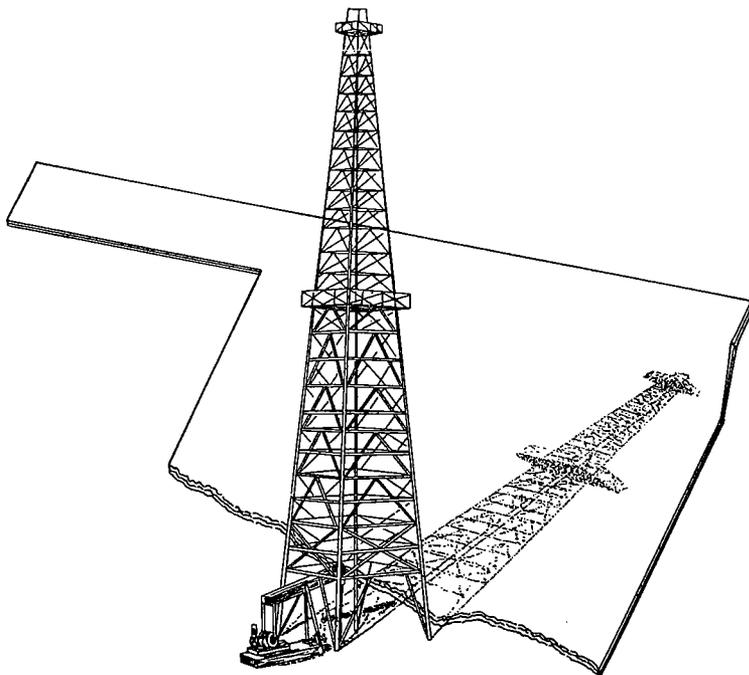


Oklahoma Geology Notes



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Rosenwald pool, Okfuskee County.

A review by Louise Jordan

"Performance of a Solution Gas Drive Reservoir, Rosenwald pool, Oklahoma" by M. R. Smith and J. H. Henderson, Jour. Petroleum Technology, vol. IX, no. 1, Jan. 1957, p. 25-29.

The Rosenwald pool, located in sections 14 and 23, T. 13 N., R. 8 E., Okfuskee County, discovered in June 1949, produces from a common reservoir in Union Valley lime and Cromwell sand. The authors define the pool as a stratigraphic trap with the limits defined by a pinchout of the sand and a loss of permeability in the limestone. Most of the 31 wells on 10-acre spacing were cored through the pay section. Average porosity of the Cromwell sand was about 12 per cent with horizontal and vertical permeabilities generally ranging from 100 to 2,200 millidarcys except toward the edges of pool. The Union Valley lime averages 5.4 per cent in porosity and has a permeability of less than 5. Connate water saturation data indicated an initial water saturation of 20 per cent of the pore volume of the Cromwell sand. The crude was highly paraffinic and sweet with gravity of 37° API.

The authors were primarily interested in investigating whether material balance calculations early in the life of the pool would provide reasonable estimates for the initial stock tank oil in place. By using a gas-oil relative permeability ratio curve based on data of other Cromwell sand reservoirs, they predicted 26½ per cent recovery of the original oil. Actual recovery, when the reservoir has been essentially depleted by primary means was 20 per cent. However, to the geologist, the article is interesting in that it contains also the geology and development of the pool with a structure map on top of the Union Valley lime and an isopach of the net effective pay of the Cromwell sand, as well as rock and fluid characteristics and reservoir performance.

THE MINERAL INDUSTRIES OF OKLAHOMA IN 1955 AND 1956¹

by

Peter Grandone² and William E. Ham³

Part 1

THE MINERAL INDUSTRIES OF OKLAHOMA IN 1955 Final Advance Summary

The total 1955 value of Oklahoma mineral production was a record \$712 millions, 9.5 percent more than the 1954 value. Production of 17 minerals and mineral fuels was reported from 76 of Oklahoma's 77 counties. Petroleum, natural-gas liquids, natural gas, coal, and cement were the 5 principal commodities in value. Mineral fuels continued as the dominant commodities among the State's mineral resources, accounting for 94 percent of the total 1955 value, followed by nonmetallics with 4 percent and metals with 2 percent. The increase in Oklahoma petroleum production, resulting from increased allowables by the State regulatory agency, more than compensated for the cutback in 1954 and accounted for the major portion of the State's gain in mineral values.

MINERAL FUELS

Coal: The 6-year decline trend of coal output in Oklahoma was reversed in 1955 when 2.2 million tons valued at \$12.7 million was reported. This production, a gain of 13 percent in both tonnage and value over 1954, was reported from 35 operators in 13 counties. Haskell, Rogers, Pittsburg, LeFlore, and Okmulgee Counties were the 5 principal producers, each reporting over \$1 million in value.

Natural Gas: Marketed production of natural gas amounted to 615 billion cubic feet valued at \$45.5 million, slightly less in quantity but a 5.6 percent gain in value compared to 1954. Production was reported from 55 counties, of which Texas, Beckham, Garvin, Oklahoma, and Grady Counties led in the order named. The gas industry continued its search for more reserves in 1955 with 359 gas wells completed out of a total of 8,411 well completions of all types. Estimated proved recoverable reserves of natural gas increased 6.5 percent in Oklahoma in 1955 to 13,204,739 million cubic feet according to the Committee on Natural Gas Reserves of the American Gas Association.

¹Prepared 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.

²Division of Mineral Industries, U. S. Bureau of Mines Region IV, Bartlesville.

³Geologist, Oklahoma Geological Survey, Norman.

TABLE 1.—MINERAL PRODUCTION OF OKLAHOMA, 1954-55¹

Mineral	1954		1955	
	Short tons (unless other- wise stated)	Value	Short tons (unless other- wise stated)	Value
Clays	452,050	\$ 1,282,848	724,156	\$ 726,856
Coal	1,914,834	11,264,692	2,163,536	12,667,563
Lead (recoverable content of ores, etc.)	14,204	3,891,896	14,126	4,215,198
Natural gas Million cubic feet	616,355	43,145,000	614,976	45,508,000
Natural-gas liquids:				
Natural gasoline & cycle prod	478,590	24,332,000	504,692	28,770,000
L-P gases	453,810	13,506,000	512,320	14,297,000
Petroleum (crude)	185,851	518,520,000	202,817	565,280,000
Sand and gravel	5,424,131	4,265,031	6,293,798	4,785,786
Stone	9,238,811	9,146,995	9,639,518	11,675,528
Zinc (recoverable content of ores, etc.)	43,171	9,324,936	41,453	10,219,578
Undistributed: Asphalt (native), cement, gypsum, lime, pumicite, salt (common) miscellaneous stone, sulfur, tripoli, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote)				
Total Oklahoma		12,584,340		16,144,994
		\$650,205,000		\$712,545,000

¹Production as measured by mine shipments or mine sales (including consumption by producers).

²Excludes certain stone, value for which is included in "Undistributed".

³Total adjusted to avoid duplication in values of clays and stone.

⁴Preliminary figure.

Natural-Gas Liquids: Production of nearly 1,017 million gallons of natural-gas liquids, valued at \$43 million, was reported in Oklahoma in 1955, a 9 percent increase in quantity and a 14 percent increase in value over 1954. Natural gasoline and cycle products accounted for 49 percent of the quantity and 67 percent of the value; LP-gases accounted for the remainder. According to the American Petroleum Institute, estimated proved recoverable reserves of natural gas liquids in Oklahoma in 1955 were 354 million barrels, an increase of 20 million barrels over 1954 estimates.

Petroleum: Oklahoma petroleum production in 1955 amounted to 203 million barrels valued at \$565 million, an increase of 9 percent in both quantity and value from 1954. Crude oil production was reported from 57 of Oklahoma's 77 counties in 1955 with Garvin, Carter, Stephens, Osage, and Seminole the leading producers. Of the 8,411 wells completed in Oklahoma in 1955, 5,131 were oil wells, 2,588 were dry and the remainder were either gas or service wells. Exploratory crews in the State drilled 832 test wells compared to 859 in 1954 and of the 832 tests, 154 were oil productive and 31 gas productive. The heaviest exploratory activity was concentrated in the southern and far northwestern counties, especially in Beaver County. The State's productive depth record was broken by the completion of an oil well in the Tulip Creek sand at 14,076 feet in the Bradley area of Grady County. Estimated proved reserves of crude oil in Oklahoma were reported by the American Petroleum Institute at 2 billion barrels, up only 1 percent over 1954 estimates.

In the refining industry of the State, upgrading of motor fuels was continued by the installations of a new 5,000-barrel per day catalytic polymerization unit at the Champlin Refinery Co., Enid, Okla., and a 9,000 barrel per day combination platforming and unifying unit at the West Tulsa refinery of The Texas Co. At the D-X Sunray Oil Co. refinery, West Tulsa, a new delayed coking unit was placed in operation that has a charge capacity of 7,000 barrels of oil daily and makes 244 tons of coke and 4,000 barrels of gas oil daily.

NONMETALLIC MINERALS

Nonmetallic minerals produced in Oklahoma reached a new record value of \$31.6 million in 1955, surpassing by 20 percent the old record of \$26.3 million established in 1954. Increased construction activity and new plants manufacturing diverse non-metallic products accounted for the new production record.

Commodities that established individual all-time high values in 1955 were cement, gypsum, sand and gravel, stone, and lime. In dollar value the leading nonmetallic commodity was cement, followed by stone, sand and gravel, gypsum, and clays. Seven miscellaneous nonmetals made up the remainder of the total.

New Developments

An almost inexhaustible deposit of clays, suited for the manufacture of brick, was discovered near Ponca City, Kay County, Okla., according to the Oklahoma Geological Survey. United Brick & Tile Co., Oklahoma City, has been constructing a new plant to

replace the old one. Oklahoma now has a second lightweight aggregate plant. Chandler Materials Co. is producing daily 120 cubic yards of expanded shale aggregate at its Garnett plant 12 miles east of Tulsa. A new gypsum quarry was opened in April, 1955, by Harrison Gypsum, Inc. four miles southeast of Cement, Caddo County. High-grade gypsum for use as portland cement retarder and as a soil conditioner is produced from thick deposits in the Cloud Chief formation.

Commodity Review

Asphalt (native): Output of native rock asphalt (bituminous limestone and bituminous sandstone) was reported from Murray County in 1955. Production and value were one-third less than in 1954.

Cement: Plants in Pontotoc and Washington Counties reported a 20 percent increase in cement production for a new record high in 1955.

Clay: Oklahoma clay production in 1955 was used primarily in the manufacture of brick and tile, and to a lesser extent in the manufacture of portland cement and lightweight expanded clay products. Bentonite was produced in Dewey County. Expanded lightweight aggregate was made from clay in Oklahoma and Tulsa Counties.

Clay sold or used in 1955, including clay used for cement, was 724 thousand tons, valued at \$727 thousand. This was a 60 percent increase in tonnage compared with 1954.

Gypsum: An all-time high tonnage and value of gypsum was recorded in Oklahoma in 1955, in response to the higher demand for wallboard, plasters, and portland cement. All production was from Blaine County, where 3 plants were in operation; at Southard, near Watonga, and near Okeene. The new quarry near Cement was just beginning production during the year.

Lime: A 39 percent increase in lime production in Oklahoma was reported for 1955. Part of the increase resulted from expanded operations following the period of conversion in 1954 from open face quarrying to underground mining by the St. Clair Lime Co. in Sequoyah County.

Salt: Output of salt increased 12 percent in 1955. Three producers reported production from Beckham, Harmon, and Woods Counties for use principally as stock food and for recharging water softeners.

Sand and Gravel: Production of sand and gravel was reported from 51 counties in Oklahoma in 1955. Johnston, Tulsa, Oklahoma, Muskogee, Murray, and Logan were the leading counties, accounting for half the total value.

Most of the State's production was used for paving, concrete, and mortar.

Production of sand and gravel in 1955 was 6,294 thousand tons valued at \$4,786 thousand, up 16 percent in tonnage and 12 percent in value over 1954.

Stone: Oklahoma stone producers in 1955 reported 9.6 million tons of crushed limestone, crushed granite, dimension granite, dimension sandstone, dimension limestone, crushed sandstone, and

miscellaneous stone (chat). The reported value of \$11.68 million was a 28 percent increase over 1954. Production was reported from 32 counties with Tulsa, Comanche, Murray, and Ottawa accounting for the major stone tonnage in Oklahoma. Thirty-seven of the 63 stone producers reported production of crushed limestone in 1955, which was used primarily for concrete and road construction.

Sulfur: Increases of 25 percent in both tonnage and value of sulfur produced from waste natural gases were reported in 1955 by Joe L. Parker at Madill, Marshall County.

Tripoli: Tonnage of tripoli produced in Ottawa County showed a 40 percent increase over that produced in 1954.

METALLIC MINERALS

Cadmium, etc: Cadmium, germanium, indium, and gallium occurred in small traces in the Oklahoma lead-zinc concentrates and were recovered from the flue and zinc dusts of zinc retort smelters and from the precipitate of electrolytic zinc smelters. This production is not assigned to state origin by the Bureau since their recovery is from the accumulated dusts and residues of ores from several states and foreign countries.

Lead: Crude ore production in Oklahoma decreased in 1955 from that produced in 1954, resulting in a slight decrease in recoverable lead to 14,126 tons. The Eagle-Picher Co. was the largest lead producer in Oklahoma followed by American Zinc, Lead & Smelting Co. (Barbara J., Rialto and Lawyers), Dewy Sims (Ritz), John Henderson (Acme), and Tom Kiser (Wesah Greenback). One labor strike was reported within the State.

Zinc: Mine production of recoverable zinc declined 7 percent to 40,262 tons during 1955. Zinc output was valued at \$9.9 million, up 6 percent over 1954 value. Eagle-Picher Co. was the major zinc producer in the State followed by American Zinc, Lead & Smelting Co. (Barbara J., Rialto and Lawyers), Buffalo Mining Co. (Buffalo and Wesah Greenback), John Henderson (Acme), and Tongaha Mining Co. (Tongaha and Kitty).

A production cut was announced by American Zinc, Lead & Smelting Co. at Picher, Oklahoma, where operations were to be resumed on a reduced scale. The company stated that the properties could not be operated economically at present because of low-grade ores and excessive operating expenses.

Smelters: Three zinc retort smelters in Oklahoma operated in 1955. They were American Metals Co., Ltd., at Blackwell, Kay County; Eagle-Picher Co., at Henryetta, Okmulgee County; and National Zinc Co., at Bartlesville, Washington County.

Uranium: The Atomic Energy Commission completed preliminary investigations of four uranium strikes northeast of Foss in Custer County, two near Cheyenne in Roger Mills County, and one south of Clinton in Washita County. A small uranium boom developed in Tulsa, Oklahoma, with the discovery of uranium ore in phosphate nodules in a gravel bar of the Arkansas River. An assay sample from one property was reported to be of commercial quality.

TABLE II—VALUE OF MINERAL PRODUCTION IN OKLAHOMA BY COUNTIES, 1954-55 ¹

COUNTY	1954	1955	Minerals produced in 1955, in order of value
Adair			Sand and gravel.
Alfalfa	68,016	50,281	Sand and gravel, petroleum.
Atoka	416,480	289,887	Stone, sand and gravel, petroleum.
Beaver	1,164,768	2,148,831	Natural gas, petroleum, sand and gravel
Beckham	16,580,523	26,108,695	Petroleum, natural-gas liquids, natural gas, salt.
Blaine			Gypsum.
Bryan	1,769,739	2,020,874	Petroleum, sand and gravel, stone, natural gas.
Caddo	13,316,836	13,918,801	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Canadian	489,252	353,897	Petroleum, natural gas, sand and gravel.
Carter	63,503,928	59,096,310	Petroleum, natural-gas liquids, natural gas.
Cherokee			Sand and gravel.
Choctaw			Sand and gravel.
Cimarron	679,591	1,447,910	Natural gas, petroleum, sand and gravel.
Cleveland	6,578,325	7,966,145	Petroleum, natural gas, natural-gas liquids.
Coal	2,373,412	2,209,649	Petroleum, stone, natural gas, coal.
Comanche	1,843,856	2,552,277	Stone, petroleum, natural gas.
Cotton	5,508,154	4,825,434	Petroleum, sand and gravel, natural gas.
Craig	104,705	110,778	Coal, petroleum, natural gas.
Creek	27,139,039	31,348,555	Petroleum, natural-gas liquids, natural gas, stone, clay, sand and gravel.
Custer			Clay.
Delaware			Sand and gravel.
Dewey	64,023		Bentonite.
Ellis			Sand and gravel.
Garfield	6,440,599	7,291,355	Petroleum, natural-gas liquids, natural gas, clay.
Garvin	59,775,003	81,815,773	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Grady	8,715,251	16,772,150	Petroleum, natural gas, natural-gas liquids, sand and gravel
Grant	1,821,866	1,787,949	Petroleum, natural gas.
Greer	108,583	189,227	Petroleum, stone, sand and gravel, clay.
Harmon	153,865	174,122	Natural-gas liquids, salt.

TABLE II—VALUE OF MINERAL PRODUCTION IN OKLAHOMA BY COUNTIES, 1954-55¹ (con.)

COUNTY	1954	1955	Minerals produced in 1955, in order of value
Harper	20,920	25,945	Natural gas, sand and gravel, petroleum, stone.
Haskell	2,795,944	4,189,584	Coal, sand and gravel, natural gas.
Hughes	14,676,018	12,853,464	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jackson	1,570,295	1,967,395	Petroleum, stone, natural gas.
Jefferson	2,552,028	2,368,888	Petroleum, natural gas.
Johnston	949,369	1,278,097	Stone, sand and gravel.
Kay	11,288,540	12,542,976	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Kingfisher	1,422,910	1,148,115	Petroleum, natural gas, sand and gravel.
Kiowa	1,153,620	966,701	Stone, petroleum, sand and gravel, natural gas.
Latimer		315,801	Coal, natural gas.
LeFlore	2,435,493	2,102,590	Coal, natural gas, stone, sand and gravel.
Lincoln	25,622,697	24,327,277	Petroleum, natural gas, natural-gas liquids, stone.
Logan	10,706,827	10,369,031	Petroleum, natural gas, natural-gas liquids, sand, grav'l.
Love	479,597	536,081	Petroleum.
Major	3,075,292	2,869,844	Petroleum, natural-gas liquids, natural gas, sand, grav'l.
Marshall	5,203,540	5,707,578	Petroleum, natural-gas liquids, natural gas, recovered sulfur, sand and gravel.
Mayes	8,507	115,348	Sand and gravel, stone, petroleum.
McClain	6,501,884	6,586,739	Petroleum, natural gas.
McCurtain		254,370	Sand and gravel, stone.
McIntosh	527,590	628,999	Coal, petroleum, natural gas, sand and gravel.
Murray	1,756,737	2,007,707	Stone, sand and gravel, asphalt (native), petroleum.
Muskogee	1,209,415	1,495,503	Petroleum, sand and gravel, coal, natural gas
Noble	7,974,173	8,892,574	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Nowata	11,882,474	13,718,460	Petroleum, stone, natural gas.
Okfuskee	12,140,945	12,001,351	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Oklahoma	35,375,750	35,309,931	Petroleum, natural-gas liquids, natural gas, sand and gravel, clay.

TABLE II—VALUE OF MINERAL PRODUCTION IN OKLAHOMA BY COUNTIES, 1954-55 ¹ (con.)

COUNTY	1954	1955	Minerals produced in 1955, in order of value
Okmulgee	6,217,827	7,695,348	Petroleum, coal, natural-gas liquids, natural gas, stone, sand and gravel.
Osage	36,825,130	56,355,654	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Ottawa	13,989,467	15,158,786	Zinc, lead, stone, tripoli.
Pawnee	6,252,247	6,862,398	Petroleum, sand and gravel, natural-gas liquids, natural gas.
Payne	13,841,312	13,418,924	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Pittsburg	2,299,336	2,014,983	Coal, stone, natural gas, sand and gravel, clay.
Pontotoc	20,005,511	19,659,597	Petroleum, cement, natural-gas liquids, stone, sand and gravel, natural gas, clay.
Pottawatomie	12,632,486	12,859,621	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Pushmataha	²	222,750	Sand and gravel, stone.
Rogers	4,327,285	4,728,179	Coal, petroleum, clay, natural gas.
Seminole	31,204,639	33,366,323	Petroleum, natural-gas liquids, natural gas, stone, clay.
Sequoyah	1,387,489	1,506,971	Lime, coal, stone, sand and gravel, natural gas.
Stephens	70,163,129	58,071,357	Petroleum, natural-gas liquids, natural gas.
Texas	24,648,657	21,586,103	Natural gas, natural-gas liquids, petroleum, sand and gravel, stone.
Tillman	643,071	864,956	Petroleum, sand and gravel.
Tulsa	6,381,912	6,533,764	Petroleum, stone, sand and gravel, clay, natural gas, coal, natural-gas liquids.
Wagoner	754,686	1,111,196	Petroleum, sand and gravel, stone, natural gas, coal.
Washington	16,288,538	20,846,117	Petroleum, cement, stone, clay, natural gas.
Washita	1,070,917	1,784,063	Petroleum, natural gas.
Woods	31,989	787,840	Natural gas, petroleum, sand and gravel, salt.
Woodward	²	²	Sand and gravel.
Various	284,141	178,098	Stone.
Undistributed	2,067,513	1,616,711	
Total	³ 650,205,000	³ 712,545,000	

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

²Included with "Undistributed" to avoid disclosing individual data.

³Adjusted for limestone used in cement and lime, and for clay used in cement.

Part 2

THE MINERAL INDUSTRIES OF OKLAHOMA IN 1956

Preliminary Annual Summary

The total value of 1956 mineral production in Oklahoma amounted to a new record of \$754.1 million, 6 percent over the 1955 previous record value of \$708.6 million. Mineral fuels accounted for 94 percent of this total 1956 value, nonmetals for 4 percent, and metals 2 percent. Twelve of the 17 minerals produced showed value gains compared with 1955.

MINERAL FUELS

The search for more oil in 1956 in Oklahoma led to the drilling of 867 exploratory wells, third in the Nation, and to the discoveries of 93 oil fields and 41 natural gas fields. This total of 134 new fields compares with 121 new fields for 1955, according to the Oil and Gas Journal and to the Mid-Continent Oil and Gas Association. Discoveries were made in 42 counties in the southwestern and northwestern parts of the State. Osage County was first in both exploratory and field wells, accounting for 16 discoveries. Beaver County, second with 13, owing to the intense drive for natural gas, was followed by Grant (12), Lincoln (7), Payne (7), and Alfalfa, McClain and Okfuskee (5 each). At the year end, special attention was centered on Cleveland County where three deep pools were tapped. Oklahoma was the only key state that failed to show a gain in the total gas wells drilled, although the 41 gas discoveries were up one-third over the 1955 figure. In addition to the exploratory wells, the industry drilled 7,189 field wells of which 4,671 were oil productive and 280 were gas productive.

Coal: Coal production declined 9 percent in Oklahoma in 1956. The 1,960,000 tons reported in 1956 was from 13 counties, the largest tonnage being from Haskell County. This reduction in output was attributed to shut downs in the Lone Star Steel Company's mine near McCurtain, Okla., caused by two explosions. One mine in the Henryetta field and two large mines in LeFlore County, both long inactive, were reopened.

Natural Gas: Marketed production of natural gas was 8 percent higher in 1956 than in 1955 when 662,000 million cubic feet valued at \$49 million was sold. 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 1956 increased about 15 percent to \$49.5 million over the 1955 value. This gain was attributed mainly to LP-gases which gained 21 percent in volume and 47 percent in value. In 1956 natural gasoline and cycle products represented 46 percent of the combined production and 58 percent of the combin-

TABLE III—MINERAL PRODUCTION IN OKLAHOMA, 1955-56¹

MINERAL	1955		1956	
	Short tons (unless other- wise stated)	Value	Short tons (unless other- wise stated)	Value
Clays	724,156	726,856	700,000	704,000
Coal	2,163,536 *	8,037,932	1,960,000	3
Lead (recoverable content, etc.)	14,126	4,215,198	12,800	4,096,000
Natural gas million cubic feet	614,976	45,508,000	662,000	48,988,000
Natural gas liquids:				
Natural gasoline & cycle products	504,692	28,770,000	526,768	28,550,000
LP-gases	512,320	14,297,000	621,520	20,989,000
Petroleum (crude)	202,817	565,280,000	215,640	601,647,000
Sand and gravel	6,293,798	4,785,786	6,316,000	5,025,000
Stone	10,245,479	12,972,150	10,796,925	14,628,000
Zinc (recoverable content, etc.)	41,543	10,219,578	29,950	8,086,500
Undistributed: Native asphalt, cement, gypsum, lime salt (common), sulfur (recovered), tripoli, benton- ite, coal (1956)				
		15,525,248		22,884,100
TOTAL VALUE OKLAHOMA		* 708,592,035		* 754,122,600

¹Production as measured by mine shipments or mine sales (including consumption by producers) except that fuels and gypsum are strictly production.

²Preliminary

³Included in "Undistributed."

⁴Value adjusted to avoid duplication of clay and limestone used in manufacture of lime and cement.

ed value; LP-gases represented the remainder.

Petroleum: Production of crude oil in Oklahoma increased 6 percent in 1956 to 216 million barrels from 1955 production. This quantity made the State the fourth largest oil producer in the Nation for the 11th consecutive year. Crude oil production was valued at \$602 million, which was 80 percent of Oklahoma's total mineral value in 1956. Production was reported from 56 of the State's 77 counties, and Stephens and Carter Counties were the leading producers. In the refining industry, the race toward upgrading of motor fuels continued unabated, forcing three small plants to shut down or change ownership.

METALLIC MINERALS

Cadmium, Germanium, 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 12,800 tons of recoverable lead valued at \$4.1 million produced in Oklahoma in 1956. This was 9 percent less in quantity and 3 percent less in value than 1955. Oklahoma accounted for 64 percent of the lead produced in the Tri-State District in 1956.

Zinc: Mine production of recoverable zinc in Oklahoma declined 28 percent to 29,950 tons in 1956 from 1955 output, a decline trend that prevailed throughout the Tri-State District. Oklahoma zinc was valued at \$8.1 million compared to the 1955 value of \$10.2 million and represented 52 percent of the zinc produced in the Tri-State District in 1956.

Uranium: Prospecting for and occurrence of radio-active mineralization was reported in Roger Mills and LeFlore Counties. An uranium strike near Cheyenne, Okla., where ore was reported to be valued at \$60 a ton, was inspected by an AEC geologist. Uranium ore from Cement, Caddo County, was sold to the Grants, New Mexico, buying station.

Smelters: Three zinc retort smelters operated 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.

Metal prices remained high throughout 1956. Zinc opened at 13.0 cents, East St. Louis, rose to 13.5 cents January 6 and remained fixed through December. Lead opened the year at 16.0 cents, New York, rose to 16.5 cents January 4, 1956, and upon dropping back to 16.0 cents on January 13, 1956, it was maintained through the rest of the year.

NONMETALLIC MINERALS

The estimated value of nonmetallic minerals produced in Oklahoma in 1956 was \$32.3 million, the same as the record value established in 1955. Gains were shown for all nonmetallic minerals except clay, cement, and native asphalt. The reduction in clay and cement production is attributed both to a decline in the construction field in the State and to work stoppage in one cement plant.

Asphalt (Native): Output of native asphalt from Murray County in 1956 was less in both quantity and value than in 1955. Mining of a high-grade asphaltite started near Sardis, Pushmataha County, Okla. The material, suitable for blending with coke in blast furnaces, is being shipped to Kaiser steel mills in Fontana, Calif. Reported deposit spreads over 3,000 acres and the vein ranges from 10 to 150 feet in thickness.

Cement: Cement production in 1956 in Oklahoma dropped 18 percent from 1955. This reduction resulted partly from a decrease in general construction in the State and partly from a 96-day work stoppage at the Dewey Portland Cement Co. plant, Washington County, which cost a production loss of 85,200 tons of cement. The partly completed \$2-million plant of Ozark Portland Cement Co. was at a standstill at the year end as plans were in progress to reorganize the firm and to invest an additional million dollars.

Clays: Production of clays in Oklahoma in 1956 was estimated to be 700,000 tons valued at \$704,000, a drop of 3 percent in both tonnage and value compared with 1955. An idle brick plant at Stroud, Okla., has been acquired by W & R Stone Co., Austin, Texas. Construction now in progress calls for a plant expansion from one kiln to 8 kilns which will have a capacity of 2 million brick a year. A new method of preventing seepage in irrigation canals, developed by Colorado A & M College, and the U. S. Bureau of Reclamation, may cut costs and save water. Pulverized bentonite, in the form of a thin mud slurry, is added into the canal. As the mud floats slowly along with the water, it sinks to bottom and seals cracks and crevices to a considerable degree.

Gypsum: Output of gypsum, all from Blaine County, increased again in 1956 in both production and value as it did in 1955. A survey of gypsum deposits made by the Oklahoma Geological Survey in the Weatherford-Clinton area of Custer County showed that sufficient quantities exist to meet the wall board and plaster requirements of the Nation for the next 129 years at the current rate of consumption of 10 million tons annually.

Lime: Lime production in 1956 increased over 1955 as demand for building materials continued. St. Clair Lime Company in Sequoyah County remained the only lime producer in Oklahoma.

Pumicite (Volcanic Ash): Stay-Ready Laboratories, Oklahoma City, a division of Sayler Refining Co., prepared to mine a deposit of almost pure white volcanic ash near Gate in Beaver County, Okla. The deposits, estimated at 5 million tons, have been known for more than 30 years and have been mined intermittently during several periods.

Salt: Salt was reported from Beckham, Harmon, and Woods Counties by three producers. The 1956 output and value was slightly greater than 1955 following the trend of the chemical industry.

Sand and Gravel: The output of sand and gravel operations in 1956 in Oklahoma was an estimated 6.3 million tons valued at \$5 million. Production trend of this construction material has been increasing steadily during the 5-year period ending in 1956.

Stone: Stone output in Oklahoma attained a new record in 1956 when an estimated 10.8 million tons valued at \$14.6 million was produced. This represents an increase of 5 percent in quantity and 13 percent in value over 1955. The most important commodities in this group are crushed limestone, chat, and crushed granite. A new rock crushing plant was established 2½ miles north of Hugo, Okla., to supply high-grade limestone for road building. Tests showed a limestone stratum from 14 to 56 feet thick at the site.

Sulfur: Sulfur was recovered from waste natural gases in Marshall County in 1956.

Tripoli: The output and value of tripoli produced in Ottawa County approximated the 1955 figures.

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