ILLINOIS STATE
GEOLOGICAL SURVEY
PRAIRIE RESEARCH INSTITUTE

# SEQUENCE STRATIGRAPHY OF THE UPPERMOST CAMBRIAN-LOWERMOST ORDOVICIAN TRANSITION INTERVAL IN THE ILLINOIS BASIN: IMPLICATIONS FOR DEFINING THE POSITION OF THE C-O BOUNDARY

Yaghoob Lasemi and Zohreh Askari,
Illinois State Geological Survey


University of Illinois at Urbana-Champaign

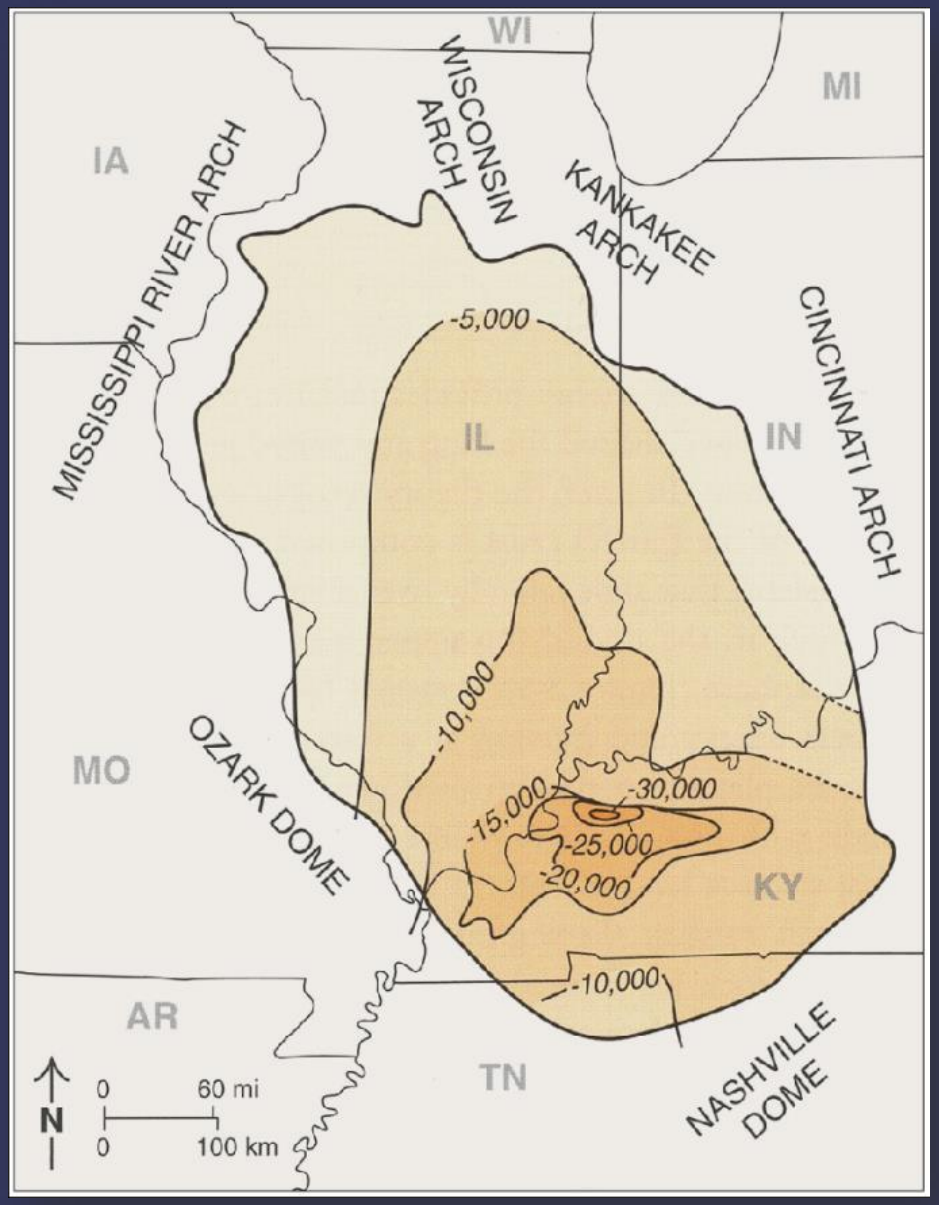
# Acknowledgements

This work is partially funded by the U.S. Department of Energy through the National Energy Technology Laboratory (NETL).

# Stratigraphic Problem

- The Cambro-Ordovician (C-O) boundary in the deep part of the Illinois Basin, presents a stratigraphic problem due to lack of biostratigraphic control and the apparent lithofacies similarities across the boundary.

- Another problem is the position of the Rose Run Sandstone in Kentucky, which has been interpreted as the coeval unit of the Ordovician Gunter Sandstone in northern Illinois.




Illinois Basin showing the depth to Precambrian basement (Kolata, 2011).

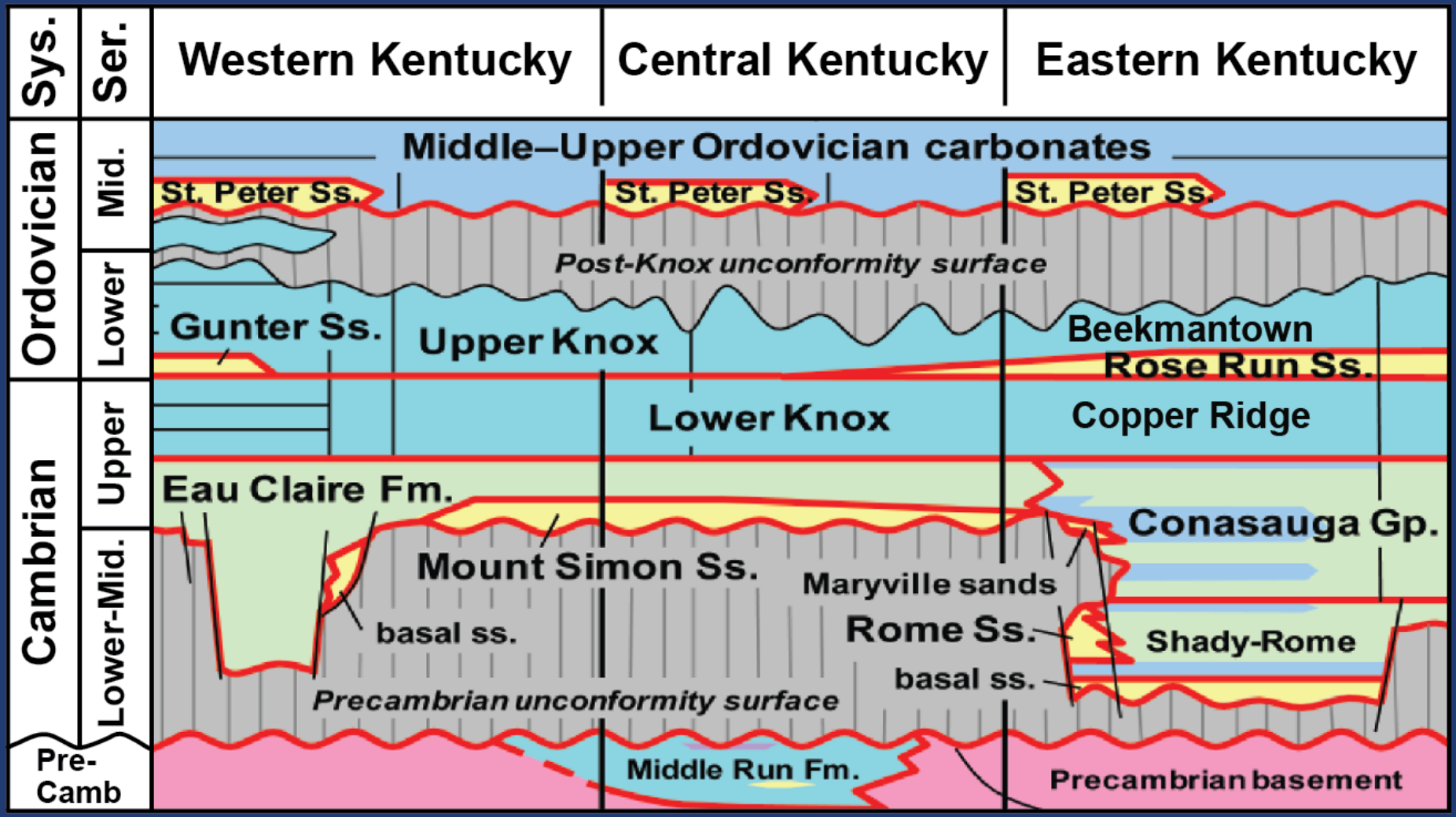
# Objective

- Development of a sequence stratigraphic framework to define the position of the C-O boundary and the coeval units of the transition interval using subsurface data.

# Stratigraphic Setting

# Stratigraphic Nomenclature of the Upper Cambrian and Lower Ordovician Rocks in the Illinois Basin

| System | Series | Group | Formation | |
|---|---|---|---|---|
| | | | Northern Illinois | Southern Illinois |
| Ordovician | Lower | Knox / Prairie du Chien | Shakopee Dolomite | Shakopee Dolomite |
| | | | New Richmond Ss. | |
| | | | Oneota Dolomite | Oneota Dolomite |
| | | | Gunter Ss. | |
| Cambrian | Upper (Furongian) | | Jordan Ss. / Eminence | Eminence |
| | | | Potosi Dolomite | Potosi Dolomite |
| | | | Franconia | Derby-Doerun |
| | | | Ironton Ss. | Bonneterre/ Eau Claire |
| | | | Galesville Ss. | |
| | | | Eau Claire | |

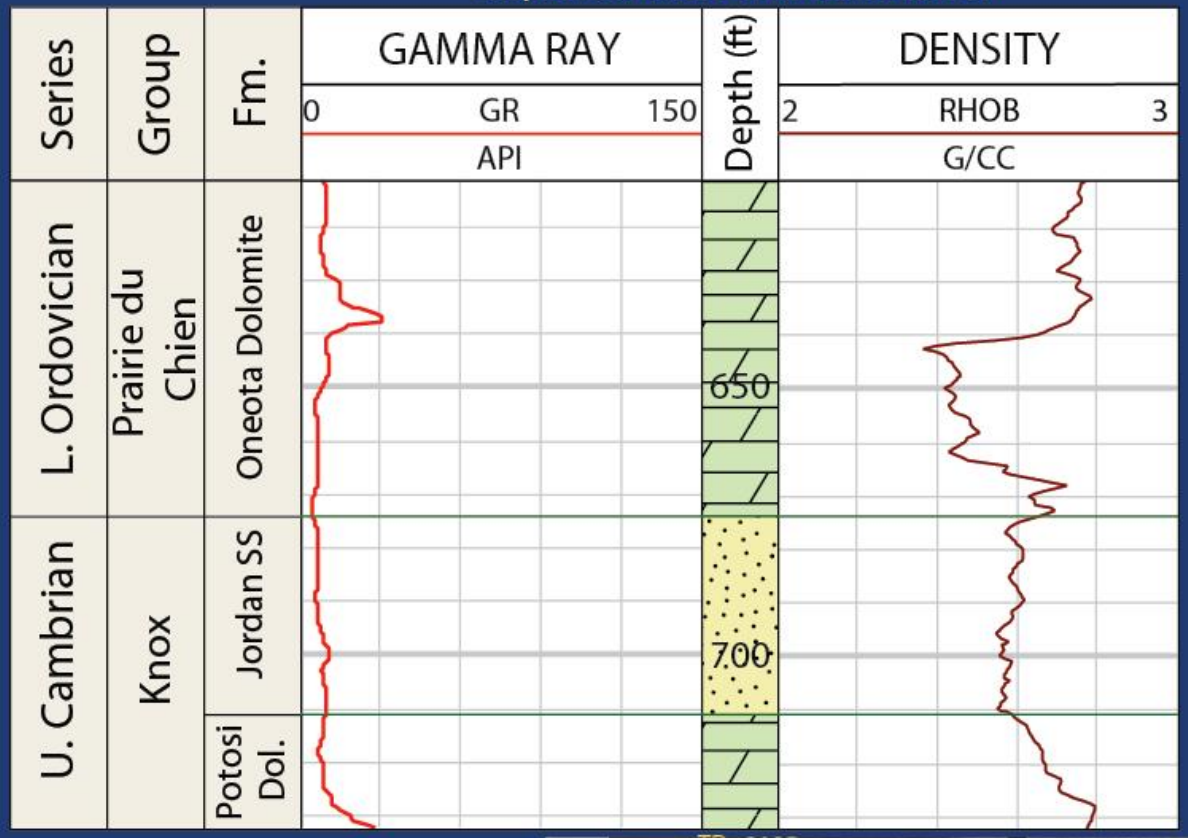



Modified from Parris, Greb, and Nuttal (2010)

# Stratigraphic Correlation of the Cambro-Ordovician Rocks in Kentucky

# Stratigraphy and Facies of the C-O Transition Interval

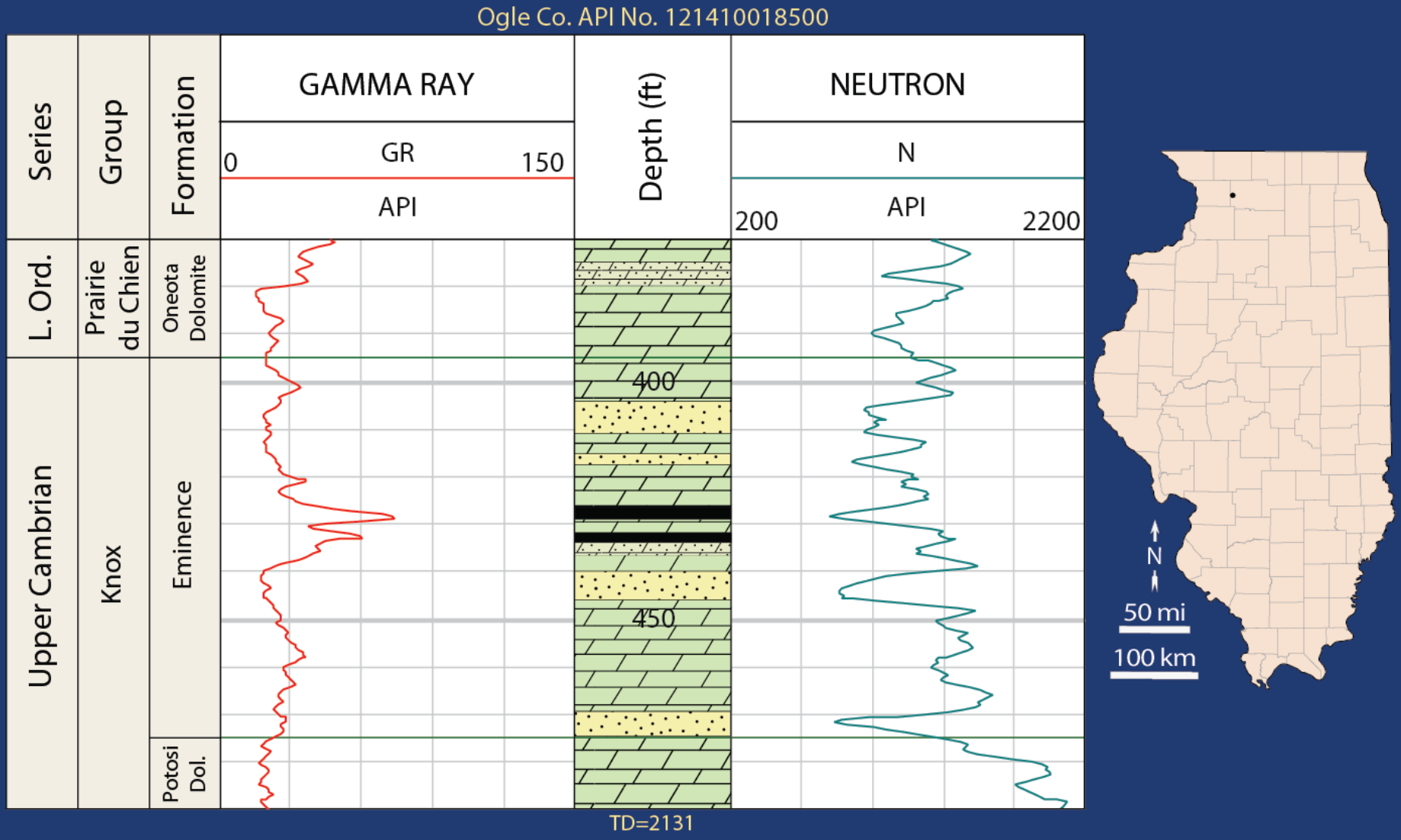
Stephenson Co. API No. 121772131700





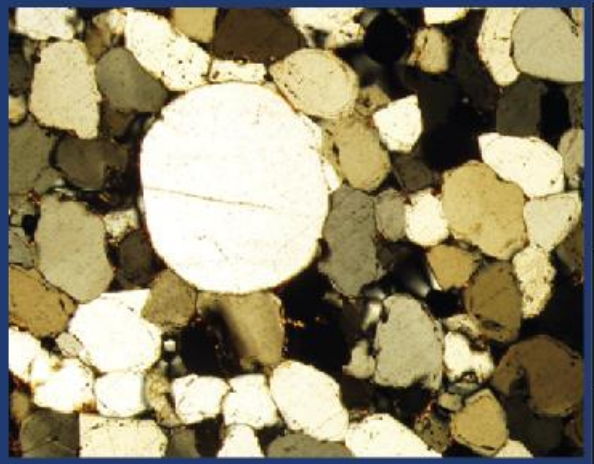


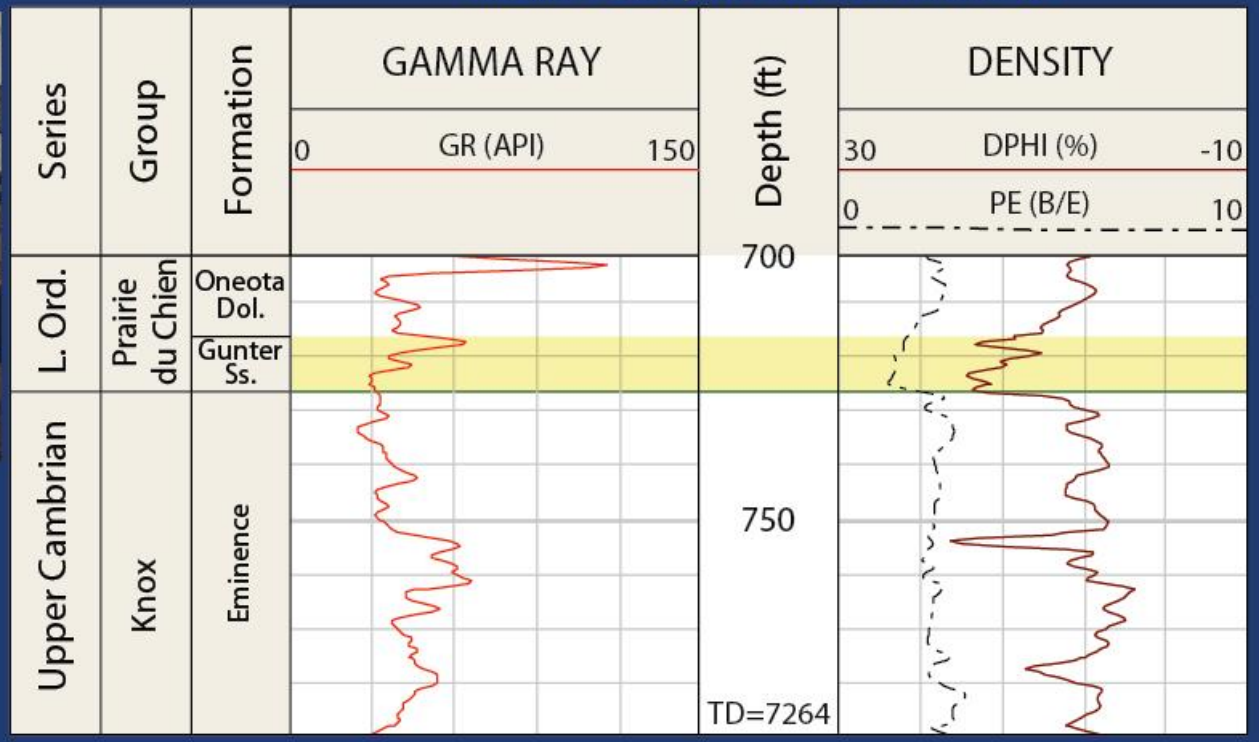

**The Eminence Formation Grades to Jordan Sandstone in Extreme Northwest Illinois**


# Stratigraphy of the Eminence Formation in Northern Illinois

LaSalle County API No. 120992698100

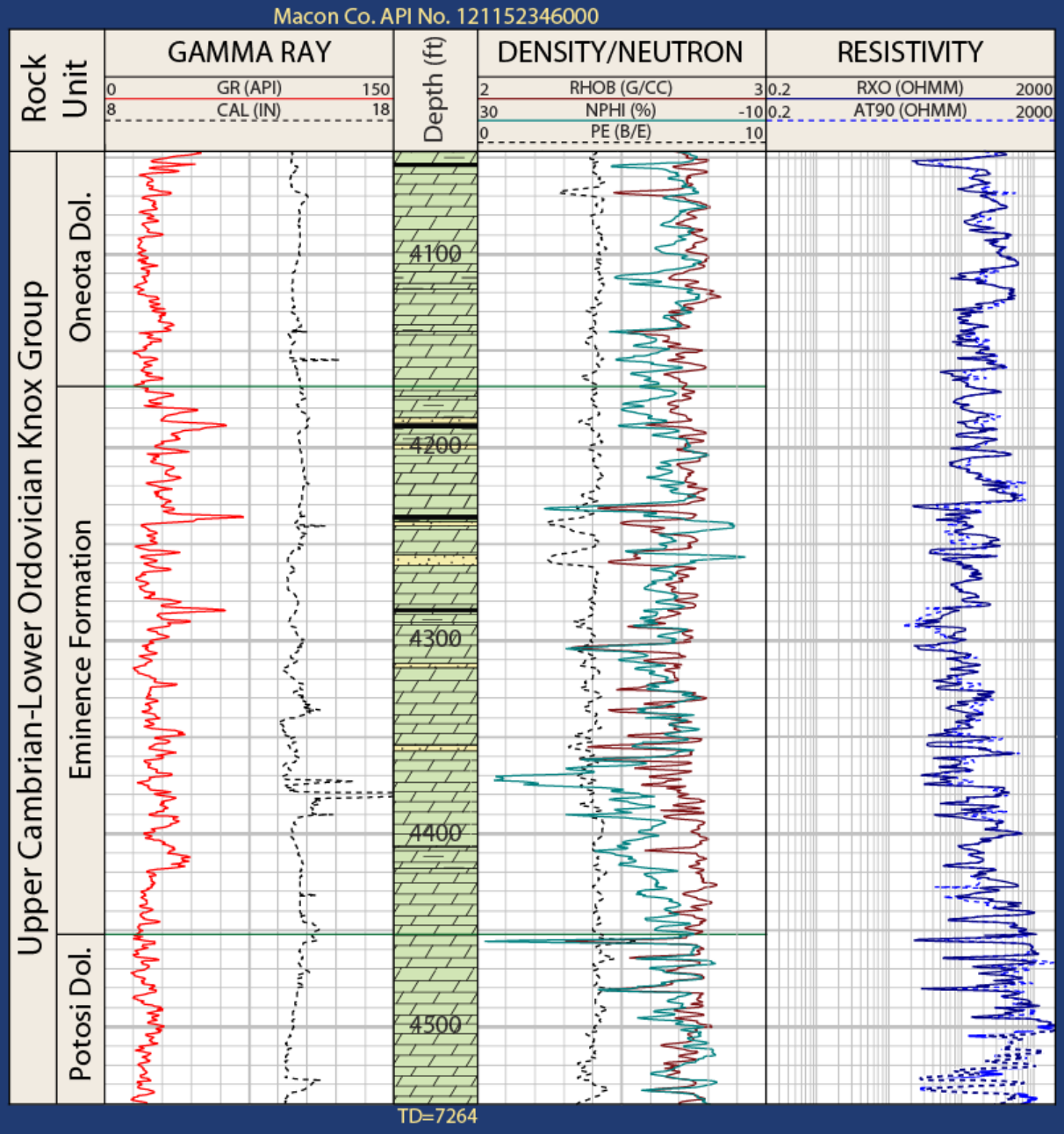


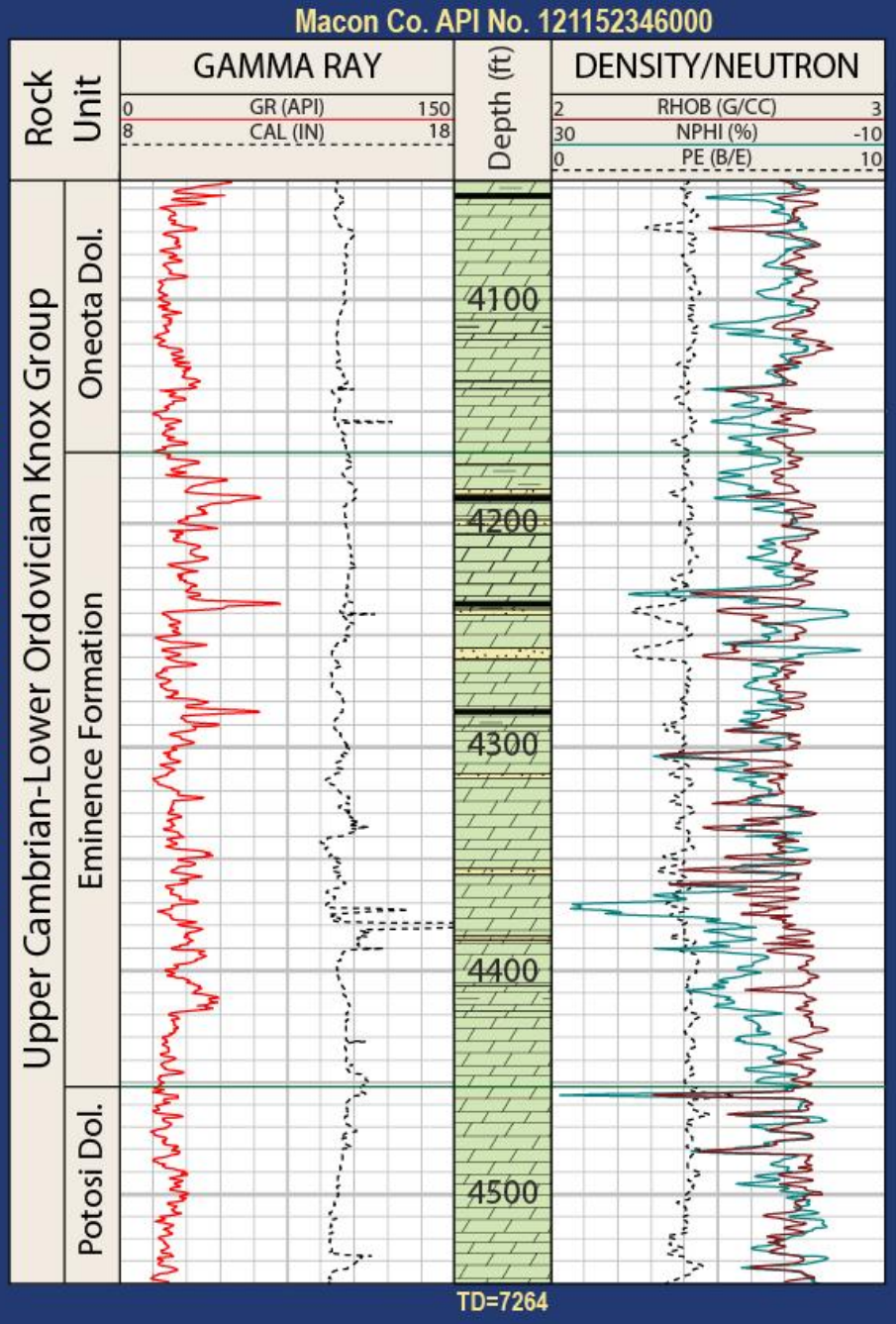

# Facies and Stratigraphy of the Basal Ordovician Gunter Sandstone

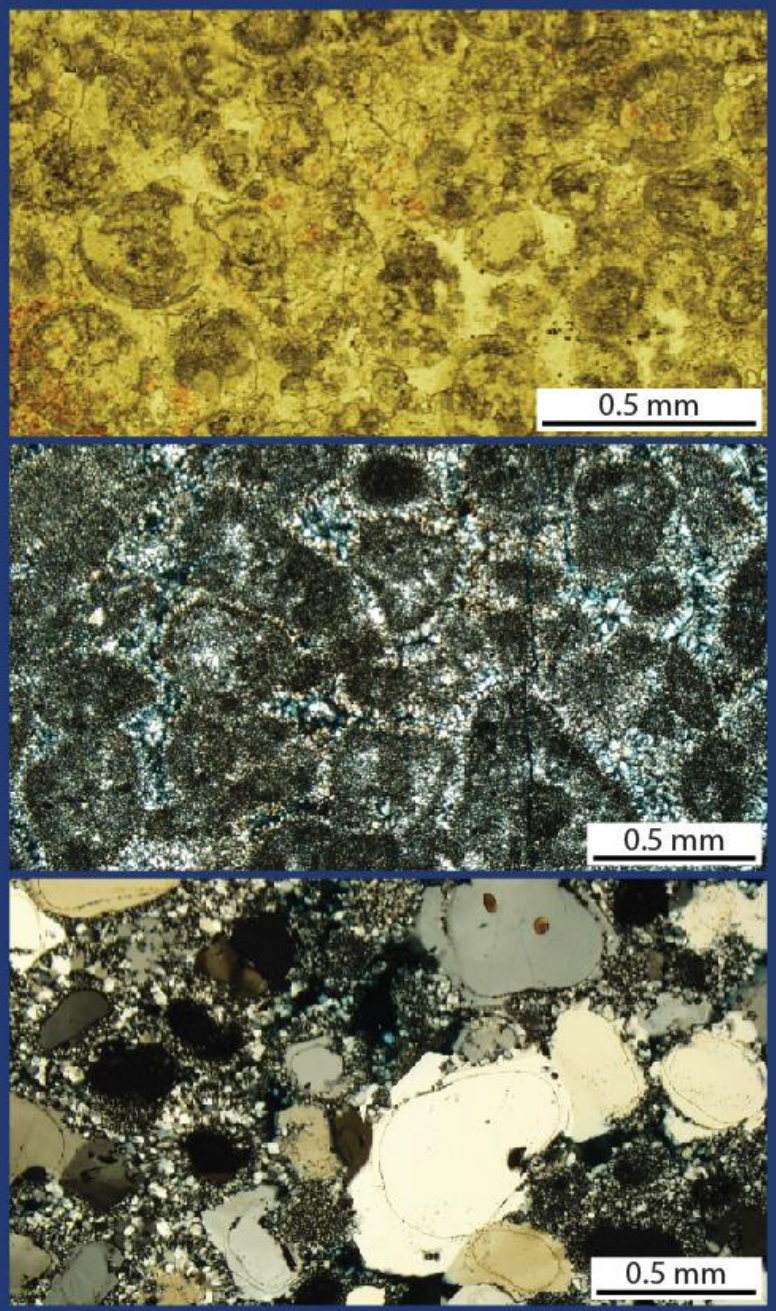
Massive Dolomite of the Eminence Formation and the Basal Ordovician Gunter Sandstone; Colosseum Trail, Ha Ha Tonka State Park, Missouri

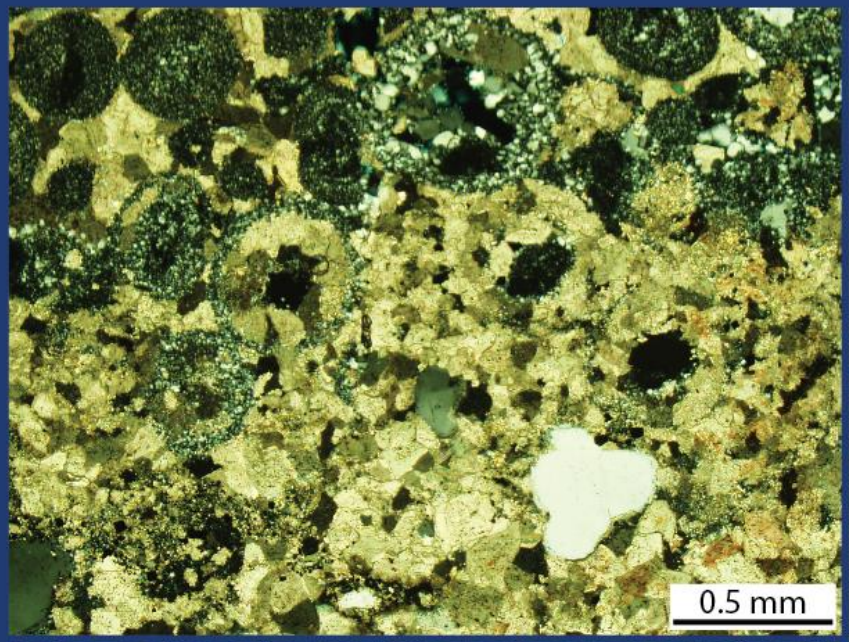
# Stratigraphy of the Eminence Formation in South-central Illinois



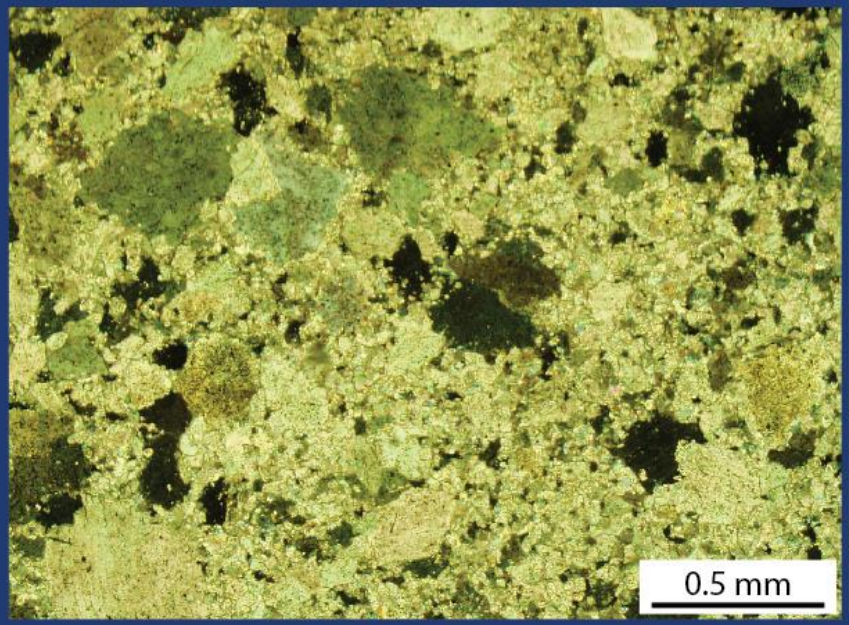

# Stratigraphy of the Eminence Formation in South-Central Illinois











# Facies of the Eminence Formation

# Correlation of the Uppermost Cambrian and Lowermost Ordovician Transition Interval in Northern Illinois


LaSalle Co. API No. 1209920178100

McLean Co. API No. 121132108400

Macon Co. API No. 121152346000

Rock Unit | GAMMA RAY 0 API 100 | Depth (ft) | RESIST/SONIC 0 RESIST (OM) 500, 140 DT (ms/ft) 40 | DENSITY/NEUT. 30 DPHI (%) -10, 30 NPHI (%) -10

Ord. — Oneota Dol.

G. Ss — Gunter Ss.

Cambrian — Eminence

A′

1100 | 1150 | 2350 | 2400 | 4100 | 4200 | 4300

TD=2494

Datum

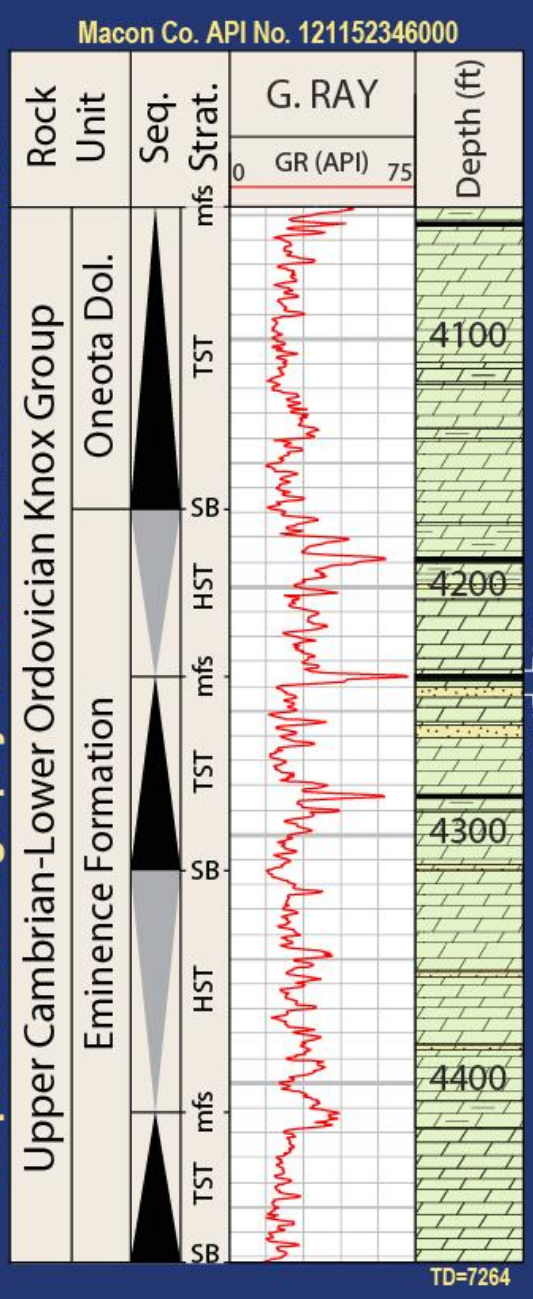
TD=3527

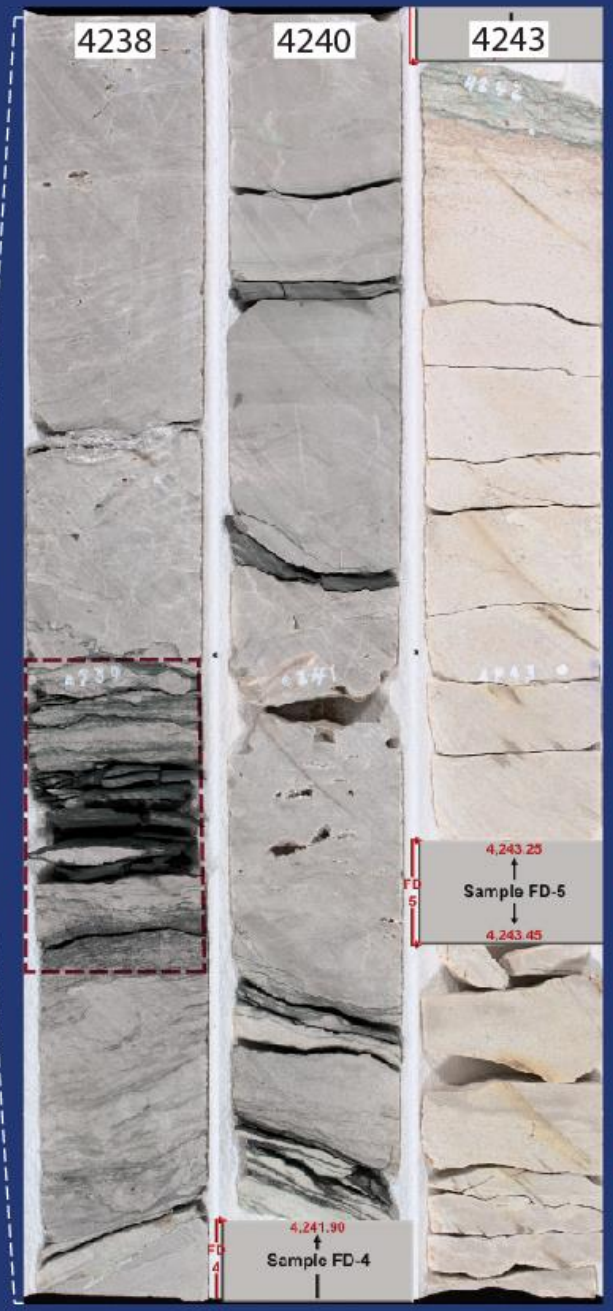
TD=7264

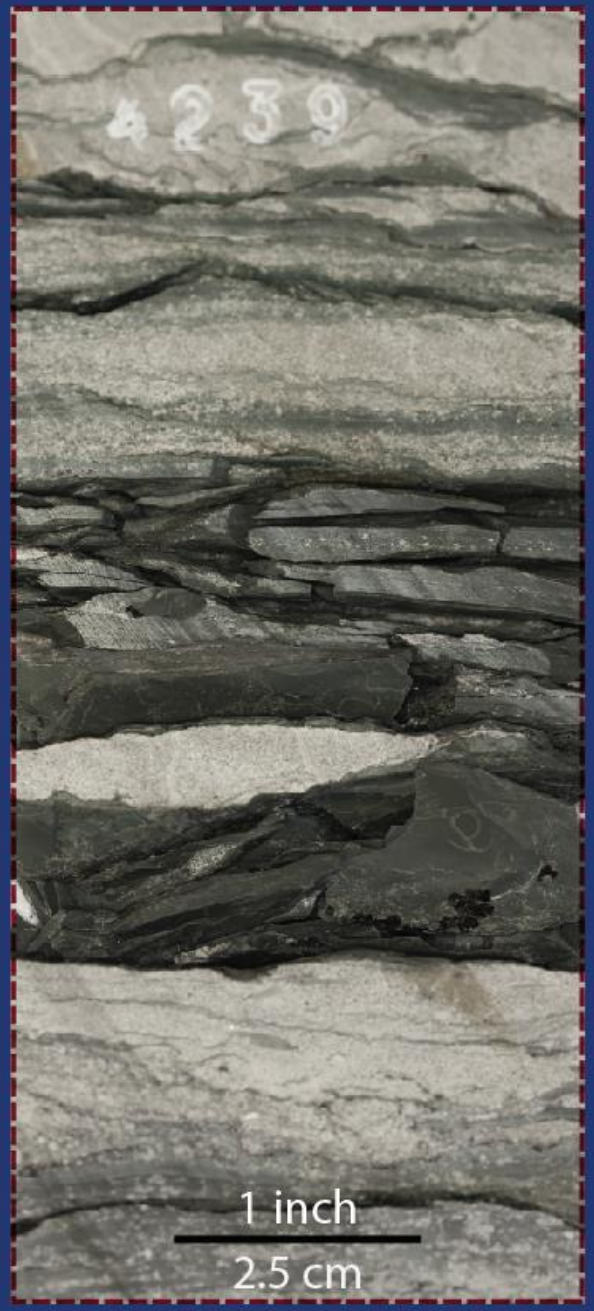
**The Gunter Sandstone sharply overlies the Eminence Formation and grades upward to Oneota Dolomite.**

# Sequence Stratigraphy

# Sequence Stratigraphy of the C-O Transition Interval



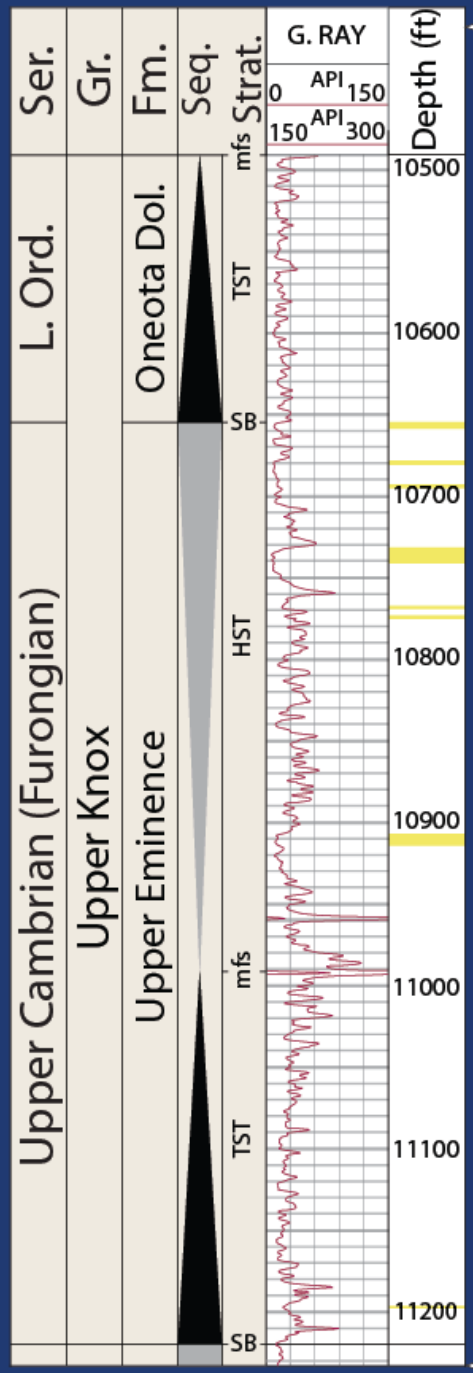



# Upper Eminence Facies

Conoco, Inc. Dyrkopp #4-1, Gallatin Co., IL

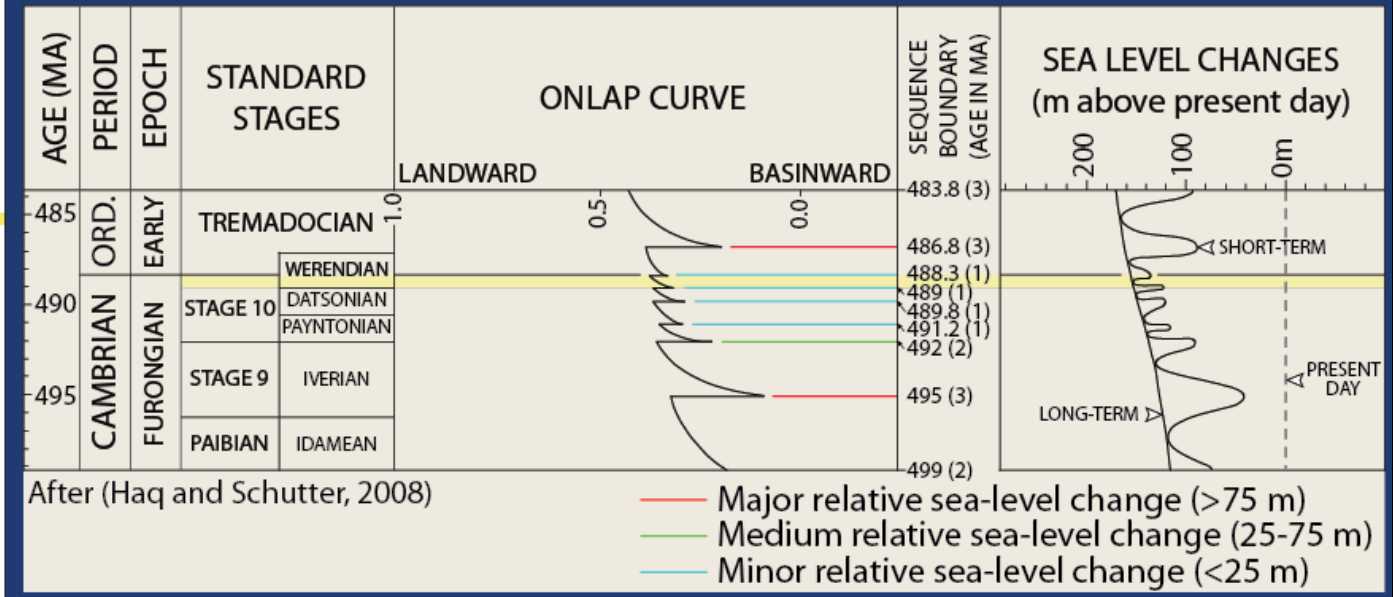
| Ser. | Gr. | Fm. | Seq. | Strat. | G. RAY 0 API 150 / 150 API 300 | Depth (ft) |
|---|---|---|---|---|---|---|
| L. Ord. | Upper Knox | Oneota Dol. | | mfs | | 10500 |
| | | | | TST | | 10600 |
| Upper Cambrian (Furongian) | | | | SB | | 10700 |
| | | Upper Eminence | | HST | | 10800 |
| | | | | | | 10900 |
| | | | | mfs | | 11000 |
| | | | | TST | | 11100 |
| | | | | SB | | 11200 |




Conoco, Inc. Dyrkopp #4-1, Gallatin Co., IL

# Sequence Stratigraphy

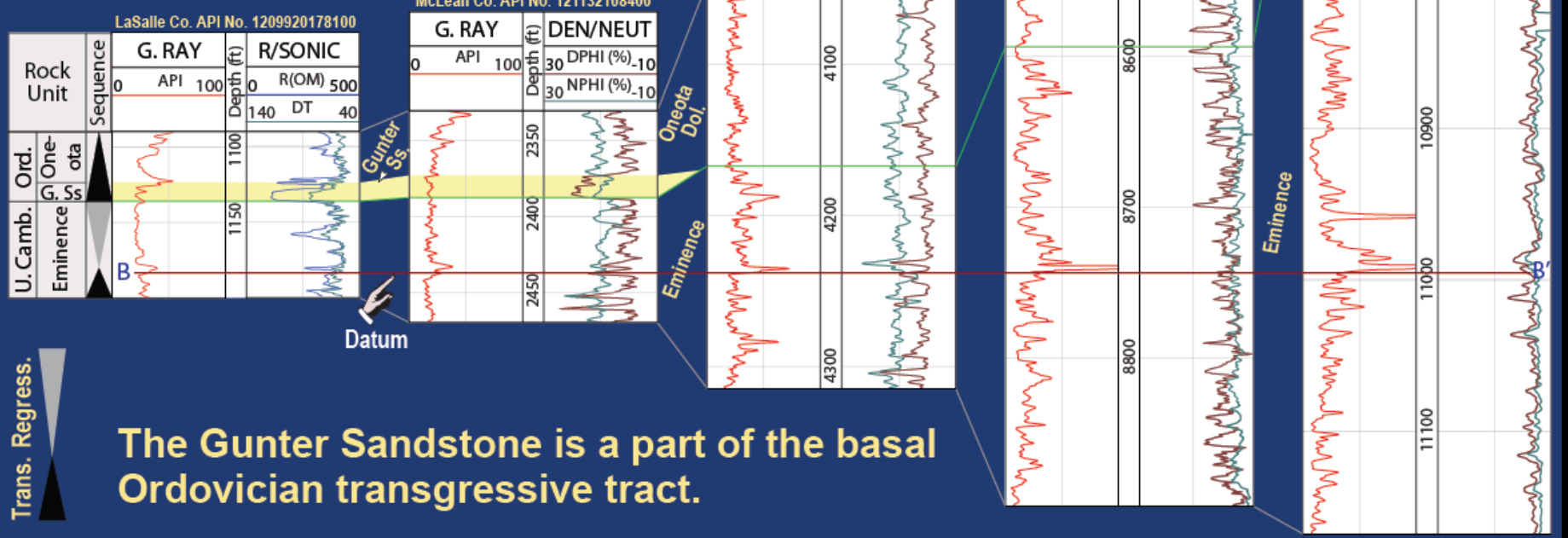
## The Upper Eminence Sequence Corresponds to the Uppermost Cambrian Sea Level Cycle


## Sea-level Changes at the Cambro-Ordovician Transition

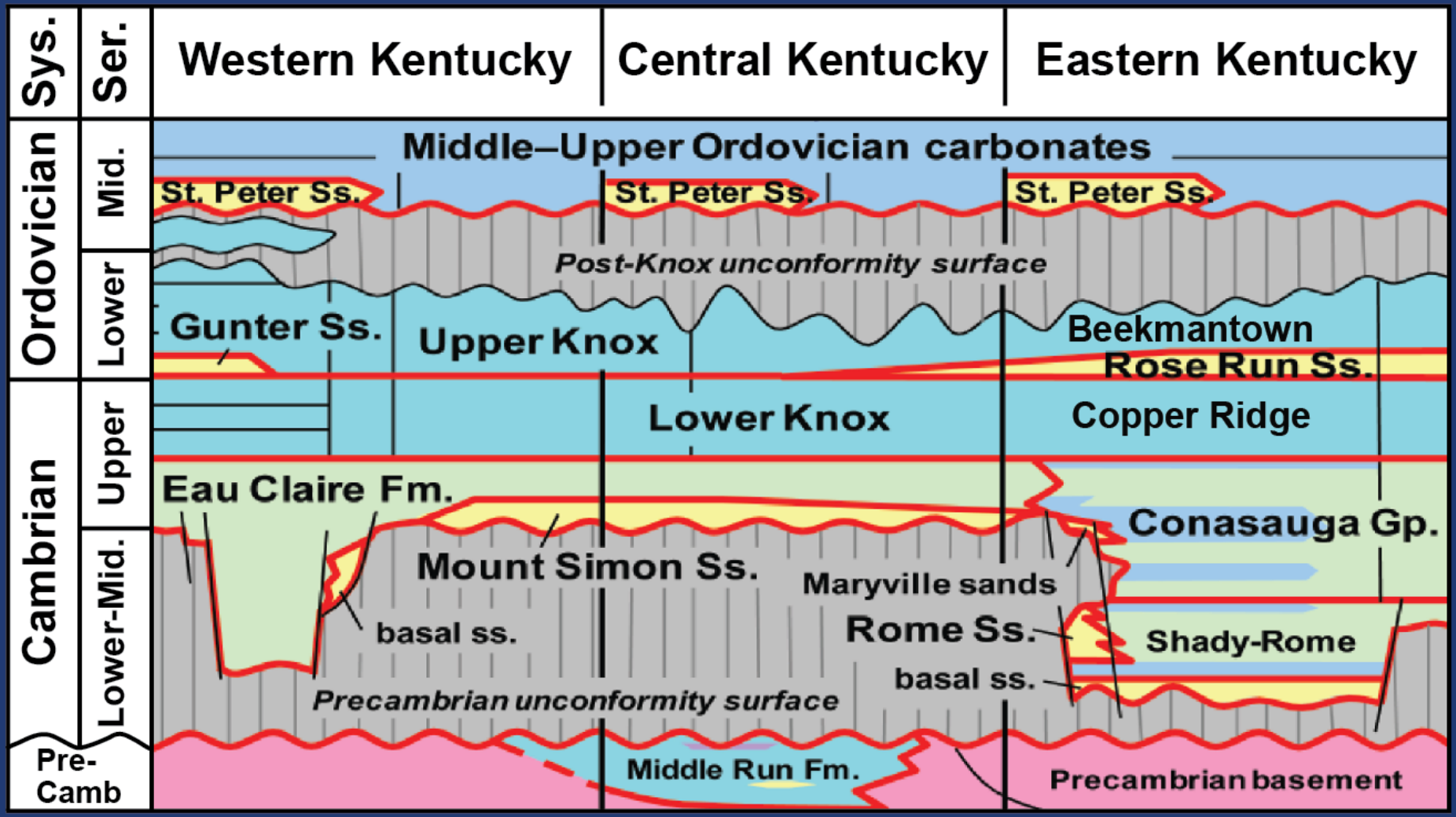
TD=14185 ft

# North-South Correlation of the Uppermost Cambrian and Lowermost Ordovician Transition Interval in Illinois


**The Gunter Sandstone is a part of the basal Ordovician transgressive tract.**

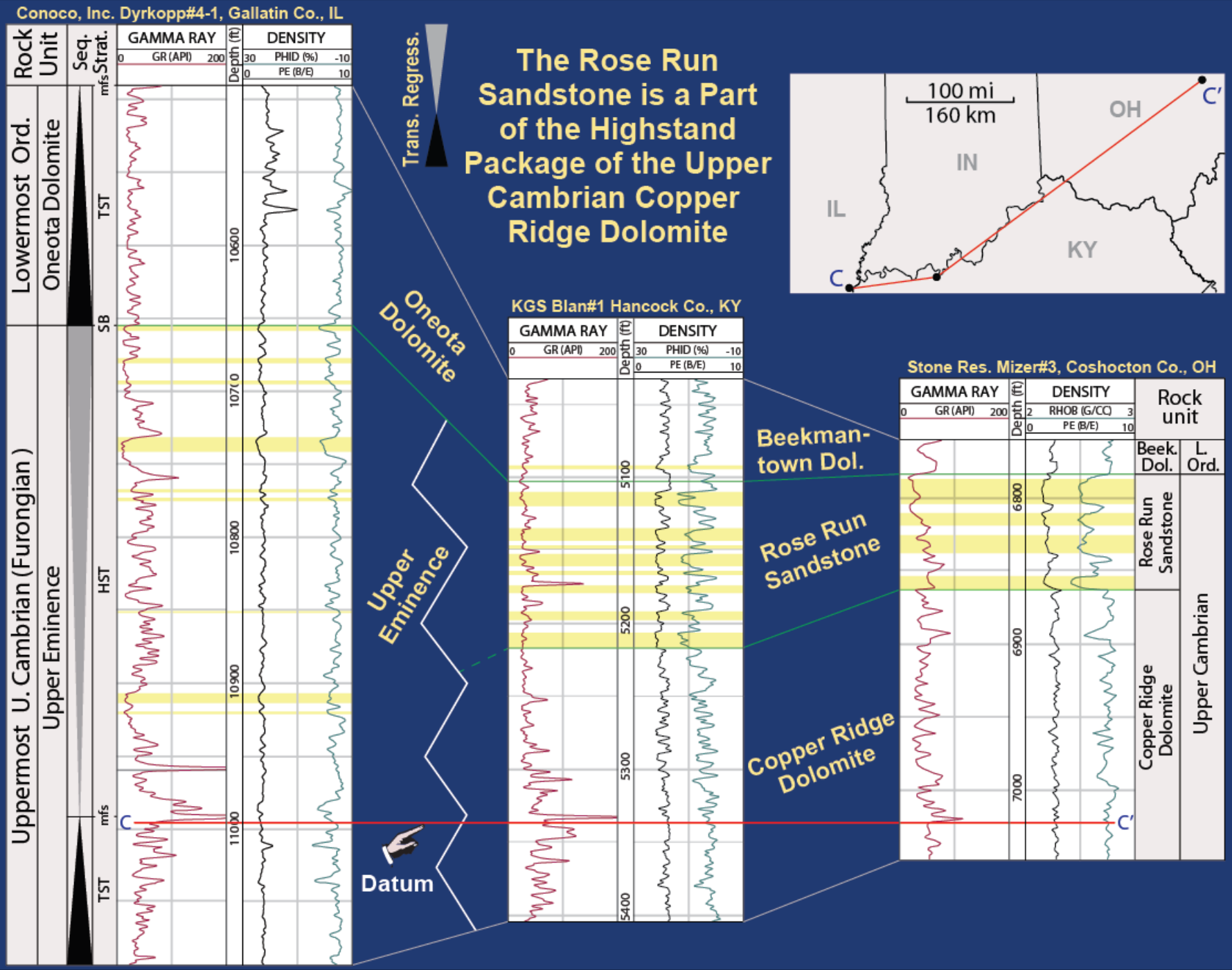
# Stratigraphic Position of the Rose Run Sandstone




Modified from Parris, Greb, and Nuttal (2010)

# Stratigraphic Correlation of the Cambro-Ordovician Rocks in Kentucky

# The Rose Run Sandstone is a Part of the Highstand Package of the Upper Cambrian Copper Ridge Dolomite



# Conclusions

- Regional wireline log correlation, incorporated with sample and core analyses in the Illinois Basin, resulted in the development of a sequence stratigraphic framework and evaluation of the position of the C-O boundary and associated stratigraphic intervals.
- The Rose Run Sandstone is a part of the highstand package of the Upper Cambrian Copper Ridge Dolomite.

# Conclusions

- The Gunter Sandston is a part of the basal Ordovician transgressive package within the Oneota Dolomite, which was deposited on a maximum regressive surface, the Cambro-Ordovician boundary.
- Results of this study indicate that, in the absence of biostratigraphic data, sequence stratigraphy provides a strong tool for regional correlation, and recognition of coeval stratigraphic units.


ILLINOIS STATE
GEOLOGICAL SURVEY
Thank you
1867
University of Illinois at Urbana-Champaign