Anadarko Basin (ABs) Carbon Management Hub
DE-FOA 0002799

Participants:

Oklahoma State University (OSU) and University of Oklahoma (OU)

University of Tulsa (TU) and Oklahoma Geological Survey (OGS)

Priyank Jaiswal, PhD
Professor, Boone Pickens School of Geology
Director, Professional Science Masters (PSM) - Geoscience

Oklahoma State University, USA
https://experts.okstate.edu/priyank.jaiswal
Priyank.Jaiswal@okstate.edu

Outline

- Project Overview
- Background
  - Source
  - Pipeline
  - Geology
  - Risks
- Technical Approach
- Current Status
- Work Ahead

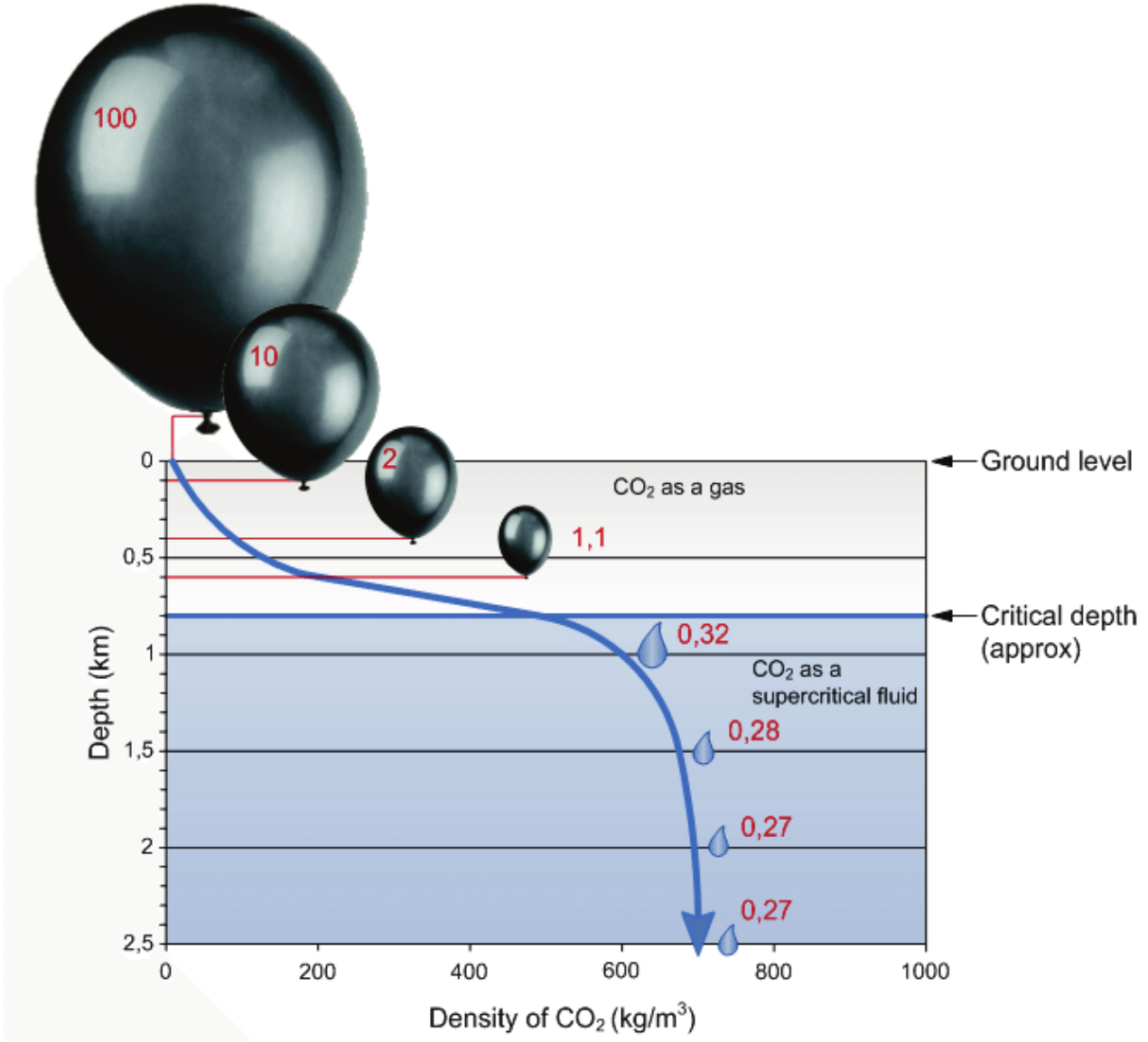


Illustration of Pressure Effects on CO2 (based upon image from CO2CRC). The blue numbers show the volume of CO2 at each depth compared to a volume of 100 at the surface.

Overview:

- Overarching Goal: Support the US Fossil Energy and Carbon Management (FECM) goal of identifying and addressing the challenges facing regional commercial deployment.

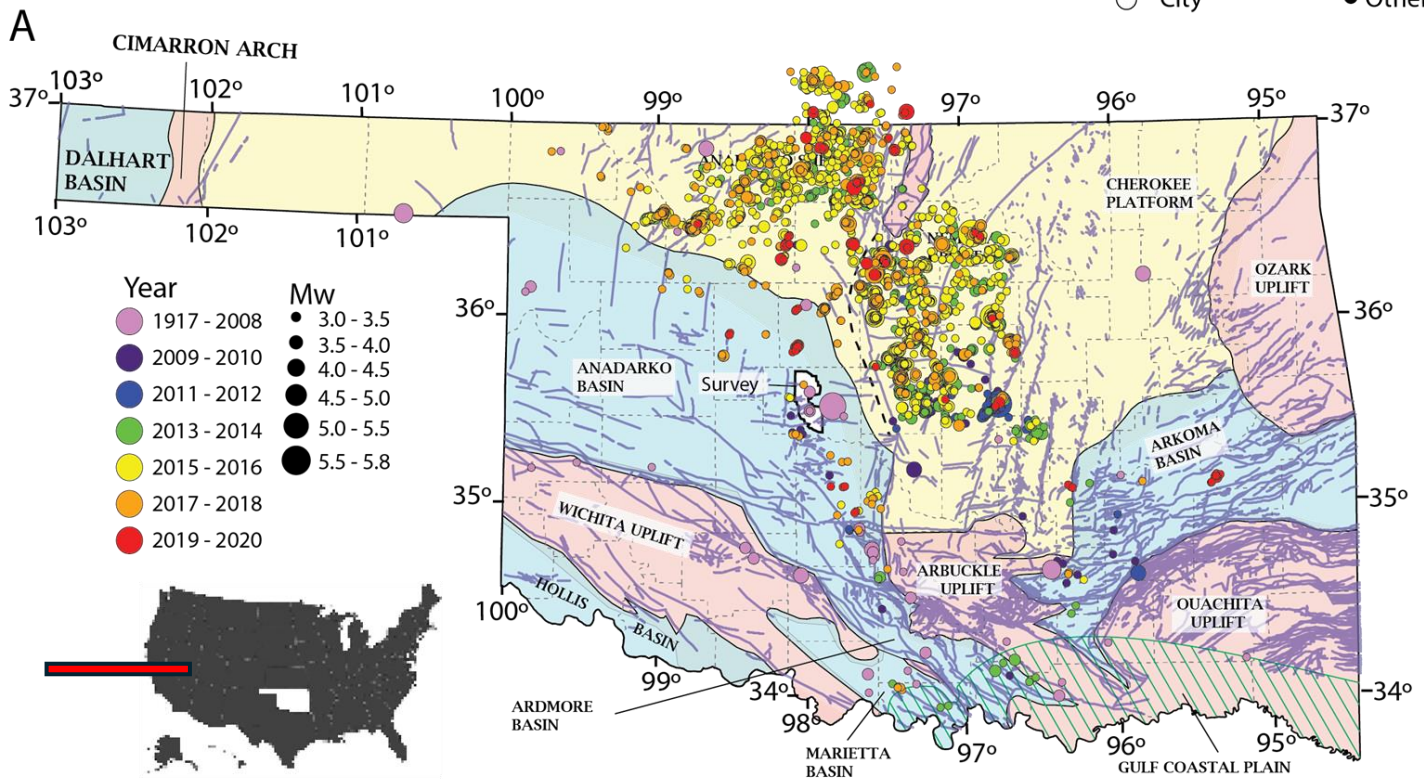
- Broad Objectives:

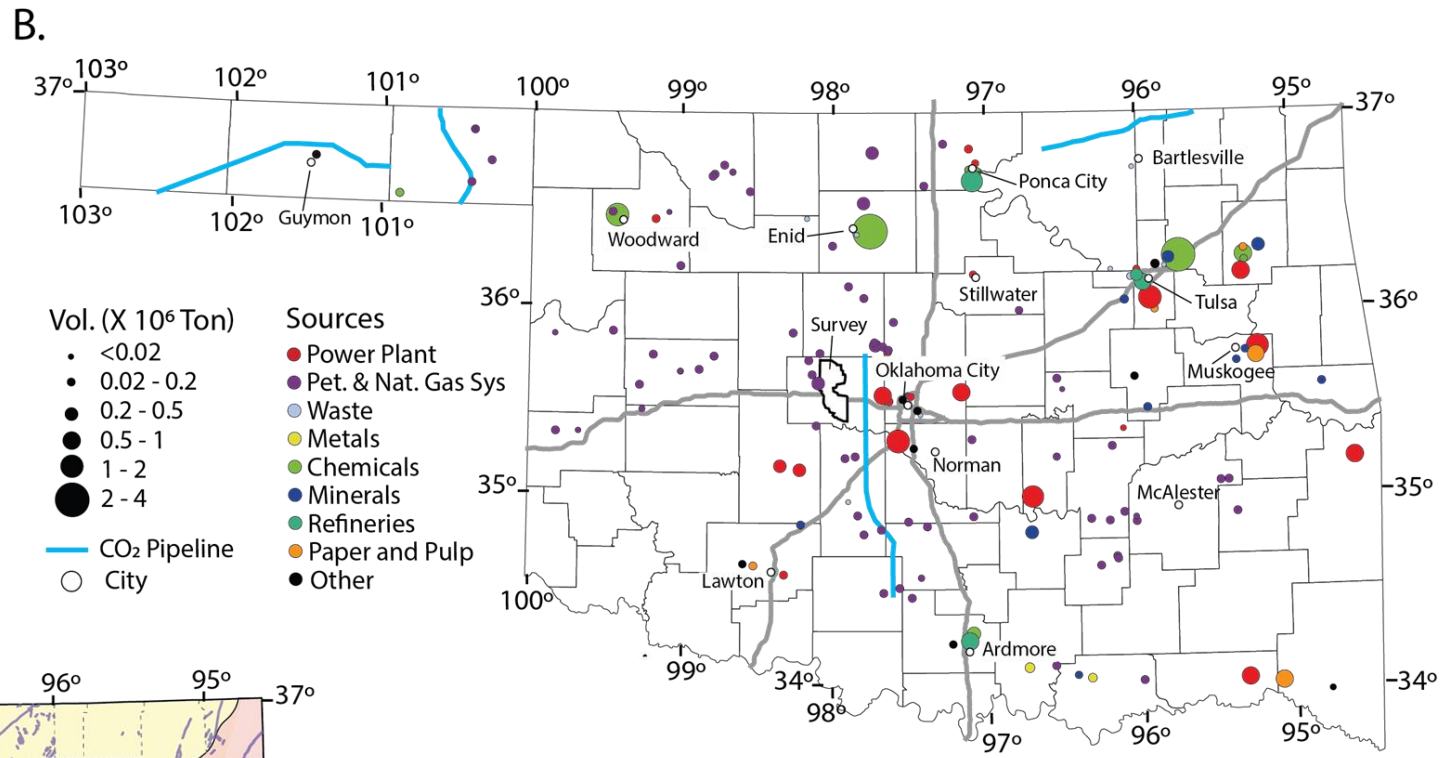
  1) Make technical information to underpin policy decisions available;

  2) Assisting project developers with the management of pore space and property rights management; and

  3) Identifying data needs for the completion of the UIC Class Six (VI) permitting process.

Background



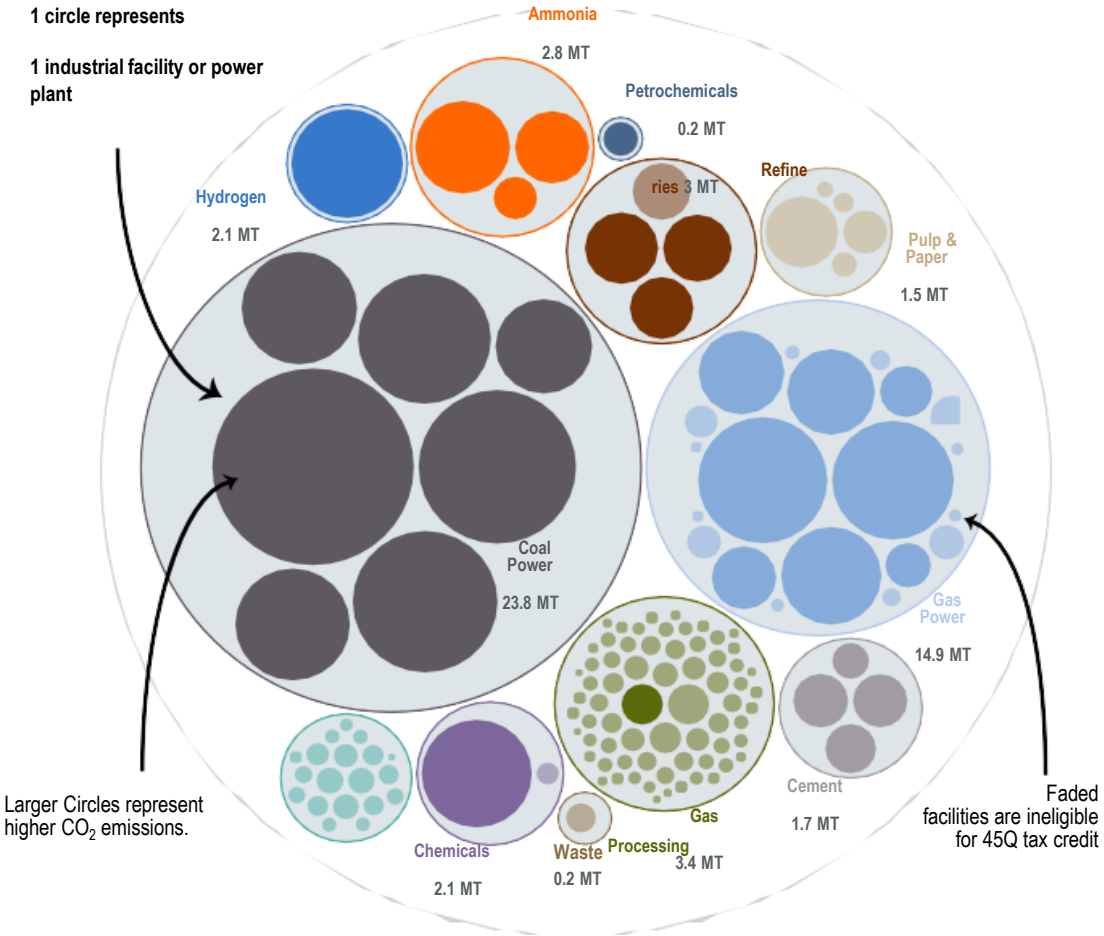


State Map of Oklahoma with:
(A) Faults and > 3 Mw epicenters color and sized coded by year-range and by magnitude (USGS)

(B) Major cities, freeways, and reported emissions for 2019 color coded by source type and size coded by CO2-equivalent volume (source: OGS). Also shown in blue are current CO2 pipelines.

The solid black polygon is the study area in (A) and (B).

Source

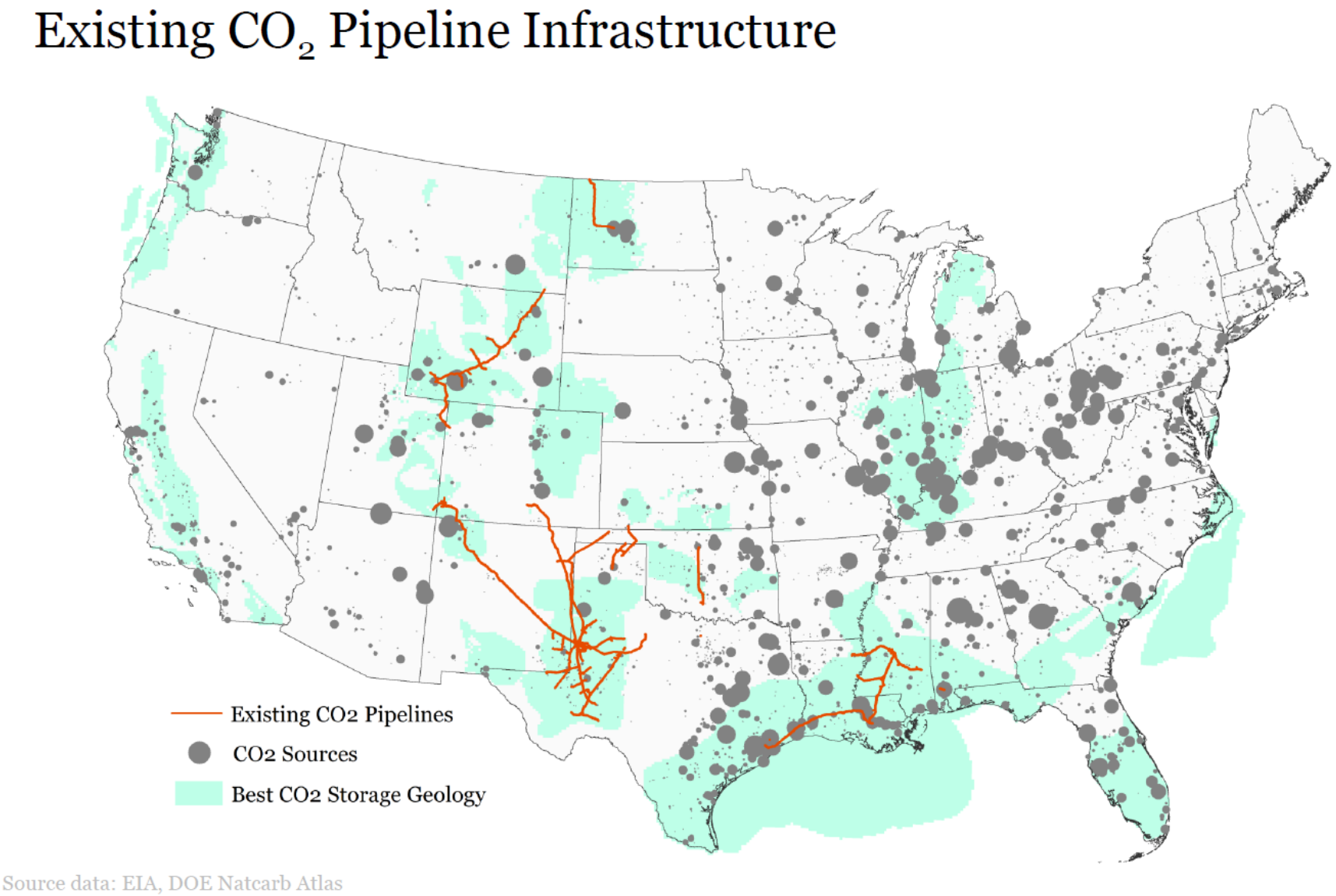


Type	Mol-% CO_2
Coal Fired	12-15
Natural Gas	3-4
Oil Refining	8-9
Cement	14-33
Steel	20-44

Sources and annual emissions for each industry type in Oklahoma.

Source: Great Plains Institute (GPI), 2022. Carbon Capture and Storage Infrastructure for Midcentury Decarbonization, US Carbon And Hydrogen Hubs Atlas. https://carboncaptureready.betterenergy.org/oklahoma/

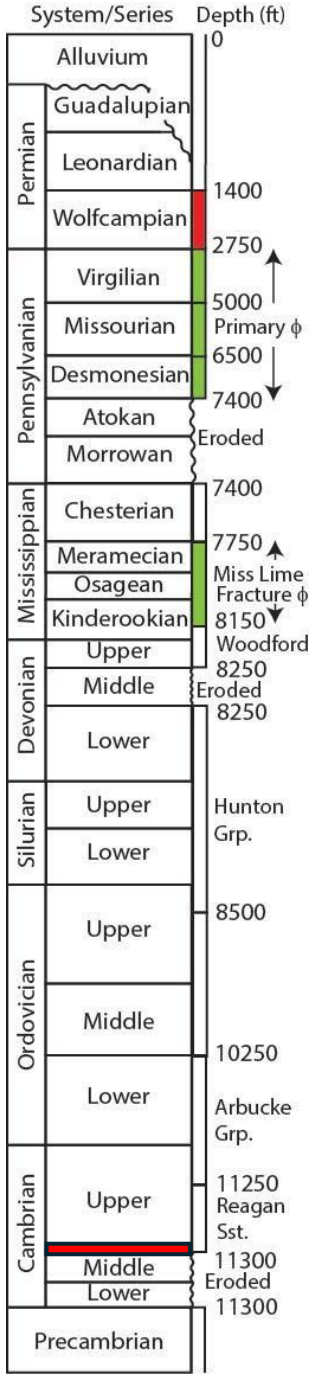
Infra: Pipelines

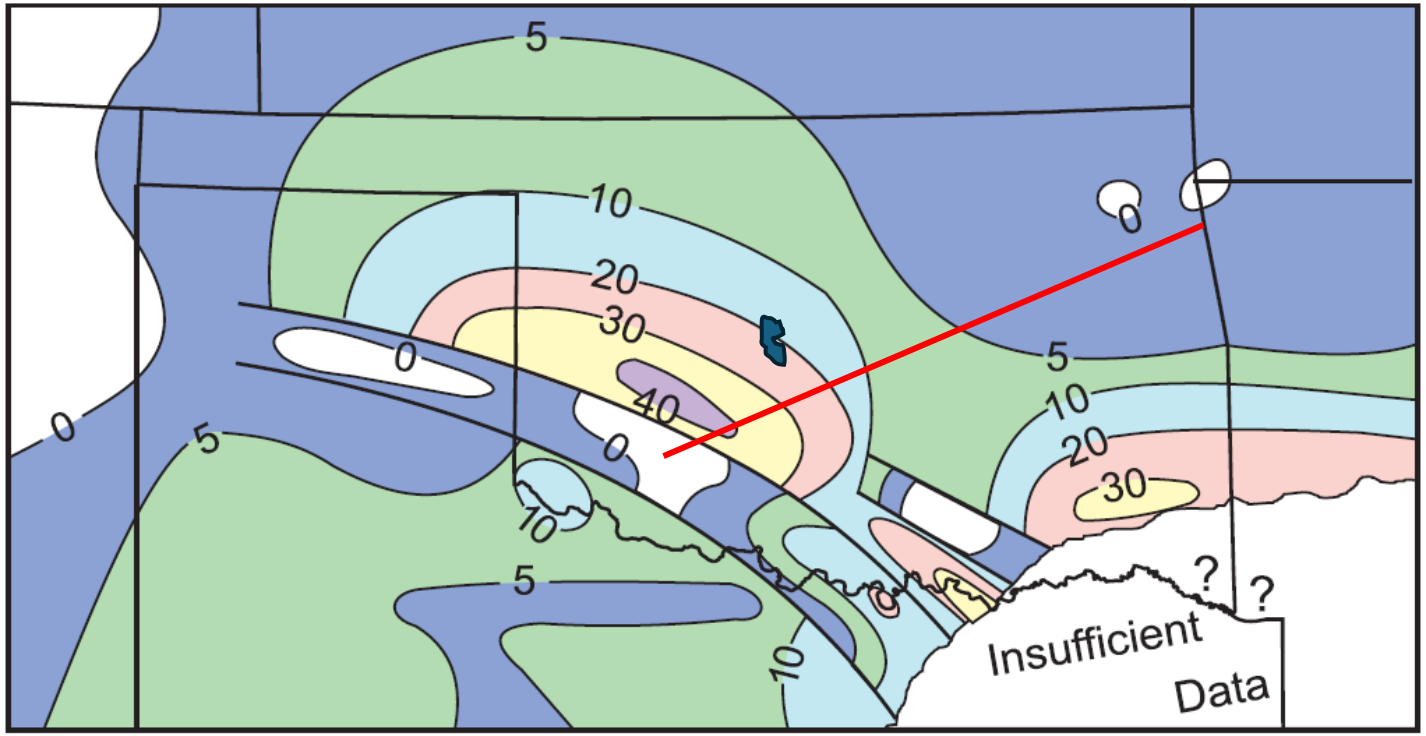


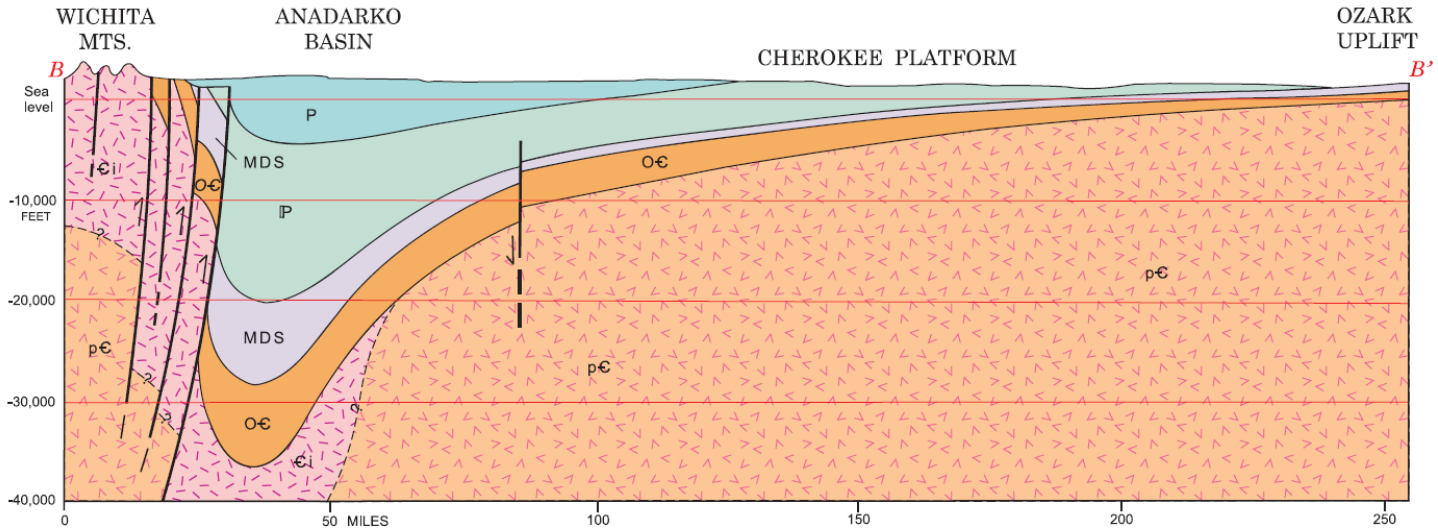
Source data: EIA, DOE Natcarb Atlas

Geo: Basement

Generalized contours showing elevation (in thousands of feet below sea level) of the eroded top of Precambrian and Cambrian basement rocks





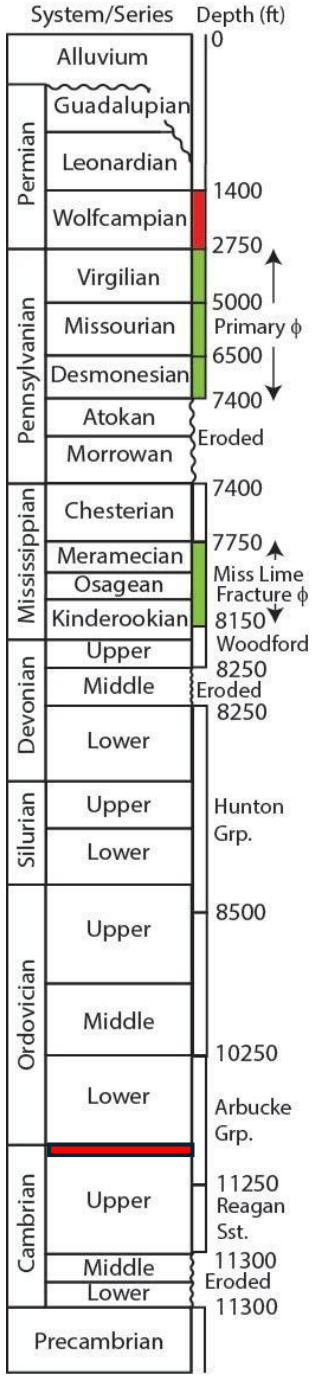


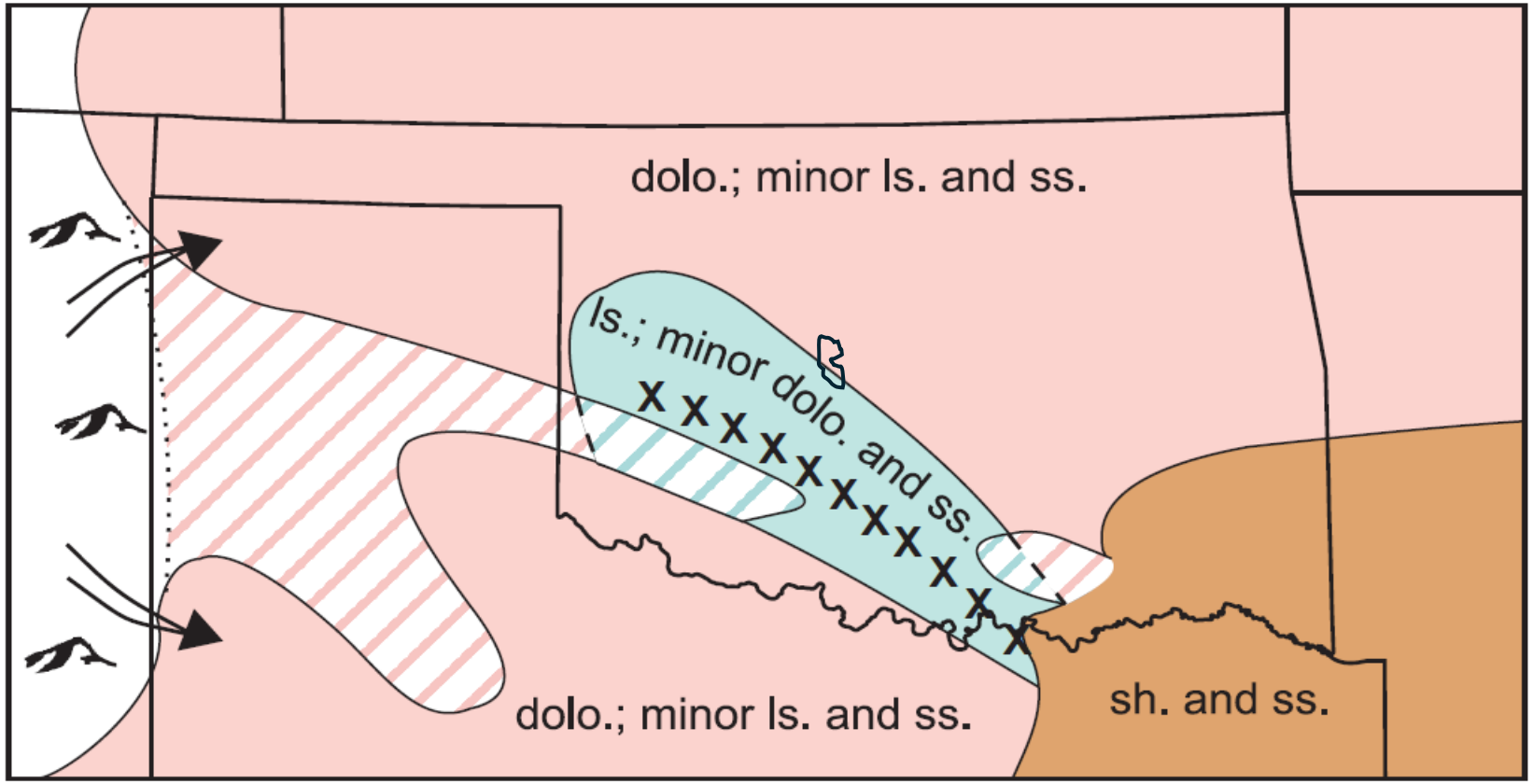
EXPLANATION

T	Tertiary	MDS	Mississippian, Devonian, and Silurian
K	Cretaceous	O€	Ordovician and Cambrian (sedimentary rocks)
KJTr	Cretaceous, Jurassic, and Triassic	€i	Cambrian (igneous and metamorphic rocks)
P	Permian	p€	Precambrian
IP	Pennsylvanian		Fault; arrow shows relative movement

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo:
Present Day





Principal rock types of Late Cambrian and Early Ordovician age

EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

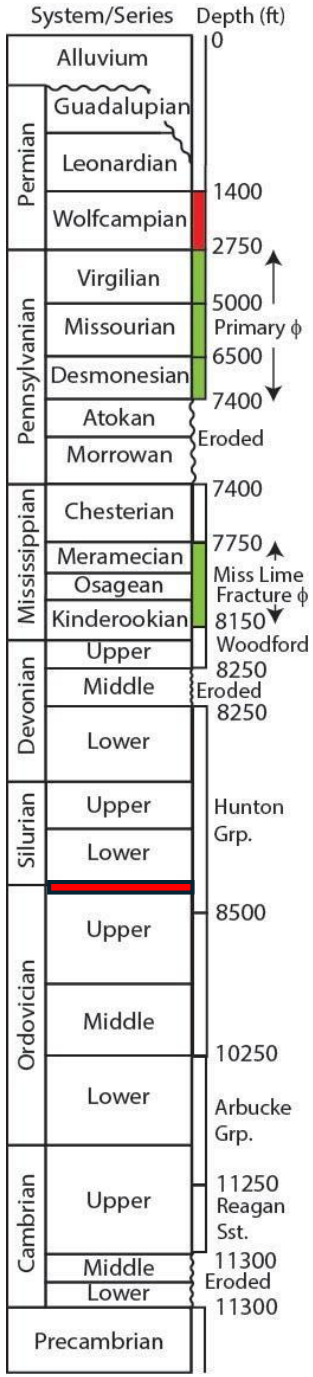
Gypsum (gyp.) Chert (cht.)

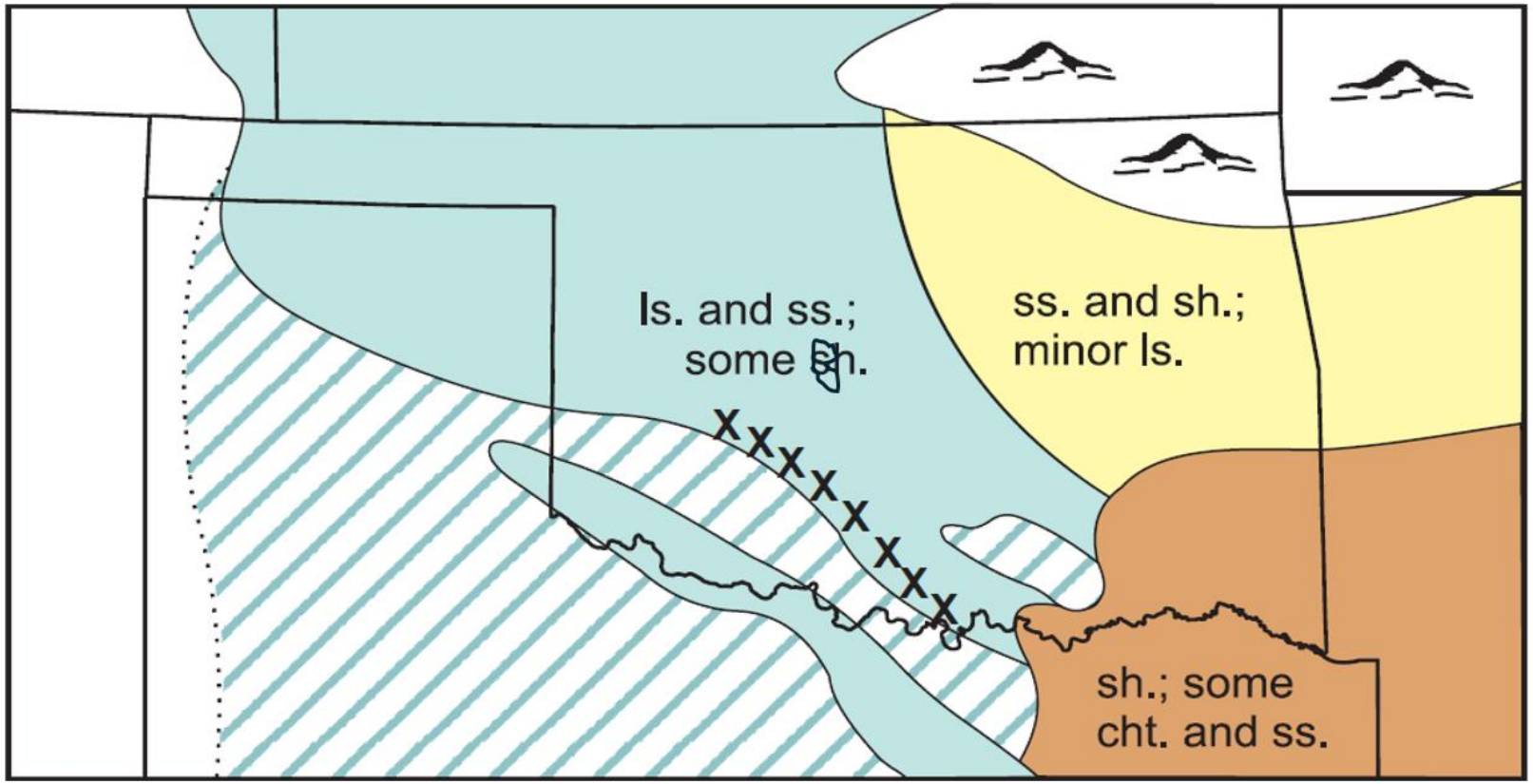
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

Gypsum (gyp.) Chert (cht.)

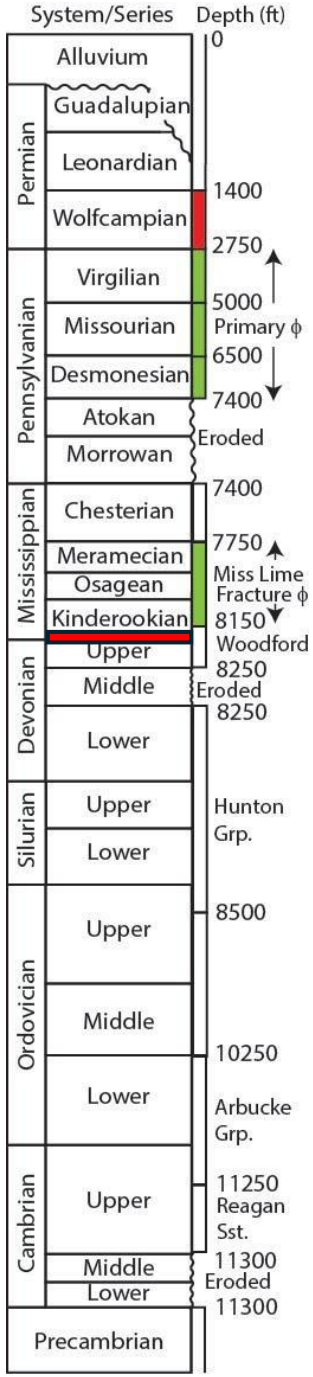
Symbols

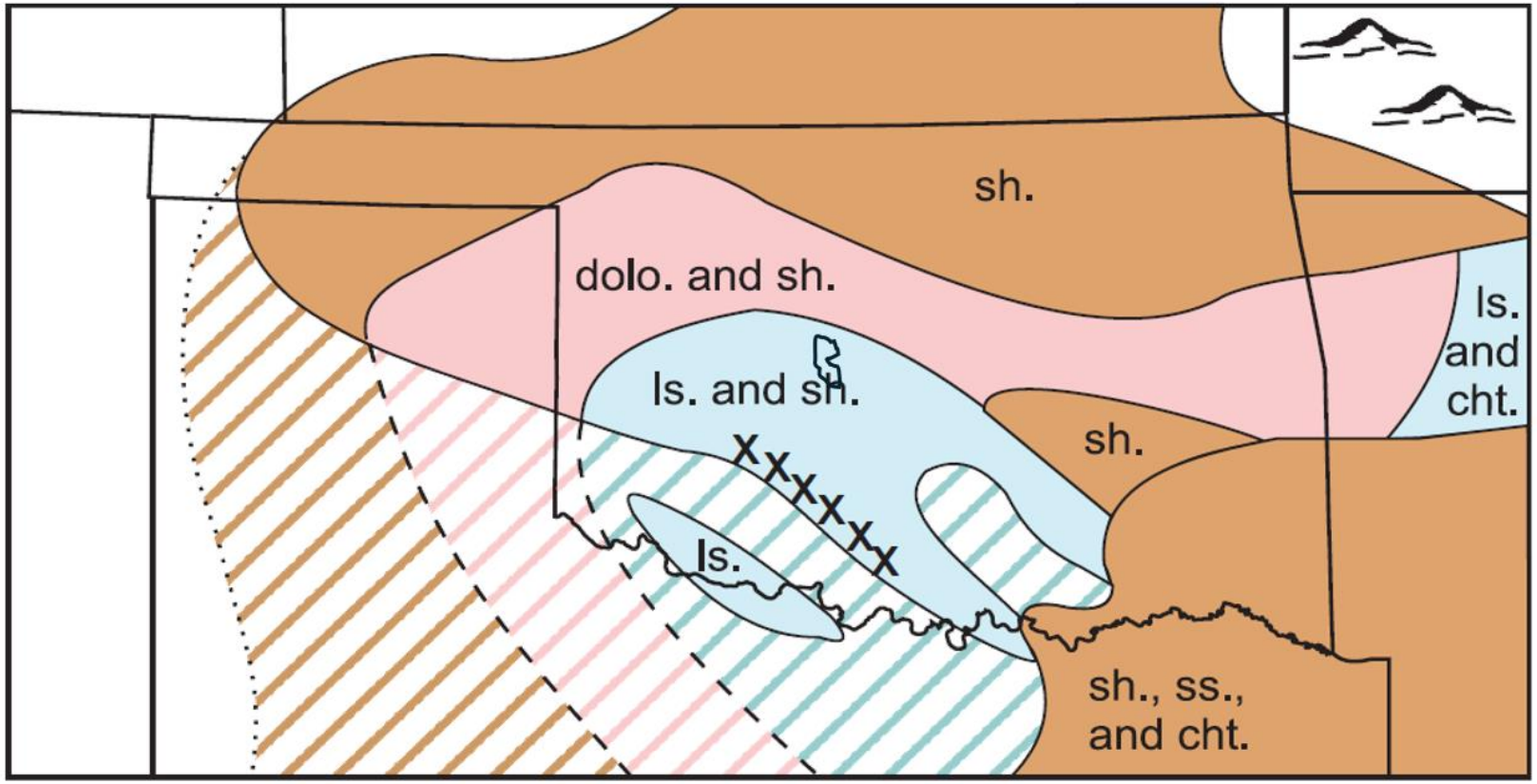
- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Principal rock types of Middle and Late Ordovician age

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Silurian and Devonian age

EXPLANATION

Principal Rock Types

	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

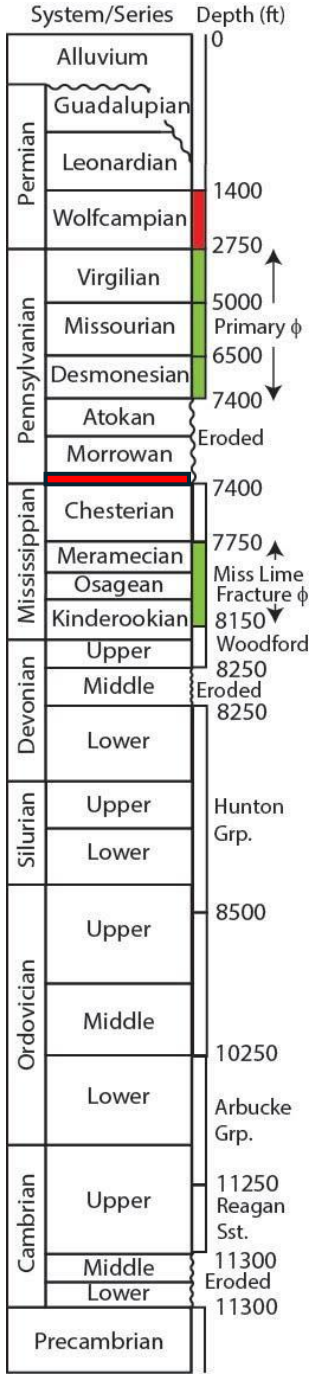
Gypsum (gyp.) Chert (cht.)

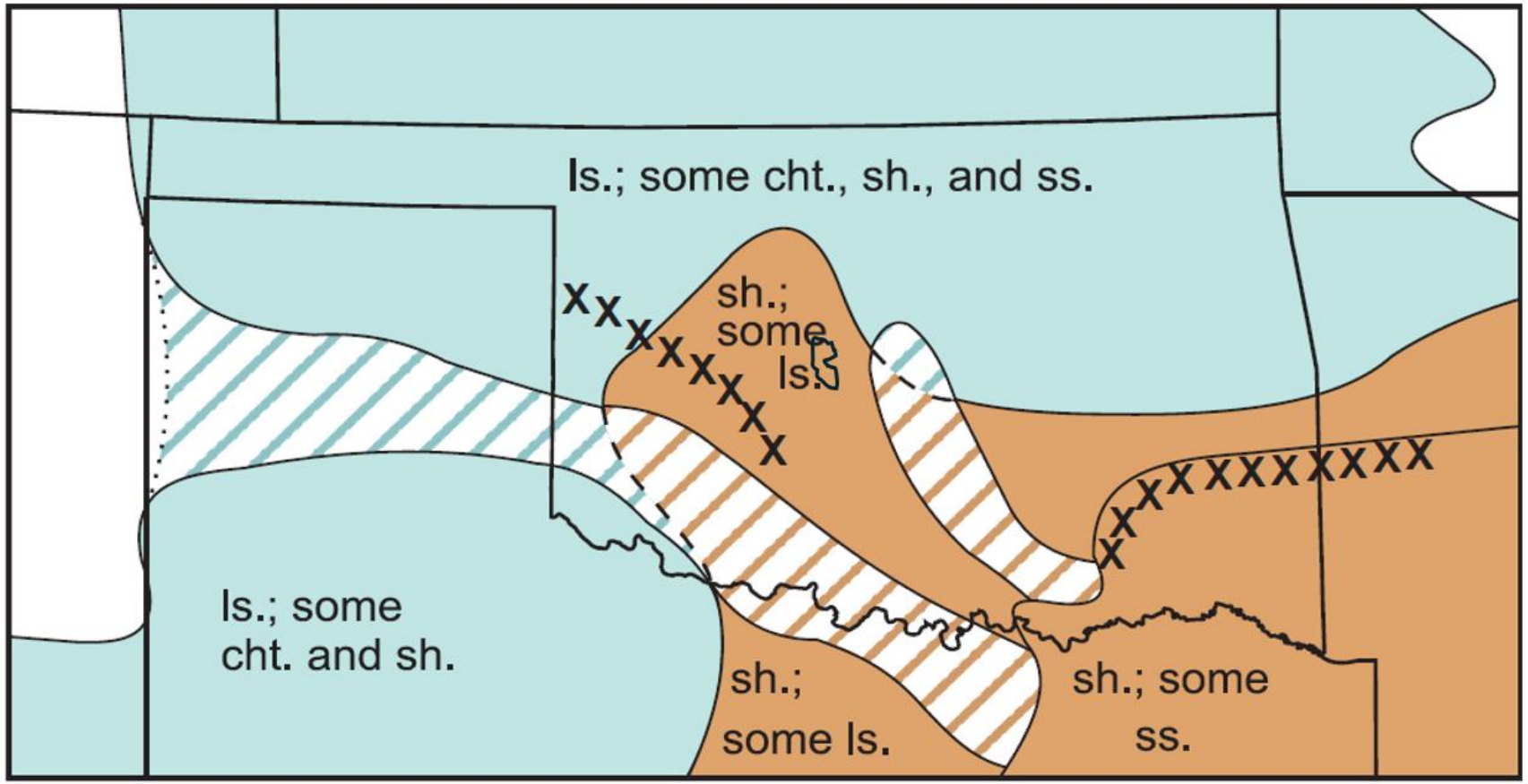
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Mississippian age

EXPLANATION

Principal Rock Types

	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

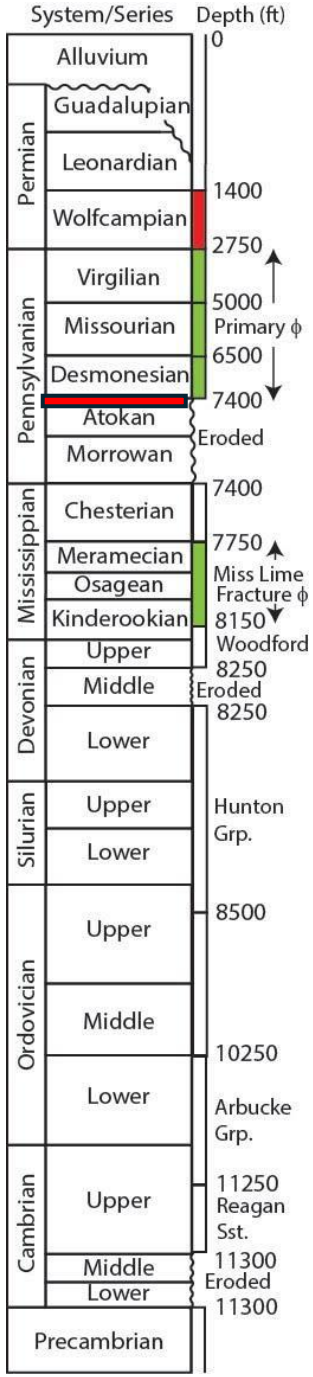
Gypsum (gyp.) Chert (cht.)

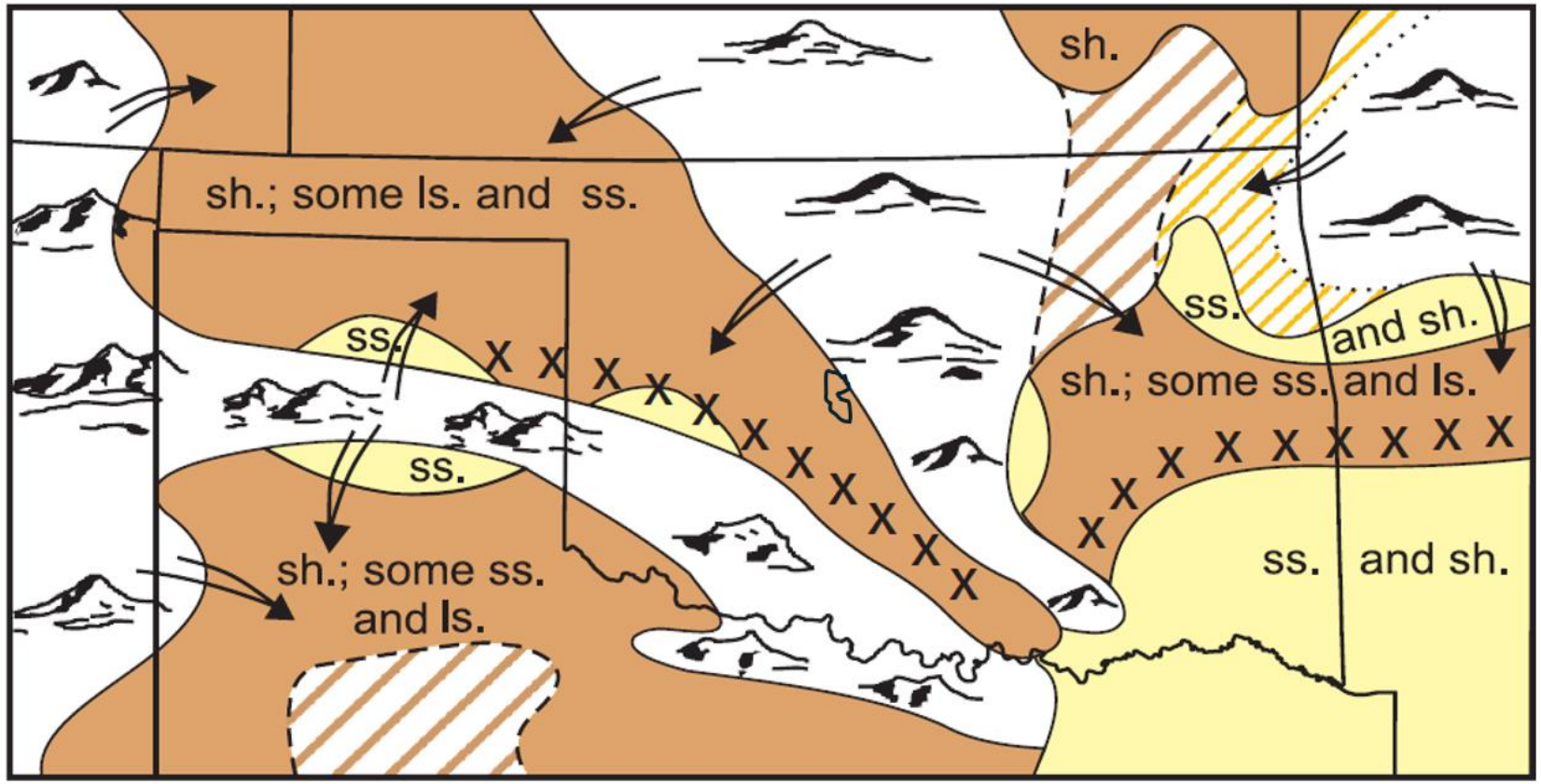
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Early Pennsylvanian (Morrowan and Atokan) age

EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

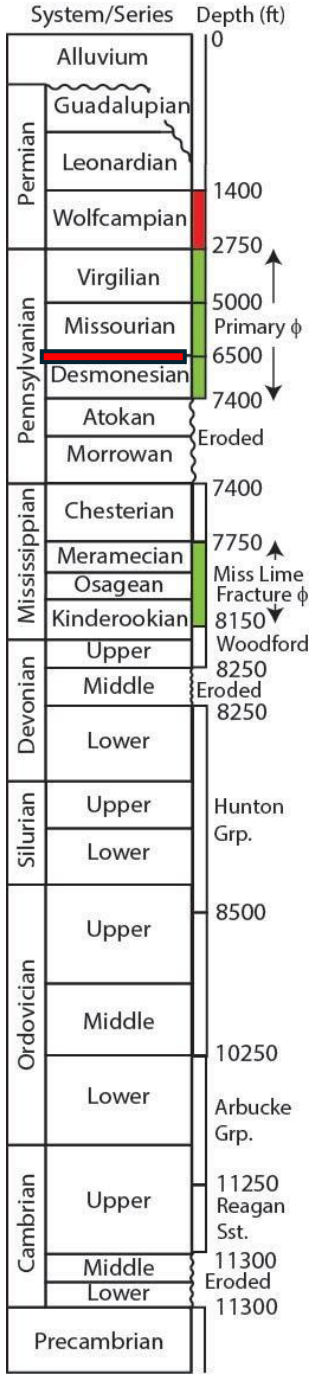
Gypsum (gyp.) Chert (cht.)

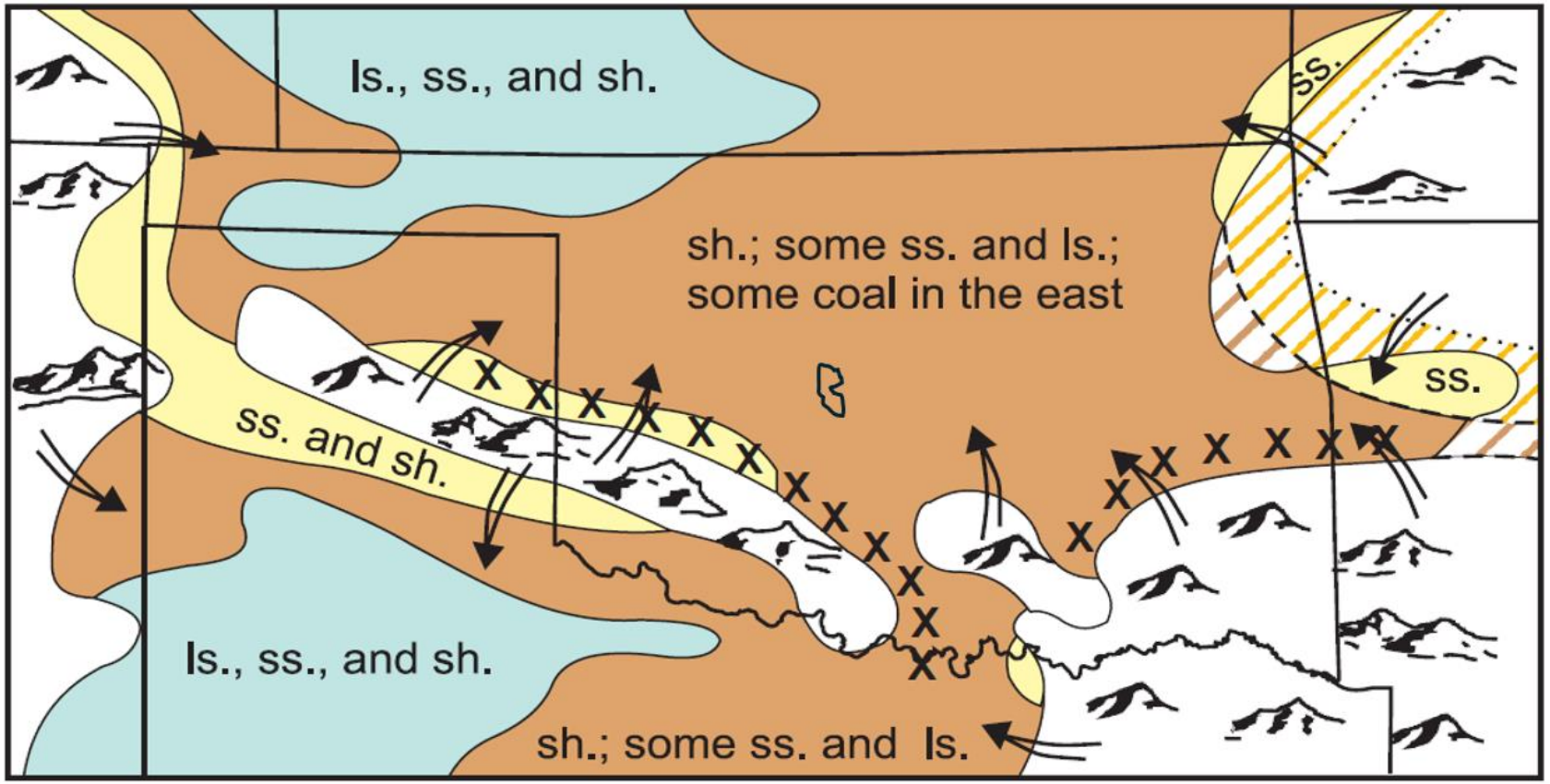
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Middle Pennsylvanian (Desmoinesian) age

EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

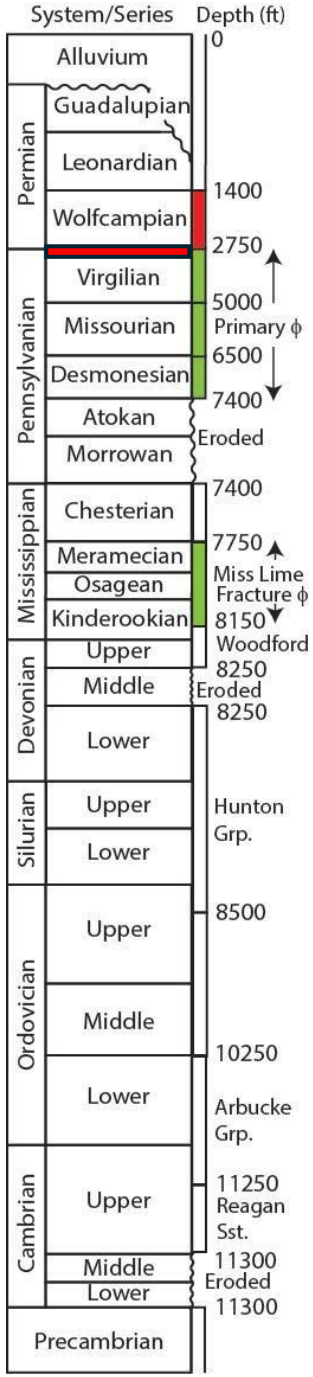
Gypsum (gyp.) Chert (cht.)

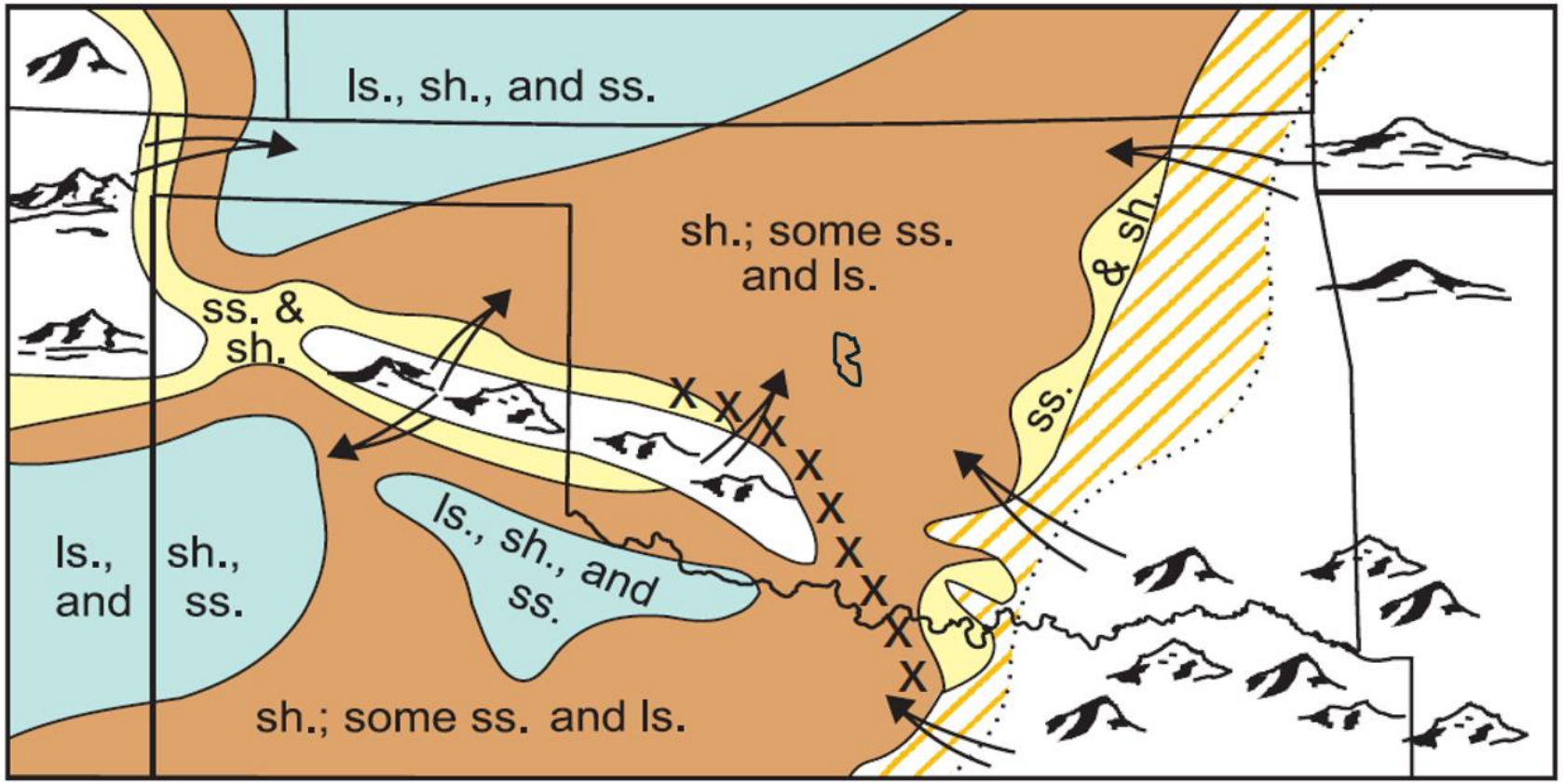
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Late Pennsylvanian (Missouri-an and Virgilian) age

EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

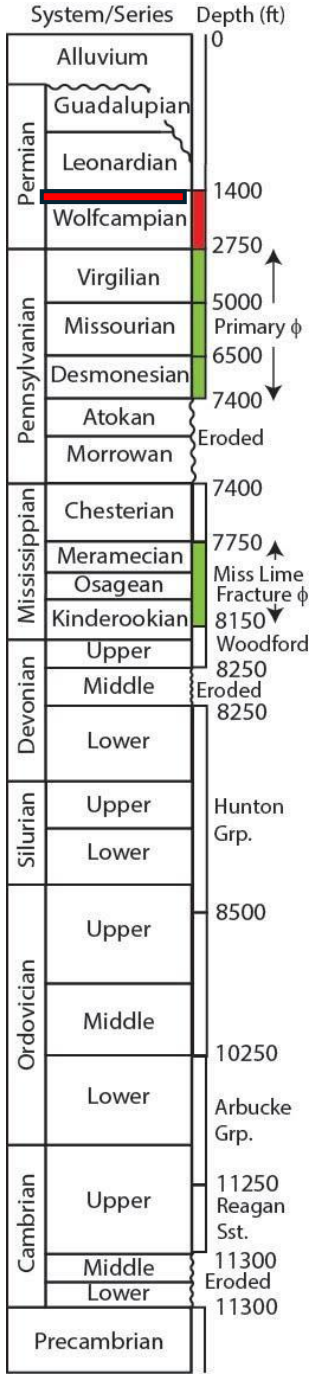
Gypsum (gyp.) Chert (cht.)

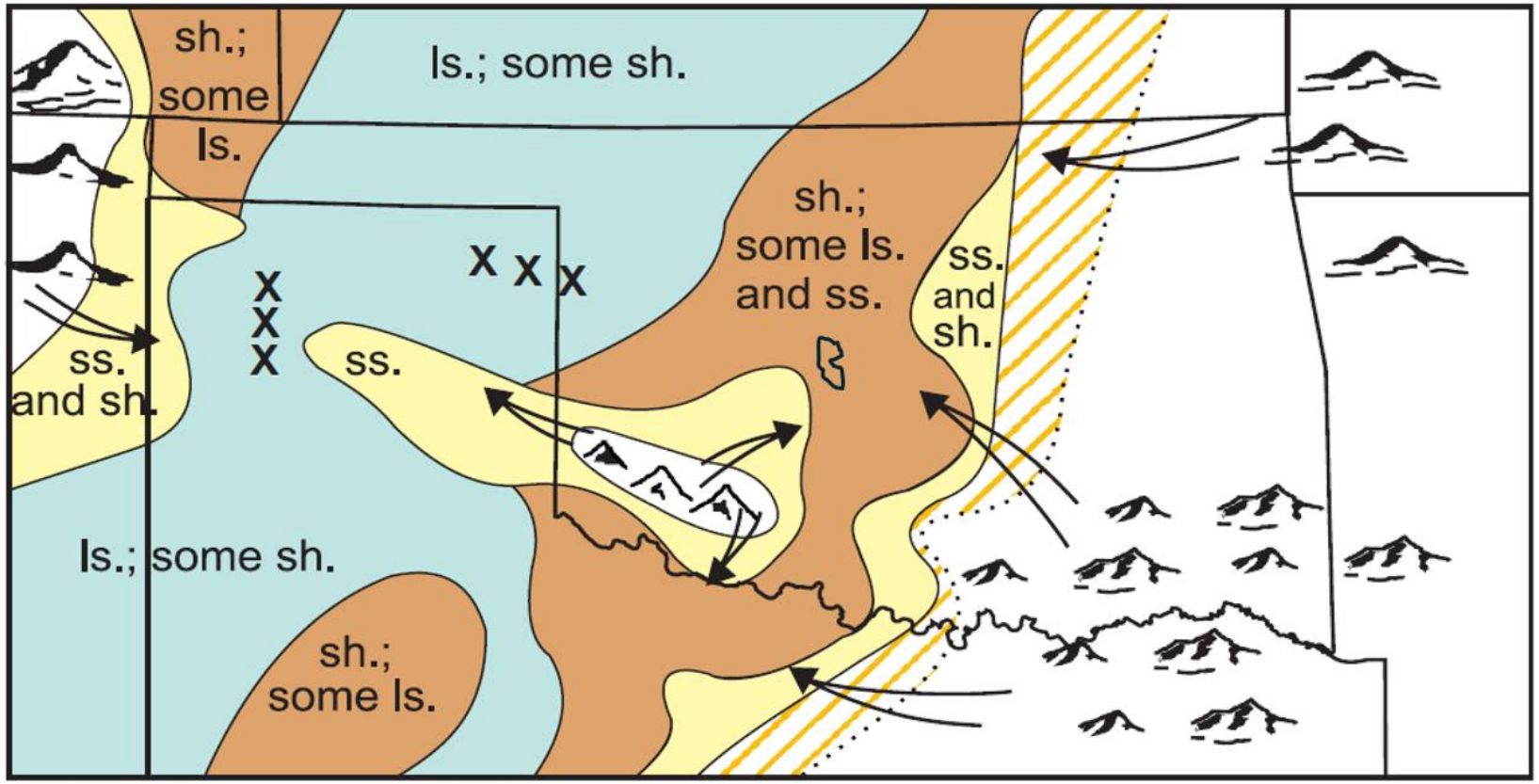
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Early Permian (Wolfcampian) age

EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

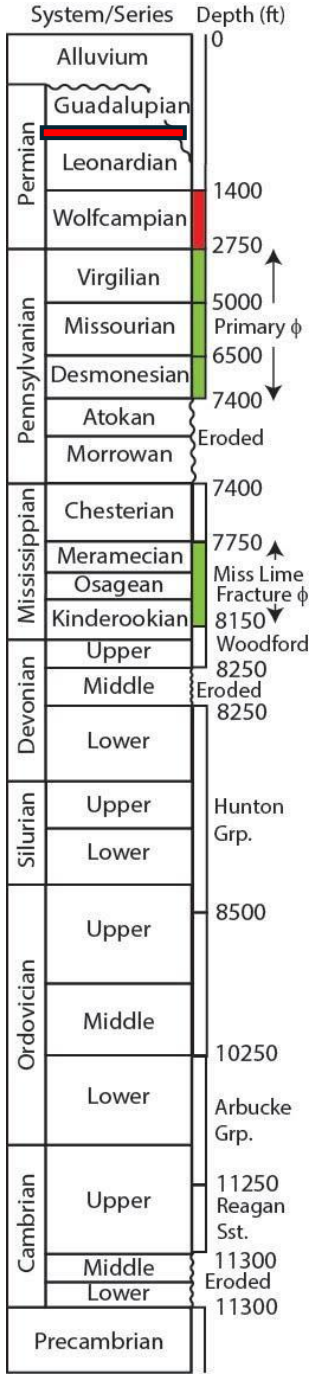
Gypsum (gyp.) Chert (cht.)

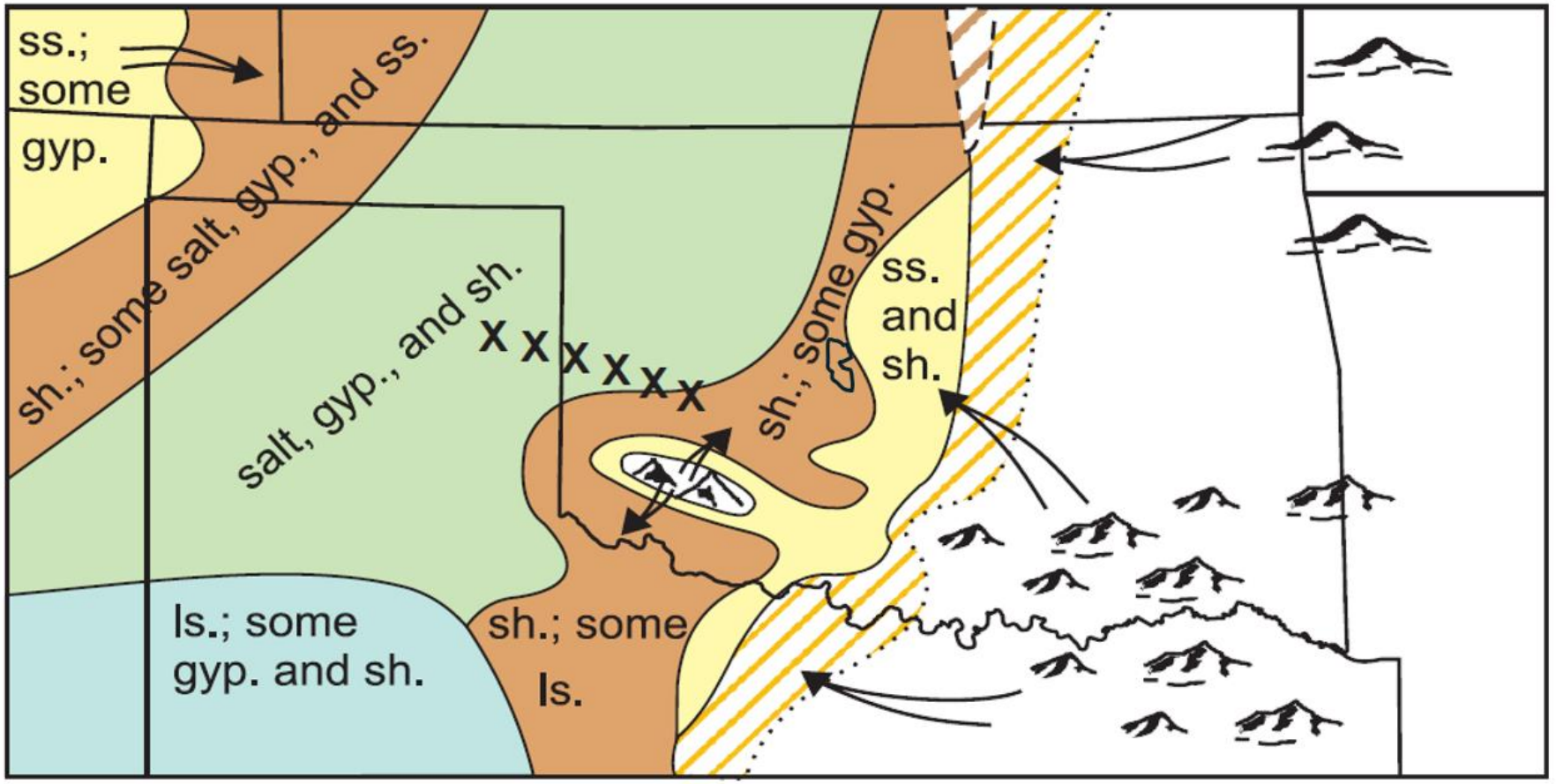
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Early Permian (Leonardian) age

EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

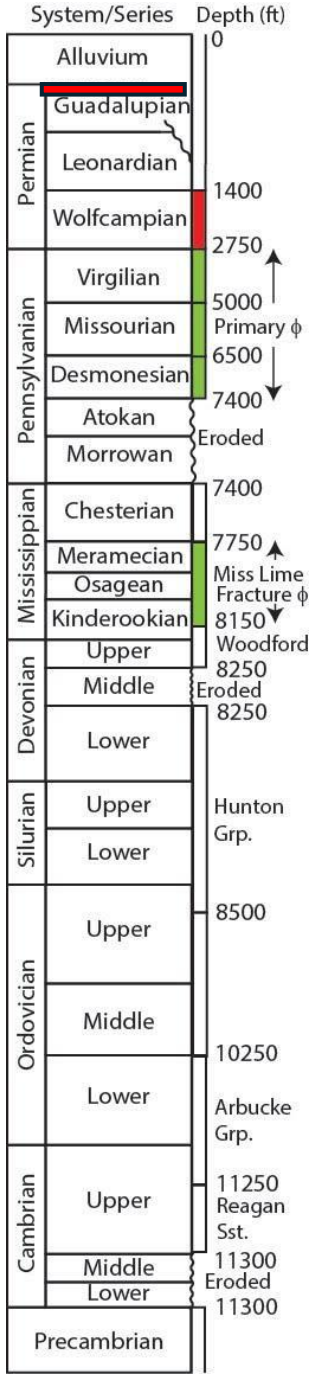
Gypsum (gyp.) Chert (cht.)

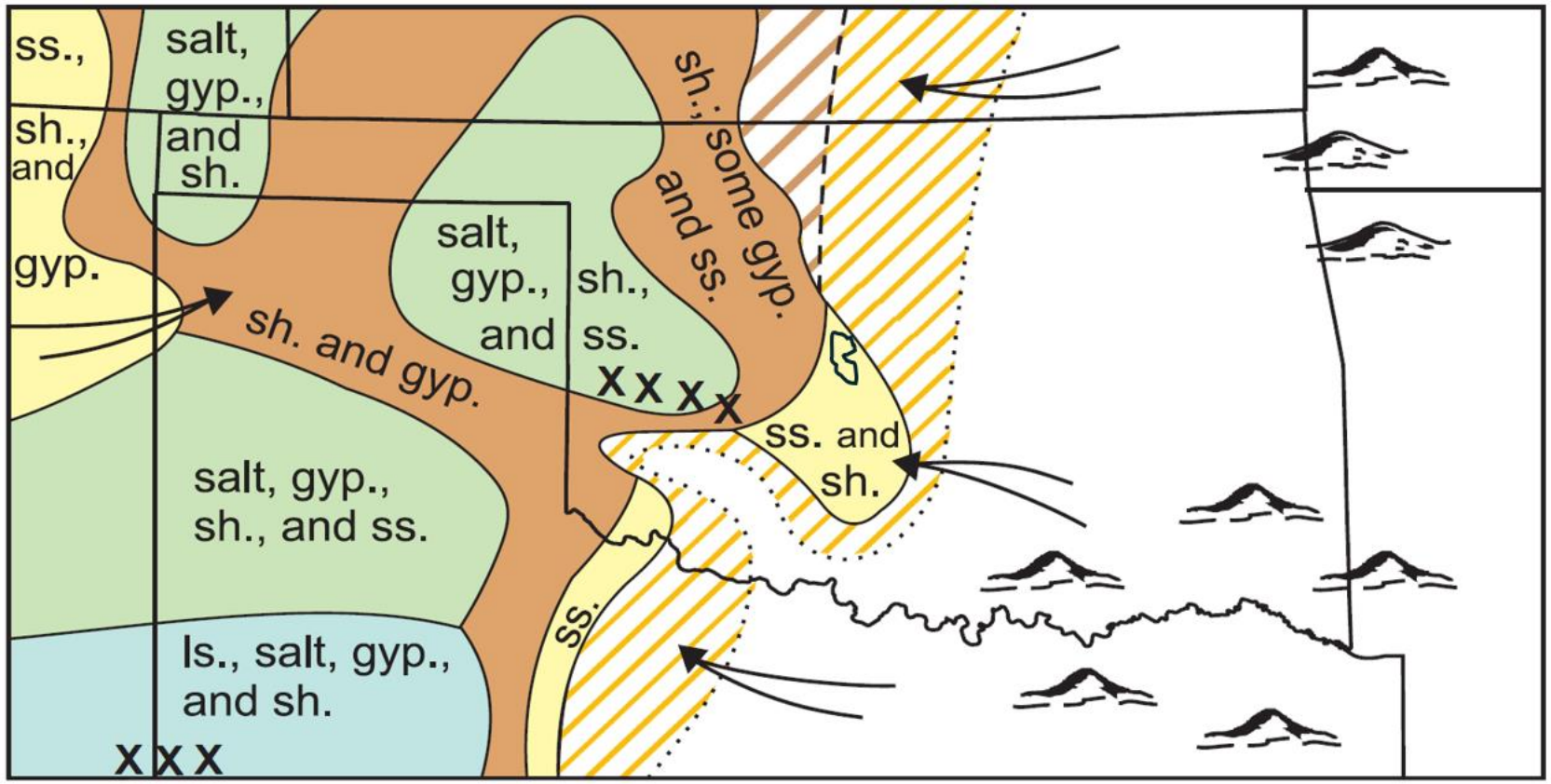
Symbols

- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- XXXXXX Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

Geo





Principal rock types of Late Permian (Guadalupian) age

EXPLANATION

Principal Rock Types	Rocks are present	Rocks now eroded
Limestone (ls.)		
Dolomite (dolo.)		
Sandstone (ss.)		
Shale (sh.)		
Salt		

Other Rock Types

Gypsum (gyp.) Chert (cht.)

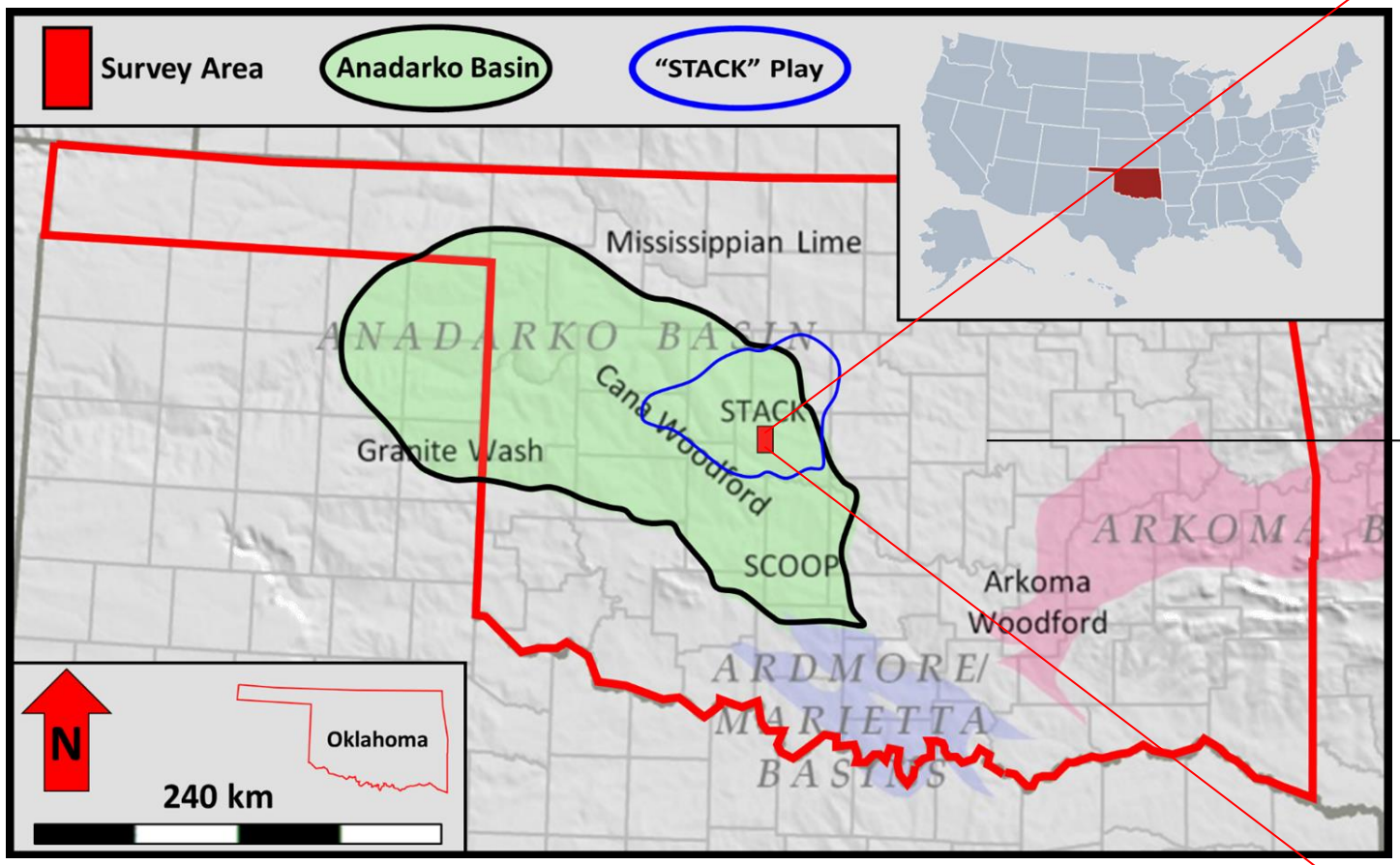
Symbols

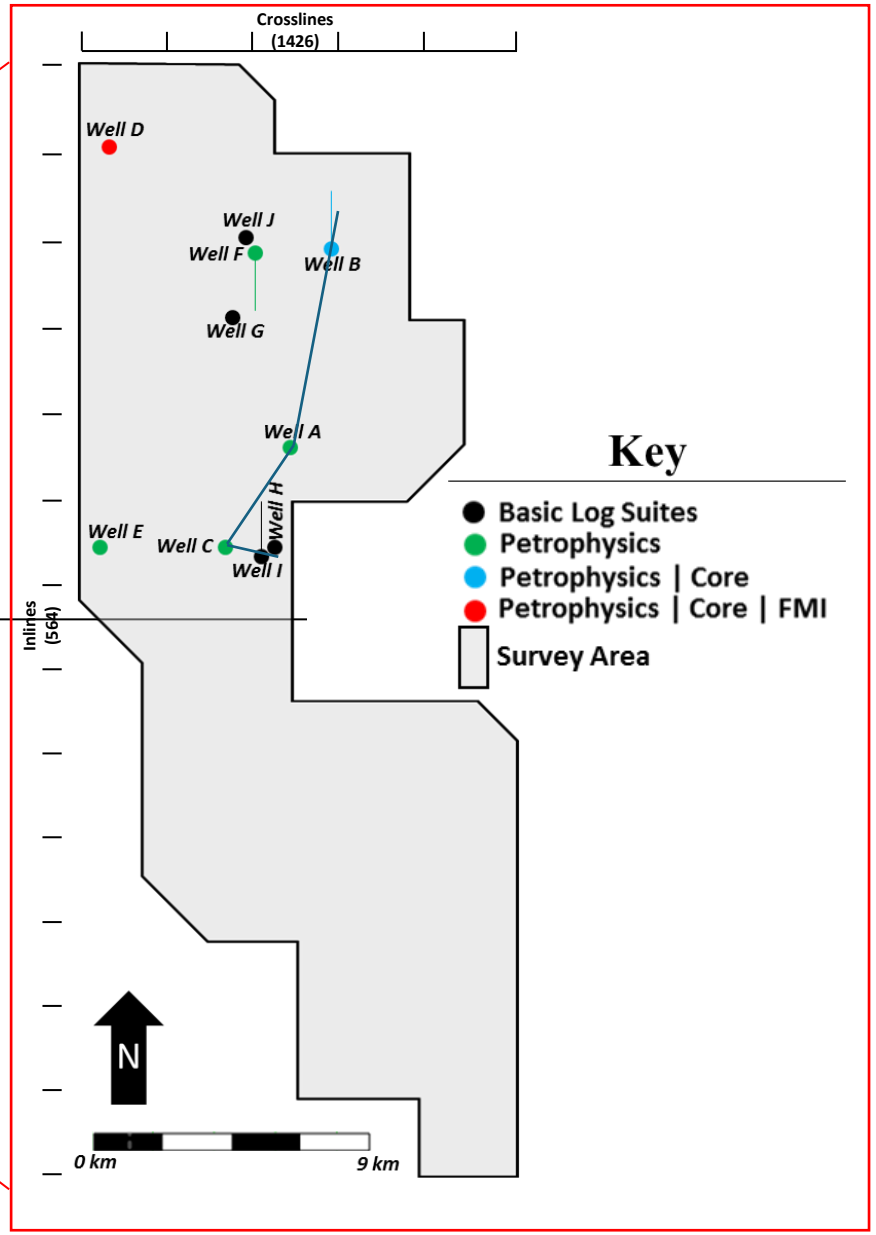
- Line separating areas of different principal rock types (dashed where eroded)
- Possible original extent of depositional area
- xxxxxx Principal axis of sedimentation
- Major mountain area
- Low mountains and hills
- General movement of clastic sediments (sand, gravel, and clay)

Oklahoma Geological Survey
Educational Pub 9: 2008

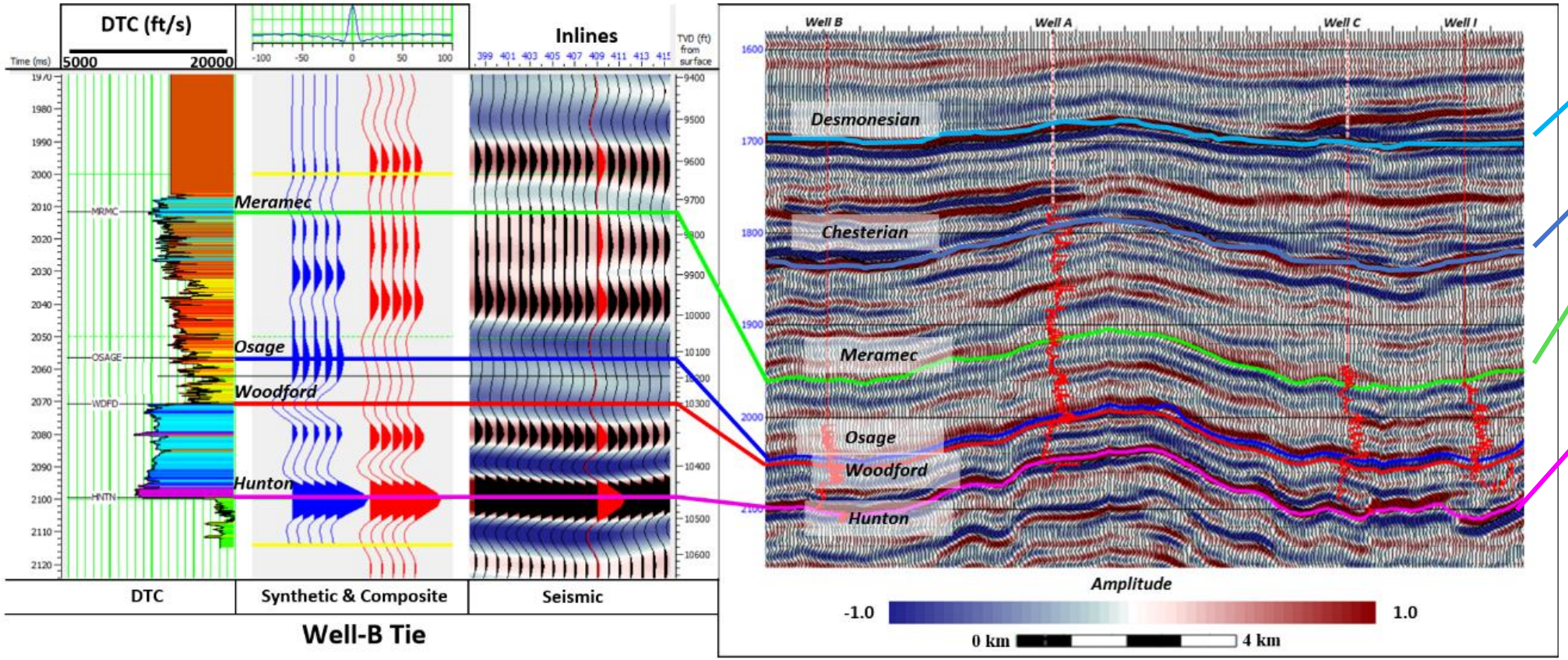
Geo

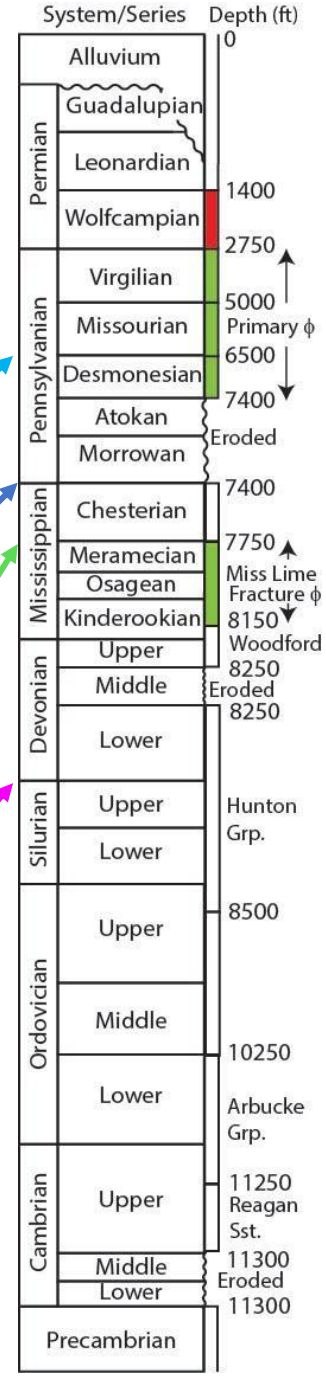
Technical Approach



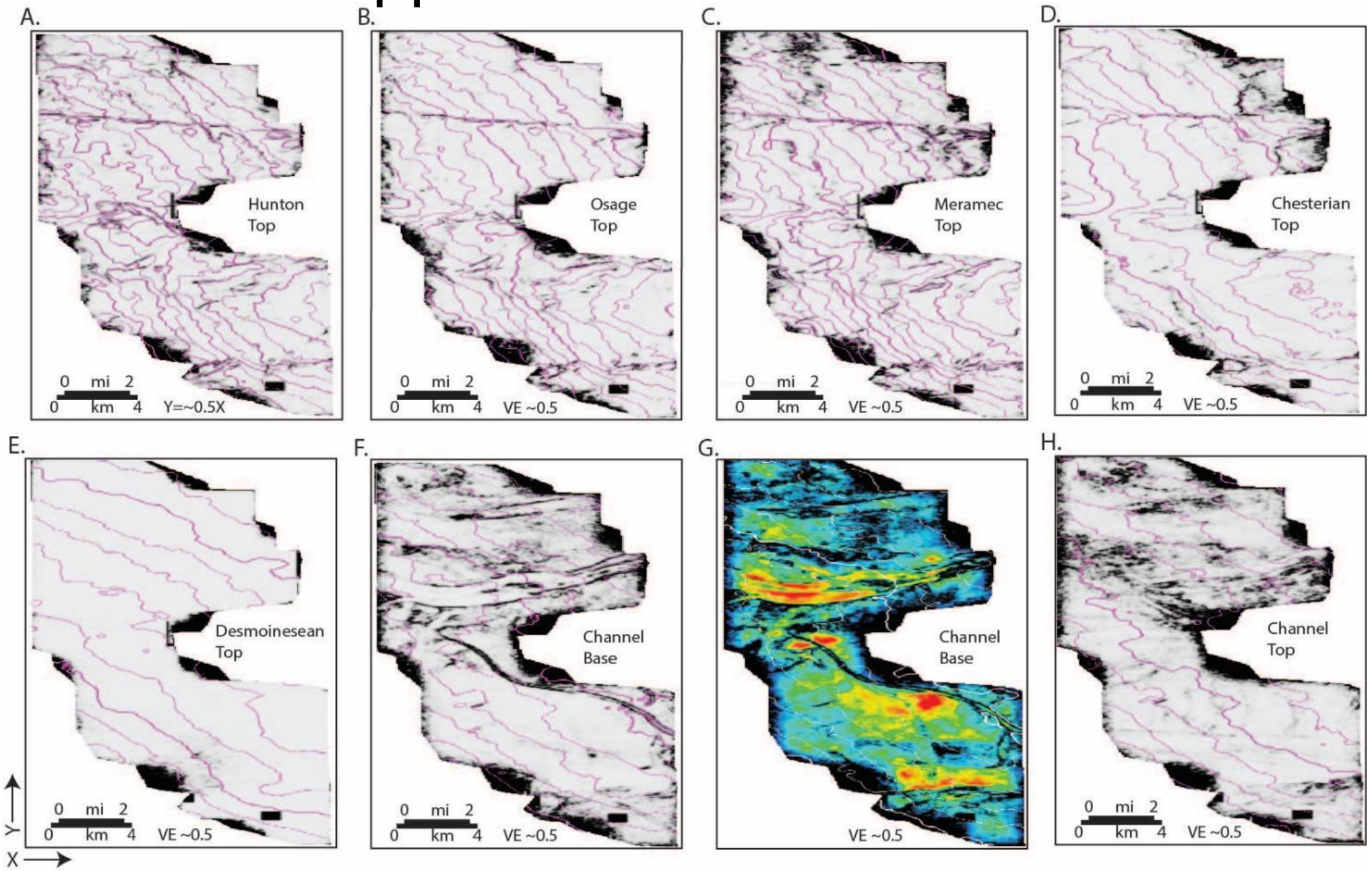


Technical Approach



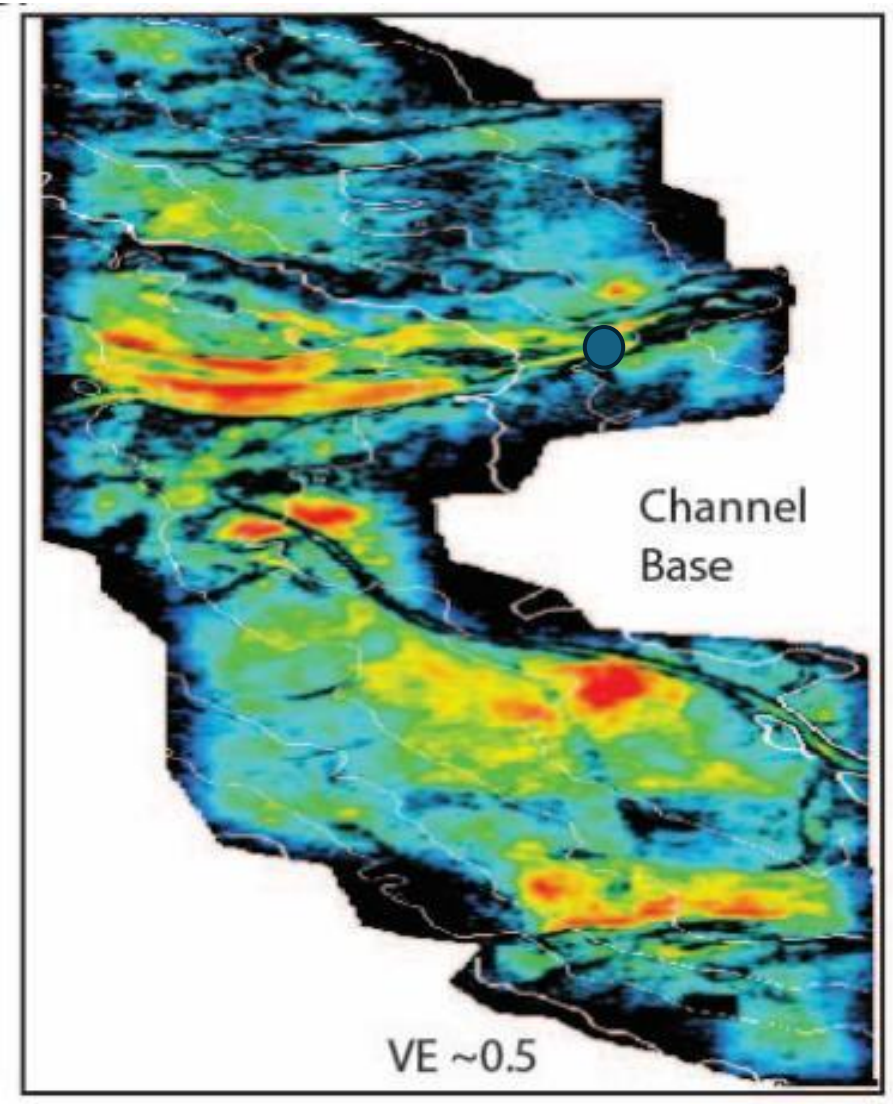


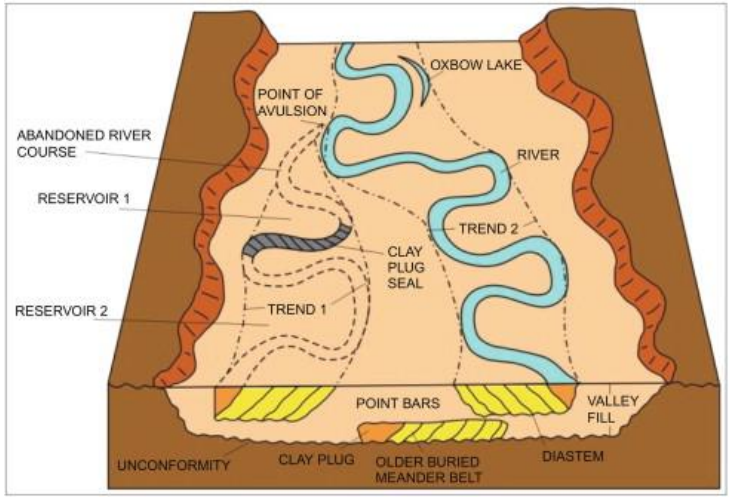
Technical Approach

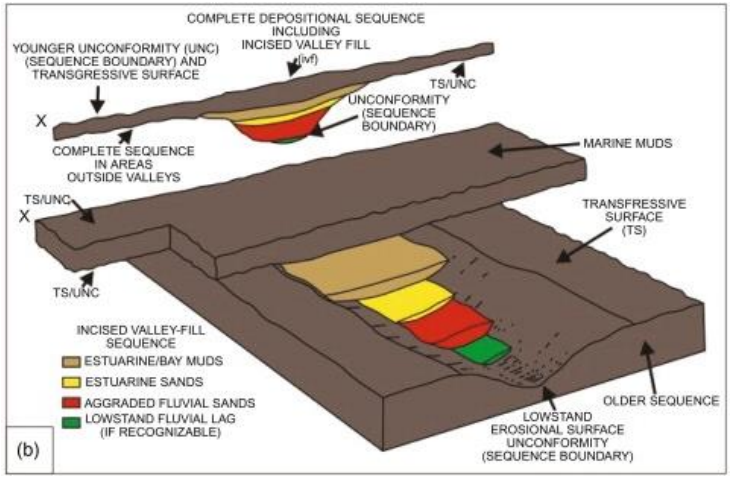


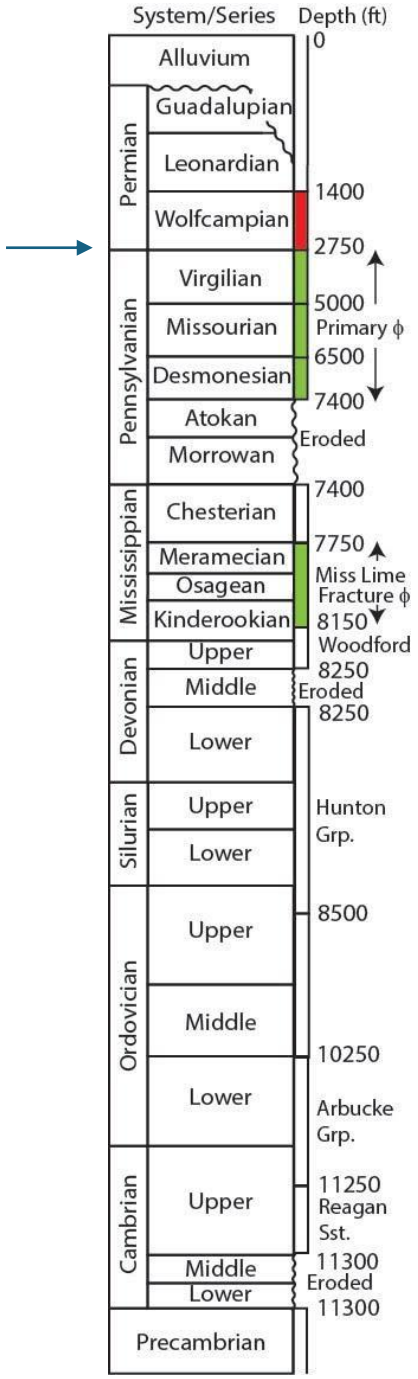
Maps are compressed in the Y direction by a factor of ~0.5

Technical Approach









Current Status (Ranking)

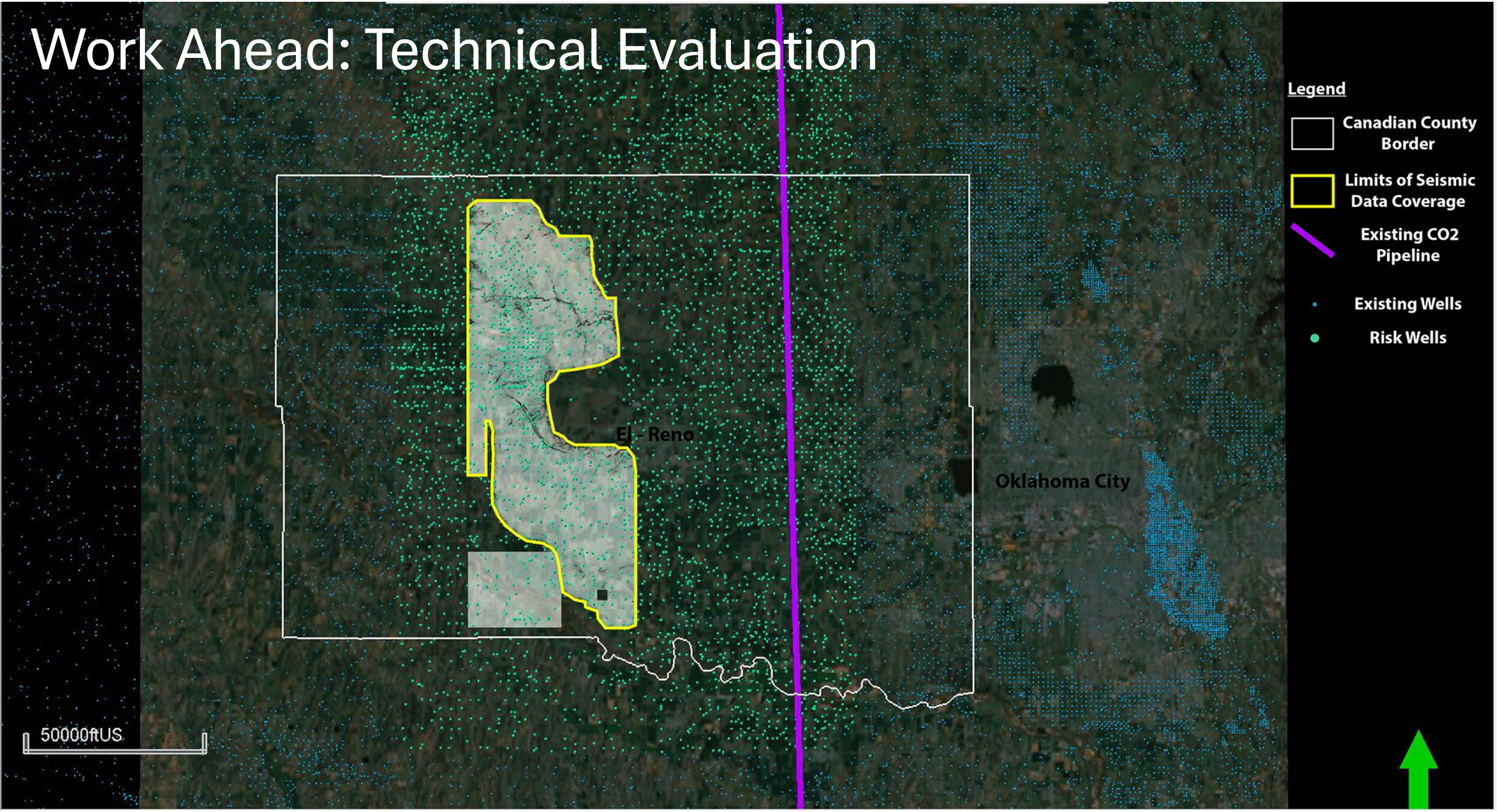
Formation	Porosity	Permeability	Homogeneity	Lat Continuity	Total
Virgilian	4/4 (P)	4/4 (P)	4/4	4/4	16
Missourian	4/4 (P)	4/4 (P)	3/4	3/4	14
Desmoinesian	4/4 (P)	4/4 (P)	2/4	2/4	12
Chesterian	2/4 (S)	2/4 (S)	3/4	2/4	9
Meramecian	2/4 (S)	2/4 (S)	2/4	2/4	8
Devonian	4/4	0/4	3/4	2/4	9
Sillurian	2/4 (S)	2/4 (S)	2/4	2/4	8
~~Ordovician~~	~~2/4 (S)~~	~~2/4 (S)~~	~~2/4~~	~~2/4~~	~~8~~
Cambrian	3/4	3/4	3/4	1/4	10
Precambrian	0/4	1/4	1/4	2/4	4

Injection Expense

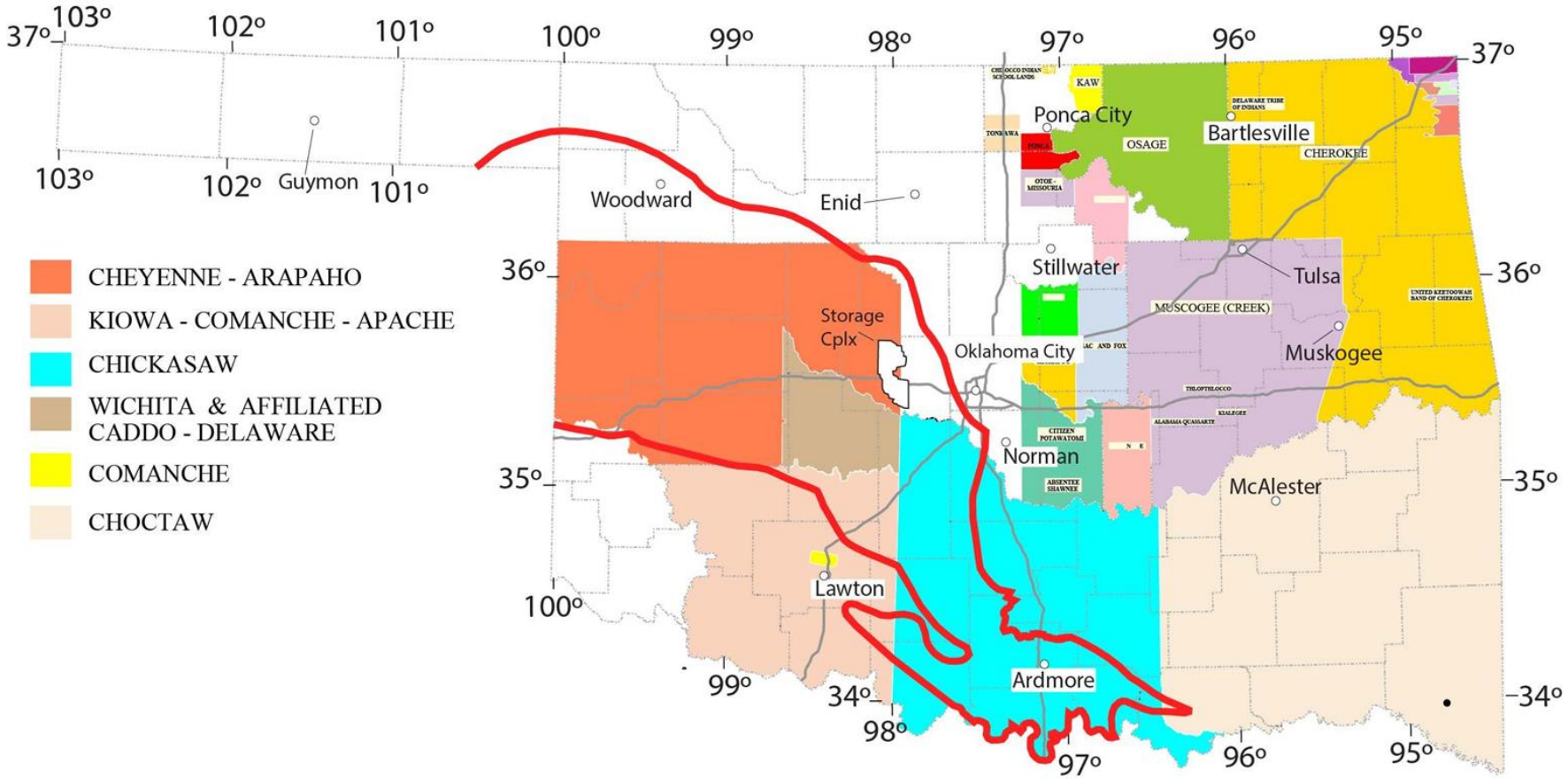
Low

High

Work Ahead: Technical Evaluation



Work Ahead:CBP



Stakeholder Engagement:

- Building trust through outreach, visits and appropriate volunteering
- One-on-one interviews (IRB approved), town hall and listening sessions at regional meetings
- Networking with business accelerators in OKC and Tulsa

Anadarko Basin Carbon Management Hub Task Description	Assigned Resource	Year1/BP1				Year2/BP2			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Subtask 5.2: Site Readiness									
Subtask 5.2.1: Data Quality Methodology									
Subtask 5.2.2: Storage Complex Data Readiness Evaluation									
Subtask 5.3: Socioeconomic Impacts & Workforce Readiness									
Subtask 5.4: Evaluation of El Reno Business Case									
Deliverable: Regional Commercialization Plan									◆
Task 6.0 Technology Transfer	Jaiswal								
Subtask 6.1: Stakeholder Engagement Plan									
Subtask 6.2: Non technical challenges to CCUS deployment									
Subtask 6.3: Business Cases Under New and Existing Tax Policies									
Subtask 6.4: CCUS Educational Series									
Subtask 6.5: Technology Transfer and Knowledge Dissemination									
Task 7.0 Public Engagement and Support	Lim								
Subtask 7.1 Engagement Events									
Subtask 7.2: Creating Analysis Products									
Deliverable: Community Benefit Deliverable Plan						◆			
Subtask 7.3: Collaborating for Analysis and Modeling									
Subtask 7.4: Developing Communications Materials									
Subtask 7.5: Community Communication Creation and Testing									

Organization Chart

Priyank Jaiswal
Lead PI

Task 1: Project Management and Technology Transfer

Rouzbeh Monghaloo
Petroleum Engineering

Task 4: Data Collection and Analysis

Rosemary Avance
Strategic Communication

Task 2: SCI Assessment and Implementation

Camelia Knapp
Geophysics

Task 5: Regional Infrastructure

Jack Pashin
Structural Geology

Task 3: Technical Challenges

Rachel Lim
Consumer Behavior

Task 7: Public Engagement and Support

Abed Hajj Chehadeh

Alisara Ngamlurdwongsakul

Project Success Criteria

- Support DOE by providing deliverables as promised:

Task/ Subtask	Deliverable Title & ID	Due Date
1.2	Project Management Plan (1.2)	Update due 30 days after award; revisions to the PMP submitted as requested by NETL Project Manager
3.4	Risk Inventory (3.4)	30 days after completion of task 3.4
5.1	Techno-Economic Analysis of Infrastructure Buildout Scenarios (5.1.b)	30 days after completion of task Q4 report
5.4	Regional Commercialization Plan (Initial 5.4.a, Final 5.4.b)	30 days after completion of task Q8 report
7.2b	Community Benefit Agreement draft	30 days after completion of task 7.2Q4 report

CO_2 storage site selection: A case study from Oklahoma, US

Participants:

Oklahoma State University (OSU) and University of Oklahoma (OU)

University of Tulsa (TU) and Oklahoma Geological Survey (OGS)

Priyank Jaiswal, PhD
Professor, Boone Pickens School of Geology
Director, Professional Science Masters (PSM) - Geoscience

Oklahoma State University, USA
https://experts.okstate.edu/priyank.jaiswal
Priyank.Jaiswal@okstate.edu