KANSAS GEOLOGICAL SURVEY
The University of Kansas

SURFICIAL GEOLOGY OF MORTON COUNTY, KANSAS

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2009

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Explanation

Boundaries and Locations

- State line
- County line
- Township/range line
- Section line
- National or state reservation boundary
- County seat
- City
- Locality
- Built-up area

Transportation

- U.S. highway
- State highway
- Medium-duty primary road
- Medium-duty secondary road
- Light-duty road
- Unimproved road
- Railroad
- Unpaved landing strip
- Airport

Geologic Unit Boundaries

- Observed contact
- Inferred contact

Hydrology and Topography

- Intermittent stream
- Water body
- Elevation contour (50-meter interval)
- Elevation contour (10-meter interval)

Resource Development

- Open gravel pit

Index Reference Features

- 1:24,000-scale quadrangle boundary

Index to 1:24,000-scale USGS quadrangle maps

Index shows the names and locations of the 25 USGS 7.5-min 1:24,000-scale quadrangles used in the digital compilation of the Morton County map. The geology was mapped in the field using these topographic maps.

APPROXIMATE MEAN DECLINATION, 2009

Elevation contours are presented for general reference. They are generated from U.S. Geological Survey National Elevation Dataset (NED) digital elevation models (DEM) with 1/3 arc-second resolution, which are in turn generated from high-resolution elevation data and other USGS DEMs. In some places the contours may be more generalized than the base maps 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.

The geology was mapped in the field using USGS 7.5-min 1:24,000-scale topographic maps.

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 also based on USGS 1/3 arc-second DEMs. The 1/3 arc-second data, in ESRI GRID format, were 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.

Map partially funded by the National Cooperative Geologic Mapping EDMAP 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.

Suggested reference to this map:

Johnson, W. C., Woodburn, T. L., and Messinger, L. G., 2009, Surficial geology of Morton County, Kansas: Kansas Geological Survey, Map M-116, scale 1:50,000.

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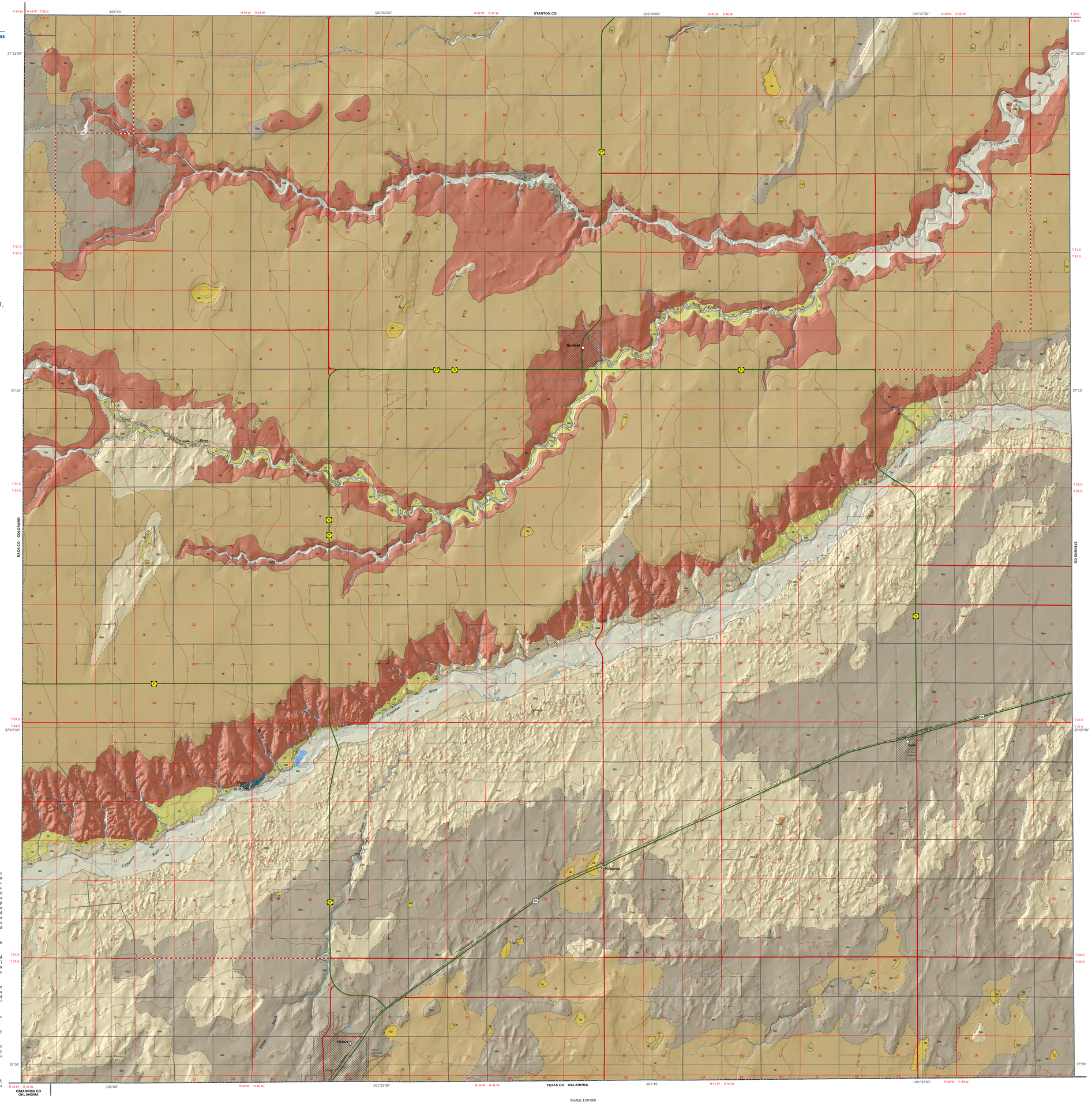
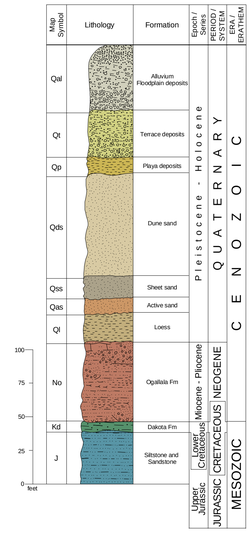


MAP M-116



Lithologic Explanation

- Unconsolidated silt, sand, and gravel
- Unconsolidated silt
- Sand
- Sandstone with shale or siltstone
- Limestone
- Sand and gravel, conglomerate, or "mortar beds"
- Bentonite
- Volcanic ash
- Undifferentiated sandstone or siltstone

CENOZOIC ROCKS

Qal

Undifferentiated floodplain alluvium - Thickness of alluvium reaches about 75 feet in the Cimarron River valley and about 30 feet in the North Fork of the Cimarron valley. Sediment is primarily sand but contains gravel, silt, and minor amounts of clay. Origin appears to be the Ogallala and Cretaceous bedrock exposed upstream.

Qt

Alluvial terrace deposits - Terrace deposits within the county occur along the North Fork of the Cimarron River. Sand dominates the fill, with some gravel, silt, and clay; the Ogallala is the primary source of this material. Although present along both sides of the Cimarron River, terraces on the south side are mantled by dune sand or sheet sand. Age of the terrace fills dates from the late Pleistocene to at least the middle Holocene.

Qp

Upland intermittent lake (playa) deposits - Shallow basins, also known as playas or buffalo wallows, have developed in the upland loess deposits, mainly north of the Cimarron River valley. The origin of these features is usually attributed to wind deflation, animal activity, dissolution, or some combination of these processes. Age of the features appears to range from at least the early Holocene to the historic period. The basins range in size from less than an acre to hundreds of acres. Fill within these basins consists of re-deposited silt and fine sand from the loess. In the larger basins, a carbonate layer (caliche) typically develops a few feet below the basin floor.

Qds

Dune sand - Sand dunes occur immediately south of the Cimarron River throughout most of the county, and in the west-central part of the county near the Colorado border. The sand is derived from the Pleistocene terraces of the Cimarron River valley and to a lesser extent from the Ogallala. The dunes are time transgressive in that some are a product of north-northwesterly late Pleistocene winds, whereas younger forms reflect post-glacial southerly wind dominance. Significant historical change in dunes occurred during the 1930s.

Qss

Sheet sand - Sand occurring in sheets, or subdued undulating swells and swales, is best expressed south of the dunes in the southern part of the county. Origin of the sand is the Pleistocene terraces of the Cimarron River valley. Where the sand sheets occur north of the Cimarron River valley, the source is the Ogallala.

Qas

Active sand - These are areas of blow sand as they existed at the time of mapping. Active sand areas are typically expressed as blowouts within the sand dune map unit.

Ql

Loess - Wind-deposited silt, with minor amounts of clay and fine sand, comprise the loess, which mantles uplands in the county, primarily north of the Cimarron River valley. The loess is calcareous and a buff color. It averages about 5 feet, with greatest thickness occurring in the northeastern part of the county where deposits are up to 20 feet thick. Age of the deposits in the county ranges from the late Pleistocene to the late Holocene.

Tn

Ogallala Formation - Ogallala sediments are believed to be primarily Miocene in age and are composed of calcareous gravel, sand, silt, and clay deposited by streams transporting sediments eastward from the Rocky Mountains. In Morton County, the Ogallala is commonly capped by a thin limestone bed that overlies thicker caliche beds. This caliche is referred to regionally as mortar beds. Within the county, the mortar beds crop out only along the north side of the Cimarron River valley (e.g., Point of Rocks). Silt dominates the Ogallala, but beds are commonly poorly sorted and occur as lentils. Most of the county is underlain by the Ogallala, and it reaches a thickness of about 600 feet (well-log data) in the southeastern part. Because Pleistocene and other post-Ogallala alluvium is difficult, if not impossible, to differentiate in the field, this older alluvium is included in the Ogallala map unit.

MESOZOIC ROCKS

Kd

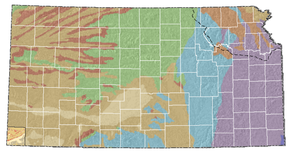
Dakota Formation - The Cretaceous Dakota Formation lies above the Kiowa Formation and crops out in small exposures along a tributary of the North Fork of the Cimarron River. It consists of light-buff to brown, well-sorted, fine-grained sandstones which include lesser amounts of shale and siltstone. The sandstone beds range from friable, to compact, to quartzitic. Clay comprises about 35% of the unit and ranges in color from buff or brown to light greenish gray. Bedding varies from silt-clay laminae to thick quartzitic sandstone beds. Thickness, determined from test holes, reaches a maximum of 150 feet near Richfield (McLaughlin, 1942).

J

Siltstone and sandstone - These red beds are the oldest rocks cropping out in the county and are exposed at only one locality – below the Point of Rocks outcrop of Ogallala Formation mortar beds. A second outcrop was mapped by McLaughlin in 1942 but, based upon study of repeat aerial photography, was inundated by sand dune migration during the late 1940s and 1950s. Though mainly red siltstone, the beds also include buff and white to red sandstone, and minor amounts of gypsum. The siltstone occurs as thin and irregular bedding, whereas the sandstone is fine grained and massive.

Reference

McLaughlin, T. G., 1942, Geology and ground-water resources of Morton County, Kansas, with analyses by Robert H. Hess: Kansas Geological Survey, Bulletin 40, 126 p.



SCALE 1:5 000 000
50 0 50 100 150 200 MILES
50 0 50 100 150 200 KILOMETERS

GENERALIZED GEOLOGY OF KANSAS

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

*The only surficial Jurassic rocks in Kansas are in Morton County.

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

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