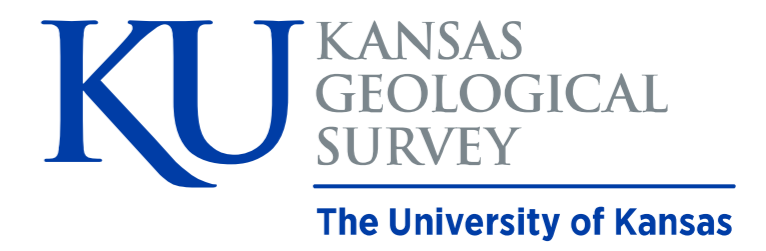


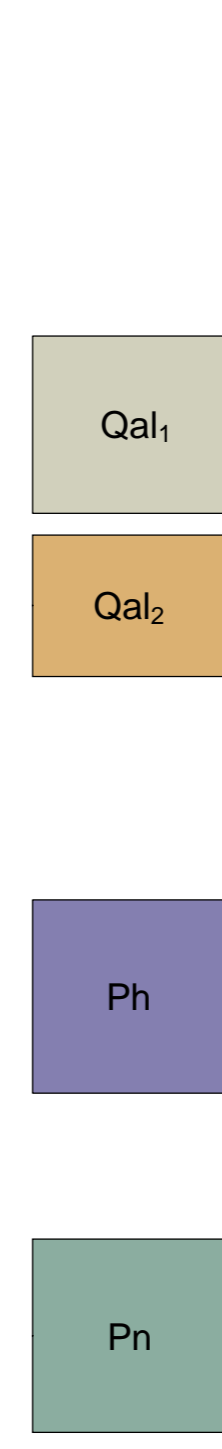
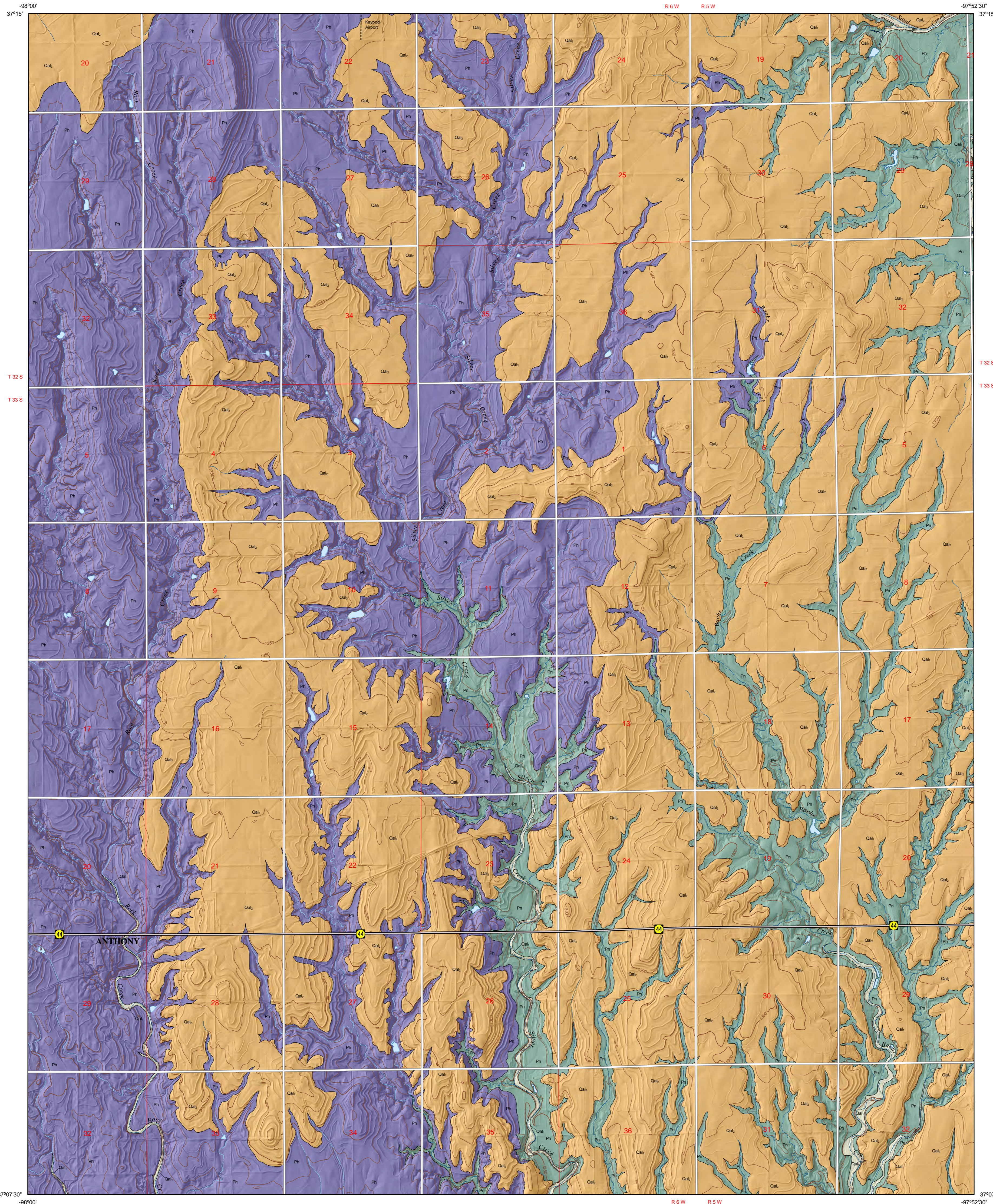
PRELIMINARY SURFICIAL GEOLOGY OF THE BLUFF CITY NW QUADRANGLE, HARPER COUNTY, KANSAS

by Jon J. Smith and John W. Dunham
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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, U.S. Department of Agriculture Natural Resources Conservation Service databases, and lithologic and other data in Swineford (1955) and Walters (1961).

GEOLOGIC UNITS

CENOZOIC

Quaternary System

Pleistocene-Holocene

Undifferentiated floodplain alluvium—These alluvial deposits make up the modern floodplain in most of the principal streams in Harper 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 not exceeding 20 ft (6 m) in thickness.

Upland alluvium—Upland alluvial deposits are mostly confined to the eastern portion of Harper County, well above and often distant from stream floodplains. Composed chiefly of Pleistocene silt, sand, and gravel, these deposits are reddish brown in color and contain rocks with various provenances, including considerable material derived locally. Upland alluvium ranges from 0 to perhaps 50 ft (15 m) in thickness.

PALEOZOIC

Permian System

Leonardian Series

Harper Sandstone—The Harper Sandstone is the lowest formation within the Permian Nippewalla Group and consists of 240 ft (73 m) of reddish-brown argillaceous siltstone, silty sandstone, and beds of red shale and white sandstone. Though mapped as undifferentiated, the Harper Sandstone contains two members: the Chikaskia Sandstone Member below and the Kingman Sandstone Member above. The Chikaskia Sandstone Member is composed of 160 ft (49 m) of reddish-brown sandstone and siltstone grading upward to silty shale. The Kingman Sandstone Member consists of 80 ft (24 m) of reddish-brown silty sandstone containing beds of silty shale and light-gray to white silty sandstone. The base of the member is marked by a white silty sandstone about 3 ft (1 m) thick.

Ninnesch Shale—The oldest rock unit exposed in Harper County is the Ninnesch Shale of the Permian Sumner Group. The Ninnesch 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 (30.5 m) crops out in eastern Harper County. The Ninnesch Shale is marked at the top by the Rumynede Sandstone Member, an approximately 8 ft (2.5 m) thick, very fine-grained, gray to grayish-green siltstone and sandstone. North of Harper County, the upper limit of the Ninnesch Shale is demarcated at the base of the Stone Corral Formation, but in Harper County, the Stone Corral is absent.

CITED REFERENCES

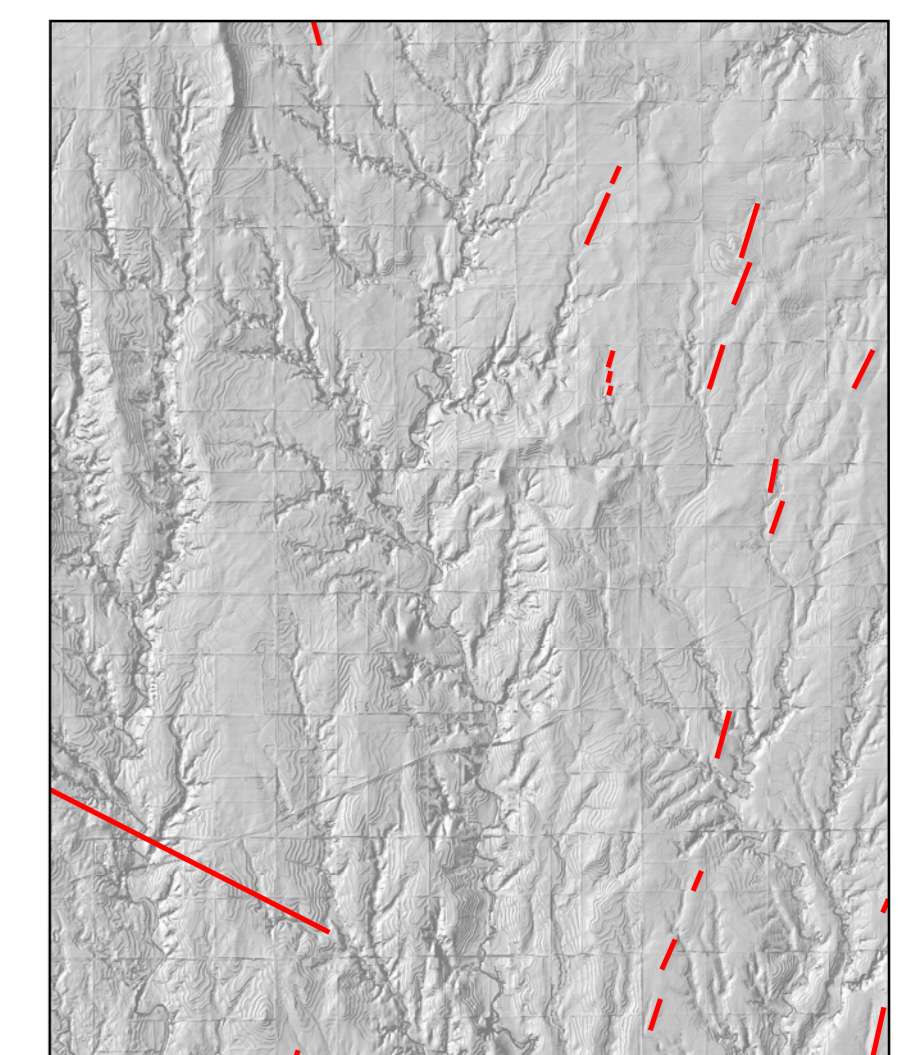
Swineford, A., 1955, Petrography of Upper Permian rocks in south-central Kansas. Kansas Geological Survey, Bulletin 111, 179 p.
Walters, K. L., 1961, Geology and ground-water resources of Sumner County, Kansas. Kansas Geological Survey, Bulletin 151, 198 p.

ADDITIONAL SOURCES

Bayne, C. K., 1960, Geology and ground-water resources of Harper County, Kansas: Kansas Geological Survey, Bulletin 143, 183 p.
McCauley, J. R., 2007, Geologic map of Barber County, Kansas: Kansas Geological Survey, Map M-106, 1 sheet, scale 1:50,000.
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>.
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EXPLANATION

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|---------------------------------|---|
| Boundaries and Locations | Hydrology |
| --- County boundary | --- Perennial stream |
| --- Township/range line | --- Intermittent stream |
| --- Section line | --- Water body |
| Transportation | --- Water body - manmade shoreline |
| --- State highway | Topography |
| --- Local road | --- Elevation contour (50-foot interval) |
| --- Unpaved landing strip | --- Elevation contour (10-foot interval) |
| Geologic Unit Boundaries | --- Depression contour (10-foot interval) |
| --- Observed contact | |



Inset showing mapped lineaments as potential surface expressions of structural features (e.g., faults, folds, joints, ridges). South-central Kansas, like other parts of the central and eastern United States, resides in a region of relatively low historical and instrumentally recorded seismicity. Despite this, the state has experienced approximately 3,500 earthquakes since 2013, with more than 130 of the events recorded as magnitude 3.0 or greater. This recent spate of seismicity raises concerns about the potential risk that structural features (faults, folds, joints, and ridges) may pose for moderate to large earthquakes. Investigations into the size or extent of these faults include mapping previously unrecognized surface features, such as lineaments, that may reflect more deeply seated structural features.

Lineaments were mapped using aerial photography and bare-earth LIDAR Digital Elevation Models (DEMs), based on one or more of the following criteria: (1) Visible offset in marker beds; (2) relatively low- to high-relief linear ridges that are not obvious geomorphic features due to erosion, slumping, subsidence, or dune formation; (3) linear ridges that cross drainage divides; (4) ridges that display curvilinear or backstepping (en echelon) configurations; (5) rectilinear or parallel drainage patterns; and (6) linear drainage patterns that align across drainage divides.

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.

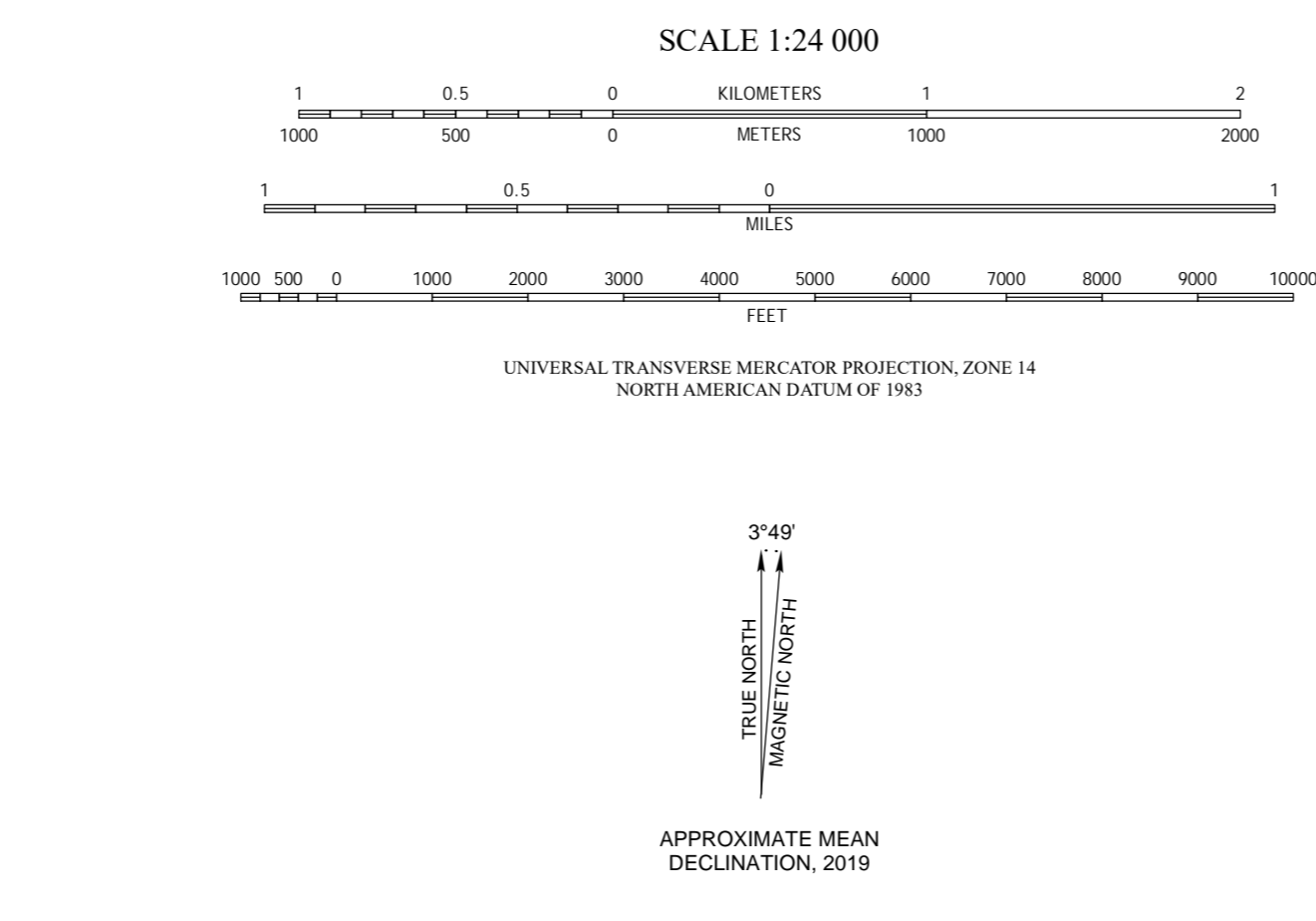
1-meter LIDAR hillshades (2010 imagery), 1-meter U.S. Department of Agriculture - Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) digital imagery (2015 imagery), and 1-foot Kansas NG911 digital imagery were used as references in the digital mapping. USDA Natural Resources Conservation Service (NRCS) SSURGO data, and other geologic maps and bulletins were used to supplement the mapping. Field mapping was undertaken from July 2019 to November 2019. Roads and highways are shown on the base map as represented by data from the U.S. Census Bureau, 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 G19AC00231 (FY2019).

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
Smith, J. J., and Dunham, J. W., 2020, Preliminary surficial geology of the Bluff City NW quadrangle, Harper County, Kansas: Kansas Geological Survey, Open-File Report 2020-9, scale 1:24,000, unpublished.