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Seismic Data Acquisition and Interpretation Strategies for MRCSP Geologic Sequestration Test Sites

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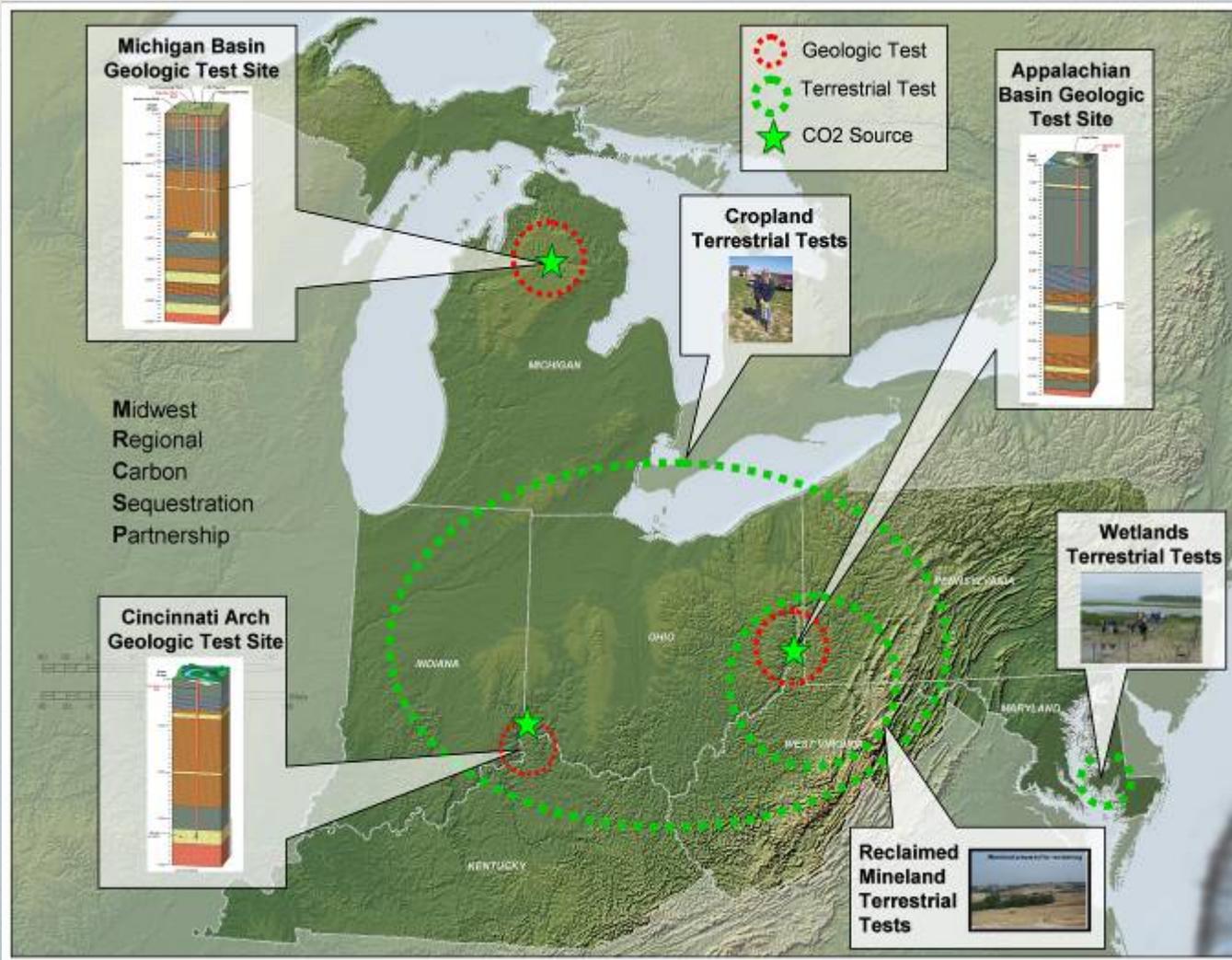
Our diverse membership is one of our core assets



Acknowledgements

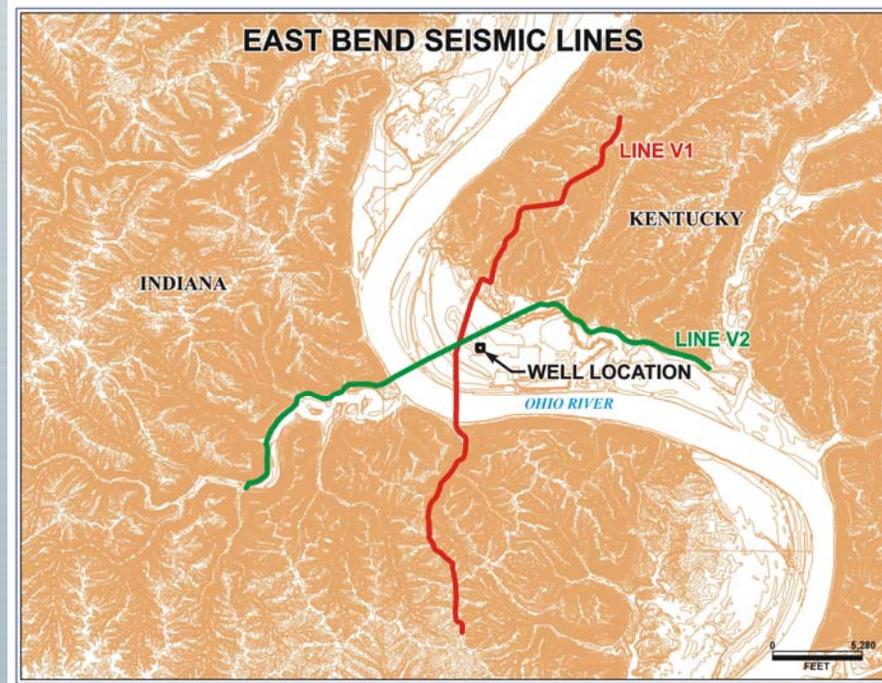
- DOE/NETL – Charlie Byrer, John Litynski, and others
- Battelle – Joel Sminchak, Danielle Meggyesy, Bob Janosy, Vic Saylor, and others
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 - Duke Energy – Abed Houssari
 - Core Energy LLC – Bob Mannes, Alan Modroo
- Independent Consultant – Bill Rike
- Appalachian Geophysical – John Foreman
- University of Houston – Gennady Goloshubin, Hai Tao Ren

MRCSP Geologic Field Tests

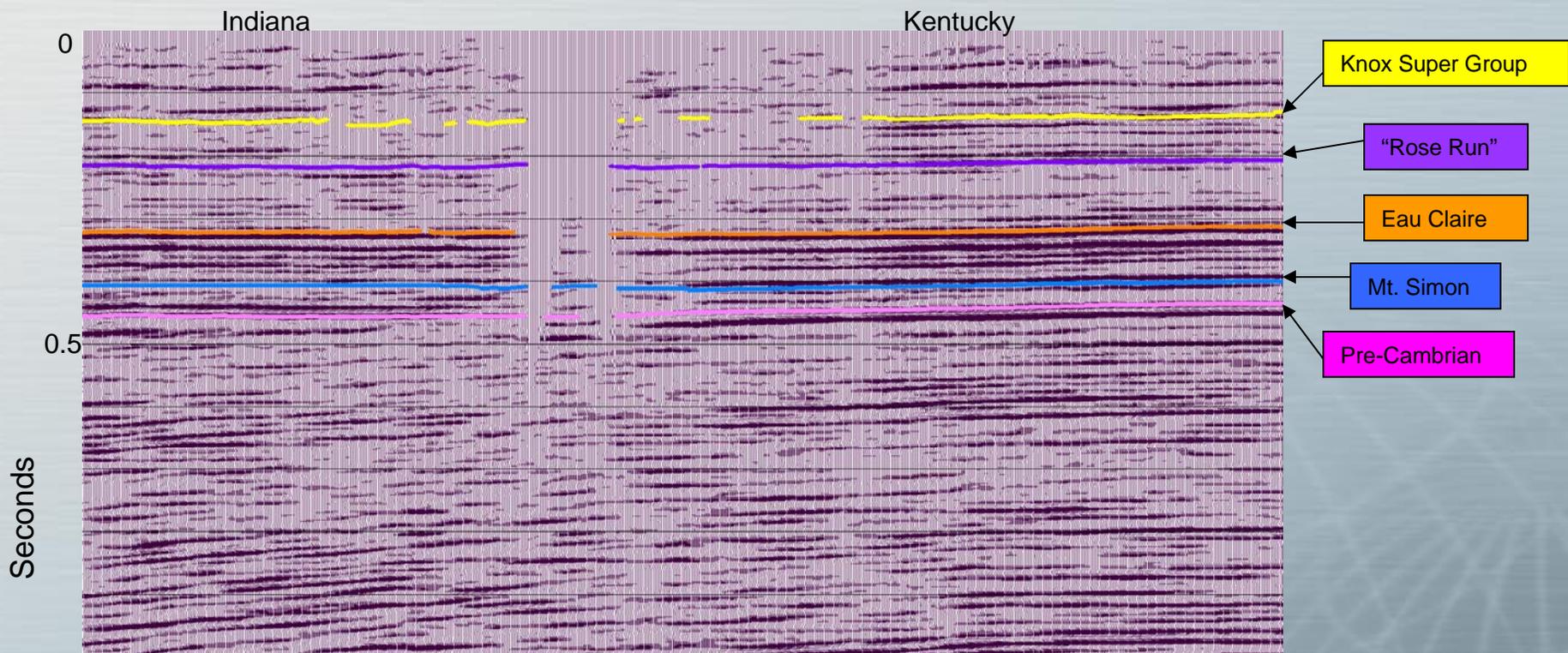


East Bend Site

- 2D Survey performed in November, 2006
- 14 miles of data collected
- Source:
 - 3 vibroseis trucks over 110 ft
- Receivers
 - 110 ft bins



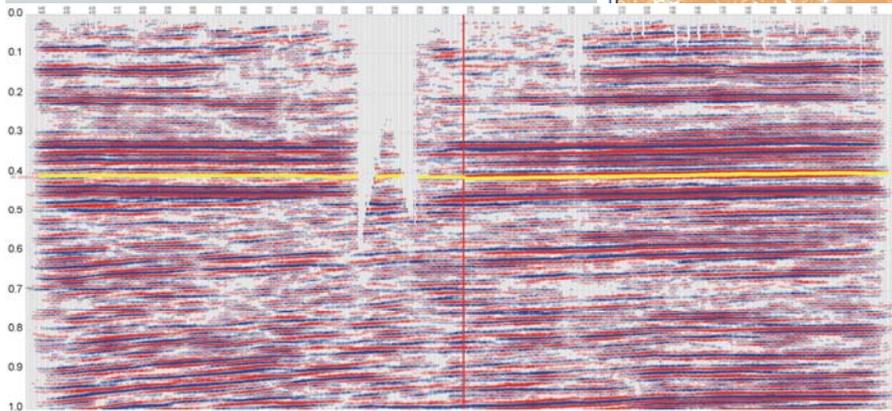
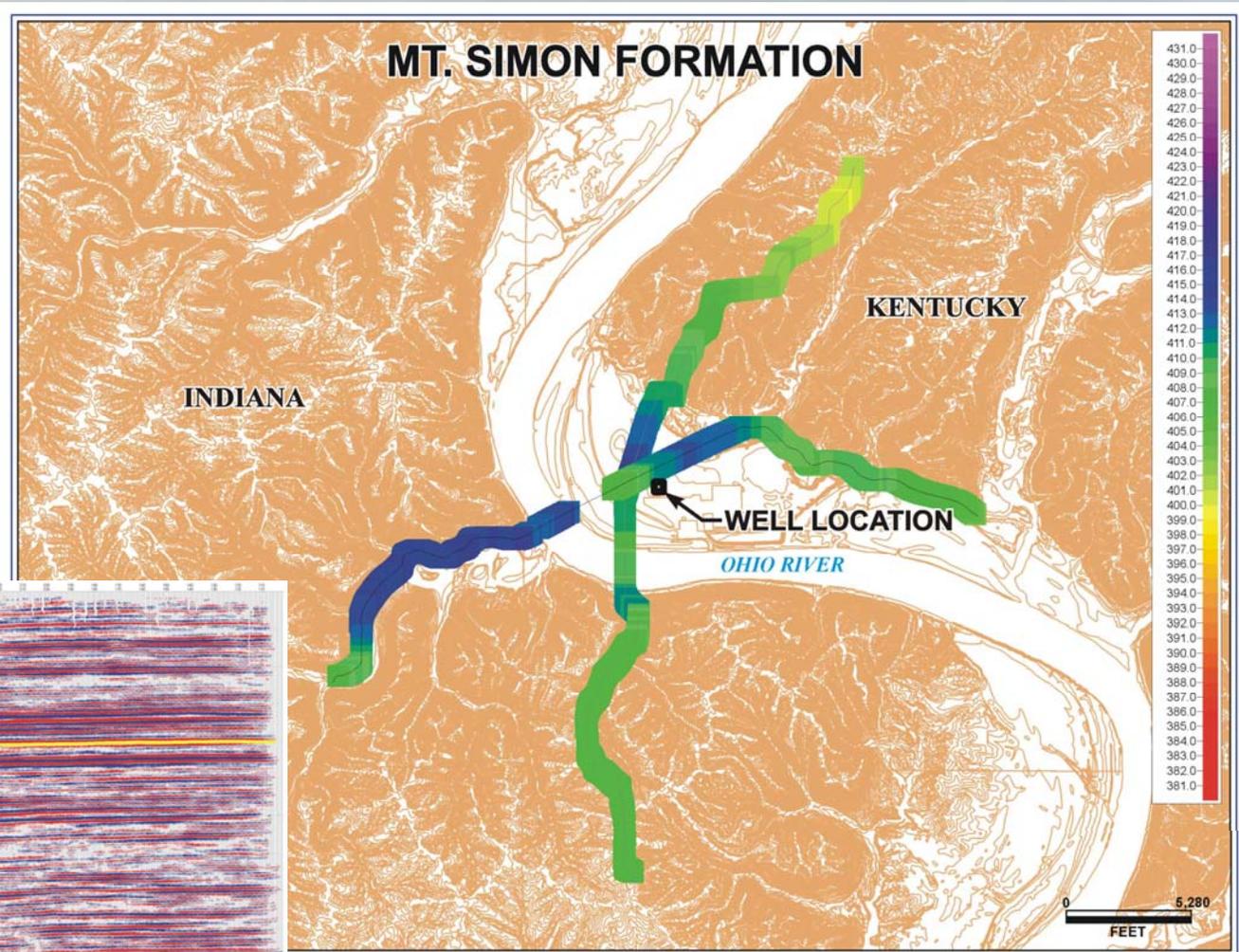
East Bend Seismic Section (S→N)



- A tighter bin size (55 ft) may have increased data quality in the flood plain
- Interpretation will need to be validated after drilling
- Numerous processing schemes were used to verify formation structure

Mt. Simon Sandstone

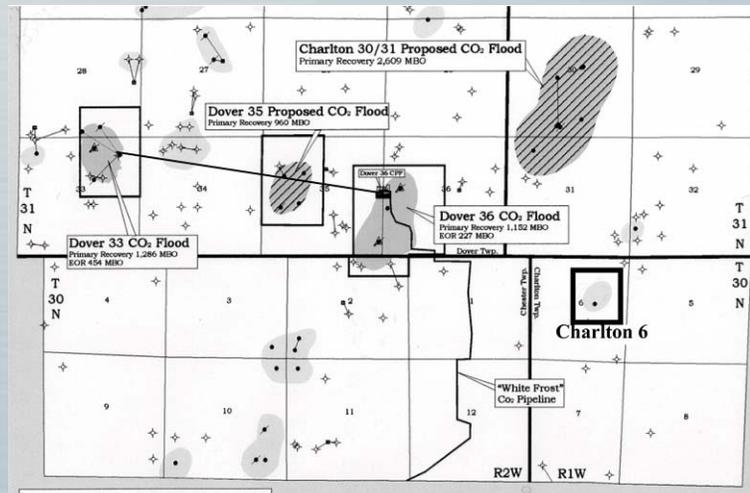
- There is a gentle deepening to the north west.
- No indication of any structure through the formation



Color represents travel time ranging from red (shorter) to purple (longer)

Michigan Site

- 3D Survey Performed in 2003
 - Dynamite shots
 - 82.5 foot spacing
 - Specifically designed to image Niagaran reefs
- Approximately 500 feet of glacial till known to be at the site

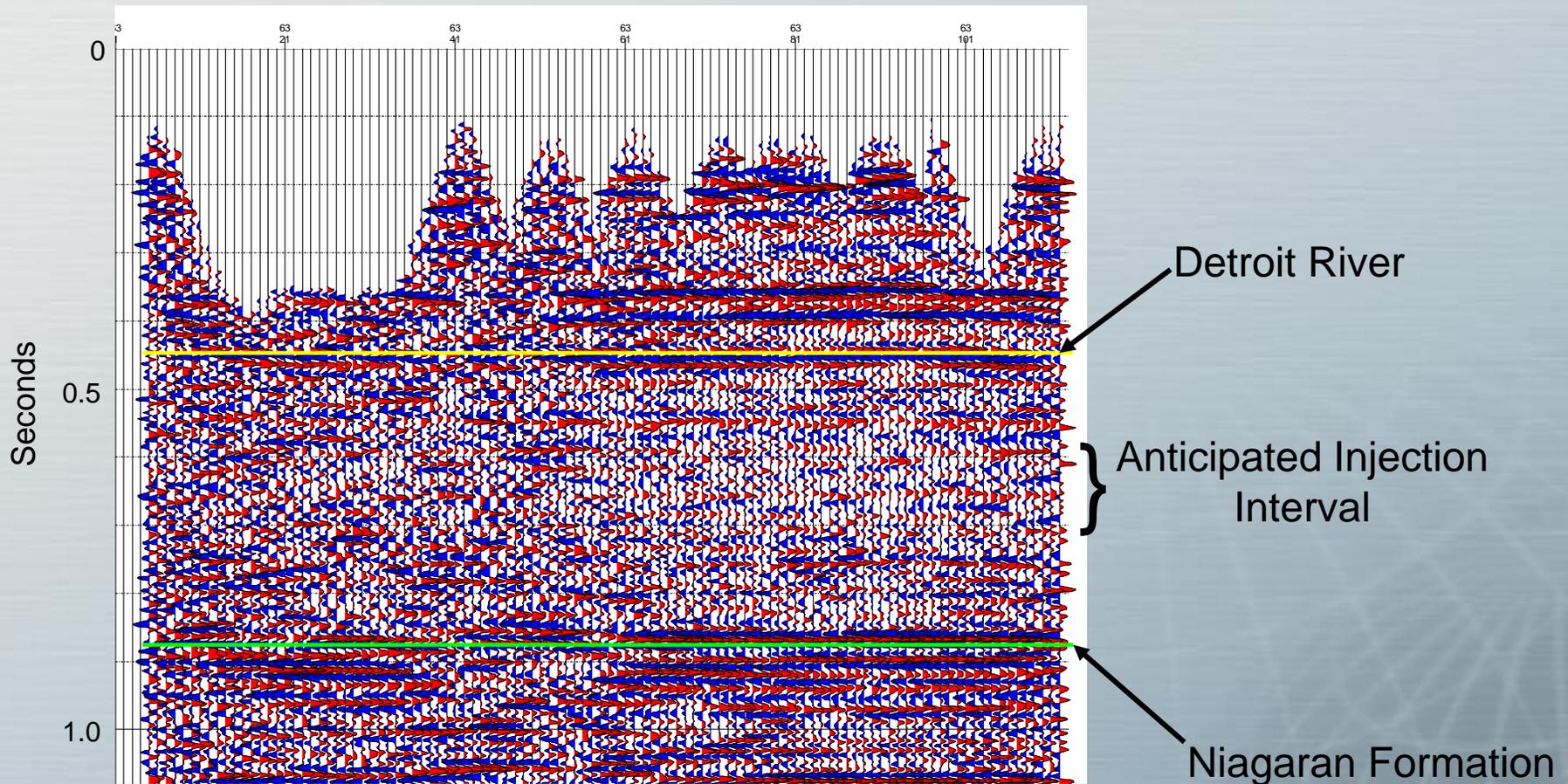


CORE ENERGY, LLC
Otsego County CO₂ Project
Otsego County, Michigan
Regional Data Map
By Austin Wade Brown

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Michigan Seismic Data - Example Slice



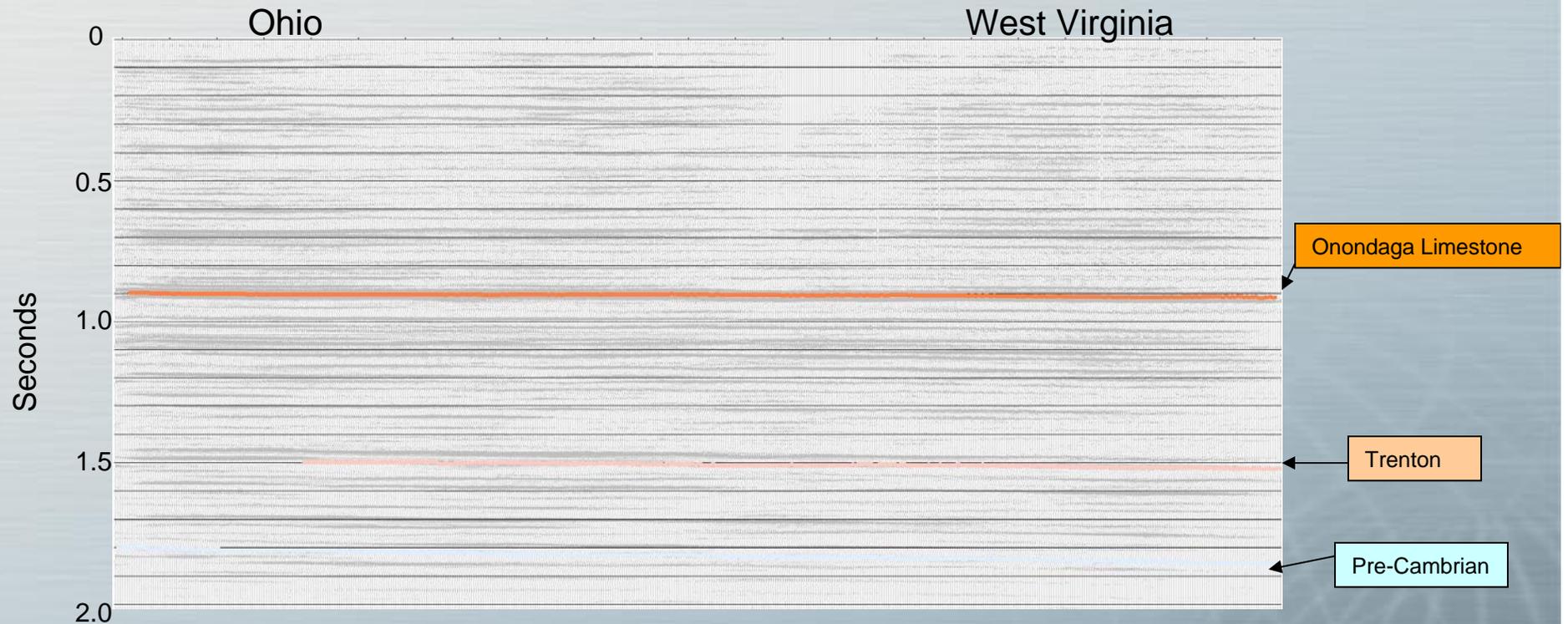
- The injection interval is not easily identified
- Crosswell seismic anticipated to help resolve formations

Burger Site

- 2D Survey performed in August, 2006
- 10 miles of data collected
- Source:
 - 4 vibroseis trucks over 110 ft
- Receivers
 - 110 ft bins
- Drilling completed in February, 2007

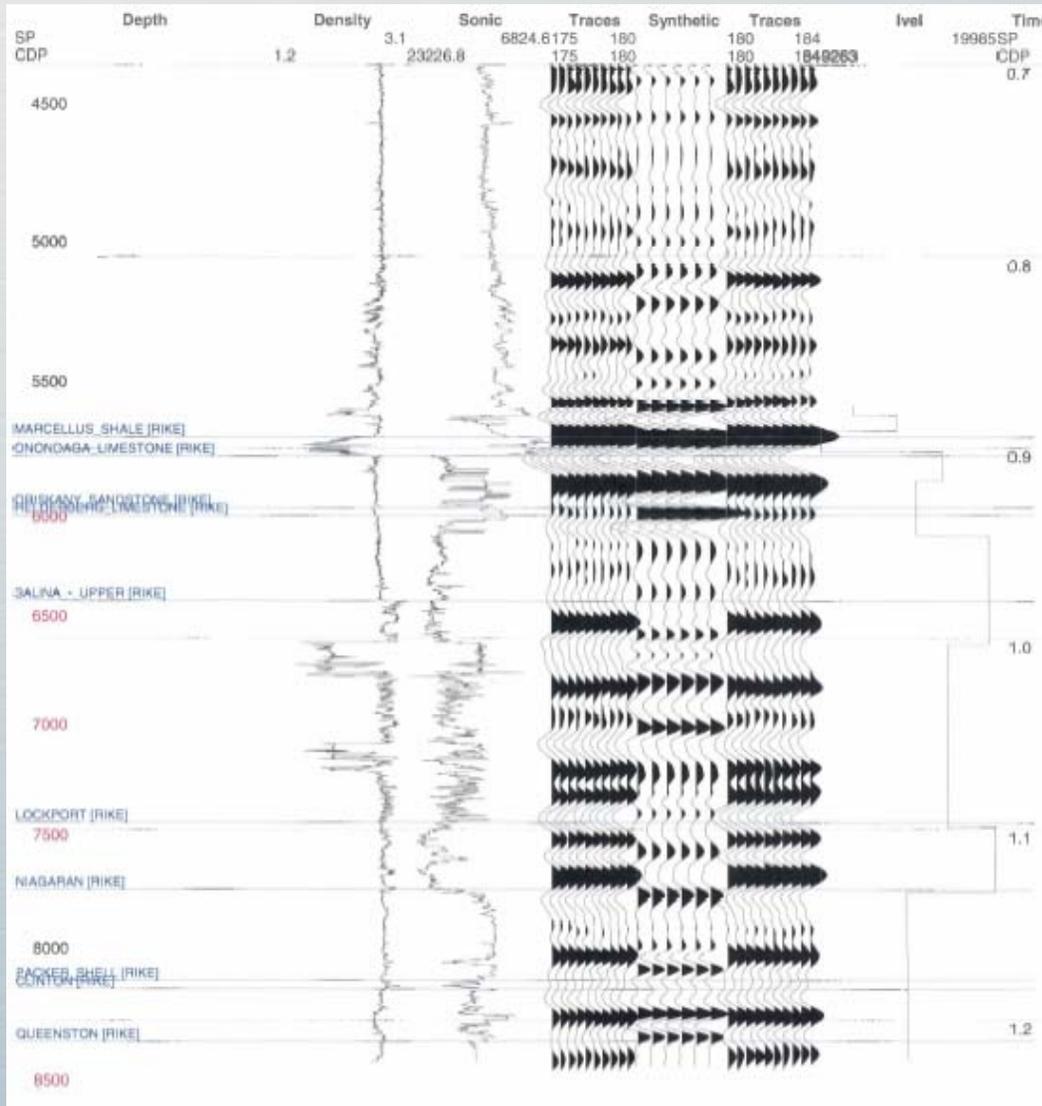


Burger Interpretation Prior to Drilling (N→S)



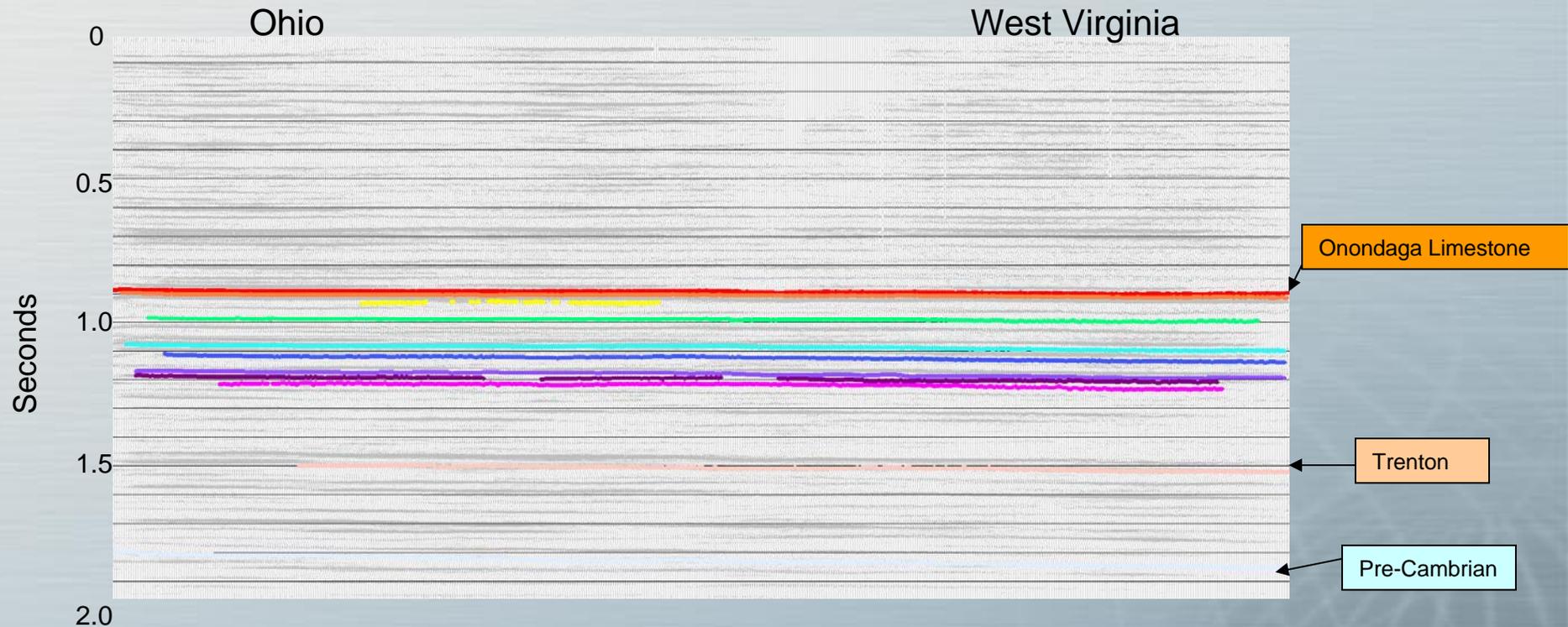
- Little regional information did not allow for many horizons to be picked prior to drilling

Burger Synthetic Seismogram



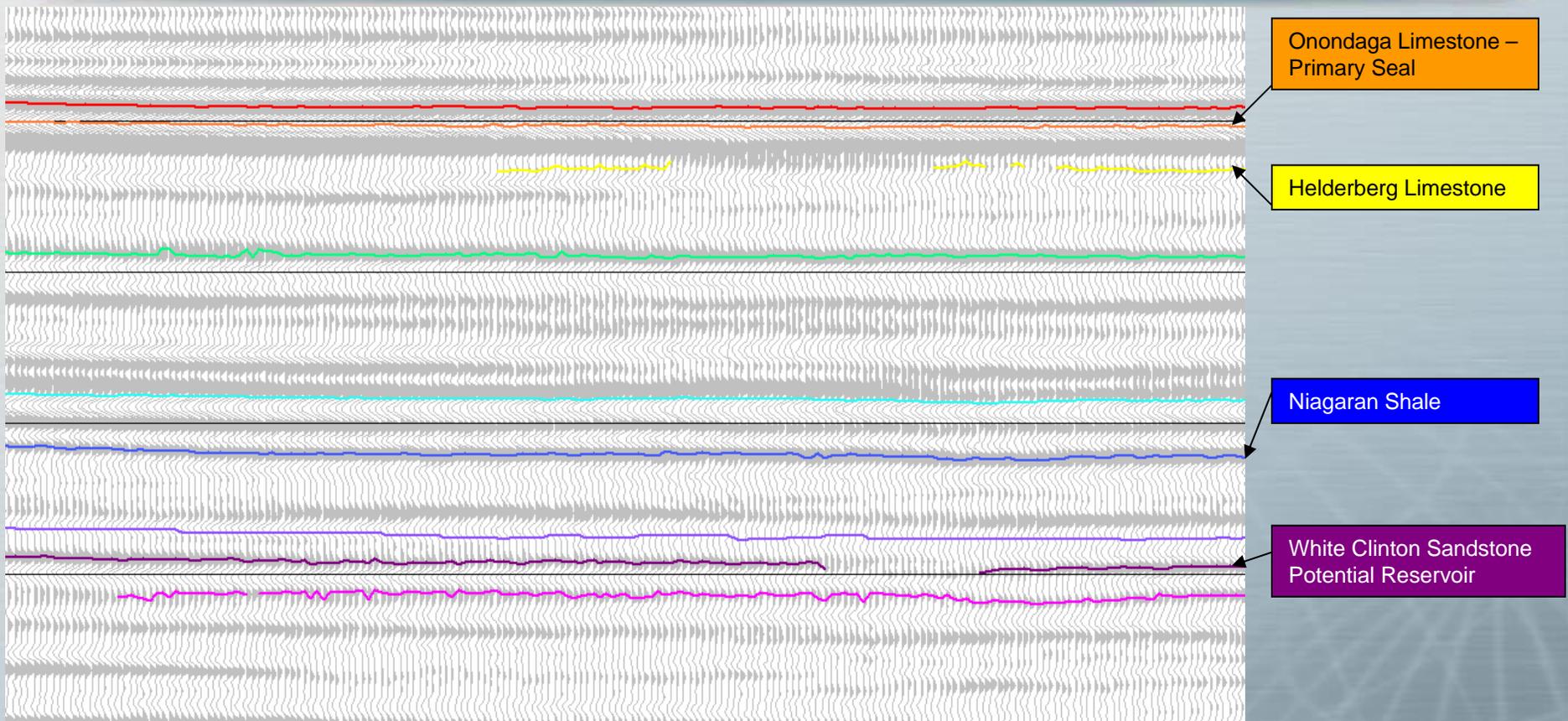
- Sonic data acquired for the FEGENCO #1 well was used to create a synthetic (center traces)
- The synthetic was used to fill in information in the seismic sections

Burger Interpretation After Drilling (N→S)



- Seven additional formations are discernable once the sonic data is used for calibration

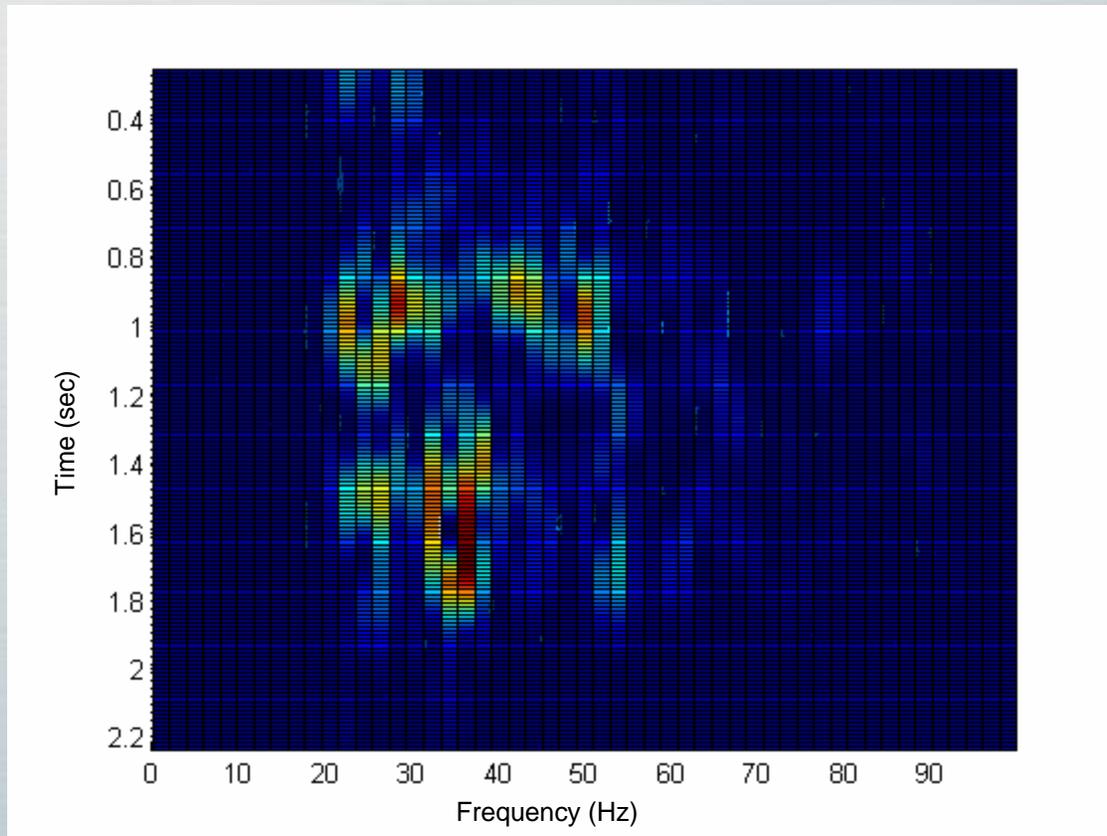
Detailed Interpretation



*Initial Results

- The Oriskany Sandstone (between the Onondaga and Helderberg) is right at the resolution limit of this data
- The White Clinton is much easier to see and post injection changes may be detectable

Low Frequency Analysis – Single Burger Trace



- Low frequency response of a formation is largely dictated by pore fluids
- Different formations should peak at different frequencies

Summary

- Although certain challenges exist (sparse regional data, difficult topography, etc.) seismic data is useful for site characterization
- Data processed in numerous different ways helps reveal more information about the subsurface
- Next Steps
 - Continue leveraging additional information and techniques to refine interpretations
 - Forward modeling to anticipate the post-injection changes

Thank You!

