KU KANSAS GEOLOGICAL SURVEY
The University of Kansas

PRELIMINARY SURFICIAL GEOLOGY OF LINCOLN COUNTY, KANSAS

by Robert S. Sawin

2023

Cartographic assistance by John W. Dunham, Emily G. Bunse, and Kolbe D. Andrzejewski

Open-File Report 2023-41

Funded in part by the
USGS National Cooperative
Geologic Mapping Program

MAP LOCATION

SCALE 1:5 000 000

50 0 50 100 150 200 MILES
80 0 80 160 240 320 KILOMETERS

GENERALIZED GEOLOGY OF KANSAS

QUATERNARY SYSTEM
- Holocene - Pleistocene Series
  - Loess and river-valley deposits
  - Sand dunes
  - Glacial-drift deposits
  - Limit of glaciation in Kansas
- NEOGENE SYSTEM
  - Pliocene - Miocene Series
    - Ogallala Formation
- CRETACEOUS SYSTEM
- JURASSIC SYSTEM
- PERMIAN SYSTEM
- CARBONIFEROUS SYSTEM
  - Pennsylvanian Subsystem
  - Mississippian Subsystem

Lincoln County 7.5-minute Quadrangle Maps

HUNTER	ASH GROVE	LINCOLN NW	BARNARD	ADA
SYLVAN GROVE	VESPER	LINCOLN	SHADY BEND	TESCOTT
WILSON NW	WILSON NE	WESTFALL NW	WESTFALL	JUNIATA
WILSON	BLACK WOLF	WESTFALL SW	WESTFALL SE	BROOKVILLE SW

Index shows the names and locations of the 20 USGS 7.5-minute 1:24,000-scale quadrangle maps used in the digital compilation of the Lincoln County map. The geology was mapped in the field using these topographic maps.

APPROXIMATE MEAN
DECLINATION, 2023

Geology was mapped in the field using USGS 7.5-minute 1:24,000-scale topographic quadrangle maps. Contacts were then converted to GIS form at, edited, and attributes added. This data was then used to generate the mapped-unit GIS data, to which necessary attribution was also added.

Elevation contours, from the U.S. Geological Survey (USGS) US Topo dataset, are presented for general reference. They were generated from 1/3 arc-second National Elevation Dataset (NED) digital elevation models (DEMs), filtered to smooth the arcs. The NED data were modified by the National Hydrography Dataset (NHD) features for better integration between hypsography and hydrography. In some places the contours may be more generalized than the base maps used for compilation of geologic contacts. Contacts on the map will typically reflect topographic variation more accurately than the associated contour lines. Repeated fluctuation of a contact across a contour line indicates that the mapped rock unit is maintaining a relatively constant elevation along a generalized contour.

The geology was mapped using a combination of field measurements and observations and subsequent digital mapping using Esri ArcGIS.

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 1-meter hydroflattened bare-earth DEMs from the State of Kansas LiDAR Database. The DEM images, in Erdas Imagine (.img) format, were mosaicked into a single output DEM in Esri file geodatabase raster format. That DEM was then downsampled to 2-meter resolution and subsequently converted to geographic coordinates. The output DEM was then converted to a hillshade, a multidirectional shaded-relief image using angles of illumination from 0°, 225°, 270°, and 315° 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 (NCGMP) under StateMap award number G22AC00574 (FY2022). Input 1:24,000- scale mapping was funded by the NCGMP in part under StateMap award numbers G15AC002258 (FY2015) and G16AC00195 (FY2016). The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

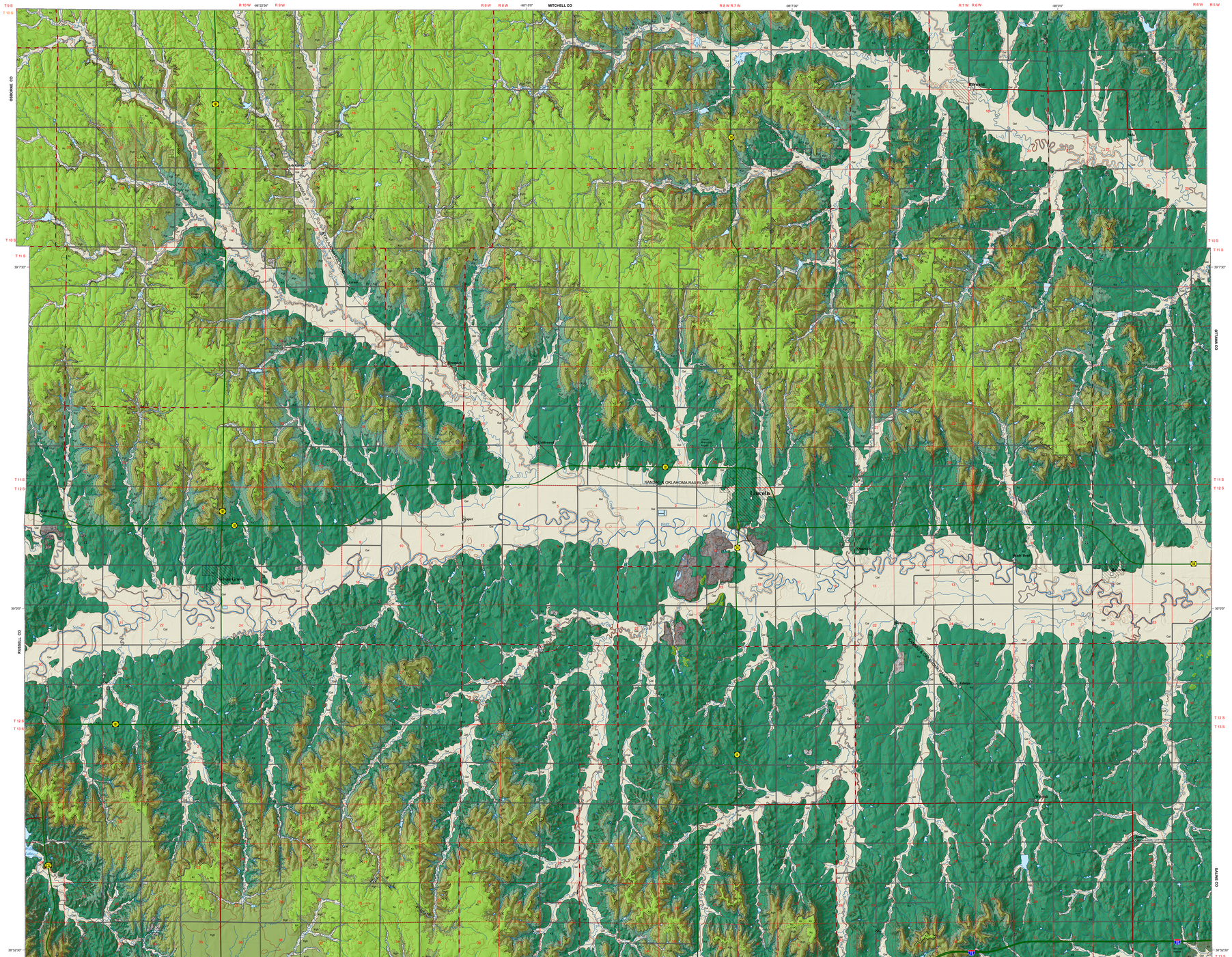
This map was produced using the ArcGIS system developed by Esri (Environmental Systems Research Institute, Inc.) and Adobe Illustrator using the ArcGIS Maps for Adobe Creative Cloud extension.

This map is a preliminary product and has had less scientific and cartographic review than the Kansas Geological Survey's M-series geologic maps. 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.

This preliminary map version was created for display at the 2023 Esri User Conference. The final published version will be released as M-127 and include a cross section, stratigraphic column, report, and significant changes to the Quaternary geology.

SUGGESTED REFERENCE TO THIS MAP

Sawin, R. S., 2023, Preliminary surficial geology of Lincoln County, Kansas: Kansas Geological Survey, Open-File Report 2023-41, scale 1:50,000, unpublished.



SCALE 1:50 000

1 0.5 0 1 2 3 4 MILES
1 0.5 0 1 2 3 4 5 KILOMETERS

LAMBERT CONFORMAL CONIC PROJECTION
WITH STANDARD PARALLELS AT 33° AND 45°
NORTH AMERICAN DATUM OF 1983

These descriptions are a compilation of several sources, including field notes and measured sections, Kansas Department of Transportation geological reports and profiles, and lithologic descriptions in Berry (1952), Bayne et al. (1971), and Arbogast and Johnson (1996).

GEOLOGIC UNITS

CENOZOIC

Quaternary System
Pleistocene-Holocene

Qal

Alluvium and terrace valley fill—Alluvium and terrace valley fill are found along the Saline River and its tributaries. Floodplain deposits contain mostly silt and clay with some sand. The thickness of the alluvium ranges up to 60 ft (18 m) in the Saline River valley and 20 ft (6 m) in other major tributaries in the county (Berry, 1952).

MESOZOIC

Cretaceous System – Upper Cretaceous Series

Kc

Carlile Shale—The Carlile Shale contains three members. In ascending order, they are the Fairport Chalk Member, the Blue Hill Shale Member, and the Codell Sandstone Member. Only the lower part of the Fairport Chalk Member is present in Lincoln County, where it is up to 20 ft (6 m) thick and very similar to the upper beds of the Greenhorn Limestone (Berry, 1952). It consists of alternating beds of thin, concretionary limestone and chalky mudrocks, as well as thin bentonite layers. The Carlile Shale caps the high hills in the northern and southwestern parts of the county.

Kgh

Greenhorn Limestone—The Greenhorn Limestone contains the following four members, in ascending order: the Lincoln Limestone Member, the Hartland Shale Member, the Jetmore Chalk Member, and the Pfeifer Shale Member. Each member is 15 to 20 ft (5 to 6 m) thick. The contacts between the members are gradational and not easily recognized in the field. In general, the Greenhorn is light gray to yellowish-gray chalky limestone, chalky mudrock, and chalk. Several limestone beds contain the fossil clam *Inoceramus* sp. that is characteristic of the formation. The lower part of the Greenhorn (Lincoln Member) is interbedded layers of chalky mudrock, chalky limestones, and dark gray crystalline limestone near the base that has a strong petroliferous odor when freshly broken. The middle part (Hartland and Jetmore Members) is chalky mudrock with interbedded layers of nodular limestone, chalky limestone, and bentonite. The upper part of the formation (Pfeifer Member) is interbedded thin chalky limestones and chalky mudrocks containing bentonite seams and is capped by the Fence-post limestone bed, a 0.7 ft (0.2 m) thick limestone that weathers light tan with a rust-colored line in the middle. The Fence-post bed has been quarried extensively in Lincoln County. The Greenhorn is 65 to 90 ft (20 to 27 m) thick in Lincoln County (Berry, 1952) and forms the prominent escarpments of the upland areas in the northern, southwest, and south-central parts of the county.

Kgr

Graneros Shale—The Graneros Shale is a gray to dark gray, noncalcareous, fissile shale that weathers to light gray and yellow-brown. Small flakes of the light gray fissile shale are characteristic of the weathered outcrop. Interbedded layers of fossiliferous (predominately *Inoceramus* sp. and *Ostrea* sp.) sandstone and limestone (up to 2 ft [0.6 m] thick) occur in the middle to lower part of the formation in Lincoln County, and thin (0.3 ft [0.1 m]) beds of limestone often occur near the top. A 1 ft (0.3 m) bentonite bed may be present near the top. Disseminated gypsum and selenite crystals also occur in the Graneros. In Lincoln County, the thickness of the Graneros Shale ranges from 20 to 45 ft (6 to 14 m). The Graneros Shale forms low hills above the Dakota Formation adjacent to the valleys and gentle slopes between the Dakota and the Greenhorn Limestone in the uplands. Landslides characterize the Graneros horizon.

Cretaceous System – Lower Cretaceous Series

Kd

Dakota Formation—The Dakota Formation is composed of two members: the lower Terra Cotta Clay Member and the upper Janssen Clay Member. The Dakota is composed of variicolored clay, claystone, and shale with irregular and sometimes massive lenses of siltstone and sandstone. The mudrocks are red-mottled pale-gray, tan to brown clay and silt. The interbedded sandstone lenses are fine to medium grained, very light gray to orange-tan to dark red-brown, and commonly poorly cemented. Concretions and thick layers of hard, gray, calcite-cemented sandstone (locally referred to as "Lincoln quartzite") are found in Lincoln County in small, isolated areas, but extensive deposits near Lincoln, Kansas are mined for aggregate. The Dakota often contains lignite and carbonaceous fragments, and small concretions and thin beds of limonite, siderite, and hematite occur as scattered fragments on eroded mudrock surfaces. The Dakota Formation ranges from about 140 ft (43 m) thick in eastern Lincoln County to about 200 ft (61 m) in the western part (Berry, 1952) and is an important source of water in Lincoln County and elsewhere in Kansas. In Lincoln County, the Dakota is exposed in much of central and southeastern parts of the county in areas adjacent to the Saline River and its tributaries.

Kk

Kiowa Formation—The upper part of the Kiowa Formation is present at the surface only in the extreme southeast corner of Lincoln County, where gray to dark gray shale and siltstone and fine-grained orange-tan sandstones outcrop near the boundaries with Ellsworth and Saline counties.

REFERENCES

Arbogast, A. F., and Johnson, W. C., 1996, Surficial Geology and Stratigraphy of Russell County, Kansas: Kansas Geological Survey, Technical Series 7, 45 p.

Bayne, C. K., Franks, P. C., and Ives, W., Jr., 1971, Geology and ground-water resources of Ellsworth County, central Kansas: Kansas Geological Survey, Bulletin 201, 84 p.

Berry, D. W., 1952, Geology and ground-water resources of Lincoln County, Kansas: State Geological Survey of Kansas, Bulletin 95, 96 p.

Resource Development
- Open gravel pit
- Quarry

Geologic Features
- Calcite-cemented concretions

Geologic Unit Boundaries
- Geologic contact

Boundaries and Locations
- County line
- Township/range line
- Section line
- A—A' Geologic cross section
- County seat
- City
- Locality
- Built-up area

Transportation
- State highway
- Medium-duty primary road
- Medium-duty secondary road
- Light-duty road
- Unimproved road
- Railroad
- Airport

Hydrology and Topography
- Perennial stream
- Intermittent stream
- Perennial water body
- Perennial water body, manmade shoreline
- 260 Elevation contour (100-foot interval)
- Elevation contour (20-foot interval)
- 260 Depression contour (100-foot interval)
- Depression contour (20-foot interval)

Last updated 10/9/2023