

**KANSAS PITS AND QUARRIES**

**By ROBERT O. KULSTAD and EARL K. NIXON**

UNIVERSITY OF KANSAS PUBLICATIONS  
STATE GEOLOGICAL SURVEY OF KANSAS, BULLETIN 90, PART 1  
LAWRENCE, KANSAS  
1951

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2. Dollar value of Kansas pit and quarry products.

## ABSTRACT

Kansas pits and quarries are briefly described and their distribution in the State is shown on the accompanying map. The current annual value of raw mineral products produced from Kansas pits and quarries is about \$40,000,000 (or 11 percent of the \$371,000,000 total value of Kansas raw minerals in 1950). This is 3.6 times the figure for 1940. The products of Kansas pits and quarries present a wide variety of mineral raw materials that play an important role in Kansas industry.

## INTRODUCTION

### PURPOSE AND SCOPE OF MAP

In every Kansas county there are pits or quarries which are yielding mineral products of value to the communities and to the State. The locations, types, and products of most of these numerous pits and quarries are known only rather locally, however. The State Geological Survey receives many inquiries for sources of pit and quarry products and also for locations within the State where pits or quarries to supply road or construction material or minerals for industry might be opened. Mineral raw material studies being made by the Survey in view of the expanding industrialization of the State revealed the need for a general map showing the pattern and distribution within the State of various types of industrial mineral production. In order to satisfy this need a map showing the location of all known pits and quarries in the State has been compiled.

The map covers only the Kansas mineral deposits that occur at the surface. The subsurface minerals, such as oil, gas, lead, zinc, ground water, coal, gypsum, and salt, are not represented on the present map. A large-scale map of Kansas showing the petroleum industry (oil and gas fields, pipe lines, refineries, and other facilities) was published by the State Geological Survey in 1948. A general map of Kansas mineral resources (now out of print) was published by the Survey in 1942.

It is believed that the present map will serve not only individuals but also township, county, and State agencies desiring information on the location of pits and quarries and their products. It is possible also that it will be of value in Kansas schools.

### PREPARATION OF THE MAP

Data for the map were compiled from several sources of infor-

mation, none of which was complete, but combined afforded fairly complete coverage of the entire State.

The first source of information used was the data on file at the State Geological Survey. A list of publications containing information about Kansas pits and quarries is given in the bibliography. A canvass was made of the county engineers of Kansas and unpublished data in the possession of staff members of the Ground Water Branch of the U. S. Geological Survey in Kansas and of the State Geological Survey of Kansas. Greenhorn limestone quarries were in such great numbers that they were located almost entirely by the use of aerial photographs.

When these sources of information were exhausted the map was then checked by the county engineers of Kansas. This was done by mailing to each engineer a map of his county as it appeared on the manuscript map. When these county maps were returned the additions and corrections were transferred to the large map.

The map was finally checked and revised by information obtained from several division materials engineers of the State Highway Commission. These men, together with the Topeka office of the Highway Commission, formed the most complete and extensive single source of information to be had.

The map as it appears gives an accurate general representation of pit and quarry operations in Kansas. Inconsistencies in detail may appear due to differences of interpretation that each of the large number of contributors placed upon the information he had to offer and to the fact that some areas unavoidably received more attention than others.

#### ACKNOWLEDGMENTS

County engineers, county clerks, secretaries of chambers of commerce, and others in almost every Kansas county were visited by a member of the Geological Survey staff in connection with the preparation of this map. To acknowledge each by name would require paragraphs; to all, we are deeply indebted.

We wish to acknowledge especially assistance from the materials department of the Kansas Highway Commission which furnished pit locations from which the Commission has produced or of which it had knowledge.

Thanks are due to various staff members of the State Geological Survey and the Ground-Water Branch of the U.S. Geological Survey for data supplied.

## HISTORY AND IMPORTANCE OF KANSAS PITS AND QUARRIES

Kansas, which ranks ninth among the states in total mineral production (about \$371,000,000 in 1950) is somewhat farther down the list in the value of its pit and quarry products. This is due in part to the fact that the surface of Kansas consists (except for a square mile or so) of sedimentary rocks—mainly limestone, sandstone, and shale of Paleozoic and later age—which have not been folded, indurated, or mineralized to any great extent. The limestones have not been changed to marble; the sandstones are mainly rather soft (with exceptions described later); and the shales have not been indurated to slates and schists—harder more brittle rocks which are utilized in their natural form or which occasionally are important as hosts to valuable minerals of secondary origin.

Early Kansas history established the pattern for pit and quarry development. The Kansas prairie was settled by colonists who made full use of the mineral substances at and near the surface of the land. There was coal to be dug at the surface; salt to be had easily from springs and marshes; limestone to be quarried for homes and fences and burned for lime mortar; gypsum to be dug and hauled away for fertilizer and for plasters; and oil seeps that exuded a gooey liquid famous for its healing properties. Products from the crust of the earth were held in high esteem—a land which provided them in considerable abundance, like “Kansas,” was a land of plenty.

Oil seeps led to the drilling of shallow wells, and to the discovery of shallow gas and later oil to be used not merely as a medicinal product but also as a fuel. The mineral economy of Kansas became firmly established on petroleum in the 1890's. It has not changed since, but since 1900 there has been a somewhat different emphasis in regard to the use and importance of pit and quarry products. Since the late 1880's salt has been mined underground and has been a manufacturing industry. Gypsum is being mined from underground and processed in plants of ever-increasing size. Due to abundant cheap natural gas in southeastern Kansas in the early 1900's, brick for paving and for construction were made in

great quantities in plants, some of which are still active. Rock quarries, opened formerly as small operations in almost every community where there were ledges, became fewer but larger. This is strikingly illustrated by the hundreds of abandoned quarries in the Fencepost limestone shown on the map as occurring in central Kansas. Most of these quarries were small operations operated locally for local consumption. Flagstone quarrying operations gradually declined as the southeastern Kansas cement plants made concrete more popular. A gradual transition has taken place from a period when every man had to be his own fuel provider, stone mason, carpenter, butcher, and jack of all trades, to a period in which one could buy from store or lumber yard the needed products processed or produced on a much larger scale, usually by machinery.

PITS AND QUARRIES IN THE KANSAS ECONOMY

The over-all economy of the State from the beginning has been largely agricultural. However, manufacturing (more accurately termed industrialization) has shown rapid increase since 1940, having passed raw mineral production in the dollar value it contributes. The breakdown, omitting consideration of services, is shown in Table 1.

Undoubtedly a substantial part of the contribution by Kansas manufacturers comes from the refining and processing of petroleum.

The importance of Kansas pit and quarry products—minerals of the surface group only—is based not as it was 100 years ago on necessity of food and shelter but on economic desirability.

TABLE 1.—Dollar value of Kansas agriculture (1949), manufacturing (1947), and raw mineral production (1949)

Product	Value, millions of dollars	Percent of total
Agriculture		
Crops .....	448.8	25.8
Livestock .....	484.8	27.8
Total agriculture .....	933.6*	53.6
Manufacturing .....	461.1*	26.4
Mineral production (including pit and quarry products) .....	352.3**	20.0
Total .....	1,747.0	100.0

\*Source: Bureau of Business Research, University of Kansas.

\*\*Source: State Geological Survey of Kansas.

In 10 years from 1940 to 1950, the value of Kansas raw pit and quarry products has increased from \$11,000,000 to \$39,600,000, or more than threefold. In the same period the quantities of cement and stone produced in the State have about doubled, but the quantity of sand and gravel produced has more than tripled. Table 2 shows the leading pit and quarry products, their value in 1940 and in 1950, and percentage increases.

Kansas people are becoming more and more conscious of the effect of the out-of-balance Kansas economy. Agriculture, largely carrying the load, has been shipping many of its products as raw materials out of the state and spending a large part of the income for imported manufactured items with which to build or equip homes and farms. Kansans are now finding it cheaper to process and manufacture numerous things at home rather than to import the finished products from considerable distances. Hence people are more interested in the utilization of the mineral substances shown on the pit and quarry map.

Kansas people are beginning to think of their limestone ledges not merely as something to be taken for granted but rather as the stuff from which cement, "ag lime," road aggregate and concrete, or enduring and beautiful homes and buildings are made. Clay banks are being talked about and investigated for possibilities not merely as common brick, tile, and other such well-known products but also for the beautiful ceramic and art ware now being made in Kansas and for refractories now being shipped in from distant points. Volcanic ash is now being looked upon not merely as the base for soap powders but as a principal component of widely used ceramic glazes. Kansas shales are soon to be used in the manufacture of lightweight aggregate, a comparatively new construction material which on account of its insulating and other properties is

TABLE 2.—*Dollar value of Kansas raw pit and quarry products\**

Product	1940	1950 estimated	1950 percentage of 1940
Cement	\$5,192,160	\$19,500,000	376
Clay	1,045,285	5,745,000	549
Sand and gravel	893,962	5,000,000	560
Stone	3,698,391	9,250,000	251
Miscellaneous (volcanic ash, natural cement, etc.)	200,285	88,060	-44
	<u>\$11,030,083</u>	<u>\$39,583,060</u>	<u>359</u>

\* Statistics given here for 1940 are from the U.S. Bureau of Mines Minerals Yearbook; estimate figures for 1950 by the State Geological Survey of Kansas are based partially on 1949 figures gathered jointly by the Survey and the U.S. Bureau of Mines.



much in demand. A dozen other materials and uses are being thought of for Kansas earth substances.

It is reasonable to prophesy that between 1950 and 1960 the importance of Kansas pit and quarry products will increase even more than it has in the past decade. It is expected that known silica sand deposits will be developed, that new uses will be found for our large deposits of volcanic ash, that an important lightweight aggregate industry will be developed from Kansas shales, that our clays will be more widely utilized, that dimension stone and sandstone will be more widely used for their permanence and beauty of construction, and that our limestones will be utilized for additional industrial or chemical purposes.

### DISTRIBUTION OF KANSAS PIT AND QUARRY PRODUCTION

The map showing Kansas pits and quarries indicates a very wide distribution for some of the products, such as sand and gravel, but a limited areal distribution for some others. This variation is due mainly to the surface geology of the State, but demand for a product coupled with its production and transportation costs accounts in part for the variation. For example, in the eastern one-third of the State where high-grade limestone is present in numerous localities, some of the larger producers of concrete aggregate, road material, and ag lime have located their quarry and crushing operations where mining costs, market, and transportation conditions combine to make the locations attractive.

The distribution of pits and quarries over the State does follow a rather definite pattern which relates to the geology, as indicated below.

#### STONE

Stone producers are divided roughly into two groups: (1) those whose quarry operations are confined to screening and crushing (for road and concrete aggregate, riprap, ag lime, and miscellaneous industrial rock including flux, filter, and chemical rock); and (2) those supplying prepared stone for building purposes (sawed veneer, wall, and trim rock, flagstone, and "rubble" for rough walls, basements, and retaining walls.)

The first group is much the larger both in number of operations and in the dollar value of its output. As the products must meet rigid chemical or physical specifications, only a hard high-grade

rock can be used. In Kansas this kind of rock is present at the surface mainly in Permian and Pennsylvanian rocks in the eastern one-third of the State. Most widely used by crusher operations are the Plattsburg, Wyandotte, Iola, Fort Scott, Oread, and Burlington limestones of Pennsylvanian age. A little farther west, the Cottonwood, Wreford, and Fort Riley limestones among others of Permian age are widely quarried locally for road material and ag lime.

Except very locally, there are no limestone formations west of Marion County that supply rock satisfactory both for aggregate and ag lime, although a cemented sandstone or "quartzite" of Cretaceous age developed mainly in Lincoln County supplies a high-grade siliceous road and concrete aggregate. Diatomaceous marl is being quarried in Wallace County in northwestern Kansas and shipped to market for industrial use. Chat, a siliceous crushed rock waste from the lead and zinc mines in the extreme southeastern corner of Kansas, is shipped to many parts of the State for use as aggregate and railroad ballast.

Building stone producers may be subdivided into those producing cut or dimension stone in diamond or gang saw plants and those who prepare the rock by hand or otherwise. At present, three beds are being quarried as saw blocks for dimension stone—the Fort Riley and Cottonwood limestones of Permian age, and the Cretaceous Greenhorn limestone. The Fort Riley, quarried at Silverdale in Cowley County and near Junction City, has been produced formerly from numerous intermediate points along its sinuous outcrop which crosses the State from north to south. The Cottonwood limestone is quarried and sawed near Manhattan and at Cottonwood Falls. Probably no limestone in Kansas has been opened in as many places as the Fencepost bed of the Cretaceous Greenhorn limestone. This rock, which is easily worked when freshly uncovered or "green," has been used locally over a wide area in central Kansas for road material, for building stone, and for stone fence posts. The Fort Hays limestone of north-central and western Kansas has formerly been sawed into building blocks at several localities.

Numerous small quarries near Kansas City produce "rubble"—hand-selected but uncut stone for walls, basements, and patios—from a Lower Pennsylvanian formation locally described as "oölite." The Bandera flagstone quarry, opened about 70 years ago

12 miles west of Fort Scott, produces gray sandstone flags and veneer stone that becomes very hard after exposure to weather.

#### SAND AND GRAVEL

Sand and gravel pits are located in every county in the State, although the nature of the products varies considerably. The distribution of sand production in Kansas is based on the drainage pattern and the transportation of sediment by streams rather than merely on the areal distribution of rocks of certain geologic age.

More than 60 percent of the recorded production of sand in Kansas comes from a few principal localities on the major streams. Lesser sources of sand are found along the smaller streams, especially in the western part of the State where natural gravel commonly is produced with the sand. In the area south of Kansas River and east of Arkansas River, the smaller streams, mainly carrying erosion materials from the Permian and Pennsylvanian rocks, yield chert or flint gravels. The latter, found in terraces as residual gravels formed from the weathering of these same rocks, supply a satisfactory source of aggregate in numerous localities.

#### CLAY

Clay pits furnish the raw material annually for several million dollars worth of brick, tile, pottery, and other ceramic products in Kansas. Plants making red brick and tile are mainly in the southeastern counties—Allen, Crawford, Woodson, Wilson, and Montgomery—where Lower Pennsylvanian shales are burned. A plant at Weir in Cherokee County produces light-buff brick and tile from the underclay of the Weir-Pittsburg coal bed. A brick plant at Salina produces red brick from shale at the very top of Permian rocks. The two most recently built brick plants, at Concordia in Cloud County and at Great Bend, both make light-buff products from Cretaceous clay of the Dakota formation.

Two of the four Kansas potteries—those at Fort Scott and Pittsburg, making flower pots and stoneware, respectively—use red-burning clay from Lower Pennsylvanian rocks. The other two potteries, at Ellsworth and Miltonvale, both make art ware and use light buff-burning clays of Cretaceous age. These two potteries use a considerable percentage of volcanic ash from Kansas deposits in their glazes.

Clays of various types and suitable for numerous uses (including refractories) are present in Kansas and have been investigated by the State Geological Survey.

#### VOLCANIC ASH

Volcanic ash deposits with substantial reserve tonnages are present in the Meade County area of southwestern Kansas and in Norton and adjacent counties along the north line of the State. Smaller deposits and occurrences are scattered rather widely across western Kansas. Their age is mainly Pleistocene although some Kansas ash is Pliocene (late Tertiary).

The largest use of volcanic ash has been as a mild abrasive in the manufacture of soaps and cleaning powders, but in recent years the demand for ash has diminished as ground feldspar has increasingly supplied the base for such cleaning preparations and as detergents have become popular. The use of volcanic ash to replace feldspar in ceramic glazes is increasing. Ash is much cheaper than feldspar and permits a lower burning temperature.

Two plant operations, one a few miles north of Meade and one in Norton County, account for the bulk of present Kansas production of volcanic ash.

#### CEMENT ROCK

Cement plants with current annual output of nearly \$20,000,000 make up the largest dollar value item in Kansas pit and quarry production. Six plants, all in eastern or southeastern Kansas, make Portland cement and one, at Fort Scott, produces natural cement. All existing plants use limestone and shale of Pennsylvanian age, although the chemical and physical requirements of the raw materials are such that they could be obtained much farther west.

In the case of cement production in Kansas, the distribution of suitable rocks was much less a factor in determining plant location than were the factors of fuel and market.

#### MISCELLANEOUS

Miscellaneous pit and quarry products that are being or can be produced in Kansas include a clay near McCracken in Ness County used for oil-well drilling mud; foundry or molding sand near Kansas City, Atchison, and a few other places; glass or silica sand (not yet in production) in Barber, Comanche, and Kiowa Counties

for molding sand and glass manufacture; chalk near Cedar, Smith County, and elsewhere in that area, for putty, paint manufacture, and perhaps whiting; clays for refractories (not yet in production) in several parts of Kansas; earth material suitable for rock wool present in several parts of the State but not now in production; and doubtless others.

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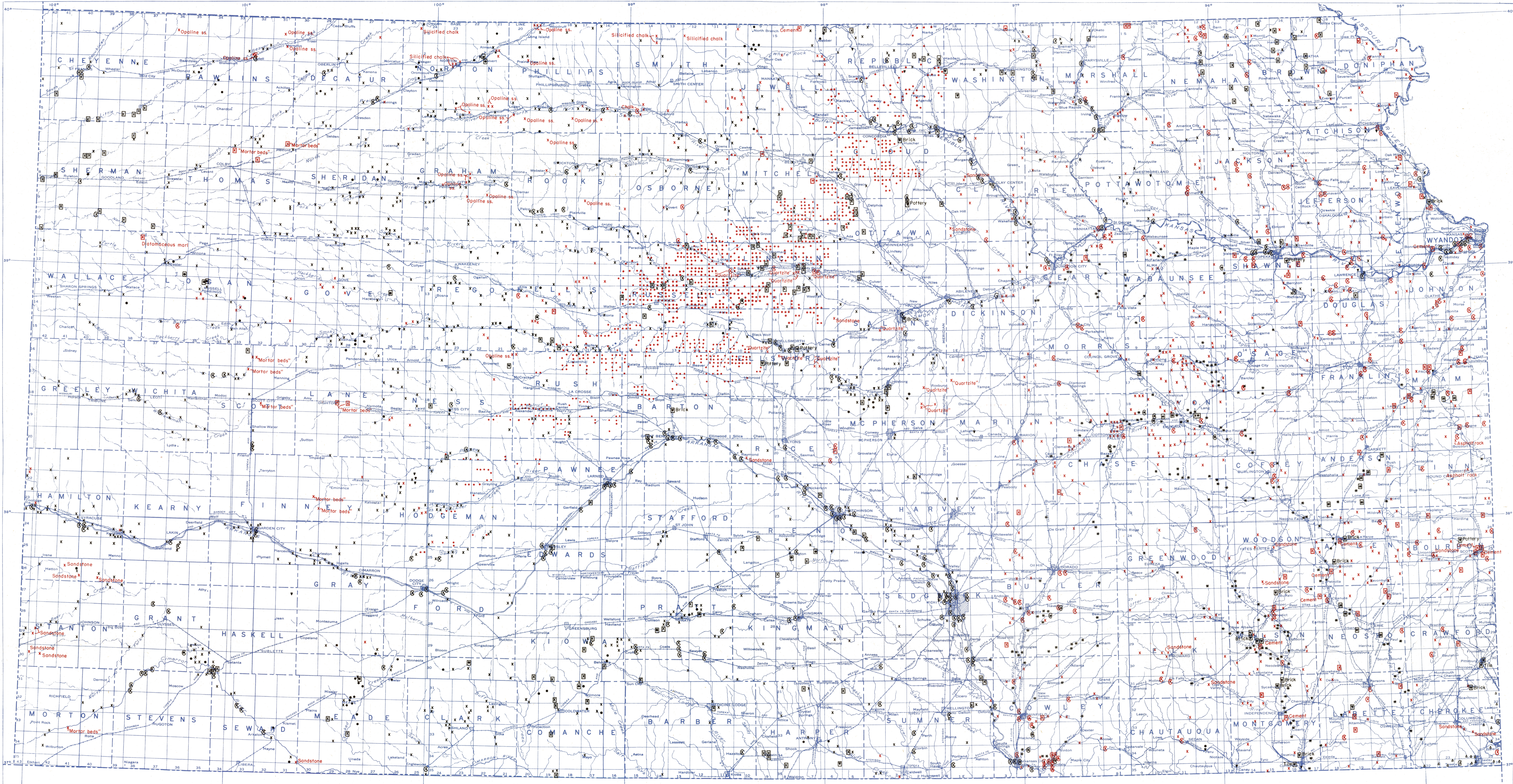
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# KANSAS PITS AND QUARRIES

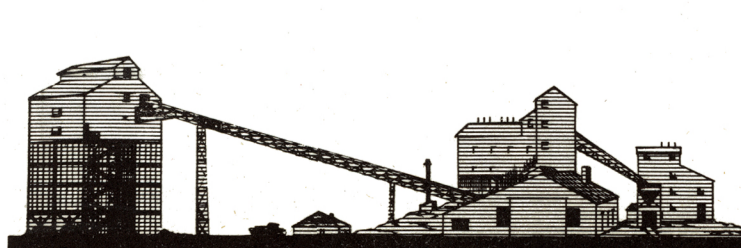
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Underground mines of zinc, lead, salt, and gypsum and all coal operations are omitted.

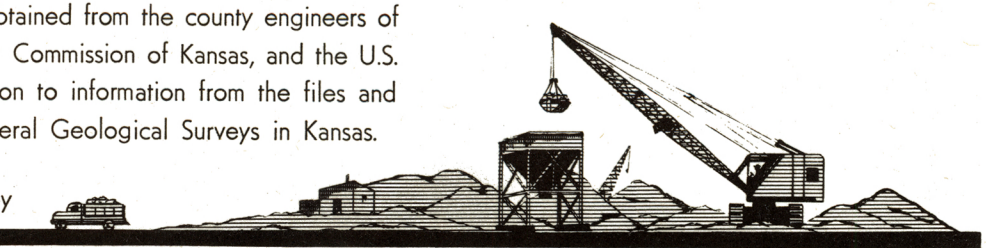


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|--|---|---|--|
| <ul style="list-style-type: none"> <li>• • • • • Abandoned or inactive pits and quarries</li> <li>☒ ☒ ☒ ☒ ☒ Active, noncommercial pits and quarries</li> <li>⊗ ⊗ ⊗ ⊗ ⊗ Active, commercial pits and quarries</li> </ul> | <ul style="list-style-type: none"> <li>⊗ ⊗ Sand or sand and gravel pits</li> <li>* ⊗ Chert gravel (and sand) pits</li> <li>⊗ ⊗ Chat, by-product of zinc-lead mines</li> </ul> | <ul style="list-style-type: none"> <li>▽ ⊗ Clay or shale pits, for ceramic uses</li> <li>• ⊗ Volcanic ash pits</li> </ul> | <ul style="list-style-type: none"> <li>⊗ ⊗ Rock or stone quarries, limestone unless otherwise indicated</li> <li>⊗ ⊗ Cut stone quarries, limestone unless otherwise indicated</li> <li>• ⊗ Greenhorn "Fencepost" limestone quarries</li> </ul> |
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Data for the map were obtained from the county engineers of Kansas, the State Highway Commission of Kansas, and the U.S. Bureau of Mines, in addition to information from the files and staff of the State and Federal Geological Surveys in Kansas.

Base map by the U.S. Geological Survey



Value of Kansas pit and quarry products during 1950—more than \$40,000,000