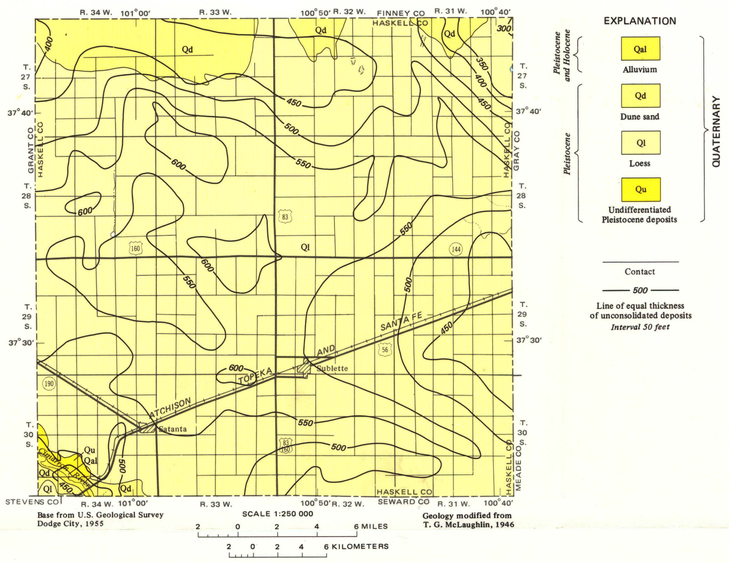
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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

HYDROLOGIC INVESTIGATIONS
ATLAS HA-515 (SHEET 1 OF 2)

GENERAL GEOLOGY AND HYDROLOGY



MAP SHOWING SURFICIAL GEOLOGY AND THICKNESS OF UNCONSOLIDATED DEPOSITS

EXPLANATION

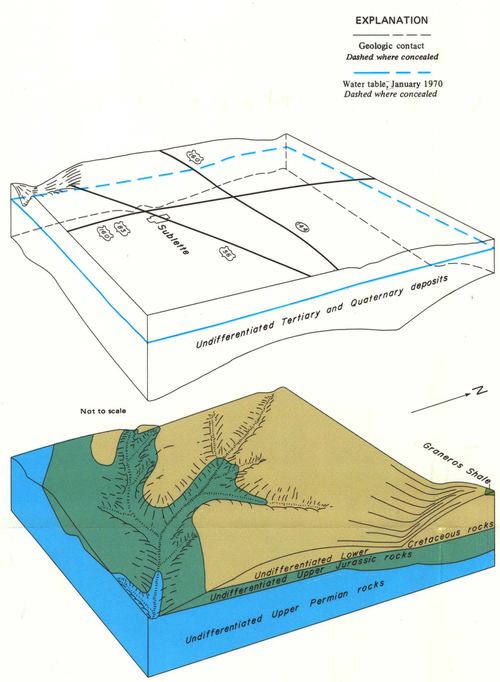
Pleistocene and Holocene
- Qal — Alluvium
- Qd — Dune sand

Pleistocene
- Ql — Loess
- Qu — Undifferentiated Pleistocene deposits

QUATERNARY

Contact

500 — Line of equal thickness of unconsolidated deposits
Interval 50 feet

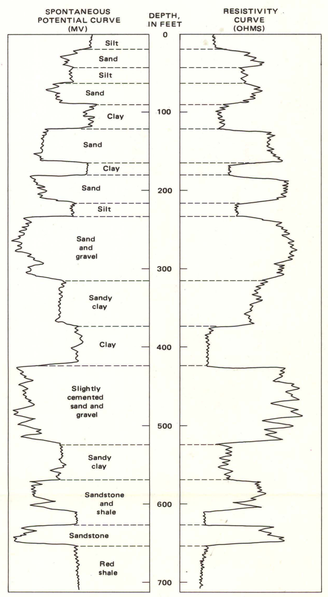


GENERALIZED BLOCK DIAGRAM

Generalized section of geologic units and water-yielding characteristics

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	Well supply
Quaternary	Holocene and Pleistocene	Alluvuim	0–60	Clay, silt, and sand of Holocene age overlying sand, gravel, and cobbles of late Pleistocene age. Occurs in the Cimarron River valley, and underlies about 1 percent of the county.	A potential aquifer, untested in Haskell County. May yield 50 to 300 gpm (gallons per minute) to wells.
	Pleistocene	Dune sand	0–75	Fine to medium quartzose sand with lesser amounts of clay, silt, and coarse sand formed into small hills and mounds by wind action. Located principally in the northern part of the county, and underlies about 7 percent of the county.	Lies above the water table, and does not yield water to wells.
		Loess	0–30	Wind-blown silt underlies about 91 percent of the county.	
		Undifferentiated deposits	250–550	Medium to very coarse sand and gravel interbedded with clay, silt, and fine sand; contains caliche and "mortar beds." Exposed along the Cimarron River valley where it underlies about 1 percent of the county.	The sand and gravel beds are the principal water-yielding deposits in the county. Yields to irrigation wells range from 500 to more than 2,500 gpm.
Tertiary	Pliocene	Ogallala Formation	0–300	Poorly sorted clay, silt, sand, and gravel; contains caliche and "mortar beds."	
Cretaceous	Upper Cretaceous	Graneros Shale	0–30	Dark-gray calcareous shale interbedded with black noncalcareous shale.	Not known to yield water to wells in Haskell County.
	Lower Cretaceous	Undifferentiated rocks	0–260	Yellow, brown, and gray fine- to medium-grained sandstone; interbedded with varicolored shale and dark-gray to black shale.	The sandstones within the unit commonly yield 30 to 300 gpm to wells. Yields of more than 1,000 gpm are reported in a few areas.
Jurassic	Upper Jurassic	Undifferentiated rocks	0–160	Dark-gray noncalcareous shale; interbedded with grayish-green and bluish-green calcareous shale. Contains very fine to medium-grained silty sandstone at the base.	
Permian	Upper Permian	Undifferentiated rocks	200–400	Red shale, sandstone, sandy shale, and anhydrite.	Yields no potable water to wells in Haskell County.



GENERALIZED ELECTRIC LOG OF TYPICAL DRILL HOLE

UNCONSOLIDATED DEPOSITS

Tertiary and Quaternary deposits underlie all Haskell County and range in thickness from about 300 feet in the northeast corner to about 600 feet in the central part (surficial geologic map).

The Ogallala Formation of Pliocene age, which does not crop out, overlies older consolidated rocks at depth. The Ogallala consists of individual and admixed layers of stream-deposited clay, silt, sand, and gravel. Calcium carbonate commonly forms caliche in the clay and silt deposits, and cements the sand and gravel into "mortar beds."

Undifferentiated Pleistocene deposits crop out along the walls of the Cimarron River valley. They overlie the Ogallala Formation in much of the county, but also are in contact with older consolidated rocks where the Ogallala was removed by Pleistocene erosion. These Pleistocene sediments consist of sand and gravel deposited in major channels, and clay, silt, and sand deposited on a flood plain. Because the lithology and hydrology of the Pliocene and Pleistocene deposits are similar, differentiation of the geologic units in the subsurface is impracticable.

Loess of late Pleistocene age underlies most of the county; the soil formed on the loess is ideally suited for farming. Dune sand of late Pleistocene age underlies part of the northern township of the county and is suitable for rangeland or irrigation by sprinkler systems. Quaternary alluvium, which consists of coarse-grained deposits of late Pleistocene age overlain by fine-grained deposits of Holocene age, underlies the flood plain of the Cimarron River.

BEDROCK FORMATIONS

Consolidated rocks (referred to as bedrock), which underlie the unconsolidated Tertiary and Quaternary deposits, range in age from Permian to Cretaceous, as shown on the bedrock geologic map.

Contours of the bedrock surface indicate that a broad drainage system in central Haskell County joined an eastward-trending channel from Grant County, and flowed out of Haskell County at the southeast corner. Two deeply incised channels trend southeastward across the northeast and southwest corners of the county.

In the southeast and southwest corners of the county, the bedrock surface is eroded on undifferentiated Upper Permian rocks. The bedrock surface in the rest of the county is formed successively on undifferentiated Upper Jurassic rocks, undifferentiated Lower Cretaceous rocks, and the Upper Cretaceous Graneros Shale. These rocks subcrop in normal stratigraphic position from the oldest to the youngest as the altitude of the bedrock surface rises northward. The dip of the bedrock formations is northeastward.

SANDSTONE AQUIFER

The sandstone aquifer is defined here to include the Upper Jurassic and Lower Cretaceous rocks in Haskell County. The Upper Jurassic rocks consist mostly of shale, with a silty sandstone unit near the base. The Lower Cretaceous rocks consist of sandstone interbedded with shale. The lithology of these formations differs within short distances and individual units are difficult to trace. Because of the varied lithology, the entire section is defined as an aquifer although only part of this unit yields water to wells. The sandstones commonly yield less than 300 gpm (gallons per minute), but uncemented zones may yield more than 1,000 gpm to wells.

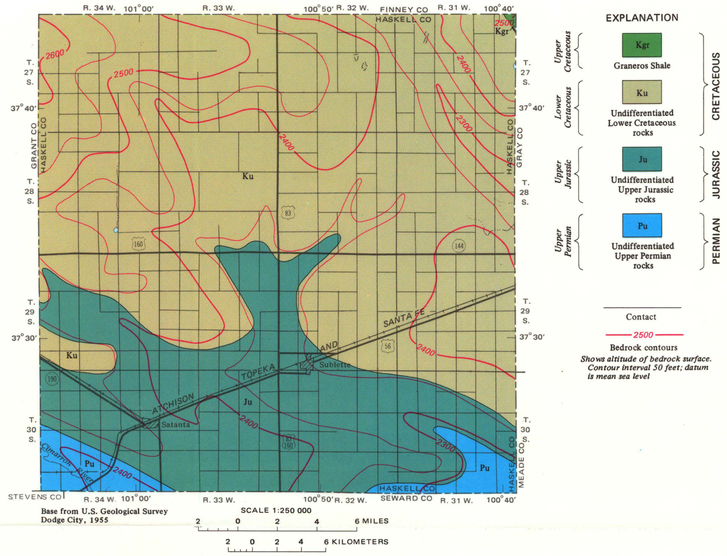
The thickness of the sandstone aquifer (map) ranges from zero in the southern part of the county (where the formations have been removed by erosion) to more than 400 feet in the northeast corner. This aquifer directly underlies the unconsolidated deposits, except in the northeast corner where it is covered by a thin layer of Graneros Shale, which is not known to yield water to wells. Thus, contours showing thickness of unconsolidated deposits (surficial geologic map) mainly indicate the depth to the top of the sandstone aquifer, which ranges from about 300 to 600 feet below land surface. The sandstone aquifer is underlain by Permian rocks (red beds), which are not a source of potable water. Thus, the Permian surface represents the maximum depth of test drilling for water wells. The depth to the top of Permian rocks at any location in Haskell County can be estimated by adding the thickness of unconsolidated deposits to the thickness of the sandstone aquifer.

RELATION OF STRATIGRAPHY AND HYDROLOGY

A generalized block diagram illustrates the relation of water levels in 1970 to the thickness of unconsolidated deposits and the relation of the bedrock surface to the underlying bedrock units. The upper block relates the water table to the land surface (depth to water) and the thickness of the water-bearing materials in the Tertiary and Quaternary deposits. The lower block shows the geology and configuration of the bedrock surface, and relates the sandstone aquifer to the other bedrock units.

ELECTRIC LOGGING

Electric logs, used in conjunction with drillers' logs, are useful in defining potential water-yielding zones. The generalized electric log relates depth below land surface with the electrical properties of the strata penetrated in a typical drill hole in Haskell County. Variations in response of the spontaneous potential and resistivity curves aid in determining the thickness of lithologic units and the relative permeability of the materials. The generalized section showing the thickness, lithology, and water-yielding potential of the geologic units discussed in this report can be used in conjunction with the generalized electric log to visualize the probable type of response for each lithologic unit.



MAP SHOWING BEDROCK GEOLOGY AND CONFIGURATION OF THE BEDROCK SURFACE

EXPLANATION

Upper Cretaceous
- Kgr — Graneros Shale

Lower Cretaceous
- Ku — Undifferentiated Lower Cretaceous rocks

CRETACEOUS

Upper Jurassic
- Ju — Undifferentiated Upper Jurassic rocks

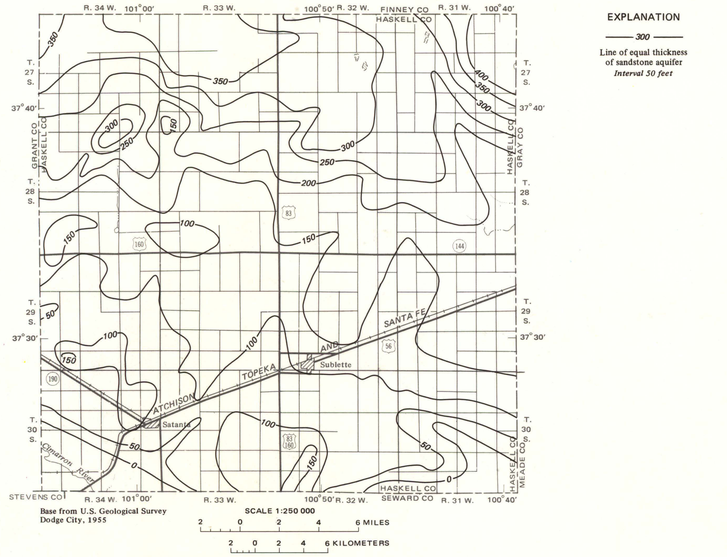
JURASSIC

Upper Permian
- Pu — Undifferentiated Upper Permian rocks

PERMIAN

Contact

2500 — Bedrock contours
Shows altitude of bedrock surface. Contour interval 50 feet; datum is mean sea level



MAP SHOWING THICKNESS OF SANDSTONE AQUIFER

EXPLANATION

300 — Line of equal thickness of sandstone aquifer
Interval 50 feet

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GROUND WATER IN HASKELL COUNTY, SOUTHWESTERN KANSAS

By
E. D. Gutentag and L. E. Stullken

1974

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