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STATE OF ARKANSAS

ARKANSAS GEOLOGICAL SURVEY

Bekki White, State Geologist and Director

COUNTY GEOLOGIC REPORT 127

GEOLOGIC REPORT

OF

SCOTT COUNTY

by

Daniel S. Rains

and

William D. Hanson

Little Rock, Arkansas

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PREFACE

This report is an accompaniment to the 1:250,000 scale geologic map of Scott County, Arkansas. The 1:250,000 scale geologic map is a mosaic of smaller scale geologic maps, printed at a 1:250,000 scale. Underlined terms are defined in glossary. This publication is available on CD, on paper, and on the Arkansas Geological Survey's website: www.arkansas.gov/agc/agc.htm

Geologic Report of Scott County, Arkansas

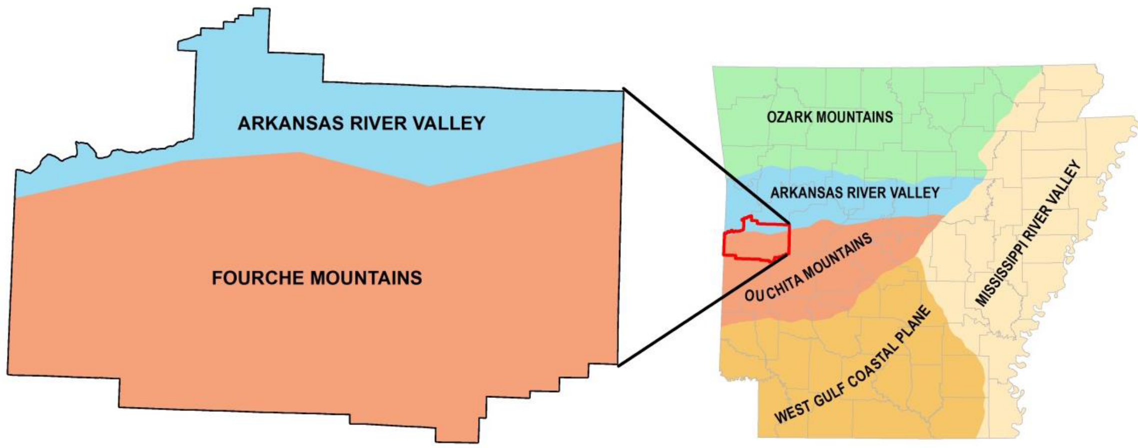


Fig. 1: Location of Scott County. Also shown are the <u>physiographic provinces</u> of Arkansas and sub-provinces of Scott County.

<u>Introduction</u>

Scott County is located in west central Arkansas partially in the Ouachita Mountains and partially in the Arkansas River Valley (Fig. 1). It has a population estimated at 11,233 and an approximate area of 898 mi^2 (2,326 km^2) (US Census Data, 2010). The county is situated between latitude coordinates 35.100^o and 34.666^o, and longitude coordinates –93.705^o and –94.454^o (Plate 1). The highest elevation, 2,360 ft. (719 m) above sea level, occurs on Petit Jean Mountain in the northeast part of the county (Blue Mountain Dam 7.5 min. USGS quadrangle). The lowest elevation, approximately 436 ft. (133 m) above sea level, is located at the confluence of Fourche La Fave and Oller Creek in west-central Scott County (Little Texas 7.5 min. USGS quadrangle).

Surface water resources in Scott County are found in streams and impoundments. The principal surface drainages in the area include the Fourche La Fave, Petit Jean, and Poteau Rivers (Plate 2). Several lakes are located in Scott County.

Some of the larger lakes include Lake Hinkle, Lake Waldron, and Square Rock Lake (Poteau River Site Five Lake).

Primary access to Scott County is provided by US Highways 71 and 270. State Highways 23, 28, and 80 provide access to more rural parts of the county (Plate 2). The Kansas City and Southern Railroad has a spur that crosses part of Scott County, roughly from west to east, entering the state from Oklahoma and terminating in Waldron, Arkansas. The Waldron Municipal Airport is located off of State Highway 71, southwest of Waldron.

Geologic History

Sedimentary rocks of the Ouachita Mountains in Scott County are between 360 and 310 million years old (Fig. 2). Around 360 million years ago, the North American continental margin was in present-day central Arkansas. The area we know as southern Arkansas, including Scott County, was a deep ocean basin. Northern Arkansas was also covered by ocean but it was much shallower. Sediments eroding from the North American continent, especially from the recently formed Appalachian Mountains to the east, accumulated in this ocean basin and eventually were lithified into layers of bedrock.

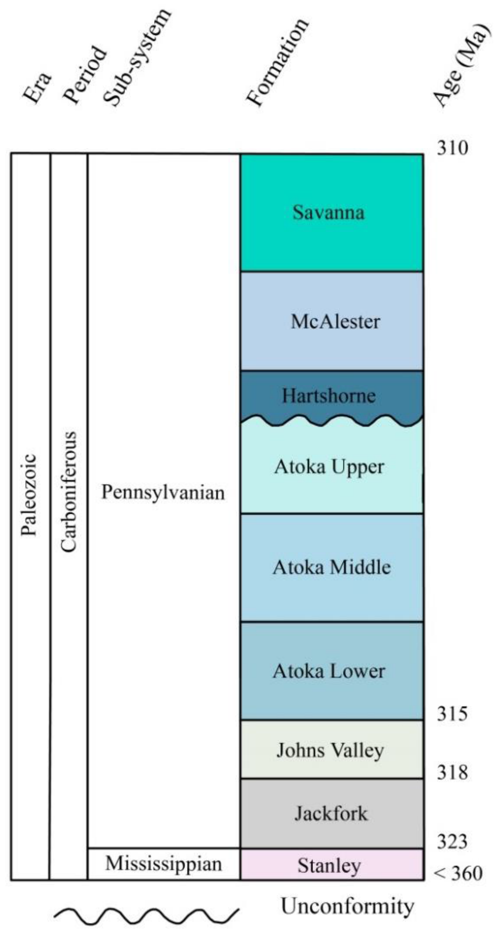


Fig. 2: Stratigraphic column of Scott County

Around 350 million years ago, a subduction zone formed between the North American continent and a landmass to the south. Those landmasses began to converge and the ocean basin between them started to narrow. The dense oceanic crust on the leading edge of the North American continent plunged under the lighter rock of the southern continent (Houseknecht and Kacena, 1983). The heat and pressure generated at the subduction zone caused melting, which resulted in volcanic eruptions on the southern continent. Ash from those volcanic eruptions is preserved locally in the bedrock of central Arkansas.

About 320 million years ago, the North American and southern land masses finally collided. Collision squeezed the bedrock between them into a series of generally east-west-trending folds riddled with thrust faults. The faulting and folding fractured the rock, and hot circulating groundwater, related to the mountain-building process, deposited quartz in the open fractures (Howard, 2008, Figure 3). The deformation also raised the uppermost rock above sea level exposing it to erosion.

Fig. 3: Arkansas quartz cluster

Since that time, the exposed bedrock has eroded into valleys and ridges. The valleys are typically underlain by erosion-prone rock such as shale, while the ridges are usually erosion-resistant rock like sandstone or novaculite. This erosion-worn landscape of deformed fractured bedrock is referred to as the Ouachita Mountains.

Paleozoic Stratigraphy (<360 - 310 million years ago)

(Text adapted from McFarland, 2004).

The Stanley Formation is the youngest rock exposed in Scott County, Arkansas and spans part of the Mississippian Period (<360 – 318 million years ago). Its exposure is limited to the southwestern portion of the county where its maximum exposed thickness is approximately 100 feet (30 m) (Plate 1). The Stanley is composed predominantly of grayish-black to brownish-gray shale with lesser thin-bedded to massive, fine-grained, gray to brownish-gray feldspathic sandstone, and chert. After weathering, the sandstone is generally porous and brown, and the shale is olive-gray.

The Early Pennsylvanian Period (323 to 318 million years ago) Jackfork Formation (Coleman et al., 1995) conformably overlies the Stanley Shale. It consists of thin- to medium-bedded, fine- to coarse-grained, brown, tan, or bluish-gray quartzitic sandstone with lesser amounts of brown silty sandstone and charcoal-colored shale. It's confined to the Fourche Mountains of southern Scott County (Fig. 1, Plate 1).

The Johns Valley Formation rests conformably on the Jackfork Formation. It was deposited during the Pennsylvanian Period, 318 to 315 million years ago. It is composed of black shale with numerous intervals of brownish sandstone. It also contains small amounts of gray-black siliceous shale, and chert. The Johns Valley locally contains exotic boulders (Fig. 4) which are thought to have been deposited by mass wasting. It is exposed in the Fourche Mountains in southwestern Scott County.

Fig. 4: Erratic limestone boulder, Johns Valley Formation, Scott County, Arkansas.

All other rocks exposed in Scott County were deposited relatively quickly in the span of 5 million years from 315 to 310 million years ago. The oldest of these is the Atoka Formation. It was deposited conformably on the Johns Valley Formation. The Atoka Formation is a sequence of marine, mostly tan to gray silty sandstones and grayish-black shales. Some rare calcareous beds and siliceous shales have been noted. It is subdivided into lower, middle, and upper units. The upper and lower units tend to be sandier and the middle Atoka is more shale rich (Cohoon et al., 2017). It crops out in southern and central Scott counties in both the Fourche Mountains and the Arkansas River Valley (Fig. 1, Plate 1).

There is a minor unconformity between the Atoka Formation and the overlying Hartshorne Formation. The Hartshorne is mostly brown to light gray, massive, commonly cross-bedded, medium-grained sandstone. The Hartshorne Formation crops out in northern Scott County (Plate 1).

Conformably overlying the Hartshorne Formation is the McAlester Formation. It consists of an extensive shale section interbedded with a few coal and sandstone beds. Plant and invertebrate fossils have been found throughout the section (Fig. 5). The McAlester Formation is widely exposed across Scott County (Plate 1).

Fig. 5: Syringodendron fossil from the McAlester Formation, northern Scott County. Syringodendrons are fossil remains of the trunk of an giant, extinct, tree-like fern.

The youngest rock in Scott County is the Savanna Formation. It crops out in the core of the Poteau Syncline in northern Scott County (Plate 1). The Savanna Formation is mostly dark gray shale and silty shale but contains minor light gray siltstone and very fine- to fine-grained sandstone. Some conglomerate intervals are present locally in the sandstone sections. A minimum of six coal beds have been identified in the formation. Fossils are rare. The Savanna

Formation conformably overlies the Hartshorne Formation.

Mineral Resources

Current Mining

Currently, crushed stone, shale, and dimension stone are being extracted from Scott County. Uses of crushed stone include aggregate for road construction, riprap, and railroad ballast. Shale is used as fill material and top dressing for secondary roads. Dimension stone is intermittently quarried from at least one location in the county.

Historical Mining

Dolomitic limestone

A single bed, 12 – 18 feet (3 – 5.5 m) thick, of dolomitic limestone is reported from the Johns Valley Formation in Scott County (Stroud et al., 1969). The limestone bed is apparently a large erratic boulder. Analysis reported in Stroud et al. (1969) indicates a combined $CaCO_3$ and $MgCO_3$ content of 89.21% which makes it of suitable purity for use as agricultural lime. The volume of the deposit has not been quantified so the value of the occurrence is unknown. A quarry was developed in the boulder at one time but recent field work was unable to identify the quarry location.

Sand and gravel

Sand and gravel occur as small alluvial deposits throughout Scott County. At one time these deposits were extensively quarried for road construction material. The Strategic Highway Research Program (SHRP) conducted in the late 80s and early 90s which aimed to improve US road construction recommended crushed stone as a better alternative road building material to gravel (Cominsky et al., 1994). Since then the sand and gravel of Scott County has been only used for secondary roads.

Water Resources

There is one active public water supplier in Scott County. Waldron Waterworks provides 2,955 residents with fresh water. The water is sourced from two nearby impoundments: Square Rock Lake to the north of Waldron, and Lake Waldron to the east (Plate 2). The remainder of the county's population relies on groundwater wells for both domestic and agricultural needs.

The two most productive wells drilled in Scott County both produced 9000 gal/hr (34,068 l/min). One is located in Sec 6, T1S, R27W and is 85 feet deep. The other is in Sec 6, T4N, R30W and was drilled to 160 foot (49 m) depth. 14 wells on file were reported dry or produced very little water. These non-productive wells are located across the county. The most unproductive wells reported for a single area are in T2N, R28W where there are records of 6 such wells. Generally, wells in Scott County are sufficient for household needs. The deepest wells drilled are around 500 feet (152 m) deep, and there are some wells shallower than 50 feet (15 m). For site-specific information, contact the Arkansas Geological Survey office or access the online water well completion reports through our interactive map below:

http://geology2.ar.gov/water/WaterWellDownload/TR/SCOTT

Fossil Fuel

There is significant fossil fuel extracted from Scott County, mostly north of Township 4 North. Natural gas is produced from the Atoka Formation and the Hartshorne Formation. No successful oil wells have been drilled in the county to date. Locations and well information, including production figures, can be accessed on the Arkansas Oil and Gas Commission's website at:

www.aogc2.state.ar.us/AOGConline/

Coal has been extracted from Scott County historically, but currently there is no active mining taking place there. All historic coal production was from the Lower Hartshorne Coal, several hundred feet of shale with sandstone and coal interbeds in the base of the McAlester Formation (McFarland, 2004; Plate 2). The rank of the coal in Scott County is sub-bituminous (Fig. 6).

Fig. 6: Sub-bituminous coal

<u>Geohazards</u>

Geohazards are geologic conditions that lead to damage or risk to life, health, or property. Some only affect a local area such as slope instability which can lead to landslides. Areas most prone to landslides and slumps in Scott County are areas where the slope is steep and there is resistant rock, such as sandstone, underlain by non-resistant rock, like shale. Many landslides are triggered in the wet season after a period of heavy precipitation that saturates and weighs down the slope material. Man-made changes to the landscape such as clearing of vegetation and undercutting of slopes, especially undercutting old landslide deposits, can also exacerbate slope instability.

Other types of geohazards affect an entire region such as active fault zones that produce earthquakes. There is only one earthquake recorded in Scott County. It occurred on June 3rd 1977 and registered a magnitude 1: a non-destructive earthquake. In the two days that preceded that event, 8 earthquakes, including a magnitude 4, occurred in neighboring Polk County to the south. The faults in Scott County, though numerous, are considered inactive. The potential for catastrophic earthquakes in the area is low.

There are also more subtle and insidious geohazards. Expansive soils don't threaten life but, nevertheless, over a period of time, can cause property damage with significant cultural and financial impacts. The American Society of Civil Engineers estimates annual cost of damage from expansive soils in the US is 2.3 billion dollars (Gromko, 1974).

Flash floods occur when a large amount of rain falls quickly in an area with relatively narrow valleys, causing stream levels to rise to or above flood stage for a brief period of time. Though their affect is local and short-lived, they can cause a lot of damage because they often occur suddenly and without warning. Certain areas of Scott County are prone to flooding. In 2013 the Fourche La Fave River valley which parallels State Highway 28 had to be closed as many low-lying areas along the route between its intersection with Highway 71 and the eastern County line were underwater (Plate 2). That same year 2 people, including the County Sherriff Cody Carpenter, were killed by floodwaters during efforts to help affected residents.

Both groundwater and surface water are vulnerable to contaminants ranging from industrial sources, such as waste products of mining or agricultural runoff, to domestic sources, such as household chemicals. Fresh water is a necessity for every person, plant, and animal in the county. Proper handling and disposal of waste and other potential contaminants, and good agricultural and industrial practices are significant defenses to protect the water supply.

For additional information about mineral commodities of Arkansas visit our interactive mining map at: www.geology.ar.gov/minerals/mining_map.htm. For more information about groundwater in Arkansas refer to: www.geology.ar.gov/water/aquifer.htm

REFERENCES

Coleman, J.L., Van Swearingen, G., Breckon, C.E., 1995, The Jackfork Formation of Arkansas: A test of the Walker-Mutti-Vail models for deep-sea fan deposition, Arkansas Geological Commission, 56 p.

Cohoon, R.R., Patton, J.A., Vere, V.K., 2017, Roadside geology series 02 - Geologic road guide to Arkansas State Highway 10, Arkansas Geological Survey, 50 p.

Cominsky, R.J., Huber, G.A., Kennedy, T.W., Anderson, M., 1994, The Superpave mix design manual for new construction and overlay. SHRP-A-407, National Research Council Washington, DC, 172 p.

Gromko, G.J., 1974, Review of expansive soils, Journal of the Geotechnical Engineering Division, Vol. 100, Issue 6, p. 667-687.

Houseknecht, D.W., and Kacena, J.A., 1983, Tectonic and sedimentary evolution of the Arkoma foreland basin, *in* D.W. Houseknecht, *ed.*, Tectonic sedimentary evolution of the Arkoma Basin and guidebook to deltaic facies, Hartshorne sandstone: SEPM Midcontinent Section, v.1, p. 3 – 52.

Howard, J.M., 2008, Arkansas quartz crystals, Arkansas Geological Survey, Brochure Series 001, 8 p.

Howard, J.M., 2012, Mineral commodity database, Arkansas Geological Commission, in-house data.

McFarland, J.D., 2004, Stratigraphic summary of Arkansas, Arkansas Geological Commission Information Circular 36, 39 p.

Stroud, R.B., Arndt, R.H., Fulkerson, F.B., and Diamond, W.G., 1969, Mineral resources and industries of Arkansas, U.S. Bureau of Mines Bulletin 645, 418 p.

U.S. Census Data, 2010, http://quickfacts.census.gov/qfd/states.html

Glossary of terms

Aggregate – Several hard inert materials, such as sand, gravel, slag or crushed stone, used for mixing with a cementing or bituminous agent to produce construction material.

Ballast – Broken stone, gravel, or similar material used in roadbed or railroad construction without a cementing agent.

Bedrock – the solid rock beneath the soil and loose sediment.

Calcareous – Containing significant calcium carbonate.

Chert – A hard dense sedimentary rock composed primarily of microscopic quartz crystals.

Conformably – Said of strata characterized by an unbroken vertical sequence of layers formed by uninterrupted deposition.

Conglomerate – A sedimentary rock composed of rounded gravel set in a matrix of finer-grained sediment.

Deformation – Change in the geometry of a rock body that occurs due to stress.

Exotic – A rock that is unrelated to the rocks with which it is associated.

Feldspathic – said of a rock or mineral aggregate containing feldspar.

Lithified – Transformed into rock.

Mass wasting – A general term for the downslope movement of soil and rock material under the direct influence of gravity.

Massive – Said of a rock that lacks bedding: homogeneous.

Physiographic province – A region of which all parts are similar in geologic structure and climate and which has had a unified geomorphic history; its topographic features differ significantly from those of adjacent regions.

Siliceous – said of a rock that contains abundant silica.

Subduction – In plate tectonics, the edge of one crustal plate descending beneath another.

Riprap – large angular rock fragments placed on a surface to prevent or lessen erosion.

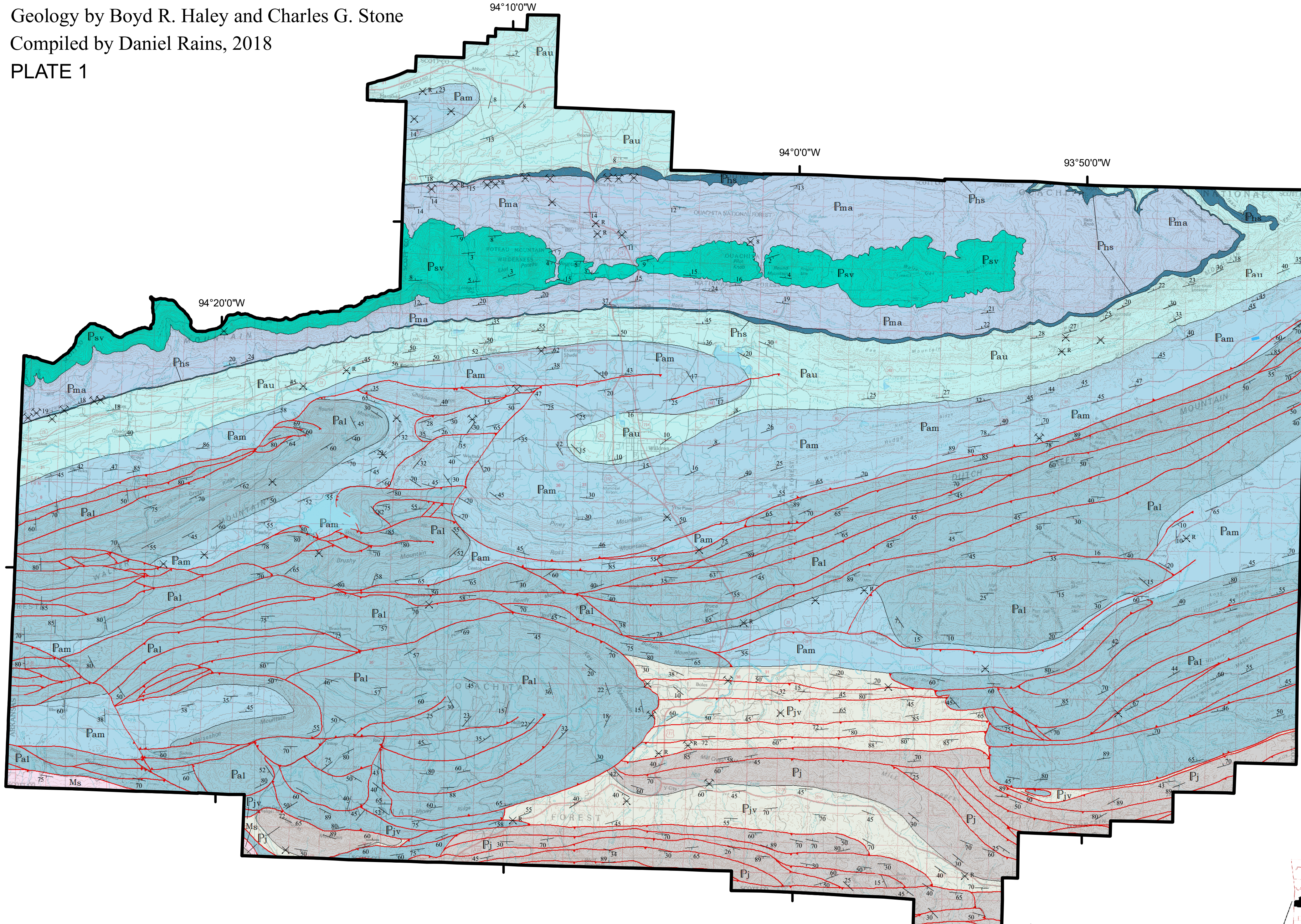
Unconformity – a gap in the geologic record, either representing erosion or non-deposition, that occurs between two successive rock layers in a vertical sequence.

Many of the above definitions are taken in part or paraphrased from "Dictionary of Geological Terms", t*hird edition, American Geological Institute, 1984.*

Geologic Map Of Scott County, Arkansas

Geology by Boyd R. Haley and Charles G. Stone
Compiled by Daniel Rains, 2018

PLATE 1



Psv — **Savanna Formation** *(Pennsylvanian)* – Dark-gray shale and silty shale, with minor light-gray siltstone and gray, very fine- to fine-grained sandstone interbeds and coal beds. Contains few plant and invertebrate fossils. Approximately 1,600 ft. (488 m.) thick.

Pma — **Mcalester Formation** *(Pennsylvanian)* – gray to black shale and tan to gray, thin-beddded sandstone, with a few coal beds. Locally contains plant and invertebrate fossils. 500 to 2,300 ft. (150 to 700 m.) thick.

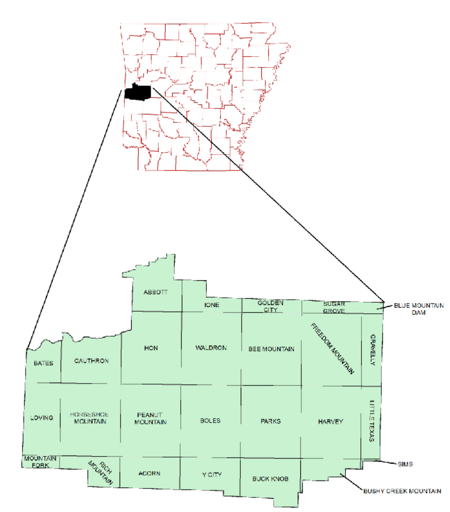
Phs — **Hartshorne Formation** *(Pennsylvanian)* – Brown to gray, massive, cross-bedded, medium-grained sandstone with some coal beds in the lower part . 10 to 300 ft. (3 to 91 m.) thick.

Pau, Pam, Pal — **Atoka Formation upper, middle, lower** *(Pennsylvanian)* – Consists of marine tan to gray silty sandstone and grayish black shale. Only split into upper, middle, and lower members in the Frontal Ouachita Mountains, and the Arkansas River Valley. The total thickness of the Atoka Formation is up to 25,000 ft (7,600 m).

Pjv — **Johns Valley Formation** *(Pennsylvanian)* - Consists of black shale with numerous intervals of brownish sandstone . Exceeds 1,500 feet thick in parts of the Ouachita Mountains.

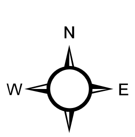
Pj — **Jackfork Formation** *(Pennsylvanian)* - Thin to massive-bedded, fine to coarse-grained, brown, tan, or bluish-gray quartzitic sandstone with subordinate brown silty sandstones and gray-black shale.

Ms — **Stanley Formation** *(Mississippian)* - Composed predominantly of grayish-black to brownish-gray shale, with lesser amounts of thin to massive-bedded, fine-grained, gray to brownish-gray feldspathic sandstone, dark green to black tuff and black chert. Up to 10,000 feet in parts of the Ouachita Mountains.



LEGEND

- MINE OR QUARRY, ACTIVE
- PIT, ACTIVE
- MINE OR QUARRY, ABANDONED
- PIT, ABANDONED
- MINE OR QUARRY, RECLAIMED
- PIT, RECLAIMED
- QUARRY, STATUS UNKNOWN



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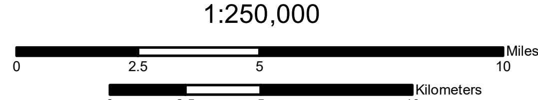
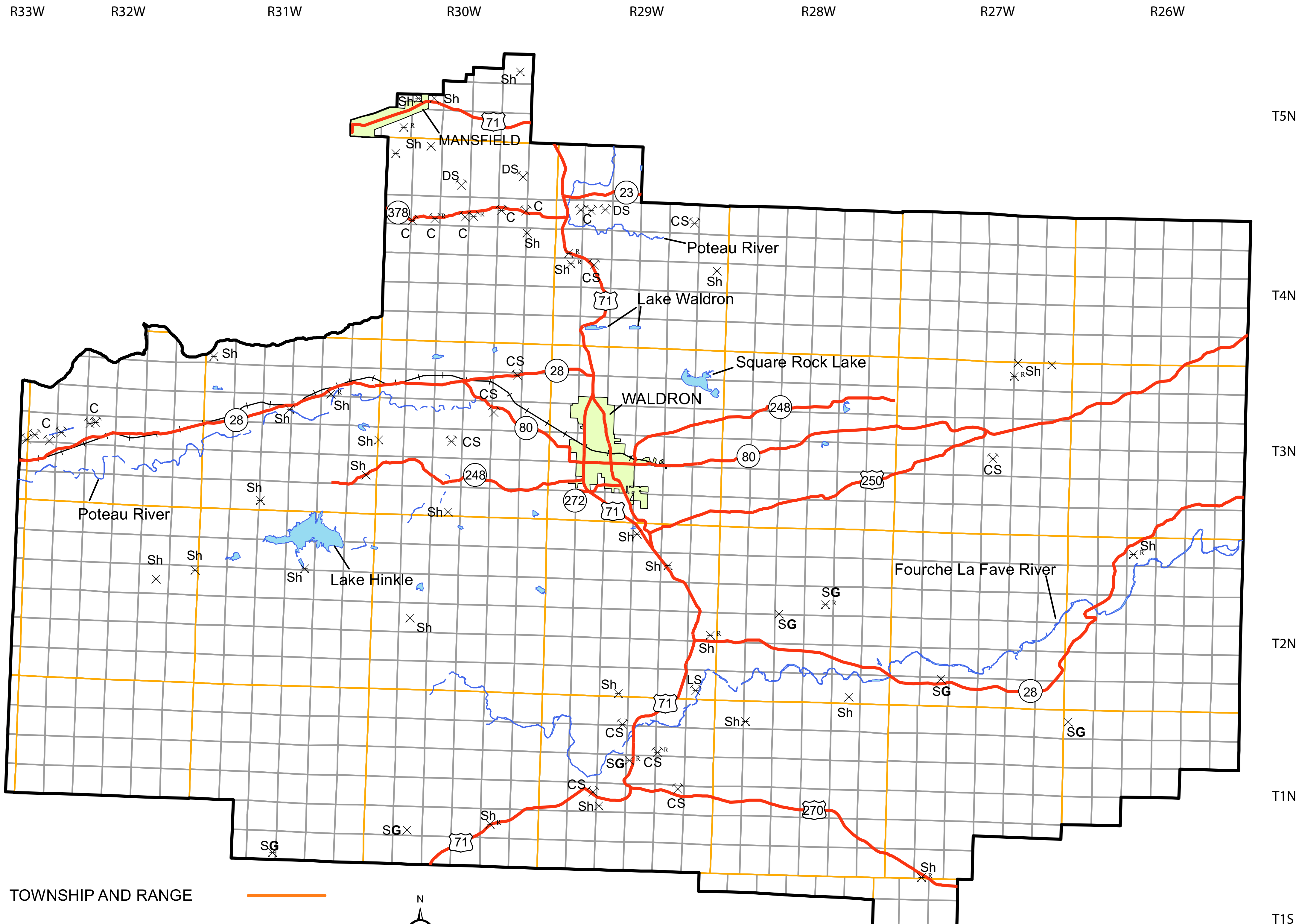
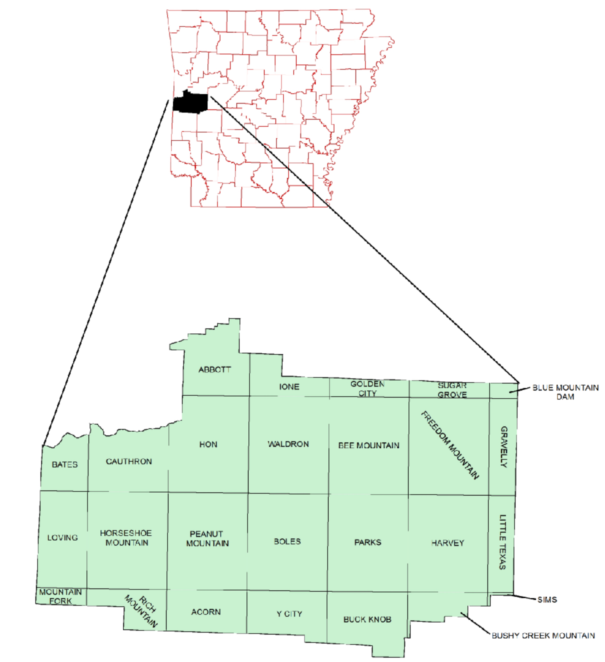


Arkansas Geological Survey
Bekki White, State Geologist

Scott County Mineral Commodities

Edited by Daniel S. Rains
2018
PLATE 2





COMMODITIES

×	PIT, ABANDONED
×	PIT, ACTIVE
×	PIT, INACTIVE
×ᴿ	PIT, RECLAIMED
⤧	QUARRY/MINE, ACTIVE
⤧	QUARRY/MINE, ABANDONED
⤧	QUARRY/MINE, INACTIVE
⤧ᴿ	QUARRY/MINE, RECLAIMED

SYMBOLS

C	COAL
CS	CRUSHED STONE
DS	DIMENSION STONE
LS	LIMESTONE
SG	SAND AND GRAVEL
Sh	SHALE

TOWNSHIP AND RANGE

US HIGHWAY

STATE HIGHWAY

1:250,000

Disclaimer

Although this map was compiled from digital data that was successfully processed on a computer system using ESRI ArcGIS 10.4.1 software at the Arkansas Geological Survey (AGS), no warranty, expressed or implied, is made by the AGS regarding the unity of the data on any other system, nor shall the act of distribution constitute any such warranty. The AGS does not guarantee this map or digital data to be free of errors or assume liability for interpretations from this map or digital data, or decisions based thereon.

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References

Howard, J.M., 2012, Mineral commodity database, Arkansas Geological Survey in-house data

Hanson, W. D. and Rains, D. S., 2018, Mineral Commodity database updates, Arkansas Geological Survey in-house data

County Commodity Map
Scott County
CCM-AR-127

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