

**KANSAS GEOLOGICAL SURVEY  
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The Geology of Shawnee County, Kansas

by

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**KANSAS GEOLOGICAL SURVEY**

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# THE GEOLOGY OF SHAWNEE COUNTY, KANSAS

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State Geological Survey of Kansas

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The State Geological Survey has not issued a publication specifically on Shawnee County, but various phases of the county's geology are treated in several reports. To insure better understanding of this paper, which is a brief and general report on geologic conditions in Shawnee County, references are made to the following Geological Survey publications, which are enclosed:

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|----------------|---|
| Map No. 1      | Geological Map of Kansas  |
| Map No. 1A     | Surface Features of Kansas  |
| Map No. 10     | The Petroleum Industry in Kansas  |
| Map No. 63     | Coal Resources of the Wabaunsee Group in Eastern Kansas                               |
| Map No. 90-1   | Kansas Pits and Quarries  |
| Bull. 96 Pt. 5 | Geology and Ground Water Resources of Kansas River Valley between Lawrence and Topeka |
| Bull. 104      | Oil and Gas in Eastern Kansas   |
| Bull. 135      | Geology and Ground Water Resources of Kansas River Valley between Wamego and Topeka   |
| (Chart)        | Graphic Representation and Classification of Rocks in Kansas                          |

Important benefits accrue from understanding geologic conditions. The character of agricultural soils, the abundance or paucity of water, stability of foundations, adaptability of earth materials for making reservoirs (for water and other fluids) above or below

ground are examples of the relation of geology to various economic activities. Laying pipes and cables underground and making excavations in defense projects can be planned and carried out only with knowledge of conditions in the rocks. The relation of geology to exploitation of economic mineral products is obvious.

### GEOLOGIC CONDITIONS

Geologic conditions of an area of the earth's surface generally can be comprehended best as a mass of bedrock, the upper part of which is shaped into a surface of relief and at least partly covered with more or less recently accumulated materials. The mass of bedrock is of indefinite depth and the covering materials commonly are called surficial deposits. In Shawnee County in areas of considerable extent the surficial material is only a thin veneer of soil; elsewhere in the county, as in Kansas River Valley, sand and gravel and other unconsolidated materials are many feet thick. In places, surficial deposits are absent; these are exposures of bare rock.

Surficial deposits. --In Shawnee County the thicker surficial accumulations are (1) alluvium, largely silt, sand, and gravel, that partly fills stream valleys carved from bedrock and (2) widespread upland deposits that mostly are of glacial origin. Soils, whether formed on unconsolidated sediments as valley alluvium and on glacial drift or formed from bedrock such as now immediately underlies them, are themselves part of the mantle rock. Wind deposits have been added to other veneering materials in most parts of the county. Hence the soils and other unconsolidated surficial materials are complex and not everywhere well understood.

Stream valleys in Shawnee County are partly filled with silt, sand, and gravel. The filling in Kansas River Valley is about 75 feet thick. In smaller streams the filling

commonly is of lesser thickness. Formerly Kansas River Valley was filled to a level about 100 feet above the present flood plain, or valley "bottom" land. The river has re excavated and partly re-filled its valley several times within the last million years. Remnants of the former valley fillings now are step-like land forms that are called terraces. In places terraces form the immediate wall of the present river valley and the alluvial deposits seem to grade laterally into upland glacial deposits. These conditions in and along Kansas River Valley are shown graphically on Plate 3 in Bulletin 96, part 5 and on Plate 3 in Bulletin 135 of the Kansas Geological Survey. Stream-laid deposits are not confined to the present river valleys; gravel beds consisting mostly of coarse chert fragments occur locally at elevations about 200 feet above nearby streams.

The importance of surficial deposits is germane to several situations. These unconsolidated highly pervious accumulations, where thick, as in river valleys, are fresh-water reservoirs. They are parent rock of soils over wide areas and are sources of commercial sand and gravel. Their presence at construction sites is consequential, especially because they conceal irregularities in the underlying bedrock surface.

Bedrock. -- Bedrock that constitutes the outer part of the earth's crust is of indefinite thickness. Drillings in Shawnee County reach very ancient crystalline rock at an average depth of about 3,200 feet. Subsurface strata above the crystalline basement in the county are described in Bulletin 104 (p. 337-338). These are the potential oil- and gas-bearing rocks of the area.

Classification and graphic descriptions of the rocks that crop out at the surface in Shawnee County are shown on the chart "Rocks in Kansas" that accompanies this paper. The part of the rock column that crops out in Shawnee County includes the Shawnee and Wabaunsee Groups of Pennsylvanian age and the Admire Group and lower part of the Council Grove Group of Permian age.

A geologic map of Kansas and a map showing surface features in the state accompany this report. These maps are aids in understanding the distribution of outcropping Pennsylvanian and Permian rocks. The older, and stratigraphically lower, layers of bedrock are exposed in areas of low elevation in the eastern part of Shawnee County; younger strata are present in the western part. The outcrop belts of strata trend in north-south directions. The beds are inclined (dip) westward; hence strata that crop out in the eastern part are about 900 feet below the land surface in the western part of the county. The outcropping rocks are principally shale, limestone, and sandstone. Limestone beds are more resistant to erosion and hence commonly occur in east-facing escarpments. This situation, which is general and is modified by local topography and geologic structural conditions, is represented on the surface features map.

#### ECONOMIC GEOLOGY

The more aspects of economic geology may be summarized.

Water. Wells in the alluvium in Kansas River Valley yield amounts ranging from a few hundred to about 1,500 gallons of water per minute. Alluvium in smaller valleys and some thick deposits of glacial drift yield smaller amounts of water. In most of Shawnee County, water in bedrock deeper than about 200 feet is highly mineralized and

unsuited for domestic use, for live stock, or for irrigation. It should be noted, however, that the depth to mineralized water varies from place to place. Shallow bedrock conditions, also, vary from place to place; hence in areas without thick surficial deposits, the ground-water situation differs from farm to farm. In places shallow sandstones are fresh-water reservoirs of sufficient capacity to support good farm wells but not irrigation (except on a very small scale) wells. Most of the thicker limestones contain small amounts of water in areas not far from their outcrops. In some parts of the county, wells of even a few gallons per minute are not possible. Water for farm and domestic use in these areas must come from sources other than ground-water supplies.

In almost all parts of Shawnee County the topography and near-surface geologic conditions are such that farm ponds can be constructed, but it should be understood that efficient dams can be built only if planned in accordance to geologic conditions at the site.

It is obvious that Kansas River is a large potential as well as an actual supply of water. The river and its alluvium offer water for considerable urban expansion, industrialization, and irrigation. There are smaller permanent streams in the county; Wakarusa Creek, Shunanunga Creek, Soldier Creek, and others are of economic importance because of water in their alluvial fills and in the creeks themselves. It should be understood, however, that in times of drought the smaller streams cease to flow.

Sand and gravel. -- Kansas River and its alluvial filling are nearly inexhaustible sources of sand and gravel. These materials may be taken directly from the river bed or in pits on the flood plain or on river terraces. The supply in the river is being replaced except in times of very low water. The amount in the valley fill is very large.

Reported sand production in Shawnee County in 1958 is 542,024 tons; gravel 30,079 tons. The reported value of the two commodities is \$446,477.

Limestone. -- Most of the limestone commercially quarried in Shawnee County is from the Deer Creek formation, in the eastern part of the County, and from the Bern and Topeka formations in the central part. Production of limestone in 1958 was reported as 346,645 tons, valued at (after crushing) \$496,000. The map, "Kansas Pits and Quarries", shows the locations of quarries as of 1951. Limestone quarries, of course, are situated in accordance with distribution of suitable quarry ledges. Seemingly limestone quarrying cannot be done as economically in Shawnee County as in some other parts of the state, where there are thicker limestone ledges. Limestones in Shawnee County cannot compete favorably with those in younger formations now being quarried for building stone near Junction City and in Cowley County.

Ceramic raw material. -- Many years ago brick was manufactured from raw material taken from the upper part of the Severy Shale in the west part of Topeka. Although there is considerable raw material available in this part of the state for making ceramic products, the establishment of a sizeable ceramic industry is unlikely because of the absence of a nearby supply of suitable fuel.

Coal. -- Reference is made to Bulletin 63. Coal has not been mined in Shawnee County for many years, and, although proved reserves of coal in the county are in excess of 15½ million tons, the coal is not economically minable. No known coal bed in Shawnee County is thicker than about 17 inches.

Oil and gas possibilities. --The Geological Survey has record of 32 wells that have been drilled as oil and gas tests in Shawnee County. It is suspected that very minor amounts of gas were found in some of the holes, but there has been no commercial production of either oil or gas in the county.

Reference is made to Bulletin 104 (p. 336-340). Three wells have been drilled in Shawnee County since 1954, when the bulletin was published. These are: (1) Musgrove Petroleum Company No. 1 Heiland, NW NW NW sec. 6, T. 10 S., R. 13 E. total depth 3329 feet, stopping in Precambrian rocks; (2) the Geo. F. Johnson, Jr. No. 1 Viergever, cen. SW NE sec. 36 T. 11 S., R. 13., total depth 2791 feet, stopping in Simpson rocks; and (3) Eureka Drilling Company et al. No. 1 Martin, NE NW sec. 1, T. 12 S., R. 14 E., total depth 2640 feet, stopping in Viola rocks. From Figure 54 and Table 64 in Bulletin 104 and from data on the three recently drilled wells, it is apparent that Shawnee County is not thoroughly tested. Future testing might discover oil, though the record to date is not optimistic.

Reference is made to the map, "Petroleum Industry in Kansas", to indicate the geographic relations of Shawnee County to oil- and gas-producing areas.

Suggested raw materials for other uses. --The chief requisites for portland cement making, limestone and clay (in the form of shale), are plentiful in Shawnee County. However, there are no near surface limestone beds as thick as those in places where cement is being made. It is believed that among the limestones in the county, the Deer Creek is best adapted for agricultural limestone production. Shale or silty alluvial material could be blended with limestone for making rock wool; however, lack of thick limestone deposits would make large scale operation difficult.

Conditions suitable for underground storage. --It does not seem out of place here to call attention to the usefulness of underground reservoirs for the storage of petroleum liquids and gases. The need for underground storage space for fuels having reasonable demands and for materials necessary to defense is obvious. In several parts of the country, liquid petroleum gases (LPG) or other petroleum hydrocarbons are stored in cavities that have been excavated from shale at depths of several hundred feet. There are several zones within a depth of approximately 1,000 feet in Shawnee County that are believed to be suitable for mined-out reservoirs.

The storage of natural gas in depleted gas pools near areas of large and reasonable demands is common. In Jefferson County gas is stored in the old McLouth gas field. Not all gas storage projects need be in structures that formerly contained gas. Porous sandstone deposits in structural positions that cause introduced gas to be retained are now being utilized in some parts of the country. It is believed that suitable conditions for this kind of gas storage can be found in many parts of eastern Kansas.