OKLAHOMA GEOLOGICAL SURVEY

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MINERAL REPORT NO. 34

The Mineral Industries of Oklahoma in 1956 and 1957

Part 1. The Mineral Industries of Oklahoma in 1956
Final Advance Summary

Part 2. The Mineral Industries of Oklahoma in 1957
Preliminary Annual Summary

by

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THE MINERAL INDUSTRIES OF OKLAHOMA IN 1956 AND 1957[1]

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Part I

THE MINERAL INDUSTRIES OF OKLAHOMA IN 1956

Annual Advance Summary

Oklahoma's phenomenal mineral production attained a record total of $757 million in 1956, compared with $711 million in 1955 and $650 million in 1954. Production of 13 minerals and 5 mineral fuels was reported from 74 of the state's 77 counties. Compared to other states in 1956, Oklahoma was the third largest producer of natural-gas liquids and natural gas, and fourth largest producer of crude petroleum. Appreciable quantities of zinc, lead, cement, coal, gypsum, sand and gravel, and stone also were produced.

The mineral fuels—petroleum, natural gas, natural-gas liquids, and coal—were the state's most important minerals in value, accounting for 95 percent of Oklahoma's total value of mineral production. Metals and nonmetals were responsible for the remaining 5 percent. Petroleum was produced in 58 of Oklahoma's 77 counties, natural gas in 56 counties; nonmetals in 70 counties, and metals (lead and zinc) only in Ottawa County. Oil and natural gas were produced in a wide belt extending from the northeastern part of the state to the southwestern and northwestern parts; nonmetal mining was widely distributed over the northeast, north-central, and central regions, and in the Arbuckle and Wichita Mountain areas of the southern part.

[1] Prepared under cooperative agreements for the collection of mineral statistics between the United States Bureau of Mines, Department of the Interior, and the Oklahoma Geological Survey.

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TABLE I.—Mineral production in Oklahoma, 1955-56[1]

Mineral	1955 Short tons (unless otherwise stated)	1955 Value	1956 Short tons (unless otherwise stated)	1956 Value
Clays	724,156	$ 726,856	705,061	$ 701,038
Coal	2,163,536	12,667,563	2,006,987	12,340,642
Lead (recoverable content of ores, etc.)	14,126	4,209,548	12,350	3,877,900
Natural gas—million cubic feet	614,976	45,508,000	678,603	54,288,000
Natural-gas liquids:				
Natural gasoline & cycle products—thousand gallons	504,692	28,770,000	489,963	26,543,000
LP-gases—thousand gallons	512,320	14,297,000	579,101	23,427,000
Petroleum (crude)—thousand 42-gallon barrels	202,817	563,830,000	215,862	600,096,000
Sand and gravel	6,293,798	4,785,786	5,946,693	4,842,506
Stone	10,933,355	12,295,274	10,546,612	12,416,886
Zinc (recoverable content of ores, etc.)	41,543	10,219,578	27,515	7,539,110
Value of items that cannot be disclosed: Asphalt (native), bentonite, cement, gypsum, lime, pumice, salt (common), sulfur, and tripoli		15,525,248		13,058,314
Total Oklahoma		[2]$711,089,000		[2]$757,116,000

[1] Production as measured by mine shipments or mine sales (including consumption by producers).
[2] Total adjusted to avoid duplication in values of clays and stone.

CONSUMPTION AND MARKETS

Oklahoma mineral industries processed a significant part of their output into finished and semi-finished products for in-state consumption and for out-of-state shipments. These industries included oil refineries, natural gasoline and cycle plants stripping natural gas of condensable liquids; zinc smelters reducing zinc concentrate mined in Oklahoma; brick, tile, pottery, glass, and cement plants using clays, shales, silica sands, and limestone of Oklahoma; and producers of building materials made of Oklahoma gypsum. Large quantities of petroleum and natural gas continued to be transmitted by pipelines to industrial sections of the eastern and north central states.

The state regulatory body under the Inter-State Oil Compact permitted the allowable production of oil to increase 4 percent above the 1955 allowable to conform with the indicated demand for the state's petroleum in 1956. Total production increased 6 percent as over half of it comes from unallocated fields, including secondary-recovery operations.

TRENDS AND DEVELOPMENTS

Demand for Oklahoma crude petroleum showed no appreciable gain until the last month of the year. This was the first noticeable effect of increased shipments of oil to western Europe which resulted from halting of Middle-East oil shipments through the Suez Canal. As a result, production of petroleum gained only 6 percent over the previous year, and recoverable reserves were slightly reduced. Widespread exploratory drilling during the year accounted for many significant discoveries, especially in the deep areas of southern, southwestern, and northwestern Oklahoma. Osage County was the scene of the largest number of completions. Harper County, with its multiple-pay zones and high initial potentials, gave promise of developing into a major gas reserve. Deep Simpson gas reserves in southern Oklahoma became a reality with the successful completion of the state's deepest producing well in southeastern Grady County.

In the refining of petroleum, the trend toward increased capacity for producing premium-grade motor fuel and toward raising even higher the octane rating of motor fuels was continued. The competitive race for upgrading motor fuels was evidenced by new installations for catalytic cracking units and catalytic reformers at refineries at Cushing and Ponca City. The Tide Water Associated Oil Co. refinery at Drumright, which was shut down last year, was dismantled. A 20,000-barrel per day refinery at Cushing will undergo change in ownership and modernization to upgrade product quality.

Custom Mills and Smelters.—Six custom mills in Oklahoma treated lead-zinc ores mined locally and from Kansas, and 3 mine mills treated lead-zinc ores from company mines only.

Three smelting companies operated 3 horizontal zinc retort plants in Oklahoma in 1956. These were the plants of American Metals Co., Ltd., at Blackwell, Kay County; National Zinc Co. at Bartlesville, Washington County; and Eagle-Picher Co. at Henryetta, Okmulgee County.

Mineral Brokers.—Several smelting companies maintained mineral brokers or ore buyers in the Tri-State District of Oklahoma, Kansas, and Southwest Missouri. No metal concentrates were stockpiled at the mines as all production continued to be purchased f.o.b. the mill by the brokers.

TABLE II.—Average unit value of mineral commodities produced in Oklahoma, 1952-56

Commodity	1952	1953	1954	1955	1956
Asphalt, native—short ton	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75
Portland cement—					
376-pound barrel	2.47	2.54	2.64	2.72	2.89
Masonry cement—do	---	---	---	---	[1]3.81
Clays:					
Miscellaneous—short ton	1.04	1.02	[2]1.09	1.01	.99
Bentonite—do	15.00	9.64	10.00	4.50	4.50
For cement—do	1.00	1.00	1.00	1.00	1.00
Coal—do	5.78	6.10	5.88	5.86	6.15
Gypsum—do	2.64	2.76	2.81	2.94	2.93
Lead—pound	.161	.131	.137	.149	.157
Lime—short ton	10.25	8.67	9.85	9.55	11.02
Natural gas—					
1,000 cubic feet	.054	.069	.070	.074	.080
Natural-gas liquids:					
Natural gasoline and cycle products, per gallon	.073	.065	.051	.057	.054
LP-gases, gallon	.037	.036	.030	.028	.040
Petroleum—42-gallon barrel	2.56	2.70	2.79	2.78	2.78
Pumice—short ton	9.87	9.54	8.36	---	10.00
Salt (common)—do	7.47	7.47	7.62	7.83	8.99
Sand and gravel—do	.77	.85	.79	.76	.81
Stone:					
Granite—short ton	95.76	102.34	60.40	[3]67.91	35.33
Sandstone—do	8.37	.60	1.45	1.16	1.49
Limestone—do	1.09	1.07	1.08	1.15	1.23
Miscellaneous (crushed)—do	.46	.41	.34	.47	.58
Sulfur (recovered)—do	---	[1]26.74	26.50	26.50	[4]26.64
Tripoli—do	---	5.00	3.00	3.00	3.00
Zinc—pound	.166	.115	.108	.123	.137

[1] First year reported.
[2] Revised figure.
[3] Dimension granite.
[4] Calculated on a sulfur content basis.

EMPLOYMENT IN THE MINERAL INDUSTRIES

Employment.—Total employment in the Oklahoma mineral industries increased slightly to an all-time high of 52,300 from the previous year. Distribution of this total employment was 93 percent to oil and gas mining, 2 percent to metals, 2 percent to coal, and 3 percent to nonmetals. Total wages in 1956 for these mineral industries was $253.9 million, a gain of 9 percent over the 1955 total. In addition to the employment for petroleum mining, 17,000 were employed in petroleum refineries and received $70 million in wages during 1956.

Accidents.—Accidents reported in coal, metal, and non-metal mining consisted of 5 fatal and 153 nonfatal injuries. Of these injuries, 3 fatal and 125 nonfatal were in coal mining.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Oklahoma continued to be a leading domestic producer of the nation's crude petroleum and natural gas in 1956 and remained a major supplier of refined products. Native asphalt and a substantial quantity of a low-bituminous coal also were produced.

Asphalt (Native).—Output of native rock asphalt (bituminous limestone and bituminous sandstone) was reported from Murray County in 1956. Production in 1956 was up 41 percent over the previous year.

Coal.—Coal production in Oklahoma, which underwent a 6-year decline trend to the end of 1954, gained in 1955, and then dropped 7 percent in 1956. Part of the loss was due to closing of the Lone Star Steel Co. mine near McCurtain following two explosions. The state had 35 operators in 11 counties. Haskell, Rogers, Pittsburg, LeFlore, and Sequoyah Counties were the 5 principal producers, each reporting over $1 million in value. Total output in 1956 was 2 million short tons valued at $12.3 million.

TABLE III.—Coal production, 1947-51 (average) and 1952-56

Year	Thousand short tons	Value	
		Total (thousand dollars)	Average per ton
1947-51 (average)	2,961	$15,080	$5.09
1952	2,194	12,688	5.78
1953	2,168	13,227	6.10
1954	1,915	11,265	5.88
1955	2,164	12,668	5.86
1956[1]	2,007	12,341	6.15

[1] Preliminary figures.

Natural Gas.—Oklahoma continued to rank third in the nation in marketed production of natural gas. Marketed production amounted to 679 billion cubic feet valued at $54.3 million, a 10-percent gain in volume and a 19-percent gain in value compared with 1955. Production was reported from 56 counties of which Texas, Garvin, Beckham, Oklahoma, and Grady Counties led in the order named. The industry continued its search for more reserves in 1956 by completing 317 gas wells out of a total of 8,052 wells of all types as reported by The Oil and Gas Journal. Exploratory drilling alone accounted for 39 gas discoveries out of 865 exploratory tests. Most promising of this exploratory drilling was in the Anadarko basin, where gas discoveries were made in Harper and Woodward Counties. Deep Simpson gas reserves in southern Oklahoma were tapped in Grady County. Estimated proved recoverable reserves of natural gas increased 4 percent in Oklahoma during 1956 to 13,755,049 million cubic feet, according to the Committee on Natural Gas Reserves of the American Gas Association.

Natural-Gas Liquids.—Production of natural-gas liquids from a total of 76 natural gasoline plants and 2 cycling plants in Oklahoma amounted to 1,069 million gallons in 1956 and was valued at $50.0 million. This was a year of rapid additions to storage of all light liquids. Demand for LP-gases for fuel was less than anticipated and markets for natural gasoline were depressed by excessive motor-fuel stocks in 1956. Natural gasoline and cycle products accounted for 46 percent of the quantity and 53 percent of the value, LP-gases for the remainder. According to the American Petroleum Institute, estimated proved recoverable reserves of natural-gas liquids in Oklahoma in 1956 were 355.6 million barrels, a gain of only 1.2 million barrels over 1955 estimates.

Petroleum.—Oklahoma remained the nation's fourth largest producer of petroleum in 1956 with an output of 216 million barrels valued at $600.1 million. This 6-percent production increase over 1955 still did not reach the 1927 record, when oil production was unregulated. Petroleum was reported from 58 counties, the leading 5 producers being Garvin, Osage, Carter, Stephens, and Creek. More than half of the 1956 production came from unallocated fields which include secondary-recovery projects.

The average price per barrel of petroleum at the wells was $2.78 in 1956, the same as in 1955. According to The Oil and Gas Journal, a total of 8,052 wells were drilled in Oklahoma in 1956, and of these, 4,825 were oil wells, 2,476 were dry, and the remainder were either gas or service wells. The search for more oil led to the drilling of 865 test wells in 1956, third in the nation. These 865 tests compared with 832 in 1955 and included 154 oil-productive and 39 gas-productive wells. Also, these tests discovered 93 oil fields and 39 gas fields, according to the Mid-Continent Oil & Gas Association.

Exploratory crews made many significant discoveries during the year. Success was widespread in the deep areas of southern, southwestern, and northwestern Oklahoma. The Anadarko basin and the counties on and adjacent to the Nemaha granite ridge were the scenes of much exploratory activity. Osage County, first in both exploratory and field development wells, accounted for 16 new fields out of 18 successful exploratory wells.

TABLE IV.—Marketed production of natural gas, 1947-51 (average) and 1952-56.[1]

Year	Million cubic feet	Value	
		Total	Per thousand cubic feet, cents
1947-51 (average)	471,192	$22,476,400	4.8
1952	554,033	29,918,000	5.4
1953	599,955	41,397,000	6.9
1954	616,355	43,145,000	7.0
1955	614,976	45,508,000	7.4
1956	678,603	54,288,000	8.0

[1] Comprises gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

TABLE V.—Natural-gas liquids produced, 1947-51 (average) and 1952-56

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value thousand dollars	Thousand gallons	Value thousand dollars	Thousand gallons	Value thousand dollars
1947-51 (average)	314,822	$22,854	244,362	$ 9,179	559,124	$32,033
1952	405,720	29,459	376,026	14,090	781,746	43,549
1953	433,650	28,066	414,036	14,886	847,686	42,952
1954	478,590	24,332	453,810	13,506	932,400	37,838
1955	504,692	28,770	512,320	14,297	1,017,012	43,067
1956	489,963	26,543	579,101	23,427	1,069,064	49,970

TABLE VI.—Production of petroleum (crude), 1947-51 (average) and 1952-56

Year	Thousand 42-gallon barrels	Value	
		At wells (thousand dollars)	Average per barrel
1947-51 (average)	159,720	$392,154	$2.46
1952	190,435	487,510	2.56
1953	202,570	546,940	2.70
1954	185,851	518,520	2.79
1955	202,817	563,830	2.78
1956	215,862	600,096	2.78

TABLE VII.—Capacity of petroleum refineries and cracking plants in Oklahoma, January 1, 1957
(Barrels per day)

Company	Location	County	Type of Plant	Crude oil capacity		Cracked gasoline capacity	
				Operating	Shutdown	Operating	Shutdown
Allied Materials Corp.	Stroud	Lincoln	S-A	3,000	----	----	----
Anderson-Prichard Oil Corp.	Cyril	Caddo	S-C-A	11,000	----	4,000	----
Bell Oil and Gas Co.	Grandfield	Tillman	S-C	8,000	----	5,800	----
Ben Franklin Refining Co.	Ardmore	Carter	S-C-A	13,000	----	8,000	----
Champlin Refining Co.	Enid	Garfield	Comp.	20,000	----	12,400	----
Cities Service Oil Co.	Ponca City	Kay	do	23,000	----	7,400	----
Continental Oil Co.	do	do	do	58,000	----	16,690	1,650
D-X Sunray Oil Co.	Duncan	Stephens	do	37,000	6,000	28,000	----
Do	West Tulsa	Tulsa	S-C-L	73,000	----	34,500	1,000
Kerr-McGee Oil Industries, Inc.	Cleveland	Pawnee	S-C	----	6,500	1,800	3,500
Do	Cushing	Payne	Comp.	22,000	----	5,250	----
Do	Wynnewood	Garvin	S-C-A	17,000	----	4,900	----
Midland Cooperatives, Inc.	Cushing	Payne	S-C	12,000	----	5,140	----
Monarch Refineries, Inc.	Oklahoma City	Oklahoma	S-A	1,000	----	----	----
Phillips Petroleum Co.	Okmulgee	Okmulgee	S-C	19,000	----	4,300	----
The Texas Co.	West Tulsa	Tulsa	do	35,000	----	22,500	----
Tide Water Associated Oil Co.	Drumright	Creek	do	----	15,000	----	4,300
Total				352,000	27,500	160,680	10,450

The following symbols indicate the type of plant:
S-A Skimming and asphalt
S-C-A Skimming, cracking, and asphalt
S-C Skimming and cracking
Comp. Complete
S-C-L Skimming, cracking, and lube

Beaver County, second with 13 new fields, owing to the intense drive for natural gas, was followed by Payne, with 7 fields, and McClain, with 5 fields. At the year end, special attention was centered on Cleveland County where 3 deep pools were tapped.

The state's depth record of 14,510 feet for a producing well was made by British-American Oil Producing Co. in the Knox field, Grady County. This discovery set off a deep search throughout the southern part of the vast Anadarko basin and is considered one of the 3 top discoveries of the year in the Mid-Continent region. Estimated proved reserves of crude oil in Oklahoma were reported by the American Petroleum Institute at 2 billion barrels, 6 million barrels less than 1955 estimates.

The indicated demand for total petroleum in 1956 was 213.6 million barrels compared with 205.3 million barrels in 1955. Crude oil stocks, originating in the state as of December 31, 1956, were 23 million barrels or 3 million barrels more than the indicated demand.

At the end of 1956, Oklahoma had 15 operating refineries, with a daily crude oil capacity that totaled 352,000 barrels, and 2 nonoperating refineries.

In the refining industry of the state, upgrading of motor fuels was continued by the installations of more cracking and reforming capacity and by the closing of two small refineries. Johnson Oil Refining Co. at Cleveland sold its pipeline gathering system to Kerr-McGee Oil Industries, Inc., and shut down its refinery in March. Wilcox Oil Co. shut down its 5,500-barrel-daily refinery at Bristow because of inability to compete in the high-octane gasoline race. The company sold 200 miles of crude-oil gathering lines to Mid-Continent Pipeline Co. and will continue marketing operations with products manufactured by D-X Sunray Oil Co.

Midland Co-operatives, Inc., put a new platformer (platinum reformer) unit in operation at its Cushing, Okla., refinery. The 3,000-barrel per day reformer will upgrade gasoline produced at the refinery.

Anderson Prichard Oil Corp. was expanding its Cyril, Okla., refinery capacity from 11,500 to 13,500 barrels of crude oil per day and also was adding a fluid cracking capacity of 11,000 barrels per day.

Cities Service Oil Co. was expanding its Ponca City, Okla., plant capacity from 23,500 to 35,000 barrels per day. A 6,500 barrel per day Rexformer was under construction.

Two Bureau of Mines reports concerning oil production in Oklahoma were published during 1956. These are: Bureau of Mines Report of Investigations 5326, "Analysis of Brines from Oil-Productive Formations in Oklahoma," by Jack Wright and others; and Bureau of Mines Information Circular 7787, "Some Recent Developments in Water Flooding in Washington County, Okla.," 1956-57, by J. P. Powell.

TABLE VIII.—Mine production of lead and zinc, 1947-51 (average), 1952-56, and total 1891-1956, in terms of concentrates and recoverable metals[1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content[2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1947-51 (average)	23,656	$ 4,553,617	89,422	$ 8,966,116	17,673	$ 5,555,487	47,821	$ 13,532,650
1952	20,473	4,104,934	101,726	11,714,605	15,137	4,874,114	54,916	18,232,112
1953	12,213	1,915,195	61,896	4,541,616	9,304	2,437,648	33,413	7,684,990
1954	19,004	3,194,245	84,444	5,466,727	14,204	3,891,896	43,171	9,324,936
1955	19,555	3,368,713	78,726	5,997,071	14,126	4,209,548	41,543	10,219,578
1956	17,971	3,225,015	52,993	4,485,122	12,350	3,877,900	27,515	7,539,110
1891-1956	1,657,395	159,975,445	9,694,067	479,249,276	1,272,276	191,135,097	5,110,897	767,195,674

[1] Based on Oklahoma ore ("dirt") and old tailings treated at mills during calendar year indicated.

[2] In calculating metal content of the ores from assays, allowance has been made for smelting losses of both lead and zinc. In comparing the values of concentrate ("ore") and metal, it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Output of metallic minerals in 1956 continued to decline for the third consecutive year owing to depletion of the higher-grade ore reserves and to increasing imports of concentrates and slab zinc. Production loss of zinc in 1956 was attributed mainly to cutbacks in the automotive industry, a principal consumer of this metal. The 1956 total value of lead and zinc, $11.4 million, represented a 21 percent drop from 1955. Government stockpile buying of lead and zinc had a stabilizing effect on prices.

Cadmium, Germanium, Indium, and Gallium.—These minor metals, occurring as trace elements in the lead-zinc concentrates of Oklahoma, were recovered from the flue and zinc duts of zinc retort smelters and from the precipitates of electrolytic zinc smelters. Production of these metals could not be assigned to state of origin, because they were recovered at the smelters from the accumulated flue dusts and residues of ores from various domestic and foreign sources.

Lead.—Mine production of lead in 1956, all from Ottawa County, was 8 percent less than in 1955 in terms of concentrates and 13 percent less in terms of recoverable metal. The value of the 12,350 short tons of recoverable lead, produced in 1956, was $3.9 million, a loss of 8 percent from the 1955 value. The largest producer of lead in the state was Eagle-Picher Co., followed by American Zinc, Lead & Smelting Co.

The price of lead opened the year at 16.0 cents per pound, New York, rose to 16.5 cents in January, dropped back to 16.0 cents the same month, and remained unchanged to the end of the year.

Zinc.—Mine production of recoverable sinc in 1956, all in Ottawa County, declined 34 percent from the previous year to 27,515 tons even though metal prices remained steady during 1956. Zinc output, valued at $7.5 million, declined 26 percent from the 1955 value. Eagle-Picher Co. was the principal producer in the state, followed by American Zinc, Lead & Smelting Co., Buffalo Mining Co., C. & M. Mining, and Contack Mining Co., Inc.

Zinc metal price at the beginning of 1956 was quoted at 13.0 cents per pound, East St. Louis, rose to 13.5 cents per pound on January 6, 1956, and remained stable to the end of the year.

A Bureau of Mines report dealing with the recovery of germanium and cadmium from Oklahoma zinc ore was published during the year. This is Bureau of Mines Report of Investigations 5190, "Laboratory Recovery of Germanium and Cadmium in Sphalerite Concentrates," by H. Kenworthy, A. S. Slarliper, and A. Ollar.

Three zinc retort smelters in Oklahoma operated in 1956. They were American Metals Co., Ltd., located at Blackwell, Kay County; Eagle-Picher Co., located at Henryetta, Okmulgee County; and National Zinc Co., at Bartlesville, Washington County.

Uranium.—Prospecting for the occurrence of radioactive mineralization was reported in Roger Mills and LeFlore Counties. A uranium discovery near Cheyenne, Okla., where ore was reported to be valued at $60 a ton, was inspected by an A.E.C. geologist.

A significant report, "Uranium-Bearing Carbonaceous Nodules of Southwestern Oklahoma," was published by James W. Hill as Mineral Report 33 of the Oklahoma Geological Survey.

Manganese.—Wayne Misner Ore Co. announced discovery of manganese in the Kiamichi area, Pushmataha County. The Kiamichi strike was reported to be higher grade ore and in larger quantities than the manganese being mined in Arkansas.

NONMETALS

Oklahoma, endowed with abundant resources of nonmetals, yielded $28.6 million worth of these commodities in 1956 compared with the record $31.3 million established in 1955. A return to a more normal amount of construction activity in 1956, from the booming 1955 year, accounted for most of the reduction. Also, a 96-day labor stoppage at one of the state's 2 cement plants caused an 85,000-ton production loss. Despite these reversals, the 1956 value of nonmetals still remained 11 percent higher than the 1954 value.

Commodities that established individual all-time high values in 1956 were sand and gravel, stone, lime, and common salt.

Cement.—Cement, the second leading product in terms of value of nonmetals produced in Oklahoma, underwent a one-fifth reduction from 1955. Two plants, at Dewey in Washington County and at Ada in Pontotoc County, operated throughout 1956. A third plant was under construction near Locust Grove, Mayes County, by the Ozark Portland Cement Co., Inc. (formerly Hercules Cement Co.). This plant, with planned capacity of 1,500 barrels daily, is situated in the midst of a reported 100-year supply of a limestone deposit of late Mississippian age.

Clays.—Oklahoma has extensive clay resources. Production in 1956 was used primarily in the manufacture of brick and tile, and to a lesser extent for the manufacture of portland cement and lightweight expanded clay products. Brick and tile were produced in Creek, Custer, Garfield, Greer, Lincoln, Oklahoma, Pittsburg, Seminole, and Tulsa Counties. Bentonite was produced in Dewey County. Expanded lightweight aggregate was made from clay in Tulsa and Oklahoma Counties.

Clay sold or used in 1956, including clay used for cement, was 705 thousand tons, valued at $701,000. This tonnage was slightly less than that of 1955. The Stroud Clay Products Co. in Lincoln County, which was idle for 3 years, changed management and underwent extensive remodeling and expansion. By the end of the year, this one-kiln plant expected to be operating 8 kilns with a total capacity of 2 million bricks yearly.

Gypsum.—Tonnage and value of gypsum recorded in Oklahoma in 1956 remained relatively high, about the same as in 1955, in response to continued demands for wallboard, plasters, and portland cement. Most of the production was from Blaine County, where the United States Gypsum Co. operated quarries and plants to manufacture wallboard and plasters. At Southard, Universal Atlas Cement Co. operated a quarry near Watonga, and S. A. Walton a quarry near Southard. Production for the first time was reported from Caddo County. A survey of gypsum deposits in the area

TABLE IX.—Clays sold or used by producers
1947-51 (average) and 1952-56

Year	Short tons	Value
1947-51 (average)	524,055	$ 433,677
1952	520,050	[1]577,420
1953	577,556	637,082
1954	452,050	1,282,848
1955	724,156	726,856
1956	705,061	701,038

[1] Revised figure.

TABLE X.—Sand and gravel sold or used by producers, 1947-51 (average) and 1952-56

Year	Commercial		Government-and-contractor		Total sand and gravel		Average value per ton
	Thousand short tons	Value thousand dollars	Thousand short tons	Value thousand dollars	Thousand short tons	Value thousand dollars	
1947-51 (average)	1,672	$1,371	941	$ 312	2,613	$1,683	$ .64
1952	2,354	2,209	1,416	703	3,770	2,912	.77
1953	2,998	2,928	2,014	1,331	5,011	4,259	.85
1954	3,211	3,380	2,213	885	5,424	4,266	.79
1955	3,654	3,719	2,640	1,067	6,294	4,786	.76
1956	3,417	3,886	2,530	957	5,947	4,843	.81

TABLE XI.—Stone sold or used by producers, 1952-56 by kinds

Year	Granite		Limestone		Sandstone	
	Short tons	Value	Short tons	Value	Short tons	Value
1952	5,337	$ 511,073	6,355,780	[1]$ 6,940,219	1,350	$ 11,300
1953	[2]6,862	[2]702,250	[2]5,654,022	6,029,258	228,897	137,407
1954	11,022	665,753	[1]6,974,697[3]	[1]7,527,413[3]	160,883	233,469
1955	576,187	1,276,088	[1]8,826,553[3]	[1]10,123,738[3]	236,778	275,702
1956	15,074	532,570	[1]8,626,450[3]	[1]10,603,022[3]	152,518	227,464

Year	Other stone		Total	
	Short tons	Value	Short tons	Value
1952	3,274,008	$1,511,742	[1]9,636,475	[1]$ 8,974,334
1953	2,600,213	1,061,822	[3]8,489,994	[3]7,930,737
1954	2,092,209	720,360	[1]9,238,811[3]	[1]9,146,995[3]
1955	1,293,837	619,746	[3]10,933,355	[3]12,295,274
1956	1,752,570	1,053,830	[3]10,546,612	[3]12,416,886

[1] Excludes dimension limestone.
[2] Revised figures.
[3] Includes limestone used in cement and lime.

of Weatherford and Clinton, Custer County, was completed by the Oklahoma Geological Survey. The survey showed gypsum deposits suitable for the manufacture of wallboard and plaster in sufficient quantity to meet the needs of the entire nation for the next 129 years at the current rate of consumption.

Lime.—Lime production in the state, all by the St. Clair Lime Co. in Sequoyah County, was slightly less than in the 1955 record year, but the value increased 14 percent.

Pumice.—Production of pumice in 1956, reported by one operator in Beaver County, was comparable with production and value in 1954. No pumice was produced in 1955. B. M. Sayler, Jr., announced purchase of a mine in Harper County. The deposit, sufficiently close to the surface to permit open pit operation, will be reopened. A promising use for the material is as a filler for fertilizers.

Salt.—Output of salt, reported by 3 producers in 3 counties, increased 12 percent over 1955. At Sayre in Beckham County, salt continued to be produced by injecting fresh water through wells into a salt bed and recovering the brine for surface evaporation. In Woods County, salt was produced from surface encrustations on the Big Salt Plain of the Cimarron River; and in Harmon County, it was recovered by solar evaporation of brine from springs. Principal uses were for stock food and for recharging of water softeners.

Sand and Gravel.—Sand and gravel deposits suitable for concrete aggregate and road surfacing, occur along and adjacent to most of the larger streams in Oklahoma. Production was reported from 57 counties in the state in 1956. Johnston, Tulsa, Cherokee, Pontotoc, Logan, and Murray were the leading counties, accounting for half of the total value.

Most of the sand and gravel produced in Oklahoma was used for paving concrete and mortar. Second in tonnage and value was high-purity glass sand, produced at 2 plants in the Arbuckle Mountain district. In addition to glass manufacturing, a small part of the high-purity sand was used as foundry sand and for making sodium silicate.

Sand and gravel (including glass sand) produced in Oklahoma during 1956 amounted to 5.9 million tons valued at $4.8 million.

Stone.—Oklahoma stone producers in 1956 reported 10.5 million tons of crushed limestone, crushed granite, dimension granite, dimension sandstone, dimension limestone, crushed sandstone, and miscellaneous stone. The reported value of $12.4 million showed little change from 1955. Production was reported from 31 counties with Tulsa, Comanche, Murray, and Ottawa accounting for the major stone tonnage in the state. Crushed limestone, reported by 19 producers who operated 34 quarries in 1956, was used primarily for cement, concrete aggregate, and road construction.

Chat.—Chat is the term used in the west central states to denote the coarse tailings obtained in milling zinc and lead ores. The material is composed mostly of chert or micro-crystalline silica, together with small quantities of limestone, sphalerite, galena, marcasite, and pyrite.

Most of the chat sold was used for railroad ballast, concrete aggregate, and road surfacing. In 1956, operators reported 35 percent more tonnage than in 1955.

Granite.—The dimension granite industry of Oklahoma is centered in the Wichita Mountains, in the southwestern part of the state, where 5 producers operated 5 quarries in Greer and Kiowa Counties in 1956. Crushed granite was produced at 1 quarry in Kiowa County. Dimension granite also was produced in Johnston County in the Arbuckle Mountain region.

Production was from Precambrian granites which are predominantly pink and red. Dimension granite was used mostly for monumental stone and partly for exterior trim. Much of the stone was finished in plants in the Wichita Mountains, and some was shipped as rough rock to other states. In 1956, granite production was reported to be 15,074 tons with a value of $532,570.

Limestone and Dolomite.—In 1956, limestone and dolomite were quarried in 23 counties; the largest production was from Tulsa, Comanche, and Murray Counties.

Chemical grade limestone was quarried at Marble City in Sequoyah County for lime making and for a flux in glass manufacturing, fertilizers, and mineral feeds.

Dimension limestone was quarried for building stone in the Arbuckle Mountains in Pontotoc County, in Caddo County, and near Eldorado in Jackson County; limestone for portland cement was quarried in Washington and Pontotoc Counties.

Sandstone.—Dimension sandstone produced in Oklahoma was used for building and veneer stone in building construction. The stone was cut in slabs 1½ to 6 inches thick from shallow- open-face quarries in Okmulgee, Sequoyah, Mayes, and Pushmataha Counties. Approximately 1,000 tons valued at $12,000 was produced in 1956.

Stone, Crushed (Government-and-Contractor).—Stone crushed by municipal, county, and state agencies included limestone and sandstone obtained from local quarries through the state.

Sulfur (Recovered).—Decreases of 11 percent on both tonnage and value of sulfur, produced from waste natural gases by Joe L. Parker at Madill, Marshall County, were reported in 1956.

Tripoli.—Tripoli, mined in eastern Ottawa County in 1956, was 18 percent less than that produced in 1955. All of the tripoli mined was shipped to Seneca, Mo., where it was processed by the American Tripoli Division of the Carborundum Co. and sold chiefly for buffing compounds and foundry use.

TABLE XII—Value of mineral production in Oklahoma by counties, 1955-56[1]

County	1955	1956	Minerals produced in 1956 in order of value
Adair	$ 2	$	
Alfalfa	50,222	365,295	Petroleum, sand and gravel, natural gas.
Atoka	289,871	257,951	Stone, petroleum, sand and gravel.
Beaver	2,148,831	2,936,262	Petroleum, natural gas, sand and gravel, pumicite.
Beckham	26,060,772	22,683,546	Petroleum, natural-gas liquids, natural gas, salt.
Blaine	2	2	Gypsum.
Bryan	2,016,431	1,840,464	Petroleum, sand and gravel, natural gas.
Caddo	13,887,291	13,831,911	Petroleum, natural gas, gypsum, sand and gravel, stone.
Canadian	353,414	328,248	Petroleum, natural gas, sand and gravel.
Carter	58,949,629	61,641,664	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Cherokee	2	534,420	Sand and gravel, stone.
Choctaw	2	23,449	Sand and gravel.
Cimarron	1,447,760	1,647,715	Natural gas, petroleum, sand and gravel.
Cleveland	7,947,487	13,684,376	Petroleum, natural gas, natural-gas liquids.
Coal	2,205,728	1,978,215	Petroleum, stone, natural gas, coal, sand and gravel.
Comanche	2,550,103	2,517,057	Stone, petroleum, sand and gravel, natural gas.
Cotton	4,813,058	4,418,543	Petroleum, sand and gravel, natural gas.
Craig	110,753	221,153	Coal, stone, petroleum, natural gas.
Creek	31,276,145	31,031,687	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Custer	2	367,402	Natural-gas liquids, clays.
Delaware	2	18,090	Stone.
Dewey	2	2	Bentonite, sand and gravel.
Ellis	2	--	--
Garfield	7,278,812	7,783,835	Petroleum, natural-gas liquids, natural gas, clays.
Garvin	81,626,943	99,725,969	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Grady	16,735,306	21,789,241	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Grant	1,783,855	1,991,254	Petroleum, natural gas.
Greer	189,002	509,539	Petroleum, stone, clays, sand and gravel.
Harmon	174,122	18,200	Salt.
Harper	25,935	43,549	Natural gas, petroleum, sand and gravel.
Haskell	4,189,584	2,617,127	Coal, natural gas.
Hughes	12,822,773	10,603,304	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jackson	1,964,499	1,006,593	Petroleum, natural-gas liquids, natural gas, stone.
Jefferson	2,362,831	3,205,422	Petroleum, natural gas.
Johnston	1,278,097	1,812,645	Sand and gravel, stone.
Kay	12,519,079	12,119,080	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Kingfisher	1,146,063	875,729	Petroleum, sand and gravel, natural gas.
Kiowa	965,988	1,143,126	Stone, petroleum, sand and gravel, natural gas.
Latimer	315,801	389,150	Coal, natural gas, sand and gravel.
LeFlore	2,102,590	2,380,770	Do.
Lincoln	24,268,790	25,064,864	Petroleum, natural-gas liquids, natural gas, stone, clays.
Logan	10,347,395	10,932,125	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Love	534,706	1,132,533	Petroleum, stone.
Major	2,865,231	2,310,055	Petroleum, natural-gas liquids, natural gas, sand and gravel.

TABLE XII—Value of mineral production in Oklahoma by counties, 1955-56[1] (continued)

County	1955	1956	Minerals produced in 1956 in order of value
Marshall	5,694,620	8,007,989	Petroleum, natural-gas liquids, natural gas, recovered sulfur, stone, sand and gravel.
Mayes	115,346	7,009	Stone, petroleum, sand and gravel.
McClain	6,570,047	7,274,912	Petroleum, natural gas, sand and gravel.
McCurtain	254,370	136,025	Sand and gravel.
McIntosh	628,929	680,503	Coal, petroleum, natural gas, sand and gravel.
Murray	2,007,591	2,140,311	Stone, asphalt, sand and gravel, petroleum, natural-gas liquids.
Muskogee	1,492,850	937,479	Petroleum, sand and gravel, natural gas.
Noble	8,871,939	9,676,220	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Nowata	13,683,708	15,681,295	Petroleum, stone, natural gas.
Okfuskee	11,971,541	10,132,686	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Oklahoma	35,248,226	35,065,312	Petroleum, natural-gas liquids, natural gas, sand and gravel, clays.
Okmulgee	7,680,766	7,821,495	Petroleum, coal, natural gas, stone.
Osage	56,223,179	68,558,343	Petroleum, natural-gas liquids, stone, natural gas, sand and gravel.
Ottawa	15,153,134	12,511,898	Zinc, lead, stone, tripoli, sand and gravel.
Pawnee	6,845,128	7,946,312	Petroleum, sand and gravel, natural-gas liquids, natural gas.
Payne	13,386,137	13,448,121	Petroleum, natural gas, sand and gravel.
Pittsburg	2,014,983	2,373,938	Coal, natural gas, stone, clays, sand and gravel, petroleum.
Pontotoc	18,784,928	17,436,733	Petroleum, cement, natural-gas liquids, sand and gravel, natural gas, stone.
Pottawatomie	12,830,112	16,227,843	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Pushmataha	222,750	53,763	Sand and gravel, stone.
Rogers	4,720,823	5,649,402	Petroleum, coal, stone, clays, sand and gravel, natural gas.
Seminole	33,293,324	28,532,761	Petroleum, natural-gas liquids, natural-gas, clays, sand and gravel.
Sequoyah	1,416,971	2,786,748	Coal, lime, stone, natural gas, sand and gravel.
Stephens	57,929,516	59,003,172	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Texas	21,584,128	26,852,160	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Tillman	862,774	1,638,025	Petroleum, sand and gravel.
Tulsa	6,523,799	7,082,548	Petroleum, stone, sand and gravel, clays, natural gas, natural-gas liquids.
Wagoner	1,108,834	1,165,168	Petroleum, stone, sand and gravel, coal, natural gas.
Washington	20,002,323	16,749,979	Petroleum, cement, stone, natural gas.
Washita	1,780,224	1,694,564	Petroleum, natural gas, sand and gravel.
Woods	787,314	665,988	Natural gas, petroleum, sand and gravel, salt.
Woodward	[2]	2,855	Sand and gravel.
Various	178,089	--	------
Value of items that cannot be disclosed	1,616,771	1,393,122	------
Total	$711,089,000	$757,116,000	

[1] Roger Mills County not listed because no production was reported.

[2] Included with "Value of items that cannot be disclosed" to avoid disclosing individual data.

Part II

THE MINERAL INDUSTRIES OF OKLAHOMA IN 1957

Preliminary

The total value of 1957 mineral production in Oklahoma amounted to a new record of $817.1 million, 8 percent over the 1956 previous record value of $757.1 million. Mineral fuels accounted for 96 percent of this total 1957 value, nonmetals for 3 percent, and metals 1 percent. Six of the 18 minerals produced showed a gain over the 1956 value.

MINERAL FUELS

The search for more oil in 1957 in Oklahoma led to the drilling of 747 exploratory wells (3,350,000 feet), third in the nation, resulting in the completion of 107 oil wells and 31 natural-gas wells. This total of 138 productive exploratory tests compared with 195 for 1956 according to The Oil and Gas Journal. Impressive reserves were tapped in the south-central counties, new producing depth records were made, and development of the Panhandle area was continued. Important discoveries were made along the south flank of the Anadarko basin and new interest appeared in the southeastern counties. Overall discoveries, however, were widespread in 46 counties. Beaver County, where the drive for natural gas continued, was first with 13, next was Grant (9), Cleveland, Harper, Lincoln, Osage, and Stephens (7 each), and Alfalfa, Logan, McClain, and Okfuskee (5 each). In addition to the exploratory wells, the industry drilled 5,488 field wells of which 3,429 were oil productive, 203 were gas productive, and 317 were service wells.

Coal: Coal production declined 6 percent in Oklahoma in 1957. The 1,950,000 tons reported in 1957 was from 13 counties, the largest tonnage being from Haskell County. The Lone Star Steel Company's mine near McCurtain, Oklahoma, remained closed because of damage from explosions. However, the company maintained production by acquiring the Kleaner Coal Company mine in LeFlore County.

Natural Gas: Marketed production of natural gas in 1957, about the same as in 1956, was 682,000 million cubic feet valued at $57 million. More than 50 counties in Oklahoma reported natural gas production with Texas County being the principal producer.

Natural-Gas Liquids: The value of natural-gas liquids produced in Oklahoma in 1957 was $50 million, about the same as in 1956. Most of the existing markets for LP-gases remained strong and demand for domestic heating and for production of petrochemicals continued to grow. In the West Moore oil field, south of Oklahoma City, Continental Oil Company completed a natural gasoline plant to process 60,000,000 cubic feet of gas daily.

TABLE XIII—Mineral production in Oklahoma, 1956-57[1]

Mineral	1956 Short tons (unless otherwise stated)	1956 Value	1957 Short tons (unless otherwise stated)	1957 Value
Clays	705,061	$ 701,038	628,000	$ 664,000
Coal	2,066,987	12,340,642	1,950,000	9,945,000
Lead (recoverable content, etc.)	12,350	3,877,900	6,500	1,872,000
Natural gas—million cubic feet	678,603	54,288,000	681,900	57,300,000
Natural-gas liquids:				
Natural gasoline & cycle products—thousand gallons	489,963	26,543,000	1,047,430	49,990,000
LP-gases—thousand gallons	579,101	23,427,000		
Petroleum (crude)—thousand 42-gallon barrels	215,862	600,096,000	213,800	665,000,000
Sand and gravel	5,946,693	4,842,506	5,672,000	4,376,000
Stone	10,546,612	12,416,886	10,150,000	12,000,000
Zinc (recoverable content, etc.)	27,515	7,539,110	14,300	3,289,000
Value of items that cannot be disclosed: Native asphalt, cement, gypsum, lime, salt (common), sulfur (recovered), tripoli, bentonite, and pumice (volcanic ash)		13,058,314		14,976,000
Total Oklahoma[2]		$757,116,000		$817,064,000

[1] Production as measured by mine shipments or mine sales (including consumption by producers) except that fuels and gypsum are strictly production.
[2] Value adjusted to avoid duplication of clay and limestone used in manufacture of lime and cement.

Petroleum: Production of crude oil in Oklahoma decreased 1 percent in 1957 to 214 million barrels from 1956 production; value gained 11 percent because of unit-price advance. This quantity made the state the fourth largest oil producer in the nation for the 12th consecutive year. Crude oil production was valued at $665 million which was 81 percent of Oklahoma's total mineral value in 1957. Production was reported from 56 of the state's 77 counties. Osage, Garvin, Stephens, and Carter Counties were the leading producers. In the refining industry, the race toward upgrading of motor fuels was continued. As a result, one small plant at Cushing remained shut down and a second plant at Drumright changed ownership for modification and expansion.

METALLIC MINERALS

Cadmium, Germanium, and Indium: Several minor metals as cadmium, germanium, and indium occur in minute quantities in the lead and zinc ores of Oklahoma and are recovered in varying amounts from the flue dusts of the zinc smelting operations. It is impossible to assign the state origin of these minor metals, since their minute quantities in the ores precludes competent assay data and because the flue dusts from which these metals are recovered are the combined dusts of both domestic and imported ores.

Lead: There was 6,500 tons of recoverable lead valued at $1.9 million produced in Oklahoma in 1957. This was 47 percent less in quantity and 52 percent less in value than 1956. Oklahoma accounted for 60 percent of the lead produced in the Tri-State District in 1957.

Zinc: Mine production of recoverable zinc in Oklahoma declined 48 percent to 14,300 tons in 1957 from 1956 output, a decline trend that prevailed throughout the Tri-State District because of oversupply on world markets. Oklahoma zinc was valued at $3.3 million compared to the 1956 value of $7.5 million and represented 48 percent of the zinc produced in the Tri-State District in 1957.

Uranium: A minor amount of ore was reported produced from Caddo and Custer Counties in 1957.

Smelters: Three zinc retort smelters were operating in Oklahoma in 1956; the Bartlesville smelter of National Zinc Company, Inc., the Henryetta smelter of the Eagle-Picher Company and the Blackwell smelters of American Metals Company, Ltd. The Henryetta smelter experienced a 4-month work stoppage during the year.

Tri-State District: Mine production in the Tri-State District of Southwest Missouri, Oklahoma, and Kansas amounted to 1,803,000 tons of zinc-lead ores. This yielded 55,600 tons of zinc concentrates containing 30,100 tons of recoverable zinc and 15,000 tons of lead concentrates yielding 10,800 tons of recoverable lead. Zinc concentrates were valued at $4.4 million and lead concentrates at about $2.7 million. Oklahoma accounted for about 48 percent of the district's recoverable zinc and about 60 percent of the recoverable lead; Kansas was responsible for the remainder as Southwest Missouri had no production. These 1957 figures for recoverable metal in the Tri-State District represent a 46-percent decline for lead and a 48-percent decline for zinc from 1956. The declines resulted mainly from a 4-month shutdown of mining and milling operations because world supply exceeded demands.

Metal prices dropped throughout 1957. Zinc opened at 13.5 cents, East St. Louis, dropped gradually to 10.0 cents October 10 and remained fixed through December. Lead opened the year at 16.0 cents, New York, and dropped gradually to 13.0 cents on December 26, 1957.

NONMETALLIC MINERALS

The estimated value of nonmetallic minerals (exclusive of mineral fuels) produced in Oklahoma in 1957 was $32 million, slightly less than the record value established in 1955 and 1956. Losses were shown for all nonmetallic minerals except cement, lime, and tripoli.

Asphalt (Native): Output of native asphalt from Murray County in 1957 was one-third less in both quantity and value than in 1956.

Cement: Cement production in 1957 in Oklahoma gained 20 percent over 1957. This gain was attributed mainly to one of the two Oklahoma plants that was not effected by the nation-wide cement strike. Ideal Cement Company had under construction additional facilities at Ada, Oklahoma. Upon completion, it will bring the company's cement capacity at Ada to 3,700,000 barrels yearly.

Clays: Production of clays in Oklahoma in 1957 was estimated to be 628,000 tons valued at $664,000, a drop of 11 percent in tonnage and 5 percent in value compared with 1956.

Gypsum: Output of gypsum, all from Blaine and Caddo Counties, decreased one-sixth in 1957 in both production and value compared to 1956.

Lime: Lime production in 1957 increased over 1956 to a new record as demand for chemical lime and building materials continued. St. Clair Lime Company in Sequoyah County remained the only lime producer in Oklahoma.

Pumice (Volcanic Ash): Production and value of pumice (volcanic ash), all from Beaver County, approximated the 1956 figures.

Salt: Salt was reported from Beckham, Harmon, and Woods Counties by three producers. The 1957 output and value were approximately the same as in 1956.

Sand and Gravel: The output of sand and gravel operations in 1957 in Oklahoma was an estimated 5.7 million tons valued at $4.4 million. Production trend of this construction material which had been increasing steadily during the 5-year period ending in 1956, declined in 1957 because heavy rainfall retarded both production and construction.

Stone: Stone output in Oklahoma decreased slightly in 1957 when an estimated 10.2 million tons valued at $12 million was produced. The most important commodities in this group are crushed limestone, chat, and dimension granite.

Sulfur: Sulfur was recovered from waste natural gases in Marshall County in 1957.

Tripoli: Output and value of tripoli produced in Ottawa County were slightly more than the 1956 figures.

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