STATE OF OKLAHOMA

HONORABLE MARY FALLIN
GOVERNOR

ANNUAL REPORT

OKLAHOMA MINING COMMISSION
DEPARTMENT OF MINES

Ninety Fifth Annual Report
Calendar Year 2013

Mary Ann Pritchard
Director

ANNUAL REPORT

2013

As authorized by Mary Ann Pritchard, Director

In compliance with Title 45, Section 31,
Oklahoma Statutes

You can review this report on our website at
www.ok.gov/mines
or
Copies of this report may be obtained from

Oklahoma Department of Mines
2915 North Classen Boulevard, Suite 213
Oklahoma City, Oklahoma 73106

405.427.3859
405.427.9646 Fax
405.424.4932 Fax

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MINING IN OKLAHOMA – OVERVIEW

The Oklahoma mining industry has been very important to Oklahoma since before statehood. Currently, mining provides the basic raw materials for all of the products that we require so that: "If it is not grown, it must be mined".

The Oklahoma Department of Mines regulates the production of solid minerals in the state, including coal and non-fuel minerals (crushed stone/limestone, granite, sand/gravel, clay/shale, dimensional stone, gypsum, salt, tripoli, asphalt, Bentonite, copper, iron ore, volcanic ash, lead/zinc, and chat). The Oklahoma Corporation Commission regulates the production of the liquid and gaseous minerals in the state including iodine and helium, which are non-fuel minerals whose values are included below in the national statistics for non-fuel minerals used in this report. The Oklahoma Corporation Commission also regulates the production of the fuel minerals, oil and natural gas, which are reported as a separate Oil/Gas category for state and national statistics and are not included in the non-fuel mineral production report totals.

In 2013, Oklahoma ranked 30th in the U.S. for non-fuel mineral production with a value of $755 million, according to the National Mining Association. Oklahoma is ranked 2nd in the U.S. for gypsum production of 5.35 million tons, according to the U. S. Geological Survey (USGS) data. Coal production slightly decreased from 1.17 million short tons in 2012 to 1.16 million tons in 2013.

Mining production in Oklahoma is expected to grow due to increased need for major repairs and expansion of Oklahoma's highway and bridge infrastructure.

The Oklahoma mining industry has an excellent record of safety and environmental responsibility. Nationally, mining safety has been greatly improved from it past history. In 2013, Oklahoma reported zero fatalities and 40 non-fatal accidents in the mining industry. While the potential hazards at mines still exist, the continuing diligent efforts of all the mining companies and their employees are proving their great value for achieving productive, safe, and environmentally responsible mining.

OFFICE OF THE DIRECTOR - STATE OF OKLAHOMA
DEPARTMENT OF MINES - KEY PERSONNEL

Director ……	Mary Ann Pritchard
Deputy Director ……	Doug Schooley
Minerals Division Administrator ……	Bret Sholar
Coal Program Director ……	Rhonda Dossett
Chief Counsel ……	Mark Secrest
Chief Financial Officer ……	Suzen Rodesney

OKLAHOMA DEPARTMENT OF MINES

The Office of the Chief Mine Inspector was created before statehood for the safe operation of mines and the protection of the health of those employed in the mines. The territorial years were well noted for the many mining disasters, and officials were busied with the necessary investigations and recommendations following each serious or fatal accident. Over the years, major revisions in mining health and safety laws and the increase in surface mining versus underground mining helped to decrease mining fatalities in Oklahoma.

The extraction or mining of minerals from the earth occurs in every county of the state. Minerals mined in Oklahoma include coal, limestone, sand and gravel, gypsum, clay and shale, granite, volcanic ash, tripoli, salt, bentonite, iron ore, asphalt, copper and chat.

Before commencement of mining operations, a permit must be obtained from the Department. A permit is issued when the mine operator submits an acceptable application and posts adequate bond to cover reclamation costs should it be necessary for a third party to complete the reclamation process. The mining operator's permit application must include the requirements for legal and financial compliance, the safeguard of environmental resources, and an operations and reclamation plan. Before opening the site, the employees of the mining operation must be trained and certified in accordance with state and federal safety regulations. Mining practices, reclamation, and health and safety procedures are monitored on a regular basis by Department inspectors.

The general provisions of Title 45 O.S. address health and safety on the mine site and reclamation of mined land. In 1967, the Oklahoma Legislature passed the state's first reclamation law which became effective January 1, 1968. That law was replaced in July 1971 with the Mining Lands Reclamation Act, which requires better reclamation in general and includes all mining. Until the passage of such legislation, however, 17,000 acres had been mined with little or no reclamation. This Act is still in effect for non-coal lands.

The Surface Mining Control and Reclamation Act of 1977 was created by Congress with the passage of Public Law 95-87. Subsequently, the State of Oklahoma enacted further legislation to equal the enforcement ability of the federal government. The Coal Reclamation Act of 1978 enabled Oklahoma to operate the interim program law and regulations (Section 715, CFR 30) under P. L. 95-87. It was followed by permanent standards adopted in 1979.

OFFICE OF CHIEF MINE INSPECTOR ABOLISHED

In 1986, State Question 594 was passed by the Oklahoma voters. This amended sections of the Oklahoma Constitution by removing all mention of the Chief Mine Inspector. The Department of Mines is now administered by a Director chosen by the Mining Commission. The Director must be knowledgeable of the Oklahoma mining industry and have the ability to administer the functions of the Department.

DIRECTORS, DEPARTMENT OF MINES

Gayle Townley ..... 1986 -- 1987
Bennie Cox ..... 1987 -- 1993
James Hamm ..... 1993 -- 1998
Mary Ann Pritchard ..... 1998 -- Present

CHIEF MINE INSPECTORS

Pete Hanraty ..... 1907 -- 1910
R. W. Church ..... 1910 -- 1911
Ed Boyle ..... 1911 -- 1927
Miller D. Hay ..... 1927 -- 1931
Robert Brown ..... 1931 -- 1947
John M. Malloy..... 1947 -- 1963
Ward Padgett ..... 1963 -- 1980
Otis English ..... 1980 – 1980

DEPUTY CHIEF MINE INSPECTORS

Blaney Qualls ..... 1980 -- 1984
Gayle Townley..... 1984 -- 1986

TERRITORIAL DIRECTORS

Luke W. Bryan .....1894 -- 1901
William Cameron .....1901 -- 1907

STATE MINING BOARD

The State Mining Board was established at statehood with the express purpose of testing and certifying persons who would hold the important positions of mine superintendent, foreman, hoisting engineer, and fire boss. The Board was later given additional responsibilities: to promulgate and enforce rules and regulations with regard to the health and safety of persons employed in the mines, to issue or revoke certificates of competency for surface and underground mine positions, to require the submission and review of plans and specifications for underground mine ventilation and safety and to recommend approval or denial of such plans to the Chief Mine Inspector. In addition, the Board acted as mediator between miners and operators on matters of health and safety; the decision of the Board was binding unless overturned by an opinion of the Attorney General or by a court of law.

As revised by the 1982 Legislature, the Mining Board was composed of ten members. Four of the members were strip miners, of which at least two represented the industry mining non-coal minerals. Two members were practical miners, who held either underground mine superintendent, mine foreman, or fire boss certification. Two members were owners or superintendents of coal mines. One member was a non-supervisory miner who was actively employed in an underground coal mine for at least five years and held a minimum of a fire boss certificate. The last member was the Chief Mine Inspector, who was the executive officer of the Board.

THE OKLAHOMA MINING COMMISSION

In 1985, the State Legislature abolished the State Mining Board and replaced it with the Oklahoma Mining Commission. This nine member board, which held its first meeting in January, 1986, is the policy-determining body of the Department of Mines and determines the broad plans and programs for the Department.

The membership of the Commission consists of one person with a background in engineering or geology; one person with a background in labor or worker's safety; one person with a background in agriculture or soil conservation; one person with a background in transportation; one person with a background in economic development or banking; one person with a background in public utilities; one person with a background in natural resources; and two persons selected at large.

OKLAHOMA MINING COMMISSION - 2013

J. Clement Burdick III, **Vice Chairman** ..... Edmond, OK
Position #1; Engineering/Geology
Thomas J. Knight, Secretary ..... Edmond, OK
Position #2; Labor/Worker's Safety
George E. Fraley, **Chairman** ..... Chelsea, OK
Position #3; Agriculture/Conservation
B. Dave Donoley ..... Wilburton, OK
Position #4; Transportation
Jed W. Winters ..... Mangum, OK
Position #5; Banking/Economic Development
Tommy R. Caldwell ..... Shady Point, OK
Position #6, Public Utilities
Larry A. Ennis ..... Ada, OK
Position #7; Natural Resources
Ronald R. Cunningham ..... Hartshorne, OK
Position #8; At-Large
Tim D. Lochridge ..... Sulphur, OK
Position #9; At-Large

OKLAHOMA MINER TRAINING INSTITUTE

The Oklahoma Miner Training Institute (OMTI) is operated under the direction of the Oklahoma Mining Commission. The Institute, located at Eastern Oklahoma State College in Wilburton, OK provides training in all aspects of mine safety and health. Regularly scheduled classes are provided at the school, or at the mine sites throughout the state to minimize the inconvenience to both miners and operators.

Courses Offered by OMTI

Annual Refresher Training (Surface)
Annual Refresher (Underground)
Cardiopulmonary Resuscitation (CPR)
(CPR) Refresher
Electrical Retraining
Fire Prevention and Control
First Aid (Initial)
First Aid (Refresher)
Instructor Training
New Miner Training #1 (Surface)
New Miner Training #2 (Surface) Blasting
New Miner Training (Underground)
State and Federal Regulations
State Surface Certification
State Surface Certification Refresher
Surface Blasters Refresher
Surface Blasters Initial

OMTI Personnel

Aaron Farris, Executive Director
Danita Oller, Secretary
Danny Thornburg, Instructor

OKLAHOMA MINER TRAINING INSTITUTE 2013 ANNUAL REPORT				
	# Miners Trained		Total #	Total #
Year	Coal	Metal/Non-Metal	Of Classes	Classroom Hours
2013	99	3,980	125	1,272

PUBLIC SERVICE

In April 2000, The Oklahoma Department of Mines presented its first Student Outreach Program. The program is designed to provide Oklahoma student and teachers with a better understanding of the mining process in Oklahoma. The Department conducted six public/student outreach presentations during 2013.

- Water Appreciation Day at the State Capitol Building in March 2013;
- U.S. Lime underground tour in March 2013;
- Aggregate Day at the State Capitol Building in April 2013;
- ScienceFest at the OKC Zoo in April 2013;
- Tahlequah Rock & Mineral Show in August 2013; and
- Camp Sparrowhawk in Tahlequah in October 2013.

SAFETY COMMITTEE

The Oklahoma Mining Commission established a Safety Committee in March 2000. This committee creates and produces monthly "Safety-Grams" for distribution to all mining permittees and operators in Oklahoma. Safety-Grams have been published since 2000. The Safety-Grams cover basic first-aid, safe operation of mining equipment, and compliance with Oklahoma mining rules and regulations. Safety-Grams are distributed on mine sites, so all mine employees have access to the information. Each Safety Gram is also posted on our website at www.ok.gov/mines under publications.

ODM INSPECTOR'S SAFETY AWARDS

In 2006, the Oklahoma Department of Mines created the Inspector's Safety Award. Since its inception, 178 awards have been earned by mine operators across Oklahoma. Recipients are chosen on an established set of criteria to reward operators for safe mining practices. These criteria include number of violations, reduction in violations from the previous year, and warnings. The awards are presented each year at the Oklahoma Mine Health & Safety Conference. ODM decided to make the awards more visible by using 30" by 36" road signs produced by the Oklahoma Department of Transportation's Sign Shop. These awards are much coveted, and ODM is proud to recognize these operators who make safety a priority.

OKLAHOMA MINE HEALTH AND SAFETY CONFERENCE

The State of Oklahoma is one of a very few states that has its own Mine Health and Safety Conference. For the past nineteen years, the Oklahoma Miner Training Institute and the Oklahoma Department of Mines have joined with the Mine Safety and Health Administration (MSHA) to co-host this conference. The purpose of the conference is to combat health and safety issues that plague the mining industry. This conference is usually held in the fall of the year at a designated site in Oklahoma City. As many as twelve other mining states come to Oklahoma to attend beneficial workshops and receive recognition awards for their safety efforts.

GEOLOGY AND MINERAL RESOURCES OF OKLAHOMA

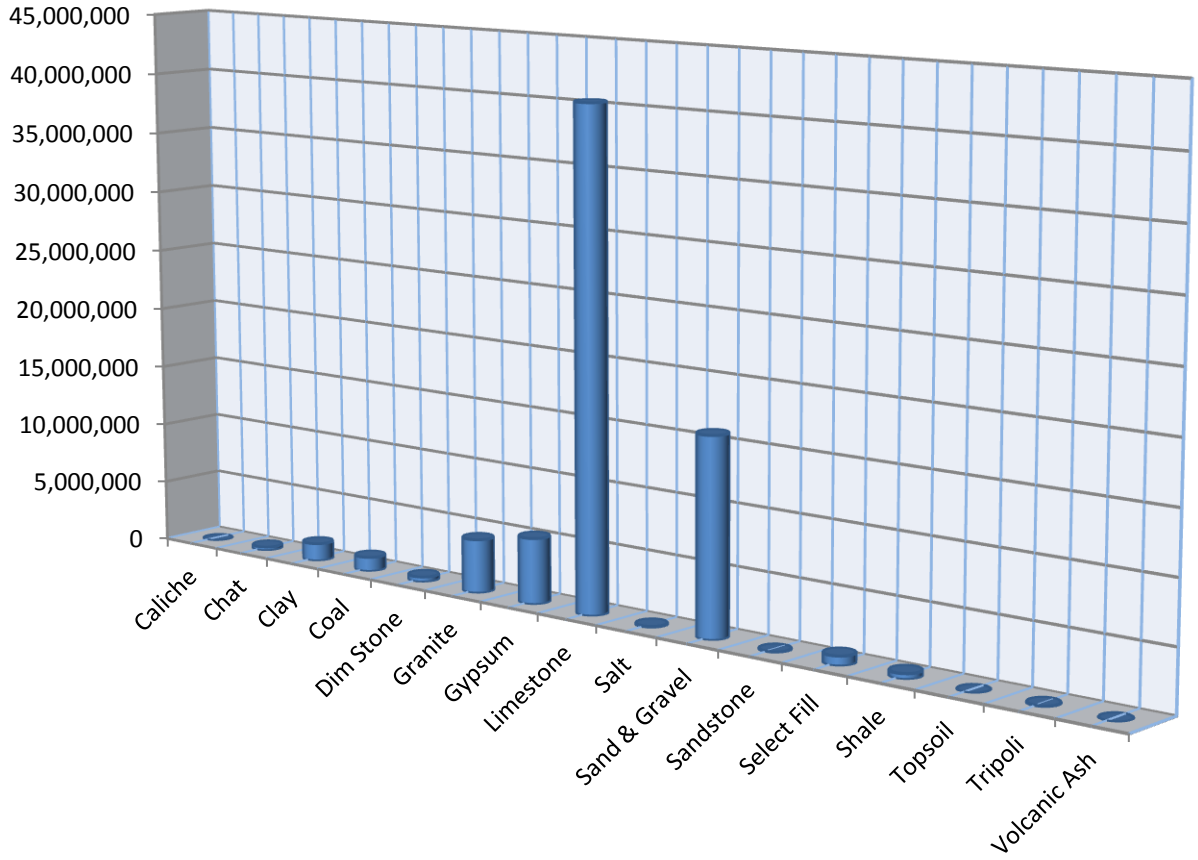
Geology

Oklahoma is a region of complex geology where several major sedimentary basins are set among mountain ranges and uplifts. The state contains many classic areas where fundamental concepts of geology, petroleum exploration, and mineral production have been formulated through the years. Because of its geologic history, Oklahoma has abundant mineral resources that include petroleum (crude oil and natural gas), coal, non-fuel minerals (lead, zinc, gypsum, limestone, salt, sand and gravel), and water.

Geologic forces deep within the earth's crust hundreds of millions of years ago caused portions of Oklahoma to subside as major sedimentary basins, while adjacent areas were folding and thrust upward as major mountain uplifts. Most of the outcropping rocks in Oklahoma are of sandstone, limestone, and gypsum. These sedimentary rocks typically are 2,000-10,000 feet thick in the northern shelf areas, and they increase sharply to 30,000-40,000 feet thick in the deep basins of the south. These sedimentary rocks contain most of the state's mineral resources, including petroleum, coal, water, and most of the non-fuel minerals. Sedimentary rocks rest upon a "basement" of igneous and metamorphic rocks that underlie all parts of the state.

Exposed in the southern Oklahoma mountain belts are a great variety of sedimentary and igneous rock units seen at few other places in the entire mid-continent region. Steeply dipping strata, such as those exposed along Interstate 35 through the Arbuckle Mountains, attest to the strong geologic forces that folded and raised the mountain blocks. Outcropping rocks outside the mountain regions are essentially horizontal, with dips of less than one degree being most common. These strata typically form gently rolling hills and plains: thick shale units form broad, flat plains and valleys, where resistant layers of sandstone and limestone cap mesas, cuestas, and hills 100-500 feet high. Rocks and soils of western Oklahoma typically are red in color, due to oxides present in the bedrock, whereas rocks and soils elsewhere are shades of brown, gray, and black.

Oklahoma Mining Production - Tons
2013



STATE OF OKLAHOMA
PRODUCTION 2013

Product Mined	2013 Production
Bentonite	0
Caliche	2,615
Chat	301,240
Clay	1,453,581
Coal	1,167,208
Dimensional Stone	420,859
Granite	4,387,976
Gypsum	5,354,300
Limestone	40,372,828
Salt	133,120
Sand & Gravel	15,930,684
Sandstone	83,898
Select Fill	757,367
Shale	434,382
Topsoil	4,133
Tripoli	84,052
Volcanic Ash	730
Total Production	**70,786,364**

OKLAHOMA MINERALS

COAL

Oklahoma fuel resources include coal, oil, and natural gas. Coal mining is regulated by the Oklahoma Department of Mines and is discussed below. Oil and natural gas production are regulated by the Oklahoma Corporation Commission and are not discussed in this report.

Identified coal resources are present in an area of approximately 8,000 square miles in 20 counties in eastern Oklahoma. The area is within the southern part of the Western Region of the Interior Coal Province of the United States. The coal beds are of Middle and Late Pennsylvanian age, 0.8-10 ft thick, 0.4-6.5% in sulfur content, coking or non-coking, contain 11,400-15,000 Btu/lb, and are low (2-7%) in inherent moisture. Oklahoma contains the most significant deposits of bituminous coal between the Mississippi River and the Rocky Mountains. Although the McClellan-Kerr Arkansas River Navigation System is available for barging coal to international ports, most coal production is shipped by truck or rail. As of January 1, 2007, 8.1 billion short tons of remaining coal resources have been identified; 76% are in the Arkoma basin and 24% are in the northeast Oklahoma shelf area. About 41% of the state's coal resources are low- and medium-volatile bituminous in rank and are present in the Arkoma basin. Four mining companies produced 1.16 million tons of coal at nine mines in five counties in 2013. The coal was used in one power plant and several lime and cement kilns in the state during 2013.

The bituminous coals of the state are low volatile in northern LeFlore County; medium volatile in northern LeFlore, Sequoyah, and most of Haskell Counties; high volatile A and B in Craig and Nowata Counties, parts of Haskell County, and in most of the remaining coal-bearing counties; and high volatile C in Coal and Pittsburg Counties.

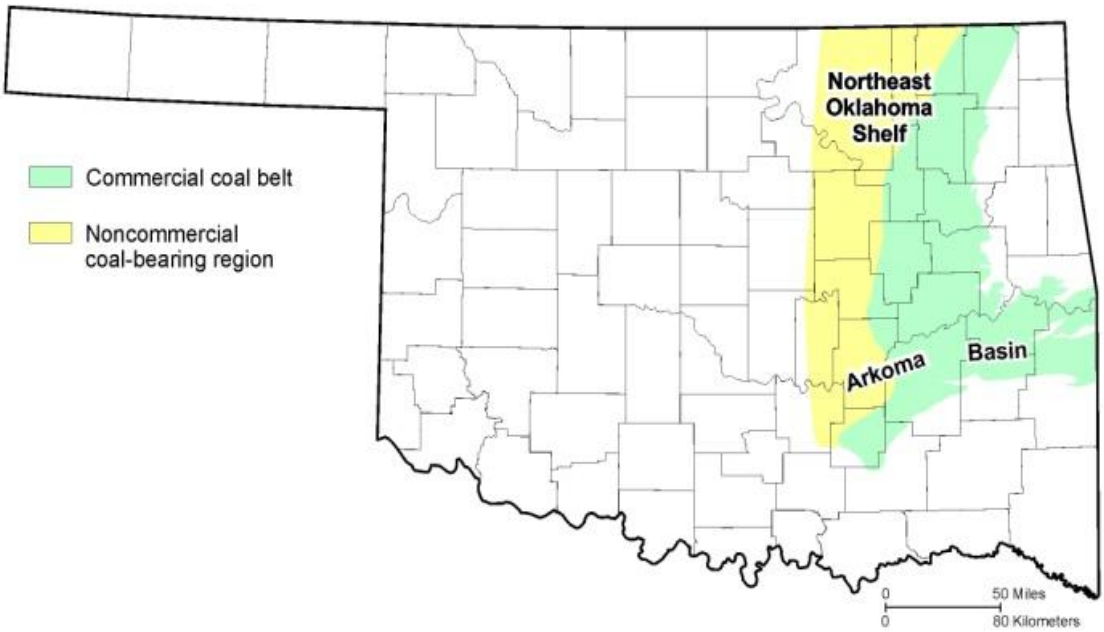
The commercial coalbeds in the Northeast Oklahoma Shelf area are 0.8-5.0 feet thick, average 2.0 feet thick, dip westward from ½ degree to 2 degrees, and contain more than 3 percent sulfur by weight with the exception of the low-sulfur Croweburg and Secor coals. The coalbeds in the Arkoma Basin area are 1-10 feet thick and occur in eroded anticlines and synclines that trend northeastward. The coals crop out mostly along the sides of these folded and faulted structures, and their dip ranges from 3 degrees to nearly vertical.

The face cleat trend is northwestward in the coal beds of the Shelf and the Basin. In the Arkoma Basin, coals that exhibit steep dips (18 degrees to 65 degrees) commonly were mined before 1960. From 1960 to 1974, no mines were developed in steeply dipping coalbeds because of cost. The Arab oil embargo of 1973 resulted in increases in demand and prices for coal. Thus from 1974 to 1984, seven surface mines were developed in steeply dipping coalbeds in the Arkoma Basin, and they produced coking and metallurgical coal in which the sulfur content was only 1%. Coal from steeply dipping beds has not been mined since 1984 because of the high cost. Of the remaining coal resources in the state, 76% are in the Arkoma Basin and 24% are in the Shelf area. The weighted average sulfur content of the total remaining coal resources is 2.3%.

Remaining Identified (Bituminous) Coal Resources in Oklahoma - January 1, 2007

County	Short Tons(thousands)
Atoka	29,619
Coal	292,875
Craig	638,560
Creek	15,573
Haskell	1,509,081
Latimer	840,492
LeFlore	1,962,725
Mayes	31,094
McIntosh	36,319
Muskogee	95,531
Nowata	27,829
Okfuskee	155,964
Okmulgee	339,909
Pittsburg	1,383,833
Rogers	360,183
Sequoyah	27,146
Tulsa	169,974
Wagoner	128,945
Washington	23,450
Total	**8,069,102**

Approximately 680 million tons of Oklahoma's remaining coal resources were estimated (Friedman, 1974) as strippable from beneath 100 feet or less of overburden, in beds 12 inches or more in thickness. Strippable coal resources were reported in Atoka, Coal, Craig, Creek, Haskell, Latimer, LeFlore, Mayes, McIntosh, Muskogee, Nowata, Okfuskee, Okmulgee, Pittsburg, Rogers, Sequoyah, Tulsa, Wagoner, and Washington Counties in 25 different coalbeds. The Demonstrated Reserve Base (DRB) shows 342 million tons as strippable (U.S. Department of Energy, 1996).



In 1986, the major use of Oklahoma coal was by out-of-state electric power generating plants, and the major use of Oklahoma coal in Oklahoma was in cement and lime kilns, at a paper plant, and for process heat at an auto assembly plant. In 1987, however, state law required blending 10% of the BTU value of total non-Oklahoma (Wyoming) coal consumed at Oklahoma power plants with Oklahoma coal. Consequently, a significant change took place in the distribution of Oklahoma coals by the end use. By 1991, more than 50% of Oklahoma coal production was shipped to Oklahoma electric power plants. Although the 1987 "10%" law was declared unconstitutional by the U.S. Supreme Court in January 1992, the 1991 Oklahoma coal production increased 16% from 1990.

This is explained by a shift in shipments of Oklahoma coal in 1991 to the AES Shady Point fluidized-bed combustion power plant in LeFlore County. Nevertheless, about 18 million tons of low-sulfur (0.4%) subbituminous Wyoming coal was shipped to Oklahoma public utilities in 1997. Oklahoma power plants rank fourth among the states consuming coal imported from Wyoming. Cumulative coal production in Oklahoma (1873-2013) is 297 million tons.

COALBEDS

A total of 25 named bituminous coal beds are present and have been mined in eastern Oklahoma. Most past production has been from the Hartshorne, Lower Hartshorne, McAlester, and Croweburg Coals, which were mined by underground methods. Coal rank, generalized for all coals at or near the surface, ranges from high-volatile bituminous in the northeast Oklahoma shelf and western Arkoma Basin to medium-volatile bituminous and low-volatile bituminous in the eastern Arkoma Basin in Oklahoma. Rank increases from west to east and with depth in the Arkoma Basin, attaining semianthracite in Arkansas.

HARTSHORNE COAL

At the southern edge of the coal region in Oklahoma, the Hartshorne Coal commonly is split into two beds by shale and sandstone that are 1 to 100 feet thick. The two beds are called the Upper and Lower Hartshorne Coals, and they have been extensively mined. North of the position of the long axis of the Arkoma Basin, the Hartshorne Coal is not split but is a single bed 1 to 7 feet thick containing, in most places, a persistent black shale or mudstone parting about 1 to 5 inches thick. Core drilling and successful efforts at underground mine development since 1969 have demonstrated significant underground coal resources in the Hartshorne Coal in areas in Haskell and LeFlore Counties, where it is 3 to 7 feet thick, of low- or medium-volatile bituminous rank, and an excellent coking coal. In 2013, two mining companies produced 708,750 tons of Hartshorne coal. 60% of Oklahoma's coal production was from Hartshorne Coal.

LOWER HARTSHORNE COAL

Mined in the Arkoma Basin mostly for metallurgical coke manufacture for 115 years, the Lower Hartshorne Coal has been shipped to electric power plants since 1985. Hundreds of underground mines, many of them referred to as no more than "dog holes", have been developed along the 120 miles of outcrop of the Lower Hartshorne Coal since 1872, at which time a railroad first connected McAlester, Pittsburg County, with Arkansas, and thus with the other states. The Lower Hartshorne Coal is 0.8 to 7.0 feet thick, averaging 4 feet in underground mines. The railroads used this premium-grade coal for steam, but historically the coal was shipped to blast furnaces in Colorado, Ohio, Pennsylvania, Texas and Japan. The Lower Hartshorne Coalbed contains at least 1,541,000 tons of remaining coal resources (Friedman, 1974), and it also contains coalbed methane resources.

UPPER HARTSHORNE COAL

The Upper Hartshorne Coal was once extensively mined at outcrops on the flanks of anticlines in LeFlore, Haskell, Latimer and Pittsburg Counties. It is 2 to 4 feet thick and is low- or medium-volatile bituminous in rank in the east end of the Arkoma Basin and high-volatile in the west end. The Upper Hartshorne Coalbed contains 663 million tons of remaining coal resources (Friedman, 1974), and it also contains coalbed methane resources.

McALESTER COAL

The McAlester Coalbed has been extensively mined by underground methods at McAlester in central Pittsburg County and in southeastern Coal County. Throughout the Arkoma Basin, the McAlester Coalbed is 1.5 to 5.0 feet thick and mostly high-volatile bituminous in rank. The coal is thickest in Coal and Pittsburg Counties. It is suitable for use in electric power generation, for blending with higher rank coal for coke manufacture, in cement and lime manufacture, and it is suitable for gasification and liquefaction conversion processes.

The McAlester Coal contains 1,012,000 tons of remaining resources (Friedman, 1974), and it contains significant coalbed methane resources in places where it is 3 to 5 feet thick.

STIGLER COAL

Correlated with the McAlester Coal (Friedman, 1978), the Stigler Coal has been mined historically to depths of 30 to 45 feet by surface methods in Haskell, LeFlore, Muskogee and Sequoyah Counties. The Stigler Coal was mined to 100 feet in Sequoyah County and to 140 feet in Haskell County. Mostly of low- and medium-volatile bituminous rank, the low-sulfur (0.5 to 1.0%) Stigler Coal has been used in coke manufacture in U.S. and overseas markets. In 1978-1979, 11 companies operated surface mines in this high BTU (13,000 - 14,500) coal, where it is 1.0 to 2.7 feet thick. This premium grade coal is overlain by 15 to 110 feet of medium- and dark-gray mudstone, the Stigler Rider Coal (correlated with the Upper McAlester Coal of Latimer, Pittsburg and Coal Counties), one sandstone bed, and in places, Quaternary silt and sand. The Stigler Coalbed contains 533 million tons of remaining resources (Friedman, 1974). One mining company produced 187,320 tons of Stigler Coal, accounting for 16% of Oklahoma's coal production in 2013.

CAVANAL COAL

The Cavanal Coal, moderate in ash and high in sulfur content, is of medium-volatile bituminous rank and crops out on the synclinal flanks of Cavanal Mountain in LeFlore County (Knechtel, 1949). Of high-volatile bituminous rank, it was mapped in Pittsburg County (Hendricks, 1937). In 1976, it was mined at a surface operation on the north side of Cavanal Mountain, where it is 2 feet thick and overlain by 35 feet of blue-gray shale that is overlain by sandstone. Total remaining resources in the Cavanal Coal in the Arkoma Basin are 159 million tons (Friedman, 1974). About 60 feet below the Cavanal, the Lower Cavanal Coal, 2.0 to 2.2 feet thick, was mined by surface and underground methods in LeFlore County in 1942-43 (Knechtel, 1949). This medium-volatile bituminous coal contains undetermined resources.

LOWER WITTEVILLE COAL

The Lower Witteville Coal is widely distributed in the Arkoma Basin. In the first half of the twentieth century, underground mines produced 522,000 tons of this coal from Cavanal Mountain, LeFlore County, where it is 3 to 4 feet thick and contains thin shale partings. The Lower Witteville may correlate with the Drywood Coal in the Savanna Formation of the Northeast Shelf area (Friedman, 1982), or with an unnamed coal that occurs in a shale interval within the Bluejacket sandstone member of the Boggy Formation (Hemish, 1994). It is medium-volatile bituminous in rank, and thus it probably contains coalbed methane resources. The Lower Witteville Coal contains 52 million tons of identified coal resources in LeFlore County (Friedman, 1974).

ROWE COAL

A high-sulfur, high-volatile bituminous coal, the Rowe is 0.8 to 3.0 feet thick in Craig, Mayes, Muskogee, Rogers and Wagoner Counties. The remaining resources in the Rowe Coal are 25 million tons (Hemish, 1986, 1989). The Rowe Coal may be suitable for gasification and liquefaction conversion processes.

SECOR COAL

The Secor Coal in the Boggy Formation contains a minimum of 446 million tons of identified coal resources (Friedman, 1974). Recent exploration and mining indicates that additional millions of tons of this coal are present in LeFlore County. The Secor Coalbed is 1.5 to 4.3 feet thick, moderately brightly banded and medium-to-high-volatile bituminous in rank. High in ash and sulfur content, it contains 12,000 to 14,000 BTU/lb. The coal has been considered of marginal economic value for most markets. Discovery of a rare occurrence of a low-sulfur (1% or less) deposit of the Secor Coal in McIntosh and Wagoner Counties (Friedman, 1978) resulted in 3.2 million tons of production of this rare coal from 10 strip mines from 1978-1990.

WEIR-PITTSBURG COAL

Correlated from outcrops and drilling data in southeastern Kansas (Friedman, 1974), the Weir-Pittsburg Coal contains 496 million tons of identified coal resources in the Northeastern Oklahoma Shelf. Mined by surface methods in Craig, Mayes, Rogers, and Wagoner Counties, the Weir-Pittsburg Coal is 1.1 to 3.0 feet thick and is overlain by 20 to 30 feet of gray shale that in some places contains marine invertebrate fossils. This coal is high in sulfur (more than 3%) and ash (more than 12%). No production has been reported from this coalbed since 1980 because its run-of-mine condition has been of marginal economic value.

MINERAL COAL & MORRIS COAL

The Mineral is a high-volatile bituminous coal, 1.2 to 2.7 feet thick, averaging 1.8 feet in Craig, Nowata, Rogers, Tulsa, and Wagoner Counties. The Mineral Coal is overlain by a hard, thin, impure limestone and gray shale in most places in Craig County. Dunham and Trumbull (1955) described the Morris Coal as 7 to 30 inches thick, averaging 16 inches in the Henryetta Mining District. About 30 million short tons of identified resources of Morris Coal have been determined (Friedman, 1974). Although adverse geologic and mining conditions are present in the faulted area north of Morris, additional resources and recoverable reserves of Morris Coal undoubtedly are present in other places in Okmulgee County. Physical, chemical, petrographic and stratigraphic characteristics of the Morris Coal strongly indicate its correlation with the Mineral Coal of the Northern Shelf area (and of Kansas and Missouri)(Friedman, 1974, 1982).

The Eram Coal in Okmulgee County is also correlated with the Mineral Coal (Hemish, 1988). The Mineral Coal (and equivalent coalbeds) contains 198 million tons of identified coal resources in Craig, Nowata, Okmulgee, Rogers, Tulsa, and Wagoner Counties (Hemish, 1986, 1989, 1990, 1994).

CROWEBURG COAL

The Croweburg has been one of three leading coals produced in Oklahoma, because it contains 1% or less sulfur and a Free Swelling Index (FSI) of 6 or more in most of the area of its distribution in the Northeastern Oklahoma Shelf. A total of 681 million tons of identified remaining resources of the Croweburg Coal has been reported (Hemish, 1986, 1989, 1990, 1994) as present in Oklahoma. The Croweburg has been known as the Henryetta Coal, the Broken Arrow Coal, and the "Sequoyah" Coal (Oakes, 1944). In 2013, 20% of Oklahoma's coal production was Croweberg Coal. Three active mines sites in Northeastern Oklahoma produced 297,327 tons of Croweberg Coal.

IRON POST COAL

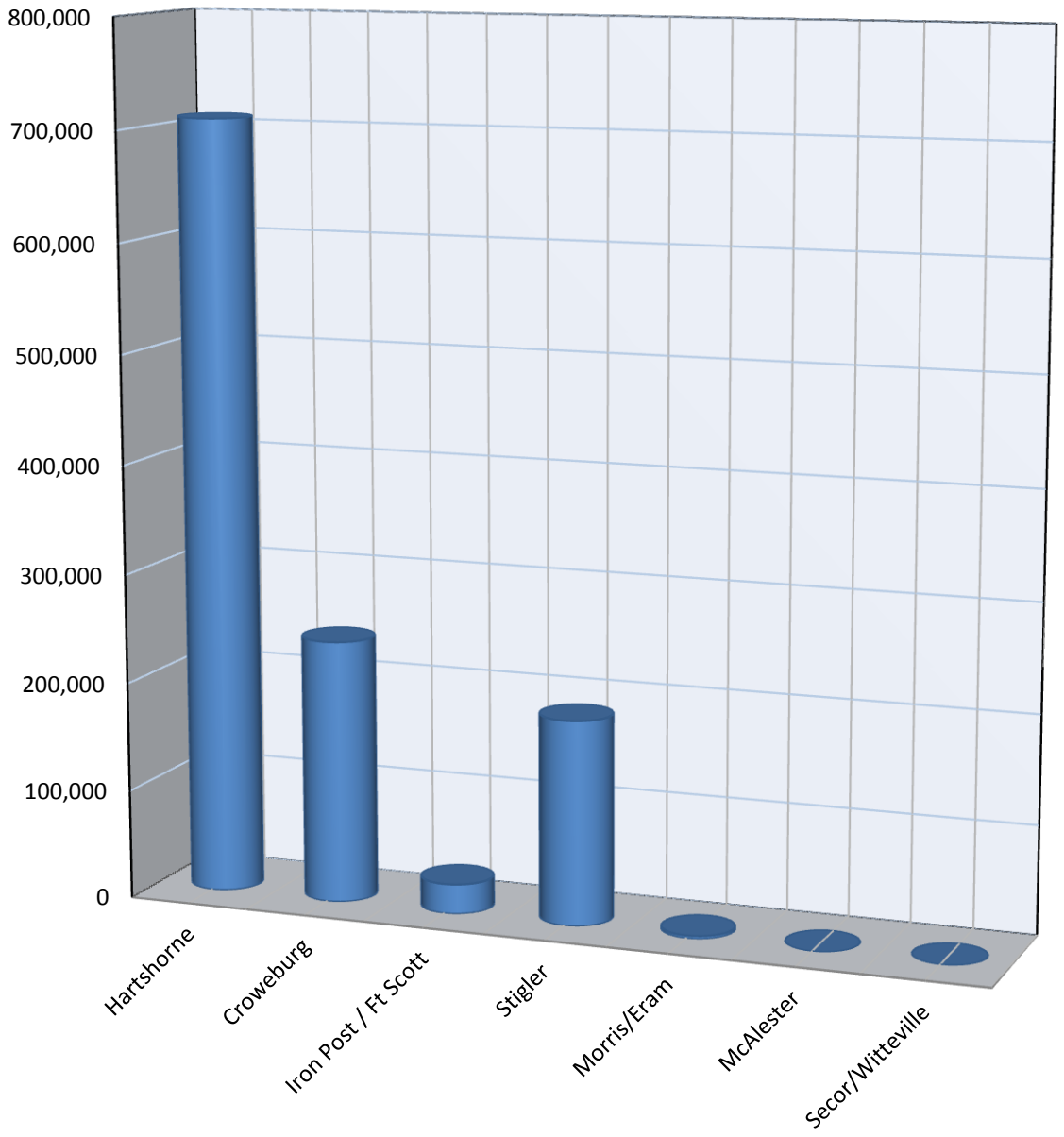
Fort Scott Coal is also known as Iron Post Coal. The Iron Post Coal is the uppermost commercial coal in the Senora Formation. It crops out across Craig, Nowata, and Rogers Counties in an irregular line roughly parallel to the outcrop line of the Croweburg Coal. The Iron Post Coal lies about 30 to 50 feet above the Verdigris Limestone and is overlain by a few inches to a few feet of black and gray shale. The shale is overlain in turn by a limestone known as Breezy Hill. It has a high BTU value that averages about 13,000. It averages about 12 inches in thickness, and has an average sulfur content of about 3.5%. In 2013, one company produced 27,217 tons of Iron Post Coal. Less than 2% of Oklahoma's coal production was from Iron Post Coal.

COAL PRODUCTION

In 2013, Oklahoma's coal production of 1,167,208 was a slight increase from the 1,075,069 million short tons produced in 2012. Oklahoma coal production has declined from its peak of 5.73 million tons in 1981 to a low of 978,842 thousand tons in 2010. Major in-state use of Oklahoma coal has been by the cement and lime industries and the use of coal at the Applied Energy Services Cogeneration Plant near Shady Point, Oklahoma. Until recent years, the major consumption of Oklahoma coal had been by out-of-state utilities. There is potential for Oklahoma's coal resources to provide the basis for economic growth; only the apex of coal resources has been exploited.

Oklahoma Coal Production Information (Tons Produced)			**2013**
Producing Counties			5
Companies Reporting			4
Mine Sites			9
Total Tonnage			1,167,208
Counties / Mine Sites / Tons / Type of Coal			**2013**
Craig County:			
Phoenix Coal 4286	Petit Mine	186,371 tons - Croweberg	
Phoenix Coal 4270	Kelley Mine	27,217 tons - Croweberg/Ft Scott	
Phoenix Coal 4194	Phoenix #3	28,440 tons - Croweberg	242,028
Haskell County:			
Farrell-Cooper 4280	Liberty #7	170,645 tons - Stigler	
Farrell-Cooper 4279	Liberty #6	16,675 tons - Stigler	187,320
LeFlore County:			
Farrell-Cooper 4275	Bull Hill	214,409 tons – Hartshorne	
GCI, Inc. 4243F	Pollyanna #8	494,341 tons – Hartshorne	708,750
Okmulgee County:			
Joshua Coal 4238	Metropolis	2,558 tons – Eram	2,558
Rogers County:			
Phoenix Coal 4282	H & H Mine	26,552 tons – Croweberg	26,552
Coal Permit Activities			
Permits Issued			1
Permits on Inspectable Units List			58
Acreage Permitted			22,140
Inspections Conducted			526
Violations Issued (NOVs/Cos)			61
Acreage Released (Phase III Bond Release Approvals)			519
Revisions Issued			27

Oklahoma Coalbed Production - Tons
2013



COAL Surface & Underground Tonnage Comparison				
YEAR (Fiscal)	Surface	Underground	% Surface Mined	Total
1930	351,109	2,905,557	11	3,256,666
1932	245,344	1,146,401	18	1,391,745
1933	228,674	758,230	23	986,904
1934	278,199	841,803	25	1,120,002
1935	275,233	832,590	25	1,107,823
1936	268,058	974,880	20	1,242,947
1937	452,704	875,037	36	1,327,741
1938	430,961	921,534	32	1,352,495
1939	355,175	707,037	33	1,062,212
1940	499,989	840,340	37	1,340,329
1941	675,429	982,583	41	1,658,012
1942	851,223	1,241,236	41	2,092,459
1943	1,273,960	1,582,462	45	2,856,422
1944	1,377,637	1,408,855	49	2,786,492
1945	1,804,954	1,295,974	58	3,100,928
1946	1,630,250	1,008,860	62	2,639,110
1947	1,812,881	1,013,885	64	2,826,766
1948	2,270,668	1,149,484	66	3,420,152
1949	2,218,492	991,960	69	3,210,452
1950	2,042,705	856,823	70	2,899,528
1951	1,437,278	957,691	60	2,394,969
1952	1,203,020	958,306	56	2,161,326
1953	1,426,672	870,162	62	2,296,834
1954	1,105,955	764,377	59	1,870,332
1955	1,118,841	787,440	59	1,906,281
1956	1,470,688	581,611	72	2,052,299
1957	1,469,891	474,875	76	1,944,766
1958	1,434,555	430,985	77	1,865,540
1959	1,347,922	348,608	80	1,696,530
1960	1,064,938	425,999	71	1,490,937
1961	953,265	128,436	88	1,081,701
1962	891,431	161,294	85	1,052,725
1963	956,232	55,713	94	1,011,945
1964	1,026,162	12,817	99	1,038,979
1965	954,043	9,523	99	963,566
1966	835,692	6,291	99	841,983
1967	822,903	2,352	99	825,983
1968	1,059,263	45,979	96	1,105,242
1969	1,716,877	120,490	94	1,837,367
1970	2,204,870	237,594	90	2,442,464
1971	2,038,565	194,928	91	2,233,493

COAL Surface & Underground Tonnage Comparison Cont…				
YEAR (Fiscal)	Surface	Underground	% Surface Mined	Total
1972	2,445,311	84,900	97	2,530,211
1973	2,194,670	0	100	2,194,670
1974	2,374,685	0	100	2,374,685
1975	2,850,427	0	100	2,850,427
1976	3,626,781	0	100	3,636,781
1977	5,346,654	0	100	5,346,654
1978	5,425,432	3,246	99	5,428,678
1979	4,491,211	1,476	99	4,492,687
1980	5,338,287	3,102	99	5,341,389
1981	5,723,312	5,149	99	5,728,461
1982	4,619,783	39,556	99	4,659,339
1983	3,672,107	13,783	99	3,685,890
1984	4,226,106	0	100	4,226,106
1985	3,343,188	0	100	3,343,188
1986	2,969,523	6,751	98	2,976,274
1987	2,866,840	0	100	2,866,840
1988	2,117,536	0	100	2,117,536
1989	1,728,437	39,855	98	1,768,292
1990	1,523,797	102,963	94	1,626,760
1991	1,863,720	26,839	99	1,890,599
1992	1,691,406	58,590	97	1,749,996
1993	1,704,275	92,076	95	1,796,351
1994	1,900,114	10,647	99	1,910,761
1995	1,860,514	25,450	99	1,885,964
1996	1,570,393	136,702	92	1,707,095
1997	1,407,562	211,686	87	1,619,248
1998	1,439,708	294,205	83	1,733,913
1999	1,461,234	199,760	88	1,660,994
2000	1,349,036	244,577	85	1,593,613
2001	1,303,334	412,434	76	1,715,818
2002	930,657	463,481	67	1,394,138
2003	1,174,237	456,837	72	1,631,074
2004	1,269,968	409,068	76	1,679,036
2005	1,172,751	465,459	72	1,638,209
2006	1,315,872	464,086	74	1,779,958
2007	1,146,230	514,288	69	1,660,518
2008	1,027,291	442,338	70	1,469,629
2009	548,961	487,063	53	1,036,024
2010	569,929	408,913	54	978,842
2011	736,306	438,266	57	1,174,572
2012	706,695	368,374	56	1,075,069
2013	494,341	672,867	57	1,167,208

MAJOR MINING DISASTERS IN OKLAHOMA

NAME & LOCATION	DATE	NUMBER KILLED	CAUSE
Osage Coal & Mining, Krebs	03/01/1885	13	Gas & Dust
Mines #1 & #2, Savanna	04/06/1887	18	Gas & Dust
Osage Coal & Mining Co., Krebs	01/07/1892	96	Gas & Dust
Choctaw-Oklahoma Gulf Railway Co., Alderson	04/29/1901	5	Gas & Dust
McAlester Coal Co., Alderson	12/28/1901	6	Gas & Dust
McAlester Coal Co., Alderson	01/13/1902	6	Cage Dump
Milby-Dow Coal Co., Dow	01/13/1902	10	Mine Fire
Central Coal & Coke Co., Carbon	04/13/1903	6	Gas & Dust
Missouri-Kansas Co., Wilburton	04/30/1905	13	Gas & Dust
Poteau Coal & Mercantile Co., Witteville	04/30/1906	14	Dynamite
Hailey-Ola Coal Co., Haileyville	08/26/1908	29	Oil Fire
Rock Island Coal & Mining Co., Hartshorne	10/21/1909	10	Gas & Dust
Western Coal & Coke Co., Lehigh	03/31/1910	6	Gas & Dust
San Boise Coal Co., McCurtain	03/20/1912	73	Gas & Oil
Union Coal Co., Adamson	09/04/1914	14	Slope Cave-In
Rock Island Coal & Mining Co., Alderson	06/30/1919	15	Gas & Dust
MK & T Coal Co., Degnan	08/21/1920	10	Gas & Dust
McCurtain Improvement Co., McCurtain	10/20/1922	8	Gas & Dust
Eastern Coal Co., Wilburton	01/13/1926	91	Gas & Dust
Superior Smokeless Coal Co., Tahona	09/03/1926	16	Gas & Dust
Covington Coal Co., Poteau	12/17/1929	61	Gas & Dust
Sample Coal Co., McAlester	10/30/1930	30	Gas & Dust
Hailey-Ola Coal Co., Haileyville	11/29/1930	13	Gas & Dust
Bond Valley Coal Co., Haileyville	01/17/1945	9	Gas & Dust

NON-FUEL MINERALS

Oklahoma's mines exclusively produced industrial minerals; no metals were mined in the state. Based upon USGS estimates of the quantities produced in the 50 states during 2012, Oklahoma was the largest producer of gypsum and the fourth largest of sand and gravel.

In 2013, Oklahoma's estimated value of non-coal raw mineral production was $755 million based upon the annual U.S. Geological Survey (USGS) data. The state ranked 30th in 2013 and 32nd in 2012 among the 50 states in total non-fuel mineral production value, of which Oklahoma accounted for 0.94% of the U. S. total value.

MINERALS PERMITS

Minerals Mining Permit Activities	2013
Permits Issued	42
Revisions Issued	118
Annual Renewals Processed	18
Inspections Conducted	3,515
Violations Issued	407
Non-Mining Blasting Activity	**2013**
Blasting Permits Issued	20
Blasting Plans Reviewed	36
Blasting Exemptions Issued	103
Non-Mining Blasting Inspections	11
Violations Issued	0

ASPHALT

Asphalt is a viscous residue of petroleum found in porous rocks. It was mined commercially in Oklahoma from around 1900 through 1960, primarily in Murray and Atoka Counties, but has not been mined in recent years.

BENTONITE

Bentonite is either of two principally aluminum silicate clays, containing some magnesium and iron, distinguished by sodium or calcium content with corresponding high or low swelling capacity and used in various adhesives, cements, and ceramic fillers. There was no Bentonite production in 2010.

CALICHE

Caliche is a sedimentary rock, a hardened deposit of calcium carbonate. This calcium carbonate cements together other materials, including gravel, sand, clay, and silt. Caliche is generally light colored but can range from white to light pink to reddish-brown, depending on the impurities present. It is generally found on or near the surface, but it can be found in deeper subsoil deposits as well. The layers can vary from a few inches to feet thick, and multiple layers can exist in a single location.

Caliche Production Information	2013
Producing Counties	2
Companies Reporting	2
Total Tonnage	2,615
Counties	
Ellis	1,109
Texas	1,506

CHAT (CHAT HAULING)

The term "***chat***" is applied to fragments of silicious rock, limestone, and dolomitic waste rejected in the lead-zinc milling operations that accompanied lead-zinc mining in Ottawa County, largely in the first half of the twentieth century. These chats, found as huge man-made mounds in that county, are utilized as construction aggregate, principally for railroad ballast, highway construction, and concrete production.

Chat Production Information	2013
Producing Counties	1
Companies Reporting	1
Total Tonnage	301,240
Counties	
Ottawa	301,240

CLAY

Clay is a naturally occurring material composed primarily of fine-grained minerals. Clay deposits are mostly composed of clay minerals, a subtype of phyllosilicate minerals, which impart plasticity and harden when fired or dried; they also may contain variable amounts of water trapped in the mineral structure by polar attraction. Organic materials which do not impart plasticity may also be a part of clay deposits.

Clay Production Information	2013
Producing Counties	22
Companies Reporting	35
Total Tonnage	**1,453,581**
Production By County	
Bryan	5,100
Canadian	443,050
Carter	1,770
Cherokee	33,684
Cleveland	1,327
Delaware	3,765
Greer	36,720
LeFlore	38,865
Lincoln	955
Logan	91,991
Mayes	27,673
Muskogee	78,348
Oklahoma	98,458
Payne	221
Pontotoc	44,445
Rogers	199,284
Seminole	243,773
Sequoyah	6,877
Tulsa	97,275

COPPER

The occurrence of **copper** in Oklahoma has been known since the mid-19th century, when observations were first recorded in what is now Jefferson County. Studies in 1962 proved that deposits in Jackson County were of a sufficient quality and thickness for commercial value. First production from these reserves was in 1965, although the operation is inactive now.

DIMENSIONAL STONE

The term **dimensional stone** refers to stone that is finished to specific dimensions and shapes. Most commonly it is quarried in large rectangular blocks, which are then sawed into slabs for further finishing, and used in building, monuments, furniture industrial applications and other uses. Other stone, sold as fieldstone, flagging, rubble and other similar names, is sold in either natural or broken sizes and shapes that are sorted into size ranges, but not finished or dressed to specific dimensions. These types of stone can be used for building, paving, decorative, or other purposes.

Dimensional Stone Production Information	2013
Producing Counties	9
Companies Reporting	58
Total Tonnage	**420,859**
Production By County	
Haskell	206,729
Johnston	3,077
Latimer	5,800
LeFlore	174,573
McIntosh	10,705
Muskogee	494
Pittsburg	15,824
Sequoyah	3,657

GRANITE

Oklahoma's commercially quarried **granite** deposits are confined to the Arbuckle and Wichita Mountains. Production is limited to Johnston and Murray Counties in the Arbuckles and Greer and Kiowa Counties in the Wichitas. The variety of colors of granite found in Oklahoma makes it desirable for use as dimension stone and monument stone.

Granite Production Information	2013
Producing Counties	4
Companies Reporting	5
Total Tonnage	**4,387,976**
Production By County	
Greer	667
Johnston	2,137,621
Kiowa	1,074,780
Murray	1,174,908

GYPSUM

Gypsum is a calcium sulfate compound found in large quantities as rock in western Oklahoma, principally in Blaine, Caddo, Comanche, Jackson, Major and Woodward Counties. The mineral is used as a plaster for interior walls and wallboard, and soil conditioners. Oklahoma is ranked second nationally in gypsum production for 2013.

Gypsum Production Information	2013
Producing Counties	6
Companies Reporting	9
Total Tonnage	**5,354,300**
Production By County	
Blaine	1,996,235
Caddo	1,036,940
Harper	1,511
Jackson	551,523
Major	1,353,851
Woods	414,240

IRON ORE

The term "**iron ore**" refers to any body of rock which contains economically extractable quantities of iron. The most common iron ores are the iron-based minerals hematite, magnetite and goethite. These minerals occur quite commonly throughout the world and account for the majority of iron ore production. These minerals occur in sedimentary, igneous and metamorphic environments with percentages of iron contained in typical ores ranging from thirty to sixty-five percent or higher. No iron ore has been mined in Oklahoma since 1988.

LEAD & ZINC

Lead and zinc ores were discovered in the Ottawa County region of northeastern Oklahoma in 1904. Rapid development of these resources and those in neighboring Kansas and Missouri made the Tri-State Mining District the leading producer of lead and zinc in the world. In almost every year from 1918 until 1945, Oklahoma led the world in the production of zinc. The greatest production levels were reached shortly after the discovery of the ore bodies at Picher in 1914; production highs for both lead and zinc mining industries were recorded in 1925. Production dropped to pre-World War I levels during the Great Depression. Although a minor resurgence in production occurred just before and during the Second World War, the lead and zinc mining industries were never able to again come close to the boom of the 1920's. Declining world prices forced a temporary shutdown of the field in 1959 and 1960; the mines were permanently closed in October 1970. Depletion of the higher grade ores in the field, a decline of the world price, and the cost of continual pumping made mining in the once-great mining center uneconomical and forced its closure. During the years of production, Oklahoma mines produced 1.3 million tons of recoverable lead and 5.2 million tons of recoverable zinc.

The lead and zinc mines of the Tri-State District operated with the room-and-pillar method of mining; many of the rooms were as much as sixty feet in height, with only a thin roof of rock separating them from the surface. Some of the contaminated waters from the mines have seeped into the drinking water and surface water systems of the area. In the 1980's and again in the early 2000's, the Department of Mines worked with task forces which focused on the pollution problems resulting from this situation. Extensive funding has been provided at various times by both the State of Oklahoma and the federal government for the remediation of soil and water contamination, but some of the problems persist. Relocation of most residents is now taking place.

LIMESTONE

Limestone represents one of the most widely available of the mineral resources of Oklahoma, and has generally accounted for around 57% of the reported tonnage of all non-fuel minerals mined in the state. Three major production areas exist within Oklahoma: the Tulsa-Rogers-Mayes counties region of northeastern Oklahoma north of the Arkansas River; the Arbuckle Mountains region of Murray County and extending into Pontotoc County; and the Wichita Mountains area of Comanche and Kiowa counties. Limestone is used mainly in the crusted state as concrete aggregate for building highways and other structures, railroad ballast, glass manufacturing, cement production, preparation of lime, and agricultural purposes. Some limestone is used as dimensional building stone.

Limestone Production Information	2013
Producing Counties	35
Companies Reporting	58
Total Tonnage	**40,372,828**
Production By County	
Adair	62,700
Atoka	1,890,946
Bryan	29,410
Caddo	19,677
Carter	992,737
Cherokee	633,033
Choctaw	1,884,454
Comanche	3,724,610
Craig	308,781
Creek	914,580
Delaware	871
Ellis	308
Haskell	245,116
Johnston	6,952,378
Kay	483,184
Kiowa	2,656,908
LeFlore	72,563

Limestone Production Cont… County	2013
Marshall	7,230
Mayes	1,743,826
McCurtain	564,186
McIntosh	66,542
Murray	4,982,482
Nowata	9,924
Osage	618,712
Ottawa	597,233
Pawnee	443,069
Payne	313,412
Pittsburg	660,117
Pontotoc	1,331,322
Pushmataha	64,126
Rogers	4,271,311
Seminole	153,264
Sequoyah	637,322
Tulsa	2,310,091
Wagoner	237,717
Washington	488,686

SAND & GRAVEL

Sand and gravel is produced in most counties in Oklahoma from deposits that are found near the many rivers and streams. Principal uses are in mixing concrete for highway building and other construction, and for railroad ballast. Silica sands, found chiefly in the Arbuckle Mountain region of south-central Oklahoma, are used in the manufacture of various grades of glass and other chemical and industrial activities.

Sand & Gravel Production Information	2013
Producing Counties	56
Companies Reporting	234
Total Tonnage	**15,930,684**
Production By County	
Atoka	48,060
Beaver	516,235
Beckham	97,711
Bryan	2,097,214
Canadian	914,336
Carter	25,647
Choctaw	58,229
Cimarron	4,226
Cleveland	704,148
Comanche	89,228

Sand & Gravel Production Cont… County	2013
Cotton	181,324
Creek	256,851
Delaware	1,836
Dewey	161,155
Garfield	64,020
Garvin	3,100
Grady	4,586
Harmon	13,045
Harper	7,567
Haskell	1,100
Hughes	13,686
Jackson	21,199
Johnston	1,792,313
Kay	261,033
Kingfisher	879,975
LeFlore	168,084
Lincoln	36,908
Logan	643,174
Love	485,608
Marshall	32,127
Mayes	2,970
McClain	105,695
McCurtain	433,975
McIntosh	795
Murray	9,680
Muskogee	359,694
Okfuskee	2,366
Oklahoma	1,031,030
Okmulgee	2,800
Ottawa	21,255
Pawnee	22,007
Payne	83,306
Pittsburg	3,933
Pontotoc	998,254
Pottawatomie	139,479
Rogers	9,000
Seminole	121,705
Sequoyah	58,044
Texas	17,108
Tillman	121,784
Tulsa	1,669,664
Wagoner	1,095,593
Woodward	36,822

SALT

Oklahoma's vast **salt** reserves underlie most of the northwestern portion of the state. Salt brine, dissolved from underground deposits by ground water, is brought to the surface either as natural springs or by pumping; the salt is recovered as a residue through solar evaporation of the brine. Salt is used primarily for stock feeds, recharging water softeners, and road de-icing.

Salt Production Information	2013
Producing Counties	2
Companies Reporting	2
Total Tonnage	133,120
Production By County	
Harmon	1
Woods	133,119

SANDSTONE

Sandstone (sometimes known as arenite) is a clastic sedimentary rock composed mainly of sand-sized minerals or rock grains. Most sandstone is composed of quartz and/or feldspar because these are the most common minerals in the earth's crust. Since sandstone beds often form highly visible cliffs and other topographic features, certain colors of sandstone have been strongly identified with certain regions. Rock formations that are primarily composed of sandstone usually allow percolation of water and other fluids and are porous enough to store large quantities, making them valuable aquifers and petroleum reservoirs.

Sandstone Production Information	2013
Producing Counties	3
Companies Reporting	3
Total Tonnage	83,898
Production By County	
Caddo	79,510
Cleveland	2,950
Haskell	1,438

SELECT FILL

Select Fill is a clay-based excavated product that packs well. This dirt has some rocks present, but is generally composed of clay and/or silty sand. It is appropriate for filling holes or as a base for other materials around a house foundation or berm.

Select Fill Production Information	2013
Producing Counties	16
Companies Reporting	19
Total Tonnage	757,367
Counties	
Caddo	8,472
Cleveland	133,791
Garvin	6,245
Love	1,428
Oklahoma	370,390
Ottawa	7,550
Pontotoc	12,199
Pottawatomie	20,441
Rogers	51,231
Stephens	6,379
Tulsa	83,939
Wagoner	35,881
Washington	19,421

SHALE

Shale is a classic sedimentary rock typically composed of variable amounts of clay sized particles and weathering debris. The addition of variable amounts of other mineral constituents alters the color of the rock. In manufacturing, shale is used as a filler material for concrete and brick.

Shale Production Information	2013
Producing Counties	14
Companies Reporting	25
Total Tonnage	434,382
Counties	**2013**
Beckham	11,619
Blaine	52,440
Canadian	8,510
Coal	63,092

Shale Production Cont….	2013
Creek	10,574
Grant	33,225
Harper	25,278
Kingfisher	46,545
LeFlore	6,870
Logan	4,980
Roger Mills	36,522
Sequoyah	103,966
Tulsa	28,311
Washington	850
Wagoner	1,600

TRIPOLI

Tripoli is the general name for soft, porous silica found in sedimentary rocks in Ottawa County and neighboring parts of Missouri and Arkansas. Primarily used as an abrasive, it is also used in concrete and as paint filler. One company is at present responsible for the production in Oklahoma. The United States is self-sufficient in tripoli and much of the product is exported.

Tripoli Production Information	2013
Producing Counties	1
Companies Reporting	1
Total Tonnage	84,052
Counties	
Ottawa	84,052

VOLCANIC ASH

Volcanic Ash is composed of fine, uncemented particles of volcanic dust that were deposited in lakes during pre-historic activity. These deposits occur in many western and central counties in Oklahoma. The material is primarily used for concrete mixtures, abrasives, and insulating compounds.

Volcanic Ash Production Information	2013
Producing Counties	1
Companies Reporting	1
Total Tonnage	730
Counties	
Ottawa	730

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Oklahoma Geological Survey
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Norman, Oklahoma

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Norman, Oklahoma

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University of Oklahoma
Norman, Oklahoma

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