

SURFICIAL GEOLOGY OF BOURBON COUNTY, KANSAS

Original geology by Ronald R. West and Robert S. Sawin (2002)
Coal and mined-land updates by Lawrence L. Brady

2020

Computer compilation and cartography by Jorgina A. Ross, Muelo Ono, and David Means (2002)
Cartographic revisions by John W. Dunham, Peter Monshizadeh, and Jan J. Ramirez (2020)

MAP M-97 (Revised)

GEOLOGIC UNITS

CENOZOIC ROCKS

Holocene

Qal

Picc

PALEOZOIC

Picc

Piccd

Picp

Picg

Pics

Picab

Piccb

Picbc

Picbd

Picbe

Picbf

Picbg

Picbh

Picbi

Picbj

Picbk

Picbl

Picbm

Picbn

Picbo

Picbp

Picbq

Picbr

Picbs

Picbt

Picbu

Picbv

Picbw

Picbx

Picby

Picbz

Picb1

Picb2

Picb3

Picb4

Picb5

Picb6

Picb7

Picb8

Picb9

Picb10

Picb11

Picb12

Picb13

Picb14

Picb15

Picb16

Picb17

Picb18

Picb19

Picb20

Picb21

Picb22

Picb23

Picb24

Picb25

Picb26

Picb27

Picb28

Picb29

Picb30

Picb31

Picb32

GENERAL GEOLOGY

Bourbon County, near the southeastern corner of Kansas, is bounded on the north by Lin County, on the south by Crawford County, on the west by Neosho and Allen counties, and on the east by the state of Missouri. The county has a total area of 837 (14,627 sq mi) (Hall and Fortner, 1981), of which 97 mi² (25 km²), or 1.5%, is water. Pennsylvanian sedimentary rocks—limestones, sandstones, and coals—crop out throughout the county and range in age from the lower Devonian (Cherokee Group) to the lower Mississippian (Kansas City Group). The general orientation of these rocks is diagonal (northeast-southwest) across the county from the oldest Cherokee Group, exposed in the southeastern corner and eastern edge of the county, to rocks of the Mazonian and Meramec Formations across the middle, to the youngest (Kansas City Group) rocks along the western edge.

Rocks of the Cherokee Group are mostly siliciclastic (sandstone and shale), with an occasional thin limestone. It is within the interval that most of the economically important coal beds occur. The lower Mazonian Group is siliciclastic and thick limestone; the upper Mazonian and Meramec groups are mostly siliciclastic with thin limestones; and the Kansas City Group is mudrock and thick limestone.

The stratigraphic sequence in Bourbon County extends from below the Mineral coal bed in the Cherokee Formation (Cherokee Group) to the lower part of the Cherokee shale (Kansas City Group). Outlying these Pennsylvanian rocks in stream valleys are Quaternary alluvium and stream terraces. Although a number of changes have been proposed for the names of lithostratigraphic units in this interval, especially those associated with the Devonian-Mississippian boundary, such suggestions are, at this time, informal. The terminology used here is that given by Zeller (1968) with one exception. The Holocene Shale has been divided into the Memorial Shale below and the Fort Scott Formation above (Hockett, 1991), and the Laderbe Shale has been changed to the Elm Branch Shale (Hockett and Witney, 2002).

The bedrock geology of Bourbon County was mapped on U.S. Geological Survey topographic quadrangle maps at a scale of 1:250,000. Data points used in mapping the bedrock geology are available in Open-File Report 2002-02 (West and Brown, 2002) at the Kansas Geological Survey (KGS). Some measured stratigraphic sections and descriptions of cores in Bourbon County are contained in KGS Open-File Report 94-37 (West and Brown, 1994). Alluvial deposits, quarries, and strip pits were mapped using the Soil Survey of Bourbon County, Kansas (Bell and Fortner, 1983). Alluvial and stream terraces 5-15 ft or more in thickness were mapped. These deposits include sand, gravel, silt, and clay that were deposited on floodplains by streams, creeks, and rivers. These units, along with data from the Kansas Department of Transportation, were also used to help locate and identify bedrock units. The groupings that have been mapped are what the authors considered most appropriate lithostratigraphic units.

GLACIOLOGY
Physiographically, most of Bourbon County lies within the Ozage-Cuestas region; only the southeast corner is considered part of the Cherokee Lowlands. Rocks found in the Ozage-Cuestas are composed of alternating layers of sandstone, limestone, and mudrock. The coarseness, with generally steeper east-facing slopes and flatter west-dipping flanks, are subtle, large-scale features that are difficult to detect from the ground. Areas with long, narrow, filled-in pits bordered by hummocky, vegetated topography now characterize much of the Cherokee Lowlands in Bourbon County. These features are the result of extensive strip mining for coal before the reclamation of the mines was required in 1969. These reclaimed areas are now private property or public hunting, fishing, and wildlife areas.

Topographic relief in the county is 190 to 1,077 m, with the highest area (1,110 ft/338 m) in the southwestern corner and the lowest (760 ft/232 m) where the Marmaton River and Little Ozage River cut the state along the eastern edge of Bourbon County. Major drainage include the Marmaton River that drains the central and southern parts of the county and the Little Ozage River along the northern part. The West Fork of the Wood Creek cuts the southwestern corner of the county. Bourbon County State Lake and Lake Fort Scott are the largest lakes in Bourbon County.

STRUCTURAL GEOLOGY

The general structure in Bourbon County is northeast-southwest with regional dips to the northwest at 15 to 20 ft (5 to 6 m) per mile. Locally, strike and dip directions can vary significantly. An inferred fault was mapped in the Hammond Quadrangle based on field data.

MINERAL RESOURCES

Bourbon County is known for its coal-mining heritage, and many different oblique groups are still being worked in the coal fields. Coal was mined from the upper Cherokee and Mazonian groups where they occur near the surface in the western part of the county. Most of the mines were surface mines, but some underground mining was conducted. Oil and gas is produced from about 20 active fields in Bourbon County, almost exclusively from Cherokee Group sandstone and coals. A few small fields have produced some oil from the Mississippian. Production for the county in 2019 was 56,422 barrels of oil from 667 wells and no gas (Kansas Geological Survey, 2020). Total cumulative production for the county, through February 2020, is 1,885,118 barrels of oil and 1,996,704 million cubic feet of gas. Limestone is quarried for aggregate from several limestone formations throughout the county. The Bandera Sandstone Member of the Bandera Shale is quarried near Redfield for flagstone and building stone.

Exploration

Boundaries and Locations
County line
Township line
Section line
Geologic cross section
Fort Scott County seat
Incorporated city or locality
Unincorporated city or locality
Transportation
U.S. highway
State highway
Medium-duty primary road
Medium-duty secondary road
Light-duty road
Unimproved road
Railroad
Airport
Resource Development
TMI material

Geologic Unit Boundaries
Observed contact
Concealed contact
Geologic Structure
Fault—Inferred
LID
Hydrology and Topography
Perennial stream
Intermittent stream
Perennial water body
Perennial water body, manmade channel
Elevation contour
100-foot interval
20-foot interval
Pits and Quarries
Coal strip pit
Limestone quarry
Sandstone quarry

Indices to 1:250,000-scale USGS quadrangle maps
Index shows the names and locations of the 20 quadrangle maps that cover Bourbon County. The index is in the digital compilation of the Bourbon County map. The names were reported in the same order as the quadrangle maps.

CITED REFERENCES
Bell, E. L., and Fortner, J. R., 1981. Soil survey of Bourbon County, Kansas: U.S. Department of Agriculture, Soil Conservation Service and Kansas Agricultural Experiment Station, SR9, 30 maps.
Ehoks, W. J., Jr., James, G. W., and Livingston, N. D., 1977. Evaluation of heavy oil and tar sands in Bourbon, Crawford, and Cherokee counties, Kansas—final report. U.S. Department of Energy, Bartlesville Energy Research Center, 110 p.
Hockett, P. H., 1991. Lost Branch Formation and revision of upper Devonian stratigraphy along midcontinent Pennsylvanian outcrop belt. Kansas Geological Survey, Geology Series 4, 67 p.
Hockett, P. H., and Witney, W. L., 2002. Revision of stratigraphic nomenclature and classification of the Cherokee Group in Bourbon County, Kansas. Kansas Geological Survey, Bulletin 246, 69 p.
Howell, W. B., 1956. Stratigraphy of pre-Mazonian Devonian (Cherokee) rocks in southeastern Kansas. Kansas Geological Survey, Bulletin 122, 132 p.
Jewett, J. M., 1945. Stratigraphy of the Mazonian Group, Pennsylvania, in Kansas: Kansas Geological Survey, Bulletin 58, 148 p.
Jewett, J. M., Emery, P. A., and Fischer, D. A., 1963. The Pennsylvanian Group (Upper Pennsylvanian) in Kansas. Kansas Geological Survey, Bulletin 175, pt. 4, 11 p.
KGS, 2020. Oil and Gas Production Data. <http://www.kgs.ku.edu/PRS/County/cherokee.html>
Schoewe, W. H., 1959. Coal reserves of the Cherokee Group in eastern Kansas—A Mafly coal. Kansas Geological Survey, Bulletin 134 (1959 Report of Studies), p. 5, p.181-222.
Severis, W. J., 1969. Geology and ground-water resources of Lin County, Kansas: Kansas Geological Survey, Bulletin 193, 65 p.
West, R. R., and Sawin, R. S., 2002. Geologic map of Bourbon County, Kansas—data control points. Kansas Geological Survey, Open-File Report 2002-02, 139 p.
West, R. R., and Sawin, R. S., 1994. Stratigraphic sections—Bourbon County, Kansas—1994 Field Station. Kansas Geological Survey, Open-File Report 94-37, 51 p.
Zeller, D. E., 1968. The stratigraphic succession of Kansas. Kansas Geological Survey, Bulletin 189, 81 p.

SUGGESTED REFERENCES TO THIS MAP
West, R. R., and Sawin, R. S., [2002] 2020. Surficial Geology of Bourbon County, Kansas. Kansas Geological Survey, Map M-97 (Revised), scale 1:50,000.

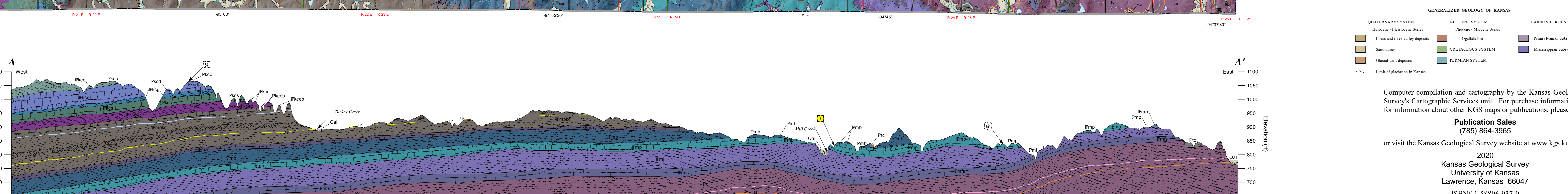
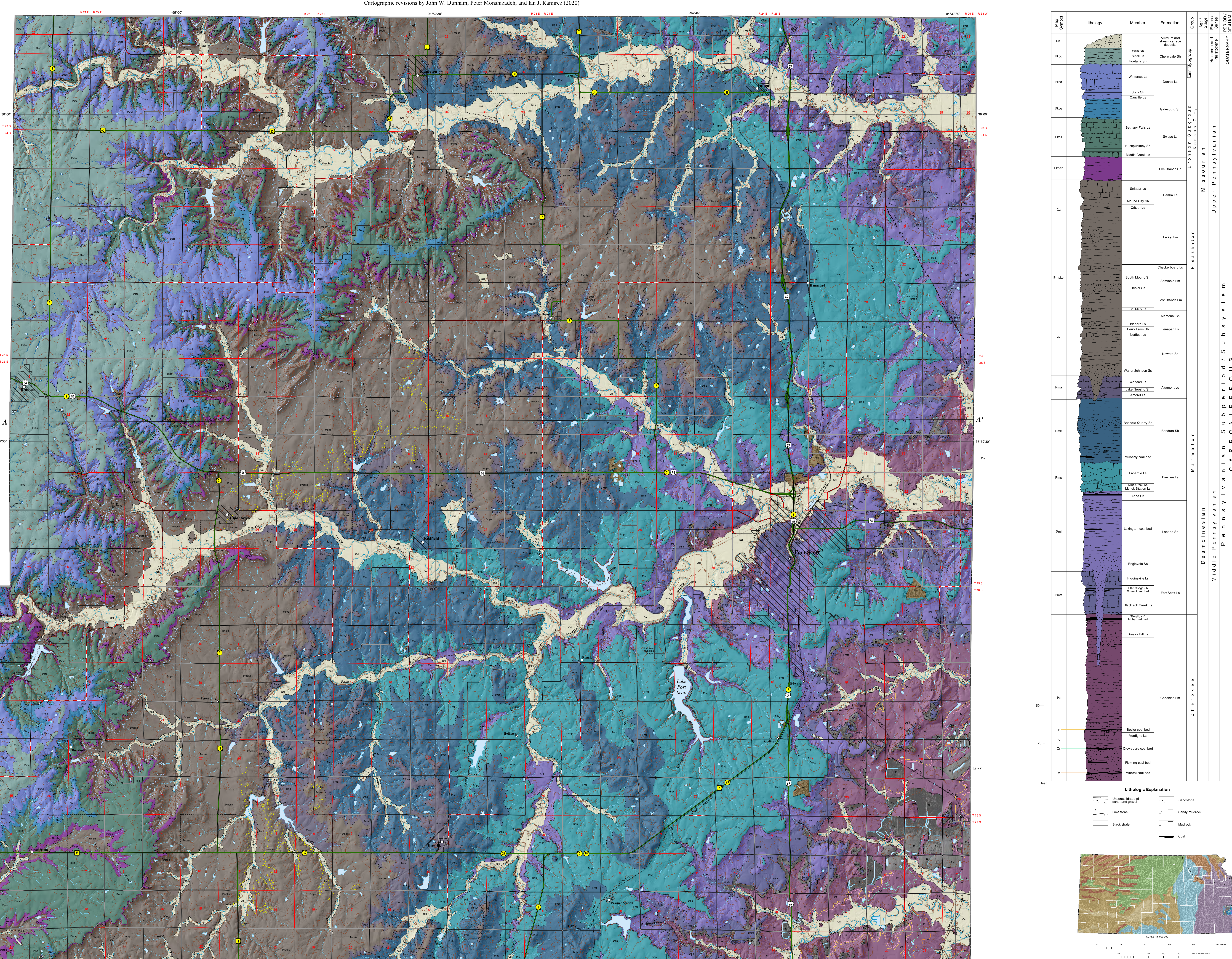
Elevation contours from the USGS US Topo dataset are presented for general reference. They were generated from 1/3-second National Elevation Dataset (NED) digital elevation models (DEM) which are available from the USGS. The NED data were modified by the Digital National Elevation Dataset (NED) features for better integration between topography and hydrography. In some places the contours may be more generalized than the base maps used for compilation of geologic contours. Contours on this map typically reflect topographic variation more accurately than associated contour lines. Reported fluctuation of a contour across a contour line indicates that the mapped rock unit is maintaining a relatively constant elevation along a generalized contour.

Roads and highways are shown on the base map as represented by data from the Kansas Department of Transportation (KDOT) and other sources. U.S. Department of Agriculture—Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) imagery also was used to check road locations.

Shaded relief is based on linearly interpolated bare-earth DEMs from the State of Kansas LIDAR Database. The DEMs, in Esri's Tagged Image File Format (TIFF) format, were mosaicked into a single output DEM file and then georeferenced to geographic coordinates. The output DEM was then converted to a hillshade, a multidirectional shaded-relief image using angles of illumination from 0°, 22.5°, 45°, and 67.5° azimuths, each 45° above the horizon, with a 4x vertical exaggeration.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program. This map was produced using the ArcGIS system developed by Esri (Environmental Systems Research Institute, Inc.).

The Kansas Geological Survey does not guarantee this map to be free from errors or inaccuracies and disclaims any responsibility or liability for interpretations made from the map or decisions based thereon.



Computer compilation and cartography by the Kansas Geological Survey's Cartographic Services unit. For purchase information, or for information about other KGS maps or publications, please call
Publication Sales
(785) 864-3965
or visit the Kansas Geological Survey website at www.kgs.ku.edu.
2020
Kansas Geological Survey
University of Kansas
Lawrence, Kansas 66047
ISBN 1-58806-937-0