NATIONAL ENERGY TECHNOLOGY LABORATORY

Oklahoma Geological Survey

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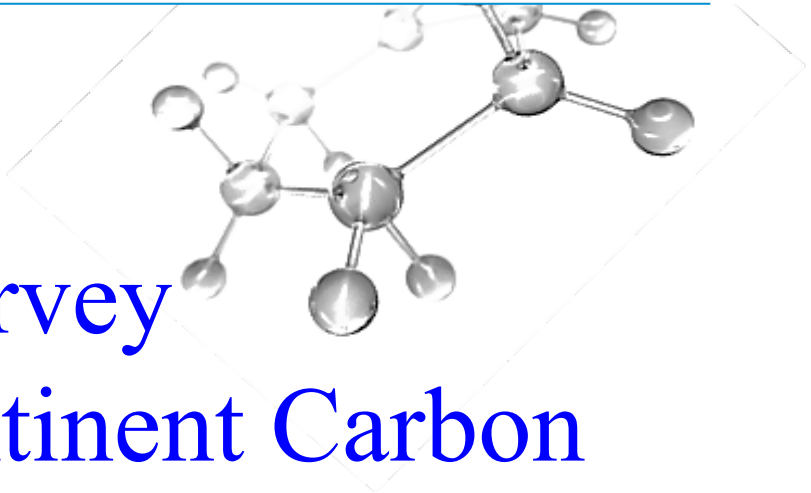

Oklahoma Geological Survey Coordination of Mid-Continent Carbon Management: Geological Assessments

Presented by:
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August 9, 2024

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Agenda

- Project Overview
- Project Background
- Current status of the project and accomplishment
- Community Engagement
- Summary and Next Steps

Project Overview

Objectives:

- Geological carbon storage opportunities in Oklahoma
- Risk management, monitoring, and hazard mitigation in carbon geological storage
- CM coordination (state and regional); and community engagement

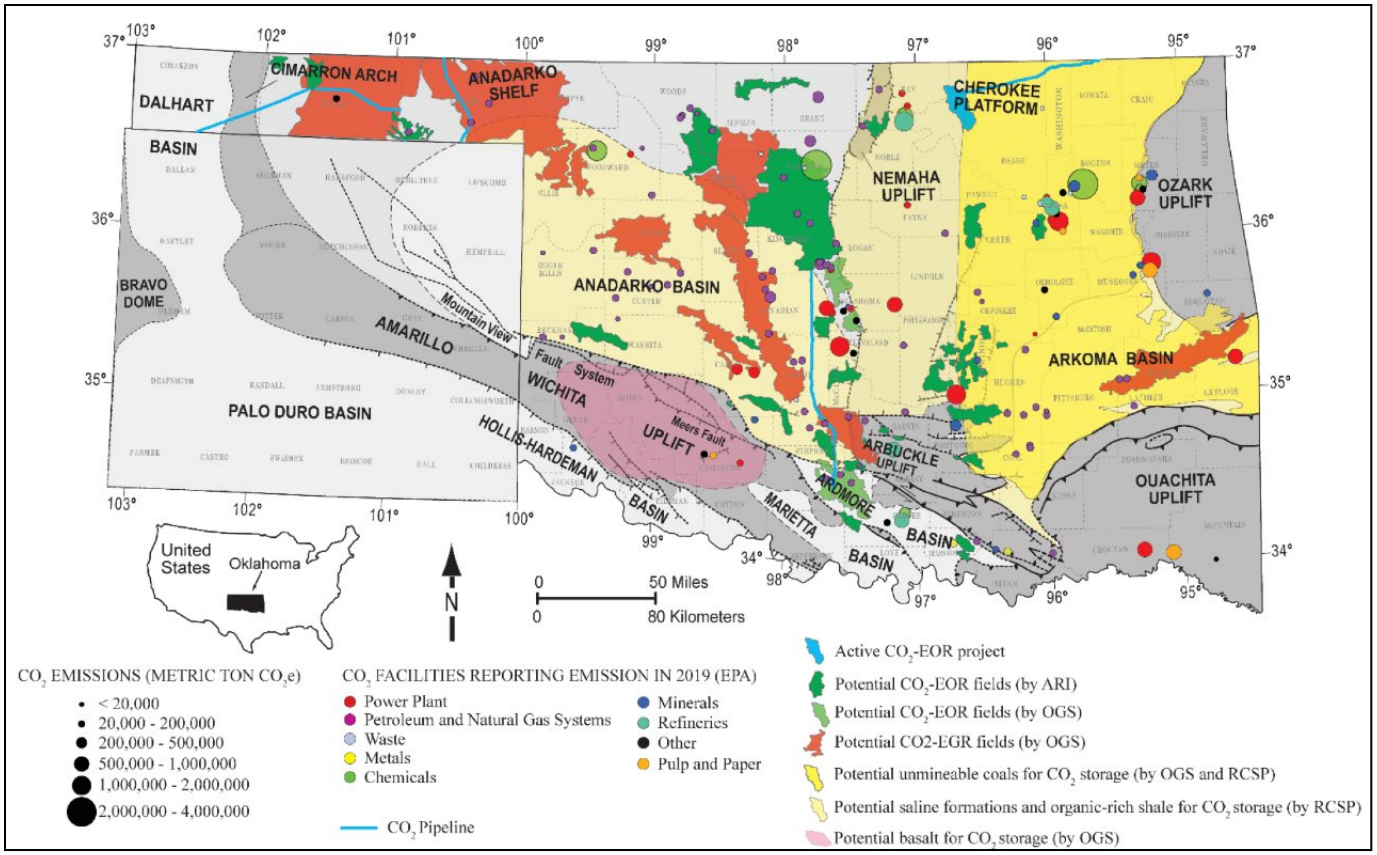
Duration: February 1, 2024 - January 31, 2026

Award: $999,999 plus $252,753 cost-share

Award#: DE-FE0032374 from FOA0002799

Primary expenditures:

- PI, Research Associate & Graduate Student salaries (~US$54,500)
- Equipment for seismology, pressure monitoring, core investigation (~US$49,000)
- Software for geoscience analysis
- Travel and additional support (~US$1,000)
- F&A (IDC -55%) (~US$30,000)



Project Overview

Personnel:

Lead PI:

- Dr. Nicholas Hayman: OGS Director & State Geologist

Education & Outreach Leads:

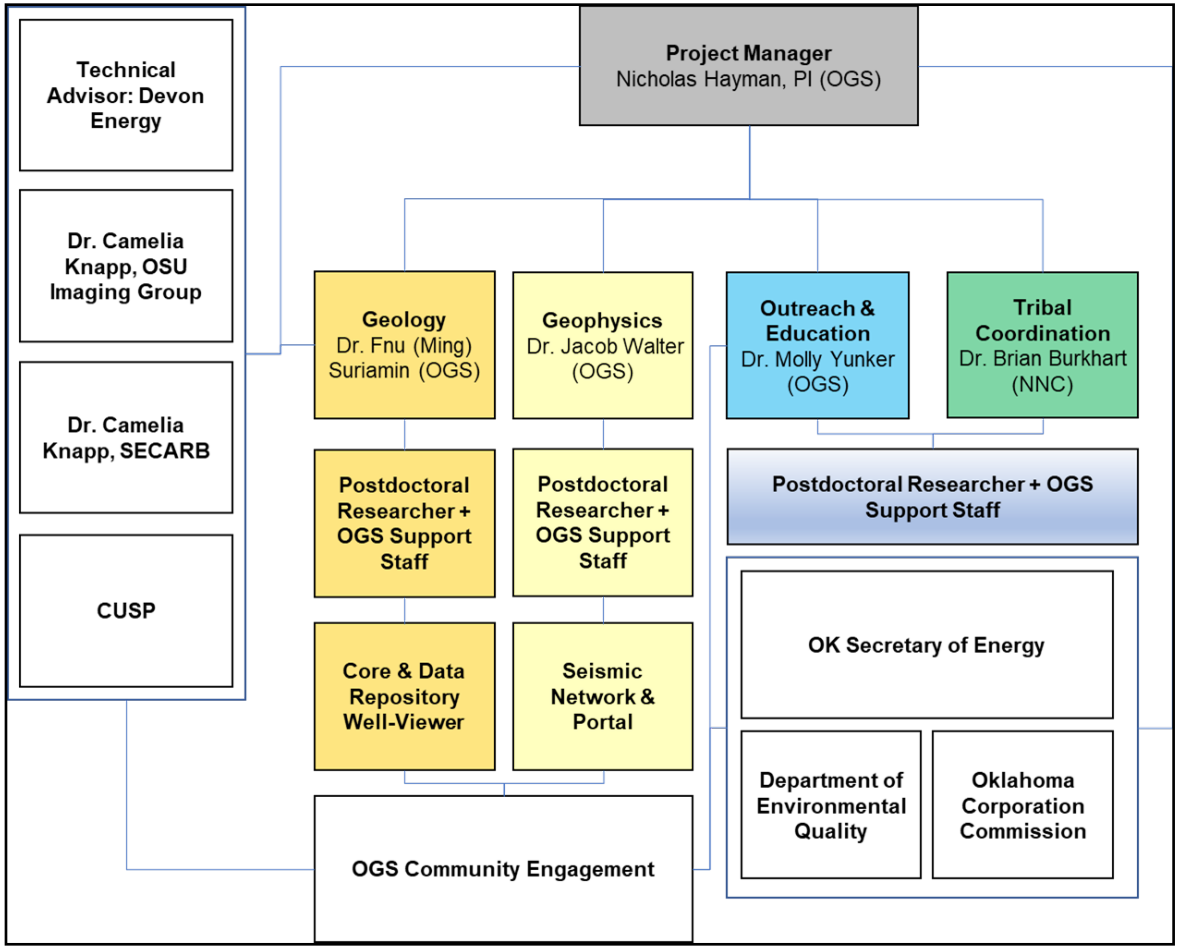
- Dr. Molly Yunker: OGS E&O
- Dr. Brian Burkhart: OU Philosophy & Native Nations
- Dr. Carrie Miller-DeBoer: Research Associate starting June 03, 2024 (US Citizen)

Technical Group:

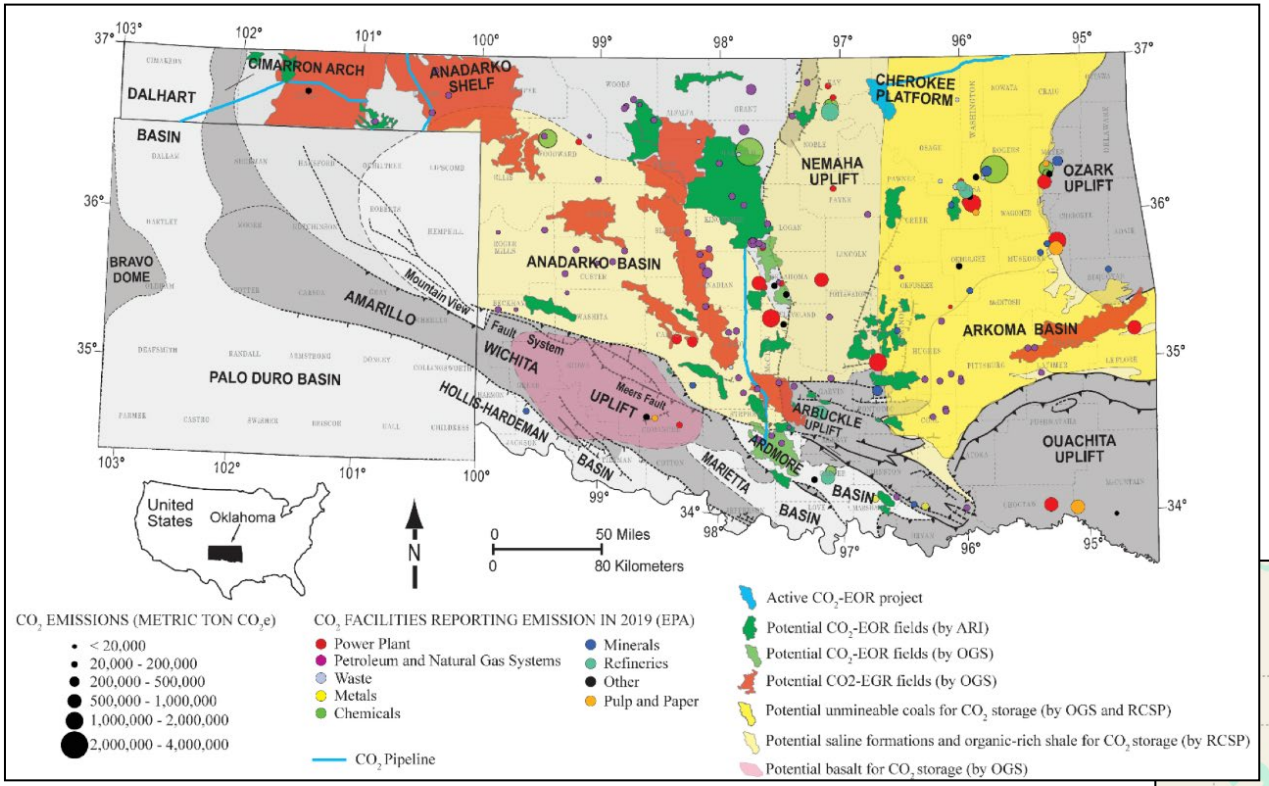
- Dr. Fnu "Ming" Suriamin: OGS Geology
- Dr. Jake Walter: OGS Seismology
- Dr. Hongyu Xiao: OGS Research Associate (pending foreign national approval)
- Dr. Dessy Sapardina: OGS Research Associate (pending foreign national approval)

Subaward to Oklahoma State University:

- Dr. Camelia Knapp: Seismic Imaging for CCSM.
- Magnolia McLaughlin: Graduate Student with Dr. Knapp



Project Background

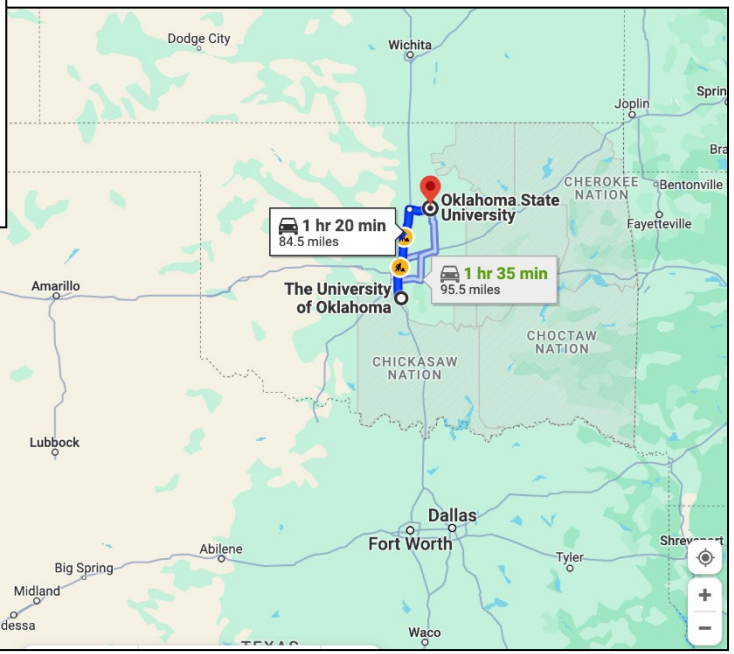


OGS offices at OU Norman campus, ~20 miles south of OKC

OPIC, ~3 miles north of main OU campus

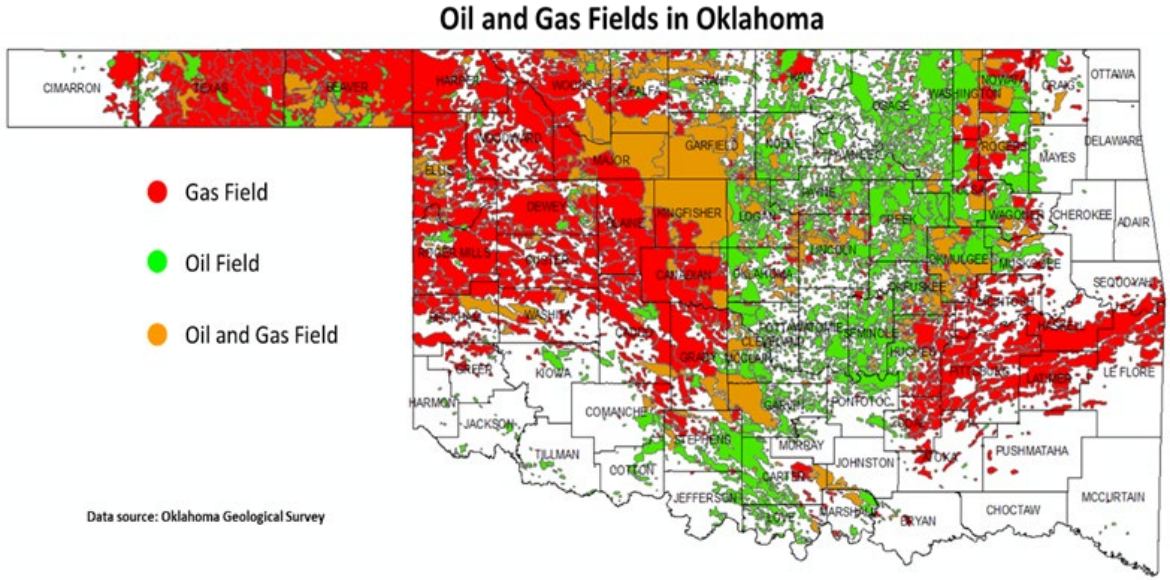
Oklahoma State University, Stillwater, OK,

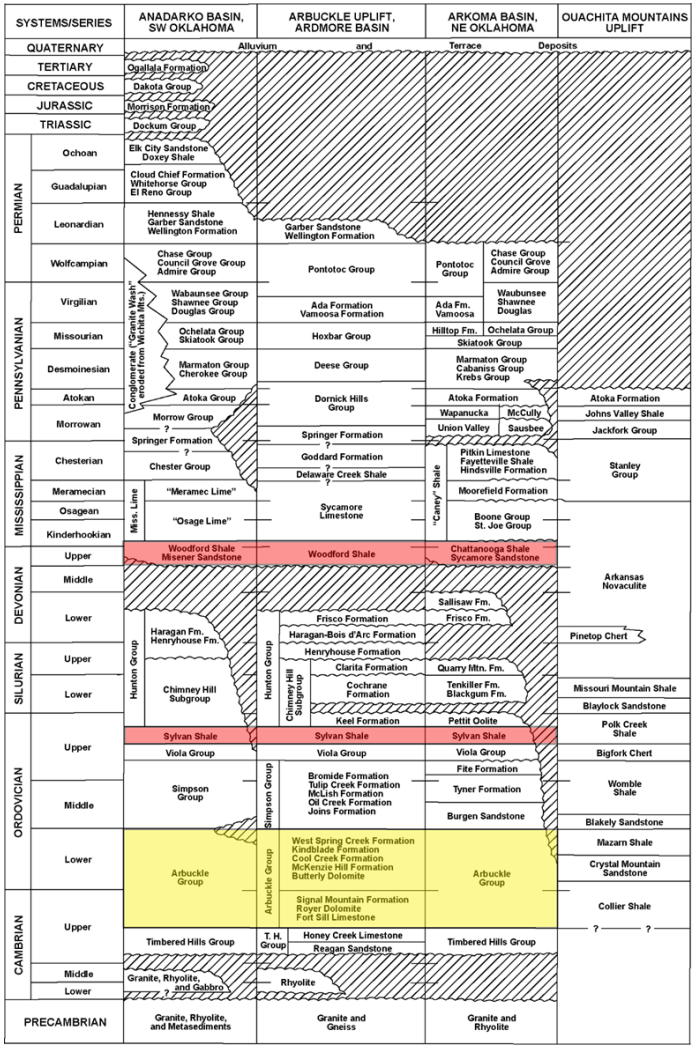
Communities statewide



Regional Assessment of the Geological CO2 Storage

To assess the Arbuckle Group and non-Arbuckle reservoirs in Oklahoma suitability for CO_2 storage using existing borehole data, reports, and seismic data (if any); characterize their geological features, properties, and create 3D models to determine storage capacity and potential risks.

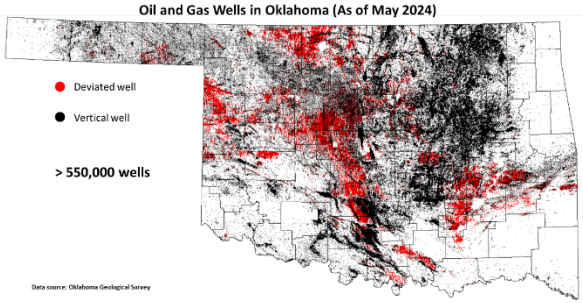


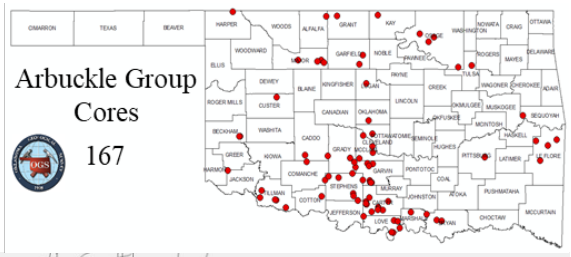


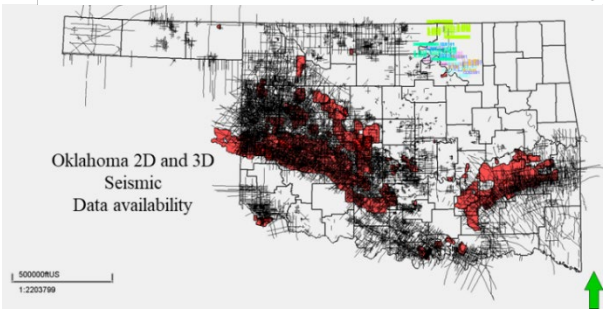
Modified after Cardott, 2017

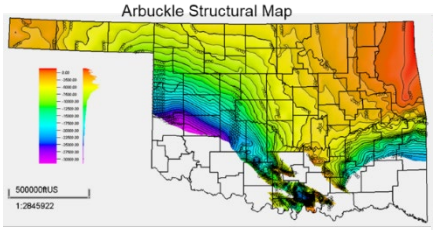
Arbuckle Reservoir Assessment

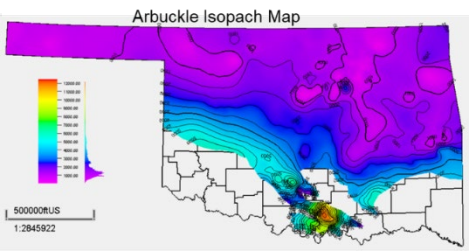
- What have been completed/on progress?
  - Data Collection: Well Logs, Seismic Info, Maps, Cores
  - SCO_2T – 80% (Map: Lithology, Structure, Isopach, Porosity, Pressure, Temperature, Permeability)
    - $G_{CO_2} = A \times h \times \phi \times \rho \times E$
  - Sites Selection (2 sites)

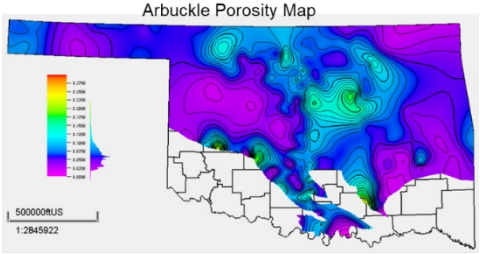


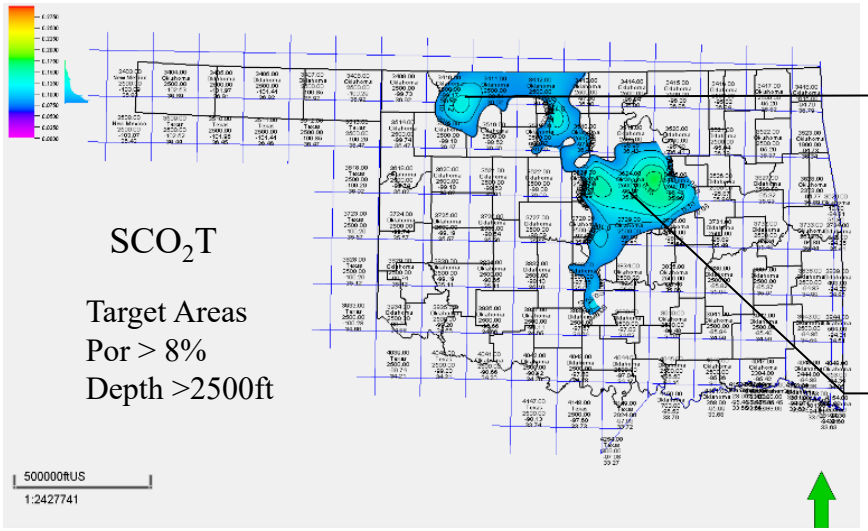








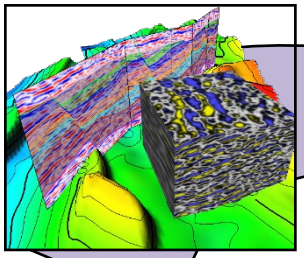




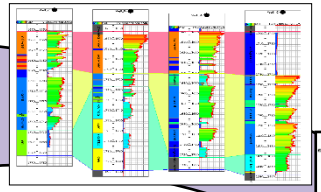
Area 1
Gross thickness 500-1000ft
~80 wells penetrated ABCK
No Core

Area 2
Gross thickness 500 - 1000ft
~120 wells penetrated ABCK
No Core

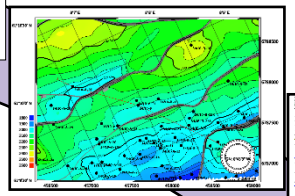
3D Geological Modeling



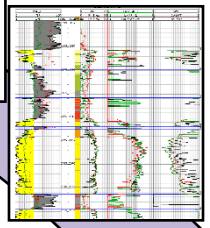
Seismic Integration
Interpretation
Attributes
Rock Physics
Rendering



Integrated Well Correlation

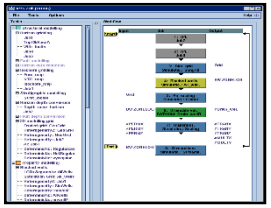


Integrated Mapping

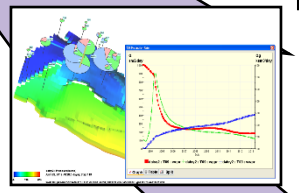


Petrophysics

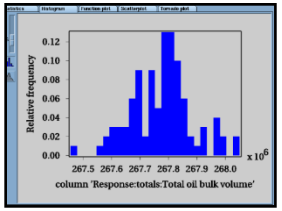
Structural Modelling
Structural Uncertainty
Complex Faulting
Fault Seal Analysis
Fracture Modelling



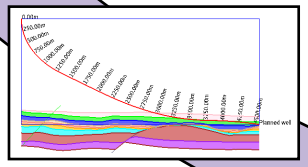
Workflow Management



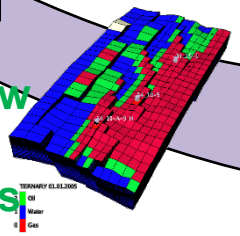
Real-time Production Monitoring & Analysis



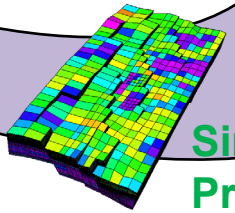
Uncertainty Evaluation



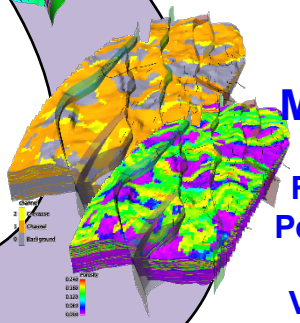
Integrated Well planning & Geo-steering
(WITSML Monitoring)



Integrated Flow Simulation & Streamlines



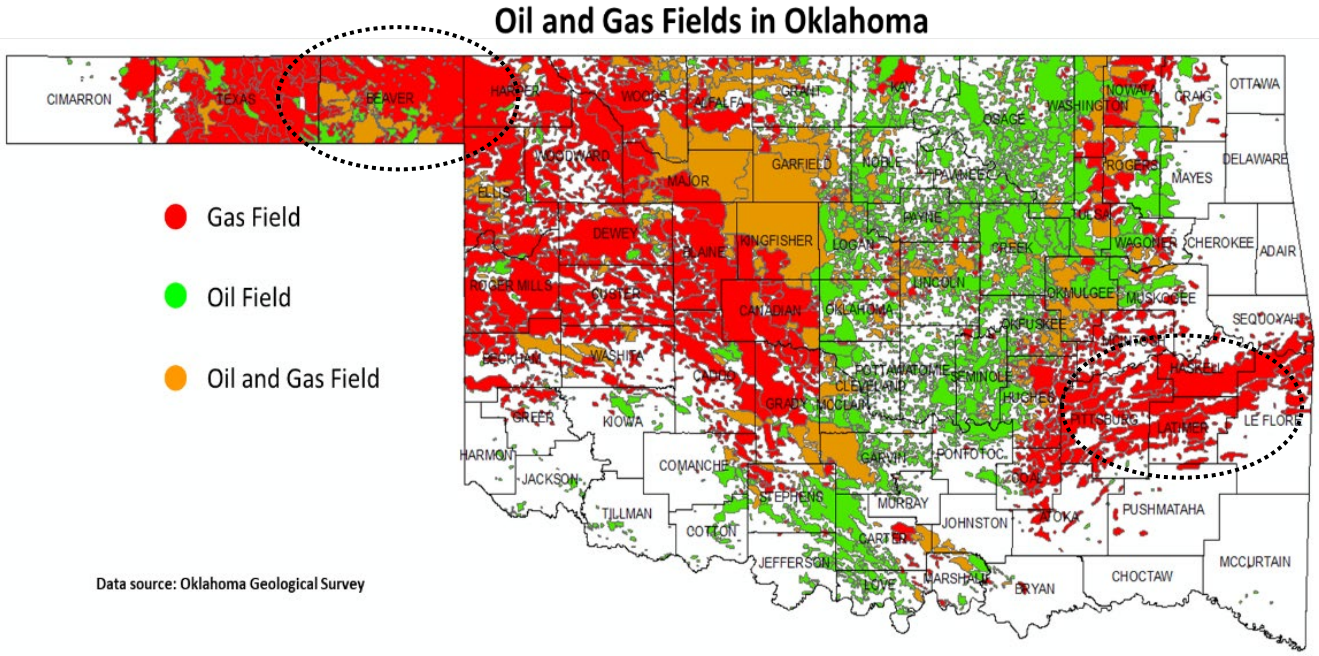
Simulation Pre & Post Processing



Static Modelling
Facies
Rock Types
Petrophysical Attributes
Volumetrics

Non-Arbuckle Reservoirs Assessment

- What have been completed?
  - Data Collection (well logs, formations' top, formations' type log, OPIC core information)
  - Oil and gas reservoirs catalog (Area, Lithology, Net Thickness, Porosity, Temp, Pressure) 200 reservoirs



67 reservoirs - NPV including:

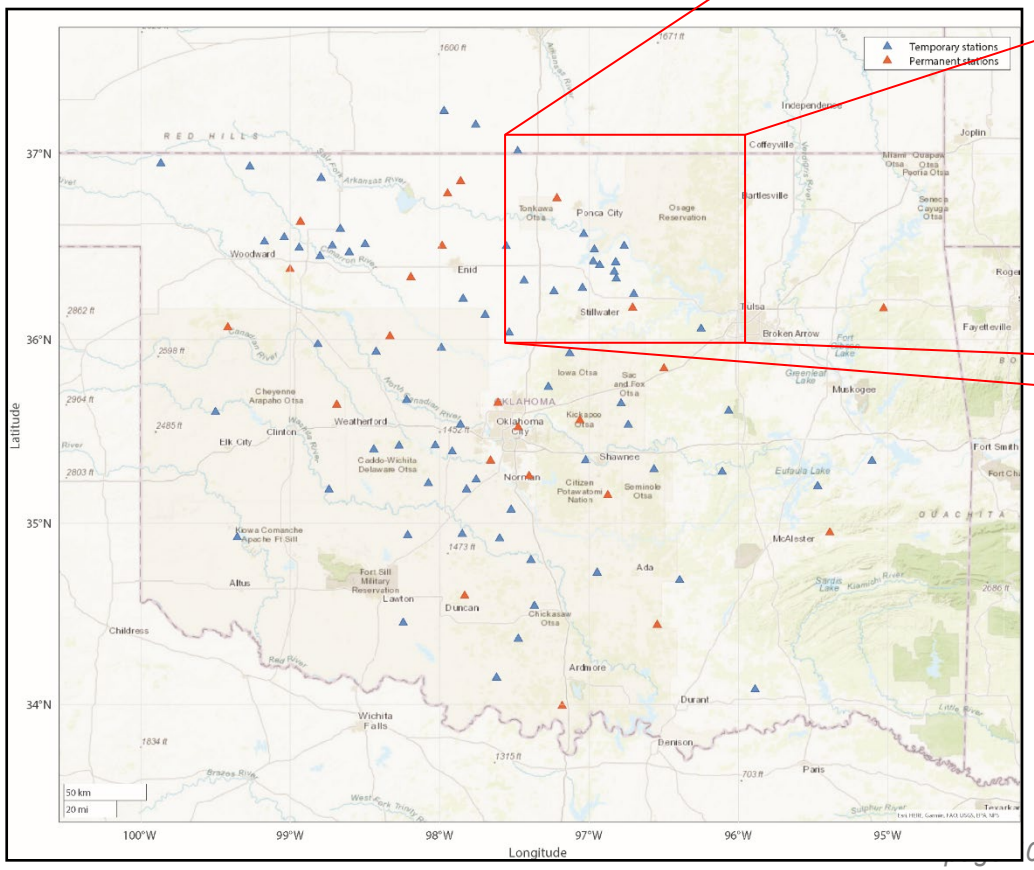
- 12 Pennsylvanian;
- 4 Virgilian (Tonkawa–Mocane Laverne gas area-Beaver: 21B ft3);
- 4 Missourian;
- 18 Desmoinesian;
- 21 Atokan (Red Oak-Red Oak-Norris-Latimer – 28B ft3; Spiro-Kinta-Haskell – 38B ft3) ;
- 10 Springer

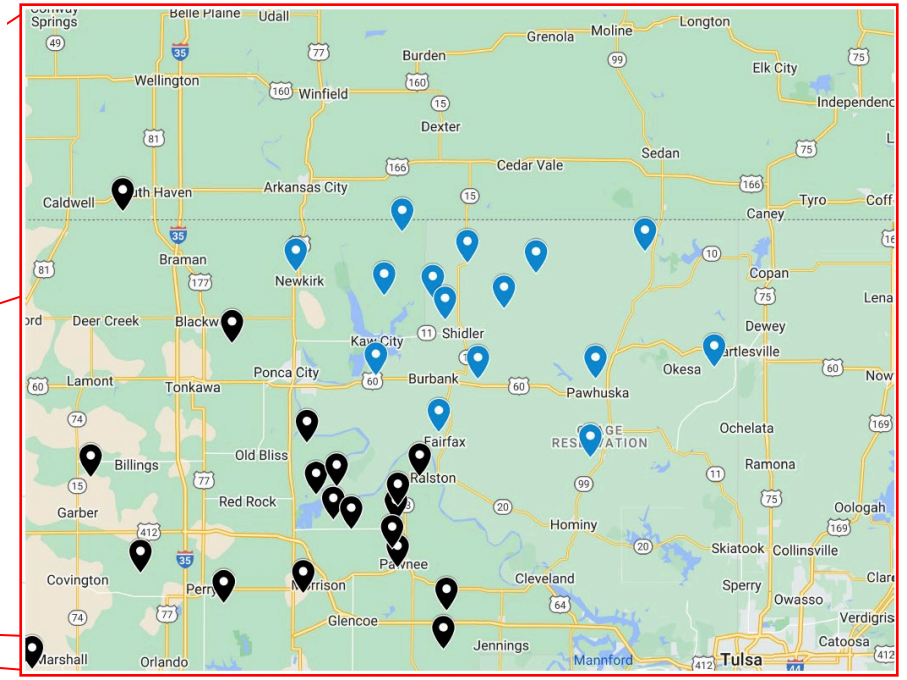
- Research Plan
  - Sites Selection (2 sites based on mainly pore volume and available data)

Monitoring & Hazard Mitigation

Seismic & Well-Pressure Monitoring strategies and test runs, data-portal development

Pressure Monitoring (downhole instruments) & seismic network deployment into areas with deployment tailored to understanding CCS monitoring (Osage Nation).



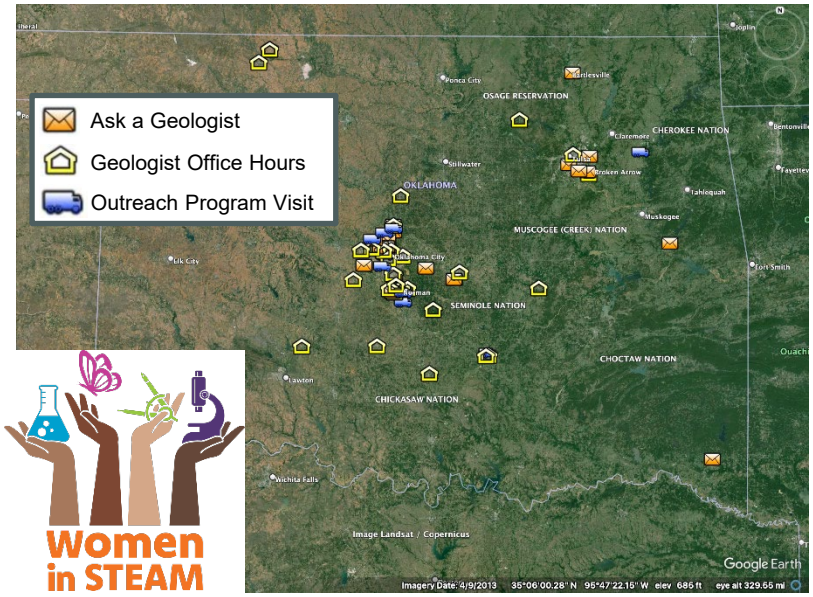


Purchased 15 downhole instruments

Community Engagement

Current & Planned Engagement:

- General Geoscience Outreach – 574 contacts (Q1- to date)
  - https://www.facebook.com/OKgeology/
- Assisting with deployment of seismic network by facilitating collaborations with local organizations & agencies (Q3)
- Women in STEAM Conference, October 8 (Q4)
  - Developing interactive CCS models and activities
- Fall Stakeholder Workshop (Q4)



Women in STEAM 2024 CONFERENCE

SMART Goals Progress

- Developing agenda, venue and date options for fall stakeholder workshop (Action 1)
- Developing program outlines, CCS models and activities for educational institutions and K12 teachers; identifying event opportunities (Action 2, 3)
- Developed stakeholder questionnaire; awaiting final IRB approval (Action 4)
- Exploring collaboration opportunities with OK Career Tech (Action 5)
- Arranging professional development opportunities with OU Office of Advocacy & Education, OU Native Nations Center, Unlearning Racism in Geoscience, and OU Accessibility and Disability Resource Center (Action 7, 8, 9)

Summary & Next Steps

Summary:

1. OGS thanks the DOE and NETL - first FECM DOE award in many years
2. OGS - good example of a state survey to conduct regional assessments, monitoring, & community engagement
3. The …2799 award - build up OGS capacity for longer term objectives.
4. Project Management: Finalize contract, fiscal-effort plan, mandatory updates, finalize meeting schedules
5. Hired 3 postdoctoral researchers
6. Completed Sites Selection (Arbuckle and Non-Arbuckle)
7. Purchased equipment and completed deployment
8. Generated initial community engagement plans
9. YTD spending: US$134,647.29 (Federal) + US$56,765.73 (Cost Share)

Immediate Next Steps:

1. Start sites characterization and assessment
2. Continue seismic monitoring in the state of Oklahoma in general and in the Osage Nation in particular
3. Fall 2024 workshop