Geologic Map of the Murfreesboro Quadrangle, Pike and Hempstead Counties, Arkansas

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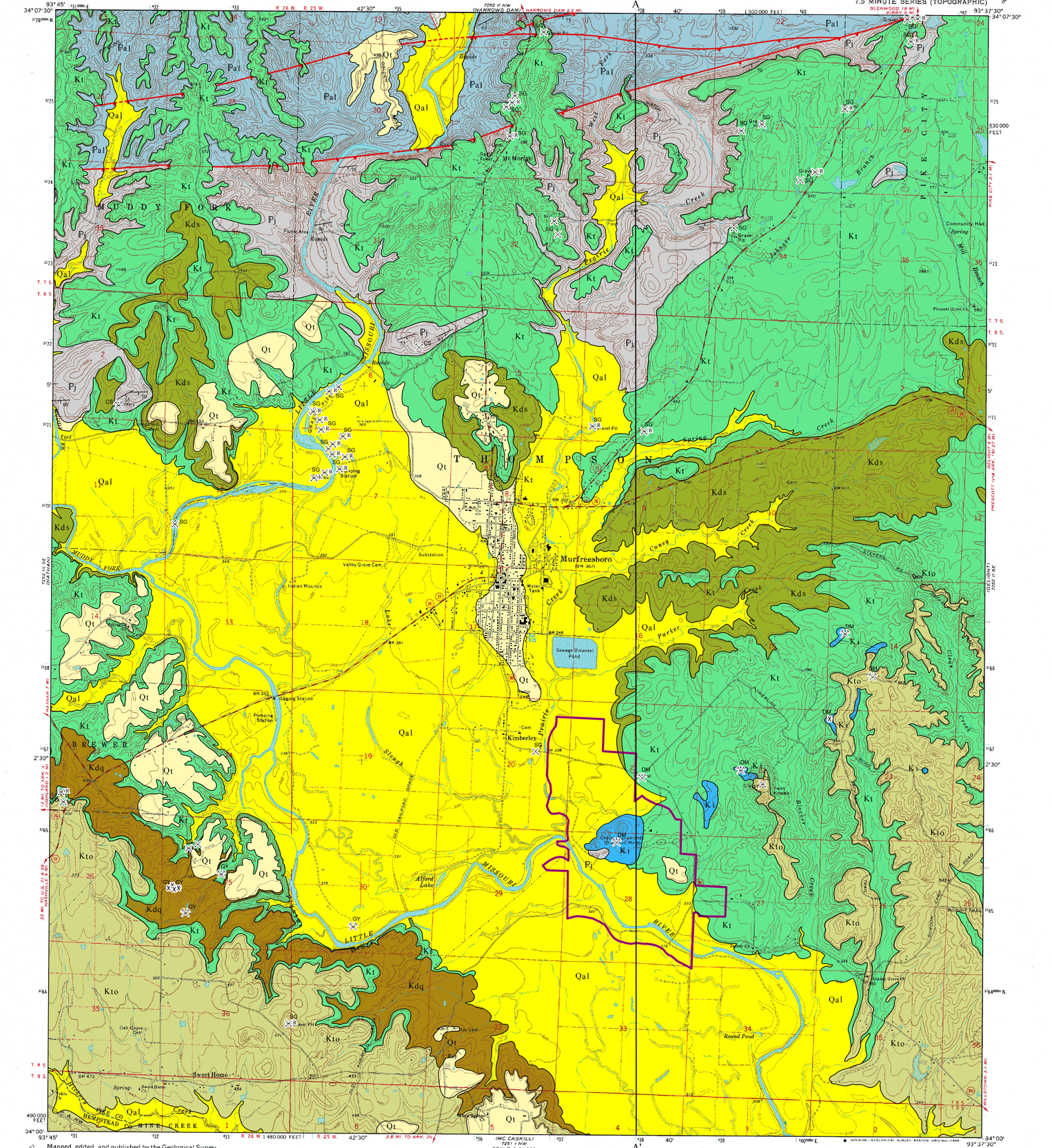
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MURFREESBORO QUADRANGLE
ARKANSAS
7.5 MINUTE SERIES (TOPOGRAPHIC)



Correlation of Map Units

Qal, Qt	Quaternary	CENOZOIC
UNCONFORMITY		
Kto	Upper Cretaceous	MESOZOIC
UNCONFORMITY		
Ki	Lower Cretaceous	MESOZOIC
UNCONFORMITY		
Kt, Kds, Kdq	Lower Cretaceous	MESOZOIC
UNCONFORMITY		
Pa, Pjv, Pj	Pennsylvanian	PALEOZOIC

Description of Map Units

Qal **Alluvium** *(Quaternary)* – Variable size gravel overlaid by unconsolidated sand, silt, and clay comprise this unit. Occurring in the floodplains of present day streams and rivers, the sediments form a rich loam and are excellent for agriculture. Gravels, primarily novaculite, originated in the Ouachita Mountain region and from local Cretaceous formations. Thickness varies from 0 to 25 feet. Mapped areas of alluvium are presently receiving sediment deposition.

Qt **Terrace deposits** *(Quaternary)* - Terrace deposits generally grade from gravel at their base to silt and clay at their top. Occurring on benches above the present day streams and rivers, the sediments form rich loamy soils. Gravels, primarily novaculite, originated in the Ouachita Mountain region and from local Cretaceous formations. Thickness varies, but is generally less than 50 feet. River terraces are topographic surfaces which mark former floor levels. Water wells generally produce from the gravels at the base of the unit. Small scale gravel-mining operations produce from basal gravel of the unit.

Kto **Tokio Formation** *(Upper Cretaceous)* - The Tokio Formation consists of cross-bedded sand and gravel, gray clay, and volcanic ash. Basal cross-bedded gravels are approximately 30 feet thick in the mapped area. Minor sand and clay lenses occur within the gravel, while sand commonly fills the interstitial spaces around gravel. Also, thinner (less than 1 foot) beds and lenses of gravel occur within the formation's sandy intervals. The gravels, from pea- size to 6 inches in diameter and well-rounded, are composed of novaculite, quartz, sandstone, and quartzite. Iron cemented conglomerates may be present locally. The basal gravels form a cuesta in the area. The cross-bedded sands are medium-to fine-grained quartz with minor amounts of heavy minerals, glauconite, iron concretions, and gray clay ripup clasts. The sands weather yellow to orange to red. Gray clays are lignitic, pyretic, fossiliferous, and may contain leaf imprints. The volcanic ash is light gray to white and has altered to a kaolinitic clay. The source area for much of the formation's sediments was the Ouachita Mountains region. The formation outcrop belt extends from near Arkadelphoa, southwest to the Arkansas-Oklahoma state line near Arkinda AR, and dips to the south approximately 80 feet per mile. The thickness of the unit in the mapped area ranges from 0 to 300 feet. The Tokio Formation was deposited in a nearshore-marine environment upon an unconformable surface separating it from the underlying Woodbine Formation.

Ki **Igneous rocks** *(Lower Cretaceous)* - Igneous rocks in this quadrangle consist of three general types: magmatic lamproite; pyroclastic lamproite tuff; and epiclastics. The rocks are very unstable at surface conditions, and rapidly weather to a sticky green and yellow clay. Unweathered igneous rocks are dark green in this area. The pyroclastic lamproite tuff is a source of gem quality diamonds. Diamonds remain as one of the resistant detrital minerals which wash out of the clay. The igneous rocks are thought to be derived from the earth's mantle. Isolopic age dates irom micas indicate these igneous intrusions occurred approximately 106+/- 4 million years ago. The diamonds, however, are much older, as inclusions within the diamonds have been dated as 3.2 billion years old.

Kt **Trinity Group** *(Lower Cretaceous)* - The Trinity Group consists of gravel, sand, clay, limestone, gypsum, celestite, and barite. The group is exposed in a east-west trending bell dipping southward approximately 100 feet per mile. Sediments composing this unit originated to the north in the Ouachita Mountain region and were deposited following a major angular unconformity developed on an uplurned and eroded Paleozoic surface in a nearshore marine environment. Members exposed are the Pike gravel, the Delight sand, the Dierks Limestone, the Holly Creek sand, the DeQueen Limestone , and the Paluxy sand.

The Paluxy sand member is composed of cross-bedded medium- to fine-grained quartz sand, minor grave, and bedded gray, light gray, and brown clay. Sands weather to yellow to orange-red. Near the bade of this member barite cementing forms sandstone, resulting in the formation of topographic highs. Thickness in the mapped area is less than 300 feet.

Kdq The DeQueen Limestone Member is composed of interbedded gray fossiliferous limestone, gray and green calcareous clay, very fine quarts sand, and silt. Thickness of the limestone beds vary, but only rarely do they exceed 24 inches. Ripple marks, mud cracks, and worm trails are common on the upper surfaces of the limestone slabs. Clays weather to a yellowish-brown and are sticky. Orangish to white celestite occurs near the base of this member and may be up to 6 inches thick. The celestite occurs in a lens, is concordant with bedding, and may be interbedded with gray clay. Thickness of member is from40 to 60 feet in the mapped area. Fossils present are primarily brackish-water molluscan fauna, the most common being *Ostrea franklini.* This member corresponds to the Ferry Lake Anhydrite in the subsurface of southern Arkansas.

The Holly Creek member is composed of cross-bedded gray, fine to very fine-grained quartz sand, gravel, and clay. Sands commonly weather red to yellow when exposed. Clays are typically gray to brown. The Ultima Thule gravel lens is a part of this member. Consisting of bedded pea-size gravel, the gravels of the Ultima Thule are composed of novaculite, sandstone, quartzite, and quartz. Minor sand and clay lenses occur within the gravel unit, while sand commonly fills the interstitial spaces around the gravel. Iron-cemented conglomerates may be present locally. Thickness of the Ultima Thule gravel in the area is 10 to 20 feet, while the thickness for the entire member is less than 250 feet.

Kds The Dierks Limestone Lentil is composed of interbedded gray fossiliferous limestone and green calcareous clay. Upon weathering, the limestone forms thin slabs (less than 1 foot thick) and nodules. Weathered clay is sticky and yellow to gray-green in color. The thickness of the member ranges from 0 to 30 feet in the mapped area, and is not recognized west of the Cossatot River. Fossils found are brackish-wather molluscan fauna with some marine influence. This lentil corresponds to the James Limestone in the subsurface of south Arkansas.

The Delight sand member is coposed of cross-bedded gray fine-grained quartz sand, which is interbedded with gray clay. Locally, asphalt-imprgnated sands occur as thin (less than 6 inches) lenses. Iron concretions, probably resulting from deterorated pyrite, are present. At the surface, weathering produces yellow to red sand. On vertical slopes, bedding features may be visible. Mapped thickness of the Delight sand member in the area ranges from 0-140 feets.

The Pike gravel member is a bedded gravel composed of novaculite, sandstone, quartzite, and quartz. The basal few feet of the unit contains a higher percentage of cobbles and boulders, some up to 24 inches in diameter, but the average size of the gravel is ½ to 10 inches in diameter. Minor sand and clay lenses occur within the gravel, while sand commonly fills the inferstitial spaces around the gravel. Due to its resistance to erosion the gravel forms ridges. It weathers reddish due to iron staining. Iron-cemented conglomerates may de present locally. Mapped thickness of the Pike gravel in the area ranges from 20 to 40 feet.

Pa **Atoka Formation** *(Pennsylvanian)* - The lower part of the Atoka Formation is exposed along the northern portions of the quadrangle. The formation is composed primarily of numerous thin to thick interbedded layers of grayish black shale, and fine- to medium-grained micaceous sandstone. The shale weathers tannish gray while the sandstone weathers light to dark brown. There are minor beds of black siliceous shale, chert, and conglomeratic sandstone. Lenses and masses of sandstone, siltstone, shale, and siderite occur in some thick chaotic intervals and also in a few thin interbedded debris flows. Some sandstones contain traces of coalified plant remains. It is estimated that approximately 4,500 feet of the lowers most Atoka Formation occurs in thrust faulted sequences in the quadrangle. About 2,500 feet of additional lower Atoka strata is present at adjoining sites. A complete section of lower Atoka strata does not exist in the Athens plateau. Trace fossils and abundant sedimentary features are indicatice of deep marine turbidite deposition. The lower Atoka Formation is conformable with the underlying Johns Valley Shale. In places a major angular unconformity separates the lower Atoka Formation from the overlying Pike gravel member of the Trinity Group (Lower Cretaceous).

Pjv **Johns Valley Shale** *(Pennsylvanian)* - The Johns Valley Shale is restricted to a very small exposure bounded by thrust faults along the north central portion of the quadrangle. The Johns Valley Shale in adjoining localities typically consists of alternating intervals of grayish black shale and micaceous, silly, fine-to medium- grained, light gray sandstone. The shale usually weathers to a clayey buff gray color while the sandstone weathers to a light to dark brown color. Minor thin sequences of siliceous shale and chert are present with small siderite concretions and nodules occurring in some shales. Chaotic intervals occur notably near the base of the formation and rarely may contain lenses of exotic, calcareous, fossiliferous siltstone. Carbonized plant remains occur in some of the silly sandstones. An incomplete section of 300 to 400 feets of Johns Valley Shale is present in the quadrangle, but nearby the formation has a total thickness of about 2,500 feet. Deep marine tubidite deposition is indicated by abundant sedimentary features and trace fossils. The formation is conformable with both the underlying Jackfork Sandstone and the overlying Atoka Formation. At adjoining sites a major unconformity separates the Johns Valley Shale form the overlying Pike gravel member of the Trinity Group (Lower Cretaceous).

Pj **Jackfork Sandstone** *(Pennsylvanian)* - The Jackfork Sandstone contains many alternating layers of grayish black shale and silty to quartzose, fine- to medium-grained, light gray sandstone. Weathering of the shale results in a reddish to tannish gray color. The sandstone weathers while to reddish brown. Some granule-conglomerate intervals occur in massive quartzose sandstones in both the upper and lower portions of the formation. Minor thin sequences of black siliceous shale and chert are present. An occasional debris flow from 5 to 15 feet thick contains clasts of shale, sandstone, and siderite. Some slurried silty sandstones contain coalified plant remains. Sedimentary features and trace fossils indicative of deep marine turbidite deposition occurs throughout the approximately 5,300 feet of the incompletely exposed formation in the quadrangle. An additional 2,500 feet of the lower Jackfork formation cours at adjoining sites. The formation is comformable with both the underlying Stanley Shale and overlying Johns Valley Shale. In Places where the Pike gravel member of the Trinity Group overlies the formation, a major angular unconformity exists.

Symbols

- Contacts
- Thrust Faults (dotted where concealed)
- Tear Faults (dotted where concealed)
- Strike and Dips
- Sand and/or Gravel Pit, Active
- Sand and/or Gravel Pit, Abandoned
- Sand and/or Gravel Pit, Reclaimed
- Open Pit or Quarry, Active
- Open Pit or Quarry, Abandoned
- Prospect, Abandoned
- CL Clay
- DM Diamond
- GY Gypsum
- SG Sand & Gravel
- CS Stone, Crushed

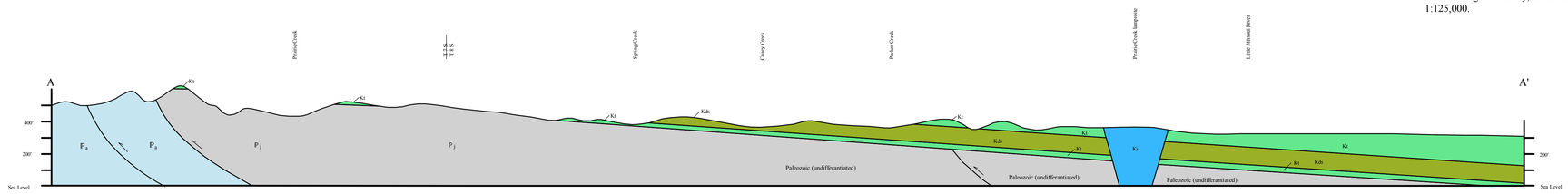
References

Bush, W.V., Clardy, B.F., Stone,C.G., Haley, B.R., 1971, Geologic map of the Murfreesboro quadrangle, Pike and Hempstead Counties, Arkansas: Arkansas Geological Commission Open-File Report, scale 1:24,000.

Dane, C. H., 1929, Upper Cretaceous formation of southwestern Arkansas: Arkansas Geol. Survey Bull. 1, 215p.

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

Miser, H. D., and Purdue, A. H., 1929 Geology of the DeQueen and Caddo Gap Quadrangles, Arkansas: U.S. Geological Survey, Bulletin 808, 195p., scale 1:125,000.



GEOLOGIC CROSS SECTION A-A'
(Quaternary deposits not shown)
Vertical exaggeration 5x

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Revised by Nathan H. Taylor