# On the Road to the Roadside Geology of Oklahoma*

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## Abstract

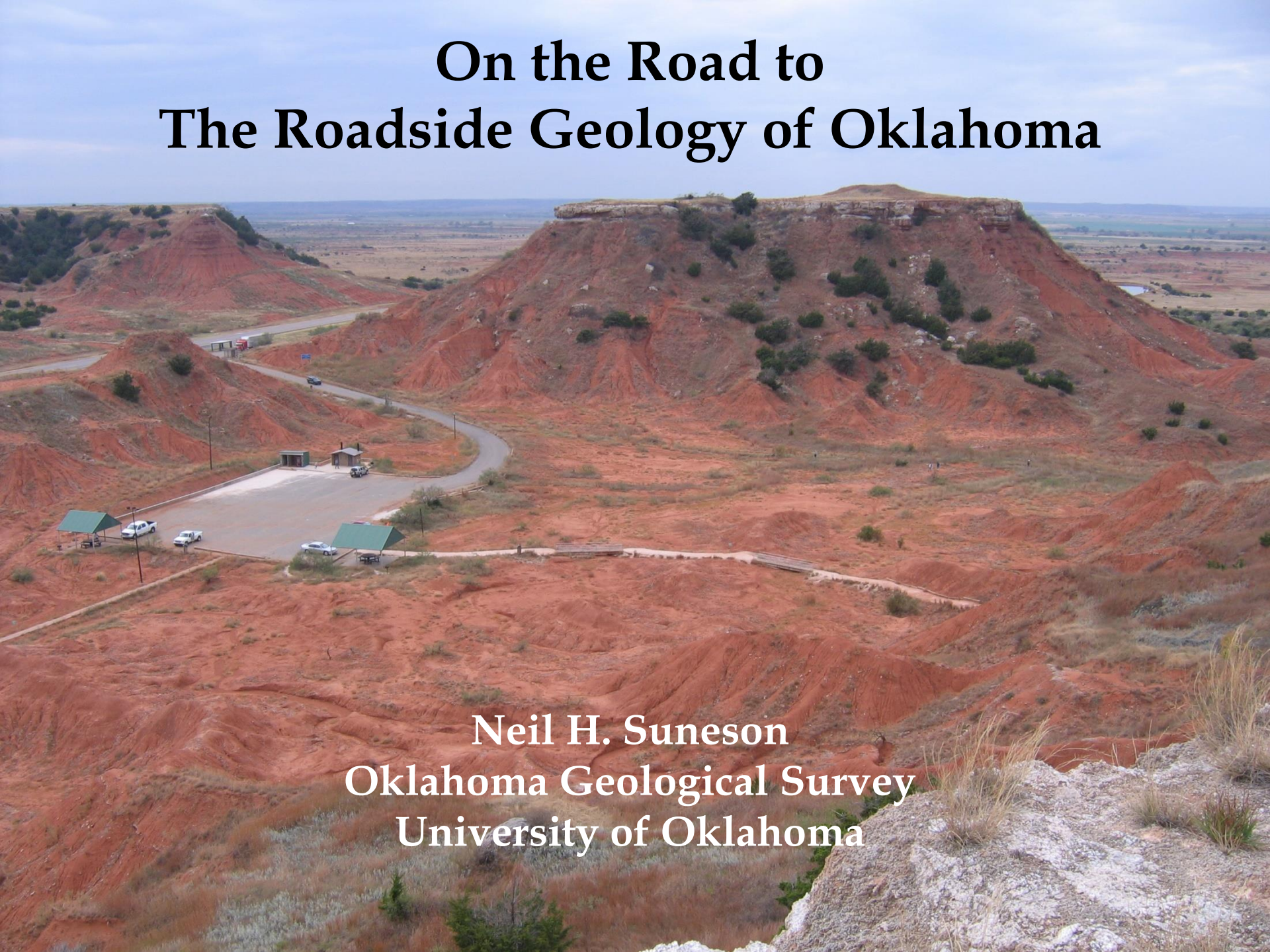
Mountain Press Publishing Company is perhaps best known amongst geologists for its Roadside Geology series. To date, guidebooks for 37 states are available, but Oklahoma isn't one of them. I am working on the Roadside Geology of Oklahoma and plan to publish it in 2019. Like most of the books in the series, the first part will cover some basic geology – geologic time periods, rock types, structures, economic geology, and history. I will summarize the role petroleum has played in the state's development and describe some very fundamental oil and gas geology and drilling and production practices (e.g., pumpjack vs. Christmas tree). The history will include the development of Oklahoma's basins and mountain ranges as well as a description of its marine shelves and shorelines. The story will start with the state's attempt to split apart in the Cambrian and end with its Pleistocene rivers and dune fields. Everything will be geared to the layman interested in what they see as they drive across the state.

The book will describe the geology along about 3900 miles of Oklahoma's major highways and will consist of four major parts – the Eastern Mountains and Hill Country, the Arbuckle and Wichita Mountains, the Red Bed Plains and Sandstone Hills, and the High Plains. Some smaller parts will include more detailed geology of the Mesozoic near Kenton, the Wichita Mountains Wildlife Refuge, the Arbuckles along I-35, and the Oklahoma City and Tulsa metro areas.

The highway logs will also include "blurbs" or "asides" describing unique (or almost unique) features of Oklahoma's geology or human interactions with it. Some examples are: Claremore's radium baths, the Ames impact structure, hourglass selenite crystals at Great Salt Plains, the Miami-Picher lead-zinc district, the Midco insect beds, the Wichita Mountains "gold" rush, coal

miners' union activity in McAlester, state parks, Bartlesville and Phillips Petroleum, Optima Dam and its non-reservoir, the Oklahoma – Texas non-border along part of the Red River, and of course, dinosaurs in the Morrison and Antlers formations. Researching and writing the "blurbs" has been a tremendous amount of fun and how many of the nearly 70 I am planning Mountain Press will allow me to include in the book is anyone's guess.

# On the Road to
# The Roadside Geology of Oklahoma



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ROADSIDE GEOLOGY

# MOUNTAIN PRESS PUBLISHING CO., MISSOULA, MONTANA

- To date, 37 states completed, inc. TX, NM, CO, MO. KS did their own.
- Contract signed April 2014. First draft due April 2017. Obviously late, but MP OK with that.
- Plan – first draft to be submitted April 2018. 6-9 months for review; 3 months rewrite; resubmit, print, on shelves 2019.

**Three fundamental parts to book (and all Roadside Geology books):**

1. **Introduction to geology and Oklahoma's geology**
2. **The road logs**
3. **"Blurbs"**

- Introduction to OK's Geology
  - OK's Rocks, Minerals, and Fossils
  - OK's Landscape
  - Geologic Provinces
  - The Surface Geology of OK
  - The Geologic History of OK
    - The Basement
    - Cambrian Igneous Activity of the Wichitas
    - Early and Middle Pz "Stability"
    - Pennsylvanian Mountain-Building
    - Permian Quiescence and Erosion
    - Triassic and Jurassic – the Missing Pieces
    - Cretaceous Seaway and Proto-GOM
    - Tertiary Erosion and Deposition – Effects of the Rocky Mountains
    - Quaternary – the Great Rivers
  - Oil Brought Oklahoma to the Dance
  - Water – Critical for Oklahoma's Future

# The Road Logs (based on physiographic provinces)

A Continental Collision – the E$^{n}$ Mtns and Hill Country

- Ozark Plateau
- Arkoma Basin
- Ouachita Mountains
- Eastern Gulf Coastal Plain
- Road Guides (10 of them)

A Failed Break-Up – the Arbuckle and Wichita Mtns

- Arbuckle Uplift
- Ardmore Basin
- Wichita Uplift
- Marietta Basin
- Hollis Basin
- Western Gulf Coastal Plain
- Road Guides (6 of them)

The High Plains

- The Ogallala Formation
- Dry Cimarron Valley
- Road Guides (2 of them)

The Red Bed Plains and Sandstone Hills

- Anadarko Basin
- Anadarko Shelf
- Cherokee Platform
- Road Guides (12 of them)

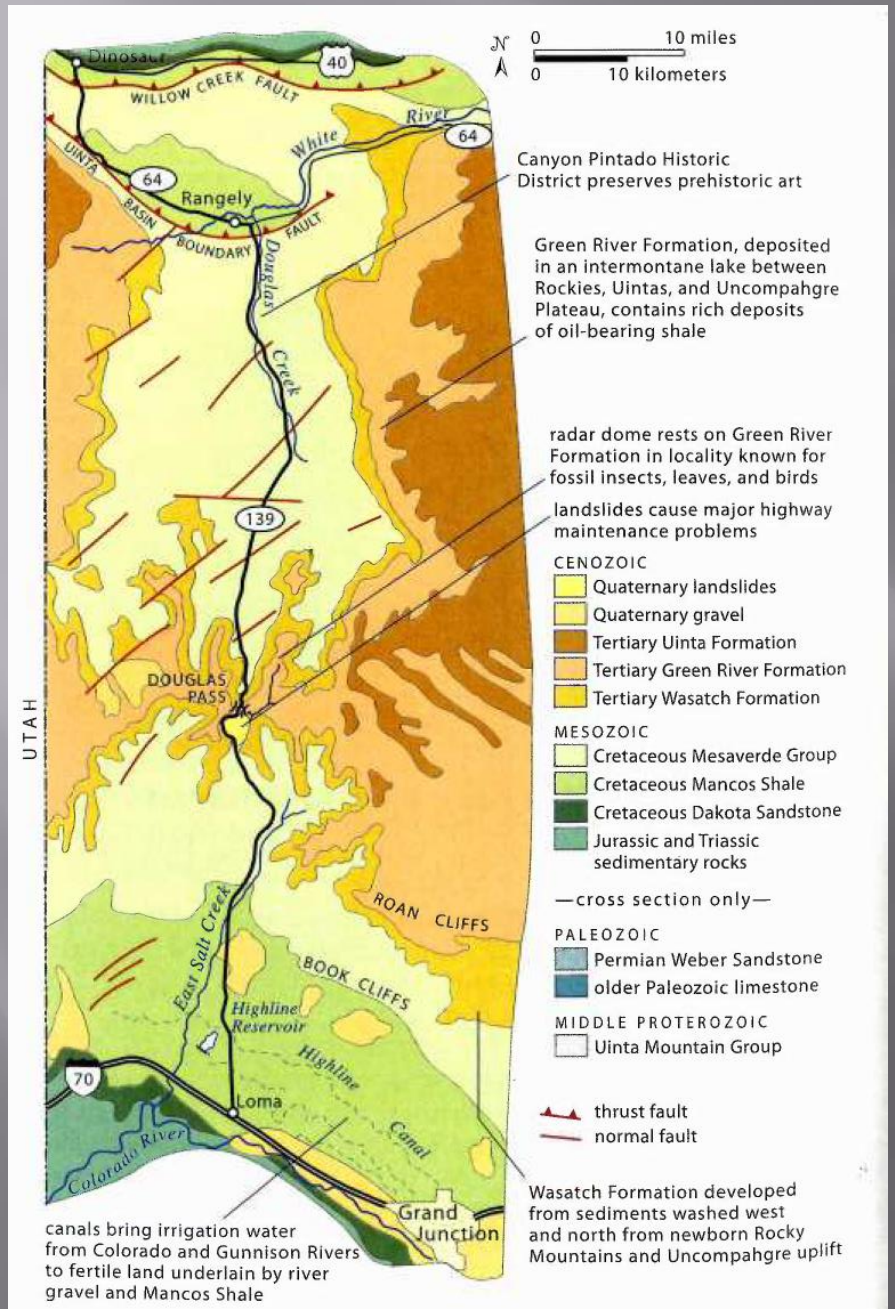
Key to road logs – ~50 geologic strip maps

# Production of Geologic Strip Maps

**Problem: No geologic map of OK exists at appropriate scale, reliability, and availability (e format).**
**Solution: 50 new ones had to be made.**

## RELIABILITY / ACCURACY

1. **OGS 1:24,000 quadrangle maps**
2. **OGS 1:100,000 quadrangle maps**
3. **OGS county maps**
4. **Some USGS maps, esp. coal resources**
5. **OGS/USGS 1:250,000 hydrologic atlas maps**
6. **Others (e.g., thesis maps)**




*Geology along Colorado 64 and Colorado 139 between Dinosaur and Loma.*

## Guidelines on maps

**Blurbs**
**Highways**
**Cities, Towns**
**Hydrography**
**Geomorphic Features**

**Stratigraphic Column**

**Note – some RGOK columns have 20 units. To lump? How to color? Maybe label?**

Interstates and turnpikes, major US 1
Statewide coverage
"Fun" roads (The Mother Road)
State Parks, inc. Black Mesa area, Arbuckles along I-35, Wichitas
Metro areas


Approx. 2600 miles total


2. Strip maps. To accommodate Mtn. Press format, maps should be ~3:1 to 4:1.

Colors - red are E-W, yellow N-S, blue something else. Metro area and "high-res" (e.g., I-35 thru Arbuckles) not shown.

# 3. COMPOSITE GEOLOGIC MAP – 1:24Ks and 1:100Ks >COUNTY MAPS >HAs.

## 4. NHS addresses:

**Border faults**

**Unnecessary or incorrect geology**

**Scale/detail Smoothing**

**Also, updated geology (e.g., Stillwater Fm.)**


Combine Simpson Group formations
Combine Hunton, Woodford, Caney
Ignore areas of thin Qa
Ignore tiny outliers
Do not do areas un-touched by highways
Deal with border areas

**Remaining steps:**

1. **Scan modified geologic strip map w/ highways, hydrography.**

2. **Add towns, names of features, "factoids." Correct minor errors, label geologic units (defines shapefiles), establish strat column.**

3. **Review finished (electronic) strip map that is modelled on RG maps.**

# Blurbs

**State Parks**

Alabaster Caverns, Black Mesa, Boiling Springs, Quartz Mtn., Natural Falls, Lake Murray, Red Rock Canyon, Beavers Bend, more

**Oil and Gas**

Ames impact structure, Burbank field and Red Eagle Ls, Cement, Gypsy Ss, Hugoton, Keyes He, OKC field, Osage and Reign of Terror, more

**Minerals**

Cargill solar salt, Granite OK, industrial minerals, Paoli silver, redbed copper, hourglass gypsum, rose rocks, coal mine reclamation, Picher, more

**Fossils**

in Arbuckle Mtns, vertebrates in Ogallala, Permian verts at Richards Spur, Midco insect beds, dinosaurs (of course), more

## Blurbs – continued

**Water**

Central OK aquifer, playa lake basins, Ogallala aquifer, historic salt springs, historic radium baths, more

**History**

oil fields, Indian Meridian and initial point, OK – TX "non"-boundary and Red River, prehistoric chert quarries, geophysics at Spiro Mounds, Frankoma pottery, more

## Next – some example road logs

# Kenton to Vinita via OK 325, US 64, US 60

Boise City to Guymon. Flat? Looks flat, but 1000 ft drop in elevation.

Keyes Helium Plant.
Helium???
Hugoton Field. Huge.
Playa lake basins – recharge of Ogallala Aquifer

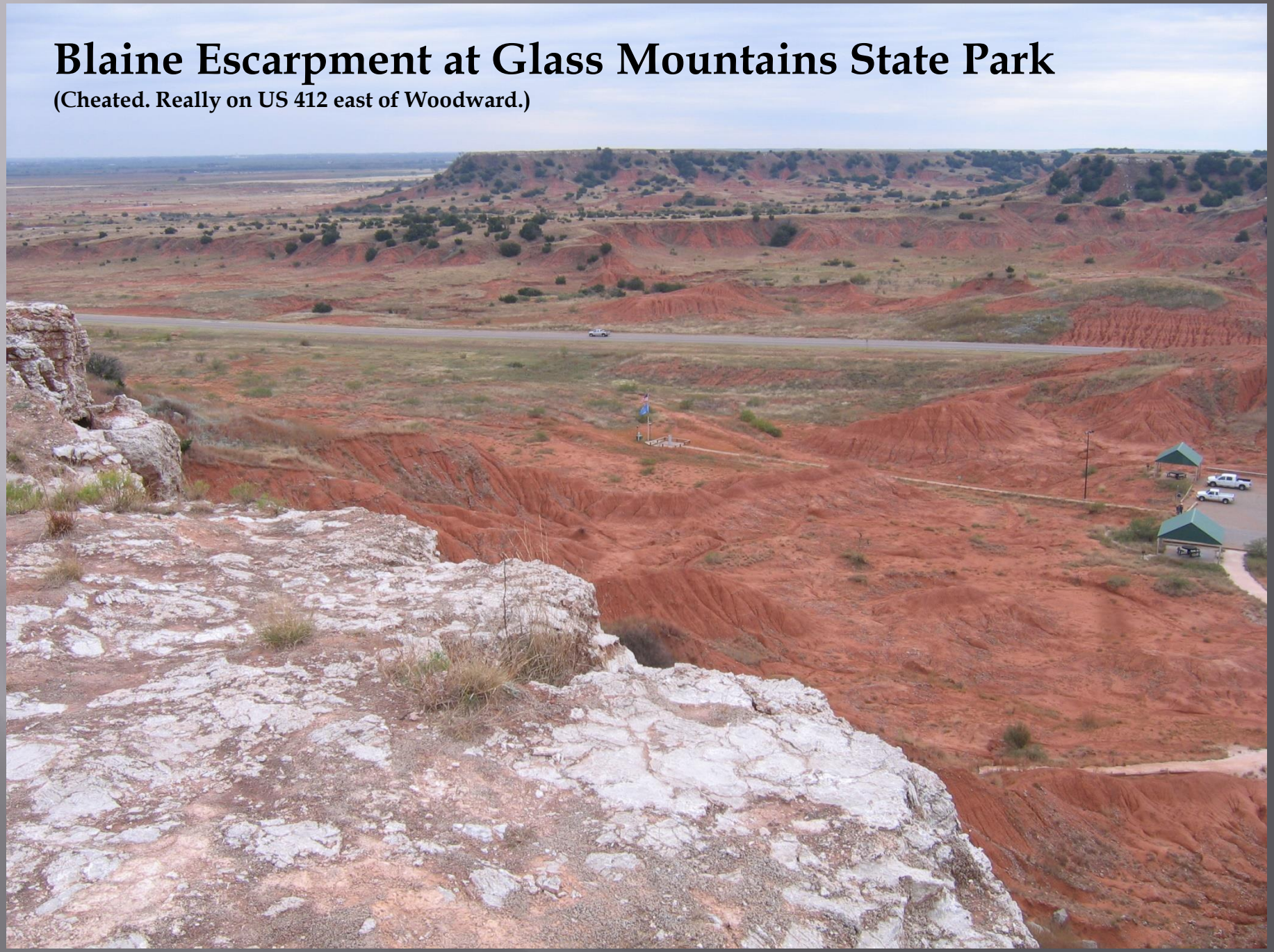

Yellowstone Ash (Lava Creek B) just north of Gate. 600,000 years old. Mined in the past for silica to be used as abrasive.

# Cargill's Solar Salt Production Plant near Freedom along Cimarron River

Pumps brine from salt in Permian Flowerpot Shale onto Cimarron River floodplain. Sun evaporates water, front-end loader scoops up salt.

# Blaine Escarpment at Glass Mountains State Park

**(Cheated. Really on US 412 east of Woodward.)**



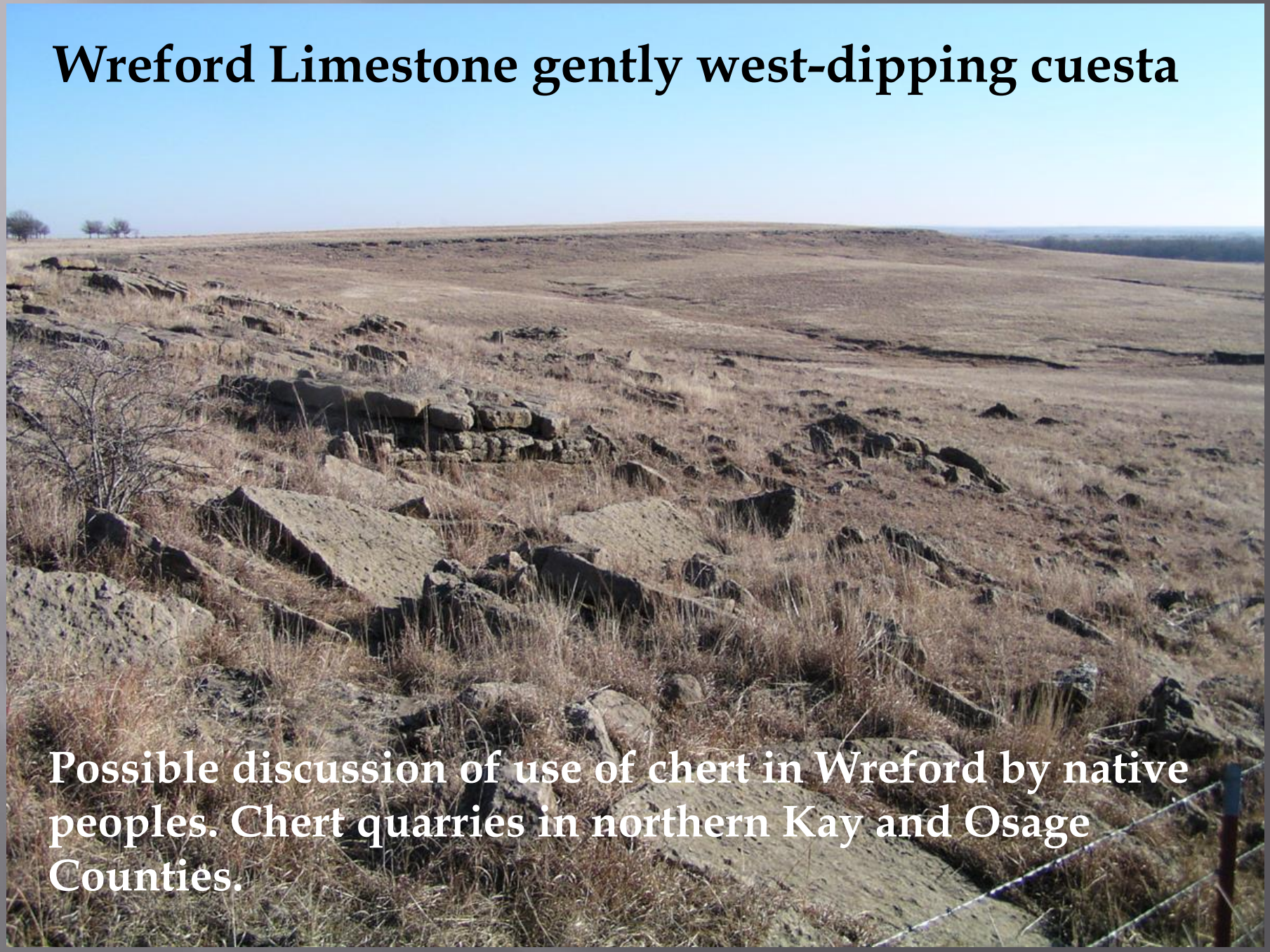
**The challenge – what do you say about the (flat) countryside along US 64/60 between Alva and Ponca City?**

- **Hourglass selenite crystal collecting at Great Salt Plains?**
- **Recent earthquakes near Medford?**
- **Recent production from Mississippian?**
- **Sand dune fields on north side of Salt Fork Arkansas River?**

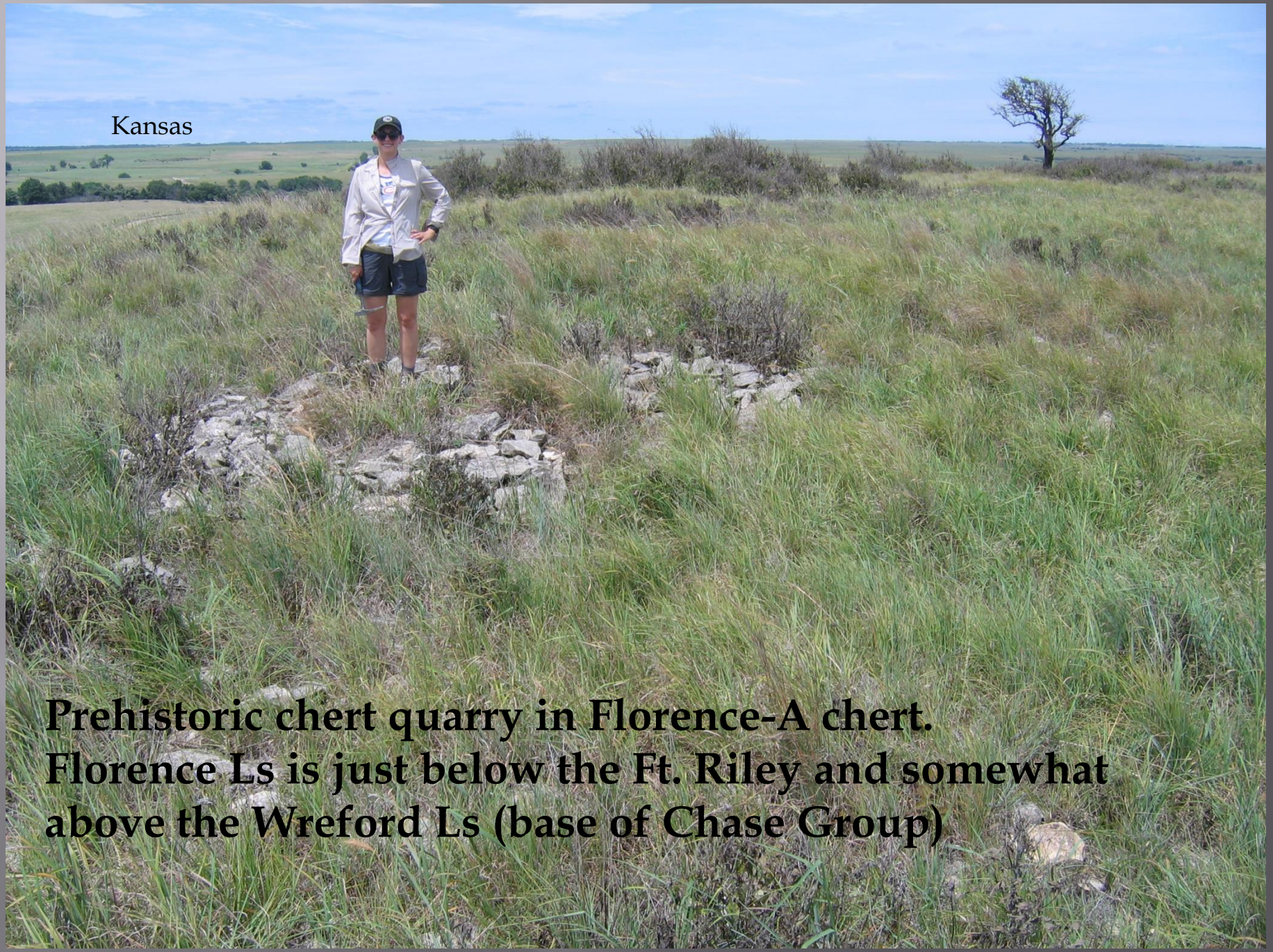
**But note – easier than along parallel US 412 between Fairview and Tulsa! Outcrops grassed over by ODOT along Cimarron Turnpike.**

# Ponca City and Conoco
# E.W. Marland, discovery of Ponca City Field, and Marland Oil Company

# Wreford Limestone gently west-dipping cuesta

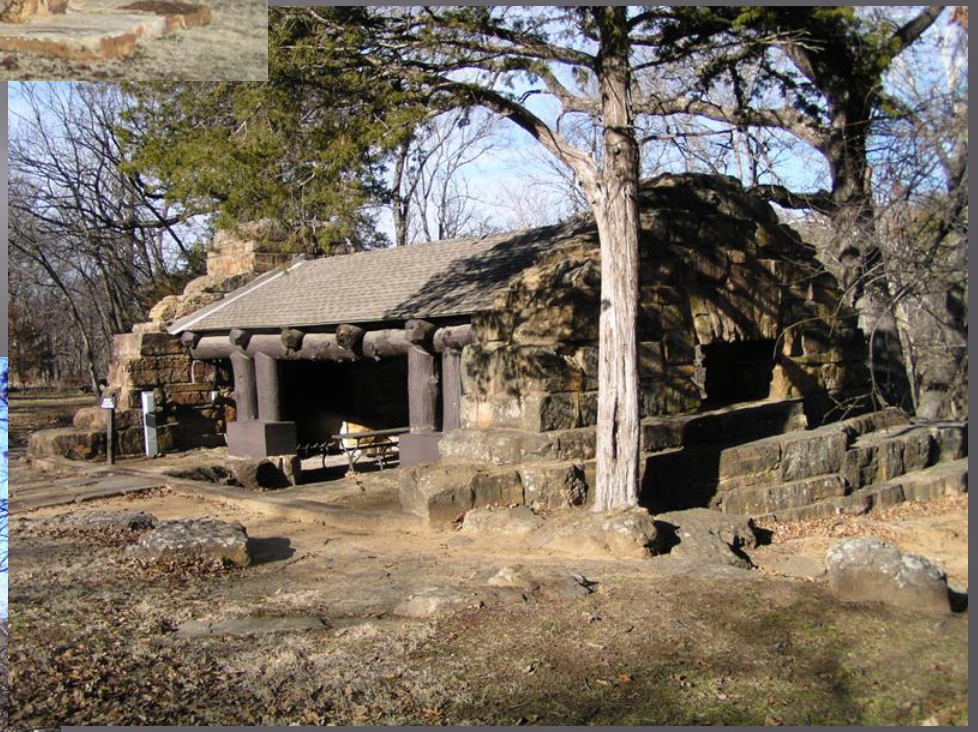


Possible discussion of use of chert in Wreford by native peoples. Chert quarries in northern Kay and Osage Counties.




**Prehistoric chert quarry in Florence-A chert. Florence Ls is just below the Ft. Riley and somewhat above the Wreford Ls (base of Chase Group)**


Quarry in Red Eagle Limestone just east of Burbank. Red Eagle is boundary between Pennsylvanian and Permian.

WPA or CCC building at OHSP.

Bigheart Sandstone at base of Tallant Fm.

**Nellie Johnstone No. 1 well in Bartlesville.**

**First commercially productive well in OK. Drilled to 1320′ and completed 4/15/1897 using nitroglycerine in Bartlesville sand.**

**Listed in National Register of Historic Places.**

**(Tell story about Nellie Johnstone)**

## Nowata, OK


Water came from well drilled for oil.

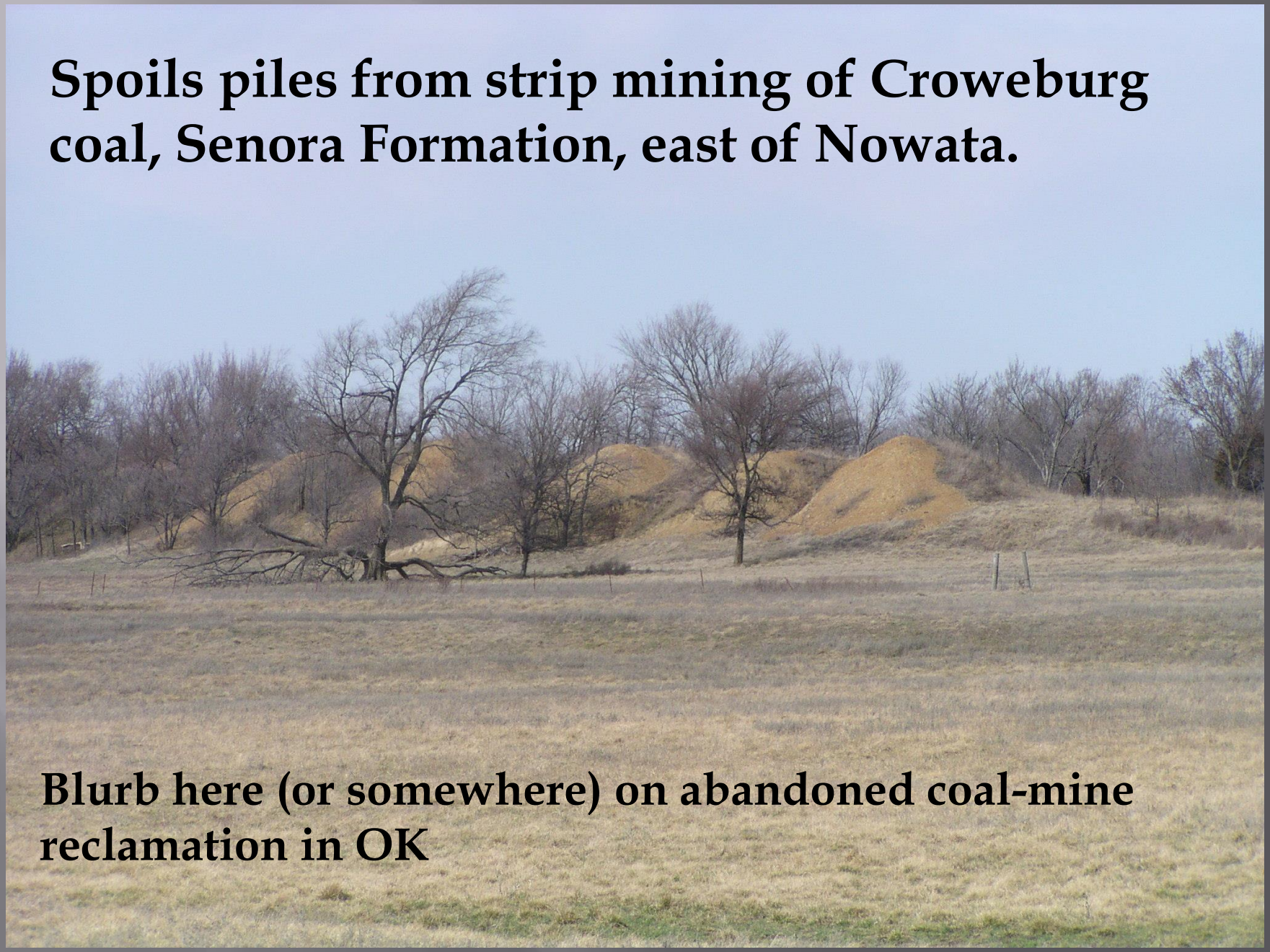
"Radium" was a ploy to attract people seeking cures.

Claremore, OK was big spa town in early 1900s.





**In 1950s USGS determined that water really was high in radium**

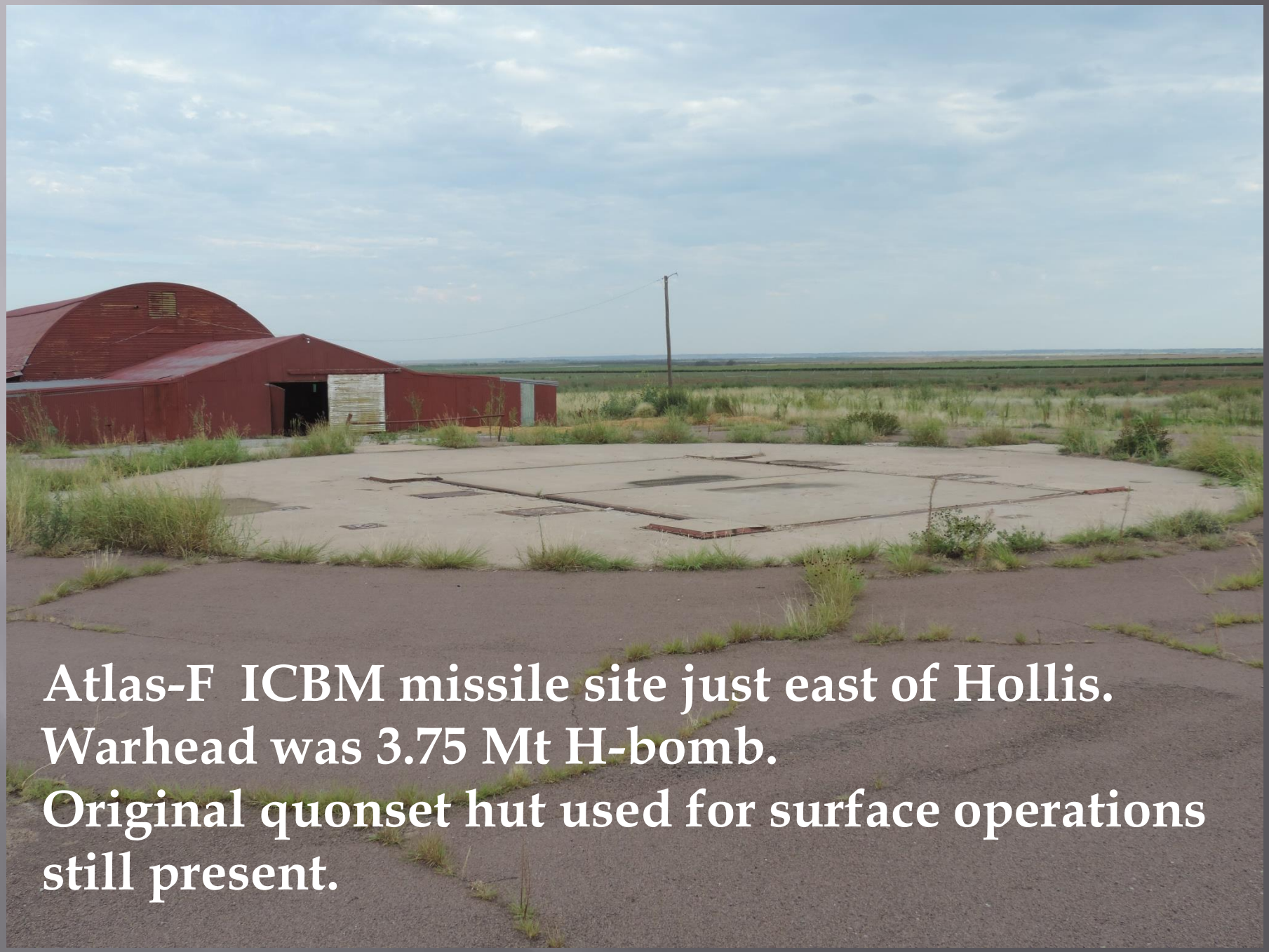

Spoils piles from strip mining of Croweburg coal, Senora Formation, east of Nowata.
Blurb here (or somewhere) on abandoned coal-mine reclamation in OK


**Texas state line west of Hollis.**

**Story of OK's borders.**

**TX – OK border only one in US that is not continuous – states are separated by federal land along much of course of Red River in west.**

**(Note – Reformatory Granite from Willis quarry (later) used.)**



Atlas-F  ICBM missile site just east of Hollis.
Warhead was 3.75 Mt H-bomb.
Original quonset hut used for surface operations still present.

# American Gypsum Co. quarry (in Van Vacter Mbr., Blaine Formation) and plant located in

# Side trip to Granite, OK and Willis Granite Quarry (Reformatory Granite)

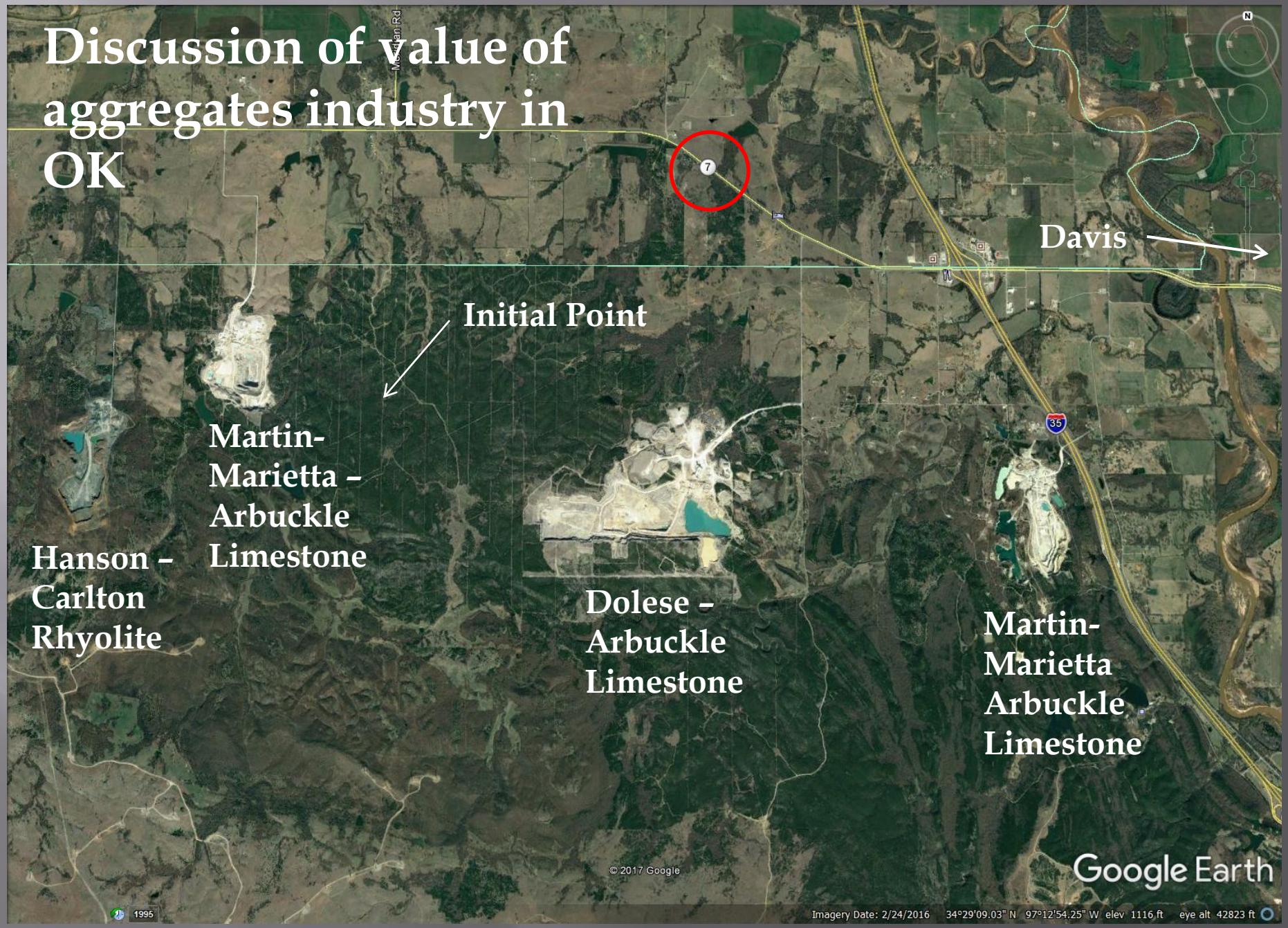
# Willis Granite Quarry, Granite, OK

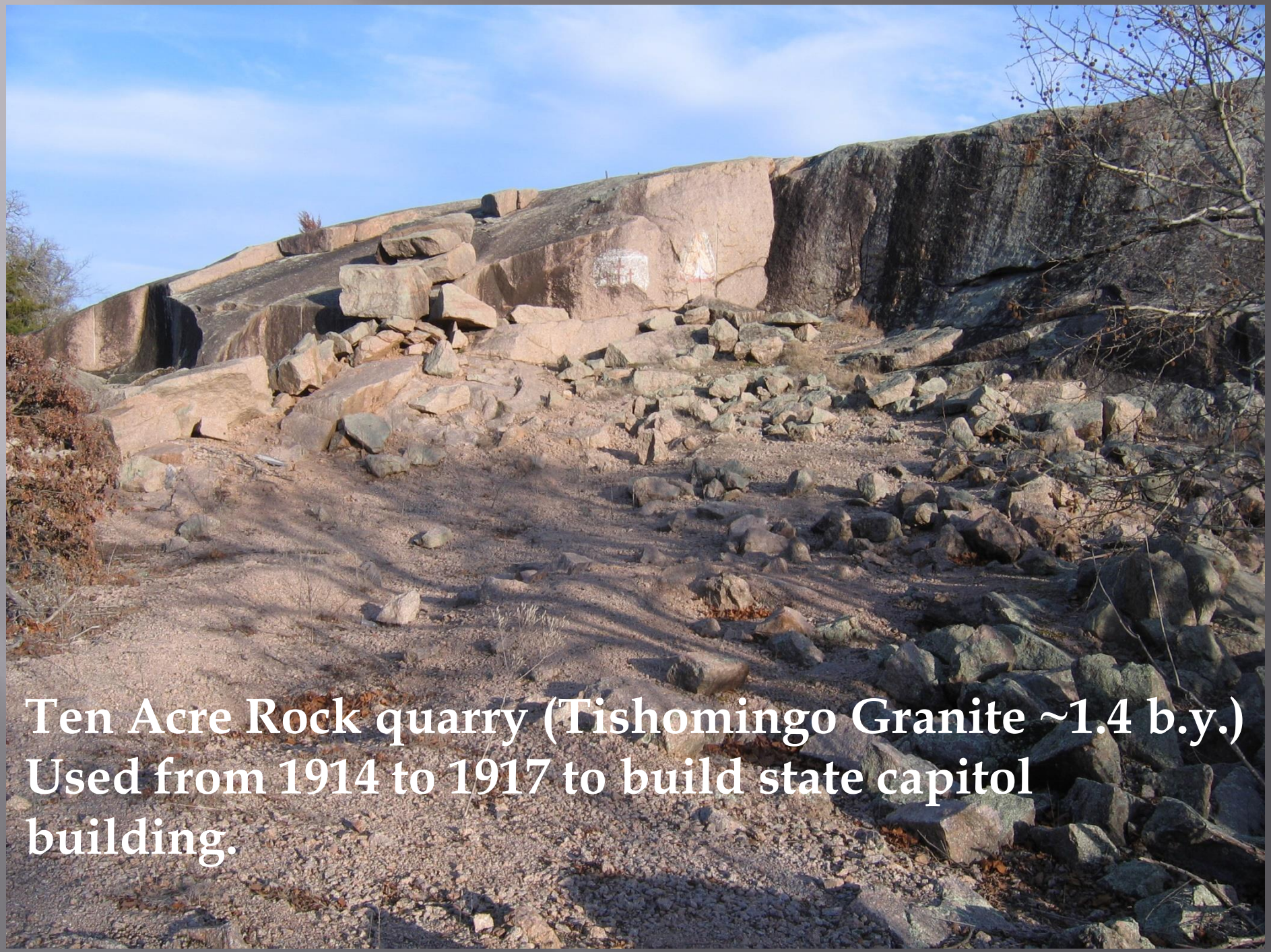
This is probably the most popular granite for stone monuments throughout the state.

Age: ~530 m.y. old (Cambrian)

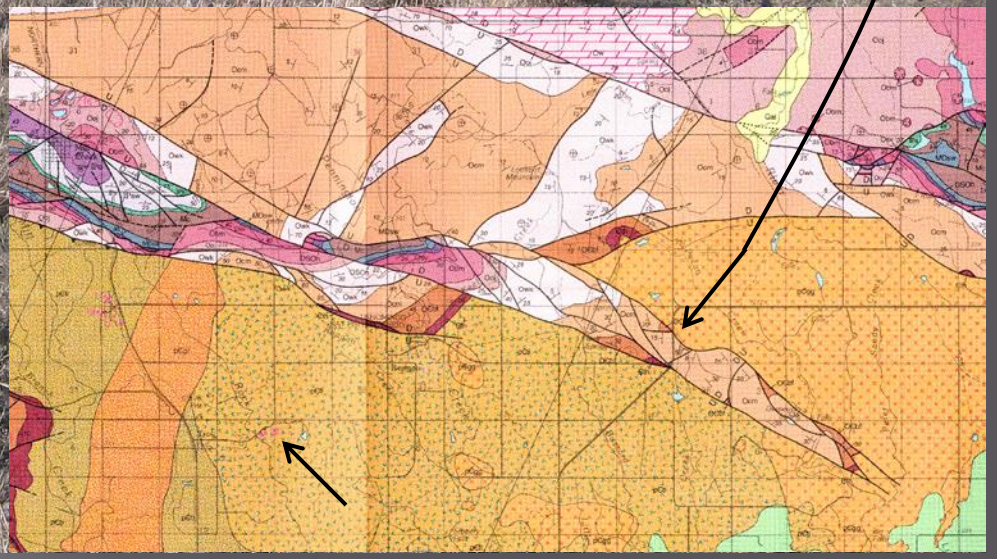
?May want to describe old (and new) methods for removing granite slabs.

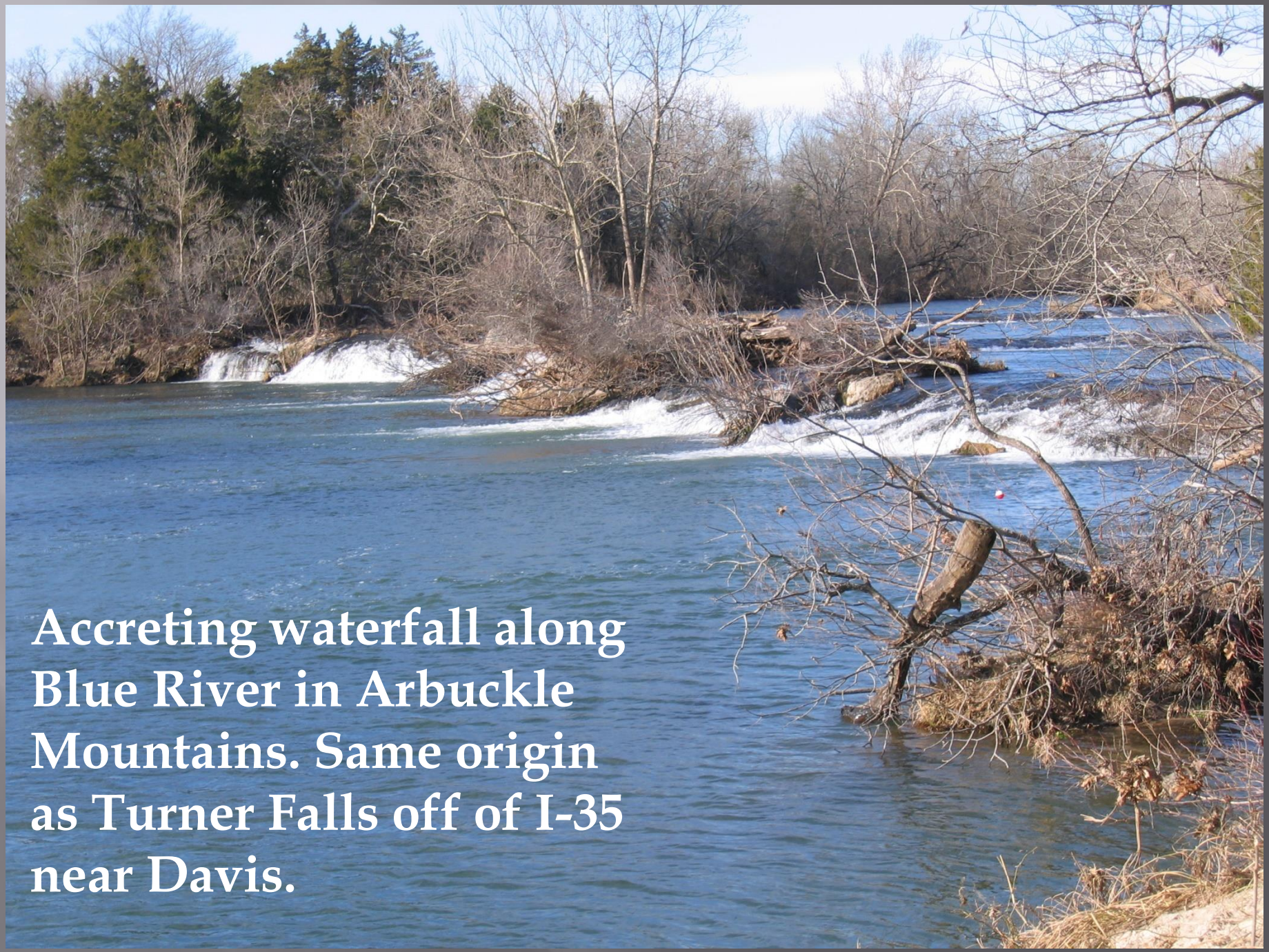

Long Mountain Granite
along old alignment of Hwy
62 east of Headrick.
Looking east.
Wichita Mtns.


Discussion of value of aggregates industry in OK
Davis
Initial Point
Martin-Marietta – Arbuckle Limestone
Hanson – Carlton Rhyolite
Dolese – Arbuckle Limestone
Martin-Marietta Arbuckle Limestone
© 2017 Google
Google Earth
Imagery Date: 2/24/2016 34°29'09.03" N 97°12'54.25" W elev 1116 ft eye alt 42823 ft


Ten Acre Rock quarry (Tishomingo Granite ~1.4 b.y.)
Used from 1914 to 1917 to build state capitol building.

# Blue River Fault. How Geologists Map. How Geologists Interpret - Up-Down or Strike Slip?




Accreting waterfall along Blue River in Arbuckle Mountains. Same origin as Turner Falls off of I-35 near Davis.

Arkansas Novaculite (Devonian – L. Mississippian) near Atoka, OK at southern end of Black Knob Ridge. Westernmost exposure of Ouachita fold-and-thrust belt.

Cretaceous Antlers Sand "stone," known as aquifer and for its dinosaurs.

*Acrocanthosaurus atokensis*. Disc. in McCurtain Co., now at NC Museum of Natural Sciences(!!)


OKLAHOMA
GEOLOGICAL
SURVEY
OGS
1908