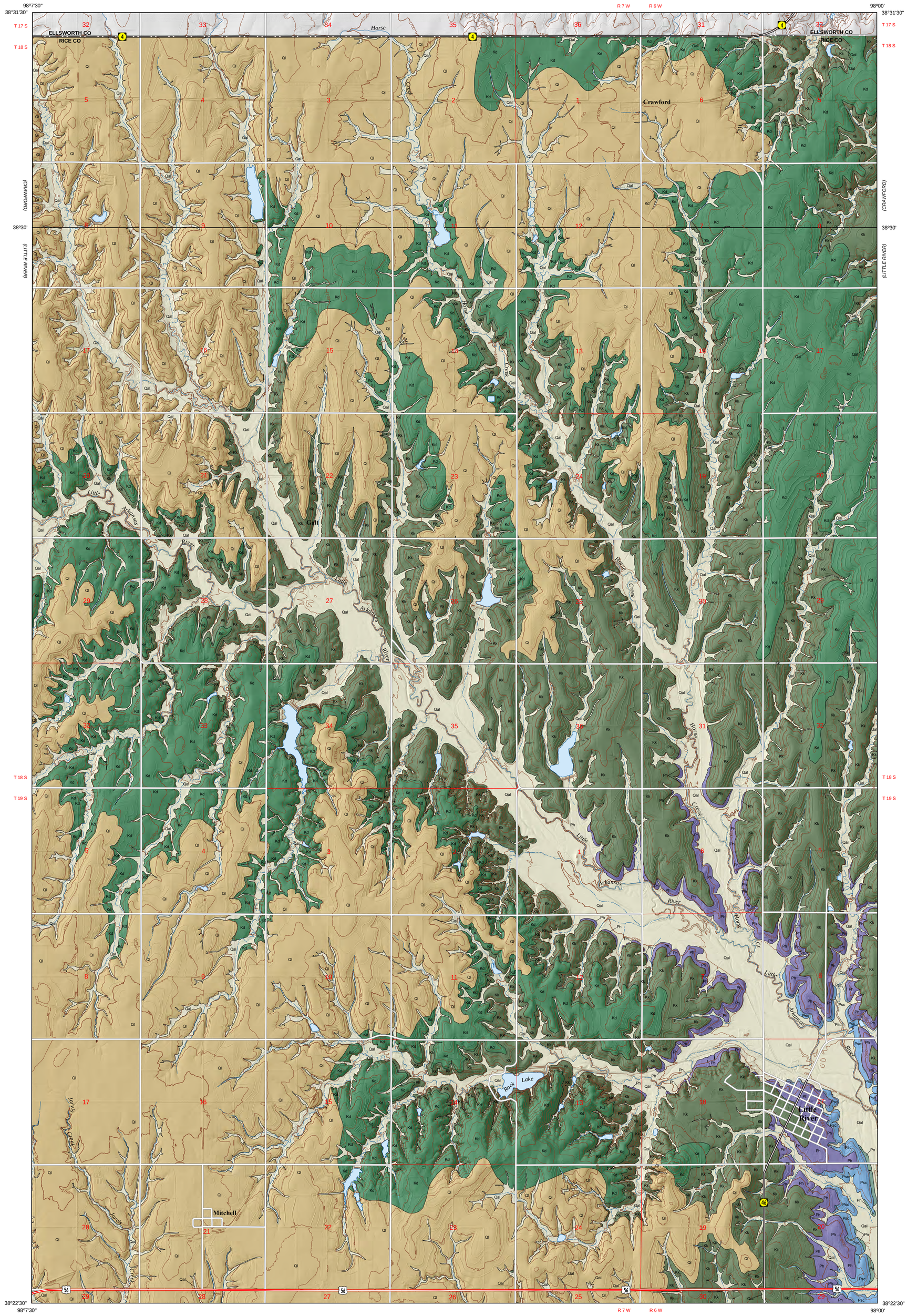
PRELIMINARY SURFICIAL GEOLOGY OF THE LITTLE RIVER QUADRANGLE AND THE RICE COUNTY PORTION OF THE CRAWFORD QUADRANGLE, KANSAS

by William C. Johnson, Nathan A. Schlagel, and John W. Dunham

2017



Qal

Ql

Kd

Kk

Ph

Psc

Pn

Open-File Report 2017-21

Funded in part by the USGS National Cooperative Geologic Mapping Program

The following descriptions consist of a compilation of several sources, including field notes and measured sections, data from shallow (<10 m) cores collected during the course of mapping, Kansas Department of Transportation geologic reports, U.S. Department of Agriculture Natural Resources Conservation Service databases, and lithologic and other data in Bayne and Ward (1974).

GEOLOGIC UNITS

CENOZOIC

Quaternary System
Holocene

Floodplain alluvium — Floodplain deposits are associated with the Arkansas River and its tributaries and are Holocene in age. These deposits consist of clay, silt, sand, and gravel. In the Arkansas River sand- to gravel-size sediment consists to a large extent of material derived from the Rocky Mountains, whereas the coarse sediment in its tributaries (e.g., Little Arkansas River, Cow Creek, and Little Cow Creek) is derived primarily from local shale and sandstone, with the exception of Rattlesnake Creek, which is dominated by sand-sized material derived from reworked Holocene sediments. Core data indicate that the thickness of the floodplain alluvium ranges from 0 to 45 ft (0–14 m) and averages about 25 ft (8 m).

Loess — Uplands in the northern and eastern parts of the county are mantled with loess, which consists of wind-transported silt with minor amounts of clay and very fine sand. The loess is buff in color and calcareous. The age of the loess is primarily late Pleistocene and is recognized as the Peoria Formation throughout the midcontinent; it ranges up to 13 ft (4 m) in thickness. The older, underlying Loveland Formation is a loess unit ranging up to 8 ft (2.5 m) in thickness. Additionally, minor loess deposition occurred in the early and middle Holocene but could not be differentiated from terminal Peoria Formation deposits in Rice County. Loess has a total thickness ranging up to 21 ft (6.5 m).

MESOZOIC

Cretaceous System

Dakota Formation — The Dakota Formation is well expressed in Rice County, particularly in the northeastern part of the county. The Dakota Formation consists of two members: the Terra Cotta Clay Member and the overlying Janssen Clay Member (Plummer and Romary, 1947), with only the former occurring in Rice County. The Terra Cotta Clay Member is composed primarily of interbedded red-mottled, light-gray to greenish-gray clay and siltstone and coarse-grained and conglomeratic sandstone. Though it contains lentils of cross-bedded sandstone, the member consists mostly of clay and siltstone (Bayne et al., 1971). Topographic expression is variable and depends on the degree of cementation. Maximum thickness of the Dakota Formation in Rice County is about 75 ft (23 m) (Fent, 1950) and maximum exposed thickness is about 55 ft (17 m).

Kiowa Formation — The Kiowa Formation crops out in the eastern third of Rice County, mainly north of a large sand dune area associated with Cow Creek in the southeast corner. A smaller outcrop area exists on the north side of the Arkansas River valley in southwestern Rice County. Originally called the Kiowa shale, the formation consists of a gray to black illitic fissile shale. Thin fossiliferous (marine mollusks) limestone beds and fossil plant debris occur locally. Selenite crystals commonly appear on weathered surfaces, particularly slopes. Lenses of sandstone, often with calcite cementation, occur in and commonly dominate some of the outcrops. Though not expressed in Rice County, a bench-forming sandstone in the upper Kiowa has ripple marks and associated sedimentary structures in addition to calcite concretions. The basal part of the formation contains a zone of siltstone underlain by mudstone and claystone with red mottles. Notably, lenses and concretions of cone-in-cone structures are common in the shale bedding. Maximum exposed thickness of the Kiowa Formation in Rice County is about 110 ft (34 m).

PALEOZOIC

Permian System

Harper Sandstone — The Harper Sandstone is a red argillaceous siltstone and very fine silty sandstone cropping out only in east-central Rice County. The unit is divided into two members: the Chikaskia sandstone and the overlying Kingman sandstone, which are separated by a conspicuous 3 ft (0.9 m) thick bed of sandy, white siltstone. The Harper Sandstone is about 220 ft (67 m) thick and attains an exposed thickness of about 65 ft (20 m) in Rice County.

Stone Corral Formation — The Stone Corral Formation consists of dolomite, anhydrite, gypsum, and halite, though only the dolomite persists in outcrops. Dissolution of the other components results in calcite- or gypsum-filled vugs. In places, the dolomite is oölitic. The formation is mainly light gray with occasional red to orange zones or bands. Ripple marks are common. A few exposures of the formation are dominated by a red shale bounded by thin dolomite beds. This formation is an established marker bed in the Permian red-bed sequence of Kansas. In Rice County, it only crops out in a narrow band along the upper bluff line of the Little Arkansas River valley in the east-central part of the county. The Stone Corral Formation is up to 100 ft (31 m) thick and occurs up to 12 ft (4 m) thick in outcrops.

Ninnescah Shale — The Ninnescah Shale is mainly a red anhydritic, dolomitic, calcareous mudrock, with some thin green shape beds; however, non-red (mostly gray) beds do occur and occasionally contain conchostracans (clam shrimp). Thin, cross-cutting, secondary satin spar gypsum veins may be present. Beds containing rosette-shaped calcareous concretions weather into prominent stratigraphic features. Outcrops occur in the extreme east-central part of Rice County immediately below the Stone Corral Formation along the lower bluffs of the Little Arkansas River valley. The Ninnescah Shale is 300–450 ft (91–137 m) thick, and outcrops are up to 16 ft (5 m) thick.

CITED REFERENCES

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.

Bayne, C. K., and Ward, J. R., 1974, Geology and hydrology of Rice County, central Kansas: Kansas Geological Survey, Bulletin 206, pt. 3, 17 p.

Fent, O. S., 1950, Geology and ground-water resources of Rice County, central Kansas: Kansas Geological Survey, Bulletin 85, 142 p.

Plummer, N. V., and Romary, J. F., 1947, Kansas clay, Dakota Formation: Kansas Geological Survey, Bulletin 67, 241 p.

ADDITIONAL SOURCES

Arbogast, A. F., 1998, Late Quaternary paleoenvironments and landscape evolution on the Great Bend Sand Prairie: Kansas Geological Survey, Bulletin 242, 74 p.

Halfen, A. F., Johnson, W. C., Hanson, P. R., Woodburn, T. L., Ludvigson, G. A., and Young, A. R., 2012, Activation history of the Hutchinson dunes in east-central Kansas, USA during the past 2200 years: Aeolian Research 5, p. 9–20.

EXPLANATION

Boundaries and Locations
- County boundary
- Township/range line
- Section line

Transportation
- U.S. highway
- State highway
- Local road

Geologic Unit Boundaries
- Observed contact

Hydrology and Topography
- Perennial stream
- Intermittent stream
- Water body
- Elevation contour (50-foot interval)
- Elevation contour (10-foot interval)
- Depression contour (50-foot interval)
- Depression contour (10-foot interval)

Elevation contours are presented for general reference. Used in the U.S. Geological Survey's current US Topo 1:24,000-scale topographic map series, they were generated from hydrographically improved 1/3 arc-second National Elevation Dataset (NED) data and smoothed during processing for use at 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 will typically reflect topographic variation more accurately than the associated contour lines. Repeated fluctuation of an outcrop line across a contour line should be interpreted as an indication that the mapped rock unit is maintaining a relatively constant elevation along a generalized contour.

1-meter LiDAR hillshades and 1-meter 2010 and 2012 U.S. Department of Agriculture – Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) digital imagery were used as references in the digital mapping. USGS 7.5-minute 1:24,000-scale topographic maps, USDA Natural Resources Conservation Service (NRCS) soil surveys, and other geologic maps and bulletins were used to supplement the mapping. 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. 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 format, were mosaicked into a single output DEM, downsampled to 2-meter resolution, 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 geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program, award number G16AC00195 (FY2016).

This map was produced using the ArcGIS system developed by Esri (Environmental Systems Research Institute, Inc.).

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

SUGGESTED REFERENCE TO THE MAP

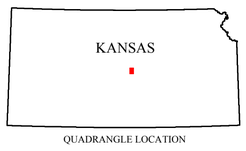
Johnson, W. C., Schlagel, N. A., and Dunham, J. W., 2017, Preliminary surficial geology of the Little River quadrangle and the Rice County portion of the Crawford quadrangle, Kansas: Kansas Geological Survey, Open-File Report 2017-21, scale 1:24,000, unpublished.

SCALE 1:24 000

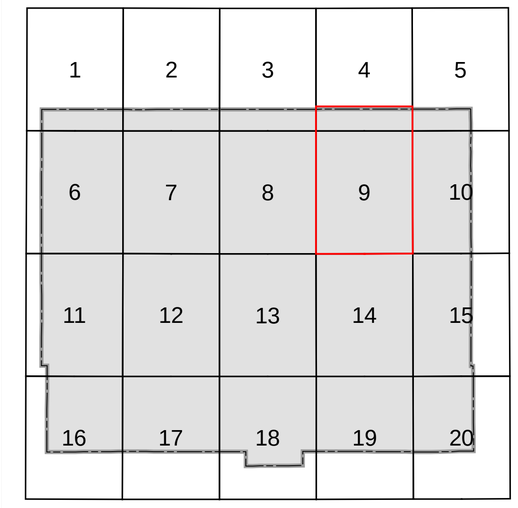
1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1 MILES
1000 500 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, ZONE 14
NORTH AMERICAN DATUM OF 1983

APPROXIMATE MEAN DECLINATION, 2017



QUADRANGLE LOCATION



RICE COUNTY QUADRANGLES

1	Holyrood	11	Raymond
2	Lorraine	12	Chase
3	Geneseo	13	Lyons
4	Crawford	14	Lyons SE
5	Langley	15	Windom SW
6	Chase NW	16	Alden NW
7	Chase NE	17	Alden
8	Lyons NW	18	Sterling
9	Little River	19	Nickerson
10	Windom	20	Hutchinson NW