PRELIMINARY SURFICIAL GEOLOGY OF THE KINGMAN COUNTY PORTION OF THE RAGO QUADRANGLE, KANSAS

Geology by Jon J. Smith

GIS compilation and cartography by Kolbe D. Andrzejewski

2026

KANSAS GEOLOGICAL SURVEY
The University of Kansas

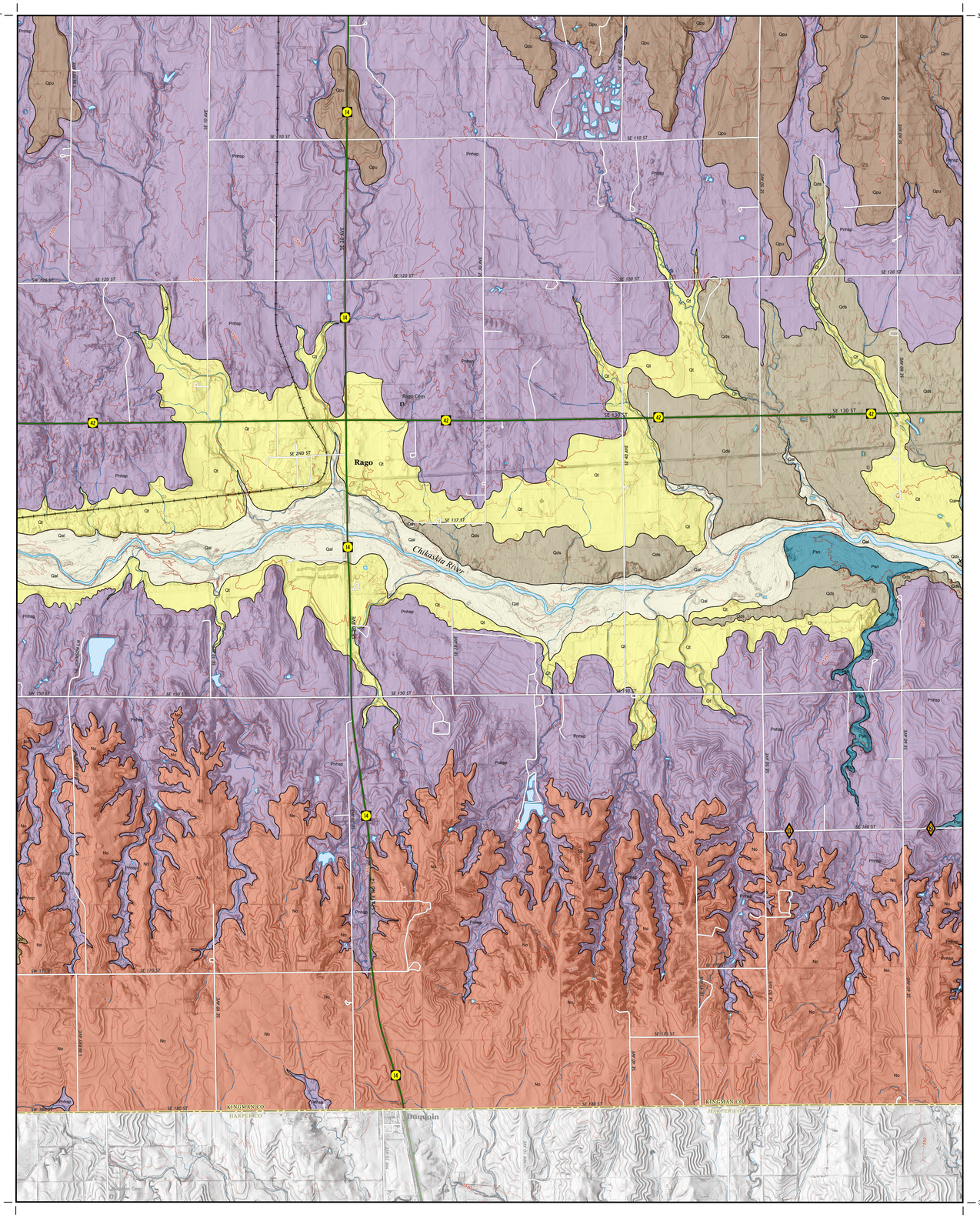
Open-File Report 2026-18

Funded in part by the USGS National Cooperative Geologic Mapping Program

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

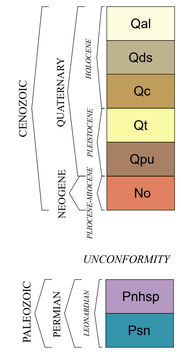
RAGO QUADRANGLE
KANSAS
7.5-MINUTE SERIES



GEOGRAPHY

Kingman County is located in south-central Kansas and has a total area of 876 square miles (2,250 km2). The county seat and the largest city is Kingman, which is located in the north-central portion of the county. The Chikaskia River drains to the southern portion of Kingman County, while the Ninnescah River and its tributaries cross and drain the northern half of the county. Snoots Creek and Nester Creek are large tributaries of the Ninnescah River that drain the northeastern corner of the county. Kingman County is mostly within the High Plains physiographic region of Kansas, while portions of the eastern third are within the Wellington-McPherson Lowlands. The surficial geology primarily consists of Quaternary alluvium and eolian deposits (floodplains and terraces), erosional remnants of the Ogallala Formation, and Permian bedrocks of the Sumner and Nippewalla Groups.

CORRELATION OF UNITS



The following descriptions consist of a compilation of several sources; including field notes and measured sections, U.S. Department of Agriculture Natural Resources Conservation Service databases, and lithologic and other data in Swineford (1955), Lane (1960), and Zeller (1968).

GEOLOGIC UNITS

Qal

Undifferentiated floodplain alluvium

Holocene alluvial deposits make up the modern floodplains in most of the principal streams in Kingman County. The main stems of streams in the county underwent deep incision during the latest Holocene and have recently re-established floodplains within the incised channels in some areas. Floodplain alluvium is composed of silt, sand, and gravel and is relatively thin, probably no more than 20 ft (6 m) in thickness.

Qds

Dune sand

Windblown dune sand is found mostly to the north of the Chikaskia River in Kingman County where it overlies terrace deposits, valley wall colluvium, and Paleozoic bedrocks. Originally a component of floodplain sediments, this material was redeposited upslope by wind. Dune sand nearest the river is up to 30 ft (9 m) thick and forms extensive fields of hillocky terrain. These deposits thin rapidly to the north as gently rolling, subdued dunes and sand sheets that are less than 6 ft (2 m) thick.

Qc

Colluvium and alluvial fan deposits

These deposits moved downslope and accumulated on river valley walls between Pleistocene alluvium and Paleozoic rocks in upland areas and ancient alluvial terraces along the margin of the Chikaskia floodplain. They consist of reddish-brown to dark gray, poorly sorted silt, sand, and gravel with angular fragments of chert and limestone and are generally less than 20 ft (6 m) thick.

Qt

Alluvial terrace deposits

Pleistocene terrace deposits are generally found adjacent to and slightly above the modern Chikaskia River floodplain and were likely deposited by the Chikaskia when it flowed at a higher level during the Pleistocene. These deposits are composed of unconsolidated clay, silt, sand, and gravel with coarser intervals functioning as locally important, shallow groundwater aquifers. Ancient terrace deposits are thickest (up to 50 ft; 15 m) near the modern river.

Qpu

Alluvial and eolian deposits (upland)

Mixed alluvial and eolian (loess) deposits are found on interfluve uplands well above and often distant from modern stream floodplains. Composed chiefly of Pleistocene silt, sand, and gravel, upland alluvium is generally reddish-brown in color and contains rounded to angular rock fragments with various provenances, including locally derived chert and limestone. This unit is the principal source of groundwater in Kingman County and supplies sufficient water to support center-pivot irrigation systems where it reaches thicknesses of up to 150 ft (46 m).

No

Ogallala Formation and undifferentiated Quaternary alluvium

This unit is present along the south-central portion to the border of Kingman County. The formation may contain Pleistocene sediments that are lithologically very similar to the Ogallala and that overlie the Ogallala in some areas. This unit is a mixture of cobbles, gravel, sand, silt, loess, clay, and caliche beds. The unit ranges in color from buff to reddish-brown with occasional beds of white caliche. The Ogallala Formation is in an upland position above the local water table in Kingman County and is generally less than 30 ft (9 m) thick.

Pnhsp

Harper Sandstone and Salt Plain Formation undifferentiated

The youngest Paleozoic rock units exposed in Kingman County are the Harper Sandstone and Salt Plain Formation of the Permian Nippewalla Group. These formations were mapped as undifferentiated because they are lithologically very similar and difficult to distinguish in outcrop and core. The Harper Sandstone, underlying the Salt Plain Formation, contains two members. The lower Chikaskia Sandstone Member is composed of approximately 150 ft (46 m) of reddish-brown sandstone and siltstone grading upsection to silty shale. The overlying Kingman Sandstone Member consists of 80 ft (24 m) of reddish-brown slabby siltstone containing beds of silty shale and light gray to white, silty sandstone. The base of the member is marked by a white, silty sandstone approximately 3 ft (1 m) thick. The Salt Plain Formation is composed mostly of reddish-orange, flaky siltstone and thin, fine-grained sandstone beds, often encrusted with salt and iron-stains on outcrop surfaces. These rocks are weakly cemented and easily eroded forming broad, low-relief areas. Much of the Pnhsp outcrop area is under cultivation; however good exposures can be found north and south of the Chikaskia River along roads crossing incised north-south running streams. These units have a combined thickness in Kingman County of approximately 250 ft (76 m). Nippewalla Group rocks are not known to yield water to wells in Kingman County.

Psn

Ninnescah Shale

The oldest rock unit exposed in Kingman County is the Ninnescah Shale of the Permian Sumner Group. The Ninnescah is composed mostly of blocky, brownish-red dolomitic or calcareous, silty shale but also contains some gray shale, argillaceous limestone and dolomite, and calcareous siltstone. The different colors of the beds give the outcrops a banded appearance. The unit's maximum thickness is 450 ft (137 m), but probably only the upper 100 ft (30 m) crops out in eastern Kingman County. The Ninnescah Shale is marked at the top by the Runnymede Sandstone Member, an approximately 8 ft (2.5 m) thick, very fine-grained, gray to grayish-green siltstone and sandstone. To the north of Kingman County, the upper limit of the Ninnescah Shale is demarcated at the base of the Stone Corral Formation, though this unit is absent in the mapped areas. In eastern Kingman County, near-surface portions of the Ninnescah Shale yield good quality water to domestic and livestock wells, though strong mineralization has been reported in the southeast corner of the county.

SOURCES

Bayne, C. K., 1960, Geology and ground-water resources of Harper County, Kansas: Kansas Geological Survey, Bulletin 143, 183 p.

Lane, C.W., 1960, Geology and ground-water resources of Kingman County, Kansas: Kansas Geological Survey, Bulletin 144, 173 p.

McCauley, J. R., 2007, Geologic map of Barber County, Kansas: Kansas Geological Survey, Map M-106, 1 sheet, scale 1:50,000.

Norton, G. H. (1939) Permian redbeds of Kansas: Am. Assoc. Petroleum Geologists, Bull., v. 23, p. 1751-1819.

Sawin, R. S., Franseen, E. K., West, R. R., Ludvigson, G. A., and Watney, W. L., 2008, Clarification and changes in Permian stratigraphic nomenclature in Kansas; in, Current Research in Earth Sciences: Kansas Geological Survey, Bulletin 254, part 2. http://www.kgs.ku.edu/Current/2008/Sawin/index.html.

Swineford, A., 1955, Petrography of upper Permian rocks in south-central Kansas: Kansas Geol. Survey, Bull. 111, p. 1-178, fig. 1-13, pl. 1-24.

Zeller, D. E., ed., 1968, The stratigraphic succession in Kansas: Kansas Geological Survey, Bulletin 189, 81 p., http://www.kgs.ku.edu/Publications/Bulletins/189/index.html.

Elevation contours are included for general reference. They are used in the U.S. Geological Survey's current US Topo 1:24,000-scale topographic map series. Elevation contours were generated from hydrographically-improved 1/3 arc-second National Elevation Dataset (NED) data and smoothed during processing for use at a 1:24,000 scale. In some places, the contours may be more generalized than the base data used for compilation of geologic outcrop patterns. Outcrop patterns on the map typically reflect topographic variation more accurately than the associated contour lines. Repeated fluctuation of an outcrop line across a contour line is an indication that the mapped rock unit is maintaining a relatively constant elevation along a generalized contour.

References used in the digital mapping include 1-meter LiDAR hillshades and 1-meter 2020 U.S. Department of Agriculture – Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) digital imagery. USGS 7.5-min 1:24,000-scale topographic maps, USDA Natural Resources Conservation Service (NRCS) soil surveys, and other geologic maps and bulletins were used as supplementary references. Roads and highways are shown on the base map as represented by data from the Kansas Department of Transportation (KDOT), U.S. Census Bureau, and other sources. Additionally, USDA-FSA NAIP imagery 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 format, were mosaicked into a single output DEM and reprojected to decimal degrees. 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 map was funded in part by the USGS National Cooperative Geologic Mapping Program, STATEMAP award number G25AC00518 (FY2025).

This map was produced using ArcGIS® software by Esri. ArcGIS® is the intellectual property of Esri and is used herein under license. Copyright © Esri. All rights reserved.
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 KGS 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.

OIL/GAS AND WATER WELLS FOR KINGMAN COUNTY

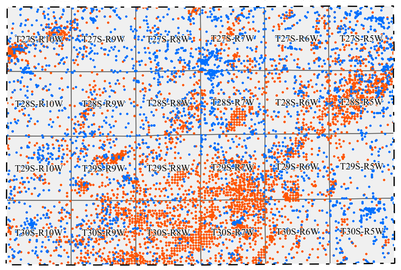
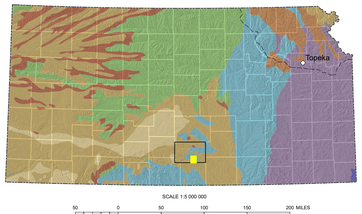


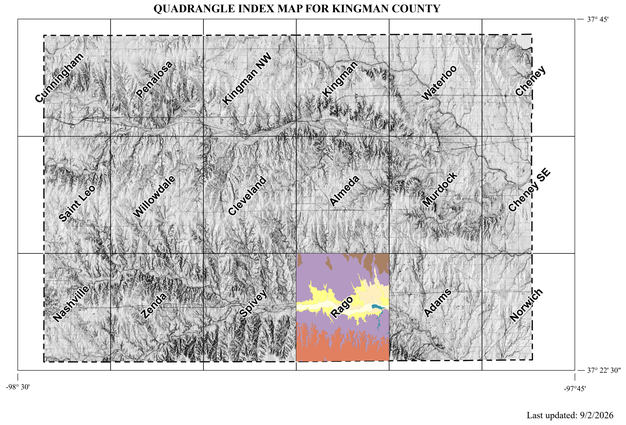
Figure 1. Road cut exposure of approximately 2 m of the undifferentiated Harper Sandstone-Salt Plain Formation (Pnhsp) consisting of thinly bedded, fine-grained orange to reddish-brown sandstone and mudstone with indurated Fe-rich intervals and salt crust precipitating on surfaces. Photo credit: Jon J. Smith, University of Kansas.

Figure 2. Stratigraphic contact between the orange-red sandstone and mudstone of the overlying Harper Sandstone-Salt Plain Formation (Pnhsp) and underlying red-brown and gray streaked, calcareous and blocky shale of the Permian Ninnescah Shale (Psn) in an approximately 10 m thick exposure along a sloped roadcut. Photo credit: Jon J. Smith, University of Kansas.

MAP LOCATION



QUADRANGLE INDEX MAP FOR KINGMAN COUNTY



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid:Universal Transverse Mercator, Zone 14S
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, August 2017 - September 2017
Roads..... U.S. Census Bureau, 2015
Names.....GNIS, 1978 - 2019
Hydrography.....National Hydrography Dataset, 2006 - 2018
Contours.....National Elevation Dataset, 2016
Boundaries.....Multiple sources; see metadata file 2019 - 2021
Public Land Survey System.....BLM, 2018
Wetlands.....FWS National Wetlands Inventory 1985 - 1985

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MN GN 3°58' 71 MILS 0°34' 10 MILS
U.S. National Grid
100,000 - m Square ID
NG
Grid Zone Designation 14S

SCALE 1:24 000
KILOMETERS
METERS
MILES
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

EXPLANATION

Transportation
- Paved road
- State highway
- Railroad

Hydrology
- Perennial stream
- Intermittent stream
- Waterbody

Topography
- Index elevation contour (50 feet)
- Elevation contour (10 feet)

Geology
- Observed contact
- Photo location

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 Fm

CRETACEOUS SYSTEM

PERMIAN SYSTEM

CARBONIFEROUS SYSTEM
- Pennsylvanian Subsystem
- Mississippian Subsystem

SUGGESTED REFERENCE TO THE MAP

Smith, J. J., 2026, Preliminary surficial geology of the Kingman County portion of the Rago quadrangle, Kansas: Kansas Geological Survey, Open-File Report 2026-18, scale 1:24,000, unpublished.

Last updated: 9/2/2026