Characterization of Subsurface Opportunities to Accelerate Carbon Capture, Utilization, and Storage (CCUS) in Indiana

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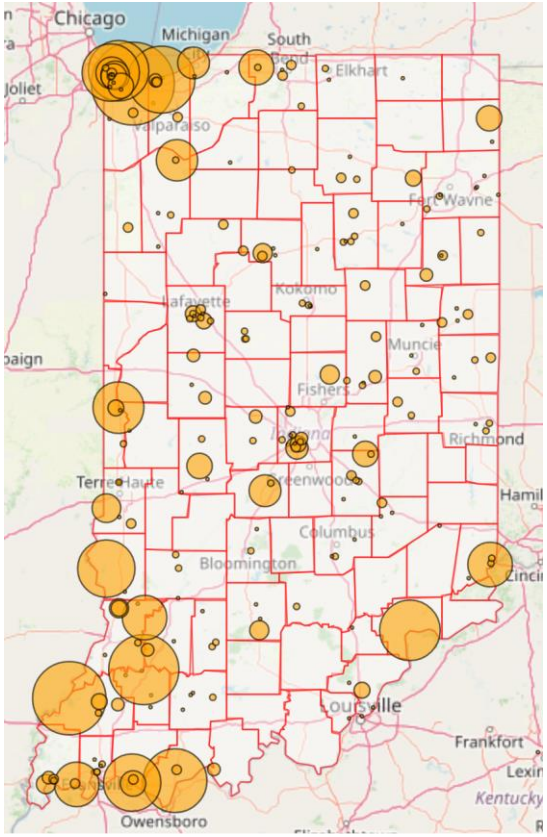
INDIANA GEOLOGICAL & WATER SURVEY
INDIANA UNIVERSITY

Project Overview

- Project Background
- Status
  - Existing data collection
  - Mapping update
  - Technical data collection
  - Community Benefits Plan
  - Outreach and Education
- Summary

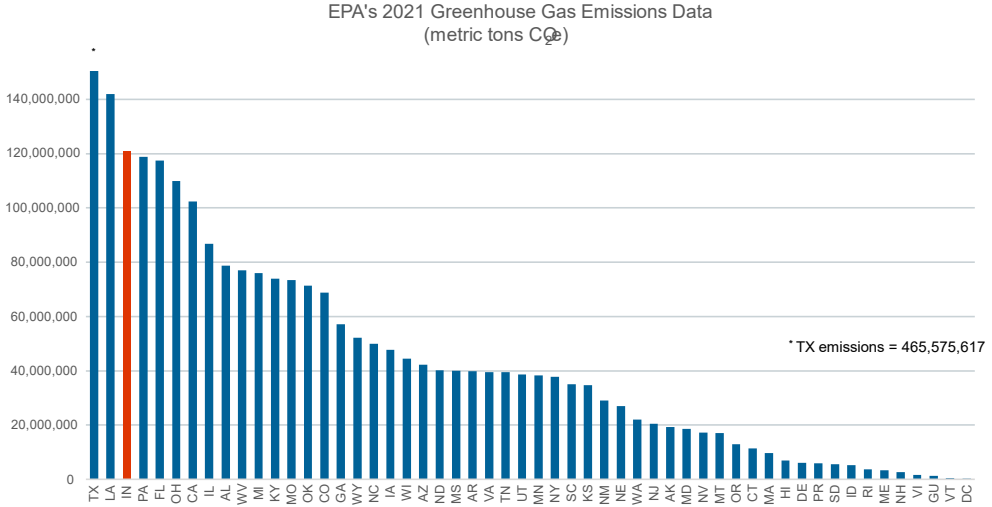
Photo courtesy James Brosher, Indiana University

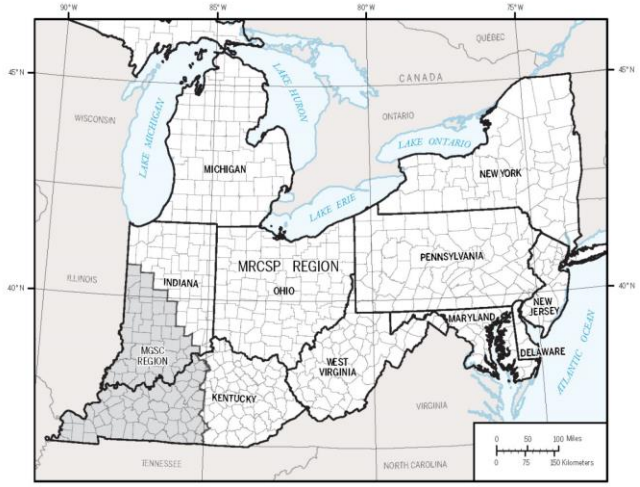
Why Indiana?



GHG Emitters plotted by relative emissions up to 69 MMT CO_2e

EPA FLIGHT database, 2022 dataset

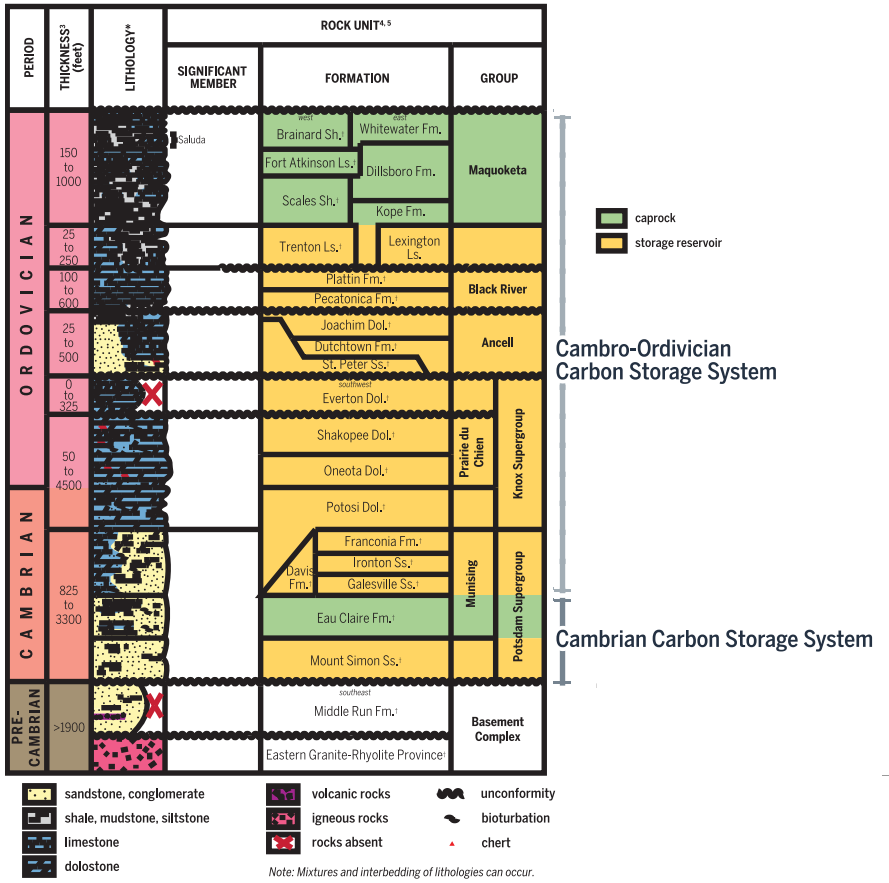




MRCSP = Midwest Regional Carbon Sequestration Program

MGSP = Midwest Geological Sequestration Consortium

What do we know today?



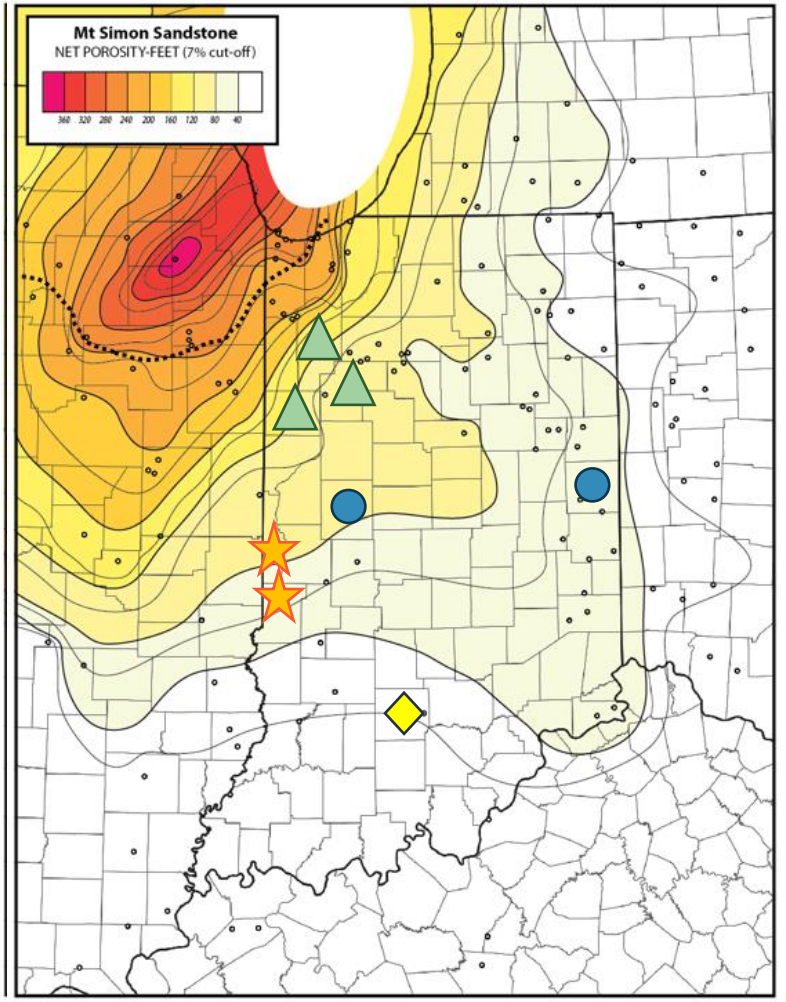
Current Published Resource Estimates

	MRCSP (million metric tons CO_2)		MGSC (million metric tons CO_2)		Indiana portion of MRCSP and MGSC (million metric tons CO_2)
	All intervals [4]	Indiana only [2]	All intervals [4]	Indiana only [3]	Indiana only [4]
Deep Saline Formations	108,000 - 143,000	14,753 - 221,363	41,000 - 421,000	7,900 - 32,000	38,140 - 128,520
Unmineable Coal Seams	< 1,000	N/A	2,000 - 3,000	88 - 126	90 - 170
Oil and Gas Reservoirs	9,000 - 26,000	N/A	< 1,000	20 - 47	20 - 70

Current activity

Note: not all are targeting Mt. Simon SS

- Publicly announced seismic surveys
- Class VI permits under review
- CarbonSAFE project
- Final Class VI permits issued



Mt. Simon SS net-porosity map courtesy Ray Boswell, NETL

Major Project Objectives

Technical Data and Map Updates

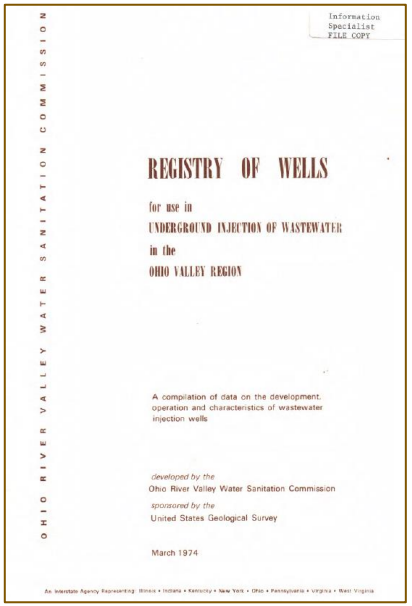
- Combine new with existing data and generate updated maps used to define potential areas for subsurface storage
  - Update and expand existing storage capacity and input maps including underground sources of drinking water (USDW), reservoir temperature and pressure maps.
  - Generate tiered maps of CO_2 hub development and other subsurface energy options
- Review and analyze regional data to identify potential migration pathways and receptors
  - Wells, groundwater resources, hydrologic conditions, atmospheric measurements, faults and fractures

Societal Considerations and Stakeholder Engagement

- Develop a comprehensive framework of the broad societal and surface use complexities within the state
- Generate a user-friendly online GIS database and socially responsible educational outreach materials for stakeholders
- Develop and refine engagement best practices to support communities in making the most of the opportunity presented by emerging CCUS projects in their regions.

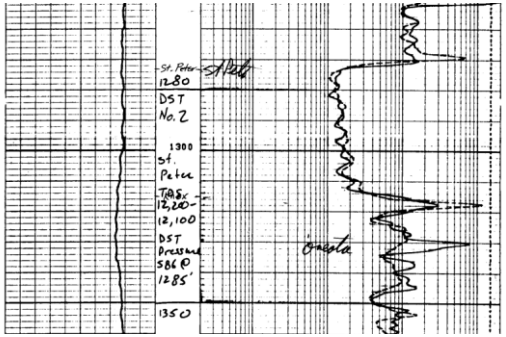
Data, data, data…

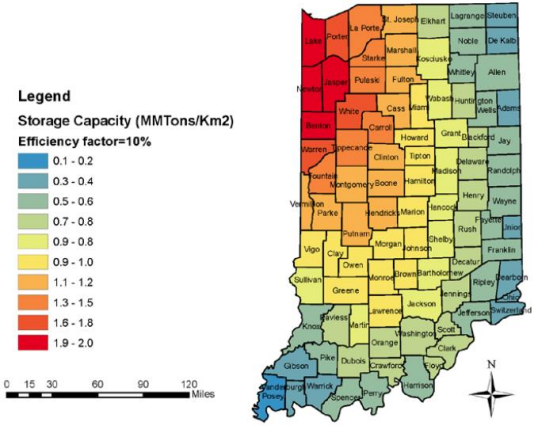
- Compiling existing data
  - Publications – maps and data
    - storage estimates, faults, historical earthquakes, injection volumes and permeability on pre-EPA injection wells
  - Scanned reports – data
    - porosity and permeability, salinity
  - Well records – data
    - Class II wells – salinity
  - Well logs – data
    - salinity written on logs, temperature, pressure
  - Water well records – data
    - information on location and depths for geothermal wells
  - Existing internal databases
    - Core data
    - Heavy metal data for groundwater resources



ORSANCO* Pre-EPA injection well data

Capture data in tabular form that only exists on scanned images



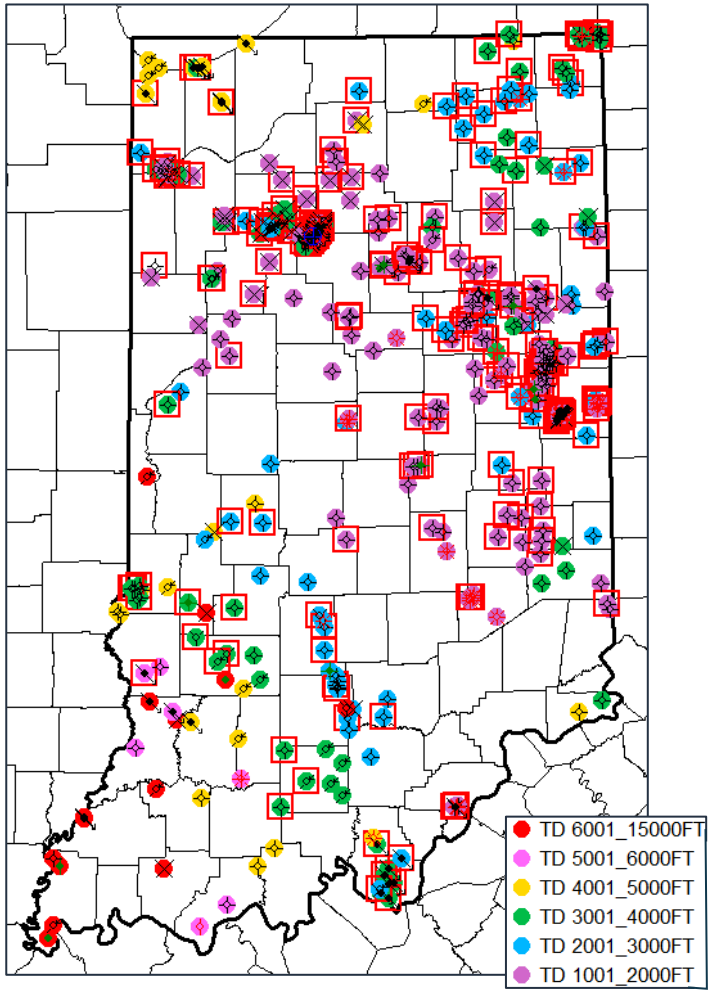


Medina, 2011

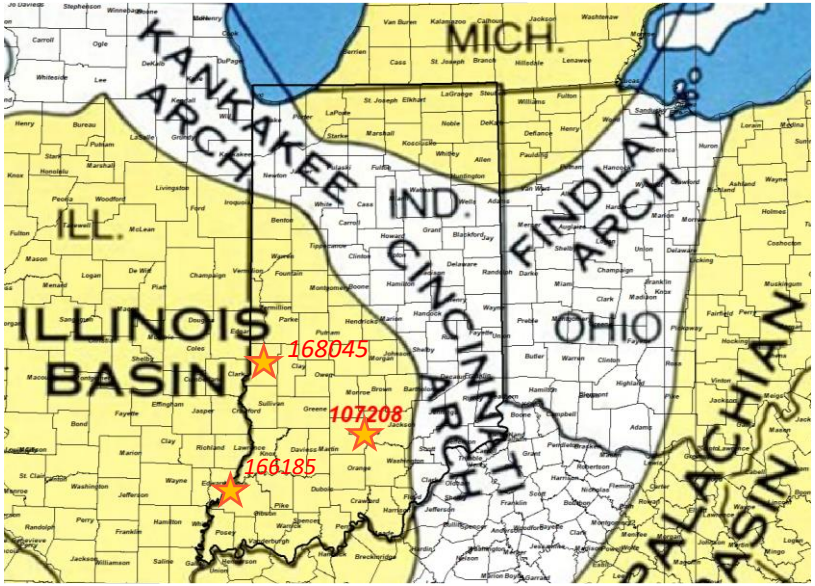
*Ohio River Valley Water Sanitation Commission

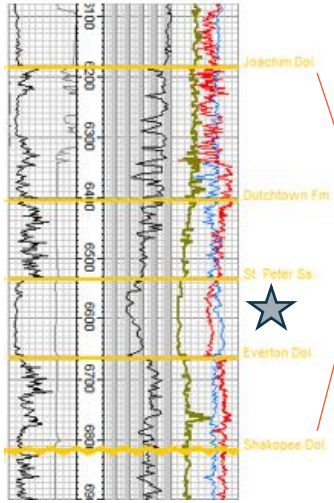
Well log digitizing

- Roughly 500 wells identified for digitizing that penetrate at least one of the reservoirs of interest and/or is needed to assist with salinity (USDW) mapping
- 300 of those wells have no digital logs, only scanned logs
- Note that operators are required to turn in 2 *paper* copies of logs to the state so even newer wells require digitizing
- Next step: normalizing the logs



Type Logs established





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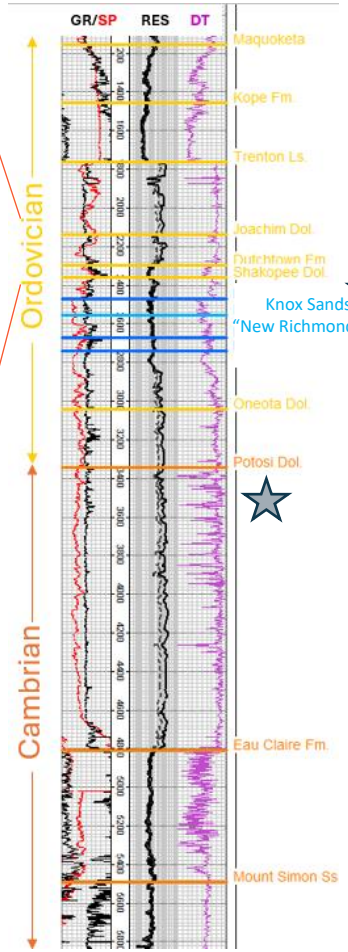

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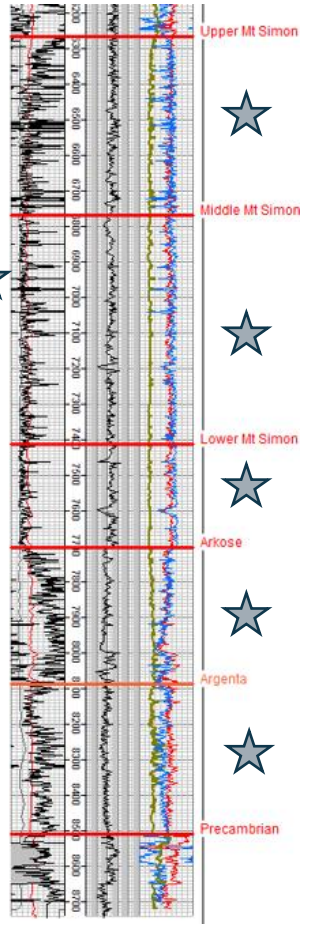

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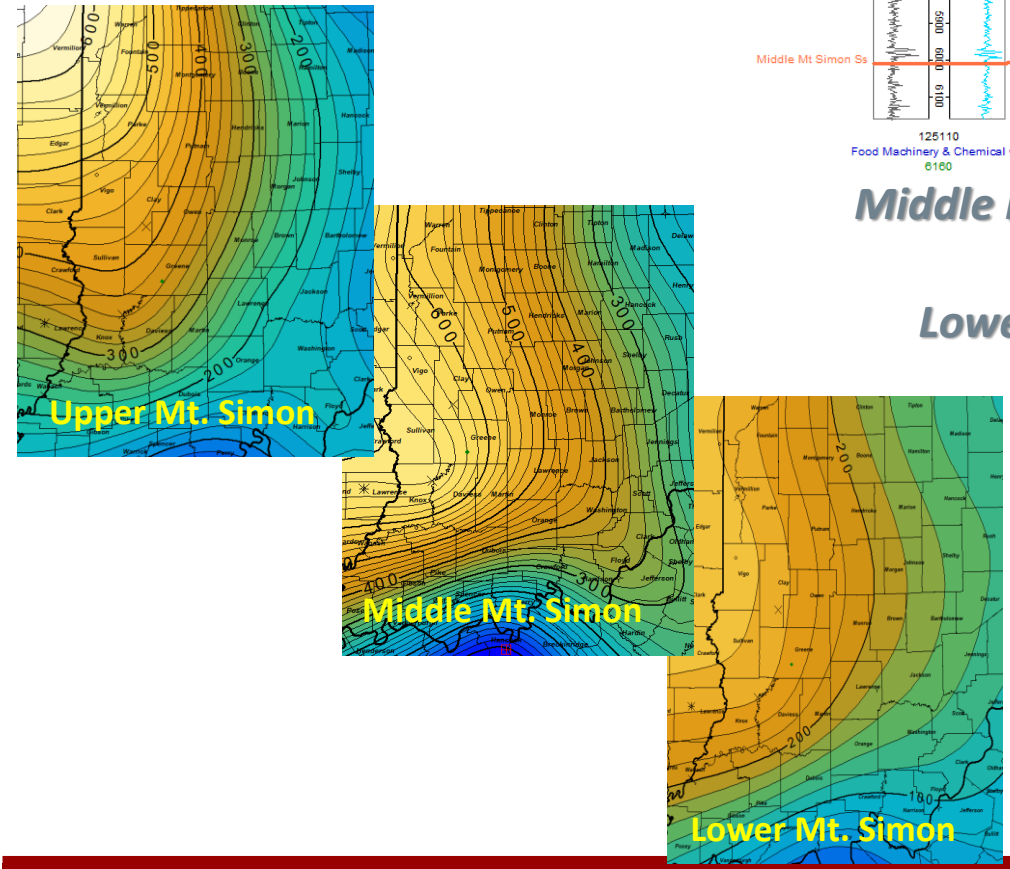
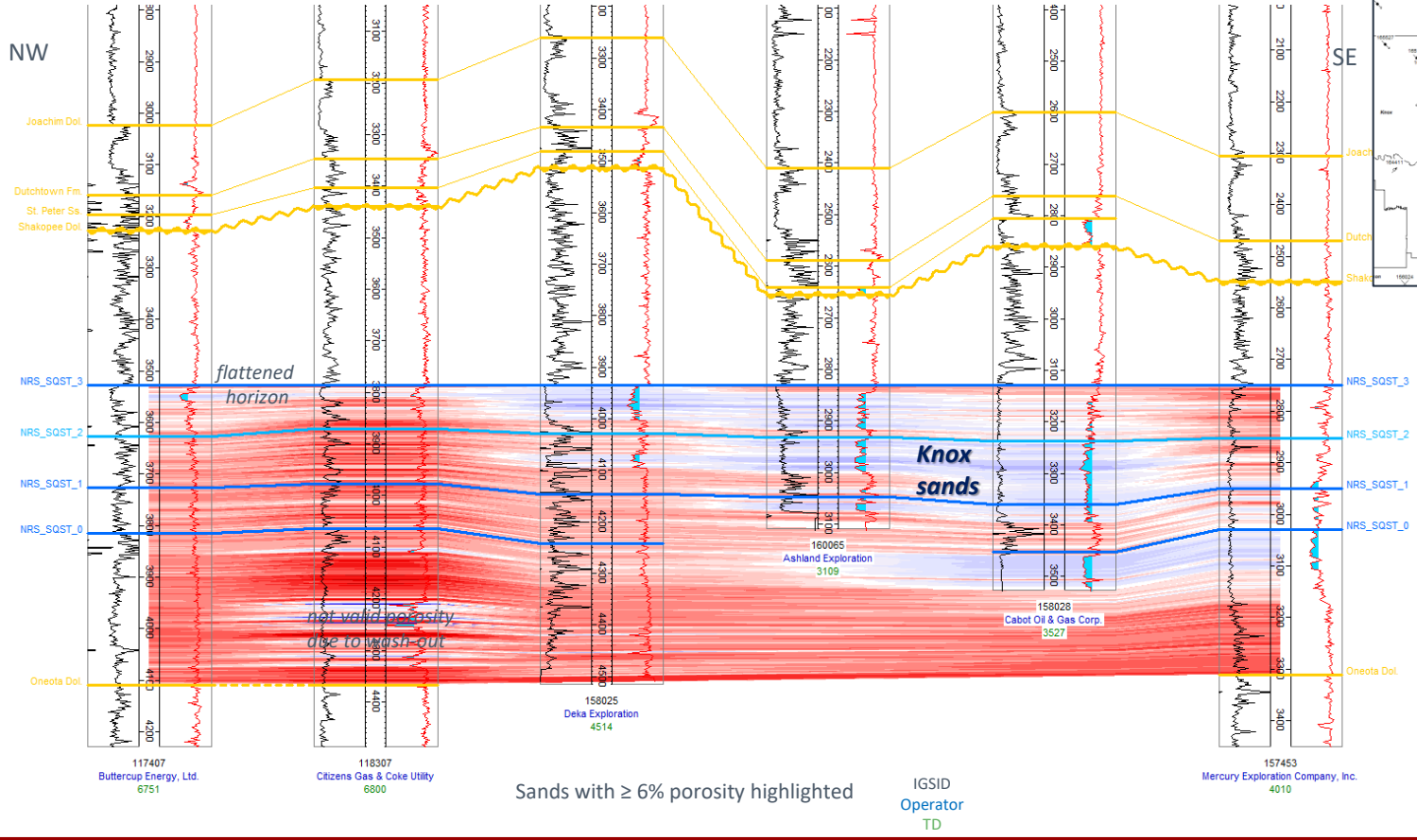
Intervals to be mapped

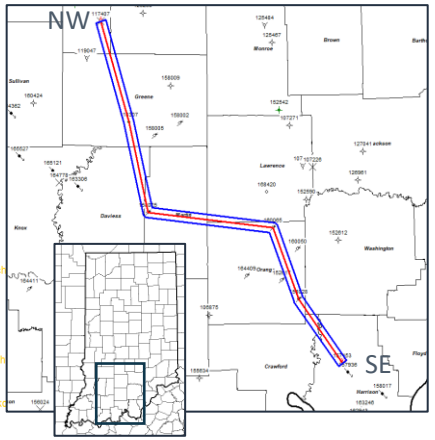
- Reviewed existing internal tops database
- Pulled well log tops from existing publications
- Occasionally relied on cuttings descriptions to conform with Indiana stratigraphic definitions
- Ensured formation top picks are clearly defined on type logs

Updated mapping

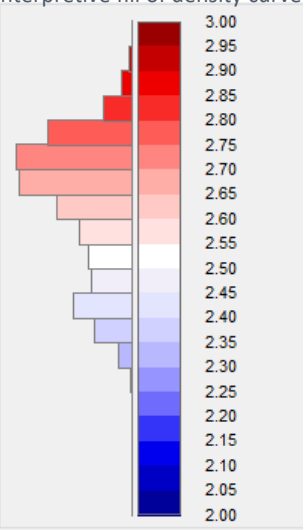


Stratigraphic cross-section of interpreted time horizons within Knox sands of south-central Indiana





Interpretive fill of density curve



Sands with ≥ 6% porosity highlighted

IGSID
Operator
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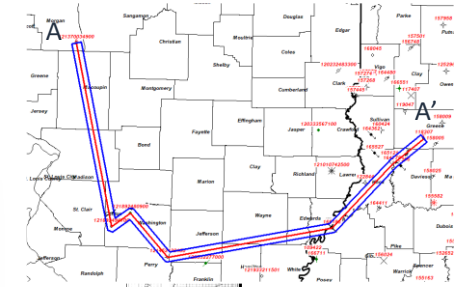
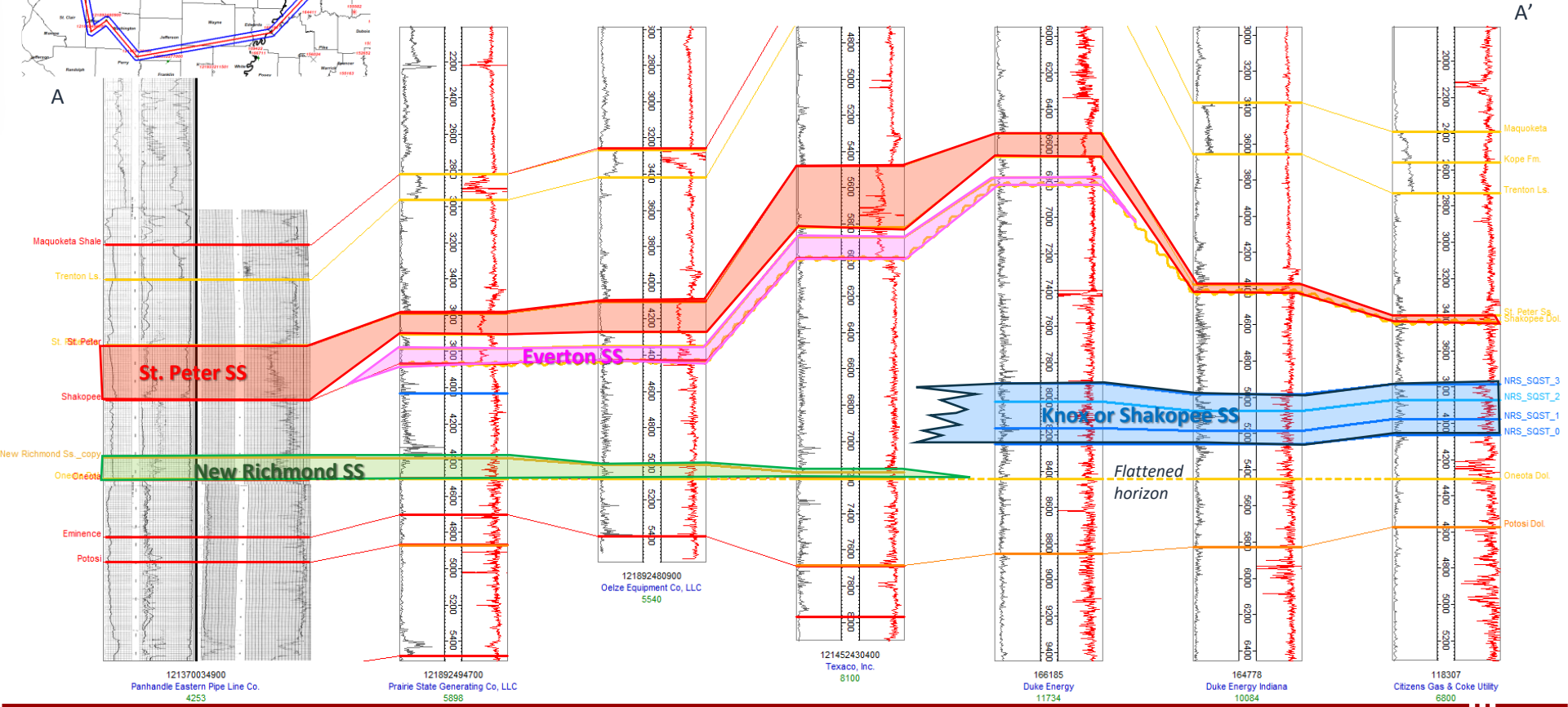
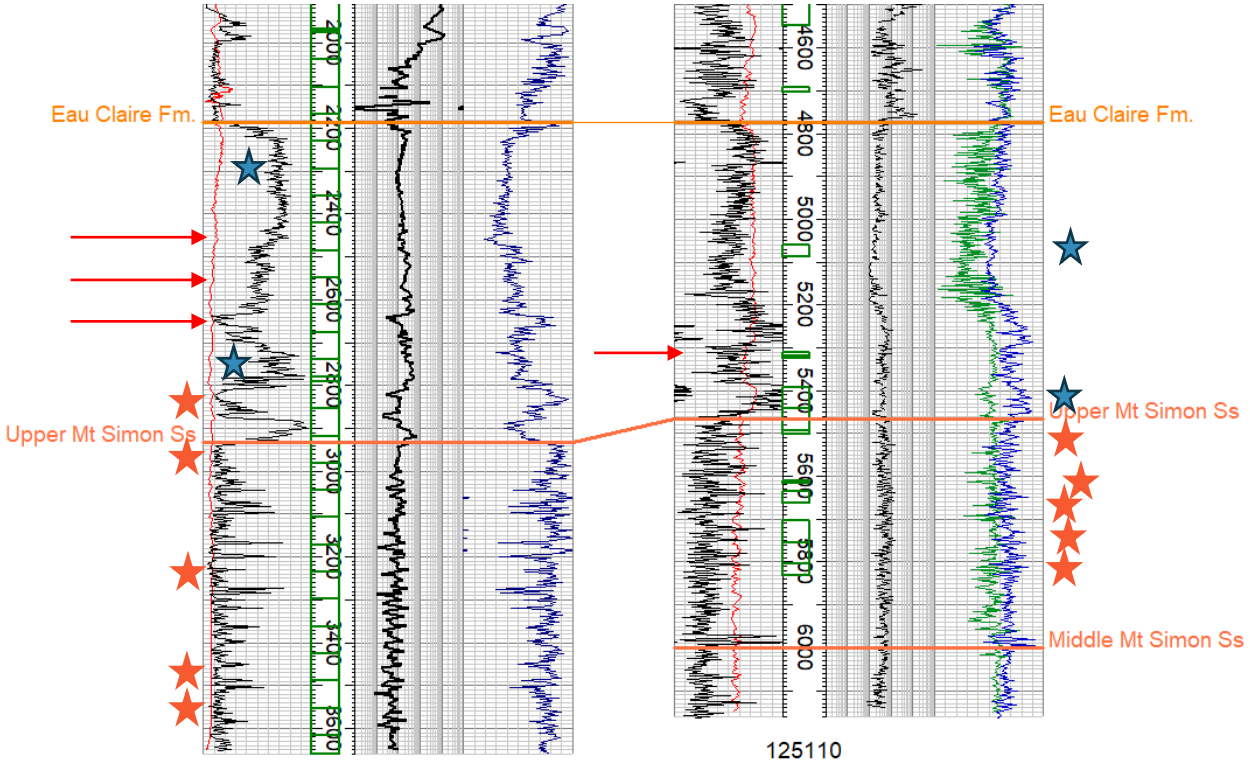
Sandstones highlighted between St. Peter SS and Oneota Dolomite

Gaining regional and stratigraphic clarity of the reservoirs

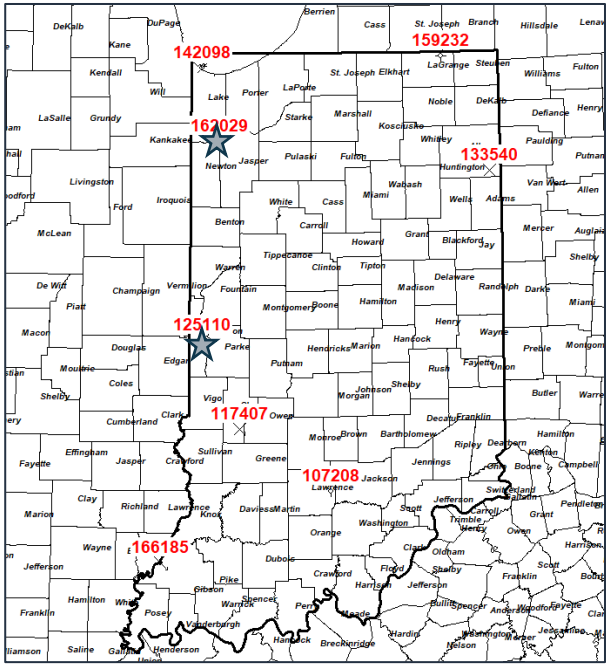




New data collection on existing material

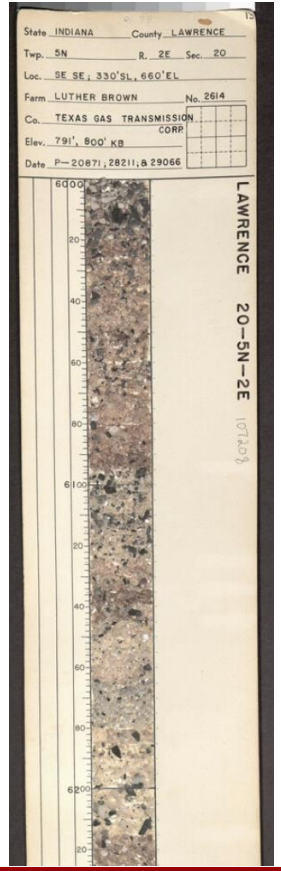


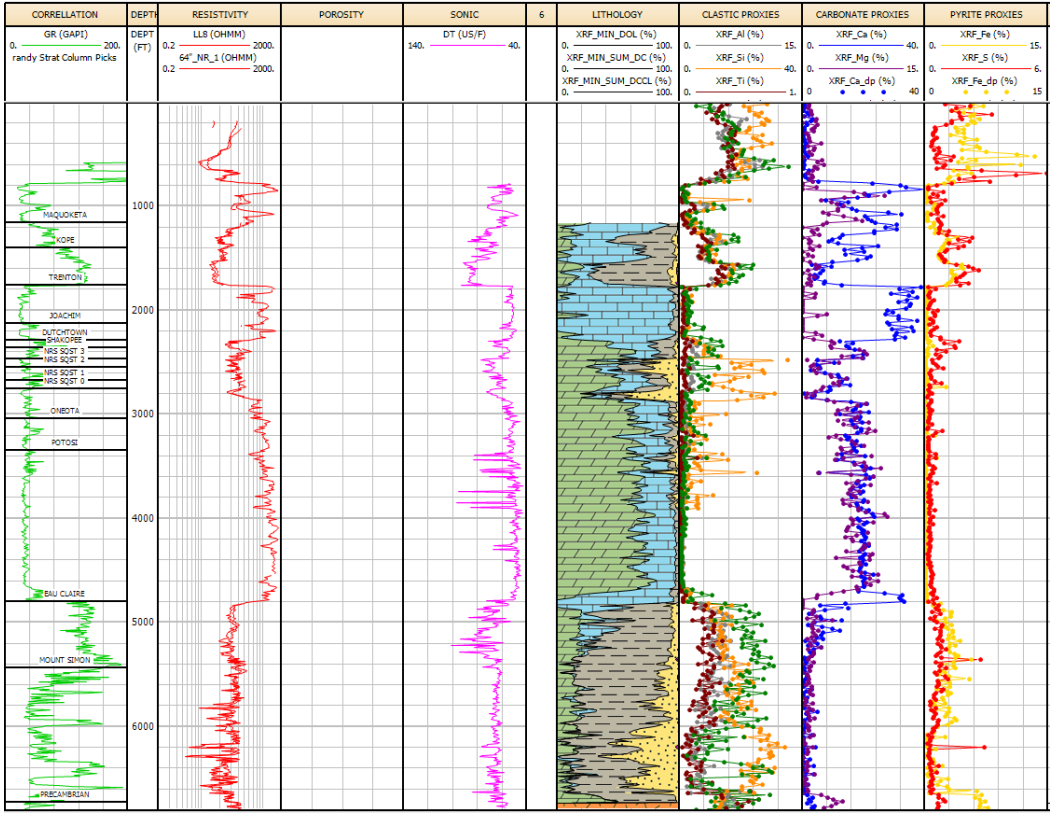
Twenty initial samples for High Pressure CO_2 adsorption isotherm, XRD, MICP, and TOC



Distribution of pXRF dataset collected on lith strips

pXRF analysis of lithologic strips (cuttings)





Many benefits to this workflow:

- pXRF analysis is a relatively quick data collection method
- Cuttings are abundant
- Lith strips represent the entire column and allow for comparison with the entire logging interval
- Cores are important for rock fabrics, ensuring abundant material for testing, and more detailed analysis

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Outreach and Education

- Educational document for the public regarding CCS
  - Overview of what CCS is
  - History of CCS
  - Indiana-specific
    - Specific reservoirs and caprocks of interest in the state
    - Reasons Indiana is a good place to explore this opportunity
    - Hazards and how they can be mitigated
- Class VI permit Fact Sheet
- Developing ArcGIS StoryMaps to act as an online version of these documents

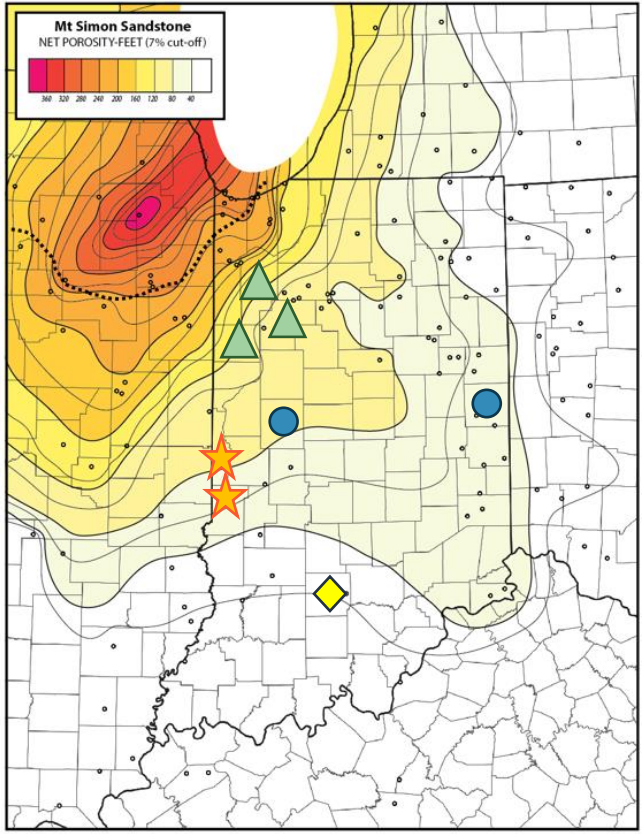
Researchers evaluating locations for carbon capture and storage in Indiana, Midwest

Mar 21, 2024

Indiana Geological and Water Survey's Ashley Douds and Katherine Tucker examine a core sample collected from Jasper County, Indiana, in the 1960s. *Photo by James Brosher, Indiana University*

Center for Rural Engagement status

- The Center for Rural Engagement has convened a national advisory group composed of carbon management scholars and practitioners to guide the community engagement that will produce the Community Benefit Plan.
- We are aggregating and reviewing a wide variety of materials including academic scholarship, federal agency reports, industry white-papers, and popular journalism.
- We have partnered with Indiana University's Polis Center for support with project elements related community information systems, geoinformatics, decision-support tools, and physical, social, and economic impact assessments.
- We are also reviewing materials related to Indiana's Class VI permits in preparation for upcoming fieldwork.
- That fieldwork will entail visits to permit sites and conversations with relevant personnel, community members, and representatives from a range of stakeholder groups.



Mt. Simon SS net-porosity map courtesy Ray Boswell, NETL

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The Polis Center

Summary

- Strong start to the data collection, regional subsurface interpretation, and mapping tasks.
- Digitizing logs are critical to the regional reservoir and caprock characterization phase.
- Initial data collection for building petrophysical models, calculating potential storage volumes, and caprock lab analysis were started.
- Outreach and education material is beginning to take shape.
- Advisory group is gathering and reviewing relevant materials to help inform upcoming fieldwork.

Photo courtesy James Brosher, Indiana University

Questions?

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