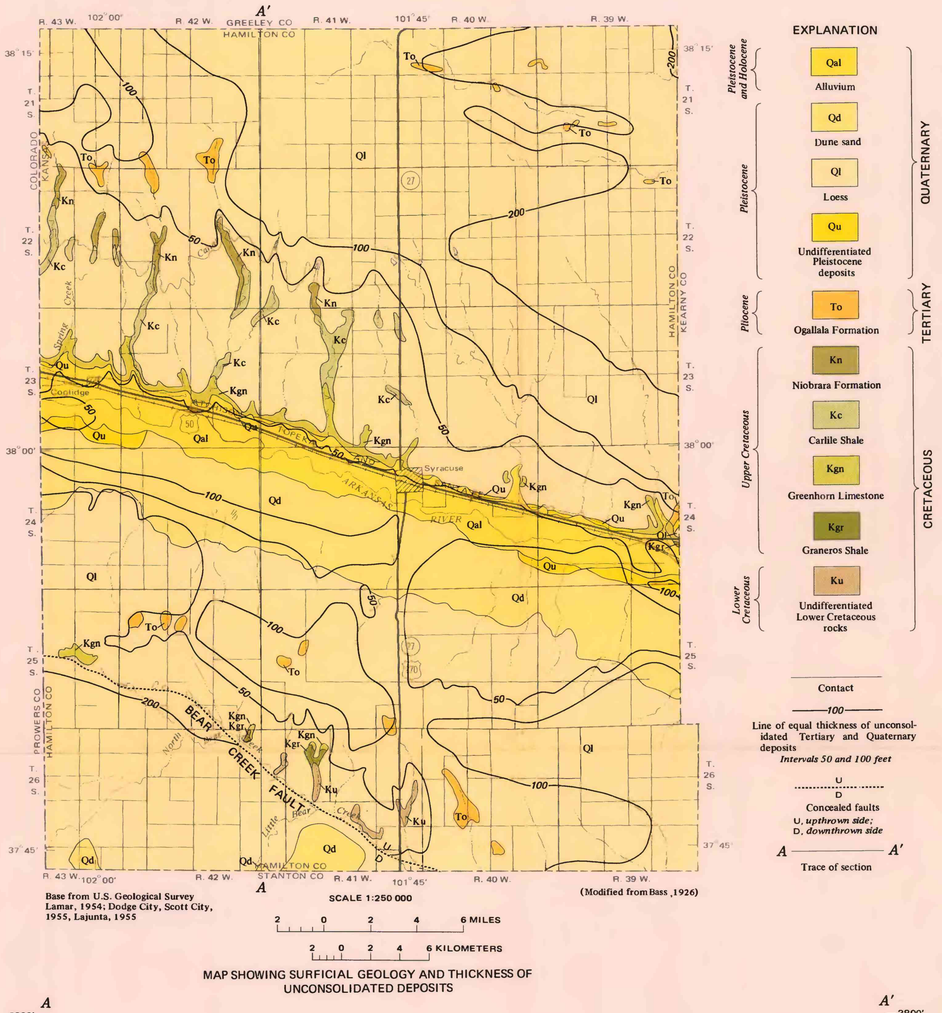
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the
STATE GEOLOGICAL SURVEY OF KANSAS
KANSAS STATE DEPARTMENT OF HEALTH
KANSAS STATE BOARD OF AGRICULTURE

HYDROLOGIC INVESTIGATIONS
ATLAS HA-516 (SHEET 1 OF 2)

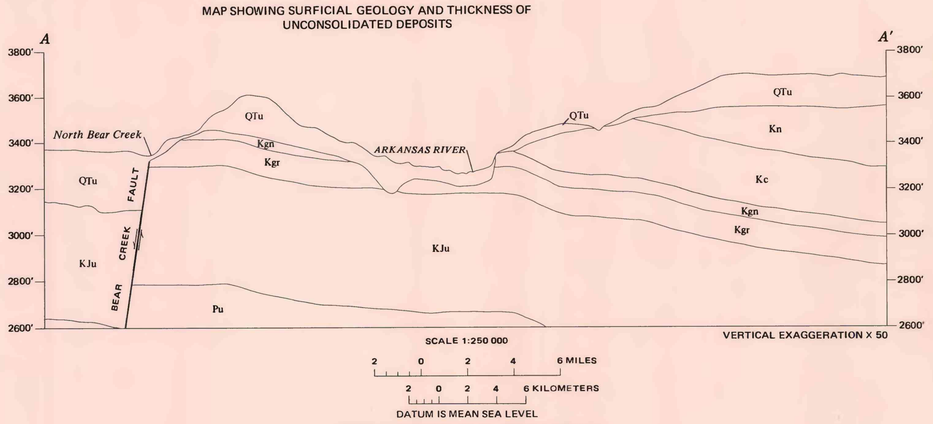
# GEOLOGY



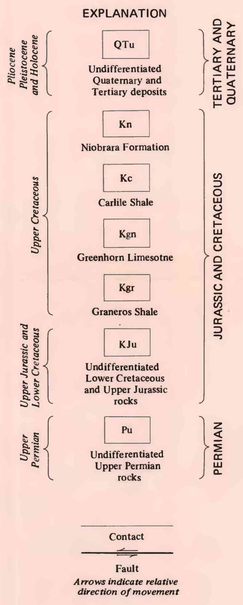

Base from U.S. Geological Survey Lamar, 1954; Dodge City, Scott City, 1955, Lajunta, 1955

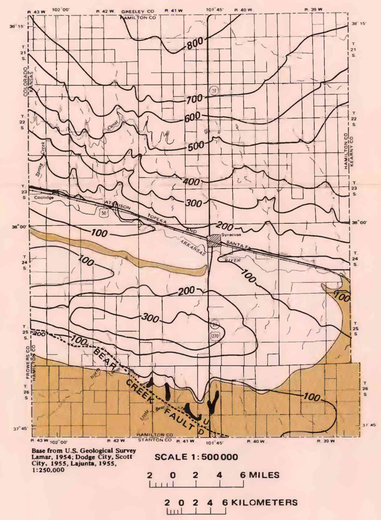
(Modified from Bass, 1926)

MAP SHOWING SURFICIAL GEOLOGY AND THICKNESS OF UNCONSOLIDATED DEPOSITS




GENERALIZED GEOLOGIC SECTION SHOWING CORRELATION OF STRATIGRAPHY




MAP SHOWING DEPTH TO TOP OF UNDIFFERENTIATED LOWER CRETACEOUS ROCKS

## UNCONSOLIDATED DEPOSITS

Tertiary and Quaternary deposits underlie most of Hamilton County and range in thickness from a few feet to about 280 feet (surficial geologic map).

The Ogallala Formation of Pliocene age, which is exposed in only a few scattered outcrops, overlies the bedrock surface in the upland areas in the northern and southern parts of the county. Undifferentiated deposits of Pleistocene age, which are exposed on terraces along the Arkansas River, overlie the bedrock in the river valley and underlie the flood plain and adjacent sandhills. These deposits, which occur in shallow channels eroded into the Ogallala Formation in the northern part of the county, constitute most of the unconsolidated sediments south of the Bear Creek fault. Both Pliocene and Pleistocene deposits commonly are mapped as a single unit in the subsurface because of their similar lithology.

Loess deposits of Pleistocene age, which are the parent materials of many of the soils, mantle most of the upland areas. Dune sand occurs along the south side of the Arkansas River flood plain and in a few small areas south of the Bear Creek fault. The sand generally is stabilized by vegetation, but in several large areas, the dunes become active during years of drought. Alluvium of late Pleistocene to Holocene age forms the flood plain of the Arkansas River.

The thickness of unconsolidated deposits (or depth to bedrock) ranges greatly as a result of faulting, erosion, and deposition during Pleistocene time. In the northern part of the county, thick alluvial sediments of Pliocene age reflect the lack of extensive Pleistocene erosion. Thick alluvial sediments south of the Bear Creek fault resulted from subsidence, erosion, and deposition during early Pleistocene time.

The deep valley of the Arkansas River indicates several stages of erosion and partial refilling during late Pleistocene time. The deepest channel of the ancestral Arkansas River underlies the present flood plain in the eastern part of the county and underlies the adjacent sandhills south of the river in the western part. Major tributary channels from the north and south, which are related to the first stage of late Pleistocene erosion, are deepest near the ancestral channel of the river; therefore, these deep tributary channels are difficult to locate in the western part of the county because they are concealed beneath the sandhills.

## BEDROCK FORMATIONS

Consolidated rocks (defined here as bedrock), which underlie the county and are of significance to this report, range in age from Late Permian to Late Cretaceous. The formations that subcrop at the bedrock surface, as shown on the bedrock geologic map, are all Cretaceous in age. Because Pliocene and Pleistocene erosion beveled the edges of northeastward dipping bedrock strata, older rocks subcrop at the lowest altitude of the bedrock surface, and progressively younger rocks subcrop northward at the higher altitudes. This general sequence is partly altered by the deep erosion of the ancestral Arkansas River and by the Bear Creek fault (shown on the geologic section). Small flexures, such as the one shown north of the Arkansas River on the geologic section, and erosional features of small areal extent are common throughout the county; therefore, the altitude of the top of a bedrock formation may differ by a few tens of feet within a short distance. The altitude of the bedrock surface (shown on the bedrock geologic map) ranges from about 3,000 feet above mean sea level in the deepest part of the ancestral Arkansas River channel and on the south side of the Bear Creek fault to about 3,700 feet in the northwestern part of the county.

Permian red beds underlie the county to depths of more than 2,000 feet. The upper surface of the red beds in Hamilton County represents the maximum depth of drilling for potable ground water. Undifferentiated Upper Jurassic rocks overlie the red beds and underlie undifferentiated Lower Cretaceous rocks throughout the county.

Undifferentiated Lower Cretaceous rocks may either underlie Upper Cretaceous rocks or directly underlie unconsolidated deposits. The depth to the top of the undifferentiated Lower Cretaceous rocks is shown on the map and the geologic section. The depth ranges from zero at the outcrop area along the upthrown side of the Bear Creek fault to about 800 feet at the northern boundary of the county. Lower Cretaceous rocks of marine and littoral origin consist of the Cheyenne Sandstone, Kiowa Shale, and Dakota Formation. Correlation of individual lithologic units in both the Upper Jurassic and Lower Cretaceous rocks is difficult because the beds are thin and discontinuous. Even the sandstone beds that are continuous over large areas differ in character from loosely to very tightly cemented.

Upper Cretaceous rocks of marine origin consist of the Graneros Shale, Greenhorn Limestone, Carlile Shale, and Niobrara Formation. Individual units of the Upper Cretaceous rocks can be correlated over large areas because the lithology of each unit is generally uniform.

The generalized section shows the stratigraphic sequence, thickness, and physical character of the geologic units and their hydrologic significance in the county.

## SELECTED GEOLOGIC REFERENCES

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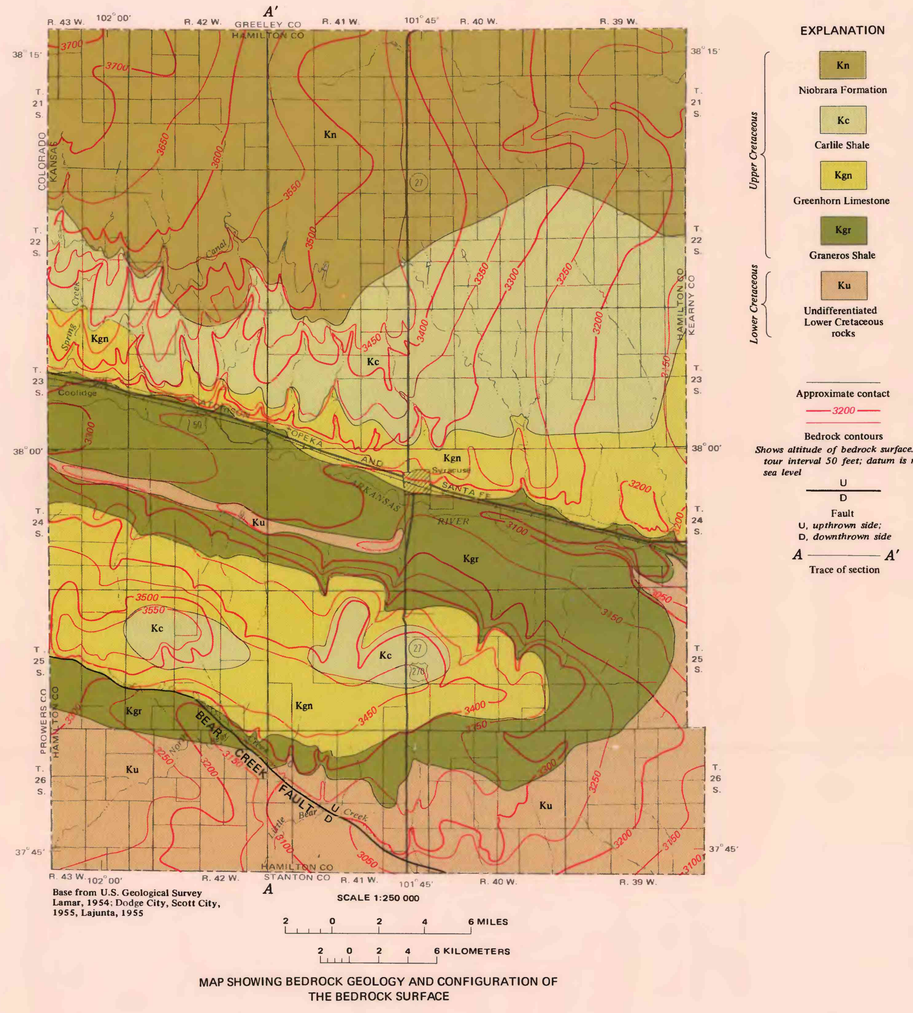


Base from U.S. Geological Survey Lamar, 1954; Dodge City, Scott City, 1955, Lajunta, 1955

MAP SHOWING BEDROCK GEOLOGY AND CONFIGURATION OF THE BEDROCK SURFACE

*Generalized section of geologic units*

NOTE.—The classification and nomenclature of the stratigraphic units used in this report are those of the U.S. Geological Survey and differ somewhat from those of the State Geological Survey of Kansas.

| System | Series | Stratigraphic unit | Thickness (feet) | Physical character |
|---|---|---|---|---|
| Quaternary | Holocene and Pleistocene | Alluvium | 0–60 | Silt, clay, and sand of Holocene age overlying sand, gravel, and cobbles of late Pleistocene age in the Arkansas River valley. |
| | Pleistocene | Dune sand | 0–75 | Fine to medium quartzose sand and lesser amounts of coarse sand, silt, and clay formed into mounds and ridges by the wind. Located along the south side of the Arkansas River flood plain and scattered localities south of the Bear Creek Fault; underlies about 10 percent of the county. |
| | | Loess | 0–20 | Windblown silt and very fine sand; underlies about 80 percent of the county. |
| | | Undifferentiated deposits | 0–280 | Sand, gravel, silt, clay, and caliche; underlies most of the county; overlies the Ogallala Formation when both formations are present. |
| Tertiary | Pliocene | Ogallala Formation | | Poorly sorted sand, gravel, silt, and caliche; unconsolidated to tightly cemented by calcium carbonate. |
| Cretaceous | Upper Cretaceous | Niobrara Formation | 250 | Tannish-white to light-gray massive chalky limestone; contains dark-gray to brownish-gray shale. |
| | | Carlile Shale | 250 | Dark-bluish-gray slightly calcareous to noncalcareous shale in upper part. Lower part consists of very calcareous dark-gray shale interbedded with thin gray limestone. |
| | | Greenhorn Limestone | 55 | Dark-gray calcareous shale and light-gray thin-bedded limestone, generally yellow on weathered surface; contains layers of bentonite. |
| | | Graneros Shale | 130 | Dark-gray calcareous shale interbedded with black shale; contains thin beds of bentonite. Also contains thin-bedded gray limestone and fine-grained silty sandstone layers. |
| | Lower Cretaceous | Undifferentiated rocks | 350 | Upper unit (Dakota Formation)—brown to gray fine- to medium-grained sandstone interbedded with gray sandy shale and varicolored shale. Middle unit (Kiowa Shale)—dark-gray to black shale interbedded with tan and gray sandstone. Basal unit (Cheyenne Sandstone)—gray and brown fine- to medium-grained sandstone interbedded with dark-gray shale. |
| Jurassic | Upper Jurassic | Undifferentiated rocks | 160 | Shale, gray, interbedded with grayish-green and bluish-green calcareous shale. Contains fine-grained silty sandstone near the base of the unit and thin limestone beds. |
| Permian | Upper Permian | Undifferentiated rocks | 300 | Red shale, sandstone, sandy shale, and anhydrite. Underlain by similar sedimentary rocks of Early Permian age. |

Interior—Geological Survey, Reston, Va.—1974

# WATER RESOURCES OF HAMILTON COUNTY, SOUTHWESTERN KANSAS

By
D. H. Lobmeyer and C. G. Sauer

1974

For sale by U.S. Geological Survey
Denver, Colo. 80225 and Reston, Va. 22092, price $1.50 per set