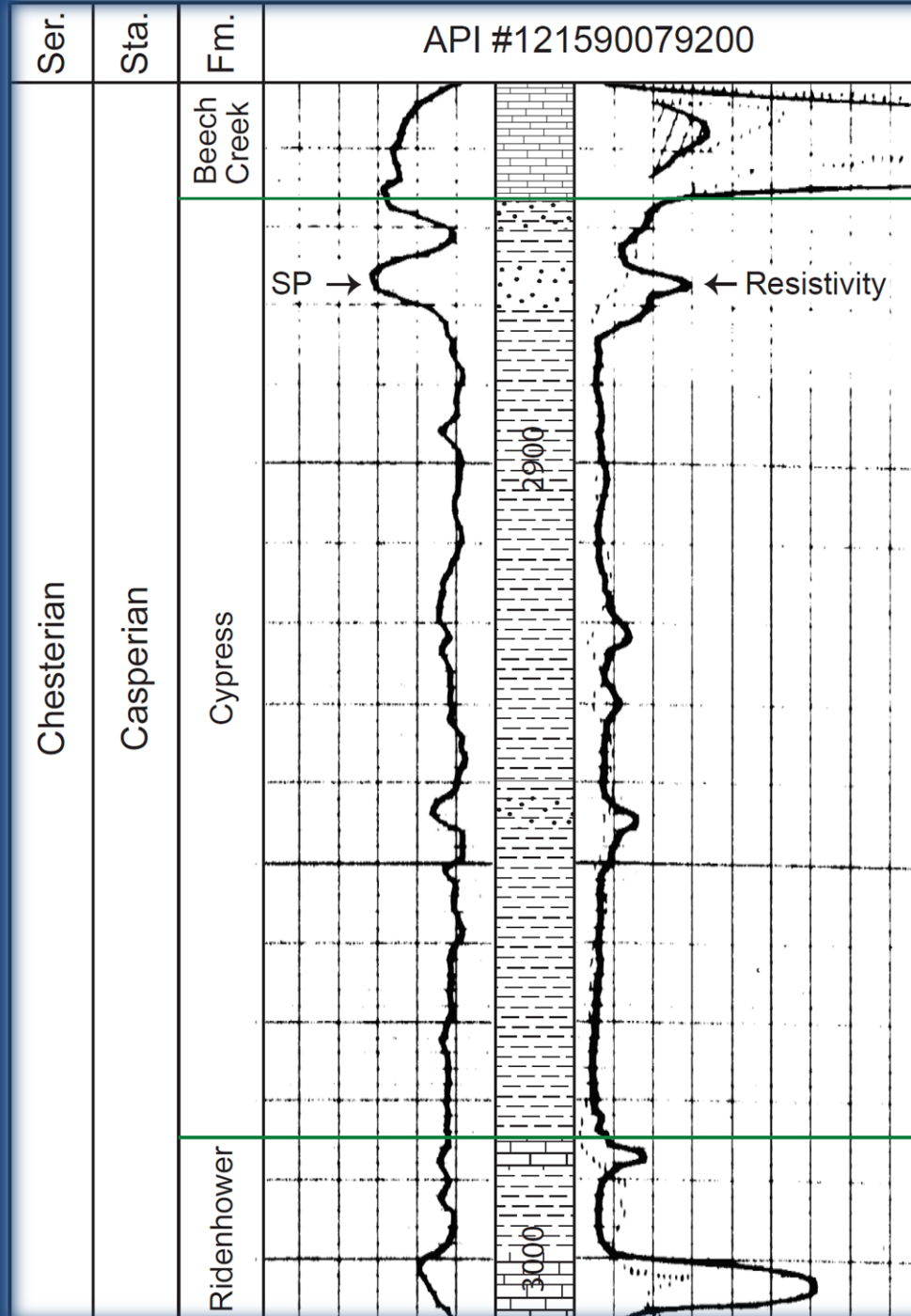


# Stratigraphy

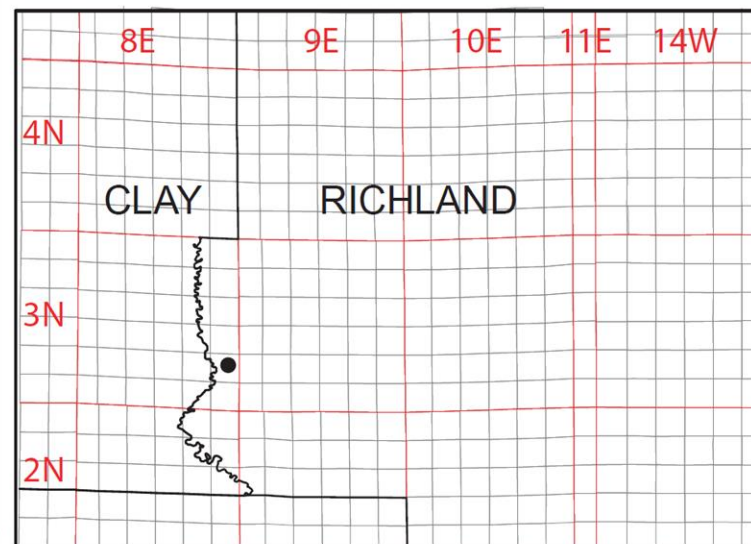
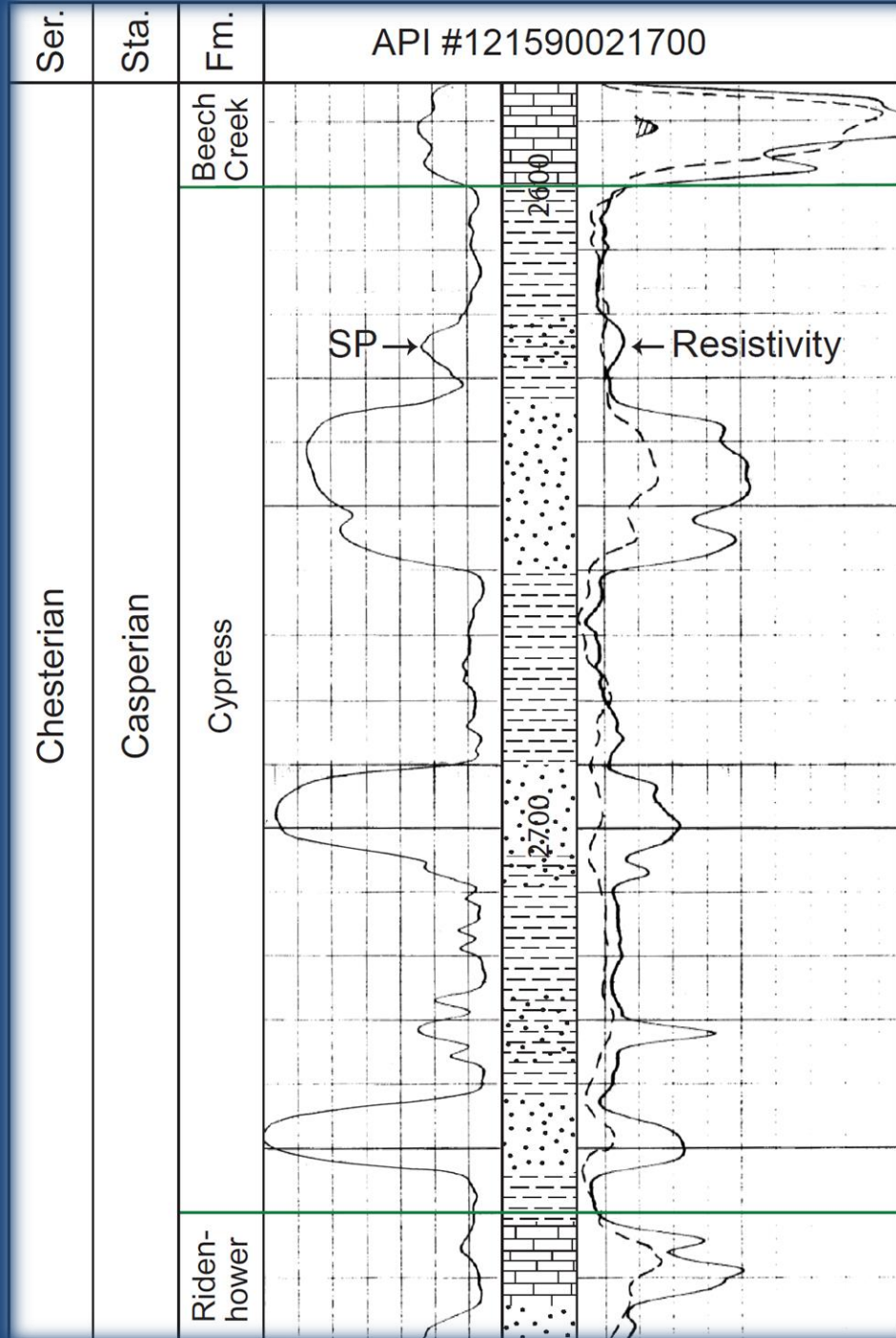
| ILLINOIS              |  | INDIANA                |                        |
|-----------------------|--|------------------------|------------------------|
| Golconda Formation    | Haney Limestone Member   | Haney Limestone Member |                        |
|                       | Fraileys Shale Member  | Big clifty Ss. Mbr.    | Indian Springs Sh. Mbr |
|                       | Beech Creek Ls. Member   | Beech Creek Limestone  |                        |
| Cypress Formation     |  | Cypress Formation      | Elwren Formation       |
| Paint Creek Formation | <div> <div>Ridenhower Shale</div> <div>Bethel Sandstone</div> </div> | Reelsville Limestone   |                        |
|                       |  | Sample Formation       |                        |
|                       |  | Beaver Bend Limestone  |                        |
|                       | Downeys Bluff Ls. Mbr.   | Downeys Bluff Member   |                        |

Y. Lasemi & Z. Askari

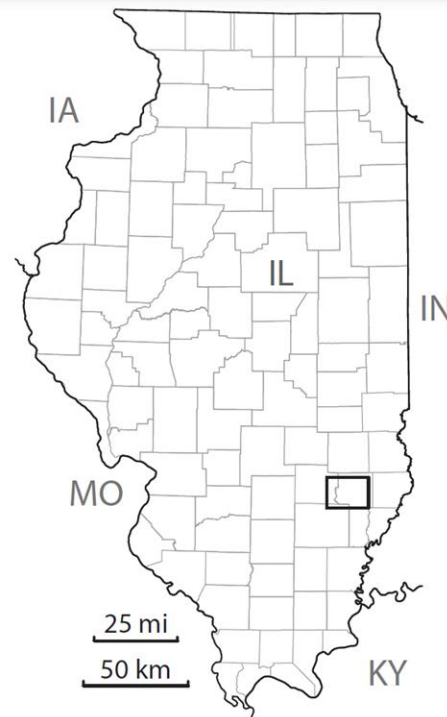
Stratigraphic Nomenclature (modified from Nelson et al., 2002)



# Cypress Stratigraphy

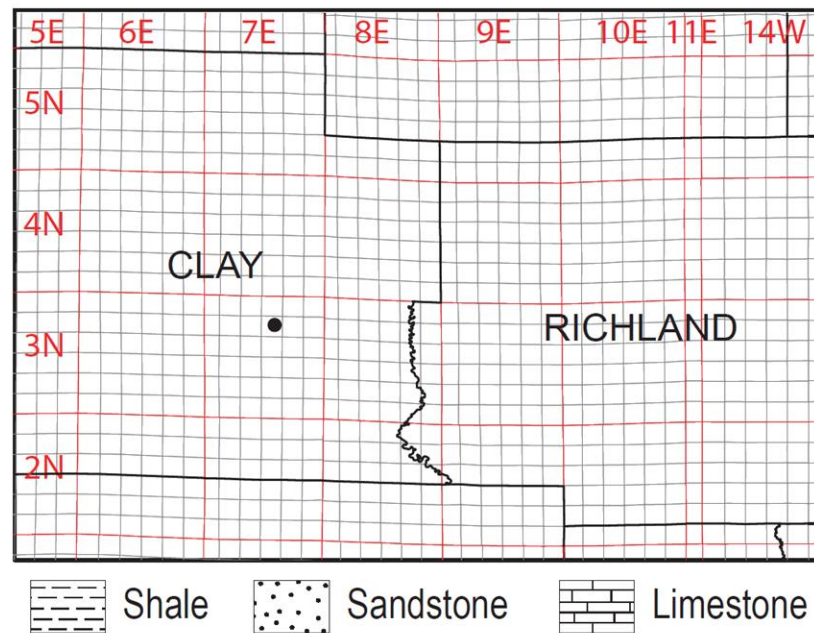
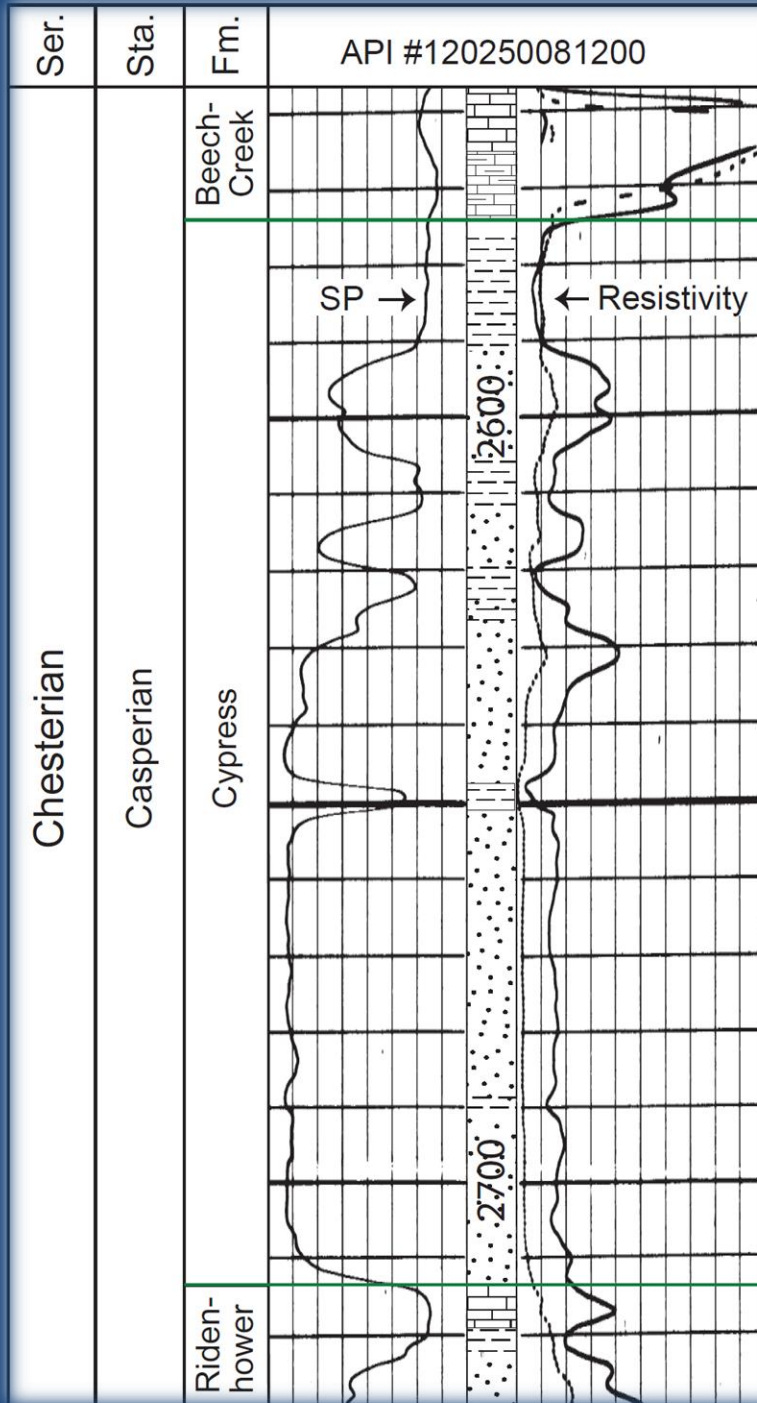


Y. Lasemi & Z. Askari

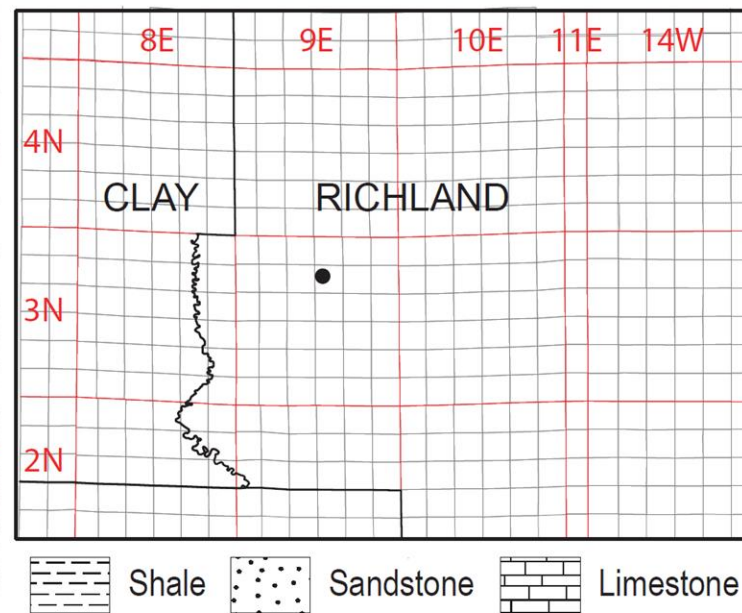
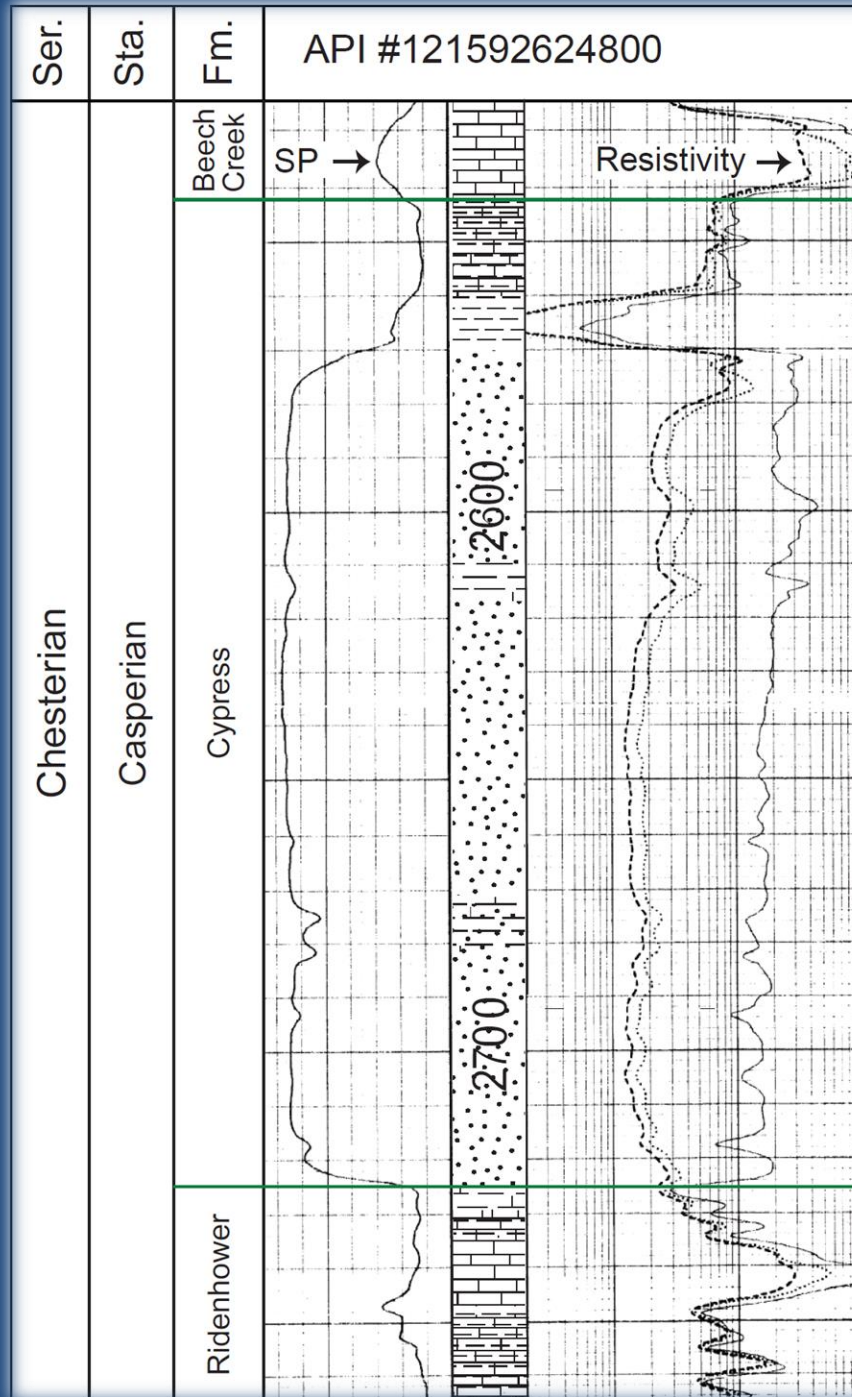


# Cypress Stratigraphy





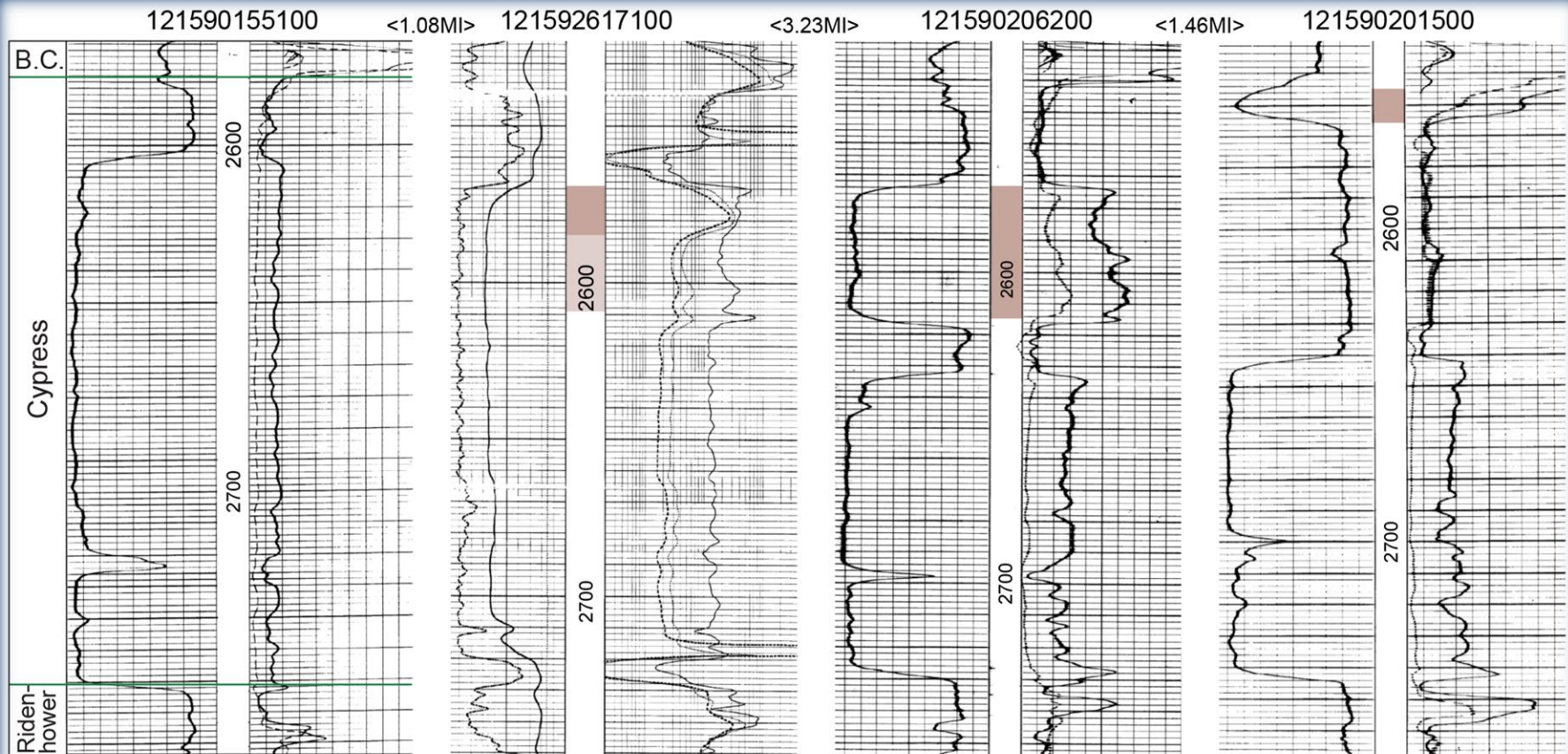
# Cypress Stratigraphy



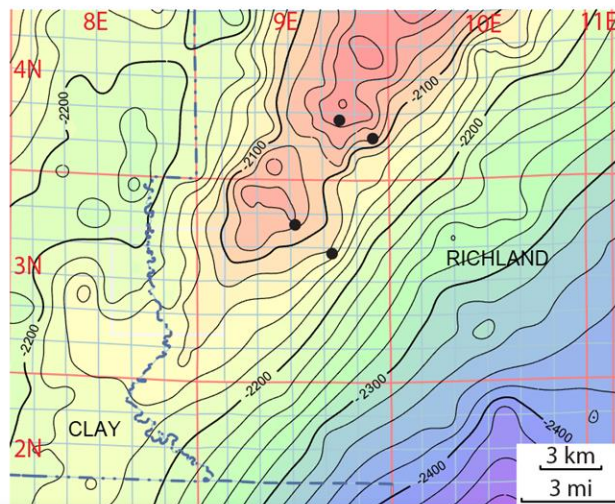
Y. Lasemi & Z. Askari

# Cypress Stratigraphy



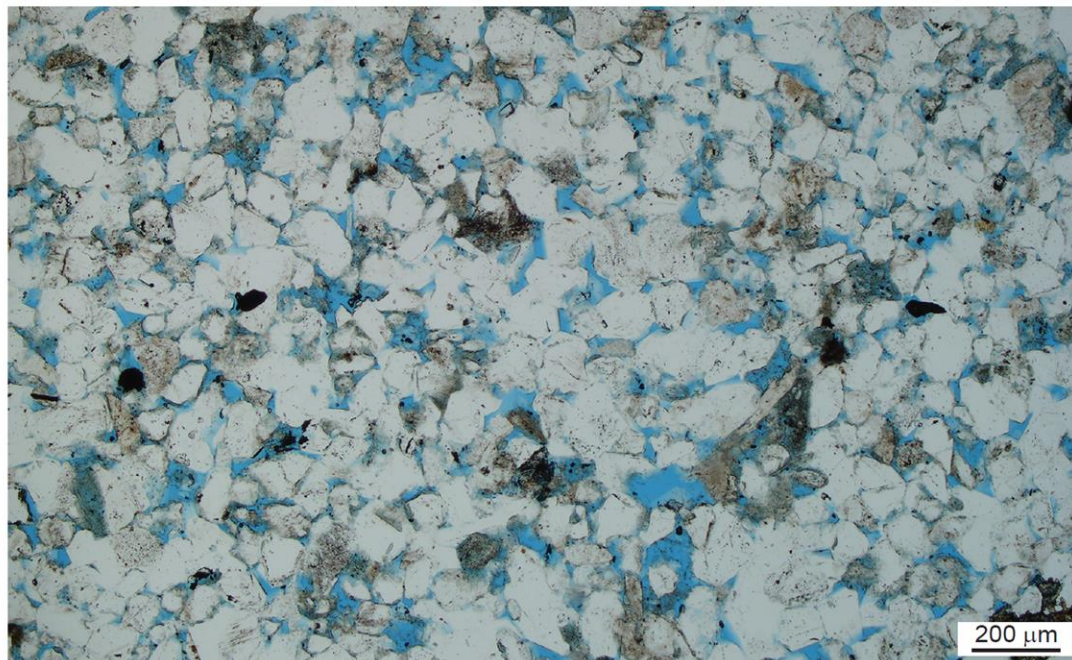
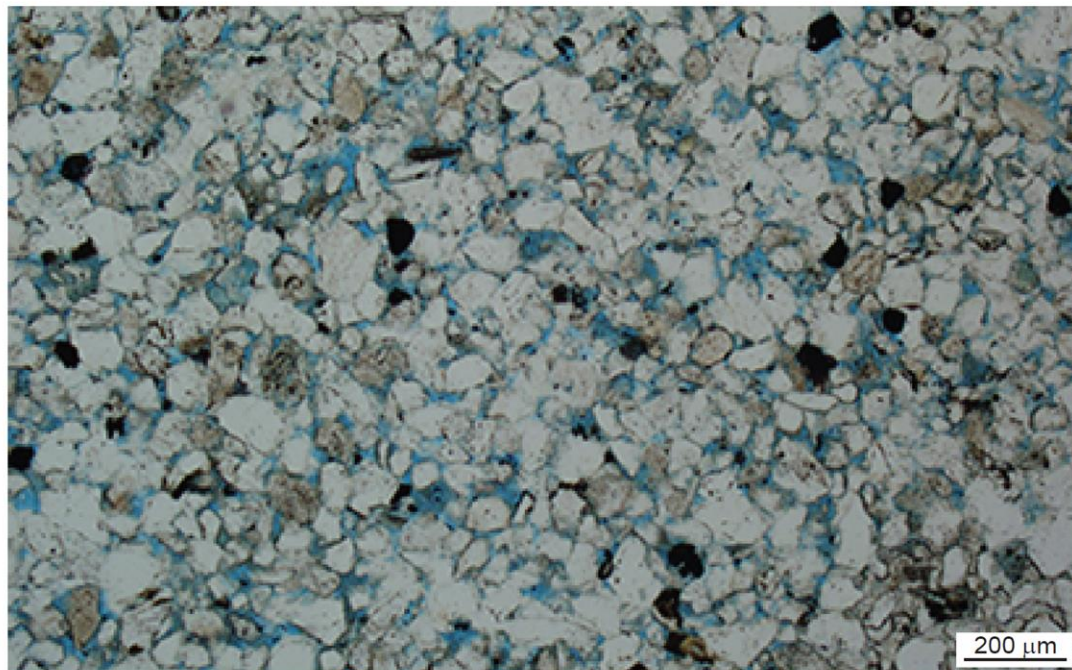
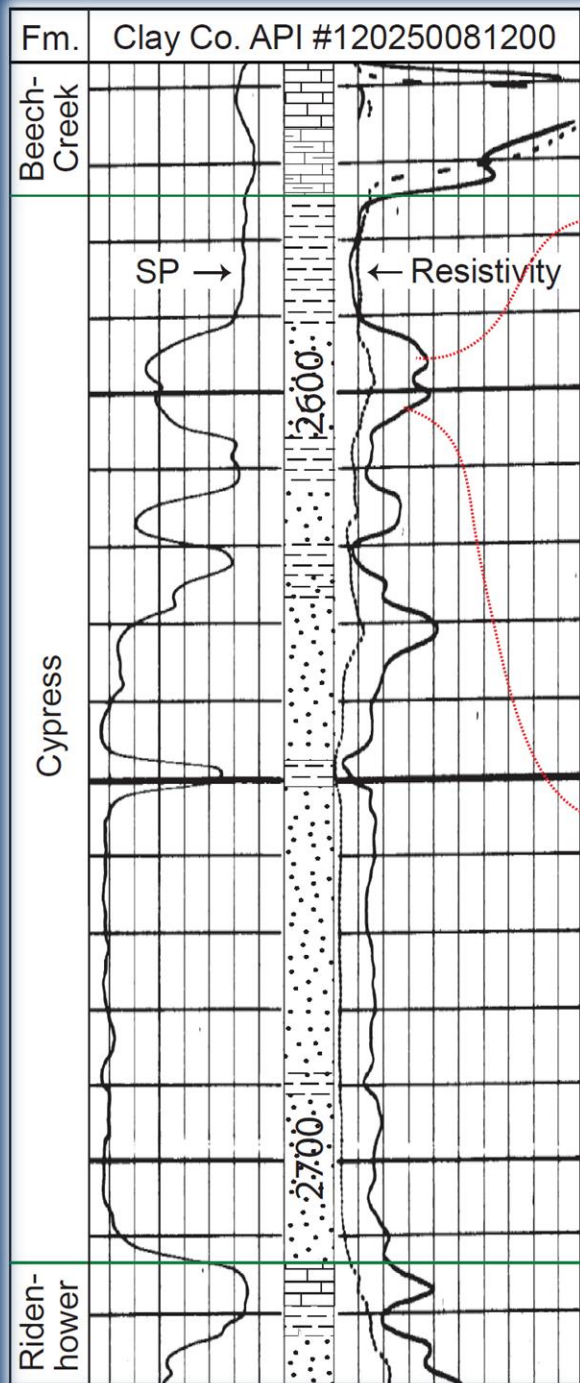


# Cypress Productive Horizons Along the Clay City Anticline



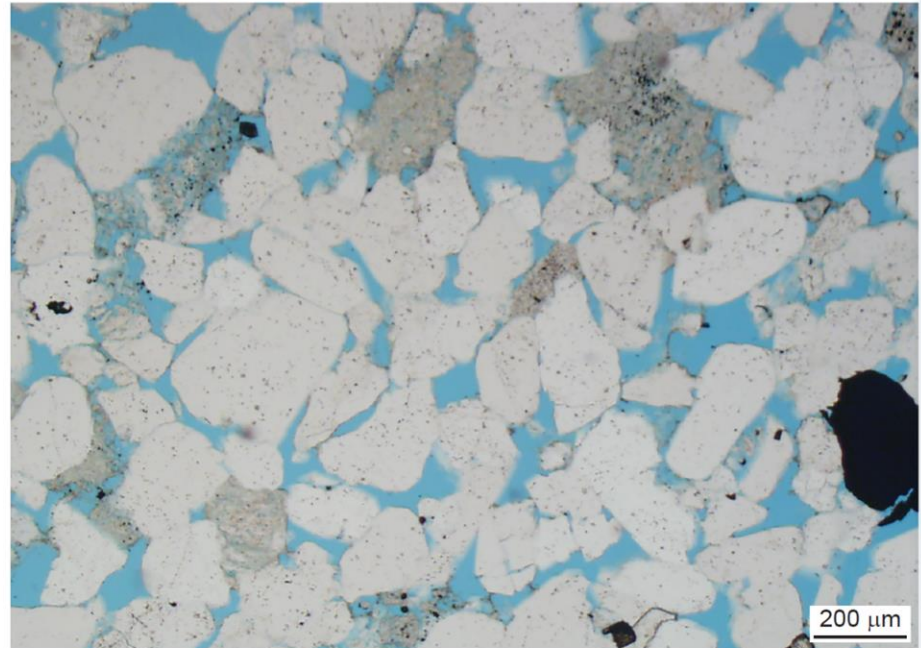
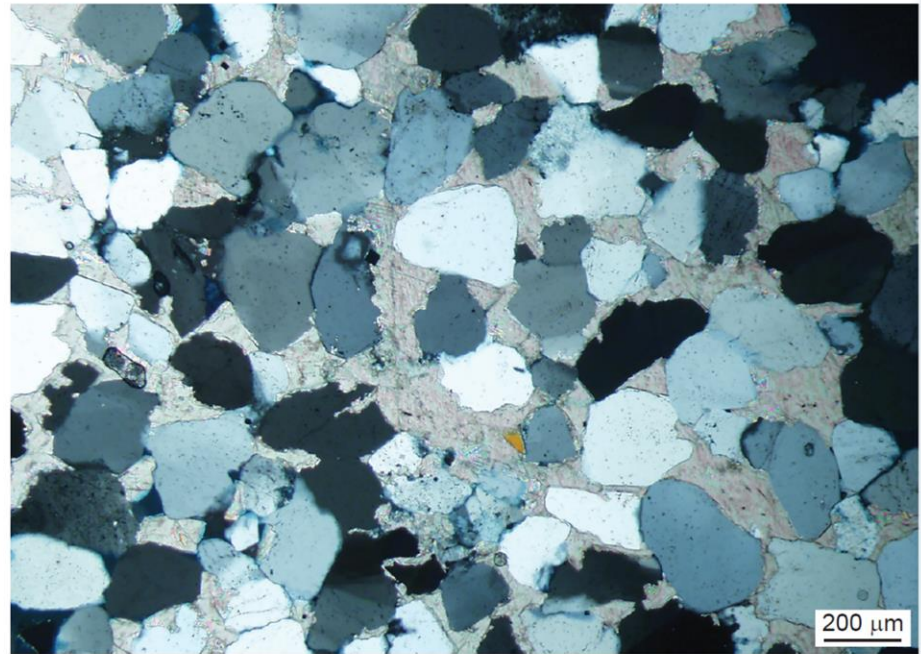
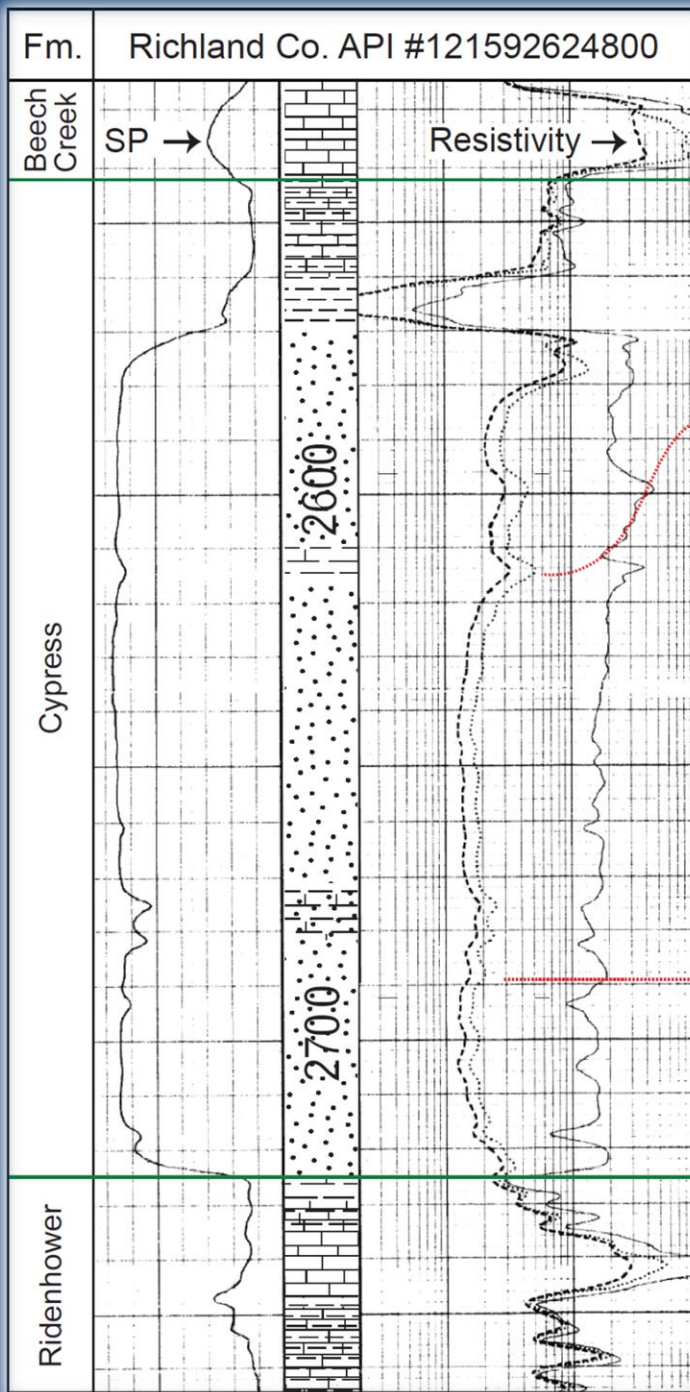
# Lithofacies Variability





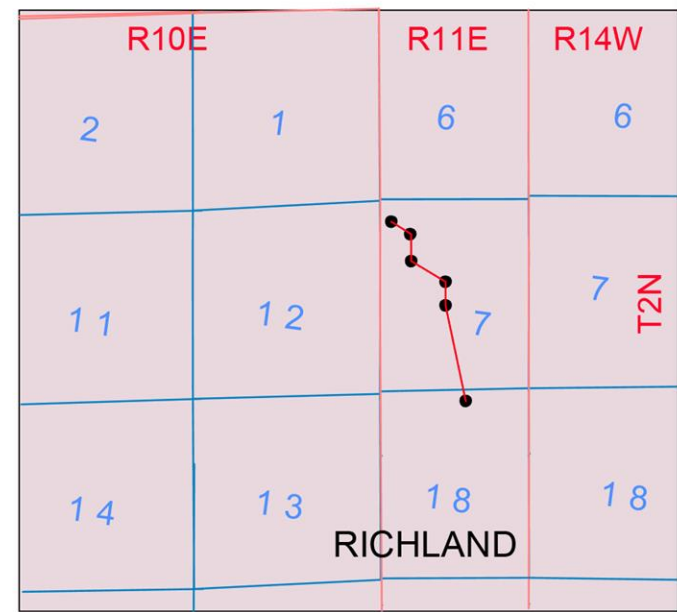
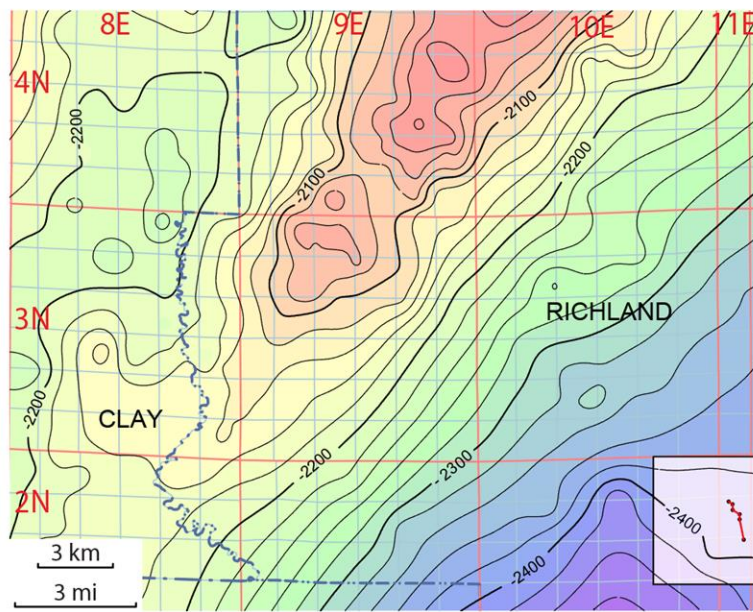
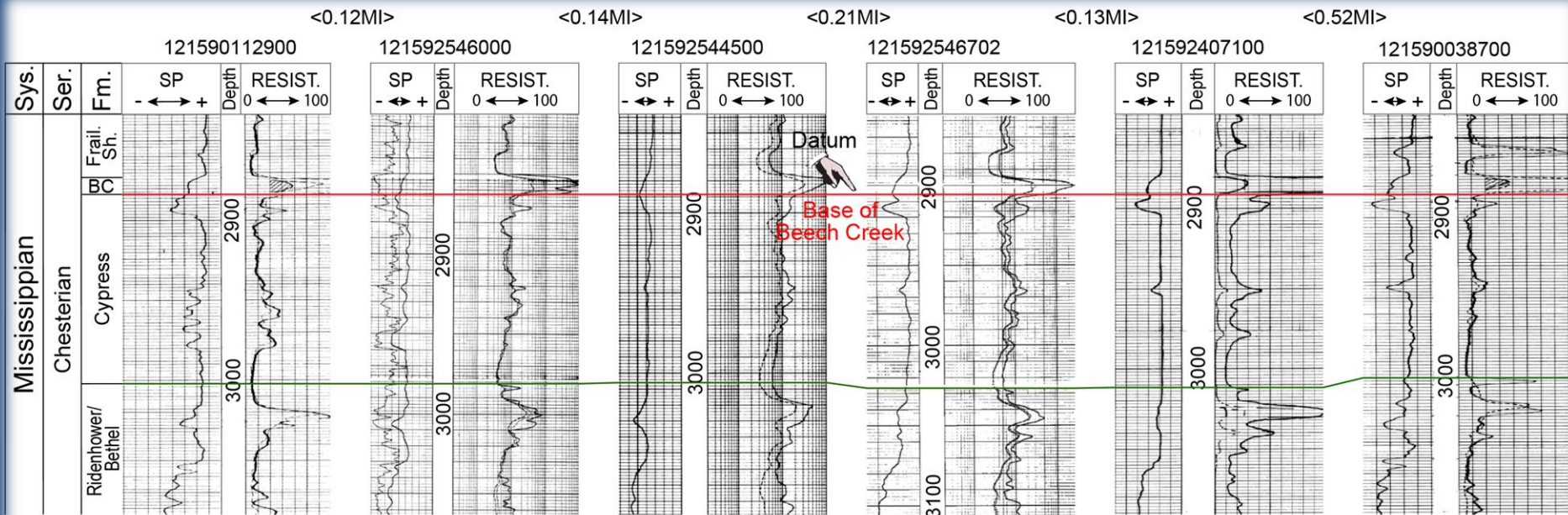
# Lenticular Cypress Sandstone Facies





‘Thick Cypress’ Sandstone Facies

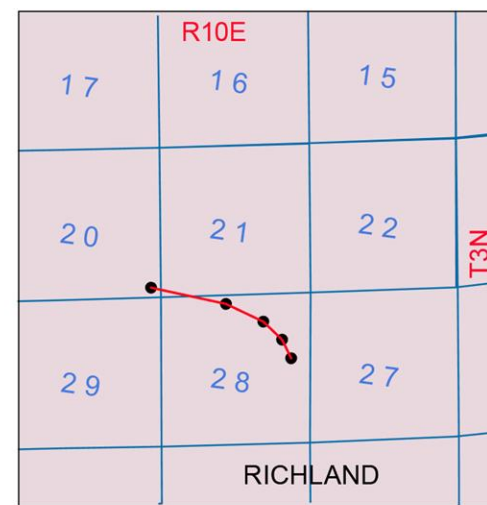
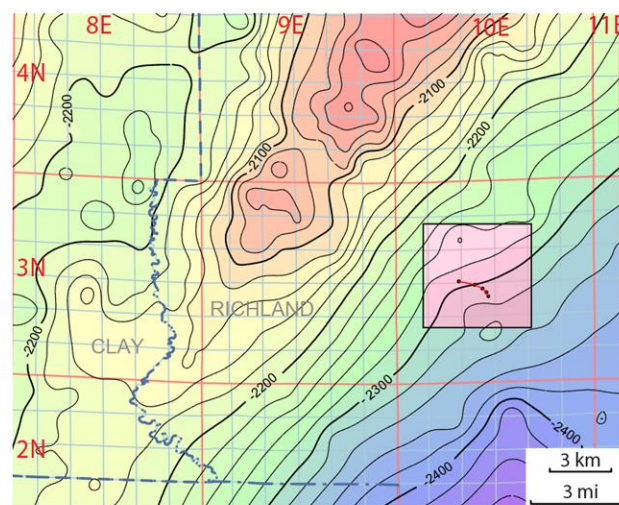
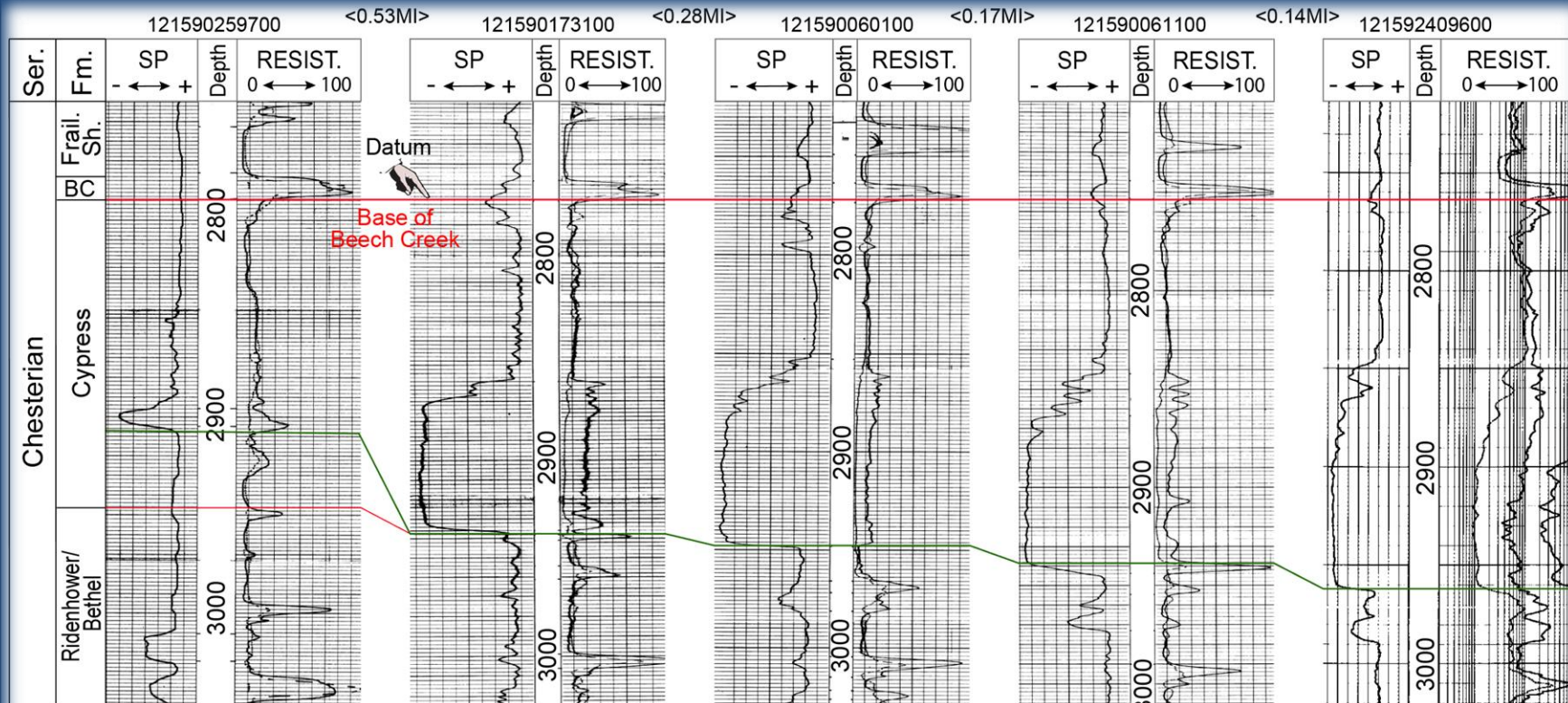




Y. Lasemi & Z. Askari

## Lateral Variability of the Cypress Formation

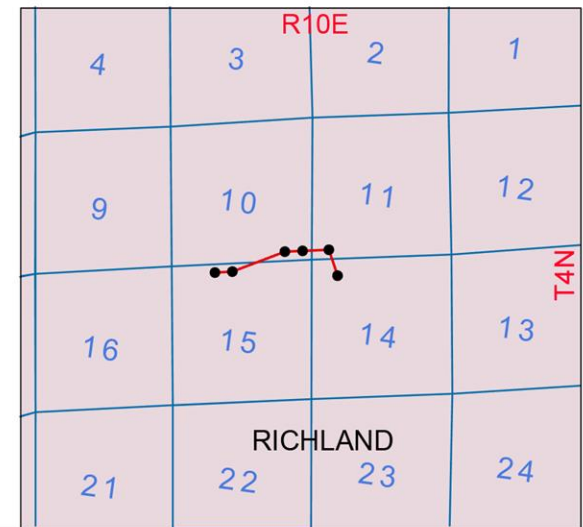
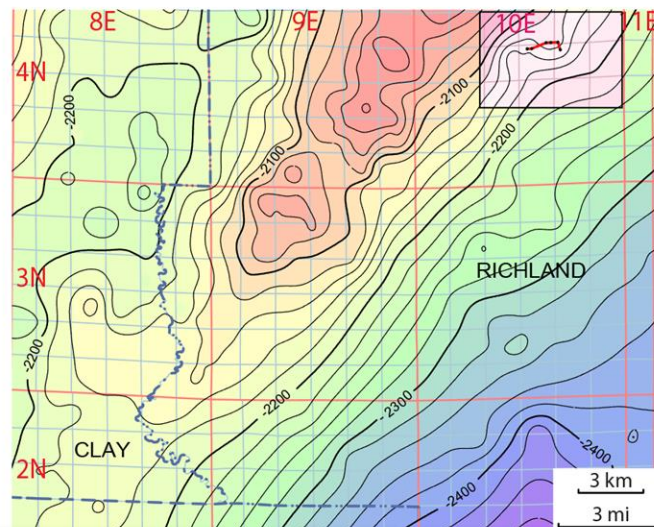
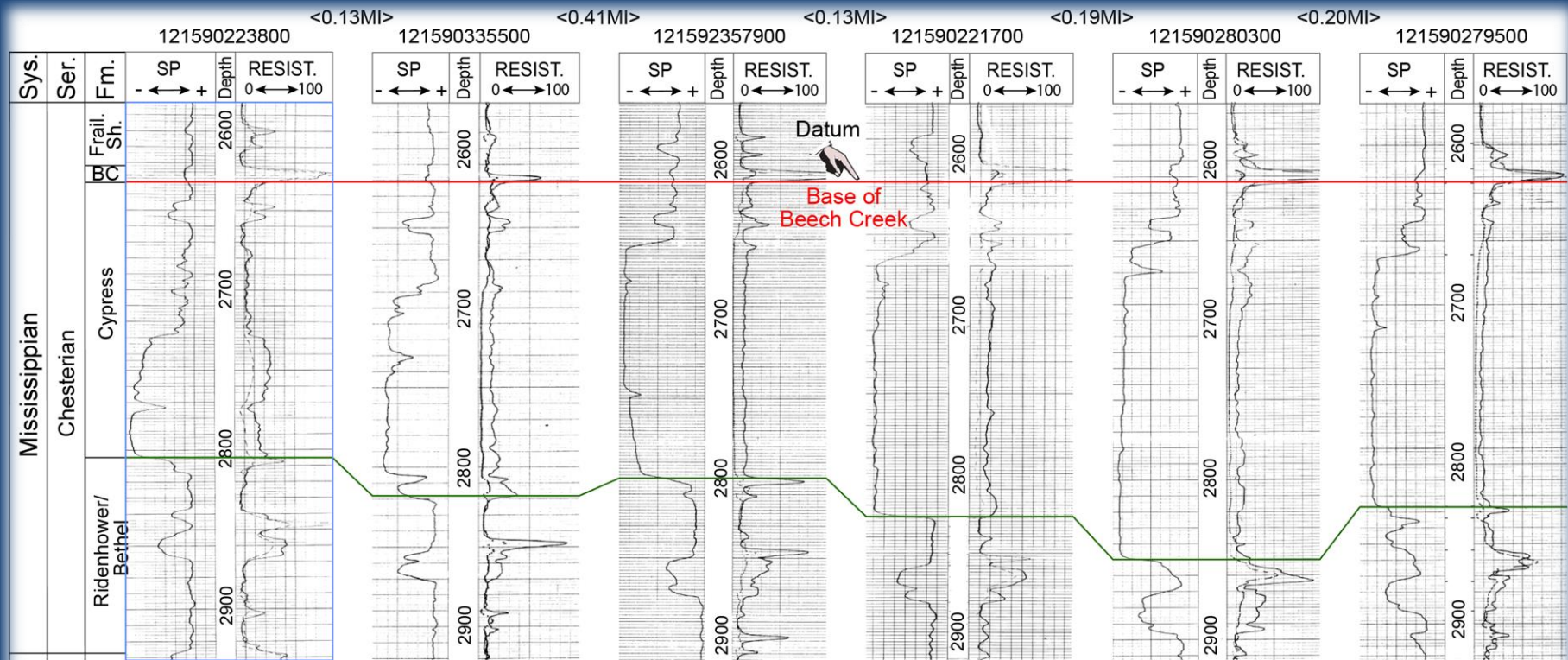




Y. Lasemi & Z. Askari

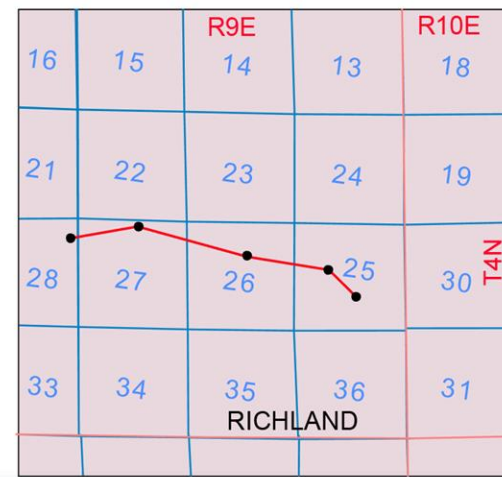
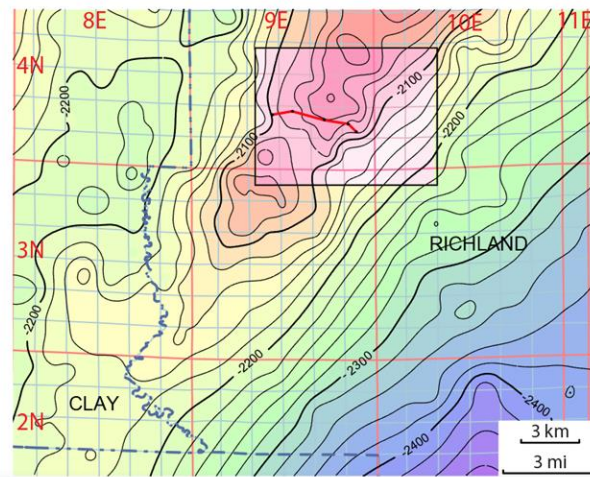
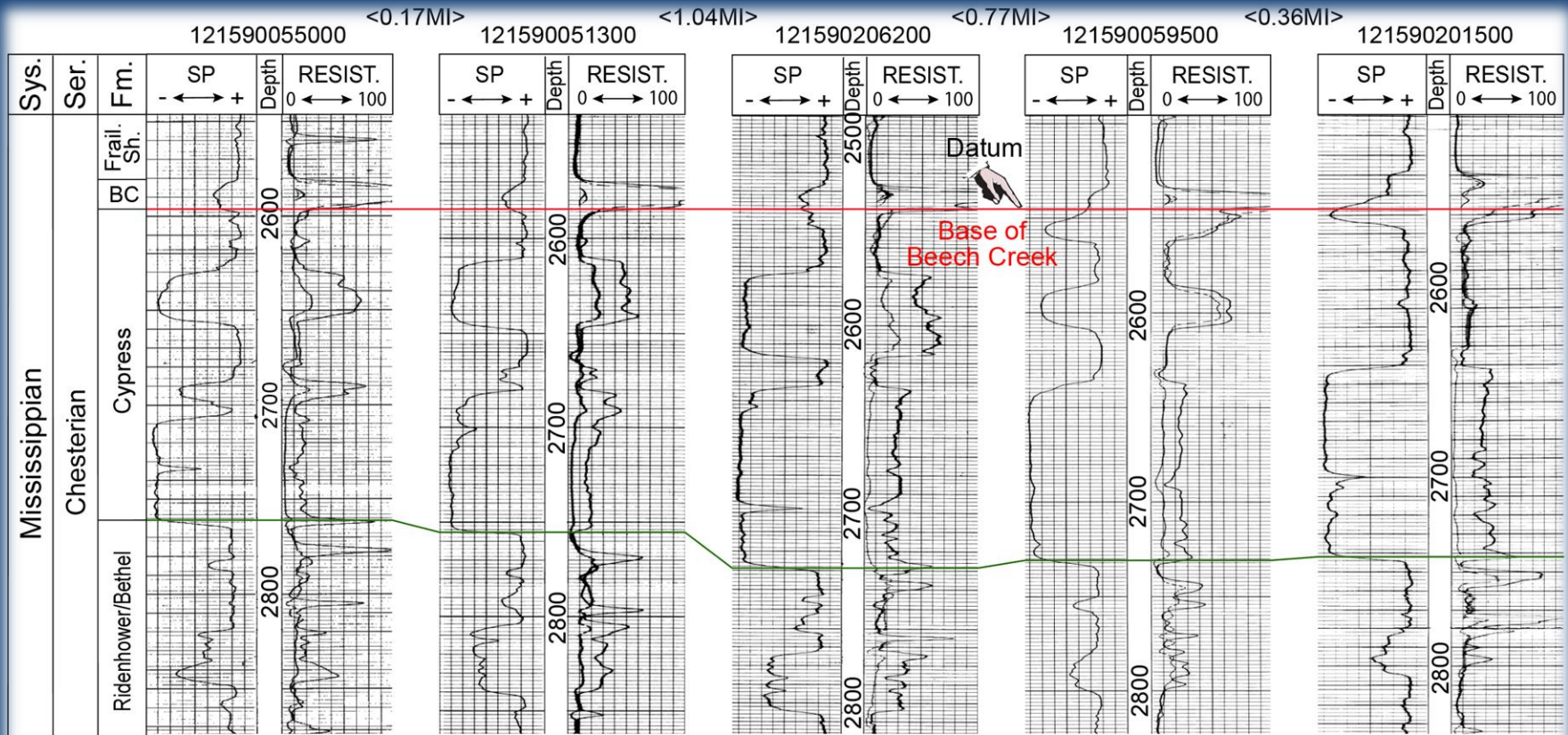
# Lateral Variability of the Cypress Formation





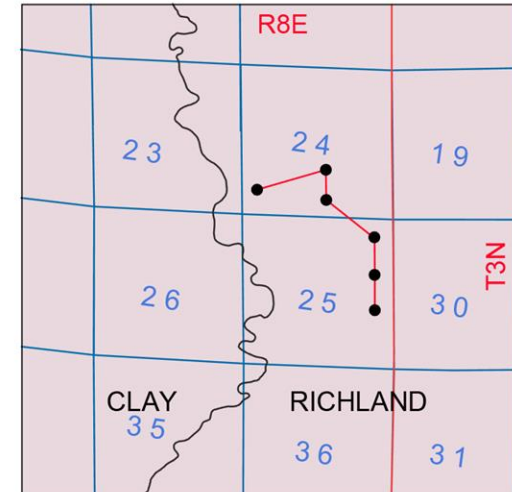
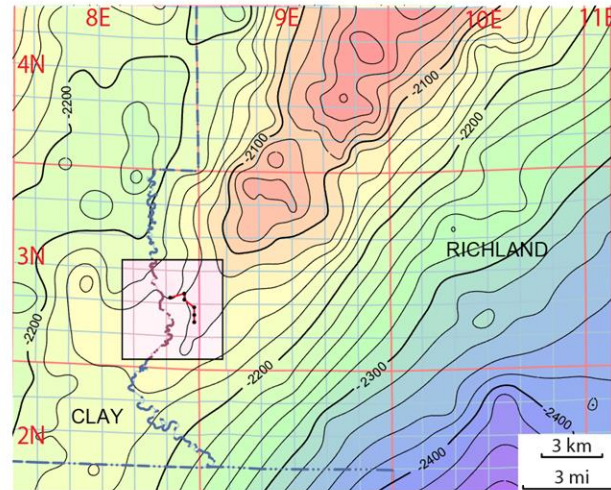
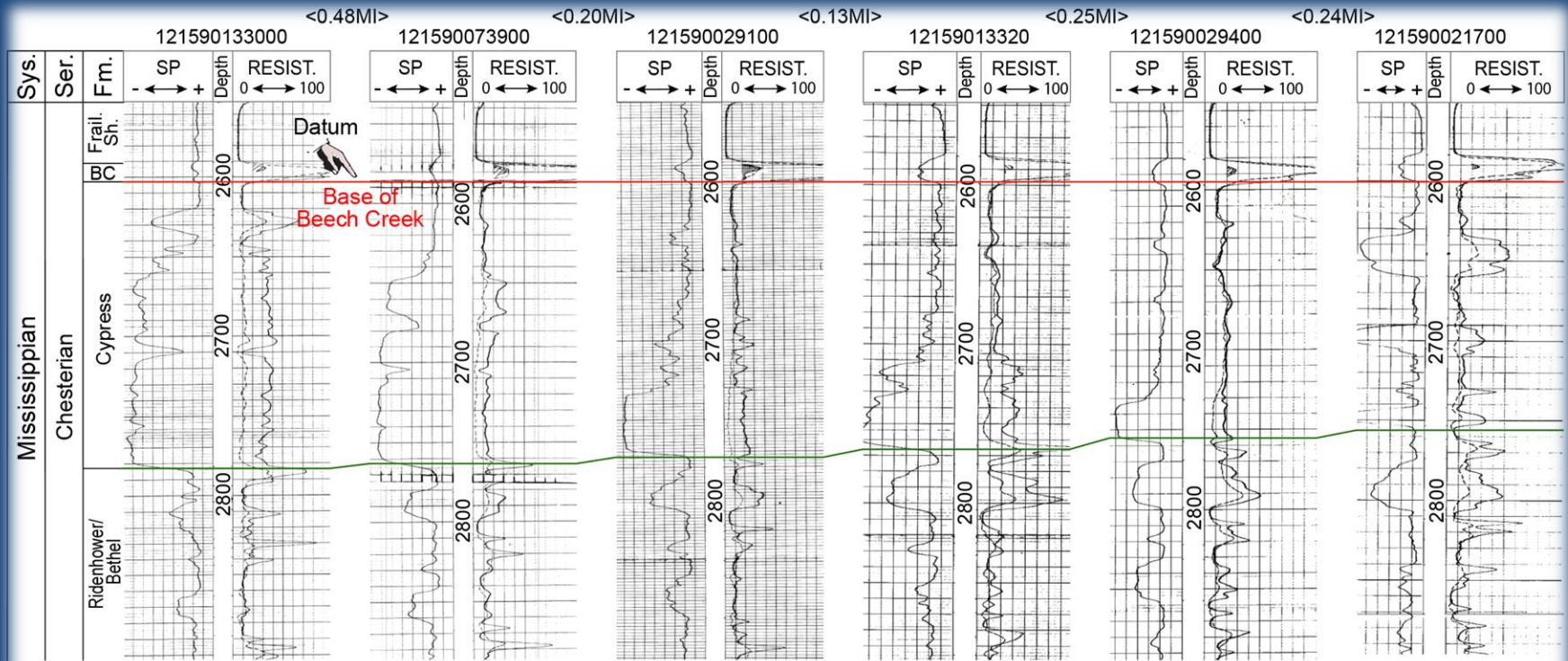
## Lateral Variability of the Cypress Formation





## Lateral Variability of the Cypress Formation





## Lateral Variability of the Cypress Formation

# Conclusions

- ❑ The Cypress Formation in the study area consists of interbedded shale and sandstone; in places, sandstone or shale constitutes the main part of the formation.
- ❑ Lenticular sand bodies showing funnel, blocky, and bell shaped geophysical log signatures are recognized in the lower, middle and upper part of the Cypress Formation.
- ❑ The sand bodies could have been deposited in fluvial channels/incised valleys, deltaic distributary channels/mouth bar, and shoreface depositional settings.



- ❑ In places, sand bodies cut down several meters into the succession; these incised valley fill sandstones are interpreted as being deposited during fourth-order sea level falls.
- ❑ Cypress oil production is from porous lenticular and stacked sandstones developed in the upper part of the formation, and from the upper part of amalgamated sand bodies ('thick Cypress') near the crest of the Clay City Anticline.