CGR-133

STATE OF ARKANSAS

ARKANSAS GEOLOGICAL COMMISSION

Bekki White, State Geologist and Director

COUNTY GEOLOGIC REPORT 133

GEOLOGIC REPORT

OF

SEVIER COUNTY

by

William D. Hanson

Little Rock, Arkansas

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PREFACE

This report is an accompaniment to the geologic map of Sevier County, Arkansas. The geologic map is a mosaic of the 7.5 minute quadrangle geologic maps which make up the county printed at 1:50,000 scale. This publication is available on CD, paper, or the agencies website, www.arkansas.gov/agc/agc.htm.

Geologic Report of Sevier County, Arkansas

Sevier County is located in southwestern Arkansas and borders Oklahoma. The county has a population estimated in 2005 to be 16,456 and has an area of approximately 564 sq. miles (U.S. Census Bureau, 2005). It is bounded by latitude and longitude coordinates 34^0 11' 32" on the north, 33^0 45' 02" on the south, 93^0 57' 27"on the east, and 94^0 28' 37" on the west. The northern portion of the county is within the Athens Plateau region of the Ouachita Mountain physiographic province, and the southern portion is within the West Gulf Coastal Plain physiographic province. The highest elevations (~880') occur in the northwestern part of the county while the lowest elevations (~255') occur in the southeastern part of the county. The major drainages (Saline River, Cossatot River, and Rolling Fork Creek) flow north to south and are tributaries of the Little River, which serves as the southern boundary of the county.

In the Athens Plateau region tightly folded, faulted, and steeply dipping Paleozoic rocks have strikes trending in an east-west to northeast-southwest direction (Miser and Purdue, 1929). Sandstones occurring in these Paleozoic rocks are typically ridge formers, while shale units occupy the valley floors. Paleozoic formations mapped within the county are the Pennsylvanian Johns Valley Formation and Jackfork Formation (325 - 275 million years before present), and the Mississippian Stanley Formation (350 – 325 million years before present). The Johns Valley consists of shale with minor amounts of siltstone, sandstone, and erratic masses. Some erratic masses have been identified as coming from the Pitkin Formation present in northern Arkansas. The Johns Valley is about 2,000 feet thick in this county. The Jackfork Formation consists of shale, sandstone, and siltstone. Some sandstone intervals are suitable for the aggregate industry. This unit is about 6,500 feet thick in the county. The Stanley Formation consists of shale, sandstone, and siltstone, with minor amounts of chert and siliceous shale. The Stanley Formation has a thickness of about 7,500 feet in the county. These units were deposited in a deep water marine environment with the Stanley Formation being the oldest sedimentary unit exposed. This unit was deposited in the deepest part of the basin.

The West Gulf Coastal Plain, represented in the southern two thirds of the county, overlapped the Paleozoic units following a major unconformity. Sedimentary deposits are both Cretaceous (144 – 66.4 million years before present) and Quaternary (1.6 million years – present) in age. Lower and Upper Cretaceous units consist primarily of sand, clay, gravel, limestone, gypsum, water-laid tuff, marl, and chalk of the Trinity, Woodbine, Tokio, Brownstown, Ozan, and Annona Formations. These formations strike east-west and the dip is to the south at about 1 degree. Quaternary deposits consist of sand, gravel, and clay, and dip very slightly to the south.

The Lower Cretaceous Trinity Group consists of sand, gravel, clay, limestone, gypsum, celestine, and barite. Basal gravels of the unit are commonly 20 to 50 feet thick and are composed of novaculite, chert, sandstone, and quartzite (Miser and Purdue, 1929). Most gravels are 1 to 6 inches in diameter, but boulders can occur at the contact or just above the contact with the Paleozoic rocks. Numerous gravel pits

north of DeQueen, Arkansas, are located in this basal gravel bed. Members in the Trinity are the DeQueen Limestone and the older Dierks Limestone. The Dierks consists of fossiliferous limestone interbedded with green and gray calcareous clay and is 30 to 60 feet thick. This member is noted for the oyster *Ostrea franklini* (Miser and Purdue, 1929) (Fig. 1).

Figure 1: Ostrea franklini specimens.

Outcrops of this member occur east of the Cossatot River. The DeQueen Limestone member consists of interbebdded limestone, calcareous clay, gypsum, and celestine. Limestone beds are fossiliferous. The most common fossils are *Ostrea franklini* (Fig. 1) and *Cassiope branneri* (Fig. 2a, b).

Figure 2a. Single specimens of Cassiope branneri.

Figure 2b. Multiple Cassiope branneri.

The occurrence of celestine and gypsum increase eastward and form thin beds and lenses on the east side of the county. This member is about 80 feet thick and was named for the community of DeQueen, Arkansas. Sands in the Trinity are primarily fine- to medium-grained, cross-bedded, and range in color from white to almost red. Barite occasionally occurs as cement in several sandy intervals in the Trinity, and barite roses and dollars occur on the east side of the county. Asphalt impregnated sand lenses, when present, occur below the DeQueen Limestone. Clays are tan, light gray, gray, and brown. The Trinity Group was deposited in a near shore marine environment following a major unconformity.

Upper Cretaceous units were deposited following an unconformity separating it from the Lower Cretaceous units. The units strike east-west and dip is to the south at about 1 degree or less. Formations occurring in this county are the Woodbine, Tokio, Brownstown, Ozan, and Annona.

The Woodbine Formation consists of gravel, water-laid tuff, sand and clay. Gravels occurring at the base of the unit can be up to 60 feet thick but are generally about 30 feet thick. In the Lockesburg, Arkansas area the basal gravel is only a few feet thick

whereas it is about 25 feet thick in the Horatio, Arkansas area (Dane, 1929). Gravels range in size from pea gravel to cobbles with the average being about 2 inches, are sub-rounded to rounded and are composed primarily of novaculite. Some highly altered igneous pebbles have also been collected in the unit. The water-laid tuffs are cross-bedded and are blue to green in color when fresh. Weathering of the tuff produces distinctive red waxy clay. The Woodbine was deposited, following an unconformity, in a near shore marine environment, and is about 200 feet thick.

The Tokio Formation consists of clay, sand, and gravel. The gravel bed occurring at the base of the unit averages 20 feet thick and is composed of sub-rounded to rounded pebbles ranging from pea gravel to 6 inches. The average size is one inch, and the gravels are composed of novaculite, chert, quartz, sandstone, and quartzite. Clays are dark gray to gray to almost white. The dark gray clays are fossiliferous and contain plant fragments and imprints. Small shell imprints are also common. Some of the lighter colored clays are altered volcanic ash beds. The clay content in the unit increases westward. Sands are fine- to medium-grained, sub-rounded to rounded, and cross-bedded. Glauconite and ilmenite are accessory minerals. The Tokio was deposited, following an unconformity, in a near shore marine environment and is about 300 feet thick.

The Brownstown Formation consists of fossiliferous gray to dark gray marl and sandy marl. These marls are fairly uniform in composition and thickness across the county. The most recognizable fossil is the oyster *Exogyra ponderosa* (Fig. 3a, 3b).

Figure 3a. Underside of Exogyra ponderosa.

Figure 3b. Top of Exogyra ponderosa.

The Brownstown was deposited, following an unconformity, in a near shore marine environment and is about 240 feet thick.

The Ozan Formation consists of marl, sandy marl, glauconitic marl, and sand. The Buckrange Sand Member occurs at the base of the unit. This sandy interval contains glauconite, phosphate nodules, black chert, and shark teeth. Marls are dark gray and fossiliferous. Notable fossils include *Exogyra ponderosa* (Fig. 3), *Ostrea plumosa*, and *Ostrea falcatta* (Dane, 1929) (Fig. 4).

Figure 4. Ostrea falcatta.

Mosasaur teeth and bones are known to occur in this unit also (Figure 5 and 6).

Figure 5. Mosasaur tooth.

Figure 6. Mosasaur bones.

The Buckrange Sand is about 20 feet thick whereas the entire unit is about 200 feet thick. The Ozan was deposited, following an unconformity, in a near shore marine environment.

The Annona Formation consists of massive, slightly fossiliferous chalk. On a fresh surface the chalk is blue-gray, when weathered it is white. The unit is about 60 feet thick and samples have conchodial fracture. A notable fossil is the echinoid *Echinocorys cf. E. texana* (Dane, 1929) (Figure 7). The Annona was deposited, following an unconformity, in a near shore marine environment.

Figure 7. Echinocorys cf. E. texana.

Quaternary alluvium and terraces (1.6 million years – present) occur along streams and rivers. The alluvium deposits are still receiving and loosing sediments and consist of sand, clay, and gravel. Gravels are composed of novaculite, chert, sandstone, quartz, and quartzite, and vary in thickness. Terraces deposits are remnants of past floodplains which set topographically above the present alluvial valleys. They consist of sand, clay, and gravel. Gravels are composed of novaculite, chert, sandstone, quartz, and quartzite. Within the county, Quaternary deposits vary in thickness but rarely exceed 50 feet.

Mineral Resources

Present mining

Mineral products from the county are primarily utilized as aggregate (Howard, 2006). Mining of West Gulf Coastal Plain sand and gravel beds in the Cretaceous Trinity Group, Woodbine Formation, Tokio Formation, and Quaternary deposits results in the production of aggregates. Sandstones from the Paleozoic Jackfork Formation in the Ouachita Mountain region are mined to produce crushed stone. Shales in Paleozoic units have been or are mined for brick-making raw material, fill material and as top dressing for secondary roads.

Historical mining

In the northern part of the county (T7S, R30, 31, 32W) antimony was mined from quartz veins in the Stanley Formation sporadically from 1873 until about WWII (Stroud, et al, 1969). The May and Otto mines were the most productive during this period. Stibnite, the primary ore mineral, occurs in quartz veins. Mining was done to a depth of only about 170 feet due in part to water drainage problems. Lead and zinc were mined intermittently from 1843 to about 1916. The Davis Mine (sec 10, T7S, R32W) produced a few thousand tons of shipping grade ore from quartz veins associated with faulting in the Stanley Formation. These quartz veins also contain sphalerite, galena, chalcopyrite, and calcite. Secondary accessory minerals are azurite, malachite, and smithsonite.

Other potentially economic minerals are barite, celestine, and clay.

Water Resources

Surface water resources occur in rivers, streams and man-made lakes. Surface water quality in the Athens Plateau area is better than water quality occurring on the West Gulf Coastal Plain. Lake DeQueen, built in the northwestern part of the county, serves as the water supply for the DeQueen, Arkansas community.

Ground water resources occur in the sand and gravel beds in the West Gulf Coastal Plain area and primarily the quartz veins in the Athens Plateau area. The majority of the wells examined in the West Gulf Coastal Plain had an average initial output of about 25 gallons per minute and were less than 250 feet deep. The further south in the county a well was drilled, the deeper it is expected to be. Wells in the Athens Plateau area are difficult to predict. They primarily produce from fractured quartz veins. Production from the shale and sandstone units is very limited, when quartz veins are not present.

Fossil Fuels

The potential for fossil fuel production in the county is very low. At the present time production of neither oil nor gas exists.

Geohazards

Although limestone occurs in the county there is little or no threat of karst development. The limestone beds are thin and are interbedded with clay which will prevent the movement of water. Calcareous clays occurring in the Dierks and the DeQueen have the potential to shrink-swell. These clay beds can affect foundations. Landslide potential is low unless induced by man. The greatest threat to the county would be from pollution of the water supply, both above ground and below ground.

References

Dane, C.H., 1929, Upper Cretaceous formations of southwestern Arkansas, Arkansas Geological Commission Bulletin 1, 215p.

Howard, J.M., 2006, Mineral commodity database, Arkansas Geological Commission in-house-data

Howard, J.M., Colton, G.W., and Prior, W.L., 1997, Mineral, Fossil Fuel, and Water Resources of Arkansas, Arkansas Geological Commission Bulletin 24, 115p.

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

Miser, H.D., and Purdue, A.H., 1929, Geology of the DeQueen and Caddo Valley Quadrangles, Arkansas, U.S. Geological Survey Bulletin 808, 195p.

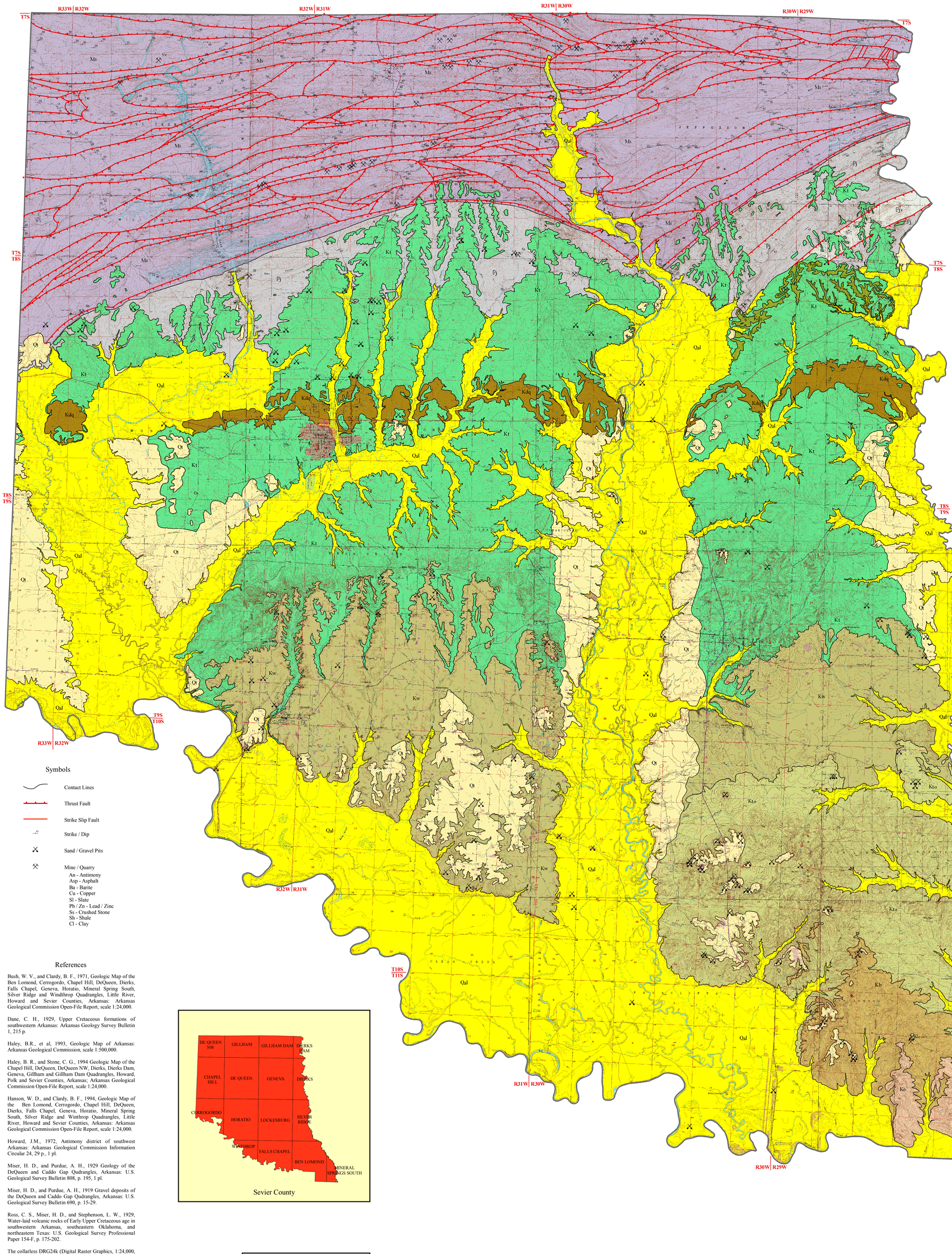
Stroud, R.B., et al, 1969, Mineral Resources and Industries of Arkansas, U.S. Bureau of Mines Bulletin 645, 418p.

U.S. Census Data, 2005, http://quickfacts.census.gov/qfd/states/05/05039.html

DIGITAL GEOLOGIC QUADRANGLE MAP
SEVIER COUNTY, ARKANSAS
CGM-AR-133

Geologic Map of Sevier County, Arkansas

Geology by William D. Hanson, Benjamin F. Clardy, Boyd R. Haley, and Charles G. Stone
Edited by William D. Hanson
2005
Arkansas Geological Commission
Bekki White, State Geologist
Digital compilation by Jerry W. Clark and William D. Hanson



Description Of Map Units

Cenozoic – Quaternary

Qal – Alluvial deposits – These deposits are a product of present active deposition and erosion. They occur along streams and rivers, have low relief, and consist of unconsolidated gravel, sand, silt, and clay. Gravels general occur at the base of the alluvium. The gravels are composed of novaculite, chert, sandstone, and quartz, and have an economic value as an aggregate resource and may serve as an aquifer. Thickness of the unit varies, but is generally less than 50 feet.

Qt – Terrace deposits – These deposits represent past floodplain levels of rivers and large streams. They have low relief and consist of unconsolidated gravel, sand, silt, and clay. Gravels are composed of novaculite, chert, sandstone, and quartz, and have economic value as an aggregate resource and may serve as an aquifer. Thickness of the unit varies, but is generally less than 50 feet.

Mesozoic – Cretaceous – Upper

Ka – Annona Formation – The Annona Formation consists of hard, white to blue-gray, slightly fossiliferous chalk. The unit was deposited in a near-shore marine environment and dips gently < 1° to the south. Chalk from this unit is used in the production of Portland cement. Thickness of this unit is approximately 60 feet.

Ko – Ozan Formation – The Ozan Formation consists of fossiliferous marl, sandy marl, sandy glauconitic marl, and sand. A glauconitic sandy bed occurring at the base of the unit is known as the Buckrange Sand Member. The unit was deposited in a near-shore marine environment and dips gently < 1° to the south. Petroleum and natural gas are produced from the Buckrange Sand in southern Arkansas. Thickness of this unit is approximately 200 feet.

Kb – Brownstown Formation – The Brownstown Formation consists of fossiliferous, dark gray marl and sandy marl. The unit was deposited in a near-shore marine environment and dips gently < 1° to the south. Thickness of this unit is approximately 240 feet.

Kto – Tokio Formation – The Tokio Formation consists of gravel, sand, and clay. Gravels are composed of novaculite, chert, quartz, and sandstone. The unit was deposited in a near-shore marine environment and dips gently < 1° to the south. Sand and gravel are mined from this unit and it also serves as a municipal water source. Thickness of this unit is approximately 300 feet.

Kw – Woodbine Formation – The Woodbine Formation consists of water-lain calcareous tuffs, gravel, and sand. Gravels occurring primarily at the base of the unit are composed of novaculite, chert, quartz, sandstone, and rare igneous cobbles. The unit was deposited in a near-shore marine environment and dips gently < 1° to the south. Sand and gravel have been mined from this unit, and it may serve as an aquifer. Thickness of this unit is approximately 200 feet.

Mesozoic – Cretaceous – Lower

Kt (Kdq, Kmb) – Trinity Group – The Trinity Group consists of gravel, sand, limestone, gypsum, and clay. Gravels are composed of novaculite, chert, and sandstone. Fossiliferous limestones, and calcareous clays occur in the DeQueen Limestone Member and the Dierks Limestone Lentil. The group was deposited in a near-shore marine environment and dips gently < 1° to the south. Gravel and sand are mined from this group, and it also serves as a municipal water source. Thickness of this group is approximately 700 feet.

Paleozoic – Pennsylvanian

Pjv – Johns Valley Formation – The Johns Valley Formation consists of shale, and minor siltstone, sandstone, and erratic lenses. Erratics that occur in the unit originated from a former landmass to the south. These turbidite sequences were deposited in a deep marine environment. Thickness of this unit is approximately 2000 feet.

Pj – Jackfork Formation – The Jackfork Formation consists of shale, sandstone, and siltstone. These turbidite sequences, which have an eastern and southern source area, were deposited in a deep marine environment. Sandstones are ridge formers and some are suitable for the aggregate industry. Fracture systems occurring in the unit serve as the best source of water. Thickness of this unit is approximately 6500 feet.

Paleozoic – Mississippian

Ms – Stanley Formation – The Stanley Formation consists of shale, clean and dirty sandstone, and siltstone, with minor chert and siliceous shale. These turbidite sequences, derived almost exclusively from a southern source, were deposited in a deep marine environment. Some of the sandstone beds are suitable for the aggregate industry. Fracture systems and quartz veins occurring in the unit serve as the best source of water, and in some instances, a source for quartz crystals. Thickness of this unit is approximately 7500 feet.

Symbols

- Contact Lines
- Thrust Fault
- Strike Slip Fault
- Strike / Dip
- Sand / Gravel Pits
- Mine / Quarry
  - An - Antimony
  - Asp - Asphalt
  - Ba - Barite
  - Cu - Copper
  - Sl - Slate
  - Pb / Zn - Lead / Zinc
  - Ss - Crushed Stone
  - Sh - Shale
  - Cl - Clay

References

Bush, W. V., and Clardy, B. F., 1971, Geologic Map of the Ben Lomond, Cerrogordo, Chapel Hill, DeQueen, Dierks, Falls Chapel, Geneva, Horatio, Mineral Spring South, Silver Ridge and Windthrop Quadrangles, Little River, Howard and Sevier Counties, Arkansas: Arkansas Geological Commission Open-File Report, scale 1:24,000.

Dane, C. H., 1929, Upper Cretaceous formations of southwestern Arkansas: Arkansas Geology Survey Bulletin 1, 215 p.

Haley, B.R., et al, 1993, Geologic Map of Arkansas: Arkansas Geological Commission, scale 1:500,000.

Haley, B. R., and Stone, C. G., 1994 Geologic Map of the Chapel Hill, DeQueen, DeQueen NW, Dierks, Dierks Dam, Geneva, Gillham and Gillham Dam Quadrangles, Howard, Polk and Sevier Counties, Arkansas; Arkansas Geological Commission Open-File Report, scale 1:24,000.

Hanson, W. D., and Clardy, B. F., 1994, Geologic Map of the Ben Lomond, Cerrogordo, Chapel Hill, DeQueen, Dierks, Falls Chapel, Geneva, Horatio, Mineral Spring South, Silver Ridge and Winthrop Quadrangles, Little River, Howard and Sevier Counties, Arkansas: Arkansas Geological Commission Open-File Report, scale 1:24,000.

Howard, J.M., 1972, Antimony district of southwest Arkansas: Arkansas Geological Commission Information Circular 24, 29 p., 1 pl.

Miser, H. D., and Purdue, A. H., 1929 Geology of the DeQueen and Caddo Gap Qudrangles, Arkansas: U.S. Geological Survey Bulletin 808, p. 195, 1 pl.

Miser, H. D., and Purdue, A. H., 1919 Gravel deposits of the DeQueen and Caddo Gap Qudrangles, Arkansas: U.S. Geological Survey Bulletin 690, p. 15-29.

Ross, C. S., Miser, H. D., and Stephenson, L. W., 1929, Water-laid volcanic rocks of Early Upper Cretaceous age in southwestern Arkansas, southeastern Oklahoma, and northeastern Texas: U.S. Geological Survey Professional Paper 154-F, p. 175-202.

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DISCLAIMER

Sevier County


Arkansas

Magnetic Declination

Scale 1:50,000

1 0.5 0 1 2 3 4 5 6 7 8 9 10 11 Miles

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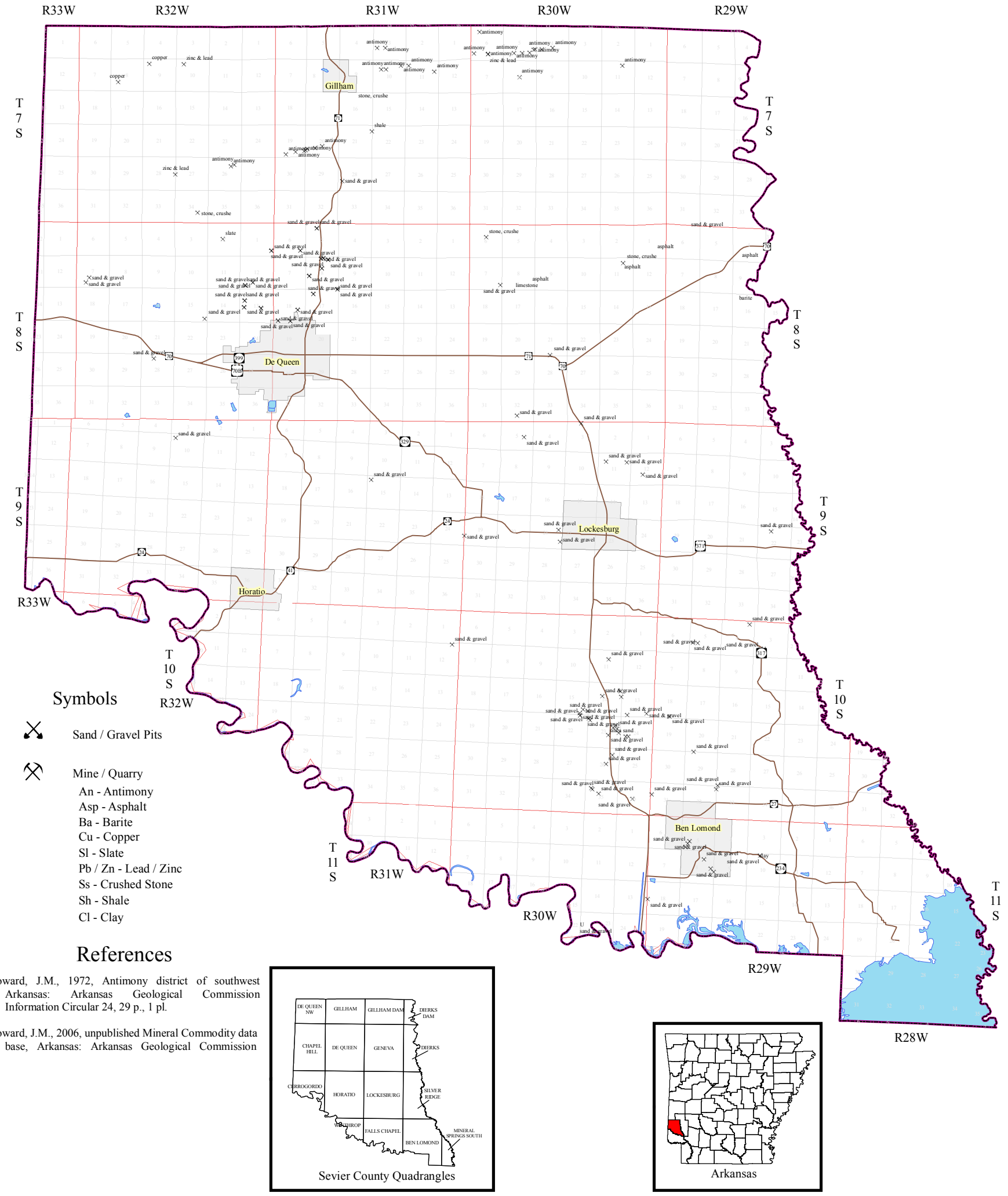
ARKANSAS GEOLOGICAL COMMISSION

Sevier County Mineral Commodity Map

Arkansas Geological Commission, Bekki White, State Geologist
Project Manager William D. Hanson
Edited by William D. Hanson and J. Michael Howard
Digital compilation by Jerry W. Clark
February 2006



References

Howard, J.M., 1972, Antimony district of southwest Arkansas: Arkansas Geological Commission Information Circular 24, 29 p., 1 pl.

Howard, J.M., 2006, unpublished Mineral Commodity data base, Arkansas: Arkansas Geological Commission

The base used in the making of this map was acquired online at the GeoStor.

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