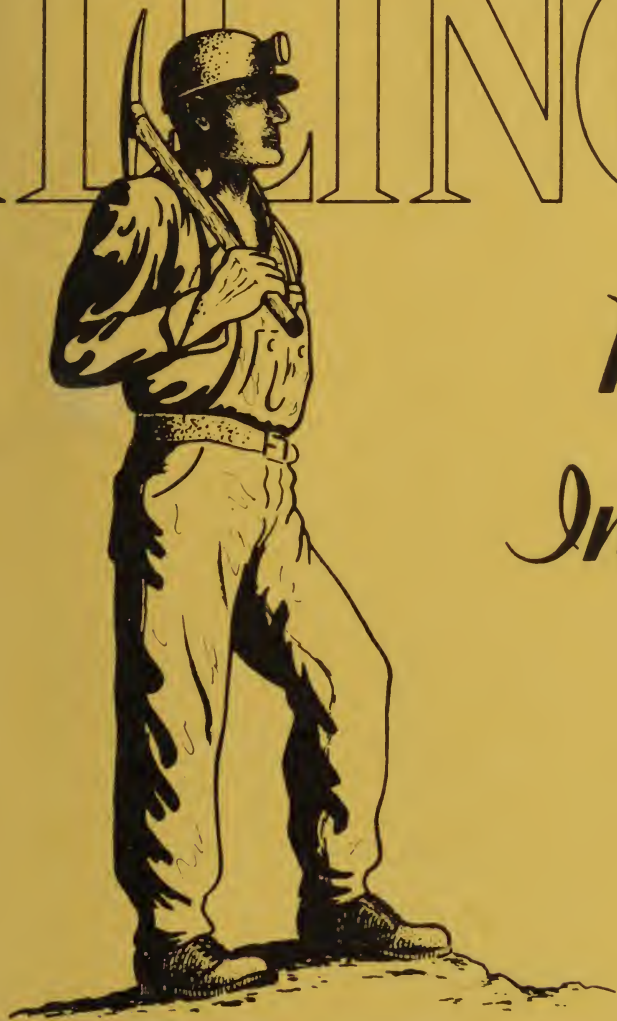


Geol Survey

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no. 10

Series 10

History of
ILLINOIS



*Mineral
Industries*

Hubert E. Risser
Robert L. Major

Illinois State Geological Survey

STATE of ILLINOIS



DEPARTMENT of
REGISTRATION and EDUCATION

COVER - Sketch of the bronze statue of THE COAL MINER at the State Capitol Building, Springfield, Illinois. The statue was created by John Szaton and is dedicated to the more than 9000 men who have lost their lives in coal mine accidents in Illinois.

ILLINOIS STATE
GEOLOGICAL SURVEY

1968
John C. Frye, Chief
URBANA, ILLINOIS

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ILLINOIS STATE GEOLOGICAL SURVEY



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FOREWORD

*A*LTHOUGH MANY people are aware that Illinois is a leading agricultural and manufacturing state, it is seldom classified as a mining state. Nevertheless, in value of mineral production Illinois has ranked among the top 10 states for over a century. In 1967, the state's mineral industries produced more than a dozen different minerals and rocks valued at \$650 million.

Because 1968 marks the 150th anniversary of statehood for Illinois, it is appropriate to take a backward look at the development of the mining and mineral processing industries of the state. This book is a brief review of the important historical events related to the growth and development of these industries.

John C. Frye, Chief
Illinois State Geological Survey
Urbana, Illinois

October 1968

HISTORICAL HIGHLIGHTS

- 1674 - COAL discovered near Ottawa
- 1803 - Commercial SALT production begun at Equality
- 1810 - First commercial mining of COAL near Murphysboro
- 1815 - First LIME produced at Hunterstown, near Alton
- 1823 - Large-scale, systematic mining of LEAD started at Galena
- 1830 - First NATURAL CEMENT in Illinois produced at Utica
- 1835 - Early POTTERY made at Highland
- 1836 - Pig IRON production begun at Illinois Furnace
- 1842 - First FLUORSPAR mined near Rosiclare
- 1856 - PEAT dug as fuel near Morrison
- 1858 - First ZINC smelter in operation at LaSalle
- 1867 - Pig IRON production begun at Grand Tower
- 1871 - First Bessemer STEEL produced in Chicago
- 1886 - First commercial GAS field discovered at Pittsfield
- 1888 - First commercial OIL field discovered at Sparta
- 1891 - First PORTLAND CEMENT produced at Oglesby
- 1896 - Systematic, commercial mining of SILICA SAND begun at South Ottawa
- 1900 - TRIPOLI mining started in Elco-Tamms area
- 1906 - Casey and Main OIL pools discovered; first oil boom
- 1937 - Clay City and Loudon OIL pools discovered; second oil boom

History of ILLINOIS MINERAL INDUSTRIES

Hubert E. Risser and Robert L. Major



THE MINERAL wealth of Illinois was being used long before the state of Illinois was created, and, indeed, long before the French explorers came to the area. The early Indian inhabitants made pottery utensils from the native clays, shaped pieces of flint into tools and weapons, and carved fluorspar into trinkets. They also procured salt from certain mineral springs.

Deposits of minerals were carefully noted by the earliest explorers. Louis Joliet and Father Marquette, who traveled the Mississippi and Illinois Rivers in 1673 and 1674, more than a century before the American Declaration of Independence, reported the occurrence of several mineral materials, including coal. Theirs was the first written report of coal in what is now the United States. Joliet's map indicated a deposit of coal in the vicinity of the present city of Ottawa in LaSalle County.

Later explorers reported finding coal, copper, iron, lead, silver, and slate in the Illinois Territory. Some of these, rather than originating in Illinois, probably had been carried into the area by glacial action. Of the six, only coal and lead were present in large enough quantities to be of commercial importance today.

During most of the 18th century, the Illinois Territory was sparsely populated, and mineral production was limited to small-scale mining of lead in Jo Daviess County and salt in Gallatin County. By the end of that century the population was only about 2500, most of it in southern Illinois, centered around Cahokia, Kaskaskia, and Shawneetown.

Population grew rapidly after 1800, creating a market for building materials. Probably the first brick building in Illinois was constructed in Cahokia of bricks made with local clay. Stone was quarried for foundations and chimneys in various parts of the state.

On December 4, 1818, Illinois became the 21st state of the Union, and for a few decades following, mineral production increased only slowly. Small-scale production of lime, clay products, coal, pig iron, and natural cement was begun during that period.

The development of the mineral industries was retarded by the lack of efficient transportation facilities, most mineral output being restricted to strictly local markets. This situation was changed by the opening of the Illinois and Michigan Canal in 1848 and by the extensive building of railroads during the following decade. For the first time, mineral products could be transported in bulk over long distances at moderate cost. The coal industry, which had begun regular production in 1833, was one of the first to take advantage of railroad service. In addition to shipping coal to large city markets, the coal producers also sold sizable amounts to the railroads for the coal-burning locomotives.

The Civil War period marked the change from a primarily agricultural state to a major manufacturing and mining state. The industrialization process stimulated demands for additional quantities of minerals already being produced in Illinois and also created markets for commodities for which there had previously been no market. Between the Civil War and the first World War, large iron and steel centers grew up at St. Louis and Chicago, zinc mining and smelting became substantial industries, and new markets for industrial materials led to the development of sizable operations in clay products, portland cement, lime, silica sand, tripoli, fluorspar, and building stone.

Although attempts to recover oil and gas in Illinois began as early as 1853, it was not until 1906 that the state became a major producer. Since then it has been among the top 10 oil-producing states.

Today, in 1968, Illinois ranks ninth in the United States in value of minerals produced annually. It ranks first in the production of fluorspar, second in stone, fourth in coal, sixth in sand and gravel, and is the principal producer of tripoli. It

also produces large quantities of petroleum, silica sand, clay and clay products, portland cement, lime, and peat.

SALT

Salt was produced in the territory long before Illinois became a state. Although some salt was produced in Vermilion and Jackson Counties, the main operations were near the present town of Equality in Gallatin County. First the Indians and later the explorers and settlers obtained salt by evaporating the salty water (brine) that came from the springs.

In 1803, as the result of a treaty with seven Indian tribes, the United States Government obtained the land containing the salt springs at Equality. In exchange for the land, the Government promised to furnish the Indians with as much as 150 bushels of salt each year. When Illinois became a state, the Federal Government deeded the salt springs to the new state with the provision that they be leased to individuals for not more than 10 years at a time.

The salt springs near Equality continued to be worked for over 70 years. The brine was drawn from the springs through wooden pipes and heated over charcoal fires in kettles which held 45 to 90 gallons each. When the water evaporated, the salt crystals were left in the bottom of the kettle. In 1819, between 200,000 and 300,000 bushels of salt, selling for 50 to 75 cents a bushel, was produced from the springs. By 1828, five salt works were in operation. In 1854 a new plant was built that used large vats or pans made of sheet iron over fire chambers built of stone. When wood became scarce, a coal mine was opened nearby to provide fuel for the salt works.

When salt imported from recently developed deposits in the eastern states became available, production in Gallatin County became uneconomical. The salt works at Equality were finally abandoned in 1875, and an Illinois mineral industry that had once been the most important source of salt west of the Appalachians, supplying people from Tennessee, Kentucky, Indiana, and other parts of the country, became of historical rather than of commercial interest.

LEAD

In the last few decades of the 17th century, several French explorers, including LeSueur and Perrot, visited north-



Weighing pig-lead at Galena for loading on train, about 1860. (Photograph courtesy of Illinois State Historical Library.)

western Illinois and southwestern Wisconsin where they traded for lead with the Indians. Their reports indicate that Indians were mining small amounts of lead prior to 1700 near the present town of Galena in Jo Daviess County. A later writer reported the French and Indians had produced 2200 bars of lead, each weighing 60 to 80 pounds, in 1742. Production in 1810 was reported as 400,000 pounds, and by 1815 20 lead-smelting furnaces were in operation near Galena. A boatload of lead was shipped down the Mississippi River in 1816, two years before Illinois became a state.

In 1823 Colonel James Johnson brought a large number of workers from southern Illinois and Kentucky to open a new mine in the Galena area. Lead production from mines located along the Fever (now the Galena) River rose from 168 tons in 1823 to 6672 tons in 1829.

Galena, primarily because of its good transportation facilities, became the center of the lead-mining district in the

Upper Mississippi Valley, which includes part of northwestern Illinois and adjacent parts of Wisconsin and Iowa. It was connected to St. Louis and New Orleans by regular river packet service by 1827. By 1855, direct rail connections were completed to Chicago, and the river transport of lead ceased.

Reported production from the Upper Mississippi Valley lead region rose rapidly after 1840 but then began to decline, as is shown by the following figures.

| Period | Tons of lead produced |
|-----------|-----------------------|
| 1831-1840 | 55,718 |
| 1841-1850 | 215,979 |
| 1851-1860 | 161,334 |
| 1861-1870 | 84,700 |

In 1845, 90 percent of United States lead production came from this area.

Various factors contributed to the decline of the region after 1850. By then the richer and shallower deposits had already been mined out, and the growing demand for workers in railroad construction and other activities led many of the work-



Steamboat docked at Galena in the mid-1800s; stacks of pig-lead in foreground. (Photograph courtesy of Illinois State Historical Library.)

men to leave the mines for other jobs. The lure of the newly discovered gold in California also enticed men from the lead mines.

In 1839, lead ore deposits were discovered in Hardin County, and some small-scale mining was carried out in 1842. However, this area did not become an important lead producer until after 1900, when lead was produced jointly with fluorspar. In recent years, the southern Illinois mining district has supplied the major portion of the state's total lead production.

In the latter half of the 19th century, production of lead in Illinois continued to decline, and less than 300 tons was produced in 1909. During World War I, production rose to more than 2000 tons but then declined to an all-time low of 31 tons in 1932. The demand again was high during and after World War II, and production in 1955 reached 4544 tons. Since then it has ranged from 2000 to 4000 tons per year.

In the early days, most of the lead produced was used to make shot for firearm ammunition. Small amounts of lead pipe and white lead for paints also were manufactured. However, technology has since created new and more important markets for this metal. In 1966, ammunition accounted for only 6 percent of the market, despite the increased demand created by the Vietnam War. Storage batteries now account for 37 percent of the consumption, anti-knock gasoline additives for 19 percent, and pigments, mostly red lead, for 9 percent.

ZINC

Zinc minerals were noted as early as 1839 in the Upper Mississippi Valley mining district, where they were found in association with lead deposits. In the 1850s the presence of zinc in the southern Illinois mining district also was reported. Up until that time there had been no process for profitably treating the ore, but in 1858, F. W. Matthiessen and Edward C. Hegeler, two Germans who had learned to process zinc ore into metal in Europe, built a smelter at LaSalle to treat Upper Mississippi Valley ores. This plant was very busy producing pig zinc and sheet zinc during the Civil War.

As the production of lead declined, zinc production in northern Illinois became more important. Prior to 1900, production had been negligible, and by 1906 it was only 282 tons.

During and shortly after World War I, the output reached slightly more than 4000 tons, but it declined again during the depression years of the 1930s.

Prior to World War II, little or no use had been made of the zinc in the southern Illinois deposits, in part because of the lack of a process for economically separating the zinc from the crude (fluorspar-lead-zinc) ore. With the development of flotation mills in the area, it became feasible to extract zinc from the ore as a by-product. The large demands of World War II greatly stimulated zinc production in Illinois, in which both the northern and southern districts shared. Since 1949, production has generally ranged from 15,000 to 30,000 tons annually. In recent years, the southern Illinois by-product output has exceeded the production of zinc from ores in northern Illinois.

One of the earliest and most important uses for zinc was in galvanizing iron and steel to give it a protective coating. Zinc was also alloyed with copper to make brass, rolled into sheets for roofing, and used in the manufacture of zinc oxide. Early records show that in 1892, 78,400 tons of zinc was consumed in the United States. During that year, galvanizing accounted for 45 percent of the market, brass-making for 26 percent, and sheet zinc for 20 percent.

Technology and competition from other materials have markedly changed the zinc market in the intervening years. In 1966, die-casting alloys consumed 42 percent of the production, displacing the former leader, galvanizing, which used 35 percent. The use of zinc in brass-making had declined to only 13 percent and rolled (sheet) zinc to 4 percent.

SILVER

Small amounts of silver have been found in the lead ores of Hardin County in southern Illinois. In the past, between 1000 and 4000 ounces of silver were produced each year as a by-product of lead and fluorspar mining. The recovery of this silver alone could never have been profitable because of the small amounts involved. No production of silver in Illinois has been reported during the past decade.

IRON AND STEEL

In the 1830s, small deposits of ironstone concretions and sedimentary iron ore (limonite) were mined in extreme southern

Illinois and converted into pig iron in smelting furnaces that burned charcoal as fuel. Two furnaces were built about 6 miles north of Rosiclare in Hardin County. The Illinois Furnace near Big Creek was built in 1837 and ceased operation in 1883 after periodic shutdowns. During the Civil War, when iron was not available from other sources, this furnace was very important to the area. The Martha Furnace was built on Hog Thief Creek in 1848 and operated until 1857.

This small iron industry served the area for over 40 years, but there was not enough ore and the operations were too small to be economical for long.

During the later 1800s, new centers of iron and steel production, based on iron ore mined outside of Illinois, were established elsewhere in the state. Iron and steel production grew



Illinois Furnace (1837 to 1883), first iron furnace in the state. Local iron ore was used in the furnace and charcoal was used for fuel. This furnace was reconstructed during 1966 and 1967. (Photograph courtesy of U. S. Forest Service.)

from 25,761 tons in 1870 to 1.66 million tons in 1890, and Illinois climbed from 15th to 3rd place among the iron and steel producing states.

In 1868, two blast furnaces were built at Grand Tower to produce iron from ore brought across the Mississippi River from Missouri. Limestone used in the smelting operation and coal for making coke for the furnaces came from nearby deposits in Illinois. A third furnace was built in 1871 near the earlier ones. Although iron production continued in the area until after the turn of the century, it apparently reached its peak in the 1880s.

The iron and steel industry of Chicago dates from 1857 when the Chicago Rolling Mill was opened on the bank of the Chicago River to roll iron rails. Eight years later, the first steel rail from American-made Bessemer steel, produced in Michigan, was rolled at this plant. The first two furnaces for smelting iron ore in the Chicago region were built in 1868.

The first Bessemer steel produced in Chicago was made at the Union Steel Company's works in 1871. Bessemer steel production grew rapidly after this initial venture, but it was soon challenged by production from open-hearth furnaces, which were introduced in 1888. However, it was not until 1917 that the open-hearth output exceeded that from Bessemer furnaces. The next major innovation in steel-making was the basic oxygen furnace, which was introduced into the United States in 1954 and into the Chicago area in 1959.

In 1894, a plant was built at Granite City to produce steel for enameled kitchenware. It continued to produce steel exclusively for household utensils until 1908, but after that date the steel output became large enough to supply other users. Later, this plant became an integrated steelworks, with coke ovens, blast furnaces, steel furnaces, and rolling mills. Other steel plants were subsequently built at Peoria, Alton, and Sterling, and the capacities in the East St. Louis and Chicago areas were expanded.

Because of the lack of iron ore within the state, blast furnaces in the Chicago area have obtained most of their ore from mines in the Lake Superior region, while those near St. Louis depend on ore from Missouri and Wisconsin.

The growth of the iron and steel industry in Illinois is shown by the production figures on the next page.

| Year | Pig iron (tons) | Steel (tons) |
|------|-----------------|--------------|
| 1885 | 327,977 | 371,939 |
| 1920 | 3,238,814 | 3,546,613 |
| 1966 | 6,499,000 | 10,960,000 |

A major new steel plant being built at Hennepin in Putnam County will increase the output of steel in Illinois in the future.

COAL

Although coal was discovered in Illinois in the 1670s, almost 200 years passed before output reached a million tons per year, in 1864. The first reported mining of coal in Illinois took place in 1810, when coal was mined from the banks of the Big Muddy River near Murphysboro. In the same year, a flatboat-load of coal was taken down the Mississippi to New Orleans.

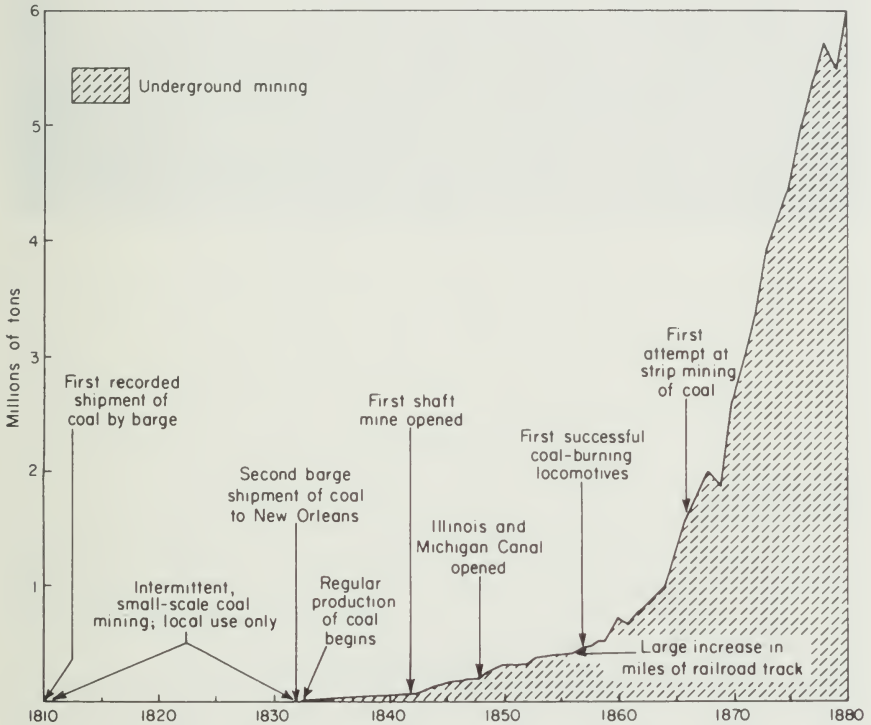
Coal later became Illinois' most important mineral product, although its use was rather limited during the first years of statehood. For the most part, it was used locally in the blacksmithing trade and for domestic heating. Small quantities were mined for domestic use in St. Clair, Peoria, Rock Island, and LaSalle Counties.

In 1832 several shipments of coal were sent by flatboat to New Orleans, and in 1833 about 6000 tons mined in the Belleville district was hauled by wagon to St. Louis. In 1837, the first railroad in the Mississippi Valley was built to haul coal mined from the bluffs in St. Clair County to the Mississippi River bank opposite St. Louis. The horse-drawn cars of this 6-mile-long railroad traveled on wooden rails.

Initially most of the coal was produced from "drift" or "slope" mines, which were driven into the coal seams exposed on bluffs or hillsides. Later production came from shafts sunk to reach coal seams at greater depths, sometimes several hundred feet beneath the surface. The first reported shaft mining was in 1842 near Belleville. One of the earliest reports of the strip mining of coal in the United States was in 1866 in Vermilion County near Danville. Horse-drawn plows and scrapers stripped

away the overburden to expose the coal. However, strip mining was not widely used until after 1920.

The biggest impetus to coal mining was the development of steam-powered railroad locomotives. The new railroads opened up new mining areas and transported the coal to rapidly growing towns and cities for both home and industrial use. The railroads soon eclipsed the Illinois and Michigan Canal, which had been completed in 1848, as a coal carrier. During the late 1850s, a new use for coal developed when the railroads began to change from wood-burning to coal-burning locomotives.



Coal production in Illinois, 1810 to 1880.

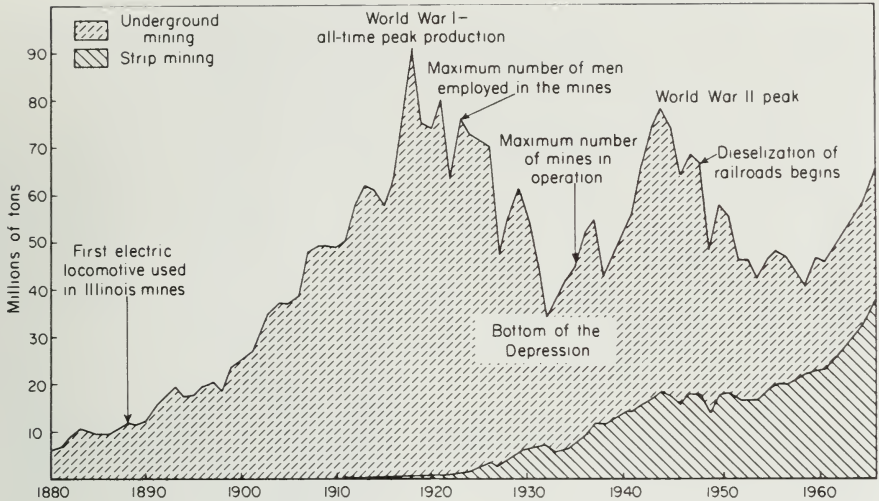
Coal production in Illinois from 1810 to 1880 and from 1880 to 1966 is shown on two graphs (above and p. 13). Production grew steadily, reaching a peak of 90 million tons in 1918. For a short



Mining coal by hand, 1912.

while after World War I, coal production remained high. However, during the Depression the production dropped rapidly to a low of 34 million tons in 1932. The railroads and industrial plants that had needed so much coal during the war years were now operating at only a fraction of their capacity and had little need for fuel.

During World War II, Illinois coal production rose, reaching 77.4 million tons in 1944, only to decline again after the war. Coal's decline in the late 1940s resulted from the loss of many of the traditional markets to other fuels. The railroads, which had been one of the largest users of coal, replaced all their coal-fired locomotives with diesels that were more economical to operate. New pipelines were built to bring natural gas into the state from the southwest, and many households, commercial firms, and industrial plants switched to this fuel. Others changed to oil as their source of energy. The one large market that coal retained was the utility companies, which used coal for the generation of electric power, and that market grew rapidly. In 1967 utilities used approximately 70 percent of the coal produced.



Coal production in Illinois, 1880 to 1966.

The thick, relatively level seams (beds) of coal in Illinois make it possible to use some of the largest mining machinery for both underground and surface mining. As a result, Illinois mines are among the most productive and efficient in the nation.

OIL AND GAS

The search for oil and natural gas in Illinois began more than 100 years ago. The first actual production is believed to have been from one or two bore holes drilled near Champaign in 1853 that gave up marsh gas. Since then drilling in the state has been nearly continuous.

In the early 1860s several holes were drilled north of Casey in Clark County. Sufficient evidence of oil was obtained to give the name "Oilfield" to the small town that grew up near the drilling, but no commercial quantity of oil was found until the Casey pool was discovered in 1906.

Several holes were drilled in a search for coal near Litchfield in Montgomery County in the late 1860s. Oil seepage from one of these holes, which had been improperly plugged, collected in the workings of an old mine. For years the oil was skimmed off the water and sold.

The Sparta oil pool or field, which was discovered in 1888 in Randolph County, is generally credited with being the first significant commercial field. A year later, in 1889, another pool was brought into production, near Litchfield in Montgomery County. It produced 1460 barrels in 1889 and by the time production ended in 1902 had provided a total of 6576 barrels.

The only significant gas fields discovered prior to 1900 were the Pittsfield in 1886 in Pike County and the Sparta in 1888 in Randolph County. Less significant than these was an earlier discovery south of Litchfield in 1882 which supplied gas for domestic use. Despite these early discoveries, Illinois has never been an important producer of natural gas.

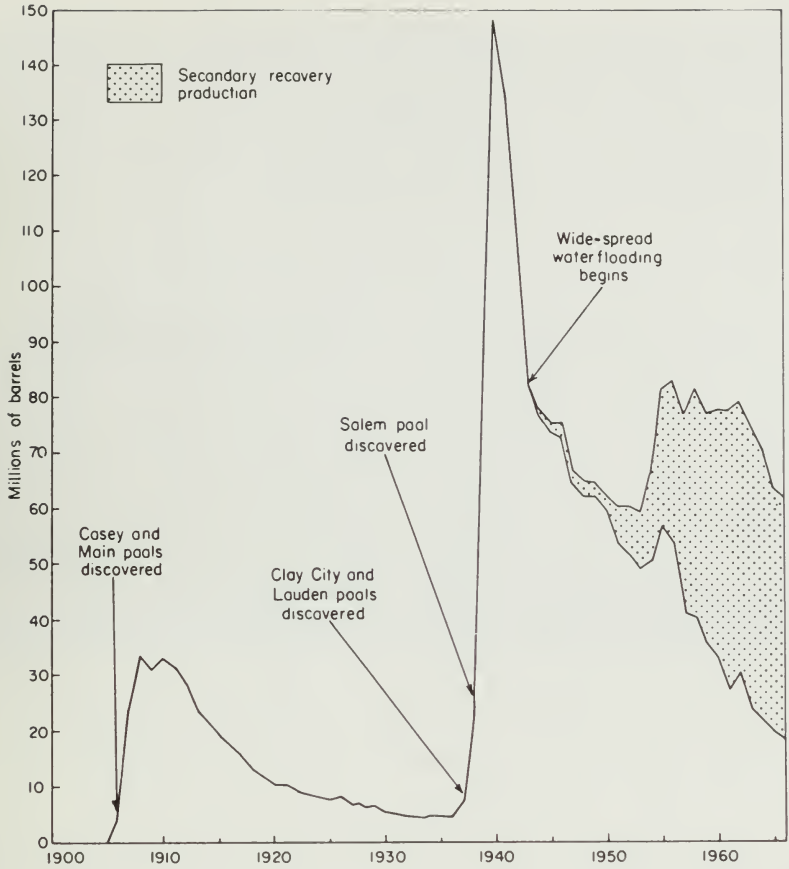
With the discovery of the Casey and Main pools in 1906, Illinois became an important oil-producing state. Production in 1905 was 181,084 barrels, and it rose rapidly during the next 3 years, in 1908 exceeding 33 million barrels (graph, p. 15). As a result, Illinois' rank as an oil producer rose from ninth to third among the states in 1907, a position held for several years.

After 1913, the major development in the eastern fields (in Clark, Cumberland, Edgar, Crawford, and Lawrence Counties) was essentially over. Production declined to only 13.4 million barrels by 1918.

Production continued to decline despite the discovery of new pools, and in 1936 it was only 4.5 million barrels. At that time new drilling began in Clay County in what is known as the "Illinois Basin," a large area in southern Illinois where the underground layers of rock are bent downward like the bowl of a



Wooden oil derricks operating
in southeastern Illinois in
the early 1900s.



Crude oil production in Illinois, 1900 to 1966.

spoon. A second oil boom was begun with the discovery of the Clay City and Loudon pools in 1937 and the Salem pool in 1938. Illinois oil production quickly rose to an all-time peak of 147.6 million barrels in 1940, after which time it declined rapidly.

Because the normal (primary) techniques used to recover oil fail to extract it all, many operators subsequently employ so-called "secondary recovery" methods to remove a portion of the remaining oil. Since the 1940s an increasing share of the state's oil—in 1966 almost 70 percent—has been produced by such methods. One of the most common secondary recovery methods is waterflooding. This involves pumping water down some of the

holes drilled into the oil-bearing layers of rock to push part of the remaining oil towards a production well from which it can be pumped to the surface.

The new discoveries of oil in Illinois in recent years have not been great enough to keep up with the amount removed, and output has been gradually declining.

STONE

Because of the lack of transportation facilities for bulk shipments in early Illinois, materials used in most construction and building had to come from the immediate vicinity. Limestone, sandstone, and glacial boulders were used for foundations of houses and barns, for road and railroad bridge abutments, and, to some extent, for churches and public buildings. For example, the Mormon Temple built at Nauvoo in the early 1840s was of stone quarried locally in Hancock County, and the old State House in Springfield was built between 1837 and 1853 of stone quarried at Crow's Mill, 7 miles south of town.

In addition, sandstone was used to make specialized stone products at various localities in the state. For example, in Edgar, Pike, Shelby, and White Counties, it was used for grindstones, in Pope and Union Counties for millstones, and in Pike County for whetstones.

In 1890, about half the stone produced was used for masonry construction; most of the remainder was crushed and broken stone used for roads, railroad ballast, or concrete. Thirty years later the market had changed markedly so that half of the stone was being used as concrete aggregate and about one-fourth for roads and railroad ballast, while all other purposes, including building stone, accounted for only a quarter of the total.

As concrete began to replace stone masonry for construction, Illinois fell from first to last as a producer of building stone. On the other hand, by 1917 Illinois ranked first in the production of crushed and broken stone.

From 1917 to 1931, the production of stone remained fairly stable, varying with the amount of construction activity. The Depression hit the stone industry hard, and by 1933 production had declined to only 2.4 million tons. Stimulated by public works projects, output was back to the pre-Depression level by 1937.



Fifth State Capitol Building built between 1837 and 1853 in Springfield, using local stone quarried at Crow's Mill, 7 miles south of town. The quarry site is now buried under Lake Springfield. (Photograph courtesy of Illinois State Historical Library.)

Another important factor contributing to the growth in demand for crushed limestone in Illinois over the next decade was the expanded use of agstone for soil improvement and conservation promoted by the U. S. Department of Agriculture. Agstone use grew from 8.7 percent of the market in 1935 to a peak of 34.5 percent in 1946, when production was 16.2 million tons.

Following World War II, a large increase in the construction of highways, airports, dams, and buildings in which large amounts of concrete were used caused a rapid increase in the demand for crushed stone. Illinois production of stone recently has reached over 40 million tons per year.

CEMENT

A cement industry, based on a deposit of natural cement rock (low magnesium limestone containing clay) near Utica began



Loading stone at the German-American Cement Co. (now Alpha Cement Co.) at LaSalle, about 1917. (Photograph courtesy of Illinois State Historical Library.)

in 1830, but production was intermittent. The rock was burned and then ground to a powder that, when mixed with water, dried to form a concrete material. The most important use for this cement initially was in the construction of the locks on the Illinois and Michigan Canal.

Regular production of natural cement began in 1838 and continued to expand until the 1890s, when the first portland cement plants were built. The latter used a specially prepared mixture of limestone, shale, and clay instead of depending on natural cement rock of the correct composition. One plant, built in Chicago in 1898, made cement from a mixture of blast-furnace slag and limestone.

In the early 1900s, four portland cement plants were operating in Illinois, two at Oglesby, one at LaSalle, and one in

Chicago; three of them are still working today. In addition, three natural cement plants were located at Utica. In 1908, a fifth portland cement plant was established at Dixon in Lee County, which is still in operation. The slag cement plant in Chicago was closed in 1914, and the last natural cement plant ceased operation in 1942.

In 1963, one of the plants at Oglesby was shut down, but in the same year a new plant was opened by another company at Joppa in Massac County.

Annual production of cement has increased from 240,000 barrels in 1900 to about 10 million barrels in recent years.

LIME

Another limestone product of early and continuing importance in Illinois is lime, which at first was used principally as



Lime kiln located about 1 mile east of Cordova in Rock Island County. Lime was first produced in this area about 1836.

mortar in masonry construction. The first recorded production was in 1815 at Hunterstown, near Alton, in Madison County. Limestone was piled onto logs that were then set afire, and the heat changed the limestone into lime. In 1818, the first lime kilns were built at Hunterstown. Within the next few years, lime was produced in many places throughout the state. Although Alton soon became the major center of lime production, by 1900 it had been surpassed by the Chicago and Quincy areas.

Although lime has been produced in Illinois for at least 150 years, the annual records date only from 1894 when the value of lime produced in the state was \$387,973. In 1904 tonnage figures became available along with the value figures. Production in that year amounted to 108,881 tons, valued at \$461,088. The industry has continued to grow, and by 1955 production had reached 644,180 tons, valued at \$9,416,135.

CLAY AND CLAY PRODUCTS

Both the Indians and the early settlers in Illinois used clay to make pottery. Later, as population increased and the need for construction materials grew, clay was used to make bricks because in many places there was no suitable building stone or timber. Drain tile also became an important product because of the need to drain large swampy areas of the state to make the land suitable for farming.

In addition to pottery and construction materials, other special types of clay products, such as terra cotta ware, coarse tableware, garden ornaments, vases, and similar products, also were made. At one time clay tobacco pipes were made at Fulton in Whiteside County. Among counties with active clay products industries at a fairly early date were Brown, Cook, Greene, Grundy, Pulaski, Rock Island, and Will. In recent years a plant at Olmstead in Pulaski County has been producing a "kitty litter" from a local clay.

The manufacturing of clay products on a small scale for local consumption was quite common and probably began soon after settlement. However, records regarding this activity are rather sparse, and, therefore, it is difficult to establish an exact date at which operations began. Construction of the Jarrot Mansion at Cahokia, one of the first if not the first brick building in Illinois, was begun in 1799. According to some accounts, the brick was manufactured on the grounds by local workmen.



Glazing room at Western Stoneware Co., Macomb, Illinois, about 1917.
(Photograph courtesy of Illinois State Historical Library.)

Others claim the brick was imported from Pittsburgh. The first state capitol building at Kaskaskia, built sometime before 1818, was a two-story brick structure probably made of local materials. Brick making began about this time in the Alton area. Other early brickyards were established upstate at Quincy in 1828; Chicago, 1833; Jacksonville, 1834; Orange Township, Knox County, 1840; Nauvoo, 1842; and Urbana, 1853.

The beginning of pottery operations is more difficult to determine; however, three of the earliest potteries were located at Highland, Madison County, in 1835, at Ripley, Brown County, in 1836, and at LaSalle, LaSalle County, in 1837. In 1860 the U.S. Census Bureau reported 34 Illinois potteries in operation.

In 1875 the first brick pavement in Illinois was laid in Bloomington. This event marked the beginning of a new use for bricks that led to establishment of a paving brick industry that was important to the state for many years. Early paving brick plants were built in Streator in 1884 and in Galesburg in 1890.

Bricks were the common material for paving streets and highways throughout the state until they were replaced by concrete pavement.

In 1894 there were 697 plants producing clay products in Illinois. The value of their output was 8.4 million dollars. Since that time the number of plants has dwindled, but remaining ones have increased in size as better transportation allowed their products to compete in larger market areas.

Except for a period during the Depression years, the value of clay products continued to increase until 1957, when it was 60.7 million dollars. Since that time there has been a decline in value of about 10 percent.

FLUORSPAR

The occurrence of fluorspar was first reported in southern Illinois in 1818, but it was not mined until 1842. At that time, some fluorspar was produced as a by-product of lead mining near



Removal of waste material from crude (fluorspar-zinc-lead) ore by hand-picking in the mill of Fairview Fluorspar & Lead Co., near Rosiclare, Illinois, 1919.

Rosiclare in Hardin County. Between 1842 and 1870 the fluorspar mined with the lead ore was discarded because of lack of market. Fluorspar shipments began sometime after 1870. Before 1887 most fluorspar was used in the manufacture of glass, enamels, and hydrofluoric acid. Smaller quantities were used as a flux in melting iron in foundries and in the smelting of gold, silver, copper, and lead.

After 1888, fluorspar found a new, important use as a flux in open-hearth steel furnaces. The demand for fluorspar in the United States rose rapidly, from about 5000 tons in 1887 to 15,900 tons in 1899, when about two-thirds of the fluorspar shipped was used in steel-making.

As a result of the rapid growth of the steel industry during the early 20th century, the demand for fluorspar continued to expand. In 1917, stimulated by World War I military demands, 156,676 tons of fluorspar was produced. Another result of the war was the substitution of clear Illinois fluorspar crystals for fluorspar in optical instruments used for scientific work. Previously Germany had supplied all such crystals to United States optical firms.

In 1929 an important technical breakthrough occurred in the Illinois fluorspar industry when a new flotation process was developed that greatly increased the recovery of fluorspar from the crude fluorspar ores.

During the 1930s fluorspar production in the United States decreased owing to the general decline in the economy and to the decline in the steel industry in particular. A low point was reached in 1932 when only 9615 tons was produced. The rapid build-up of the economy in response to World War II demanded greatly stimulated production of fluorspar in Illinois. By 1943, production had increased to 198,789 tons. After a period of decline, the all-time peak production was reached during the Korean War in 1951 when 204,328 tons was produced.

Continuous records have been kept since 1880 showing that Illinois has been the leading domestic producer of fluorspar, except for the years 1898 to 1904 when it was surpassed by Kentucky. In 1905 Illinois regained the lead and has held it ever since, generally accounting for over half of the nation's fluorspar production.

In recent years, the domestic industry has suffered from growing competition from imported fluorspar, chiefly from Mexico, and only two companies now operate in Illinois on a regular basis.

Despite this, Illinois mines accounted for almost 70 percent of the fluorspar produced in the United States in 1966.

In the post-war years, the markets for fluorspar have been changing. The most rapidly growing market has been the chemical industry, where fluorspar is used in the manufacture of hydrofluoric acid. Since 1956, the chemical industry has displaced the steel industry as fluorspar's most important consumer.

Fluorspar has the distinction of being named the official State mineral by the 74th General Assembly of the Illinois Legislature in July 1965.

SILICA SAND

For 100 years the high-quality silica sand obtained from the St. Peter Sandstone in the vicinity of Ottawa has been used in the manufacture of glass. This sand was until recently the basis of an important glass industry in the Ottawa area.

The first glass plant in the Ottawa area was built in 1867, and a bottle works was opened in 1881 in nearby Streator. Special glass products included chimneys for oil lamps, manufactured in a plant built in 1885. These chimneys, supposedly made by a secret process, were claimed to be of superior quality. Another glass plant, constructed in 1886, turned out stained glass used in Pullman cars, churches, art lamps, and similar decorative purposes.

Ottawa sand producers also shipped large quantities of their high-purity silica sand for use in glassmaking at points outside the state.

Among other important uses, silica sand is used as a material for making molds for metal casting in foundries. The Rock Island-Moline, Peoria, East St. Louis, Rockford, and Chicago areas are all important centers of foundry operations.

Silica sand ground to powder is used as an abrasive and polishing material, a filler in paints, an ingredient of scouring compounds, and in ceramics.

In 1908, glass sand production, which had been at a level of more than 200,000 tons for several years, dropped to 195,000 tons, but in succeeding years began to climb. In 1943 the output exceeded one million tons per year for the first time, and it has since climbed to more than 1.75 million tons per year.

In 1967 silica sand was being produced from seven operations in LaSalle County and one in Ogle County. More than a dozen plants within the state were making glass during the year.

SAND AND GRAVEL

Sand and gravel are mineral resources that occur widely throughout much of Illinois. These deposits were laid down by ancient glaciers and in many parts of the state are found redeposited along stream beds.

In the early 1800s, small amounts of sand and gravel were used to top the dirt roads of the state to make them more passable during rainy weather. Later, with the coming of the railroad, gravel became important as railroad ballast. The large expansion in sand and gravel use did not occur, however, until after the turn of the century when the use of concrete for construction became common.

In 1905, only 762,000 tons of sand and 277,000 tons of gravel were produced in Illinois. From that time on, the production of both has increased, although the level from year to year has varied somewhat, depending on the level of construction activity.

The following table shows the general upward trend in sand and gravel production for the past 60 years.

| Year | Sand (tons) | Gravel (tons) |
|------|-------------|---------------|
| 1905 | 762,346 | 277,050 |
| 1915 | 1,900,333 | 4,424,527 |
| 1925 | 6,162,022 | 6,137,785 |
| 1935 | 2,615,361 | 4,641,593 |
| 1945 | 3,306,383 | 6,093,060 |
| 1955 | 7,750,860 | 10,637,000 |
| 1965 | 13,424,000 | 18,194,000 |

Production has approximately doubled during each of the past two decades. Northeastern Illinois, serving the huge metropolitan Chicago market, is the most important producing region. McHenry County has been the leading producer of both sand and gravel in recent years.

The growth in the use of sand and gravel is due to the large increase in construction and parallels that for the United States as a whole. Future growth in production will depend largely on construction programs by federal, state, and local governments and on industrial growth. Such major programs as the Federal Interstate Highway System have been important factors.

COKE

The early iron furnaces of Hardin County, which operated from the 1830s until after the Civil War, used charcoal made from local timber for their fuel. As timber became scarce and technology improved, the iron industry turned to coke as a fuel. Although Illinois coal was used for coke in the furnaces at Grand Tower in 1868 and to some extent during the early days of the steel industry in Chicago, Illinois coals were soon displaced by "coking" coals imported from eastern states. Coke ovens were also built in other parts of Illinois.

In 1880, Illinois produced 12,700 tons of coke, giving it eighth rank among producing states. However, by 1899, the Illinois output, only 2370 tons, ranked 22nd. With improved rail transportation and lower freight rates, it was possible to bring higher quality coke to the ironblast furnaces from the eastern coal fields, and Illinois coke was made only for manufacturing water gas and for heat.

New coke ovens built after 1903 increased production in Illinois, but for many years most of this coke was made from coal brought in from the eastern coal fields. Illinois coke production rose from 4400 tons in 1904 to more than 2 million tons during World War I, increasing by the late 1920s to 4 million tons. During the Depression years, coke production fell to a low of 1.4 million tons. It reached another peak, 3.9 million tons, in 1944 during World War II. In recent years coke production in Illinois has been around 2 to 2.5 million tons.

For almost 50 years after 1893, very little Illinois coal was used for making coke for the iron and steel industry, with the exception of a brief period during the 1920s when it was used at Granite City with some success. The scarcity of transportation for the shipment of coal during World War II brought renewed interest in the possibility of using Illinois coal in blast furnace coke.



"Beehive" ovens located $2\frac{1}{2}$ miles southeast of Sparta in Randolph County. These ovens were used to convert Illinois coal to coke; operated in the 1880s.

Illinois coal, used alone, does not make strong coke. A research program was begun in the laboratories of the Illinois State Geological Survey in Urbana to revive its use by blending coal with eastern "coking" coal in such a way that acceptable coke could be made. When mixed in the proper proportions, high-volatile coal from Illinois and low- or medium-volatile coals from the southern Appalachian coal fields proved to make satisfactory coke for blast furnace use.

As the result of this research program, the use of Illinois coal in the manufacture of blast furnace coke has increased from 140,000 tons in 1944 to 637,000 tons in 1960, and to 1.9 million in 1966. This use for Illinois coal not only provides a new and growing market for Illinois coal producers, but also results in lower costs for the coke manufacturers.

OTHER MINERALS

In addition to the mineral products that have made major contributions to Illinois' growth and development, there are others

of less significance. Among these are peat, tripoli, and pyrites.

Peat

Peat, dug from deposits in the northern part of Illinois, was produced and used locally as early as 1856. It has been used for household fuel, for burning lime, for firing a clay products kiln, and for boiler fuel in a stationary steam engine. Cook, Kane, Lake, and Whiteside Counties are now producing peat commercially; McHenry County has been a producer in the past.

Although peat has not been used as a fuel since coal, oil, and gas have become available, sizable quantities are still produced each year for use as a soil conditioner, mostly for shrub and flower plantings. Production in 1966 was reported to have been almost 50,000 tons, making Illinois the second largest producer in the nation.

Tripoli

Tripoli, also known as amorphous silica, has been produced in extreme southern Illinois for many years. It is dug from underground mines and ground to a fine powder consisting of tiny particles of silica. It is used as "white rouge" in polishing optical lenses and as an abrasive in soaps and cleansing and polishing compounds. Other uses are in the manufacture of glass and pottery, as a paint filler, and for coating foundry molds.

Illinois has been the nation's principal producer of this material for more than half a century.

Pyrites

A product that became important in Illinois for a very brief period shortly before and during World War I was iron sulfides, or pyrites, used to manufacture sulfuric acid. The pyrites occur in thin layers, or bands, within seams of coal and were a by-product of coal-mining operations. In 1917, production amounted to 24,596 tons. After World War I, production of pyrites from coal became uneconomic and was terminated. With the high prices of sulfur existing in the late 1960s, interest in pyrite recovery has revived somewhat, but thus far no attempts have been made to start commercial operations.

SUMMARY

The mineral industries have played an important role in the past development of Illinois, and will continue to do so. In 1963 they employed over 22,000 persons, whose payroll amounted to \$138 million. The value of mineral products produced in Illinois has amounted to over \$600 million per annum in recent years.

These industries and commodities have left their imprint on the map of Illinois as well. There are over 50 communities that bear mineral names, ranging in size from Carbondale, with a population of 15,000, to hamlets and crossroads such as Kao-lin, Oilfield, Iron, and Sands, with populations of less than 25 persons. The map on the inside of the back cover indicates the locations of some of these "mineral" places.

The size of operations, the geographical distribution, and the technology of the mineral industries have changed greatly during the past 150 years. Some of these industries began early and have continued to prosper. Others faltered after an early start and have either slipped to a minor role or have disappeared completely. Still others did not develop until new technology provided economical processes for production of unused mineral materials or created new needs for them. Some of these have since become very important.

In general, the early mineral industries were made up of numerous small operations designed to serve very limited local markets. Later, with improvements in transportation, it became possible to ship mineral materials long distances at low costs, thus expanding the market area that each operation might serve. Under these conditions, less efficient operations and those working the least suitable mineral deposits were displaced by those more favorably situated. As a result, the Illinois mineral industry has gradually become an industry of fewer but larger operations.

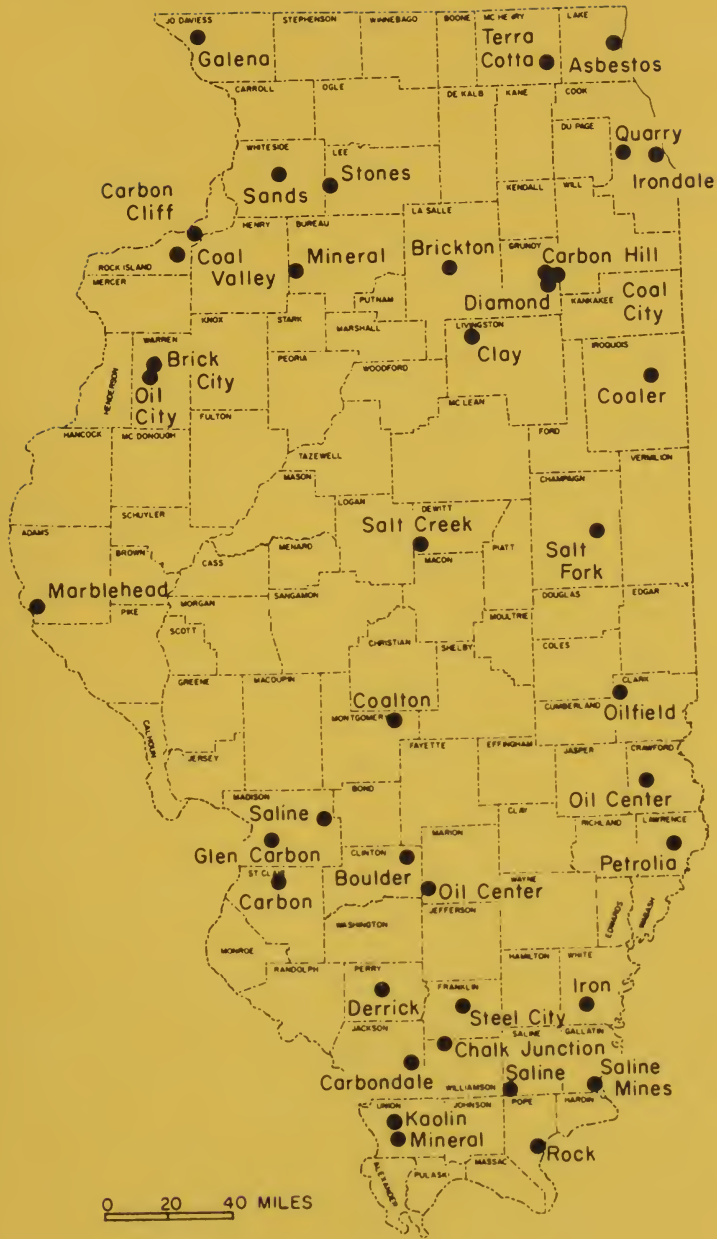
In the future, as in the past, some segments of the mineral industry can be expected to expand at a faster rate than others. Coal, stone, sand, gravel, fluorspar, and some other minerals have shown a strong growth in recent years. With rising demand and ample reserves, these probably will continue to grow in the foreseeable future. On the other hand, the present Illinois production of petroleum, lead, and zinc is well below

peak levels of the past. Any significant future growth in these commodities will depend on both an increase in demand for them and on the discovery of new deposits to supplement those already known.

The minerals and mineral industries of Illinois will play a very vital role in the state's growth and economic development in the future, as they continue to supply energy and materials for homes, factories, agriculture, construction, and many other uses.

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Geologic and mineral place names.

Educational Series 10



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