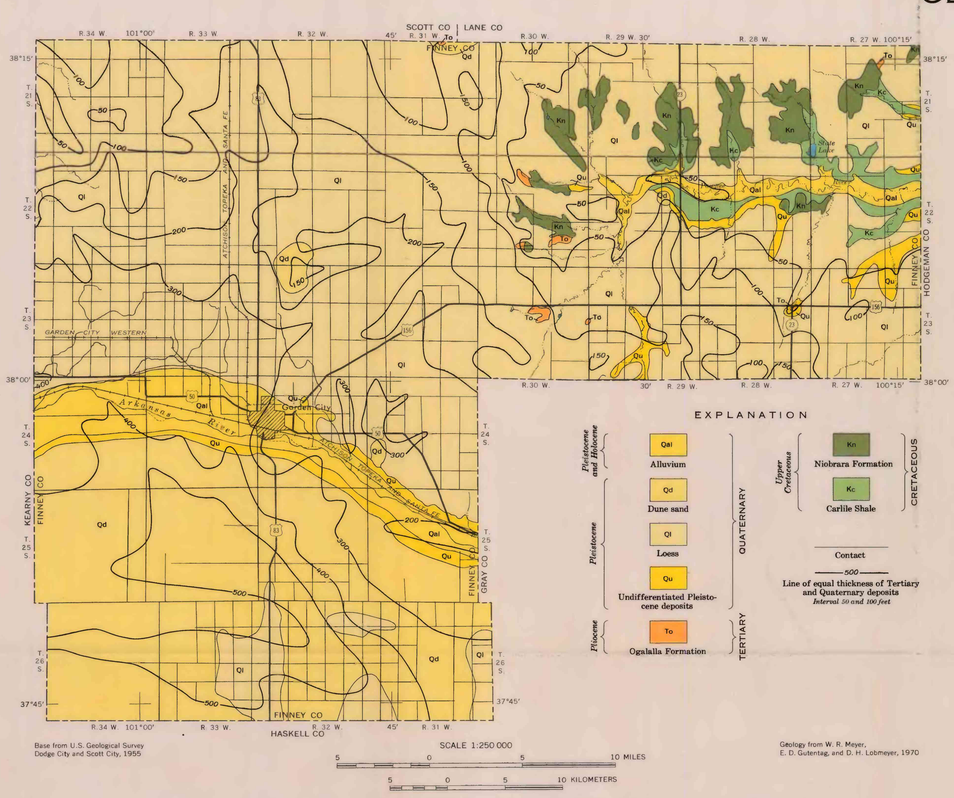
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
STATE GEOLOGICAL SURVEY OF KANSAS
KANSAS STATE DEPARTMENT OF HEALTH
KANSAS STATE BOARD OF AGRICULTURE

HYDROLOGIC INVESTIGATIONS
ATLAS HA-442 (SHEET 1 OF 3)

GEOLOGY AND STRATIGRAPHY



SURFICIAL GEOLOGIC MAP SHOWING THICKNESS OF TERTIARY AND QUATERNARY DEPOSITS

GENERAL GEOLOGY AND HYDROLOGY

GENERAL FEATURES

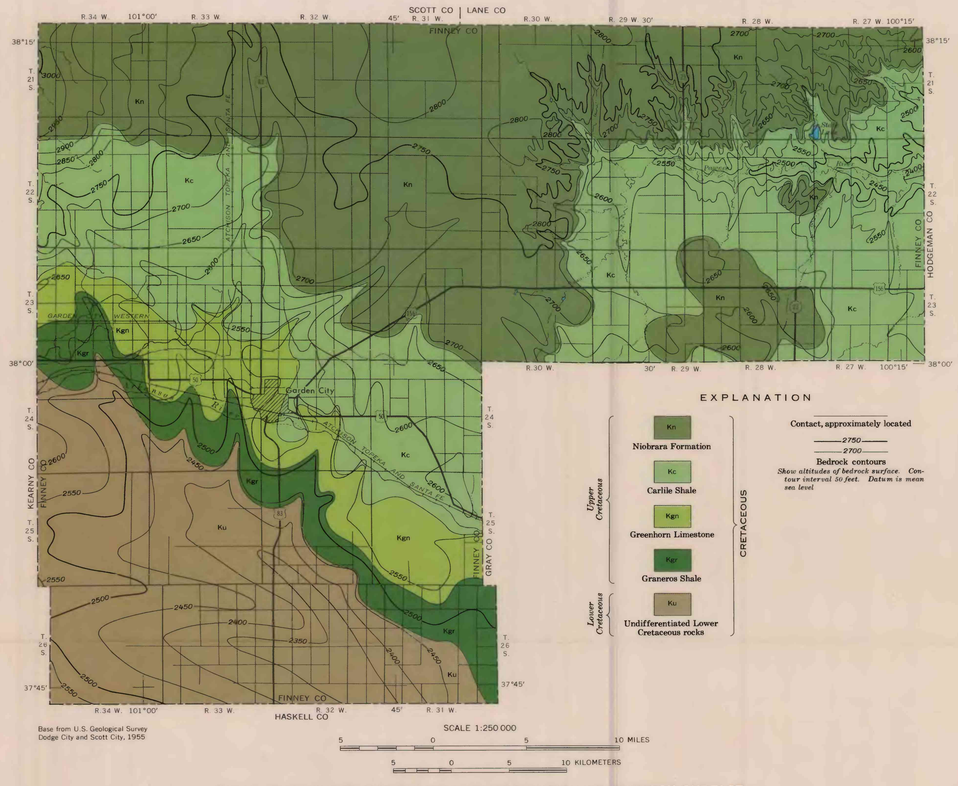
The oldest rocks exposed in Finney County are the Carlile Shale and Niobrara Formation of Late Cretaceous age (surficial geologic map). These rocks crop out in the Pawnee River drainage basin in the northeastern part of the county. The Ogallala Formation of Pliocene age and undifferentiated deposits of Pleistocene age uncomformably overlie the older rocks, and comprise the major part of the unconsolidated sediments in the subsurface. Both the Ogallala and the undifferentiated Pleistocene deposits are exposed in small areas in the northeastern part of the county. The Pleistocene deposits also are exposed on the bluffs north of the Arkansas River, and underlie terraces along the south side of the river. Loess deposits of late Pleistocene age are the principal surficial material, and the loess-derived soils are ideally suited for cultivation. Dune sand of late Pleistocene age mantles most of the southern part of the county, and forms rolling hills that are generally suited for rangeland. Quaternary alluvium, which consists of coarse-grained deposits of late Pleistocene age overlain by fine-grained deposits of Holocene age, underlies the flood plains of the Arkansas and Pawnee Rivers.

Unconsolidated deposits of Tertiary and Quaternary age range in thickness from a few feet in the northeastern part of the county to more than 500 feet in the southern part (map showing thickness of Tertiary and Quaternary deposits). The great variation in thickness results from differential erosion and subsequent deposition by Pliocene and Pleistocene streams. Areas of greatest thickness coincide with ancient stream-channel courses.

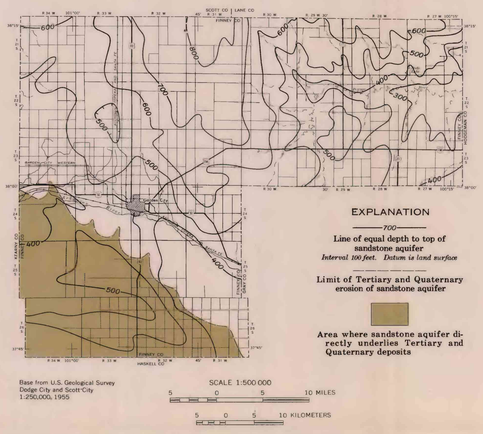
Contours on the bedrock surface (see bedrock geologic map) indicate that a major valley trends from Kearny County on the west to Haskell County on the south. A tributary valley extends from Scott County on the north, and converges with the major valley at a point about 9 miles south of Garden City.

Consolidated rocks of Cretaceous age, which underlie the unconsolidated Tertiary and Quaternary deposits, are referred to as bedrock in this report. In the southern part of the county, the deeply eroded bedrock surface is formed on undifferentiated Lower Cretaceous rocks. The bedrock surface in the rest of the county is formed successively on Graneros Shale, Greenhorn Limestone, Carlile Shale, and Niobrara Formation of Late Cretaceous age. These rocks are in normal stratigraphic position, as the altitude of the bedrock surface rises northward. The dip of the Cretaceous rocks is northeastward. The stratigraphic and hydrologic relationship of the geologic formations is illustrated on the block diagram.

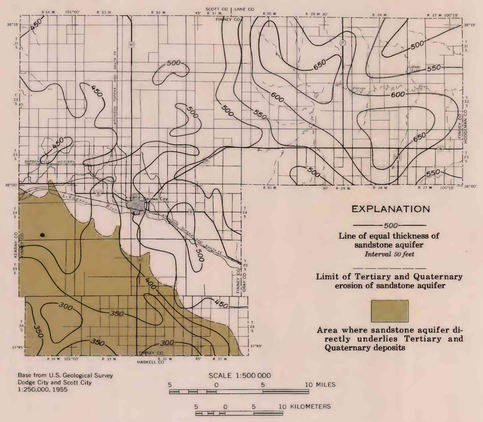
The generalized columnar section shows the thickness, lithology, and water-yielding potential of geologic units discussed in this report.



BEDROCK GEOLOGIC MAP SHOWING CONFIGURATION OF BEDROCK SURFACE



MAP SHOWING DEPTH TO TOP OF SANDSTONE AQUIFER



MAP SHOWING THICKNESS OF SANDSTONE AQUIFER

SANDSTONE AQUIFER

The bedrock formations of Late Jurassic and Early Cretaceous age, defined here as the sandstone aquifer, generally yield sufficient quantities of water for domestic and stock use. Although the aquifer has not been tested adequately in Finney County, information from adjacent counties indicates that ground-water yields may be sufficient for irrigation supplies in some places. Bedrock formations of Late Cretaceous age generally yield little or no water to wells.

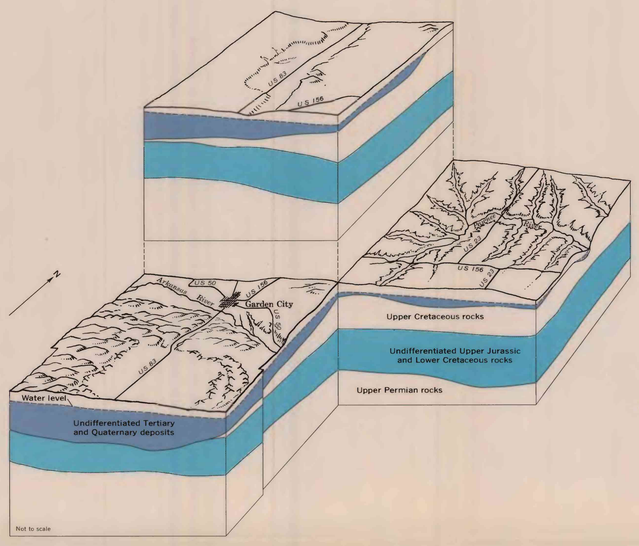
The Upper Jurassic rocks consist predominantly of shale with a fine-grained silty sandstone at the base. The undifferentiated Lower Cretaceous rocks contain three major units. The lower unit (Cheyenne Sandstone) consists of a very fine to medium-grained sandstone interbedded with shale. The middle unit (Kiowa Shale) is predominantly a shale interbedded with sandstone layers. The upper unit (Dakota Formation) consists of a fine- to medium-grained sandstone interbedded with shale and sandy shale.

Upper Permian rocks, which are not a source of potable ground water, underlie the sandstone aquifer throughout the county. The contact between the Upper Permian sandy shale and the Upper Jurassic sandstone or shale usually is distinguishable on gamma-ray logs of oil and gas test holes.

In the southern part of the county, the sandstone aquifer directly underlies unconsolidated deposits at a depth of about 400 to 500 feet (see map showing depth to sandstone). In the central and northern parts of the county, where intervening Upper Cretaceous rocks overlie the sandstone aquifer, the depth ranges from less than 300 to more than 800 feet.

The thickness of the sandstone aquifer (see map showing thickness of sandstone) ranges from about 300 feet in the southern part of the county to more than 650 feet in the northern part. The thickness has been reduced by post-Cretaceous erosion in southern Finney County.

Ground water is obtained from cemented to very silty sandstone layers in the aquifer. Hence, wells generally yield only enough water for domestic or stock supplies. In some parts of Finney County, however, irrigation supplies of more than 1,000 gpm (gallons per minute) are reportedly obtained from clean uncemented sand.



BLOCK DIAGRAM SHOWING CORRELATION OF STRATIGRAPHY AND HYDROLOGY

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Generalized columnar section and water-yielding characteristics

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	Water supply
Quaternary	Pleistocene and Holocene	Alluvium	0–60±	Clay, silt, and sand of Holocene age overlying sand, gravel, and cobbles of late Pleistocene age in the Arkansas River and Pawnee River valleys. Covers about 10 percent of the county.	Yields in the Arkansas River valley range from 800 to 1,200 gpm (gallons per minute) from battery wells. Yields in the Pawnee River valley range from 50 to 500 gpm.
	Pleistocene	Dune sand	0–75±	Fine to medium quartzose sand and lesser amounts of coarse sand; contains clay and silt. Formed into rolling hills by the wind. Located along the south side of the Arkansas River. Covers about 20 percent of the county.	Lies above the water table and does not yield water to wells.
		Loess	0–30±	Windblown silt covers about 66 percent of the county.	
		Undifferentiated deposits	0–300±	Medium to very coarse sand and gravel interbedded with clay, silt, fine sand, and caliche. These deposits are in contact with the Upper Cretaceous rocks where the Ogallala Formation is absent.	The sand and gravel of the Ogalalla Formation and the undifferentiated Pleistocene deposits are the principal water-yielding deposits in the county. Yields to irrigation wells range from 500 to 2,500 gpm.
Tertiary	Pliocene	Ogallala Formation	0–300±	Poorly sorted clay, silt, sand, and gravel; unconsolidated to tightly cemented by calcium carbonate.	
Cretaceous	Upper Cretaceous	Niobrara Formation	0–200	Upper unit (Smoky Hill Chalk Member) consists of yellow chalk and light- to dark-gray beds of chalky shale. Lower unit (Fort Hays Limestone Member) consists of a white to yellow massive chalky limestone; contains thin beds of dark-gray to brownish-gray chalky shale.	Yields ranging from 200 to 800 gpm are obtainable for irrigation from solution cavities where overlying unconsolidated material is saturated.
		Carlile Shale	0–330	Blue-gray slightly calcareous to noncalcareous shale in upper part. Lower part consists of very calcareous dark-gray shale interbedded with thin gray limestone beds.	May yield small quantities of water for domestic purposes in northeastern Finney County.
		Greenhorn Limestone	0–75	Chalky yellowish shale and thin-bedded limestone. Dark-gray calcareous shale and light-gray thin-bedded limestone; contains layers of bentonite.	Not known to yield water to wells in Finney County.
		Graneros Shale	0–110	Dark-gray calcareous shale interbedded with black noncalcareous shale; contains thin beds of bentonite. Also contains thin-bedded gray limestone and fine-grained silty sandstone layers.	
	Lower Cretaceous	Undifferentiated rocks	120–460	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. Lower unit (Cheyenne Sandstone)—gray and brown very fine- to medium-grained sandstone; interbedded with dark-gray shale.	Yields of 30 to 300 gpm generally are available. Yields of more than 1,000 gpm are reported in a few areas.
Jurassic	Upper Jurassic	Undifferentiated rocks	50–350	Shale, dark-gray, noncalcareous; interbedded with gray-green and blue-green calcareous shale. Contains some thin limestone beds and a fine-grained silty sandstone at the base.	A potential aquifer, untested in Finney County. May yield 30 to 300 gpm.
Permian	Upper Permian	Undifferentiated rocks	200–500	Red shale, sandstone, sandy shale, and anhydrite.	Yields no potable water to wells in Finney County.

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GROUND WATER IN FINNEY COUNTY, SOUTHWESTERN KANSAS

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1972

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