



CARBON CAPTURE AND STORAGE IN THE CAMBRIAN AND ORDOVICIAN STRATA OF THE ILLINOIS BASIN, USA

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Illinois State Geological Survey

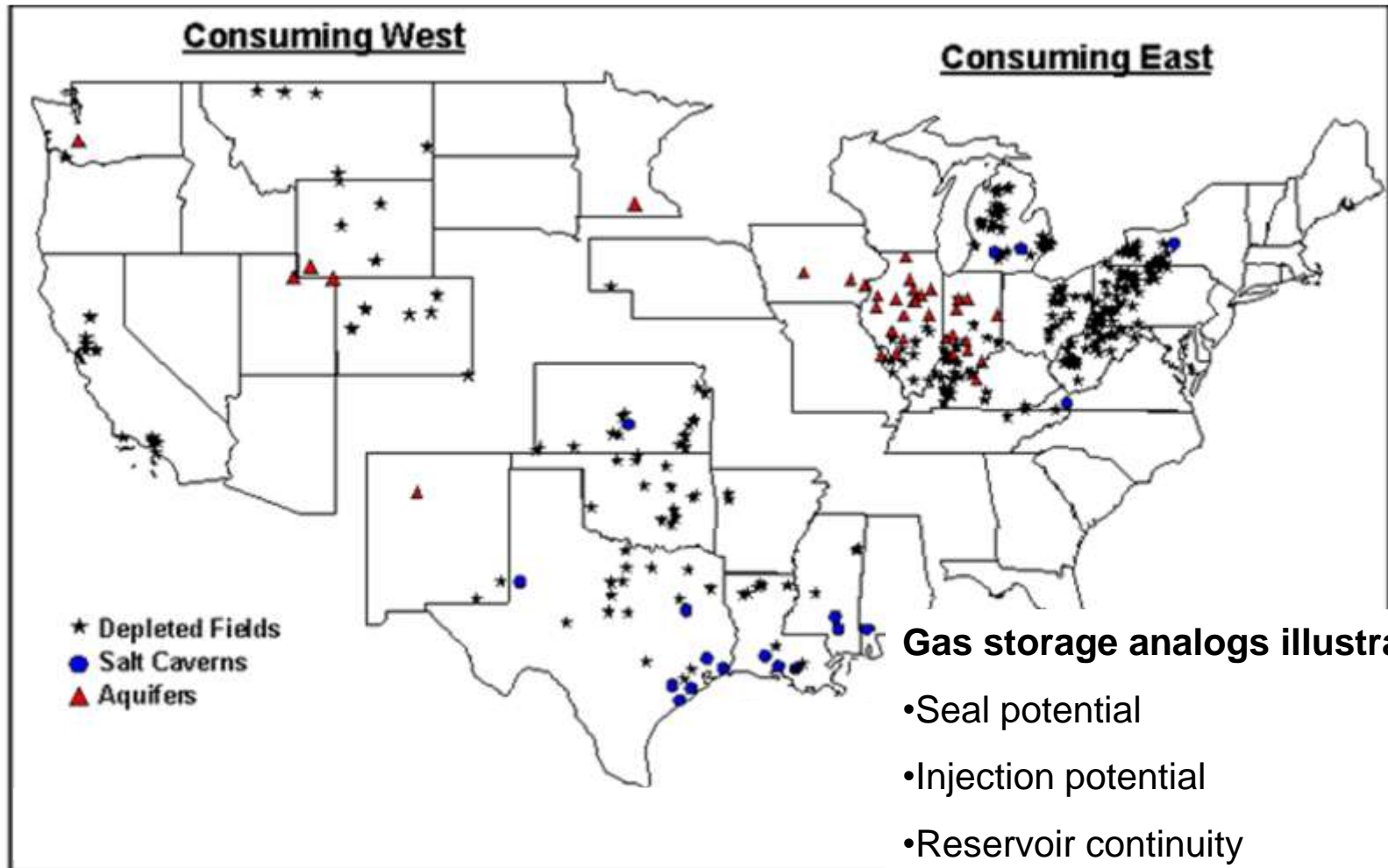
November, 2011

London, UK

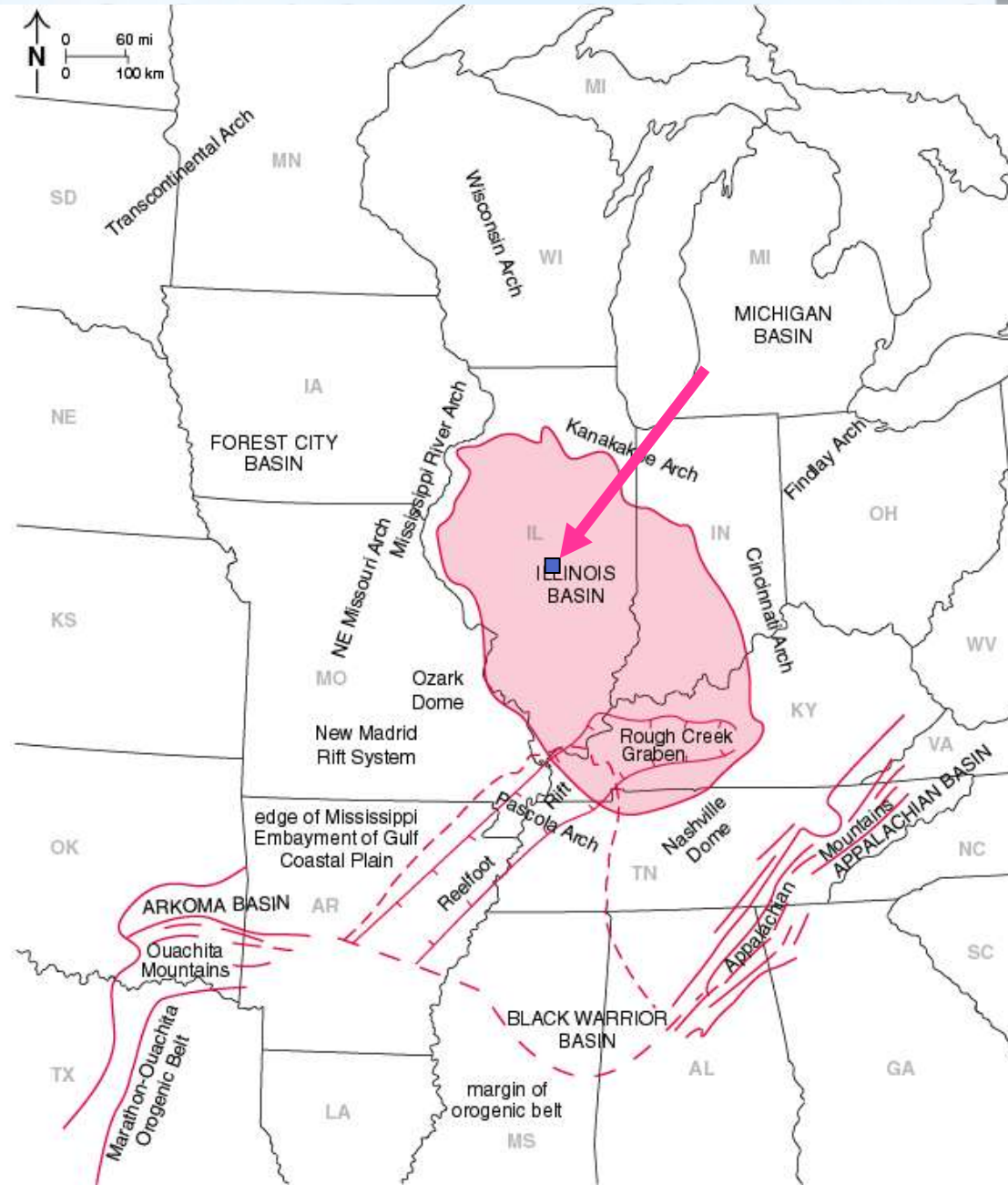
Acknowledgements

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Illinois Basin has the Largest Concentration of Saline Natural Gas Storage Reservoirs in the US

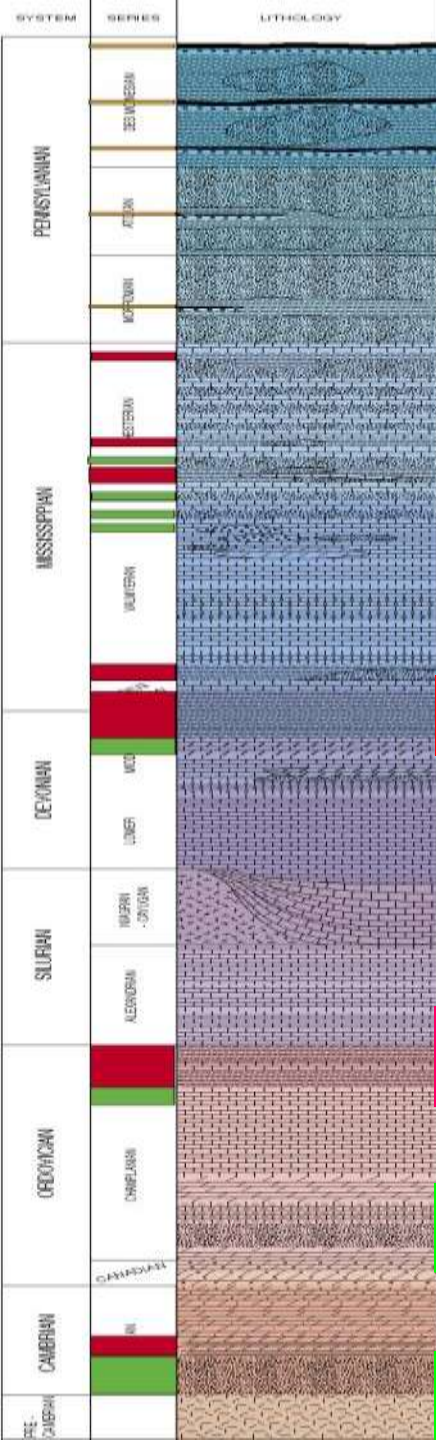


Illinois Basin - Decatur Project



What are our sequestration targets?

Illinois Basin Stratigraphic Column Showing Seals and Sinks



New Albany (Seal)

Maquoketa (Seal)

St Peter (Sink)

Knox (Potosi) (Sink)

Eau Claire (Seal)

Mt. Simon (Sink)



Why these Formations?

- Mt. Simon is a regional sandstone that underlies most of the Midwest of the United States
- Knox is regionally widespread at supercritical CO₂ depths, yet shallower than the Mount Simon
- St. Peter Sandstone has significant thickness and porosity in both the Michigan and Illinois Basins

St. Peter Sandstone

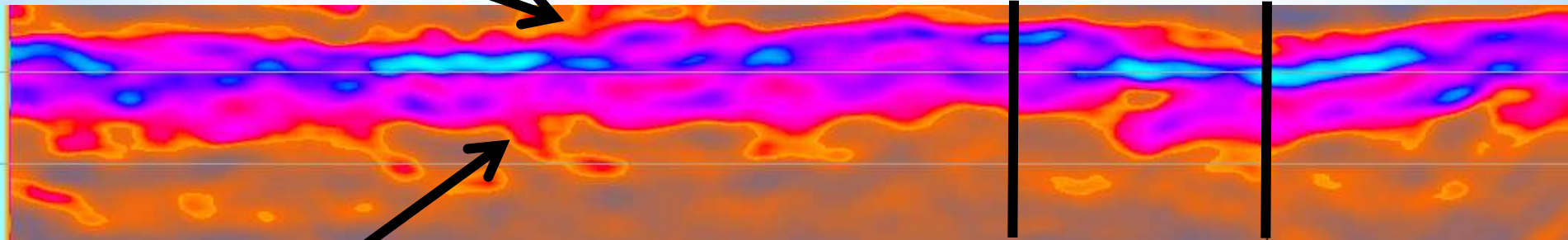
25' Level Sandstone

Seismic Inversion: Density

Seismic Inversion: Density

Top St. Peter

Verification # 1 Well CCS #1 Well



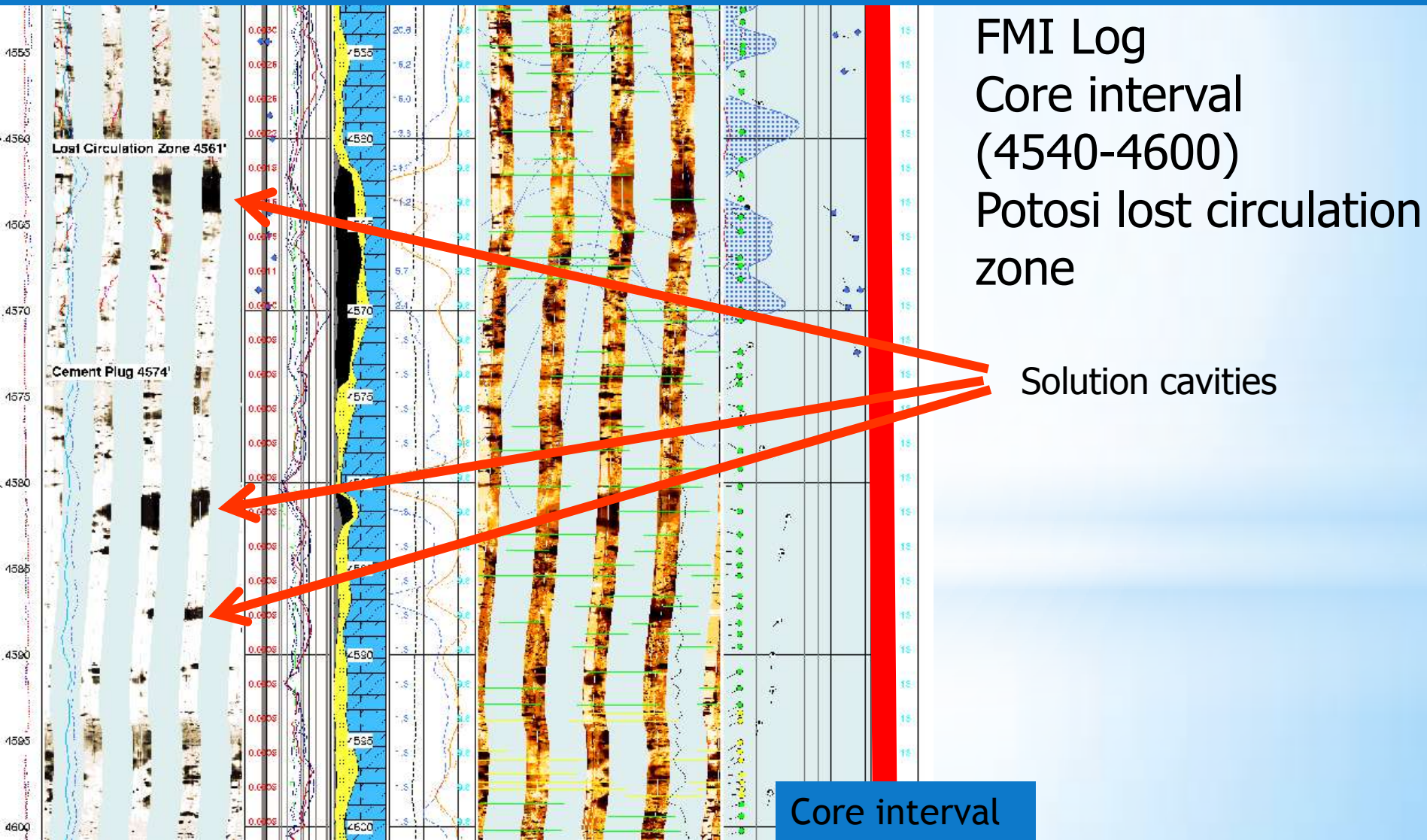
Top Knox

Top is 20 feet on seismic

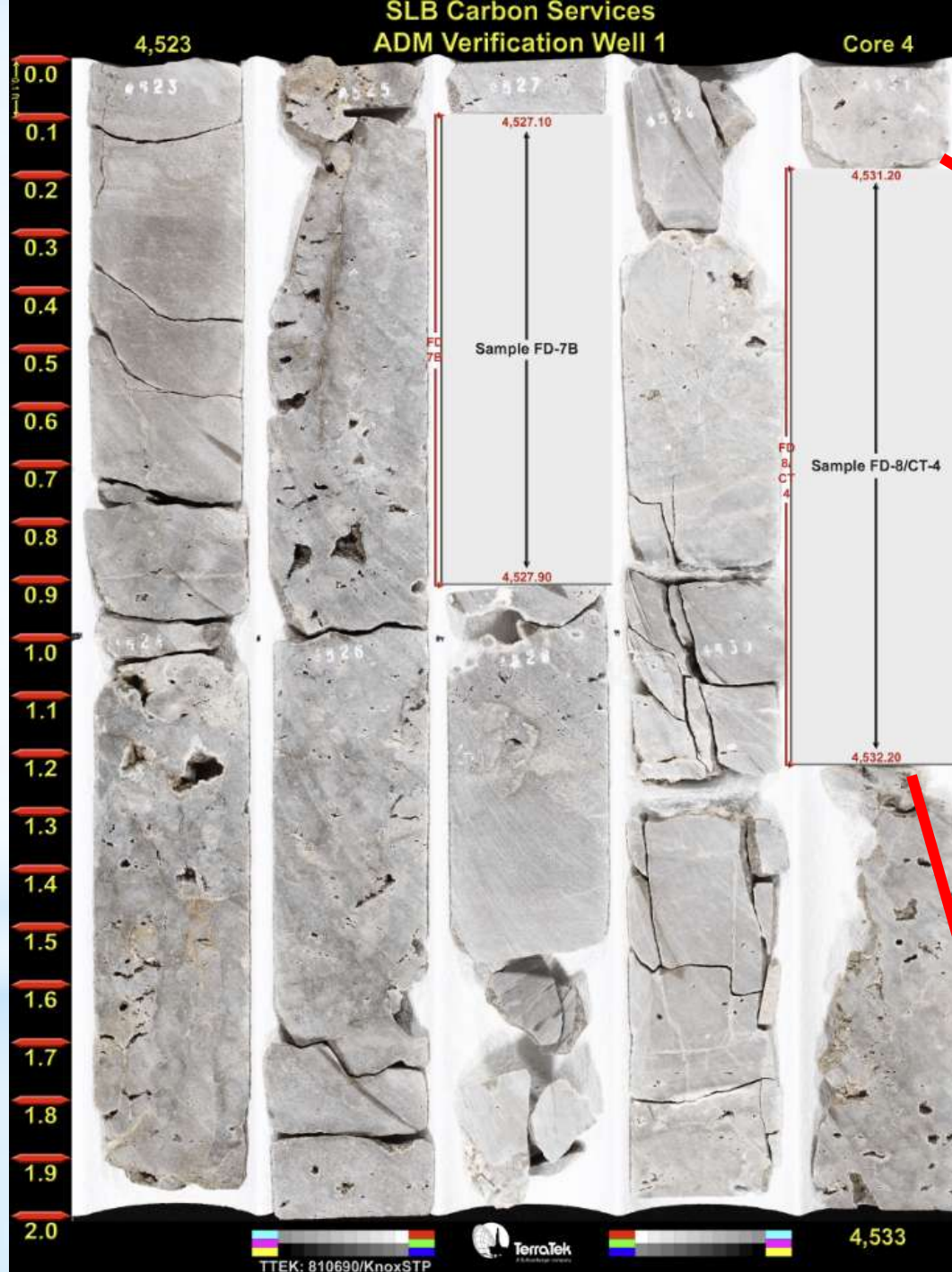
Potosi Interval

LOCO21 UNCLAS

4513 - 4544 cut 31 feet recovered 29 ½
4544 - 4599 cut 15 feet recovered 11 ½
Lost almost 400 barrels of mud during coring

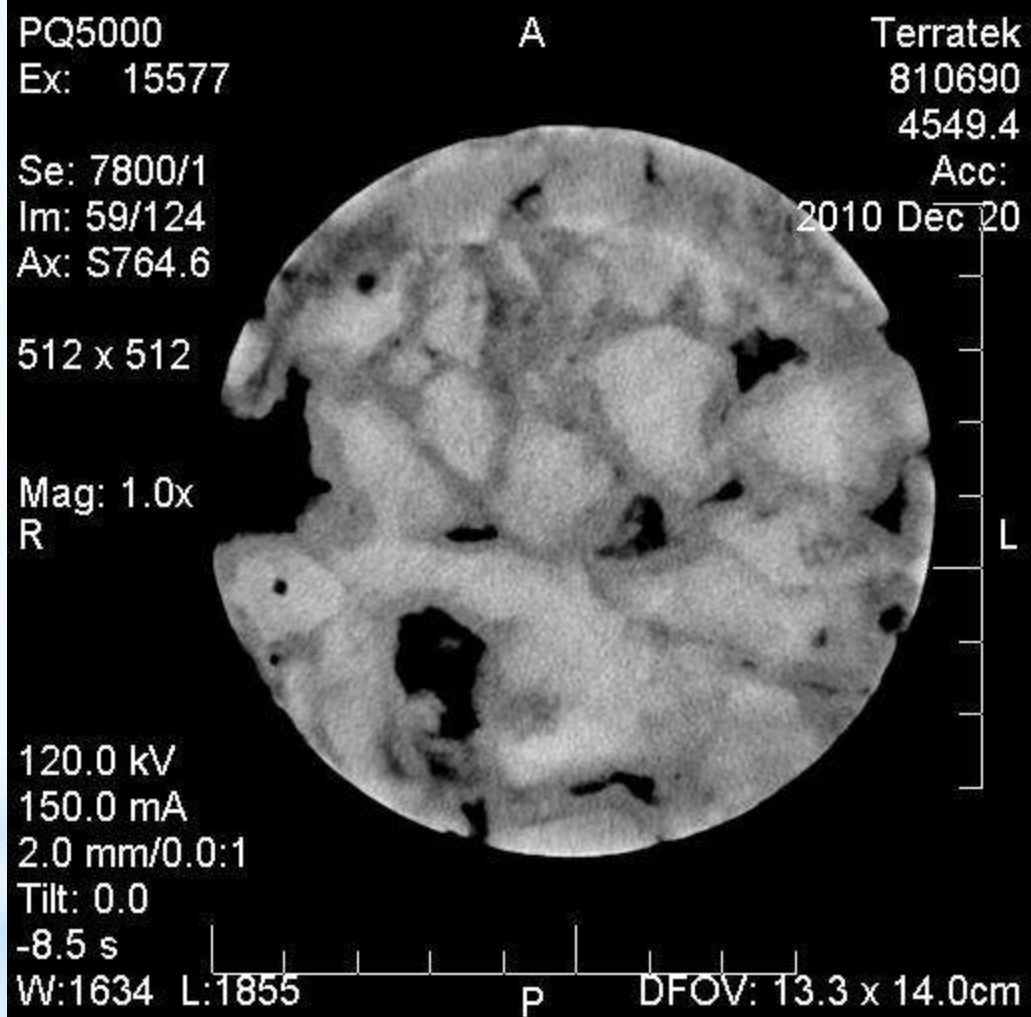


Potosi



CT Scan

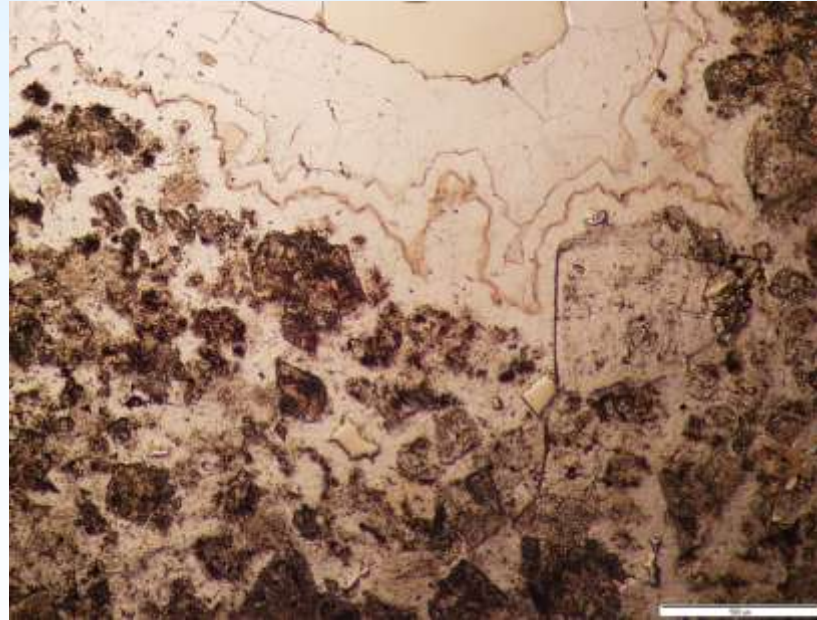




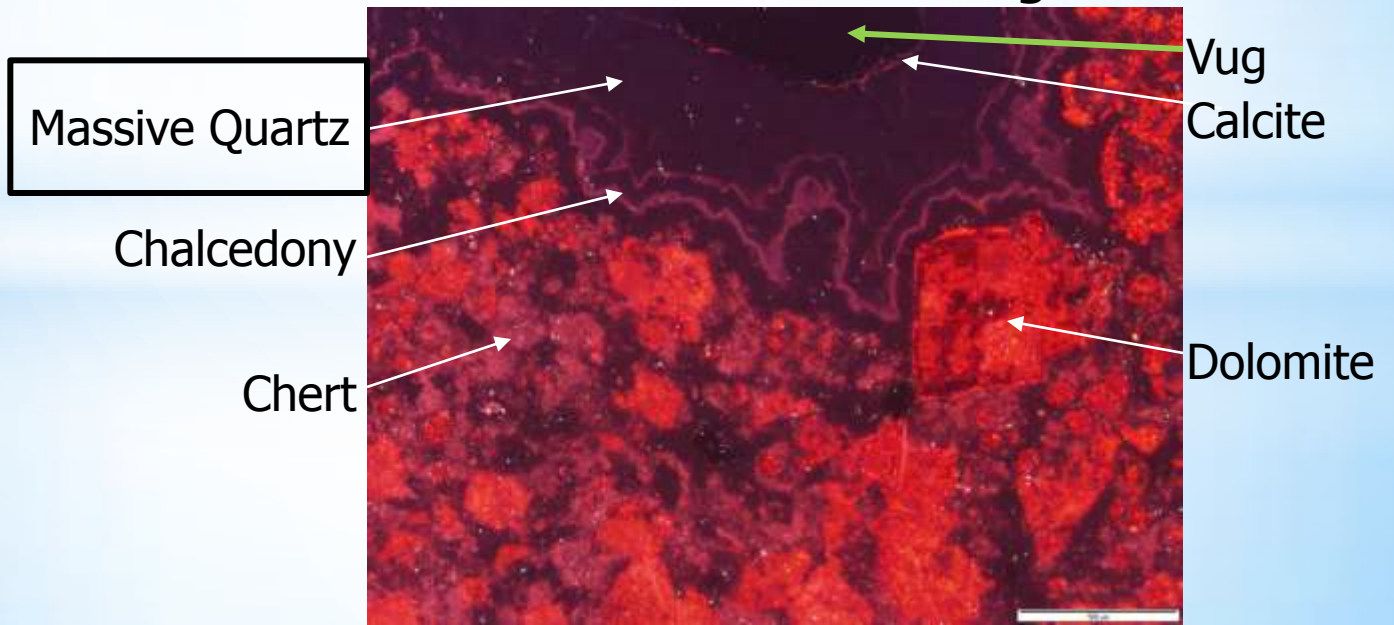
Potosi Dolomite

Depth 4533.9'

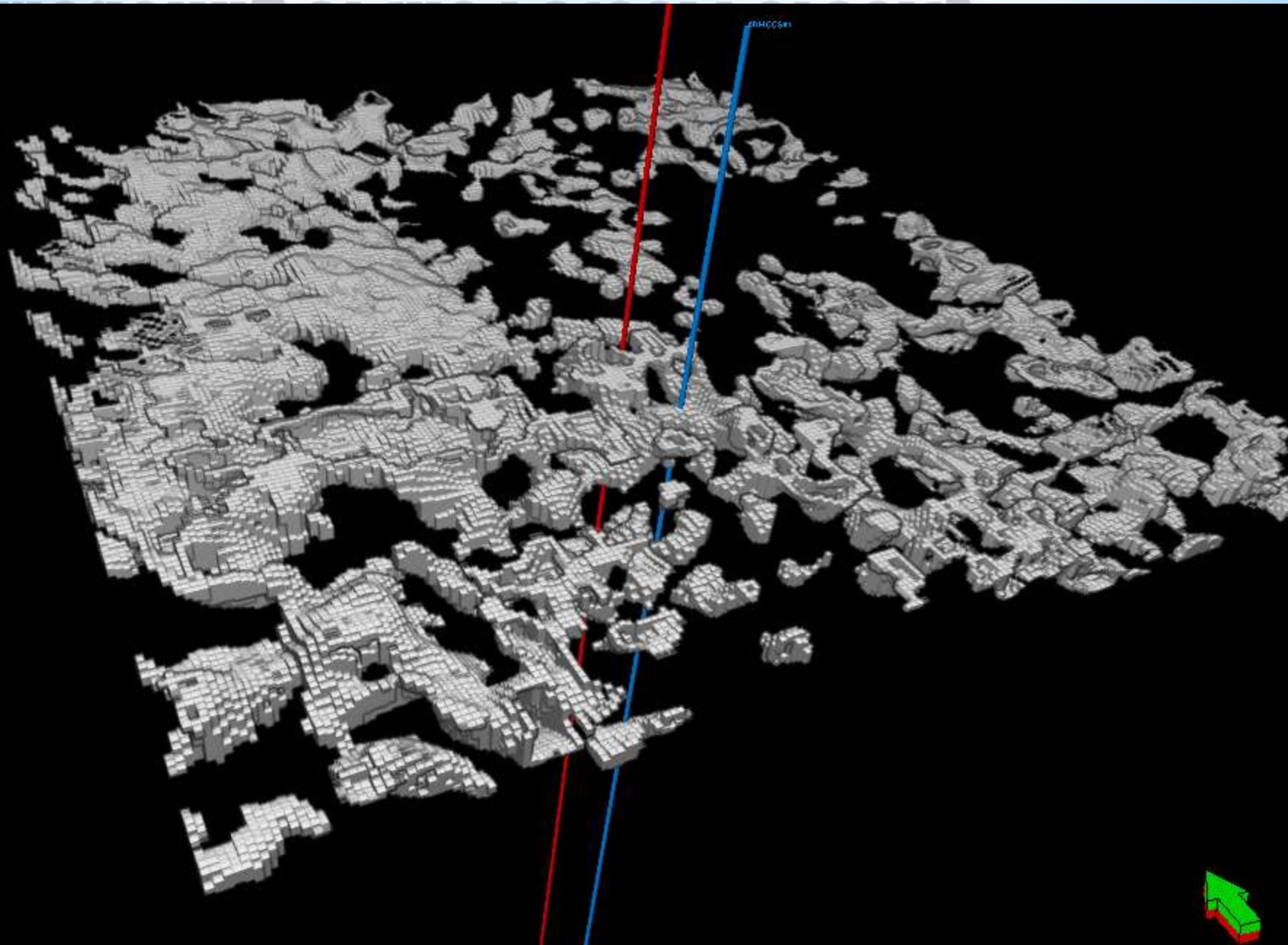
Plane Polarized Light



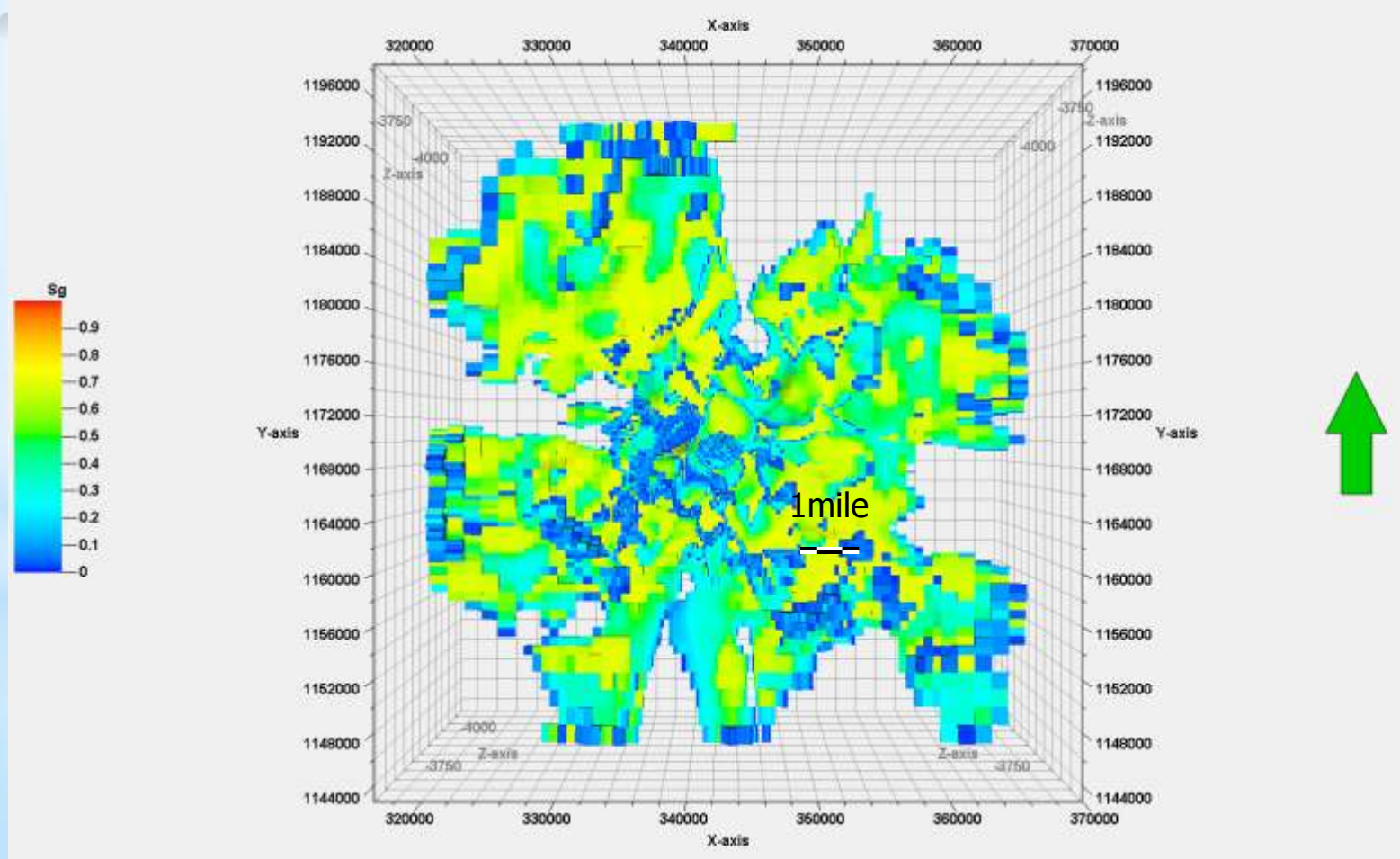
Cathodoluminescent Light



Modeling of the Potosi Porosity



Geostatistical reservoir model. CO₂ plume plan view at the end of 20 years with an approximate radius of 5 miles



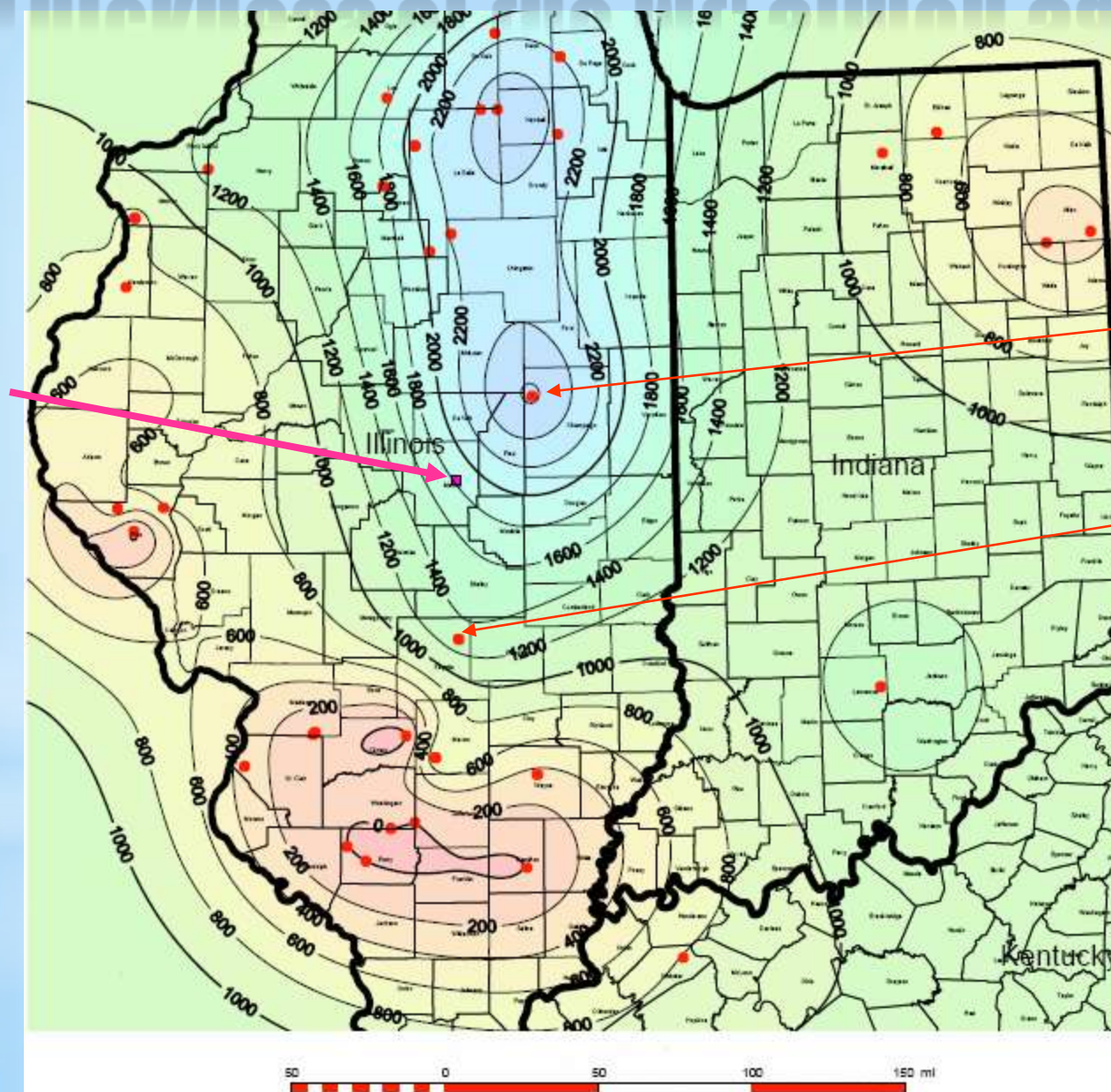
Reservoir Simulation of CO₂ injection into the Knox

- Plume diameter will be difficult to predict because the CO₂ will follow the solution cavities and could move at a rapid pace through the subsurface

Mt. Simon Sandstone

Mt. Simon Sandstone

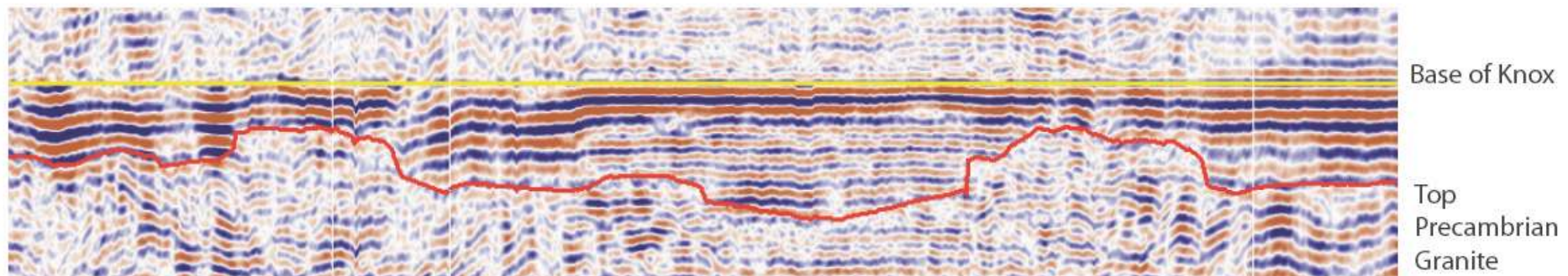
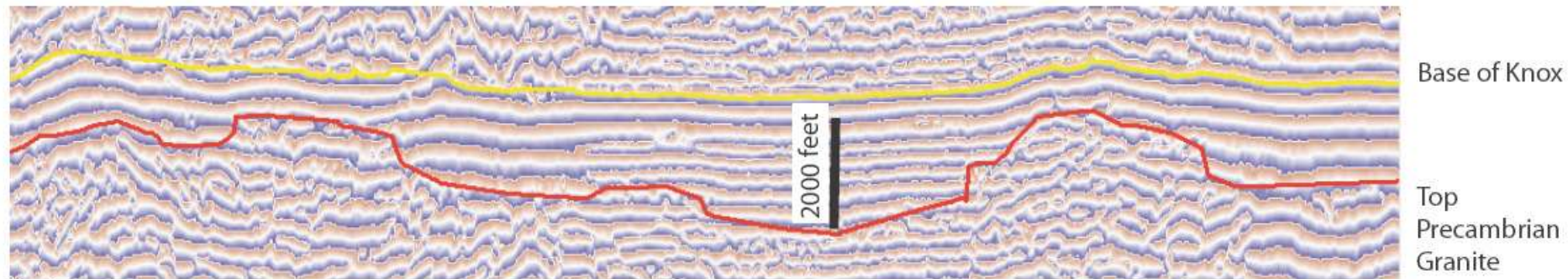
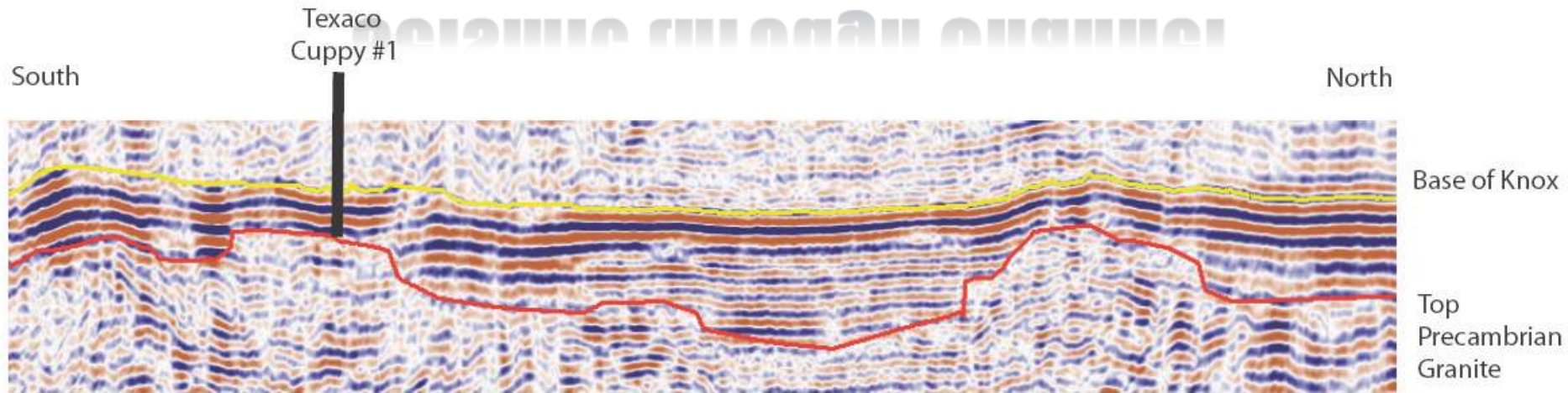
Thickness of the Mt. Simon Sandstone



Hinton #7
penetrated 2600
feet of Mt. Simon

Wells with
Precambrian
granite

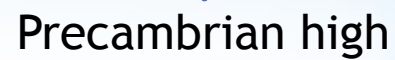
Seismic through Channel



14 miles

Արդարադատություն

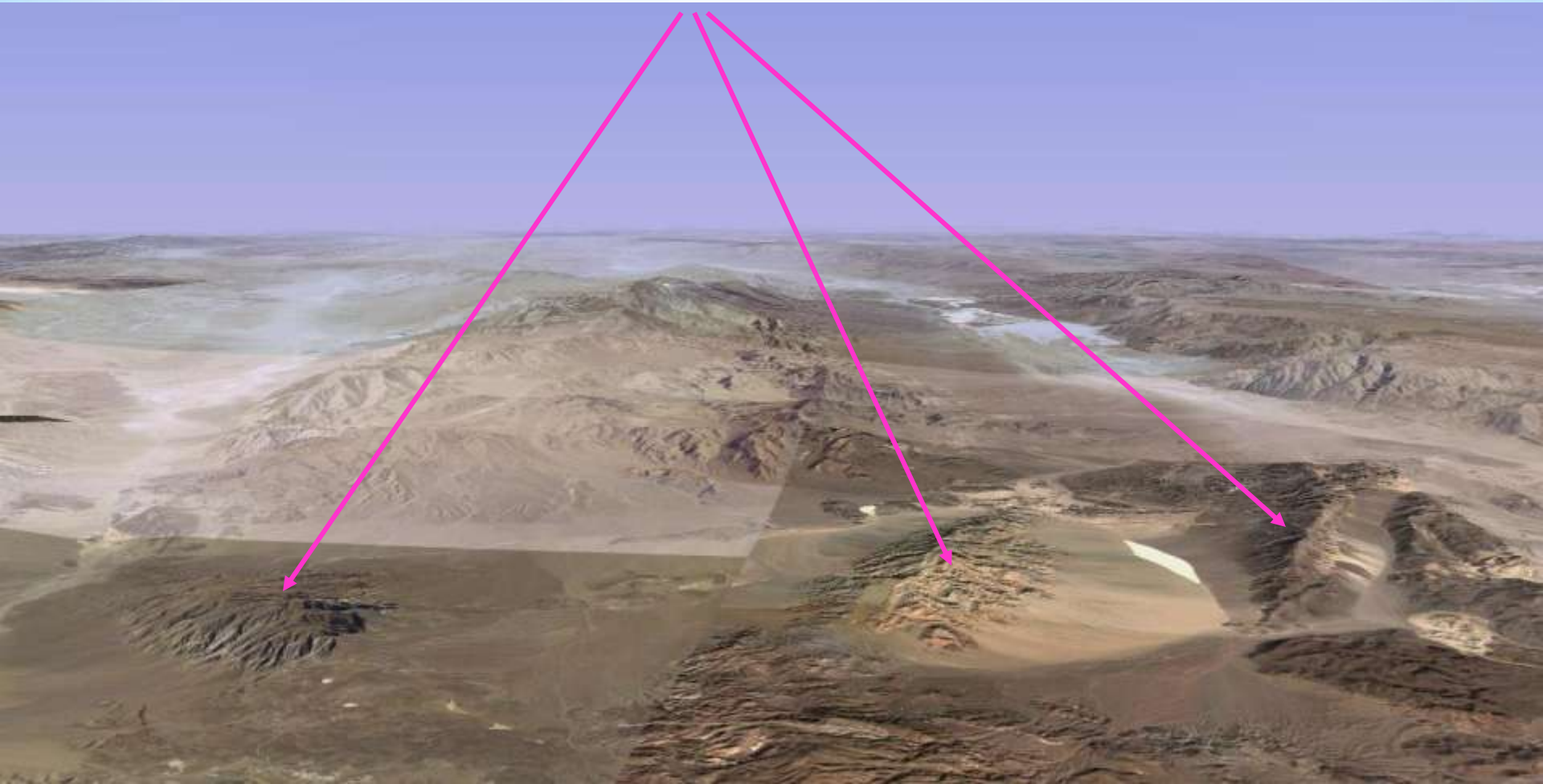
South



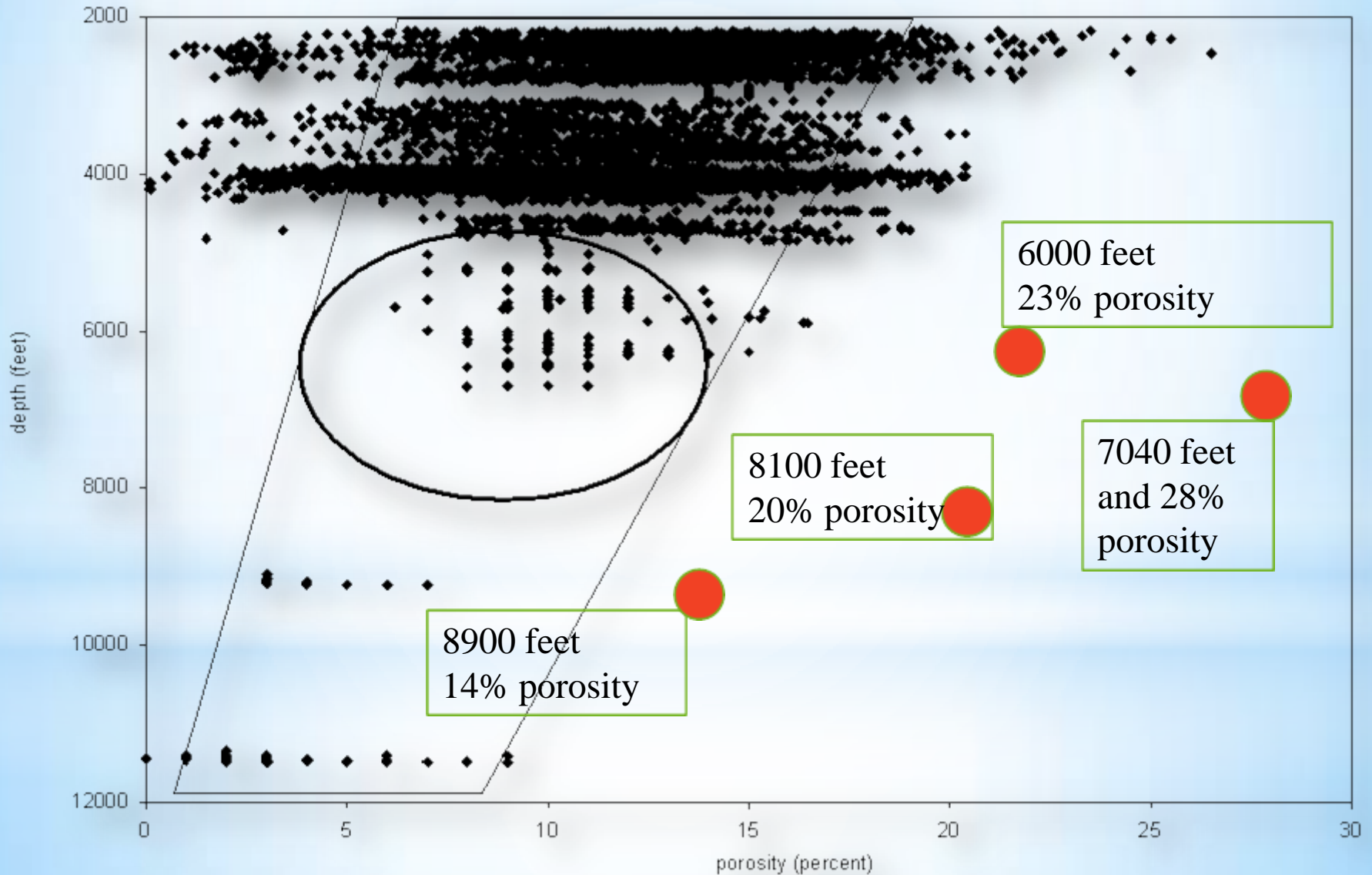
Death Valley Analog

Death Valley Analog

Topography that could become buried hills



Porosity and its Relationship with Depth

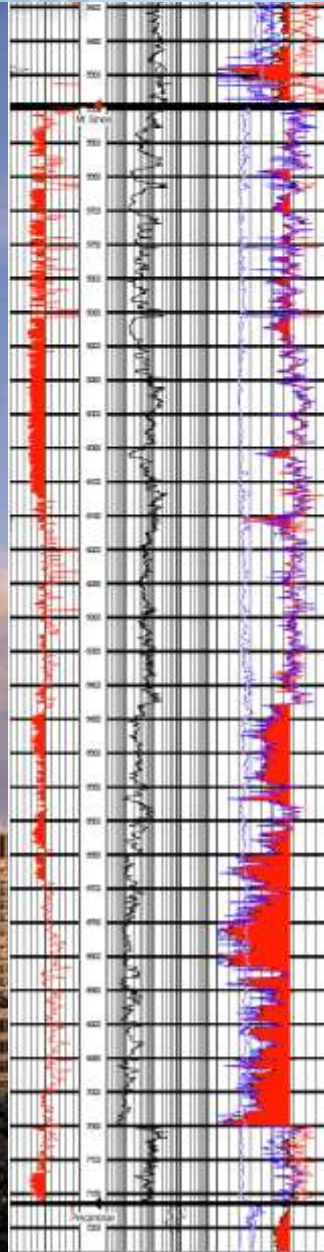


The CCS#1 Well

Washington
Monument is 555
feet tall



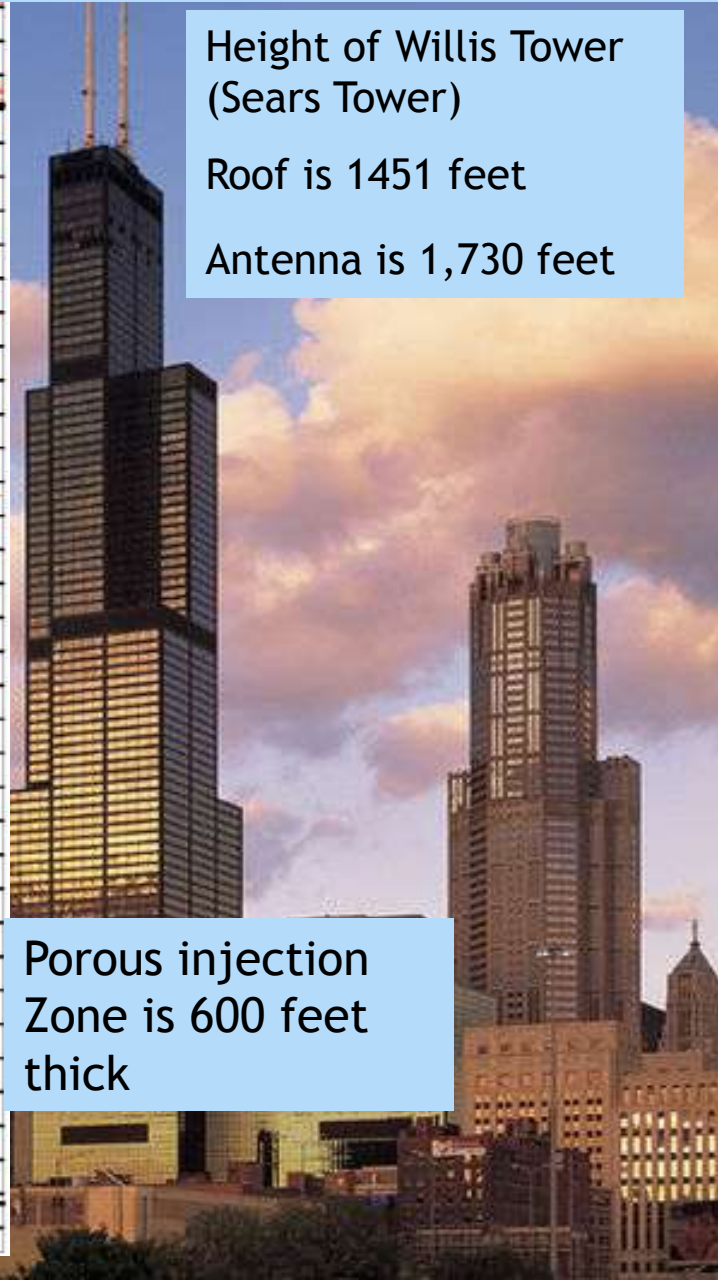
Flag pole
about 30
feet



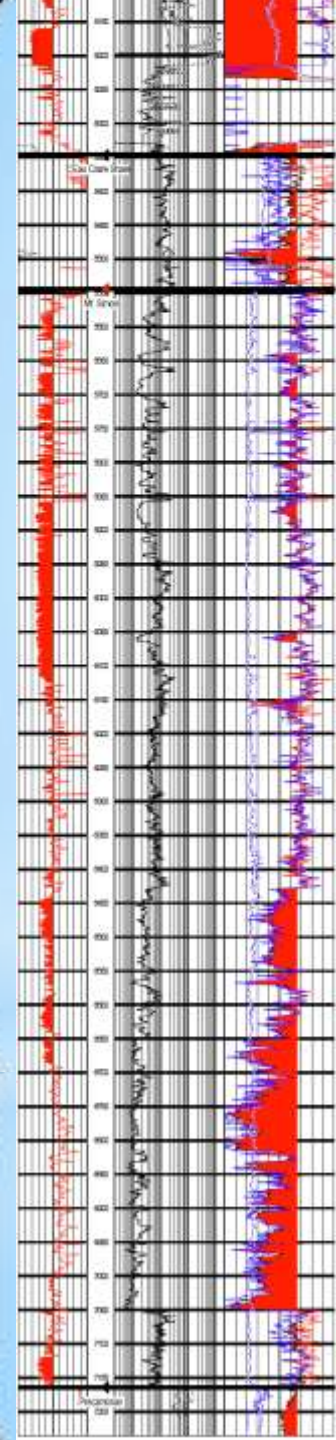
Height of Willis Tower
(Sears Tower)

Roof is 1451 feet

Antenna is 1,730 feet



Porous injection
Zone is 600 feet
thick



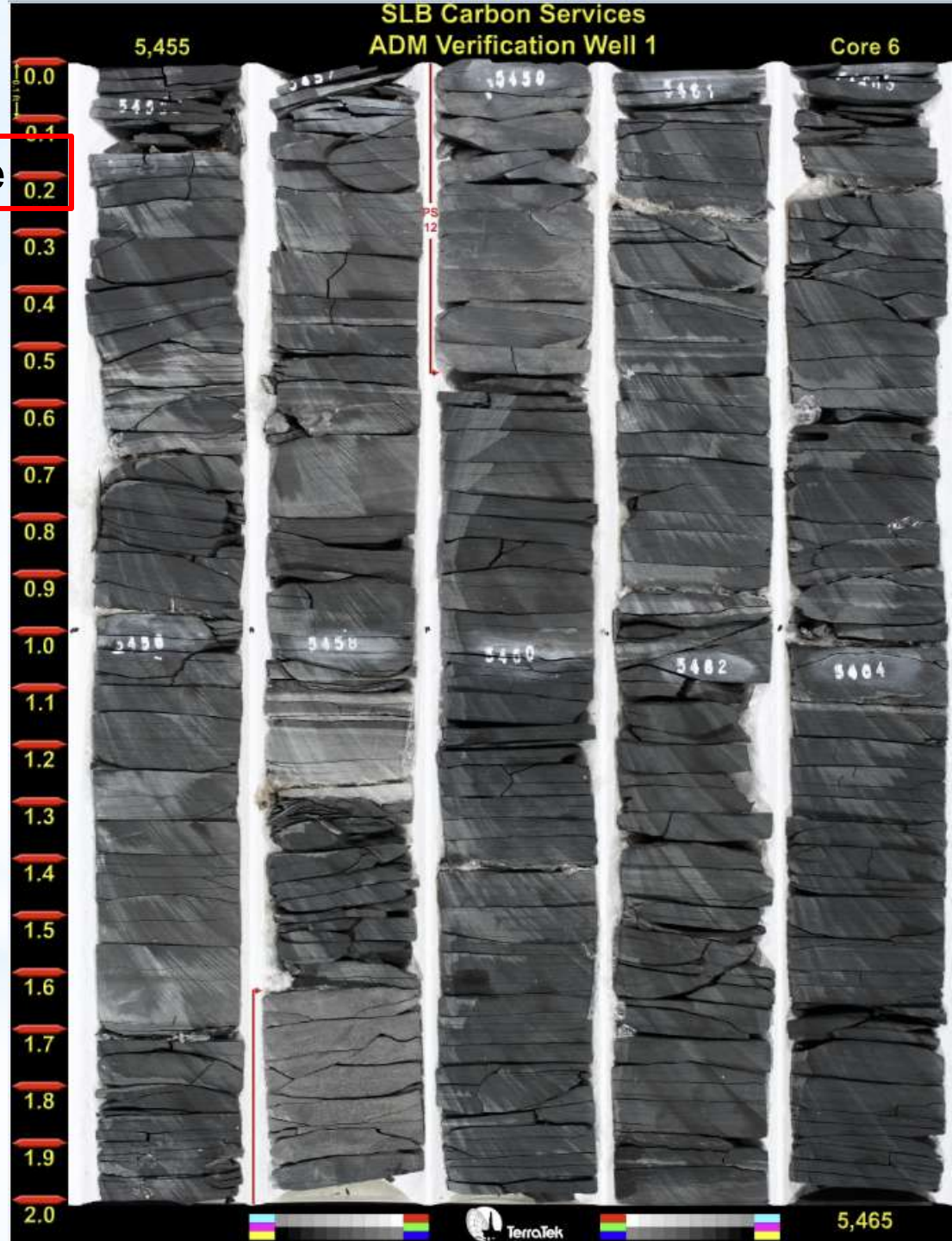
Eau Claire Shale

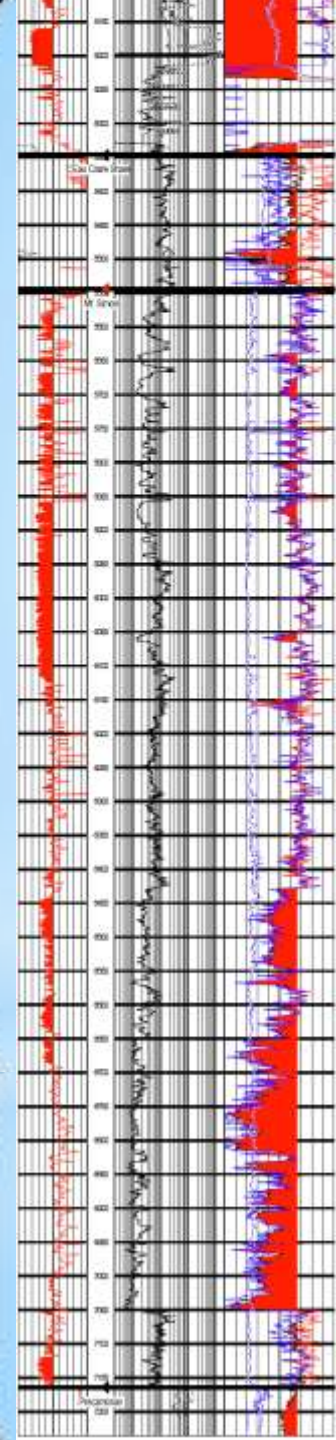
Upper Mt. Simon

Middle Mt. Simon

Lower Mt. Simon

Injection Interval





Eau Claire Shale

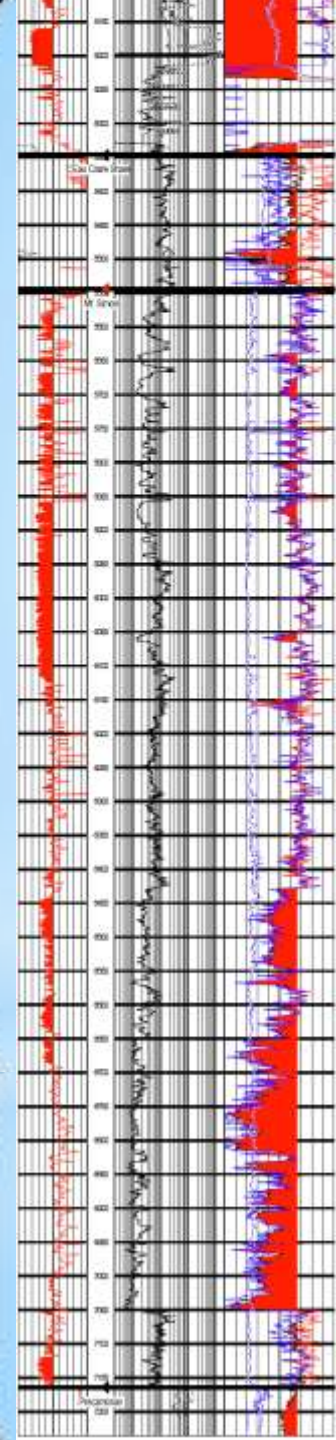
Upper Mt. Simon

Middle Mt. Simon

Lower Mt. Simon

Injection Interval





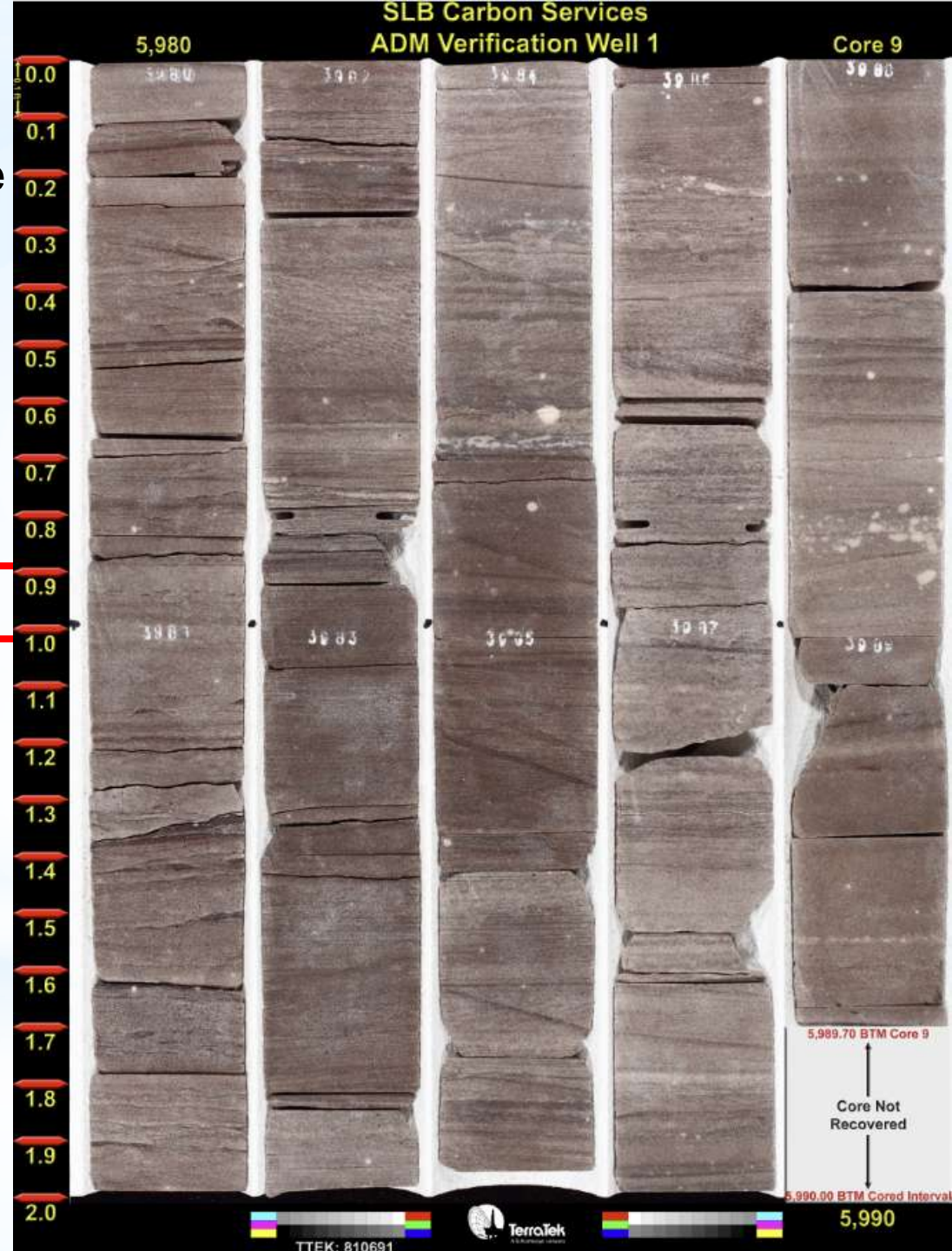
Eau Claire Shale

Upper Mt. Simon

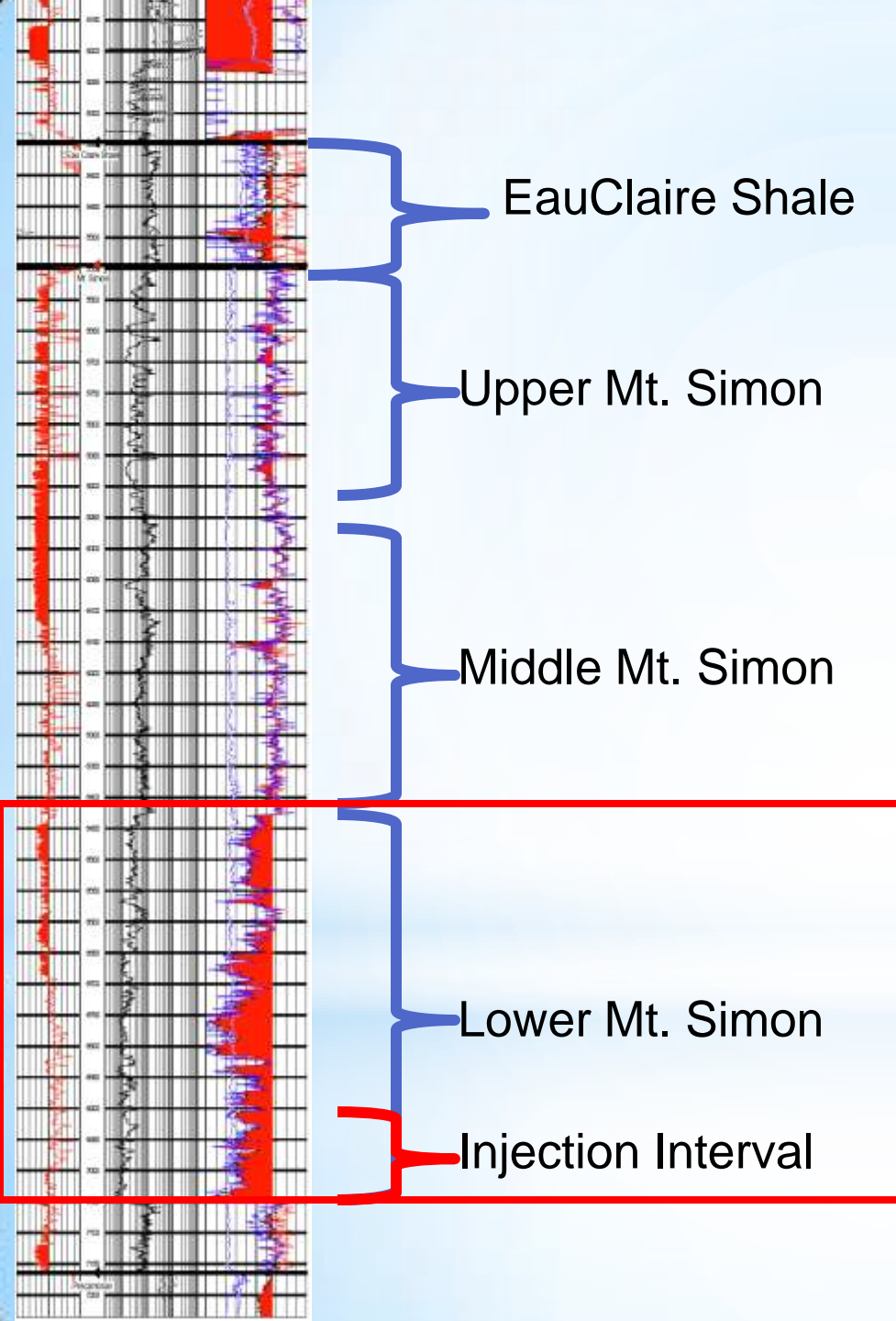
Middle Mt. Simon

Lower Mt. Simon

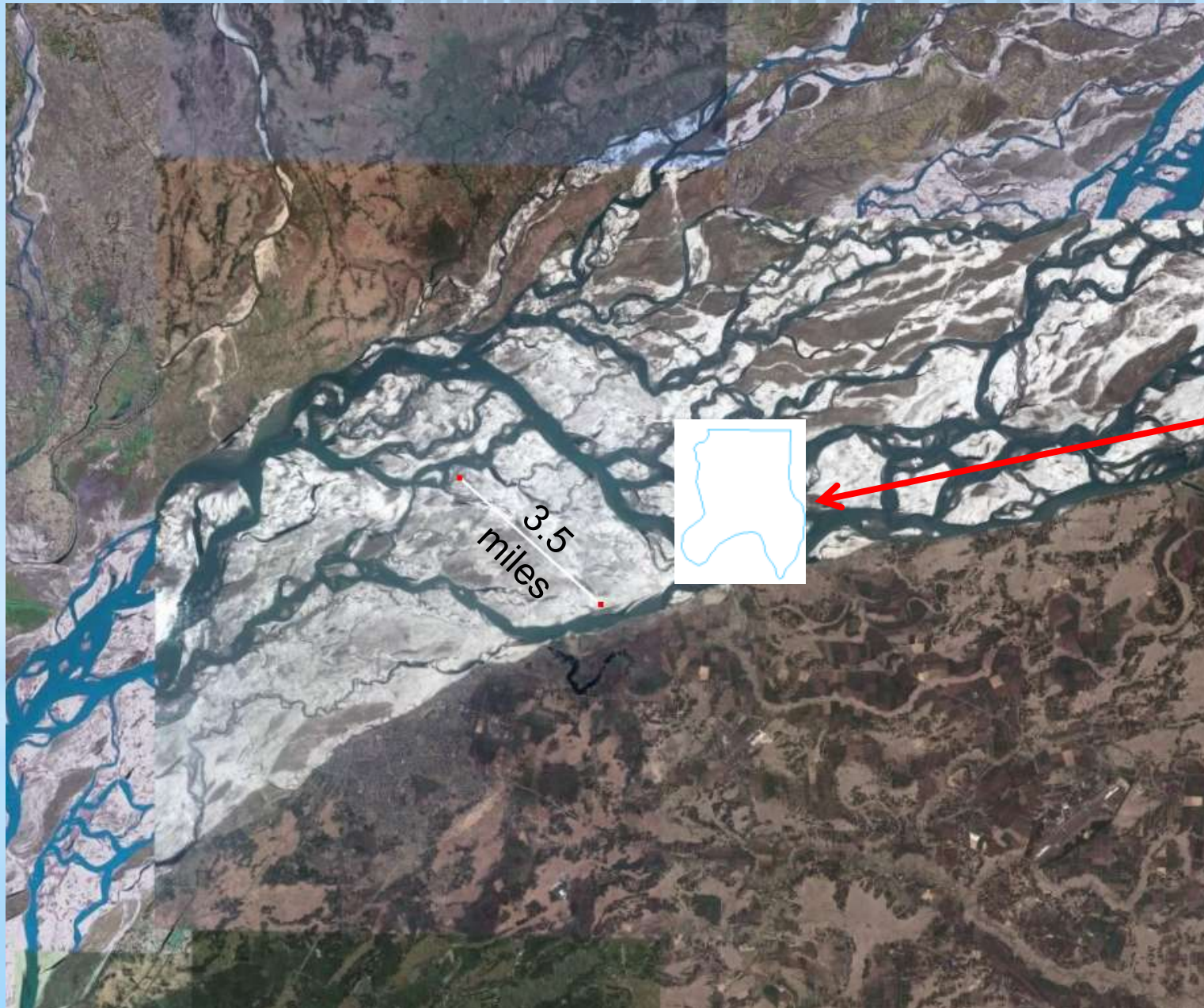
Injection Interval



Geology of the Lower Mt. Simon



Bhramaputra River System

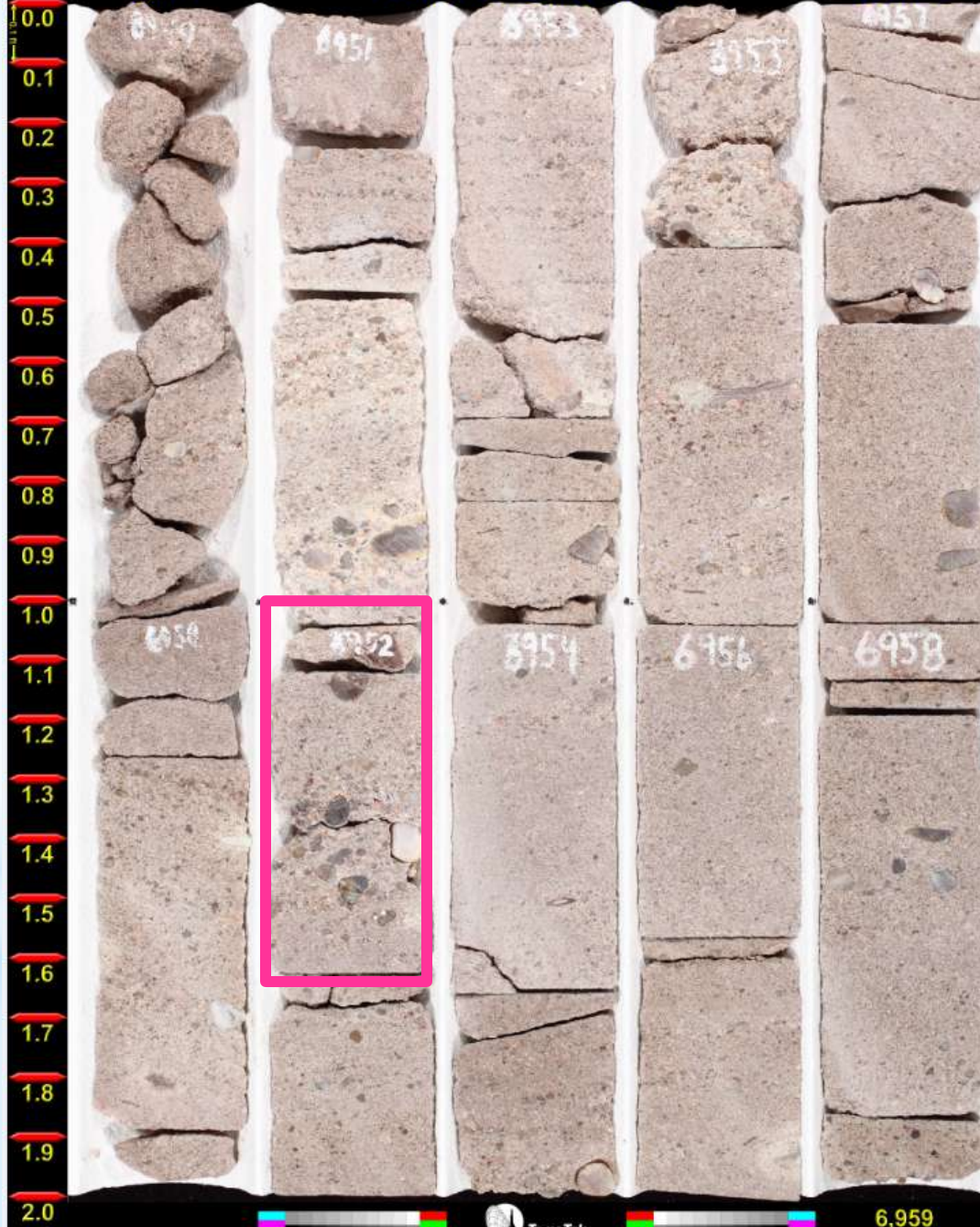


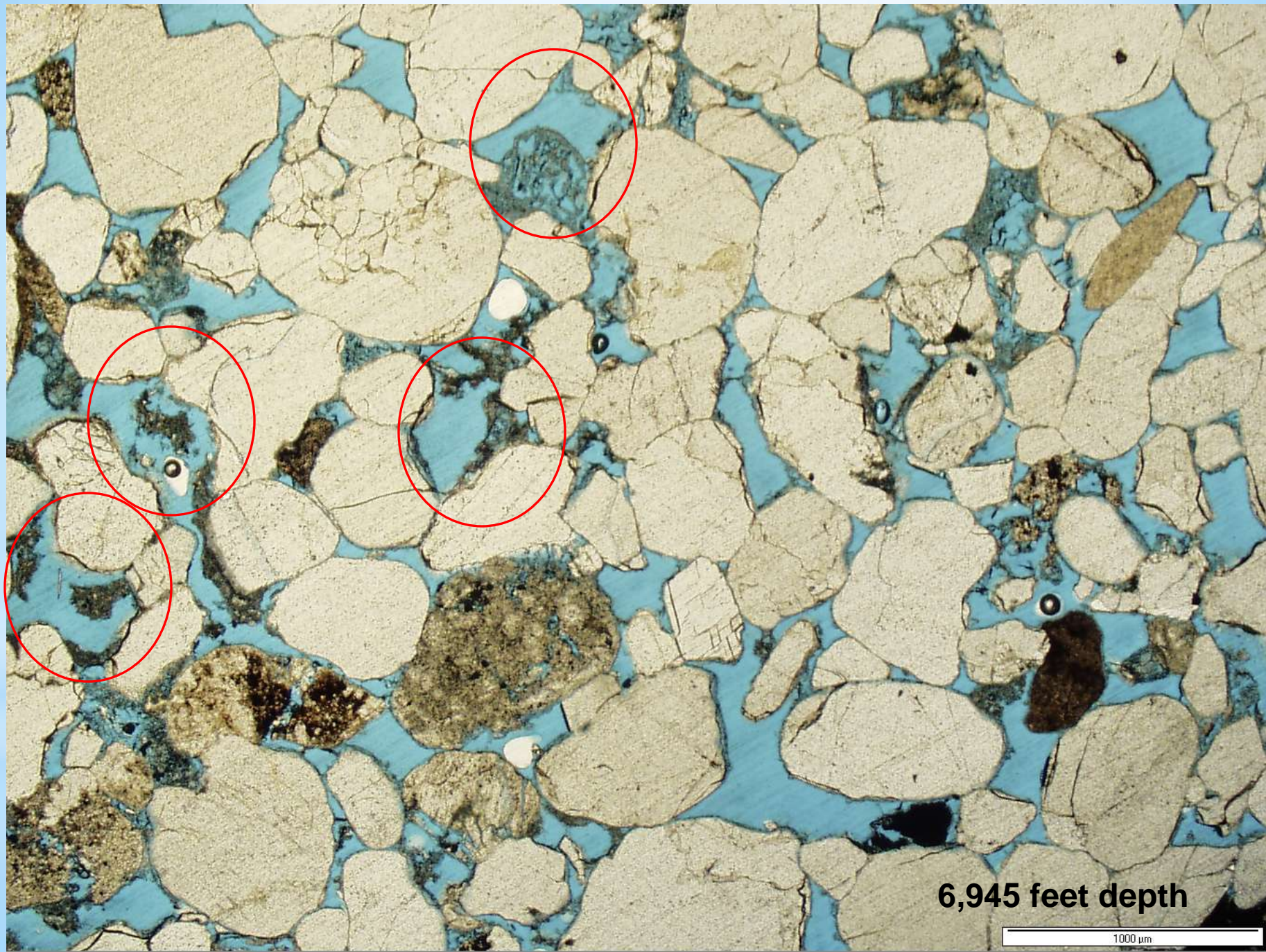
Decatur Site
3D Seismic
Coverage

SLB Carbon Services
ADM Verification Well 1

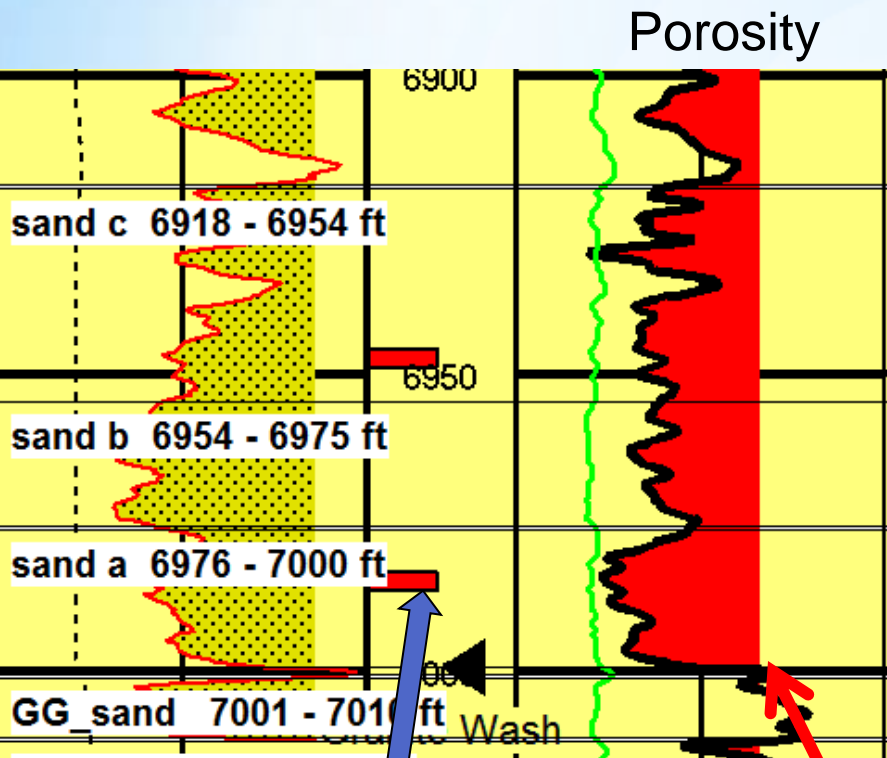
6,949

Core 14





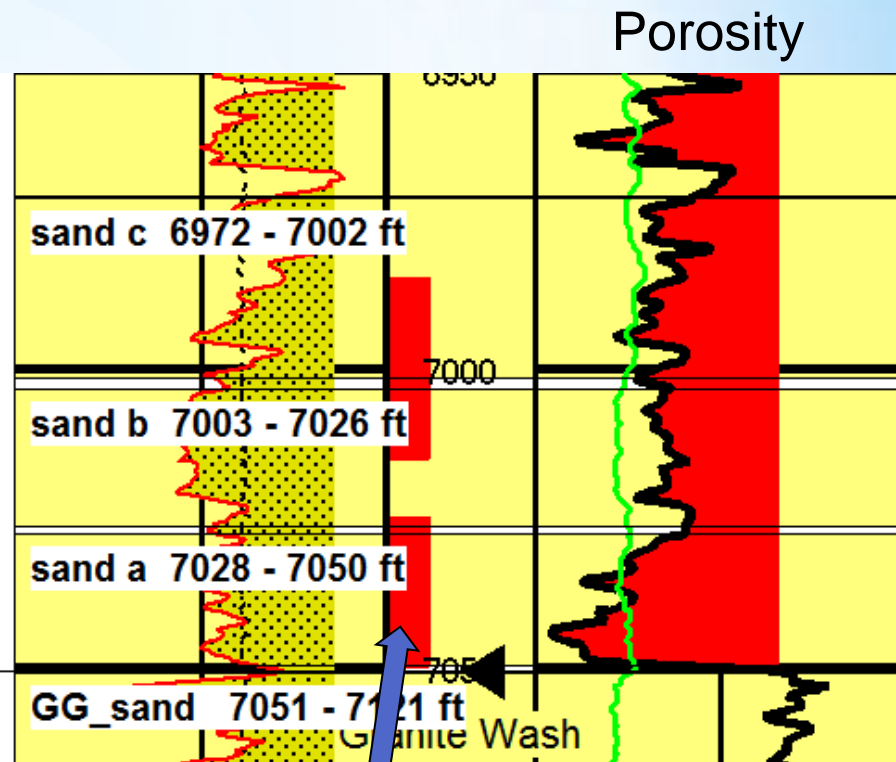
Verification #1



10 % porosity

Westbay Monitoring Interval

CCS#1

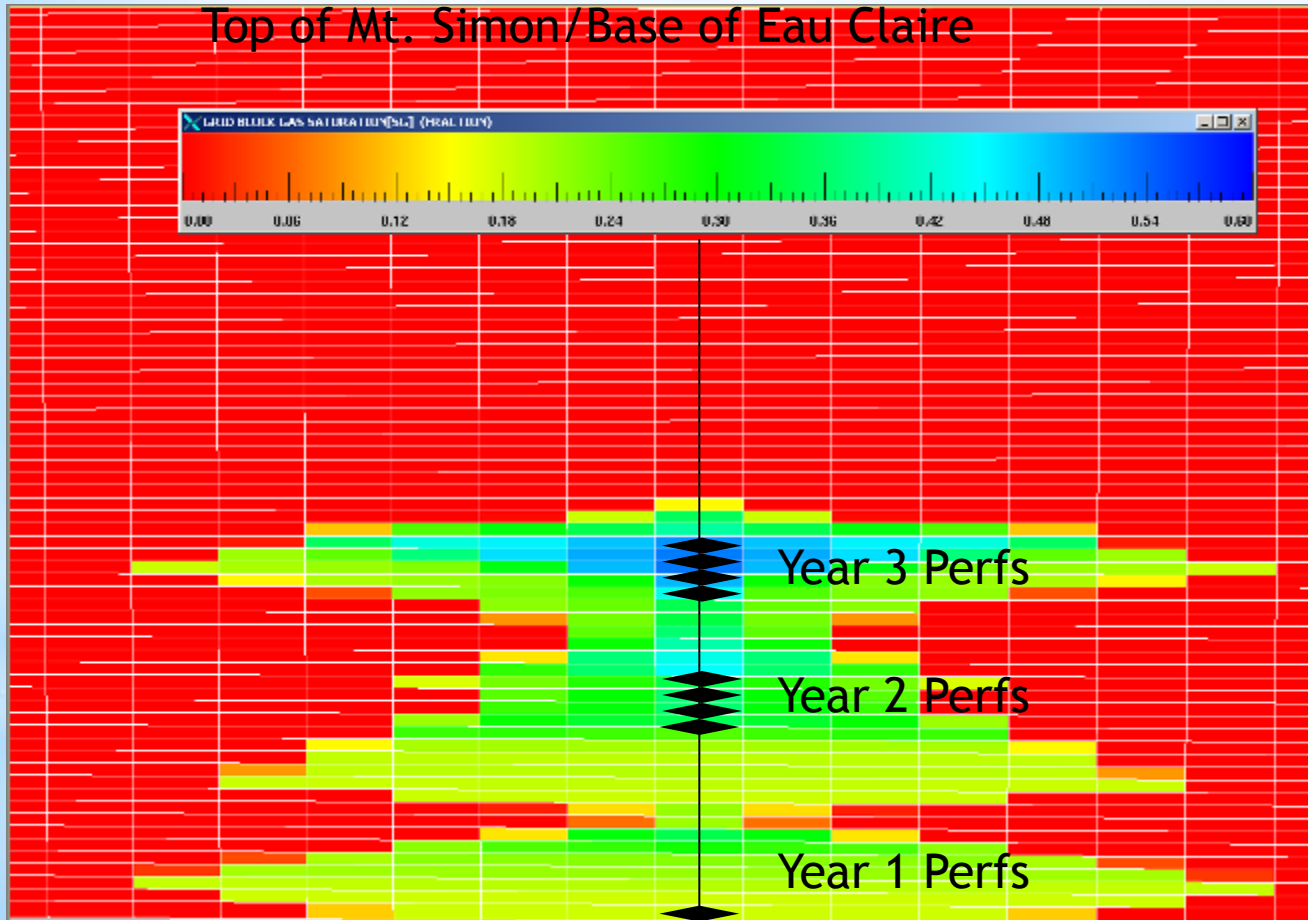
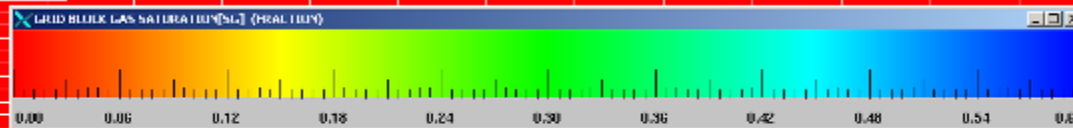


Injection Interval

Reservoir Model: Forecasts

Plume Management

Top of Mt. Simon/Base of Eau Claire



**Perforation
Strategy:**

**Perforate
bottom to top
in annual
increments**

Cell size: 220 x 220 x 15 ft

Summary

- Exactly one week ago we started injection of 1000 tonnes of CO₂ into the Mt. Simon at the Illinois Basin Decatur Site.
- Both the St. Peter and Potosi are potential targets for carbon sequestration



**ILLINOIS STATE
GEOLOGICAL SURVEY**
PRAIRIE RESEARCH INSTITUTE



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