ARKANSAS RIVER REGION REPORT

VOLUME III
ECONOMIC BASE

SECTION D
MINERAL AND WATER RESOURCES

PART 1 - MINERALS
CHAPTERS 1, 2, AND 3

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CHAPTER 1

INTRODUCTION

Work now under way to make the Arkansas River navigable will bring numerous benefits to the State of Arkansas. Most directly affected will be the counties and regions lying within the valley itself, but the State in its entirety will share in the economic gains.

The purpose of this report is to investigate the position and role of the mineral resources and activities of the State, especially within the Arkansas portion of the Arkansas River Valley, and the potential effects of river transportation on the mineral industries.

The Arkansas River Region

The territory designated as the Arkansas River Region encompasses twenty-five counties that cover more than a third of the State's area.

For purposes of analysis, the Region has been divided into four subregions designated as the West Subregion and Central Subregions, Numbers 1, 2, and 3. The Region and the subregional borders are shown in Figure 1.01. Counties assigned to the various subregions are as follows:

West Subregion		Central Subregion No. 1	
Crawford	Scott	Johnson	Yell
Franklin	Polk	Pope	Perry
Sebastian	Logan	Conway	

Central Subregion No. 2		Central Subregion No. 3	
Van Buren	Saline	Grant	Dallas
Cleburne	Pulaski	Jefferson	Cleveland
Faulkner	Lonoke	Arkansas	Lincoln
White	Prairie		

Population

Slightly more than 40 percent of the 1,786,000 persons residing in Arkansas in 1960 lived within the Arkansas River Region. The subregional populations in 1960 and population projections for 1980 are shown below:

| | Population | | |
| | 1960 | Projected for 1980 | |
Geographic Area	Census	Low	High
West Subregion	133,451	169,300	189,150
Central Subregion No. 1	65,895	78,950	87,400
Central Subregion No. 2	380,337	525,850	582,600
Central Subregion No. 3	144,935	182,050	199,250
Arkansas River Region, Total	724,618	956,150	1,058,400

Minerals in the Economy of Arkansas and the Arkansas River Region

Although it is impossible to measure accurately the total contribution that minerals and mineral production make to a region's economy, it becomes quickly apparent that they play an important role. Without mineral fuels for heat and energy, metals and nonmetallic minerals as materials for machines, structures and other facilities, and mineral plant foods for agriculture, the modern industrial economy could not exist.

Fortunately, Arkansas possesses within its borders many of the minerals required by the people of the State. Furthermore, a number of them are of a quality and available in sufficient quantities for export to other states whenever the proper economic and competitive conditions exist.

The annual dollar value of minerals produced within Arkansas is steadily rising, as shown in Table 1.01. Of the 175 million dollars of production shown for the State in 1964, about 51 million dollars, or 29 percent, came from minerals produced within the 25 counties of the Arkansas River Region. Exclusive of the value of crude oil, which is produced only in the southern part of the State, the Arkansas River Region accounted for 49 percent of the total.

The dollar value of production is only one measure of the contribution of minerals to the economy of the area. The employment of workers engaged both in the production and the processing or utilization of the raw mineral products and the income they receive from such employment are also important factors. Table 1.02 shows employment data for the State in mining and mineral related manufacturing.

Table 1.02 shows mineral production employment data for 1958 and 1963 for the entire State of Arkansas. In Tables 1.03 and 1.04 are shown data for mining and selected categories of mineral related manufacturing for the subregions.

Less direct but extremely significant benefits to the economy result from the contribution of minerals to transportation activity and employment. An estimated 40.9 percent of the rail revenue freight shipments originating in Arkansas in 1962 were products of mines. Similarly, mine products consti-tuted 33.9 percent of the revenue freight shipments terminating within the State.[1]

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[1]Based on Carload Waybill Statistics, 1962, State-to-State Distribution, Products of Mines, One Percent Sample of Terminations in the Year, 1962, Interstate Commerce Commission, Bureau of Economics, Washington, June, 1965.

ARKANSAS

Figure I.OI—ARKANSAS RIVER REGION OF ARKANSAS AND SUBREGIONS.

TABLE 1.01

MINERAL PRODUCTION IN ARKANSAS, 1961-1964

Area and Mineral	1961 Quantity	1961 Value (thousands)	1962 Quantity	1962 Value (thousands)	1963 Quantity	1963 Value (thousands)	1964 Quantity	1964 Value (thousands)
Barite—short tons	277,855	$ 2,630	258,691	$ 2,232	236,077	$ 2,161	233,455	$ 2,202
Bauxite—long tons, dried equivalent	1,178,898	13,462	1,270,124	14,606	1,478,047	16,701	1,561,984	17,431
Clays—thousand short tons	773	1,758	654	1,693	769	1,763	892	2,152
Coal (bituminous) do	395	2,888	256	1,809	221	1,505	212	1,503
Gem stones	(1)	19	(1)	15	(1)	42	(1)	33
Gypsum—thousand short tons	167	531	83	261	W	W	W	W
Iron ore (usable)—thousand long tons, gross weight			43	296				
Lime—thousand short tons	90	1,196	350	4,542	167	2,237	189	2,814
Natural gas—million cubic feet	59,547	8,039	66,213	9,866	76,101	11,796	76,167	11,806
Natural gas liquids:								
Natural gasoline and cycle products—thousand gallons	27,889	1,640	29,415	1,673	26,219	1,466	30,082	1,678
LP gases do	75,157	3,286	69,452	2,432	66,377	2,497	61,616	2,460
Petroleum (crude)—thousand 42-gallon barrels	29,246	80,427	27,649	73,546	27,406	72,900	26,737	71,120
Sand and gravel—thousand short tons	9,389	9,074	10,847	10,006	12,099	13,589	11,794	14,836
Stone do	12,029	12,402	20,611	19,866	18,913	22,727	20,241	26,172
Zinc (recoverable content of ores, etc.)—short tons	37	9	211	49				
Value of items that cannot be disclosed: Abrasive stones, bromine, cement, phosphate rock (1963-64), soapstone, and values indicated by symbol W	XX	10,906	XX	11,063	XX	17,900	XX	20,582
Total	XX	148,267	XX	153,955	XX	167,284 r	XX	174,789

XX - Not Applicable.

W - Withheld to avoid disclosing individual company data.

r - Revised.

(1) - Weight not recorded.

Source: U.S. Department of the Interior, Bureau of Mines, 1964 Minerals Yearbook, Vol. III, Area Reports: Domestic, p. 11.

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TABLE 1.02

EMPLOYMENT IN MINING AND IN MANUFACTURING DIRECTLY UTILIZING MINERAL
MATERIALS IN ARKANSAS, 1963 AND 1958

Activity	Employees	
	1963	1958
Mining[1]		
Metal mining	544	⎰900
Bituminous coal mining	109	⎱
Oil and gas extraction	2,272	2,038
Nonmetallic minerals	1,834	1,136
Subtotal, mining	4,759	4,074
Manufacturing based on minerals and metals[2]		
Petroleum and coal products	1,453	1,582
Stone, clay and glass products	4,022	3,377
Primary metal industries	3,121	2,450
Fabricated metal products	4,187	2,709
Subtotal, manufacturing	12,783	10,118
Total	17,542	14,192

[1] From U.S. Department of Commerce, Bureau of the Census, Census of Mineral
Industries, 1963: Summary Series, General Statistics for Geographic Divisions
and States, Preliminary Report MIC (P)2 (Washington: Government Printing
Office, 1966).

[2] U.S. Department of Commerce, Bureau of the Census, Census of Manufactures,
1963: Summary Series, General Statistics for States (Washington: Government
Printing Office, 1966).

TABLE 1.03

SELECTED STATISTICS OF MINING EMPLOYMENT AND INCOME BY AREA

Item	United States	State of Arkansas	Arkansas River Region	West Subregion	Central Subregion No. 1	Central Subregion No. 2	Central Subregion No. 3
Employees engaged in mining:							
1960	NA	NA	1,706	602	191	792	121
Projected, 1980							
High			2,210	550	220	1,330	110
Low			1,400	350	140	840	70
Mining employment as percent of total employment:							
1950	1.6	1.1	1.4	2.7	2.0	1.0	0.1
1960	1.0	0.9	0.7	1.4	0.9	0.6	0.3
Mining income payments as percent of total income payments:							
1950			1.7	2.9	3.6	1.4	--
1955			1.3	1.6	1.5	1.4	--
1960	1.1	1.2	1.0	1.2	1.5	1.1	0.2
1963			0.7	0.8	1.0	0.8	--

NA - Not available on comparable basis.

Source: Industrial Research and Extension Center, University of Arkansas, Little Rock, Arkansas.

TABLE 1.04

EMPLOYMENT IN MINERAL-RELATED MANUFACTURING, BY REGION

Industry Category	Arkansas River Region	West Subregion	Central Subregion No. 1	Central Subregion No. 2	Central Subregion No. 3
Primary Metal Industries[1]					
1950	473	Not available for subregions - combined with fabricated products			
1955	428				
1960	286				
1963	554				
Fabricated Metal Industries[1]					
1950	714	598		451	135
1955	948	566		616	183
1960	1,032	406		609	291
1963	1,419	538		1,023	395
Stone, Clay and Glass Products[2]					
1950	1,389			397	
1955	1,557			632	
1960	1,894			861	
1963	1,948			858	

[1] Regional data for Primary and Fabricated Metal Industries are combined.

[2] Stone, Clay and Glass Products data are not available separately for some regions.

Source: Industrial Research and Extension Center, University of Arkansas, Little Rock, Arkansas.

CHAPTER 2

THE CONTRIBUTION OF MINERALS TO PRODUCTIVE ACTIVITY

The Role of Minerals

Minerals are indispensable to the modern industrial economy of any region or nation. Where they are not available locally they must be obtained from other sources if a high level of industrialization is to be attained. Mineral materials play a three-fold role by providing the materials, energy and plant foods to support the population and its economic activity.

Materials

Although some types of materials are available from other sources, it is minerals and mineral commodities that provide by far the largest portion of the materials utilized and consumed by modern man.

Metallic minerals are the basic materials for the manufacture of machines, tools and equipment used in further manufacturing. Automotive vehicles, ships and barges, railroad equipment and aircraft providing most of the means of transportation, consist primarily of metal, and the availability of agricultural tractors, tools and implements essential to modern farming likewise is dependent upon this class of materials. In addition metals provide the basis for the construction of bridges, buildings and other structures.

Nonmetallic minerals including stone, sand and gravel, and clay products are used primarily as materials for the construction of buildings, highways, airfields and similar facilities. They also supply the basic ingredients for numerous industrial and chemical processes.

Energy

The principal uses of mineral fuels are as sources of power for vehicles, machines and other equipment and for the generation of electricity. They also provide heat energy for innumerable industrial processes and for comfort. The major so-called "fossil fuels"--oil, natural gas and coal--supply about 95 percent of the inanimate energy consumed within the United States each year, with hydro-electric power providing most of the remainder. Nuclear energy fuels, also obtained from minerals, currently supply only an extremely small portion of the total but will become increasingly important in the future.

Plant Foods

Mineral fertilizers provide a source of much needed nutrients to supplement the natural plant-growing capacity of the soil. Even the most fertile soils eventually become exhausted and require the replacement of their plant food constituents. The use of mineral plant foods has enabled the United States to increase its agricultural output to the point where it is one of the few nations of the world today having a capacity to produce food in excess of the requirements of their own people.

A further aid to agriculture is provided by chemicals derived from minerals that protect crops from insects and plant diseases that would otherwise take a heavy toll in crop damage.

Factors in Resource Utilization

The mere existence or availability of mineral resources within an area does not necessarily mean that economic benefits will be derived. Many factors

enter into the determination of which mineral deposits will be exploited and which will be left idle. Among these are the size and quality of the deposit and its manner of occurrence, its geographic location with respect to transportation and markets, and the existence of competing and substitute materials. As a result, mineral deposits of apparently superior character may often remain idle while others that seem to be poorer or less desirable are exploited.

Mode of Occurrence

If the quality and size of a mineral deposit were the only factors to be considered, the largest and richest deposits would, almost without exception, be the first to be mined. But from an economic standpoint a large deposit of low grade ore having long term prospects may be preferable to a much higher grade deposit that is too small to justify the investment required for its exploitation. An easily processed ore may replace a considerably richer ore requiring complicated processing in preparation for use. A thin coal bed at strippable depth often can be mined more economically than a thicker bed at a depth that requires underground mining.

Geographic Location

The geographic location of a mineral deposit is of importance primarily from two standpoints. One is the accessibility of the deposit, or the ease with which it can be reached. The second is its proximity to the consuming market and the resultant cost of transportation.

Transportation and Proximity to Market

In the mining of precious metals or other materials of high unit value and small size or bulk, the distance from market may have little bearing on the marketability of the product. But with most mineral products the distance they must be transported to the consumer has a direct bearing on their cost and marketability.

It is not uncommon for the cost of transporting and handling minerals to equal or exceed the initial cost at the mine. Because of the variations in the costs, the type of transportation may, in some cases, be equally as important as the distances involved.

Truck transportation is more expensive in terms of cost per ton mile than rail or barge movement but provides much greater flexibility and frequently requires a minimum of handling and transfer costs. Trucking costs generally are estimated to range from 3 to 5 cents per ton mile, but other factors may serve to offset the greater mileage costs. Trucks are especially suitable for transporting minerals when the distance from mine to market is relatively short.

For greater distances rail shipment is highly economical and, where available, barge transportation is even less expensive than rail. Average costs for the rail shipment of coal, for example, are estimated at approximately 1.2 cents per ton mile, in single-car quantities. Recently established "shuttle train" and "unit train" rates are about half the single-car rates, or approximately 6 to 7 mills per ton mile. In contrast, barge rates are

roughly 3.5 to 4.0 mills per ton mile, depending on the size of shipment and distance involved.

For fluid materials such as oil and natural gas the most economical movement is by pipeline. But even here, the cost varies with the character of the material, and the cost of moving the unit of energy contained in natural gas is approximately twice that of moving the same amount of energy in the more concentrated form as oil.

Because of variations in the availability and types of transportation, and the effect of these, in turn, on delivered costs, resources from many locations lying at different distances may compete for a single market. And river development or any other action which improves transportation or decreases its cost will extend the distance at which resources can compete.

Substitution

Among the many uses to which mineral commodities are put there are few in which one mineral or metal cannot be replaced by another. In the construction of bridges and other structures, steel has been largely replaced by reinforced concrete. As a fuel for general use, coal has been replaced by oil and oil, in turn, is being replaced in many locations by natural gas. It is true that no suitable substitute has yet been found for aluminum and its alloys in the construction of aircraft. Likewise, the modern automobile is designed to run on gasoline and no other fuel is equally suitable without appreciable modification of the engine. But with recent technological

developments, oil shale, tar sands and coal can substitute as sources for the gasoline whenever the proper economic situation exists.

Where substitution of one commodity for another is physically possible, an important determinant as to whether such substitution will take place is availability at a sufficiently low cost. New low-cost transportation can be a factor in shifting the economic or competitive balance between alternative materials. Likewise, it can mean the replacement of a commodity from one source by an identical commodity from a new source.

CHAPTER 3

MINERAL RESOURCES OF THE ARKANSAS RIVER REGION

The State of Arkansas possesses a variety of minerals equaled by a few regions of comparable size throughout the world. A number of these minerals are available within the twenty-five counties of the Arkansas River Region. The most significant are stone, sand and gravel, clay, bauxite, coal, natural gas, lignite, and phosphate rock.

This array of minerals provides at least one commodity for each of the categories discussed in Chapter 2. They may be grouped as follows:

> Materials--
>> Stone
>> Sand and gravel
>> Clay
>> Bauxite
>
> Energy--
>> Coal
>> Natural gas
>> Lignite
>
> Plant Foods--
>> Phosphate rock

Total mineral production for Arkansas was valued at $174,789,000 in 1964. Of this amount, the Arkansas River counties accounted for almost 30 percent. They produced 49 percent of the value of all minerals other than petroleum, which is not produced at all within the Valley. The mineral production of the Region and subregions is shown in Table 3.01.

Mineral Materials

Stone

Stone provided $26,172,000, or about 15 percent of the total annual value of minerals produced in Arkansas in 1964. The general categories of stone produced in the State are shown in Table 3.02. The greatest portion of the stone classified as "miscellaneous varieties" in Table 3.02 was nepheline syenite, used in crushed and broken form.

The major uses for crushed stone were for concrete aggregate and road stone. These uses accounted for 9 million tons of crushed Arkansas stone in 1964, of which 2 million tons were limestone and the balance sandstone and syenite. An additional 286,000 tons were used for agricultural purposes, and the balance for a wide variety of uses.

Table 3.03 shows the general uses to which crushed stone is put in the United States and the percent used for each purpose. This Table provides a guide to existing and potential uses for Arkansas stone.

Stone production in the 25 counties of the Arkansas River Region represents approximately 60 percent of the State total. Table 3.04 shows trends in the Region since 1960. No production whatever is reported for Central Subregion No. 3. The other subregions are important producers of stone. Necessity for withholding data for certain counties to avoid revealing confidential information means that production from year to year for other regions may not be strictly comparable. However, a distinct upward trend is apparent.

The stone from the Region is used for numerous purposes. A major use, and one responsible for an important share of the growth in recent years,

is as construction material in connection with the river improvement program. Whether production can be sustained at its current high level after the project is completed remains to be seen.

Figure 3.01 shows the location of stone producing operations in the Arkansas River Region at the end of 1965. The location and types of stone produced at the various operations also indicate the locations of the various resource types.

Most widely distributed is the production of sandstone, which comes, for the most part, from Central Subregions No. 1 and No. 2. (See Figure 3.01.) A smaller number of sandstone quarries is located in the West Subregion. The absence of quarries in Central Subregion No. 3 points out the lack of stone resources there.

As would be anticipated, the heaviest concentration is near the principal urban areas, where the greatest amount of construction is carried out. But the distribution of sources also reflects the location of waterway and highway construction activities.

The principal dimension stone area lies toward the western end of the Central Subregion (Figure 3.01). In Pulaski County, quantities of novaculite and nepheline syenite are produced. Nepheline syenite is the aluminum-bearing parent rock whose weathering and decomposition resulted in formation of the bauxite deposits. About 3,400 tons of this material were produced during 1964 and crushed for use as concrete aggregate and other general purposes.

In western Pulaski County and eastern Saline County three operations were engaged in producing quartz.

Sand and Gravel

Approximately 12 million tons of sand and gravel are produced in Arkansas each year. The 11,794,000 tons produced in 1964 had an estimated value of $14,836,000.

Sand and gravel deposits are widespread throughout the State, and production was recorded for 71 of the 75 counties of Arkansas during 1964. Twenty-two of the twenty-five counties of the Arkansas River Region produced sand and gravel amounting to about one-third of the State's total output.

Most of the sand and gravel was used in construction. Table 3.05 shows the general categories of use within the State. It can be assumed that, in general, the sand and gravel of the Arkansas River Region served the same purposes.

Table 3.06 shows production data for the Arkansas River Region. All the subregions produced significant quantities. The greater production, however, came from the more urbanized areas where construction activity, both in building and pavement, was greatest. Pulaski County was the largest reported producer, with Crawford County in second place.

Figure 3.02 also shows the concentration of sand and gravel operations near the urban centers. Numerous smaller operations are shown in Central Subregion No. 3, but the six counties combined account for only about half the amount from Pulaski County alone.

The quantities and widespread distribution of sand and gravel resources within the Arkansas River Region assure adequate supplies to meet any foreseeable future needs.

Clay

Arkansas produced approximately a million tons of clay during the year. The trends in annual production and value are shown in Table 3.07. The production, by type and value for 1964 as reported by the U.S. Bureau of Mines, is shown in Table 3.08.

Approximately 50 percent of the clay production comes from the Arkansas River development regions.

All of the clay produced in Arkansas in 1964 was reported to have been used by the producers. Numerous products were manufactured.

Figure 3.03 shows the general regions of occurrence of clays of various types. Also shown are the locations of major plants producing clay products.

The high-alumina fire clays come from Pulaski and Saline counties. These fire clays, or refractory clays, gain their name from their ability to withstand satisfactorily extremely high temperatures. They are used for the manufacture of heat-resistant refractory brick for lining high-temperature furnaces required for many industrial processes.

Clays of Paleozoic age are used by plants near Clarksville(Johnson County) and Fort Smith (Sebastian County) to produce structural clay products such as brick and tile.

Clays and shales of both Paleozoic and Quaternary ages are used in the manufacture of lightweight aggregate material. Such material is used, in turn, in the manufacture of lightweight concrete blocks, brick, and other products. In 1965, plants for the production of lightweight aggregate were operating in Sebastian and Lonoke counties.

The clay resources of the Tertiary portion of the Arkansas River Region
are considered virtually unlimited. Clay and weathered shale reserves in the
areas of Paleozoic age are somewhat less extensive but are believed to be sub-
stantial.

Bauxite and Aluminum

The United States is the leading producer and consumer of aluminum. At
the same time its known deposits of bauxite, the ore from which aluminum is
produced, are so limited that it must import a large portion of its annual
requirements. In 1964, the United States depended upon foreign sources to
supply more than 85 percent of its needs. It has been estimated that by 1970
the rapidly growing aluminum industry of the United States will be forced to
obtain 92 percent of its requirements for bauxite outside the country.[1]

Figure 3.04 shows the general sources of bauxite for the aluminum plants
of the United States in 1963 and the location of the reduction plants
producing metallic aluminum. Capacities also are shown.

Of the bauxite produced in the United States each year, about 98 percent
comes from deposits lying within the Arkansas Valley in Saline and Pulaski
counties. The location of these deposits is shown in Figure 3.05.

The annual tonnage and value of bauxite produced in Arkansas since
1945 is shown in Table 3.09. Domestic bauxite production, made up largely
of the Arkansas output, has failed to parallel the growth in consumption.

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[1]U.S. Department of the Interior, Bureau of Mines, Mineral Facts and
Problems, 1965 Edition (Washington: Government Printing Office), p.25.

While total United States bauxite consumption increased from 8.1 million tons in 1959 to 12.5 million tons in 1964, domestic production was 1.7 million tons during both of these years.

A problem affecting the domestic bauxite producers is the lower grade of their deposits. Arkansas deposits, constituting 98 percent of the known domestic reserves, average about 52 percent Al_2O_3 and 10 percent SiO_2 compared to imported ores having an Al_2O_3 content of about 60 percent and silica content of about $1\frac{1}{2}$ percent. The range of silica content in domestic ores in 1963 and 1964 was as follows:

| | Percent of Ore Containing | | |
Year	Less Than 8 Percent Silica	8 to 15 Percent Silica	More than 15 Percent Silica
1963	8	53	39
1964	6	63	31

The higher silica content presents a problem in the processing of the ore. High grade, low silica ore is processed by the Bayer process. Ore containing more than 8 percent silica must be processed by a more complicated combination process in order to obtain maximum recovery of alumina and economy of chemicals. The upper limit of silica that commonly is considered suitable for treatment by the combination process is about 15 percent. Higher silica ores may be blended with other ores to drop the average content within the limits required for treatment.

The Arkansas reserves of bauxite, estimated at approximately 50 million tons in 1963, assure a supply for several decades. An additional 65 million

tons of potential reserves, currently too low in grade, too thin or too deep
to be considered economic also are available. Rapidly improving technology
may make these commercial long before the better reserves are exhausted.

Figure 3.05 shows the location of the Arkansas bauxite deposits and
plants producing alumina. Also shown in Figure 3.05, adjacent to the Pulaski
County deposit, is the location of other plants whose operations are based on
the availability of alumina. To the south, in Hot Spring and Clark counties
there are reduction plants to convert the alumina to metallic aluminum.

Mineral Fuels

Coal

In Arkansas, as in most other states, coal once contributed a major por-
tion of the energy consumed. With the production and pipeline transportation
of oil and natural gas, coal gradually was displaced from its position of
prominence. The coal industry of Arkansas reached its peak in 1907 when 2.67
million tons were produced. Thereafter, competition from coal in other regions
and from oil and gas caused a gradual decline. A resurgence during the early
1940's, based on the Arkansas coal's smokeless characteristics, brought pro-
duction back to almost 2 million tons per year, but another decline then
occurred.

Figure 3.06 shows the location of the coal fields of Arkansas, which also
extend westward into Oklahoma. The coal in the Arkansas-Oklahoma fields ranges
from a semi-anthracite in the eastern part of the field, through low volatile
in western Arkansas to medium volatile coal in eastern Oklahoma and high

volatile coal in the western part of the field lying in east central Oklahoma. The Arkansas field is one of the very few areas in the United States where low volatile coal occurs and it holds special significance because of the use of such coal in blends for coke making.

Table 3.10 shows the annual tonnage and value of coal produced in Arkansas from 1945 through 1965, and in Table 3.11 is shown the production, by counties, since 1950. The location of mines producing coal in 1965 is also shown in Figure 3.06. As seen in Table 3.11, Johnson County has been and still remains the principal producer of coal. In 1964 it accounted for 43 percent of production. Franklin County produced 36 percent during that year. Sebastian and Logan counties, which were important producers in the early 1950's, now account for only small tonnages.

In the years since coal mining began in Arkansas, a total of about 100 million tons has been produced. Table 3.12 shows the estimated original, remaining and recoverable reserves of coal of semi-anthracite and bituminous rank in the Arkansas coal fields at the end of 1965. Adequate reserves exist to provide coal for many years at the highest level of production ever attained within the State.

The pattern of decline shown by Arkansas coal production after World War II was experienced by the entire United States coal industry. From a high of 630.6 million tons in 1947, United States production declined to 391.7 million tons in 1954, despite the fact that total energy consumption within the Nation was steadily rising. Since 1954, United States coal production has risen gradually until, in 1965, it again had reached 507 million tons and is still rising. Unfortunately, the Arkansas coal industry has not yet shared in the gain.

Table 3.13 shows the shifts in the United States market for coal which first caused a decline and then an increase in coal mining activity within the country. The use of coal for railroad fuel and retail purposes has almost completely disappeared, and significant declines have occurred in the manufacturing and mining industries. The relative stability of the coke industry demand and the rapidly expanding use of coal by electric utilities account for coal's resurgence in recent years.

The residential and general industrial markets have been captured, to a large extent, by natural gas in those areas where gas is available and, to a much smaller extent, by fuel oil. Likewise, electric utilities use gas almost exclusively in areas where it is available in unrestricted quantities at low cost. In other areas where the cost of gas is higher than that of coal, electric utilities have provided a rapidly growing market for coal. For the manufacture of coke, neither gas nor oil can be substituted for coal, but improved economy in the use of coke has retarded growth in this market.

Table 3.14 shows the consumption of coal in the West South Central Region of the United States in 1957 and trends in consumption since that year.[2] Major declines are shown in all categories except the manufacture of coke. The market is discussed further in Chapter 4 of this report.

Because natural gas is available at low cost, both from the gas fields of Arkansas and the nearby Oklahoma, Louisiana, and Texas fields, it has replaced coal within the Region for nearly all purposes and now provides most

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[2] The West South Central Region consists of Arkansas, Louisiana, Oklahoma, and Texas.

of the energy consumed here. The abrupt decline in coal production in Arkansas

in 1953 and 1954 coincided with the construction of major natural gas pipelines

into the State from Louisiana and Oklahoma. Although the cost of gas at the

wellhead has risen significantly in recent years it appears unlikely that it

will reach a level in the near future where coal can compete with it in Arkansas

or the other West South Central states on any appreciable scale.

Natural Gas

Natural gas production came from 15 counties in two general areas of Ark-

ansas in 1964. One area lies in the southern part of the State and the other

in the western part of the Arkansas River Region. Location of gas production

in the Arkansas River Region is shown in Figure 3.07. Production came from

9 counties of the area during the year.

Marketed production of natural gas within the State in 1964 amounted to

76,167 million cubic feet, with an estimated value of 11,806,000 dollars.

Approximately 72 percent of the gas and 75 percent of the value came from the

River Region. Natural gas of the Arkansas River Region occurs as "dry" gas,

whereas that from the southern part of the State is, for the most part asso-

ciated with the presence of oil and is produced from the oil wells. In Table

3.15 is shown natural gas production within the State of Arkansas and within

the Region from 1954 through 1964.

Almost four times as much natural gas was consumed in Arkansas in 1964

as was produced within the State. Table 3.16 shows the sources, and the

general uses to which the gas was put. From Table 3.16 it may be noted that

about 75 percent of the consumption is for industrial purposes, with the

remaining 25 percent going to residential and commercial purposes. The average

price of industrial gas, shown in Table 3.16 is lower than that for more than

four-fifths of the states of the Nation, and can provide an attraction for many

types of energy consuming industries.

At the end of 1964 the estimated reserves of gas in Arkansas were 27.9

times the year's production, as compared to a ratio of 18.9 for the Nation

as a whole.

Changes in the State's estimated natural gas reserves during the year

1964 were as follows:

	Million Cubic Feet
Proved reserves, December 31, 1963	1,792,644
Additions due to extensions and new discoveries	384,366
	2,177,010
Less net production during year	76,918
Proved reserves, December 31, 1964	2,100,092

The above indicates a rate of discovery four times the rate of pro-

duction. This compares with a nationwide discovery-production ratio of

1.3 or less.

Lignite

Figure 3.08 shows the location of the lignite deposits lying within the

Arkansas River Region. For the most part they lie within the western half

of Central Subregion No. 3, but do extend northward into Saline and Pulaski

counties. An isolated area lies in northern Lonoke County. Small tonnages

of lignite have been produced from time to time as follows:

Year	Short Tons	Value
1949	84	$ 160
1951	149	284
1952	311	933
1959	818	2,454

In Arkansas, the general availability of coal, oil and natural gas would appear to make it unlikely that any significant quantity of lignite will be used soon. However, in Texas, the leading oil and gas producing state of the Nation, lignite is being mined for use in the generation of electric power, and the manufacture of activated charcoal. While the lignites of Arkansas are not currently being produced, their presence adds another potential source of energy that may some day have economic significance.

Reserves of lignite in counties lying within the Arkansas River Region were estimated by the United States Geological Survey in 1954 at 24 million tons, as shown in Table 3.17.

Plant Foods

Phosphate Rock

Among the plant food elements essential to modern agriculture is phosphorous. The main source of this plant food is the phosphate rock mined in Florida, Tennessee, and several of the western states. The phosphate may be applied directly to the soil as finely ground rock (a practice most common in the midwestern states), but usually is first manufactured into superphosphates, or triple superphosphates

In 1963, 76 percent of the phosphate consumed in the United States was used for agriculture purposes. The remainder went into a wide variety of uses.

Phosphate beds were mined in Arkansas during a period extending from about 1900 to 1912. The deposits, in Independence County, provided about 33,000 tons during that period.[3] In 1963 interest in the Arkansas phosphates was renewed and the following tonnages were produced from deposits on the northern border of Van Buren County:
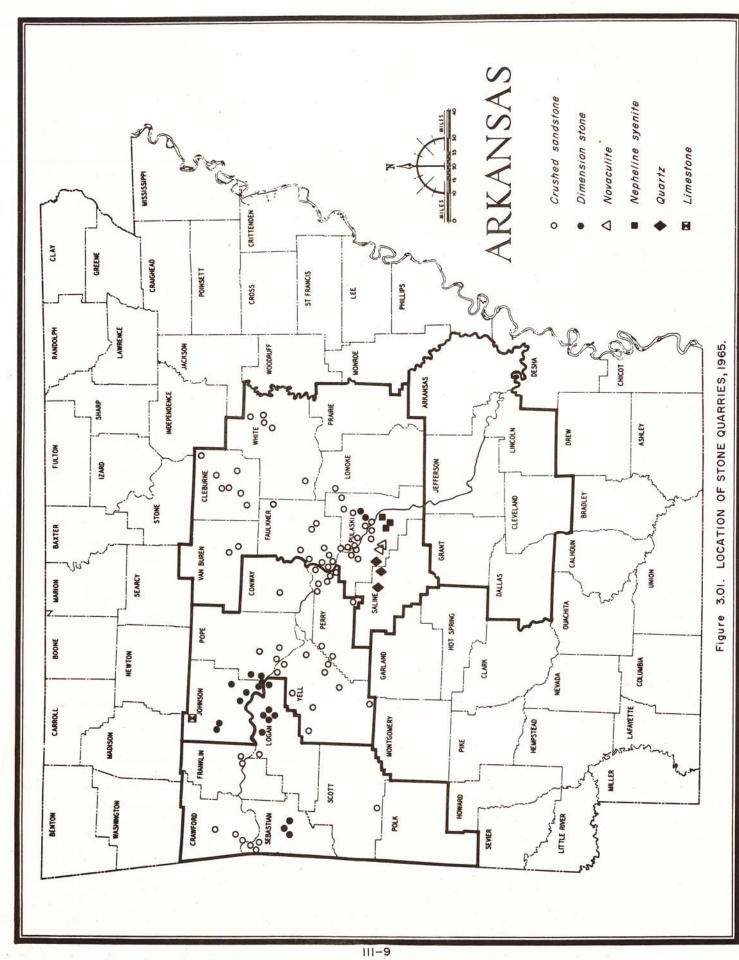
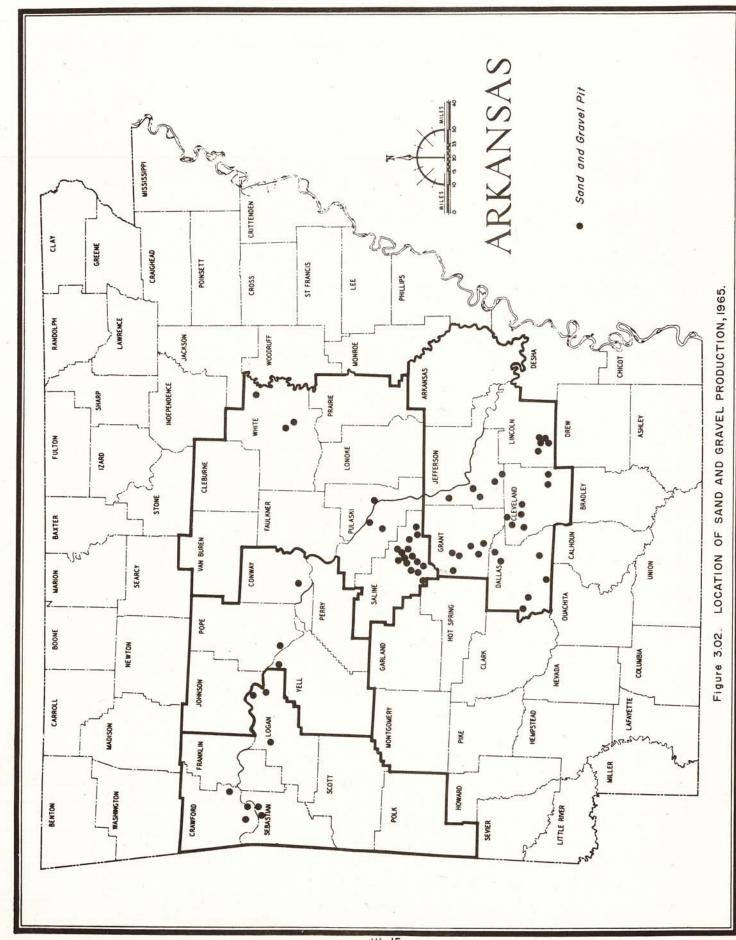| Year	Tons	Value
1963	453	$ 1,812
1964	5,226	20,904
1965	890	3,560

In 1964 about 75 percent of the domestic production came from Florida, 11 percent from Tennessee, and the remainder from the "western" states including Arkansas, Idaho, Montana, Utah, and Wyoming. Facilities were under construction in 1965 for production in North Carolina.
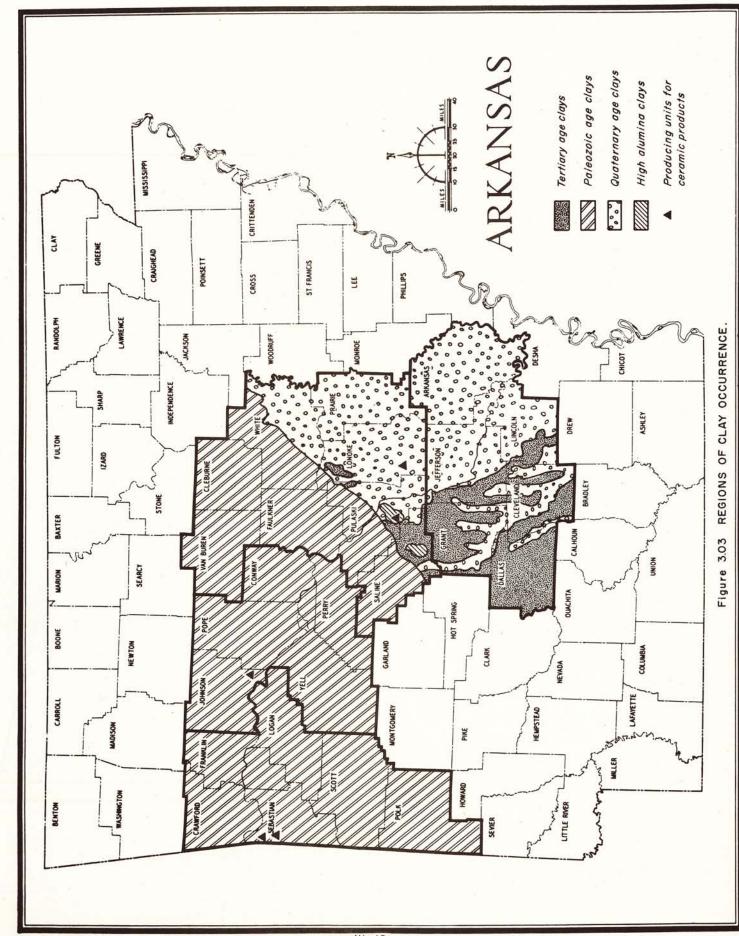
It has been estimated that by 1980 demand for phosphate rock in the United States will increase from the 1964 level of 5.36 million tons (P_2O_5 content) to about 12 million tons. This assures a growing market for the phosphate industry.

To a large degree the phosphate fields of Arkansas remain unexplored. Estimates have placed Arkansas' potential resources at 20 million tons with a P_2O_5 content of 5 million tons. Proven reserves are estimated at 3 million tons of phosphate rock averaging 19 percent P_2O_5.

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[3]Mineral Facts and Problems, p. 699.

ARKANSAS

Legend:
- ○ Crushed sandstone
- ● Dimension stone
- △ Novaculite
- ■ Nepheline syenite
- ◆ Quartz
- ⊠ Limestone

Figure 3.01. LOCATION OF STONE QUARRIES, 1965.

Figure 3.02. LOCATION OF SAND AND GRAVEL PRODUCTION, 1965.

ARKANSAS

Legend:
- Tertiary age clays
- Paleozoic age clays
- Quaternary age clays
- High alumina clays
- ▲ Producing units for ceramic products
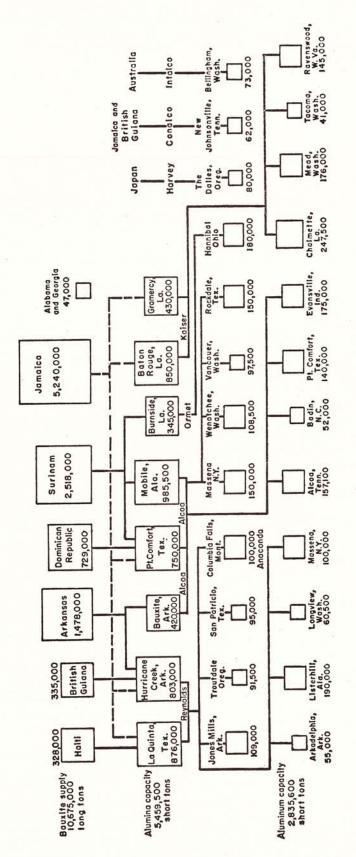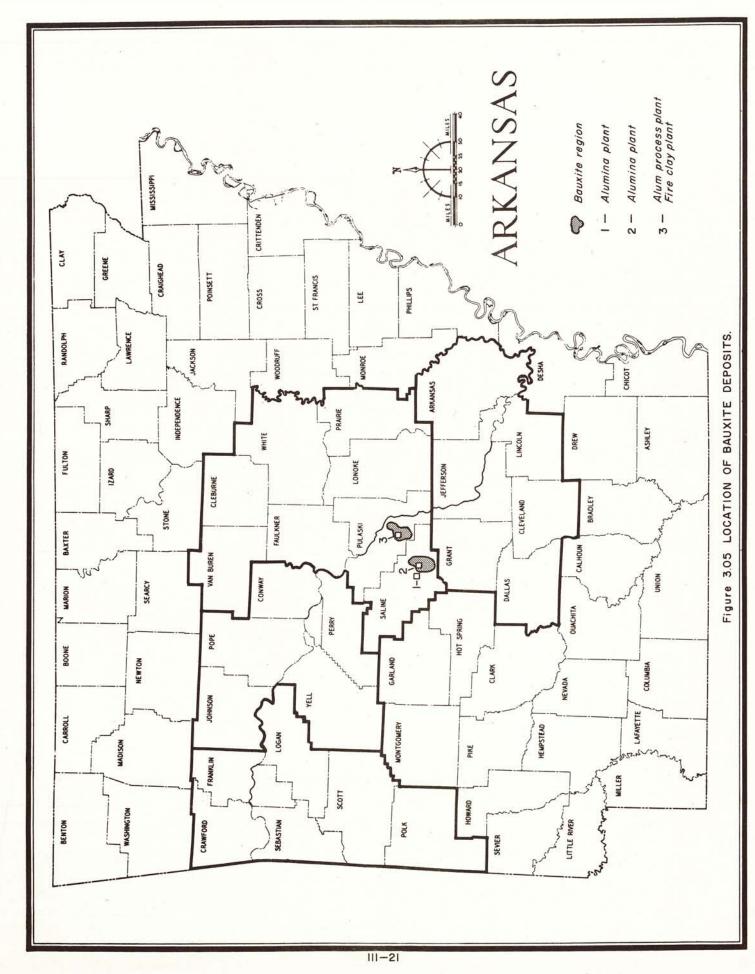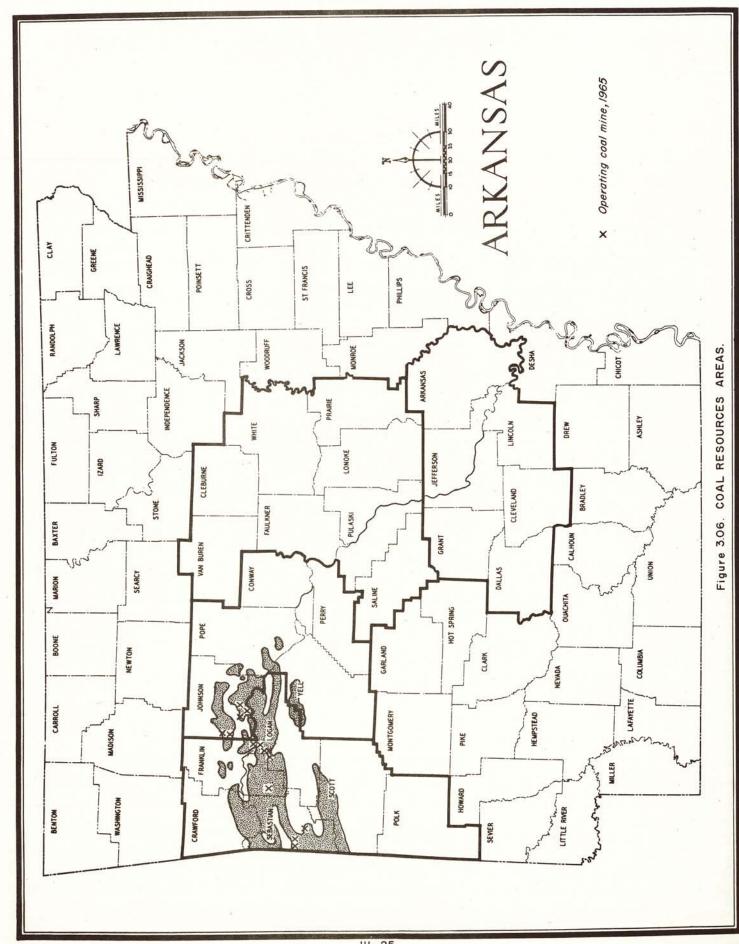
MILES

N

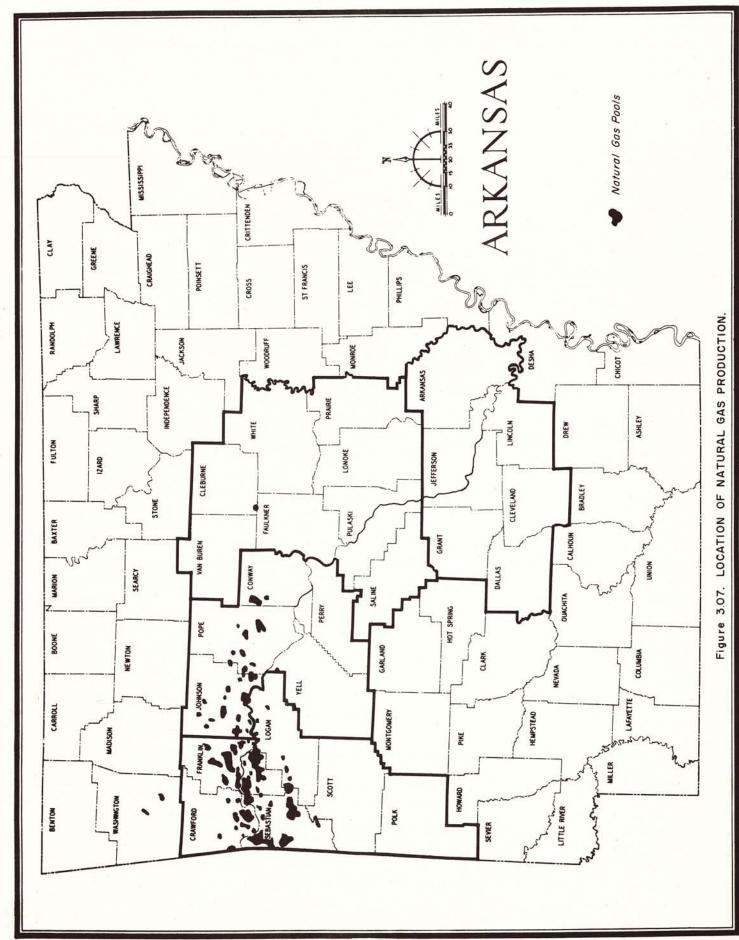Figure 3.03 REGIONS OF CLAY OCCURRENCE.

Figure 3.04. Bauxite Supply and Alumina—and Aluminum—Plant Capacities in the United States in 1963 (Includes Plants Under Construction).

Source: U. S. Bureau of Mines Bull. 630, Mineral Facts and Problems, 1965 edition, p.17.
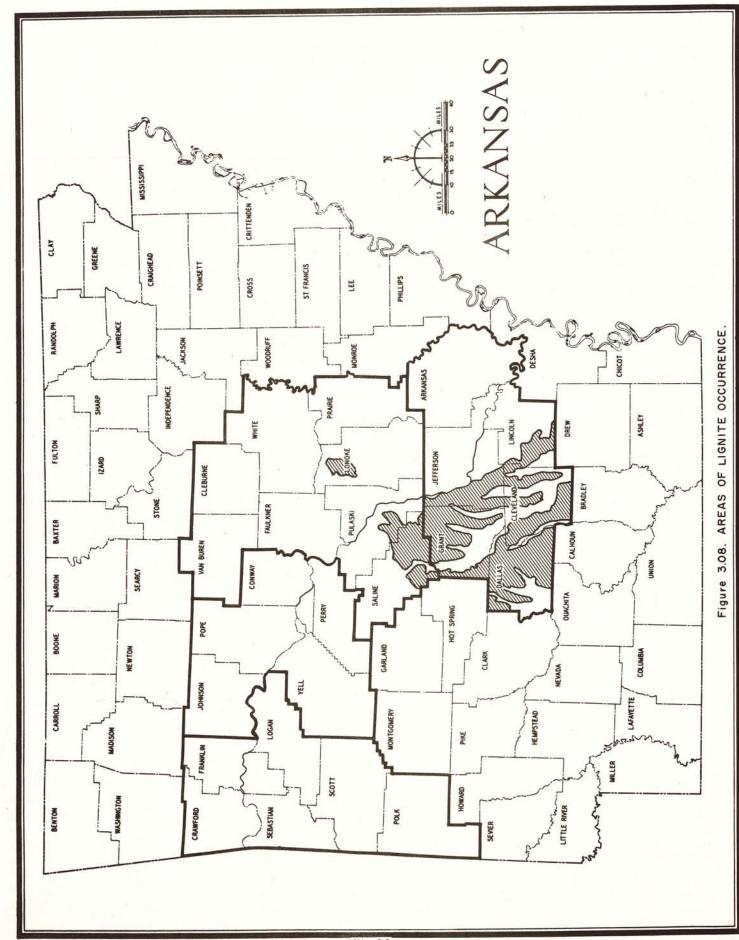
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Figure 3.05 LOCATION OF BAUXITE DEPOSITS.

ARKANSAS

- Bauxite region
1 — Alumina plant
2 — Alumina plant
3 — Alum process plant
    Fire clay plant

ARKANSAS

X   *Operating coal mine, 1965*

Figure 3.06. COAL RESOURCES AREAS.

ARKANSAS

Natural Gas Pools

Figure 3.07. LOCATION OF NATURAL GAS PRODUCTION.

Figure 3.08. AREAS OF LIGNITE OCCURRENCE.

ARKANSAS

TABLE 3.01

ARKANSAS RIVER REGION MINERAL PRODUCTION, 1964

County	Value	Minerals Produced (in order of value)
West Subregion		
Crawford	$ 2,762,320	Stone, natural gas, sand and gravel
Franklin	5,505,074	Natural gas, coal, stone, sand and gravel
Sebastian	1,826,230	Natural gas, stone, clays, coal, sand and gravel
Logan	1,322,792	Stone, natural gas, sand and gravel
Scott	116,000	Sand and gravel
Polk	72,533	Clays, stone, sand and gravel
	$11,604,949	
Central Subregion No. 1		
Johnson	$ 2,347,985	Coal, natural gas, stone, clays
Pope	1,581,208	Stone, natural gas, sand and gravel
Conway	382,325	Natural gas, stone, sand and gravel
Yell	536,061	Stone, sand and gravel
Perry	220,800	Stone
	$ 5,068,379	
Central Subregion No. 2		
Van Buren	$ 484,900	Stone, sand and gravel, phosphate rock
Cleburne	161,140	Stone, sand and gravel, natural gas
Faulkner	688,629	Stone, sand and gravel
White	326,638	Stone, sand and gravel
Saline	19,208,141	Bauxite, lime, sand and gravel, soapstone, slate
Pulaski	11,579,789	Stone, clays, sand and gravel, bauxite
Lonoke	1,136,917	Stone, sand and gravel, clays
Prairie	9,000	Sand and gravel
	$33,595,154	
Central Subregion No. 3		
Grant	$ 345,000	Sand and gravel
Jefferson	w	Lime, sand and gravel
Arkansas	56,000	Sand and gravel
Dallas	79,000	Sand and gravel
Cleveland	43,000	Sand and gravel
Lincoln	113,000	Sand and gravel
	$ 636,000	
Total for Region		$ 50,904,482
STATE TOTAL		174,789,000

[w]Withheld to avoid disclosure of individual operations.

Source: U.S. Bureau of Mines.

TABLE 3.02

GENERAL CATEGORIES OF STONE PRODUCED IN ARKANSAS, 1964*

Category	Short Tons	Value
Dimension sandstone	13,359	$ 200,791
Crushed and broken sandstone	9,872,053	11,745,391
Crushed and broken limestone and dolomite	4,663,240	6,474,553
Miscellaneous varieties	5,605,831	6,843,924
	20,154,483	$25,264,659

*These four categories account for approximately 96.5 percent of the total value of stone produced in the State.

TABLE 3.03

CRUSHED OR BROKEN STONE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1964

Use	Quantity (1,000 short tons)	Value ($1,000)
Agriculture	27,047	$ 46,485
Cement	97,950	102,486
Concrete and roadstone	455,981	628,331
Fill	1,416	946
Filtration	183	394
Flux	31,979	46,633
Glass	1,635	5,219
Lime and dead burned dolomite	25,299	43,601
Mineral food	684	4,077
Poultry grit	861	6,391
Railroad ballast	14,170	16,801
Refractory	600	5,237
Riprap	39,495	49,780
Roofing granules, aggregates, and chips	2,369	12,407
Stone sand	3,536	5,270
Terrazzo	421	5,547
Other uses and unspecified	19,098	57,760
TOTAL	722,724	$1,037,365

TABLE 3.04

REPORTED PRODUCTION OF CRUSHED AND DIMENSION STONE IN THE ARKANSAS RIVER REGION[a]

Geographic Area	1952 Short Tons	1952 Value (Dollars)	1954 Short Tons	1954 Value (Dollars)	1956 Short Tons	1956 Value (Dollars)
West Subregion						
Crawford	0	0	0	0	0	0
Franklin	0	0	0	0	1,239	$ 15,862
Sebastian	0	0	0	0	12,133	72,000
Logan	24,800	$ 61,500	5,578	$ 79,672	19,491	235,873
Scott	0	0	0	0	0	0
Polk	0	0	0	0	0	0
Total	24,800	$ 61,500	5,578	$ 79,672	32,863	$ 323,735
Central Subregion No. 1						
Johnson	w	w	w	w	1,735	$ 29,435
Pope	0	0	0	0	w	w
Conway	0	0	0	0	0	0
Yell	0	0	w	w	w	w
Perry	0	0	0	0	0	0
Total					1,735	$ 29,435
Central Subregion No. 2						
Van Buren	0	0	0	0	0	0
Cleburne	0	0	0	0	0	0
Faulkner	0	w	w	w	0	0
White	0	0	0	0	w	w
Saline	0	0	0	0	0	0
Pulaski	2,227,861	$2,373,778	2,320,953	$2,811,293	1,134,166	$1,490,501
Lonoke	0	0	0	0	11,964	15,952
Prairie	0	0	0	0	0	0
Total	2,227,861	$2,373,778	2,320,953	$2,811,293	1,146,130	$1,506,453
TOTAL for Region[b]	2,252,661	$2,435,278	2,326,531	$2,890,965	1,180,728	$1,859,623
STATE TOTAL	2,967,479	$3,346,201	4,604,067	$5,929,638	6,325,000	$8,113,000

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TABLE 3.04
REPORTED PRODUCTION OF CRUSHED AND DIMENSION STONE . . . . - (Continued.)

Geographic Area	1958 Short Tons	1958 Value (Dollars)	1960 Short Tons	1960 Value (Dollars)	1961 Short Tons	1961 Value (Dollars)
West Subregion						
Crawford	w	w	w	w	w	w
Franklin	1,180	$ 14,706	w	w	150	$ 1,950
Sebastian	75,671	139,491	340,800	$ 221,520	0	0
Logan	17,478	215,044	8,704	118,023	497,818	455,746
Scott	0	0	0	0	0	0
Polk	0	0	0	0	0	0
Total	94,329	$ 369,241	349,504	$ 339,543	497,818	$ 457,696
Central Subregion No. 1						
Johnson	0	0	17,000	$ 11,050	324,100	$ 209,525
Pope	22,481	$ 103,818	w	w	186,678	284,318
Conway	56,007	33,600	0	0	284,438	205,023
Yell	0	0	0	0	204,115	186,323
Perry	0	0	45,200	22,600	276,748	182,833
Total	78,488	$ 137,418	62,200	$ 33,650	1,276,079	$ 1,068,022
Central Subregion No. 2						
Van Buren	0	0	0	0	13,110	$ 8,128
Cleburne	0	0	975,000	$ 1,519,750	1,004,496	1,228,545
Faulkner	0	0	0	0	72,843	77,552
White	w	w	w	w	w	w
Saline	0	0	0	0	0	0
Pulaski	5,404,837	$ 5,205,177	w	w	4,732,736	3,288,939
Lonoke	0	0	0	0	179,592	163,892
Prairie	0	0	0	0	0	0
Total	5,404,837	$ 5,205,177	975,000	$ 1,519,750	6,002,777	$ 4,767,056
TOTAL for Region[b]	5,577,654	$ 5,711,836	1,386,704	$ 1,892,943	7,776,824	$ 6,292,774
STATE TOTAL	8,461,000	$10,178,000	10,939,000	$13,555,000	12,029,000	$12,402,000

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- continued -

TABLE 3.04
REPORTED PRODUCTION OF CRUSHED AND DIMENSION STONE . . . - (Continued.)

Geographic Area	1962		1963		1964	
	Short Tons	Value (Dollars)	Short Tons	Value (Dollars)	Short Tons	Value (Dollars)
West Subregion						
Crawford	w	w	w	w	1,160,109	$ 1,407,983
Franklin	0	0	250,069	$ 244,576	423,878	288,622
Sebastian	w	w	847,113	491,965	w	w
Logan	263,245	$ 295,141	634,712	600,295	368,963	874,517
Scott	0	0	0	0	0	0
Polk	0	0	0	0	0	0
Total	263,245	$ 295,141	1,731,894	$ 1,336,836	1,952,950	$ 2,571,122
Central Subregion No. 1						
Johnson	w	w	293,658	$ 236,349	338,058	$ 640,014
Pope	w	w	373,164	514,537	w	w
Conway	w	w	w	w	93,945	164,494
Yell	w	w	247,338	300,681	543,709	484,061
Perry	456,949	$ 248,169	370,803	377,367	441,560	220,800
Total	456,949	$ 248,169	1,284,963	$ 1,518,934	1,417,272	$ 1,509,369
Central Subregion No. 2						
Van Buren	18,687	$ 12,147	w	w	187,453	$ 399,231
Cleburne	w	w	2,000	4,000	72,466	139,087
Faulkner	802,786	468,589	193,090	324,131	383,119	683,629
White	w	w	358,992	581,301	273,638	273,638
Saline	0	0	0	0	0	0
Pulaski	8,155,822	5,745,418	w	w	8,080,618	9,154,379
Lonoke	54,973	35,732	70,758	120,996	507,440	803,917
Prairie	0	0	0	0	0	0
Total	9,032,268	$ 6,261,886	624,840	$ 1,030,428	9,504,734	$11,453,881
TOTAL for Region[b]	9,752,462	$ 6,805,196	3,641,697	$ 3,886,198	12,874,956	$15,534,372
STATE TOTAL	20,611,000	$19,866,000	18,913,000	$22,727,000	20,241,000	$26,172,000

wFigures withheld to prevent disclosure of data for individual operations.

[a]No production was reported for Central Subregion No. 3.

[b]Excludes counties in which data were withheld.

Source: U.S. Bureau of Mines, Minerals Yearbooks.

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TABLE 3.05

SAND AND GRAVEL SOLD OR USED BY ARKANSAS PRODUCERS IN 1964

Class of Operation and Use	Amount (thousands of tons)	Value (thousands of dollars)
Commercial Operations		
Sand		
Building	1,676	$ 1,857
Paving	1,414	1,369
Other[1]	578	1,166
Total	3,668	4,392
Gravel		
Building	1,745	2,728
Paving	3,186	3,833
Fill	16	14
Other[2]	22	23
Total	4,969	6,598
Total sand and gravel	8,637	$10,990
Government and Contractor Operations		
Sand		
Building	-	-
Paving	1,442	1,226
Fill	-	-
Total	1,442	1,226
Gravel		
Paving	1,709	2,616
Fill	6	4
Total	1,715	2,620
Total sand and gravel	3,157	3,846
GRAND TOTAL	11,794	$14,836

[1]Includes fill, glass, molding, and other construction, industrial, and ground sand.

[2]Includes other construction, railroad ballast (1963), and miscellaneous gravel.

TABLE 3.06

REPORTED SAND AND GRAVEL PRODUCTION IN THE ARKANSAS RIVER REGION

Geographic Area	1952 Short Tons	1952 Value (Dollars)	1954 Short Tons	1954 Value (Dollars)	1956 Short Tons	1956 Value (Dollars)
West Subregion						
Crawford	w	w	w	w	0	0
Franklin	0	0	0	0	0	0
Sebastian	0	0	0	0	498,275	$ 382,000
Logan	0	0	0	0	0	0
Scott	0	0	0	0	0	0
Polk	0	0	0	0	0	0
Total					498,275	$ 382,000
Central Subregion No. 1						
Johnson	84,292	$72,368	0	0	0	0
Pope	0	0	85,000	$ 65,000	w	w
Conway	0	0	0	0	0	0
Yell	0	0	0	0	0	0
Perry	0	0	0	0	0	0
Total	84,292	$ 72,368	85,000	$ 65,000		
Central Subregion No. 2						
Van Buren	0	0	0	0	0	0
Cleburne	0	0	0	0	0	0
Faulkner	0	0	0	0	0	0
White	0	0	0	0	34,377	$ 9,604
Saline	395,016	$303,957	313,458	$ 290,175	385,442	287,491
Pulaski	0	0	0	0	0	0
Lonoke	0	0	0	0	0	0
Prairie	0	0	0	0	0	0
Total	395,016	$ 303,957	313,458	$ 290,175	419,819	$ 297,095
Central Subregion No. 3						
Grant	0	0	0	0	w	w
Jefferson	w	w	w	w	w	w
Arkansas	0	0	0	0	0	0
Dallas	0	0	0	0	0	0
Cleveland	0	0	0	0	0	0
Lincoln	0	0	0	0	125,434	73,996
Total					125,434	$ 73,996
TOTAL for Region[1]	479,308	$ 376,325	398,458	$ 355,175	1,043,528	$ 753,091
STATE TOTAL	5,011,095	$4,977,219	6,611,260	$6,566,806	10,199,515	$8,729,402

TABLE 3.06
REPORTED SAND AND GRAVEL PRODUCTION . . . (Continued.)

Geographic Area	1958 Short Tons	1958 Value (Dollars)	1960 Short Tons	1960 Value (Dollars)	1961 Short Tons	1961 Value (Dollars)
West Subregion						
Crawford	w	w	w	w	w	w
Franklin	0	0	0	0	0	0
Sebastian	0	0	0	0	0	0
Logan	0	0	0	0	0	0
Scott	0	0	0	0	0	0
Polk	0	0	0	0	108,562	$ 108,562
Total				0	108,562	$ 108,562
Central Subregion No. 1						
Johnson	0	0	0	0	0	0
Pope	187,475	$ 120,809	w	w	227,705	$ 194,263
Conway	67,430	47,200	55,080	38,556	0	0
Yell	0	0	0	0	122,933	112,805
Perry	0	0	0	0	0	0
Total	254,905	$ 168,009	55,080	$ 38,556	350,638	$ 307,068
Central Subregion No. 2						
Van Buren	0	0	0	0	0	0
Cleburne	0	0	w	w	105,409	$ 36,893
Faulkner	0	0	0	0	0	0
White	0	0	0	0	0	0
Saline	245,398	$ 176,811	79,608	$ 105,155	32,539	66,307
Pulaski	2,527,673	1,441,088	w	w	1,397,156	812,093
Lonoke	0	0	0	0	0	0
Prairie	0	0	0	0	0	0
Total	2,773,071	$1,617,899	79,608	$ 105,155	1,535,104	$ 915,293
Central Subregion No. 3						
Grant	0	0	0	0	0	0
Jefferson	w	w	71,425	$ 49,996	155,971	$ 104,620
Arkansas	0	0	0	0	0	0
Dallas	0	0	0	0	0	0
Cleveland	0	0	0	0	37,104	52,316
Lincoln	47,824	39,550	43,800	49,537	92,905	117,758
Total	47,824	$ 39,550	115,225	$ 99,533	285,980	$ 274,694
TOTAL for Region[1]	3,075,800	$1,825,458	249,913	$ 243,244	2,280,284	$1,605,617
STATE TOTAL	8,644,000	$7,040,000	8,192,000	$10,262,000	9,389,000	$9,074,000

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TABLE 3.06
REPORTED SAND AND GRAVEL PRODUCTION . . . . – (Continued.)

Geographic Area	1962 Short Tons	1962 Value (Dollars)	1963 Short Tons	1963 Value (Dollars)	1964 Short Tons	1964 Value (Dollars)
West Subregion						
Crawford	w	w	w	w	696,000	$ 553,000
Franklin	0	0	0	0	18,000	21,000
Sebastian	w	w	0	0	w	w
Logan	27,000	$ 30,000	7,662	$ 7,662	29,000	$ 43,000
Scott	0	0	13,484	13,484	77,000	116,000
Polk	0	0	0	0	0	0
Total	27,000	$ 30,000	21,146	$ 21,146	820,000	$ 733,000
Central Subregion No. 1						
Johnson	w	w	0	0	0	0
Pope	w	w	372,978	$ 464,789	w	w
Conway	w	w	w	w	14,000	$ 12,000
Yell	w	w	2,146	1,006	34,000	52,000
Perry	0	0	0	0	0	0
Total			375,124	$ 465,795	48,000	$ 64,000
Central Subregion No. 2						
Van Buren	0	0	0	0	62,000	$ 53,000
Cleburne	w	w	6,325	$ 6,325	22,000	22,000
Faulkner	0	0	1,229	1,229	5,000	5,000
White	0	0	0	0	23,000	53,000
Saline	34,335	$ 49,356	73,888	131,913	193,000	250,000
Pulaski	560,829	564,409	w	w	1,141,000	1,154,000
Lonoke	0	0	0	0	318,000	273,000
Prairie	0	0	0	0	10,000	9,000
Total	595,164	$ 613,765	81,442	$ 139,467	1,774,000	$ 1,819,000
Central Subregion No. 3						
Grant	0	0	103,556	$ 103,556	274,000	$ 345,000
Jefferson	w	w	w	w	w	w
Arkansas	0	0	0	0	66,000	56,000
Dallas	0	0	25,561	25,561	46,000	79,000
Cleveland	16,553	$ 12,415	13,446	13,446	34,000	43,000
Lincoln	114,675	112,053	101,768	80,240	64,000	113,000
Total	131,228	$ 124,468	244,331	$ 222,803	484,000	$ 636,000
TOTAL for Region [1]	753,392	$ 768,233	722,043	$ 849,211	3,126,000	$ 3,252,000
STATE TOTAL	10,847,000	$10,006,000	12,099,000	$13,589,000	11,794,000	$14,836,000

wFigures withheld to prevent disclosure of date for individual operations.

[1] Excludes counties in which data were withheld.

Source: U.S. Bureau of Mines, Minerals Yearbooks.

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TABLE 3.07

CLAY PRODUCTION IN ARKANSAS

Year	Short Tons	Value
1945	162,658	$ 106,704
1946	263,812	(1,287,404 clay products)
1947	294,639	(1,437,839 clay products)
1948	332,090	(1,620,599 clay products)
1949	340,462	(1,678,478 clay products)
1950	345,479	NA
1951	397,748	974,483
1952	423,719	635,579
1953	407,633	611,450
1954	473,831	NA
1955	605,184	NA
1956	607,737	NA
1957	602,502	1,371,511
1958	569,510	1,253,342
1959	957,852	2,207,263
1960	653,582	2,633,954
1961	685,919	NA
1962	712,004	NA
1963	813,662	2,038,156
1964	1,009,408	2,110,016

NA-Not Available.

TABLE 3.08

ARKANSAS CLAY PRODUCTION, 1964, BY TYPE

Type	Short Tons	Value
Fire clay	242,360	$1,515,893
Miscellaneous clays	649,266	636,241
	891,626	$2,152,134

Source: U.S. Bureau of Mines.

TABLE 3.09

BAUXITE PRODUCED IN ARKANSAS, 1945-1964[1]

Year	Long Tons (dry equivalent)	Value
1945	1,073,349	$ 5,591,630
1946	1,044,939	6,546,479
1947	1,032,035	6,438,697
1948	1,295,693	7,761,679
1949	1,149,143	6,733,096
1950	1,257,232	7,198,685
1951	1,493,557	11,994,882
1952	1,849,287	14,084,274
1953	1,689,207	15,042,236
1954	1,711,386	15,239,244
1955	1,660,263	14,844,798
1956	1,668,432	13,307,000
1957	1,356,898	11,600,000
1958	1,348,000	14,373,000
1959	1,580,000	17,960,000
1960	1,603,000	18,982,000
1961	1,080,000	13,220,000
1962	1,481,000	17,535,000
1963	1,478,047	16,701,000
1964	1,561,984	17,431,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Source: U.S. Bureau of Mines, Minerals Yearbooks.

TABLE 3.10

ANNUAL PRODUCTION AND VALUE OF ARKANSAS COAL

Year	Short Tons	Value
1945	1,881,899	$ 7,887,764
1946	1,635,174	7,044,161
1947	1,591,248	9,169,323
1948	1,796,335	11,118,160
1949	1,336,295	7,061,239
1950	1,004,589	8,234,610
1951	1,144,014	7,782,541
1952	1,048,497	5,960,479
1953	834,982	4,528,139
1954	578,724	3,831,153
1955	540,218	3,576,243
1956	613,571	4,061,840
1957	535,773	4,204,948
1958	415,081	2,436,314
1959	473,489	3,098,114
1960	412,360	2,863,271
1961	380,320	2,529,128
1962	327,516	2,177,981
1963	263,049	1,654,575
1964	241,725	1,344,019
1965	246,217	1,371,428

TABLE 3.11

COAL PRODUCTION DATA, ARKANSAS RIVER REGION, BY COUNTIES[a]

Year	Tons Shipped by Rail or Water[b]	Tons Shipped by Truck	Tons Used at Mine[t]	Total	Average Value Per Ton[d]	Average Tons Per Man/Day
Franklin County						
1950	63,003	4,187	1,108	68,298	$7.02	2.99
1951	73,695	6,655		80,350	7.25	3.28
1952	13,676	4,717		18,393	5.95	3.59
1953	10,242	3,954		14,196	3.91	5.30
1954	(e)					
1955	6,563	2,228		8,791	4.38	8.46
1956	6,873			6,873	4.36	6.93
1957	(e)					
1958	(e)					
1959	35,528			35,528	6.60	23.53
1960	117,127			117,127	6.67	24.98
1961	99,386			99,386	6.35	22.21
1962	87,180			87,180	6.61	21.23
1963	80,686			80,686	6.65	21.49
1964	86,880			86,880	6.77	32.07
Johnson County						
1950	474,353	10,262	488	485,103	$7.02	8.91
1951	416,268	5,677	408	422,353	7.33	9.14
1952	321,947	8,293	30	330,270	7.30	8.78
1953	350,472	5,481	30	355,983	7.80	9.97
1954	210,193	2,712	501	213,406	7.59	9.23
1955	286,104	--	48	286,152	7.34	10.26
1956	249,898	42	3	249,943	7.68	10.75
1957	194,586	1,000	14	195,600	7.00	8.53
1958	186,564	--	--	186,564	8.20	9.92
1959	148,544	150	--	148,694	8.07	10.71
1960	112,805		--	112,805	7.88	9.08
1961	96,175	3,200	--	99,375	7.08	7.14
1962	110,086	2,153	--	112,239	7.21	8.02
1963	107,925	401	--	108,326	7.01	7.73
1964	112,905	1,980	--	114,885	7.32	8.19

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TABLE 3.11
COAL PRODUCTION . . . . BY COUNTIES^a - (Continued.)

Year	Shipped by Rail or Water[b]	Shipped by Truck	Used at Mine[c]	Total	Average Value Per Ton[d]	Average Tons Per Man/Day
Logan County						
1950	171,084	14,606	192	185,882	$ 9.42	2.85
1951	163,660	1,789	116	165,565	9.40	2.96
1952	104,952	3,003	208	108,163	10.20	3.53
1953	64,142	618	805	65,565	10.89	3.05
1954	(e)					
1955	27,744	--	447	28,191	11.90	3.87
1956	23,903	1,320	--	25,223	8.00	3.47
1957	(e)					
1958	17,885	1,223	2	19,110	9.62	4.27
1959	9,302	426	--	9,728	9.88	4.00
1960	(e)					
1961	(e)					
1962	(e)					
1963	6,492	--	--	6,492	8.96	3.33
1964	--	--	--	--		
Pope County						
1950	41,666	2,324	--	41,666	$ 8.00	2.83
1951	20,935	1,146	200	23,459	8.66	2.65
1952	12,100	--	--	13,246	8.86	2.96
1953	--	--	--	--		
1954	--	--	--	--		
1955	--	--	--	--		
1956	--	--	--	--		
1957	1,390	--	--	1,390	6.56	11.18
1958	(e)	--	--	--		
1959	66,708	--	--	66,708	6.84	10.98
1960	(e)					
1961	(e)					
1962	(e)					
1963	--	--	--	--		
1964	--	--	--	--		

TABLE 3.11
COAL PRODUCTION . . . . BY COUNTIES[a] - (Continued.)

Year	Tons Shipped by Rail or Water[b]	Tons Shipped by Truck	Tons Used at Mine[c]	Tons Total	Average Value Per Ton[d]	Average Tons Per Man/Day
Sebastian County						
1950	290,820	26,990	309	318,119	$7.99	3.42
1951	401,152	13,596	230	414,978	7.82	2.78
1952	388,891	14,125	--	403,016	7.68	3.71
1953	318,233	21,230	--	339,463	7.66	4.13
1954	182,535	44,360	12	226,907	6.90	4.50
1955	250,276	4,306	10	254,592	7.25	4.33
1956	298,438	9,614	11	308,052	7.95	3.99
1957	250,933	8,166	11	259,110	8.59	3.97
1958	86,113	5,386	--	91,499	7.88	4.69
1959	174,025	6,625	--	180,650	8.27	4.64
1960	94,404	7,350	--	101,754	8.52	4.45
1961	117,238	8,307	--	125,545	7.76	5.03
1962	29,091	12,362	--	41,453	6.95	4.54
1963	17,823	7,303	20	25,146	6.03	6.45
1964	10,550	--	--	10,550	6.98	3.00
Scott County						
1950	70,000	--	--	70,000	$5.33	8.62
1951 - 1964	no production					
Other Counties						
1950 - 1953	no production					
1954	35,336	848	771	36,955	7.52	3.37
1955 - 1956	no production					
1957	49,718	1,913	--	51,631	7.19	6.08
1958	64,418	1,040	1,507	66,965	6.09	9.64
1959	--	--	--	--	--	--
1960	77,513	--	--	77,513	7.45	8.81
1961	68,254	2,368	8	70,630	8.19	7.82
1962	14,867	--	--	14,867	7.07	8.44
1963	--	--	--	--	--	--
1964	--	--	--	--	--	--

[a]Production from mines producing 1,000 tons or more per year.

[b]Loaded directly at mine or hauled by truck to loading port.

[c]Used at mine, sold to employees, etc.

[d]Value received or charged FOB the mine.

[e]Included in "Other Counties" to avoid disclosure of individual operations.

Source: U.S. Bureau of Mines, Minerals Yearbooks.

TABLE 3.12

COAL RESERVES OF THE ARKANSAS VALLEY ESTIMATED AS OF
DECEMBER 31, 1965
(million short tons)

County	Original Reserves	Production and Mining Losses[a]	Remaining Reserves	Recoverable Reserves[b]
Crawford	289.9	(c)	289.9	144.9
Franklin	230.4	24.3	206.1	103.0
Johnson	361.8	34.9	326.9	163.5
Logan	198.9	13.8	185.1	92.5
Pope	23.4	6.0	17.4	8.7
Scott	104.2	3.0	101.2	50.6
Sebastian	1,063.0	118.5	944.5	472.3
Total	2,072.4	200.5	2,071.1	1,035.5

[a] Mining losses are considered to be equivalent to tonnage of coal produced.

[b] Remaining reserves less estimated future mining losses, assuming 50 percent recoverability.

[c] Production records incomplete; known production small and of little importance.

Sources: Boyd R. Haley, Coal Resources of Arkansas, U.S. Geological Survey Bulletin 1077-P, 1954; and the 1965 Annual Report of the Arkansas State Inspector of Coal Mines.

TABLE 3.13

CONSUMPTION OF BITUMINOUS COAL AND LIGNITE BY CONSUMER CATEGORY, UNITED STATES, 1933-1964

Year	Electric Power Utilities [1]	Bunker, Lake Vessel and Foreign [2]	Railroads (Class I) [3]	Manufacturing and Mining Industries					Retail Deliveries to Other Consumers [6]	Total of Classes Shown [7]
				Beehive Coke Plants	Oven Coke Plants	Steel and Rolling Mills [4]	Cement Mills	Other Manufacturing and Mining Industries [5]		
1933	27,088	2,298	72,548	1,408	38,681	14,129	2,760	81,377	77,396	317,685
1934	29,707	2,423	76,037	1,635	44,343	15,391	3,457	87,314	83,507	343,814
1935	30,936	2,683	77,109	1,469	49,046	16,585	3,456	94,598	80,444	356,326
1936	38,104	3,052	86,391	2,698	63,244	19,019	4,711	111,030	80,044	408,293
1937	41,045	3,433	88,080	4,927	69,575	18,148	5,182	124,056	76,331	430,777
1938	36,440	2,310	73,921	1,360	45,266	11,877	4,413	94,196	66,498	336,281
1939	42,304	2,764	79,072	2,298	61,216	13,843	5,194	100,637	68,770	376,098
1940	49,126	2,989	85,130	4,803	76,583	14,169	5,559	107,864	84,687	430,910
1941	59,888	3,304	97,384	10,529	82,609	15,384	6,735	121,880	94,402	492,115
1942	63,472	3,226	115,410	12,876	87,974	14,722	7,462	132,767	102,141	540,050
1943	74,036	3,042	130,283	12,441	90,019	15,864	5,842	142,149	120,121	593,797
1944	76,656	3,069	132,049	10,858	94,438	15,152	3,767	131,498	122,112	589,599
1945	71,603	3,192	125,120	8,135	87,214	14,241	4,203	126,562	119,297	559,567
1946	68,743	2,632	110,166	7,167	76,121	12,151	6,990	117,732	98,684	500,386
1947	86,009	3,087	109,296	10,475	94,325	14,195	7,919	123,928	86,657	545,891
1948	95,620	2,552	94,838	10,322	96,984	14,193	8,546	110,060	86,794	519,909
1949	80,610	2,056	68,123	5,354	85,882	10,529	7,966	96,629	88,389	445,538
1950	88,262	2,042	60,969	9,088	94,757	10,877	7,923	95,862	84,422	454,202
1951	101,898	2,220	54,005	11,418	102,030	11,260	8,507	103,188	74,378	468,904
1952	103,309	1,839	37,962	6,912	90,702	9,632	7,903	93,637	66,861	418,757
1953	112,283	1,839	27,735	8,226	104,648	8,764	8,167	95,160	59,976	426,798
1954	115,235	1,244	17,370	980	84,411	6,983	7,924	77,115	51,798	363,060
1955	140,550	1,499	15,473	2,869	104,508	7,353	8,529	89,611	53,020	423,412
1956	154,983	1,470	12,308	4,043	101,870	7,189	9,026	93,302	48,667	432,858
1957	157,398	1,364	8,401	3,473	104,547	6,938	8,633	87,202	35,712	413,668

TABLE 3.13
CONSUMPTION OF BITUMINOUS COAL AND LIGNITE . . . - (Continued.)

Year	Electric Power Utilities [1]	Bunker, Lake Vessel and Foreign [2]	Railroads (Class I) [3]	Manufacturing and Mining Industries					Retail Deliveries to Other Consumers [6]	Total of Classes Shown [7]
				Beehive Coke Plants	Oven Coke Plants	Steel and Rolling Mills [4]	Cement Mills	Other Manufacturing and Mining Industries [5]		
1958	152,928	955	3,725	1,017	75,563	7,268	8,256	81,372	35,619	366,703
1959	165,788	969	2,600	1,827	77,354	6,674	8,510	73,396	29,138	366,256
1960	173,882	945	2,101	1,640	79,375	7,378	8,216	76,487	30,405	380,429
1961	179,629	770	(8)	1,496	72,385	7,495	7,615	77,280	27,735	374,405
1962	190,833	687	(8)	1,339	72,923	7,319	7,719	78,766	28,188	387,774
1963	209,038	670	(8)	1,613	76,020	7,401	8,138	82,797	23,548	409,225
1964	223,032	711	(8)	2,025	86,732	7,394	8,679	82,928	19,615	431,116

[1] Federal Power Commission.

[2] Bureau of the Census, U.S. Department of Commerce, Ore and Coal Exchange.

[3] Association of American Railroads. Represents consumption of bituminous coal and lignite for all uses, including locomotive, powerhouse, shop, and station fuel.

[4] Estimates based upon reports collected from a selected list of representative steel and rolling mills.

[5] Estimates based upon reports collected from a selected list of representative manufacturing plants.

[6] Estimates based upon reports collected from a selected list of representative retailers. Includes some coal shipped by truck from mine to final destination.

[7] The total of classes shown approximates total consumption. The calculation of consumption from production, imports, exports, and changes in stocks is not as accurate as the "Total of classes shown" because certain significant items of stocks are not included in year-end stocks. These items are: Stocks on Lake and Tidewater docks, stocks at other intermediate storage piles between mine and consumer, and coal in transit.

[8] Canvass discontinued.

Source: U.S. Bureau of Mines, Minerals Yearbook, 1964: Volume II, Mineral Fuels (Washington: Government Printing Office), pp. 135 and 136.

TABLE 3.14

TRENDS IN BITUMINOUS COAL RECEIPTS BY USERS, WEST SOUTH CENTRAL REGION OF THE UNITED STATES

Coal Use	Thousands of Tons 1957	Index of Volume Shipped (1957 = 100)							
		1957	1958	1959	1960	1961	1962	1963	1964
Total	1,868	100	85.6	74.3	59.6	42.9	44.9	42.9	58.8
Electric utilities	65[a]	100	1.5	0	0	0	0	100.0	75.0
Coke and gas plants	1,050	100	92.0	79.2	67.3	49.0	61.5	58.7	82.5
Retail dealers	161	100	32.9	36.0	44.1	28.0	28.6	23.0	19.3
All others	592	100	97.8	84.0	56.8	41.0	24.8	22.3	31.1

[a]Base period 1963.

Source: U.S. Bureau of Mines, Minerals Yearbooks.

TABLE 3.15

ANNUAL PRODUCTION AND VALUE OF NATURAL GAS IN ARKANSAS

Year	Marketed Production (million cubic feet)		Value (thousands of dollars)	
	State	Arkansas Valley	State	Arkansas Valley
1954	33,471	11,581	$ 1,841	$ 637
1955	32,123	12,254	1,799	686
1956	30,162	14,365	1,810	862
1957	31,327	17,852	2,256	1,285
1958	32,890	23,466	2,664	1,901
1959	40,674	31,971	3,539	2,782
1960	55,451	41,942	6,599	4,991
1961	59,547	42,146	8,039	5,691
1962	66,213	50,227	9,866	7,484
1963	76,101	56,758	11,796	NA
1964	76,167	55,817	11,806	NA

NA-Not Available for these years.

Source: U.S. Bureau of Mines, Minerals Yearbooks.

TABLE 3.16

NATURAL GAS STATISTICS FOR ARKANSAS, 1964

		Million Cubic Feet
Disposition of Arkansas production:		
Marketed within the State		70,482
Shipped from the State		5,685
Total		76,167
Sources of gas received in Arkansas:		
Arkansas		70,482
Other West South Central states (Louisiana, Oklahoma, Texas)		222,063
East South Central Region (Alabama, Kentucky, Mississippi, Tennessee)		11
Mexico		573
Total quantity marketed		293,129
Less transmission losses and unaccounted for		-18,826
Changes in storage		-632
Total consumption		273,671
Uses of natural gas in Arkansas:		
Residential		41,296
Commercial		23,918
Industrial		
Field (pumping, drilling, extraction loss and fuel)	7,990	
Petroleum refineries	10,757	
Used as pipeline fuel	11,388	
Electric utilities	64,419	
All other fuel uses	113,903	
Total industrial use		208,457
Total consumption		273,671

	Cents Per MCF[*]
Average value at point of consumption:	
Residential	73.4
Commercial	52.4
Industrial (total)	23.9
Average for all uses	33.8

[*] Thousand cubic feet.

Source: U.S. Bureau of Mines, Minerals Yearbooks.

TABLE 3.17

ESTIMATED RESERVES OF LIGNITE, BY COUNTIES IN THE
ARKANSAS RIVER REGION, 1954[a]

County	Short Tons
Pulaski	12,500,000
Saline	6,500,000
Grant	300,000
Dallas	4,900,000
Cleveland	200,000
Total	24,400,000

[a] Limited to those deposits lying less than 100 feet below the surface.